ASIA PACIFIC ENERGY RESEARCH CENTRE

ENERGY SECURITY INITIATIVE:

SOME ASPECTS OF OIL SECURITY

2003

Published by

Asia Pacific Energy Research Centre
Institute of Energy Economics, Japan
Inui Bldg.-Kachidoki 16F, 1-13-1 Kachidoki
Chuo-ku, Tokyo 104-0054 Japan
Tel: (813) 5144-8551
Fax: (813) 5144-8555
Email: address: apercadmin@aperc.ieej.or.jp

APEC#203-RE-01.3
ISBN 4-931482-22-8

Printed in Japan

FOREWORD

This report, *Energy Security Initiative: Some Aspects of Oil Security*, continues the ongoing efforts of the Asia Pacific Energy Research Centre to inform and assist APEC member economies on the energy security issues and challenges facing the region.

In these turbulent times, threats to energy supply and price volatility, especially as they pertain to oil, occur almost daily. Hence energy security issues are high on the agenda of governments, policymakers and other energy market participants. Previous APERC projects on energy security have focussed on strategic oil stockpiles. In this report, we focus on the Asian Premium pricing and export and import dependence issues as they apply to oil security. Both issues are of particular interest and concern to the oil importing economies of APEC Asia but are also of relevance to other APEC economies given the global nature of aspects of the oil industry.

Thus, although energy security issues are many and varied, as are the circumstances facing each member economy, I hope that this report will contribute not only to the ongoing discussion, but also to the improvement, of energy security in APEC member economies and the APEC region as a whole.

This report is published by APERC as an independent study and does not necessarily reflect the views and policies of the APEC Energy Working Group or of individual member economies.

Masaharu Fujitomi
President
Asia Pacific Energy Research Centre

ACKNOWLEDGEMENTS

We wish to express our appreciation to the energy experts who have contributed to the development of this report.

In particular, helpful advice, insights and information were received from a number of APEC energy experts. These include Vladimir Ivanov (Japan/Russia), Vicki Brown (Australia), Yoshiki Ogawa (Japan), Joonboem Lee (Korea) and Robert Manning (USA). The input of members of the APERC Advisory Board and the APEC Expert Group on Energy Data and Analysis (EGEDA) have also been very helpful. The assistance of a number of other experts engaged in energy security matters is acknowledged anonymously.

APERC CONTRIBUTORS

PROJECT LEADER:

Gary Eng (New Zealand)

PROJECT PARTICIPANTS:

Ahmad Bin Haji Mohamad (Brunei Darussalam)

Shiro Konishi (Japan)

Jaya Singam Rajoo (Malaysia)

Oleg Sinyugin (Russia)

Chung-Yang Lin (Chinese Taipei)

EDITOR

Gary Eng

ADMINISTRATIVE SUPPORT

Sutemi Arikawa, Shohei Okano, Sachi Goto, Mizuho Fueta and Chie Koshino.

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LIST OF ABBREVIATIONS

APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
APSA	ASEAN Petroleum Security Agreement
ASEAN	Association of Southeast Asian Nations
CO_2	carbon dioxide
CNOOC	China National Offshore Oil Corporation
CNPC	China National Petroleum Corporation
CPC	Caspian Pipeline Consortium
CTL	coal-to-liquids
EIA	Energy Information Administration (USA)
ESI	Energy Security Initiative
EWG	Energy Working Group (APEC)
FSU	former Soviet Union
FT	Fischer-Tropsch
GDP	gross domestic product
GTL	gas-to-liquids
IEA	International Energy Agency
IEEJ	Institute of Energy Economics, Japan
IEF8	8th International Energy Forum
IEP	International Energy Program
JODI	Joint Oil Data Initiative
LNG	liquified natural gas
LPG	liquified petroleum gas
mbbl	million barrels
mbd	million barrels per day
Mtpa	Million tonnes per annum
MTBE	methyl tertiary butyl ether
OECD	Organisation for Economic Co-operation and Development
OLADE	Organización Latinoamericana de Energía
OPEC	Organisation of Petroleum Exporting Countries
PADD	Petroleum Administration Defense District
SPR	Strategic Petroleum Reserve
UN	United Nations
USA, US	United States of America
WTI	West Texas Intermediate

EXECUTIVE SUMMARY

OBJECTIVE

This report continues the development of the Energy Security Initiative (ESI) by discussing issues related to:

- The growing energy import dependence of the Asia-Pacific Economic Cooperation (APEC) economies and its implications for APEC energy security. As such, of the different energy types, this report focuses on oil with some discussion on gas (and other energy types insofar as they are relevant to the oil and gas issues).
- The recent energy security developments in some APEC economies, especially in the context of the challenges that have been faced since the unfortunate events of 11 September 2001.
- The main discussion is from the usual quantitative perspective. Given the APEC region's, and especially APEC Asia's, high and increasing reliance on imports to meet demand, we seek to address how APEC economies may be able to reduce their supply risks in the longer term.
- We also address the oil security issue from the price perspective. This perspective focuses on a discussion of the "Asian Premium" and its impacts on affected economies.

MESSAGES

The key messages from this ongoing research can be summarised as follows:

- Economies have negotiated through recent disruptions in oil supply quite well. Shortages have been managed through commercial stocks. There has been no call on the strategic reserves of those economies that have them. The high prices, that still persist to some extent, have undoubtedly been damaging to importing economies but beneficial to exporting economies.
- The Asian Premium on oil prices is recognised by oil producers as a real phenomenon. There appear no easy ways of reducing the Asian Premium in the short term. However, it can be reduced, and security of supply enhanced, over the longer term through measures such as bilateral investments and diversification of fuel supplies and energies.
- The key issue is energy diversification, not dependence, and in particular, oil import source diversification.
- Russia is likely to make a significant contribution to oil supplies in Asia, probably mostly to China, beginning as early as 2005. Russia's exports to the US will likely increase as well, showing that diversifying their markets is also in the interests of suppliers. Central Asian economies can make an indirect contribution to oil supplies in APEC Asian economies by exporting oil to Europe and thereby freeing up some oil supplies from the Middle East. Asia may also command a greater share of African exports. Overall, the Middle East will remain Asia's dominant and "natural" supplier.
- Russia will also become an increasingly important supplier of natural gas to Asia. In the short and medium term, to at least 2010, the region's gas markets appear quite competitive. Thus security of supply concerns are much less for gas than for oil.
- Gas-to-liquids (GTL) technology could make a worthwhile contribution to enhancing oil security by providing another source of middle distillates using lower value gas resources.

- The Producer-Consumer Dialogue and regional dialogues are important. An instance of these being translated into action was the cooperation of suppliers, especially OPEC, in increasing their production during the recent disruptions.
- The need to recognise that there is also competition for supply, primarily motivated by the revenue and commercial requirements of both national economies and oil companies. This aspect should ensure that increasing demand can be met in normal circumstances and, at times, may exert pressure on prices and market imperfections such as the Asian Premium.
- Most oil and gas exporters and exporting economies are highly dependent on energy revenues to fund their economies and will most likely have a big interest in maintaining market stability, in terms of both quantity and price.
- Developing economies are more sensitive to volatility in oil supply and prices. Hence it is important for them to develop energy security measures that are consistent with their circumstances and aspirations.
- Some economies need to be more assertive, imaginative and agile in their oil (and energy) procurement policies in order to enhance their energy security and/or reduce their energy bills.

CHAPTER 1

INTRODUCTION, SCENE-SET AND DEFINITION

INTRODUCTION

This report continues the development of the Energy Security Initiative (ESI) by investigating issues related to:

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- The recent energy security developments in some APEC economies, especially in the context of the challenges that have been faced since the unfortunate events of 11 September 2001.
- The main discussion is from the usual quantitative perspective. Given the APEC region's, and especially APEC Asia's, high and increasing reliance on imports to meet demand, we seek to address how APEC economies may be able to reduce their supply risks in the longer term.
- The oil security issue from the price perspective. This perspective focuses on a discussion of the "Asian Premium" and its impacts on affected economies.
- Measures to mitigate the Asian Premium and reduce import dependence on the Middle East. The common and most apparent measure is supply diversification. The potential of emerging supply regions is analysed to show that security of supply can be improved in this way.
- Importing economies' practice of investing in upstream operations and exporting economies' investing in downstream operations as methods of improving security in the supply chain. Other measures to reduce dependence on the Middle East such as synthetic oil and fuel substitution are also discussed.
- The co-dependence of oil importing and exporting economies, that is, their commonality of interest in ensuring a stable oil marketplace. This is shown by assessing the dependence of exporting economies on oil revenues and their budgeting practices and assumptions. From the importer economy's perspective, oil price levels have pervasive macroeconomic
- Competition between economies in their efforts to secure energy supplies, effects that in turn, can have deleterious effects on oil demand. Notwithstanding such issues, some advantages are shown for a shared responsibility and dialogue leading to action with regard to reducing the negative impacts of supply disruptions.

GLOBAL AND APEC OIL MARKET OVERVIEW

The last decade has seen significant shifts in global oil supply and demand demographics. Specifically, for the APEC region, the former Soviet Union (FSU) experienced sharp declines in oil production and consumption. It has, however, substantially recovered in the last few years and seems likely to have a more promising future. There was also rapid increases in Asian oil demand that have not been met by supply from within the region, resulting in an increasing import dependence of APEC Asia economies on the Middle East.

The Asia Pacific Energy Research Centre's (APERC) APEC Energy Demand and Supply Outlook 2002[1] and similar studies by other organisations indicate that Asian oil demand will grow substantially over the period to 2020, with a continued increasing dependence on Middle East OPEC to satisfy the energy demand growth. This increasing dependence has focused the attention of APEC governments and energy officials, as well as the producer economies, on the desire not only for secure supplies of oil, but also on the importance of stable and reasonable prices and the need for emergency measures should supplies or their delivery be disrupted.

Since November 2002, three significant oil supply disruptions, viz. Venezuela, Iraq, and Nigeria, have occurred. These have tested oil consuming nations' abilities to deal with such disruptions. In general, shortages have been minimised by production increases in some producing economies, notably Saudi Arabia, some co-incident economic weakness in consuming economies and demand restraint. High oil prices have undoubtedly exacerbated weak economic performance. However, no call was made on the strategic oil reserves in economies where these exist.

DEFINITION AND SCOPE

The subject of energy security means different things to different people. APERC's deliberations, in recent years, have focused on oil, and in particular, on strategic oil stockpiling. In fact, the usual mention of "energy security" (in importing countries) invokes security of supply concerns of oil with some residual consideration given to natural gas, particularly now that gas is increasing in importance as part of the energy mix. Electricity and coal, of the four commonly understood energy types, hardly get attention even though, for example, there are significant security issues associated with the supply of electricity. The oil stockpiling emphasis effectively means a focus on the short-term (emergency preparedness) in a temporal sense, while the emphasis on oil does stretch, in a strategic sense, to the issue of securing longer term supplies and some issues of mitigating (oil) demand such as fuel diversification and energy conservation.

The diversity of APEC economies, ranging from major energy (oil and gas) importers to major exporters, and ranging from developed to less developed economies, provokes wide-ranging discussions and opinions as to energy security.

This report takes the reasonably conventional definition of energy security – *that of securing adequate energy supplies to sustain economic performance and growth* - and extends this quantitatively oriented definition, again in a fairly conventional albeit less usually discussed direction, to include prices, that is - *that of securing adequate energy supplies at reasonable and stable prices in order to sustain economic performance and growth.*

This definition forms the basis for a discussion of research results on a selected few issues that are not normally on the first rung of energy security issues, namely, the Asian Premium that concerns prices, some supply-side issues including supply source diversification as a basis for both diversifying the risk of supply disruptions and of enhancing supply-side competition.

This report does not discuss, in any depth, other pertinent issues relating to energy security, for example, strategic stockpiles and energy conservation. The former has been extensively researched and discussed by APERC[2,3] and discussed in APEC and other regional fora. The role of energy conservation, on the other hand, is significant in its own right, and is better left as a self-standing study, probably starting from a conservation, rather than security, perspective.

[1] APERC, APEC Energy Demand and Supply Outlook, 2002.

[2] APERC, Emergency Oil Stocks and Energy Security in the APEC Region, 2000.

[3] APERC, Energy Security Initiative: Emergency Stocks as an Option to Respond to Oil Supply Disruptions 2002.

This report also presents an overview of recent energy security developments in some APEC economies, particularly with consideration for recent events and circumstances. This serves to highlight concerns of energy security that have accelerated and heightened since the events of 11 September 2001 and the development of energy and geopolitical issues since then. By doing so, we hope to scope the policies and measures that APEC economies perceive as being pertinent to their particular circumstances and provide a basis for the further development of energy security within APEC economies.

CHAPTER 2

RECENT DEVELOPMENTS IN ENERGY MARKETS AND APEC ECONOMIES PERTAINING TO ENERGY SECURITY

The last year or so, since the terrorist attacks in the USA of 11 September 2001, have been turbulent and volatile times in energy markets with heightened concerns for energy security, particularly in but not restricted to, the world's oil markets. As tension mounted and violence ensued in major oil supply areas such as the Middle East, Venezuela and Nigeria, the threats of shortages led to accelerated buying and higher prices, and then the actuality of supply disruptions in those areas led to even higher and often volatile oil prices. With the help of increased production from suppliers with spare production capacity, notably from Saudi Arabia, shortages did not actually occur although commercial stocks were severely run down in some economies. No call was made on the strategic stockpiles of those economies, the USA, Japan and Korea within APEC, that have them. The protracted period of global economic weakness since the beginning of 2001 has, in all likelihood, depressed energy demand somewhat, thus alleviating supply constraints that would otherwise have been more severe.

All APEC economies have been affected by these events, some more so than others. The high prices, which still prevail to some extent, have undoubtedly been detrimental to the economic performance of oil importing nations but, on the other hand, provided windfall gains for oil exporters. Many economies have and are looking at their energy security policies and measures with a view to shielding their economies from energy supply disruptions and to improve the resilience of their economies to supply and (energy) price shocks, in both the short-term and longer-term.

This chapter presents a brief survey and update of energy security developments as they pertain to APEC economies.

OIL SUPPLY DISRUPTIONS

Significant oil supply disruptions can be thought of as low probability but high impact events. As it turns out, recently there have been significant disruptions to oil supply around the world. Since November 2002, there have been three large, somewhat overlapping, supply disruptions, namely, the loss of supply in Venezuela due to a general strike, the loss of supply from Iraq due to the US-led military action in that country and the partial loss of supply in Nigeria due to ethnic strife.

In benign times, these 3 countries are around the 8th, 9th and 12th largest producers, respectively, in the world, producing a total of around 7.7 mbd, or approximately 10 percent of the world's supply. A loss of 7 percent of supply, or slightly less than 5.5 mbd based on current demand of around 77 mbd, constitutes a "major international oil disruption" and, in theory, triggers the IEA's International Energy Program (IEP) suite of emergency responses that include stock draw, demand restraint, fuel switching, surge production and the sharing of available supplies. For supply disruptions of (slightly) below the level of 7 percent of supply, the IEA has a suite of coordinated emergency response measures (CERM).

Venezuelan supply losses were at their peak in December 2002 and January 2003. Although production has still not quite fully recovered to normal levels, they have not significantly overlapped the losses in supply from Iraq and Nigeria which began in March and April 2003 and which may continue at significant levels for some months. Together with the shortfalls from Venezuela, these three independent supply disruptions have, at the peak, totalled around 3 mbd. In part, production increases from OPEC, notably Saudi Arabia (around 1.5 mbd), and other producers such as Russia have ameliorated the shortages. These production increases have, on occasion, reduced the world's estimated spare capacity to around 1 mbd.

Prices rose before the shortages in anticipation of conflict in Iraq, undoubtedly partly as a consequence of precautionary stockbuilds, and peaked at just under US$40 per barrel. Relatively high prices, above the top of the OPEC price band of US$28 per barrel, have persisted for some months but have returned to more "normal" levels of around US$25-30 per barrel after the effective end of the Iraq war, with exports from Iraq not likely to recover to more usual levels for some months. It appears that importing economies have managed supply shortfalls by a combination of commercial stockbuilds before the Iraq war and commercial stockdraws when supply has been inadequate. Notably, shortages did not become so severe that there was a "call" on the strategic stocks of those economies that have them.

The following is a summary of the policies and actions of a number of APEC economies during the 2002/03 supply interruptions.

JAPAN

Japan has the second largest strategic stockpile of crude oil in the world behind that of the US. Currently, it is around 311 mbbl, equivalent to 92 days' imports with commercial stocks of crude and products comprising another 79 days' demand. As a member of the IEA, these stocks, taken together, meet the requirements of the IEP.

During the recent supply disruptions, pump prices of gasoline have been over Yen110 per litre, around 10-15 percent higher than during 2002, raising consumer enquiries and concern about the situation. On the plus side, a relatively strong currency at around Yen120 per US dollar did mitigate (import) price effects somewhat.

The enforced shutdown of a number of nuclear power reactors serving the Tokyo metropolitan area due to inadequate inspection reports and safety concerns had increased the demand for fuel oil for power generation by around 300,000 bpd during the first quarter of 2003. This was during the height of the oil supply disruptions and thus exacerbated the already tight and uncertain world oil supply conditions. While the situation will improve with the progressive restart of some reactors, the threat of electricity shortages during the summer peak demand period still exists. The use of oil-fired generation facilities and thus the demand for fuel oil and heavy crude will continue to be higher than usual for some months.

On the other hand, the SARS virus that has severely impacted economic activities in most parts of Asia, especially China and Hong Kong, China, and Chinese Taipei will depress oil demand in the region for much of 2003, albeit impacting mostly on the transportation fuels cuts of the barrel.

Japan was not directly impacted by the supply disruptions in any of Iraq, Venezuela or Nigeria as it imports a minimal amount of crude from these producers. However, the Japan Minister of Economy Trade, and Industry did communicate with Saudi Arabia's Oil Minister, then also the OPEC Chairman, to seek Saudi Arabia's and OPEC's cooperation in managing the Iraq supply disruption.

THE PHILIPPINES

The Philippines is totally dependent on imports for its oil needs (Table 2), of which over 90 percent has been sourced from the Middle East since 1995 (Figure 18). Saudi Arabia and Iran often each supply over 30 percent of annual needs.

The events of 11 September 2001 activated the Energy Contingency Task Force who then supervised the updating of the Oil Contingency Plan that has its origin in the 1970s.

Due to instability in the oil markets, the Philippines has been one of the economies to increase its oil stocks. As at March 2003, the Philippines' 3 major oil companies held 86 days of crude and petroleum stocks, the highest level in 10 years and above the required level of 40 days of demand. Aramco, the Saudi national oil company, has a 40 percent shareholding in one of the economy's majors, Petron Corporation (Petron). Petron was the marketing arm of the Philippine National Oil Company when it was partially privatised in 1993. By retaining a 40 percent shareholding in Petron, the Philippines gets some surety of supply from its partner, Aramco.

For further assurance of supply, the Philippines had also secured the commitment of the Indonesian government as an alternative oil supplier. PERTAMINA, the Indonesian national oil company, and PNOC have both agreed on a contingent oil supply that will provide additional supply to the Philippines as needed.

Likewise, the government received some assurance from Sakhalin Energy, a joint venture of Shell, Mitsui and Mitsubishi. At present, Sakhalin Energy supplies high quality oil only to Japan, Korea and Chinese Taipei.

The Philippines is a signatory to the ASEAN Petroleum Security Agreement (APSA), an agreement among energy ministers of ASEAN that commits the oil exporting economies in ASEAN to supply crude to other non-oil producing ASEAN members when overall supply is severely curtailed. APSA was updated in 2002.

The successful development of the Malampaya gas/oil field has provided the Philippines with significant energy diversification opportunities. Currently, much of this gas supply is used for electricity generation that will moderate the use of fuel oil for this purpose. The extension of the supply system to some direct users, mostly industry, will further improve the situation.

Indigenous oil supply is expected to increase from minimal amounts to around 50,000 bpd in the near future, around a sixth of demand of around 300,000 bpd.

