

# APEC ENERGY OVERVIEW

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## FOREWORD

Securing energy's future remains the primordial concern for all APEC member economies. Rising energy prices, particularly oil, had driven pressures on energy policies; shifting demand/supply sources and the pursuit of energy alternatives. Constraints on upstream and transportation infrastructure have remained a virtual challenge as investments continued to tighten the growth of most developing economies in the region.

Despite the bleak future however, economies maintained a positive outlook as more new energy technologies are developed and frontier areas are discovered.

Individual APEC economy energy policy initiatives and notable developments particularly on energy security, upstream and downstream development, transformation and transportation, market reform, efficiency and conservation, alternative energy development, renewable energy deployment, environmental protection, and international/regional cooperation are compiled in this report.

We extend our special thanks to the efforts of APEC member economies in improving the accuracy and currency of the information provided. We also acknowledge the expert contributions of the APERC researchers, EDMC staff and a special note of appreciation to the guidance and provision of basic energy data by EGEDA members. We sincerely hope that this report would help deepen the mutual understanding among member economies on the current energy issues in the region.



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## LIST OF ABBREVIATIONS

ABARE	Australia Bureau of Agriculture and Resource Economics
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
bbbl/d	Barrels per day
BCM	Billion cubic metres
BFOE	Barrels of Fuel Oil Equivalent
Bt	Billion tonnes (Thousand Mt)
CO <sub>2</sub>	Carbon dioxide
DOE	Department of Energy (USA)
EDMC	Energy Data and Modelling Center (Japan)
EIA	Energy Information Administration (USA)
EVN	Electricity of Viet Nam
EWG	Energy Working Group (APEC)
GDP	Gross domestic product
GHG	Greenhouse gases
GW	Gigawatts (Thousand MW or Million kW)
GWh	Gigawatt-hours (Million kWh)
HKC	Hong Kong, China
IPP	Independent Power Producer
ktoe	Kilotonnes (thousand tonnes) of oil equivalent
kW	Kilowatts
kWh	Kilowatt-hour
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas (propane)
MCM	Million cubic metres
Mt	Megatonnes (Million tonnes)
mtpa	Million tonnes per annum
MW	Megawatts (Thousand kW)
NZ	New Zealand
PDOE	Department of Energy (the Philippines)
PNG	Papua New Guinea (or pipeline natural gas, depending on context)
PPP	Purchasing Power Parity
R&D	Research and development
SDPC	State Development and Planning Commission (China)
TFEC	Total final energy consumption
TPES	Total primary energy supply
toe	Tonnes of oil equivalent
TWh	Terawatt-hours (Billion kWh)
US or USA	United States of America
VND	Viet Nam Dong

# AUSTRALIA

## INTRODUCTION

Australia is the sixth largest country and smallest continent in the world. It is the only continent that is its own country and lies between the Indian and South Pacific Oceans. Its dry flat continent spans approximately 7.6 million square kilometres, mostly plateaus, deserts, and fertile plains and is divided into six states and two territories. Australia's population of about 19.88 million live mostly in cities or major regional centres located on the eastern and south-eastern seaboard.

Australia has maintained robust economic growth increasing on average at 3.3 percent over the period 1990 to 2003. In 2003, GDP reached US\$517.94 billion (1995 US\$ at PPP) from US\$ 498.98 billion in 2002, further reducing its unemployment rate to 5.6 percent (December 2003) from 6.1 percent the previous year.

Australia is abundant in minerals, fossil fuels and other energy resources and is a major exporter of coal, LNG and uranium. The resource sector is the largest exporting sector of the economy and covers over 35 percent of Australia's export earnings. Over 70 percent of Australia's international trade is with APEC economies and Asia accounts for around 60 percent of Australian trade. However, reliance on energy export markets has made the Australian economy very sensitive to changes in foreign earnings, arising from fluctuations in international market prices.

Table 1 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	7,600,000	Oil (MCM)	700
Population (million)	19.88	Gas (BCM)	2,550
GDP Billion US\$ (1995 US\$ at PPP)	517.94	Coal (Mt)	82,090
GDP per capita (1995 US\$ at PPP)	26,052		

Source: Energy Data and Modelling Centre, IEEJ. \* Proved reserves at the end of 2003 from BP Statistical Review of World Energy 2004.

## ENERGY SUPPLY AND DEMAND

### PRIMARY ENERGY SUPPLY

In 2003, the total supply of primary energy net of trade in Australia reached 123,536 ktoe. Significant increases have occurred in coal, which contributed the largest share of about 40 percent, followed by oil at 30 percent, and natural gas at 20 percent. Since 1980, supply from gas exhibited the greatest growth at 5.2 percent, followed by coal 2.8 percent, and oil (the least) at 0.9 percent per annum. Supply from other sources (i.e. wood, bagasse, hydro, geothermal, solar, etc.) has also shown significant growth in recent years increasing on average at 3.9 percent over the period 1980 to 2003.

Australia is the world's largest exporter of coal and the fourth largest producer behind China, US and India. Australia produces high quality coking and steaming coals that are high in energy content, low in sulphur, ash and other contaminants. In 2003, total coal production reached 179,573 ktoe, 72 percent (or 128,530 ktoe) of which was exported to other economies. Coal plays a central role in the Australian economy, accounting for approximately 10 percent of Australia's total

export income and around 77 percent of all electricity produced in Australia. Over the past few years, Australia's production and exports of coal have grown, with exports increasing by approximately 6 percent a year.

In 2003, Australia's natural gas reserves reached 2,550 BCM, an almost four fold increase over the past two decades. Most of the increase came from the western and north-western areas and at current production levels, Australia's natural gas reserves should last around 77 years. Total consumption from natural gas reached 25,229 ktoe in 2003. About half of this, or 17,594 ktoe was consumed domestically, while the rest was exported, as liquefied natural gas (LNG) mostly to Japan. Australia began exporting LNG to the Asia Pacific region in the late 1980s<sup>1</sup>.

Australia is a net importer of oil and petroleum products. Despite its 31,726 ktoe crude oil and condensate production in 2003, its total demand exceeded domestic supply. In 2003, import dependency for crude oil and petroleum products was around 23 percent. Oil reserves in 2003 stood at 700 million cubic metres (MCM), up from 254 MCM in 1990. The reserve to production ratio is around 19 years.

About 229,015 GWh of electricity was generated in 2003, mostly from thermal sources (92 percent) with a modest amount (about 7 percent) from hydro sources. Most of the fuel used in thermal plants came from coal, while the rest was generated from oil and gas. Electricity demand has been growing at about 3.4 percent per year for the past two decades.

Table 2 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	257,241	Industry Sector	24,187	Total	229,015
Net Imports & Other	-133,705	Transport Sector	28,382	Thermal	209,705
Total PES	123,536	Other Sectors	27,271	Hydro	16,448
Coal	49,393	Total FEC	79,840	Nuclear	-
Oil	37,666	Coal	2,793	Others	2,862
Gas	25,229	Oil	37,817		
Others	11,247	Gas	17,798		
		Electricity & Others	21,432		

Source: Energy Data and Modelling Center, IEEJ.

For full detail of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

### FINAL ENERGY CONSUMPTION

In 2003, the total energy consumption in Australia reached 79,840 ktoe. Total energy consumption was equally divided between the industry, transport and other sectors. Industry<sup>2</sup> consumed 30 percent of energy, the transport sector 36 percent, and other sectors (including residential, commercial and agriculture) 34 percent. By fuel source, petroleum products accounted for 47 percent of consumption, natural gas for 22 percent, and coal 4 percent. Electricity accounted for 27 percent of consumption.

<sup>1</sup> The commencement of LNG shipments to Japan from the newly commissioned Darwin LNG plant and to China from the North West Shelf in 2006 will result in a significant increase in Australia's LNG exports. Further expansion of the North West Shelf in 2008 and the development of greenfield projects such as Greater Gorgon and Pluto could result in Australian LNG exports more than doubling by the end of this decade.

<sup>2</sup> Industrial consumption includes the mining sector; however, does not include the agricultural sector, which is contained in "other".

Impediments to the widespread use of gas domestically are the large distances between the main sources of supply in the far west part of the continent and the centres of demand on the eastern seaboard, and the very competitive price of steam coal for power generation. Despite these impediments, it is expected that extensions of the natural gas pipeline network will be built in response to strong demand, particularly from the mining, manufacturing and electricity generation sectors. Since 1980, consumption of natural gas has grown at an annual rate of 5.0 percent, much faster than any other energy type and it is expected that domestic natural gas consumption will grow at around 5 percent per annum over the next decade.

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## POLICY OVERVIEW

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### NATIONAL ENERGY SECURITY<sup>3</sup>

Australia enjoys a high level of energy security characterised by relatively low-priced reliable energy supplies and a significant natural endowment of energy resources including coal, natural gas, crude oil and a significant potential for renewable energy. Underpinning Australia's natural energy endowments are extensive infrastructure and well-functioning domestic and international energy markets.

Notwithstanding its current energy security position, the Australian Government undertook a wide-ranging review of Australia's energy policy. This culminated in the release of the Energy White Paper Securing Australia's Energy Future in June 2004<sup>4</sup>.

The Energy White Paper (EWP) provides the policy context for Australia's energy policy as well as Australia's energy security policy. The Australian Government's energy objectives consist of:

- prosperity – that the value of energy resources is optimised;
- security - that Australians have reliable access to competitively priced energy; and
- sustainability – that environmental issues are well managed.

Within these broad energy policy objectives, the EWP establishes an energy security policy to address both short-term and long-term energy security challenges. The policy is characterised by a focus on well-functioning national and international energy markets, minimum effective regulation, meaningful public-private partnerships, and practical, intra-regional dialogue on energy security rather than viewing self-sufficiency in energy resources as synonymous with energy security.

The EWP identifies the main long-term energy security challenge as that of attracting timely large-scale investment in sustainable supply systems to meet the growing demand for energy. Accordingly, it recommended that the Government undertake a biennial review of the national energy security outlook, to consider the adequacy of existing policy and Australia's international commitments and obligations. Consequently, this review, being undertaken by the Australian Government Department of Industry, Tourism and Resources, analysed energy security from the perspective of the domestic stationary and non-stationary energy sectors, providing information on short and long-term issues that may impact on the security of Australia's energy supplies, thereby facilitating informed policy-development.

### UPSTREAM ENERGY DEVELOPMENT

To maximise the value of Australia's energy resources, the Australian government aims to provide consumers with reliable supplies of competitively priced energy, ensure an appropriate

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<sup>3</sup> [http://www.pmc.gov.au/publications/energy\\_future/docs/energy.pdf](http://www.pmc.gov.au/publications/energy_future/docs/energy.pdf)

<sup>4</sup> Australia's energy white paper is available from [http://www.pmc.gov.au/energy\\_future/](http://www.pmc.gov.au/energy_future/)



return to the community for the development of its depletable resources, and meet environmental and social objectives.

The Australian government's approach in developing the economy's energy resources is guided by the following basic principles:

1. Private decision makers should be allowed to manage risk in a regulatory framework that is predictable, transparent, equitable and timely
2. Energy resource development should be required to comply with standards of environmental performance which are commensurate with those imposed on other sectors of the economy
3. Commercial decisions should determine the nature and timing of energy resource development, with government interventions being transparent and allowing commercial interests to seek least-cost solutions to government objectives (e.g. environment, safety or good resource management objectives)
4. Government objectives should generally be driven by sector-wide policy mechanisms rather than impose inconsistent requirements on individual projects/private investors

Australia is proven to be highly prospective for many of its resources, particularly for coal, uranium and gas. Large oil resources, such as the giant Bass Strait oil fields, have been found. Australia also has some 40 offshore basins of petroleum potential, but half of these remain unexplored because of the cost and high-risk nature of exploration in frontier areas. Encouraging further exploration in these areas is one of the Australian government's priorities.

To this end in April 2005, the Australian government made available a number of new offshore petroleum areas for exploration. Twenty-nine (29) areas in Commonwealth waters (that is between 3 nautical mile territorial limit and limit of Australian jurisdiction) were released. Fourteen (14) areas are available for bidding (in the form of work programs) until April 2006; a further fifteen (15) areas remain open until October 2006.

### **FISCAL REGIME AND INCENTIVES**

Determining the relative attractiveness of energy resource projects depends for the most part on Australia's taxation requirements. The large-scale nature of energy projects and its consequent need for international capital support has made the energy sector most sensitive to the international competitiveness of Australia's fiscal regime than in many other sectors.

The attractiveness of Australia's fiscal regime is based on two areas: 1) general taxation regime that applies to all projects; and 2) secondary taxation system that applies to the use of community-owned underground resources. In principle, energy sector investments are treated equally with other large investments in the general taxation system. The Australian government has implemented major reforms to business taxation to improve the economy's international competitiveness, including the reduction of company tax rate from 36 to 30 percent from 2001-2002. Secondary taxes, on the other hand, apply to underground mineral and energy resources, and are applied by both the Australian (offshore) and state (onshore) governments. The taxes are designed to compensate the community for allowing the private extraction of Australia's depletable resources.

The secondary tax system, which applies to coal, uranium, gas and liquid petroleum vary across Australia. State and territory royalties apply to energy resources in those jurisdictions and are generally 'ad valorem'. In Australian government jurisdictions (e.g. beyond coastal waters to the outer limits of Australia's continental shelf), Petroleum Resource Rent Tax (PRRT) applies in all areas except for the North-West Shelf; where the excise and royalty regimes have been maintained to keep up with government's long standing assurances that the fiscal regime for the North West Shelf project would remain stable.

The PRRT is a profit-based tax that automatically adjusts to changes in prices and costs. The regime has performed well, owing to its international competitiveness and efficiency.

## NATIONAL ELECTRICITY MARKET REFORM

Restructuring of the Australian electricity industry (which actually started as early as 1990) consisted of vertical separation of the vertically integrated, state-owned utilities into separate: generation, transmission, distribution, and retail supply components; corporations, privatization of electricity businesses; horizontal separation of generation sector into numerous competing businesses; separation and regulation of transmission and distribution functions; introduction of retail competition; and others.

One important element of reform was the establishment of the 'National Electricity Market' (NEM) in December 1998. NEM is composed of the Australian Capital Territory, New South Wales, Victoria, South Australia and Queensland. NEM is basically made up of the electricity generators, a competitive retail sector, and the regulated network sectors. It was created to promote competition and efficiency, both in production and consumption of electricity, and its associated services. It should also allow customers some flexibility and choice of supplier, without room for discrimination against technology, location of customers and suppliers.

The National Electricity Market Management Company (NEMMCO), will be responsible for the management of the spot market and the central coordination of the dispatch of electricity from all generators to ensure sufficiency of supply to meet the demand. NEMMCO will also be responsible for maintaining power system security. The NEM spot market is the mechanism for balancing electricity supply and demand. Generators with a capacity greater than 30 MW are required to sell all electricity through the spot market. NEM's operations are governed by a set of rules and regulations contained in the National Electricity Code. The code should allow participants maximum level of commercial freedom, in a market that is transparent and efficient. Trading risks are hedged via financial contracts managed in secondary markets.

A single National Energy Regulator has now been established, which is responsible for transmission and market monitoring. At the end of the decade, it is expected to be the only regulatory body for the electricity industry.

## NATIONAL ENERGY POLICY FRAMEWORK

In 2001, Australian governments agreed to establish a national energy policy framework to guide future energy policy decision making by jurisdictions and to provide increased policy certainty for energy users, including households and small businesses.

The Council of Australian Governments (COAG) has agreed on the following national energy policy objectives:

- Encouraging efficient provision of reliable competitively priced energy services to Australians, underpinning wealth and job creation and improve quality of life, taking into account the needs of regional, rural and other remote areas. stronger
- Encouraging responsible development of Australia's energy resources, technology and expertise, their efficient use by industries and households and their exploitation in export markets.
- Mitigating local and global environmental impacts, notably greenhouse gas emission impacts of energy production, transformation, supply and use.

COAG also commissioned a wide-ranging review of the strategic direction of stationary energy markets in Australia. The review, which was published at the end of 2002, recommended an ambitious programme of reform. Measures included significant changes to improve and streamline governance and regulation, a market oriented approach to transmission, and new demand-side proposals. The projected impact on GDP of the review's reform programme was estimated at nearly \$7 billion in net present value terms over the period 2005-2010.

The Ministerial Council on Energy (MCE) responded substantively to the COAG review proposals in December 2003 in their report to COAG on *Reform of Energy Markets*. This was

followed by an Expanded Gas Program in April 2004. The energy market reform program was formalised in the *Australian Energy Market Agreement*, which was endorsed by the Prime Minister and all Premiers and Chief Ministers on 30 June 2004. The program consists of the following elements:

*Governance and Institutions:*

- The Ministerial Council on Energy as the single national energy market governance body, supported by a national legislative framework (effective 1 July 2004).
- Two new national institutions, the Australian Energy Market Commission and the Australian Energy Regulator will be established. These bodies will undertake market development functions and economic regulation, respectively.

*Economic Regulation:*

- National approaches to energy access and distribution and retail regulation for electricity and gas will be developed.

*Electricity Transmission:*

- Improve the market orientation of electricity transmission arrangements through market-based incentives for transmission performance, improved assessment of regional boundaries and transmission planning, and a new regulatory test for transmission investments.

*User Participation:*

- Encourage increased end-user participation in the energy market through various means including enhanced demand-side response mechanisms and interval metering.

*Gas Market Development:*

- Improve gas access arrangements through the Ministerial Council on Energy's response to the Productivity Commission's 2004 Review of the Gas Access Regime.
- Develop principles to underpin future gas market development<sup>5</sup>.

## RENEWABLES

Australia's renewable energy currently accounts to less than 5 percent or 244 petajoules of total energy consumption. Hydro is largely used for electricity generation and accounts to approximately 90 percent of the total share of renewable electricity generated and is expected to grow at about 0.6 percent per year, reaching about 18 TWh by 2019 – 2020. By contrast, wind power is expected to grow from 1 TWh to 4 TWh.

Australian authorities have introduced a range of policy measures to support the development of renewable energy. Among these measures are the: 1) Mandatory Renewable Energy Target (MRET) scheme and 2) the State Government's solar hot water scheme amongst others. MRET requires the generation of 9,500 GWh of extra renewable electricity per year by 2010. Certificates are issued to the electricity generated from eligible technologies. Purchasers of electricity, on the other hand, are required to surrender a specified number of certificates for the electricity they require during the year.

In the 2004 Energy White Paper released by the government, there are a number of programs in relation to the promotion of renewable energy that have been announced, these include;

- Renewable Energy Development Initiative (REDI), which is designed to encourage innovation through a competitive, merit-based grants program focused on supporting innovative technology, products, processes, and services that have a strong early-stage commercialization and emissions-reduction potential.

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<sup>5</sup> Further information on the MCE's energy market reform program can be found at [www.mce.gov.au](http://www.mce.gov.au).

- \$75 million Solar Cities trials to provide working demonstrations of how technology and efficient markets can combine for a sustainable energy future.
- Other programs include wind forecasting and electrical storage initiatives.
- In January 2006, the Australian government announced that of the AU\$ 100 million designated for low emission technology demonstration projects under the Asia-Pacific Partnership on Clean Development and Climate (AP6) AU\$ 25 million will be dedicated to renewable energy projects.

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## **NOTABLE ENERGY DEVELOPMENTS**

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### **NATIONAL ENERGY SECURITY OUTLOOK**

The Australian Government, through the Department of Industry, Tourism and Resources, is undertaking a biennial review of the national energy security outlook considering existing policy and international obligations. The review will analyse energy security from the perspective of the domestic stationary and non-stationary energy sectors, providing information on short and long-term issues that may impact on the security of Australia's energy supplies. The first draft report was presented to Government in 2005.

### **NATIONAL ENERGY MARKET REFORM**

Australia has made significant progress in implementing its energy market reform program, involving coordinated actions by federal and state governments through the Ministerial Council on Energy (MCE). The key objective of the MCE is to develop a competitive and efficient national energy market, for electricity and gas.

Recent progress includes:

- On 1 July 2005, National Electricity Laws, Rules and Regulations commenced operation. This legislation is a co-operative scheme for electricity, which establishes a wholesale exchange for participants in the National Electricity Market and an open access regime for transmission and distribution networks.
- In July 2005, two new energy market governance bodies commenced operations for the electricity market, the Australian Energy Regulator (AER) and the Australian Energy Market Commission (AEMC). The new National Electricity Laws and Rules confer the responsibility for market regulation on the AER and rule making and market development on the AEMC.
- The previous National Electricity code formed the basis for the new statutory rules, which have the force of law.
- In May 2005, the MCE released a statement outlining a broad forward agenda for achieving the objective of a national transmission system.

Further work is progressing on:

- The development of a national approach to energy access.
- Establishment of an agreed national framework for distribution and retail regulation, that will reduce regulatory uncertainty and compliance costs for businesses operating across jurisdictions.
- Further increasing the penetration of natural gas:
  - Legislation is currently being developed to bring the gas sector under the new governance and institutional arrangements by 2006.

- The MCE is to respond to the Productivity Commission's Review of the Gas Access Regime in mid 2005.
- Following industry consultation in March/April 2005, the MCE is considering options for the development of a natural gas (wholesale) market.
- Improving the planning and development of electricity transmission networks to create a stable framework for efficient investment in new generation and transmission.
- Enhancing user participation in energy markets through demand-side response, interval metering, consumer advocacy and awareness:
  - A national model for energy consumer advocacy is being developed following consultation on options in April 2005<sup>6</sup>.

### **OFFSHORE PETROLEUM EXPLORATION ACREAGE RELEASE AND INCENTIVES**

The Australian Government does not undertake or finance petroleum exploration, and therefore relies upon an annual acreage release to create opportunities for exploration investment. Details of the areas released, bidding requirements and permit conditions are contained in a comprehensive information package that is widely distributed in Australia and overseas.

In April 2005, the Australian Government made available details of its annual acreage release of offshore areas for petroleum exploration. The 29 areas released this year include acreage in Commonwealth waters adjacent to South Australia, Western Australia, Northern Territory and the Territory of Ashmore and Cartier Islands.

As part of Australia's efforts to encourage the exploration and testing of petroleum prospectivity in frontier areas, five of the blocks released have been designated as "frontier areas" attracting a tax concession. This concession takes the form of a 50 percent increase in the value of exploration expenditure tax credits. To enhance further interest in these areas Geoscience Australia, the geological research arm of government, has collected seismic and sample data in two of the frontier blocks. A report assessing the outcomes of this work was presented in a workshop to industry in October 2005 with a view to attracting bids<sup>7</sup>.

### **PETROLEUM RESOURCE RENT TAX (PRRT)**

The PRRT is a secondary tax based on a project's profitability, and applies to all petroleum products from a project (but not value added products, such as LNG) in Commonwealth waters, except for the North West Shelf project. The tax provides a fiscal regime that encourages the exploration and production of petroleum, while ensuring an adequate return to the community for the exploitation of these non-renewable resources.

On 10 May 2005, the Australian Government announced that it would introduce a number of policy changes to the PRRT. The changes to the PRRT will reduce compliance costs, improve administration and remove inconsistencies in the PRRT regime. These changes will take effect from 1 July 2006.

### **NATURAL GAS**

The North West Shelf joint venture partners have announced that work will begin immediately on expanding the onshore-liquefied natural gas (LNG) facilities at Karratha, Western Australia, following final investment decisions by all of the joint-venture participants. The A\$2 billion Phase V expansion project will include a fifth train to process 4.4 million tonnes of LNG a year,

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<sup>6</sup> Further information on Australia's national energy market reform program is available at <http://www.mce.gov.au>

<sup>7</sup> Further information on Australia's 2005 Offshore Petroleum Exploration Acreage Release is available at <http://www1.industry.gov.au/acreagereleases2005/main.htm>

increasing the facility's capacity to 16.3 million tonnes a year. The first LNG cargoes are planned for the fourth quarter of 2008.

Shipments to Japan from the newly commissioned Darwin LNG plant, utilising gas from the Bayu Undan field in the Timor Sea, commenced in February 2006.

Following extensive consultation with the petroleum industry, the Australian Government has decided to adjust the proposed Gas Transfer Pricing Regulations. The changes will improve taxpayer certainty and simplify the calculation of a gas transfer price for an integrated gas-to-liquids project. Further technical changes have been made to the proposed Regulations dealing with the materiality threshold for apportioning costs and the endpoint of the downstream stage of a project.

The implementation of the Regulations will facilitate investment in Australia's natural gas resources and provide a sound basis for the development of the liquefied natural gas industry. The Regulations will commence prior commencement of the next relevant project.

Australia's main short-term security concerns include disruptions to energy production and distribution. The Ministerial Council on Energy (MCE) is developing a Protocol for the sharing of gas between interconnected jurisdictions in the event of a major gas disruption. The first phase of this process has been completed with the signing of a Memorandum of Understanding (MOU) in January 2005 which provides for MCE Ministers and jurisdictional officers to use all reasonable endeavours to consult before invoking State emergency powers in the event of a major gas supply shortfall affecting more than one jurisdiction. The MOU and Protocol will complement arrangements already in place to handle oil supply disruptions.

### **CRITICAL INFRASTRUCTURE PROTECTION**

The Australian Government has an established Energy Infrastructure Assurance Advisory Group (the Energy Group) within Australia's, cross-sectoral cross-jurisdictional, Trusted Information Sharing Network (TISN). Under the terms of the TISN, the Energy Group facilitates the sharing of information between owners and operators; including information on issues relating to generic threats to, and vulnerabilities in, critical energy infrastructure, and the development of appropriate measures, and strategies to mitigate risk.

### **URANIUM**

The Australian Government is developing a Uranium Industry Framework to identify key opportunities for, and impediments to, the growth of the Australian uranium mining industry in the short, medium, and longer term. The Framework is being developed in partnership with relevant State and Territory Governments, industry and other stakeholders.

A high-level Steering Group comprised of senior stakeholder representatives will be responsible for guiding the development of the Framework. In addition, a Reference Group will be established to inform a broad range of stakeholders of developments in the Framework.

The Framework will have a three-year timeframe, and will involve the identification and prioritization of issues. During the first year, an Action Plan is to be developed followed by a two-year implementation phase. Issues likely to be considered include infrastructure, transport (international and domestic), royalties, environmental, and regulatory arrangements.

### **ALTERNATIVE FUELS**

In May 2005, the Australian Government announced the establishment of a Biofuels Taskforce to examine the latest scientific evidence on the impacts of biofuel use on human health, environmental outcomes and automotive operations. On this basis, and taking into account the most recent economic analyses of Australian fuel supplies, the Taskforce assessed the costs and

benefits of biofuels production, and presented its final report to the Government at the end of July 2005<sup>8</sup>.

### DOWNSTREAM PETROLEUM

In March 2005, the Australian Government continued stakeholder consultations, on a reform package for domestic downstream petroleum legislation.

The reform package seeks to strengthen the current legislative environment by repealing the two separate Acts legislating downstream petroleum industry and introducing a single national Oil Code under the *Trade Practices Act, 1974*. Implementation of the package is being considered by the Government and a bill to repeal the existing legislation may be introduced to the Australian Parliament during 2006.

The new Oil Code will apply to all market participants and is intended to provide industry benefits including:

- Greater flexibility in efficiently marketing products;
- A national approach to terminal gate pricing;
- Fairer contractual arrangements; and
- Access to a downstream petroleum dispute resolution scheme.

In addition, the Oil code will provide improved tenure agreements for both commission agents and oil company franchisees, including retail operators.

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<sup>8</sup> Further information on Australia's Bio fuels Taskforce is available at: <http://www.pmc.gov.au/biofuels/index.cfm>.

# BRUNEI DARUSSALAM

## INTRODUCTION

Brunei Darussalam (the Abode of Peace) is located on the northwest side of the island of Borneo. It has a total land area of about 5,765 square km and a 161 km coastline along the South China Sea. It is bounded on the north by the South China Sea and all other sides by the Malaysian state of Sarawak; which divides Brunei Darussalam into two parts. The eastern part is the Temburong District, and the western part consists of Brunei-Muara, Tutong and Belait Districts. In 2003, the population of Brunei Darussalam was about 0.36 million.

The real gross domestic product (GDP) at current price in 2003 was recorded at US\$5,340 million and the GDP per capita was at US\$14,988, a decrease of 1.6 percent compared to the previous year which was at US\$15,237 for the GDP per capita and at the same real gross domestic product (GDP) at current price, mainly attributed to oil and gas sector.

The steady political situation and excellent vision of His Majesty the Sultan and Yang DiPertuan have made it possible for Brunei Darussalam to achieve sustainable economic prosperity and stability. Brunei Darussalam's economy has been heavily relying on oil and gas since its discovery in 1929. The oil and gas sector is the main source of the economy's revenue which constitutes about 90 percent of Brunei Darussalam's exports and about 37 percent of its GDP. To further sustain and strengthen the oil and gas industry, his Majesty's Government is promoting and pursuing an economic diversification policy thus actively pursuing the development of the new upstream and downstream activities.

Brunei Darussalam's crude oil and condensate production in 2003 averaged 214 thousand barrels per day. The gas production for 2003 was about 34 million cubic metres per day, which were mostly exported to Japan and South Korea as liquefied natural gas (LNG).

Table 3 Key data and economic profile (2003)

Key data		Energy reserves**	
Area (sq. km)	5,765	Oil (MCM)	223
Population (million)	0.36	Gas (BCM)	350
GDP at current prices (Million US\$)*	5,34	Coal (Mt)	-
GDP per capita (US\$)*	14,988		

Source: Energy Data and Modelling Center, IEEJ. \* Brunei Darussalam Key Indicators 2003.

\*\* Proved reserves at the end of 2003 from BP Statistical Review of World Energy 2004.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Brunei Darussalam is the third-largest oil producer in Southeast Asia. It is also the fourth largest producer of liquefied natural gas in the world. In 2003, the total primary energy supply of Brunei Darussalam reached 3,798 ktoe, increasing by 14 percent compared to 2002. Brunei's oil and gas production was 21,774 ktoe, an improvement of 4.8 percent from its 2002 production of 20,769 ktoe, and 89 percent of which was exported. Natural gas represents 77 percent of the total energy supply while oil represents 23 percent.

Total proven crude oil reserves are 223 MCM. Oil is exported mostly to Japan, Korea, Singapore, Chinese Taipei and Thailand. Brunei Darussalam has natural gas reserves of 350 BCM,



and the long-term prospects for its production are thought to be excellent. Most of Brunei's LNG is exported to Japan, with a small amount going to South Korea. Despite the good prospects for the growth of oil and gas exports, Brunei Darussalam's economy is still vulnerable to movements in global oil prices. The drop in global oil and gas prices (as was experienced in the past) have continued to weigh down on Brunei Darussalam's economy, including that of its trading partners, which resulted to reduced energy demands.

However, Brunei Darussalam's economy is expected to remain strong with the implementation of the 8<sup>th</sup> National Development Plan (NDP 2001-2005). With the US\$4 billion budget allocated for the implementation of the 8<sup>th</sup> NDP, the economy is optimistic that its targeted growth rate of 5-6 percent will be achieved.

In 2003, the economy's total installed generating capacity under the Department of Electrical Services (DES) and the Independent Power Utility namely the Berakas Power Company (BPC), reached 810.1 MW. DES and BPC each have an installed capacity of 552.5 MW and 257.6 MW respectively. Almost all, or 99.7 percent of the total electricity generated was supplied by natural gas. Total generation for 2003 was 3,169 GWh, about 5 percent higher than 3,017 GWh in 2002.

### FINAL ENERGY CONSUMPTION

In 2003, the total final energy consumption of 703 ktoe went up by 2 percent from 689 ktoe in 2002. The shares of the three sectors remain unchanged. The transportation sector consumed 52 percent of the total amount, followed by other sectors (residential, commercial and non-energy) at 34 percent and industrial sector at 14 percent. By source, petroleum products contributed the largest share with 63 percent of consumption, followed by electricity at 33 percent and gas at 4 percent.

Table 4 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	21,774	Industry Sector	94	Total	3,169
Net Imports & Other	-17,977	Transport Sector	371	Thermal	3,169
Total PES	3,798	Other Sectors	238	Hydro	-
Coal	-	Total FEC	703	Nuclear	-
Oil	684	Coal	-	Others	-
Gas	3,113	Oil	442		
Others	-	Gas	27		
		Electricity & Others	233		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

### POLICY OVERVIEW

Brunei Darussalam has so far implemented seven National Development Plans (NDPs). The long-term objectives outlined in these NDPs, particularly the current 8<sup>th</sup> NDP, place specific emphasis on programmes to strengthen and expand the oil and gas industry, economic diversification through non-oil industries, maximum economic utilisation of national resources, improvements in the quality of life of the people, and promotion of a clean and healthy environment. In pursuing these objectives, development plans will continue to focus on strategies and programmes that will expedite the process of industrialisation with the end in view of achieving more balanced socio-economic development. The government is also working on improving the economy's investment climate to attract and encourage the private sector to play a more active and important role in the development of the economy.

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## OIL AND GAS

To extend Brunei Darussalam's oil reserves, the Brunei Oil Conservation Policy was introduced in 1980. It came into effect in 1981 and has resulted in oil production of around 150,000 barrels per day. Since November 1990, the government has given flexibility to the Conservation Policy, which further increased production availability.

In 1992, the Petroleum Mining Act was amended with all its schedules (including the Second and the Third Schedules) repealed. The move is partly due to the government's desire to introduce other forms of agreements (non-concessionary) for future petroleum mining activities. The amended act provides for procedures where the government may invite persons to bid for a petroleum mining agreement with respect to any onshore state land or offshore state land for purposes of exploring or mining petroleum. Any person interested to bid shall therefore conform to such terms and conditions, imposed by the Government, in the invitation to bid.

In 2000, the Brunei Natural Gas Policy (Production and Utilisation) was introduced. It seeks to sustain gas production levels in order to adequately satisfy current obligations. It also seeks to open new areas and encourage more exploration activities by new and existing operators. It provides that priority shall always be given to domestic utilisation of gas, especially for power generation.

Amendments to the Petroleum Mining Act, made in January 2002, recognise the formation of Brunei National Petroleum Company Sdn Bhd (Petroleum Brunei). The company has the right to perform both commercial and regulatory functions. One of its regulatory functions is to act as a state party in the negotiation, conclusion and implementation of Petroleum Mining Agreements. New petroleum areas such as the deepwater Blocks J and K are to be awarded under Production Sharing Contract (PSC) with Petroleum Brunei's participation.

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## NOTABLE ENERGY DEVELOPMENTS

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### DEVELOPMENT OF DOWNSTREAM OIL AND GAS INDUSTRY

In an effort to diversify Brunei Darussalam's oil and gas based economy, the government commissioned an international consultant to conduct the Brunei Darussalam Master Plan Study on Downstream Oil and Gas Industry. The study was completed in 2001 and has identified the following potential industries to be developed in Brunei Darussalam:

- Gas based industry such as ammonia, urea and methanol;
- Derivatives of olefins and aromatics from naphtha cracker with the possibility of integration with a refinery; and
- Energy intensive industry such as aluminium smelters.

In 2002, Petroleum Brunei called for expressions of interest for investment in the petrochemical projects to be located at the Sg. Liang Industrial site in the Belait District from which investors were short listed to conduct their Detailed Feasibility Study (DFS) on their proposals. The DFS reports were submitted in the third quarter of 2003 from which selection for project implementation will be by first half 2004.

In January 2003, the Brunei Economic Development Board (BEDB) has announced its "two-pronged strategy" that included plans for the development of Sungai Liang, Pulau Muara Besar and the identification of other industry clusters for FDI, as well as for local investment. BEDB has reviewed one of its current policies and procedures that an approval has been granted by His Majesty's Government for the change of policy on the ownership and lending of industrial land. This would enable BEDB to lease, sublease or sublet industrial lands and buildings to investors and for the assets involved to be changed as collateral for bank financing.

## LNG SIXTH TRAIN EXPANSION OPPORTUNITY

Brunei LNG has embarked on a program to expand its present capacity of 7.2 million tonnes per year to 11.2 million tonnes per year by 2010. Brunei LNG will also refurbish existing capacity to extend its operating life to 20 years, or up to 2033. It is also aiming for continued LNG sales beyond 2013. Around B\$2.4 billion is earmarked for investment over the next 13 years to support such activities. The feasibility study will begin early 2003, and a final investment decision is expected in 2005.

## OPENING OF NEW PETROLEUM AREAS

In the new petroleum areas, two consortia bid for Block J (5,020 sq km), and one for Block K (4,944 sq km) were received. Both blocks are located offshore in the deep water Exclusive Economic Zone (EEZ). Evaluating bids were submitted by many multinational firms and the exploration work for oil and gas on two blocks 'L' and 'M' are due to begin soon. Block L covers 2,253 square kilometres covering an area of the whole Brunei-Muara District and part of the Tutong District. The eastern boundary covers the Brunei Bay area. Block M covers an area of 3011 square kilometres: it includes acreage recently relinquished by BSP and an unlicensed area of the southern tip of Belait District.

On 29 January 2002, the government awarded Block J to a joint venture of TotalFinaElf, BHP Billiton, and Amerada Hess Corporation. TotalFinaElf (the designated operator) holds a 60 percent interest, while BHP Billiton and Amerada Hess hold the remaining 25 percent and 15 percent respectively. The government has also awarded exploration rights to Block K to a joint venture led by Shell International (the designated operator) owning 50 percent interest, including Conoco and Mitsubishi with 25 percent interest each.

## POWER SECTOR

There are two major power utilities in Brunei Darussalam, namely the state-owned Department of Electrical Services (DES) and an independent power utility, the Berakas Power Company Private Limited (BPC). The existence of BPC has actually relieved the Department of Electrical Services of the administrative and financial burden of supplying power to several strategic loading (areas). BPC today supplies about 40 percent of the total loads in Brunei Darussalam.

The total installed capacity of DES and BPC are about 553 MW and 258 MW respectively. The total installed capacity is about 811 MW. In 2003, the maximum demand recorded by DES and BPC were about 258 MW and 184 MW respectively, an increase of about 3 percent of the total load demand compared to previous year. Today, almost 100 percent of the population are being provided with the electricity supply from the grid. However, Brunei Darussalam electricity industry may face a major challenge of increasing electricity demand if the various industrial projects being considered by BEDB are materialised.

The Department of Electrical Services has formulated plans to fulfil the increasing energy demands in line with the economic development. To accomplish its mission to provide electricity supply in an efficient, reliable, safe, as well as economical manner to upgrade the standard of living of the people and for the development of the country, the Department has embarked on several major projects in its power development plan in the current 8<sup>th</sup> NDP (2001-2005). In this 8<sup>th</sup> NDP, the electricity sector has been allocated B\$529.7 million or 7.3 percent of total development funds.

The collective factors from the natural demand growth and scheduled retirement of generating machines, necessitates the Department to undertake the construction of various planting up program so as to uphold the supply and demand profile in the best secure and effective manner. In 2001, two units 3 MW diesel-generating sets were installed and commissioned in the Temburong District. Ninety-nine (99) MW of additional generation capacity in Gadong I Power Station was commissioned in 2002. In addition, a contract has been awarded on 27th April 2005 for the

construction of a 116 MW Combined Cycle Power Plant (Phase I) at Bukit Panggal and is expected to be completed in July 2007.

### **REDUCING THE OIL AND GAS INDUSTRY'S CONTRIBUTION TO GLOBAL WARMING**

The oil and gas industry is one of the major contributors to global warming through the emission of methane and carbon dioxide (CO<sub>2</sub>). The main sources of methane emissions are process venting, instrument gas and fugitives. Major sources of CO<sub>2</sub> emissions include process flaring, atmospheric gas flaring (where recovery is uneconomic), fuel gas combustion (gas turbines and other prime mover exhausts), and transport.

As part of their environmental initiatives, major oil and gas producers in Brunei Darussalam plan to reduce the disposal of gas by continuous venting and flaring by 2003 and 2008 respectively. Projects undertaken to reduce venting include:

- Simplifying and rationalising old facilities, centralising processes at main complex facilities, and improving operations to reduce venting from compressor trips, fugitive losses, atmospheric gas disposal and from use of instrument gas;
- Converting existing vent stacks to flare stacks; and
- Simplifying and rationalising facilities to recover and recompress vented flash gas from surge vessels and to reduce instrument gas consumption.

Realising that fuel gas combustion contributes to a large percentage of CO<sub>2</sub> emissions, companies intend to focus more on improving the energy efficiency of gas turbines. Furthermore, new facilities will not be designed to continuously vent and flare gas for disposal, and instrument gas in new projects will not be allowed unless it is recovered. However, venting and flaring cannot be totally phased out. Venting and flaring will be limited only to atmospheric gas disposal, instrument gas in old facilities, fugitives (minimised), safeguarding measures (purge and pilot gas, and emergency relief) and process deviations (like compressor trips, or oil production during plant shutdown and maintenance), and it will take place under strict controls.

### **DIRECTIVE ON THE SALE OF PETROLEUM PRODUCTS**

In December 2005, Prime Minister's Office issued Directive on the Sale of petroleum Products (Premium 97, Super 92, Regular 85 and Diesel aimed to cap drastic increase of demand petroleum in 2005. The Directive limit the purchase of gasoline and diesel by maximum purchase one full tank or not exceed 250 litres for direct filling into vehicle's fuel tank. For every purchase where the gasoline or diesel is filled into a container, the container to be used must be a container that has been approved by Brunei Shell Marketing Sendirian Berhard (BSM), and the amount should not exceed 100 litres. In addition purchases are limited to Brunei Darussalam's Identity card Holders only. The Directive is effective from 1 January 2006.

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# CANADA

## INTRODUCTION

Canada covers the northern part of North America and is second only to Russia in geographic size. Its small population of around 31 million, of which two-fifths is concentrated in the province of Ontario, is spread over 10 million square kilometres of territory. Canada is known for its wealth of energy and other natural resources. In 2003, its GDP accounted to roughly US\$857 billion (in 1995 US\$ at PPP), or US\$27,080 per capita. Due to this high standard of living, cold climate, long distances between major cities, and many energy intensive and bulk goods industries, Canadians are heavy energy consumers. Canada's final energy consumption per capita in 2003 was 6.3 toe or about four times the APEC average.

In recent years, Canada's economic picture has generally been very positive, providing resources for increased investments to meet social and environmental objectives. Supporting by low interest rates as well as creating strong domestic demand, Canada's real GDP increased by 3 percent compared with 2 percent in 2003. Inflation remained low and stable, with consumer prices increasing 2.8 percent in 2003 and 1.9 percent in 2004. Real GDP has grown an average of 3.2 percent per annum since the late 1990s. Unemployment averaged 7.6 percent in 2003 and 7.2 percent in 2004.

Canada is the fifth largest energy producer in the world (behind the United States, Russia, China and Saudi Arabia) and is a major energy exporter. It has abundant reserves of oil, natural gas, coal and uranium in its western provinces and enormous hydropower resources in Quebec, Newfoundland, Manitoba and British Columbia. It also has significant offshore oil and gas deposits near Nova Scotia and Newfoundland. At the end of 2003, energy reserves included 655 MCM of conventional crude oil, 27,730 MCM of oil in oil sands, 1,530 BCM of natural gas, 6,578 Mt of coal, and 432 kt of uranium. Estimates of remaining conventional crude oil reserves decreased by 5.1 percent for 2004, but this was offset by an increase in estimates for in situ bitumen in Alberta's oil sand areas. Installed electric generating capacity amounted to some 113 GW. Energy production is very important to the Canadian economy, accounting for 6 percent of GDP and 300,000 jobs in upstream and downstream operations, representing 1.8 percent of the Canadian labour force, in 2004. The gross export revenues from natural gas, petroleum, electricity and coal in 2004 were almost CAN\$59 billion, about 1 percent lower than 2003 levels.

Table 5 Key data and economic profile (2003)

Key data		Energy Reserves**	
Area (square km)*	9,984,670	Oil (MCM)***	655
Population (million)	31.95	Gas (BCM)***	1,530
GDP Billion US\$ (1995 US\$ at PPP)	856.53	Coal (Mt) - Recoverable	6,578
GDP per capita (1995 US\$ at PPP)	27,080	Oil Sands (MCM)***	27,730

Source: Energy Data and Modelling Center, IEEJ. \* Statistics Canada. \*\* National Energy Board.

\*\*\* Established reserves of oil, gas and oil sands are equal to the sum of all proven reserves and half of probable reserves.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

In 2003, Canada's energy production exceeded 395 Mtoe. Natural gas accounted for most of the supply at 38 percent, crude oil 38 percent, coal 7 percent, hydropower 7 percent, nuclear power 6 percent and other sources 4 percent. Historically, Canada is a net exporter of main petroleum

products, including motor gasoline and middle distillates. Total crude oil exports are estimated at 246 500 m<sup>3</sup>/d for 2003, an increase of 14 000 m<sup>3</sup>/d over 2002. Exports of main petroleum products and partially processed oil increased 6 percent from 2002. In 2003, crude oil imports were 141 000 m<sup>3</sup>/d and represented 47 percent of total refinery feedstock requirements in Canada. Exports account for a large portion of Canada's oil and gas production. High commodity export prices pulled up the total gross export earnings for natural gas, petroleum, coal and electricity, increasing it from a record CAN\$43 billion in 2002 to CAN\$62 billion in 2003.

Taking into account the amount of exports, imports and stock changes, Canada's domestic primary energy demand in 2003 reached a total of 271 Mtoe or 69 percent of production. In response to higher commodity price and low storage levels, exploration for oil and gas increased in 2004. At the same time, about 21,671 wells were drilled, exceeding that of 2003 by 8 percent or 1,714 wells.

In spite of the oil price increases throughout 2004, oil well completions were only 2 percent higher than 2003 and the proportion of dry wells drilled remained at 6 percent. The largest source of crude production is the Western Canadian Sedimentary Basin (WCSB). Declining WCSB reserves were nearly offset by reserve additions from the East Coast offshore and oil sands. Recent declines in light crude production have been offset by additional production of heavy crude. Conventional crude oil and natural gas liquids made up the bulk of oil production, but 36 percent of production in 2004 came in the unconventional forms of bitumen, synthetic crude and pentanes plus. Synthetic crude from oil sands in Alberta, which had a supply cost of some CAN\$22 per barrel in the 1990s, is expected to grow in importance as technology lowers costs to CAN\$15-\$18 per barrel. In 2003, crude oil production exceeded 136 Mtoe, where 75 percent was exported mainly from western Canada. Meanwhile, nearly 54 Mtoe of oil was imported into eastern Canada, so that net oil exports were equivalent to just 31 percent of production. But the long-term prospects for oil and gas exports remain bright due to the robust demand in the US, expanding pipeline capacity, and continued discoveries. The oil pipeline infrastructure is being strained to the limit and plans are being made for both expansions and new pipelines to accommodate growing oil sands production.

Because of the strong natural gas prices in 2003, exploration activities focused on gas; reaching about 72 percent of all wells drilled. Producers have actively expanded their drilling programs in Northeastern British Columbia, the Alberta Foothills, Southeast and Central regions increasing with 11 percent from 2003. In addition, natural gas production increased 1 percent in 2004 from 2003. Gas production in 2004 totalled more than 170 Mtoe, of which net gas exports of around 90 Mtoe were equivalent to 53 percent. In 2004, net export volumes on natural gas increased by 3.1 percent from 2003 while total gross exports went up 2.9 percent from the previous year because of slightly increasing in gas production and moderately decreasing in weather-sensitive gas demand in Canada. In addition, the higher exports were primarily used to meet increased gas consumption in the United States for the industrial and electric power generation sectors. Net export on natural gas accounted for 51 percent of total Canadian production in 2004, higher than that of 49.8 percent in 2003. While the existing natural gas transportation infrastructure has some spare capacities, applications for new pipelines to delivery production from new sources continue to be filed.

To deal with the growing natural gas demand in Canada as well as exporting additional natural gas supplies to the US, there are seven proposals to construct LNG import facilities in Canada, six of which are at various stages of the environmental assessment (EA)/ regulatory review process. In August 2004, proposals of Irving Oil and Anadarko Petroleum Corporation received federal-provincial EA approval.

Table 6 Energy supply &amp; consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	395,326	Industry Sector	76,156	Total	587,023
Net Imports & Other	-124,246	Transport Sector	54,367	Thermal	174,390
Total PES	271,059	Other Sectors	69,217	Hydro	337,541
Coal	31,784	Total FEC	199,740	Nuclear	74,892
Oil	102,148	Coal	4,708	Others	200
Gas	79,195	Oil	84,502		
Others	57,931	Gas	54,208		
		Electricity & Others	56,322		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

Canada generated about 587 TWh of electricity in 2003, nearly 2.2 percent lower than in 2002. Hydropower dominated with a 58 percent share, followed by thermal plants with 29 percent and nuclear power at 13 percent. Although water conditions improved in many parts of Canada, hydro generation remained unchanged at about 59 percent of total generation in 2003 due to hydro provinces conserving water in order to refill depleted reservoirs. Natural gas is increasingly favoured over coal for incremental thermal generation, owing to its reputation as a cleaner fuel and the availability of cost-effective combined-cycle generators. There is a substantial two-way electricity trade with the western United States mostly among hydropower facilities. Net electricity exports to the US in 2003 accounted to roughly 7.8 percent of production. The Canadian electric power generation, transmission and distribution sector accounts for 2.1 percent for total Canadian GDP.

Canada coal production in 2004 reached 66 Mt, increase by about 6.8 percent from 62 Mt in 2003. Such an increase was from the new coal mines opened in Alberta and British Columbia, as well as the coal prices strengthened, and all the increases were for exports. Canada's coal exports decreased by 8 percent to 26 Mt in 2004 of which 24 Mt was coking coal. Export demand was growing fastest in United States and exports to the Middle East had a moderate increase. However, exports to Asia declined by 6 percent in 2004, even with the new demand from China. The only significant import of coal is for thermal requirements and cement industry in Ontario, New Brunswick and Nova Scotia, and for steel industry in Ontario. Canada imported 19 Mt of coal in 2004, lower than the import in 2003. Finally, Canada remains the world's leading producer and exporter of uranium, of which it accounts for about 30 percent of 2003 global mine production.

In 2003, alternative and renewable energy production increased by about 2 percent over 2002 and accounted for nearly four percent of total energy consumption in Canada.

### FINAL ENERGY CONSUMPTION

In 2003, total end use energy consumption in Canada reached almost 200 Mtoe. Industry accounted for 38 percent of energy use, residential and commercial buildings 31 percent, transport 28 percent, and agriculture 3 percent. By fuel source, petroleum products accounted for 42 percent, natural gas 27 percent, electricity 28 percent, and coal 2 percent.

In the residential and commercial sectors, space and water heating account for about 72 percent of energy use while lighting, air conditioning and electronic equipment account for the other 28 percent. Growth in consumption has been slow, averaging just 1.4 percent per annum in the 1990s. Significant improvements in the energy efficiency of buildings, HVAC (heating, ventilation and air conditioning) and electronic equipment have occurred. But these efficiency gains have been offset by demand growth associated with increases in population and GDP, by greater market penetration of household appliances and office equipment and by a strong preference for larger homes.



Three industries - pulp & paper, petroleum refining and iron & steel - account for approximately 6 percent of Canada's GDP, yet are responsible for around 45 percent of industrial energy consumption. Energy is used to power equipment, generate process heat, and provide raw material in production processes. Energy consumption in the industrial sector grew on average 1.38 percent per annum during the 1990s. Growth in energy consumption was boosted by strong economic growth but moderated by efficiency improvements in some key industrial sub-sectors. Structural change has found in the industrial sector that pulp and paper, petroleum refining and lime consumed more than 6 MJ/CAN\$ of GDP, represented 42 percent of industrial activity in 1990, but accounted for 25 percent in 2003.

With the strength in both passenger and freight traffic, energy use grew faster in the transportation sector than in any other sector during the 1990s, at an average of 1.8 percent per annum. Petroleum products dominated the sector, accounting for 90 percent of its energy consumption in 2003. Five-sixths of transport demand, in terms of distance travelled, is met by road transport. Light trucks, including sport utility vehicles and minivans, which consume far more fuel per kilometre than cars, continue to be popular for passenger transport. Modest fuel efficiency improvements in new vehicles, strong market preferences for enhanced performance and significant increases in average distance travelled per vehicle have contributed to energy consumption growth. In freight transport, energy use has been boosted by growing demand and a shift away from railways towards more energy-intensive truck transport.

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## POLICY OVERVIEW

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In Canada, jurisdiction over energy matters is shared between the provincial and federal governments. The constitution gives the provinces ownership of natural resources, which thus have authority over the conservation, and management of these resources within their borders. But jurisdiction over international and inter-provincial trade is a federal responsibility. The division of power outlined by the constitution requires the different levels of government to cooperate in important policy areas such as climate change, environmental protection and regulation of gas and electricity grids. Through Natural Resources Canada (NRCan) and other government departments including Environment Canada, the Department of Fisheries and Oceans, and Indian and Northern Affairs Canada, the federal government works with provincial governments to implement national development strategies and to honour international agreements.

Energy policy in Canada is market-based. Due to its huge and diverse resource base, physical energy security is not an issue in Canada. However, sustainable development of existing resources to ensure adequate supplies for the future is a key priority. Policies are therefore aimed at promoting economic growth while encouraging the sustainable development of resources and limiting environmental impacts. NRCan intervenes in areas where the market does not adequately support these policy objectives. NRCan implements policies and programmes which encourage scientific and technological research, promote energy efficiency and assist the development of renewable and alternative energy sources.

## OIL AND GAS MARKETS

Wellhead oil and natural gas prices in Canada have been fully deregulated since the Western Accord between the federal government and energy-producing provinces was reached in 1985. The Accord opened up the gas market to greater competition by permitting more exports, allowing users to buy directly from producers and unbundling production and marketing from transportation services. Oil and gas pipeline networks, over which competing oil and gas supplies are transported, continue to be regulated as natural monopolies. Federal authorities have the main responsibility for regulating long-distance, high-pressure transport networks, as well as exports. Provincial authorities have the main responsibility for regulating local and regional distribution networks. The National Energy Board (NEB), a federal regulatory body under the Minister of Natural Resources, regulates oil and gas pipelines that cross international and inter-provincial borders and approves exports of oil, gas and electricity. It also prepares reports on current and

future energy market developments in Canada, such as *Natural Gas Prices in the Maritimes* (March 2004), *Canada's Oil Sands: Opportunities and Challenges to 2015* (May 2004), *Short Term Canadian Natural Gas Deliverability 2004-2006* (November 2004), etc.. Under COGO Act, the NEB will continue to develop and maintain regulations regarding exploration and development activities.

### ELECTRICITY MARKETS

Electricity markets in Canada are organised along provincial lines and regulated by provincial governments. In most provinces, the power industry has been highly integrated, with the bulk of generation, transmission and distribution provided by a few publicly owned utilities. But since the mid-1990s, driven in part by restructuring efforts in the United States, several provinces have taken measures to make electricity markets more competitive. Such measures include the unbundling of major utility functions into transmission, generation, distribution and marketing segments, with provisions for fair access of competing generators and suppliers to the transmission grid. In 2004, the electricity markets featured continuing efforts to restructure the industry.

To maintain access to US export markets, British Columbia, Manitoba, Alberta, Quebec and Ontario have complied with rules of the US Federal Energy Regulatory Commission (FERC) and have opened up their transmission systems to competition. Several Canadian utilities have taken steps to coordinate their operations with regional transmission organisations (RTOs) being set up under FERC proposals for standardised market design. Manitoba Hydro has participated in the first RTO approved by FERC and signed a coordination agreement with the Midwest Independent Transmission System Operation, Inc. (MISO). Ontario has been assessing the merits of alternative options for joining RTOs in adjacent US markets as well. RTOs expected to achieve approval in 2005 are the New England Independent System Operation (adjacent to New Brunswick and Quebec), and the Midwest Independent System Operator (adjacent to Ontario, Manitoba, Saskatchewan). It is less certain about the timing for Grid West, formerly RTO West (adjacent to Alberta and B.C.). British Columbia has expressed an interest in joining Grid West through the B.C. Transmission Corporation. Alberta is also considering participation in the Grid West.

Alberta was the first province to reform its power markets. In 1996, it introduced a competitive wholesale market, including location-based rates and a power pool. In 2000, it compelled electricity producers to sell their electricity output at auction to wholesalers. Since the start of 2001, it has allowed large and small electricity customers to choose among competing retail suppliers. Alberta Government Services has enforcement powers to deter dishonest marketing practices. The Market Surveillance Administrator is responsible to monitor, investigate and enforce market rules, and the Alberta Energy and Utilities Board (EUB) is responsible to review most regulated energy and delivery charges through open and transparent hearings. The *Electric Utilities Act* (EUA 2003) came into force in June 2003. It legislates changes that will help deliver the benefits of deregulation to Albertans faster and ensures the electricity marketplace continuous to operate efficiently. Refinements to the *Act* enhanced the retail electricity market by providing an equal footing for companies looking to enter Alberta's electricity market, and for those already operating in the province. As of 1<sup>st</sup> January 2004, the EUB began regulating certain municipally owned electric utilities to ensure that customers receive safe and reliable service at reasonable rates. Alberta Department of Energy established a Wholesale Market Policy Task Force (WMPTF) to ensure that the review would have broad stakeholder consultation and input, and a separate process to consider issues specific to the competitive retail market. In addition, they released a draft discussion paper entitled "*Refinement Option for Alberta's Whole and Retail Electric Markets*" (the "Integrated Options Paper") in March 2005. In May, the draft recommendations for refinements to the wholesale market were released.

In November 1997, the Province of Ontario released a policy setting out a restructuring plan for electricity industry in Ontario. The market restructuring legislation, the *Energy Competition Act* 1998, was enacted in 1999. The wholesale and retail electricity markets were opened to competition in May 2002. The provincial government has implemented a number of modifications to the initial design and operation of the market to ensure adequate electricity supplies and stability in electricity prices. There were significant changes on the electricity market in the way the electricity industry

operates after the market opened. The Independent Electricity System Operator will retain most of the responsibilities of the former Independent Electricity Market Operator (IMO), including those pertaining to the operation of the Ontario wholesale market and the operation and reliability of the transmission system. In December 2004, the government took a number of actions culminating in the *Electricity Restructuring Act*. Under this new legislation, Ontario Power Authority (OPA) has been established, which will be responsible for ensuring future power supplies for Ontario by taking an active role in issuing requests for proposals, promoting clean and renewable electricity sources, promoting conservation initiatives, and developing an integrated plan for generation and transmission. The operation of OPA is overseen by the Ontario Energy Board (OEB). In addition, the legislation includes establishing a three-tier wholesale market with prices consisting of the province's heritage assets, independent power production based on long-term power purchase arrangements through the OPA, and other independent power production. In 2005, the OEB has developed the Regulated Price Plan for eligibility of customers. Eligible consumers include residential customers, municipalities, universities, colleges, schools, hospitals, farms, and customers whose annual electricity usage is 250,000 kW hours or less. Starting from 1<sup>st</sup> April 2005, the currently qualify customers under the Two Block Price Plan would be eligible for the Regulated Price Plan and this eligibility would apply for three years. Beginning 1<sup>st</sup> April 2008, eligibility for the Regulated Price Plan would be limited to residential customers and general service customers under 50 kW. Furthermore, Ontario plans to phase out its coal-fired power generation by the end of 2007. A preliminary study, called *Clean Energy Transfer Initiative*, was undertaken to examine a potential long-term supply solution, including the development of three hydro electric power sites in Northern Manitoba in the 2010-2017 time period and new transmission capacity to accommodate a transfer of 1,500 MW into Ontario.

Nova Scotia put in place its restructuring plans with the passage of the *Electricity Act (2004)* in October. The Act mandates wholesale access to Nova Scotia Power's transmission system for six municipal distributors accounting for about 5 percent of Nova Scotia's electricity demand starting in 2005. Renewable portfolio standard given in the legislation requires that 5 percent of Nova Scotia's electricity supply come from renewable generating capacity constructed after 2001 by 2010.

New Brunswick pursues a "deliberate and controlled" restructuring policy that would allow for the gradual transition of the electric industry from its current monopoly structure by introducing wholesale competition and allowing non-utility generation and retail competition for large industrial customers, while waiting until conditions prove more favourable before permitting full retail competition. New Brunswick opened its market on 1 April, 2004, the date of proclamation of the *Electricity Act*, providing competitive access to wholesale customers and large industrial customers. The *Electricity Act* will allow four main objectives to be met including a competitive electricity market for 39 large industrial customers and three municipal utilities; re-organization of NB Power into five distinct units (a holding company and four subsidiaries including generation, transmission, distribution and customer services, and nuclear); empowering the Public Utilities Board (PUB) to play a greater role in the electricity market and protecting ratepayers; and creation of a system operator as independent body to manage the market rules and the electricity transmission system.

British Columbia has initiated some steps toward restructuring. The vertically-integrated BC Hydro and Power Authority is to have its transmission assets unbundled into a new BC Hydro Transmission Corporation by 2004, according to a new energy policy announced in November 2002. This should reinforce the ability of competing electricity generators to obtain fair access to the provincial transmission grid. But the energy policy also provides that consumers should continue to share the rents from existing hydro generating assets, which are low in cost because they are almost completely depreciated, through a ten-year extendable "heritage contract" on the output from these assets to ensure low electricity rates. In addition, the policy ended a seven-year rate freeze in 2003 and established that rates would once again be regulated by the BC Utilities Commission. The policy envisions some rate increases to attract investment in new generation and transmission facilities, but would limit the increases through shared rents from hydro assets, competition among generators, and performance-based regulation. British Columbia, Saskatchewan, Manitoba, and Quebec will offer wholesale access to transmission.

Quebec has pursued a different path on electricity market reform. Hydro Quebec's low cost resource power is protected for domestic use, by legislation. Rates for Quebec retail customers are fixed at a level that is below Northeast market prices. The role of Hydro Quebec's regulator, the Regie de l'energie, was reduced as a result of the legislation.

### ENERGY END USE MARKETS

To promote energy efficiency and conservation in end use markets, the Government of Canada relies on a variety of policy instruments. These include leadership by example, voluntary measures, equipment and product labelling, financial incentives for certain types of investments, and energy efficiency standards for household appliances, office equipment and industrial motors. In 1998, NRCan established the Office of Energy Efficiency (OEE) with a mandate to strengthen and expand Canada's commitment to energy efficiency. OEE manages energy efficiency measures in all energy end-use sectors and alternative fuel initiatives in transport to overcome barriers of inadequate information and knowledge, institutional deterrents, and financial and economic constraints in the energy end-use market. The OEE developed a set of progress indicators to track the impact of these measures.

Programmes aimed at improving energy efficiency are sponsored not only by the Government of Canada but also by provincial and territorial governments, municipalities, utilities and some non-governmental organisations. Over the period from 1990 through 2002, the OEE Index has indicated an overall energy efficiency improvement of about 13 percent, which translates into energy savings of 880.7 petajoules in 2002 and reducing annual greenhouse gas emissions by 50 megatonnes. An annual assessment of trends in energy use is published in a technical report entitled *Energy Efficiency Trends in Canada*.

### ENERGY AND ENVIRONMENT

Canada was one of the 160 countries that negotiated the Kyoto Protocol in December 1997 under the United Nations Framework Convention on Climate Change. Under this Protocol, Canada's target is to reduce its greenhouse gas emissions to 6 percent below their 1990 levels by the first commitment period of 2008-2012. This is a challenging target for Canada; being a cold-climate economy with long distances and energy-intensive industries. According to business-as-usual scenarios, emissions in Canada should rise significantly between 1990 and 2010, fuelled by economic and population growth. To achieve its Kyoto target, Canada will have to reduce its 'business-as-usual' emissions by 29 percent or 240 million tonnes.

