APPENDIX

Commonly Used Abbreviations and Outlook Results by Economy

COMMONLY USED ABBREVIATIONS

ABARE	Australian Bureau of Agriculture and Resource Economics
APEC	Asia Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
AUS	Australia
BCM	billion cubic metres
BD	Brunei Darussalam
CCGT	combined cycle gas turbine
CDA	Canada
CAN$	Canadian Dollar
CHL	Chile
CNG	compressed natural gas
CO_2	carbon dioxide
CT	Chinese Taipei
DOE	Department of Energy (USA)
DSM	demand-side management
EDMC	Energy Data and Modelling Center (Japan)
EIA	Energy Information Administration (USA)
EWG	Energy Working Group (APEC)
FEC	final energy consumption
FED	final energy demand
FDI	foreign direct investment
FPI	foreign portfolio investment
FSU	Former Soviet Union
FT	Fischer-Tropsch technology
GDP	gross domestic product
GHG	greenhouse gases
g/kWh	grams per kilowatt-hour (used to measure the emissions caused by the generation of one unit of electricity)
GMS	Greater Mekong Sub Region
GNP	gross national product
GTL	gas to liquids
GW	gigawatt
GWh	gigawatt-hour
GWP	gross world product
HKC	Hong Kong, China
IDR	Indonesian Rupiah
IEA	International Energy Agency
IEEJ	Institute of Energy Economics, Japan
INA	Indonesia
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power producers
JPN	Japan
kgoe	kilogram of oil equivalent

ktoe	thousand tonnes of oil equivalent
LEAP	Long-term Energy Analysis Programme
LHV	lower heating value
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MAS	Malaysia
mbd	million barrels per day
MCM	million cubic metres
MEX	Mexico
MMBTU	Million British Thermal Units
MOU	Memorandum of Understanding
MSW	Municipal Solid Waste
Mtoe	million tonnes of oil equivalent
NAFTA	North American Free Trade Agreement
NGV	natural gas vehicle
NRE	new and renewable energy
NYMEX	New York Mercantile Exchange
NZ	New Zealand
PE	Peru
PNG	Papua New Guinea
PPP	purchasing power parity
PRC	People's Republic of China
PV	Photo-voltaic
R&D	research and development
ROK	Republic of Korea
RM	Malaysian Ringgit
RP	the Republic of the Philippines
R/P	reserves-to-production ratio
RUS	the Russian Federation
SIN	Singapore
SUVs	Sports Utility Vehicles
tcf	trillion cubic feet
toe	tonnes of oil equivalent
TPED	total primary energy demand
TPES	total primary energy supply
TWh	terawatt hours
US or USA	United States of America
WTO	World Trade Organisation
VN	Viet Nam

OUTLOOK RESULTS BY ECONOMY

INTRODUCTION

This section provides a compilation of the outlook results by APEC member economy in table formats. A summary of the energy projections for the periods 2002, 2010, 2020 and 2030 is compiled at the beginning of the economy section as the energy balance table (EBT). EBTs are first presented followed by tables on the key macro economic assumptions, total primary energy consumption and transformation, final energy demand, electricity, energy-economy-environment interaction, and investments.

- Figures are rounded off and may not add up to 100 percent.
- Data values that appear negligible or inaccurate are rejected.

ENERGY BALANCE TABLES

The Energy Balance Tables are the final output produced by APERC. Energy Balance Tables included in this section are only for the years 2002, 2010, 2020 and 2030. Discrepancy in the data for the year 2002 is explained by Statistical Differences and Stock Change records in the IEA database.

Primary energy demand, transformations, and final energy demand are presented as:

- "Coal" - all coals, both primary and derived fuels, and peat;
- "Oil" - crude oil, natural gas liquids, refinery feedstocks, and additives as well as other hydrocarbons and petroleum products (excluding biofuels for the US);
- "Gas" - natural gas and town gas;
- "NRE" - biomass, geothermal, wind, solar and other new and renewable energy;
- TFED - Total Final Energy Demand; by fuel (coal, oil, gas, NRE, electricity and heat) and by sector (industry, transportation, residential and commercial).
- TPED - Total Primary Energy Demand; includes indigenous production (coal, oil, gas, hydro, NRE and nuclear) and net imports (coal, oil - both crude and petroleum products-, and natural gas). This equals Total Final Energy demand plus fuel inputs for the transformation sector (electricity and heat generation, petroleum refineries, and others). Net import is import minus export. Regional imports and exports include intraregional trade.
- Transformation sector includes:
  - "Electricity and Heat Generation" includes both public and private utility electricity and heat generation as well as auto-production, and losses in transmission/distribution.
  - "Petroleum refineries" includes biomass (ethanol for blending), heat and electricity for ancillary refining processes.
  - "Others" includes both coal transformation and gas processing, and energy consumption for oil, natural gas and coal extraction industries.
- "(2 %)" - numbers enclosed in parenthesis are the percentage share

KEY MACRO ASSUMPTIONS

Key macro assumptions include GDP, population, income, shares of Services and Industry sectors in GDP, and urbanisation level. Except for the urbanisation level, all macro economic assumptions were obtained from Global Insight Data up to 2025; APERC made the necessary calculations and projected the data between 2025 up to 2030. Urbanisation level was obtained from United Nation Habitat projections.