THAILAND

Thailand is around 88 percent (Table 2) dependent on imports for its oil. Around 85 percent of it, that is, around 75 percent of oil supplies, is sourced from the Middle East. The United Arab Emirates (UAE) and Oman provide around 25 percent each of imports. Indigenous production could be increased to around 120,000 bpd, or around 21 percent of consumption, if needed.[4]

Oil companies are required to maintain reserves of 36 days of consumption, up from 22 days prior to 11 September 2001. During the Iraq war, stocks were likely somewhat above this level as they were estimated to last for 56-66 days without imports.[5] The available storage capacity of oil companies and refineries is around 100 days of consumption.[6] Thailand is considering the establishment of a government stockpile but no decision has been made yet.

Thailand is also a signatory to APSA and has apparently secured emergency supplies of 270,000 - 290,000 bpd from neighbouring producers that together with increased domestic production are estimated to extend supplies in an emergency to around 246 days of consumption.

INDONESIA

Indonesia is the only APEC member who is also a member of OPEC. It has been a net oil exporter for many years. However, a combination of rapid consumption growth and declining production means that Indonesia could be a net importer within the next few years.

In 2002, Indonesia's net exports are estimated to have averaged less than 100,000 bpd. APERC projections[7] are for consumption to increase by 3.7 percent per annum and production to decrease by 2.4 percent per annum between 1999 and 2020, resulting in an import dependence of 58 percent in 2020.

Like Canada, Indonesia is a significant exporter of oil, currently around 500,000 bpd, and a significant importer as well, currently around 400,000 bpd of crude and products combined. Crude imports are mainly from Saudi Arabia and Kuwait. This practice is simply one of exporting the

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[4] Petroleum Authority of Thailand (PTT), May 2003.

[5] Krungtep Business newspaper.

[6] Jirapraditkul, V., Thailand's Energy Security Policy, presentation made at The APEC Energy Security Initiative Workshop on Elements of Energy Security Policy in the Context of Petroleum, Bangkok, September 2001.

[7] APERC, APEC Energy Demand and Supply Outlook, 2002.

higher quality indigenous crude and replacing it with a crude that more closely reflects the domestic demand slate.

During the recent supply disruptions, Indonesia took extra measures to ensure continuity of supply. Emergency stocks of 30 days' consumption were already required to ensure supply in the archipelago. A contingency shipping location in the Red Sea was agreed with Saudi Arabia and Kuwait in case of disruption in the Persian Gulf. The domestic refinery maintenance programme was postponed to support a possible diversion of crude exports to meet domestic demand. The government and oil companies enhanced security measures at energy installations against terrorism and violence in the predominantly Muslim economy.

Indonesia as a member of ASEAN is also a signatory to APSA and so, would, more likely than not, be a net supplier should there be a significant supply shortfall in any ASEAN economy or economies.

BRUNEI DARUSSALAM

Brunei Darussalam is a small but significant oil exporter, currently exporting around 180,000 bpd, or around 95 percent of production. Additionally, Brunei Darussalam is a major LNG exporter. All of Brunei Darussalam's electric generation capacity is gas-fired. This consumes around 10 percent of production so that around 90 percent of gas production is exported. Brunei Darussalam holds operational reserves of petroleum products equivalent to 21 days' demand.

Being a net oil and gas exporter, Brunei Darussalam was not directly affected by the Iraq war nor by other supply disruptions around the world. Higher crude prices did mean higher oil revenues. At times of higher prices, oil products' prices within Brunei Darussalam are subsidised above a certain maximum under the Price Stabilization Agreement between the Government and Brunei Shell Marketing, the sole supplier of petroleum products in the economy since the company has to purchase petroleum products at higher costs than it can sell them for.

Brunei Darussalam as a member of ASEAN is also a signatory to APSA and so, especially as it is a very small energy consumer, would, more likely than not, be a net supplier should there be a significant supply shortfall in any ASEAN economy or economies.

NEW ZEALAND

New Zealand is around 70 percent dependent on imports for its oil and petroleum products' demand and is self-sufficient in the other energy types. In practice, New Zealand imports almost all of its oil consumption, 92 percent in 2002[8], as some of its crude production is exported since it has a higher value when processed in refineries other than its single refinery.

New Zealand does not hold any strategic stocks. As a member of the IEA, its obligations are met with the stocks held by oil companies. As one of the most distant economies from some of its major supply sources such as Saudi Arabia, the UAE and Oman, contracted supplies can take up to around 5 months before they become available to the consumer.

During the recent supply disruptions in various parts of the world, authorities were at a higher level of alert but no actions were needed to manage any (impending) supply disruptions.

During the Southern Hemisphere's fall (autumn) and early winter, New Zealand did face an energy crisis. Very low rainfall, or inflows, into New Zealand's hydro-dominated power system (around 60 percent of generation), resulted in potential shortages and very high and volatile spot prices. At the time, some economic losses were experienced through foregone production when the high prices contributed to some types of production becoming uneconomic. Consumers were asked to make savings of 10 percent of their normal usage. This was the third time in 12 years that New Zealand had faced electricity shortages due mainly to insufficient rainfall.

[8] (New Zealand) Ministry of Economic Development, Energy Data File, January 2003.

One factor that exacerbated the shortages was the lack of reserve capacity in the New Zealand system. It was generally agreed that the New Zealand electricity system's ownership structure[9] meant that there was no commercial incentive for generators to provide a level of supply security for very dry years.

As things have turned out, more rainfall eventually averted shortages during the winter period.

The government decided to establish an Electricity Commission that, amongst other functions, would be tasked "to manage the sector such that demand can be met in a 1 in 60 dry year without the need for national conservation campaigns".[10] The Commission will decide how the cost of reserve generation will be recovered. The Commission is also expected to be able to reduce the (high) volatility in spot prices.

[9] Ownership is a mixture of private companies and government-owned companies that operate on private sector principles.

[10] (New Zealand) Minister of Energy, Electricity Supply Security for New Zealand, speech notes, 20 May 2003.

CHAPTER 3

PRICE ISSUES AND THE ASIAN PREMIUM

The so-called "Asian Premium" is based on the observable assertion that the economies of Asia pay more for the equivalent barrel of imported oil compared to their European or American counterparts. This situation has existed since 1992, after the Gulf crisis, due to strong economic growth in Asian developing economies resulting in rapid oil demand growth and also due to the accelerated decline of Dubai crude oil production. Prior to the 1990s, Dubai production at over 400,000 bpd was traded to both Europe and Asia and the price arbitrage by spot trading between Asia and Europe was minimal.

The Asian Premium pertains particularly to the North Asian economies who are generally more dependent on imported oil than most of their South and Southeast Asian neighbours, who in any case may also have more diversified sources of supply.

Thus the economies that have been most concerned and vociferous about the issue are Japan and Korea. The Philippines is known to have raised concerns at IEF8 (Osaka), September 2002. And as an importing economy of increasing magnitude, China is thought to be developing views and positions on the issue.

Research by Japan,[11] Korea[12] and independent analysis,[13] suggest that the premium has averaged around US$1 per barrel of oil, as illustrated in Table 1, Figure 1 and Figure 2. At this level, the premium costs the Japanese economy around US$1.5 billion and the Korean economy around US$0.8 billion annually without consideration for its impact on other energy forms such as LNG and other downstream effects.

Ogawa[14] shows in his extensive analysis that the Asian Premium problem is rooted in the fact that Asia's substantial imports from the Middle East are priced using a marker crude, namely Dubai crude, in the pricing formula that is no longer reliable in the sense that Dubai crude's production has declined from around 400,000 b/d in 1990 to around 150,000 b/d in 2003. Of that amount not all is spot traded, meaning that price formation is somewhat unreliable.

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[11] For example, Ogawa, Y., Proposals on Measures for Reducing Asian Premium of Crude Oil, The Institute of Energy Economics, Tokyo, Japan, 2003.

[12] Lee, D. S. and Moon, Y.S., Energy Cooperation in Northeast Asia: A Study on the Efficient Logistics of Crude Oil Import in Northeast Asia, Korea Energy Economics Institute mid-term report, 2001.

[13] Fesharaki, F, and Vahidy, H., Middle East Crude Oil Trade and Formula Pricing, Middle East Economic Survey, Vol 44, No 43, October 2001.

[14] *Ibid*, Ogawa, Y., 2003.

Table 1 Price Differentials (US$/bbl)

	IEEJ			KEEI			Facts Inc.		
	Asia-Europe	Asia-USA	Asia-Europe	Asia-Europe	Asia-USA	Asia-Europe	Asia-Europe	Asia-USA	Asia-Europe
1991	-0.13	-0.03	-0.1						
1992	0.69	0.67	0.02						
1993	1.01	0.56	0.45						
1994	1.15	1.13	0.02				1.03	1.07	0.04
1995	0.95	0.95	0	1.02	0.96	0.06	1.09	1.04	0.05
1996	0.17	0.15	0.02	0.2	0.09	0.11	0.52	0.52	0
1997	1.67	1.41	0.26	1.58	1.36	0.22	1.74	1.57	0.17
1998	1.43	0.98	0.45	1.42	1.06	0.36	1.03	1.04	-0.01
1999	0.95	1.15	-0.2	1.1	1.2	-0.1	0.89	1.20	-0.31
2000	0.72	0.37	0.35	0.73	0.58	0.15	0.88	0.44	0.44
2001	0.89	2.68	-1.79				*1.02	*2.80	*-1.78
2002	*1.59	*1.83	*-0.24						
Average	0.94	1.00	-0.06	1.01	0.87	0.15	1.03	1.21	-0.18

Source: Ogawa, Y. (2003), Proposals on Measures for Reducing Asian Premium of Crude Oil. (* part year)

Figure 1 Asian Premium in Arab Light

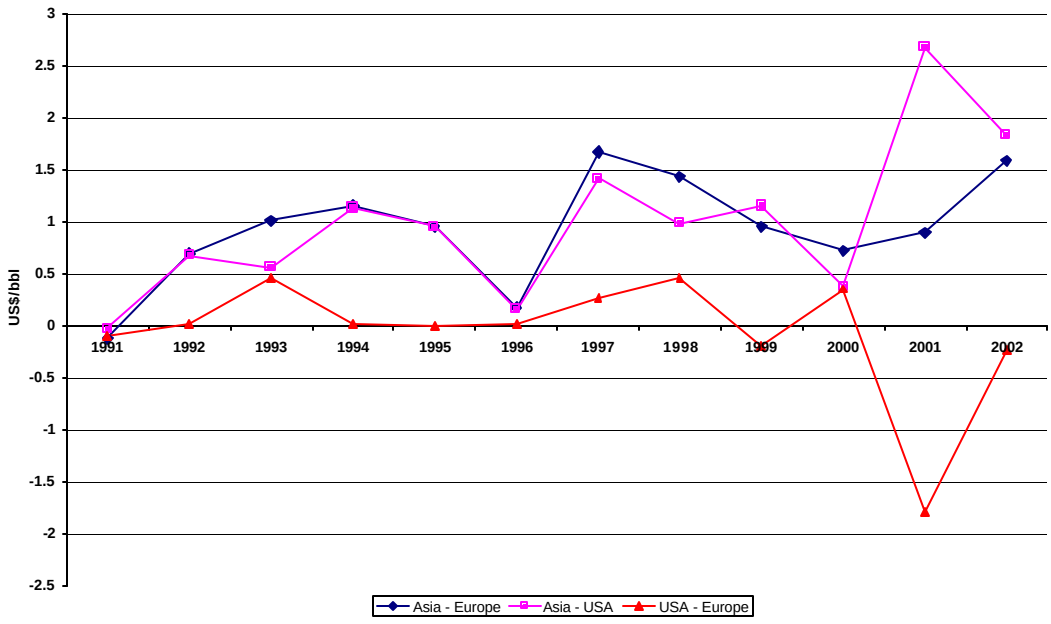
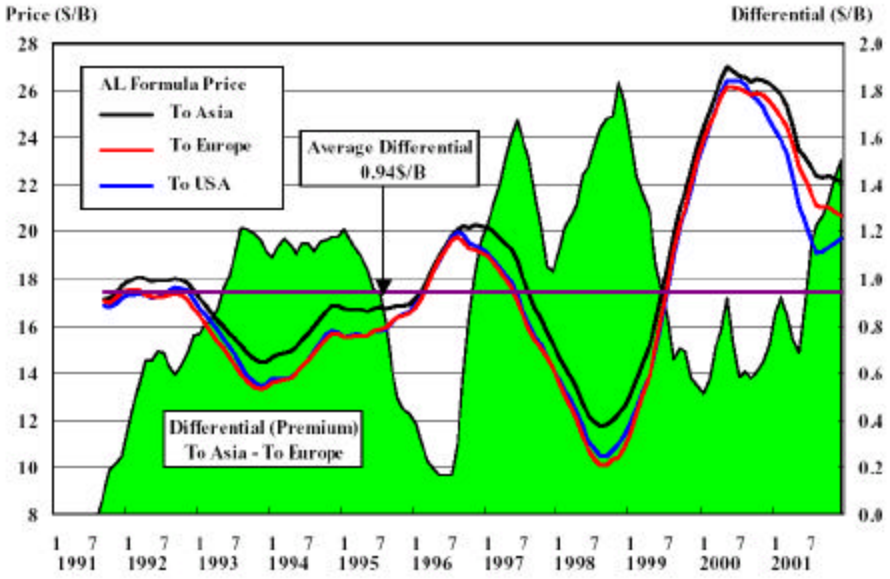


Figure 2 Changes in Formula Prices of Arabian Light Crude and Asian Premiums
(FOB basis at the timing of shipment, twelve-month moving averages)



Source: Ogawa, Y., Proposals on Measures for Reducing Asian Premium of Crude Oil, 2003.

FORMULA PRICING, THE MIDDLE EAST OIL MARKER PRICE AND THE ADJUSTMENT FACTOR

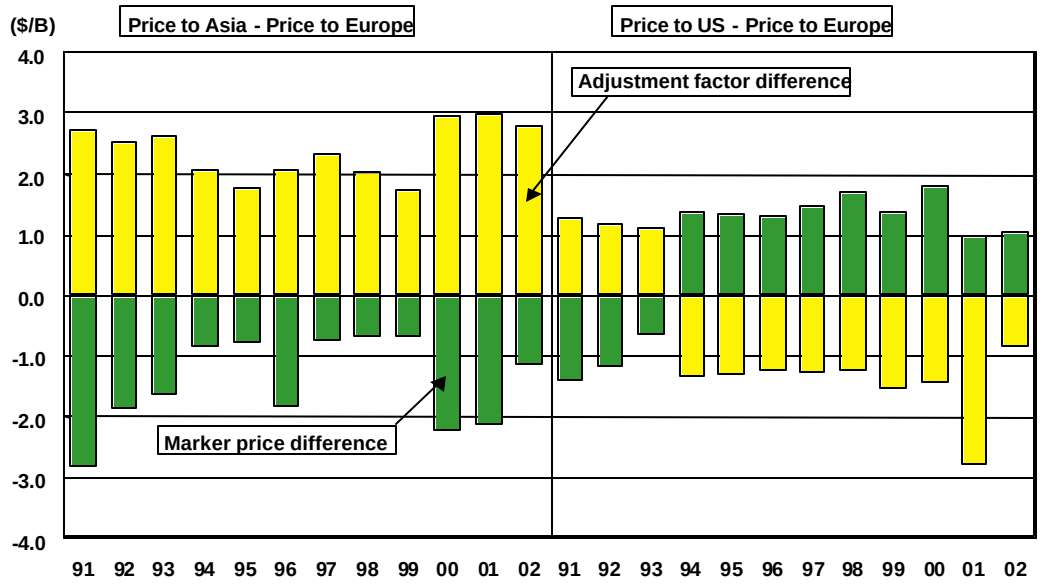
Oil-producing countries began adopting the formula method for pricing crude oil in and after the second half of 1987. Thus term contracts are priced using the formula method. The formula price is composed of two elements – the price of the marker crude representing the consuming area and oil-producing country's adjustment factor which is based on a quality differential and transport costs as shown by the following formula:

Formula price of crude oil = Price of marker crude applicable to the consuming area

± Oil producing country's adjustment factor

Figure 3 decomposes the numbers shown in Table 1 and illustrates how the two components combine to yield the formula price, and in this instance, give rise to the price difference, the "premium". The marker price difference is composed mostly of timing differences and the transport cost difference between destinations, in this case, between Asia and Europe. The adjustment factor difference is composed of a quality differential and transport cost and is usually determined by the producer taking into account "market conditions" in the destination.

Figure 3 Components and Differences in Formula Prices among Con sumption Areas



Source: Ogawa, Y., Asia Oil Price Analysis 1 – Middle Eastern Crude for Asian Market Priced at Comparatively Higher Levels and Switchover of Marker Crude Inevitable to Gain Market's Confidence, IEEJ, Tokyo, June 2002.

In Figure 3, the sum of the (positive) adjustment factor difference and the (negative) marker price difference is significantly and consistently positive for each period when comparing the crude pricing between Asia and Europe. In contrast, when comparing the prices to the US with the prices to Europe, the price differences are smaller and are both negative and positive.

Due to the low volumes of Dubai crude being traded on the spot market and its consequential low liquidity, (Asian) importers consider it to be unresponsive to market conditions and have begun to question its efficacy as a marker crude.

Also considered a problem is the way in which oil producers set the adjustment factors by taking into account "market conditions" in the destination although these market conditions do sometimes cause them to reduce premiums.[15]

The Middle East marker oil for Asian destinations is Dubai crude while Brent is used in European markets and West Texas Intermediate (WTI) in US markets:

Ogawa proposes a number of possible remedies to the Asian Premium problem:

(1) Change the marker crude to Brent

(2) Change the marker crude to a combination of WTI and Brent

(3) Use a different Middle East crude as a marker crude

(4) Diversify sources of imports

Clearly, options (1) and (2) have more potential in the short term while all may be considered applicable in the longer term.

Ogawa demonstrates that the price differential can be virtually eliminated by adopting a marker pricing method using either Brent or a combination of Brent and WTI.[16] Thus (East) Asian

[15] International Herald Tribune, Saudi Aramco set to slash premiums on oil products, 7 November 2002.

[16] WTI, alone, is not considered because it is not traded outside of the US.

importers would need to negotiate with the Middle Eastern oil-producing economies to change the marker crude for the Asian market. That this may be met by limited success can be viewed as the degree of market power held by the Middle East producers over importers who are highly dependent on them for supplies.

The applicability of option (3) is in many ways, the ideal solution for price discovery given that Middle East crudes are more reflective of Asian demand conditions than using either or both of Brent and WTI as marker crudes. However, given the major Middle East producers' ability to withhold their crudes from spot markets suggests that the prospects for this are slim.

One emerging possibility arises from the recent ructions in Iraq and what may evolve when oil production returns to "normal" levels and the organisational structure stabilises.

Iraq is a major oil producer with proven reserves second only to those of Saudi Arabia and production costs similarly amongst the lowest in the world. Its current export potential is around 2 mbd, with a considerably higher potential in the longer term. A significant stream is Basra Light, from the fields of southern Iraq. While Iraqi exports to Asia have not been substantial for a number of years, peaking at around 11 percent of exports or 230,000 bpd in 1999 and 2000 but less than 50,000 bpd (3 percent of exports) in 2001,[17] Basra Light is considered attractive to (North) Asian importers.[18] In general, how the "new" Iraq impacts on world oil markets is of interest to all market participants. Whether Basra Light has a role in Asia, possibly even as a benchmark or marker crude, only time will tell.

Option (4) has potential as a longer-term solution for reducing the Asian Premium. In particular, the role of Russian oil and natural gas seems likely to play important roles in contributing to and diversifying East Asia's energy imports. Other supply regions such as Africa and Central Asia may also play more important roles but are less certain. The topic of supply diversification is explored further in Chapter 4.

MONOPOLY SELLING POWER

The Middle East is the world's major oil exporting region, currently accounting for around 30 percent of the world's production (excluding NGLs) and around 57 percent of the world's exports[19]

The Asia-Pacific region is the main destination for Middle East exports, taking around 60 percent of its production and around two-thirds of exports. The Middle East depends on APEC Asia to take around 50 percent of its exports. In turn, Asia is heavily dependent upon the Middle East for its oil supplies, at around 80 percent of imports.

Other importing regions such as (western) Europe and the USA are able to (economically) source their supplies from more diverse regions such as the North Sea, Africa and Russia in the case of Europe and indigenous, Latin America, Canada and Africa in the case of the US. Nevertheless, their imports from the Middle East are still significant enough to warrant maintaining and developing political, economic and commercial relations and interests in what has historically been a politically volatile region.