In February 1998, the Climate Change Secretariat was established to play an integral role in the development of the National Implementation Strategy. In addition, the Climate Change Action Fund was created to facilitate early actions to reduce greenhouse gas emissions and to support the development of an implementation strategy to meet Canada's Kyoto commitments. From 1998 through 2002, intense discussions took place between the federal government and its provincial and territorial counterparts. Stakeholders were also actively engaged under this National Climate Change Process to identify best options to reduce emissions in the various sectors of Canadian society. Discussions and consultations led governments to take some initial actions on climate change. For instance, a *First National Climate Change Business Plan* was released in October 2000 and identified emissions reduction actions to be undertaken by federal, provincial and territorial governments. The federal component of this Business Plan was the *Government of Canada Action Plan 2000 on Climate Change*, which represented a financial commitment of CAN\$500 million. Overall, federal financial commitments during the period 1998 to 2002 amounted to CAN\$1.7 billion for investments in climate science, mitigation, and the development of new long-term technologies.

In December 2002, the Government of Canada officially ratified the Kyoto Protocol. This decision reconfirmed Canada's strong commitment to addressing climate change and to working with the international community in dealing with this global problem. To support its ratification decision, the Government of Canada released the *Climate Change Plan for Canada*, which is a road map for Canada to follow in order to achieve its Kyoto target. The Plan established that measures

underway at the time of its release were expected to achieve 80 Mt of emissions reductions. These included carbon sinks of 30 Mt from existing forestry and agricultural practices. As a second step, the Plan highlighted measures to reduce emissions by an additional 100 Mt. At the heart of this second step are the negotiations of covenants with large final emitters to reduce industrial emissions by 55 Mt. Also proposed was a series of measures targeted at sectors non-covered under the covenant approach. As a third step, the Plan suggests further emissions reductions of 60 Mt from various sources such as new technologies and initiatives by provincial and territorial governments.

In October 2003, the Government of Canada launched several additional climate-change programmes including a public investment to extend Canadian leadership in the emerging hydrogen economy. A financial incentive for energy-efficiency retrofits of houses was initiated as well.

The first climate change Memorandum of Understanding (MOU) signed with the Government of Canada was Nunavut on 31 October 2003, followed by Prince Edward Island on 7 November 2003. On 6 November 2003, the Government of Canada signed an MOU with the pulp and paper industry, the first such agreement concluded in the context of negotiating covenants with large final emitters. The Government of Manitoba signed an MOU for Co-operation on Addressing Climate Change with the Government of Canada on 19 March 2004. They agreed to explore cooperation on renewable energy development opportunities. In October 2002, the Government of Manitoba released "Manitoba's Climate Change Action Plan – 2002: Kyoto and Beyond" – a plan of action to meet and exceed Manitoba Kyoto target. On 21 May 2004, the Government of Canada and the Government of Ontario signed an MOU to work together on climate change. They have agreed to explore cooperation on the areas of electricity supply and renewables, energy efficiency, conservation and fuels, environmental management, innovation and technology, land resources and agriculture, impacts and adaptation, and public awareness and education.

Since 1990 overall energy efficiency has improved by 13 percent or lower CAN\$ 12 billion in energy costs in 2004 comparing with if those energy efficiency improvements had not taken place. The *Moving Forward on Climate Change*, which was building on the *2002 Climate Change Plan for Canada*, was released in April 2005. The Plan will contribute significantly cleaner air for Canada's cities, enhance biodiversity, help to preserve wild spaces and generally improve the quality of life for Canadians. To fight the climate change, Budget 2005 laid the foundation for the Plan providing the funds of Clean Fund, Partnership Fund, Renewable Energy, and existing programs. Associated with the federal investment, the overall funding is in the range of CAN\$ 10 billion through 2012. It is estimated that the Plan could reduce GHG emissions by about 270 Mt annually over the 2008-2012 period.

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## NOTABLE ENERGY DEVELOPMENTS

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### CARBON SEQUESTRATION

Canada is part of an international effort to address climate change. In 1997, Canada signed the Kyoto Protocol and committed to reduce greenhouse gas (GHG) emissions to 6 percent below 1990 levels by the commitment period 2008-2012. A two-year initiative was announced in February 2004 to help develop a market for carbon dioxide (CO<sub>2</sub>) capture and storage in Canada, as well as innovation new uses of CO<sub>2</sub> from industrial emitters. Incentive funding will be used to support projects that demonstrate CO<sub>2</sub>-based enhanced resource recovery in small-scale commercial settings, to help abate the costs of CO<sub>2</sub> capture and storage. Carbon dioxide is collected during processes such as oil sands recovery, electricity generation and cement, petrochemical and fertilizer production. The captured CO<sub>2</sub> can then be processed, compressed, transported and injected into geological sites, such as oil and natural gas reservoirs, deep coal beds or deep saline aquifers. The Western Canada Sedimentary Basin, which covers large portions of Alberta, Saskatchewan, Manitoba and the Northwest Territories, is believed to be the most promising location for such projects.

A CAN\$15 million investment in CO<sub>2</sub> capture and storage builds on the unique expertise Canada has developed from the Weyburn CO<sub>2</sub> Monitoring Project and offers significant long-term potential for addressing GHG emissions, while continuing the pursuit of industrial economic objectives. Four projects were selected after a call for proposals on 1 March 2004 that injects CO<sub>2</sub> from a Canadian industrial source into a geological formation for storage enhanced oil and gas recovery, and/or disposal in Canada. On the first round of proposal, it awarded CAN\$10.8 million in funds supporting the CO<sub>2</sub> Capture and Storage Incentive Program. A call for a second round of proposals was made available in April 2005 with a total of CAN\$4.2 million in funds. The second round of proposals will continue to build on the cooperation between NRCan and the Government of Alberta to manage GHG emissions and enhance conventional-resource recovery.

### **ETHANOL EXPANSION PROGRAM**

As part of the Climate Change Plan for Canada, as announced in August 2003, the Ethanol Expansion Program will provide up to CAN\$100 million in contributions over the next three years toward the construction of fuel ethanol production facilities in Canada. It is intended to expand fuel ethanol production and use and reduce transportation-related greenhouse gas (GHG) emissions that contribute to climate change. The first round of the Ethanol Expansion Program has a total allocation of CAN\$ 72 million to six projects for construction of new fuel ethanol facilities. The second round of the Program announced in July 2005 invested an additional CAN\$ 46 million for the construction or expansion of five ethanol plants.

The funding under the Ethanol Expansion Program is part of a larger bio-fuels strategy that also includes the extension of the National Biomass Ethanol Program, research and development under the biotechnology component of the Technology and Innovation Strategy, and an investment in biodiesel. Funding of this program is part of the CAN\$2 billion commitment to climate change action made in Budget 2003. The Government of Canada has committed more than CAN\$3.7 billion to climate change programs and to the development of leading-edge technologies over the past five years. The Government of Canada is also promoting greater use of ethanol through consumer-awareness campaigns and ongoing education initiatives. Under both rounds of the Ethanol Expansion Program, it is expected to produce a total of about 1.2 billion litres of fuel ethanol per year by the end of 2007, meeting with the Government of Canada's target of 35 percent of Canadian gasoline containing 10-percent ethanol by 2010. It is also achieve the Government of Canada's climate change target for ethanol production two years ahead of schedule.

In the Round 1 of the Program, the projects will produce fuel ethanol from grain (corn or wheat) using proven technology. The Government of Canada is also working with industry to develop and commercialize new technology that produces ethanol from agriculture residues (including staw and corn stalks) and forestry byproducts in the Round 2 of the Program. Ethanol produced with this technology is expected to result in even greater GHG reductions.

### **ENERGY EFFICIENCY**

Government and industry established energy efficiency ratings for gas fireplaces in March 2004. Natural Resources Canada (NRC), the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI), and the Hearth, Patio and Barbecue Association of Canada (HPBAC) announced the new rating program for natural gas fireplaces based on the well-known EnerGuide program. NRCan has worked with manufacturers and dealers in the gas fireplace industry to develop the EnerGuide Fireplace Efficiency Rating for Gas Fireplaces.

The ratings are based on test results under the new Canadian Standards Association P.4.1-02 standard, introduced in Canada in 2003. This standard is the first in North America for testing and validating the energy efficiency of gas fireplaces, and is a more accurate way to determine how a gas fireplace works in a house than previous methods.

The manufacturers representing these industry groups produce approximately 80 percent of all fireplaces sold in Canada. Consumers will be able to find EnerGuide ratings on the back of manufacturers' brochures. The list of products and their ratings can be found from the website of

[www.oee.nrcan.gc.ca/equipment/english/gas\\_fireplaces.cfm](http://www.oee.nrcan.gc.ca/equipment/english/gas_fireplaces.cfm). The list will be updated frequently as new models are rated.

### **ALTERNATIVE AND RENEWABLE ENERGY**

In 2002, the CAN\$260 million *Wind Power Production Incentive* (WPPI) was launched to assist in the development of wind energy projects across Canada. In 2003, Canada's first urban wind turbine was installed in Toronto, and its largest wind farm to date, with CAN\$100 million invested in 114 turbines, opened in Alberta. Saskatchewan, Quebec and Prince Edward Island also have wind farms. The installation of wind power facilities increased capacity by 81 MW to a total of 316 MW for this type of generation. It is estimated that Canada's wind energy capacity will grow over 700 MW by the end of 2005. The original WPPI provides financial support for the installation of 1,000 MW of new wind energy capacity by March 2007. In the February 2005 Budget, the Government of Canada quadrupled the WPPI target to 4,000 MW and the Budget provided CAN\$200 million over 5 years, and a total of CAN\$ 920 million over 15 years of the expansion.

Between 2001 and 2003, less than 200 hybrid electric vehicles were sold in Canada. The interest in these vehicles has been limited but it is expected that over time they will gain greater consumer acceptance.

A Strategic Business Plan for the Renewable Energy Deployment Initiative, know as REDI, was announced in 2004 to stimulate renewable energy deployment from green heating and cooling (GH&C) sources, which can help Canada diversify its energy supply mix, reduce its greenhouse gas emissions and contribute a future of sustainable energy. REDI aims to reduce 0.284 megatonnes of carbon dioxide by 2007. REDI was announced in December 1997 and came into effect on 1 April 1998, as a three-year, CAN\$ 12 million program. It was then extended into a second three-year cycle, from 2001 to 2004, with CAN\$ 14 million in additional funding. In 2004, REDI was extended for a third three-year cycle, from 2004 to 2007, with another CAN\$ 25 million in funding. Overall, REDI represents a nine-year, CAN\$ 51 million program investment by the Government of Canada.

In Budget 2005, the Federal government announced a Renewable Power Production Incentive (RPPI) to stimulate the installation of up to 1,500 MW of new renewable energy electricity generating capacity, other than wind. An incentive payment of 1 cent per kilowatt-hour of production for the first 10 years of operation will be introduced for eligible projects commissioned after 31 March 2006 and before 1 April 2011. Budget 2005 provided CAN\$ 97 million over the next five years and a total of CAN\$ 886 million over 15 years for the RPPI. A discussion paper on Phase 1 consultation on the design and implementation of the RPPI has been developed by NRCan in September 2005. By the end of 2005, Phase 2 consultations will start to determine the detailed design elements and the terms and conditions for participation in the program. The final Phase will be program implementation and be scheduled in April 2006.

### **POWER BLACKOUT IN ONTARIO**

On 14 August 2003, a cascading power outage caused the largest blackout in history, affecting some 50 million people and nearly 62 GW of generating capacity in Ontario and the northeastern United States. In some parts of Ontario, rolling blackouts continued for ten days before full power was restored and the entire system was back to normal. In response to the blackout, Prime Minister Jean Chrétien and President George Bush established the Joint Canada - U.S. Power System Outage Task Force to identify the causes of the outage and recommend actions to prevent future outages. Canadian energy ministers established a Federal-Provincial-Territorial Electricity Working Group in September 2003. The objectives of this group are to exchange information on the August power outage, work towards reducing constraints on investment in electricity infrastructure and assess initiatives to implement mandatory electricity reliability standards.

The Power System Outage Task Force issued an interim report in November 2003 on the causes of the blackout. It assessed the conditions on the transmission grid that contributed to the blackout, outlines the physical causes of the outage, and discussed events and conditions that

allowed the blackout to spread. The report assigned primary responsibility for the blackout to the actions of one utility company and one independent system operator, noting specific ways in which they violated operating procedures established by the North American Electric Reliability Council. Key factors identified in the Task Force's Interim Report were a lack of training, a lack of communication with other regions, and improper maintenance plans. The Final Report of the Task Force presented 46 recommendations for action in April 2004. After the issuance of the Final Report, the mandate of the U.S. – Canada Power System Outage Task Force was extended for a year to ensure that the recommendations would be implemented. Government agencies, North American Electric Reliability Council (NERC), and the electricity industry have continued to pursue a wide array of initiatives to reduce the risk of future blackouts since the release of the report. To improve the reliability, the Canadian Council of Energy Ministers (CEM) endorsed the Task Force recommendations, including the implementation of mandatory electric reliability standards in July 2004, and the *Energy Policy Act of 2005* was enacted in the United States in August 2005. The Bilateral Electric Reliability Oversight Group was officially established on 30 June 2005 to have ongoing responsibilities to consult on the establishment of an international reliability framework, monitor its operation and consult on other reliability policy and regulatory issues that may arise. NRCan and the US Department of Energy (DOE) have co-sponsored a joint study on the relationships among industry restructuring, competition in power markets and grid reliability. Two public workshops were held in Washington, D.C. on 15 September 2005, and in Toronto, Ontario, on 28 September 2005 for the experts presenting their analyses on the potential impact of competition on reliability. The Task Force is preparing a status report providing an assessment of the actions taken on the recommendations, as outlined in the final report on the August 14, 2003, power outage. That report is expected to be released in the fall of 2005.

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# CHILE

## INTRODUCTION

Chile is one of the two APEC economies in South America. Located in the southern South America, it is bordered by the South Pacific Ocean between Argentina and Peru, and stretches along a coastline of 6,435 km. Its area covers nearly 757,000 square kilometres. Most of its 15.77 million population (as of December 2003) live in urban areas, with nearly one-third residing in Santiago, the capital city. Chile is a major producer and exporter of copper.

Chile's GDP in 2003 reached nearly US\$140 billion, and US\$8,904 per capita, both in terms of purchasing power parity, PPP, in 1995 US\$. The economy grew at an average annual rate of 4.81 percent a year during 1980-2003. The global economy recovery has helped boost export demand, particularly copper, the price of which has nearly doubled since end 2002. In 2003, Korea and Chile ratified a Free Trade Agreement (FTA) between governments, becoming the first FTA agreement in place between an Asian and an American country. It expects to sign similar agreements with China and Japan in the near future.

Chile has very limited indigenous energy resources and has to rely on imports to meet all of its needs. In 2003, its energy reserves consisted of 23.8 MCM of oil, 99 MCM of natural gas and 1,302 Mt of coal. In 2003, roughly two-fifths of its total primary energy supply was produced indigenously. Natural gas is the main import fuel for electricity production, which comes entirely from Argentina through pipelines (located in north, central and south parts of frontier) connecting both countries.

Table 7 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	757 000	Oil (MCM) - Proven	23.8
Population (million)	15.77	Gas (BCM)	99
GDP Billion US\$ (1995 US\$ at PPP)	140.45	Coal (Mt)	1,302
GDP per capita (1995 US\$ at PPP)	8,904		

Source: Banco Central de Chile, Energy Data and Modelling Center, IEEJ. \*2003 figures from Energy Information Administration, USA.

Chile's main concern in 2003 was Argentina's decision to reduce its natural gas exports. Such a decision has forced some weeks of its domestic electricity generation to switch from a relatively cheap natural gas to a more costly diesel-generated power. In addition, plans for an LNG port are being studied in order to stabilize the supply of this fuel in the near future. The economy is currently pursuing preliminary LNG agreements with Indonesia and other economies of APEC region. Government had also promoted the establishment of an "energy ring" in South America by building a natural gas pipeline connecting Peru (Pisco) and Chile (Tacopilla), and integrating Camisea field with the existing pipelines in Argentina, Brazil and Chile.

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## ENERGY DEMAND AND SUPPLY

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### PRIMARY ENERGY SUPPLY

Chile's total primary energy supply (TPES) grew at an average annual growth rate of 3.65 percent from 1980 to 2003. In 2003, TPES reached 25,018 ktoe, approximately 39 percent of which comes from crude oil, 27 percent from natural gas, 9 percent from coal and 25 percent from other sources, mainly biomass and hydropower. Natural gas and other sources (renewable energy - hydropower and biomass) together contributed half of the TPES, with each sharing 27 percent. The introduction of natural gas from Argentina in 1997 has led to a slight change in Chile's TPES mix (more gas use). Oil however remained a major energy source, 39 percent of share in 2003 compared to 44 percent in 1990. The change took its toll on coal, causing a drop on its share from 18 percent in 1990 to 9.9 percent in 2002.

Chile's dependence on imported energy had been increasing for many years. In 1980, approximately 64 percent of TPES was contributed by indigenous production and 36 percent from net imports. However in 2003, this proportion was reversed, 60 percent from imports and the rest from indigenous production. The change is caused mainly by an increase in gas and oil imports.

For the past two decades, imports have increased for several reasons. One is the dwindling of oil reserves. Crude oil production peaked at 32 percent of domestic supply in 1982, and later declined to only 3 percent of total oil supply in 2002. The lack of competitiveness of the domestic coal industry has also led to an increase in coal imports. Domestic coal production has accounted for only 10 percent of Chile's consumption in 2002, down from nearly 70 percent in 1980. The gas market reform (which started in 1997) has also increased imports from Argentina to the most populated regions in north and central parts of Chile while previously, due to infrastructure constraints, gas was only available in the south. However in April 2004, Argentina began curbing natural gas imports to almost half of the contracted volumes on some occasions; this restriction continued in 2005.

Empresa Nacional del Petróleo (ENAP), a state-owned enterprise, is the major oil producer and refiner in Chile. Because of decreasing domestic energy resources, ENAP has increased its exploration and production operations abroad, mainly in Latin America and North Africa, through its international subsidiary, SIPETROL. ENAP is working towards supplying at least 30 percent of Chile's total oil demand, which comes mostly from Argentina, Ecuador, Nigeria, and Venezuela. Both the retail and wholesale markets of petroleum products trade at competitive basis. There are three refineries in Chile: Petrox Talcahuano (100,640 bbl/d throughput capacity, scheduled to increase 25 percent by the first quarter of 2002), Refinería de Petróleo de Concón (94,350 bbl/d) and Gregorio Magallanes (9,859 bbl/d).

In 2003, Chile's power generation was 48,780 GWh. During the period 1980 to 2003, the generation increased consistently around 6.4 percent per annum. Over the last two decades hydropower has accounted for most of the installed capacity. However, thermal is getting more significant, and in 2003, the thermal generation reached 26,177 GWh, or 54 percent of the total generation. The introduction of natural gas from Argentina has boosted the use of combined cycle plants. Thermal relies mainly on natural gas and coal, 24.1 and 22.5 percent of total, respectively. In addition, there are some production from fuel oil, biomass, and other fuels (6 percent) as well. The use of petroleum coke (petcoke) is allowed in some plants, but under restrictions for environmental control.

Table 8 Energy supply &amp; consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	9,896	Industry Sector	6,271	Total	48,780
Net Imports & Other	15,122	Transport Sector	6,683	Thermal	26,177
Total PES	25,018	Other Sectors	6,699	Hydro	22,603
Coal	2,289	Total FEC	19,653	Nuclear	0
Oil	9,862	Coal	784	Others	0
Gas	6,711	Oil	9,995		
Others	6,155	Gas	1,401		
		Electricity & Others	7,474		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.iecei.or.jp/egeda/database/database-top.html>)

There are four separate power grids in Chile: Sistema Interconectado Central (SIC), Sistema Interconectado del Norte Grande (SING), Sistema Aysen and Sistema Magallanes. Sistema Interconectado Central (SIC – Central Interconnected System) is the most important. It serves over 90 percent of the population and more than 40 percent of the land area. Its installed capacity as of December 2002 was 6,732 MW, of which 61 percent was hydro. Sistema Interconectado del Norte Grande (SING – Great North Interconnected System), on the other hand, serves mainly mining consumers. It has an installed capacity of 3,645 MW (including 643 MW in Argentina), almost entirely thermal, in 2002. Sistema Aysén and Sistema Magallanes, the other two grids, represent only a small portion of installed capacity.

### FINAL ENERGY CONSUMPTION

Chile's total final energy consumption (TFEC) grew at an average annual rate of 3.8 percent from 1980 to 2003 and reached 19,653 ktoe in 2003. It accounts for a 0.6 percent increase in growth rate as compared to 2002. The main energy consuming sectors were transport (34 percent) and industry (32 percent); with residential, commercial and public sectors consuming 34 percent. By energy source, oil products have accounted for 51 percent of final consumption, with electricity and "other" sources, gas and coal at 38 percent, 7 percent, and 4 percent, respectively.

Chile is the largest producer of copper in the world. Its copper production is expected to grow to nearly 40 percent of world production in the medium term. The copper industry is by far the most important industrial energy consumer in Chile. In 2002, the total consumption was 13.5 GWh, which is nearly 48 percent of the total energy consumption in the industrial sector.

Other important sectors are pulp and paper and iron and steel industries, each consuming 15 percent and 8 percent respectively. In the 1990s, most of the 6.6 percent annual growth in industrial energy use was driven by non-energy-intensive industries, which grew at 9.1 percent annually. For the total industrial energy consumption by fuel type, oil products account for 28 percent, electricity for 35 percent, biomass for 15 percent, coal and coke for 10 percent and natural gas for 12 percent. Gas has been replacing petroleum products, especially heavy fuel oil and coal in the industrial sector due to the introduction of Argentinean gas in the northern and central Chile.

Transportation has recently been the fastest growing end-use sector, with an average increase of about 4.7 percent per annum over the last 20 years. In 2003, road transport was responsible for 88 percent of energy consumption. Petroleum products have accounted for 99.3 percent, electricity 0.2 percent and natural gas 0.5 percent.

In the residential, commercial and public sectors, growth in energy use is similar to transportation, averaging about 4.5 percent per annum between 1990 and 2002. The residential sector accounted for 30 percent of energy consumption in 2002. In 2002, biomass (mostly firewood) was the most important fuel in this sector, which accounted for 59 percent, followed by petroleum products at 20 percent, electricity at 13 percent and natural gas at 7 percent.

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## POLICY OVERVIEW

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Energy policy in Chile aims to promote dynamic development in the energy sector, overall economic growth and a better quality of life for its people. To achieve such goals, government has set out to develop its energy sector, based on the following principles:

- To promote free competitive market in the energy sector. The role of government is to regulate the market in order to avoid market distortions, especially in those areas where natural monopolies arise;
- Improvement of energy supply conditions as well as the quality and security of energy products and services;
- Reduction in the prices of energy products and services, within reason, in order to reflect technological and managerial advances, improve the economy's international competitiveness, maintain incentives for investment, and offer consumption opportunities to the poorest segments of the population;
- Protection of energy consumers by minimising abnormal fluctuations in prices of key products, especially those caused by temporary distortions in markets;
- Focused and transparent support, through efficient and effective mechanisms, to sectors that do not have access to key energy resources, where providing such access has a high social priority or social return;
- Development of and compliance with regulations that protect the environment.

In other words, the main objective of Chile's energy policy is to achieve strong energy supply and economic growth, without compromising the welfare of energy consumers, key industries or the environment. The general guidelines for achieving this objective are as follows:

- Assure an adequate degree of regulatory stability to minimise risks to investment, while upgrading and improving the regulatory framework with prudence and timeliness;
- Strengthen local competition, increase participation in international markets, and increase energy diversification;
- Create conditions where the prices and quality of energy products and services approach those theoretically obtainable in perfectly competitive markets;
- Foster sustainable development and efficient use of energy;
- Contribute to social equity using economically transparent mechanisms;
- Monitor energy security;
- Take advantage of international opportunities and anticipate potential problems.

An example of a policy supporting these objectives is energy sector privatisation. Chile was the first economy in the world to restructure its power sector in the 1980s, almost a decade before the United Kingdom. The market reform strategy that Chile developed twenty years ago has served as a model for other economies in South America.

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## NOTABLE ENERGY DEVELOPMENTS

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### INTERNATIONAL ENERGY INTEGRATION

Chile is engaged with other South American economies in a process to diversify its energy matrix and strengthen bilateral relations to ensure adequate energy supply.

#### ARGENTINA

Although energy integration with Argentina has progressed more than with any other economy, a shortage of natural gas from Argentina has prompted problems for the electricity sector in Chile. As combined cycle units are an important source of energy for electricity production (nearly 24 percent in 2003), the impact of natural gas reduction has affected the Chilean policy for this fuel. On one hand, a bilateral agreement regarding shortages is under development between Chile and Argentina. The aim of this agreement is to ensure crisis management and to allocate appropriate compensation schemes. On the other, Chile is planning to build an LNG port to accommodate additional supply sources from other economies.

#### LNG TERMINAL FOR PACIFIC LNG GAS

In 2004 and 2005, Chile was confronted by an import restriction of natural gas from Argentina that almost reached to 45 percent of the total volume previously supplied.

This situation left in evidence that it is not possible to access new natural gas supply contracts from Argentina, which generates difficulties for companies that use natural gas within their production processes, as well as for electricity generation and distribution.

To address the problem, the President of the Republic, publicly recommended to the National Oil Company, ENAP, to head a project that would develop an LNG re-gasification terminal and, provide the country with a new source of natural gas. Currently ENAP is leading and coordinating the project in order to receive, store and re-gasify natural gas in Chile starting in 2008.

The rationale behind the project is two-fold. Firstly, ENAP is a major consumer of natural gas, and the demand is projected to exceed 1.5 million cubic meters per day by 2008. At the same time, the facility will diversify the country's sources of energy, stabilizing it against future supply fluctuations. Thus, this project has a strategic interest in securing a reliable supply, at competitive prices for the Chilean energy demand.

The project aims to construct, by the end of 2008, a plant capable of accepting, storing and re-gasifying liquefied natural gas. Liquefied natural gas will be imported by sea from parts of the world where supplies are readily available.

In addition to the re-gasification plant itself, the full installation will include a docking bay for off loading liquid natural gas, storage tanks and ducting into the existing gas network. The most likely location will be Quintero Bay in the 5th Region, close to the main distribution and consumption centres.

In this line, preliminary contacts with Indonesia, Algeria and other nations are under way in order to seek proper partners for the construction of the LNG port. Also Chilean Government impulse the "energy ring" in South America, this consist in the construction of the natural gas pipe line between Peru (Tacopilla) and Chile ( Tacopilla) with the goal to connect existing pipelines with Camisea gas field and get sustainability in the natural gas supply in the region.

#### MODIFICATIONS TO THE ELECTRICITY LAW

The Chilean government passed a bill to change the General Law of Electrical Services of 1982, which was approved in March 2003. The goal of the proposed changes is to improve economic incentives and encourage efficiency in the competitive segments of the electricity market, particularly in the small-scale production segment. Where market intervention by regulatory agencies is necessary, this intervention should increase sectoral efficiency, economic equality and

the active participation of energy consumers in the market. In achieving these goals, environmental law and regulations will play an important role. The main points included in the approved law are:

- Incorporation of low scale producers into the market;
- Tariffication in medium-sized systems;
- Reduction of the price band used in the determination of node prices; and
- Basic procedure to calculate distribution tolls.

The House of Congress approved the law in March 2003 and the corresponding regulatory instruments and norms are underway. It is expected that the new law, along with all the regulatory instruments, will be in place in 2004. A key point in this law is the incorporation of small power generating units in the market, which will open the possibilities for NRE proliferation in the Chilean market. In fact, due to its longitudinal structure, NRE resources are economically competitive in several parts of the economy, and clear rules for their commercialization are the only true barrier for their deployment.

Also in May 2005, the House of Congress included a new modification in the electricity law which would increase the safety of energy facilities in the economy and warrant the supply in response to the demand. There are basically three modifications:

1. One is the introduction of a mechanism for the award of contracts between generation and distribution companies that supply to regulated customers; in this aspect was the rule on regulated customers which produce electricity from renewable energy of up to 5 percent of the demand, and allowing these renewable generators to sell or supply electricity to the distribution company at bidded prices.
2. The second is to let generation companies to negotiate with their customers, allowing temporary increases or reductions of consumption and subsequent compensations.
3. Defined the fortuity case or “greater force” in the operation of the system power; specifically indicating that the absence of security and quality caused by disability of power generators as regards the partial or total restrictions of natural gas will not be considered as fortuity case or “greater force”.

## **HYDROCARBONS**

Regulations are being revised to improve the requirements regarding emissions for new fuels and ENAP will be mostly affected. ENAP will also be influenced by a National Energy Commission (CNE) study on the impacts of current gas regulation on different energy market participants.

## **RURAL ELECTRIFICATION**

Within the framework of the National Rural Electrification Program of Chile, which is coordinated by CNE, the Government of Chile aims to reach a goal of 90 percent of rural households electrification coverage in the year 2006, as well as, to improve the electric generation systems for isolated rural communities. In this line, a project for the Implementation and eventually Operation of a Hybrid Electric Generation System, Wind-Diesel, in the Robinson Crusöe Island, of the Archipelago of Juan Fernández, in Valparaíso Region is currently under way.

## **RENEWABLE ENERGY**

A strong boost to renewable energy technologies came with the modification of the law for the electricity sector, which has incorporated small-scale power production as a specific segment in the supply market. The streamlining of the law has been a key issue in the policy of the National Energy Commission to allow competition for wind, biomass, PV and geothermal power sources, which are typically in the range of 100 kW to 10 MW.

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## ENVIRONMENT

Chile ratified the Kyoto Protocol on 9 July 2002. It is expected that the National Commission for the Environment (CONAMA) will have measures in place to use the Clean Development Mechanism (CDM) by 2003. CNE will help implement these measures.

The first approved CDM project in Latin America, the Chacabuquito Hydro Project, started producing energy in July 2002. The 25MW run-of-river power plant is located some 100km northeast of Santiago, Chile's capital. The project obtained support from the Carbon Prototype Fund of the World Bank. It is expected to reduce emissions by approximately 6.9 Mt of CO<sub>2</sub> during its lifetime. An agreement to buy 11,000 tonnes of its emissions reduction has been reached between the Chilean company Hidroeléctrica Guardia Vieja S.A. and Mitsubishi of Japan.

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# CHINA

## INTRODUCTION

China is the fourth largest economy in the world, next to Russia, Canada and the United States. It is located in East Asia, and bordered by the East China Sea, Korea Bay, and South China Sea. It lies between North Korea and Viet Nam. Its population of 1.3 billion is roughly one fifth of the world's population. Its diverse landscape consists mainly of mountains, deserts, and river basins and covers around 9.6 million square kilometres.

Currently, China is the world's second largest energy consumer (next to the United States) and the second largest energy producer (after the United States). However, its per capita primary energy consumption (at 1.06 toe) is by far lower than in many developed economies and the world's average.

China has sustained high rates of economic growth, just under 10 percent, for more than 20 years. However, in the late 1990s, growth slowed slightly to about 8 percent per year. Energy consumption resumed to grow rapidly through most of the 1990s but has dropped off since 1997. In 2003, energy consumption growth rate achieved 18.3 percent, a historical peak, driven by strong GDP growth, industrialization, urbanization and motorization. GDP per capita is still quite low, at US\$4,403 (1995 US\$ at PPP) in 2003.

China is rich in energy resources, particularly coal. It is the largest producer and consumer of coal in the world, as well as the sixth largest producer and second largest consumer of oil in 2003. However, after a long history of being a net oil exporter, China finally became a net oil importer in 1993. According to recent estimates, China has recoverable coal reserves of some 114.5 Bt, proven oil reserves of 2,555 MCM and proven natural gas reserves of 2,229 BCM. In addition, China is endowed with 676 GW of hydro potential, more than any other economy in the world. For power generation and industrial development purposes, coal and oil resources have been utilised more extensively than reserves of gas and hydro potential.

Table 9 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	9,600,000	Oil (MCM) - Proven	2,555
Population (million)	1,288.40	Gas (BCM) - Proven	2,229
GDP, Billion US\$ (1995 US\$ at PPP)	5,672.29	Coal (Bt) - Recoverable	114.5
GDP per capita (1995 US\$ at PPP)	4,403	Hydro (GW) - Potential**	676

Sources: Energy Data and Modelling Center, IEEJ. \*Proved reserves, end of 2004, *BP Statistical Review*.

\*\*China Energy Annual Review 1997.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

China's primary energy supply has expanded sharply since 2001, driven mainly by the rapid growth, especially heavy industry, in energy consumption. In 2003, the total primary energy supply (TPES) reached 1,067.7 Mtoe. Of this total, coal has accounted for 69.2 percent, oil for 24.5 percent, and natural gas for 2.6 percent, while hydropower, nuclear power and other sources accounted for the remaining 3.7 percent.

China has since given much political and financial support for the development of its abundant indigenous coal reserves to ensure the security of its energy supply. As early as the 1990s, Chinese authorities have been encouraging the switching of fuels (for example from coal to cleaner fuels), introduced energy efficiency initiatives (to reduce pollution and emissions from energy use) and optimise existing energy structure. The use for coal reached its peak in 1996, then experienced a significant decline between 1997 and 2000. It did however recover in 2001, followed by strong growths in 2002, 2003, and 2004. In 2003, coal production reached 738.9 Mtoe and climbed 977.3 Mtoe<sup>9</sup> in 2004, reaching new historic high.

The supply of petroleum products in 2003 grew by about 11 percent compared with the preceding year while domestic oil output also slightly increased to 168.9 million tons. China has imported approximately 97.4 Mtoe<sup>10</sup> of petroleum. Import dependence on oil reached around a third of total oil consumption. Most of China's oil production comes from onshore, mainly from its largest production fields in the northeast at Daqing, Liaohe and Shengli. Oil production from the west and offshore in recent years has also increased rapidly with a growth rate of 9.0 percent and 7.6 percent respectively from 2000 to 2003. Primary natural gas supply totalled 27.8 Mtoe in 2003 while its share in the total primary energy supply remained at 2.6 percent. Although its proportion in the total primary energy supply is still quite small, primary natural gas supply increased very rapidly at a rate of 6.8 percent in the last three years along with the construction of natural gas pipelines and increase in gas reserves. The demand for gas is expected to more than double by 2010. This will involve an increase in domestic production, and imports, by pipeline and in the form of liquefied natural gas (LNG).

Table 10 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	1,022,632	Industry Sector	400,084	Total	1,907,384
Net Imports & Other	45,082	Transport Sector	76,442	Thermal	1,580,361
Total PES	1,067,714	Other Sectors	213,816	Hydro	283,681
Coal	738,884	Total FEC	690,342	Nuclear	43,342
Oil	261,364	Coal	311,554	Others	-
Gas	27,770	Oil	181,983		
Others	39,696	Gas	33,634		
		Electricity & Others	163,170		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

China's electric power industry experienced a serious oversupply problem in the late 1990s, due largely to demand reductions from closure of inefficient state-owned industrial units, which were major consumers of electricity. However, shortage of electricity supply appeared as a result of economic expansion after 2001. Since then, the installed generation capacity increased rapidly, a 7.8 percent increase from 2002. It reached 384.5GW at the end of 2003 with a corresponding growth in power generation to 1907TWh. By type of fuel, 74.3 percent of the total installed capacity was from thermal plants, 24.0 percent hydro, and 1.6 percent nuclear. The corresponding shares of power generation were 82.8 percent for thermal power, 14.8 percent for hydropower, and 2.3 percent for nuclear power.

<sup>9</sup> China Statistical Yearbook, 2005

<sup>10</sup> International Petroleum Economics, 2005(3)

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## FINAL ENERGY CONSUMPTION

Final energy consumption in China reached 690.3 Mtoe in 2003, or 8.8 percent higher than the previous year. Industry was the largest user accounting for 58 percent of total final energy consumption. Transportation sector accounted for 11.1 percent of energy use and other sectors 31 percent. In terms of fuels, coal (45.1 percent) remained the most important fuel in 2003, followed by oil (26.4 percent), electricity, heat and other fuel (23.6 percent), and gas (4.9 percent).

Coal consumption in 2003 reached 738.9 Mtoe, exceeding its peak in 1996 (at 681.6 Mtoe), driven by the recent increase in economic activity. China's power sector is the biggest coal consumer. In 2003, around 56 percent coal consumption came from power sector, followed by metallurgical industry (13 percent), building materials sector (11 percent), chemical sector (5 percent) and others (15 percent).

Electricity demand increased by 16.5 percent from the previous year and reached 1,907.4 TWh in 2003. The high demand growth resulted mainly from the increase in consumption in commercial, industrial and transport sectors at 24.6 percent, 17.9 percent and 17.4 percent respectively. The highest consumption for electricity was by the industrial sector at 73 percent, followed by residential sector at 11.8 percent, agriculture at 4.1 percent, commercial sector at 3.3 percent, transport sector at 2.1 percent and others at 4.8 percent.

China has consumed 261.4 million tons of petroleum in 2003, surpassing Japan to become the second-biggest oil consumer behind the United States for the first time. The industry sector was the largest oil consuming sector, accounting for 50.5 percent of total final oil consumption. The transport sector, the second biggest oil consumer and the fastest-growing oil consumer in sub-sectors, accounted for 26.1 percent of the total oil consumption and its annual growth rate was 15.2 percent, an increase of 7.1 percent from the previous year.

The market for gas is mainly in the Southeast China, accounting for a third of total natural gas consumption of 27.8Mtoe. However, the market is moving to North China and East China along with the completion of the Shaanxi-Beijing gas pipeline and West to East gas pipeline. At present, the chemical industry is the biggest gas user, accounting for about 35 percent of the total, followed by industrial feedstock (28 percent), city gas (24 percent) and power generation (13 percent). City gas use has increased faster in recent years as a result of accompanying construction of city gas pipeline network.

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## POLICY OVERVIEW

In recent years, energy consumption grew rapidly with the robust economic development and acceleration of the industrialization process. Energy has become an important strategic issue concerning China's economic growth, social stability and national security. To strengthen the government's ability to make a uniform plan in the energy field, China has set up a national energy leading panel headed by Premier Wen Jiabao, Vice Premiers Huang Ju and Zeng Peiyan serving as deputy directors of the panel in late May 2005. The members of the panel include 13 top leaders from the country's key ministries and administrations such as Director of National Development and Reform Commission (NDRC), Ministers of Commerce, Foreign Affairs, the State Commission of Science Technology and Industry for National Defence, State-owned Assets Supervision and Administration Commission of the State Council and State Electricity Regulatory Commission of People's Republic of China and other Ministries.

The energy leading panel is mainly in charge of strengthening the leadership on forward-looking, comprehensive and strategic policy-making issues such as energy strategic planning and important policies, energy development and conservation, energy security and emergency response as well as energy cooperation at home and abroad. It will offer proposals for the State Council to make sustainable energy industry development policies.

Under the panel is a 24-member execution office at the vice-ministry level to oversee the macro energy growth trends, organize research, and aid the leading team's administration. Previous energy-regulating administrations such as the Energy Bureau of the National Development and Reform Commission (NDRC) remain unchanged to control the energy industry by examining industrial projects and supervising energy-affiliated activities.

### **ENERGY DEVELOPMENT POLICY**

The year 2006 will be the first year of the Eleventh Five-Year Program (2006-2010) in China. In October 2005, China issued the Communist Party of China Central Committee's proposal on the Eleventh Five-Year Program (2006-2010) for National Economic and Social Development. In the proposal, the government stresses the importance of the development of the energy sector in the next five years and sets two goals of economic and energy development for the next five years. One is that per capita GDP of the country is set to double by 2010 compared with 2000. The other is that energy consumption per unit of GDP should drop by 20 percent from 2005. This further shows that the government has taken energy conservation as a vitally important aspect of the basic national policy. Based on the proposal, China's energy sector should adhere to the basic principle of giving priority to energy conservation, tapping domestic resources, making coal as the basic energy form while developing other forms of energy and encouraging a stable, economical and clean energy supply system.

In accordance with this energy development principle, China will build large coal production bases, renovate medium-size and small coalmines and develop and utilize coal-bed methane(CBM). The government will pay equal attention to the development of oil and gas resources, spare no efforts on oil/gas E&D and the cooperation with foreign countries to enhance oil stockpiling capacity. Products used to substitute oil will also be further developed. The government will vigorously develop nuclear power, built more power grids and transmit more electricity from the west to the east, and set up the pace of developing renewable energy such as wind and solar power.

The proposal will be taken as the guidance document for formulating the Eleventh Five-Year Program (2006-2010).

### **DEVELOPMENT AND UTILIZATION OF RENEWABLE ENERGY**

Since the 1980s, the Chinese Government has been attaching great importance to the development and utilization of renewable energy. Over the past two decades, the government issued a series of policies to promote the development of renewable energy. In the 1980s, the State Council issued Several Recommendations on Promoting the Development of Rural Energy, which made renewable energy as a part of the plans for the development of rural energy and rural electrification. With the maturation of renewable energy power generation technologies, particularly wind power technologies, in 1994, the former Ministry of Power issued Several Recommendations on the Construction and Management of Wind Farms, establishing a firm foundation for wind power in China. In 1999, the Chinese Government issued Several Policy Recommendations on Promoting the Development of Renewable Energy, making further progress in removing barriers to the development of renewable energy. To further confirm the important role of renewable energy in China's energy strategy and remove barriers to the development of the renewable energy market as well as to create market space for renewable energy, On 28 February 2005, the National People's Congress ratified China's Promotion Law for Renewable Energy Development. The law will take effect on 1 January 2006.

The government plans to raise the share of renewable energy from 10 to 12 percent of the total installed capacity by 2020, from its current 3 percent level. At the same time, great emphasis will be put on technologies using renewable energy to supply heat and on liquid biofuels, etc., so that the target of providing, by 2020, 200 million additional tons annually of standard coal equivalent (tce) of renewable energy of all types in the energy mix. This amounts to an additional 8,000 PJ, which would bring China's annual use of renewable energy up to 20,000 PJ and up to a 17 percent share in China's projected energy consumption in 2020.

To ensure that RE electricity would grid successfully, the Law states that RE electricity has the priority to grid and power grid enterprises must purchase all the power generation by RE from registered renewable energy producers and also identifies the relationship between power grid enterprise and RE generation enterprises. The government encourages power grid enterprises to invest in and construct transmission connections components of grid-connected renewable power projects.

### **ENERGY CONSERVATION AND EFFICIENCY IMPROVEMENT**

Aware of the importance of energy conservation and energy efficiency improvement for alleviating the problems of energy constraint and environmental pollutions, China has topped these in its government energy security agenda. In Nov. 2004, the National Development and Reform Commission had issued China's first medium and long-term plan for energy conservation. The directive's idea, principles and targets on energy conservation are given in the Plan. Under the Plan, China will aim to burn 2.25 tonnes of coal for every 10,000 yuan (US\$1,200) worth of GDP by 2010, down from 2.68 tonnes per 10,000 yuan in 2002. By 2020, the level should be 1.54 tonnes of coal per 10,000 yuan of GDP and energy conservation is expected to reach 1.4 billion tons of coal equivalent and correspondingly a reduction of sulphur dioxide of 21 million tons. In order to implement the Plan's objective, the Chinese government has outlined 10 measures insisting on prioritization of energy conservation, consolidate energy and environment polices on promoting energy conservation, industrial polices on strengthening energy conservation, speeding up development, demonstration and dissemination of energy conservation technologies, strengthening the enforcement of implementing energy conservation management, promoting new energy conservation mechanism based on market mechanism, enhancing energy conservation management of key and large energy consumers, and expanding energy conservation awareness, education and training and concreting organization and leadership to realize energy conservation program. Three fields including major industries, transportation and construction, commercial and residential building are specified as key fields of energy conservation. Ten projects are also specified as key projects for energy conservation.

Voluntary Agreements (VAs) are considered as a policy for increasing industry energy efficiency in China. The agreement of the first VAs pilot project was signed in Jinan Iron and Steel Company and Laiyang Iron and Steel Company in April of 2003. The government planned to invite six firms from energy-intensive sectors (steel, chemicals and cement) to join voluntary pilots over the next three years. Energy conservation mechanism of Energy Management Company (EMC) has been applied in more enterprises. By now, more than 60 EMCs have been established in China.

China launched a US\$80 million program with the United Nations (UN) to promote the efficient use of energy and cut pollution in 2005. The program aims to reduce energy consumption by nearly 19 million tons of coal equivalent in the first three-year phase of the program, cutting carbon emissions by 12 million tons.

### **ENERGY SECURITY**

The Chinese government has decided to establish a state strategy for oil stockpiling and included it in the Tenth-Five Year Energy Plan in order to ensure the nation's energy supply security (especially oil). The Plan has pointed out the need to strive and complete the construction of a state strategic oil stockpile (in certain scale) during the Tenth-Five Year Plan period and to encourage enterprises to expand the capacity of their own oil stockpiling. At present, the first stage facilities of state oil stockpiling have been under construction and the relevant laws and management measures for the state strategy oil stockpiling are underway. The Chinese government expects the facilities in Dalian of Liaoning Province, Huangdao of Shandong province, Zhenghai and Zhoushan of Zhejiang province to be completed by end of 2008. Aside from the establishment of state strategy oil stockpiles, Chinese government has also adopted other measures to ensure energy/oil supply security such as accelerating the exploitation and development of domestic oil reserves to increase indigenous oil production, decrease oil consumption of industrial

and civil vehicles by utilizing alternative fuels and enhancing the standards of fuel economy, utilizing natural gas resource in large scale, and encouraging oil exploitation overseas to Chinese oil companies.

### **ENVIRONMENTAL PROTECTION**

While becoming the second-biggest energy consumer and energy producer in the world, China has also become the first-biggest sulphur dioxide and second-biggest carbon dioxide emitting economy in the world. In 2004, the total sulphur dioxide emission in China reached 22.6 million tons<sup>11</sup>, while the total emission of carbon dioxide reached 953 million tons-C<sup>4</sup> in 2002. To fulfil the sustainable development objective of the economy, through adequate resources utilization and environmental protection, the Chinese government is undertaking efforts to lessen emissions of pollutants such as sulphur dioxide and nitrogen oxide, through improved pollution controls on power plants as well as policies designed to increase the share of natural gas in the country's fuel mix. After issuing a new version of the regulation for charging pollutant emissions in January 2003 (which took effect in July 2003), the Chinese government has promulgated a new version of air pollutant emission standards on power sector in 2004. In the version, pollution emission standards for thermal power plants, which refer to internationally advanced standards to be issued in 2003, will greatly enhance sulphur dioxide emission. New building thermal power plants have to desulphurize coal without consideration of the sulphur content in coal while older thermal power plants have to desulphurize, after a grace period, and conform to the same emission standards. China also introduced SO<sub>2</sub> emission power trading mechanism besides forces the enterprise using the administrative method to reduce their SO<sub>2</sub> emission and plans to expedite policy research and the trial program work of SO<sub>2</sub> emission trading, which started in Shandong, Shanxi, Jiangsu, Henan provinces as well as Shanghai, Tianjing and Liuzhou cities since 2002.

The government has made a number of policies for prevention of pollution from vehicles, namely the implementation of the Euro II (heavy vehicle) standard in 2005 and of the international standard for all light vehicles including car and diesel vehicle in 2010, of the Euro III standard in Beijing, Shanghai and Guangzhou cities in 2005, and ethanol-blended fuel projects.

### **WORK SAFETY LAW**

The Law of the People's Republic of China on Work Safety became effective on 01 November 2002. The law has requested all production and business units to redouble their efforts to ensure work safety by setting up and improving the responsibility system for work safety, thus improving the conditions for it to guarantee work safety.

The recent increases in serious accidents at coalmines, as well as other production and traffic accidents have raised concerns from the highest government officials. The government therefore has resolved to close those coalmines that cannot meet the national standards or industrial specifications for work safety, as formulated by law. China plans to restructure its mining industry, forcing small coalmines to merge or join syndicates in an effort to improve safety conditions.

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## **NOTABLE ENERGY DEVELOPMENTS**

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### **COAL PRODUCTION BASE**

Relying mainly on domestic energy resources and decreasing the dependency on overseas energy resources will be the basic guideline of China's energy policy. To ensure long-term coal efficient supply and alleviating the pressure from oil supply in late 2004, Ministry of China Land

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<sup>11</sup> China Environmental Protection Bureau

<sup>4</sup> Handbook of Energy and Economic statistics in Japan (2005)

and Resources and National Development and Reform Commission jointly announced the plan of building 13 larger coal production bases in the coming years by restructuring the economy's 28,000 coal mines. The 13 bases cover an area of 103.4 Km<sup>2</sup>, and involves 14 provinces and autonomous regions and occupy more than 40 coal mining areas where the total coal resources has 690.8 billion tonnes, taking up 70 percent of the total coal resources of China. Based on the Plan, coal production from 13 coal production bases will be 1.7 billion tonnes by 2010, accounting for 78 percent of total coal production of 2.17 billion tonnes. Meanwhile, China will build 2 or 3 coal giants with production capacity of 100 million tonnes and 6 or 7 bigger coal enterprises with production capacity of 50 million tonnes. Since these bases are also rich in coal bed methane, the government also plans to strengthen the development coal bed methane through cooperation with foreign companies. Planning for the 13 state coal production bases will aim to control the development right of coal resources so as to achieve a rational layout of coal mines and the optimisation of coal production structure and exploitation and production of coal on a large scale as well as safety management.

### **NEW RECORD OF ELECTRIC POWER CAPACITY**

China has started a new round of electric power construction in large scale in order to meet its growing electric power demand since 2003. Over the past two years China's installed power capacity increased at an average annual growth rate of 14.9 percent or a newly added installed capacity of 50 GW in 2004 and over 60 GW in 2005. The newly added installed power capacity in the past two years has repeatedly broken the highest historical record of electric power construction in China and even that of the world. By the end of 2005, total installed power capacity has reached 508 GW, with hydro power accounting to 117 GW, or for 22.9 percent of the total capacity. Thermal power still accounted for the largest share at 75.6 percent or 384 GW. In the newly added installed capacity of 2005, around 60 GW came from thermal power and followed by hydro power of some 9 GW. Regions with higher capacity growth rate (above the national average growth level 14.9 percent) were Jiangsu, Shanxi, Zhejiang, Henan and Yunnan. Among them, Jiangsu province itself increased more than 14 GW in 2005. In December 2005, the second phase of Lingao nuclear power project with two 1 GW units was started. The commencement of the project shows an indication that China has entered into the new stage of nuclear power development with self-reliance design, manufacture, construction and operation.

### **SECOND LARGEST HYDROPOWER PROJECT**

After three years of preparations, in terms of technical planning, environmental protection, water protection, and the relocation of over 7,000 residents in the construction area, China started building Xiluodu hydropower station in the upper reaches of the Yangtze River in December 2005. The station, the second largest hydropower project after the Three Gorges Project on the Yangtze in China, is located in Xiluodu Gorge between Yongshan county of Yunnan province and Leibo county of Sichuan province. The station, with the total installed capacity of 12.6 GW and 11.57 billion cubic meters of sluice capacity, is expected to stem the turbulent Jinsha River in November 2007. The first generating unit will be installed in June 2012. The entire project, with an investment of 67.5 billion yuan (8.33 billion US dollars), will be completed in 2015. Besides power generation and water storage, the project is also designed to prevent flood on the unruly Jinsha River, block sand, protect the local environment and facilitate water traffic in the lower reaches of the river. Construction of the hydropower station is part of China's West-to-East Electricity Transmission Project, which aims to transfer power from the hydro power-rich southwest to the electricity-thirsty East.

### **OIL AND GAS RESOURCES SURVEY**

As a policy measure to enhance energy security, acceleration of exploration and development of domestic oil and natural gas resources has been adopted by the Chinese government. To clarify the domestic oil and gas resources situation, the Ministry of Land and Resources (MLR), National Development and Reform Commission (NDRC) and the Ministry of Finance (MOF) co-organized

a new round of national oil and gas survey in November 2003. This was the first government-led oil and gas survey as the previous round was conducted by the state oil companies. A total of 17 units, including the governmental research centres, three Chinese oil majors and petroleum universities, are involved in the survey. This round of survey shows two features; one is to fill several blanks that were not included in the previous rounds, for example, the recoverable modulus of China's oil and gas resources and the initial survey on the areas in Tibetan regions and in the southern part of the South China Sea. Another feature is more non-conventional oil and gas resources, such as oil sand and oil shale, are included in the survey. The survey is going smoothly and will probably report the final results in June 2006.

### **ALTERNATIVE ENERGY DEVELOPMENT**

Coal conversion is another measure the Chinese government has considered to minimize the gap between petroleum production and consumption. In China, coal is more abundant than crude oil. The coal liquefaction project shall open a new channel to solve the problem of domestic oil supply. Coal liquefaction also brings significance to environmental protection as China's environmental pollution especially air pollution is closely related to energy exploitation and consumption. In 2004, China started its first coal-to-oil project, Shenhua Group's coal liquefaction project in Inner Monogolia. This is the world's biggest coal-to-oil project. The main objective of coal liquefaction is to produce synthetic oil to supplement natural sources of petroleum. The whole project will be built in two stages and upon completion will have an output of 5 million tons of oil production a year. The first stage of the project will cost 24.5 billion (US\$2.96 billion), and will be able to produce 3.2 million tons a year of oil products when completed in July 2007. The second production line is due to be finished around 2010. Output from the first phase will include 2.15 million tons of diesel and 500,000 tons of gasoline.

The Chinese government also paid great attention to the R&D of Ethanol-blended fuel. China has four ethanol plants at present and the four plants' capacity could be expanded to 1.2 million tons a year by 2006 and 1.5 million tons by 2008. By the end of 2005, gas stations in nine provinces will be required to replace regular gasoline with gasohol (10% ethanol-blended gasohol), a blend made of 90 percent gasoline and 10 percent ethanol.

### **RATIFIED STATE STANDARD ON MAXIMUM VEHICLES FUEL CONSUMPTION**

The transport sector, the second biggest oil consumer and the fastest-growing oil consumer in sub-sectors, accounted for 26.1 percent of the total oil consumption in 2003. To control vehicles oil consumption and improve fuel efficiency, Chinese government ratified the state standard "Maximum vehicles fuel consumption" in September 2004. The target of the first phase of the standard will be brought into effect on 1 July 2005 and the target of the second phase will be brought into effect on 1 Jan. 2008. For the vehicles whose weight is lower than 1 ton, in the first stage, the standard stipulates their maximum fuel consumption have to be controlled under 8.3 liter per 100 kilometers and in the second phase its maximum fuel consumption must be controlled under 7.5 liter per 100 kilometers. For the vehicles whose weight is over 2 tons, in the first phase their maximum fuel consumption must be controlled under 12.8 liter per 100 kilometers and in the second phase their maximum fuel consumption have to be controlled under 11.5 liter per 100 kilometers. The implementation of the compelling state standard will limit the popularization of higher oil intensive cars and luxury cars and will be conducive to oil conservation.

### **NATURAL GAS AND OIL PIPELINE CONSTRUCTION**

The year 2004 is a fruitful year for China's gas and oil pipeline construction. Firstly, China's long-distance west to east natural gas pipeline started its full commercial operation on 30 December 2004, with gas from the Tarim and Changqing gas fields in western Xinjiang and Shaanxi provinces being pumped across the country to Shanghai. The pipeline, which was started in 2002, with an investment exceeding 140 billion yuan (US\$16.9 billion), is expected to transport 12 billion cubic meters of gas a year, running through Xinjiang, Gansu, Ningxia, Shaanxi, Shanxi, Henan, Anhui,



Jiangsu, Shanghai and Zhejiang. By the end of 2004, PetroChina had signed 43 take-or-pay contracts with 40 gas consumers. From January to July of 2005, the pipeline has already supplied 2 billion cubic meters of gas to 30 gas users in the eastern part of China and it is expected that 3.6 billion cubic meters of gas will be supplied in 2005. The completion and operation of the gas pipeline project will increase China's gas yield by nearly 50 percent and increase the gas share in China's energy consumption structure by one to two percentage points. Secondly, the commercial operation of the trunkline of the "Zhongxian-Wuhan" gas pipeline and its two branches, the Zhijiang-Xiangfan pipeline and the Wuhan-Huangshi pipeline, helped two target markets of Hubei and Hunan to realize the dream of consuming natural gas. Thirdly, the construction of the parallel line of Shaanxi-Beijing gas pipeline is near completion. Fourthly, the construction of two parallel pipeline transporting from Xingjiang to Lanzhou, a 1,550km crude pipeline and a 1,840km oil product pipeline, is well underway. The second phase of the Sino-Kazakhstan crude pipeline started construction in September 2004, which will mainly feed PetroChina's western refineries.

### **FIRST CROSS-BORDER OIL PIPELINE**

In November 2005, the completion of the 246-kilometer-long Alashankou-Dushanzi crude pipeline had finally achieved the first phase of the construction of Sino-Kazakhstan crude pipeline. The Sino-Kazakhstan crude pipeline is the first cross-border oil pipeline in China. It spans into a 960-kilometer-long cross-border pipeline which starts at Atasu of Kazakhstan, entering into Dushanzi of Xinjiang autonomous region of China and through Alashankou. The first flow of Kazakh crude is expected to arrive at PetroChina's Dushanzi Petrochemical in May 2006. The first phase's Sino-Kazakhstan crude pipeline, the largest (in terms of diameter) ever built in the economy, will have an initial annual handling capacity of 10 million tons per year and would reach its full annual capacity of 20 million tons soon after the second phase of the pipeline is completed in 2010. The pipeline will on the one hand diversify the channels for China's crude oil import and on the other hand provide a large market for Kazakhstan's abundant oil and gas.

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# HONG KONG, CHINA

## INTRODUCTION

Hong Kong, China is a world-class financial, trading and business centre of some 6.8 million people situated at the southeastern tip of China. Since 1997, it has been a Special Administrative Region (SAR) of the People's Republic of China. All of the energy consumed in Hong Kong, China is imported, as it has no natural resources; except for deep-water ports – considered to be one of the finest in the world. The energy sector consists of investor-owned electricity and gas utility services.

Hong Kong, China is a modern economy with a high GDP per capita of US\$24,489 (1995 US\$ at PPP) in 2003. The services sector has grown significantly in the past two decades and it is responsible for 88.5 percent of GDP in 2003. The services sector is dominated by small and medium enterprises (SMEs), which are also the driving force of economic growth in the manufacturing sector. GDP of Hong Kong, China expanded by a robust 8.1 percent in real terms in 2004, distinctly faster than the 3.1 percent rate in 2003. Hong Kong, China was ranked the 14th largest banking centre in terms of external banking transactions, and the 6th largest foreign exchange market in terms of market capitalisation. Its stock market is Asia's 2nd largest in terms of market capitalisation. In addition, it was ranked the 11th largest trading entity in the world in 2004. It operates the busiest container port in the world in terms of throughput, as well as the busiest airports in terms of number of passengers and volume of international cargo handled. As the recovery gathered pace from SARS, the labour market improved progressively on a broad front throughout 2004. Average unemployment rate reached 6.8 percent in 2004, lower than that of the 2003 average of 7.9 percent. Unemployment rate remains high, with wages not showing an evident rebound and the disparity between the rich and the poor becoming more serious as the Hong Kong, China economy has entered a period of inflation.

In recent years, Hong Kong, China's relationship with China has strengthened in terms of business ties, the extent of government contacts, and flow of people. To stay competitive and attain sustainable growth, Hong Kong, China needs to restructure and re-position itself to face-up with the challenges posed by globalisation and closer integration with the Mainland China. The Mainland China and Hong Kong, China Closer Economic Partnership Arrangement (CEPA) is a manifestation of advantages under "One Country, Two Systems". Under the three phases of CEPA, starting from 1 January 2006, all products of Hong Kong origin will enjoy tariff-free access to the Mainland upon applications by local manufacturers and upon the CEPA rules of origin being agreed and met. On trade in services, Hong Kong services suppliers enjoy preferential treatment in 27 service areas in the Mainland. The Government's strategy is to go up the value chain by; speeding up structural transformation to a high-value, knowledge-based, and skill-intensive economy; pursuing reforms in education and population policy to amass the pool of talent; as well as leveraging on the immense business opportunities in Mainland China. Financial, logistics, tourism, professional, and producer services are the five high value added sectors in the economy, which Hong Kong, China possess as a competitive advantage.

Table 11 Key data and economic profile (2003)

Key data		Energy reserves	
Area (sq. km)	1,103	Oil (MCM)	-
Population (million)	6.82	Gas (BCM)	-
GDP Billion US\$ (1995 US\$ at PPP)	166.91	Coal (Mt)	-
GDP per capita (1995 US\$ at PPP)	24,489		

Source: Energy Data and Modelling Centre, IEEJ.

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## ENERGY DEMAND AND SUPPLY

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### PRIMARY ENERGY SUPPLY

In 2003, total primary energy supply in Hong Kong, China was 15,592 ktoe. Of this total, 47 percent was oil, 41 percent coal and 8 percent gas. Electricity imports from China accounted for the remaining 4 percent. Hong Kong, China has no domestic energy reserves or petroleum refineries and therefore imports all of its primary energy needs. It however generates some electricity.

Hong Kong, China had a total installed electricity generating capacity of 9,703 MW in 2003. Electricity is supplied by CLP Power Hong Kong Limited (CLP Power) and The Hong Kong Electric Company Limited (HEC). CLP Power supplies electricity from its Black Point (1,875 MW), Castle Peak (4,108 MW) and Penny's Bay (300 MW) power stations. Natural gas is currently used for power generation at the Black Point and Castle Peak power stations. It is imported from the Yacheng 13-1 gas field off Hainan Island in southern China via a 780-kilometre high-pressure submarine pipeline. At the Black Point power station, one 312.5 MW gas combined-cycle generator was commissioned in 2005, while one more 312.5 MW gas combined-cycle generator is scheduled for commissioning in 2006. CLP Power has contracted to purchase about 70 percent of the power generated at the two 984 MW pressurised water reactors at the Guangdong Daya Bay Nuclear Power Station to help meet the long term demand for electricity in its supply area. It also has the right to use 50 percent of the 1,200 MW capacity of Phase 1 of the Guangzhou Pumped Storage Power Station at Conghua. Electricity for HEC is supplied from the Lamma Power Station and its total installed capacity was 3,420 MW. In May 2000, the Government has approved HEC's new power station at the Lamma Extension and the installation of the first 300 MW gas combined-cycle generator. The unit is scheduled for commissioning in 2006. All locally generated power is thermally fired.

Towngas and liquefied petroleum gas (LPG) are the two main types of fuel gas used throughout Hong Kong, China. Towngas is distributed by the Hong Kong and China Gas Company Limited. It is manufactured at plants in Tai Po and Ma Tau Kok, both using naphtha as feedstock. LPG, on the other hand, is supplied by oil companies and imported into Hong Kong, China by sea and stored at the five terminals in Tsing Yi Island.

### FINAL ENERGY CONSUMPTION

Total final energy consumption in Hong Kong, China reached 10,532 ktoe in 2003. The bulk of energy was used in the transportation sector (53 percent), followed by the residential/commercial sector (35 percent) and the industrial sector (11 percent). With the dominance of transport, the most important end use fuel was petroleum, accounting for 63 percent of energy use. Electricity and others made up 31 percent of end-use consumption, while gas accounted for only 6 percent.

As mentioned earlier, gas is supplied for domestic, commercial and industrial uses in two main forms. In addition, LPG is used as a fuel for LPG taxi and light buses, and natural gas is used for electricity generation. In energy terms, town gas accounted for 80 percent of gas use in these sectors in 2003.