ENERGY PROJECTIONS

Energy production, primary energy demand, transformation, and final energy demand by sector and energy source, including average annual growth rates and shares are presented. The Energy Balance Tables and Energy Projections Tables are using the aforementioned terminologies, except for the transformation sector. "Input for Electricity and Heat Generation" does not include losses and own use. On the other hand,

"Other Transformation" is a combination of all other transformation processes including petroleum refineries and energy extraction industries (oil and natural gas), coal mining and city gas production. Due to the lack of historical data, energy demand for Russia and biomass demand in the residential sector of China has been included only from 1992 and 1994 respectively. The residential and commercial sector energy demand of Papua New Guinea has been combined in one sector.

Net electricity import is not considered in Primary Energy Demand for the Energy Projections tables, but instead is included in the net imports section.

Historical data prior to 2002 are from the IEA database, and therefore include statistical differences, stock changes, non-energy consumption and others. As a result of the different methodologies in how the data is aggregated some discrepancy in the trend analysis was observed. The energy demand for non-energy use, non-specified transport, pipeline transport, and non-specified other that are included in the IEA database are not included in final energy demand for the APERC energy outlook.

ENERGY SECURITY

"Diversification of Primary Energy Demand" (DoPED) is calculated as the weighted average of the main energy sources consumed by each economy to total primary energy demand (Equation (1)), and are normalised on a 0-100 scale, where a result close to zero implies that the economy is dependent on one energy source and a result close to 100 implies that the economy's energy sources are evenly distributed among the main energy sources

$$\text{DoPED} = \frac{\sqrt{\left(\text{Coal}^2 + \text{Oil}^2 + \text{Gas}^2 + (\text{Hydro} + \text{NRE})^2 + \text{Nuclear}^2\right)}}{\text{TPED}} \quad (1)$$

Net Energy Import Ratio (NEIR) (Equation (2)) represents the economy's dependency on energy imports. For regional balances this parameter is not adjusted to reflect intraregional trade flows.

$$\text{NEIR} = \frac{\text{Net Imports}}{\left(\text{Production} + \text{Net Imports}\right)} \quad (2)$$

Net Oil Import Dependency (NOID) (Equation (3)) represents the economy's dependency on oil imports. For regional balances this parameter is not adjusted to reflect intraregional trade flows.

$$\text{NOID} = \frac{\text{Net Oil Imports}}{\left(\text{Oil Primary Energy Demand}\right)} \quad (3)$$

ELECTRICITY GENERATION

The tables on electricity include total electricity generation and total installed generation capacity by fuel, where installed thermal generation capacity consists of coal, oil and gas.

ENERGY INTENSITY

"Energy intensity" is divided into two sections, the first represents the amount of primary energy consumed per unit volume of GDP, while the second represents the amount of primary energy consumed per capita. In the first section, the "Energy intensity in Industry or Commercial" represents the total amount of final energy consumed in each sector per unit volume of Industrial or Services GDP. In the second section, the "Energy intensity in Industry, Transport, Residential or Commercial" represents the total amount of final energy consumed in Industry, Transport, Residential or Commercial per capita.

CO_2 EMISSIONS

Historical data prior to 2001 are obtained from the IEA CO_2 Emissions from Fuel Combustion database, thus include statistical differences, emissions from non-energy consumption and others. As a result of the different methodologies in how the data is aggregated some discrepancy in the trend analysis was observed. The unit of CO_2 emissions is million tonnes of CO_2.

Projection of CO_2 emissions from fuel combustion is calculated using the "default method" and "IPCC Tier 1 default emissions factors" within LEAP.

TOTAL ENERGY INVESTMENT REQUIREMENTS

The range of values for the energy investment requirements in each time period represents the differences in construction costs among economies, technology costs, facility complexity, land costs difference among economies, differences in construction time.

Energy investment requirements for each type of energy infrastructure from 2003 up to 2030 were calculated. The types of energy infrastructure include:

- Coal production and transportation:

  Coal infrastructure includes major mine installations, equipment and transportation facilities in the form of railways and shipping ports. Other types of transportation infrastructure such as water barges, rail cars or road transport are not considered. The investment requirements for coal production and coal trading were not calculated separately. Investment requirements for coal-import facilities in non-coal producing economies such as Brunei Darussalam, Hong Kong, China, Japan, Papua New Guinea, Singapore, and Chinese Taipei, were not calculated.

- Oil and gas production and processing:

  This category covers simply the necessary investment for increasing domestic oil and gas supply capacity and or imports to meet the projected demand growth. However, this investment excludes investment for exploration activities, which includes all investments needed before a discovery is confirmed, including geophysical and geological analysis, and drilling of exploration wells.

- Oil and gas international trade:

  Necessary investment for LNG-related activities and cross-border pipelines are included. The assumptions about the share between LNG and piped gas for each economy are computed by considering i) the current gas situation of the economy, ii) known government plans, iii) approved LNG projects as at the end of 2005, iv) expert judgement.

- Oil and gas domestic pipeline:

  Mainly to be used for the construction of domestic pipelines and oil-related facilities.

- Electricity generation and transmission:

  Generation includes investments for new generation capacity additions and refurbishment of existing facilities. The transmission investment requirements were calculated by multiplying the current transmission cost for each economy per GWh of electricity demand and the projected growth in electricity demand.