The Asian region does not possess the luxury of sourcing its oil requirements from such a diverse area as Europe or the US except (perhaps) at some additional (transportation) cost that effectively attaches an insurance premium to source diversification. In recent times, some Asian importers' dependence on Middle East supplies have been greater than 80 percent (for example see Figure 9, Figure 18 and Figure 22). In many ways, the Middle East is the "natural supplier" to the Asian region, at least from an economic perspective.

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[17] OPEC Annual Statistical Bulletin 2001.

[18] Petroleum Intelligence Weekly, Vol XLII, No. 23, June 9, 2003.

[19] www.energyintel.com, April 2003.

It follows that the Middle East is, in many ways, a monopoly supplier to APEC Asia importing economies, especially those of Northeast Asia. The next chapter looks at the supply side in more detail and analyses whether there is significant potential for Asia to diversify the sources of its oil imports away from the Middle East. If possible to any significant extent, this will serve the twin objectives of (i) increasing the competition for supplies, and (ii) diversify the supply risks, associated with the current high dependence on imports from the Middle East.

MONOPSONY BUYING POWER

Although Asia is a large market for Middle Eastern oil, this situation does not confer any buying power or privileges to the customers. However, a case of monopsony, or at least dominant, buying power, does appear to exist in the APEC region. Recently, a Canadian producer has complained about its oil selling at up to a US$2 per barrel discount to comparable crudes.[20] Canadian producers suggest that this is the case because the US is the sole effective market for its oil exports, of which around 60 percent are destined for the Midwest. Producers are said to be looking for markets in the Asia-Pacific. This could well be of some benefit to the economies of East Asia in the longer term.

[20] Petroleum Intelligence Weekly, Vol XLII, No. 19, May 12, 2003.

CHAPTER 4

SUPPLY SIDE PERSPECTIVE AND ISSUES

SUPPLY DEPENDENCE ISSUES

The dynamics of oil supply poses significant (price) competition and security of supply issues for a number of APEC economies, especially the net importing economies of the Asian region. As stated in the previous chapter, the APEC region as a whole is a significant net oil importer. Production within the APEC Asia region is generally expected to remain essentially unchanged in aggregate in the next two decades, with the result that increasing demand, the fastest in the world on a regional basis, will need to be met by imports from outside of the APEC region.

One perspective of the Asian Premium is that it is due, in part at least, to Asia's, and especially North Asia's not only high oil import dependence but, in particular, the region's high dependence on imports from the Middle East.

The following table reproduced from the APEC Energy Demand and Supply Outlook 2002 shows that overall oil demand in APEC economies is projected to increase by some 60 percent between 1999 and 2020. With increased demand far exceeding projected increased production of 10 percent between 1999 and 2020, import dependency is expected to increase from 36 percent in 1999 to 54 percent in 2020.

Focussing on the economies of North Asia, viz. China, Japan, Korea and Chinese Taipei, this group of economies are projected to increase their overall demand from 12.7 mbd in 1999 to 20 mbd in 2020 (by two-thirds). With China being the only producer within this group, and its production projected to fall slightly, imports into the North Asia region are required to increase from 9 mbd in 1999 to 17 mbd in 2020, with overall import dependency rising from 74 percent in 1999 to 85 percent in 2020.

Table 2 Oil Production and Consumption in APEC Economies – 1999 and 2020

Annual	Consumption ktonnes	Production ktonnes	Dependency	Consumption ktonnes	Production ktonnes	Dependency
	1999	1999	1999	2020	2020	2020
Australia	36,105	25,093	30.5%	60,008	32,374	46.1%
Brunei Darussalam	428	9,712	-2169.2%	1,109	11,204	-910.3%
Canada	90,327	123,376	-36.6%	120,824	193,600	-60.2%
Chile	10,990	412	96.3%	27,281	140	99.5%
China	204,291	159,896	21.7%	497,249	151,886	69.5%
Hong Kong, China	11,241	0	100.0%	23,876	0	100.0%
Indonesia	46,666	70,053	-50.1%	100,023	42,040	58.0%
Japan	266,438	746	99.7%	288,359	0	100.0%
Korea	99,913	446	99.6%	163,045	446	99.7%
Malaysia	22,231	37,348	-68.0%	52,129	32,874	36.9%
Mexico	93,147	167,250	-79.6%	104,365	181,879	-74.3%
New Zealand	6,457	2,279	64.7%	9,686	1,937	80.0%
Papua New Guinea	922	4,335	-370.2%	1,062	210	80.2%
Peru	6,404	5,341	16.6%	10,323	7,818	24.3%

Annual	Consumption ktonnes	Production ktonnes	Dependency	Consumption ktonnes	Production ktonnes	Dependency
	1999	1999	1999	2020	2020	2020
Philippines	17,682	41	99.8%	36,996	1,124	97.0%
Russia	127,315	304,921	-139.5%	197,757	377,713	-91.0%
Singapore	21,218	0	100.0%	27,842	1	100.0%
Chinese Taipei	38,227	44	99.9%	51,085	0	100.0%
Thailand	33,859	4,138	87.8%	73,117	3,560	95.1%
United States	882,083	365,986	58.5%	1,228,860	360,343	70.7%
Viet Nam	7,532	15,331	-103.5%	32,238	30,529	5.3%
Total	**2,023,476**	**1,296,748**	**35.9%**	**3,107,234**	**1,429,678**	**54.0%**
	58.5%	37.8%				
	of	of				
World	3,461,385	3,433,498				
Asia + Oceania	813,210	329,462	59.5%	1,417,824	308,185	78.3%
North Asia						
China	204,291	159,896	21.7%	497,249	151,886	69.5%
Japan	266,438	746	99.7%	288,359	0	100.0%
Korea	99,913	446	99.6%	163,045	446	99.7%
Chinese Taipei	38,227	44	99.9%	51,085	0	100.0%
	608,869	161,132	73.5%	999,738	152,332	84.8%
(mbd)	12.18	3.22		19.99	3.05	
Imports		8.95			16.95	

Source: APERC, APEC Energy Demand and Supply Outlook 2002.

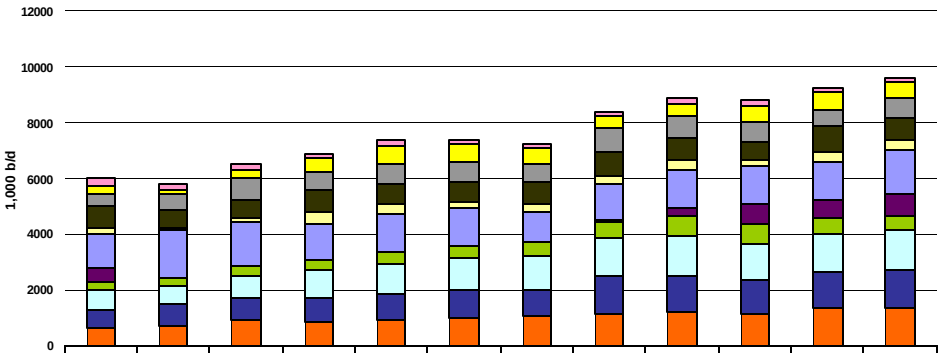
The following discussion and tables provide some analysis and insights into the specific circumstances of a selected number of economies. Numbers in the text refer to 2001 unless otherwise stated.

USA

The USA is the world's largest oil consumer, consuming around 25 percent of world supply, largest importer and third largest producer behind Saudi Arabia and Russia. Its import dependency, which has been rising for some time, is around 60 percent (2001). APERC projections to 2020 show flat production and with increasing demand (1.6 percent per annum), import dependency rises to around 70 percent by 2020, representing a demand increase of around 7 mbd between 1999 and 2020.

Figure 4 and Figure 5 show US imports and shares since 1990. The four biggest exporters to the US are Canada, Mexico, Venezuela and Saudi Arabia, having a combined share of around 60 percent of imports and roughly equal shares each in the last few years. The first three are relatively "natural" exporters to the US by virtue of their geographical proximity to the US. They have provided an average of 43 percent of US imports (25 percent of demand) over the last decade. In 2001, 32 percent of imports was from the Middle East and 11 percent from Africa. By most measures the US has well diversified sources of supply for its oil requirements.

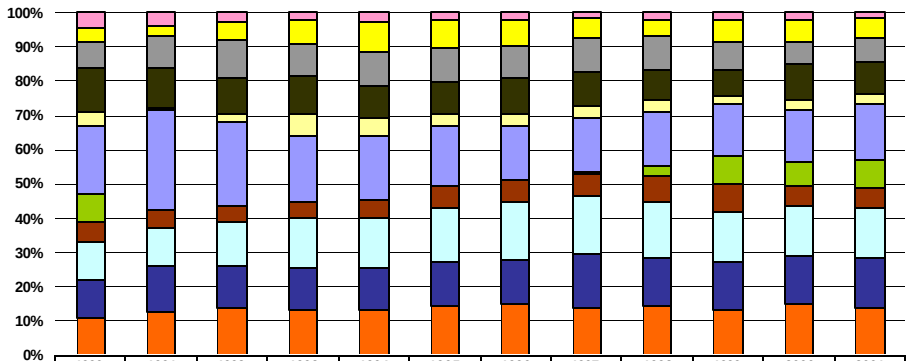
Figure 4 USA: Crude Imports



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	280	234	194	143	194	147	153	162	218	195	186	149
Europe	245	180	327	476	681	636	543	468	421	578	619	563
Other Africa	452	517	747	645	691	701	709	837	846	728	609	709
Nigeria	781	683	675	758	702	723	734	833	786	632	937	853
Other Middle East	218	40	131	458	402	250	279	305	318	231	307	295
Saudi Arabia	1195	1703	1607	1303	1353	1299	1111	1320	1390	1341	1384	1604
Iraq	509	0	0	0	0	0	0	47	297	722	635	780
Other Western Hemisphere	329	306	307	334	384	477	482	556	657	726	567	535
Venezuela	664	668	846	999	1079	1164	1241	1405	1429	1263	1367	1429
Mexico	689	759	788	839	937	947	921	1325	1286	1227	1294	1373
Canada	642	743	915	899	954	1040	1083	1164	1262	1162	1368	1338

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

Figure 5 USA: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	5%	4%	3%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Europe	4%	3%	5%	7%	9%	9%	7%	6%	5%	7%	7%	6%
Other Africa	8%	9%	11%	9%	9%	9%	10%	10%	9%	8%	7%	7%
Nigeria	13%	12%	10%	11%	10%	10%	10%	10%	9%	7%	10%	9%
Other Middle East	4%	1%	2%	7%	5%	3%	4%	4%	4%	3%	3%	3%
Saudi Arabia	20%	29%	25%	19%	18%	18%	15%	16%	16%	15%	15%	17%
Iraq	8%	0%	0%	0%	0%	0%	0%	1%	3%	8%	7%	8%
Other Western Hemisphere	5%	5%	5%	5%	5%	6%	7%	7%	7%	8%	6%	6%
Venezuela	11%	11%	13%	15%	15%	16%	17%	17%	16%	14%	15%	15%
Mexico	11%	13%	12%	12%	13%	13%	13%	16%	14%	14%	14%	14%
Canada	11%	13%	14%	13%	13%	14%	15%	14%	14%	13%	15%	14%

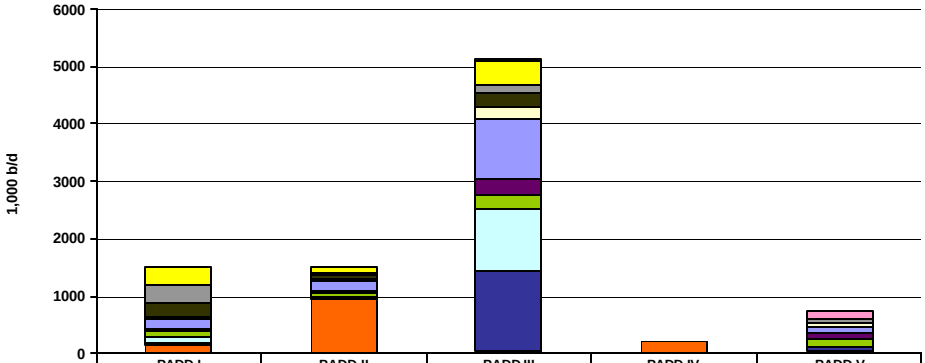
Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

The national import picture for the US masks some salient details in import patterns into the US. Figure 6 and Figure 7 summarise imports by PADD[21] region[22] and import shares by PADD

[21] Petroleum Administration Defense District.

region respectively, in 2002.[23] They show that by far the largest import region, which is not necessarily the region of consumption, is the Gulf Coast. Imports in 2002 landed at Gulf Coast ports exceeded 5 mbd, or 56 percent, of total imports, not to mention the domestic Gulf production that is also landed in this region. A combined 82 percent of crude imports from the major suppliers, Saudi Arabia, Mexico and Venezuela were landed in the Gulf Coast region.

Figure 6 USA: Crude Imports by PADD (2002)



	PADD I	PADD II	PADD III	PADD IV	PADD V
Asia Pacific	0	0	9	0	132
Europe	311	102	418	0	12
Other Africa	306	30	146	0	53
Nigeria	264	62	264	0	0
Other Middle East	3	22	188	0	67
Saudi Arabia	198	177	1043	0	101
Iraq	18	57	275	0	109
Other Western Hemisphere	96	53	272	0	141
Venezuela	107	36	1051	0	6
Mexico	47	10	1391	0	52
Canada	152	946	59	229	58

Source: Data from (US) Energy Information Administration, Petroleum Supply Annual 2002, Vol 1.

By contrast, around 1.5 mbd are imported through each of the PADD I (Atlantic Coast and New England) and PADD II (Midwest) regions' ports. In the case of PADD I, the major sources are Europe, around 20 percent, and Africa, around 40 percent. For PADD II (Midwest), Canada, unsurprisingly, is the major source is, accounting for 63 percent of imports into the region in 2002, and comprising 65 percent of Canada's exports to the US. Despite being a large demand region, PADD V (West Coast) is a relatively minor importer, at around 0.73 mbd, or 8 percent, of US imports, in 2002. PADD IV (Rocky Mountain) is a very small importing region, comprising around 0.23 mbd, all of it from Canada.

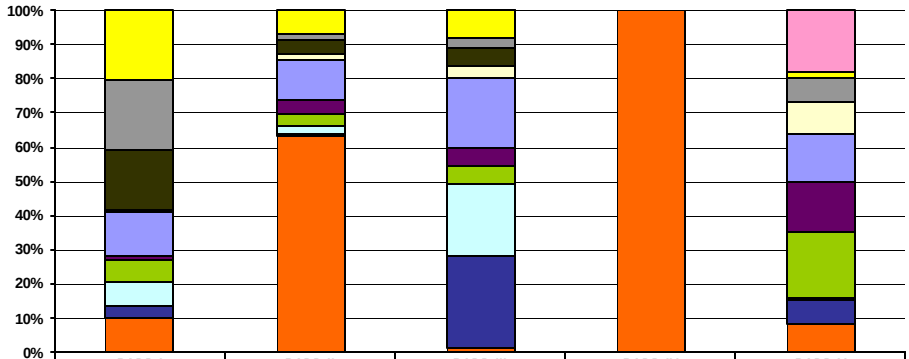
The PADD III region is a major importing and processing region and is a supplier to other regions, spanning both the east and west coasts. The PADD V region consumes around 14 percent of total US petroleum products consumption[24] and with domestic production only in Alaska, is an importing region. Implied in this analysis is that the Pacific states of the US may seek to increase oil imports from the Pacific region. For example, it has been suggested that the construction of an Angarsk-Nadhodka pipeline in Russia will allow the possibility of, at least, some exports to the US.

[22] PADD I = Atlantic Coast + New England, PADD II = Midwest, PADD III = Gulf Coast, PADD IV = Rocky Mountain, PADD V = West Coast.

[23] US Energy Information Administration, Petroleum Supply Annual 2002, Volume 1, Washington DC, 2003.

[24] US Energy Information Administration, Annual Energy Outlook 2003, Washington DC, 2003.

Figure 7 USA: Crude Import Shares by PADD (2002)



	PADD I	PADD II	PADD III	PADD IV	PADD V
Asia Pacific	0%	0%	0%	0%	18%
Europe	21%	7%	8%	0%	2%
Other Africa	20%	2%	3%	0%	7%
Nigeria	18%	4%	5%	0%	0%
Other Middle East	0%	1%	4%	0%	9%
Saudi Arabia	13%	12%	20%	0%	14%
Iraq	1%	4%	5%	0%	15%
Other Western Hemisphere	6%	4%	5%	0%	19%
Venezuela	7%	2%	21%	0%	1%
Mexico	3%	1%	27%	0%	7%
Canada	10%	63%	1%	100%	8%

Source: Data from (US) Energy Information Administration, Petroleum Supply Annual 2002, Vol 1.

Likely, the apparent efforts the US makes to secure and diversify its oil supplies are an indication of the importance it attaches to the issue of obtaining adequate oil supplies and indeed supplies of other forms of energy. In the Energy Security section of the National Energy Policy[25], of the current Bush Administration, released in May 2001, it states, *inter alia*, that:

"The National Energy Policy seeks to lessen the impact on Americans of energy price volatility and supply uncertainty."

Consistent with being the world's pre-eminent economic power and largest energy and oil consumer, the US has an international and outward-looking energy policy. Discussed in *Chapter 8: Strengthening Global Alliances*, there are a large number of recommendations pertaining to energy security in the international context. Those that involve APEC include:

[25] (US) National Energy Policy Development Group, National Energy Policy, presented to the President of the United States, May 2001.

- That the President make energy security a priority of trade and foreign policy.
- That the President direct the Secretaries of State, Energy and Commerce to improve dialogue among energy producing and consuming nations.
- That the President direct the Secretaries of State, Commerce and Energy to continue to work in the APEC Energy Working Group to examine oil market data transparency issues and the variety of ways petroleum stocks can be used as an option to address oil market disruptions.
- That the President reaffirm the SPR is designed for addressing an imminent or actual disruption in oil supplies, and not for managing prices.
- That the President direct the Secretary of Energy to encourage major oil-consuming nations that are not IEA members to consider strategic stocks as an option for addressing potential supply disruptions. In this regard, we should work closely with Asian economies, especially through APEC.
- That the President direct the Secretary of Energy to lease excess SPR storage facilities to countries that might not otherwise build storage facilities or hold sufficient strategic stocks, consistent with statutory authorities.
- That the President direct the Secretary of Energy to work with producer and consumer country allies and the IEA to craft a more comprehensive and timely oil data reporting system.

JAPAN

Japan is essentially completely dependent on imports for its oil supplies. It is the world's second largest importer behind the USA. Figure 8 and Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

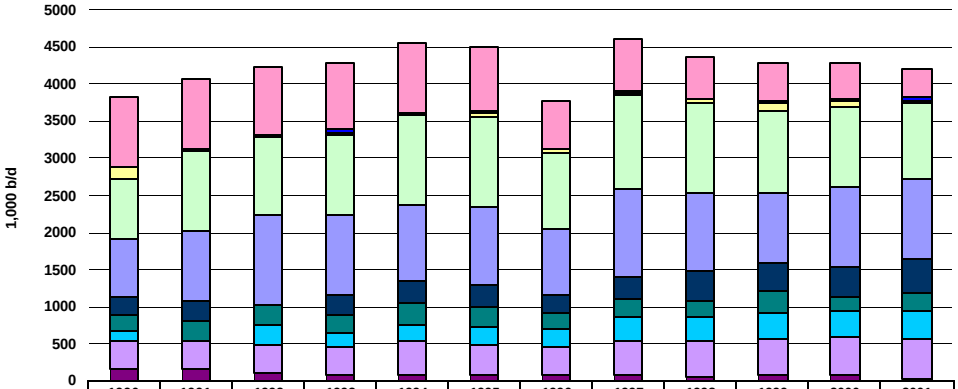
Figure 9 show Japan's level and shares of imports from various parts of the world since 1990. It can be observed that Japan has a very high dependence on Middle East sources for its oil imports. Its dependence on the Middle East has been rising in recent years and is near 90 percent with six suppliers providing all of this share and OPEC Middle East (Middle East less Oman) supplying over 80 percent of total imports. In 2001, Japan's largest suppliers, Saudi Arabia, the United Arab Emirates, Iran and Qatar supplied around 26 percent, 25 percent, 13 percent and 11 percent respectively. At around 3.7 mbd in 2001, Japan is the Middle East's largest customer, taking around 21 percent of that region's exports.