Table 12 Energy supply &amp; consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)*	
Indigenous Production	-	Industry Sector	1,192	Total*	35,506
Net Imports & Other	15,592	Transport Sector	5,626	Thermal	35,506
Total PES	15,592	Other Sectors	3,714	Hydro	-
Coal	6,401	Total FEC	10,532	Nuclear	-
Oil	7,319	Coal	5	Others	-
Gas	1,237	Oil	6,639		
Others	635	Gas	580		
		Electricity & Others	3,306		

Source: Energy Data and Modelling Centre, IEEJ. (See <http://www.ieej.or.jp/egeda/database/database-top.html>)

\* Total does not include electricity generated by hydro and nuclear facilities located in China.

## POLICY OVERVIEW

The Government of the Hong Kong Special Administrative Region (SAR) pursues two key energy policy objectives. The first is to ensure that the energy needs of the community are met safely, efficiently, and at reasonable prices. The second is to minimise the environmental impact of energy production and promote the efficient use and conservation of energy.

In keeping with Hong Kong, China's free market economic philosophy, the Government intervenes only when necessary to safeguard the interests of consumers, ensure public safety, and protect the environment. The Government works with the power, oil and gas companies to maintain strategic reserves of coal, diesel and naphtha. It monitors the performance of the power companies through the Scheme of Control Agreements. It has entered into an Information and Consultation Agreement with the Hong Kong and the China Gas Company Ltd to make the town gas tariff adjustment mechanism more transparent. In consultation with the power companies, the Government also promotes energy efficiency and energy saving measures.

To help monitor the energy situation, Hong Kong, China has developed an energy end-use database and forecasting model. The database will provide useful insight into the energy supply and demand situation, including energy consumption patterns and trends, and energy use characteristics of the individual sectors and sub-sectors. A basic data set is publicly available on the Internet.

The Electricity Ordinance and the Gas Safety Ordinance regulate the safe supply of electricity and gas. Among other things, these ordinances cover the registration of generating facilities, workers and contractors for electrical and gas installations, wiring and gas installation standards and safe distribution and use of electricity and gas. Most provisions of the Electrical Product (Safety) Regulation, which regulates the safety of household electrical products, came into effect in May 1998. To regulate the import, supply and installation of domestic gas appliances for use in Hong Kong, China, the Gas Safety (Installation and Use) Regulation and the Gas Safety (Miscellaneous) Regulation were amended in 2002.

The Government is also currently conducting an electricity market review to map out the regulatory arrangements for the electricity market after the current Scheme of Control Agreements with the two power companies expires in 2008. In mapping out the future regulatory arrangements, the power companies will be required to install effective emissions reduction facilities to achieve emissions reduction targets, as a precondition for licensing. The Government has asked the power companies to accelerate the timing of emissions reductions to fully achieve the emission reduction targets in 2010.

In the latest 2005-2006 Policy Address, the Government has taken vigorous measures to make sustained improvement in air quality. The Government is to introduce, in stages, Euro IV emission standards for newly registered vehicles from January 2006. In addition, the Government will take the lead to reduce power consumption. From January 2006, power consumption in all Government office buildings will be reduced by 1.5 percent annually, and the Government will take the lead in using ultra-low sulphur diesel in all government projects. Furthermore, the Government will issue guidelines to all government drivers, requiring them to switch off engines while waiting.

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## **NOTABLE ENERGY DEVELOPMENTS**

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### **COMPREHENSIVE BUILDING ENERGY CODES**

The Government has promulgated a Comprehensive Building Energy Codes which covers lighting, air-conditioning, electrical, lift & escalator installations, and overall thermal transfer value of buildings. To encourage innovative energy-efficient building design features, a performance-based building energy code using total-energy-budget approach was published in April 2003.

### **ENERGY EFFICIENCY LABELLING SCHEMES**

As of end January 2005, the Government has issued labels for more than 2,670 appliance models including refrigerators, room coolers, washing machines, electric clothes dryers, compact fluorescent lamps, electric storage water heaters, electric rice-cookers, dehumidifiers, televisions, multifunction devices, photocopiers, laser printers, LCD monitors, electronic ballasts, computers, and domestic gas instantaneous water heaters under voluntary Energy Efficiency Labelling Scheme.

The voluntary Energy Efficiency Labelling Scheme has also been extended to cover Petrol Passenger Cars in February 2002, to raise the level of public awareness in the energy efficiency of vehicles. This was the first labelling scheme for vehicles in Hong Kong, China.

In 2005, a public consultation on a proposed mandatory energy efficiency labelling scheme was carried out to collect views from the public and trades about making it a mandatory requirement for specified energy-using products to have energy labels. In the initial phase, the proposed mandatory scheme will cover refrigerators, room coolers and compact fluorescent lamps. The Government is working on a legislative proposal for the introduction of the mandatory scheme, taking into account comments and views received during the public consultation.

### **ENERGY AUDIT PROGRAMME**

Since 1993, the Government has been implementing Energy Audit Programmes in government buildings. As of January 2005, energy audits and re-audits had been performed in 224 major government energy-consuming buildings.

Pilot tests on Energy Management Opportunities (EMO) using innovative energy efficient equipment related to lighting, air conditioning and vertical transportation have also been carried out to achieve energy savings in government buildings since 1999. The tests have been very successful and substantial energy savings were achieved. Application guidelines to promulgate the use of the EMOs have been published.

### **ENERGY END-USE DATABASE**

The Government has continuously maintained and updated the energy end-use database. The database provides useful insight into energy consumption patterns of different sectors, sub-sectors and the end uses in Hong Kong, China. A basic data set (Year 2003 basic data) from the database was published in September 2005 and is made available for public access at the Electrical & Mechanical Services Department (MSD) website (<http://www.emsd.gov.hk>).

### **ALTERNATIVE FUEL VEHICLES**

In Hong Kong, almost all the diesel taxis had been replaced by liquefied petroleum gas (LPG) models. In August 2002, the Government launched a voluntary incentive scheme to encourage owners of existing diesel public and private light buses to replace their vehicles with LPG or electricity models. About 2,400 diesel public light buses, representing over 80 percent of the newly registered public light buses have been replaced with LPG ones. EMSD, being the Government department responsible for gas safety, is closely involved in the safety control and approval of the LPG vehicles, LPG filling stations, LPG vehicle workshops, as well as establishing and maintaining registers of trained LPG vehicle mechanics. In addition, the Government is continuously identifying possible ways to encourage vehicle owners to use cleaner alternative fuel. EMSD will carry on playing its role on advising gas safety.

### **RENEWABLE AND CLEAN ENERGY**

Several local institutions have received both direct and indirect funding from the Government to support their research projects on the utilisation of renewable energy resources. The scope of research projects varies from the theoretical study of solar irradiation to the development of a computer model to estimate the quantity of renewable energy resources over Hong Kong.

In late 2000, the Government commissioned a two-stage consultancy study to investigate the viability of using new and renewable energy technologies in Hong Kong, China, including a review of the associated institutional, legal, regulatory and financial issues. The first stage of the study was completed and identified a number of new and renewable technologies as likely options for wide scale local adoption. These new and renewable energy technologies, include solar power, wind power, energy from waste and building integrated fuel cells. The consultancy study also involved the installation of building-integrated photovoltaic panels in existing high-rise buildings to demonstrate to the general public the applicability of renewable energy technologies. The installation was completed in end 2002. The performance of the photovoltaic system was monitored over a 12-month period so as to collect technical data to assess their performance under local weather and environmental conditions. The whole consultancy study was completed in 2004.

Further demonstration projects on renewable energy power systems have also been installed by the Government to promote public awareness in renewable energy. In 2005, the largest photovoltaic installation in Hong Kong, with 350 kW peak capacity, has been put into service on the roof of EMSD's headquarters building. Apart from solar energy, a micro wind-turbine has also been installed on the rooftop of EMSD's building to study the application of wind power system in an urban environment. In the second stage of the public consultation to draw up an outline for future development of the electricity market, the Government has included the use of renewable energy to generate electricity and the implementation of demand side management. Moreover, one of the two power companies in Hong Kong, China has completed the construction work of Hong Kong, China's first commercial scale wind turbine of 800 kW in end of 2005. The wind turbine is expected to produce 1 GWh of electricity a year. The other power company has also agreed to set up similar pilot commercial scale wind turbine project for public demonstration and evaluation purposes by end 2007, subject to detailed feasibility studies.

Based on the findings of the public engagement process carried out in 2004, the Government promulgated the First sustainable Development strategy for Hong Kong in May 2005. A target of having 1% to 2% of the local power needs met by renewable energy by 2012 has been set so as to meet the strategic objectives on renewable energy.

### **CONSULTANCY STUDIES ON WIDER USE OF WATER-COOLED AIR CONDITIONING SYSTEM (WACS)**

The Government has completed three consultancy studies on the energy saving potential of WACS. One is on the territory-wide implementation of WACS and the other two are on the implementation of district cooling system in a new development area and an existing developed

area. The Government is materializing some recommendations put forward by the studies, such as increasing the designated areas in the territory for allowing the use of fresh water cooling towers in non-domestic buildings.

### **ENERGY CONSUMPTION INDICATORS AND BENCHMARKS**

In order to investigate the detailed energy consumption patterns of specific energy consuming groups, energy consumption indicators and benchmarks have been developed for hospitals, clinics, universities, schools, hotels and boarding houses, private offices and commercial outlets in the commercial sector, as well as medium and heavy goods vehicles, private cars and light goods vehicles in the transport sectors. The energy consumption indicators and benchmarks enable targeted groups to identify opportunities, set their own targets, and implement measures for improvement. Indicators and on-line benchmarking tools were also made available at the EMSD website, where individual operators could benchmark their energy consumption with others in the same group.

### **LIFE CYCLE ENERGY ANALYSIS FOR COMMERCIAL BUILDING DEVELOPMENT**

In Hong Kong, China, commercial buildings are responsible for 34 percent of the city's total energy end-use. Enhancing sustainability of building development is of paramount importance to the sustainability of Hong Kong, China. To achieve this goal, the Government is developing a software tool for assessing the environmental impact, energy use and cost implication of building development. It integrates the approaches of Life Cycle Analysis and Life Cycle Costing for decision-making on commercial building development. The beta version of the software tool was distributed free of charge to the industry in mid-2005.

### **ENERGY SAVING PROGRAMMES IN PUBLIC AND PRIVATE SECTORS**

To demonstrate its commitment to protect the environment, the Government sets targets in March 2003 to cut down the annual electricity consumption of Government departments by 1.5 percent, 3 percent, 4.5 percent and 6 percent in Financial Year (FY) 2003-04, 2004-05, 2005-06 and 2006-07 respectively, using FY 2002-03 as the base year. Since then, EMSD has been providing technical support and expert advice to Government departments by publishing energy saving tips and guidelines, organising experience sharing workshops, advising on good housekeeping practices, implementing energy saving retrofits etc. With these efforts in place, a saving of about 3.1 percent in electricity consumption of Government departments was achieved in the first two years since the targets were announced.

In line with the Government's drive to save energy, an energy saving competition aiming to recognize best practices among Government departments in energy efficiency and conservation was launched in 2003. Some 192 entries from various departments, accounting for 48 percent of the total Government consumption, participated in the competition. The overall saving achieved by the participants was 5.9 percent in the one-year competition period.

A similar competition titled "Hong Kong Energy Efficiency Awards" was launched in October 2004 for the private sector to help property management organisations and schools build up stronger sense of environmental protection and sustainable energy use. Encouraging responses to the Awards were received and some 230 entries went through the one-year competition period with due diligence and enthusiasm.

In Hong Kong, China, it is estimated that air conditioning systems consume about one-third of total electricity consumption of the whole territory. In order to reduce electricity consumption, the Government initiated a policy in October 2004 to maintain the air-conditioned room temperature of Government premises at 25.5 deg C in summer months. In June 2005, the Government further promoted the 25.5 deg C initiative to the public as one of the themes of World Environment Day 2005.

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# INDONESIA

## INTRODUCTION

Indonesia is an archipelago located between 6° 08' North to 11° 05' South Latitude, and from 94° 45' to 141° 05' East Longitude. The economy is comprised of 17,508 large and small islands near the equator, with a total area of 9.8 million square kilometres (including Exclusive Economic Zone), about 81 per cent of which or about 7.9 million square kilometres are at sea and the land mass about 2 million square kilometres.

There are two main seasons in Indonesia, the dry and wet season (and occasional transition periods). The dry season (June to September) is influenced by the Australian continental air masses, while the rainy season (December to March) is influenced by the Asia Continental and Pacific Ocean air masses passing over oceans, which carry lots of moisture and rain to fall in Indonesia.

Temperature varies across the economy and influenced mostly by altitude. Average temperature ranged from 28.2° C to 34.6° C in the day time and from 12.8° C to 30° C during the night.

The population in 2003 is about 215 million, the majority of whom reside in Java and Bali, and in the four other main islands namely Kalimantan, Sulawesi, Sumatra and West Papua.

In 2003, real gross domestic product (GDP) was US\$ 617.92 billion and per capita GDP was about US\$2,878 (both in 1995 US\$ at PPP). Since 1991, manufacturing was the major contributor, to Indonesian economy. In 2003 it accounted for 24.65 percent of the real GDP, while agriculture, livestock, forestry and fishery contributed 16.58 percent. Trade, hotel and restaurant contributed around 16.32 percent. Mining and quarrying contributed about 10.70 percent, transport and communication 6.25 percent, financial ownership & business services 6.88 percent, services 10.39 percent and construction 6 percent. Electricity, gas and water supply contributed the least at 2.2 percent.

In 2003, Indonesia's economy grew by an average of 4.1 percent, a slight improvement from its 3.1 percent growth in 2001 and 3.7 percent in 2002.

Mining activities, especially of petroleum, and tin, have expanded since 1970. Fossil energy resources, such as oil, natural gas and coal, played important roles in the economy both as industrial raw materials and foreign exchange earners. Oil and gas contributed US\$15.2 billion or 23.8 percent of total export earnings and about 18 percent of government budget in 2003. And coal contributed US\$2.5 billion to export earning.

In 2003, Indonesia's oil and natural gas reserves slightly decreased to around 641.1 MCM and 2,560 BCM respectively, while that of coal remained at 5,370 Mt.

Table 13 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	1,937,179	Oil (MCM)	641.1
Population (million)	214.67	Gas (BCM)	2,560
GDP Billion US\$ (1995 US\$ at PPP)	617.92	Coal (Mt)	5,370
GDP per capita (1995 US\$ at PPP)	2,878		

Source: Energy Data and Modelling Centre, IEEJ.

\* Proved reserves at the end of 2003 from the BP Statistical Review.

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## ENERGY DEMAND AND SUPPLY

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### PRIMARY ENERGY SUPPLY

In 2003, total primary energy supply was 103,353 ktoe. Of this total, 44.4 percent was oil, 34.5 percent gas, 15.0 percent coal, and 6.0 percent for other energy such as geothermal, hydro and new and renewable energy resources.

Most of Indonesia's proven oil reserves are located onshore in the Duri and Minas fields in central Sumatra. Other significant production fields are located in offshore north-western Java, East Kalimantan and the Natuna Sea. During the last decade, crude oil production in Indonesia ranged between 1.3 and 1.4 million bbl/d. But as fields were continually developed and reserves were depleted, crude oil production started to decline in the recent years. Thus, in 2003, Indonesia was only able to produce crude oil at an average rate of 1.1 million bbl/d, further declining to 966,466 bbl/d in 2004. In total, oil production declined from 457 billion barrels in 2002, to 419 billion barrel in 2003 and 401 billion barrels in 2004. Aside from oil, Indonesia also produces about 131,000 bbl/d of natural gas liquids and condensate in 2002, 2003 and 2004.

Besides relying on its domestic oil production, Indonesia also imports crude oil and refinery products to support its domestic oil requirements. Prior to 2002, Indonesia has been an energy exporter, exporting oil, gas, and coal. But in 2002, because of increased demand and depleting reserves, Indonesia (for the first time) became a "net oil importer". It has exported 185.9 million barrels of crude oil and 42 million barrels of refinery products, but imported 124 million barrels of crude oil and 106.9 million barrels of fuel oil. In total, Indonesia's net oil imports reached 3 million barrels in 2002. Net oil import increased to 30 million barrel in 2004.

Indonesia is however optimistic that it will immediately recover and get out of its current status as a "net oil importer" when new oil resources are discovered and developed in the next few years. BP Migas the Indonesian downstream oil and gas regulatory body has set up a target to increase the oil production into 1.3 million barrel by 2009.

In 2003, Indonesia's natural gas production reached around 3,155 BCF, an increase of 3.7 percent from its 2002 production of 3,041 BCF. More than half (54 percent) of Indonesia's natural gas production was converted to LNG for export, while the rest (46 percent) was used to supply the domestic demand and exported through pipeline. In the domestic market, about 41 percent are utilized by industry and electricity, while 25 percent are used for gas injection and fuel on the field. The rest of the domestic supply is utilized either as city gas (7 percent), or in refineries (3 percent).

About 90 percent of the gas is exported as LNG, 4 percent as LPG and 6 percent as piped gas. Of the exported LNG, around 69 percent went to Japan, 19 percent to Korea and 12 percent to Chinese Taipei. Despite however the availability of natural gas in Indonesia, its domestic use is still relatively under-developed.

More than half of Indonesia's total recoverable coal reserve is lignite (about 57 percent), 27 percent is sub-bituminous, 14 percent bituminous and less than 0.5 percent is anthracite. Based on a recent assessment of Indonesia's coal reserves, 10 more coal basins were identified which contain 336 tcf of Coal Bed Methane (CBM). The major coal reserves in Indonesia are located in the islands of Sumatra, and Kalimantan, while some reserves are also found in West Java and Sulawesi. Indonesian coal generally has a heating value ranging between 5,000 - 7,000 kcal/kg, with low ash and sulphur levels. The sulphur content of Indonesia coal is below 1 percent.

In 2003, Indonesia has produced about 115 million tonnes of coal, an increase of 11 percent from its production in 2002 of 104 million tons. Most or about 70 percent of production was exported, about 70 percent to Japan, South Korea and Chinese Taipei. Indonesia plans to double its coal production, eyeing other economies in East Asia and India as potential markets.

Indonesia has 25,562 MW of installed generating capacity in 2003, of which it has generated about 142,288 GWh of electricity. Most of the electricity generated came from thermal (89 percent), while the rest were supplied by hydro (6.4 percent) and geothermal and others (4.6 percent).

Table 14 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	184,957	Industry Sector	23,453	Total	142,288
Net Imports & Other	-81,604	Transport Sector	20,965	Thermal	126,889
Total PES	103,353	Other Sectors	22,476	Hydro	9,106
Coal	15,551	Total FEC	66,893	Nuclear	-
Oil	45,939	Coal	5,191	Others	6,294
Gas	35,677	Oil	40,585		
Others	6,196	Gas	10,637		
		Electricity & Others	10,481		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

### FINAL ENERGY CONSUMPTION

Indonesia's final energy consumption slightly decreased to 66,893 ktoe in 2003 from 69,641 ktoe in 2002. The decrease was mainly because of the 10 percent reduction in oil consumption in 2003, as a result of the oil price hike, averaging 55 percent in 2002 and 20 percent in January 2003. Consumption of coal, gas and electricity in 2003 however increased to about 3.4 percent, 11.62 percent and 3.8 percent respectively.

The most important end use fuel was oil, accounting for 60 percent of consumption, followed by gas at 16 percent, electricity at 15.6 percent and coal at 8.4 percent. There was however a slight change in the domestic use of gas in 2002. Lack of supply and infrastructure has slowed down domestic consumption from 10,345 ktoe in 2001 to 9,528 ktoe in 2002. However, in 2003 domestic gas consumption recovered and reached 10,637 ktoe in 2003.

Coal consumption, on the other hand, has continuously increased in 2003. After almost doubling from 2000 to 2001, and an increase by almost 18 percent from 2001 to 2002, the consumption reached 5191 ktoe or a 3.4 percent increase from 2002. Power generation has accounted for 64 percent of coal consumption, while the rest was consumed by cement (16 percent), pulp industry and residential.

Electricity consumption in 2003 has increased to about 3.8 percent from 2002, and reached 10,481 ktoe. The growth was however lower than the recorded growth in 2001 to 2002 (about 8 percent).

Increased tariff and subsidy removal especially for oil based fuel and electricity have affected the sector's energy consumption. From 2001 to 2003 both sectors' consumption decreased continuously.

Industrial sector's final energy consumption which accounts for 35 percent of final energy consumption in 2003, dropped to 3.7 percent from 24,357 ktoe in 2002 to 23,453 ktoe in 2003. While from 2001 to 2002 industrial sector's consumption dropped by 7 percent.

The energy consumption in transport, which has accounted for 31 percent of final energy consumption in 2003, suffered the downtrend with consumption dropping to 20,965 ktoe from 22,085 in 2002 or about 5.1 percent from 2002. Consumption also dropped in 2002 to about 7 percent from 2001.

Although the others sector's (household and commercial) consumption grew by 7 percent from 2000 to 2001 and 13 percent from 2001 to 2002, in 2003 the consumption also experienced negative growth. From 2002 to 2003, house hold and commercial sector final energy consumption decreased from 23,198 ktoe to 22,476 ktoe or slow down of 3.1 percent.

Considering both sector's continuous growth during the years, it would seem that increases in energy prices has motivated the consumers to use energy more efficiently, which resulted to significant reduction in final energy consumption. This fact also supported by declining trend of energy intensity to GDP from 5.14 BOE/US\$ 1000 in 2000 to 4.11 BOE/US\$ 1000 in 2003.

Non-commercial biomass, an important source of energy in the residential sector, is not currently taken into account due to difficulties in measuring consumption levels.

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## POLICY OVERVIEW

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Indonesia's energy policy is collaboratively formulated by inter-ministerial bodies; the BAKOREN (Badan Koordinasi Energy Nasional) the National Energy Coordinating Board. BAKOREN is a cabinet level inter-ministerial body, created in 1980 to formulate government policies on the development and utilization of national energy resources and to coordinate the implementation of the policy. The membership consists of Minister of Energy and Mineral Resources, Public Works, Industry, Agriculture, Forestry, Environment, Defence, Research and Technology and Head of Nuclear Agency and Pertamina Director.

In the executive level, the Ministry of Energy and Mineral Resources has overall responsibility for the development of mining, oil, natural gas, electricity and new and renewable energy. The line supervision and regulation of Indonesian energy sector falls under three Directorate General of the Ministry.

The Directorate General of Oil and Gas (MIGAS) covers regulation and supervision of the upstream and downstream oil and gas industry. MIGAS is also responsible for offering oil and gas acreages to oil and gas companies. Under the Oil and Gas Law, promulgated in 2001, MIGAS is supported by two independent bodies; BP Migas and BPH Migas. BP MIGAS (Badan Pelaksana Minyak dan Gas Bumi) is an upstream implementing body responsible for managing oil and gas contractors. BPH Migas (Badan Pengatur Hilir Minyak dan Gas Bumi), on the other hand, is responsible for controlling downstream activities, such as regulating and determining the supply and distribution of oil based fuel, regulating the transmission and distribution of natural gas, allocating fuel to meet national oil fuel reserves, the use of oil and gas transportation and storage facilities, setting tariff for gas pipelines use, and the price setting of natural gas for household and small consumers.

The Directorate General Geology and Mineral Resources (DJGSM) renamed as Directorate General Mineral, Coal and Geothermal in 2005 handles the promotion and supervision of the mining industry, including coal, mineral and geothermal. The National Geology Agency formed in 2005, is now responsible for geological related research and services.

The Directorate General Electricity and Energy Utilization (DJEEU) is responsible for policy planning and supervision of electricity industry and new and renewable energy development.

Indonesia's energy policy was launched in 1990 and was amended in 1991, 1998 and 2004. The National Energy Policy was also supported by Blue Print Energy National, Policy on Coal, Policy on Geothermal, Policy on Renewable Energy and Conservation.

The main objective of the National Energy Policy is to secure reliable energy supply to the economy in order to maintain economic growth and welfare. The policy aiming to address the current state of Indonesian energy situation is indicated by:

1. Low access to commercial energy due to inadequate energy infrastructures. Energy per capita is 23 BOE among the lowest in APEC region. Electrification reaches only 58 percent of population recently.

2. High intensity of energy consumption 5.14 BOE/US\$(1993) 1000 of GDP in 2000 and slightly decreased to 4.11 BOE/US\$ (1993) 1000 in 2003.
3. Market in transition from monopoly to more competitive market
4. High price distortion as petroleum fuel and electricity highly subsidized.
5. Endowed with fossil fuel reserves and net exporter of energy, however reserves are in declining trend. Indonesia turns into net oil exporter to net oil importer in 2002 with increasing demand in oil import.
6. Oil takes dominant share in the economies energy mix about more than 50 percent recently.

The Energy Policy consists of 3 major policies objectives, namely: 1) diversification of energy resources, 2) intensification of searching for new reserves, and 3) energy conservation.

#### DIVERSIFICATION OF ENERGY SOURCES

The main objective of diversification is to reduce share of oil in the economy's energy mix. To meet this objective, Indonesia promotes the consumption of energy other than oil, including coal, geothermal, gas, new and renewable energy. The economy is also seriously considering nuclear in the energy mix.

Expected coal share in national energy mix would be increased from 14 percent in 2002 to 20 percent by 2020 and 32 percent in 2025. To support the target, the Minister of Energy and Mineral Resources issued the National Coal Policy in June 2004. The policy focused on the intensification of exploration to increase reserves and production for export and domestic uses by providing better business environment. To increase national coal consumption, Indonesia will invite the private sector to build mine mouth coal power plants.

To increase the share of renewable energy, Indonesia has issued several policies. In 2002, the Ministry of Energy and Mineral had issued decree No. 1122 K/30/MEM/2002 which provided the guidance for remote small power producers of less than 1 MW to be connected to the national grid. The state electricity company PLN is obliged to buy power from small power producers which generate power from wind, solar, mini-micro hydro, agricultural and industrial wastes, municipal solid waste, dendro-thermal and geothermal. However, sales of electricity should be concluded on conditions accepted by both parties.

In October 2003, the Geothermal Law was enacted to promote a more favourable business climate for the sector. The law effectively abolished the monopoly of Pertamina. The geothermal businesses are conducted under competitive transparent open tender and open to every business entities. With the new business environment, the expected installed capacity of electricity generation from geothermal will increase to 6,000 MW by 2020 and 9,500 MW by 2025 from its current 800 MW.

In early 2004, Indonesia had introduced a new Policy on Renewable Energy Development and Energy Conservation. Under the policy, the Indonesian Utilities Company is required to generate 5 percent of produced electricity from renewable energy. With this policy, it is expected that Indonesia will utilize 78,500 BOE of renewable energy by 2010.

In order to meet the target, Indonesia planned to increase power generation from solar photo voltaic, wind, geothermal and other new and renewable sources. In the National Energy Blue Print issued in July 2005, Indonesia planned to have 70 MW Photo Voltaic Power plant by 2025, a significant increase from 5 MW recently. In addition, installed wind power generation capacity is expected to increase from 0.5 MW recently to 250 MW by 2025.

For transport sector, Indonesia plans more utilization of bio diesel and gasohol. Indonesia plans to produce 720 million liters of bio diesel by 2010 to supply about 2 percent of total demand. The production capacity is expected to increase to 4.7 million kilo litre or 5 percent of projected demand in 2025. Gasohol production is also expected to provide the alternative fuel for at least 2

percent of the gasoline demand in 2010 and 5 percent of demand by 2025. In addition, the economy also considered the development of bio oil to partly substitute fuel oil. The economy target is to produce 900 million liters of bio oil per year by 2025.

Indonesia has seriously considered nuclear in its national energy mix. Under the Blue Print of National Energy 2005 – 2025, first nuclear power plant to supply high demand in Java Island will be constructed in 2010, and the first operation is expected to start in 2016. By 2025 Indonesia plans to have 4 or at least 3,600 MW of installed capacity from nuclear power plant.

With all of these programs, the expected share of coal, natural gas, oil, geothermal, hydro and others renewable in the economy's energy mix will be 32.7 percent, 30.6 percent, 26.2 percent, 3.8 percent, 2.4 percent and 4.4 percent, respectively.

#### INTENSIFICATION OF THE SEARCH FOR NEW ENERGY RESERVES

The policies encourage the exploration of energy resources such as oil, coal and new and renewable energy. Explorations of energy resources need significant investment. To invite investment in exploration of energy resources, favourable business environment is necessary.

Although such policies have been in place since the 1990's, its effectiveness has been questioned. Oil exploration, for over 10 years, has not yielded significant discoveries. More than 80 percent of Indonesia's commercial reserves came from oil blocks signed before 1971, and only five percent of the oil reserves found from the work area were signed after 1990.

Gas exploration, on the other hand had shown better prospects. However, only 60 percent of Indonesia commercial gas reserves come from gas block signed before 1971. While, blocks signed after 1990 accounted for only 14 percent of the commercial reserves. With only 38 out of 60 basins explored, Indonesia's failure to find significant additional oil and gas reserves strongly indicate under-investment.

In 2003 and 2004 the Ministry of Energy and Mineral Resources has initiated measures to improve the investment climate in oil and gas sector by simplifying procedures for exploration and production contract and increasing the profit shares for companies. Previously, oil and gas companies could only receive working areas through official tenders. By simplifying procedures, company can apply for working areas without waiting for a formal bidding session. Upon receipt of application, Government invites other bidders to participate. If there are no other bidders within a prescribed time, the sole bidder will be awarded the block. The new fiscal system will allow an increase in production shares for companies from 15 percent to 25 percent for oil, and from 30 percent to between 35 percent and 40 percent for gas.

In addition to intensified search for domestic energy resources, the National Energy Policy 2004 also encourages access to overseas oil and gas resources by permitting Indonesian oil companies to participate in upstream oil and gas projects overseas. By 2005, Pertamina, Indonesia's oil company secured oil exploration in Iraq and Libya and joint operation in Viet Nam and Malaysia.

#### ENERGY CONSERVATION

Institutionally, Indonesia's energy conservation program started in 1991, by the issuance of Presidential Decree No. 43 on energy conservation. The decree led to the National Master Plan for Energy Conservation in 1995. The plan included programmes for training, efficiency award, energy management, and industrial energy audit. It also outlined fiscal incentive such as tax reduction and soft loans for energy conservation projects. The plan has set a target for 15 percent energy savings by 1999, which was not achieved. In 2000, a more realistic target was set, to reduce energy intensity by 1 percent per year.

Along with all ASEAN members, except Brunei Darussalam, Indonesia adopted the voluntary building energy codes in 1992. Full adoption of the codes estimates about 20 percent energy savings in the long term.

In 2000, Indonesia promulgated mandatory standard for compact fluorescent lamps (CFLs). Refrigerators will be subject to mandatory standard by 2005, with maximum allowable consumption of 250 kWh per year. Standard for other electrical equipment such as air conditioner, flat iron, TV and freezers has been in effect since 1992.

To boost energy conservation program, Indonesia also introduced Demand Side Management Program (DSM) in 1992. The program focused on introduction of more efficient lighting, time of use tariff and motor efficiency improvement. Revised program in 2002, expected in 2005, will bring 1,555.4 MW peak load reduction.

To support energy conservation program, Indonesia created energy service companies PT Konservasi Energy Abadi (KONEBA). The company performed industrial energy audit, energy conservation planning, database development, training, information dissemination and the procurement and installation of energy saving equipment.

Despite having the conservation program in place for quite a long time, Indonesia's energy conservation have been limited by subsidised energy prices which limit incentive to use energy efficiently, lack of mandatory minimum energy performance standard and weak institutional support.

As a response to recent high oil price and fuel shortage President Susilo Bambang Yudoyono in July issued Presidential Instruction No.10/2005 on Energy Conservation. The instruction aiming to short term remedy asked Ministers, Governors and all Government agencies to implement energy conservation in their areas of responsibilities.

To support the implementation of President Instruction on Energy Conservation, Minister of Energy issued Guideline for Energy Saving, which consisted of guidelines on saving energy in commercial building, government office building, household, industry and transportation. Some of the those policies are:

1. Advice luxury car (car with engine capacity more than 2000 CC) to use the non subsidized fuel Pertamina (high Octane number fuel) instead of gasoline.
2. Set the air conditioned room temperature at 25 degrees Celsius, instead of common practice 18 – 20 degrees Celsius.
3. Advice household to reduce electricity consumption for about 50 watt during peak time (5:00 pm – 10:00 pm).

Although the policy is non mandatory, it was reported that Indonesia could manage 600-900 MW saving during peak time.

#### SUPPORTING POLICIES

In order to meet the policy objectives, Indonesia has also issued 7 supporting policies, namely:

1. Accelerating energy infrastructure development. Access to energy resources is important factor for sustainable economic growth. Improving access to energy by accelerating development of infrastructure has become a priority. Indonesian Government established the National Committee for the Acceleration of Infrastructure Provision. Main objective of the committee is to coordinate with all related sectors to reduce the burden for infrastructure development, including energy infrastructures, such as electricity and oil and gas storage, transportation and distribution. Started in 2005, the committee hosted regular infrastructure summit, where government of Indonesia announced planned infrastructure and offer participation to private and public. The summit followed by transparent bidding to seek the most attractive partner for infrastructures projects.
2. Promoting rational and market based pricing. The policy directed the establishment of appropriate energy pricing, the main objective of which is to provide affordable energy price and stimulate investment in energy sector. Market based pricing is considered as the optimal pricing mechanism. The pricing policy imperatively also suggested the internalisation of

external cost and the introduction depletion premium for fossil energy as it is an exhaustible resources. In addition, the policy also mandated price discrimination between productive and consumptive use of energy.

3. Providing direct and targeted subsidy to low income population. It is considered government obligation to provide energy access to the poor. However, providing subsidy to final energy price proved to be inefficient and ineffective. Subsidy to final price of energy have burdened government budget and has lead to inefficient use of energy sources by consumers. New subsidy system by providing direct subsidy to low income population and population in underdeveloped area started in 2004 and 2005.
4. Protecting the environment. The policy mandated that environmental aspects should be considered on every stage of energy development, from exploration to final use. This policy is supported by policy that required environmental impact assessment for energy projects, promotion of low emission fuel for transportation, abolishment leaded gasoline, and development clean coal technology for power generation.

In addition Indonesia also adopted the Convention on green house gases. In 2004, Indonesia ratified the Kyoto Protocol. Although, Indonesia is not on the Annex I list of the Protocol, the ratification could provide positive contribution to meet Kyoto requirements by participating in projects aimed to support Kyoto Protocol such as Clean Development Mechanism.

To reduce emission from transportation sector, Indonesia has imposed a new mandatory standard emission. For all new vehicles, manufactured in Indonesia from 1 January 2005, should meet Euro 2 emission standard. For vehicles being produced the requirement will be in force from 1 January 2007. Indonesia will stop the production of motorcycles with two stroke engines by 1 January 2007.

5. Enhancing private participation. As the private sector develops, government considers that private sector participation is important in energy development as energy sector also could provide appropriate or attractive return for private investment. In order to attract private participation, Indonesia improved investment climate by removing barrier to entry for private sector in energy sector, promote transparency and fair treatment and competition. All of those spirit unified in oil and gas law, electricity law, and other related law.
6. Enhancing Community development. This policy aimed to empower community, especially in the rural area to develop their own energy resources, such as micro hydro, solar photovoltaic, biomass and other local potential.
7. Encouraging research and development in energy sector. This policy objective is to develop capability and capacity in energy technology.

In addition Indonesia also issued sector's policy such as oil and gas policy, electricity policy, coal policy, geothermal policy, oil and gas policy and new and renewable and conservation policy. Detail program and target are formulated in the Blue Print National Energy Management 2005 – 2025 issued in July 2005.

## OIL AND GAS POLICY

Main policies for oil and gas sectors are stipulated in the Oil and Gas Law, Law No. 22/2001. Under the law oil and gas mining rights are held by government. According to Article 3 of Oil and Gas Law, exploration and exploitation of oil and gas (upstream activities) should be competitive, and that processing, transportation, storage and trading should be conducted through a mechanism that allows fair and transparent business competition.

The Oil and Gas law 2001 mandated the application of a market price for petroleum product pricing in the domestic market. However, in 2004 Indonesian Constitutional Court rejected the provision and returned the power to set up tariff to the Government.

The law mandated Government to transform the government owned oil and gas Pertamina and PGN from a monopoly into limited liability companies. Pertamina's transformation started in 2002,



when the company legally transformed into a limited liability Company, and was completed in 2005, when all privileges given to the company were removed entirely. However, Pertamina still operates all 7 of the economy's refinery with a capacity 1.03 MBOPD.

PGN a government owned gas transmission and Transportation Company divested in 2003, when 39 percent of shares were offered to the public through an IPO. In 2005, privileges given to PGN were removed. The company should then compete with others to secure its gas infrastructure project.

## ELECTRICITY POLICY AND MARKET

As the Indonesian Court had annulled Electricity Law No. 20/2002 in 2004, Indonesian power market is thus regulated by Regulation No. 15 /1985. Under the regulation Government therefore is responsible to provide electricity to the Indonesian market through the creation of a state owned enterprise Perusahaan Listrik Negara (State Electricity Company) known as PLN. PLN is operated as a vertically integrated monopoly. However, whenever the company is unable to provide electricity to the market, regulation authorizes PLN to establish cooperation with other entities and cooperate with the private sector. In any event that PLN could not provide the necessary services; consumers are allowed to develop its own electricity generation for its own use or captive power. Excess production may also be sold to PLN.

In 2005, the national power capacity was 44,767 MW. Among those 25,218 MW was owned by PLN, 15,215 MW by non-PLN (captive power) and 4334 MW owned by private sector. Among PLN's generating capacity 19,516 MW are located in Java and 5,702 MW are located in other islands. The islands of Java and Bali are served by an interconnected power system, while on the outer islands isolated systems have developed around major load centres, and electricity is delivered through mini-grids.

The initial step in restructuring power market in Indonesia began in 1994 through the conversion of PLN corporate status from states owned agency with a social purpose to a Limited Liability Company. Restructuring efforts continued in 1995 through the unbundling of PLN's Java-Bali generation, distribution and transmission assets. Generation assets unbundled into two generations companies, called PJB and Indonesia Power. Distribution unit was separated into four-distribution units (East, West and Central Java and Jakarta). Each distribution unit operates as semi-autonomous, where they receive funds allocation to cover their operational expenses in order to meet performance as set out in contract with headquarter. Java-Bali transmission is transferred to Java-Bali Electricity Transmission unit and load dispatch centre as a subsidiary of generation unit. Structure market becomes a single buyer market, where PLN transmission unit buy the power from PLN generators and IPPs. Outside Java and Bali restructuring take place in form of decentralization of PLN. Government is proposing more robust competition are planned to allow transition from single buyer market to full competitive multi-buyer, multi-seller market (MBMS).

Pricing is an important aspect in the Indonesian Power market. Although in theory in setting up the energy price, government will consider the cost of generation and suitable rate of return for the company, in reality the electricity tariff has not yet covered the long-range marginal cost of its production. As a result government has to subsidize PLN in order to meet the cash flow. However, it seems that government will reduce subsidy and allowing electricity price increase. Subsidy will likely provide to low income population through direct targeted subsidy.

## COAL POLICY

Coal business is regulated by Law No 11/1967 regarding general mining and Government Regulation No. 25/2000 regarding the Role of Central and Provincial Government. The Ministry of Energy and Mineral Resources is responsible for administering coal mining. A company wishing to mine coal must first submit an application to the Ministry of Energy and Mineral resources. An application should include a topographic map scale 1:250,000, brief description of area being applied for, work plan and budgeting program. The contractor is restricted from mining other minerals, and is fully responsible for all risks in all activities. It must complete a general survey and to

relinquish 25 percent of the initial contract area within the first year of the general survey, 50 percent within 3 years and 75-80 percent of the contract area on or before the end of the exploration period. In addition, the contractor should spend US\$2.50/ha on the coal-field by the end of the general survey period, to commence exploration upon completion of the general survey and spend at least US\$15.00/ha on exploration. Following the enactment of an autonomy law, a new CCOW is being drafted to empower regional governments and introduce a new royalty scheme. CCOW terms require that domestic entities must eventually have majority ownership of mining projects. During the first 10 years of production, foreign shareholders must transfer shares according to a fixed timetable so that Indonesian companies eventually hold 51 percent of the mining project.

Upon production, companies will have the privilege to export or sell coal in domestic market. Coal productions are subject to 13.5 percent royalty. In addition, since 2005 a 5 percent export tax is imposed on coal exports.

#### GEOTHERMAL

Under law No. 27/2003, geothermal belongs to the state. Government exercises its right through the Ministry, Provincial Government and Regency by determining policy, regulating, licensing. Geothermal exploration and exploitation are conducted on a licensing basis. Government opens competitive bidding for prospective geothermal working area where any business entities, public company, private, or cooperative could submit a bid. Successful bidders are awarded a maximum of 200 thousand hectares working area, and reserves the right to conduct exploration for 3 years (with possible extension to 2 more years). Upon completion of exploration, the company is mandated to complete feasibility study within 2 years, and in exploitation stage, the company is granted 30 years exploitation right (extendable). Company awarded working areas are subject to tax, land rent, and royalty determined by GOI. The utilisation of geothermal for electricity is subject to electricity regulation and policy.

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### NOTABLE ENERGY DEVELOPMENTS

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#### OIL

In the last three years Indonesia has continued its oil industry reform process as well as inviting investors to conduct oil and gas exploration activities in order to increase the economy's oil reserves. The reform continued the development of several instruments to support the operationalisation and implementation of the new oil and gas law. Efforts were likewise focused on inviting more investor by offering new areas for bid and improvements in the petroleum fiscal system. Indonesia also continues its programs of abolishing the oil subsidy that placed a burden on the state budget for a long time. Exploration activities in 2005, successfully found 134.6 million barrel from Pertamina, BP offshore North West Java and ConocoPhillip field.

#### REFORMS

The oil sector reforms in Indonesia proceeded with further progress in 2005. Pertamina, GOI owned oil and Gas Company has taken further step in its reform. After it converted into a limited liability company in 2003, Pertamina established 2 subsidiaries, Pertamina Exploration and Production (EP) and Pertamina Exploration and Production Cepu. Pertamina EP is responsible for controlling and managing the whole assets of Pertamina upstream business, exploration and production of oil and gas. While Pertamina Cepu will be responsible for managing Pertamina's interest in Block Cepu, one of the most prospective field jointly developed with Exxon Mobil. Upon the establishment of Pertamina EP, the company signed a cooperation contract with BP Migas for explorations and exploitations on areas formerly held by PERTAMINA. The cooperation contract was the final step for the transformation of Pertamina into equal business entities as other companies which operate in exploration and production activities in Indonesia.

In the downstream oil sector, reforms also proceeded significantly. From the 6 companies which were awarded licences to run business in retail fuel product in 2004, two companies Shell and Petronas started the retail fuel product business in Jakarta in 2005. Shell started selling unsubsidized high octane gasoline in October and Petronas in late December. Each company will build about 400 gasoline stations by 2008. In addition, Petronas started selling jet kerosene in 3 Indonesian airports.

However, the Indonesian government deferred further the liberalization in the downstream market. Government extended Pertamina's public service obligation to distribute subsidized fuel around the economy. According to oil and gas law, Pertamina's obligation was due to expire on 23 November 2005. After the set up time, Government should select either through tender or direct appointment, the distribution agent for subsidized fuel. However, since there are no other companies which have the infrastructures, especially for regions outside Java and Bali, Pertamina's obligation was extended until 31 December 2005. Later, Government also appointed Pertamina as a single distributor for subsidized fuel within the economies for the year of 2006. Pertamina has requested a premium of between 15 percent and 19 percent above the Mean Oil Platt's Singapore (MOPS) prices, or between IDR 500 and IDR 700 per litre, to cover transportation and distribution costs and profit margin.

In 2005, Indonesia has started a new business practice for the transportation of gas. Government decided to tender out the construction of pipelines projects. The two onshore transmission pipelines, Cirebon - Semarang and Gresik- Semarang became the first project tendered by Indonesia's oil and gas downstream regulatory body BPH Migas in July 2005. Winner of the bid will be granted special right to build and transmit gas for certain period of time. The second project to be tendered is the 1,200 km gas pipeline that will transport gas from East Kalimantan to Java.

#### MORE INCENTIVE FOR MARGINAL FIELDS

In order to meet the national target production of 1.3 million barrel per day by 2009, the Ministry of Energy and Mineral Resources introduced additional incentives on April 2005. The incentive allows the investor to recover 120 percent cost recovery for fields with an estimated rate of return less than 15 percent. However, in the production period if the rate of return exceeds 30 percent the incentive will be abolished.

#### NEW BIDDING ROUND

The introduction of new fiscal system in 2003, which allows an increase in production shares for companies from 15 percent to 25 percent for oil and from 30 percent to between 35 percent and 40 percent for gas depending on the field condition, seemed to have improved the investment climate in the upstream oil and gas sector.

In 2005, Indonesia maintained its success in inviting investor for the development of prospective working areas. There were 27 working areas offered by the Ministry of Energy and Mineral Resources in 2005; 14 working areas through regular competitive bidding and 13 through direct offer. Offered working areas are located in Natuna Sea, South Sumatra, East Java, Makassar Strait, Arafura Sea, West Java, East Kalimantan, Aceh and offshore West Papua.

There are 29 companies which participated in the 13 working area direct offer. It was reported that 9 companies were awarded 11 out of 13 working areas. The companies awarded contracts will invest US\$ 102.5 million in the first three years of the contract period. In addition Government also received US\$ 7.9 million signature bonus.

Working areas offered through competitive bidding also has attracted several oil companies. However, the successful bidders have not yet been announced.

#### PERTAMINA PERFORMANCE

Reform in oil and gas sector drives Pertamina to improve its performance. In 2005, Indonesian Government owned oil and Gas Company report some improvement in its operation. In 2005,

Pertamina revenues exceeded its target by 177 percent from IDR 6.4 trillion to IDR 11.3 trillion. Partly that increase was driven by high oil price. However, more efficient operation had likely contributed significantly. In the upstream sector, oil production cost was reduced from US\$ 9-10 per barrel to US\$ 8.79 per barrel. Production cost of gas also declined from US\$ 0.56 per BOE to US\$ 0.43 per BOE. Processing cost in Pertamina refinery also decreased from US\$ 1.71 per barrel to US\$ 1.62 per barrel.

In addition Pertamina also extended its business activity. The company started businesses in gas transportation after successfully winning a competitive bidding for pipeline construction in East Java.

#### IMPACT OF OIL PRICE

High oil price, which started in July 2004, is widening the Government's budget deficit, due to the increase in subsidy. Although theoretically, GOI only subsidized kerosene, high crude oil price in practice make government subsidize all fuel products. The political situation where Indonesia faces a general election in 2004 brings an unfavourable climate for government to increase fuel price or pass down the additional crude oil price to consumer. As a result, Indonesian Government who originally plans to spend 14 trillion rupiah on fuel subsidies in 2004 has to increase the budget for subsidy to 63 trillion rupee, equal to 1.5 percent of the GDP in 2004. In 2005 the high oil price still was a burden to the Government budget. The economy has allocated IDR 96.5 trillion.

A more stable political situation after the election has provided elected President Susilo Bambang Yudoyono an opportunity to pursue a more appropriate policy to respond to high oil prices and used the situation and timing cleverly. Indonesia passed on the high oil price to consumer by increasing domestic oil production in 2005. In order to protect the poor GOI modified the existing subsidy system from subsidizing retail price into direct compensation to targeted poor population.

#### FUEL PRICE ADJUSTMENT

To overcome the impact of high oil price on Pertamina cash flow and the economy budget, Indonesia made 3 time price adjustment in 2005.

From 1 July 2005, Pertamina increased the price of Industrial Diesel Oil (IDO) for mining, oil and gas, and export oriented industries. Pertamina selected Mean Oil Platt's Singapore (MOPS) plus 15 percent margin as a reference price, which meant an increase of the price by about 113 percent from IDR 2200 to IDR 4740 per litre.

The second price adjustment was made in August 1, where Pertamina the economy owned oil and Gas Company increased the fuel price by an average of 13 per cent from IDR 2360 per litre IDR 2600 per litre for its industrial customer.

And the third adjustment was made in October 2005. By President Decree No. 55/2005 Indonesia made a breakthrough in fuel price adjustment. President Susilo Bambang Yudoyono made a brave decision to increase the fuel price by the highest amount in Indonesian history. Kerosene price was increased by 185.7 percent from IDR 700 to IDR 2000 per litre. Diesel price was increased by 104.76 percent from IDR 2100 to IDR 4300 per litre. Gasoline price increased 87.5 percent from IDR 2400 to IDR 4500. Those prices have included 10 percent value added tax.

#### FUEL PRICE HIKE COMPENSATION PROGRAM

To reduce impact of fuel price hike, GOI issued a compensation program which consists of 4 main measures:

1. Cash transfer program. The program targeted 15.5 million the poorest population to receive cash transfer to temporary cushion the impact of the fuel price hike. Amount to be transferred to each poor household is IDR 1.2 million (approximately US\$ 120) in one year. The transfer will be made every 3 months through local post office and will cost the economy IDR 3 trillion.

2. Grant program to participating primary and junior secondary school to raise the quality of the education and reduce student tuition fee from poor student. Total amount to be spent in this program for 2005 was IDR 6.3 trillion.
3. Rural infrastructure program to improve village level infrastructure such as bridge and road. The program targeted 12,000 villages in which each village received IDR 250 million. Total fund to be allocated to this program in 2005 was IDR 3.3 trillion.
4. Free health service to everyone at public clinics and free in patient treatment at third class hospital for the poor. GOI allocated IDR 3.9 trillion for this program.

Compensation program likely met the target and was acceptable to the public, except for the cash transfer program. Because of lack of solid system and infrastructure it was reported that some mismanagement occurred in the disbursement of the program. Cash transfer according to the critique wasn't used wisely by the recipients.

As the fuel price doesn't cover all production cost as yet, Indonesia still is burdened by subsidy in 2005. It was reported that total subsidy which included fuel price subsidy and compensation program cost the economy IDR 96.5 trillion.

#### EXPORT EARNING

Despite the burden to the economy's budget, however, high oil price in 2005 also benefited Indonesia as the economy is an oil and gas exporter. Despite the declined in oil and gas export compared with 2004, Indonesia oil and gas export earnings in 2005 increased. Crude export in 2005 was 157.5 million barrel, a decline from 178 million barrel in 2004. However, export value rose from US\$6.5 billion in 2004 to US\$8 billion in 2005. LNG export declined from 237.5 million BOE in 2004 to 234.5 million BOE in 2005. However, export value increased from US\$7.2 billion to US\$ 8.2 billion. Piped gas export in 2005 increased from 56.2 million BOE to 61.4 million BOE, and export value increased from US\$950 million to US\$1.1 billion.

#### DECLINE IN FUEL COMSUMPTION

Following the 126 percent average fuel price increase, it was reported that domestic fuel consumption dropped by 27 percent from 191,000 kilo litre to 140,000 kilo litre per day. Unleaded gasoline consumption declined by about 37 percent from 53,400 kilo litre to 33,700 kilo litre per day. Diesel consumption declined about 30 percent from 77,000 kilo litre to 53,600 kilo litre per day. However, kerosene consumption was relatively stable at 36,100 kilo litre per day.

Gasoline and diesel consumption has declined likely because of new fuel price promotion to consumers to use fuel more efficiently. On the other hand constant consumption of kerosene despite the price was increased almost 186 percent is because kerosene are use by low income family for cooking and lighting without other alternative available and have already in minimum consumption, and left no room for further reduction.

#### 10 MILLION COAL BRIQUETTE STOVE

In order to substitute utilisation of kerosene in household, Government had introduced the 10 million coal briquette stove program. The briquette which costs about half of kerosene for the same calorie expected become substitute for low income population. However, considering the environmental impact, environmentalist opposes the utilisation of coal briquette in urban areas and big cities in Java.

#### NATURAL GAS

In 2005, Indonesia successfully found 3.6 TCF of additional gas reserves. Also the economy had successfully increased gas production by 20 per cent to about 8,160 MMSCFD. Indonesia also almost doubled gas exports via pipeline to Singapore from 99.3 MMSCFD to 205.5 MMSCFD.

However because of the robust domestic demand, the total gas export decreased from 4,810 MMSCFD in 2002 to 4,667 MMSCFD in 2005.

Indonesia had not successfully overcome its LNG shortfall it experienced in 2004. In 2005, Indonesia had asked its Japanese buyers to cancel its 41 LNG cargoes. It was reported that the shortfall in LNG production was caused by lower gas production in east Kalimantan because of maintenance problems, an accident, and the domestic gas demand to produce fertilizer. It is likely that Indonesia will cut further LNG export by 10 per cent in 2006.

On the other hand, the construction of Tangguh LNG plant which has already secured long term sales contract for its capacity is likely to proceed according to plan. It is expected that the plant will start production by 2008 or 2009. Indonesia Government has granted final approval for the construction and had also extended BP production sharing contract from 2017 to 2034.

Following the government approval, in March 2005, BP Berau Ltd., awarded the engineering, procurement, construction and commissioning (EPC) contract worth US\$1.8 billion to a Kellogg, Brown and Root (KBR) partnership. KBR appointed the JGC Corporation of Japan and Indonesian firm PT Pertamina Engineering as partners for the project completion.

However, the project which when completed will be able to produce at least 7.6 million metric tons LNG per year, has not yet secured its financial support. In 2005, BP MIGAS approached ADB to JBIC of Japan to secure US\$ 3.5 billion additional funding.

#### GAS SUPPLY DEAL

In 2005 Indonesia made international and domestic gas supply deal. Basically, Indonesia and Japan reached an agreement to continue LNG supply after its current contract expires in 2010. However, BP Migas reportedly was only able secure exports to Japan for 6 million metric tons per year, despite Japan's LNG demand from Indonesia after 2010 which could reach 12 million ton or more per year.

Domestic companies PLN, PGN and Petrokimia Gresik signed 6 gas sales agreement and 2 head of agreement (HOA) with gas supplier Energy Mega Persada, Pertamina, Medco and Petrochina. Gas sales agreement last for 2 to 15 years and will utilise gas from field in east Java, central Java and Pekanbaru worth US\$ 4.5 billion.

In total, from 2002 to 2005, there were 52 total domestic gas contract signed, with a total volume of 92.21 TBTU.

#### LNG RECEIVING TERMINAL

The growing gas demand in Java and the lack of supply from adjacent fields have lead PLN Indonesian Government Owned Company to build an LNG receiving terminal in Cilegon West Java. It is expected that LNG could secure gas demand for PLN for a 2,030 MW power generation located in Jakarta. In addition PLN is expected to supply gas to big industries located in surrounding areas, including city gas supply. The LNG receiving terminal capacity is expected to deliver gas to consumers by 2007/2008 and is designed to have a capacity 400 MMSCFD, expandable to 1,000 MMSCFD. The project is reported to be proceeding with significant progress. Land acquisition and environmental study had been completed in 2004. There were 33 prequalification bids from 14 group companies for EPC contract of the terminal. PLN also have approached BP Migas and BP to secure LNG supply from uncommitted LNG Tangguh.

#### NEW LNG PLANT

In addition to Tangguh LNG project, which is in the construction process, an Australia based LNG Company known as LNG International, Ltd., jointly with local company PT Maleo Energy Utama planned to build a mini LNG plant with a capacity of 2000 to 2400 tonnes LNG per day in Luwuk, Central Sulawesi. The LNG plant, which is estimated to cost US\$160 million, is expected to be on stream by the end of 2007.

Feed gas required will come from Senoro-Toili field, a gas field operated under joint operating body between Pertamina and Medco E&P. Exclusive agreement to supply 120 million standard cubic feet of gas per day over 20 years have been signed in June 2005.

## **POWER SECTOR**

### **ELECTRICITY LAW AMMENDMENT**

Indonesian Constitutional Court annulled the Electricity Law No. 20/2002 in December 2004. The court considered that electricity is commodity vital to the lives of many citizens and should therefore remain under Government control. Further liberation in Indonesian electricity market is likely stalled for the time being until a new regulation is enacted.

The annulment of the new law has put Electricity Law No. 15/1985 and its operationalization Government Regulation No. 10/1989 back in power. However, considering the centralistic system in the law Government of Indonesia issued Government Law No. 3/2005 regarding Amendment Government Law No. 10/1989. The amendments of the law, among others, are:

1. National electricity plan determined in cooperative way between central and local government.
2. Cooperative, Local Municipal Utilities, private preserve right doing business in electricity generation
3. Open access of transmission lines
4. Electricity price for consumers set up by government
5. Wholesale electricity price determined by competitive bidding or direct appointment
6. Priority to new and renewable energy for generation.
7. Government/local government responsible for electricity supply in remote area, under developed and poor consumers.

The amended government regulation provides better business climate for electricity sector, which is significantly needed in the close future.

## **GEOHERMAL**

Indonesia has made significant progress in the development of geothermal power plant in 2005. PT Geo Dipa Energy a joint venture of PLN and Pertamina was selected to develop 300 MW Sarulla geothermal power plants in North Sumatra. Construction is expected to start in August, 2006 and the power plant is scheduled to be operational in 2009.

Government owned electricity company PLN awarded contract to Sumitomo Corporation for construction of the Lahendong II geothermal power plant project in North Sulawesi. The 20 MW power plant worth US\$ 28.5 million is expected to start electricity production by 2007.

Drajat III geothermal power plant construction started in November 2005. The 110 MW power plant jointly developed by Pertamina and Chevron Texaco worth US\$ 128 million is expected to start production at the end of 2006.

However, with current progress it is difficult to meet national target to double geothermal capacity to 2000 MW by 2009.

## **COAL**

In October 2005, the Ministry of Finance issued the Ministry Regulation No.95/2005 that subjected coal export to 5 percent tax based on FOB export price. Currently Indonesia does not regulate coal export, so that each company could export coal freely. Export tax aimed to secure

domestic supply as imposition of the tax will make domestic price more attractive. However, as up until close future domestic demand of coal remains less than one third of coal production.

Despite the imposition of tax on export, investment in mineral mining and coal in 2005 reportedly exceeded target. By the end of 2005, total investment in coal and mining reached US\$880.04 million, while government target was US\$ 816.13 million. While the production of coal reached 132 million metric ton in 2004 and reached about 150 million metric ton in 2005.

### ENVIRONMENT

Jakarta Metropolitan administration is considering restricting the number of motor bikes in Jakarta, as the number of motorbikes in Jakarta now reaches 6.5 million and growing at about 16 percent per year during the past 5 years. Excessive number of motorbikes in Jakarta has contributed significantly to the worsening traffic and air pollution. Additional policy planned to be put in place is the environmental tax to motorcycles with two stroke engines.

### INVESTMENT

In 2005, Indonesia recorded a significant investment in the energy sector. Upstream oil sector successfully invited US\$7.314 billion, slightly lower from 2004 where total investment reached US\$7.5 billion investment. The investment was made in working areas for exploration, development, production and administration. Among the projects 13 projects was inaugurated by President in October 2005. With those investments in upstream sector Indonesia could maintain crude oil production at 1.076 million barrel per day and increase oil and gas reserves.

Investment in electricity sector increased significantly from IDR 14 trillion in 2004 to IDR 21 trillion in 2005. Those investments increased household electrification ratio from 53.38 per cent in 2004 to 53.61 percent in 2005. While investment in coal and mining reached US\$880 million, exceed the government target of US\$870 million.

Besides investment made in 2005, there were also intention to invest or agreement to invest, in oil and gas or electricity sector. Pertamina also invested overseas; in Iraq, Malaysia and Libya.

### PERTAMINA'S OVERSEAS INVESTMENT

Pertamina increased its overseas operation activities in 2005. In addition to its overseas operations in Malaysia, Vietnam and Iraq, in 2005 Pertamina won two oil exploration block bid in Libya. Pertamina committed to conduct 5 year exploration including 2 wildcat drilling and 3D seismic acquisition for each block. The first block is Block 17-3 located in Sabratah Basin estimated has 3.5 TCF gas and 75 million barrel oil. While the second block is Block 123-3 located at Sirte Basin in Sahara Desert, estimated has oil reserves around 400 million barrel.

### NEW AND PLANNED REFINERY

In August 2005 Indonesia commissioned additional refinery capacity of 47,000 barrel of unleaded gasoline in Pertamina refinery Balongan. The refinery which also produces 200 tons LPG per day cost approximately US\$ 228 million. It is projected that additional capacity will help to reduce fuel import by 12 million barrel annually.

In order reduce import of oil product and overcome possible oil shortages Indonesia decided to build new refinery in Tuban, East Java province. The nameplate capacity of new refinery would be about 150,000 to 200,000 barrel per day. The project which will process crude oil from Cepu and Jeruk block and worth of about US\$ 1 billion will be jointly financed by Pertamina and China Petrochemical Corporation (Sinopec). Output of the refinery will supply consumers in East Java start in 2010 or 2011.

In addition, local company PT Intanjaya Agromegah Abadi and its joint venture partner Interglobal Technologies proceeded with the construction of Pare Pare refinery after having been



postponed for more than 6 years. The refinery, which has a capacity to process 300,000 barrels crude oil per day is expected start operation by 2010.

Pertamina was also reported to increase its Diesel production capacity to build high quality synthetic diesel fuel factory in East Kalimantan. The plant jointly financed with Canadian company Accelon Energy Systems, will utilize low calorie coal as feedstock to produce 28 million barrel per year of Euro IV standard diesel by 2008. The project is estimated to cost US\$ 6 billion.

#### BIOFUEL

In 2005, Indonesian Investment Coordinating Board issued licences to 7 companies to build bio diesel plants. At least 5 million hectare land spread over Kalimantan, Sumatra, Lombok, Sumbawa Sumba and Flores has been allocated for raw material plantation, such as palm oil, cassava and *Jatropha curcas*.

Two Indonesian oil companies PT Medco Energi International and PT Pertamina have made significant move in the development of bio fuel. PT Medco plan to invest US\$ 34.1 million to build an ethanol plant capacity of 60,000 kiloliter per year in Lampung province in southern Sumatra. The construction of the plant, which will processes cassava and sugarcane molasses started in 2006, and expected will start to produce industrial grade ethanol by the end of 2007, which will be marketed to Singapore and Japan.

On the other hand, Pertamina the Indonesia state's owned oil companies signed agreement with local university Institute Teknologi Bandung and local manufacturing company PT Rekayasa Industry to construct bio diesel plant. The construction of bio diesel will proceed into 3 steps. First step is construction small scale bio diesel capacity of 1000 litre per day and followed by middle scale plant capacity of 15 cubic metres per day. At the end of the program expected, it will be able to build and operate diesel plant to produce bio diesel 100,000 ton per year. Raw material for bio diesel *Jatropha Curcas* will come from farmer's plantation across Indonesia.

#### ELECTRICITY

Indonesia is set to tender out eight electricity generation projects worth US\$3.67 billion in 2005 aiming to increase the economy's power capacity by almost 15 percent or 3670 MW.

Four power projects will be built in Java Island: combined cycle power plant Pasuruan with capacity of 500 MW (US\$ 500 million), Central Java steam power plant capacity of 1200 MW (US\$ 1,200 million) and Paiton III capacity of 400 MW each (US\$ 400 MW each). The rest are 200 MW Bali power plant worth of US\$ 200 million, 50 MW North Sulawesi power plant worth of US\$ 50 million and 120 MW East Kalimantan worth of US\$ 120 million. The construction will be completed in 7 years time.

#### NUCLEAR POWER PLANT

The Indonesian Parliament in December 2005 approved a Government plan to build a Nuclear Power Plant. This approval could be a good start for the realization of 4 nuclear power plants by 2025. The realization of the construction of power plant will be initiated in 2 years; socialization program started in 2006 and followed by the tender for the first nuclear power plant in 2008. However, the socialization program could also become a set back, if strong opposition arises.

#### INFRASTRUCTURE SUMMIT

The newly elected Indonesian President Dr. Susilo Bambang Yudoyono has made infrastructure development as one of the pillar for Indonesia's development strategy for next 5 year's. It is considered as an appropriate strategy since the infrastructure of the economy has remained weak from the effects of the 1998 financial crisis and lags behind other neighbouring economies. The economy's spending on infrastructure chronically remained on a declining trend from 5.34 percent of GDP in 1993/1994 to 2.33 percent in 2002. One example is Indonesia's low electrification level where about 48 percent of households in Indonesia are still without electricity

connection. Without innovative programs to improve infrastructure, it seemed that the President's target to increase GDP growth from 4.5 to 7.2 percent by 2009, and reduce unemployment from 9 to 5.1 percent will be difficult to realize.

It was estimated that Indonesia would need US\$150 billion to finance its infrastructure requirements in the next five years, and about US\$80 billion of which is expected to come from the private sector. To invite private sector involvement, the Government hosted the first Indonesia Infrastructure Summit on 17-18 January 2005. In the Summit, Government has offered 91 commercially viable infrastructure projects to the private sector, with a total value of US\$22.5 billion. Among the projects in the list are energy infrastructures; 6 gas pipelines and 12 electricity generation plants, including 2 LNG receiving terminal. The summit was attended by 700 business representative from 22 economies and was followed by several tendering processes in March and succeeding months. Government has decided to hold infrastructure summit annually and use it as a effective medium to offer economically viable infrastructure projects for private sector participation.

As a follow up, Government has again taken several measures to improve investment climate; among others are the establishment of The National Committee for Acceleration of Infrastructure Development, promulgation new regulation to support infrastructure development, and infrastructure project risk sharing mechanism.

The Committee for the Acceleration of Infrastructure Development chaired by the Coordinating Ministry of Economy and sector Minister as a members aimed to integrate policy and accelerate coordination and decision making process.

In order to improve investment climate several regulation has been issued, for example the most important is government regulation on land acquisition for infrastructure projects and private public partnership, and amendment electricity law. Government regulation No. 36/2005 regarding land acquisition for public infrastructure issued in May, streamlining acquisition process to maximum 90 days. Government regulation No.67/2005 issued in November provide foundation for private and public partnership for infrastructure development, which aimed to secure financing of the project, and improve quality of the project. Among infrastructure viable for partnership are electricity generation, transmission and distribution and oil and gas infrastructure such as refining, storage, transportation, transmission and distribution oil and gas. There are three mechanisms available for partnership. First, government or sector ministry or local government identify prospective infrastructure project and invite private participation through transparent competitive bidding. Second, private sector could propose project for partnership. Accepted proposals are tendered for competitive bidding and the company propose the project receive appropriate compensation. And third, government conducts licence auction.

Accepted projects could benefit support for risk management. Under careful consideration, Government could provide risk management support in the form of subsidy, guarantee and tax exemption.

#### STORAGE INVESTMENT

Two Dutch companies, Oil Tanking and Royal Vopac were awarded licences to build fuel storage in Indonesia. Oil Tanking will start the construction of the 300,000 ton storage in Cilegon area in 2006, with total investment US\$200 million, while, Royal Vopac is still seeking for a suitable site or location, including a local partner.

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# JAPAN

## INTRODUCTION

Japan is a small island nation in Eastern Asia. It consists of several thousand islands, the largest of which are Honshu, Hokkaido, Kyushu and Shikoku. It spans across a land area of approximately 377,800 square kilometres and most of its land area is mountainous and thickly forested.

Japan is the world's second largest economy after the USA. Japan's real gross domestic product (GDP) in 2003 was about US\$3,132 billion (1995 US\$ at PPP). With a population of 127 million people, per capita income was US\$24,557.

Up to the early 1990s, Japan enjoyed a long period of rapid socio-economic development. In 1992, however, Japan's economy entered a decade of stagnation. GDP grew 1.2 percent annually between 1992 and 2002, while previous decade, GDP grew by 3.9 percent per year. In 2003, the Japanese economy showed signs of recovery, with the annual GDP growth rate at 2.7 percent (2002-2003). The recovery was driven by exports, mainly to China, and strengthened domestic capital investment. Unemployment rate has fallen down to 4.6 percent in 2003 from 5.4 percent in previous year.

Japan possesses a modest amount of indigenous energy resources and imports almost all of its crude oil, coal and natural gas requirements to sustain economic activity. In 2003, proven energy reserves included around 9 MCM of oil, 40 BCM of natural gas and 773 Mt of coal.

Table 15 Key data and economic profile (2003)

Key data		Energy reserves	
Area (sq. km)	377,800	Oil (MCM) – Proven	9.3
Population (million)	127.57	Gas (BCM)	40
GDP Billion US\$ (1995 US\$ at PPP)	3,132.85	Coal (Mt) – Proven	773
GDP per capita (1995 US\$ at PPP)	24,557		

Source: Energy Data and Modelling Center, IEEJ.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Japan's total primary energy supply (TPES) was 498 Mtoe in 2003, down by 0.49 percent from previous year. By fuel, oil represented the largest share at 50 percent, coal was second at 20 percent, followed by natural gas at 14 percent, nuclear at 13 percent, hydro at 4 percent and NRE, including geothermal, wind and others at 1 percent. In 2003, 84 percent of the total primary energy was imported. With limited indigenous energy sources, Japan imported almost 100 percent of oil, 99 percent of coal and 97 percent of gas.

In 2003, Japan was the world's third largest oil consumer after the United States and China<sup>12</sup>, and almost all of the oil was imported. The bulk of these imports (85 percent in 2003) came from economies in the Middle East such as the United Arab Emirates (UAE), Saudi Arabia, Iran, Qatar

<sup>12</sup> In 2003, China overtook Japan to become the second largest consumer of oil in the world.

and Kuwait. In 2003, the primary oil supply was 251 Mtoe, up by 2.6 percent from the previous year.

Japan is endowed with only limited coal reserves at 773 million tonnes. The small amount of coal production had been heavily subsidised until January 2002 when Japan's last coal mine in Kushiro eastern Hokkaido was closed. Japan is the world's largest coal importer of steam coal for power generation, pulp and paper and cement production and coking coal for steel production. Japan's main steam coal suppliers are Australia, China, Indonesia, Russia, the United States, South Africa and Canada. Coking coal is imported from Australia, Indonesia, Canada, China, Russia, the United States and South Africa. In 2003 primary coal supply was 101 Mtoe or 5.2 percent higher than the previous year due mainly to make up for the suspension of nuclear power production.

Natural gas resources are also scarce in Japan. Domestic reserves stand at 40 BCM, located in Niigata, Chiba and Fukushima prefectures. Domestic demand is met almost entirely by imports of LNG<sup>13</sup>, which come mostly from Indonesia (28 percent of imports in 2003), Malaysia (19 percent) and Australia. Natural gas is mainly used for electricity generation, followed by reticulated city gas and industrial fuels. In 2003, primary natural gas supply was 72 Mtoe, or 11.5 percent increase from the previous year. Much of the increment came from power sector, which increased gas consumption to balance the loss from suspension of nuclear power generation.

Japan has 268 GW of installed generating capacity and generated about 1,075 TWh of electricity in 2003. The generation amount by energy type is broken-down as: thermal (coal, natural gas and oil) at 67 percent, nuclear at 21 percent, hydro at 9 percent and geothermal, solar and wind taking up the remainder.

Table 16 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	78,632	Industry Sector	158,409	Total	1,075,338
Net Imports & Other	419,543	Transport Sector	86,329	Thermal	724,434
Total PES	498,176	Other Sectors	112,497	Hydro	96,802
Coal	100,844	Total FEC	357,235	Nuclear	230,423
Oil	250,813	Coal	37,768	Others	23,679
Gas	71,782	Oil	207,471		
Others	74,737	Gas	24,805		
		Electricity & Others	87,191		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/apcc/database/selecttable.html>)

After the first oil crisis in 1973, Japan invested heavily in nuclear power generation to reduce its reliance on oil. Despite Japan's desire to increase the reliance on nuclear, Japanese nuclear power industry was forced to face several challenges in recent years. In 2002, Tokyo Electric Power Company (TEPCO) was found to have falsified their safety reports in the later half of 1980s and during 1990s. This led to the closure for inspection of all 17 nuclear units belonging to TEPCO for several months<sup>14</sup>. In early August 2004, an accident occurred in one of the Kansai Electric Power Company's nuclear reactors caused by a fracture on of its secondary piping system at the Mihama Unit 3<sup>15</sup>. As a result of these incidents, public opposition against nuclear power generation has increased.

<sup>13</sup> In 2002, LNG imports to Japan comprised 61 percent of total world LNG trade.

<sup>14</sup> To make up for nuclear capacity shortages, TEPCO had to increase its generation from crude oil, diesel, coal, and LNG.

<sup>15</sup> Five workers were killed by the release of steam into the plant.

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## FINAL ENERGY CONSUMPTION

In 2003, Japan's total final energy consumption was 357 Mtoe, or 0.95 percent higher than the previous year. The industrial sector consumed 44 percent of the total, followed by the other sectors mainly residential/commercial at 31 percent and the transportation sector at 24 percent. By fuel source, petroleum products accounted for 58 percent of the total final energy consumption, followed by electricity and others at 24 percent, coal at 11 percent and city gas at 7 percent.

Energy consumption for the industrial sector showed an increase by 2.3 percent in 2003, compared to a decline by 5.3 percent in 2001 and moderate increase by 1.7 percent in 2002. The upturn of industrial energy consumption since 2002 reflects the increase in production for energy intensive industries such as iron and steel, cement and petrochemicals.

The energy consumption of the residential/commercial sector in 2003 showed modest decline by 0.06 percent. Exceptionally cold summer has reduced the electricity demand for cooling, while warm winter has resulted in the decline in oil demand for heating.

In the transportation sector, the passenger sector accounted for 65 percent of the total energy consumption while the remaining 35 percent went to the freight sector in 2003. Energy consumption of both the passenger and freight sectors showed slight decline by 0.1 percent in 2003 from previous year. Epidemic of SARS reduced the energy consumption for international air transport, and continued industries' efforts for rational utilisation of energy resulted in the decline in freight transport.

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## POLICY OVERVIEW

The Ministry of Economy, Trade and Industry (METI) is responsible for formulating Japan's energy policy. Within METI, the Agency for Natural Resources and Energy (ANRE) is responsible for the rational development of mineral resources, securing stable supply of energy, promoting efficient energy use, and regulating electricity and other energy industries. The Nuclear and Industrial Safety Agency (NISA) is responsible for the safety of energy facilities and industrial activities while the Ministry of Foreign Affairs formulates international policies.

The fundamental goal of the Japanese energy policy is to achieve a stable energy supply while meeting the demands for environmental conservation and efficiency improvement.

Japan is faced with the following energy challenges. First is securing a stable energy supply at reasonable prices, despite the 82 percent reliance on imports for its total energy supply. The second is, meeting the Kyoto Protocol commitment for reducing greenhouse gas (GHG) emissions to 6 percent below the 1990 levels between the time period 2008 and 2012. The third is on improving the Japanese industries' (including the energy sector's) economic efficiency and thereby increasing their domestic and international competitiveness.

### OIL

Japan aims to decrease its dependency on oil due to past experiences of the oil crises. However, oil still accounts for around 50 percent of Japan's total primary energy supply and oil is expected to take the dominant share of Japan's future energy supply. Securing stable supply of oil will continue to be one of Japan's major energy policy issues.

Japan's oil supply structure is vulnerable to incidents of supply disruption since Japan imports almost all of its crude oil. Middle East dependency in 2003 was high at 85 percent. In preparation for any incident of supply disruption, Japan has been pursuing emergency measures by: 1) holding emergency oil stockpiling, and 2) conducting independent development of resources and promoting cooperation with oil producing economies for emergency situations.

The Japan National Oil Corporation (JNOC) had carried out the national stockpile business until 2003. JNOC provided financial and technical assistance to the Japanese oil industries for their

oil and natural gas exploration and development both domestically and abroad. In 2004, functions of the national stockpile business were transferred to Japan Oil, Gas and Metals National Corporation (JOGMEC), which was established in February 2004. Following the Specially Designated Public Corporation Rationalisation Plan, JOGMEC was established through merging JNOC and the Metal Mining Agency of Japan.

The oil industries have been making every effort for rationalisation with huge cost reduction, like downsizing and tie-up with distributors. The reorganisation of the structure and consolidation of the groups are still ongoing. Making a strong oil industry through the promotion of rationalisation and efficiency is also important for the energy security in Japan.

### NATURAL GAS

Demand for natural gas has been increasing rapidly over the last two decades. Between 1980 and 2002, natural gas demand grew at an annual growth rate of 5.3 percent – the fastest growth rate in all primary energy sources. The robust growth in natural gas demand is expected to continue because of environmental reason and ease of use factor.

Japan has undergone natural gas market reform since 1995 in an attempt to lower the cost of gas supply and increase the industrial competitiveness in the global market. To date, Japan has taken three steps to liberalise gas market

- The Gas Utilities Industry Law was amended in 1995. The Law allowed industrial customers with contracted amounts of more than 2 million m<sup>3</sup> per year to directly negotiate prices with suppliers.
- The Gas Utilities Industry Law was further amended in 1999. The scope of deregulation for large volume supply was extended by lowering the annual contract volume to 1 million m<sup>3</sup> per year and over. Regulations for third-party access for large-volume supply were also established.
- In June 2004, the Diet passed the amended Law on the Gas Utilities Industry. The amendment in 2004 stipulated that customers with the contracted amount of 0.5 million m<sup>3</sup> could freely choose suppliers. The Law has set a timetable for those customers with contracted amount of 0.1 million m<sup>3</sup> to be allowed to choose their suppliers by 2007.

Natural gas is supplied almost entirely by imports in the form of LNG from Indonesia, Malaysia, Brunei Darussalam and Australia. Since Japan has taken priority on their stable and secure supply of LNG, Japanese LNG buyers have been paying a higher price than buyers in Europe or in USA under a long-term “take or pay” contract with rigid terms on volume and price.

Now Japanese gas and electric utilities are faced with mounting pressure to reduce cost because of the deregulation of gas and electricity markets. Japanese gas and electric utilities have been making efforts to secure LNG supply at flexible terms that enable them to quickly respond to the change in market situation and to supply gas at lower cost. For example, the agreement reached by Tokyo Electric Power Company (TEPCO) and Tokyo Gas for their purchase on LNG from Malaysia’s MLNG Tiga project includes outstanding features: (1) some of the LNG will be shipped on FOB, rather than Ex-Ship, and (2) agreement increased both the upward quantity tolerance and downward quantity tolerance.

### COAL

In 2003, coal accounted for 20 percent of the total primary energy supply. Coal will continue to play an important role in Japan’s energy sector mainly for power generation, iron and steel, cement and paper and pulp. Coal mines in Japan have become increasingly deeper and remoter and the mining costs are approximately three times that of imported coal. The government has since then subsidised the coal mining industry and has achieved structural adjustments by reducing coal production gradually. The domestic production of commercial coal substantially ended at the end of fiscal year (FY) 2001.

Japan is the biggest importer of coal, with imports reaching over 20 percent of the total imported coal in the world. From its standpoint, it is essential therefore, to promote the development of overseas coal for energy security in Asia, to address its growing coal demand. To secure a stable supply of overseas coal, Japan is implementing a five-year plan to transfer coal-mining technologies overseas in economies that still have abundant coal resources. Some of the concrete measures to support overseas coal development include, subsidies for investigations prior to mine exploration and development and loans for mine exploration, technology cooperation with coal producing economies and for environmental concerns, development of technology to improve heat efficiency such as technologies of pressurised fluidised-bed combustion, coal gasification combined power generation and coal gas production for fuel cells, support to introduction of high efficiency coal boilers and development and diffusion of Clean Coal Technologies (CCT).

### **ELECTRICITY**

Electricity is an important source of energy that took the second largest position in the total final energy consumption in 2003. The increased use of electrical home appliances, widespread use of personal computers and related information technology in offices, and shift in industry structure to services sector have caused an upward pressure on electricity demand for the future.

Despite Japan's heavy reliance on electricity, its electricity price is among the highest in developed economies. To lower electricity price and increase industrial competitiveness, Japan has undergone a programme to reform electricity sector.

The Electricity Utilities Industry Law, the main legislation covering the electricity industry, was amended in 1995 to address global energy sector reform, comparatively high electricity tariffs in Japan and deteriorating load factors. The amendments permitted the entry of independent power producers (IPPs) into the Japanese electricity market. The 10 major electric utilities, each of which holds a regional monopoly, were given the right to accept tenders for IPP investment in generation to cover short-term thermal power requirements.

Subsequent amendment in 1999, allowed the partial liberalisation of retail sales starting in March 2000. Eligible customers, either high voltage users (20kV) or users with contracted demand over 2,000 kW, can now freely enter into contracts with power suppliers, including IPPs.

In June 2004, the Japanese Diet passed an amendment on the Electricity Utilities Industry Law. The amendment includes plan to permit more eligible customers that can choose electricity supplier. According to the law, customers with 500kW of consumption can directly negotiate with suppliers. This is followed by a plan to open market in 2005 for those customers with 50kW. Discussion has started to consider the total opening of retail market for the introduction of full competition in 2007.

### **NUCLEAR ENERGY**

Nuclear energy is perceived to address two key energy issues: supply stability and the environment (no CO<sub>2</sub> emissions). It has now become a major source for electric power generation and will most likely play a big role in the future. To achieve its goal of supply stability and environmental sustainability, Japan is expected to install an additional 10 to 13 nuclear power stations by 2010 (according to the Long-term Energy Supply-Demand Outlook (July 2001)). However, it is deemed necessary that significant and sufficient dissemination of information about the safety and necessity of nuclear power in order to get the national and regional support. The government has undertaken several promotion measures for the siting of the future nuclear power stations.

To ensure efficient use of nuclear resources, it is essential to work out countermeasures to establish the nuclear fuel cycle. In May 2000, the "Specified Radioactive Waste Disposal Act" was approved to ensure the planned, and most importantly reliable execution of high-level radioactive waste disposal. In October 2000, authorisation was granted by METI to establish the Nuclear Waste Management Organisation of Japan (NUMO). NUMO is responsible for identification of



the disposal site, construction, operation and maintenance of the repository, closure of the facility and post-closure institutional control. The Low-level Radioactive Waste Disposal Center of the Japan Nuclear Fuel Limited (JNFL) has been in operation at Rokkasho-mura in Aomori Prefecture since 1992.

### **ENERGY CONSERVATION**

In order to achieve its target set forth at the Kyoto conference on climate change (COP 3), Japan formulated its energy efficiency measures in 1998. In 2000, the Advisory Committee for Natural Resources and Energy started the total review of energy policy and the Energy Efficiency and Conservation subcommittee has re-evaluated the energy efficiency measures set in 1998 and has added measures for the industrial, residential/commercial and transportation sectors.

The current energy efficiency measures include, measures for factories based on Law Concerning the Rational Use of Energy, a follow-up of the Keidanren environmental voluntary action plan in the industry sector, strengthening efficiency improvement of equipment and improvement of energy efficiency performance of houses in the residential/commercial sector, strengthening fuel efficiency improvements in cars and acceleration of the popularisation of clean-energy motor vehicles in the transportation sector.

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### **NOTABLE ENERGY DEVELOPMENTS**

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#### **ESTABLISHMENT OF JOGMEC**

On 29 February 2004, JOGMEC (Japan Oil, Gas and Metals National Corporation) was established. JOGMEC takes over major functions from JNOC (Japan National Oil Company) and MMAJ (Metal Mining Agency of Japan). This reorganisation was conducted as part of the Japanese government's administrative reform.

As a result of this reorganisation, JOGMEC has become responsible for providing financial and technical assistance to the Japanese companies in their oil and gas exploration and production (E&P) activities. It has also become responsible for management and operation of national crude oil stockpile and the national stockpile bases.

#### **AMENDMENT OF ENERGY CONSERVATION LAW**

Given the substantial increase in green house gas emissions from energy consumption, the Ministry of Economy, Trade and Industry has amended the Energy Conservation Law to strengthen energy efficiency measures. The amendment of the Energy Conservation Law will become effective in April 2006.

The amendment will newly include transportation sector to enforce: 1) owners of freight trucks, rail, air and cargoes; and 2) companies operating passenger travel for road, rail, ship and air, to report the METI their annual plan for efficiency improvement, and annual energy consumption regarding transportation. Further to increase the scope of industrial factories responsible for the measures under the Law, the amendment will lower the threshold for annual energy consumption by a factory. The amendment enforces those who newly build new residential and commercial buildings with more than 2,000m<sup>2</sup> to report the energy conservation measures to the local governments.

#### **STRENGTHENING ENERGY COOPERATION IN ASIA**

At the 1<sup>st</sup> ASEAN+3 Energy Ministers Meeting, held in Manila, the Philippines, on 9 June 2004, the Energy Ministers agreed to achieve greater energy security and sustainable development through the effective use of programmes under ASEAN+3 Energy Partnership.

Subsequent to the agreement in Manila, the Advisory Committee on Natural Resources and Energy under METI recognised the importance of strengthening existing framework of cooperation among Asian economies for the establishment of shared prosperity. The Advisory Committee proposed to conduct the following activities:

Introduction or strengthening of emergency oil stockpiling in Asian economies,

- Creation of market for regional trade on crude oil, petroleum products and natural gas in the Asia-Pacific region, and
- Improvement of energy efficiency and environmental quality in Asian economies.

To facilitate these activities, METI has established the “Study Group on International Business Activities of Energy Related Industries for the Asian Energy Partnership. Members of the study group include representatives of electric companies, gas companies, trading firms, and oil companies. The first meeting was held on 13 October, 2004 and an interim report is scheduled to be published by March 2005.

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# KOREA

## INTRODUCTION

Korea is located in Northeast Asia between China and Japan. It has an area of about 99,601 square kilometres and a population of around 48 million. Approximately 21 percent of the population lives in Seoul, Korea's largest city and capital.

In the last few decades, Korea has been one of Asia's fastest growing and most dynamic economies. Its GDP has increased at an unprecedented growth rate of 7.0 percent per year over the period 1980 to 2003, reaching US\$752.7 billion (1995 US\$ at PPP) in 2003. Its per capita income in 2003 reached US\$15,711, more than 3.7 times higher than its 1980 level. Its major industries include semi-conductor, electronics, shipbuilding, automobile, steel and chemicals.

Korea has very few indigenous energy resources. It is completely without oil resources, and at the end of 2003, there were only 308 Mt of recoverable coal reserves and 250 BCM of gas at a recently discovered small natural gas field. To sustain its high level of economic growth, Korea imports large quantities of energy products. In 2003, Korea was the fourth-largest importer of oil and the second-largest importer of both coal and liquefied natural gas in the world.

Table 17 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	99,538	Oil (MCM)	-
Population (million)	47.91	Gas (BCM) - Recoverable	250
GDP Billion US\$ (1995 US\$ at PPP)	752.74	Coal (Mt) - Recoverable	308
GDP per capita (1995 US\$ at PPP)	15,711		

Source: Energy Data and Modelling Center, IEEJ.

\* Korea Ministry of Commerce, Industry and Energy and Korea Energy Economics Institute (2004), *Yearbook of Energy Statistics*.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Korea's total primary energy supply increased 5.6 fold from 38 Mtoe in 1980 to 214 Mtoe in 2003. In particular, energy supply from 1990 to 2000 increased by an annual average growth rate of 7.7 percent, far exceeding the economic growth rate of 6.2 percent for the same period. Likewise, per capita primary energy supply grew from 1.0 toe in 1980 to 4.5 toe in 2003. This is a level similar to that of Japan and most European economies.

In 2003, Korea's total primary energy supply was 214 Mtoe, 7.5 percent increase from the previous year. By energy type, oil represented the largest share at 51 percent, coal at 21 percent, nuclear at 15 percent and gas at 10 percent. The remaining 2 percent of primary energy came from hydro and other fuels. Korea imported around 82 percent of its total energy needs in 2003, including all of its oil and gas requirements and 95 percent of its coal supply.

The total primary oil supply in 2003 was 109 Mtoe, a 9.2 percent increase from 100 Mtoe in 2002. The share of oil in total primary energy supply declined to 51 percent from 64 percent in 1980, as the fuel switching from oil to LNG and other energy sources is taking place. In 2003, the amount of imported crude oil increased to 805 MB from 791 MB in 2002 due to the growth of industrial energy use and petroleum product export. The economy imported about 80 percent of

its crude oil from the Middle East. Korea was the world's seventh-largest consumer of oil (sharing 3 percent of world oil consumption) in 2003.

Coal use in 2003 totalled 45 Mtoe, 2.0 percent higher than the previous year, reflecting the continuous growth of steam coal demand for power generation. The power sector's share of coal consumption reached 59 percent in 2002, from 26 percent in 1990. Korea has modest reserves of low-quality, high-ash anthracite coal that is not sufficient to meet its demand. Almost all of Korea's coal demand, therefore, is met by imports. Korea is the world's second-largest importer of both steam and coking coal after Japan. Coal imports come from China, Australia, Indonesia, Canada, Russia, and the US.

Since the introduction of liquefied natural gas (LNG) in 1986, gas use in Korea has grown rapidly, reaching up to 22 Mtoe in 2003, increasing its share in the primary energy supply mix of up to 10 percent. Bulk of Korea's LNG imports comes from Qatar, Indonesia, Oman, Malaysia, and Brunei Darussalam. Korea has begun to produce natural gas since November 2004, with a recent discovery of a small quantity of natural gas of about 250 BCM of recoverable reserves, in the Donghae-1 offshore field southeast of the economy.

Korea's electricity generation in 2003 was 322 TWh, 5.2 percent more than in 2002. Nuclear produced 40 percent of the total electricity generation, followed by coal at 37 percent, gas at 12 percent, oil at 8 percent, and hydro at 2 percent. The installed capacity in 2003 reached 56.1 GW. There are currently 20 nuclear power plants with a total installed capacity of about 17.7 GW.

Table 18 Energy supply & consumption for 2003

Primary Energy Supply (Ktoe)		Final Energy Consumption (Ktoe)		Power Generation (GWh)	
Indigenous Production	39,033	Industry Sector	80,020	Total	322,429
Net Imports & Other	175,280	Transport Sector	32,904	Thermal	185,883
Total PES	214,313	Other Sectors	43,747	Hydro	6,887
Coal	45,257	Total FEC	156,671	Nuclear	129,659
Oil	109,075	Coal	21,479	Others	-
Gas	22,358	Oil	91,508		
Others	37,623	Gas	13,923		
		Electricity & Others	29,760		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>).

### FINAL ENERGY CONSUMPTION

Korea's total final energy consumption in 2003 was 157 Mtoe, a 2.2 percent increase from the previous year. Industry accounted for the largest share at 51 percent, followed by residential and commercial sector at 28 percent and transport at 21 percent. In general, demand growth in the industry has weakened since the late 1990s, while the rate of demand growth in the transport and commercial sector has increased.

By energy type, petroleum products were the most important energy source, accounting for 58 percent of total demand. Electricity was responsible for 19 percent, coal for 14 percent and gas for 9 percent of end use. Because of strong policy measures, gas consumption has increased particularly in the residential and commercial sectors, from 4 percent in 1990 to 31 percent of the sector's energy consumption in 2003.

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## POLICY OVERVIEW

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Supporting high levels of economic growth despite inadequate indigenous energy resources has been the key driver of Korea's energy policy platform. The Ministry of Commerce, Industry and Energy (MOCIE) is responsible for developing and implementing energy policies and programmes, administrating the energy industry, supporting research and development of new energy technologies and formulating international cooperation on energy-related matters.

In the past, the primary goal of Korea's energy policy has been focused on ensuring a stable energy supply to sustain economic growth. The new and changing environments, however, have induced the government to seek a new direction in energy policy that would support sustainable development in full consideration of the 3E (Energy, Economy, and Environment). To this end, in December 2002, the Korean government announced "The 2nd National Basic Plan for Energy Policy." The Plan sets "Sustainable Development" as Korea's new goal on energy policy.

Korea has been shifting its energy market operations from a government-controlled system into market-oriented system in due consideration of the challenge of recent world trends in efficiency and privatisation. In addition, since world energy market has rapidly been integrated, Korea is now pursuing an active international role in regional energy cooperation with an open energy system. Korea is also set to put more resources in new energy technology development.

In summary, the following four dimensions comprise Korea's energy policy:

- Goal - sustainable development;
- Energy industry - from government-controlled system to market-oriented system;
- International relations - open to outside markets and regional cooperation; and
- Activity - support to technological innovations.

## OIL

Due to Korea's complete dependence on oil imports, its government has been trying to secure supplies in the short and long term. To smooth short-term supply disruptions and meet its International Energy Agency (IEA) obligations, the Korean government plans to increase its strategic oil stocks from 74.3 million barrels (54 days of net imports) in December 2004 to 141 million barrels (72 days of net imports) by 2008. By combining oil inventories of both public and private oil companies could replace about 109 days of net imports and would substantially exceed the IEA's obligation of 90 days.

In the longer term, the Korea National Oil Corporation (KNOC) has been actively exploring and developing oil and gas locally and abroad to improve its energy security. To encourage private companies to invest in the development project of overseas resources, the Korean government has expanded its policy of supplying long-term low-interest loans through the Special Account of Energy and Resources. As of the end of 2004, Korea had equity stakes in 56 overseas exploration and production projects in 24 economies including Indonesia, Vietnam, and Peru.

Korea has also been trying to diversify its supply channels for crude oil. The number of source economies increased to 29 in 2004 from only 9 in 1980, but oil import dependency from the Middle East remains high at 78 percent in 2004. Korea is also actively strengthening its bilateral relations with oil-producing economies as well as multilateral cooperation through the IEA, APEC, ASEAN+3, IEF and ECT, in order to enhance its crisis management capabilities. In particular, the government plans to play a leading role in energy resource development and trade in Northeast Asia by creating the collaborative framework on energy cooperation in Northeast Asia.

## NATURAL GAS

To reduce the economy's dependence on imported oil, Korea has introduced natural gas-based city gas to the residential sector in the 1980s. Since then, gas use has grown rapidly, replacing coal and oil in the residential sector, to reach 10 percent share of primary energy supply in 2003. Korea Gas Corporation (KOGAS) has monopoly over Korea's natural gas industry including import, storage, transport and wholesale businesses. Thirty two city gas companies monopolize the gas retail business in each region of the country.

According to "*The 7th Plan of Long Term Natural Gas Demand and Supply*," which was finalised by MOCIE in December 2004, it is projected that natural gas demand would grow by 3.9 percent per year from 2003 to 2017. To ensure a stable supply base for gas, KOGAS plans to expand LNG storage capacity to 8.6 MCM (64 units) in 2017 from 4.2 MCM (33 units) in 2004.

The first success story with respect to domestic exploration efforts was the discovery of a commercially viable gas reserve in the Donghae-1 offshore field, southeast of the economy. The field is estimated to hold about 250 BCM of recoverable gas. It plans to provide Ulsan with an annual 400,000 tons until 2018, accounting for 2.2 percent of annual demand in Korea.

## ELECTRICITY

Electricity consumption has gone up quite substantially for the last few decades, marking a 9.5 percent average annual growth through the 1990s. The installed capacity in 2004 reached 60 GW from 21 GW in 1990, more than three-fold increase. According to "*The 2nd Basic Plan of Electricity Demand and Supply (2004-2017)*," which was finalised by MOCIE in December 2004, it is projected that electricity demand would grow by 2.5 percent per annum from 2003 to 2017 and a total of 38.2 GW in capacities will be added by 2017. Taking decommissioning into account, it translates into 88 GW of total generation capacity for that year.

In order to rectify an energy supply and demand structure that was overly dependent on oil, construction of oil-fired power plants was strictly controlled and the development of non-oil power sources such as nuclear, coal and gas was promoted. Gas-fired power plants were introduced in 1986 and now account for more electricity production than oil-fuelled plants, with capacity shares being around 26 percent and 8 percent, respectively. While the gas-fired share of generating capacity is expected to stabilise at around the current level, the oil-fired share is expected to decline substantially to under 4 percent during the next 15 years.

Korea has been building nuclear power plants since the 1970s, which now accounts for around 38 percent of electricity production. The capacity share of nuclear is projected to increase to 30 percent in 2017 from 28 percent in 2003, surpassing the traditionally largest share of coal-fired capacity. Eight additional nuclear power plants (currently 20 plants) will be built by 2017, including the two currently under construction.

## ENERGY MARKET RESTRUCTURING

Since the late 1990s, Korea has been pursuing the restructuring of its energy sector with the introduction of the principle of free competition to such utility industries as electricity and gas that have been considered natural monopolies. In a move to introduce competition to the electricity industry, the government announced "The Basic Plan for Restructuring the Electricity Industry" in January 1999. The basic plan includes unbundling and privatisation of Korea's state-owned monopoly company, Korea Electric Power Corporation (KEPCO).

Part of the plan has been implemented, including the establishment of the Korea Power Exchange and the Korea Power Commission in April 2001. The power generation part of KEPCO was split into six companies (five thermal generation companies and Korea Hydro & Nuclear Power Co., Ltd.). The five thermal generation companies that split from KEPCO will be privatised in stages. Currently, privatisation is in progress for the first of the five companies, Korea South-East Power.

Along with electricity market restructuring, the Korean government developed “The Basic Plan for Restructuring the Gas Industry” in November 1999. The plan outlines a scheme to introduce competition into the import and wholesale gas business. The government plans to enact the relevant law on restructuring based on agreement by labour, management and government.

With regard to introducing competition into KOGAS's import/wholesale sectors, the final decision will be made on whether to split the sectors from KOGAS or to introduce new companies, following sufficient discussion among interested parties. Given the strong public interest on this sector, the existing public utility system is expected to be maintained. As for the retail sector, which is currently operated under a monopoly system by each region, competition will be introduced in stages, in consideration of the progress made in the wholesale sector.

### **ENERGY CONSERVATION AND EFFICIENCY PROMOTION**

To establish a low energy-consuming economy, the Korean government has promoted energy conservation and enhanced efficiency at the end use sector. In the industrial sector, the Korean government has enforced stringent administrative regulations on energy management in combination with provision for free consulting services to small enterprises. In addition, government has been developing voluntary agreements on energy saving with large energy-consuming enterprises that consume more than 2 Ktoe. The number of such agreements increased to 1,110 in 2004 from only 15 in 1998.

In the transport sector, tax and fee incentives are provided for the purchase of small cars with less than 800 CC engine displacements to increase usage of low energy-consuming vehicles. The government enforced a regulation that automobile industries should improve the energy efficiency of vehicles by 20 percent from the 1999 levels by 2009. In the public sector, all agencies were mandated to reduce energy consumption by 3 percent in 2006, from its 2003 levels. In addition, newly constructed public buildings are obliged to adopt the High Efficiency Energy-Using Appliance as certified by MOCIE.

Korea has recently launched several conservation programmes aimed at the residential and commercial sectors. At present there are three major energy efficiency programmes in operation: 1) the Energy Efficiency Standards and Labelling Programme targeting some household appliances, lighting and automobiles which began in 1992; 2) the Certification of High Efficiency Energy-Using Appliance Programme implemented in December 1996; and 3) the Energy-Saving Office Equipment and Home Electronics Programme which began in April 1999. One key objective of these programmes is to grant incentives to manufacturers to improve the energy efficiency of their products. Another key objective is to induce consumers to purchase more energy efficient products among those available in the marketplace.

District heating and cogeneration for industrial parks, factories and large buildings were also encouraged. As of the end of 2004, 7.6 percent of total households, or 1.3 million households, were supplied by district heating. Further, more rational energy price structure has continuously been developed and implemented to facilitate the efficient use of energy. Aided by these policies, the GDP elasticity of energy consumption has declined from 0.89 on average in the 1990s to 0.59 in 2004.

### **NEW AND RENEWABLE ENERGY**

The Korean government plans to increase the share of new and renewable energy to 5 percent in its total primary energy consumption by 2011. As of 2004, the share stood at approximately 2.3 percent, comparably lower than that of other advanced economies. To advance the development of new and renewable energy technologies, government has selected three major areas with viable market potentials and plans to concentrate support in these areas: hydrogen fuel cell, photovoltaic, and wind power.

To disseminate new and renewable energy, the government also plans to strengthen its support for this energy source. As of the end of 2003, the number of Green Villages that are energy self-

sufficient (thanks to new and renewable energy) has increased to five. Since May 2002, MOCIE has implemented the price support program to compensate the difference between power generation cost and selling price of new and renewable energy. In addition, the government made it mandatory for the installation of new and renewable energy facilities in March 2004, for all new public buildings that exceed a certain size.

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## NOTABLE ENERGY DEVELOPMENTS

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### KOREA CONTRACTED NEW LONG-TERM SPA OF LNG

KOGAS, the world's biggest buyer of LNG, will purchase 5 million tons per year for 20 years starting from 2008. MOCIE has chosen KOGAS to negotiate a new long-term SPA, surpassing KEPCO's bid. According to MOCIE's policy in November 2004, the company that submits the best conditions (KOGAS and KEPCO) will contract the new SPA. KOGAS will import 1.5 million tons a year from Malaysia LNG and Shell's Sakhalin-2 project respectively and 1.3 million tons from Yemen LNG for 20 years. The new contracts will replace an accord with Indonesia's PT Arun NGL that ends in November 2007. Under the new contract, KOGAS can buy LNG for about 30-40 percent cheaper than before and an option to buy an additional 700,000 tons annually. In addition, KOGAS will import two-thirds of the contracted 5 million tons in the winter season, to facilitate coordination of supply and demand.

### 'STANDBY KOREA 2010' LAUNCHED

The Korean government has made public the 'Standby Korea 2010', a national roadmap for saving standby power in July 2005. This initiative intends to lower the standby power of all the electronic devices circulated in Korea to 1 watt by 2010. The average standby power consumption per device in Korea is currently 3.66 watt. While this may seem insubstantial, standby power accounts for 11 percent of the nation's total residential power usage. The estimated annual cost for electricity lost to standby power is approximately 500 billion Korean Won (about US\$495 million).

The initiative is scheduled to be carried out in 3 stages. At the 1<sup>st</sup> stage (2005-2007), voluntary 1 watt program will be implemented. 1 watt standard will be applied to energy labelling standards, and the products will be given top priority in government procurement. The 2<sup>nd</sup> stage (2007-2009) is a transition period towards the 3<sup>rd</sup> stage. At this stage, preparatory measures to mandatory 1 watt program will be set up. Rational Energy Utilisation Act will be revised to reflect mandatory 1 watt regulation. At the 3<sup>rd</sup> stage (2010- ), the mandatory 1 watt program will be fully implemented. Products must have warning labels if they do not meet the 1 watt regulation. If the program goes as planned, standby power use per household is expected to fall 4.3 percent by 2020 compared to 2003 levels, even though the number of home appliances used will be more than doubled. The campaign is expected to save 121 billion Korean Won (about US\$ 120 million) annually by 2010.

### AFE PROGRAM FOR PASSENGER CARS TO BE IMPLEMENTED

The Korean government announced in April 2005 that it will implement the Average Fuel Economy (AFE) program for passenger cars starting in January 2006. Standard AFE was set at 12.4 km/ℓ for less than 1,500 cc vehicles and 9.6 km/ℓ for over 1,500 cc vehicles. The standard AFE will be required to auto makers and sellers of vehicles which sold more than 1,000 cars per year. The regulation will be applied to domestic cars from 2006 and to imported cars from 2010. This AFE program is Korean government's effort to meet the challenge of low fuel economy in the face of the recent high oil price regime. Due to the Korean consumers' favouring larger cars including SUV and vehicles with automatic transmission, AFE has deteriorated to 10.5 km/ℓ in 2004 after it hit the highest level of 13.74 km/ℓ in 1998. If auto makers or sellers fail to comply with the regulation, MOCIE can make an order to improve their fuel economies. When the auto makers or sellers do not implement the improvement order, MOCIE will make the fact public through the media.



### GYEONGJU TO HOST NUCLEAR WASTE STORAGE FACILITY

The site for storing low-and-intermediate-level radioactive waste (LILW) was decided in Gyeongju City, the ancient capital of the Silla Kingdom. Gyeongju's bid to accommodate the LILW repository was approved by 89.5 percent of the residential vote, beating out three other candidates. The project was to be awarded to the bidder with the highest approval rating in votes. The project has drifted for 19 years because everyone has opposed the building of nuclear waste storage facilities in their residential area even though they have all recognized the necessity for it. Two years ago, the government was forced to scrap its construction plan in Wido because of strong protests from residents and environmental activists. Gyeongju City will receive a financial support package of 300 billion Korean Won (about US\$297 million) for regional development and yearly storage fees, which is estimated at 8.5 billion Korean Won (about US\$8.4 million) a year. In addition, Korea Hydro & Nuclear Power Company (KHNP) headquarters, which is in charge of the facility, will be relocated to the area from Seoul. The government plans to complete the construction of the repository by 2008.

### KOREA OPENED GREENHOUSE GAS REDUCTION REGISTRY

As part of preparations for UNFCCC and the Kyoto Protocol, the Korean government opened a greenhouse gas reduction registry in July 2005 to encourage companies to cut back on emissions. The move is designed to prepare domestic companies for the emissions-reduction scheme in the Kyoto Protocol on climate control. The registry was established under the Korea Energy Management Corporation. Companies that submit plans to cut back on gas emissions will receive benefits for their efforts, and if companies cut back on emissions now, the level of emissions that the government will ask them to reduce later will be less.

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# MALAYSIA

## INTRODUCTION

Malaysia is located in Southeast Asia. Its 330,242 square kilometres of territory consist of Peninsular Malaysia and the Sabah and Sarawak States on the island of Borneo. The total population of Malaysia was 24.77 million in 2003. GDP grew at an average of 7 percent per year from 1990 to 2000. After experiencing a sluggish growth in 2001, the economy recovered with a growth of 5.3 percent in 2003<sup>16</sup>.

Malaysia is well endowed with conventional energy resources such as oil, gas, and coal, as well as renewables such as hydro, biomass and solar energy. As of December 2003, reserves included 4.55 billion barrels of oil, 89.0 tscf of gas and 1,483.06 million tons of coal. Malaysia is a net energy exporter. Crude oil, LNG and petroleum products contributed 12.4 percent of the economy's export earnings in 2004.<sup>17</sup>

Table 19 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	330,242	Oil (Bbl) - Proven	4.55
Population (million)	24.77	Gas (Tscf) - Proven	89.0
GDP Billion US\$ (1995 US\$ at PPP)	202.76	Coal (Mt) -Recoverable	1,483.06
GDP per capita (1995 US\$ at PPP)	8,184.46		

Source: Energy Data and Modelling Centre, IEEJ. \*National Energy Balance Malaysia, 2003

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Total primary supply in 2003 was 58,445 ktoe. Gas accounted for 46 percent of total primary supply, while oil, coal and others accounted for 43 percent, 10 percent and 1 percent respectively. Most of the coal used in Malaysia was imported.

Malaysia produced 37 million tonnes of crude oil in 2003. Most of Malaysia's oil fields are located offshore near Peninsular Malaysia. In view of the declining domestic reserves, PETRONAS, the state oil and gas company, is investing in exploration and production projects outside of Malaysia. As of 1 January 2005, Malaysia's total international reserves reached 5.93 million barrel of oil equivalent (boe), representing nearly a quarter of PETRONAS' total reserves. For the financial year ending 31 March 2005, PETRONAS had already signed 5 new production-sharing-contracts (PSC), bringing the current total to 59 ventures in 26 economies.<sup>18</sup>

Gas production in Malaysia reached about 46.1 Mtoe in 2003, an increase of 198 percent from 1990<sup>19</sup>. Forty one percent of this gas was exported, usually in the form of liquefied natural gas (LNG), to Japan, Korea and Chinese Taipei While a small percentage of the gas is exported to

<sup>16</sup> The Malaysian Economy in Figures 2005, Economic Planning Unit, Malaysia

<sup>17</sup> Monthly Statistical Bulletin July 2005, Department of Statistics, Malaysia

<sup>18</sup> Annual Report 2005, PETRONAS.

<sup>19</sup> Energy Data and Modeling Centre, IEEJ

Singapore by pipeline. Gas is used domestically for electricity generation and as feedstock in the petrochemicals industry.

In 2003, total electricity generation was 78,427 GWh. Thermal generation, mostly from natural gas (65.3 percent) and coal (24.6 percent), accounted for 93 percent of production and hydropower for the remaining 7 percent.<sup>20</sup>

Table 20 Energy supply & consumption (2003)

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	83,691	Industry Sector	13,473	Total	78,427
Net Imports & Other	(25,246)	Transport Sector	14,271	Thermal	73,371
Total PES	58,445	Other Sectors	6,843	Hydro	5,056
Coal	5,717	Total FEC	34,587	Nuclear	0
Oil	25,053	Coal	1,212	Others	0
Gas	27,257	Oil	21,176		
Others	418	Gas	5,886		
		Electricity & Others	6,313		

Source: Energy Data and Modelling Centre, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

### FINAL ENERGY CONSUMPTION

In 2003, total final energy consumption in Malaysia was about 35 Mtoe. The transport sector consumed 41 percent of this total, followed by the industrial sector at 39 percent and other sectors (agriculture, residential/commercial and non-energy) at 20 percent. By fuel source, petroleum products contributed the largest share with 61 percent of consumption followed by electricity (18 percent), gas (17 percent) and coal and coke (4 percent).

### POLICY OVERVIEW

The Prime Minister's Department, and the Ministry of Energy, Water and Communications are responsible for formulating Malaysia's Energy Policy. The Energy Commission, on the other hand, regulates the quality of energy service. The Ministry of International Trade and Industry (MITI) and the Ministry of Domestic Trade and Consumers Affairs (MDTCA), through the Petroleum Regulations of 1974 (amended in 1975 and 1981), are vested with powers to regulate downstream petroleum activities.

### MALAYSIA ENERGY POLICY

The following constitute Malaysia's energy policy:

- I. National Petroleum Policy (1975)
- II. National Energy Policy (1979)
- III. National Depletion Policy (1980)
- IV. The Four Fuel/Diversification Policy (1981); and
- V. Five Fuel Policy (2001)

<sup>20</sup> Energy Data and Modeling Centre, IEEJ

### NATIONAL PETROLEUM POLICY (1975)

The National Petroleum Policy had been formulated with the objective of bringing about the efficient utilisation of this resource for industrial development as well as ensuring that the nation exercises majority control over the management and operation of the industry.

The cornerstones of Malaysian petroleum policy were fleshed out in the Petroleum Development Act (PDA) of 1974 and the National Petroleum Policy of 1975. This legislation aims to regulate the oil and gas industry to achieve economic development needs. It outlines the following policy goals:

- Making sure adequate energy supplies at reasonable prices are available to support national economic development objectives;
- Promoting greater Malaysian ownership and providing a favourable investment climate, including creating opportunities for downstream industries; and
- Developing oil and gas resources at a socially and economically optimal pace, while conserving these non-renewable assets and protecting the environment.

The PDA established PETRONAS as a state-owned enterprise with exclusive ownership, exploration and production rights. It comes under the direct purview of the Prime Minister and is responsible for planning, investment and regulation of all up-stream activities. The PDA also introduced a system of production sharing contracts (PSCs) to replace the previous system of concessions. In these ways, the oil and gas sector was streamlined to ensure greater Malaysian participation in the ownership, management and control of oil and gas resources and activities.

### THE NATIONAL ENERGY POLICY (1979)

The National Energy Policy can be broadly defined in terms of three policy objectives as follows:

1. The Supply Objective: To ensure the provision of adequate, secure and cost-effective energy supplies by developing indigenous energy resources, both non-renewable and renewable, using least-cost options, and diversifying supply sources both within and outside the economy;
2. The Utilisation Objective: To promote the efficient utilisation of energy and the elimination of wasteful and non-productive patterns of energy consumption; and
3. The Environment Objective: To minimise the negative impacts of energy production, transportation, conversion, utilisation and consumption on the environment.

### THE NATIONAL DEPLETION POLICY (1980)

The National Depletion Policy of 1980 was formulated to prolong the life of the economy's oil and gas reserve. The policy, aimed at major oil fields of over 400 million barrels of oil initially in place (OIIP), restricted production to 1.75 percent of OIIP. However, the initial restriction proved too conservative, and in 1985, the ceiling was raised to 3 percent of OIIP. Due to this policy, total production of crude oil is limited to about 650,000 barrels per day. The National Depletion Policy was later extended from crude oil to include natural gas reserves. An upper limit of 56.6 MCM per day (2,000 million standard cubic feet per day) has been imposed in Peninsular Malaysia.

### FOUR-FUEL POLICY (1981)

To complement the National Depletion Policy and ensure the reliability and security of supply, the government adopted the Four-Fuel Policy. This strategy was designed to reduce the economy's dependence on oil, and its goal is to achieve an optimum mix of oil, gas, hydropower and coal in the supply of electricity.

As much as possible, development of domestic resources is encouraged to enhance security of supply. Under this initiative, oil share has fallen significantly. Consumers, particularly the power sector, have substituted oil with natural gas, which is available domestically and is environmentally-friendly compared with other fossil fuels. In year 2000, natural gas share in the fuel mix for power generation is 78.7 percent while hydro, coal and oil is 8.0 percent, 7.9 percent and 5.3 percent respectively. Too much dependent on natural gas is seen just as risky as being too dependent on oil in the 1970s. To reduce the heavy reliance on natural gas the government has turned to coal as a major fuel in the country's fuel mix, currently the coal represent 25 percent of the fuel mix and it is targeted that the coal share in the fuel mix to be 40 percent by 2010<sup>21</sup>.

#### FIVE-FUEL POLICY (2001)

The policy was formulated under the 8th Malaysia Plan (2000-2005) to encourage the utilization of renewable resources such as biomass, solar, mini hydro, etc as an additional source of electricity generation.

To fast track the implementation of the Five-Fuel Policy, the Government has launched the Small Renewable Energy Power Program (SREP) in May 2001. Under this program, the utilisation of all types of RE sources including biomass, biogas, municipal solid waste, solar, mini hydro and wind are allowed. Besides the launching of SREP, there were a few more initiatives taken by the government to promote RE including the implementation of Biomass-based Grid Connected Power Project and Malaysian Building Integrated Photovoltaic Project.

In 1998 the Pusat Tenaga Malaysia (PTM) was established as an independent non-profit entity to formulate, coordinate and manage energy-related research and development programmes and promote the development of indigenous technologies. The organization was officially launched by the Prime Minister during the World Renewable Energy Congress in June 1999, in Kuala Lumpur. One of the important roles of PTM is to promote RE and energy efficiency (EE) programmes in Malaysia and to formulate innovative financing mechanisms to make these projects commercially viable.

For the education and training of RE and EE in Malaysia a program called the Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE) was established. CETREE also helps in increasing public awareness on the positive attributes of RE and EE measures Under the 8th Malaysia Plan. CETREE had been recognised as a centre to assist the school and university education sectors in upgrading knowledge and awareness of RE and EE.

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### NOTABLE ENERGY DEVELOPMENTS

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In the key sectors of Malaysian economy, oil and gas make up nearly 90 percent of the primary energy supply. The economy currently has an ample reserve margin of about 30 percent, enough to guarantee sufficient supply of electricity. However this reserve capacity is expected to be reduced in the future. Malaysia has been fortunate since it possesses an abundant energy resource base in the form of oil and natural gas. However, these fossil fuels have resource limitations and therefore Malaysia has given importance to the implementation of energy efficiency measures and development of renewable energy resources. By applying energy conservation measures, the economy could save about RM1.6 billion\* or 10 percent of total energy consumption. The Government is encouraging the use of renewable energy such as solar power, hydro, geothermal and agricultural biomass to ensure the sustainability of energy resources.

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<sup>21</sup>Speech by Minister of Energy, Water and Communications, Y.B. Dato' Seri Lim Keng Yaik, 'Energy Demand and Investment Opportunities' at The 5<sup>th</sup> International Conference & Exhibition on Coaltech 2004, 7 December 2004

\* US\$1 = RM3.80

## FUEL DIVERSIFICATION

To avoid over-dependence on natural gas for power generation, the government has decided to increase the share of coal in the fuel mix. It is targeted that by the year 2010 the share of coal in the fuel mix for electricity generation will be 40 percent<sup>22</sup>.

The existing coal-fired plants in the country are the Kapar Power Plant and the TNB Janamanjung Plant with installed generating capacities of 2,400 MW and 2,100 MW respectively. Two new Independent Power Producers (IPPs) for coal-fired power plants, Jimah IPP Project and SKS Tanjung Bin Power Project with a combined installed capacity of about 3,500 MW, will be constructed and commissioned in the next five years. The development of the two power plants will be staggered, with some units coming on stream in 2006 and others in 2007. Jimah's power plants will have a final capacity of 1400 MW and SKS Tanjung Bin Power Plants will have a final capacity of 2100 MW.<sup>23</sup>

The use of coal to reduce the heavy reliance on natural gas is promoted due to its competitive price, relatively stable supply and the development and availability of clean coal technology. The coal for the power sector is imported from Australia, Indonesia, China and South Africa. Australia (60 percent) and Indonesia (30 percent) are the major supplier due to its coal availability, reliability and competitive cost.

The government has taken a few steps to monitor issues related to coal such as its supply, pricing and shipments. To ensure continuous supply of coal at competitive prices policies and strategies have been developed by the government. In 2003 Energy Commissions has been appointed as the secretariat for a Coal Supply Committee that is responsible in providing regular feedback to the government on the use of coal for electricity generation.

## RENEWABLE ENERGY (RE) INITIATIVES

Concerns about environmental degradation and more recently the volatility of oil prices have brought to the forefront the important role that renewable sources of energy can play in the national energy mix. While it is clear that renewable sources of energy will not be able to replace fossil fuel driven systems in the near or medium term future, there are significant potentials for renewable energy systems to make an impact in reducing dependence on fossil fuels and paving the transition to smaller and more efficient energy systems.

Under the 8<sup>th</sup> Malaysia Plan, the Government has made a commitment towards the development of RE in the country. This was done with the introduction of the Five Fuel Policy where RE will constitute the fifth fuel in the national energy mix. Under this policy the Malaysia's energy mix focused primarily on oil, gas, coal, hydro and RE sources.

Being the largest palm oil producer in the world, the economy has abundant source of renewable energy especially palm oil biomass. In 2004 Malaysia has 381 palm oil mills in operation; processing 79.7 million tonnes of fresh fruit bunches per year<sup>24</sup>. It is estimated that this industry will generate 19 million tonnes of crop residue yearly in the forms of empty fruit bunches, fiber and shell. These resources can be used to generate 2098 MW of electricity<sup>25</sup>. Other sources of biomass waste include wood waste, rice husk and municipal solid waste.

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<sup>22</sup> Speech by Minister of Energy, Water and Communications, Y.B. Dato' Seri Lim Keng Yaik, 'Energy Demand and Investment Opportunities' at The 5<sup>th</sup> International Conference & Exhibition on Coaltech 2004, 7 December 2004

<sup>23</sup> Speech by Minister of Energy, Water and Communications, Y.B. Dato' Seri Lim Keng Yaik, 'Energy Demand and Investment Opportunities' at The 5<sup>th</sup> International Conference & Exhibition on Coaltech 2004, 7 December 2004

<sup>24</sup> Malaysian Palm Oil Board, 'Number of Mills capacity 2004', website <http://econ.mpob.gov.my/economy/annual/stat2004/process1.htm>

<sup>25</sup> Report, Comprehensive Biomass Energy Resource Inventory in Malaysia (2004) by BIOGEN Project, Pusat Tenaga Malaysia.

Other than SREP which was launched to fast track the implementation of Five-Fuel Policy, the Government has also supported RE development by providing funding for feasible projects by the Malaysian Electricity Supply Industry Trust Fund (MESITA). For instance in 2004/2005 a total of RM 27 million has been approved for solar hybrid projects both in Peninsular Malaysia as well as Sabah in East Malaysia<sup>26</sup>. These projects have proven to be very viable in terms of electrifications of remote areas. As solar, hydrogen and fuel cells hold potential to provide a clean, reliable and affordable energy supply that can enhance Malaysia economy, environment and security, MESITA had approved RM800, 000 grants for a study on the Roadmap for Solar, Hydrogen and Fuels Cells by PTM. The main objectives of this roadmap is to identify the short, medium and long term action plans, strategies and goal for solar, hydrogen and fuel cells utilization in Malaysia and to identify its required resources and future R&D directions.

#### SMALL RENEWABLE ENERGY POWER PROGRAM (SREP)

Small and Renewable Energy Power Program (SREP) was launched on 11 May 2001. SREP projects are power generating projects that are capable of converting RE resources into electricity. A Renewable Energy Purchase Agreement (REPPA) allows each independent power producer to negotiate directly with utility company on all aspects including selling price on a 'willing-seller, willing-buyer' and 'take and pay' basis. RE electricity producers receive a 21-year license, and allowed to export to grid up to a maximum of 10MW. Under this program, the utilizations of all types of renewable energy including biomass, biogas, municipal solid waste, solar, mini hydro and wind are permitted. A SREP developer can apply to sell electricity to the utility company through distribution Grid System.

In order to streamline the approval process of SREP applications, Suruhanjaya Tenaga was appointed as the SREP One-Stop Centre and a Special Committee on Renewable Energy (SCORE) was formed to assess the applications. As of August 2005, SCORE has approved 52 projects with the capacity to export about 266 MW to the national grid<sup>27</sup>. To date, only two SREP projects have been commissioned and operating that are 2MW landfill gas project in Peninsular Malaysia and 10 MW biomass waste project in Sabah. A few issues were identified as the cause of low plant up rate of the SREP projects, two major issues are the viability of power purchase price set by TNB and the REPPA terms and project viability. The government is now studying the possible ways to tackle to issues.

#### GRID CONNECTED PALM OIL BIOMASS POWER GENERATION AND COGENERATION PROGRAM

A national program on Grid-connected Palm Oil Biomass Power Generation and Co-generation was launched in October 2002. The project is co-financed by the Government of Malaysia, United Nation Development Program (UNDP)/Global Environment Facility (GEF) and private institutions. The goal of this project is to reduce the rate of greenhouse gas (GHG) emissions from fossil fuel-fired combustion processes through the utilisation of palm oil waste. To develop energy potentials from biomass waste, the program envisions a two-stage implementation covering five project components over a five-year period (2002-2007): These components are information services and awareness enhancement, policy studies and capacity building, financial assistance for biomass energy projects, demonstration projects and biomass energy technology development. The first demonstration project site had been identified and is currently in the process of development.

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<sup>26</sup>Speech of Deputy Secretary General II, Ministry of Energy, Water and Communications, 'Seminar and Business Forum on Malaysia-Japan Solar PV Strategy and Applications' at Nikko Hotel Kuala Lumpur, 22 February 2005

<sup>27</sup>Suruhanjaya Tenaga, SREP Statistics, August 2005

### MALAYSIAN BUILDING INTEGRATED PHOTOVOLTAIC PROJECT (MBIPV)

The Malaysian Building Integrated Photovoltaic (MBIPV) Project was launched on 25 July 2005. The project is co-financed by Government of Malaysia, UNDP/GEF and private institutions with funding reaching a total of US\$25 million. The objective of this five-year project is to reduce the long-term cost of Building Integrated Photovoltaic (BIPV) technology within the Malaysian market which will subsequently lead to a sustainable and widespread BIPV technology applications that will subsequently reduce GHG emissions from the electricity supply industry.

The MBIPV project is looking into the development of strong financing mechanism and economic assessment model to support BIPV applications towards increment in market share. It is estimated that the project when implemented will increase the number of BIPV applications to about 300 percent with costs going down to 30 percent by the year 2010.

The MBIPV project consists of four components critical to the realization of the project. The components are:

1. Information services, awareness and capacity

The goal of this component is to improve overall acceptance to BIPV technology and also to build the national capacity. This will be achieved through promotion and educative campaigns to the public, Government and Industry sectors. This component will also facilitate the setting up of a National PV Council (NPVC). The NPVC will become the focal point for national BIPV development and to promote quality installation and practice.

2. Market enhancement and infrastructure development

This component will create the essential market penetration for BIPV technology through the development of BIPV showcases, demonstrations projects and the execution of National Suria 1000 Program. The National Suria 1000 Program will be carried out to encourage public participation and to create local demand. This component will also review the existing building standard and create new installation guideline for the BIPV technology.

3. Policies and financing mechanisms

The purpose of this component is to review and improve the institutional and financial supports for a sustainable BIPV market. This component will determine the necessary support frameworks needed to establish a favorable environment for a sustainable BIPV market in Malaysia.

4. Industry development and R&D enhancement

This component will develop and optimize the local BIPV industry for the local conditions in Malaysia. This including assistance to small and medium size industries to pioneer the local development and establishment of a product testing facility to ensure the quality and reliability of the local products.

### FISCAL INCENTIVES FOR RENEWABLE ENERGY

Fiscal incentives were given in the 2003 Budget for the development of renewable energy resources, which include palm oil mill or estate wastes, rice mill wastes, sugar cane mill wastes, timber/sawmill wastes, paper recycling mill wastes, municipal wastes and biogas (from landfill, palm oil mill effluent, animal waste and others). The incentives also apply on the use of small hydropower not exceeding 10MW, including solar power.

### ENERGY EFFICIENCY (EE) INITIATIVES

There have been a few initiatives engaged to pursue the utilisation objective on energy efficiency. Demand side management initiatives by the utilities, particularly through tariff incentives, have encouraged more efficient use of energy. The government has taken a few initiatives in promoting EE. Such initiatives included the implementation of the Malaysian Industrial Energy Efficiency Improvement Programme (MIEEIP) as a collaborative effort between



the Government of Malaysia and the United Nation Development Programme (UNDP)/Global Environmental Facility (GEF). This 4-year project aims to remove EE barriers, encourage rational use and improve energy efficiency in Malaysian industries. Other EE initiatives currently being carried out including an energy auditing programme, an energy service companies support programme and a technology demonstration programme. The government also has taken the lead in promoting EE in buildings within the economy by constructing the Low Energy Office (LEO) Building which houses its Ministry of Energy, Water and Communications (MEWC). There is also plan to construct a Zero Energy Office (ZEO) Building in Bangi Selangor which will house PTM. As its name implies, this building will produce its own electricity and sell it to the national grid equal to the amount of electricity imported from the grid.

#### MALAYSIAN INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT PROGRAM (MIEEIP)

The four-year MIEEIP project is co-funded by the Government of Malaysia, UNDP/GEF and the private sector in Malaysia with a total cost of US\$20,790,200. The project's main goal is to remove barriers to the efficient use of energy in the industrial energy sector in Malaysia. The MIEEIP project focuses on selected industrial sectors which were found to be energy-intensive. The eight industrial sectors selected are wood, food, glass, cement, rubber, pulp& paper, iron& steel and ceramic. In 2005 it was extended to other three energy intensive industries namely oleo-chemical, plastic and textiles.

An Energy Efficiency Project Lending Scheme (EEPLS) has been established with the Government of Malaysia contributing RM4 million and GEF another RM4 million. The EELPS will be distributed out as a soft loans to energy services companies (ESCOs) and industries to implement EE projects.