Residually, its imports from regions such as Africa and Asia as a share of overall imports are low compared to other Asian importers (see below). Among APEC importers, Japan has the second highest dependence on the Middle East for its imports after the Philippines.

Japan's concerns over its oil security are reflected in many of its energy policy actions, including having developed a sizeable strategic petroleum reserve, currently around 310 mbbl, since the oil crises of the 1970s. Through concerted conservation, Japan has significantly reduced its overall oil demand from what it might otherwise have been in the absence of measures. The volume of crude imports in 2002 was below that prevailing during the peak of the 1970s and also lower than it was in the 1990s although higher than during the 1980s. The (crude) oil import intensity is at its lowest, at 0.45 litres/1,000 Yen GDP, since at least before 1970. This measure has generally declined since the peak of 1973 and in 2001, for the first time, was less than 40 percent of the intensity in 1970[26] (Figure 10).

[26] This measure is an approximate, albeit good, indicator of oil intensity in the economy as it excludes products trade.

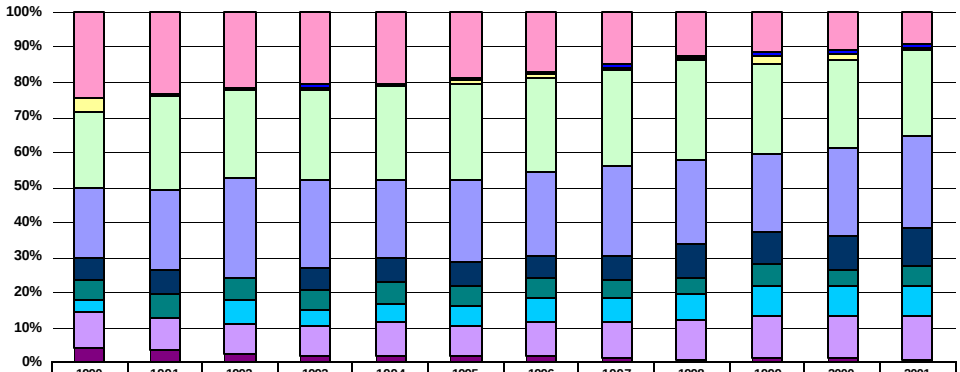
Figure 8 Japan: Crude Imports



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	930	944	918	885	925	855	646	694	549	499	470	396
Africa	17	13	12	46	19	27	20	31	21	35	44	47
Other Middle East	149	12	11	22	23	39	40	34	36	107	68	21
UAE	823	1084	1057	1098	1217	1231	1025	1256	1222	1101	1080	1032
Saudi Arabia	766	939	1215	1056	1011	1049	890	1178	1051	942	1069	1086
Qatar	242	261	5	287	289	291	245	308	416	398	399	456
Oman	212	277	264	231	301	264	212	233	208	271	196	244
Kuwait	136	7	276	190	212	250	250	337	323	355	367	363
Iran	389	380	370	376	455	400	368	456	483	502	509	534
Western Hemisphere	153	140	104	76	84	76	79	65	45	66	67	27

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

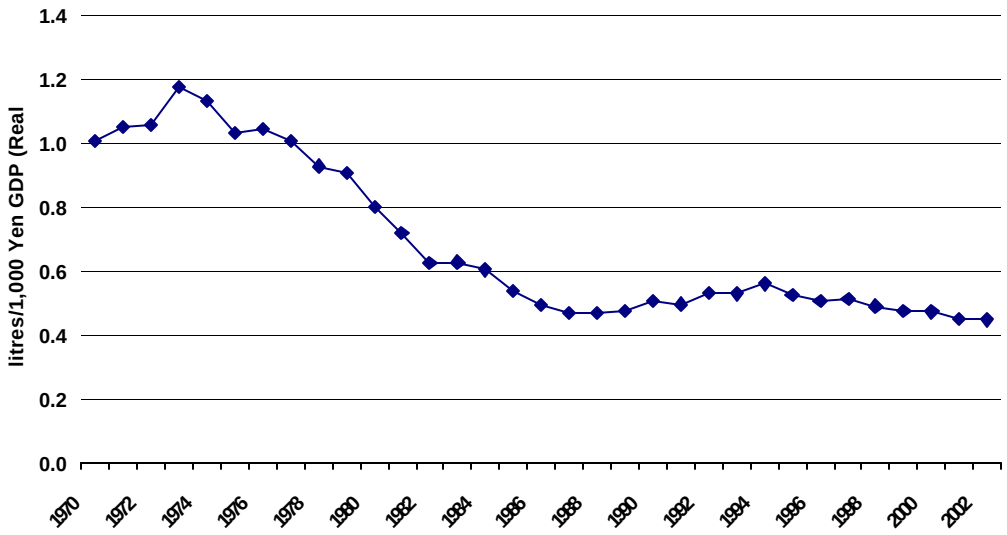
Figure 9 Japan: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	24%	23%	22%	21%	20%	19%	17%	15%	13%	12%	11%	9%
Africa	0%	0%	0%	1%	0%	1%	1%	1%	0%	1%	1%	1%
Other Middle East	4%	0%	0%	1%	0%	1%	1%	1%	1%	3%	2%	0%
UAE	22%	27%	25%	26%	27%	27%	27%	27%	28%	26%	25%	25%
Saudi Arabia	20%	23%	29%	25%	22%	23%	24%	26%	24%	22%	25%	26%
Qatar	6%	6%	0%	7%	6%	6%	7%	7%	10%	9%	9%	11%
Oman	6%	7%	6%	5%	7%	6%	6%	5%	5%	6%	5%	6%
Kuwait	4%	0%	7%	4%	5%	6%	7%	7%	7%	8%	9%	9%
Iran	10%	9%	9%	9%	10%	9%	10%	10%	11%	12%	12%	13%
Western Hemisphere	4%	3%	2%	2%	2%	2%	2%	1%	1%	2%	2%	1%

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

Figure 10 Japan: Crude Oil Intensity



Source: APERC

However, the progress made on some other measures for improving oil security seem to lag those of some neighbouring economies. For example, Japan is relatively undiversified in its import sources (as shown) and its reciprocal investments in the oil sector seem not as extensive compared to the likes of Korea and Chinese Taipei, which are equally as dependent on imports, and China, which is less dependent on imports.

However, recent activities and initiatives seem to move in the right direction with active assessment of the Asian Premium issue, leadership in promoting regional dialogues focused on improving energy security in Asia and leadership in promoting consumer-producer dialogues. The pursuit of import diversification possibilities has recently intensified. Efforts include lobbying for a Russian west-east oil pipeline from Angarsk to the port of Nadhodka, in competition with China. This proposal is for a pipeline with a capacity of around 1 mbd, costing around US$5 billion. Japan has offered to provide funding for both the pipeline and the development of sufficient resources to justify its construction. In 2000, Iran granted Japan priority rights to develop the giant Azadegan oil field, estimated to contain 26 billion barrels of oil. However, at the critical juncture, the priority rights may be compromised by Japan's policy towards Iran's nuclear developments. Consistent with its developed economy status and oil-poor status, Japan is at the forefront of research aimed at producing oil substitutes and oil substitution.

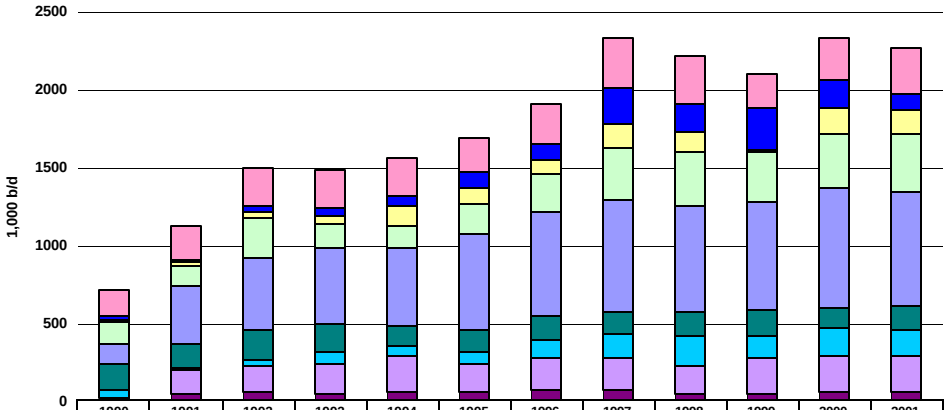
In Japan's favour, is the fact that a combination of aggressive conservation policies, low population growth and low economic growth will see little growth in its oil requirements. APERC projects demand to grow at a rate of just 0.4 percent per annum through to 2020. Hence, any realised new supply sources will represent true diversification outcomes as compared to imports that effectively satisfy increased demand.

KOREA

Korea is also entirely dependent on imports for all of its oil needs. Its import sources are akin to those of Japan with a very high dependence on the Middle East at around 75-80 percent with Saudi Arabia usually providing over 30 percent and the UAE around 16 percent. Korea has a higher diversification into African sources, albeit at quite low (and recently declining) levels of around 5-8 percent. Its imports from Asia, at around 10 percent, are comparable to those of Japan. Figure 11 and Figure 12 summarise the Korean situation.

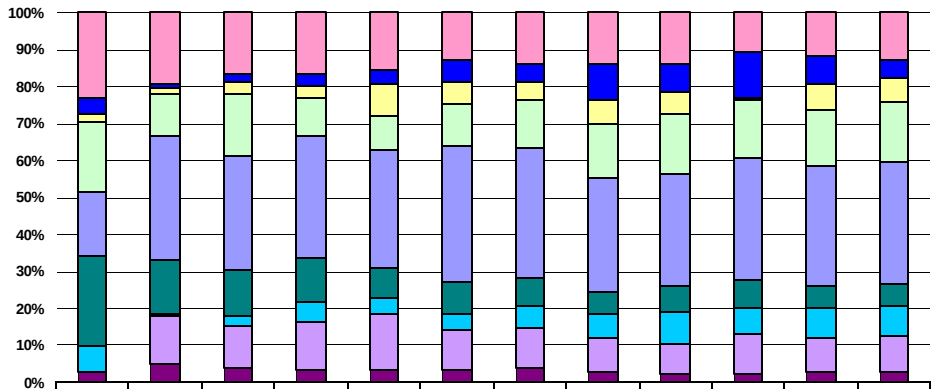
Figure 11 Korea: Crude Imports

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	168	217	249	251	239	215	263	328	306	220	273	295
Africa	29	11	33	44	64	103	103	223	172	265	179	105
Other Middle East	17	19	45	53	133	101	86	152	133	17	168	152
UAE	134	129	254	151	144	194	249	341	353	328	345	370
Saudi Arabia	126	371	459	488	494	622	673	720	673	687	762	738
Oman	174	162	193	178	126	146	151	135	155	162	132	146
Kuwait	48	5	40	80	74	69	109	154	189	151	187	175
Iran	0	151	166	191	229	188	212	212	184	222	222	225
Western Hemisphere	21	52	58	49	54	52	69	69	46	50	62	61

Figure 12 Korea: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	23%	19%	17%	17%	15%	13%	14%	14%	14%	10%	12%	13%
Africa	4%	1%	2%	3%	4%	6%	5%	10%	8%	13%	8%	5%
Other Middle East	2%	2%	3%	4%	9%	6%	4%	7%	6%	1%	7%	7%
UAE	19%	12%	17%	10%	9%	11%	13%	15%	16%	16%	15%	16%
Saudi Arabia	18%	33%	31%	33%	32%	37%	35%	31%	30%	33%	33%	33%
Oman	24%	15%	13%	12%	8%	9%	8%	6%	7%	8%	6%	6%
Kuwait	7%	0%	3%	5%	5%	4%	6%	7%	9%	7%	8%	8%
Iran	0%	13%	11%	13%	15%	11%	11%	9%	8%	11%	10%	10%
Western Hemisphere	3%	5%	4%	3%	3%	3%	4%	3%	2%	2%	3%	3%

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

Korea's increased imports of African crudes since the early 1990s is due, in part, to the strengthening of sulphur regulations pertaining to diesel and residual fuel oil. The processing of the

low sulphur content crudes means that refiners can avoid the investment burden of installing desulphurisation units.

As a still industrialising economy with considerable economic growth expectations, Korea's oil demand is projected to continue rising. The APERC Outlook projects demand growth to be around 2.4 percent per annum to 2020.

Korea is the IEA's newest member, having joined in March 2002 and is one of three APEC economies, along with the US and Japan, that has developed strategic reserves. Currently, it has accumulated strategic reserves of around 32 days of net imports that together with commercial stocks gives Korea reserves of around 70 days of demand. There are plans to increase the coverage to 90-100 days by 2006.

CHINA

As a rapidly developing large economy with strong economic growth and concomitant high energy demand growth, China poses particular energy security and procurement issues for itself, for the APEC region and for the world.

China is currently around 30 percent dependent on imports for its oil needs, having turned from net exporter to net importer in 1993. China will surpass Japan as APEC's, and the world's, second largest oil consuming economy in the next year or so. Overall, the APERC Outlook suggests that China's oil production has peaked at around 3.3 mbd and projects a slow decline into the future. Thus, all increases in demand will need to be met from imports. Recent increases in consumption of around 5 percent per annum, or slightly more than 200,000 bpd and imports increasing at around 15 percent per annum show that this is the case, at least for the time being. The Outlook's projection for 4.3 percent per annum consumption growth through to 2020 is thus in line with recent growth, and together with rapid growth in transport demand suggests that overall oil demand is not about to decouple from economic growth.

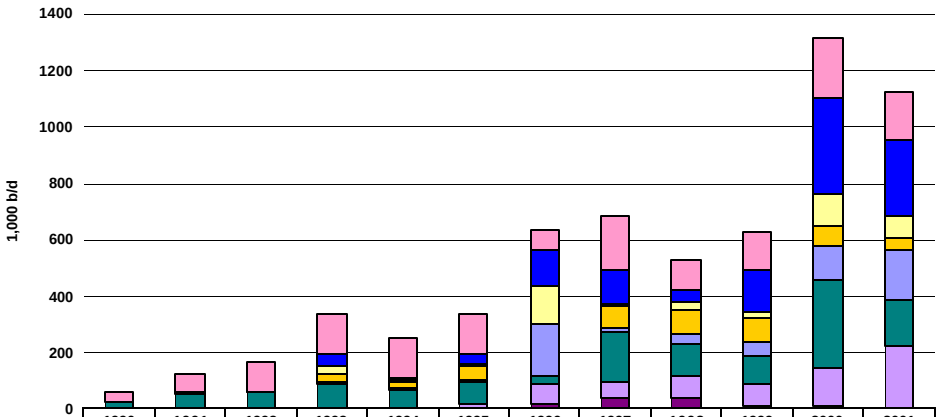
China's sources of oil supply are summarised in Figure 13 and Figure 14. They show that around 20 percent of consumption, or around 55-60 percent of imports are from the Middle East, with Iran, Saudi Arabia and Oman, supplying over 12 percent of imports each in some years. Significantly, China seldom obtains more than 15 percent of its imports from any economy in any year. In recent years, over 20 percent of China's imports have been sourced from Africa. Its import share from Asia of around 13 percent in 2001 is the highest among the East Asia importers even though it has declined from almost 18 percent in 1998.

As with Korea, China's imports from Africa are partly influenced by the configuration of China's refineries which have been designed to process domestic crudes such as Daqing which have low sulphur content. PetroChina, the company to receive the Russian crude from the proposed Angarsk-Daqing pipeline is upgrading its refineries in order to process the crude, which has a sulphur content of 0.6-1.0 percent.[27]

APERC projects China's oil demand to increase from around 5.2 mbd in 2002 to around 10 mbd in 2020, with crude imports increasing from around 1.4 mbd (2002) to around 7 mbd in 2020. This will be an import dependence of 70 percent compared to around 30 percent in 2002.

[27] China Oil, Gas & Petrochemicals, Vol 10, No. 24. December 15, 2002.

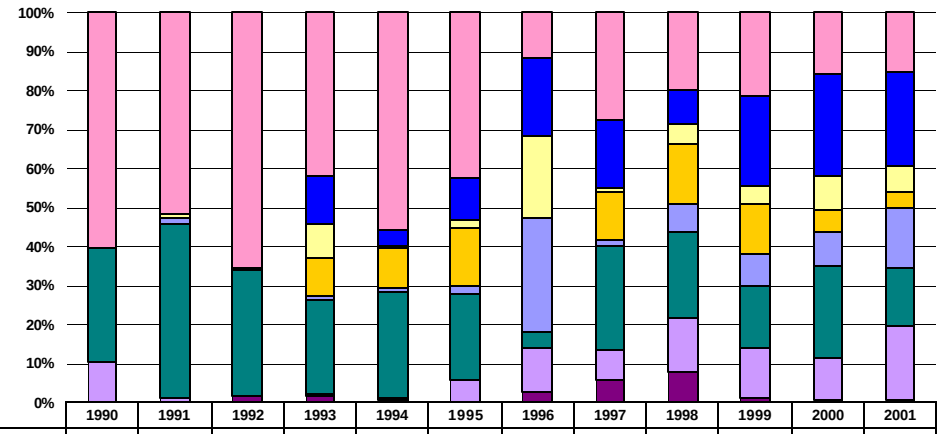
Figure 13 China: Crude Imports



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	36	63	111	143	139	143	76	188	106	135	209	173
Africa	0	0	0	42	10	35	128	118	44	146	341	268
Other Middle East	0	1	1	28	1	8	133	9	29	26	115	78
Yemen	0	0	0	33	25	50	0	81	81	83	72	46
Saudi Arabia	0	2	0	4	3	7	185	10	36	50	114	175
Oman	17	54	54	82	68	73	26	181	116	101	314	164
Iran	6	1	0	1	1	19	72	56	73	79	139	217
Western Hemisphere	0	0	3	5	1	0	17	37	41	7	7	4

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

Figure 14 China: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	60%	52%	66%	42%	56%	43%	12%	28%	20%	21%	16%	15%
Africa	0%	0%	0%	12%	4%	10%	20%	17%	8%	23%	26%	24%
Other Middle East	0%	1%	1%	8%	1%	2%	21%	1%	5%	4%	9%	7%
Yemen	0%	0%	0%	10%	10%	15%	0%	12%	15%	13%	6%	4%
Saudi Arabia	0%	1%	0%	1%	1%	2%	29%	1%	7%	8%	9%	16%
Oman	29%	45%	32%	24%	27%	22%	4%	27%	22%	16%	24%	15%
Iran	10%	1%	0%	0%	1%	6%	11%	8%	14%	13%	11%	19%
Western Hemsiphere	0%	0%	2%	2%	0%	0%	3%	5%	8%	1%	1%	0%

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

China is competing with Japan for the construction of a pipeline to originate from Angarsk and terminating in Daqing as per the China proposal instead of Nakhodka as per the Japan proposal. The 2,300 km pipeline will supply Russian oil from Eastern Siberian fields (see the Russia supply discussion below). With an eventual supply of around 600,000 bpd, this would represent a

significant additional source of oil for China as well as an export diversification for Russia which currently exports only small amounts to Asia.

China has recently been quite active in its policies and actions to increase its oil security and improve its oil procurement in anticipation of its rapidly growing requirements to sustain high economic growth. For example, two of China's oil majors, China National Offshore Oil Corporation (CNOOC) and Sinopec recently bid unsuccessfully for a combined stake of US$1.23 billion in Kazakhstan's giant Kashagan oil and gas field when they were pre-empted by the remaining incumbent shareholders. In late 2002, the third Chinese major, China National Petroleum Corporation (CNPC) was, at a late stage in the process, prevented from bidding in the privatisation of Slavneft, a Russian oil company, that eventually remained in Russian ownership. It has had rather more success in places like Sudan where its developments resulted in imports averaging 130,000 bpd in 2002,[28] almost 10 percent of total imports, and making China, Sudan's largest customer by far. In addition to Sudan and Kazakhstan, the Chinese companies have exploration and production interests in geographically diverse economies such as Iran, Venezuela, Peru, Azerbaijan and Iraq (if the Saddam-era contracts are honoured). The strategy to secure oil supplies is thought to require an investment of US$100 billion over the next 20 years.[29]

If anything, China's actions in securing gas supplies have been on a greater scale than its oil activities. The major domestic project is the construction of the West-to-East pipeline, led by PetroChina, the main unit of CNPC, to transport natural gas from the Xinjiang Autonomous Region to the Shanghai area. The Xinjiang region with 2.5 billion tons of proven oil reserves and 700 bcm of proven gas reserves is expected to become China's most important hydrocarbon producing area by 2010.

As with oil, China's indigenous gas resources are insufficient to satisfy increasing demand. The construction of LNG terminals in the south-eastern provinces of Guangdong and Fujian to be supplied by LNG from the North-West Shelf project in Australia and the Tangguh project in Indonesia, respectively, will be the start of gas imports in the form of LNG. In the longer term, there remains the considerable potential for pipeline natural gas from the Russian Far East and Eastern Siberia.

However, for the time being, pipeline natural gas from such sources is more expensive than LNG.

The vulnerability to oil supply disruptions is acknowledged with plans to develop strategic stockpiles as stated in the 10th Five-year Development Plan. Current targets are to have a stockpile of 73-88 mbbl by 2005, rising to 110-220 mbbl by 2010 and 250-440 mbbl by 2020. The latter would comprise between 35 and 63 days of import coverage based on APERC projections. Significant progress has been made towards the 2005 target by the recent purchase and storage of 50 mbbl.

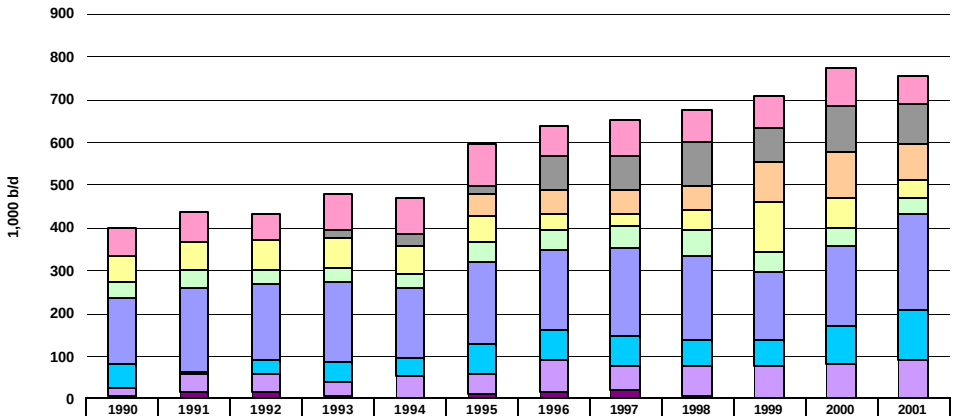
CHINESE TAIPEI

Chinese Taipei imports all of its oil. APERC projects demand to increase from around 0.9 mbd in 2002 to around 1.1 mbd in 2020, growing at a comparatively low growth rate of 1.4 percent per annum. Figure 15 and Figure 16 summarise the import situation for Chinese Taipei. Chinese Taipei obtains over 60 percent of its requirements from the Middle East. In 2001, almost 30 percent of total imports was from Saudi Arabia, over 15 percent from Kuwait, and almost 12 percent from Iran. Amongst Asian APEC importers, it has the highest proportion of imports from Africa, which was 23.6 percent in 2001. Of all the APEC Asia net importing economies, excluding Hong Kong, China or Singapore, Chinese Taipei has reduced its dependence on the Middle East as a source of imports. This dependence has fallen to below 70 percent in recent years from over 80 percent, a decade ago.

[28] Petroleum Intelligence Weekly, Vol XLII, No. 21, May 26, 2003.

[29] Petroleum Intelligence Weekly, Vol XLI, No. 47, November 25, 2002.

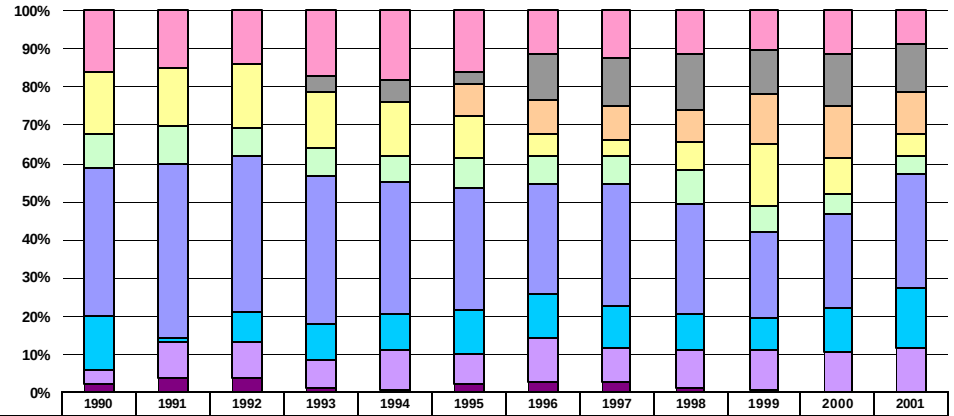
Figure 15 Chinese Taipei: Crude Imports



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	65	66	61	81	85	95	74	82	77	74	87	67
Other Africa	0	0	0	21	29	19	76	82	102	82	106	95
Congo	0	0	0	0	0	51	56	55	56	93	107	83
Other Middle East	64	66	71	70	66	63	38	27	48	115	72	42
UAE	38	44	33	34	30	46	47	48	59	46	41	37
Saudi Arabia	153	196	176	185	164	190	185	209	196	160	190	225
Kuwait	57	6	34	46	45	69	74	70	65	59	86	117
Iran	15	41	43	34	48	49	72	58	68	76	83	89
Western Hemisphere	9	16	15	5	4	11	17	18	7	4	0	0

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions

Figure 16 Chinese Taipei: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	16%	15%	14%	17%	18%	16%	12%	13%	11%	10%	11%	9%
Other Africa	0%	0%	0%	4%	6%	3%	12%	13%	15%	12%	14%	13%
Congo	0%	0%	0%	0%	0%	9%	9%	8%	8%	13%	14%	11%
Other Middle East	16%	15%	16%	15%	14%	11%	6%	4%	7%	16%	9%	6%
UAE	9%	10%	8%	7%	6%	8%	7%	7%	9%	6%	5%	5%
Saudi Arabia	38%	45%	41%	39%	35%	32%	29%	32%	29%	23%	25%	30%
Kuwait	14%	1%	8%	10%	10%	12%	12%	11%	10%	8%	11%	15%
Iran	4%	9%	10%	7%	10%	8%	11%	9%	10%	11%	11%	12%
Western Hemisphere	2%	4%	3%	1%	1%	2%	3%	3%	1%	1%	0%	0%

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

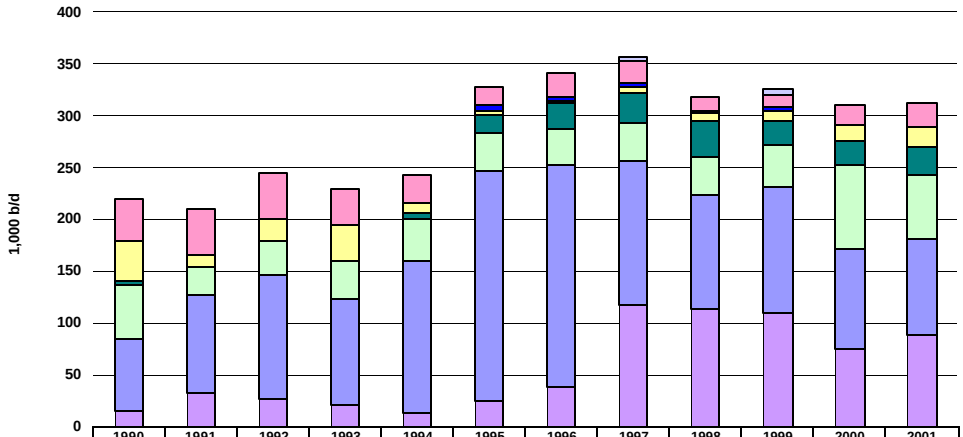
Similar to China and Korea, Chinese Taipei's quite large share of imports of African crudes since the early 1990s is due, in part, to the strengthening of sulphur regulations pertaining to diesel and residual fuel oil and the preferences of refiners to not install desulphurisation facilities.

The Petroleum Business Act passed in November 2001 promulgated the creation of an oil stockpile for security purposes. Procurement for the stockpile was planned to be 0.5 billion litres (3.14 mbbl) in 2002, 1 billion litres in 2003 and 1.5 billion litres in 2004, totalling around 30 days of average sales.

THE PHILIPPINES

The Philippines is essentially entirely dependent on imports for its oil supplies. Figure 17 and Figure 18 show where the Philippines obtains its imports from. The data shows that the Philippines is very dependent on the Middle East, and on a small number of Middle East producers, at that. Between 93 and 95 percent of imports are from the Middle East with this dependence having risen from around 85 percent a decade ago. In recent years, since 1997, Saudi Arabia and Iran often supplied over 30 percent each, and together with the United Arab Emirates and Oman, supplied around 90 percent. At one time, in 1995, 68 percent of imports was sourced from Saudi Arabia. Since then, this high reliance has been diversified through increased imports from other economies, mostly from Iran and the UAE. While the relatively small level of demand of currently around 320,000 bpd would partly explain the heavy reliance on a small number of suppliers, this situation does leave the Philippines vulnerable to supply disruptions from any one of these economies.

Figure 17 Philippines: Crude Imports

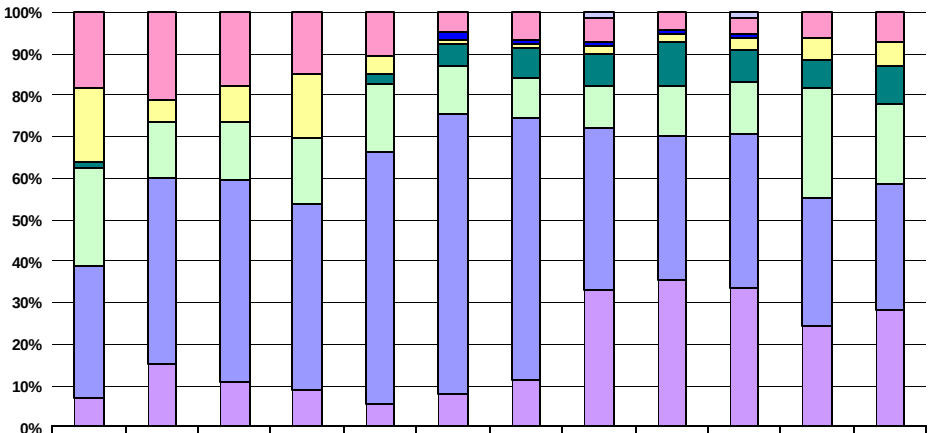


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Western Hemisphere	0	0	0	0	0	0	0	5	0	5	0	0
Asia Pacific	40	45	44	35	26	16	24	21	14	13	19	22
Africa	0	0	0	0	0	7	3	3	2	3	0	0
Other Middle East	40	12	21	35	10	3	3	7	7	9	17	19
Oman	3	0	0	0	6	17	25	28	34	25	22	29
UAE	52	28	34	37	39	38	34	36	37	41	82	61
Saudi Arabia	70	95	119	103	147	221	215	139	111	121	95	93
Iran	15	31	26	20	13	25	38	117	113	109	75	88

Sources: Data from World Oil Trade, Blackwell Energy Research, 1997-2002 editions, 1996-2001 data;

Philippines National Statistical Coordination Board, 2000 Philippine Statistical Yearbook, 2000, ISSN -0118-1564, 1990-1995 data.

Figure 18 Philippines: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Western Hemisphere	0%	0%	0%	0%	0%	0%	0%	1%	0%	2%	0%	0%
Asia Pacific	18%	21%	18%	15%	11%	5%	7%	6%	5%	4%	6%	7%
Africa	0%	0%	0%	0%	0%	2%	1%	1%	1%	1%	0%	0%
Other Middle East	18%	6%	8%	15%	4%	1%	1%	2%	2%	3%	5%	6%
Oman	1%	0%	0%	0%	3%	5%	7%	8%	11%	8%	7%	9%
UAE	24%	13%	14%	16%	16%	12%	10%	10%	12%	12%	27%	20%
Saudi Arabia	32%	45%	49%	45%	61%	68%	63%	39%	35%	37%	31%	30%
Iran	7%	15%	11%	9%	6%	8%	11%	33%	35%	34%	24%	28%

Source: Data from World Oil Trade, Blackwell Energy Research, 1996-2002 editions.1996-2002 data; Philippines National Statistical Coordination Board, 2000 Philippine Statistical Yearbook, 2000, ISSN -0118-1564, 1990-1995 data.

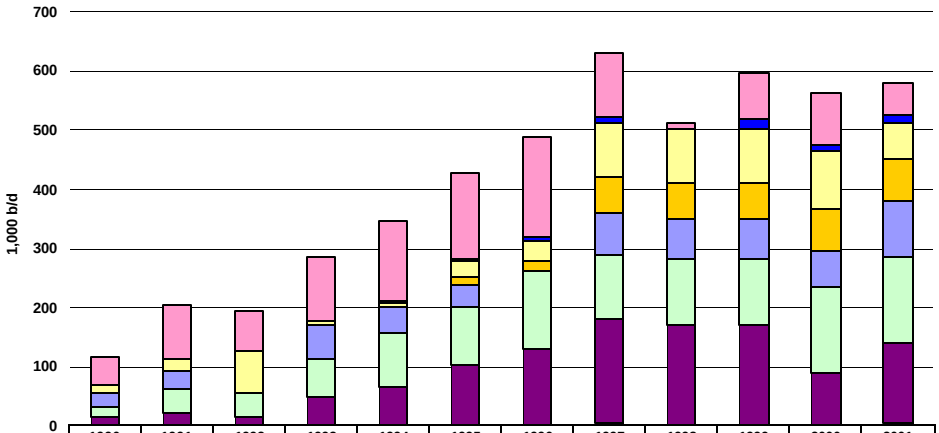
The APERC outlook projects the Philippines' oil demand to grow by around 3.6 percent per annum between 1999 and 2020, with demand, therefore, more than doubling by 2020. Projected import dependence of 97 percent in 2020 means that the Philippines is the only APEC importer to improve its situation between now and 2020, albeit in a small way. Recent hydrocarbon discoveries and developments in the Philippines, dominated by the Malampaya gas/oil field suggest that indigenous potential may be better than that projected.

THAILAND

The APERC Outlook estimates Thailand to have been 88 percent dependent on imports for its oil supplies in 1999 and projects the figure to rise to 95 percent in 2020. Demand is projected to increase from around 0.58 mbd in 1999 to around 1.45 mbd in 2020, a growth rate of 3.7 percent per annum.

Figure 19 and Figure 20 show that Thailand sources over 80 percent of imports from the Middle East, with high proportions from the United Arab Emirates, 25 percent of imports in 2001, Kuwait, 23.5 percent, Saudi Arabia, 16.3 percent and Yemen, 12.1 percent.

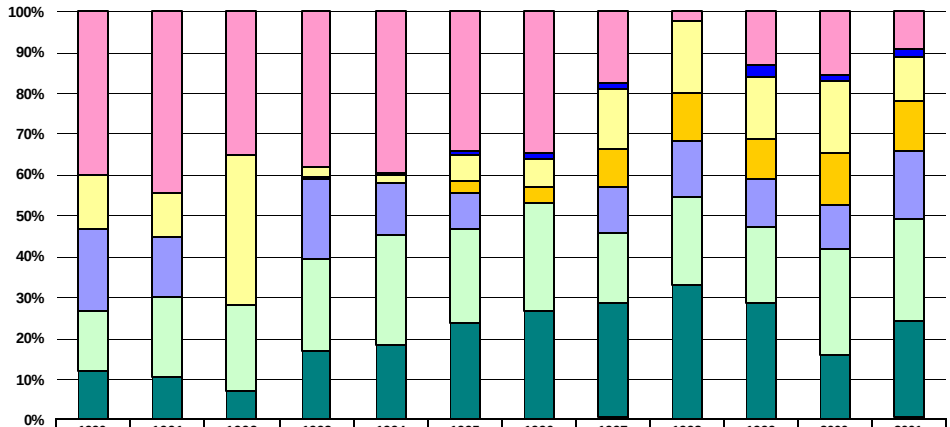
Figure 19 Thailand: Crude Imports



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	46	91	68	109	136	146	168	110	12	78	89	53
Africa	0	0	0	0	2	5	8	11	0	17	8	13
Other Middle East	15	22	72	6	7	26	34	91	90	90	99	61
Yemen	0	0	0	2	0	14	18	61	60	60	71	71
Saudi Arabia	23	30	0	56	45	36	0	70	70	70	61	95
UAE	17	40	40	64	92	100	130	108	110	110	146	145
Oman	14	22	14	49	64	102	130	177	170	170	88	136
Western Hemisphere	0	0	0	0	0	0	0	4	0	0	0	4

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

Figure 20 Thailand: Crude Import Shares



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Asia Pacific	40%	44%	35%	38%	39%	34%	34%	17%	2%	13%	16%	9%
Africa	0%	0%	0%	0%	1%	1%	2%	2%	0%	3%	1%	2%
Other Middle East	13%	11%	37%	2%	2%	6%	7%	14%	18%	15%	18%	11%
Yemen	0%	0%	0%	1%	0%	3%	4%	10%	12%	10%	13%	12%
Saudi Arabia	20%	15%	0%	20%	13%	8%	0%	11%	14%	12%	11%	16%
UAE	15%	19%	21%	22%	27%	23%	27%	17%	21%	18%	26%	25%
Oman	12%	11%	7%	17%	18%	24%	27%	28%	33%	29%	16%	24%
Western Hemisphere	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

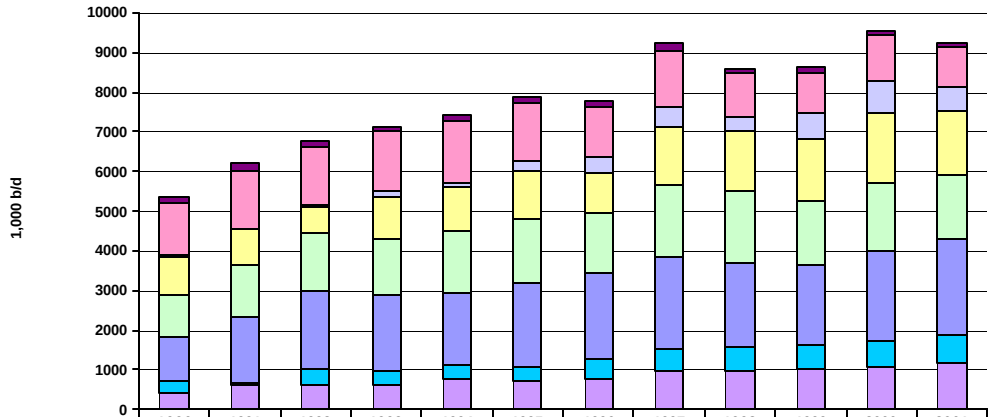
SUMMARY

Figure 21 aggregates the imports for the six APEC Asia economies analysed above. It shows that crude imports from the Middle East have almost doubled between 1990 and 2001, increasing from almost 3.9 mbd to just over 7.5 mbd, a growth rate of 6.2 percent per year. As of 2001, The Philippines', Thailand's and Korea's crude imports had not recovered to the levels in 1997, before the Asian financial crisis and notwithstanding rapidly increasing imports by China, the combined imports of the six economies had just recovered to the level of 1997.

For the same period, imports from non-Middle East economies increased from 1.5 mbd in 1990 to only 1.7 mbd in 2001. While the increased contribution from Africa is encouraging, the declining trade volumes within the Asia-Pacific region is not with the Asia-Pacific share more than halving from 24 percent in 1990 to 11 percent in 2001.

Between 1990 and 2001, for the six APEC Asia economies, import dependence on the Middle East increased from 72 percent to over 81 percent. Figure 22 shows the evolving situation for the economies individually. All the Asian economies with the exception of Chinese Taipei, are increasing their import dependence on the Middle East.