Under the MIEEIP project, nine EE demonstration projects will be developed. Currently, two EE demonstration projects have been successfully implemented. The projects are in Haveaboard Berhad, from a wood industry sector, and Johnson Suisse (M) Sdn. Bhd., from a ceramic industry sector. The Master Services Agreement (MESA) for the demonstration project in Haveaboard Berhad was signed on April 2003 between the company and ESCOs. The project is expected to reduce the company's energy bill by 90 per cent by changing the oil-based boiler to a wood waste boiler; the wood waste comes from the factory's wood dust. The MESA for the project in Johnson Suisse (M) Sdn. Bhd. was signed on April 2004.

#### ENERGY EFFICIENCY IN BUILDINGS

In 2003 the commercial and residential sector consumed 13 percent of the total final energy demand, where electricity is the main fuel in the residential and commercial sector amounting to 58 percent on average. Even though commercial and residential sector consumes the least by percentage, it grew by 7.54 percent annually from the year 1980 to 2003.<sup>28</sup> In order to reduce the energy intensity in the economy, a few initiatives has been taken including increasing energy efficiency in buildings:

1. Low Energy Office Building (LEO Building)

The Low Energy Office (LEO) Building is the first large government office building to be specifically designed as an integrated energy efficient design and fitted with cost-effective features. The construction for this building is one of the government initiatives in leading the way in improving energy efficiency in government and private buildings. The LEO building is located at the Federal Government Administrative Centre Putrajaya and houses the Ministry of Energy, Water and Communications (MEWC). The Ministry had moved to the LEO building on September 2004.

The LEO building is used as a showcase building for EE and low environmental impact building. It is also used to demonstrate that EE buildings can be build without excessive

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<sup>28</sup> National Energy Balance 2003, Ministry of Energy, Water and Communications Malaysia

construction cost penalty. The LEO building is a platform for improving the capacity of local professionals, academicians and industries by giving them the opportunity to carry out research and analysis on energy efficient building.

The targeted Energy Index (EI) in the LEO Building is 100kWh/sqm per year compared to the EI in a conventional office building which is 200-300kWh/sqm per year. This means that energy saving for the LEO Building is 50 percent or an equivalent annual energy cost savings of up to RM600,000. The extra construction cost of the LEO building is less than 10 percent while the pay back period of the extra investment is less than 10 years<sup>29</sup>.

Among the key features of the building are the energy efficient space planning, energy efficient cooling system, maximum usage of day light, usage of high efficiency lighting which are controlled by daylight availability and occupancy, energy efficient office equipments, well insulated building façade and building roof and the implementation of an Energy Management System.

The Ministry has published a book regarding the LEO building entitled “Low-Energy Office: The Ministry of Energy, Water and Communications Building” The book is used to disseminate information on the LEO Building. The book has been distributed to all sectors and government agencies that have been identified in order to share the experience of the Ministry in developing the LEO Building.

## 2. Zero Energy Office Building (ZEO Building)

The Zero Energy Office (ZEO) Building is a building where the energy consumption is less than the energy produced. The ZEO Building design incorporates both RE and EE features. The building will house Pusat Tenaga Malaysia (PTM) and will start its construction by end of 2005 and targeted be completed on September 2006.

The Building is targeted to achieve EI of 50 kWh/sqm, which is half that of the EI of the MEWC's LEO Building and well below the 135 kWh/sqm specified in the *Guideline for Energy Efficient in Building 1989*<sup>30</sup>.

The ZEO Building will also be used as a showcase for BIPV technology and will perform as a demonstration project for BIPV under the MBIPV Project implemented by Pusat Tenaga Malaysia. A solar PV system will be installed on the roof of the building, and the electricity load of the building will be covered by the system. The building will utilize electricity from the grid to operate the chillers at night where the electricity tariff is cheaper and the electricity produced by the PV system during the day will be exported to the grid; thus the term ‘Zero Energy Building’.

Apart from producing electricity using the PV systems the building will be fitted with many EE features, including high performance glazing which allow the use of natural light in the building but avoid unnecessary heat radiation from entering the building, concrete floor slabs with thermal storage and radiant cooling to store the cooling from night time to daytime, fresh air and dehumidification and usage of energy efficient office equipments.

## FISCAL INCENTIVES FOR ENERGY EFFICIENCY

Fiscal incentives for energy efficiency (EE) initiatives were provided for in the 2003 National Budget. The incentives would be up to the year 2005.

## CLEAN DEVELOPMENT MECHANISM (CDM)

Malaysia ratified to the Kyoto Protocol on 4 September 2002. Under the protocol, Malaysia is not subject to any commitment to reduce the greenhouse gas (GHG) emissions. However, the

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<sup>29</sup> Ministry of Energy, Water and Communications, MEWC Low Energy Office (LEO) Building Putrajaya, Malaysia. Website, <http://www.mecm-leo.gov.my>

<sup>30</sup> Pusat Tenaga Malaysia, Energy Smart Quarter 1 Issue 0017, Paul E. Kristensen, ‘Special Focus: The New PTM ZEO Building is on the Drawing Board’, 2005

economy could reap benefits from the investments in the GHG emission reduction projects through participations in CDM, which will also contribute towards the overall improvement of its environment. CDM is also utilized as an alternative financing scheme for RE projects in Malaysia.

Malaysia has a high potential for CDM market. According to the Malaysia Initial Communication 2000, the economy's GHG emission for 1994 is 14 million tonnes of CO<sub>2</sub>, where 68 percent originates from the energy uses and 19 percent from waste. It is estimated that Malaysia will be able to produce 18 million tonnes Certified Emission Reductions (CERs) annually by 2010<sup>31</sup>.

The total number of CDM project applications that have been received is 27 projects; 21 Project Idea Notes (PIN) and six Project Design Document (PDD). All the 21 PINs are waiting for conditional approval and only two of the applications with PDDs have received the host company approval while the other four PDDs are waiting for host country approval. 56 percent of the proposed CDM projects are for the palm oil industry while 12 percent are for landfill projects, the remaining are proposed CDM projects for animal waste, manufacturing industries, composting, solid waste and mini hydro.

#### ALTERNATIVE FUEL

Currently, the economy has two programs to develop alternative fuel for transport sector which is natural gas vehicle (NGV) program and biofuel utilisation plan.

#### NATURAL GAS VEHICLE (NGV) PROGRAM

The Natural Gas Vehicle (NGV) program in Malaysia is championed by PETRONAS, the state-owned oil company. The program was introduced in 1986 by PETRONAS as part of its efforts to utilize the abundant natural gas resources and to diversify the use of natural gas other than for power and industrial use.

The development of NGV in Malaysia was carried out in a few stages. The Pilot Program which was implemented from 1986 to 1988 enabled the company to understand the technology and to lay the framework for its commercialization. In this stage one NGV outlet was established and 21 vehicles were converted to bi-fuel. The Natural Gas for Vehicles Program which was implemented from 1991 to 1994 identified and resolved issues regarding the wider usage of NGV in the economy. Six stations under the 'Mother-daughter' concept were also established and started operation on 1992 in Klang Valley. A total of 930 vehicles were converted to bi-fuel operation. For a wider NGV Program, in 1996, PETRONAS incorporated a subsidiary, PETRONAS NGV Sdn. Bhd., to spearhead the development and commercialization of NGV in Malaysia<sup>32</sup>.

To date, the company has 39 NGV refueling stations which are located in Kuala Lumpur, Johore, Penang and Seremban. The company plans to expand the operation and increase the number of stations to 51 by the end of 2005 and to 94 refueling stations by 2009. The total number of NGV in the economy is currently 14,700 units; including 1,000 units of Enviro 2000 NGV Taxis. It is planned to be increased to 57,000 vehicles by 2009<sup>33</sup>. The company is now extending the effort of championing the development of NGV in the economy by introducing NGV for heavy duty vehicles such as buses and trucks. Currently one NGV bus is operating in Putrajaya, the Federal Government Administrative Capital, and two other units are being prepared for operation.

Even though most NGV are taxis, there is an increasing interest exhibited by other motorists, mainly because of rising oil prices. The retail pump price of NGV is currently cheaper than the

<sup>31</sup> Soon HY, 'CDM Potential in Malaysia- A preliminary Assessment', at the EC-ASEAN Workshop, February 2004

<sup>32</sup> PETRONAS NGV Sdn. Bhd., Mohd Ghazali Daud, 'Opportunities and Challenges for Natural Gas as Transport Fuel in Asia- A Malaysian Perspective', December 2003

<sup>33</sup> International Association for Natural Gas Vehicles (IANGV), 'Malaysia-Country Report', 4 May 2005 Website: [http://www.ngvglobal.com/index.php?option=com\\_content&task=view&lang=en&id=117&Itemid=2](http://www.ngvglobal.com/index.php?option=com_content&task=view&lang=en&id=117&Itemid=2)

premium grade petrol by 50 percent. The exhaust emission of these NGV is below EURO II limits on nitrogen oxide, hydrocarbon and carbon monoxide. Another attractive aspects of the NGV is that on a full tank the vehicle can travel up to 480 km which is quite equivalent to the petrol powered vehicle.

The government has introduced many incentives over the years to support the NGV industry. The incentives including exemption on duty on the sale of CNG, exemption on the import duty and sale tax on NGV conversion kits, reduction on road tax, 25 percent for bi-fuel and 50 percent for monofuel NGV and accelerated capital allowance for purchase of monofuel natural gas buses and the construction of NGV outlets.

#### BIO-FUEL UTILISATION

In respond to the escalation of oil and gas prices, the Government has announced the introduction of a National Biofuel Policy on 10 August 2005. The Policy is scheduled to be tabled for approval to the parliament by the end of 2005. The objective of the policy is to encourage the production and usage of palm oil biofuel as an environmentally friendly alternative energy source and also to stabilize the palm oil price at higher level through the increased of palm oil usage. The National Biofuel Policy consists of three important strategies that are the production and utilization of biofuel for transportation, production of biofuel for export, especially to European market and commercialization of biofuel technology as a local technology.

Biofuel are fuel made from biological ingredients, ranges from vegetable oil to animal fat, instead of fossil fuel. Similarly, biodiesel is an alternative or additive to a standard diesel fuel that is made from biological ingredients instead of petroleum. Biodiesel in Malaysia will be mixture of 5 percent palm oil and 95 percent diesel fuel. The utilization of biodiesel in Malaysia is targeted to be enforced by 2008. Three biodiesel production plant will be build in one year period at a total cost of RM120 million. The total capacity of the biodiesel plants will be 180,000 tonnes of biodiesel per year. Two of the plants will be located at Port Klang, Selangor and another one at Pasir Gudang, Johor. As part of the government inducement to boost the new industry, the plants will be built in collaboration of Malaysian Palm Oil Board (MPOB), a government-run company, with private sectors where MPOB will have an equity stake of 50 per cent in each plant.<sup>34</sup>

It is estimated that diesel import will be reduced by 500,000 tonnes a year or 10 percent by blending 5 percent biofuel to diesel at pumps. This will benefit the government as recent higher oil prices has increases government spending on fuel subsidy, it is estimated that the fuel subsidies will increase by 34 percent to USD 4.2 billion in 2005.<sup>35</sup>

As Malaysia is the world leading palm oil producer and exporter, the move to produce biofuel from palm oil will increase the domestic and export market for palm oil. Stronger demand for palm oil will improve its price and the soon to be constructed biodiesel plants will help to stabilize the palm oil prices by absorbing 500,000 tonnes of palm oil annually. In 2004, the global demand for biofuel was 2.5 million tonnes and its expending by 25 percent a year. Malaysia has the potential to capture 10 percent of the biofuel market share due to its position as the world largest palm oil producer and exporter<sup>36</sup>.

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<sup>34</sup> Mail & Guardian Online, 'Malaysia to Build Biodiesel Plants Fuelled by Palm Oil', 26 September 2005. Website [http://www.mg.co.za/articlePage.aspx?articleid=251964&area=/breaking\\_news/breaking\\_news\\_business/](http://www.mg.co.za/articlePage.aspx?articleid=251964&area=/breaking_news/breaking_news_business/)

<sup>35</sup> Reuters, 'Malaysia to Make Biofuel Mandatory by 2008-Report', 7 October 2005. Website <http://www.planetark.com/dailynewsstory.cfm/newsid/32867/story.htm>

<sup>36</sup> FT.Com Financial Times Asia Pacific, 'Malaysia May Require Use of Biodiesel From 2007', 11 October 2005. Website <http://news.ft.com/cms/s/246868b2-371d-11da-af40-00000e2511c8.html>

### MARKET LIBERALISATION OF ELECTRICITY SECTOR<sup>37</sup>

The market liberalization of the electricity sector in Malaysia has been implemented in a few phases. The first phase involves the generation segment; the electricity generation section has been deregulated since 1992 with the introduction of Independent Power Producers (IPPs). To date, there are 19 IPPs in operation which contributing to about 64 percent of the total grid-connected electricity output. The transmission section, however, remains a monopoly by the Utilities in view of the relatively small market. The distribution section on the other hand has been liberalized to a certain extent with the introduction of franchise areas such as Kulim Hi-Tech Park (KHTP) and the granting of license to the 'dedicated' power plant in KHTP.

A study on the merits and demerits of further liberalization has been carried out by the Government. After taking into consideration some of the adverse consequences of deregulation in a number of countries, the government has decided that for the now a 'managed market model' would be the answer to the country's requirement for adequate, reliable and efficient supply in the electricity sector.<sup>37</sup>

Since 2003, new elements of competition, i.e. Demand Risk Sharing (DRS), are being gradually introduced into the Power Purchase Agreements in preparation for a further liberalization of the electricity sector. Under the concept of DRS the IPPs is required to bear part of the demand risk with the offtaker; that is Tenaga Nasional Berhad.

### MARKET LIBERALISATION OF OIL AND GAS SECTOR<sup>38</sup>

Oil and gas industry in Malaysia have been liberalized for a very long time. Multi-national Corporation such as SHELL and Exxon of USA have been operating in the upstream sector of the oil and gas industry since 1910 and 1960s respectively.

PETRONAS, the national oil company, has been incorporated in 1974 and the production sharing contracts were introduced to enable multinational oil corporations to operate in the upstream activities in Malaysia.

The mid-stream sector of the oil industry has also been liberalized. Apart from PETRONAS who has set-up three refineries in Malaysia, multi-national oil corporations such as SHELL and ESSO have also set-up refineries in Malaysia to support their business in the downstream sector.

The downstream sector of the oil industry, the retailing oil business, has long been liberalized where multi-national oil companies such as SHELL, Exxon Mobile, BP, Conoco are competing for the oil retailing business. PETRONAS Dagangan Bhd., a public listed PETRONAS subsidiary, competes with the other multi-national oil companies in the downstream sector.

Multinational oil and gas companies such as Exxon Mobil and SHELL are producing gas together with PETRONAS Carigali Sdn. Bhd., a subsidiary of PETRONAS, while the gas processing and transportation in Peninsular Malaysia is managed by PETRONAS Gas Bhd., a public listed subsidiary of PETRONAS. The distribution of the gas to the end consumer is managed by Gas Malaysia Bhd., a joint venture company between Malaysia Mining Corporation, Tokyo Gas and PETRONAS.

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<sup>37</sup> Statement, 29<sup>th</sup> Energy Working Group Energy Working Group Meeting Energy Market Liberalization in Malaysia, Hanoi 16-17 March 2005

<sup>38</sup> Statement, 29<sup>th</sup> Energy Working Group Energy Working Group Meeting Energy Market Liberalization in Malaysia, Hanoi 16-17 March 2005

### OIL AND GAS SECTOR<sup>39</sup>

As at January 2005, Malaysia has total domestic reserves of 19.49 billion barrels of oil equivalent (boe); 73 percent gas and 27 percent oil. At the current rate of production the reserve life for crude oil and gas is 19 years and 33 years respectively.

Malaysia total oil and gas production for the year ending March 2005 was 583.3 million barrels of oil equivalent (boe): 275.9 million boe oil and condensate, 307.4 millions boe gas.

For the year 2005, five new Production-Sharing Contracts (PSCs) were signed where two of the five PSCs were ultra-deepwater blocks with the water depth up to 4000 meters. The exploration of deepwater and ultra-deepwater areas will give a significant boost to the oil reserve of the economy.

For the year ended March 2005, 47 production well were drilled which had resulted in the discovery of 1,084.7 million boe of oil and natural gas reserves, where 70 percent of the discovery were for the deepwater reserves. The oil and natural gas discoveries were made in deepwater Gumusut-Kakap and Malikai field offshore Sabah, NCH and F2 Attic fields offshore Sarawak and Anding Utara oilfield offshore Peninsular Malaysia.

The number of fields in operation at March 2005 is 75: 53 oil fields and 22 gas field, about half of the field are operated by PETRONAS Carigali (The E&P arm of the national oil company, PETRONAS).

To increase the national reserve, the economy through its national oil company-PETRONAS, is involves in international oil and gas exploration and production. As at January 2005, the total international reserve is 5.93 million boe. Most of the reserves are located in Egypt, Sudan, Turkmenistan, Chad and Malaysia-Thailand Joint Development Area (JDA). During the year, five new PSCs were acquired, which added up to 59 ventures in 26 countries.

### GAS DEVELOPMENT AND UTILISATION<sup>40</sup>

The ensure a sufficient natural gas supply in order to meet increasing local demand, additional supply had been secured both through local production and through imports from Vietnam, Indonesia and the Malaysia-Thailand JDA. The first delivery of the Malaysia's share of natural gas from the Malaysia-Thailand JDA was received by the PGU system in February 2005. The Trans-Thailand Malaysia (ITM) pipeline is the latest component of the growing interconnection of the cross-border gas infrastructure in ASEAN and charts another important step towards the realisation of the Trans-ASEAN Gas Pipeline (TAGP). Interconnection with the existing and future infrastructure in the gas-prolific areas of ASEAN will enhance security of gas supply to meet the region's increasing energy requirement.

Development and utilisation of gas continues to be the main thrust of PETRONAS' activities to exploit the economy's substantial gas reserve through value adding projects. PETRONAS is involved in the whole chain of the gas development including gas processing, liquefaction, pipeline transmission, marketing and trading of LNG, gas district cooling and supply of industrial utilities. Currently PETRONAS is the largest LNG producer from a single location in the world. Their LNG complex in Bintulu has the capacity of about 23 million tonnes per year. The complex churned up 18.4 million tonnes of LNG for the financial year ended March 2005.

Malaysia's LNG was exported mainly to Japan (61 percent), South Korea (22.9 percent) and Taiwan (11.8 percent). PETRONAS continued to venture into international scene in 2005, the first of two trains of Egyptian LNG project had produced its first cargo in May, four month ahead of schedule and became the fastest LNG project ever executed with only six years between first

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<sup>39</sup> Annual Report 2005, PETRONAS

<sup>40</sup> Annual Report 2005, PETRONAS

explorations well and the first cargo. Long-term contract had been signed with Gaz de France and BG Gas Marketing for supplying the entire output of trains 1 and 2.

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# MEXICO

## INTRODUCTION

Mexico is located in North America, bordering the United States to the north and Belize and Guatemala to the south. Mexico is one of the most populous economies in Latin America, with a total population of about 102.29 million people that grew by 1.46 percent between 2002 and 2003<sup>41</sup>. As a result of urbanisation in the last part of the 20<sup>th</sup> Century, 67 percent of the population now live in urban areas. Thirty four percent of the population is concentrated in nine metropolitan areas, the largest of which is Mexico City, serving as home to 19 million people in 2003.<sup>42</sup> GDP growth rate at purchasing power parity has grown by an average of 2.37 percent per annum (1980-2003) reaching about US\$838 billion in 2003. GDP per capita actually *decreased* in terms of Purchasing Power Parity between 2002 and 2003 by 0.16 percent.

Table 21 Key data and economic profile (2003)

Key data		Energy reserves	
Area (sq. km)	1,964,375*	Oil (MCM) – Proven**	2353
Population (million)	102.29	Gas (BCM) – Proven**	414
GDP Billion US\$ (1995 US\$ at PPP)	838.06	Coal (Mt) –Recoverable***	1,211
GDP per capita (1995 US\$ at PPP)	8,193		

Sources: Energy Data and Modelling Center, IEEJ

\* INEGI, Información geográfica. 2003.

\*\* As of January 2005. Anuario Estadístico PEMEX 2005.

\*\*\* As of January 2003. Handbook of Energy & Economic Statistics in Japan 2004. EDMC.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Total primary energy supply in Mexico was about 156.8 Mtoe in 2003. Oil and gas (with contributions of 52.5 percent and 30.3 percent respectively) dominate primary energy supply with a combined share of 82.8 percent. The remaining energy sources are coal (5.9 percent), nuclear power (1.7 percent), hydro (1 percent) and others (8.6 percent).<sup>43</sup>

#### OIL

One-third of the government revenue comes from the oil industry therefore it is safe to say that oil industry plays a major role in the economy. Proven oil reserves in January 2005 were the 14<sup>th</sup> largest in the world, totalling 14.8 Bbl (including condensates and plant liquids).<sup>44</sup> In 2003, total Mexican oil production was 176 Mtoe, a 6.6 percent increase than the previous year.<sup>45</sup>

<sup>41</sup> Energy Data and Modelling Center, IEEJ

<sup>42</sup> La Situación Demográfica de México 2003. CONAPO.

<sup>43</sup> Energy Data and Modelling Centre, IEEJ

<sup>44</sup> Anuario Estadístico PEMEX 2005

<sup>45</sup> Energy Data and Modelling Centre, IEEJ



In 2003 Mexico was the world's 7<sup>th</sup> largest crude oil exporter. In 2003, 1.84 million barrels per day of crude were exported, or around 49 percent of its total production. About 87 percent of exports in the same year were directed to the United States<sup>46</sup>.

PEMEX owns six major refineries domestically and has a 50 percent control on a refinery in Texas, the total domestic processing capacity is 1.54 million barrels per day. In order to increase output volume and improve the quality of gasoline and distillate production the government has carried out a long-term upgrading plan for all six refineries. The upgrading work in four of the refineries has been completed (Madero, Salamanca, Tula and Cadereyta). As a result of the refinery upgrades, the economy has a balance in diesel, but still has gasoline imports in 2004. Currently PEMEX is upgrading the Minatitlan refinery which will increase its capacity by about 150 thousand barrels per day (tbd) to reach a total capacity of 330 tbd by 2008<sup>47</sup>. In 2003 Mexico produced 1,343 thousand barrels per day of oil products and imported an additional 200 thousand barrels per day, which was 18 percent less than the previous year.<sup>48</sup>

#### NATURAL GAS

Mexico's proven natural gas reserves in January 2005 were 414 BCM<sup>49</sup>. Indigenous production of natural gas in Mexico was 42 Mtoe in 2003, a 2.58 percent increase than the year before<sup>50</sup>. Mexico both imports and exports natural gas along its northern border with the United States.

Natural gas consumption is expected to grow substantially in the coming years driven mostly by electricity generation. According to the Mexican Energy Secretariat total gas consumption will grow annually at a rate of 5.8 percent in average between 2004 and 2013, with the demand from the power sector growing at a rate of 10 percent annually in the same period.<sup>51</sup> In anticipation of this growth, plans are underway to increase domestic supply by focusing investments on gas exploration and production activities and on transportation infrastructure. More immediate are the plans for several LNG importing facilities to be located both on the Gulf of Mexico and Pacific coasts, with the one closest to completion scheduled for start of operations by 2006. Still, the large amount of investments required and budget restrictions in PEMEX mean that in the medium term domestic natural gas demand will continue to grow more quickly than production, and imports are expected to account for as much as 41 percent of domestic demand in 2013.<sup>52</sup>

#### COAL

The total coal supply in 2003 was 9.22 Mtoe and accounted for around 5.88 percent of total primary energy in the same year<sup>53</sup>. Total coal resources are 1,211 Mt and are mostly located in the northern part of Mexico. Around 70 percent of recoverable reserves are anthracite and bituminous, while 30 percent are lignite and sub-bituminous.

Coal in Mexico is mostly used for steel production and electricity generation, and imports from United States, Canada and Colombia are needed to complement domestic demand. The largest coal producer in Mexico is Minera Carbonífera Rio Escondido (MICARE), now owned by U.S.-based Mission Energy.<sup>54</sup>

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<sup>46</sup> Indicadores Petroleos, PEMEX, 2006.

<sup>47</sup> Anuario Estadístico, PEMEX, 2005 e informacion de Pemex Refinacion

<sup>48</sup> Anuario Estadístico PEMEX 2005.

<sup>49</sup> Anuario Estadístico PEMEX 2005

<sup>50</sup> Energy Data and Modelling Centre, IEEJ

<sup>51</sup> Prospectiva del Sector Electrico 2004-2013. Secretaria de Energia, Mexico. 2004.

<sup>52</sup> Prospectiva de gas natural 2004-2013. Secretaria de Energia, Mexico. 2004.

<sup>53</sup> Energy Data and Modelling Center, IEEJ

<sup>54</sup> Country Analysis Briefs Mexico. EIA/USDOE. 2003.

## ELECTRICITY

Electricity generation capacity in Mexico in 2003 was 49,672 MW, 8.75 percent more than in 2002. Seventy-six percent of the generating capacity is owned by the two state electric utilities CFE (74 percent) and LFC (2 percent); 13.6 percent is provided by IPPs; 6.3 percent by self-supply; 2.9 percent by co-generators; and 1.2 percent by small own-users.<sup>55</sup>

The total power generation for 2003 was 203,735 GWh which is a 1.2 percent increase from the total power generation in 2002. Most of the power was generated by thermal generation (82.2 percent)<sup>56</sup>. The share of fuel in the power generation fuel mix is; heavy fuel oil (39.3 percent), natural gas (34.5 percent), coal (17.9 percent), nuclear (6.7 percent) and diesel (1.6 percent)<sup>57</sup>.

In 2003 fuel oil contributed 31.8 percent to the electricity produced within the interconnected grid, while natural gas contributed 33.3 percent (26.2% in combined cycles), hydropower 9.7 percent, coal 14.8 percent, nuclear power 5.2 percent and geothermal, diesel, wind power, cogeneration and self-supply, 5.2 percent.<sup>58</sup> For the next 10 years (2004-2013), Mexico has plans to base between 52 and 79 percent of its future additional generation capacity on natural gas combined cycles. In the government's latest plans, coal has an almost imperceptible participation in future additional capacity.<sup>59</sup>

Table 22 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	240,810	Industry Sector	27,302	Total	203,735
Net Imports & Other	-84,043	Transport Sector	40,220	Thermal	167,535
Total PES	156,768	Other Sectors	29,927	Hydro	19,753
Coal	9,215	Total FEC	97,449	Nuclear	10,502
Oil	82,312	Coal	1,703	Others	5,945
Gas	47,529	Oil	61,867		
Others	17,711	Gas	11,843		
		Electricity & Others	22,035		

Source: Energy Data and Modelling Center, IEEJ.

For full details of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

## FINAL ENERGY CONSUMPTION

As a result of the periodic economic downturns, energy consumption has fluctuated significantly over the last twenty years. However, the average growth rate in energy demand was 1.77 percent over the period between 1980 and 2003. Total energy consumption in 2003 was 97.4 Mtoe, an increase of 0.72 percent relative to the previous year. The transportation sector accounted for 41.3 percent of consumption in 2003, industry for 28 percent, the residential and commercial sectors for 21.1 percent, agriculture for 2.8 percent, and non-energy uses for 6.8 percent.<sup>60</sup>

<sup>55</sup> Prospectiva del Sector Electrico 2004-2013. Secretaria de Energia, Mexico. 2004.

<sup>56</sup> Energy Data and Modelling Centre, IEEJ

<sup>57</sup> Prospectiva del Sector Electrico 2004-2013. Secretaria de Energia, Mexico. 2004

<sup>58</sup> Secretaria de Energia con datos de CFE.

<sup>59</sup> Prospectiva del Sector Electrico 2004-2013. Secretaria de Energia, Mexico. 2004.

<sup>60</sup>Energy Data and Modelling Center, IEEJ

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## POLICY OVERVIEW

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Introduction of “Energy Sector Program 2001-2006” by the Government acknowledged the tendency to increase private sector participation in the energy sector. In Mexico, modifications to the legal framework made the participation of private and foreign investors possible in the electricity industry and oil industry.

In the electricity sector, changes to the “Public Service Electric Energy Law” of 1992 opened the door to private investment in the form of Independent Power Producers, co-generators, auto-producers and small (less than 30 MW) generators.

For oil industry, the Oil Regulatory Law was reformed in 1995 to open the possibility to investors to construct, own and operate natural gas transportation, distribution and storage systems. The modifications have also made it possible for private entities to import, export and commercialise natural gas to final consumers. In 1996, another modification was made to the Oil Regulatory Law to allow private investment and participation of up to 100 percent in new plants for the production of non-basic petrochemicals.

In the Liquefied Petroleum Gas (LPG) market, a new “LPG Regulation” published in June 1999 reorganised the industry into four areas and defined the participants allowed in each. National and foreign private participation was allowed in transportation and storage, while final distribution and commercialisation was established as an exclusive area for national private investors.

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## NOTABLE ENERGY DEVELOPMENTS

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### OIL AND GAS SECTOR DEVELOPMENTS

The increase in oil prices in 2004 has underscored the importance of expanding investment in exploration and production. Mexico has made a determined effort to increase investment in exploration and production by allocating US\$ 10.6 billion in 2004, up from US\$ 5.4 billion in 2000. PEMEX plans to increase crude oil production to 4 million barrels per day by 2006. The company estimated that for the next five years capital expenditures needed for exploration and production is US\$45.3 billion, and for refinery upgrades for the next ten years is US\$16.1 billion. Over the next 15 years PEMEX is expected to utilize US\$29.8 billion for the development of 13,500 wells at Chicontepec which have an estimated 18 billion barrels of hydrocarbon reserves. Another project currently undertaken by PEMEX is the Marine Platform Building Program, which will include building of 47 offshore platforms. The project is expected to be completed by 2006 and capable to produce 1.5 million bbl/d of crude oil and 1.5 Bcf/d of natural gas.<sup>61</sup>

In 2003, natural gas production reached record levels and reversed the decreasing trend since 1998. In 2004 natural gas production averaged 4.57 Bcfd<sup>62</sup>. However, Mexico continues to import natural gas from the United States and the price increases during 2004 reaching US\$ 6.33/Mill. BTU (Henry Hub price) in October, negatively impacted the nation’s natural gas trade balance. Natural gas imports in 2004 averaged 1,124 Mcfd, an increase of 1.3 percent compared to the previous year<sup>63</sup>.

PEMEX is using the “multiple services contracts” system to work around constitutional limitations and allow private parties to participate in exploration activities for oil and natural gas. In these contracts, PEMEX pays a set fee for services provided and retains ownership of the energy resources produced. The scheme has been used on a few occasions since 2003. In July 2003 to

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<sup>61</sup> EIA, Country Analysis Briefs-Mexico, November 2004. Website (<http://www.eia.doe.gov/>)

<sup>62</sup> Anuario Estadístico PEMEX 2005

<sup>63</sup> Prospectiva del mercado de gas natural 2005-2014, Secretaría de Energía

February 2004 five blocks located in the Burgos Basin have been awarded which will bring in a total investment of US\$4.5 billion. Four more blocks were put up for offer in July 2004.<sup>64</sup>

In November 2005, the Mexican Senate State ratified a bill to reduce tax burden on PEMEX, which currently turning over 60.8 percent of its revenue to the Government. This move will enable PEMEX to save approximately US\$2.1 billion in 2006. As a result, PEMEX could use more of its resources to renovate its plants, maintain its installations and produce more petroleum derivatives. PEMEX can also use more of its earning for oil exploration and drilling.<sup>65</sup>

In total, 6 contracts have been awarded up to now amounting to a total production volume of 681 Mcfd of gas; despite doubts raised in Congress about their legitimacy under the present constitutional legal framework.<sup>66</sup>

### LNG FACILITIES

The rapid growth expected of natural gas consumption in the mid-term future will represent a challenge for PEMEX. PEMEX' plans a natural gas supply annual average growth rate in the next 10 years of 2.5 percent compared to a growth of 5.8 percent for consumption, resulting in a deficit 3.784 Bcfd of the fuel in 2013 or 41 percent of domestic demand.<sup>67</sup> Restrictions on the availability of funds for reinvestment on the required schedule mean that alternative supply sources have to be found. Mexico's strategy to cover the expected demand at present is based on focusing funds to the exploration of new resources and to promote the construction of importing LNG facilities.

Four permits for LNG regasification and storage facilities have been granted by the Energy Regulatory Commission, one to be located on the Gulf of Mexico coast and three on the Pacific coast in Baja California near the border with the United States. Two of them were integrated in the project of the company "Energia Costa Azul" in Baja California. The capacity of the three terminals total 2.7 Bcfd at an estimated investment of US\$1.75 billion, and are scheduled to be online between 2006 and 2008. Four other terminals are being proposed on the Pacific coast for an additional 3.9 Bcfd of capacity to fuel electric power plants in the western and southern regions of the economy. The scheduled date for the initial operation of these new units is 2008.<sup>68</sup>

In response to the plan for the construction of new LNG terminals in Baja California, the transportation system for the produced natural gas to the market in the United States has also been looked into. The existing North Baja Pipeline is only certified to transport roughly 500 Mcfd of natural gas to the southbound direction. North Baja Pipeline proposed a plan to carry out an expansion which will enable up to 2 Bcfd of natural gas to be delivered to California and other south western parts of the United States via the existing or the proposed new pipeline. The system expansion will be done in three phases. Phase I will start its construction in 2007, Phase II in 2008 or 2009, while Phase III's expansion will depend on future LNG import capability and market demand.<sup>69</sup>

### RENEWABLE ENERGIES (RE)

The targets for the implementation of grid-connected energy projects were set under the Mexico's Energy Sector Program 2001-2006.

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<sup>64</sup> EIA, Country Analysis Briefs-Mexico, November 2004. Website (<http://www.eia.doe.gov/>)

<sup>65</sup> Rigzone.com, 'Mexican Sanate Ratifies Tax Braek for PEMEX', 9 November 2005. Website: ([http://www.rigzone.com/news/article.asp?a\\_id=26800](http://www.rigzone.com/news/article.asp?a_id=26800))

<sup>66</sup> Secretaria de Energia, Mexico. 2004.

<sup>67</sup> Prospectiva del mercado de gas natural 2004-2013. Secretaria de Energia, Mexico. 2004.

<sup>68</sup> Secretaria de Energia, Mexico. 2004.

<sup>69</sup> 'North Baja Expansion Project Update', North Baja Pipeline, August 2004. Website ([http://www.northbajapipeline.com/lng\\_expansion/project\\_updates.html](http://www.northbajapipeline.com/lng_expansion/project_updates.html))

Mexico has large potential reserves of renewable resources. The General Federal Ministry of the Environment, in its presentation at the International Expert Workshop in Buenos Aires, Argentina on 27-28 April 2005, reported the estimated generating capacity of each of the RE sources. In terms of solar potential, it is estimated that more than half of the national region has energy density of 5 kWh per square meter. The largest solar-insolation level is in Northwest, South and the Pacific Coast regions. Wind on the other hand is projected to have a wind electric potential of 5,000 MW in Southern Mexico, an area exposed to strong wind and constant thermal driven wind. A current study by U.S National Renewable Energy Laboratory (NREL) revealed that the region of "La Ventosa" in the state of Oaxaca has a potential of more than 33,000 MW in a 7,000 km<sup>2</sup>. Small hydro (generation plants of less than 5 MW) could provide an electricity generation potential of 3,000 MW, while CONAE identified that the small-hydro potential in a mountainous region between the states of Puebla and Veracruz is 400 MW in capacity. Biomass potential, as reported by IIE would reach 300 MW in generation capacity when gathered from 90,000 tonnes of daily urban residues. CONAE also estimated that a 0.7 MW capacity per million tonnes of garbage can be installed in a landfill. In terms of geothermal potential, CFE estimates that about 2,000 MW could be harnessed in the states of Michoacan and Baja California, where the largest potential for geothermal could be found.<sup>70</sup>

At present some of the NRE sources have already been utilized, for example in 2003 large hydro plants and geothermal generation plants have generated 19,754 GWh and 6,282 GWh respectively.<sup>71</sup> In terms of solar water heating, a total of 500,000 m<sup>2</sup> of the system have been installed by mid-2002. Most of the systems are installed in the cities of Guadalajara, Cuernavaca and Morelia, mostly in hotels throughout the state of Quintana Roo and the Pacific Coast. Photovoltaic systems are widely used for the rural electrification. In the 1980s more than 40,000 systems were installed. There are a few wind energy systems currently in operation in Mexico. One example is the 1.5 MW wind generation plant operated by CFE in the state of Oaxaca. Another is the 600 kW generation plant in the Baja California Peninsular and other wind energy systems for water-pumping in the states of Sonora and Chihuahua. It is estimated that the total small hydro installed capacity is 36.78 MW. The total installed capacity for geothermal generations plants is 906 MW. The plants are located in the states of Michoacan and Baja California.<sup>72</sup>

Part of government's policy to promote NRE includes the continued support for research and the introduction of favourable conditions for generators using NRE resources. Attention will be given to biomass and wind plants, and plans are underway to develop wind farms along the southern pacific coast in the State of Oaxaca. Solar energy in combination with other renewable sources including wind and biomass are currently being promoted as a power source for isolated rural communities, where extending the national grid would prove too costly due to terrain conditions. It was reported that FIRCO's Renewable Energy Program for the Agricultural Sector would install 1,152 water-pumping and refrigeration modules while CFE estimates the installation of three hydro power generation plants with total capacity of 450 MW. CFE has also considered 17 new hydro-power projects with the total capacity of 6,750 MW. CFE has considered increasing the installed capacity of six existing hydro projects by 1,528 MW. Three new geothermal projects are also being eyed for development in the States of Baja California, Jalisco and Puable by CFE. The total installed capacity of the 3 new geothermal generation plants will be 220 MW.<sup>73</sup>

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<sup>70</sup> General Federal Ministry of the Environment, 'Report on the situation in Mexico', at the International Expert Workshop 27-28 April 2005 in Argentina. Website: ([http://www.ises.org/cdm/workshop/docs/Mexico\\_C\\_Fuentes.pdf](http://www.ises.org/cdm/workshop/docs/Mexico_C_Fuentes.pdf))

<sup>71</sup> General Federal Ministry of the Environment, 'Report on the situation in Mexico', at the International Expert Workshop 27-28 April 2005 in Argentina. Website: ([http://www.ises.org/cdm/workshop/docs/Mexico\\_C\\_Fuentes.pdf](http://www.ises.org/cdm/workshop/docs/Mexico_C_Fuentes.pdf))

<sup>72</sup> General Federal Ministry of the Environment, 'Report on the situation in Mexico', at the International Expert Workshop 27-28 April 2005 in Argentina. Website: ([http://www.ises.org/cdm/workshop/docs/Mexico\\_C\\_Fuentes.pdf](http://www.ises.org/cdm/workshop/docs/Mexico_C_Fuentes.pdf))

<sup>73</sup> General Federal Ministry of the Environment, 'Report on the situation in Mexico', at the International Expert Workshop 27-28 April 2005 in Argentina. Website: ([http://www.ises.org/cdm/workshop/docs/Mexico\\_C\\_Fuentes.pdf](http://www.ises.org/cdm/workshop/docs/Mexico_C_Fuentes.pdf))

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# NEW ZEALAND

## INTRODUCTION

New Zealand is a small island nation in the southern Pacific with a population of approximately 4.01 million in 2003. GDP has grown by an average of around 2.8 percent per annum (1990-2003), reaching about US\$79.6 billion in 2003.

New Zealand had modest energy resources including 10.8 MCM of oil, 41 BCM of natural gas, and 8,600 Mt of coal. Hydro and geothermal resources currently meet around 68 percent of electricity demand. New Zealand is currently self-sufficient in all energy forms apart from oil.

Table 23 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	268,680	Oil (MCM)	10.8
Population (million)	4.01	Gas (BCM)	41
GDP Billion US\$ (1995 US\$ at PPP)	79.61	Coal (Mt) - Recoverable	8,600
GDP per capita (1995 US\$ at PPP)	19,856		

Source: Energy Data and Modelling Center, IEEJ.

\*Ministry of Economic Development (New Zealand) as at 31 December 2002.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

New Zealand's total primary energy supply in 2003 was 18,694 ktoe. A variety of energy sources are used to meet these needs comprising of oil (36 percent), gas (24 percent), geothermal (11 percent), hydro (11 percent), coal (10 percent) and others (8 percent). Self-sufficiency in 2003 was 77 percent.

New Zealand was over 50 percent self-sufficient in oil in 1986. By 1995, with demand having increased faster than production, this figure declined to 36 percent. By 2003, self-sufficiency had continued to decline to 23 percent and reached 20 percent in 2004. This decrease is mainly due to declining production from the Tariki/Ahuroa, Waihapa/Ngaere, Maui including condensate and naphtha, Maui F Sands, Mangahewa, McKee and Kaimiro fields.

Domestic transport is the main consumer and energy user of petroleum products, accounting for 84 percent of the total oil consumption in 2003. Consumption in the other sectors was shared between agriculture (7 percent), industrial (6 percent), commercial (2 percent) and residential (1 percent).

In terms of power generation, in 2003 New Zealand generated 41,227 GWh, which was up 0.3 percent over the previous year. Around 68 percent of generation was from hydro and renewable resources. Hydro at 57 percent was the most important source of generation. Thermal generation – particularly that of coal – showed a large increase compared with the previous year increasing by 17 percent to 13,594 GWh and made up 32 percent of power generation. Around 70 percent of hydro electricity is generated in the South Island, and all geothermal electricity is generated in the North Island. The balance, almost all of which is generated in the North Island, is generated by natural gas, coal, and wind and landfill gas. The largest electricity-using sector is industry (with an aluminium smelter, iron and steel works, several pulp and paper mills and large dairy factories being the main consumers), which accounted for 40.8 percent of electricity demand in 2003. The

residential sector consumed around 34.1 percent with the commercial sector and others (agriculture and domestic transport) consuming the balance of 25.1 percent.

Table 24 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	14,374	Industry Sector	3,826	Total	41,227
Net Imports & Other	4,320	Transport Sector	5,463	Thermal	13,594
Total PES	18,694	Other Sectors	4,200	Hydro	23,689
Coal	1,777	Total FEC	13,489	Nuclear	0
Oil	6,949	Coal	1,049	Others	3,944
Gas	3,858	Oil*	6,549		
Others	6,110	Gas*	1,859		
		Electricity & Others	4,031		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

\*The figure had included with non-energy use

### FINAL ENERGY CONSUMPTION

New Zealand's final energy consumption fell by 3.7 percent in 2003 to 13,489 ktoe compared with the previous year. The industrial sector consumed 28.4 percent of energy used, the transportation sector 40.5 percent and other sectors 31.1 percent. In 2003 consumer energy was dominated by oil, comprising 6,549 ktoe (49 percent), followed by gas 1,859 ktoe (14 percent), coal 1,049 ktoe (8 percent) and 4,031 ktoe (29 percent) for electricity and others (heat etc).

Domestic transportation is the largest end user of energy accounting for 41.2 percent of final consumption with the bulk of petroleum products used in New Zealand consumed by this sector (84 percent). The next largest energy consumer is the industrial sector on 33.6 percent followed by others which comprises residential/commercial, non-energy, and agricultural sectors' consumes the remaining 25.2 percent.

### POLICY OVERVIEW

New Zealand's energy sector has experienced a period of significant change and reform over the past 10-15 years, in particular, quite dramatic change in the structure of the electricity industry. Former government-owned/operated electricity and gas monopolies have been either corporatised or sold to the private sector. The former vertical integration in both gas and electricity sectors has been dismantled to separate natural monopoly elements from those that are competitive, and a wholesale electricity market has been established.

Recently it has become apparent that New Zealand faces some challenge to ensure security of supply in gas and electricity sectors at the best price. These include the depletion of the Maui gas field, low storage capacity of hydro lakes and vulnerability to low rainfall/dry year in addition to growth in demand for electricity.

### OIL

Deregulation of the oil industry in the late 1980s removed price control, government involvement in the refinery, licensing of wholesalers and retailers and restriction on imports of refined products. In the financial year ending March 2005, there were 14 fields producing crude oil in New Zealand – all located onshore and offshore of the Taranaki region. With the inclusion of natural gas liquids the Maui oil field was the largest producer making up 67 percent of total production. This was followed by the Kapuni field on 10 percent and the McKee field on 7 percent,



with the remaining 16 percent being produced at Tariki/Ahuroa, Waihapa/Ngaere, Mangahewa (which commenced production in September 2001), Ngatoro (including Goldie well), Kaimiro, Moturoa, Rimu (including Kauri well), Cheal and Radnor. New Zealand has one oil refinery, at Marsden Point in Northland, which is jointly owned by the four major oil companies (BP, Shell, Mobil and Caltex) through the New Zealand Refining Company. There are six petrol retailers: BP, Caltex, Challenge! (now owned by Caltex), Gull (owns its import terminal at the port of Tauranga), Mobil and Shell.

New Zealand's primary self-sufficiency in oil depends on both indigenous oil production and petroleum product demand. Over the period from 1974 to 1986 self-sufficiency increased dramatically from under 5 percent to over 50 percent. However, by 1995 with demand having increased faster than production, this figure declined to 36 percent. As a result of maturation and associated production decline of most prominent oil fields this decreasing trend has continued with self-sufficiency reaching 30 percent in 2002 and 21 percent in 2003. In the year ended December 2004 self-sufficiency further fell to 19 percent. To circumvent falling self-sufficiency and to promote New Zealand's exploration potential, in October 2005, seven petroleum blocks were announced by the government bringing the total number of blocks on offer to 19 – a record number in New Zealand at any one time, with the likelihood of a further blocks offer being announced before the end of the year.

The Ministry of Economic Development is also leading work with New Zealand's major oil companies to investigate how best to increase the economy's stockpiling of crude oil and oil products – chiefly gasoline and diesel. The project follows a review and recalculation of industry data on oil stock to meet International Energy Agency's obligation to maintain 90-days of stocks of oil products as a buffer against disruptions to global oil supplies. The government has decided to augment its stockpiling requirements through a tender to be carried out in early 2006.

### NATURAL GAS

The gas sector has a critical role to play in achieving the government's objective of sustainable and efficient energy future and higher economic growth rates. Gas is also a critical component of electricity production, contributing approximately 25 percent towards total electricity generation. However, New Zealand's proven gas reserves have steadily declined since the Maui field commenced production in 1976. Subsequent discoveries have failed to off-set this decline and significant new discoveries are needed to meet projected electricity demands.

The Government initiated a wide-ranging review of the gas sector in February 2001. A draft Government Policy Statement was released in November 2002 and after a period of consultation and comment, the final Statement "Development of New Zealand's Gas Industry" was released on 28 March 2003. The package of changes contained in the Statement is designed to enhance efficiency and reliability in gas production and transportation, and improve fairness for gas customers<sup>74</sup>. Exploration for new gas reserves will be encouraged through the Minerals Programme for Petroleum that was announced in January 2005 (see below).

### ELECTRICITY

In May 2003 the Government announced the establishment of the Electricity Commission to govern the electricity industry due to concern that existing market arrangements did not ensure security of supply in dry years/years of low rainfall. The Commission is responsible for managing the electricity sector so that electricity demand can be met even in a 1 in 60 dry year. The key tasks of the Commission include ensuring New Zealand's electricity supply is secure with adequate

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<sup>74</sup> In July 2005 the Commerce Commission deemed that the gas pipeline services provided by Powerco and Vector were subject to only limited competition and that the companies were charging excessive prices for gas transportation. As a result of this investigation it has been decided that gas pipeline services in New Zealand are to be subject to government regulation.

reserve generation for dry years, establishing transmission pricing methodology for investment in the natural grid and improving demand-side participation in the wholesale market<sup>75</sup>.

On the retail market side electricity sold by generators and purchased by retailers and large industrial users is subject to the Electricity Governance Regulations and Rules 2003 that came into force on 1 March 2004. This replaced two multi-lateral industry contracts related to the operation of the New Zealand Electricity Market (NZEM) and the Metering and Reconciliation Information Agreement (MARIA).

To establish a new legal framework for the electricity and gas industries, the Bill on Electricity and Gas Industry was passed on 13 October 2004. The major features of the Bill include:

- Update the Electricity Act and Regulation to enable the Electricity Commission to take over the responsibility for gas industry governance if the gas industry's arrangements fails to deliver government policy objectives;
- Provide further regulation to enhance consumer protection, promotion of retail competition, information for market participants and development of distributed generation;
- To ensure security of electricity supply, the Electricity Commission is authorised to contract for reserve energy supplies; and
- Amend the Commerce Act to clarify the roles of the Commerce Commission and the Electricity Commission in regulating electricity distribution companies.

The Bill also allows for the establishment of a co-regulatory governance body for the gas industry and backstop powers for the establishment of an Energy Commission. Other changes include enabling electricity lines companies to own generation equivalent to the higher of 50MW or 20 percent of their network load, allowing Transpower to contract for generation to manage grid reliability and delaying the transfer of jurisdiction for the lines targeted price control regime from the Commerce Commission to the Electricity Commission until after 31 March 2009.

### **RENEWABLE ENERGY AND ENERGY EFFICIENCY**

Renewable energy sources are already making a significant contribution to New Zealand's total energy, with hydroelectricity and geothermal being the main renewable energy sources in New Zealand. However, in recent years the introduction of wind power has gained momentum<sup>76</sup>.

In order to establish sustainable development and values, the Sustainable Development Programme of Action (SDPOA) was released in January 2003. The SDPOA calls on government agencies to take a wider, more integrated approach to policy development with the three desired outcomes for the SDPOA being:

- Energy use in New Zealand becomes more efficient and less wasteful;
- Renewable sources of energy are developed and maximised; and
- New Zealand consumers have a secure supply of electricity.

A discussion document "Sustainable Energy – Creating a Sustainable Energy System" was released in October 2004 (by the Ministry of Economic Development) which identifies the energy

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<sup>75</sup> In June 2004 the 155MW Whirinaki oil fired reserve generation plant was commissioned by the government to provide increased certainty of electricity supply. It is intended only to run in times when the limits of the electricity system are tested. This plant is owned by the government with the Electricity Commission being responsible for bringing it online in times of need.

<sup>76</sup> In May 2005 a report entitled "Wind Energy Integration in New Zealand" was released by the Ministry of Economic Development and the Energy Efficiency and Conservation Agency (EECA). The main finding of this report was that the potential for wind generated electricity in New Zealand was much higher than previously thought and that in the future as much as 35 percent of peak demand could be supplied through wind energy.

challenges and opportunities facing New Zealand, explains Government's strategic direction in energy policy and outlines possible future directions for policy development.

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## **NOTABLE ENERGY DEVELOPMENTS**

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### **MINERALS PROGRAMME FOR PETROLEUM 2005**

To encourage domestic exploration for petroleum and particularly gas resources the New Zealand government has released a package of incentives through the Minerals Programme for Petroleum 2005. The major features of the programme include:

- Reduced royalties payment on new exploration discoveries made between 1 July 2004 and 31 December 2009;
- The introduction of a definition of "discovery" for the purposes of royalty eligibility;
- Exclusion of the Titi Islands from exploration and mining for the reasons of cultural significance; and
- Simplification of the procedure to process for flaring and venting.

### **OIL SECURITY REPORT**

In December 2004, a report outlining options for improving New Zealand's oil security was released. The report was commissioned by the Ministry of Economic Development and examines ways of increasing New Zealand's oil stocks to a level that ensures New Zealand is compliant with its obligation, as a member of the International Energy Agency (IEA), to hold 90 days of oil stocks.

After extensive consultation Cabinet decided in March 2005 that the Government would tender for the additional oil stocks required to return New Zealand to its IEA obligations. The cost of the tenders will be met by an increase in the Petroleum Fuels Monitoring Levy (PFML), which is collected from the oil companies based on petrol and diesel sales. Tenders will be administered by the Ministry of Economic Development (MED). Further decisions were taken by the Government in July 2005 on the details and design of the tender process. The timetable for the tender process is that a Request for Proposals (RFP) will be run in late 2005, final tenders in March-April 2006, with acquisition of stocks commencing from July 2006.

The Ministry is also developing an oil emergency response strategy which will detail the policy and operational aspects of managing an emergency disruption of oil supplies. The overall objective of the strategy is to ensure that the effects of an oil supply disruption are minimised and to ensure that New Zealand is able to effectively meet its obligations as a member of the International Energy Agency (IEA). To this end a report was undertaken to identify the demand restraint options that New Zealand could employ during an emergency disruption of oil supplies. The report determines the available demand restraint options and discusses the implementation issues, costs, and benefits of each. The report also recommends a programme of demand restraint measures including advice on the measures that should be implemented depending on the level of restraint required, and the length or stage of the emergency.

## **CLIMATE CHANGE DEVELOPMENTS**

### **CARBON TAX**

A tax on greenhouse gas emissions from fossil fuels will be introduced from 1st April 2007. This tax will be applied to fossil fuels including petrol, diesel, fuel oil, natural gas and coal and to industrial process emissions. The tax will be set at a level approximating the price of emissions emerging from international trading, but will be capped at NZ\$25 per tonne of CO<sub>2</sub> –equivalent with the rate initially being set at NZ\$15/t CO<sub>2</sub> –equivalent.

The carbon tax may disadvantage New Zealand companies' competitive advantage with international companies operating in countries that have a lower carbon tax or no charge at all. To alleviate this burden the affected companies can enter Negotiated Greenhouse Agreements<sup>77</sup> with the government. Under these agreements, in exchange for full or partial relief from the carbon tax, they will have to move to international best practice standards for managing greenhouse gas emissions.

### **NEGOTIATED GREENHOUSE AGREEMENTS STREAMLINED**

In April the Government announced a streamlining of the process through which companies can gain exemptions from the carbon tax. It had just completed a simplification of Negotiated Greenhouse Agreements (NGAs) making them more straightforward in an effort to reduce compliance costs. The changes were guided by feedback received from a consultation with firms likely to apply.

In particular, the process for defining world's best practice in emissions management, and the setting of a pathway against which progress towards attaining it is measured, have been simplified. Issues around the consequences of switching fuel supply have also been addressed. There has been no change to the tight eligibility test that applies.

To date NGAs have been signed with OceanaGold and the New Zealand Refining Company, with negotiations with six other companies underway/ongoing.

### **CARBON TAX MITIGATION**

In May the Government announced the introduction of pilot grants, and a training and education package to help energy intensive small and medium size enterprises take up energy saving technologies to offset the impact of the carbon tax. \$4.45 million will be made available for the pilot programme over the next three years.

The package was in recognition that a number of energy intensive small and medium sized enterprises that might be adversely affected by the tax. While many larger companies are applying for Negotiated Greenhouse Agreements, the transaction costs involved for individual smaller companies might be prohibitive.

The package is being developed in partnership with representatives of energy intensive businesses. It is being rolled out from 1 July 2005 and closely monitored to ensure that it is developed in a way that meets the needs of business.

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<sup>77</sup>Negotiated Greenhouse Agreements (NGAs) are for sectors and industries that would face difficulty in adjusting to a full price on emissions in the first commitment period. These sectors and industries are identified as having their competitiveness at risk. Negotiated Greenhouse Agreements comprise a contractual commitment by the industry or sector to achieve international best practice in managing emissions, in return for exemption from an emissions charge.

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# PAPUA NEW GUINEA

## INTRODUCTION

Papua New Guinea (PNG), an island nation in the South Pacific, is geographically located north of Australia and is comprised of more than 600 islands, several habitable ones including half of the main island of New Guinea with West Papua, Indonesia. PNG has a population of more than five million people, spread across its total area of 462,840 square kilometres.

The PNG economy is slowly recovering from the current global economic slowdown. Current per capita GDP (US\$2,033)<sup>1</sup> is 0.39 percent higher than 2002 level (US\$2,005). In 2003, real GDP at 1995 US dollars at PPP was estimated at US\$11.19<sup>1</sup> billion, which increased by 2.7 percent from 2002 level. Inflation was 8.4 percent<sup>2</sup> in 2003.

PNG's energy use per capita at 0.2 toe is far below the APEC average of 1.5 toe. Export of energy resources is a very important foreign exchange earner and contributes greatly to the national revenue. In 2003, the energy industry accounted for approximately 14 percent of the economy's GDP and about 20 percent of total exports. It has also employed more than 1,000 Papua New Guineans in both upstream and downstream operations.

Table 25 - Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	462,840	Oil (MCM) - Proven	63.6
Population (million)	5.50	Gas (BCM)	430
GDP Billion US\$ (1995 US\$ at PPP)	11.19	Coal (Mt)	-
GDP per capita (1995 US\$ at PPP)	2,033		

Source: Energy Data and Modelling Centre, IEEJ, WDI 2005 and BP 2005 Statistical Review of World Energy.

## ENERGY SUPPLY AND DEMAND

### PRIMARY ENERGY SUPPLY

In 2003, PNG's net primary energy supply was 1,553 ktoe, or an increment increase of 11 percent from 2002. Light crude oil and petroleum products accounted for 86 percent, gas 8 percent while hydro and other fuels, the remaining 5 percent. Around 50 percent or 1,320 ktoe of indigenous energy production is exported to other economies. To sustain its export goals, the national government allots about US\$20 million in its annual budget for oil and gas exploration.

PNG's small oil field has been producing 100,000 bbl/day of light crude since 1992, mainly for export. However, with the commissioning of its first Napanapa Oil Refinery in 2004, crude is now refined locally. Sixty five percent of the refinery's output is consumed locally while the remaining 35 percent is exported overseas.

PNG also has a natural gas field with an estimated reserve of 430 BCM. Since 2001, small amounts of gas (144 ktoe) have been produced annually to supply the electricity requirements of the gold mine in Porgera. PNG however plans to sell this gas to Australia and negotiations are underway to supply 212 petajoules per year as base load.

The project participants, Exxon Mobil, Oil Search, MRDC and Japan Papua New Guinea Petroleum, have started the project front end engineering design in 2004 and are anticipating a decision and closure of finance by late 2006.

To deliver gas to Australia, the PNG Gas Project owners signed a Letter of Intent (LOI) with APC (a consortium led by AGL and Petronas). Under the LOI, APC will be responsible for designing, owning and operating the pipeline that brings the gas to Australia. Total investment for the project is estimated at US\$2 billion.

Table 26 - Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	2,640	Industry Sector	601	Total	3,178
Net Imports & Other	-1,087	Transport Sector	374	Thermal	2,249
Total PES	1,553	Other Sectors	120	Hydro	929
Coal	-	Total FEC	1,095	Nuclear	-
Oil	1,340	Coal	-	Others	-
Gas	132	Oil	839		
Others	80	Gas	-		
		Electricity & Others	256		

Source: Energy Data and Modelling Center, IEEJ.

For full detail of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

As of 2003, PNG's total installed power generating capacity stood at 487.3 MW. In the same year, PNG had generated 3,178 GWh of electricity (a 10 percent increase from 2002). The sources of generation were hydro at 32 percent, geothermal at 1 percent and thermal (gas and fuel oil) at 67 percent (an increase of 10 percent to meet demand as the share of hydro has remained steady over the last 3 years). There is little economic potential for the expansion of large hydro, due to the lack of substantive demand near supply sources. However, there is a greater potential for developing smaller hydro schemes. Most thermal and hydro power stations are owned and operated by PNG Power Limited (formerly PNG Electricity Commission).

### FINAL ENERGY CONSUMPTION

In 2003, the total final energy consumption in PNG was 1,095 ktoe (an increase of 9 percent from 2002 or 16 percent from 2001). The industrial sector, accounted for 55 percent (an increase of 9 percent over 2002) and was the largest end user, followed by transport at 34 percent (an increase of 9 percent over 2002), and other sectors including agriculture and residential/commercial at 11 percent (an increase of 8 percent over 2002). Petroleum products accounted for 77 percent of total consumption (an increase of 8 percent over 2002), electricity and others accounted for 23 percent (an increase of 9 percent over 2002) and natural gas accounted for less than 1 percent.

In PNG about 85 percent of the population live in rural areas and electrification rates remain low. Petroleum products such as diesel or petrol are used in the transport sector as well as for the generation of electricity. PNG Power Limited is continuously extending rural distribution network throughout the economy especially within the outskirts of urban areas.

### POLICY OVERVIEW

In PNG, the national government has jurisdiction over energy matters including overall energy policy matters. Exploration and development of petroleum resources are authorized and administered by the Department of Petroleum and Energy. The Petroleum Act of 1972 and the Oil and Gas Act of 1998 mandated Department of Petroleum and Energy authority over the licensing and development of petroleum resources.

The provincial governments work with the PNG Power Limited, the Energy Division of Department of Petroleum and Energy and/or private companies to organise new projects such as grid extensions or the development of small hydro and other renewable energy resources.

The PNG National Energy Policy and Rural Electrification Policy have been reviewed by the PNG Government Task Force on Policy and the documents are undergoing refinement for distribution to the government agencies for comments. Upon accommodating all the comments, these documents will be submitted to the Government for endorsement before first half 2006.

In the Electricity Industry Act of 2000, Sections 21 and 23 spell out the functions and powers of the PNG Power Limited. According to this Act, PNG Power Limited's function is to plan and coordinate the supply of electricity throughout the country especially in the urban areas.

The Act also authorized the Independent Consumers and Competition Commission (ICCC) as the technical regulator of the electricity sector to determine the standards, inspection and controlling of applications on all matters relating to the operations of the supply of electricity.

The Independent Consumer and Competition Commission was established in 2002 to oversee and regulate price and service standard issues relating to utilities such as PNG Power Limited and selected corporatized Government statutory entities and therefore, is responsible for setting prices or tariffs for electricity and petroleum products.

However, due to lack of technical capacity to perform the technical regulatory role in the electricity sector, ICCC has outsourced this role to PNG Power Limited on contracted basis for an initial period of 2 years ending 2005 and was extended for another 3 year period ending 2008.

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#### **NOTABLE ENERGY DEVELOPMENTS**

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- In 2005, a 30 MW geothermal power plant was commissioned by Lihir Gold Limited in addition to the first 6 MW geothermal plant in April 2003. Lihir Gold Limited is the first in PNG to use geothermal energy for electricity generation and the expansion of additional capacity of 30MW in line with the government's goal of attaining green energy and reducing its dependency on fuel oil.
- The Highland Gas Project's Front End Engineering Design stage which started in 2004 is expected to be completed at the end of 2005. The project is also hoped to enter into the Project Sanction Decision stage by early 2006 and gain a closure of finance also in the same year. PNG hopes to have its first gas production in 2009.
- The Government has set aside US\$133 million in its 2006 National Budget (as government equity) for the development of the gas pipeline to Australia.
- A 32,500-barrel per day nameplate capacity refinery built by Canadian independent, InterOil at Port Moresby (Napanapa) was commissioned in May 2004. First sale of refinery product occurred in 10 August 2004. The first batch of the refined product for sale was dispatched in 7 September 2004. The operation of the refinery has transformed PNG from importer to exporter of refined product. Sixty five (65) percent of refined petroleum products from Napanapa Refinery accounts for the domestic energy needs.
- InterOil Products Limited (IPL) has acquired the retail and distribution assets from British Petroleum (BP) and an agreement was made between IPL and Shell PNG Limited for IPL to purchase Shell PNG Limited retail and distribution assets in PNG upon Government's approval.
- Transeuro Energy Corporation from Canada has established an office in PNG and has been granted prospecting licenses over four identified prospecting areas to explore gas and oil as of November 2005.