Figure 21 Asia 6[30]: Crude Imports

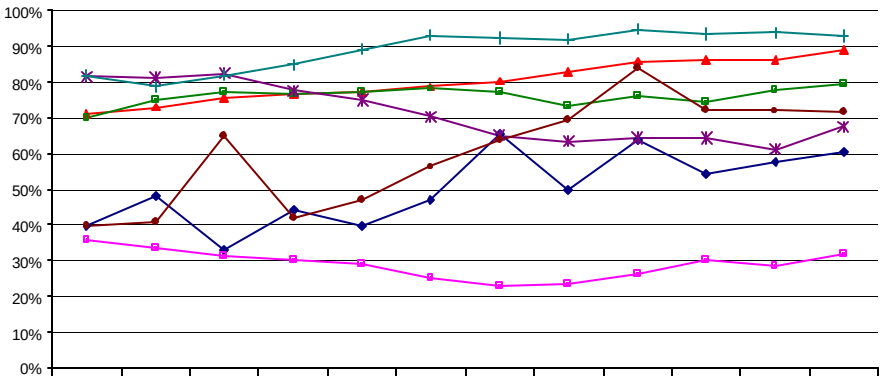


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Western Hemisphere	184	207	180	136	143	140	183	198	140	132	135	96
Asia Pacific	1283	1425	1451	1503	1550	1470	1250	1423	1064	1017	1147	1005
Africa	45	24	46	152	124	247	393	523	396	641	786	611
Other Middle East	960	912	687	1073	1120	1175	1000	1463	1506	1567	1764	1594
UAE	1063	1325	1420	1395	1524	1616	1530	1791	1792	1625	1703	1658
Saudi Arabia	1139	1634	1969	1894	1864	2125	2148	2325	2137	2030	2291	2412
Kuwait	274	45	410	367	341	390	507	572	592	582	677	710
Iran	431	626	626	626	752	695	781	948	970	1037	1049	1153

Source: Data from World Oil Trade, Blackwell Energy Research, 1992-2002 editions.

[30] Asia 6: China, Japan, Korea, The Philippines, Chinese Taipei and Thailand

Figure 22 Crude Imports Dependence on the Middle East



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
China	40%	48%	33%	44%	40%	47%	65%	50%	64%	54%	58%	60%
USA	36%	33%	31%	30%	29%	25%	23%	23%	26%	30%	29%	32%
Japan	71%	73%	76%	76%	77%	79%	80%	83%	86%	86%	86%	89%
Korea	70%	75%	77%	77%	77%	78%	77%	73%	76%	75%	78%	80%
Chinese Taipei	82%	81%	82%	77%	75%	70%	65%	63%	64%	64%	61%	68%
Thailand	40%	41%	65%	42%	47%	56%	64%	69%	84%	72%	72%	71%
Philippines	82%	79%	82%	85%	89%	93%	92%	92%	95%	94%	94%	93%

SUPPLY ISSUES

A relatively obvious way to increase supply competition, and thereby reduce contentious pricing practices such as the Asian Premium, but more importantly to diversify supply risks and thereby enhance supply security, is to diversify imports by sourcing supplies from a larger number of economies and regions. In other words, perhaps, the key issue is *diversification, not dependence*. Practically, the level of (import) dependence is primarily one of endowments or lack of endowments, a situation that only a limited amount can be done to improve. The former, diversification, is a proven method of reducing risk in investment portfolio theory and practice.

The foregoing analysis has shown the high dependence of many APEC oil importers to supplies from the Middle East, leading to the hypothesis that this high dependence confers a degree of pricing power to the producers and thus giving rise to the Asian Premium. This high dependence is, nevertheless, based on sound economics, in the sense that the Middle East is Asia's "natural supplier" from the logistical perspective, given insufficient supply, "closer to home", within the Asian region. In the long term, a high reliance on the Middle East seems likely to continue given the Middle East's share of the world's proven reserves that also have the lowest production costs in the world.

However, there is merit and (security) advantages to be gained from diversifying one's imports and while import source diversification may be easier said than done, there is activity on the part of importers to do exactly this, even by economies such as the USA that are not as dependent on the Middle East as many of the Asian economies. This section presents an analysis of alternative sources of oil supplies and their prospects.

RUSSIA

Russia, an APEC member, has the world's largest natural gas reserves and the seventh largest oil reserves, the latter estimated at 60,000 mbbl,[31] around 21.7 years production at current rates.

[31] BP Statistical Review of World Energy, 2003

Production plummeted after the breakup of the former Soviet Union (FSU) and exports reached a nadir of 3.16 mbd in 1994. Exports have since recovered somewhat to levels in excess of 5 mbd, the second highest in the world, after Saudi Arabia. Currently, the great majority of exports are destined for Western Europe with much of the balance going to Commonwealth of Independent States (CIS) economies. Production above the current level of around 8 mbd is believed to be mainly constrained by supply chain (midstream) bottlenecks.

In comparison to the production numbers shown in Table 2, Russian oil companies estimate that production could grow to 10.5-11 mbd by 2010 and hence exports of around 7.5 mbd.

Russian companies began testing the US market in the summer of 2002, when the economy's second largest producer, Yukos, sent several shipments from the port of Murmansk. In the first seven months of 2002 Russian crude exports to the US averaged 61,000 bpd. Yukos estimates the breakeven point for crude oil exports to Atlantic US ports at US$19 per barrel. This figure suggests that at times of lower prices, this trade may be uneconomic.

Even though its 60 percent import dependence is comparatively well diversified, the US is eager to find suppliers outside the volatile Middle East and sees Russia as a potential major new crude oil supplier. The Energy Ministry of Russia estimates a maximum target volume of oil export to the US of 1 mbd.

Russian companies currently lack the transport facilities and infrastructure for large-scale supplies of crude to the US market. The major Russian oil companies, Lukoil, Yukos, TNK and Sibneft have launched a transportation infrastructure development project in the North European part of Russia. In November 2002, they signed a memorandum of understanding to build a 1-1.2 mbd oil terminal in the Port of Murmansk and a 2,500 km pipeline from West Siberian oil fields to the port. A feasibility study should be carried out in 2003-04 with operations potentially starting in 2007. The project can only be justified if production volumes significantly increase together with a favourable oil price outlook. Estimated required investments are around US$3.4-4.5 billion depending on the pipeline route geography. Environmental impacts are a major issue to resolve for oil transportation schemes in northern regions with fragile ecosystems.

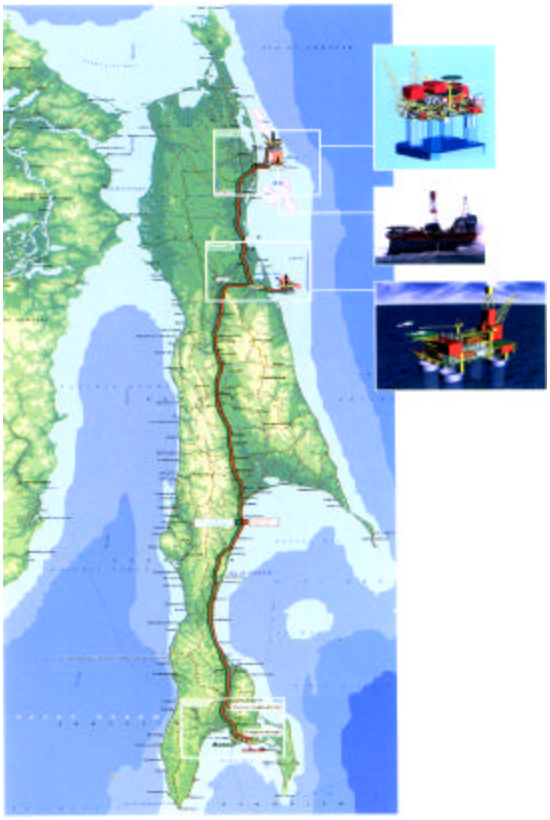
Participants have initially agreed oil supply volumes: 0.4 mbd by Lukoil, 0.4 mbd by Yukos, 0.2 mbd by TNK and 0.2 mbd by Sibneft. Corresponding investment shares are US$1.1 billion, US$1.1 billion, US$0.6 billion and US$0.6 billion guaranteed by oil export revenues. Thus this project could increase Russia's share of US oil imports from less than 1 percent now to around 7 percent after 2010.

In recent years, there has been growing interest and activity in developing oil and gas resources in East Siberia and the Russian Far East (RFE) including the Sakhalin Islands that serve the twin objectives of diversifying both Russia's export destinations and the imports of economies such as China, Japan and Korea.

The competing Sakhalin 1 and Sakhalin 2 projects are the most advanced of the Russian Far East developments. Figure 23 shows the location and infrastructure for the Sakhalin 2 resources and Figure 24 illustrates the location of the anticipated markets. Small amounts of oil, now up to around 60,000 bpd have been delivered from Sakhalin 2 to North Asia markets since 1999. Sakhalin 2 plans to be producing 250,000 bpd beginning in 2006 from resources estimated at 4.5 billion barrels of crude oil and condensate.[32] Both projects are developing combined oil/condensate/natural gas fields. However, both the Sakhalin 1 and Sakhalin 2 projects, which operate under production sharing agreements (PSA), face uncertain futures due to insufficient firm gas purchase commitments in increasingly competitive Asian markets. In particular, ExxonMobil's plans to build a gas pipeline to Japan, for its Sakhalin 1 development seems in some doubt for the time being. However, the Japanese government's policy of promoting natural gas use may eventually see an 8-10 bcm pipeline to Tokyo via Niigata or Sendai being constructed. As an alternative, ExxonMobil is considering the construction of a pipeline to China where robust

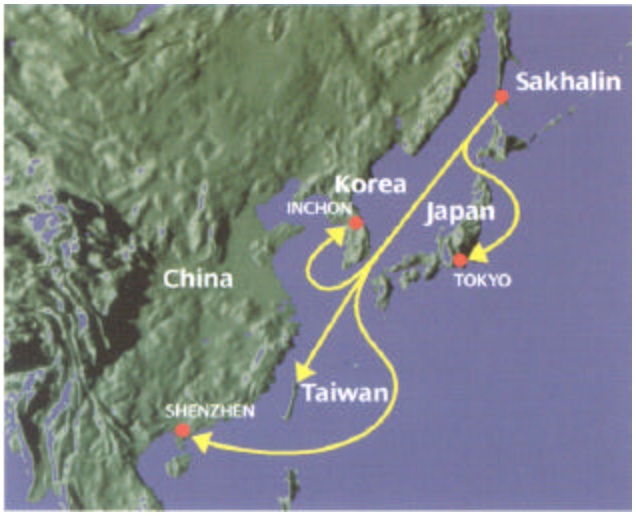
[32] Sakhalin Energy, Sakhalin Energy – The Natural Partner in Asia, Yuzhno-Sakhalinsk, Russia, April 2003.

Figure 23 Location and Infrastructure for Sakhalin 2 Project



Source: Sakhalin Energy, Sakhalin Energy – The Natural Partner in Asia, Yuzhno-Sakhalinsk, Russia, April 2003.

Figure 24 Location of Anticipated Markets for Sakhalin 2 Project



Source: Sakhalin Energy, Sakhalin Energy – The Natural Partner in Asia, Yuzhno-Sakhalinsk, Russia, April 2003.

economic growth and an expanding fuel share for gas probably makes that market more promising than the relatively mature Japanese market that relies on LNG and has no tradition for pipeline natural gas. As of June 2003, Tokyo Electric Power Co (TEPCO) and Tokyo Gas of Japan have

contracted for 2.3 million tonnes per annum (Mtpa) of LNG from Shell's Sakhalin 2 project beginning in 2007, a quarter of the plant's planned capacity of 9.6 Mtpa. There are yet to be firm development proposals for the Sakhalin 1 and other Sakhalin projects.

Total development costs are estimated at US$12 billion for Sakhalin 1 and US$8-10 billion for Sakhalin 2 and financing remains a major issue to resolve. Overall, it is thought that oil exports from these and subsequent Sakhalin projects could produce 0.8-1.0 mbd of oil by 2015.[33] This would constitute around 6-7 percent of North Asia's import requirements.

Perhaps of greater potential and strategic relevance is production from East Siberia. China and Japan are vying to buy oil from this region.

The rapidly growing Chinese market is a major drection for Russian oil companies in the next two decades. It has almost been decided that Yukos will build a pipeline that will feed West Siberian oil from the Tomsk region and East Siberian Yurubcheno-Tokhomskoye field to Daqing in north-eastern China. Yukos intends to invest US$1.5 billion in the 1,500 km long Russian part of the pipeline, while CNPC will invest about US$500 million in the 760 km long Chinese part. In the planned commissioning year of 2005, the transportation volume is expected to be 0.4 mbd, increasing to its capacity of 0.6 mbd in 2010, and maintaining this level to the expiration of the (proposed) contract in 2030. According to the Russian Academy of Sciences' figures, the initial volume will be 95 percent from West Siberia with East Siberia increasing its share of the total volume to 70 percent by 2020. In a more optimistic scenario, they predict that 60 percent will be from East Siberia by 2010 and almost 100 percent by 2020. The Russian Energy Ministry estimates crude reserves to be around 2,700 mbbl. Based on APERC projections, amounts of 0.4-0.6 mbd would constitute around 15-20 percent of China's import requirements. However, such is the potential scale of China's oil requirements that this pipeline may supply only around 3 years' demand growth.

Demonstrating its intent about the Chinese market, Yukos tested Russian oil supplies by shipping about 36,000 bpd of oil in 2002 by rail to China. Yukos plans to increase these rail shipments to around 40,000 bpd until 2006.

Currently all the oil pipeline transportation in Russia is carried out by the Transneft state company. The most eastern point of Transneft's pipeline system currently ends in Angarsk near Irkutsk and Lake Baikal. Transneft's vision is to extend its network from the Atlantic coast to the Pacific coast. Transneft is proposing the construction of a US$5.2 billion, 3,780 km pipeline to the Far Eastern port of Nakhodka from Angarsk, also known as the Baikal-Pacific, to deliver around 1 mbd for seaborne export to Asia Pacific markets from around 2008. This proposal is the subject of governmental lobbying by Japan who have indicated that it is not only willing to provide loan money for the project but also assist in finding and developing the resources required to justify the pipeline. The Russian government seems likely to decide on the Yukos alternative (as discussed above), stating that there are insufficient proven reserves to justify this much longer and more expensive alternative.

The East Siberian region is relatively under-explored and under-developed. For example the Yurubcheno-Tokhomskoye field is estimated to be around 10 percent explored.[34] It is possible that, within a few years, enough "probable" reserves may be confirmed into "proven" to justify the Angarsk-Nakhodka pipeline in addition to the Angarsk-Daqing route. Alternatively, the initial pipeline could be designed and constructed in such a way that a spur line can be added sometime in the future. Figure 25 gives a perspective of the oil and gas pipelines that are being considered to export Russian energy into Northeast Asia.

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[33] Ivanov, V.I., Energy Security: Northeast Asia and Russia, Economic Research Institute for Northeast Asia, Niigata, Japan, presentation made at 2003 APERC Annual Conference, Tokyo, February 2003.

[34] Ivanov, *ibid.*

Figure 25 Russia Pipeline Proposals for Northeast Asia

Source: Petroleum Argus, Vol XXXIII, No. 20, 26 May 2003.

Thus combining Siberian and Sakhalin supplies, Russia could supply at least 10 percent of the import demand of North Asia in the next decade. Confirmed new supplies will be as much as 500,000 bpd by 2005. Full realisation of the Angarsk-Daqing pipeline and Sakhalin projects could increase supplies to around 1.1 mbd by 2015-2020. The Baikal-Pacific pipeline or a suitably constructed pipeline serving both China and the Pacific could add around another 1 mbd should enough reserves be confirmed to justify its construction. Each of these major new increments in supply represent significant new supply compared to the current situation. They are both export diversification opportunities for Russia and import diversification opportunities for the importers in the region.

The construction of a Russian West-East pipeline would also facilitate the cheaper construction of a parallel gas pipeline to exploit the extensive gas resources of the region to serve increasing demand in the north Asia region.

In summary, the oil and gas export potential of Siberia and the Russian Far East is substantial. Especially for oil, there are ready and expanding markets in Asia, and Northeast Asia, in particular. However, significant upstream and midstream developments and funding are required to expand and re-orientate Russian energy industry towards the Asian region.

CENTRAL ASIA

The hydrocarbon-rich Central Asia republics surrounding the Caspian of Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan have often been regarded as a major source of oil and gas for the world's markets. According to the BP Statistical Review of World Energy 2002, the region's reserves comprise: Azerbaijan (7,000 mbbl), Kazakhstan (8,000 mbbl), Turkmenistan (500 mbbl) and Uzbekistan (600 mbbl). Annual output (2001) was 0.3 mbd, 0.83 mbd, 0.16 mbd and 0.17 mbd respectively. Russian and Iranian reserves in the Caspian region are estimated at 2,700 mbbl and 100 mbbl, respectively. Some territorial issues regarding Caspian Sea entitlements between the littoral states are still unresolved.

The resources of the Caspian and Central Asia regions are landlocked. Currently, exports of oil and gas from the Caspian region and Central Asia are shipped mainly through Russian state controlled pipeline transportation networks in the westerly (Atlantic) direction (small quantities of Turkmen oil go to the Persian Gulf through Iran by rail). Currently, the combined capacity of existing pipelines is around 1.2 mbd, of which the most recently commissioned Caspian Pipeline Consortium (CPC) pipeline comprises almost half of that capacity. Pipelines under construction, (Iran internal, 105,000 bpd and Baku, Azerbaijan-Ceyhan, Turkey (BTC), 1 mbd) and proposed (Kazakhstan-Turkmenistan-Kharg Island, Iran, 1 mbd) and planned expansions to existing pipelines could add up to 3.36 mbd of additional capacity.[35] Of interest to oil strategists is the observation that none of the new pipelines traverse Russian territory. In most cases, oil transported through any of these pipelines then need to be shipped by tanker to their import destinations.

Thus Caspian and Central Asian oil exports will generally be sold to distant consumers involving significant transportation costs paid to third parties. And including relatively higher development costs, all these factors act to reduce the netback price available to the governments, field developers and operators.

In general, it is thought that transport options for Central Asian oil and gas to Asia Pacific markets are uneconomic mainly due to the large distances involved. Pipelines, either oil or gas, from central Asia into western China and thence into the centres of demand located in eastern China are (each) estimated to cost around US$10 billion.[36]

Of the current production of around 1.4 mbd indicated above, around 900,000 bpd are being exported. It is estimated that with the considerable number of development projects taking place in the region, exports could increase to over 3 mbd by 2010 and to 5 mbd by 2020.[37] Sizeable export opportunities exist mainly for Kazakhstan (currently around 620 bpd) and Azerbaijan (currently around 175 bpd).

For primarily logistical reasons, Asia's rising oil demand seem unlikely to be significantly met from Caspian and Central Asian sources even though both Chinese and Japanese companies have commercial stakes in the region. The transportation infrastructure is currently entirely west-oriented and so, more likely, increased exports from this region will release production from other regions, such as the Middle East, for Asian consumers.

AFRICA

Africa currently produces around 10 percent of the world's oil, of which around 1.2 mbd (20 percent) of exports are destined for Asia, including non-APEC economies. Short and medium term prospects for African production seem positive and the continent is gaining in importance as a source of oil for APEC Asia economies. The likes of China, Korea and Chinese Taipei source a

[35] Gelb, Bernard A., Caspian Sea Oil and Gas: How much and much more?, US Congressional Research Office, paper presented at 22nd USAEE/IAEE Conference, Vancouver, Canada, 7-8 October 2002.

[36] Khartukov, E. M., Russia chapter, in "Rethinking Energy Security in East Asia", (Ed. P B Stares), Japan Center for International Exchange, Tokyo, 2000.

[37] EIA, Country Analysis Brief – Caspian Sea Region, July 2002.

significant proportion of their imports from Africa, thus, in a small way, diversifying the Middle East risk. While the US and European majors dominate the foreign investor scene in Africa, Canada, Malaysia and China, among APEC economies also have investments in Africa.

In summary, the above analysis suggests that there is some significant, though limited, potential for the oil importing economies of APEC Asia to (geographically) diversify their sources of supply away from the Middle East to other supply regions.

GAS-TO-LIQUID (GTL) TECHNOLOGIES

Another source of oil, or more correctly (mainly) transport fuels, is to manufacture or obtain other fuels that are suitable for use in transportation. Potential technologies include the Fischer-Tropsch (FT) process which has been technologically available since the 1920s. It can be used for the manufacture of gasoline or diesel from other hydrocarbons such as natural gas or coal, commonly referred to as gas-to-liquids (GTL) or coal-to-liquids (CTL). Other potential transport fuels that can be manufactured from gas or coal include ethanol or methanol, usually considered as a low percentage blend in gasoline. Other "extenders" such as MTBE[38] have also been considered and used since the oil crises of the 1970s but have fallen from favour as unforeseen problems such as ground contamination have arisen.

Ethanol is currently used as a blendstock in economies such as Brazil and the US, Canada, Australia and Thailand among APEC economies, although generally subsidised to some degree. Methanol is no longer considered to have much potential due to problems such as phase separation and the fact that separate storage and distribution systems are required.

In response to the oil crises of the 1970s, as part of a policy to boost domestic self-sufficiency, New Zealand built a gas-to-gasoline plant in the mid-1980s using a Mobil process that converted gas to methanol and then to gasoline. While the Fischer-Tropsch process presented no technological difficulties, the process was and remains uneconomic[39] and the plant has not produced so-called synthetic gasoline since 1997 with the plant having been converted by its new owners, Methanex Ltd, to produce chemical methanol. It appears that this plant was not only a first of a kind but, possibly, only of a kind.

Also one of a kind since 1955, is the Sasol plant in South Africa that processes low grade coal into (mainly) petroleum products. At 100,000 bpd of crude equivalent, it is still the largest synthetic fuels plant in the world.

Of considerably more promise is the FT process applied to converting natural gas to gas oil and kerosene (middle distillates). Two commercial plants are currently in operation. Mossgas' plant in South Africa which has produced around 30,000 bpd of gasoline and diesel since 1991 and Shell's pilot plant in Bintulu, Malaysia which has produced 12,500-15,000 bpd of diesel since 1993. In November 2002, Sasol entered into a joint venture with Qatar Petroleum to build a plant in Qatar to produce 24,000 bpd of diesel, 8,000 bpd of naphtha and 1,000 bpd of LPG with production scheduled to commence in late 2005.[40]

Around 15 plants totalling over 500,000 bpd of capacity[41,42] are being planned or considered around the world. The current state of the various technologies seeks to exploit remote, stranded or otherwise low value gas. While larger gas fields would seem to have economies of scale, the process is able to economically exploit smaller gas fields that may not be sufficiently large to justify LNG developments.

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38 Methyl tertiary butyl ether

39 The process is estimated to be economic at an oil price of, very approximately, US$40 per barrel.

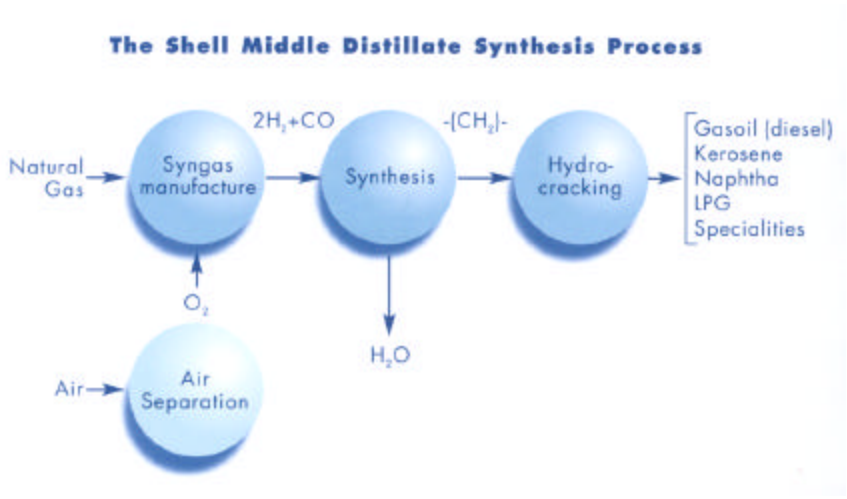
40 www.mbendi.co.za/a_sndmsg/news_view.asp

41 Morita, Y., Marketability of GTL from Natural Gas, IEEJ, October 2001.

42 Department of Industry, Tourism and Resources (Australia), Gas to Liquids (GTL) Industry Development – Discussion paper, June 2001.

The GTL processes for middle distillates can best be considered to be "near commercial" with considerable process cost improvements having been made in the latter 1990s. An example of the process is shown in Figure 26. GTLs are estimated to be economic if the price of gas is less than US$0.50/MMBTU and the crude oil price is around US$20 per barrel.[43,44] A higher (sustained) crude oil price makes GTLs less marginal or more advantageous as does cheaper gas. Similarly, a higher crude price, say US$25 per barrel would be able to justify a higher price for the gas feedstock and make the technology more viable.

Figure 26 An Example of the Gas-to-Liquids Process



Source: Shell International Gas Ltd, Gas to Liquids: Shell Middle Distillate Synthesis Process and Products, August 2002.

An advantage of FT diesel is its attractive, environmentally friendly, properties, being low in sulphur and aromatics, amongst others. In this sense, it has some potential as a premium fuel where regulations mandate, such as might occur in metropolitan areas. Importantly, the fuel does not require any additional or modified distribution or storage infrastructure.

Ogawa *et al*[45] estimate potential GTLs demand in Asia to be 500,000 bpd in 2005, rising to almost 5 mbd if the supply price is no more than US$25 per barrel. With a supply price higher than this the uptake is smaller and later.

In their analysis, in 2005, the demand is restricted to Japan and India while this scenario has significant demand also in Korea, China and other ASEAN economies by 2020. In 2020, the almost 5 mbd include around 2 mbd in India, and around 800,000 bpd in each of Japan, China, Korea and ASEAN. For Japan, this estimate represents around 35 percent of middle distillate demand in 2020.

Since 1 barrel of GTL requires around 320 m^3 of gas, with a thermal efficiency of 60-70 percent, these estimates show that 58 bcm of gas is required in 2005 and 580 bcm in 2020. Under this scenario, Ogawa *et al* estimate that the gas required over the lifetime of the plants would exceed the proven recoverable reserves in the Asia-Oceania region. The lack of significant developments

[43] Morita, Y., Marketability of GTL from Natural Gas, IEEJ, October 2001.

[44] OPEC, Oil and Energy Outlook to 2020, September 2002.

[45] Ogawa, Y., Hasenaka, K., and Kawasaki, Y., Research on Marketability of GTL (Liquid Fuel from Natural Gas), IEEJ, September 2000.

since 2000 would suggest that this potential demand is optimistic and certainly will not be met in the shorter term (to 2010, say).

Suzuki *et al*[46] have, more recently, presented an analysis that suggests demand for Japan to be in the range of 91,000 to 204,000 bpd by 2010 and 209,000 to 358,000 bpd in 2020. In 2020, these estimates represent around 9 to 16 percent of middle distillate demand.

The Japanese government is "striving for the continuation of accelerative efforts for the active implementation of Natural Gas, based on the fact that its burden on the environment is small, and its comparatively superior supply stability, … and the promotion of new useable forms such as GTL …".[47]

Of other views, Ivanov[48] estimates Russian supply potential at 100,000 bpd by 2010 and double that by 2020. Sasol Chevron suggests that GTL diesel could account for as much as 10 percent of the global diesel market within 15 years.[49] Shell is investigating new projects in addition to those it already operates. Arthur D. Little suggests that there is potential for around 1 mbd by 2015.[50] This will still be less than 3 percent of world middle distillate demand if this is assumed to be around 35 mbd by then. ExxonMobil are even less optimistic suggesting that many projects under investigation will not proceed and that GTLs will comprise at most 1 percent of road transport fuels demand in 2020.[51]

The more optimistic figures will begin to impact on oil demand, refinery design and operations and on crude buying patterns. GTLs present a potential outlet for the use of lower value gas resources. They could also diversify the sources of traditional liquid fuels and lessen the market power of suppliers of crude oil. For GTLs to gain critical mass and traction, most likely there will need to be further reductions in costs, further mandated improvements in fuel quality or subsidies put in place, for example, by governments that may attach a premium to improved security through diversification, bearing in mind, that the Asian Premium at around US$1 per barrel constitutes a burden of around 4 percent. Although gas prices are often linked to oil prices, this type of technology is another factor that effectively puts a cap on the longer-term price of oil.

SUMMARY

The issue for oil importers, and especially those of APEC Asia that are highly dependent on the Middle East for their imports is not one of quantitative dependence which is essentially unavoidable but one of reducing source dependence and increasing (import) source diversification.

APEC oil importers, facing increasing demand and slowly increasing production growth from within the region, have the potential to reduce their oil supply risks by diversifying the sources of their imports. Russian intentions and plans would suggest a supply increment of over 1 mbd to North Asia within a decade, if production and pipeline infrastructure plans materialise. This amount would represent about 7-8 percent of North Asian import requirements in, say, 2010.

Central Asia also carries some promise of similar amounts although the infrastructural, logistical, institutional and political hurdles to be overcome are not inconsiderable. More likely, Central Asian resources will head west, freeing up Middle Eastern resources for Asia. This would increase Asia's already high dependence on the Middle East albeit in a more plentiful world. Some Asian importing economies are increasing their imports from Africa which is a sensible risk

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[46] Suzuki, T., Miyanohara, M., Katahira, N, and Sano, S., Investigation of Diffusion Scenarios for Natural Gas Technologies, IEEJ, October 2002.

[47] www.enecho.meti.go.jp/english/policy/measures.html.

[48] Ivanov, *Ibid.*

[49] Sasol Chevron, GTL – Making It Happen.

[50] Arthur D. Little, Gas-to-Liquids Conversion, 1998.

[51] Genova, J.V., Long-Term Economic and Energy Outlook, ExxonMobil presentation made to IEEJ, Tokyo, May 2003.

diversification strategy, especially if the crude types are particularly suitable for their needs, notwithstanding slightly higher shipping costs than for imports from the Middle East.

Increasing supply from non-Middle East regions, even if in relatively small amounts, may still have the competitive effect of diluting the Asian Premium.

New oil technologies such as GTLs would appear to offer potential, especially given the relative abundance of gas that is available. In the longer term, new technologies such as fuel cells have the potential to absolutely diversify energy types and thus reduce oil needs.

CHAPTER 5

MUTUAL DEPENDENCE ISSUES

It is often argued that reliable oil supplies is a "two-way street". That is, there is a mutual interdependence between suppliers (exporters) and buyers (importers) so that both parties maximise their benefits in some sense.

In short, it is said that exporters like to have reliable and stable markets and revenue streams so that they may fund their domestic economies in a reasonably predictable way[52] and also have enough funds to maintain and develop their oil (and gas) sectors. All else being equal, nevertheless, it is the obvious objective of exporters, to maximise prices and revenue, in the visible short-term, but more wisely, in the strategic longer term. But oil producers also do not want prices so high that they induce too much new supply, bring forth (permanent) oil conservation developments, as has been the response to the oil crises of the 1970s nor the extensive development and adoption of oil substitutes such as gas-to-liquids technologies. Also, just as oil price volatility is not in the interests of importers, it is also not usually in the interests of producers as high oil revenues tend to increase pressures for increased government expenditure which may prove to be unsustainable and also induces increased production, often leading to undershooting low prices as happened during 1997 and 1998.

On the other hand, the twentieth century has seen oil emerge as an essential good in the supply chain of economic prosperity and development. Energy, particularly oil and electricity, are classic examples of the hysteresis effect. That is, once they become consumption items, it is impossible to do without them and consumers not only find them essential but view their ability to affordably access them as an entitlement. Thus despite oil's maturity in production and supply chain senses, many market participants still see it as a *strategic* commodity on which the lifelines of their economies depend. In short, oil consumers, especially those with a significant, or worse, total, dependence on imports for their supplies view the assured availability of energy, whether oil, electricity or gas, at "reasonable" prices as vital to (the wellbeing of) their economies and societies.[53]

Many oil exporting economies have oil, and gas, comprising a significant, and often dominant, component of their export revenues, government revenues and economies as measured as a share of GDP. Thus export volumes and prices that can be obtained are important to sustain and develop these economies as well as to provide reinvestment funds to sustain and expand their hydrocarbon sectors. This is especially the case since many energy exporting economies have government-owned national oil companies (NOCs) conducting the oil (and gas) business. In these cases, hydrocarbon revenues serve as a major source of income for general government expenditure.

While exporters naturally want to maximise revenue through higher prices, for example, OPEC is considered to aim for the higher range of its price band of US$22-28 per barrel, they need to consider the threats of higher prices inducing additional supplies (from other potential producers) and of the implementation of oil conserving policies by consumers such as conservation, fuel diversification and the development of synthetic fuels. All of these and other reactions to high prices have the potential to depress both volumetric demand and prices. Thus a balancing act is

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[52] Al-Moneff, M. A., Prospects for East-West Energy Co-operation, Symposium on Pacific Energy Co-operation, Tokyo, February 2002, for example.

[53] In the 2nd quarter of 2003, New Zealand faced electricity shortages and concomitant high (spot) prices due to low inflows into its hydro-dominant power generation system and the US has begun, again, to suffer from gas shortages and high prices. Both economies have indicated that the shortages will impact on economic growth.

involved. In fact, OPEC's own analysis "confirms the broad result that export revenues are not maximised by sustaining extremely high or low prices".[54]

Table 3 gives some indication of the importance that oil (and gas) revenues have on certain, mostly OPEC, exporting economies. An estimate of a US$1 per barrel change in price is given. Any change in price affects the revenue and profit from every barrel supplied. Loss of supply, for reasons such as quotas, of course, affects revenue, by the price of every barrel not supplied, except insofar as that the barrel of oil may be produced and sold at some future time.

Table 3 Importance of Oil to various Economies

2001	GDP (US$m)	Total Exports (US$m)	Petroleum Exports (US$m)	Share of Total Energy (Petroleum Exports) to GDP	Share of Energy Revenues in Government Revenues	Share of Energy in Exports	Share of Energy in Exports (2002)	Exports mbbl	Effect of a ?$1/barrel in oil on Revenues (US$m)	Effect of a ?$1/barrel in oil on Revenues (as %GDP)
Algeria	54,643	19,132	11,790	22%		62%	95%	161.1	161.1	0.29%
Indonesia	145,501	54,700	8,944	6%		16%	12%	218.7	218.7	0.15%
Iran	114,141	24,065	21,420	19%	40%-50%	89%	85%	892.8	892.8	0.78%
Iraq	27,800	15,905	12,676	46%		80%	98%	624.2	624.2	2.25%
Kuwait	32,806	16,206	14,975	46%		92%	92%	443.1	443.1	1.35%
Libya	28,597	11,187	10,880	38%		97%	98%	360.5	360.5	1.26%
Nigeria	41,107	20,827	17,188	42%		83%	90%	762.6	762.6	1.86%
Qatar	16,160	10,247	6,964	43%		68%		221.0	221.0	1.37%
Saudi Arabia	186,489	73,032	62,981	34%	70%-80%	86%	92%	2,203.1	2,203.1	1.18%
UAE	67,488	41,403	22,414	33%		54%	45%	652.1	652.1	0.97%
Venezuela	124,910	27,409	20,300	16%		74%	84%	717.1	717.1	0.57%
OPEC	839,642	314,113	210,532	25%		67%		7,256.3	7,256.3	0.86%
Non-OPEC										
Brunei Darussalam	4,510	3,000	3,000	67%	75%-90%	80% -90%	80% -90%	69.3	69.3	1.54%
Russia	319,300	101,600	41,000	13%	25%	40%	47%	1,792.1	1,792.1	0.56%

Sources: Derived from OPEC Annual Statistical Bulletin (2001), www.energyintel.com (2002 data)

For many oil exporting economies, oil and gas exports comprise over a third of the economy as measured by GDP and well over half of export revenues, more than 90 percent in some cases. These economies' government revenues are also highly dependent, either directly or indirectly, on oil and gas related royalties, taxes, etc.

It can be seen from Table 3 the revenue impacts of a US$1 per barrel change in oil prices, either as loss of revenue due to lower prices or additional revenue, in the case of higher prices. Clearly, in these cases, such price changes have a significant impact on economic performance and growth.

While many exporters seek to maximise revenues by increasing production, this can be a risky strategy as witnessed during the price crash of 1997-98 when OPEC policies and the Asian financial crisis drove prices down to the US$10-15 per barrel range, half of prices prevailing in 2003. In fact, many exporters are known to base their national budgets on price assumptions of around US$19-20

[54] OPEC, Oil and Energy Outlook to 2020, September 2002.

per barrel, and regard any revenues from higher prices as windfall gains, in some cases to be banked into "stabilisation" funds. The Russian Energy Ministry estimates that Russia's "benign" price range is US$20-25 per barrel while one may consider OPEC's US$22-28 price band as the benign range for its producers.

Since 2001, relatively high prices have assured robust economic growth in oil exporting economies, in some cases leading to the expectation of citizens that such conditions may be sustainable. Similarly, relatively low oil prices during the 1990s are likely to have played a part in the economic prosperity of developed economies during the decade.

Insofar as it is possible, many oil exporters are seeking to diversify their economies away from a heavy reliance on energy revenues. For example, Russia is known to be concerned about its situation, yet its dependence on energy revenues is not as high as for many other exporters at an estimated 40-45 percent of export revenues and 25 percent of government revenues. Some Middle East producers are seeking to further develop their natural gas exports and downstream processing industries including refining and petrochemicals.

Table 4 shows some estimates of the GDP effects of a (permanent) US$5 per barrel increase in the price of oil.

Table 4 Effect on GDP of (Permanent) US$5 per Barrel Increase in Price of Oil

	Real GDP
USA	-0.3
Japan	-0.1
Chile	-0.2
China	-0.4
Korea	-0.9
Malaysia	-0.2
Philippines	-0.8
Thailand	-0.9
Indonesia	0.1
Mexico	0
Russia	0.7

Sources: International Monetary Fund, The Impact of Higher Oil Prices in the World Economy, Washington, December 2000; Hyun Joon Chang, The Impact of Oil Price Increase on the Global Economy, Korea Energy Economics Institute, paper presented at IEA Millenium Conference on Oil Supply Security, Paris, March 2001.

It can be seen from Table 4 that the economic effect on net importing economies is unambiguously negative. Developed economies such as the US and Japan are less impacted than the developing economies. The main factors are their lower oil intensity relative to GDP and their more diversified economies with a lower share of energy intensive manufacturing industries. Developing oil importing economies suffer the most as they have to spend a larger share of their income on oil and they are likely more oil intensive. Additionally, lesser developed economies will be more vulnerable to deterioration in trade balances, higher interest rates, exchange rates, etc.

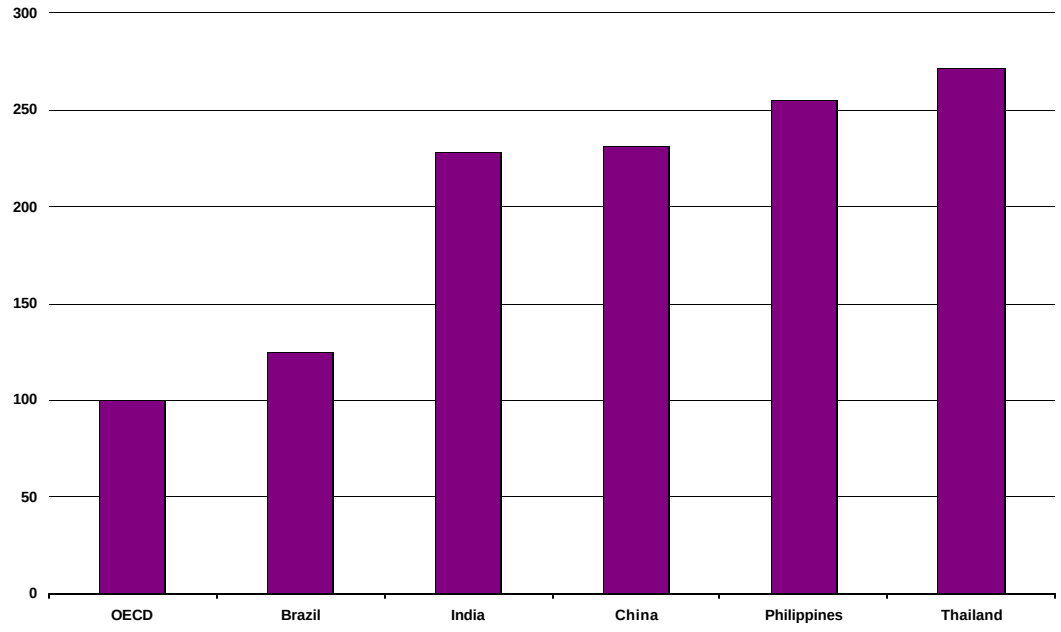
Thus, as shown in Table 4, the Philippines and Thailand, among APEC economies, are likely to be the most heavily impacted by changes in oil prices. Korea, as a middle income economy, is similarly impacted, due to having a relatively large heavy industry sector.