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- PNG Sustainable Energy Limited has secured US\$673million to enhance electricity under the electrification programme in the country.
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# PERU

## INTRODUCTION

Peru is located on the Pacific Ocean coast of South America. It shares borders with Chile to the south, Ecuador and Colombia to the north, and Brazil and Bolivia to the east. Its 27.15 million people are spread over an area of 1,285,216 square kilometres, 73 percent mostly of which live in urban areas. Geographically, about 53 percent of the population live in the coastal region, 37 percent in the mountainous region and 10 percent in the Amazonian region. Peru has three main regions and climates: the western desert coastal plains, the cold central Andean mountains, and the tropical eastern Amazon jungle. The huge metal deposit in the Andean mountains make Peru a major metal exporter and the world's second largest silver and third copper exporter after Mexico and Chile. It is also among the top five exporting economies for gold, zinc, tin and lead.

Peru's GDP in 2003 was US\$124.02 billion while GDP per capita was US\$4,568 (both in 1995 US\$ at PPP). In the same year, its real gross domestic product (GDP) grew at 3.76 percent, down from 4 percent in 2002. Overall, real GDP growth is projected to remain favourable in 2005, at around 5.5 percent, with mineral exports, construction, and the long-expected Camisea energy project driving Peru's economy.

Peru is currently a net importer of energy. Of the total energy imported, more than 90 percent is crude oil used as refinery feedstock; domestic crude is not of adequate quality for such feedstock. The remainder of Peru's energy imports consist of coal. Its energy proven reserves in 2004 included 57.24 MCM of oil, 325 BCM of gas and 58.7 Mt of coal.

Table 27 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	1,285,216*	Oil (MCM) – Proven	57.24
Population (million)	27.15	Gas (BCM) – Proven	323
GDP Billion US\$ (1995 US\$ at PPP)	124.02	Coal (Mt) - Proven	58.7
GDP per capita (1995 US\$ at PPP)	4,568		

Source: Energy Data and Modelling Center, IEEJ.

\*January 2004 data from Ministry of Energy and Mines, Peru.

## ENERGY SUPPLY AND DEMAND

### PRIMARY ENERGY SUPPLY

Peru's total primary energy supply (TPES) in 2003 was 10,273 ktoe, nearly the same as in 2000, which was 10,653 ktoe. Oil still comprised the biggest share of TPES (59.7 percent). The share of natural gas in 2003 reached 16.7 percent, with a year-on-year growth. The giant leap is due to the coming on stream of the Camisea natural gas field in August 2004, supplying gas to the Ventanilla power plant.

Coal's share in 2003 decreased by 1.3 percent from 783 ktoe in 2002 to 773 ktoe in 2003. Peru imported about 2,278 ktoe or 22 percent of its energy requirements (mostly oil from Colombia, Ecuador and Venezuela) in 2003, close to previous year import of 2,788 ktoe.

In the absence of new important oil discoveries, production of crude oil declined by 7 percent in 2000 and 3 percent in 2001 to an average of 96,000 barrels per day (bbl/d). In 2002, Peru increased the production slightly, to about 96,865 bbl/d. In 2003, Peru produced 91,350 bbl/d of oil, a decrease of 2.7 percent year-on-year, while consuming 6,186 ktoe.

Current production areas are located in the northern jungle along the Ecuador border, north eastern and central Peru and offshore. The total number of wells drilled by oil companies decreased significantly from around 30 wells in 2000 and 2001 to only 10 in 2002 but in 2004 these number of wells drilled increased to 34. President Toledo's administration had taken several measures to attract more investors; however, the economy's political situation remains unstable.

The Norperuano pipeline, with a capacity of 200,000 bbl/d and runs from the Amazon to the Pacific Ocean is being utilized to meet domestic oil demand at 30 percent of its total capacity. In 2001, Ecuador utilised the line to export oil. Oil is currently shipped using river barges and transferred to Peru's existing pipelines. However, there are plans to build a connecting pipeline to Norperuano.

Peru's annual gas production increased from 1,660 ktoe in 2002 to 1,720 ktoe in 2003. The share of natural gas in TPES is about 16.7 percent in 2003.

In August 2004 start the production Camisea natural gas field and start too the Ventanilla Power plant using natural gas. Peru has the potential to produce far more gas than it does today as domestic gas demand and gas export markets grow. Upstream operations recently began at the Camisea field, one of the largest in South America, which was first discovered in Peru's southern jungle in the early 1980s. The field is expected to produce 10 MCM/d of gas and 0.004 MCM/d of condensate once fully operational. The revenue from royalties and taxes over the next 30 years is expected to reach US\$ 5-6 billion. . The two reservoirs in this area are estimated to contain 325 BCM of gas and over 114.7 BCM of condensate. The power generation and industrial sectors are expected to be major gas consumers.

Table 28 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	7,995	Industry Sector	3,252	Total	22,926
Net Imports & Other	2,278	Transport Sector	3,088	Thermal	4,393
Total PES	10,273	Other Sectors	2,123	Hydro	18534
Coal	773	Total FEC	8,462	Nuclear	0
Oil	6,131	Coal	463	Others	0
Gas	1,720	Oil	6,186		
Others	1,649	Gas	20		
		Electricity & Others	1,793		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

The installed electricity generation capacity in Peru increased from 5,936 MW in December 2002, to 5,970 MW in December 2003; 76 percent of the population had access to electricity in 2003. Hydropower with 51 percent and thermal with 49 percent share almost equally the electric generating capacity. However, hydropower produced 85.71 percent of the electricity in 2003 and thermal plants produced the remaining 14.29 percent. Thermal power is generated from residual fuel oil, diesel, natural gas and coal.

Peru had a north central interconnected system (SICN) and southern (SIS) grids to form the National Interconnected Electrical System (SEIN). In 2003, of the 22,926 GWh of electricity generated in the economy, 98 percent was delivered through the SEIN and the remaining 2 percent was delivered through several smaller isolated systems (SSAA).

Of all electricity traded in 2003, 52 percent was traded in regulated market and 48 percent in free trade. With the privatisation of Peru's transmission electricity sector in June 2002, the government awarded Red de Energía del Perú (REP), a consortium comprising of Colombian companies Empresa de Energía de Bogotá (EBB), Isaperu, and ISA subsidiary Transelca, a 30-year concession to own and operate Peru's two main transmission companies, Empresa de Transmision

Centro Norte (Etecen) and Empresa de Transmision del Sur (Etesur). EBB is the largest shareholder of REP, with a 40 percent stake. Isaperu and Transelca each hold 30 percent. In order to regulate the operation of the market, the Peruvian government created Osinerg (Organismo Supervisor de la Inversion en Energía), which is currently Peru's energy regulator.

### FINAL ENERGY CONSUMPTION

Between 1980 and 2003, final energy consumption in Peru increased by 36 percent while energy production fell by 25.5 percent. In 2003, final energy consumption in Peru amounted to 8,462 ktoe, of which, the transport sector consumed 36.5 percent, industry sector 38.4 percent and other sectors 25 percent. Petroleum products dominated end use consumption, accounting for 73 percent of demand in 2003, a decrease of 2 percent from its share in 2002. The share of electricity from final energy consumption was 21.1 percent. Coal accounted for 5.4 percent while gas was less than 1 percent.

### POLICY OVERVIEW

In 2002 Peru amended the constitution and began to decentralise the structure of Government. The amendment mandated the creation of three levels of government (National, regional and local), with political and economics autonomy. Regional elections were held in November 2002 and the new administration took office on 1 January 2003. The decentralisation of government structure will be followed by a decentralised neutral fiscal system.

In order to improve neutrality tax and increase tax base in 2002, Peru also reformed the tax policy and tax administration measures. Reform includes the removal of some VAT exemptions, an increase in kerosene tax by 80 percent to partially reduce the differential with the tax on diesel, intensifying the control of tax collection and improve the administration.

Peru's economy is becoming more market-oriented. Virtually all trade, investment and foreign exchange controls were eliminated in 1990. The mining, electricity, hydrocarbons and telecommunication industries have been partially privatised. In particular, the state oil company, Petroperu, was partially privatised in 1993. In the same year, Perupetro, State Company, was created by law to be responsible for promoting the investment of hydrocarbon exploration and exploitation activities. Several laws affirm that "national and foreign investment are subject to the same terms" and have permitted foreign companies to participate in almost all economic sectors.

The Electricity Concessions Law, passed in 1992, allows private firms to invest in power generation, transmission and distribution. The state utility ElectroLima and the bulk of state utility ElectroPerú were privatised soon after the law was implemented. Another law, passed in 1997, promotes competition in the power sector by prohibiting control of more than 15 percent of power generation, transmission or distribution by any one firm. The government can block acquisitions to ensure that private companies do not gain excessive market power. The private sector, including foreign companies, today controls about 65 percent of generating capacity and 72 percent of the distribution system. The government retains ownership of key hydroelectric plants.

Peru is a member of the Andean Community, set up in March 1996 by leaders of Bolivia, Colombia, Ecuador, Peru, and Venezuela. Currently, the Community is working towards integrating energy sectors, particularly electricity and natural gas markets, through physical networks and harmonised regulatory frameworks. In November 1997, Peru joined the Asia Pacific Economic Cooperation (APEC) forum. Peru has also been participating in the Free Trade Area of the Americas negotiations.

As a part of Peru's effort to reduce air pollution in major cities and monetise stranded natural gas fields, Peru is considering to develop a Gas to Liquid (GTL) plant to exploit Talara and Northwest gas fields. With the support from Syntroleum, Peru's GTL project will be developed in two stages. Phase I would consist of the construction of a GTL plant with a capacity of 5,000 barrels per day near Talara. The output will be expanded to between 20,000 and 40,000 barrels per

day. The development of this plant would also reduce sulphur dioxide emission from diesel combustion considerably, and support the proposed Clean Air Initiative for Lima-Callao.

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## NOTABLE ENERGY DEVELOPMENTS

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### PRIVATISATION PROGRAMME

The government that took office in July 2001 stepped up privatisation activities in the energy sector that had slowed under the two previous governments. While opposition claim that privatisation contributes to unemployment and high-energy tariffs, the government believes that it increases investment and lowers prices. Active promotion of private investment helped bring about the July 2001 sale of the Electroandes Power Company to PSEG Global of the US. The Talara oil refinery and the Mantaro hydroelectric plant are also being considered for privatisation. However, violent demonstrations and riots in June 2002 in the cities of Arequipa and Tacna, which followed the government's announcement of the sale of the Egasa and Egesur electric utilities to Belgium's Tractebel, have delayed privatisation plans. In January 2003, the Government also postponed the privatisation of Yuncan hydro, as it failed to gain support from local government.

The private company with the largest presence in Peru is Spain's Endesa, which manages 1.5 GW of installed capacity. As of December 2003, Endesa held 60 percent of generators Etevensa (340 MW) and Empresa Eléctrica de Piura (Eepsa) (148 MW), as well as a controlling interest of 63.3 percent of Edegel (970 MW), through its subsidiary Enersis. Endesa, in conjunction with Enersis, also holds a 60 percent interest in electricity distributor Edelnor, the largest of Peru's 21 distributors. Some other international companies include Belgium's Tractebel, which holds 78.95 percent stake in Enersur (362 MW); Duke Energy International, which owns 100 percent of Egenor (529 MW); and PSEG Global, which owns 100 percent of Empresa de Electricidad de los Andes (ElectroAndes). Electroandes's main assets are four hydroelectric plants: Yaupi (108 MW); Malpaso (54 MW); Pachachaca (12 MW); and Oroya (9 MW). PSEG Global, along with Sempra Energy, jointly own 84.05 percent of Luz del Sur, (previously Edelsur), the second-largest electricity distributor in Peru. In 2004 the government gave the Yuncan hydro (130 MW) concession to ENERSUR.

### ADVANCES IN THE CAMISEA GAS PROJECT

Camisea gas was discovered by Shell in 1986, however, its development only started in 2000 with the establishment of the Special Committee of Camisea Project (CECAM). CECAM had divided the Camisea development into two projects, upstream and downstream. A consortium led by Argentina's Pluspetrol SA and consisting of Hunt Oil, SK Group and Tecpetrol, was awarded the 40-year contract to develop the upstream project. A 33-year contract for the downstream project consisting of transportation of the gas from Camisea to Lima, transportation of liquid gas (condensate) to coast and distribution of gas in Lima and Callao was awarded to Transportadora de Gas del Peru (TGP). TGP, a consortium made-up of Techint, Pluspetrol, Hunt Oil, Sonatrach, SK Corporation and Tractebel will build two pipelines, one for natural gas (714 kilometres) and another for condensate (540 kilometres). The pipelines are expected to deliver 250 mmscfd of natural gas expandable to 729 mmscfd by 2015 and 70,000 bpd of condensate, with the first delivery beginning in August 2004.

In 2002 an additional downstream project, a 30-year concession for the construction and operation of gas distribution network in Lima and adjacent port Callao was awarded to Tractebel. The distribution network spans 37 miles to deliver gas to industries and power generators around Lima but in the same year TGP transfer contract position to Gas Natural de Lima y Callao SRL Company and start the operation in August 2004.

The total investment required for developing the Camisea project is estimated at US\$1.6 billion. The Peruvian Government and the Camisea Company had attempted to secure financing from US Exim Bank and Inter-American Bank (IDB). Due to strong pressures from environmental groups,

the US Exim Bank had rejected the US\$ 214 million loan application on 28 August 2003. However, on 10 September 2003 IDB approved US\$135 million loan for the project. The loans consist of a US\$75 million loan from ordinary capital and a US\$60 million syndicated loan. TGP intends to issue US\$200 million bond for additional funding.

Pluspetrol believes that Camisea could yield as much gas as fields in neighbouring Bolivia, where recent exploration and development activities have uncovered reserves of 3.68 BCM of natural gas and 95 MCM of condensate. Techint SA, also from Argentina, operates a transportation concession to deliver gas from Camisea to the city of Lima, and Belgium's Tractebel SA heads the consortium that will handle distribution in Lima. Additional reserves could make Peru a regional gas exporter, with potential customers in Mexico, the western United States and the countries connected at the "energy ring" composed with natural gas pipeline such as Brazil, Uruguay, Paraguay, Argentina, Chile and Bolivia.

The government, in cooperation with the private sector, is carrying out an aggressive plan to expand gas utilisation in Peru that could lead to a gas grid linking all communities with more than 5,000 inhabitants and help reduce the dependence on oil imports nationwide. In transportation sector the rail company Empresa Ferrocarril Central Andino started to use compressed natural gas (CNG) in their units. Also envisioned is a greater use of compressed natural gas (CNG) along the lines of Argentina's programme that has yielded a fleet of 800,000 CNG vehicles.

Pluspetrol has drilled its first well, San Martin 1, which was tested in November 2002. A second well was also completed in 2002, and three more wells are planned in the same area. Pluspetrol had wanted to start commercial operations in April 2004 even though the original concession contract calls for operations to begin in August of that year.

Work has also started on the construction of a gas pipeline that would distribute gas from the Camisea project to the major Peruvian cities of Lima and Callao. This would serve as a trunk line for distribution to other areas in the future.

In December 2004, the 300 MW Ventanilla power plant (owned by ETEVENSA), started its commercial operation using natural gas after its conversion from oil.

### **PERU LNG PORT**

The huge reserves of natural gas discovered in Camisea, besides the reserves discovered at less than 20 kilometres in the Pagoreni Field, which together made an estimated 11 TCF of proven and probable reserves, had arisen the interest of two of the enterprises integrating the consortium in charge of the Camisea Project. Hunt and SK (Korean Enterprise) had established the LNG Peru Consortium in order to export liquefied natural gas, for which they have signed an agreement with Tractebel, an enterprise with vast experience in commercialising liquefied natural gas. In virtue of this Agreement, Tractebel will purchase and export 2.7 million tones per year of liquefied natural gas (LNG) for 18 years. Potential markets for these exports will be Mexico and the State of California in United States of America. The initial investment to build a plant to liquefy natural gas will be within 900 and 1000 million dollars. The total investment of the project includes a reception terminal (possibly in Mexico) where the re-gasification plant and the tankers for LNG transport will be located, making a total estimated investment of 2,150 million dollars. Peruvian gas market demand will always be guaranteed.

REPSOL – YPF enter to the LNG company and made a agreement regarding to the buy all the production in the Cañete LNG plant, REPSOL – YPF bought too 20 percent of the LNG project also participate in the exploration and production in Camisea field.

### **POWER GRID**

Peru has been in the process of integrating its power grid with Colombia and Ecuador. Those three economies signed the agreement in September 2001 and April 2002. The integration will possibly be expanded to Andean Community common electricity market, which will increase the efficiency of the market. The first inter-country electricity sales began in 2005, when Peru started

exporting electricity to Ecuador. A \$15 million 56 kilometres transmission line has being built and in the future a US\$1 million continuous AC substation that allows the transmission line to transport 150 MW of electricity in both directions is going to build. The capacity of the lines will be increased to 250 MW. The facilities will enable Peru to sell excess hydropower during its rainy seasons to Ecuador.

### ENCOURAGING NEW EXPLORATION

The participation of E&P contractors in exploration activities has been discouraging recently. The Government of Peru has introduced a more attractive fiscal term in May 2003 to address this problem. This new fiscal term offers two options; the first being, royalty based on production level that ranges from 5 to 20 percent and the second with a royalty based on a fixed component (5 percent) and a variable component (up to 20 percent) and are dependent on the profit margin. The new scheme also reduces payable royalty by up to 30 percent from the previous scheme. In addition, the government also offers other incentives such as the right to market hydrocarbon freely, allow free capital flow both within and outside the economy, a more flexible work programme and international arbitration on resolving disputes in 2004 with these actions, 34 well was drilled in comparison with 10 in 2002.

### RURAL ELECTRIFICATION

Within the framework of the National Rural Electrification Program of Peru, which is coordinated by Energy and Mines Ministry, the Government of Peru aims to reach a goal of 91 percent of rural households electrification coverage in the year 2012, as well as, to improve the electric generation systems for isolated rural communities.

### RENEWABLE ENERGY

A strong boost to renewable energy technologies going to come with the signing the agreement to do the Electrification Rural master plan with JICA using no conventional energy such as small hydro, wind, biomass, PV and geothermal power sources.

### ENVIRONMENT

Peru ratified the Kyoto Protocol on 9 July 2002. It is expected that the National Commission for the Environment (CONAMA) will have measures in place to use the Clean Development Mechanism (CDM).

The first approved CDM project in Peru, the Poechos Hydro Project, started producing energy in March 2004. The 15.4 MW damp power plant is located some 20 km to border to Ecuador. The project obtained support from the Carbon Prototype Fund of the World Bank. It is expected to reduce emissions by approximately 1.26 Mt of CO<sub>2</sub> during its lifetime.

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# THE PHILIPPINES

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## INTRODUCTION

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The Philippines is located along the western rim of the Pacific Ocean. It is home to 81.50 million (2003 estimate) Filipinos of various ethnic origins spread over 300,000 square kilometres of land which is carved out into an archipelago of 7,107 islands and islets. Luzon, the largest among the three major island groups, accounts for more than half of the population. North of the Philippines is Chinese Taipei and in the south, the Indonesian archipelago.

Despite internal-fiscal deficit and peace and order issues (which were concerns of investors) and external factors, such as geopolitical tensions, slump in electronic and information technology sectors, severe SARS, and continued increases in the price of oil, the domestic economy still managed to grow at a respectable rate over the last 2 years. Gross Domestic Product (GDP) in 2003 grew by 4.52 percent at US\$320.50 billion {1995 US\$ at 1995 purchasing power parity (PPP)}. Its GDP per capita likewise posted an improvement of 2.52 percent at US\$3,932 (1995 US\$ at PPP). The key growth driver was the service sector which expanded at an average rate of 5.1 percent between 2001 and 2003. The continued expansion in this sector is largely due to the telecommunications sector as telecommunications companies expanded their operations outside Metro Manila. Added new investments in call/contact centers, business process outsourcing (BPOs) and software development have also performed very well. The trade sector likewise improved due to strong personal computer spending which was supported by the steady growth in agricultural sector and remittances of overseas Filipino workers (OFW) who are deployed in higher paying jobs as ICT professionals, teachers and nurses/caregivers.<sup>78</sup>

The Philippines energy consumption per capita remains the lowest among the APEC member economies. For this reason, the economy is perceived to play an important role in the world energy market as it is eyed by many as a growing consumer (a net importer) of energy, particularly for oil, coal and natural gas in the power and transport sectors. It has been considered a promising market for foreign energy companies.<sup>79</sup> In the long term, it may turn out either as a significant natural gas producer (with more gas discoveries) or an LNG importer (with increased gas demand).

The Philippines' indigenous energy reserves are relatively small with only about 24 million cubic metres (MCM) of crude oil, 107 billion cubic metres (BCM) of natural gas and 399 million metric tonnes of coal, mainly lignite. It however boasts of a geothermal resource that could make the economy the world's largest producer and user of geothermal energy for power generation. Other renewable energy resources (solar, wind, biomass and ocean) are theoretically estimated to have a power generation potential of more than 250,000 MW.

An effort to limit oil and coal imports to reduce the economy's dependence on imported energy has led to the prioritised and expanded use of natural gas for power generation.

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<sup>78</sup> Medium Term Philippine Development Plan 2004-2010, National Economic Development Authority (NEDA), Philippines.

<sup>79</sup> Philippines Country Analysis Brief, Energy Information Administration (EIA), 2002

Table 29 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	300,000	Oil (MCM) - Proven	24
Population (million)	81.50	Gas (BCM) - Proven	107
GDP Billion US\$ (1995 US\$ at PPP)	320.50	Coal (Mt) - Recoverable	399
GDP per capita (1995 US\$ at PPP)	3,932		

Source: Energy Data and Modelling Centre, IEEJ. \*Philippine Department of Energy (DOE)

## ENERGY SUPPLY AND DEMAND

### PRIMARY ENERGY SUPPLY

In 2003, the total primary energy supply (TPES), excluding traditional fuels, accounted to 30.09 Mtoe. The economy imports more than half (or 56 percent) of the total energy supply; the remainder was supplied through domestic production of indigenous resources, at 13.3 Mtoe. The main energy sources were oil (48 percent), geothermal and others (30 percent), coal (13 percent), and gas (9 percent). Because of the coming on-stream of the Malampaya gas field in October 2001, gas production increased considerably in 2002 (by about 1,173 percent from 135 ktoe in 2001 to 1,724 ktoe in 2002), increasing further through to 2003 to 2,628 ktoe, at 52.4 percent. Oil production on the other hand decreased from 15.17 ktoe in 2002 to 14.38 ktoe in 2003, with the still unresolved decision whether to pursue the exploitation of the Malampaya oil rim.

Most of the economy's total coal requirement is supplied through imports. However because of the improved production of big coal mining companies and good weather condition, domestic coal production improved to 910 Ktoe in 2003 from 751.8 Ktoe in 2002.

The Philippine government through the DOE will be conducting studies to identify additional coal areas to boost the domestic production of coal in view of the increasing demand for coal in the world market and help mitigate the economy's dependence on imported coal. Studies will include among others the use of advanced mining methods and technologies to increase mine productivity with due consideration to the deep-seated nature of the Philippine coal deposits.

The commissioning of the natural gas fired power plants in October has pushed upward the economy's natural gas production more than a thousand times, from 0.087 Mtoe in 2000 to 2.6 Mtoe in 2003. Following the success of the Malampaya project, more natural gas supply is expected as more areas are opened following the development of more natural gas infrastructures for prospective oil and gas developers.

In 2003, electricity production reached about 52,863 GWh. Bulk of this electricity generated came from thermal power plants, mostly run on coal and fuel oil (67 percent), geothermal and others (19 percent), and hydro (15 percent). The total installed electricity generating capacity is 14,702 MW. APERC predicts that electricity demand would grow to about 6 percent per annum to 2020: this implies that significant additional generation capacity will be required in the future.

### FINAL ENERGY CONSUMPTION

Final energy consumption was about 17.7 Mtoe in 2003. Almost half (or 49 percent) of the economy's energy supply was consumed by the transport sector, due mainly to oil, which made up more than 74 percent of the final energy demand. The residential, commercial and other sectors consumed about 28 percent mostly for electricity use while the remaining 23 percent was taken up by the industrial sector: utilising coal for power generation, industrial direct process, small end-use household fuel and briquetting.

The Philippines updated Philippine Energy Plan 2005 indicates that between 2005-2014, the economy's final energy demand will grow at 4.7 percent per year with petroleum used mainly in the transport sector taking the bulk of the final energy demand with an average share of 39.4 percent. This will be followed closely by biomass sharing a 38.4 percent. Electricity, coal and natural gas will post an average share of 15.1 percent, 2.7 percent, and 2.2 percent, respectively.<sup>80</sup>

Table 30 Energy supply & consumption for 2003

Primary Energy Supply Ktoe		Final Energy Consumption Ktoe		Power Generation GWh	
Indigenous Production	13,308	Industry Sector	4,158	Total	52,863
Net Imports & Other	16,780	Transport Sector	8,677	Thermal	35,171
Total PES	30,088	Other Sectors	4,871	Hydro	7,869
Coal	3,961	Total FEC	17,707	Nuclear	-
Oil	14,375	Coal	885	Others	9,822
Gas	2,628	Oil	13,155		
Others	9,124	Gas	-		
		Electricity & Others	3,667		

Source: Energy Data and Modelling Centre, IEEJ.

For full detail of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

## ENERGY POLICY OVERVIEW

The Energy Independence Agenda of the Arroyo Administration has been the focus of planning and operation of the government sector. Following this mandate, the Department of Energy (DOE) stepped-up the promotion and development of the economy's indigenous energy resources to meet the increasing demand for energy. With final energy demand reaching 165.3 million barrels of oil equivalent (MMBFOE) in 2004, all forms of energy sources were exhausted to meet the demand while providing a diverse and balanced supply mix.

### PROMOTION AND DEVELOPMENT OF RENEWABLE ENERGY

Rising oil prices and concerns on environmental pollution continue to fuel interest in the use of renewable energy to meet the economy's energy demand. Issues on implementation costs and the provision of investment incentives are intensively being addressed by the government to promote greater private sector participation in these energy resources. For one, the passage of House Bill 1068 "An Act to Promote the Development, Utilization and Commercialization of Renewable Energy Sources" is being pursued to encourage the flow of private capital with the grant of an incentive package that includes tax and duty free importation of machineries/equipment, exemption on VAT, real property and even income tax holidays. The DOE is likewise studying the mandatory use of renewable energy by power generators/distributors as part of the recommendations raised during the first Wind Power Summit held in December 2004.

#### Geothermal

The Philippines ranks second to the US as the world's largest geothermal producer with an aggregate capacity of 1,932 megawatts (MW). In 2004 the total generating capacity from geothermal resources reached 10,282 GWh, displacing about 17.7 MMBFOE.

<sup>80</sup> Philippine Energy Plan 2004-2013

To promote further utilization of indigenous geothermal resources, the Geothermal Contracting Round (Geothermal-1) was formally launched on 11 March 2004 as a culminating activity of Philippine National Oil Company-Energy Development Company's (PNOC-EDC) Annual General Conference. The program aims to gather proposals for the development of additional capacities within the prospective sites, as well as the development of geothermal greenfields. Geothermal fields offered in the 2005 Public Energy Contracting Round (PECR) could provide about 330 MW of additional capacity. This includes the development of new fields in Daklan (Benguet), Natib (Bataan), Mabini (Batangas), Montelago (Oriental Mindoro), Biliran (Biliran Province), and Amacan (Compostela Valley). Likewise, proposals for the exploration and development of the prospective sites in Biliran and Amacan by PNOC-EDC are currently being reviewed and evaluated.

Among the active geothermal power producers are the state-owned PNOC EDC, Unocal Philippines, California Energy and Ormat Incorporated. PNOC EDC currently operates nine geothermal projects, i.e. Tongonan I, Palinpinon 1, Palinpinon II, Bacman I, Bacman II, Mindanao I, Leyte-Cebu, Leyte-Luzon and Mindanao II with an aggregate capacity of 1,149.4 MW.

### Hydropower

Hydropower resources had contributed about 15.9 percent of the total power generation mix in 2004, an increase of about 8.5 percent from the previous year. The increase could be attributed to the commissioning of the 345 MW San Roque Hydropower plant in Pangasinan. Fuel oil displacement increased by 17.8 percent from its 2003 level to reach 14.8 MMBFOE in 2004.

PNOC EDC is currently working on the evaluation/conduct of feasibility studies on the following hydropower projects:

- 29.0 MW Timbaban Hydropower Project in Barangay Maria Cristina, Madalag, Aklan
- 17.8 MW Sicopong Hydropower Project in Sta. Catalina, Negros Oriental
- 24.0 MW Catuiran Hydropower Project in Calapan, Oriental Mindoro
- 16.5 MW Villasiga Hydropower Project in Sibalom, Antique
- MW Talubin Hydropower Project in Ifugao
- MW Pasil Hydropower Project in Kalinga

### Solar

The increasing demand for clean and renewable energy makes the use solar energy the most viable alternative to fossil fuel for the electrification of far-flung communities, specifically in the installation of off-grid power systems.

PNOC's Solar Homes Systems Distribution Project is aimed at making electricity available to rural households through the installation of solar power cells in about 15,000 houses in remote areas in Regions I to VII, including the Cordillera Autonomous Region (CAR) and Mindanao Region over the next five years. The solar system package consists of a solar panel, battery, wiring, lights and other fixtures, inclusive of maintenance visits within the first year of installation. The solar panels can run up to 20 years and can generate enough electricity to run small electrical appliances.

The Solar Project, which earned the prestigious Energy Globe Award in 2003 and the Congressional Medal of Achievements Award in 2004, was made possible through a grant from the Netherlands. As of June 2005, a total of 8,005 Solar Home Systems (SHS) were installed in the target areas. Of the total, 3,967 SHS were installed between August 2002 and December 2004, while about 4,038 SHS were installed from January to June 2005, mostly in Mindanao conflict areas. Likewise, the Solar Power Technology Support (SPTS) Project was launched to help improve the socio-economic conditions of Agrarian Reform Beneficiaries (ARB) in un-energized and off-grid Agrarian Reform Communities (ARC) in Mindanao. The project would involve the installation of solar-powered facilities such as water pumps for irrigation, incubators and hatcheries for agri-business activities, community lighting in schools and barangay halls and vaccine refrigerators for

rural health clinics. The first phase of the project covers 40 ARCs and 110 barangays (rural villages) within the 16 provinces in Mindanao. The second phase will likewise benefit 40 ARCs, 114 unenergized barangays and some 40,000 rural households in the same region.

Another major project for 2004 includes the ceremonial switch-on of the country's first and largest on grid solar power facility in Cagayan de Oro. The 1 MW Solar Power plant involved an investment of about US\$5.3 million and utilizes 6,480 units of poly-crystalline silicon solar cells. The project is expected to boost Mindanao's energy generation mix considering that additional generation capacity for the region is urgently needed to meet the rapid increase in electricity demand.

## Wind

The economy has taken a major step in promoting wind energy with the signing of the first greenhouse gas emission reduction purchase agreement (ERPA) for the implementation of the US\$35 million wind farm project in Bangui Bay, Ilocos Norte, the first of its kind in the Philippines and the entire ASEAN region. The World Bank has lauded the project as ASEAN's first under the Clean Development Mechanism (CDM) of the Kyoto Protocol and called it a good example of how global partnership on environmental protection can be realized.

The 180 kW wind-diesel hybrid plant consists of three Vergnet 60 kW wind turbines and two 500 kW diesel generators designed to provide an uninterrupted power supply to the area. The wind facility proves the feasibility of harnessing wind energy to lessen government subsidy for missionary electrification.

Sixteen more wind power sites were identified by the DOE with a potential of 345 MW for private sector participation. Sites open for investments include Pagudpud and Bayog (Ilocos Norte), Sual (Pangasinan), Mauban (Quezon), Abra de Ilog and Bulalakaw (Mindoro Oriental), Manoc-Manoc (Aklan), Pandan and San Remigio (Antique), Carranglan (Nueva Ecija), Caliraya (Laguna), Marinduque, Tablas Island, Romblon, Masbate, Nuventa (Surigao del Sur), and San Carlos (Negros Oriental). Based on the study conducted by the US DOE-National Renewable Energy Laboratory (NREL), the country being situated in the fringes of the Asia Pacific monsoon belt, has a full wind potential of 76,000 MW, with 47 provinces having at least 50 MW wind potential and 25 provinces with about 1,000 MW each. Another study by the World Wildlife Fund (WWF) showed that the country has 1,038 wind sites that could generate about 7,404 MW of electricity.

During the Wind Power Summit held in December 2004, Pre Commercial Contracts (PCCs) were signed between DOE and the private sector to further explore and develop potential wind power sites in the country with a combined capacity of 140 MW. Contracts were awarded to Trans-Asia Renewable Energy Corporation and San Carlos Wind Power Corporation to develop wind potential in Sual, Pangasinan and San Carlos City, Negros Occidental. These projects are expected to generate 25 MW and 30 MW of power, respectively. On the other hand, the Philippine Hybrid Energy Systems Inc. (PHESI) was awarded PCCs to develop the potential sites in Masbate, Oriental Mindoro and Marinduque. Potential generating capacity of these projects varies from 5 to 20 MW each. Other companies are in the process of securing PCCs from the DOE for the remaining wind power sites.

As a follow-through activity, the remaining 11 wind sites were re-offered to investors during the first quarter of 2005. As a result, Coastal Power Development Corporation was recently awarded a PCC to develop the wind power project in Carranglan, Nueva Ecija with an estimated capacity of about 50 MW. Likewise, a bilateral agreement between the Philippines and Spain was signed to develop the wind resources of Abra de Ilog in Occidental Mindoro.

### **STABLE AND SECURE ENERGY SUPPLY<sup>81</sup>**

The Philippine government continued its aggressive promotion of its indigenous energy oil and gas resources through improved contracting schemes and enhanced fiscal incentives.

The First Philippine Petroleum Public Contracting Round (PCR-1) offered 46 new exploration blocks near oil producing areas in Northwest Palawan and in the vast frontier basins in Southwest and East Palawan, Sulu Sea and Reed Bank. To continue the gains from PCR-1, the DOE initiated another PECC in 2005 where four oil and gas areas were offered. Areas considered include prospective blocks in East Palawan (two areas), Southwest Palawan (one area), and Sulu Sea regions (one area). The DOE expects more contract applications with the increased investor confidence following the Supreme Court reversal of its ruling on the Mining Act of 1995 which now allows 100 percent foreign ownership in the mining sector.

As of December 2005, the country has 21 active service contracts and one geophysical service exploration contract (GSEC) in the petroleum sector.

### **WIDER ACCESS TO ENERGY SUPPLY AND SERVICES**

The provision of wider access to energy supply is the primary responsibility of government. Such a task requires accelerated establishment of critical infrastructure, vigorous rural electrification program and prudent decentralization of various energy facilities.

#### **ENHANCED INFRASTRUCTURE**

##### **Downstream Natural Gas**

The use of natural gas will continually be a subject of intensive promotional campaign programs of DOE for its wider application in all the demand sectors. This will be complemented by an integrated enabling law in both Houses of Congress to put in place the ground rules for all players in the industry.

##### **Developments in Natural Gas Infrastructure**

The DOE has identified major infrastructure networks, i.e. transmission and distribution pipelines and related facilities which are being promoted locally and internationally for private sector investments. These critical and strategic infrastructures are in their various stages of implementation:

1. Batangas-Manila Gas Pipeline Project (BatMan-1) : Declared by NEDA as a project of national importance, BatMan 1 has already an Environmental Clearance Certificate issued by the DENR on 30 March 2004. By the end of 2004, project proponent PNOEC was able to secure local government unit (LGU) endorsements and necessary letters of intent from potential gas users. Eight contractors also submitted tenders for the project's front end engineering design (FEED) in August 2004 but bidding was deferred in view of PNOEC's re-evaluation of its business plan on the project. Target date to complete the project is 2007.
2. Bataan-Manila Gas Pipeline Project (BatMan 2) : PNOEC has shown keen interest to undertake BatMan2 through its submission of a Partial Compliance with Motion for Issuance of Provisional Permit to DOE in September 2004. Market studies are currently being made to determine the techno-economic viability of the project. The project completion date is 2009.
3. Pilippinas Shell Petroleum Corporation (PSPC) Own-Use Pipeline Project : PSPC has applied a permit to construct, operate and maintain an own-use pipeline for its refinery in April 2004.

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<sup>81</sup> 2004 Energy Sector Accomplishment Report, Philippine Department of Energy, 2005

4. LNG Terminal in Mariveles, Bataan : DOE has issued an own-use permit to GNPowr for an LNG terminal to be established in Mariveles, Bataan. It also signed an EPC contract with Chicago Bridge and Iron (CBI) in May 2004 to construct an LNG facility. GNPowr is currently negotiating with the Distribution Utilities (DUs) and major electricity users for a power purchase agreement and EPC contract for plant construction.

### Expanded Use of Natural Gas

#### Natural Gas Vehicle Program for Public Transport (NGVPPT)

In September 2004, the NGVPPT program was given a boost with the signing of the contract between Cummins Westport Inc. and the local bus operators. Meanwhile, a number of incentives for transport operators have been lined up to promote the use of CNG in public utility vehicles. The price differential of CNG with respect to diesel at about Php 7.35 per liter would make its use in public utility vehicles more economically attractive. In the long term, CNG will be promoted for use in private and even three-wheeled vehicles.

#### Promotion of Natural Gas Demand in the Residential and Building Sectors

In buildings, natural gas use is being promoted as piped gas for domestic applications in place of LPG as well as fuel for airconditioning and internal power requirement. The district cooling technology could be used by a large number of buildings using natural gas as fuel.

To determine and evaluate the readiness and openness of the household sector to use natural gas as fuel (replacing LPG), a survey (Household Energy Consumption Survey) was conducted in coordination with the National Statistics Office. The results of the survey questionnaire will serve as a basis for the future plans and programs of DOE on the sector. Preliminary results released in August 2005 showed a marked awareness on natural gas as a clean fuel and 63 percent of the respondents who were not aware are willing to learn.

### Downstream Oil Sector

Since the implementation of the Downstream Oil Industry Deregulation Law, the number of oil industry players has grown significantly to 356 players (in 2004), engaged in different downstream oil industry activities, from 315 players in 2003.

To address the impact of rising high oil prices, the DOE (as part of its contingency measure) remained vigilant in the strict implementation of Executive Order (EO) No. 13 which mandated oil companies to undertake a Minimum Inventory Requirement (MIR) of in-country stocks equivalent to 30 days for refiners, 15 days for bulk suppliers and 7 days for LPG players. The end of the US-Iraq war however reduced requirements to much lower levels. The current MIR stood at 15 days of reserves for refiners and 7 days for bulk suppliers and LPG players. To date, oil players normally would maintain more than the required minimum inventory levels.

Aside from the MIR imposed on oil players, the following were some of the measures initiated by government to diversify its energy supply sources, as well as ensure oil supply security in the economy:

Undertake joint cooperation on supply security : In February 2004, PNOOC and PTT (Thailand) signed an Memorandum of Understanding (MOU) which provided for the creation of a Technical Working Group (TWG) that would study and explore the mutual areas of cooperation in oil and gas activities for the two economies. The TWG will be under the supervision of a Joint Cooperation Committee, composed of energy officials of both economies.

Explore stockpiling initiatives: In view of the economy's dependence on imported oil (majority from the Middle East), the DOE has requested USAID's assistance in assessing the options and potential for the economy's strategic oil stockpile. A US DOE Strategic Oil Stockpiling Advisory Team was dispatched in August 2004 to conduct briefings on US experience on Strategic Petroleum Reserve (SPR). The briefing was attended by energy industry players, officials and representatives of government agencies, and representatives from both house of Congress. A site tour was conducted and followed by the inspection and assessment of the economy's existing oil facilities.

Based on the initial assessment, three possible areas for underground storage were identified which will be subject to further studies (in terms of location, type of storage, cost, etc.).

#### EXPANDED RURAL ELECTRIFICATION

In April 2003, the expanded rural electrification program of the national government was developed. The program is aimed at further integrating and strengthening the electrification efforts of both the government and private sector. It also promotes cost-effective uses of NRE and provides policy directions and guidelines to achieve the economy's goal of fully electrifying 100 percent of its villages in 2008 and 90 percent of its households by 2017.

In 2004, the program has energized a total of 1,002 villages, bringing the cumulative number of villages energized to 38,763 out of the 41,945 villages nationwide, or an electrification level of 92.41 percent. Of the 1,002 villages energized, 190 villages were electrified through PV installations (83 battery charging stations; 90 PV solar home systems; 3 micro hydropower system; and 14 solar projects).

The promotion of the rural electrification program has also gained positive results with the commencement of two World Bank Global Environmental Facility (GEF) financed projects, namely: the Rural Power Project (RPP) and the EC Systems Loss Reduction Project (EC-SLRP) in 2004. The former is a 14 year project aimed at providing increased access to electricity services and the transformation of electric cooperatives into more viable and commercial entities. The latter on the other hand is a 7 year program which will support the pilot use of contingent financing and contractual mechanisms for energy efficiency investments in the rural power distribution sub-sector. The GEF grant for this initiative was signed in May 2004 with a total project cost of US\$10 million.

#### FAIR AND REASONABLE ENERGY PRICES THROUGH POWER SECTOR REFORM

The DOE continues to supervise the restructuring of the electricity industry to ensure transparent and reasonable prices of electricity and achieve greater operational and economic efficiency in a regime of fair trade competition and full public accountability. Major reforms have been implemented over the last two years to attain these objectives.

#### PROVISION OF TRANSPARENT AND REASONABLE PRICES OF ELECTRICITY

The Energy Regulatory Commission (ERC), the ratemaking entity created under the Electric Power Industry Reform Act (EPIRA), has undertaken various reform processes to ensure transparent and reasonably priced electricity.

##### Unbundling of Electricity Rates

For end-users to better understand the cost component of electricity rates, EPIRA provides for the unbundling of electricity rates where charges are itemized per type of service: generation, transmission, distribution, metering and supply. As of December 2004, ERC has approved 129 unbundling applications of NPC, NPC-SPUG and other Private Utilities and Electric Cooperatives (ECs).

##### Imposition of the Universal Charge

Section 34 of EPIRA provides for an imposition of a universal charge on all electricity end-users which include among others the missionary electrification and environmental charges. As of September 2004, total collection from these two ERC approved universal charges reached Php 1.9 billion.

##### Loan Condonation

Section 60 of EPIRA provides for the condonation of all the outstanding financial obligations of ECs to the National Electrification Administration (NEA) and other government agencies incurred specifically for the purpose of financing the rural electrification program. The condonation is expected to translate to a reduction in electricity rates of ECs. As of October 2004, 96 ECs have subsequently reduced its electricity rates equivalent to the amount of loans condoned.



### Removal of Cross Subsidies

The removal of all forms of cross-subsidies will reflect the true cost of electricity being rendered by each type of customer, grid and area within the regional grid. Full removal of inter-regional cross-subsidy started in September 2002. Intra-regional cross-subsidy on the other hand was gradually implemented with the reduction by 1/3 of the original subsidy in September 2003, another 1/3 in September 2004 until its final removal in September 2005. The two-phased removal scheme of inter class cross-subsidy for MERALCO customers was approved by ERC in October 2004. The first phase covered the removal of 40 percent subsidies beginning October 2004 while the second phase covered the remaining 60 percent in October 2005.

### Review of NPC Independent Power Producer (IPP) Contracts

Under Rule 25 of the EPIRA-IRR, PSALM is mandated to seek the reduction in the stranded contracts of NPC resulting from the renegotiation of IPP contracts. As of August 2004, PSALM has concluded negotiations of 20 (out of 35) contracts with an expected savings of US\$1.036 billion (in discounted present value terms). The amount translates to a reduction of Php 0.0098/kwh over the remaining life of the contracts.

## PRIVATE SECTOR PARTICIPATION IN POWER RELATED ACTIVITIES

EPIRA mandates DOE to establish the WESM in order to facilitate the competitive scheduling and dispatch of power plants in an optimal and transparent manner. Preparatory works are underway to prepare for the commercial operation of the WESM. In March 2004, the contract for the Turnkey Implementation of the Market Management System (MMS) was awarded. The MMS consists of the computer hardware and software required to manage the bidding, scheduling, dispatch optimization, pricing and market settlement functions of the WESM. After a successful factory acceptance test in October 2004, the final MMS was delivered in December 2004 at the WESM site in Pasig City. Site acceptance test of the MMS and the development of necessary guidelines and procedures for the operation of the WESM are still ongoing.

### Implementation of Retail Competition and Open Access

Retail competition and open access at distribution levels will provide end-users the choice of power; whether to choose suppliers or buy through the WESM. The ERC will commence the initial implementation of retail competition in Luzon in July 2006 for end users with monthly average peak demand of at least 1 MW for the preceding 12 months. Thereafter, the threshold level for the contestable market will be reduced to 750 kWh starting in July 2008. At this level, suppliers/aggregators will be allowed to supply electricity within a contiguous area with at least 750 kWh demand. ERC shall subsequently evaluate the performance of the market to determine the final threshold level for the contestable market. In the case of ECs, retail competition and open access will start in July 2007. ERC will determine the schedules for the Visayas and Mindanao region.

### Privatization of NPC Assets

In 2004, six power plants with a total installed capacity of 608 MW were sold by PSALM to the private sector, amounting to US\$567 million. PSALM is targeting to transfer the management and control of at least 70 percent of the total generating power plants under contract with NPC to IPP administrators by January 2006. DOE has likewise issued DC 2004-01-001 in January 2004 and prescribed the rules and procedures for private sector participation in existing NPC-SPUG areas in accordance with Rule 13 of the implementing rules and regulations of EPIRA. The first wave of areas recommended for privatization include: Mindoro, Marinduque, Palawan, Catanduanes, Masbate, Tablas, Roblon, Bantayan, Camotes Island, Tawi-tawi, Basilan and Sulu.

## USE OF ALTERNATIVE ENERGY FUELS

The energy sector is now aggressively working on the development of clean and efficient energy fuels such as CNG, coco-methyl ester (CME), ethanol and autogas.

### Natural Gas

The launching of the NGVPPT in October 2002 has paved the way for the promotion of the use of alternative fuels in the transport sector. The DOE has laid out several measures to accelerate incentives for the program stakeholders and encouraged other transport firms to shift to CNG. In February 2004, an inter-agency NGVPPT Executive Forum was led by DOE. The forum was created to provide the leadership, coordination and direction needed in the implementation of the program. Likewise, it is envisioned to strengthen commitments between government and industry players for the establishment of natural gas infrastructures and other related facilities including market development for NGVs.

### Coco-Methyl Ester

The DOE has issued the implementing rules and regulations for a Memorandum Circular (MC) 55, through a Department Circular (DC) 2004-04-003 in March 2004. Subsequently a group composed of DOE, as lead agency, with DENR, DOST, DOTC, DTI, DOF, PCA, Office of Presidential Adviser for Poverty Alleviation and CME manufacturers/suppliers was created. The group shall provide further direction for CME. The DOE also facilitated the conduct of additional test on CME through the US DOE-NREL and expects to complete the tests in 2005. The following blends made by NREL are 1% CNG in additized diesel fuel (DA), 1% CME in unadditized diesel fuel (DUA), 5% CME in DA and 5% CME in DUA. The test to be performed on DA and DUA fuel samples and CME fuel samples are Diesel Fuel property specification, Biodiesel Fuel Property Specs., Storage Stability, High temperature stability, oxidation stability, water separability and microbial degradation. The DOE has also approved the application for accreditation of two manufacturing companies in July 2004. The first small-scale CME demonstration plant was launched by PNOC-ERDC in October 2004.

### Autogas

The tie-up of a local manufacturer and conversion kit supplier has given the autogas technology another big boost in 2004. The joint venture intends to develop a semi-original equipment manufactured (OEM) bi fuel sedans that will make bi-fuel vehicles readily available in the domestic market. Financing will be provided by the Development Bank of the Philippines (DBP) through the Clean Fuels Financing Program for the autogas project. Potential autogas investors are granted income tax exemptions as stipulated in the 2004 Investment Priorities Plan with the inclusion of autogas assembly facilities, conversion shops, refuelling stations and taxi fleet operations.

### Ethanol

The DOE continues to pursue the development of fuel ethanol also known as ethyl alcohol. Two separate bills were filed in the two houses of Congress supporting the measure. In August 2004, the Philippine sugar industry launched the first Philippine Fuel Ethanol Alliance composed of the Sugar Regulatory Authority, Center for Alcohol Research and Development Foundation, Sugar Master Plan Foundation and the Philippine Sugar Millers Association. Correspondingly the DOE had entered into a bilateral cooperation agreement with Thailand for the formulation of a harmonized regional standard, rationalization of the ASEAN automobile industry and technical collaboration between PTT of Thailand and Petron Philippines for the distribution and logistics of ethanol in the economy. The DOE has also developed the implementation plan for the fuel ethanol program in cooperation with concerned government agencies. The plan includes policy action, supply infrastructure, technology, IEC program and market development of ethanol.

## **PROMOTION OF ENERGY EFFICIENCY AND CONSERVATION MEASURES**

A revitalized National Energy Efficiency and Conservation Program (NEECP) was implemented by DOE alongside a banner campaign dubbed "EC (Energy Conservation) Way of Life" launched in August 2004. The campaign was primarily used as a mitigating measure to curb the impact of rising oil prices, reduce expenditures on fuel and power, and protection of the environment through enhanced awareness on energy conservation. As a result, the program has

attained a total of 8.1 MMBFOE energy savings and an equivalent emission avoidance of about 1,827 gigagram carbon dioxide (GgCO<sub>2</sub>) in 2004.

### **REGIONALIZATION OF ENERGY PLANNING PROCESS**

It was recognizing that the Philippines is an archipelago with 16 administrative regions; with inherent geographic, economic, social and cultural differences. Differences in energy resources, development thrusts, energy demand structure and end-use mix among regions call for specific regional plans and programs.

Therefore in 2004, the DOE made its first effort to bring the concept of regional energy planning down to the regional level. The DOE laid the groundwork for coordination with the Regional Development Councils (RDCs) through the regional offices of the National Economic Development Authority (NEDA) and invited the Provincial Planning and Development Officers (PPDOs), City Planning Development Coordinators (CPDCs) and concerned government and non-government organizations to a series of briefing-orientation meetings and discussed regional energy planning concepts and processes, including energy forecasting methodologies. Prior to the regional energy plan's (REPs) finalization, the draft REPs were presented to the Regional Development Councils for final comments. Subsequently, the plans were endorsed by the RDCs as vital reference for their local development plans.

The Philippine Energy Plan Update 2005, which include the national energy plan and the six regional energy plans were completed in December 2004.

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### **NOTABLE ENERGY DEVELOPMENTS**

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In pursuing its energy policy objectives, the Philippine government has actively pursued the review of existing policies and carried out various reforms not only in the power and downstream oil and gas sectors but also in renewable energy. The following is the economy's statement of recent and notable energy developments<sup>82</sup>.

### **INSTITUTIONAL REFORMS**

#### **DOWNSTREAM OIL INDUSTRY MANAGEMENT**

The downstream oil industry sustained significant growth since the implementation of the Downstream Oil Industry Deregulation Act of 1998, particularly with the establishment of new petroleum product facilities. As of June 2005, there were 361 industry players engaged mostly in different downstream activities. Total investments from new players reached US\$ (Php28.35 billion) in June 2005.

As of June 2005, the industry has 3,969 gasoline stations, 67 percent of which are in the island of Luzon while the remainder is distributed in the islands of Visayas (15 percent) and Mindanao (18 percent). Total petroleum product storage capacity stood at 25.87 MB.

The Department of Energy (DOE) continued to monitor daily international prices such as those of Dubai, Brent and WTI for crude oil, and Mean of Platts Singapore (MOPS) for petroleum products in order to ensure the reasonableness of prices in the domestic market. The public is likewise kept informed of any price adjustments through the conduct of a tri-media IEC, done on a continuing basis. Domestic product prices of various companies and gasoline stations are posted at the DOE website. The posting provides consumers alternative options in selecting cheaper priced petroleum products.

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<sup>82</sup> Statement of Notable Energy Developments, Philippines, June 2005. Philippine Department of Energy.

To cushion the impact of high oil prices, particularly in the transport sector, the Philippine government has enjoined the assistance of oil companies in reviving the implementation of a support mechanism that would put up diesel re-filling stations/pumps at passenger “jeepney” terminals including the granting of discounts (on diesel) in gasoline stations.

In the wake of rising oil prices and successive oil price hikes, several sectors prompted the review of Republic Act (R.A.) 8479 or the Downstream Oil Industry Deregulation Law and sought to a return to price control. Upon the directive of President Gloria Macapagal-Arroyo, the DOE issued Department Order (DO) 2005-02-001 and 2005-05-005 in February and May 2005 and created a six-man independent review committee (IRC). The IRC was mandated to primarily review the law and give corresponding recommendations; taking into consideration the views and opinions of all affected sectors and giving more emphasis on balancing the interest of both the consumers and the oil industry. A report was turned over to the DOE on 07 July 2005.

The confluence of factors and events worldwide, such as the continuing demand from giant economies like the US, China and India; the recurring conflicts in the Middle East; the production losses in the Mexican Gulf caused by devastating hurricanes, among others, have triggered the overwhelming increasing in prices of oil in the recent months.

Among the long-term strategies to address the impact of rising oil prices implemented by the Philippine government include the establishment of a National Petroleum Strategic Reserve by 2010. Necessary fuel stockpile infrastructures will be established together with the actualization of oil discovery prospects. Another strategy is the possible development of the Malampaya oil rim and dedicating its production to the economy’s national reserve.

### *Oil Stockpiling*

The DOE, through the financial assistance from Japan Ministry of Economy, Trade and Industry (METI), agreed to the conduct of a feasibility study for the development of a master plan and comprehensive scheme for oil stockpiling in the ASEAN economies including the Philippines.

Results of the study were presented by METI at the 29<sup>th</sup> APEC Energy Working Group (EWG) meeting in Hanoi, Viet Nam. Currently, the Philippine government is waiting for the study’s formal presentation to the DOE.

A Philippine delegation attended a related workshop on Oil Stockpiling in the APEC Region: Implementing Best Practices, Facilitating New Commitments, sponsored by the US Department of Energy and hosted by the East-West Center under the auspices of the APEC EWG, held on 26-27 July 2005.

The Philippines presented a paper on “Considerations for Oil Stockpiling in the Philippines”. Among the reasons cited by the Philippines on the need for stockpiling are: a) only about half of the oil products is produced locally; b) international oil prices have been on an increasing trend; c) supply security and price stabilization

Among the initiatives undertaken regarding the stockpiling concept are the Technical Assistance (TA) through feasibility studies from the US-DOE on Strategic Petroleum Reserves and the Japan METI Assistance on Regional Oil Stockpiling. On the Joint Cooperation on Oil and Gas Activities with Thailand, there is the MOU between RP-DOE and Thailand Ministry of Energy (MOE) and the MOU between the Philippine National Oil Company (PNOC) and the PTT of Thailand,

In January 2003, the Philippine DOE has issued a Department Circular that required a 30 day minimum inventory in-country of crude and products for refiners, 15 days minimum inventory of finished products for other oil companies and 7 days minimum inventory for LPG marketers.

APERC reported that the Philippines’ three major oil companies held about 86 days of crude and petroleum stocks., the highest level in 10 years and above the required level of 15 days of demand. Thus, the government believes that establishing a regional joint stockpile in the Philippines would give the economy strategic access to oil. A regional (ASEAN) stockpile based in

the Philippines (potentially Subic Bay) was discussed at the 8<sup>th</sup> International Energy Forum (EF) in Osaka, Japan.

The proposed storage location is the former US Subic Naval Base. The Subic Base is strategically located 120 kilometers north of Manila near the International shipping lanes in the South China Sea. It has a large protected natural harbour surrounded by hills, forest and white sandy beaches. The base has also some facilities, such as oil pipelines and connecting depots that might be expanded for the bigger joint project among the ASEAN nations.

#### DIVERSIFICATION OF SUPPLY SOURCES

The Philippines will continue to strengthen its bilateral supply agreements with other possible suppliers such as Indonesia, Russia, Angola, Kazakhstan, among others. Likewise, it will also conduct vigilant monitoring of the industry through reports from the players for more timely and accurate data on the economy's supply and demand situation.

#### POWER SECTOR REFORMS

##### *Power Market Reforms*

The effective implementation of the Electric Power Industry Reform Act (EPIRA) stands as a major challenge in pursuing at least two critical macroeconomic reforms: a) attaining fiscal stability and b) providing access to power.

In the near term, the newly created Electricity Reform Action Team shall ensure the energy sector compliance to the performance commitments set forth in the EPIRA. Primarily, the Action Team is tasked to address the identified gaps in the law's implementation and build a common database for policy and regulatory purposes among the DOE, WESM and other power corporations. The database will be made available to the Energy Regulatory Commission (ERC) to foster information sharing and the pooling of efforts and resources.

The full commercial operation of WESM starting in Luzon in January 2006 will usher in a newly created electricity industry that will lead to greater efficiency and transparency and eventually, reasonable prices to the consumer. On the other hand, the other remaining EPIRA conditions in promoting open access will be put in place in 2006. This includes the privatization of at least 70 percent of the total capacity output of generating assets of the National Power Corporation (NPC) to the independent Power Producers (IPPs) administrators.

In providing nationwide access to electricity, the DOE will work to achieve total electrification of the economy at the barangay (village) level by 2008. The goal is to attain 98.8 percent electrification in 2007 from the 2004 level of 92.5 percent. The extremely remote and unserved areas will be open for private sector participation to augment government's efforts starting off with the opening of the 14 "First Wave" areas served by NPC-Small Power Utilities Group ( NPC-SPUG). The first 14 areas are set for completion by 2006, with complete roll out of the first three pilot areas in 2005.

##### *Transmission Sector*

Some of the more notable/significant milestones in the transmission (ckt-km) and substation capacity addition projects are the laying of submarine cables and fiber optics for the Leyte-Cebu Uprating Interconnection Project (32 ckm) and XLPE cables underneath the Mactan Bridge for the Cebu-Mactan interconnection Project (8.5 km), all ahead of schedule.

Likewise the 100 MVA Batangas Substation Expansion Project has been energized, while the installation of the substation equipment have been completed at the Bacolod Substation (100 MVA) and Maco (100 MVA) while Maco Substation (100MVA) is due for completion in December 2006.

##### *Wholesale Electricity Spot Market (WESM)*

1. MMS Market Trial Operation Program

The commercial operation of WESM in Luzon is expected to commence in April 2006. From January 2005 to date, more than 50 groups (comprised of power industry participants, government, large consumers, industry associations, consumer groups, and foreign traders) have attended trainings offered by the Philippine Electricity Market Operation (PEMC). As of October 2005, there were 24 full participants and 30 observers in the Trial Operation Program (TOP).

## 2. Development and Implementation of Electronic Fund Transfer (EFT) Facility

On 07 April 2005, the EFT service contract was awarded to Standard Chartered-Banco de Oro. The Contract Signing took place on 06 May 2005 and following the said signing, System Development started covering the following: a) System Development –Collection Side; b) User Acceptance Test (UAT) – Collections and Testing of Interfaces with MMS; c) Variances and Collections and Retests; d) System Development – Payment Side; e) User Acceptance Test (UAT) – Payments and Testing of Interfaces with MMS; and f) Variance and Retesting.

## 3. WESM Commercial Readiness of Trading Participants

A survey on various industry participants' overall readiness towards the commercial operation of WESM was conducted by the Philippine DOE and PEMC on 04 September 2005. The objective of the survey was to see how ready the industry participants especially the electric cooperatives and to formulate an action plan on how to address the problems that may arise that may impede the readiness of the industry participants. To date, the completion of the survey is ongoing.

A Department Circular for the creation of a Task Force to coordinate efforts in relation to the WESM Commercial Operation was approved on 11 November 2005.

## 4. WESM Guidelines, Manuals and Procedures

The PEM Board has approved the following manuals and guidelines pertaining to the operation of the WESM and as required by the WESM Rules:

- a. WESM Market Network Model
- b. WESM Load Forecasting Methodology
- c. WESM Consultation Guidelines
- d. WESM Billing and Settlement Manual
- e. Ancillary Services and Monitoring Manual
- f. Systems Security and Reliability Manual
- g. Management Procedure for Load Shedding
- h. Dispatch Criteria for Must-Run Units
- i. Dispatch Protocol
- j. Administration Price Determination Methodology
- k. Rules Change Manual
- l. Management Procedure During Excess Generation
- m. Emergency Procedures
- n. Constraint Violation Coefficients

## 5. Regulatory Compliance Prior to Commercial Operation

### WESM Price Determination Methodology (PDM)

This was formulated to provide the necessary procedures and methodologies that will give more detailed provisions to the general principles contained in the WESM Rules. The PDM details the specific principles and methodology by which energy and reserves in the WESM will be priced. This was submitted to the Energy Regulatory Commission (ERC) for approval.

### Market Fees

The structure and level of the Market Fees was deliberated upon and endorsed by the interim Rules Change Committee to the PEM. The PEM Board, in turn, will endorse this methodology to the ERC Board for approval. The Administered Price determination methodology specifies the

procedure for the establishment of the administered price that will be used by the Market Operator for the settlement of energy transactions during intervention by the System Operator and suspension of the market by the ERC.

#### Amendments of the WESM Rules

To ensure smooth transition to WESM commercial operations, a continuous review of the WESM Rules is currently being undertaken through the Interim Rules Change Committee and the PEM Board.

Initial amendments were already promulgated by the DOE through Department Circular 2004-07-08 on 107 July 2004. These initial amendments encompass customer forecasting, customer pricing zones, treatment of bilateral trade of energy, and other matters relevant to the pricing and scheduling functions in the WESM.

Other WESM Rules amendments currently being deliberated include clarificatory and additional provisions on market operations, billing and settlements and governance arrangements in the WESM.

#### Transition to Competitive Electricity Market

Under the ADB Loan No. 1984-PHI: Electricity Market and Transmission Development Project, a technical assistance was provided by ADB to DOE to ensure the smooth transition to a competitive electricity market. The project was awarded to the Union Fenosa Soluziona, Spain in association with Mercados Energeticos, Spain. The Consultants' tasks include:

- Set up market administration function of WESM including the development of Market Manuals for Operation;
- Develop appropriate market monitoring indices and provide market monitoring system for market surveillance;
- Develop a Transition Plan from AGMO to IMO
- Study on the appropriate policy and regulatory framework to ensure a sustainable electricity market.

## NATURAL GAS

### Natural Gas for the Power Sector

The existing 2,700 MW installed capacity of gas-fired power plants remains the major user of natural gas produced from the Malampaya gas field in offshore Palawan.

The completion of the transmission line upgrade in early part of 2005, coupled with crude oil price reaching close to US\$60/bbl led to higher dispatch or utilization of the natural gas fired power plants. As a result, consumption of natural gas for the first six month of the year amounted already to 50,242 MMSCF with a total generation of 7,985 GWh of electricity. These factors made natural gas as the primary fuel in the generation mix providing 40 percent of the total generation for the island of Luzon.

### Non-Power Application of Natural Gas

Pursuant to the environmental programs currently being implemented by the government, and consistent with its policy of promoting the use of environment-friendly fuels in the transport sector, the DOE is aggressively promoting the use of CNG in public utility vehicles to address vehicular emissions. The demonstration program on the use of natural gas in the public sector continues to progress as there are already five units of OEM public buses expected to arrive in the economy.

Likewise, DOE's demonstration vehicles from Ashok Leyland and Daewoo consumed a total of 207,581 scf of natural gas supplied mainly by the San Antonio Gas Field of Philippine National Oil Company- Exploration Corporation (PNOC-EC) in Isabela Province.

#### On-Going Infrastructure Program for the Development of the Natural Gas Industry

The Batangas-Manila pipeline projects continue to undergo economic re-evaluation with the government's decision to rehabilitate the retired Sucat power plant for power delivery in 2008. Additional supply of natural gas in the form of Liquefied Natural Gas (LPG) remains a strong option for the immediate expanded use of natural gas. Parties interested in putting up the LNG on their own or in tandem with their own partners in the power generation sector continue to discuss with potential customers and direct buyers. The entry of natural gas in industries will start during the latter part of 2005 as Pilipinas Shell Petroleum Corporation (PSPC) makes use of the fuel in its refinery.

On the other hand, commercial use of compressed natural gas in public utility buses plying Batangas-Manila route is also expected during the last quarter of 2005 with the operation of Mother and daughters refuelling system.

#### Natural Gas Bill

Both Houses of Congress (House of Representatives and the Senate) have refiled their Natural Gas Bills otherwise known as "An Act Ordaining the Development of Downstream Natural Gas Industry; Consolidating for the Purpose All Laws Relating to the Transmission, Distribution and Supply of Natural Gas and for Other Purposes" under the 13th Congress on 20 July 2004 and 30 June 2004, respectively.

### ENVIRONMENTAL MANAGEMENT AND PROTECTION

The pursuit of ISO certificates for the three power plants of the National Power Corporation (NPC) is consistent with NPC's quest for continued improvement for environmental and global competitiveness on their quality, environmental, health and safety management systems.

#### Watershed Management

To ensure productivity of the watershed under its jurisdiction, NPC has implemented various programs and projects such as a watershed rehabilitation, protection and law enforcement, aquatic resources management, community development and extension and infrastructure construction. Such activities were meant to extend services to host communities in pursuit of a harmonious co-existence with residents for sustained power generation.

### RENEWABLE ENERGY DEVELOPMENT

Government's relentless efforts in pursuing expanded use of renewable energy to meet the economy's energy demand bears fruit with the following accomplishments in the sector:

1. Commissioning of the first 25 MW Bangui Bay Wind Power Plant; the first large wind power plant in Southeast Asia.
2. Identification of the 2<sup>nd</sup> Batch of Wind Sites for USAID Anemometers;
3. On-going construction of four additional mini-hydro projects:
  - MW Sevilla Mini-Hydro Project in Bohol
  - 500 kW Loreto Mini-Hydro Project in Dinagat Island
  - 750 kW San Luis Mini-Hydro Project in Aurora
  - 900 kW Cantingas Mini-Hydro Project in Romblon
4. Completed energization of 98 Agrarian Reform Communities under the DOE-DAR Solar Power Technology Support (SPOTS) Phase 1 Project.



5. Commissioning of PV-Wind-Diesel Hybrid System in Sitio Sicud, Barangay Candawaga, Rizal, Palawan.
6. Commissioning of PV-Diesel Hybrid System in New Ibajay, El Nido Palawan.
7. Commissioning of 18 kW Pantikian Micro-hydro Plant in Balbalan, Kalinga under the Japan Grass Roots Grant Aid Program.
8. Launching of the First Wind Contracting Round; completed the packaging of 11 sites to be offered to private investors.
9. Energization of 32 Villages using renewable technologies; completed the bidding for 46 more villages.

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# RUSSIA

## INTRODUCTION

Russia is the largest economy in the world in terms of land area (about 17 million square kilometres). It is located in East Europe and Northern Asia, bordering the Arctic Ocean, between Central Europe and the North Pacific Ocean. Broad plains with low hills west of Urals, vast coniferous forests and tundra in Siberia, and uplands and mountains along the southern border regions, characterise its terrain. It has a vast natural resource base which includes major deposits of oil, natural gas, coal and other minerals. Despite the land area advantage, it is unfavourably located in relation to major sea lanes of the world. Likewise, it lacks the proper climate (either too cold or too dry) for agriculture. The overall population density is low - less than 9 persons per square kilometre, with its northern and eastern regions very sparsely populated. Since 1990 the population declined from 148.4 million to 144.2 million as of 1 January 2004.

After a decade of economic contraction, of about 40 percent compared to the 1990 GDP level, the Russian economy began to grow again at the beginning of 1999, boosted by the stimulating effect of the 1998 ruble devaluation and higher oil prices. Russia's economy is continuing its strong development and achieving the 5<sup>th</sup> year of positive economic recovery, reaching 6.7 percent average growth rate of GDP. GDP in 2003 was estimated US\$1,126 billion (at 1995 purchasing power parity dollars) and the inflation, which remains under the control of the government, was 11.9 percent. The official unemployment rate is about 7.7 percent.

Russia has the world's largest proven gas reserves, 6 percent of the world's proven oil reserves and 15.9 percent of the world's coal reserves. However, formidable obstacles of climate, terrain, and distance have hindered exploitation of these natural resources. The economic potential of hydropower is estimated at 852 TWh per year, while only 20 percent has been developed. Economic reserves of uranium ore comprise about 14 percent of the world total.

Russia is the world's largest exporter of energy, largest exporter of natural gas, the second largest oil exporter (behind Saudi Arabia), the second largest primary energy producer (behind the United States) and the third largest energy consumer (behind US and China).

The energy sector is very important to the Russian economic development. In 2003, it accounted for 25 percent of GDP and approximately 55 percent of the economy's export including oil, petroleum products and natural gas.

Table 31 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	17,075,200	Oil (MCM) - Proven	11,496
Population (million)	144.2	Gas (BCM) - Proven	48,000
GDP Billion \$ (1995 \$ at PPP)	1126.3	Coal (Mt) - Recoverable	157,010
GDP per capita (1995 US\$ at PPP)	7,810		

Source: Energy Data and Modelling Center, IEEJ. \* The BP Statistical Review of World Energy, 2005.

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## ENERGY DEMAND AND SUPPLY

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### PRIMARY ENERGY SUPPLY

Russia's total primary energy supply in the year 2003 was 620.2 Mtoe, making 4.5 toe per capita, the level similar to that of Japan and Korea. This total is broken down to 55.2 percent of natural gas, 20.8 percent of crude oil and petroleum products, 14.5 percent of coal and 9.5 percent others including nuclear and hydro. Russia was the largest net exporter of energy in the world in 2003 with 43 percent of energy production exported. Western and Eastern Europe including Commonwealth of Independent States accounted for 98 percent of Russia's total energy export destinations. Currently, Russia is developing new energy export routes aimed at markets in such APEC economies as USA, China, Japan, South Korea, and Canada.

#### OIL

In 2003, Russia produced 421.3 Mt of crude oil and gas condensate. The net exports of crude and petroleum products totalled 300.3 Mtoe, or 55 percent of crude production and 52 percent of petroleum products production, while 190 Mt crude was processed in domestic refineries.

Currently, the oil industry is highly profitable because of high world oil prices. The main oil province of West Siberia produces some 70 percent of total crude oil and NGL. New prospective oil provinces are located in the Timano-Pechora region, East Siberia, the Far East and North Caspian and North Arctic offshore.

#### NATURAL GAS

Natural gas production in 2003 reached 620 BCM. Net exports accounted for 189 BCM or 30 percent of production. About all of natural gas exports are destined to West and Central Europe, including Turkey, with small amount pumped to Transkaukasian states - Armenia, Azerbaijan and Georgia.

Since the 1990s natural gas production has exceeded the rate at which reserves are discovered. This is mainly due to insufficient investment in exploration. New resource bases are located in remote regions without the necessary infrastructure to start upstream operations. Such areas are the Barents Sea offshore (Shtokman field), East Siberia (Kovykta), Yakutia (Chayanda) and Sakhalin offshore.

The East Siberian and West Yakutian gas fields belong to the ancient sediments and along with central US, this region contain the world's largest reserves of helium in natural gases.

#### COAL

In 2003, Russia produced 274.8 Mt of coal, or 7.6 percent more than in the previous year. Hard coal contributed most of the production (about 75 percent of total production), with lignite filling the balance. Net export of coal in 2003 amounted to 21.7 Mtoe, or 17 percent of production.

The main coal production areas are located in the Asian Part of Russia - the Kuznetsk and Kansk-Achinsk regions. Prospective coal basins have been found in more remote areas of Eastern Siberia, South Yakutia and the Far East. The government envisions a greater role of coal in national energy balance, particularly in power generation.

#### ELECTRICITY

Russia produced 912.3 TWh of electricity in 2003, of which 66 percent was produced from fossil fuels (gas, coal and fuel oil), and almost equally 17 percent by hydro and nuclear energy.

There is significant untapped hydro energy potential in the Asian part of Russia. Hydropower performs an important function to regulate peak loads in the unified power grid. The largest stations and the most prospective resources are located in southern Siberia; however, the capital costs of new hydro are prohibitively high. Russia hopes to complete construction of some of the

large hydros in the next 10 years namely: the Boguchanskaya station in East Siberia; Bureya, Ust'-Srednekanskaya; and Vilyi stations in the Far East.

In 2003 Russia operated 31 nuclear reactors with an installed capacity of about 22.7 GW. Most of these reactors are located in the European part of Russia.

Table 32 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	1 086,633	Industry Sector	152,289	Total	912,296
Net Imports & Other	-466,464	Transport Sector	78,914	Thermal	603,901
Total PES	620,168	Other Sectors	187,173	Hydro	157,720
Coal	90,400	Total FEC	418,375	Nuclear	150,342
Oil	129,140	Coal	42,836	Others	332
Gas	342,600	Oil	62,812		
Others	58,028	Gas	123,736		
		Electricity & Others	188,991		

Source: Energy Data and Modelling Center, IEEJ.

For full detail of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

### FINAL ENERGY CONSUMPTION

In 2003, total final energy consumption in Russia was 418 Mtoe, an increase of about 0.2 percent compared with the previous year. By sector, industry had accounted for 36.4 percent share, transport for 18.9 percent and other sectors for 44.7 percent. By fuel shares, coal accounted for 10.2 percent, petroleum products 15.0 percent, natural gas 29.6 percent and electricity, heat & others 45.2 percent. The most important energy use is for space heating, comprising about 40 percent of total final consumption due to the extreme cold climate.

Russia's final energy intensity is the highest among APEC economies, a clear sign of inefficient energy use in the national economy. The traditional energy intensive industrial structure with its aging capital stock has not changed greatly, due to the lack of investment. Structural shifts to less energy intensive services and high technology industries are considered as a major policy direction to encourage energy savings, along with energy efficiency measures in existing industries. According to various estimates, Russia has an untapped energy savings technical potential of 35 - 45 percent of total energy consumption.

### POLICY OVERVIEW

#### ENERGY STRATEGY UP TO YEAR 2020

One of the milestones in Russia's energy sector development is the adoption of the Energy Strategy of Russia to 2020, which was approved by the Federal Government in August 2003. The document identifies the main directives of the country's long-term energy policy. As stated in the Strategy, "the natural fuel and energy resources and industrial, scientific, technological and human resources potential of the energy sector is Russia's national wealth. Its effective use should create necessary conditions for sustainable economic development of the country improving the welfare and living standards of the people". The Energy Strategy of the Russian Federation to the year 2020 is the document which contains the system of principles and priorities of long-term state energy policy and mechanisms of its realization.

Main priority of Energy Strategy of Russia is to improve energy efficiency using state interference on the energy market. Among others instruments there are: energy pricing policy, tax and customs policy. Russia will also perform institutional and organizational reforms in the fuel and energy sector by improving its legislative and regulatory policies.

Main pricing policy includes:

- Gradual expansion of the application of market pricing for fuel and energy in the internal energy markets
- Provision for financial stability and investment attractiveness of fuel and energy enterprises

Another key factor in Russia's energy policy is its participation, as the large supplier of energy resources, in improving the international energy security. To achieve these objectives, Russia has adopted the following strategic initiatives:

- modernization and construction of port terminals to enhance export shipments of energy resources
- development of the trunk oil and gas pipelines system
- development of a close nuclear fuel cycle and nuclear power generation
- development of new oil and gas bearing provinces, and
- creation of bulk oil and gas export routes to the economies in the Asia-Pacific region.

### **MARKET LIBERALISATION**

During the transition period, the government is keeping control over the tariff-setting policy for natural monopolies services. The Federal Tariff Service is authorised to set maximum allowable regional natural gas, electricity and centralized heat tariffs. In October 2005 correlation for per energy unit producer's price for oil, fuel oil, steam coal and natural gas was 1-0.9-0.2-0.1 respectively.

Oil and coal markets in Russia have been deregulated since the 1990s. Oil industry consists of 10 large companies that produce about 90 percent of crude oil in Russia, and some 300 small-scale enterprises producing the remaining 10 percent. Operators of three Production Sharing Agreements make less than 0.5 percent. There is no state control on petroleum prices except under the Federal Antimonopoly Supervision Agency.

Refining sector is controlled by 8 vertically integrated oil companies leaving 20 percent share of this market to 8 large and some 40 small independent refineries.

Federal Government will remain the key shareholder in economy's gas monopoly, Gazprom, despite its IPO in 2006. Independent companies reach 15 percent share in Russian gas production. Access for independent producers to Gazprom's gas transportation system as well as wholesale gas prices is regulated by a special Federal Government Decree.

The coal sector has been restructured since 1996, when the state coal monopoly was privatised. Quantitative export restrictions have been removed and no export quotas exist. Coal is the single largest commodity transported by Russia's railway network, accounting for over 27 percent of the economy's rail freight. The geographical size of Russia's vast economy requires the haulage of coal over long distances; therefore, it is extremely important to set up freight rates that are competitive to allow coal to maintain its share in the energy mix. Rail tariffs were relatively cheap in the past; however there has been a significant increase in rail freight rates due to the restructuring in the railway industry. Although domestic price controls have been removed, many coal producers fight to compete with low natural gas prices. Foreign ownership in the Russian coal sector is practically nonexistent.

Market liberalisation is a strategic direction for power industry development. One of the main issues is the gradual move from state-regulated energy pricing to free market regulation. The urgent

problem to resolve is the introduction of a regulation for the retail electricity market and issuance of Federal Government guarantees for investments into new generation capacities and supply reliability facilities construction. In December 2005, the Federal Government has approved investments mechanisms which lead to the development of its technological reserve capacity. Thermal electricity generation and distribution networks are expected to be privatised, while the hydro, nuclear and backbone transmission grids will remain under the state's control.

Free electricity trade market was launched on 1 November 2003 within the framework of the Federal Wholesale Electricity Market (FOREM). After just two years, there was already 174 players on the two-sectional market (Europe and Siberia), and the free trade volume exceeded 11 percent of total electricity generation for European section and reached 3 percents for Siberia. In October 2005, the real-time capacity balance trading started for both European and Siberian sections. A new model for wholesale electricity trading, based on a long-term contract scheme, is expected to be introduced in year 2006.

### **ENVIRONMENTAL POLICY**

Russian President V.V. Putin has signed the bill ratifying Russia's accession to the Kyoto Protocol on 5 November 2004, effectively enforcing the Protocol in Russia. This decision reconfirmed Russia's strong commitment in addressing climate change and to working with the international community in dealing with this global problem. After Russia's ratification and approval of the treaty, the Kyoto Protocol went into affect on 16 February 2005.

One of major concern for world energy development is nuclear safety. Some economies have no large-scale plans for development of national nuclear energy and, accordingly, do not require new energy fuel - recycled products of spent nuclear fuel (SNF) processing. The Russian Federation, however, as the USSR did before, uses another approach, based on the so-called "Fast Breeder Reactor" technology.

Russia adopted the concept of "the closed fuel cycle" with SNF processing and obligatory return of fission nuclear materials to a fuel cycle. That concept improved the technological side, global environment protection and safety. The adoption of closed fuel cycle was announced in the initiative of the President of the Russian Federation at "Summit of Millenium" in the United Nations, in September 2000. To provide legal framework in managing nuclear wastes, amendments to the Environment Protection Law and Nuclear Energy Utilization Law were made in June 2001. The amendment allows treatment of other country's SNF and permanent storage of nuclear waste in Russia.

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### **NOTABLE ENERGY DEVELOPMENTS**

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#### **GAZPROM MOVES TO BECAME GLOBAL GAS SUPPLIER**

In September 2005 Gazprom shortlisted five companies to participate and compete in the Shtokman offshore gas extraction and the 15 million ton LNG production project in Arctic's Barents Sea. The final list is expected to be released in March 2006.

The first LNG tanker from Russia arrived in September 2005, at a receiving terminal in Cove Point, Maryland through a swap deal with Royal Dutch Shell. Earlier in July, Gazprom had signed a memorandum of understanding over an asset swap between the two companies. It was agreed that Shell will give Gazprom a 25 percent stake in its Sakhalin-2 natural gas project, in return Gazprom will grant Shell access to the giant Zapolyarnoye-Neocomian field in West Siberia.

In September 2005, Russia and Germany had finalized an agreement to build the Northern Europe Gas Pipeline (NEGP) underneath the Baltic Sea, directly connecting Russia's natural gas production with German consumers by 2010. The consortium with Germany's EON and BASF has discussed about eventually extending the system to the Netherlands and the United Kingdom.

Official opening of “Blue Stream” under sea gas pipeline across the Black Sea in November 2005 was attended by Presidents of Russia, Italy and Turkey.

Also in September, the state-owned Gazprom signed off a deal to purchase a majority control of the Russian oil company Sibneft. The combined company will produce about 10 percent of Russia's total crude oil and 85 percent of natural gas production. Gazprom finalised the Programme for development of East Siberian and Russian Far East gas industry in order to establish an international gas pipeline market in the East Asian region. In December 2005 President V.V.Putin signed a decree liberalising the stock trade of Gazprom shares. Gazprom IPO is expected in the middle of 2006.

### **SAKHALIN ISLAND OIL AND GAS FIELDS DEVELOPMENT**

New offshore platform, called the Orlan was completed in July 2005 and will be used to develop Chayvo, one of the main oil and gas fields of Sakhalin 1 production sharing agreement. In October, ExxonMobile under Sakhalin 1 PSA started its oil and natural gas production. Earlier in September another PSA Sakhalin 2 operator, Sakhalin Energy announced changes for the second stage of the project, increasing investments to US\$20 billion from previous US\$12 billion.

### **DOMESTIC REGULATION BECAME CLOSER TO INTERNATIONAL STANDARDS**

Federal Government has set the scheduled implementation for EURO gasoline and diesel fuel standards in Russia. EURO-2 will come into force starting July 2006, EURO-3 from January 2008, EURO-4 from January 2010, and EURO-5 from January 2014.

The Ministry of Natural Resources has approved a new classification of oil and gas reserves, approaching the United Nations Framework Classification for Fossil Energy and Mineral Resources (UNFC) and compatible with WPC/SPE/AAPG reserve classification. It will come into force in 2009.

### **EAST OIL PIPELINE PROJECT**

Also in November 2005 the Federal Government started the discussion on the design and construction of oil trunk line and pipelines from Eastern Siberia to the Pacific coast. It was proposed that the first stage for the 30 mtpa capacity will stretch from Taishet in Irkutsk region to Skovorodino on Baikal-Amur railway. Simultaneously, loading facilities should be constructed on the Pacific coast to deliver Siberian oil to the Asian-Pacific market.

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# SINGAPORE

## INTRODUCTION

Singapore is an island nation, situated in Southeast Asia at the intersection of the Straits of Malacca and the South China Sea. Singapore's neighbour to the north is Malaysia and its neighbour to the south, east and west is Indonesia. Singapore has a total land area of 699.0 square kilometres and a population of about 4.24 million (2004 figure). Despite its small size and population, Singapore is one of the more highly industrialised and urbanised economies in the Southeast Asian region.

A highly developed and successful free market economy, Singapore is a remarkably open and corruption-free environment, with stable prices and high per capita GDP. In 2003, real gross domestic product (GDP) was US\$87.2 billion and per capita GDP was US\$20,514 (both in 1995 US\$ at PPP). The economy depends heavily on exports, particularly in electronics and manufacturing (including consumer goods, chemicals and mineral fuels). Major industries include electronics, chemicals, financial services, oil drilling equipment, petroleum refining, rubber processing and rubber products, processed food and beverages, ship repair, offshore platform construction, life sciences, etc. Its major trading partners are Japan, Hong Kong, Malaysia, US, and the EU. Because of its strategic location on the Straits of Malacca, Singapore serves as an important shipping centre and host to a large petroleum refining industry. Singapore however does not have its own energy resources and relies entirely on imports to meet its energy requirements.

Table 33 Key data and economic profile (2003)

Key data		Energy reserves	
Area (sq. km)*	699.0	Oil (MCM)	-
Population (million)	4.24	Gas (BCM)	-
GDP Billion US\$ (1995 US\$ at PPP)	87.18	Coal (Mt)	-
GDP per capita (1995 US\$ at PPP)	20,514		

Source: Energy Data and Modelling Center, IEEJ. \* Singapore Department of Statistics.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

Singapore is a net energy importer. Its domestic energy supply depends on imported oil and gas. In 2003 Singapore imported S\$30,191 million of oil. More than half of the oil imports around S\$25,388 million was re-exported as refinery products, while the rest was retained for domestic consumption. Oil accounted for 83 percent of the domestic supply, 16 percent was gas, and the remainder was coal and others. The four-fold increase of gas share in energy supply, from 5 percent in 2000 to 16 percent in 2003 was mainly due to gas imports through pipeline from Indonesia.

Singapore's electricity demand grew at an average annual rate of 5.96 percent from 1995 to 2003 and is expected to grow from 3 to 5 percent per annum from 2003 through 2013. The amount of electricity consumed in 2003 was 35,331 GWh. The total installed generation capacity of electricity in 2003 was 8,919 MW using mainly natural gas and fuel oil. By plant types, Singapore installed generation capacity consists of 52.7 percent steam plant, 29.9 percent combined cycle plant, 10.8 percent cogeneration plant, 5.2 percent gas turbine and 1.5 percent incineration plant. At the end of 2003, gas contributed to 60.8 percent of Singapore's electricity production. Gas share is expected to increase to 70 percent of the total fuel used in electricity generation.



## FINAL ENERGY CONSUMPTION

In rough terms, the industrial and transport sectors each account for about two-fifths of final energy consumption, while the residential and commercial sectors account for somewhat less than one-fifth. About three-quarters of final consumption are in the form of oil fuel, mostly for transport and industry, while about a quarter is in the form of electricity.

Singapore's final energy consumption increased by 2 percent, from 11,270 ktoe in 2002 to 11,501 ktoe in 2003. The growth achieved is a reflection of the recovery from the adverse impact of the SARS epidemic.

Table 34 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)*		Final Energy Consumption (ktoe)*		Power Generation (GWh)*	
Indigenous Production	123	Industry Sector	5,409	Total	35,331
Net Imports & Other	44,439	Transport Sector	4,251	Thermal	33,897
Total PES	20,035	Other Sectors	1,591	Hydro	-
Coal	8	Total FEC	11,501	Nuclear	-
Oil	16,618	Coal	-	Others	1,434
Gas	3,285	Oil	8,644		
Others	123	Gas	106		
		Electricity & Others	2,751		

Source: \* Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

## POLICY OVERVIEW

### PRICING

Singapore pays great attention to ensuring that its energy market is robust, competitive and reliable. In the absence of alternative energy resources, the economy has to rely on imported fuel. Hence, the energy policies are set to ensure competitive market structures, open access to energy infrastructures for all players, and ensure diversity in energy sources. There are no price subsidies in Singapore. Energy prices are allowed to reflect international market to ensure that energy is used efficiently. Electricity tariffs are periodically reviewed to reflect the actual economic costs. Prices for other fuels, such as piped gas and petroleum products, are determined by the individual private suppliers and reflect international market price. Many reforms have been introduced to increase competition in the natural gas and electricity markets.

### ENHANCING RELIABILITY AND SECURITY

After experiencing a major power shortage due to gas supply disruptions, reliability of electricity supply has become a critical concern for Singapore's electricity market. The generation companies have been incentivised to take measures to improve reliability. Measures taken included: 1) investing in dual source gas feeds to generate power plants and 2) improving the systems so that they can switch from gas to diesel in the event of a prolonged gas disruption. Liquefied Natural Gas (LNG) imports have been considered as a long term option for fuel supply reliability and security.

To enhance its gas security and ensure that there is adequate supply to meet the economy's future demand, Energy Market Authority (EMA) has moved to consider added diversification of gas supplies from non-traditional sources. Singapore currently has a plan to import LNG to be

used as a back-up fuel in the event of a disruption of piped gas imports. Tokyo Gas Engineering Co. Ltd was appointed to conduct a feasibility study into the business, financial and technical aspects of importing LNG. The study will identify suitable sites to construct the LNG terminal. If found feasible, LNG imports will enhance not only the reliability and security, but also the opportunity to develop a gas trading market in the future.

### ENERGY EFFICIENCY AND RENEWABLE ENERGY

Singapore is reliant principally on fossil fuels to meet the economy's energy demand. To date, there are no renewable energy sources that Singapore could harness in an economically viable way to reduce its reliance on fossil fuel. However, the Energy Market Authority (EMA) is now continuing to look into ways to diversify the sources of energy. Natural gas has been first introduced in lieu of fuel oil in power sector. To switch from fuel oil to natural gas has not only reduced carbon dioxide emission, but has also helped reduce energy consumption and achieve cost saving. To date, more than 60 percent of electricity is generated from natural gas with the adoption of highly efficient generation technologies such as combined cycle gas turbines, which increases generation efficiencies from the 35 percent to 45 percent.

In the energy end-use sector, the programme to improve the energy efficiency in the transport, manufacturing, consumer and building sectors are implemented. For the transport sector, a package of incentives for Compressed Natural Gas (CNG) vehicles has been implemented. For instance, tax and Additional Registration Fee (ARF) rebates are given to all new Euro 4 diesel engines and CNG vehicles. For households, the Energy Efficiency Labelling scheme has been introduced to guide consumers choose energy-efficient appliances. The "Energy Smart Building" label will also be recognised for the buildings that are designed and constructed to better manage and take control of their energy performance.

Solar thermal energy for hot water is already being implemented commercially in several hotels, large food-catering facilities and some private homes. However, commercial photovoltaic technologies are still costly and have low energy yields. Singapore hopes that renewable technologies can be implemented in the future in the entire island through new technological advances that can drive down the cost of generation and improve energy yields.

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### NOTABLE ENERGY DEVELOPMENTS

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#### FURTHER DEREGULATION OF THE ELECTRICITY INDUSTRY

The vertically integrated and government-owned electricity industry in Singapore begun its first reform in October 1995 to introduce competition in electricity generation and supply. Under the restructured framework, the generation and retailing sectors are separated from transmission and distribution businesses at the ownership level. The second phase of reform was implemented when the Singapore Electricity Pool (SEP) came into operation in April 1998; to facilitate trading of electricity under a competitive environment. In April 2001, The Energy Market Authority (EMA) was set up to be the regulator for the electricity and gas markets in Singapore. To further enhance competition and market efficiency, a new electricity wholesale market has been developed to replace the existing Singapore Electricity Pool. It started operation in January 2003.

As for the retail market, consumers are given an option to purchase electricity either from a licensed retailer, directly from the wholesale market or buy directly from the wholesale through SP services Ltd. Liberalisation in the retail market is being implemented in phases. **Phase 1** involves consumers with average monthly consumption of 20,000 kWh and above; this was completed in September 2003. **Phase 2** comprised of consumers with an average monthly consumption of 10,000 kWh and above; this commenced on 21 December 2003. The remaining consumers, mainly households, are included in **Phase 3**; this is currently being studied on how to introduce Full Retail Contestability.

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## STRUCTURAL REFORM IN THE GAS INDUSTRY

The gas industry in Singapore began its first restructuring when the Gas Act was passed in 2001. Under the framework, competitive business of gas importation and retailing are unbundled from the monopolistic business of gas transportation in the form of legal separation. The gas transmission and distribution network is owned by a gas grid company, giving an open access to all players.

PowerGas Ltd, formerly an integrated gas company, had divested its gas import and retail businesses in January 2002 to the government's holding company, Temasek Holdings. With the divestment, PowerGas will ultimately become the monopoly gas transporter and own Singapore's entire gas pipeline network. The process of restructuring to bring the gas industry under regulation is in progress. EMA also plans to implement by the end of 2005 the Network Code to ensure the fair and non-discriminatory on open access.

## ENERGY DIVERSIFICATION AND EFFICIENCY

Singapore imports gas from Malaysia and Indonesia. The gas is mainly used for power generation; 60 percent of Singapore's electricity is being generated from gas. It is envisaged that Singapore will need more gas in the future as it is a more efficient fuel than fuel oil. To enhance its gas security and to ensure that there is adequate supply to meet future demand, the Energy Market Authority is now exploring the possibility of importing Liquefied Natural Gas (LNG). The feasibility study of importing LNG as an option to further diversify the sources of natural gas has been carried out. The study will look into the business, financial and technical aspects of importing and recommend the most efficient and cost effective method for its implementation as well as the suitable site(s). The feasibility study is expected to be completed by the end of 2005.

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# CHINESE TAIPEI

## INTRODUCTION

Chinese Taipei, consisting of the islands of Taiwan, Penghu, Kinmen, Matsu, and several islets, strategically located in the middle of a chain of islands stretching from Japan in the north to the Philippines in the south, and only 160 kilometres off the south eastern coast of the China, is a natural gateway to East Asia.

Chinese Taipei has an area of about 36,006 square kilometres. With a population of about 22.5 million in 2003 and 22.6 million in 2004, it is one of the most densely populated areas in the world. Only one quarters of the land is arable and the subtropical climate permits multi-cropping of rice and growing of fruit and vegetables all year round. However, in the structure of domestic production, services sector was 66.9 percent, industrial sector was 31.3 percent and the agricultural sector accounted only 1.8 percent in 2003. For 2004, services sector was 68.7 percent, industrial sector was 29.5 percent and the agricultural sector was 1.7 percent.

Chinese Taipei sustained high levels of economic growth, averaging 6 percent per year, between 1980 and 2003. The economy slowed substantially in 2001, but real GDP growth recovered to 3.9 percent in 2002, 3.3 percent in 2003 and 5.7 percent in 2004. The GDP reached US\$356 billion in 2003. GDP per capita was US\$15,784 in 2003.

Contrary to the more than 1.2 million of population growth in the past fifty years, there was still an increase of population in recent years, but at a relatively mild speed. The annual growth rate of population was 1.1 percent from 1980 to 2003 and it was 0.41 percent from 2003 to 2004. The development of urbanization has seen to low down as well. The annual growth rate of urbanization from 1980 to 2003 was 1 percent, but it was 0.46 percent between 2003 and 2004.

Chinese Taipei has very limited domestic energy resources and relies on imports for most of its energy requirements. Oil reserves are 0.44 MCM and coal reserves are 1 Mt. Gas reserves are around 9 BCM. In 2003, electricity generation capacity totalled 40,102 MW.

Table 35 Key data and economic profile (2003)

Key data		Energy reserves**	
Area (sq. km) *	36,006	Oil (MCM) – Proven	0.44
Population (million)	22.54	Gas (BCM)	9
GDP Billion US\$ (1995 US\$)	355.68	Coal (Mt) - Recoverable	1.03
GDP per capita	15,784		

Source: Energy Data and Modelling Centre, IEEJ

\* Directorate General of Budget, Accounting and Statistics, Executive Yuan, Taiwan

\*\* Bureau of Energy, Taiwan

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

The total primary energy supply has grown greatly from 25.1 million tons of oil equivalent (Mtoe) in 1980 to 92.6 Mtoe in 2003, with annual growth rate of 5.8 percent. The structure of total primary energy supply in 2003 is 44 percent of oil, 36 percent of coal, 11 percent of nuclear power and 8 percent of natural gas. Chinese Taipei has very limited domestic energy resources and relies

on imports for most of its energy requirements. If excluding nuclear fuel, around 98 percent of energy needs were imported, including most of the natural gas and nearly all of the oil and coal.

For Chinese Taipei, coal is used for electric power generation as well as for the steel, cement and petrochemical industries. Coal production totalled more than five million metric tons annually from 1964 to 1968. Thereafter, production tapered off due to increasing competition from imported coal and spiralling local production cost that were the result of increasingly difficult mining condition. Coal has been totally imported from foreign countries since 2001, mainly from Canada, Indonesia and Australia. In 2003, 54.7 million tons were imported. In order to secure a stable supply of coal, exploration and development overseas on a joint venture are being pursued.

In 2003, Chinese Taipei's current annual indigenous crude oil production is 45.8 thousand KL (0.1 percent), compared to total crude oil supply of 51,783 thousand KL. Seventy nine percent of Taiwan's crude oil imports came from the Middle East, though West African countries also are important suppliers. To ensure against a supply disruption, Chinese Taipei's refiners are required by the Petroleum Administration Law to maintain stocks of no less than 60 days of sales volumes.

Chinese Petroleum Corporation (CPC), Taiwan's state-owned oil company, is the dominant player in all sectors of the country's petroleum industry, including exploration, refining, storage, transportation, and marketing, with the capacity of 770,000 bbl/d. However, significant competition began in July 2000 with the opening of a refinery at Mailiao, with the capacity of 450,000 bbl/d; owned by Formosa Petrochemical Company (FPC), a subsidiary of the private Taiwanese petrochemical firm Formosa Plastics Group.

Prior to the construction of the FPC Mailiao refinery, Chinese Taipei imported a significant quantity of refined petroleum products. Now the economy's refining capacity exceeds its domestic consumption of petroleum products, making it a net exporter. Three refineries, Tañin, Kaohsiung and Taoyuan, are all owned by CPC. Total refining capability in Chinese Taipei has reached 1,220,000 bbl/d; exceeding the local demand of petroleum product. Both of them will export their surplus oil to adjust the market situation.

CPC is responsible for Chinese Taipei's natural gas exploration, production and imports. Chinese Taipei had net imports of 7,300 million cubic meters of liquefied natural gas (LNG) in 2003, compared with 831 million cubic meters of indigenous natural gas production. Indonesia and Malaysia are Chinese Taipei's two LNG suppliers.

CPC operates Chinese Taipei's only LNG receiving terminal at Yungan, Kaohsiung, with the handling capacity of 7.44 million tons per year. In order to supply 1.68 million tons of natural gas to the Taiwan Power Company's (Taipower) Datan Power Station by the end of 2007, CPC is carrying out the construction of an LNG receiving terminal in Taichung. An agreement has been signed with Qatar's RasGas for LNG supplies. This procurement signifies a long-term stable energy source through a new diversified fuel sources. It is also expected to comparatively reduce carbon dioxide emissions.

On 13 February 2001, Chinese Taipei's legislative and executive departments signed an agreement, publicly proclaiming that the future planning of the country's overall energy development should, on the premise of maintaining a constant and sufficient supply of energy, take into account such relevant factors as national economy, social development, world trends, and the spirit of international trends, so as to achieve the country's ultimate goal of building a "Non-Nuclear Homeland". Nevertheless, two advanced light water reactors in the Fourth Nuclear Power Project, 1,350 MW each, are under construction and will be scheduled for commercial operation in July 2006 and 2007, respectively. At the current environment, this nuclear power plant maybe the last one to be built in Chinese Taipei.

Chinese Taipei's total hydro potential is estimated at 5.15GW. Up to now, there were 49 hydro plants developed, with capacity of around 2.14GW, excluding the two pumped storage plant (2.6GW). There is still an undeveloped capacity of about 3.01GW for Hydro and 9.6GW for pumped storage. However, there are still concerns about the building of hydro plant might have negative impacts to the environment.

In order to effectively promote renewable energy and respond to the requirements of the private sector for institutionalised incentive measures, Chinese Taipei has proposed a “Renewable Energy Development Bill”. With the Bill, it is hoped that electricity from renewable resources will be able to make up over 12 percent of the total electricity generation capacity.

The renewable energy development plan, which was approved by the executive Yuan on 1 January 2002 will lead to concerted efforts by all levels of government, as well as the general public, to develop renewable energy and to aggressively adopt its use. Taipower has already planned to install 60 units with a total capacity of 100.8 MW, which would be implemented from 2004 to 2005.

Taipower, the state-owned electric power utility, currently dominates Chinese Taipei’s electric power sector. However, Taipower’s monopoly status technically ended after 1994 when a measure allowed independent power producers (IPP’s) to provide up to 20 percent of Chinese Taipei’s electricity. IPPs are required to sign power purchase agreements with Taipower, which distributes power to consumers. To expand foreign participation, the government decided in January 2002 that foreign investors permitted to own up to 100 percent of an IPP. The MOEA reviews applications on a case-by-case basis.

In 2003, total installed capacity reached 40,102 MW, of which 76.01 percent was thermal, 12.26 percent was nuclear, and 10.73 percent was hydropower. IPP consisted of 17 percent of the total capacity. Taipower retains exclusive control over nuclear and hydropower plants. Taipower currently has 5,144 MW of nuclear generating capacity at 3 plants (Kuosheng and Chinshan stations in the north and Maanshan station in the south). The Chinese Taipei produced 209,000 GWh of electricity in 2003 with 78 percent coming from thermal plants, 19 percent from nuclear power, 3 percent from hydropower.

Table 36 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	11,432	Industry Sector	35,892	Total	209,051
Net Imports & Other	81,147	Transport Sector	12,914	Thermal	163,267
Total PES	92,579	Other Sectors	13,506	Hydro	6,895
Coal	33,675	Total FEC	62,312	Nuclear	38,890
Oil	40,962	Coal	9,232	Others	-
Gas	7,214	Oil	35,764		
Others	10,728	Gas	1,687		
		Electricity & Others	15,628		

Source: Energy Data and Modelling Center, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

### FINAL ENERGY CONSUMPTION

In the past two decades, with the fast economical growth and the upgrading of living standard, the final energy consumption increased dramatically. The total final energy consumption has increased greatly from 17.0 million Mtoe in 1980 to 62.3 Mtoe in 2003, with annual growth rate of 5.8 percent. When classified by consumers in 2003, the consumption structure of each sector was as follows: industrial sector 57.6 percent, transportation sector 20.7 percent, and other sectors 21.7 percent. When classified by form of energy in 2003, oil is the dominant fuel, accounting for 57 percent of energy consumption. Electricity accounted for 25 percent of energy use, coal for 15 percent and gas for just 3 percent.

The industrial sector has been the primary energy consumer, but its structure in the total consumption has been declining according to the adjustments of industrial structures and the popularity of transportation vehicles. The consumption of the transportation sector has also increased significantly, due to the rise in national income and improvement of transportation

system, including the common usage of various transportation vehicles. The consumption of commercial and residential sectors has grown for the upgrading of living and the expansion of the tertiary industries.

Oil and oil products are the dominant player in meeting the energy demand, but after the second energy crisis, Chinese Taipei had been dedicated to the diversification of energy sources, which had brought down the percentage of oil and oil products in the energy consumption structure ever since. When Chinese Taipei started the import of liquefied natural gas in 1990 to compensate the limited indigenous natural gas resource, the use of natural gas in consumption has been stable, but only with a small promotion in the total energy consumption. The electricity has become the most important energy in the total energy consumption. With the improvement in living standard, technological progress and innovations in electrical appliances, the electricity consumption steadily increased.

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## **POLICY OVERVIEW**

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The Energy Commission, which was established in 1979 under the Ministry of Economic Affairs (MOEA), was legalized and became an Energy Bureau when the Constituent Act of the Energy Bureau was promulgated in January 2004. The Bureau took over the role of Energy Commission to formulate and implement national energy policy. It is also charged with carrying out the Energy Management Law and the Electricity Law. It regulates natural gas utilities, petroleum and LPG filling stations, and the importation, exportation, production and sale of petroleum products. It maintains an energy database, evaluates energy demand and supply, and promotes energy conservation. Further, it implements research and development programmes and promotes international energy cooperation.

The ultimate goal of the Chinese Taipei Energy Policy is to promote energy security, supported by secure import of oil, gas and coal as well as the development of domestic energy resources, nuclear, fossil fuel and new and renewable energy. For environmental reason Chinese Taipei plans to triple LNG consumption by 2010. To increase efficiency of its energy sector, Chinese Taipei promotes privatisation of energy market.

## **STABILITY OF ENERGY SUPPLY**

More than 98 percent of energy is imported to Chinese Taipei. The stockpiling policy is an important means to the stability of energy supply in the economy. In addition to the 60 days of oil stockpiles in the private companies, the Bureau of Energy (BOE), Ministry of Economic Affairs, is required to have 30 days oil stockpile of average daily consumption. After the oil market was liberalized, there is an over-supply of oil products domestically. As a result, there are surplus storage facilities available and oil stockpile should lease the surplus storage tanks owned by domestic oil firms. The Natural Gas Business Law, now under scrutiny by the Legislative Yuan, is considering taking into account the natural gas storages for consumption requirements. The incentives for reserve margin of power generation capacity are placed in the transfer price mechanism between Taipower and IPP operators.

## **ENERGY MARKET REFORMS**

The liberalisation and privatisation of energy-related enterprises has been promoted in recent years to let the private sector build power plants and oil refineries, promote transparency in domestic fuel prices and electricity rate adjustments, strengthen the management of energy supply and demand, and address energy-related environmental impacts.

In electric power markets, wholesale competition was established in 1995 when independent power producers were allowed to invest in generating facilities and sell their output to Taipower, the integrated state electric utility. Retail competition and unbundling of Taipower's generating assets from its transmission and distribution assets are proposed in a new electricity law.

The Petroleum Management Law was passed in Chinese Taipei, which had liberalized the oil market. The law for natural gas is under scrutiny and the law for electricity had been drafted but suspended from legislation procedures. The progress of privatization for the two largest state-owned enterprises (Chinese Petroleum Corporation and Taipower) had been on hold for many years. With no clear regulations setup in gas and electricity market, and with the two biggest players in the energy market still owned by government, the energy market in Chinese Taipei is still far from a free market. In order to encourage private investors to get into the energy market, the laws and the execution of privatizations in the state-owned companies should be put into practice.

### **POLICY OF NO NUCLEAR HOMELAND**

One major controversy is the concerns on the future role of nuclear power. Taiwan's Democratic Progressive Party government came into office in early 2000 and had raised the question of what to do about the fourth Kungliao nuclear power plant and claim for the Policy of Non-nuclear Homeland. The Executive Yuan announced the resumption of construction of the Fourth Nuclear Power Plant on 14 February 2001 after the ruling of the Council of Grand Justice over the constitutionality of the decision and negotiations between the Executive Yuan and Legislative Yuan. These two advanced light water reactors in the Fourth Nuclear Power Project, of 1,350 MW each, are scheduled for commercial operation in July 2006 and 2007 respectively. After that, the current government does not plan to support any additional nuclear generating capacity in the future.

### **CO2 EMISSIONS AND ENERGY MIX**

The high cost of LNG and the need for overseas transportation, storage and pipeline facilities limit the use of gas as a low-cost entrant fuel for the electricity market that brings with it environmental improvements. With Chinese Taipei being densely populated, the construction of new transmission and distribution lines is increasingly difficult. The renewable energy is relatively costly and can only play a small portion in the primary energy supply. Hydro plant reservoirs are used for irrigation, flood prevention and scenic beauty, as well as power generation. The government is considering retaining ownership since it believes proper regulation secured by legislation is necessary. Chinese Taipei maintains cheap electricity prices to customers and has not raised these for more than a decade. In order to meet the future electricity demand growth, from both CO2 emission and cost effective concern, leaves Chinese Taipei without many options but to turn to coal and natural gas for power generations.

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### **NOTABLE ENERGY DEVELOPMENTS**

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#### **CONSTITUENT ACT OF THE ENERGY BUREAU**

Chinese Taipei has passed the “Constituent Act of the Energy Bureau, MOEA” in January 2004 to cope with the liberation of energy enterprises and effectively speed up implementation of the energy policy.

The Act finalized the legalization process as a supervision Bureau of the overall energy affairs, which had existed as “Commission” status for years prior to legislation. It is important that the Act provides a Legal Framework for the liberalization of petroleum, natural gas and electric power industries, which has been regulated since the overall status and implementation of the codes in regulating energy industries have become current issues in meeting with global situation.

As usual, the policy on “Bureau of Energy, BOE” will continuously lead the promotion of energy saving, upgrading energy efficiency and development of renewable energy. The major responsibilities of BOE include: drafting of energy policies and legislation, planning of energy supply and demand and reviewing activities related to the exploration, production, storage, conversion, distribution and marketing of energy resources.



## GENERAL ENERGY CONFERENCE RESPONDING TO KYOTO PROTOCOL

With the Kyoto Protocol taking effect in February 2005, Chinese Taipei held a General Energy Conference on 20 and 21 June 2005 to develop response strategies for addressing the climate change issue. With the three objectives of attaining a stable energy supply, promoting economic growth and taking care of environmental protection, the Conference reviewed the implementation of 1998 General Energy Conference conclusions, considered new worldwide trends, domestic energy situations, and future visions, and addressed issues which include: overall response strategies; energy policy and structures; green energy and energy efficiency; as well as strategies for the industrial, transportation, and residential and commercial sectors.

### OVERALL RESPONSE STRATEGIES

Chinese Taipei will first reduce the growth rate of CO<sub>2</sub> emissions to the same growth rate as that of the OECD countries, and then reduce per capita greenhouse gas (GHG) emission level to the same level as the OECD countries. In the present stage, develop the emission reduction capability of all sectors through voluntary emission reductions and growth reducing measures, and, to the extent possible, implement effective emission reducing measures. In the future, implement measures such as emissions cap and trade mechanism, and carbon tax. Overall strategies include assessment of aggregate economic impacts, development and implementation of policy tools for emissions reduction, establishment of the administrative and management mechanism for CO<sub>2</sub> emission reduction, technical assistance in emission reductions, R&D in science and technology, forest planting, international cooperation, as well as promoting public awareness and participation. One policy tool is the rationalization of energy prices, which involve reflecting fuel costs at first, and then reflecting the changes in the structure of electricity generation and the internalization of external environmental costs.

### ENERGY POLICY AND ENERGY STRUCTURE

Energy policy involves the following six strategic directions: 1) maintain stable energy supply by strengthening international cooperation and increasing domestically supplied energy; 2) improve energy efficiency by upgrading the market mechanism and strengthening management of energy efficiency; 3) liberalize energy market by continuing the energy market liberalization process; 4) emphasize environmental protection by harmonizing the development of three E's (energy, environment, and economy); 5) improve research and development by expanding capabilities in basic science and technology; and 6) engage in education and communications through expanded public participation.

- Adjustments to energy structure include the following:
- The weight of oil will be lowered.
- While the proportion of coal in total energy supply will vary according to the operation of nuclear plants, those for natural gas and renewable energy will be increased.
- With respect to nuclear power, Power Plant No. 4 will be completed and put into commercial operation. The other existing nuclear plants will continue to operate normally.
- Actively promote the CO<sub>2</sub> emission reduction management mechanism.
- Adopt five principles for major energy - consuming development projects, including a requirement that new emitting sources incorporate CO<sub>2</sub> emissions into environmental impact assessment and promise that they will meet the requirement of the emissions cap and trade system when implemented.

#### *Green Energy and Energy Efficiency*

A cross-departmental coordination mechanism for energy will be established. Set up a national energy science and technology development plan to promote the development of aggregate energy science and technology. To develop green energy, the proportion of renewable energy in total energy supply in 2010 is projected to reach 3~5 percent, or renewable installed generation capacity

of 5,129 MW, approximately 10 percent of total installed capacity. Promote energy conservation and energy efficiency, including amending Energy Management Law, promoting energy service (ESCO) industry, establishing energy saving performance guarantee, no-collateral credit guarantee, assistance in combined heat and power, and upgrading generator efficiency. Assist and guide the development of renewable energy and green energy industries.

#### *Strategies of the Industrial Sector*

Actively promote emission reduction capability in the industrial sector. Promote voluntary emission reduction agreements containing review and verification mechanisms. Incorporate GHG emission reduction issue into pollution prevention and remediation, industrial waste reduction, and green productivity related plans and implementation activities. Establish assessment standards for voluntary emission reduction for the industrial sector by using reference measure and technology approach and energy intensity indicators. Raise the efficiency standards of equipment. Formulate long-term industrial development strategy; assist and guide the upgrading of industries. Set up regulatory requirements for major industrial investments: enterprises to provide short-, medium-, and long-term emission reduction targets; new sources to agree to abide by the requirements of the emission cap and trade system that is implemented; i.e., enterprises will acquire sufficient rights (to emit) as are required by the system. Set up GHG emission management mechanism for the sector. Participate in international cooperation.

#### *Strategies of the Transportation Sector*

In short and intermediate terms, the transportation sector is in the emission growth slowing strategy and will promote energy conservation and reduce GHG emission in three fronts: developing green transportation systems, slowing the growth in the use of autos and motorcycles, and increasing transportation system energy use efficiency. In the long term, it is in the enhanced emission reduction stage. While the three strategies in the short and intermediate terms will be continued, more stringent measures to restrict the ownership and use of automobiles and motorcycles will be adopted. Strongly promote the use of energy conserving vehicles.

#### *Strategies of the Residential and Commercial Sectors*

The primary strategic direction of the residential and commercial sectors is energy conservation. Recommended strategies include: adjusting the price differentials in the progressive electric rate structure; raise energy efficiency standards for appliances and equipments; promote energy efficiency services of existing buildings, including promotion of ESCOs, energy audits, and offering financial incentives and subsidies; promote use of renewable energy in buildings; establish building design standards for efficient air conditioning and lighting; expand promotion of green buildings; develop energy-conserving and green building materials and promote building energy saving applications and demonstration projects.

### **MAJOR NATURAL GAS CONTRACT**

The petroleum company CPC has won a bid to supply natural gas to Tatan Power Plant of Taiwan Power Co. for twenty-five years. CPC won over three other contenders with a lowest bidding price of NT\$298.2 billion, equivalent to nearly US\$9 billion. CPC has signed SPA with Qatar's Ras Lafan Liquefied Natural Gas II Co.(Ras Lafan) to secure the gas supply in November 2005. This procurement signifies a long-term stable energy source through a new diversified fuel sources after the operation of Tatan Power Plant in 2008. It is also expected to comparatively reduce carbon dioxide emissions. According to the contract, RasGas II will provide 3 million tons of LNG annually starting from 2008.

### **PURCHASE CONTRACT FOR WIND POWER**

In December 2003, Taipower signed a Sales and Purchase Contract with InfraVest Windpower Co. for 22,100 kW wind power electricity. InfraVest Windpower Co has been known as a newly established German firm planning to invest NT\$13 billion to install wind power generators at 10 different coastal locations along the western coast of the economy.

Another two local companies will also sign the contract with Taipower shortly in supplying wind power electricity. These procurements have been qualified through the “MOEA Operation Guidelines of Evaluation on Renewable Energy Electric Power Providers” as the first phase suppliers. It is considered a significant new step of adopting renewable energy in coping with the energy policy as it conforms to the government target of reaching wind power capacity to 10 percent of total installed capacity in 2010 and 12 percent in 2025. The government is considering adding a duty in the electricity bill to compensate Taipower for purchasing wind power.

### **OIL STOCK PILE PROCUREMENT OPERATION**

In addition to the 60 days of oil stockpiles in private companies, the Bureau of Energy (BOE), Ministry of Economic Affairs, claimed that the procurement operation of public-sector oil stockpile of 30 days of average daily consumption, amounting to a total of 2.83 million kilolitres (KL), or about 17.8 million barrels, required by the Petroleum Administration Law, was completed on 14 December 2004. The total is composed of 1.6 million KL (about 10.1 million barrels) of crude oil and 1.23 million KL (about 7.7 million barrels) of refined oil products. The contracting firms will deliver the oil into storage facilities in accordance with the delivery schedules specified in the contracts.

BOE explained that, after the oil market was liberalized, there is an over-supply of oil products domestically. As a result, there are surplus storage facilities available and oil stockpile should lease the surplus storage tanks owned by domestic oil firms. With the objectives to fully utilize societal resources and to maximize economic benefits, an economic assessment reached the conclusion that public sector oil stockpile operation should be conducted in accordance with the following principles:

1. Public sector oil stockpile should be stored, in principle, in domestic facilities and is done through the accounting format. Public sector oil stockpile can be stored in foreign territories under the following conditions: 1) when domestic storage facilities are in short supply; 2) when the fees on domestic storage facilities are excessive; or 3) when meeting obligations under international agreements.
2. Oil storage in the accounting format is defined as follows: The Ministry of Economic Affairs entrusts the oil storage task to oil storage firms and contracts with them. An oil storage firm can use the actual amount of oil in storage as documented in its account as the basis for the monitoring and verification of the oil stockpile in storage. An oil storage firm can use its own storage tanks, or lease storage facilities to do the storage operation, and can keep the oil “moving.”
3. Integrated operations of oil purchase, storage and release: In a turnkey contract operations; one single contract will allow an oil storage firm to perform the three sequential tasks of oil purchase, oil storage, and oil release.

The public sector oil stockpile procurement operation started in 2002, and in the intervening period, encountered wildly fluctuating world oil supply situations, including the US-Iraq War and oil prices jump sharply. The purchase was done in accordance with the Procurement Law. BOE held several tendering rounds for the national stockpiling program. Two companies bid for the contracts: Chinese Petroleum Company (CPC) and Formosa Petrochemical Corporation. Total value of the winning bids amounted to NT\$36.6 billions (approximately US\$1.16 billion), including cost of oil purchases and the storage fees for four years.

The contract period is 4 years. Delivery schedules were set with the shipping schedules in mind. By the end of February 2005, a total of 1.53 million KL had been delivered. The rest will be delivered follow the contract schedule. In the future, when oil emergencies occur threatening the stability of oil supply or when national security is of concern, caused by a shortage of oil supply or wildly fluctuating oil prices, oil from the stockpile will be released into the market to avoid any potential shortage of oil and refined products.

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# THAILAND

## INTRODUCTION

Thailand is located in Southeast Asia and shares borders with Malaysia to the south and Myanmar, Lao PDR and Cambodia to the north and the east. It has an area of 513,115 square kilometres and a population of about 62.01 million at the end of 2003.

Thailand achieved one the highest economic growth rates in the world during the period between 1975 and 1995. The economy experienced a setback during the Asian financial crisis of 1997-98, but recovered fairly rapidly due to continuing strong growth in exports. In 2003, Thailand's Gross Domestic Product (GDP) which amounted to US\$409 billion (at US\$ 1995 at PPP), grew at 6.8 percent, a record high since the 1997 crisis. In contrast with other Asian economies, Thailand is a medium-sized economy with about 62 million people (2003). Its GDP per capita is US\$ 6591 (at US\$ 1995 at PPP).

Thailand is highly energy import dependent,, particularly in oil. In 2003, net energy imports accounted for 58 percent of energy supply in the economy; down significantly from 96 percent in 1980.

Table 35 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	513,115	Oil (MBBL)	289
Population (million)	62.01	Condensate (MBBL)	321
GDP Billion US\$ (1995 US\$ at PPP)	408.74	Gas (MMSCF)	14,754
GDP per capita (1995 US\$ at PPP)	6,591	Lignite (Mt) - Recoverable	2,942

Source: Energy Data and Modelling Centre, IEEJ. \* Proved reserves, Department of Mineral Fuels, Ministry of Energy.

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

In 2003, the primary energy supply was 77,608 ktoe. Oil comprised 53 percent of primary supply, natural gas 34 percent, coal 12 percent and others 1 percent. Energy imports accounted for 58 percent of primary energy supply in 2003, slightly higher than in 2002 by 0.4 percent. The supply of oil and natural gas slightly increased compared to 2002, at 11 percent and 6 percent increase in primary energy supply, respectively.

Thailand produced only 4,782 ktoe of crude oil, while it imported more than 89 percent of its oil requirements or 38,721 ktoe. A high level of import dependence is expected to continue in the foreseeable future. The major sources of crude oil imported are the Middle East at 78.6 percent of total oil imported, following ASEAN 18.1 percent, Asia Pacific 1.3 percent (excluding ASEAN Economies), Africa 1.4 percent and Europe 0.6 percent. According to the Department of Mineral Fuels, and Ministry of Energy, at the end of 2003, Thailand had proven reserves of petroleum both onshore and offshore as follows: 289 million barrels of crude oil, 321 million barrels of condensate, and 14,754 million cubic feet of natural gas, and coal (lignite) at 2,942 million tons.

Thailand has a combined refinery capacity of 862,500 barrels per day. Over 95 percent of domestic demand is served by local refineries. In 2003 domestic consumption for refined oil products increased by 5.7 percent compared with that in 2002. The demand increased resulting

mainly from the increase of diesel consumption by 9.1 percent due to the price ceiling imposed on diesel retail price between the months of February-May 2003; during the US-Iraq crisis. However, a small portion of 88,000 barrels per day of refined petroleum was exported.

Thailand is more self-sufficient with respect to natural gas. Production of natural gas in 2003 was increased by 6 percent from the previous year. Around 80 percent of natural gas consumption is used in power generation. In addition to the domestic production, around 25 percent of natural gas demand is supplied by imports from Myanmar.

Coal and lignite in Thailand are used for electricity generation and in the industrial sector. Most of Thailand's proven coal reserves are lignite, coal of low calorific value. The total volume of lignite reserves include the remaining reserve from produced area and the measured and indicated reserve from undeveloped area is 2,942 Mt, most of which is located in the Mae Moh basin.

In 2003, the total electricity generation reached 116,985 GWh, a 7.3 percent increase from 2002. The generating capacity was constituted by domestic power plants and power purchases from Lao PDR and Malaysia. Natural gas accounts for 75 percent of fuels used for power generation and the balance is contributed from fuel oil, coal, hydro, and other renewable fuel sources.

Table 36 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	32,868	Industry Sector	15,659	Total	116,985
Net Imports & Other	44,740	Transport Sector	21,123	Thermal	109,684
Total PES	77,608	Other Sectors	13,582	Hydro	7,299
Coal	9,710	Total FEC	50,364	Nuclear	-
Oil	41,027	Coal	5,034	Others	2
Gas	26,054	Oil	33,815		
Others	817	Gas	2,316		
		Electricity & Others	9,198		

Source: Energy Data and Modelling Centre, IEEJ.

For full detail of the energy balance table see <http://www.ieej.or.jp/egeda/database/database-top.html>

### FINAL ENERGY CONSUMPTION

Thailand's total final energy consumption for 2003 was 50,364 ktoe, an increase of 5.4 percent over the previous year, resulting mainly from the increase of oil consumption by 12.6 percent and lignite by 16.6 percent. Petroleum products account for the highest proportion of secondary demand (67.1 percent), followed by electricity (18.3 percent), lignite/coal (10 percent) and natural gas (4.6 percent).

The transportation sector was the largest energy consuming sector and has accounted for 41.9 percent of the total final energy consumption at 21,123 ktoe. Rising oil prices, especially in the third quarter to October 2003, spurred by the threat of a US-Iraq war, did not deter the upswing in domestic oil demand. The oil consumption in transportation sector in this year was 6.6 percent higher than its consumption in 2002. Spurring demand for oil was the sharp increase in new vehicles entering Thailand's congested road system in 2002. The industry sector consumed 15,659 ktoe in 2003, an increase of 3.9 percent from the previous year.

As a result of economic expansion in this year, domestic electricity demand increased by 6.8 percent from the previous year reaching 106,959 GWh. The demand growth resulted from the increase in industrial and commercial sector consumption at 7.3 and 6.4 percent respectively. The highest consumption portion of electricity was consumed by the industrial sector at 45.9 percent,

followed by commercial sector at 31.5 percent, residential sector at 22 percent, and the rest of 0.6 percent for agriculture, transportation and others.

Natural gas consumption increased 7.2 percent over the previous year. The increase could be attributed to the 7.8 percent increase in power sector consumption due to the coming on stream of two new power plants from Independent Power Producers (IPPs), and the 7.9 percent increase in industrial sector demand from the previous year. LPG is mainly used in residential, commercial and transportation sectors. In 2003 consumption in residential accounted for 70 percent, following 19 percent and 10 percent by manufacturing and transportation sectors respectively.

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## **POLICY OVERVIEW**

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### **PROMOTE ALTERNATIVE FUELS AND EFFICIENT USE OF ENERGY**

An important strategy to help reduce energy consumption by 13 percent in 2008 and 20 percent in 2009 is to promote the use of alternative fuels and energy efficiency. The proactive national energy policy matrix is, therefore, aimed at reducing the ratio of energy demand growth rate to GDP growth, or energy elasticity, from 1.4:1 to 1:1 by the year 2007. Importance is attached to the two major energy intensive sectors, that is, transportation and industrial sectors. In the transportation sector, the largest energy consumer accounting for around 37 percent of energy consumption in the year 2002, in order to increase energy efficiency, emphasis is placed on the improvement of efficient multi-mode transportation infrastructure. Thailand's mass transport networks will undergo a massive Bt900 billion (or around US\$22 billion) expansion to improve access and reduce oil consumption. Focus will be on the improvement and promotion of greater use of the energy-efficient rail mode for both freight and passenger transport. Also a target to reduce 25 percent of oil consumption is expected via the use of alternative fuels. Various alternative fuels have been promoted into the market. Plans and measures are currently being worked out to promote the use of natural gas for vehicle (NGV), and bio-fuels, such as ethanol and bio-diesel.

### **EXPLORE NEW ENERGY SOURCES**

It is estimated that Thailand's energy reserves will last for only 30 more years, and this has become a national energy security issue. Besides the accelerated procurement from various domestic sources, negotiations from overlap areas with neighbouring countries has been speeded up by the Thai government in order to expand the availability of energy reserves. In this regard, there are currently on-going investments in hydropower electricity generation with 17,000 MW capacity in the Lao People's Democratic Republic, Myanmar, Cambodia and China. In addition, PTT Plc. plans to invest in petroleum exploration and drilling in Myanmar, Malaysia, Viet Nam, Cambodia and Indonesia. Additional resources have also been sought in other regions- such as the Middle East and Africa.

### **PUBLIC AWARENESS CAMPAIGNS ON ENERGY CONSERVATION**

The higher oil price worldwide is considered worrisome, since it has adversely impacted on economy activities, from transportation to services and from food prices to products costs. As part of energy consumption in households to be cut by 10 percent, an incentive campaign for energy conservation was kicked off on 1 June 2005 nationwide in Thailand with the aim to boost public awareness concerning the importance of energy conservation. The campaign calls for the public to observe three energy-saving measures: 1) turn off at least one light bulb one hour a day, 2) turn off air conditioners for one hour between noon and 1:00 p.m., and 3) limit driving speed to not more than 90 kilometres an hour. Under the campaign Thailand will save Bt1.2 billion in annual electricity generation costs, Bt63 million a month from not using air conditioners during lunch breaks, and Bt1.5 billion in fuel bills a month from the slower driving speed. The campaign is

considered a good start for public involvement in energy savings with the expectation that the Thai people will conscientiously adopt these measures as part of their habits.

### **REVIEW OF THE 3<sup>RD</sup> GAS PIPELINE MASTER PLAN AND LNG IMPORT PLAN**

To cope with the increasing demand for natural gas from 2005 onwards, the Thai government has approved the review of the country's 3<sup>rd</sup> Master Plan for the construction of a national natural gas pipeline which was announced in 2001. The plan includes investment in several natural gas pipeline projects during the period 2001-2011. About half of the budget has been focused mainly on the 3<sup>rd</sup> offshore transmission pipeline transporting natural gas from the Gulf of Thailand to the in land pipeline network located in the Rayong province, eastern part of the country. The pipeline stretches to about 475 kilometres with a capacity of 1,400 million cubic feet per day. The 3<sup>rd</sup> Master Plan will bring Thailand's total pipeline network to 4,013 kms, with a total capacity of 5,120 MMSCFD. The completion of the 3<sup>rd</sup> offshore gas pipeline is expected in 2006.