The economic impact of higher oil prices on oil exporting economies is not unambiguously positive as shown by the case of Malaysia. Ultimately, the aggregate effect depends on the structure of the economy insofar as whether the sectors negatively impacted outweigh the positive effects of higher oil and gas revenues or not. The significant positive effect estimated for Russia could well be the basis for Russian public policy concern over the weight of energy revenues in its economy.

On the other hand, while developed economies are now less oil dependent and thus more resilient to higher oil prices than they were prior to the oil crises of the 1970s, developing economies are known to be more sensitive to the deleterious effects of higher oil prices.[55] This is because their economies are more dependent on energy-intensive activities. Alternative energies such as gas and electricity are less well developed. Increasing energy bills also tend to more negatively impact developing economies since they are paid from lower incomes. Higher import bills, deteriorating trade balances, depreciating currencies and higher inflation are but some of the negative effects that may manifest themselves in a cycle of poor economic performance.

That developing economies are generally more oil intensive than developed economies is illustrated in Figure 27. In 1998, for every unit of economic output, each of the APEC developing economies shown, China, the Philippines and Thailand used well over twice as much oil as the OECD average. At the time, of APEC economies, Australia, Canada, Japan, Korea, Mexico, New Zealand and the US were OECD members. Although not shown, it is worth noting that the average OECD oil intensity has been halved since prior to the 1970s oil crises. Notwithstanding that economic growth will generally result in growth in energy demand, developing economies have the potential to similarly reduce the oil intensities in their own economies, and thus reduce oil demand from what it might otherwise be, through measures such as improved energy efficiency or energy diversification.

Figure 27 Oil Intensity (1998)



Source: IEA, "High Prices Hurt Poor Countries More Than Rich", March 2000.

[55] IEA, High Oil Prices Hurt Poor Countries More Than Rich, Paris, March 2000.

CHAPTER 6

SUMMARY AND CONCLUSIONS

As a significant oil net importing region, APEC economies' energy security concerns have increased in importance as a consequence of the events of 11 September 2001. Partly caused by those events, there has been considerable turmoil and (price) volatility in oil markets in the last 6 months or so.

Oil consuming economies' responses to a number of large and partly overlapping supply disruptions have been encouraging. Significant losses in production in Iraq, Venezuela and Nigeria have undoubtedly been undesirable but have not been unduly disruptive to world oil markets and the economic activities that are affected by the availability and price of oil.

While commercial stocks were, in some cases, run down, no call was made on the world's strategic petroleum reserves in Europe, the US, Japan and Korea. Prices above US$30 per barrel were undoubtedly not welcomed by oil importing economies. However, these high prices have proved to be temporary. That the supply disruptions have followed and coincided with a period of weak global economic performance notwithstanding also coinciding with the high demand season have made the deleterious effects less severe as demand would have been higher if economic growth had been more robust and inflationary pressures higher.

Producing economies, including those of OPEC, and notably Saudi Arabia, were helpful in increasing their production where spare capacity made this possible. This underscores the current co-operative relationships between producers and consumers, who both stand to benefit from stable markets.

Having to contend with an increasingly competitive global economic environment, Asia oil importers have become more concerned with the fact that they pay more for oil compared to US and European importers. There seems no easy solution to the dilution or elimination of the Asian Premium so long as Asian importers continue to depend on the Middle East for most, currently around 73 percent, of its oil imports.

In the short term, importers may need the cooperation of producers to change the pricing basis of crude by such measures as changing the marker crude for Asia or for them to take a more benign view of market conditions. New LNG contracts, with lower prices and more flexible terms, suggest that this market may have delinked from oil prices to some degree.

A longer-term solution based on market forces seems more likely than any short-term resolution. Such possible solutions would include import source diversification by importers accelerated by the emergence of new sources of supply from regions such as eastern Russia, Central Asia and West Africa, the emergence of credible candidates for a new marker crude such as might occur if events in Iraq result in changes in Middle Eastern markets, the adoption of new sources of liquid fuels such as GTLs where economic, and fuel diversification away from oil.

Oil importers can take a range of measures to improve their oil security. In this report, we have focused more on improving longer-term security. The main measures include the diversification of sources of imports, improving bilateral political and economic ties and reciprocal investments in each other's oil sectors.

The foregoing analysis suggests that some Asian economies, in particular, those that are highly dependent on oil imports can improve oil security by diversifying their import sources, not only by reducing their dependence on supplies from the Middle East but even by diversifying their sources in the Middle East. Source diversification may also contribute to diluting or eliminating the Asian Premium.

The key issue is not the high level of import dependence, a situation that is unavoidable, but, rather, an issue of reducing supply risk through diversification.

Any diversification actions will not alter the fact that the Middle East possesses two-thirds of the world's proven conventional reserves, has the lowest costs of production and is, in many ways, the natural supplier to the markets of Asia. Thus an increasing dependence on the Middle East seems inevitable from a long-term perspective. However, mitigation is possible for the medium term. This may allow enough time for new sources of supply to emerge or for new oil or other energy technologies to become commercially available.

The Eastern Siberia and Far East regions of Russia seem certain to emerge as major sources of energy supplies for Asia, especially the energy importing economies of Northeast Asia. Although significant infrastructural and financial difficulties exist, some supplies of oil and gas are being realised and further opportunities exist not only for oil and gas but also, possibly, for power.

The emerging oil and gas supply regions of Central Asia are more problematic for assuaging Asia's increasing energy needs due to their distance from Asian markets. However, new supplies from these regions supplying other markets could serve to free supplies elsewhere for Asian markets.

Most energy exporters are highly dependent on energy revenues to fund their economies and develop their energy sectors. Thus, there is an interdependence between exporters and importers. Exporters need assured markets just as importers need assured supplies. While exporters clearly prefer higher prices and importers prefer lower prices, both stand to benefit from stable prices within reasonable bounds.

The Producer-Consumer Dialogue has been helpful to furthering the common goals and narrowing the disparate ones of oil producers and consumers. It is important that it is fostered and continued. Similarly, regional dialogues between economies with common or complementary interests such as within APEC, ASEAN or North Asia should be encouraged to achieve improved energy security and economic outcomes.

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ANNEX

THE JOINT OIL DATA INITIATIVE AND REAL-TIME EMERGENCY INFORMATION SHARING SYSTEM

Security of supply concerns have encouraged oil importing economies to consider and implement (additional) measures that involve cooperation between economies with similar interests, even if, at times, they may be seen to be competing to secure their individual interests – so-called "regional cooperation". A wider community of interest is seen by way of improving understanding and relationships between consumers and producers – the Consumer-Producer Dialogue, that has resulted in the formation of the International Energy Forum.

The prime objective of these groupings is to improve the flow and quality of information with a view to enhancing the operation of oil markets by reducing uncertainty and volatility in both supply and price for both producers and consumers.

With the recognition that improved oil data would improve the transparency, and therefore, the functioning, of oil markets, representatives from six international organisations involved with oil statistics, namely APEC, Eurostat, IEA/OECD, OLADE and the UN, first met at the IEA in Paris in November 2000 to discuss how to harmonise and improve oil statistics.

Shortly afterward, discussions at the 7th International Energy Forum, Riyadh, November 2000 agreed that "*co-operation among relevant organizations, as well as participating countries, in improving and timely accessing energy data is important for market assessment and transparency*". A workshop on oil data transparency to which each of the six international organisations invited 3 to 4 of its member economies held in Bangkok, April 2001, initiated the (Monthly) Joint Oil Data Exercise[56, 57] on a trial basis. Around 80 countries now contribute to the renamed Joint Oil Data Initiative (JODI). The JODI was highly commended and supported by the 8th International Energy Forum, Osaka, September 2002.

The IEA members of APEC contribute to the JODI as part of their IEA reporting obligations and mechanisms. The Energy Data and Modelling Center, IEEJ and APERC have led and coordinated the involvement and contributions of the non-IEA members of APEC.

The APEC Real-Time Emergency Information Sharing System has been proposed to leverage off the developments of the JODI. The following proposal which was tabled at EWG-25, Portland, USA, June 2003, explains the objectives and rationale for the system.

Action Proposal for
A Real-Time Emergency Information Sharing System

1. Objectives

The system is intended to provide the basic data and a communications room for APEC member economies to share oil information with each other to facilitate improved crisis management during emergencies. It is expected that through real-time information exchanges, member economies can more accurately assess market conditions during supply disruptions and emergencies. By being more easily and better informed, they would be able to resolve

[56] www.oil-data-transparency.org

[57] www.ieej.or.jp/egeda/

problems and reduce the negative effects associated with disruptions such as oil shortages and oil price volatility.

A database system, which will provide basic information regarding current oil market trends, will be developed for the purpose of smoothing exchange of information and decision-making.

The proposed information sharing and communications system is a good way of mitigating the effects of supply disruptions.

2. Benefits of this system

What various economies must absolutely avoid during a supply disruption is to cause panic among the public due to inaccurate or lack of information. For example, during the first oil crisis, Japan failed to obtain sufficient real time information from overseas, and therefore could not provide information quickly enough to reassure the public that enough oil had been secured. This resulted in the public rushing to buy up certain products and paying unreasonably high prices for them.

In today's society, with highly developed and sophisticated information systems in place, it is unlikely that such things would occur. On the other hand, particularly in the media, information tends to be supplied selectively and sensationally, leading to the danger of people overlooking, or failing to see, the truth behind such information.

In this regard, this system supports APEC economies' agencies to easily and quickly share credible, up-to-date, and accurate information amongst themselves, and thereby, enable better decision-making.

3. Functions

It is essential that member economies deal with oil supply emergencies in a calm manner. To do this, APEC economies should join together to obtain and provide accurate, up-to-date information. The importance of these activities was verified by APERC's Sea Lane Disruption Simulation exercises conducted last year. One of the major functions of this system, therefore, will be to support communication among the economies. However, if the economies exchange views without possessing the latest information on oil demand-supply trends, those discussions will be less successful. To make the discussions more productive and worthwhile, the economies require a system that provides information on the most recent oil demand-supply trends. Therefore, the following are proposed as functions of this system: to support communication among the economies, and to provide accurate and timely information.

Each APEC economy shall appoint a contact person as a representative responsible for sharing information (henceforth referred to as "Emergency Contact"). These Emergency Contacts will be chosen from among EWG members of various economies, or from ministries responsible for energy. If possible, they should be the Director (or Director General) of such organizations. A list of all Emergency Contacts, including their contact information will be distributed to members of all APEC economies, and updated whenever necessary. Furthermore, economies shall appoint Deputy Emergency Contacts from among oil (or oil statistics) experts. These Deputy Emergency Contacts shall provide information to, and be able to access information from the system.

The contacts are asked to elect a coordinator. The coordinator has a right to open the communications room by receiving the demand from the contacts.

Any Emergency Contact, who recognizes an emergency, is able to propose discussions to the other Emergency Contacts and request them to participate in discussions facilitated by the communications room provided by this system. Other Emergency Contacts who understand the proposal can visit the room to share their opinions and current information and as a result, all APEC economies can minimize the damage from the emergency situation.

4. System Overview

4.1. Communication system

Geographically, the APEC region spreads wide from east to west, so there is a problem of time difference. In this sense, a real-time communication system is not necessarily appropriate. Instead, it is important to combine a real-time communication system (that makes use of the Internet) with a non-real-time communication system.

- **Real-time communication systems**

- **Chat system**

  This system enables economies to take part in chats by accessing the "chat" website set up within the APERC server, and entering their ID and password. By saving the data of past chats, economies can use this as a non-real-time communication system similar to email.

- **Non-real-time communication systems**

- **Bulletin Board System (BBS)**

  This system enables economies to take part in written opinions and messages by accessing the BBS website set up within the APERC server, and entering their ID and password. By accessing this site at any time, economies can use this as a geographical real-time communication system.

To commence the information sharing among the contacts through this system, the coordinator informs the opening to them using a mailing list containing the email addresses of the contacts appointed by each economy. This system is also set up inside the APERC server.

4.2. Database system

This is a system that organizes and stores the oil data that are submitted by APEC member economies and, in turn, provides the consolidated data via the Internet to authorized persons. Since most of the data are shared among member economies and must therefore be kept strictly confidential, the system must be equipped with high-level security features, including, strict security during information transmission and receipt, user management via ID and passwords, and other features.

5. Type of data that should be exchanged, and frequency of exchange

In the case of an emergency, various economies basically gather and assess the oil market information and activities available to them, and reflect it in their domestic policies. Sometimes, however, problems emerge that a single economy cannot handle on its own or may prefer to seek the information, guidance or assistance of others, such as the cooperation of suppliers or the lending and/or sharing of stockpiles.

Economies should share information that helps them decide their policies in emergency situations, such as "the current status of economy A is such and such, so we need to provide assistance in some way" or "the current status of economy B is such and such, so we should devise a policy to deal with such and such." For example, it is important for the economies with oil stockpiles to share information that would help them decide on such matters as when to release their stockpiles, or to which economy they should lend their stockpiles on an emergency basis. As a basic rule, the data gathered by the Monthly Oil Data Initiative will be updated more frequently to enable member economies to share even more detailed data. The types of data and the frequency of data updates are described below.

- **Monthly basis (in normal circumstances)**

- CIF prices of crude oil

The economies will be asked to provide data to the system.

- Level of crude oil and oil products in stock (aggregated commercial, strategic)

Although the Joint Oil Data Initiative (JODI) gathers this information, some economies do not provide such information because of confidentiality problems. Therefore, these economies will be requested to provide such data on condition of confidentiality.

- Demand for oil products

Although the JODI gathers this information, some economies do not provide such information because of confidentiality problems. Therefore, these economies will be requested to provide such data on condition of confidentiality.

- **Weekly basis (in emergencies)**

- Sales prices of gasoline, gas oil, and kerosene (sticker prices)

The economies will be asked to provide data to the system.

In addition, APERC will gather, assess and provide relevant information from outside the APEC region, such as OPEC's crude oil output, estimates of the world's spare capacity and trends in oil product prices in major markets (New York, Rotterdam, and Singapore).

It goes without saying that these data should be gathered on a regular basis, and shared, via Emergency Contacts, in the event of an emergency. The regularly collected data can be used as a benchmark for the information to be gathered during emergencies. It is therefore important that the Monthly Oil Data Initiative incorporate information on what "normal circumstances" entail.

After the member economies appoint their Emergency Contacts and Deputy Emergency Contacts, APERC will finalize the type of data to be collected from the member economies through discussion with the contacts. APERC will set up the scheme for the data collection and develop the database system used to disseminate the data to the contacts.

6. Examples of anticipated usage

6.1 Outbreak of regional conflicts

War has broken out in an oil-producing nation, with the area of battle being restricted to certain regions. Crude oil price hikes have become a serious concern. APEC economies have investigated the most recent crude oil stocks as well as trends in the demand for oil products, and have used the communication system to discuss the possibility of oil shortages.

6.2 Soaring oil product prices

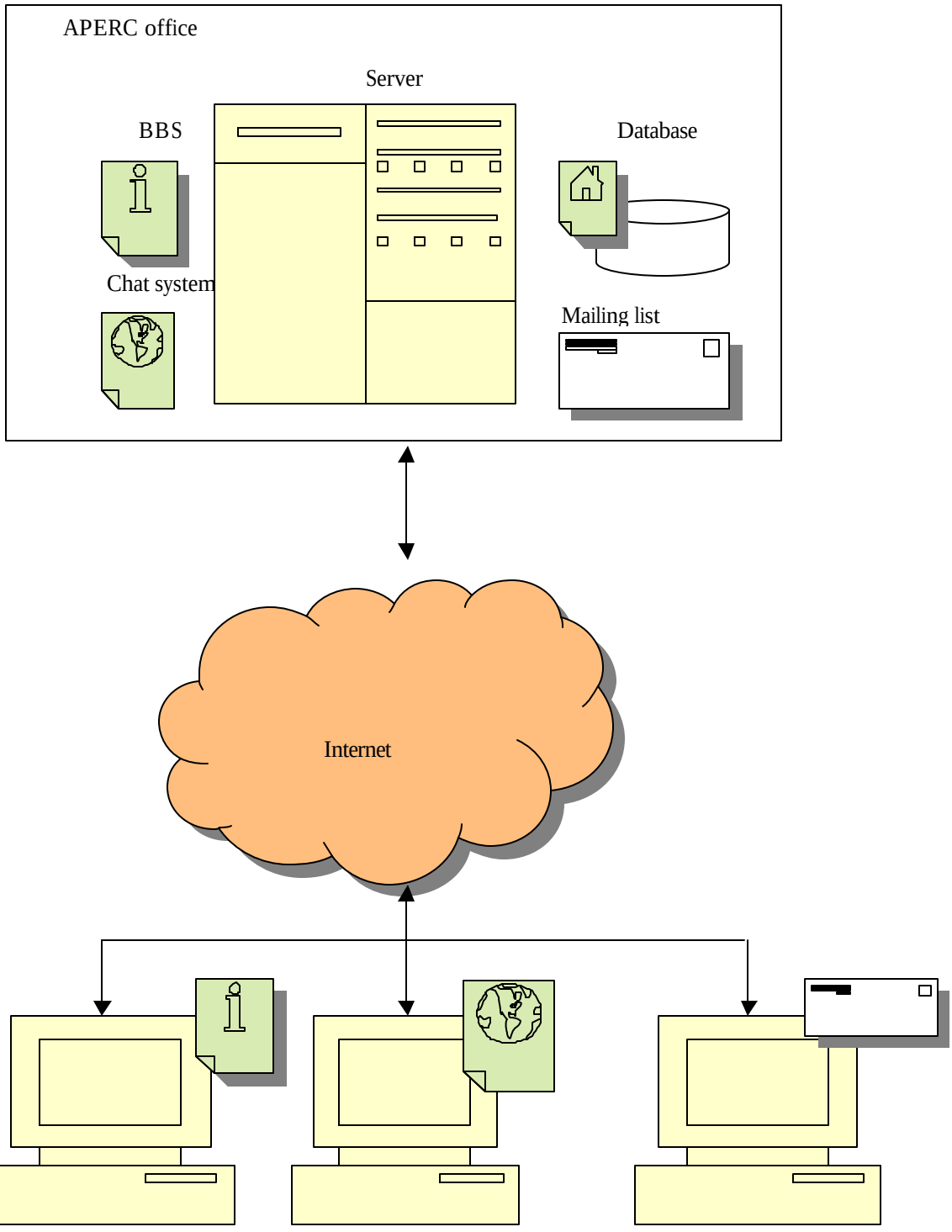
Prices of oil products have suddenly risen in a market outside the APEC region. To prevent this price hike from spreading to the APEC region, the economies have used data provided by the information system and exchanged information using the communication system to confirm that there are no problems with the supply of said oil products, and have then issued a press release, to calm markets and demanding speculators to use caution.

6.3 Information exchange during the Iraq war in 2003

During the Iraq war in April 2003, several member economies in the APEC region exchanged information regarding the oil situation using email, showing that this method is effective for exchanging information and useful for the member economies, although it is not quite a real-time system.

7. Precautions when using the data

The data to be collected from APEC member economies, described in section 5, include sensitive information for some economies. Therefore, the economies should step up their discussions, through EWG forums, on the scope of information that each economy is capable of providing. Based on such discussions, consideration should be given to information that many economies perceive as being sensitive. This may include gathering such information while "processing" it, such as not publishing economy-specific information per se but showing only the total values for each economy, or showing graphs instead of citing specific numerical values.



A conceptual diagram of the communications and information systems