With regards to the long-term supply of natural gas, the government has assigned PTT Plc. to arrange a clear plan for the import of Liquefied Natural Gas (LNG) to support the development of alternative plans in future fuel supply for electricity generation. In addition, the government will enforce supporting measures so that the country is ready for the import of LNG to replace natural gas-thus strengthening the country's stability in long-term natural gas supply.

### **OIL PRICES STABILISATION**

In early 2003, due to the excessively high oil prices caused by the US-Iraq crisis, Thailand introduced the oil price-stabilising measure on 8 February 2003. Later, given the appeasement in Iraq and decreasing world oil prices, the oil price stabilising measure was revoked. The total number of days of oil price stabilisation was 101 days, with an average subsidy of US\$83,500 per day from the Oil Fund.

The impact of the oil price hike was of great concern regarding the economic outlook. The rise would have an adverse effect on local consumption, a key engine driving the kingdom's economy. In addition, oil price increase could bring about cost-push pressure on the economy system and a drop of economic growth. Again in 2004, the Thai government decided to introduce the oil price stabilising measure on 10 January 2004 due to excessively high oil prices in the world market. Retail prices of gasoline had been fixed for a period of nine months before being allowed to float in October 2004. For diesel price the government decided to adopt a "semi-floatation" mechanism on 1 June 2004 once the subsidy toll topped Bt 80 billion (US\$2,000 million). From January 2004 to July 2005, total subsidy from the Oil Fund amounted to Bt 92 billion. This amount is almost 8 percent of government budget and 1.4 percent of GDP. The five-year fuel subsidy bond worth Bt 85 billion has been issued to raise the money to be used to compensate the government's Oil Fund for the huge cost of subsidising the retail prices of diesel and gasoline.

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## **NOTABLE ENERGY DEVELOPMENTS**

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### **THE 19<sup>TH</sup> BIDDING ROUND 2005 FOR PETROLEUM CONCESSIONS**

As an effort to enhance energy security, acceleration of exploration for and development of indigenous petroleum resources has been promoted by the Thai government. The Ministry of Energy on 1 July 2005 announced the 19<sup>th</sup> Bidding Round for concession rights in petroleum exploration and production of 82 exploration blocks located both onshore and offshore; in the Gulf of Thailand, and in the Andaman Sea, covering a total area of 440,704 sq. km. The applications must be submitted within one year from the date of the announcement date. All applications submitted will be evaluated each month by the Department of Mineral Fuel of the Ministry of Energy.



### **DEVELOPMENT OF THE ENERGY CONSERVATION PROGRAMME, PHASE III**

The Energy Policy and Planning Office (EPPO) have developed the Energy Conservation Programme to ensure that the management and allocation of the Energy Conservation Promotion Fund (ECON Fund) is in line with the objectives stipulated in the Energy Conservation Promotion Fund Act. B.E. 2535 (1992). The implementations of Phase I (1995-1999) and Phase II (2000-2004) have been completed. The programme is responsible for the annual reduction of electricity consumption by 5,447 GWh and fuel utilisation (heat) by 430 million litres of crude oil or equivalent to 20.89 billion baht (about US\$ 522 million).

ECON Programme Phase III which is now being implemented targets to reduce the national energy elasticity from 1.4:1 to 1:1 by the year 2007 and increase the share of renewable energy in the total energy mix from 0.5 percent in 2002 to 8 percent by the year 2011. In developing the Phase III framework, the programme or projects and the expenditure will be reviewed and adjusted every year reflecting the changes of new government policies/strategies, economic and social conditions. The expected outcome at the end is to reduce commercial energy use by 12.7 percent or 10,354 ktoe.

The Phase III implementation will focus on the three main sub-programmes, that is, 1) Renewable Energy Development Programme 2) Energy Efficiency Improvement Programme and 3) Strategic Management Programme.

### **PROMOTION OF ALTERNATIVE FUELS FOR TRANSPORTATION**

The transport sector is the largest energy consumer and accounts for 37 percent of total energy consumption in the year 2002, various alternative fuels have been introduced. Measures are currently undertaken to promote the use of Natural Gas for Vehicles (NGV), gasohol and bio-diesel.

#### **NATURAL GAS FOR VEHICLES (NGV)**

A 10 percent target has been set to increase the use of NGV to replace gasoline and diesel by year 2008. The retail prices of NGV is initially set at 50 percent of diesel retail price and will be adjusted to be 55 and 60 percent of 91 octane gasoline prices in the year 2007 and 2008 respectively. From 2009 onwards, the NGV price would be around 65 percent of 91 octane gasoline price. A number of NGV stations will be increased from 34 stations (as of July 2005) to 180 by 2008, with 180,000 NGV vehicles.

#### **GASOHOL**

The Gasohol Roadmap has been developed with the target to distribute gasohol 95 across the country as replacement for 95 octane gasoline starting on 1 January 2007. Within this year the number of gasohol stations will be increased from 1,327 to 4,000 stations. It is expected that utilising gasohol 95 will increase the need for ethanol around 4 million litres a day. In order to promote greater use, the price of gasohol 95 is set to be cheaper than that of 95 octane gasoline. From 2008 onwards, gasohol will be promoted nationwide.

#### **BIO-DIESEL**

The development of bio-diesel requires long-term implementation. The blending ratio and distribution areas will increase in line with the increase in raw materials. The first demonstration project of community-based production from used cooking oil has been launched in Chiang Mai province, northern part of Thailand. The trial product known as "B2" which is the mixture of 2 percent of used oil and 98 percent diesel. The application target is 1,000 public passenger pick-ups running in the city. The outcome has been quite successful with more than the targeted of participants achieved. The blending ratio of 5 percent is the target during the year 2007-2011 and 10 percent from 2012 onwards.

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## ELECTRICITY SUPPLY REFORM

The Electricity Supply Industry reform model has been approved by the Cabinet on 9 December 2003 known as the “Enhanced Single Buyer (ESB)” model. Under the ESB model, Electricity Generating Authority of Thailand (EGAT) remains the single buyer of electricity produced. EGAT has now been corporatised to the EGAT Public Company Limited. The other two state-owned power utilities, the Metropolitan Electricity Authority and the Provincial Electricity Authority are also in the pipeline of corporatisation. An Independent Regulatory Agency or “the Regulator” will be established under the new Electricity Act, which is now being finalised.

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# UNITED STATES

## INTRODUCTION

The United States (US) is the world's largest and most influential economy, with a GDP of \$ 9.6 trillion (in 1995 US\$ at PPP) in 2003. The US is located in North America between Canada and Mexico. It has a population of 291 million people (2003), and spans 9.6 million square kilometres.

The US enjoyed a long economic expansion from 1991 through 2000. Growth was particularly robust from 1995 to 2000, averaging 3.8 percent per annum. A brief recession slowed growth to 0.8 percent in 2001, recovering to 1.6 percent in 2002, 2.7 percent in 2003 and 4.2 percent in 2004. Unemployment rate rose from 5.8 percent in 2002 to 6.0 percent in 2003 before subsiding to 5.5 percent in 2004 as recovery from economic growth.

The US is the largest producer, consumer, and importer of energy in the world. It is also rich in energy resources. At the end of 2004, there were 3,480 MCM of proven oil reserves, 5,293 BCM of natural gas reserves and 246.6 billion tonnes of coal reserves. There were over 933 GW of electricity generating capacity in 2003, of which 79.9 percent was thermal, 10.5 percent was nuclear and 8.5 percent was hydro. Due to a large, wealthy population and broad industrial base, the economy consumed 5.45 toe per capita in 2003, nearly four times the APEC average and far in excess of production.

Table 37 Key Data and Economic Profile (2003)

Key Data		Energy Reserves	
Area (square km)	9,631,418*	Oil (MCM) - Proven**	3,480
Population (million)	290.81	Gas (BCM) - Proven***	5,293
GDP Billion US\$ (1995 US\$ at PPP)	9,637	Coal (Bt) - Proven***	246.6
GDP per capita (1995 US\$ at PPP)	33,138		

Source: Energy Data and Modelling Centre, IEEJ.

\* CIA World Fact book.

\*\* Oil and Gas Journal, 2005

\*\*\* Data are at end of 2004, BP Energy Statistical Review, 2005

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

In 2003, total primary energy supply in the US was about 2,217 Mtoe. By fuel type, 42 percent of supply came from crude oil and petroleum products, 24 percent from coal, 23 percent from natural gas and 11 percent from nuclear, hydro, geothermal and other fuels. The US imported about 29 percent of its energy requirements in 2003.

In 2003, the US used approximately 848 Mtoe of petroleum for final energy consumption. Petroleum product supply grew 1.5 percent per annum during the 1990s, but domestic crude oil production levels declined by 2.2 percent per year as oil exploration and production companies turned their attention to cheaper, less mature basins in Africa, Asia, Middle East, and South America. While 42 percent of crude oil and products demand was met by net imports in 1990, the net import share had climbed to 56 percent by 2003. About 42 percent of imported oil in 2003 came from OPEC economies. Neighbouring Canada and Mexico are the largest non-OPEC suppliers to the US. Growth in the transportation and industrial sectors has been driving demand

for petroleum products. Four-fifths of the economy's oil reserves are located in Texas, Alaska, Louisiana and California, which are the four largest states in terms of current oil production.

The US contains about 2.9 percent of the world's natural gas reserves. Primary natural gas supply totalled 519 Mtoe in 2003, exceeding domestic production by 18 percent. Most of the production shortfall was met by imports from Canada through an extensive network of pipelines. Gas use by industry and power generators has grown because gas is a clean fuel that favours environmental approvals. Its growth was assisted by a period of falling wellhead gas prices following their deregulation in the 1980s and by an expanding pipeline network that made gas more widely available. From 1990 to 2003, natural gas consumption annual growth rate was about 1.1 percent, although consumption fell about 5 percent in 2003 due to high gas prices.

At the close of 2003, the U.S. natural gas transportation network included more than 226 gas pipeline systems, more than 306,000 miles of pipeline, and more than 178 Bcf/d of gas transportation capacity. During 2003, total U.S. gas pipeline system mileage increased by about 1 percent while overall system capacity increased by slightly more than 5 percent. There are currently approximately 400 underground gas storage sites located in the US, operated by 127 companies. On balance, interest is growing in LNG as a source of natural gas for U.S. electric power generation and also as a source that would provide supply flexibility. EIA expects that LNG imports to the US will increase sharply beginning in 2007, growing to 2.1 Tcf in 2010 and 4.1 Tcf in 2025, and 4.4 Tcf in 2030.<sup>83</sup> During 2003, the US received about 507 Bcf of LNG, mainly from Trinidad and Tobago, Algeria, and Nigeria.

Table 38 Energy supply & consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation GWh	
Indigenous Production	1,568,520	Industry Sector	476,128	Total	4,054,353
Net Imports & Other	648,519	Transport Sector	633,283	Thermal	2,891,081
Total PES	2,217,039	Other Sectors	464,689	Hydro	278,609
Coal	530,650	Total FEC	1,574,100	Nuclear	787,818
Oil	921,410	Coal	38,842	Others	96,845
Gas	519,169	Oil	848,154		
Others	245,810	Gas	387,289		
		Electricity & Others	299,815		

Source: Energy Data and Modelling Centre, IEEJ (see <http://www.ieej.or.jp/egeda/database/database-top.html>)

Primary energy supply of coal in the US totalled 531 Mtoe in 2003. US coal reserves are concentrated in Appalachia and key western states. Appalachian coal, which accounted for 35 percent of production in 2003, is mainly higher-sulphur coal from underground mines. Western coal, which accounted for most other production, is mainly low-sulphur coal from surface mines. Western coal production, which first surpassed that of Appalachian coal in 1998, was given a major boost by the Clean Air Act Amendments of 1990, which have required reduced sulphur emissions from coal combustion since 1995.

The US is the seventh largest coal exporter in the world behind Australia, Indonesia, China, South Africa, Russia and Colombia.<sup>84</sup> Since 1998, US coal exports have fallen sharply due to lower world coal prices, increased competition among coal-producing economies, and substitution of natural gas for coal in power production. In 2002, US coal exports fell to their lowest level of 40 million short tons since 1962, as a strong dollar made coal from elsewhere cheaper and high spot prices for domestic coal made it attractive for producers to sell at home. In 2003, the coal export

<sup>83</sup> EIA, Annual Energy Outlook, 2006

<sup>84</sup> IEA Coal Information 2005

increased to 43 million short tons, of which nearly half went to Canada. In the coming years, the U.S. coal industry is expected to continue to face strong competition from other coal-exporting countries, with limited or negative growth in import demand in Europe and the Americas.

The US produced 4.05 million GWh of electricity in 2003 with 71 percent coming from thermal plants, 19 percent from nuclear power, 7 percent from hydropower, and 2 percent from other sources.

On 14 August 2003, a huge electric power blackout hits large parts of the north eastern United States, the Midwest, and southern Canada late in the afternoon. Power was knocked out for at least several hours in major cities like New York, Detroit, Cleveland, and Toronto. Three months later (November 2003), the U.S.-Canada Power System Outage Task Force released an investigative report which concluded that the blackout was "largely preventable" and cited several failures by regional utility companies and regulators.

The US generates more nuclear power than any other economy in the world but has not had any new nuclear power plants built since 1977. The Three Mile Island accident in 1979, construction delays, high capital costs, concerns on safety and waste disposal, and impact of the Chernobyl, raised concerns about nuclear power plant safety while ad-hoc regulatory responses to these concerns made some new plants very expensive; both factors deterred further expansion. But the average utilisation rate of 104 commercial nuclear plants had risen steadily to over 90 percent in 2002. In 2003, the utilisation rate dropped to 87.9 percent and came back to 90.1 percent in 2004. Moreover, many nuclear plants have applied to the Nuclear Regulatory Commission (NRC) for 20-year extensions of their operating licenses, to 60 years. As of October 2004, the NRC had approved license extensions for 26 nuclear units and had applications for another 20 extensions under review, while more than 20 other units had informed the agency of their intent to seek extensions by 2012.

### **FINAL ENERGY CONSUMPTION**

In 2003, end use energy consumption in the US totalled 1,574 Mtoe. Broken down by sector, transport consumed 40 percent, industry accounted for 30 percent, and the rest used 30 percent. By fuel, petroleum accounted for 54 percent of consumption, natural gas for 25 percent, coal for 2 percent, and electricity and other fuels for 19 percent.

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### **POLICY OVERVIEW**

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Energy policy in the US is very supportive of market mechanisms. The Department of Energy (DOE) is responsible for implementing energy policies and programmes initiated by the Congress, monitoring the state of energy markets, maintaining energy security, and supporting research and development of new energy technologies. The Federal Energy Regulatory Commission (FERC) and various state public utility commissions share responsibility for regulating gas and electricity markets and promoting competition in those markets.

### **STRATEGIC PETROLEUM RESERVE**

The US imports more than half of its oil requirements, and its heavy dependence on oil imports is expected to continue. A vital policy instrument in this context is the Strategic Petroleum Reserve (SPR), established in 1975. With a stock of 676 million barrels in 2004, the SPR is the largest emergency oil stockpile in the world. In 2005, IEA member economies agreed to make a total of 63 million barrels of oil available to the market in response to Hurricane Katrina. Just over 61 million barrels of this amount was to be from emergency stocks and increased indigenous production. The effective IEA response from these measures by the end of October 2005 was approximately 42 million barrels. Additionally, the US made loans from the SPR available upon request. Including these loaned volumes, the total additional oil made available to the market by the end of October reached nearly 54 million barrels.

The government intends to fill the SPR to its 700 million barrel capacity by 2006 through a “royalty-in-kind” exchange program whereby oil produced from federal leases in the Gulf of Mexico is exchanged for oil going into the SPR. In the late 1990s, the SPR was upgraded to ensure its full and safe operation until at least 2025. The SPR represents a total investment of more than \$20 billion with an annual requirement in the range of \$158 million for maintenance and operation. Crude oil is stored mainly in four underground salt caverns on the Gulf Coast in Texas and Louisiana, with a distribution system in place for the oil’s use. DOE manages the SPR facilities and periodically conducts test sales and releases. The current SPR inventory could replace roughly 53 days of imports, down from a peak of 118 days in 1985. Public and private oil inventories combined could replace about 150 days of imports, which substantially exceeds the International Energy Agency’s requirement of 90 days. Upon order of the President, oil can be delivered to the US market within 13 days at a maximum rate of 4.3 million barrels per day.

### **TECHNOLOGIES AND POLICIES TO LIMIT ENVIRONMENTAL IMPACTS**

The US, being the world's largest economy, is the world's largest single source of anthropogenic (human-caused) greenhouse gas emissions. Current estimates indicate that US emissions of carbon dioxide, which was released into the atmosphere from fossil fuel burning, reached 5,697 million metric tons in 2005, an increase of 719 million metric tons from the 4,978 million metric tons emitted in 1990; roughly one-fourth of the world’s energy-related carbon emissions. To address the greenhouse gas emissions issue, the Bush Administration has proposed several initiatives:

#### **CLEAN COAL TECHNOLOGY**

*Federal Energy and Carbon Sequestration Programs:* Since the US obtains over half of its electricity from coal, major emphasis has been placed on the development of technologies for limiting environmental emissions from coal-fired power plants. In February 2003, President Bush announced that with international and private-sector partners, the US is sponsoring a \$1 billion, 10-year demonstration project to create the world’s first coal-based, zero-emissions electricity and hydrogen power plant (FutureGen).

A FutureGen demonstration plant is being designed to separate carbon and hydrogen streams from coal so that all the carbon can be sequestered without entering the atmosphere. If the costs are not too high, carbon separation and sequestration could point the way to a hydrogen economy in which continued use of coal is environmentally sustainable.

#### **HYDROGEN TECHNOLOGY**

The Hydrogen Fuel Initiative, launched in 2003, is working closely with the private sector to accelerate our transition to a hydrogen economy, on both the technology of hydrogen fuel cells and a fuelling infrastructure. The Hydrogen Fuel Initiative and the FreedomCAR Partnership that began in 2002 will provide \$1.7 billion through 2008 to develop hydrogen-powered fuel cells, a hydrogen infrastructure, and advanced automobile technologies, allowing for commercialization of fuel cell vehicles by 2020.

#### **NUCLEAR POWER TECHNOLOGY**

Nearly one-fifth of electricity in the US is generated by nuclear power, from which atmospheric pollution and carbon dioxide emissions are close to zero. The US is an active participant, along with Japan and others, in development of Generation IV technologies with enhanced passive safety features and more standardised designs to limit costs. These hold the promise of retaining nuclear power as a major option after the current generation of plants is retired.

#### **FUSION ENERGY TECHNOLOGY**

In January 2003, President Bush committed the US to participate in the ITER (International Thermonuclear Experimental Reactor) project, the largest and most technologically sophisticated research project in the world to harness the promise of fusion energy. If successful, this \$5 billion research project will advance progress toward producing clean, renewable, commercially available

fusion energy by the middle of the century. Participants include the European Union, Russia, Japan, China, and South Korea.

#### RENEWABLE ENERGY AND HYBRID AND FUEL-CELL VEHICLES:

The Bush Administration has called for tax incentives totalling \$4.1 billion through 2009 to spur the use of clean, renewable energy, and energy-efficient technologies, such as hybrid and fuel-cell vehicles, residential solar heating systems, renewable energy produced from landfill gas, wind, or biomass, and efficient combined heat and power systems.

### ENERGY CONSERVATION

#### FUEL EFFICIENCY STANDARDS AND TRANSPORTATION TECHNOLOGY

Corporate Average Fuel Efficiency (CAFE) standards, in place since 1978, require that light trucks and automobiles sold by each vehicle manufacturer attain a certain average level of fuel economy, with sales in excess of this standard subject to fines. Historically, CAFE standards helped to bring about and sustain a huge improvement in the efficiency of the vehicle fleet, despite relatively low gasoline prices. But the fuel economy standard has been static at 27.5 miles per gallon (mpg) for cars since 1985 and 20.7 mpg for light trucks since 1996. Due to increased sales of sport utility vehicles and minivans, which fall within the light truck category, average fleet efficiencies have even declined slightly in recent years, reaching a 20-year low of 24.4 mpg by 2001. However, a statutory prohibition on examination of fuel efficiency standards by the Department of Transportation (DOT) was lifted in December 2001. In April 2003, DOT issued a final rule raising fuel economy standards for light trucks by a total of 7 percent to 21.0 mpg in 2005, 21.6 mpg in 2006 and 22.2 mpg in 2007.

In addition to fuel economy standards, several other policies are proposed or in place to raise the efficiency and limit the environmental impacts of transport. The Department of Energy has invested heavily over the last decade, with major US automakers, in the Partnership for the Next Generation of Vehicles and then the FreedomCAR initiative, to support research and development of gasoline hybrid and fuel cell vehicles that could ultimately triple the efficiency of vehicles on the road. It has also supported the Hydrogen Fuel Initiative to develop technologies for vehicle use of hydrogen. DOE expects to invest \$1.7 billion over the five years through 2008 on research and development of advanced hybrid vehicle components, fuel cells, and hydrogen infrastructure technologies. It is anticipated that with improved technology for electrolysis, hydrogen might be produced from renewable energy sources at a delivered cost of \$2.25 per gallon of gasoline equivalent by 2015.

#### BUILDING AND APPLIANCE STANDARDS

The Department of Energy has energy efficiency standards in place for all major types of energy-using appliances, including air conditioners, clothes washers and dryers, space and water heaters, kitchen ranges and ovens, refrigerators and freezers, and lighting. In 2001, new minimum efficiency standards were issued for central air conditioners and heat pumps, water heaters, clothes washers, and some types of commercial heating and cooling equipment. The National Energy Plan called for appliance standards to be strengthened for products already covered and extended to additional products where technologically feasible and economically justified.

The highly successful Energy Star labelling programme clearly signals high efficiency in office buildings and appliances to consumers. The NEP recommended that the program be expanded from office buildings to include schools, stores, homes, and health care facilities. It also recommended that Energy Star labels be extended to additional products, appliances, and services. Further, the NEP recommended doubling expenditure on weatherisation of houses for low-income households, as well as support for educational programs related to energy development and use.

### ELECTRICITY MARKET REFORM

The US has achieved a high degree of competition in its electric power markets. Roughly one-fourth of all electricity generated in the US in 2002 was provided by independent, non-utility

generators. Seventeen states, with nearly half the US population, allow consumers to choose their electricity supplier. Virtually all new electric generating capacity which is planned or under construction is being financed and built by independent power producers; very little new capacity is being provided by traditional vertically integrated utilities.

The competitive power market came about as a result of initiatives by the Federal Energy Regulatory Commission (FERC). FERC orders 888 and 889, issued in 1996, required investor-owned utilities to open up their transmission systems to competing power providers on a non-discriminatory basis. Order 2000, issued in 1999, encouraged transmission-owning utilities to cede operational control of their high-voltage power lines to independent Regional Transmission Organisations (RTOs), while retaining ownership of these lines and revenue streams from their use. FERC's authority to issue these orders was upheld by the Supreme Court in 2001.

In July 2002, FERC issued a Standard Market Design proposal to govern the structure and operation of wholesale US power markets. FERC's idea is that all utilities that own, operate or control interstate transmission should conform to this standard design. Key elements include stronger inducements to participation in RTOs, active monitoring and mitigation measures to prevent market abuses, a centralised spot-power market to complement decentralised bilateral contracts for power, steps to enhance price and market transparency, and measures to encourage construction of needed power plants and transmission infrastructure.

*RTOs:* Under the Standard Market Design, all transmission owners and operators would have to join an RTO or contract with another independent transmission provider (ITP) to operate their transmission facilities. It is anticipated that if utilities have to cede operational control of their transmission in any case, they are likely to opt for the operational advantages of an RTO. RTOs and other ITPs would help FERC monitor the market for potential anticompetitive actions by market participants. Each RTO would also provide for seamless trading within the market it serves, so that transmission customers can avoid "pancaked" rates in which fees are paid to each utility that owns transmission assets needed to carry out a power transaction. Electricity sellers would pay a single access fee and a region-wide transmission rate that better reflects the true (lower) cost of transmission service and will therefore promote additional cost-saving transactions. RTOs would be overseen by a governing board of directors completely independent of market participants, as well as by an advisory committee of market participants and state government officials.

*Bilateral Contracts:* For the vast majority of power transactions are made under bilateral contracts between buyers and sellers, the Standard Market Design provides for physical delivery of power through Congestion Revenue Rights, or CRRs. These are tradable financial rights for transmission between two points on the grid over a particular period of time. A secondary market would be created for such rights that electricity suppliers who value the pathways can use congested transmission pathways the most. In addition, a new "network" transmission tariff would allow all transmission users to schedule power deliveries using multiple receipt and delivery points, with the same operational flexibility enjoyed by transmission owners.

*Spot Market:* To complement bilateral contracts, RTOs and other ITPs would administer voluntary markets for short-term transactions: spot markets for wholesale power, ancillary services and transmission congestion rights; a real-time "balancing" market to maintain reliable operations of the power grid; and a separate "day-ahead" market. The centralised spot-power markets would be "security-constrained" with measures to ensure grid reliability and "bid-based" with buyers and sellers bidding the price at which they are willing to buy or sell power during any day or hour. This would ensure that electricity trade is not pursued at the expense of reliability. Market-clearing prices would be provided transparently to all supply and demand-reduction sources to encourage efficient short- and long-run operations. A "circuit breaker" provision, to help prevent short-term price spikes, would bar bids above US\$1,000 per megawatt-hour. The length and severity of price spikes would also be limited by allowing demand reduction measures to be bid into the spot market.

*Investment:* Several aspects of the Standard Market Design would promote required investment in new transmission capacity, generating plants and conservation. The market for CRRs would allow suppliers to hedge transmission cost uncertainty and would assign values to congestion that



could signal the need for investment to relieve transmission bottlenecks. Location marginal pricing at each point on the grid would potentially signal where investment in generation and transmission is needed to improve grid operations. Companies that invest in new transmission would be allowed to retain rights to the added power-transfer capacity. A generation adequacy requirement would compel companies serving retail customers to arrange sufficient supplies and demand reductions to meet peak demand plus a 12 percent reserve margin. Infrastructure needs would be identified by RTOs through a planning process in each region that includes state regulators and local zoning authorities, so that projects meeting these needs could more readily obtain financing on the basis of anticipated returns. Such incentives and procedures should strengthen competition, limit tight supply situations that lead to short-run price spikes, and enhance the reliability of service.

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## NOTABLE ENERGY DEVELOPMENTS

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### ACCELERATING TECHNOLOGY DEVELOPMENT

President Bush's FY 2005 Budget proposed \$5.8 billion for climate change programs and energy tax incentives, which is over \$700 million (13.9 percent) more than FY 2004, as enacted. This figure includes nearly \$3 billion for the Climate Change Technology Program (CCTP), a multi-agency program to accelerate the development and deployment of key technologies that can achieve substantial greenhouse gas emissions reductions.

### TAX INCENTIVES PROMOTING GREENHOUSE GAS EMISSION REDUCTIONS

The President's FY 2005 budget proposes energy tax incentives that promote greenhouse gas emission reductions totalling \$680 million in FY 2005 and \$4.1 billion through FY 2009. The incentives are designed to spur the use of cleaner, renewable energy and more energy-efficient technologies that reduce greenhouse gas emissions. They include credits for hybrid and fuel-cell vehicles, residential solar heating systems, energy from landfill gas, electricity produced from alternative energy sources such as wind and biomass, and combined heat and power systems.

### INTERNATIONAL COOPERATIONS

Internationally, as the largest founder of activities under the United National Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC), the US has recently created or revitalized a range of climate initiatives, including:

- *Methane-to-Markets Partnership:* Australia, China, Colombia, India, Italy, Japan, Mexico, Ukraine, the United Kingdom, and other countries joined the US in launching the Methane-to-Markets Partnership at a November 2004 Ministerial meeting in Washington, DC. Announced by EPA Administrator Leavitt in July 2004, the Methane-to-Markets Partnership is a new and innovative program to help promote energy security, improve environmental quality, and reduce greenhouse gas emissions throughout the world. The Partnership will work closely with the private sector in targeting methane currently wasted from leaky oil and gas systems, from underground coalmines, and from landfills. EPA estimates that this Partnership could recover up to 500 billion cubic feet of natural gas (50 million metric tons of carbon equivalent) annually by 2015. Achieving this goal will develop new and cleaner energy sources that stimulate economic growth, improve the environment, and reduce global emissions of this powerful greenhouse gas. The US intends to commit up to \$53 million to the Partnership over the next five years.

- *International Partnership for a Hydrogen Economy:* The US hosted the first Ministerial meeting of the International Partnership for a Hydrogen Economy in Washington DC in November 2003. The Partnership's 15 countries and the European Union (EU) are working together to advance the global transition to the hydrogen economy, with the goal of making fuel cell vehicles commercially available by 2020. The Partnership will work to advance research, development, and deployment of hydrogen and fuel cell technologies; and develop common codes and standards for hydrogen use.

- *Carbon Sequestration Leadership Forum:* The US hosted the first meeting of the Carbon Sequestration Leadership Forum in Tysons Corner, Virginia, in June 2003. This international

partnership works to advance technologies for pollution-free and greenhouse gas-free coal-fired power plants that can also produce hydrogen for transportation and electricity generation, such as those being developed through our FutureGen initiative. The Forum, which now includes 15 countries and the EU, held its second Ministerial meeting in September 2004 in Melbourne, Australia, where ministers approved 10 capture and storage projects as well as a Technology Roadmap to provide future directions for international cooperation.

• *Generation IV International Forum*: The US has led the development of the Generation IV International Forum, a multilateral partnership fostering international cooperation in research and development for the next generation of safer, more affordable, and more proliferation-resistant nuclear energy systems. This new generation of nuclear power plants could produce electricity and hydrogen with substantially less waste and without emitting any air pollutants or greenhouse gas emissions. Since the Forum was formally established in July 2001, the US has led the development of a technology roadmap, and increased support for R&D projects carried out in support of the Forum's goals.

• *Global Environmental Facility (GEF)*: The US contributes more than any other country to the Global Environmental Facility (GEF), the financial arm of the UNFCCC. President Bush's FY 2005 Budget requests \$107.5 million for the third of four annual payments under the third GEF replenishment (GEF-3) and \$13.2 million to pay a portion of the U.S. arrears to the GEF-2. The clean energy portion of the GEF portfolio accounts for about 36 percent of its financial commitments, which is about \$43 million for climate-related activities in FY 2005. This commitment will fund technology transfer and capacity building in developing countries.

### **ENACTMENT OF THE ENERGY POLICY ACT OF 2005**

The Energy Policy Act of 2005 was signed into law on August 8, after several years of debate on several different versions of comprehensive energy legislation. The Act takes major steps to strengthen energy infrastructure, promote energy efficiency, expand the use of renewable energy, and boost the domestic production of conventional fuels. Some of the more notable measures in the Act are as follows, though there are many others:

#### *Measures to Encourage Conservation and Energy Efficiency*

- Energy efficiency standards for a wide variety of appliances and equipment.
- Tax incentives for the purchase of efficient appliances and equipment.
- Tax incentives for the purchase of fuel-efficient hybrid and diesel vehicles.
- Authorization of funding to accelerate R&D of batteries, power electronics, systems integration and other technologies for use in hybrid vehicles.
- New, multi-year rulemaking by the Department of Transportation to raise fuel economy standards for passenger cars, light trucks, and sport utility vehicles.
- National Highway Traffic Safety Administration, which administers Corporate Average Fuel Economy Standards, is to report by August 2006 on the feasibility of reducing automobile fuel consumption by a significant percentage by 2014.
- Environmental Protection Agency is to update procedures for rating automobile fuel efficiency, so that they more accurately reflect fuel efficiency with today's higher speed limits, different driving patterns, and faster acceleration rates. With fuel efficiency measured more strictly, vehicles would have to achieve higher actual fuel efficiency, on average, to meet corporate average efficiency standards.

#### *Measures to Expand the Use of Renewable Energy*

- Renewable Fuel Standard that requires the yearly use of 7.5 billion gallons of ethanol and biodiesel by 2012.

- Extension of existing tax credit for production of electricity from wind, biomass and landfill gas, with a new credit for residential solar systems
- Full funding authorized for the Hydrogen Fuel Initiative, which aims to develop fuel cell technology and ways of producing and distributing hydrogen fuel.

#### *Measures to Boost Production of Conventional Fuels*

- Reforms to clarify process for obtaining onshore oil and gas production permits.
- Clarification of the Federal Energy Regulatory Commission's jurisdiction over the siting of onshore LNG facilities, which should facilitate the siting of such facilities where needed and thereby encourage global natural gas trade.
- Full funding authorized for the Clean Coal Research Initiative, which includes the FutureGen plant to demonstrate separation of carbon streams for sequestration.
- Elimination of a 2-percent oxygenate requirement for reformulated gasoline, reducing the number of "boutique fuels" and making fuel supply more flexible.
- Royalty relief for marginal oil wells, as well as renewal of royalty relief in risky frontier areas such as offshore Alaska and ultra-deep waters in the Gulf of Mexico.

#### *Measures to Strengthen Energy Infrastructure*

- Requirement for mandatory reliability standards to better protect power grids against outages in a competitive marketplace for electricity generation.
- Establishment of a last-resort government site authority for transmission lines that are found to be of national interest, to ensure a better-functioning power grid.
- Elimination of the Public Utility Holding Company Act (PUHCA), which should help to expand investment in electric generation and transmission.

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# VIET NAM

## INTRODUCTION

Viet Nam is located in South East Asia. It shares borders with China on the north side, the west side with Laos and Cambodia, and its 3,400 km coastline on the south and east side with the East Sea. The whole economy spans over an area of 333,111 square kilometres, half of which is in a mountainous region with altitude of over 500m. In 2003, most of Viet Nam's population of about 80.9 millions live in 2 vast plains, the Red river delta in the North and the Mekong river delta in the South.

The economy grew rapidly after 1991; GDP growth rate from 1990 to 2003 averaged 7.5 percent. In 2003, its GDP reached US\$178.6 billion (in 1995 US\$ at PPP) and GDP per capita at about US\$2,210 (in 1995 US\$ at 1995 PPP).

Energy is a key component in Viet Nam's economy which contributed greatly to its recent industrialisation and export earnings. Viet Nam is endowed with diverse fossil energy resources such as oil, gas and coal, as well as renewable energy (such as hydro, biomass, solar and geothermal). At present, total energy reserves stood at about 500 MCM of oil, 400 BCM of gas, 4,000 Mt of coal and 20,000 MW of hydropower potential. Natural gas and crude oil are found mainly in the southern region (offshore), while coal reserves (mostly anthracite) are located in the northern region. Since 1990, Viet Nam has been a net energy exporter, exporting mainly crude oil and coal.

Table 39 Key data and economic profile (2003)

Key data		Energy reserves*	
Area (sq. km)	331,111	Oil (MCM) - proven	500
Population (million)	80.9	Gas (BCM) - proven	400
GDP Billion US\$ (1995 US\$ at PPP)	178.6	Coal (Mt)	4,000
GDP per capita (1995 US\$ at PPP)	2,210		

Source: Energy Data and Modelling Center, IEEJ. See <http://www.ieej.or.jp/apec/database/selecttable.html>

## ENERGY DEMAND AND SUPPLY

### PRIMARY ENERGY SUPPLY

In 2003, Viet Nam's total primary energy supply was 21,007 ktoe, an increase of 8.18 percent from 2002, or about nearly 4 times of supply in 1990. By fuel type, 47.8 percent of supply came from petroleum products, 31.2 percent from coal, 13.2 percent from natural gas and 7.8 percent from hydro and other fuels.

With the aim at determining petroleum potential and additional reserves, and discovering new fields that will ensure sustained petroleum production for the economy, PetroVietnam continues with its exploration expansion by entering into production sharing contracts (PSC), business cooperation contracts (BCC) and joint venture (JV) contracts. From 1988 up to the beginning of 2005 Vietnam has signed 49 petroleum contracts with about 50 world petroleum companies. The exploration activities in the continental shelf were mostly performed in the shallow water area

(under 200m), accounting for 25-30 percent of the whole surface of the continental shelf (mainly concentrated in the Cuu Long and Nam Con Son basins) where there have been several commercial oil and gas discoveries while production was in progress. PetroVietnam plans to speed up production of discovered fields through the application of advanced technologies, improving recovery factor, and protecting the environment and resources. The 9 major oil and gas fields including Bach Ho, Rong, Dai Hung, Rang Dong, Ruby, Lan Tay – Lan Do, Emerald and Su Tu Den and Bunga Kekwa have been put into production and some other oil and gas fields (Rong Doi - Rong Doi Tay, Hai Thach, Block B...) were appraised and being developed in the period of 2006 - 2010.

As of end 2004, Vietnam's proven oil reserves were reported at 500 MCM. From 1991-2003, Vietnam's oil production grew significantly as of 15.5 percent per annum. Oil developments nowadays occur offshore in Cuu Long, Nam Con Son and Malay-Tho Chu Basins. In 2003, Viet Nam produced 17,917 ktoe of crude oil, mostly of which were exported to Japan, Singapore, US and South Korea.

Although Viet Nam exported 17 - 20 millions tons of crude oil in the recent past, it has however imported petroleum products for most of its domestic consumption owed to its lack of refining capacity. In 2003 imports of petroleum products reached 10,456 ktoe. Viet Nam is set to complete and operate its first refinery in 2009 with a capacity of 140,000 B/D.

Vietnam's gas industry is in its early stage of development. Current gas proven reserves of 400 MCM are expected to increase because of several significant gas discoveries during the last 5 years on its continental shelf. Gas supply experienced a strong growth of 40.2 percent per annum on average since 1995 to 2,776 ktoe in 2003. Growths in industrial and especially power sectors have driven demand for natural gas. Up to mid 2005, Vietnam has invested and completed two gas pipelines (with combined transport capacity of 9 Bcm per year) and related infrastructure facilities, seven gas-fired power plants (with about 4,300 MW capacity), and one 0.8 million tonnes per year-capacity fertilizer plant, supporting its gas production.

Compared to oil and gas, Vietnam coal production grew more gradually during the period 1991-2003. Coal production reached 10,619 ktoe in 2003, about more than 4 times of the level in 1990. Attributing the increase in exports to a rise in global coal demand and record high oil prices, coal exports have increased from 657 ktoe and accounted for 23 percent of total production in 1991 to 4,058 ktoe, occupying 38.2 percent of total output in 2003. Vietnam exported coal to more than 30 economies, mainly China, Japan, Thailand, South Korea, and India. As of end 2004, coal reserves were estimated 4,000 Mt, excluding the recent discovery of a potential hundred billion tonnes in the Red River Delta.

As of end 2003, Vietnam's economic and technical potential of hydropower was estimated at 83 billion kWh or 20,000 MW. In 2003, with a total power plant available capacity of 9,500 MW, Vietnam produced 40,825 GWh (or 3,511 ktoe), an increase of 14 percent from its 2002 level, of which 46.5 percent of electricity output came from hydro power plants, 30.2 percent from gas, 17.8 percent from coal and 5.5 percent from oil-fired power plants. Distribution loss was on downward trend since 1990 at an average rate of 1.0 percent per annum but still considerable as 12.7 percent in 2003. The Vietnam's electricity elasticity coefficient has been always nearly 2 from 1990 – 2003 and is forecasted to be less than 1 only beyond 2020.

Table 40 Energy supply &amp; consumption for 2003

Primary Energy Supply (ktoe)		Final Energy Consumption (ktoe)		Power Generation (GWh)	
Indigenous Production	32,944	Industry Sector	6,604	Total	40,825
Net Imports & Other	-11,938	Transport Sector	5,571	Thermal	21,826
Total PES	21,007	Other Sectors	4,815	Hydro	18,999
Coal	6,562	Total FEC	16,989	Nuclear	-
Oil	10,037	Coal	4,337	Others	-
Gas	2,776	Oil	9,639		
Others	1,633	Gas	18		
		Electricity & Others	2,996		

Source: Energy Data and Modelling Center, IEEJ. See <http://www.ieej.or.jp/apec/database/selecttable.html>

### FINAL ENERGY CONSUMPTION

Vietnam's total final energy consumption (TFEC) enjoyed a steady annual growth of 11.3 percent from 1990 to 2003. In 2003, the economy consumed 16,990 ktoe, up 10.44 percent from that of 2002. However, its number per capita of 0.21 toe is very low in comparison to the APEC average (1.51 toe) as a large proportion of the Vietnamese population still relies heavily on non-commercial biomass energy sources. Oil, electricity and coal contributed major increments, as of 55 percent, 25 percent and 20 percent respectively. And in the energy consumption mix, oil accounted for 56.7 percent, coal 25.5 percent, electricity 17.6 percent, and gas 0.2 percent.

Industry as the driver sector in the GDP growth had the biggest demand as of 38.9 percent of TFEC. This sector consumed mainly coal at 47.1 percent, then petroleum products 32.8 percent, electricity 19.8 percent, and natural gas 0.3 percent. Transport ranked the second with a need accounting for 32.8 percent of TFEC and remained as the main consumer of oil at 57.7 percent of the economy's total oil requirement. Residential and commercial consumption represented 24.4 percent of TFEC. In this sector, electricity accounted for 39.3 percent, oil 31.8 percent, and coal 28.9 percent. Demand on electricity was on the strongest upward trend. This reflects the improvement of household income, which brings about an increase in electric appliance use, and of power supply quality. However, in remote and rural areas, non-commercial energy such as wood and agricultural by-products was still main source of households.

### POLICY OVERVIEW

The Ministry of Industry (MOI) is responsible for the state management of whole energy industries, namely electricity, new and renewable energy, coal, and oil and gas industries. MOI is in charge of presiding over the formulation of law, policies, development strategies, master plans and annual plans with respect to these sectors, and submitting to the Government and Prime Minister for issuance or approval. Also, MOI is responsible for directing, supervising development of energy sectors and reporting to the Prime Minister.

The MOI has completed the National Energy Policy and submitted to Government for approval, below are some of its highlights:

- Develop energy infrastructures and ensure adequate, stable and long-run energy supply;
- Develop energy with due consideration of environmental protection and sustainable development.
- Use energy economically and efficiently; step by step replace low-efficient equipment and facilities; domestically manufactured equipment and facilities are required to meet criteria

and standards of energy efficiency; carry out measures in favour of energy efficiency and conservation in high buildings; apply demand-side management (DSM) and energy supply management;

- Develop new and renewable energy resources such as small hydro, wind power and solar energy, geothermal power and so on;
- Promote rural energy policy by ensuring adequate energy supply to socio-economic sustainable development in the rural and mountainous areas; further concentrate on rural electrification and basically complete rural access to electricity by 2010;
- Enhance international cooperation in energy;
- Improve legal framework and implement market-oriented power reform.

### **ENERGY SECURITY**

The national energy security is the concern of most of economies, especially after the 11 September 2001 terrorist attack on US and the energy crisis (that contributed to rise in crude oil prices). It is predicted that after 2010, Vietnam shall become a net energy importing economy, turning from a net energy exporting economy. The Viet Nam government therefore is giving special attention to energy security and suggested MOI to consider the following:

- Apply preferential policies in financing and widening of international cooperation in order to strengthen exploration and development of indigenous resources thereby increasing reserves and exploitability of oil, gas, coal and new and renewable energies. Strengthening the use of domestic energy resources by reducing dependence on imported energies that are unstable, especially petroleum. Diversifying oil imported sources, increasing efficiency of using oil by replacing old and energy consuming equipment and facilities and finally study the prospect of oil stockpiling.
- Study the development of nuclear energy sector and build up nuclear power plants through coordination with international organizations to develop and use nuclear power; gradually mastering nuclear technologies and development for peaceful purposes.
- Strengthen energy cooperation relations with multilateral international organizations such as ASEAN, APEC, GMS and other bilateral cooperation.

### **ENERGY EFFICIENCY**

Government Decree 102/2003/ND-CP dated 3 September 2003 brings a legal and institutional framework for energy saving and efficient use of energy. The Decree regulates energy conservation and efficiency in production, building and equipment, power intensive machines and residential use. The Decree also addresses a number of other relevant issues, such as measures to reduce import tax on selected energy efficiency equipment to support its implementation.

Circular No. 01/2004/TT-BCN dated 2 July 2004 of the Ministry of Industry on the guidance of energy efficiency in industrial facilities that requests large industrial customers to use energy more efficiently, to report their energy consumption and energy audits, etc.

The long term objective of energy efficiency is reducing the elasticity factor (growth rate of energy demand/growth rate of GDP) from the 1.46 times in average at present to 1 time in 2015, and down to 0.9 in 2020 and 0.8 in succeeding years after 2020. It can save about 1 million toe or equivalent to US\$250 million in 2010, about 2 million toe or equivalent to US\$500 million in 2020. Thus, the decrease in energy consumption through the effective and economical energy use policy shall help ease the burden on imported energy, and accordingly, saving foreign currencies. In addition, it also helps increase the national energy security.

## RESTRUCTURING ENERGY SECTOR

### POWER SECTOR

Electricity of Vietnam (EVN) is a state owned utility founded in 1995, engaged in generation, transmission and distribution of the electricity in the whole Vietnamese territory. EVN is responsible for the electricity supply to meet the demand for development of the economy and the consumption needs of the people with the power tariffs approved by the Government. EVN is responsible for the investment to power generation and network expansion to meet the power demand of the country.

In accordance with the Strategy for Electricity Sector Development approved by Government dated 5th October 2004, the Government has laid down a policy to gradually establish a domestic competitive power pool, diversify investment and trading methods, stimulate the participation of several economic sectors. The State maintains monopoly in transmission, construction and operation of big scale hydropower and nuclear power plants.

Vietnam sets out its policy to build up a power market with progressive competitive levels from low to high, subject to the development scale, management level, physical and legal infrastructures for market operation. The power market in Viet Nam is expected to undergo three phases of development. In phase 1, competition is introduced (for the first time) to generation. Generation companies have to compete to sell electricity to EVN. In the second phase (wholesale competition market), competition in generation will be intensified, power companies and big customers participating the market have a choice of whom to buy power from. In phase 3 (retail competition market) which is the highest development phase of competitive power market, besides generation companies, retail distribution companies have to compete to sell power; all customers have a choice of whom to buy power from.

Electricity of Viet Nam (EVN) has been proceeding with its plan of equitising member enterprises since early 2000s, including the good settlement of financial issues and redundant employees. It expects to earn more than VN\$11,000 billion (about US\$702 million) by 2010 from acquisitions of State-owned enterprises (SOEs). Up to 2005, 6 units, namely the Joint Stock Mechanical Electricity Company, the Power Mechanical Engineering Company, the Electric Equipment Manufacturing Company, the Vinh Son-Song Hinh Hydro Power plant, Pha Lai power plant and the Khanh Hoa Power Company have already sold their shares. In the future EVN will only operate 'significant' power plants to ensure the national energy security. Among these larger power plants that the corporation plans to retain ownership are: Hoa Binh, Yaly and Tri An hydro-power plants, and the Phu My thermal power plant. Other power plants and companies under EVN will be equitized or reformed as one-member limited liability companies between 2006 and 2010.

### COAL SECTOR

Most of the coal in Viet Nam is produced by Viet Nam National Coal Corporation (VINACOAL), which was established in 1995 by the Prime Minister under the Decree No.91 and placed under the state management of the Ministry of Industry (MOI). VINACOAL's business includes the exploration, production, processing, distribution and export. VINACOAL has various subsidiary companies: Cam Pha, Hon Gai, Uong Bi, Coalimex Companies and others. Its companies are specialised in business segments and operate under market orientation.

Prime Minister Decision No. 199/2005/QĐ-TTg, dated 8 August 2005, had transformed the state-owned Vietnam National Coal Corporation (VINACOAL) to a new Vietnam National Coal Group, which will operate in the form of a holding company. This is in the framework of Government strategy to create more dynamic and strong state-owned enterprises to enhance their productivity and competitiveness. VINACOAL will be formed by restructuring the Viet Nam Coal Corporation and its subsidiaries into a robust economic group, with advanced technology, modern management methods and diversified fields of business, including the coal industry, energy engineering, mining, shipbuilding, the automobile industry, and mineral exploitation and processing.



The restructured VINACOAL will comprise of 11 businesses, including three coal companies, a financial company, a mining company, and a rescue centre for miners, a human resources development centre, two coal project management boards and a clinic. VINACOAL will also hold 100 percent statutory capital in 18 affiliates, over 50 percent statutory capital in 24 subsidiaries and less than 50 percent in four other enterprises.

### *OIL & GAS SECTOR*

Participants in the oil and gas sector belong to different private and public organizations and ministries. Among them, only the Vietnam Oil and Gas Corporation (PETROVIETNAM), which was established in 1975 and supervised by the Ministry of Industry since July 2003 (instead of the Prime Minister) is vested the responsibility for the entire oil and gas resources in Vietnam. PETROVIETNAM is entrusted the responsibility of developing and adding value to these resources. Its business activities cover all the operations from oil and gas exploration and production to storage, processing, transportation, distribution and services.

PetroVietnam will develop itself into a conglomerate operating in various fields such as finance, trade, services and industry.

The State-owned Corporation has been allowed by the Government to operate in different fields. In the service sector, it will maintain oil and gas operations, and technical and logistic services. Oil exploration and exploitation abroad will be expanded. In the trade sector, PetroVietnam will not limit its business to crude oil export, but will join the world oil and petroleum products trading market.

In the finance sector, the company is looking to establish a bank and join the world financial market. To shift to a conglomerate, PetroVietnam will equitise a number of subsidiaries and turn several others into limited liability companies. Over the next two years, seven subsidiaries will be equitised in which PetroVietnam will hold a minimum stake of 50 percent. The company will maintain control in eight other subsidiaries.

In the long term, PetroVietnam expects to list on the stock exchange abroad to raise funds for its operations.

## **ENVIRONMENT**

In the 1990s, Vietnam adopted a number of laws related to natural resources and environmental protection, including the Law on Protection and Development of Forest (1991), Law on Land and Territory (1993), Law on Environmental Protection (1994), Law on Minerals (1996), and Law on Water Resources (1999). Under these laws the government exercises unified management over natural resources and environmental protection throughout the country.

The institutional framework for environmental governance consists of the administrative hierarchy, with representation at the national level through the National Assembly, and at the provincial, district, and commune levels through People's Councils and Committees. More than ten line ministries and central agencies dealing with natural resources, and other ministries with general planning responsibilities. Ministry of Natural Resources and Environment played a central coordinating role in environmental management.

Viet Nam fulfils all requirements to be a Clean Development Mechanism (CDM) as host country. It has signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 16 November 1994, signed the Kyoto Protocol (KP) in 1997 and ratified it on 20 August 2002. The ratification comes into force in 25 September 2002. The Ministry of Natural Resources and Environment of Viet Nam (MONRE) was assigned by the Government of Viet Nam as a National Focal Agency for taking part in and implementing the UNFCCC and KP.

The Vietnamese government is highly interested in the climate change issue. It considers that the global warming due to anthropogenic greenhouse gases is a real threat and Viet Nam is one of

the most vulnerable countries. By participating in CDM, Viet Nam wants to show its willingness to contribute to global environmental protection while looking for additional investment and for technology transfer.

In June 2003, the Vietnamese government designated the National Office for Climate Change and Ozone Protection (NOCCOP), part of the International Cooperation Department (ICD) of MONRE as CDM National Authority CNA. Moreover, the CDM National Executive and Consultative Board were established in April 2003. It is composed of government officials from MONRE and other Ministries.

### ENERGY INTERNATIONAL COOPERATION

**In Oil & Gas sector:** The Vietnamese and Malaysian governments have authorized PetroVietnam and Petronas to sign the Commercial Arrangement Agreement (CAA) for Joint Development of Petroleum from overlapping area between two countries. Vietnam has joined ASEAN economies in signing a memorandum of understanding (MOU) to build a Trans-ASEAN gas pipeline project at the ASEAN Energy Ministerial Meeting in Bali in 2001, Indonesia.

**In Power sector:** Viet Nam and Laos Governments have signed an Agreement on energy cooperation, under the accord; Viet Nam will import about 2,000 MW from Laos. Viet Nam and Cambodia Governments have also signed an Agreement on energy cooperation. Viet Nam will supply power to Cambodia with scale 80 - 200 MW through 220 KV transmission line in 2007 - 2008. In the future, when Cambodia builds some hydro power plants and starts participating in regional electricity market, Vietnam will buy electricity from Cambodia. Viet Nam joined the Power Trade Agreement amongst Greater Mekong Subregion (GMS), which include: Viet Nam, Laos, Cambodia, Thailand, Myanmar and China (signed in 2002). At present, Viet Nam supplies electricity to Laos and Cambodia by medium voltage lines at some places and buys electricity from China by 110 kV lines.

**In Coal sector:** Vietnam and Japan will cooperate to explore deep underground coal deposits in southern Quang Ninh province and in the Red River delta.

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### NOTABLE ENERGY DEVELOPMENTS

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#### POWER SECTOR

In 2003, Viet Nam's total installed generating capacity stood at 9,500MW of which 8,370 MW was provided by EVN's power plants and the remaining 1,130 MW generated by other suppliers. During 2004 - 2005, there was 1,820 MW (EVN: 625 MW, other sources: 1,195 MW) added to the power system to get the total installed capacity of 11,325 MW (9,000 MW from EVN and 2,325 MW supplied by other owners). Existing, hydropower accounted for roughly 37 percent, thermal power (coal and oil - Fired) 18 percent; gas turbine (use gas & DO) 41 percent and diesel 4 percent

In 2003 - 2004, two 720 MW Phu My 3 & Phu My 2.2 power plants in the Phu My power generating complex commenced operations. EVN will purchase the plant's output under a 20-year power purchase agreement. The Phu My 4 power plant, which belongs to EVN, commenced operation in May 2004. In 2004 - 2005, three smaller IPPs, namely Can Don HP (72 MW), Na Duong (Coal fired - 100 MW), Cao Ngan (Coal fired - 100 MW) also commenced operations.

The energy generation of Viet Nam Power System increased from 26.56 TWh in the year 2000 to 46.21 TWh in the year 2004, average growth rate is about 14.9 percent. In 2005, the estimated energy generation was about 52.2 TWh, an increase of 13 percent. Share of energy generation from IPPs also increased from 4 percent in 2003 to 13.1 percent in 2004. The peak load of Viet Nam increased from 4,890 MW in year 2000 to more than 9,000MW in 2005. The annual Load Factor is about 66 percent.

The North-South 500 kV transmission system which interconnects three regions of the economy, Northern, Central and Southern, was, completed in September 1994. In 2004 - 2005, the second 1,600 km 500 kV transmission line from the Southern to the Northern regions commenced operations. At the end of June 2005, the National Power Grid has reached all of provinces about 100 percent of districts and about 95,5% of communes and 88,91% household in rural have access to electricity.

## OIL AND GAS SECTOR

### Oil

Oil exploration in Vietnam continues to yield new discoveries in last several years, mostly in the Cuu Long basin. A new oil and gas deposit has been discovered at the Su Tu Nau (Brown Lion) part of Block 15.1 in Cuu Long basin by the Cuu Long joint venture company. The first oil stream came from the oil deposit with a flow of 9,100 bbl/d. A new oil field has been discovered at Block 16.1 of the White Rhino (Te Giac Trang) structure in the Cuu Long basin. The oil flow is estimated at 5,900 bbl/d. The discovery was made by the Hoang Long Joint Operating Company. The Viet Nam - Russia Oil and Gas Joint Venture discovered an oil stream spouting from the 09-1 - Rong-20 drilling well on the Nam Rong structure of Cuu Long basin. The flow is 1,000 barrels of crude oil a day. Hoan Vu Joint Operating Company (JOC) has struck oil at the Ca Ngu Vang site (Block 09-2, Cuu Long basin, Vietnam continental shelf). The well tested at a rate of 5,700 barrels a day, and could reach 8,700 bpd.

While production of the Bach Ho (White Tiger) field has reduced since 2003, exploitation of the Su Tu Den (Black Lion) field has begun with 70,000 barrels per day. The planned development of several new oil fields in coming years is expected to increase Vietnamese production. In addition, exploitation of the Su Tu Vang (Yellow Lion) and Su Tu Trang (White Lion) fields will start soon, promising new growths for the oil industry.

In 2004 Vietnam exploited 20.3 million tons crude oil. PetroVietnam plans to pump more than 18 million tonnes this year. Crude oil is a key export product of Vietnam, oil export value has also increased year on year, from \$3.47 billion in 2000 to \$5.6 billion in 2004 and estimated \$6 billion in 2005.

### Gas

In as early as 1995, associated gas from Bach Ho field was transported onshore to meet the requirements of power generation and LPG production for supply domestic market. Production of gas increased from 183 million cubic metres in 1995 to 2 billion cubic metres in 2004.

The second gas pipeline from Nam Con Son Basin to Phu My was completed at the end of 2003, connecting the Lan Tay and Lan Do fields to the mainland at Vung Tau. From this pipe line, natural gas is supplied for power plants at the Phu My complex. In 2004, the pipeline was flowing approximately 3.1 billion m<sup>3</sup>.

Up to 2010, Vietnam will build more gas pipelines in the Southern part of the economy; Pipeline Phu My - Ho Chi Minh City to supply gas to the power plants, industrial and household consumers in the area; Pipeline PM3 - Ca Mau supplying gas to Ca Mau electricity - fertiliser complex. Pipeline Block B - O Mon supplying to O Mon power complex.

## DOWNSTREAM OIL AND GAS SECTOR

Vietnam is accelerating its plan for building up three refineries with total capacity of 20 Mt per year in order to be 60 - 70 percent self-sufficient in oil by 2020. Refinery No.1 project in Dung Quat - Central Vietnam restarted on November 2005, which has a capacity of 6.5 million tone crude oil. The plant will provide refined products at the beginning of 2009. The contractors which are Technip (France), JGC (Japan), and Technicas (Spain) will provide an engineering - procurement - construction (EPC) project.

Viet Nam National Petroleum Corporation (Petrolimex) has joined with a Singapore firm to build the terminal and oil-storage facility in the coastal central province of Khanh Hoa. Spreading over 40 hectares on My Giang Island in Van Phong Bay, the terminal will be the economy's largest.

Sixty million dollars will be invested initially in building tanks with a total capacity of 500,000 cubic metres and a wharf to receive ships of up to 150,000 tonnes in weight. The tank storage capacity will later be doubled to 1 million cubic metres.

The economy's first gas-fuelled fertiliser plant was operated in Phu My Industrial Park in 2005. The Phu My Fertiliser Plant, equipped with the most advanced technology, has a designed capacity of 2,200 tonnes of urea and 1,350 tonnes of ammonia per day.

### **COAL SECTOR**

Viet Nam produced about 25 million tonnes of coal in 2004. , VINACOAL plans to exploit more than 30 million tonnes in 2005. In the past recent years, VINACOAL and many coal mines have developed steadily and reached the target set in the current coal sector development plan through 2020. Domestic demand for coal, however, is forecast to increase sharply to 40 million tonnes by 2010, and over 50 million tonnes by 2020, which would be 50 percent higher than previous forecasts.

Under MOI guidance, VINACOAL are now drafting the Study on National Coal Development Master Plan to soon submit to the Government. The plan is an essential and urgent step in creating sustainable coal sector growth

In order to keep pace with this increased mining activities, existing coal processing factories, including the Cua Ong, Hon Gai, and Vang Danh factories, will be expanded and new factories will be built at Khe Cham, Lep My, Ha Lam, and Uong Bi. The new development plan will also outline the construction of several new railroads to transport coal. Ports for coal transport will be built in three major areas of Uong Bi, Hon Gai, and Cam Pha.

Sustainable growth of the coal industry, however, is inextricably linked to environmental protection. Mines have realized this and increasingly use modern equipment and technology to increase efficiency and output, while at the same time minimizing harm to the environment.

### **NEW ELECTRICITY LAW**

The Electricity law has passed the National Assembly of Vietnam on 9 November 2004 and enforced on 1 July 2005. This Law provides regulations on the electric power sector planning and investment; electricity savings, power market; the rights and obligations of organisations and individuals participating in electricity activities and usage, protection of electrical equipment, electricity works and power safety. The Law applies to all organisations and individuals who engage in electricity activities and usage or other activities related to electricity in Viet Nam. In case otherwise stipulated by an International treaty, to which the Socialist Republic of Viet Nam has signed or acceded, the regulations specified in the treaty would prevail. According to the law, electricity market will be established and gradually developed through three competition levels, from power generation, then wholesale and retail business. The Prime Minister is responsible for issuing regulations of itinerary and conditions for forming and developing power market levels. Power price will be set appropriately to market development levels and in the manner facilitating investors to achieve their reasonable profit, encouraging energy saving, protecting lawful rights and benefits of electricity companies as well as consumers. As for rural, mountainous and island regions, the government will reserve supports on investment capital, operational expenses, and favour conditions for loan and taxes to projects invested in the areas, especially to projects of electricity grids and generating stations which use local energy resources and NRE.

### **ESTABLISHMENT OF ELECTRICITY REGULATORY AUTHORITY**

Under the Electricity Law, the Ministry of Industry will be responsible for administering electricity activities and use, and the People's Committees will manage electricity activities and use within their jurisdiction. In November 2005 Government has decided the establishment of the Electricity Regulatory Authority of Viet Nam. It will assist the Minister of Industry in the following regulatory activities: preparing national master plans of power sector; developing regulations on the operation of a competitive power market and directions for implementation; assessing and

promulgating the tariffs for electricity generation and wholesale, and the fees for transmission and distribution; assessing electricity retail tariffs and submitting to the government for approval, issuing, amending and revoking electricity licences; issuing guidance on the conditions and procedures for electricity outages and on the reduction of electricity consumption; studying and recommending measures to regulate power supply-demand relationship and manage the realisation of power supply-demand balance; issuing guidance on the conditions and procedures for interconnection to the national electricity system; monitoring the implementation of plans and projects of investment in the development of electricity sources, electricity transmission and distribution grids for compliance with the master plans; keeping track of the implementation of the approved electricity tariff; and settling complaints and disputes in the electricity market.

### ENERGY EFFICIENCY

World Bank reaffirms its support for energy efficiency improvement in Viet Nam with its US\$225 million credit. The Project funding is expected to help optimize the transmission and distribution system, reduce system peak load, and improve the rural power networks in the economy so that the poor in the rural areas have access to good quality electricity at reduced prices. It will also pilot community-based utilities to provide electricity from renewable energy to about 10,000 households in the remote rural areas, including some of the poorest communes identified in the Government's special community program.

The residential energy efficiency programme implemented from 2004 to 2006 through the second phase of DSM program (US\$8.2 million) by EVN along with its subsidiary power companies expects to achieve a 120 MW reduction in the peak demand over three years. One of the major activities conducted by EVN in the full second phase of its DSM programme is to promote the sale of one million Compact Fluorescent Lamps (CFLs) to households located in high load areas.

### NEW AND RENEWABLE ENERGY

**Waste power:** In 2005, the first 750kW waste to power project was completed. The turbine, originally owned by the Ho Chi Minh City Urban Environment Co was sold to Electricity of Viet Nam. The facility which generates power from garbage in the Go Cat dump is part of a VN\$260 billion (US\$16.4 million) project. About 60 per cent of the money was provided by the Netherlands, with the rest from domestic capital. Methane gases generated from decaying garbage in sumps are fed into an underground gas station where it is processed and then used as fuel to run the turbines. Two additional turbines, with capacities of 750 kW and 920 kW are expected to be commissioned in 2006.

Another biogas-fuelled power plant would be built at Phuoc Hiep, an 822 hectare dumpsite in Cu Chi suburban district with partners from Japan, Canada and the Netherlands.

**Wind power:** Aside from the 15MW wind energy plant in Phuong Mai (constructed in the Binh Dinh province), another plant is being built with a capacity of up to 250 MW.

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