APEC

Energy Demand and Supply Outlook

updated September 1998

APERC *Asia Pacific Energy Research Centre*

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Forward

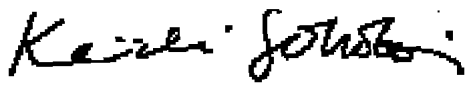
I am pleased to present the updated 'APEC Energy Demand and Supply Outlook' which examines energy trends in the APEC region over the 15-year period from 1995 to 2010. Specifically, the revised Outlook considers an up-to-date appraisal of the economic crisis affecting Asian economies and the implications for regional energy demand and supply.

This work is a response to the request made at the Seoul meeting of the Energy Data and Outlook Expert Group (EDOEG), in February 1998. The Asia Pacific Energy Research Centre (APERC) reviewed the original APEC Energy Demand and Supply Outlook report, taking account of the recent economic changes in the APEC region, particularly in Asia, and also providing a more detailed and assessment of the production potentials for oil and natural gas. The Ixtapa Energy Working Group endorsed this request.

The Outlook examines three scenarios. First, a new 1998 Baseline scenario (B98) is established. This scenario utilises GDP growth projections provided by the ABARE's (Australian Bureau of Agricultural and Resource Economics) MEGABARE model of the global economy as the basis for developing the energy projections. MEGABARE's latest projections are as of September 1998. The second scenario, also using MEGABARE's GDP projections, is a more pessimistic Protracted Crisis Scenario (PCS) which assumes the economic turmoil in Asia will continue for a longer period of time with more severe ramifications for APEC economies. Consequently, the PCS energy projections are significantly lower than the B98 scenario. Finally, the Outlook examines an environmentally friendly scenario (EFS) that assumes the same GDP projections as the B98 but postulates that energy efficiencies are improved throughout the region and fuel switching takes place to minimise the use of carbon intensive fuels in response to environmental pressure. Although not a comprehensive assessment of the Kyoto Protocol, the scenario does illustrate the difficulty of reducing carbon dioxide emissions.

It is hoped that this document, in conjunction with the accompanying APEC Energy Balance Tables and previous Outlook research, will serve as a valuable resource for APEC policy makers to address key energy policy issues.

I would like to thank all who have been involved in developing and updating the Outlook at APERC, both professional and administrative, the experts who have helped us through our seminars and workshops, and the many others who have provided valuable comments.



Keiichi Yokobori
President
Asia Pacific Energy Research Centre

September 1998

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Executive Summary

The recent economic changes affecting the APEC region will have significant effects on the level of energy demand and supply. The economic downturn in Asia has slowed the rate of growth in energy demand, but total primary energy demand for the region is still projected to increase by 41 per cent over the period to 2010. Even in the more pessimistic Protracted Crisis Scenario (PCS), total energy demand is projected to grow by 34 per cent. However, higher energy efficiencies and fuel switching will reduce the growth in total energy requirements to 26 per cent in the Environmentally Friendly Scenario (EFS).

The industrial sector accounts for 43 per cent of the increase in total final energy consumption, and is dominated by the rapidly expanding energy needs of energy intensive industries in Southeast Asia and China. Increased energy consumption in the transportation sector is dominated by growth in oil products, which averages 2.6 per cent pa. While Southeast Asian economies' transport sectors grow most rapidly, the largest absolute growth occurs in the United States, which accounts for 44 per cent of the growth in APEC.

The key finding on the supply side is the increased net energy imports into the APEC region, as increases in regional production are unable to keep up with energy consumption. Net imports almost double during the Outlook projection period, while regional production expands by 31 per cent. While increases in the oil supply of around 34 per cent constitute the largest component of the total increases in regional energy supply, oil imports will account for 53 per cent of total oil supply in the region, and over 76 per cent in East Asia by 2010. However natural gas records the most rapid growth of major energy types, increasing by 63 per cent between 1995 and 2010 while electricity and heat generation grow by 60 and 162 per cent (from a small base) respectively.

In the short term, excess capacity in energy production is expected, leading to lower energy prices and investment contributing further to the weak global energy markets. Some delays and cancellations have taken place in large-scale energy production and infrastructure projects. Lower energy infrastructure and production investment could induce bottlenecks preventing the efficient delivery of energy to satisfy the higher energy demand growth expected beyond 2000.

The policy implications discussed in this report are generally consistent with those in the original Outlook. However, this update invites the Energy Ministers and other energy policy makers to address the following issues: how APEC energy policies could contribute to a faster economic recovery; how the long term energy supplies could be secured to meet the growing regional energy demand in the future and to alleviate potential supply security concerns; how potential environmental degradation arising from production, delivery and use of energy could be minimised at the lowest costs; and how regulatory reforms should be promoted in the prevailing economic circumstances.

APERC will continue providing relevant analytical inputs to those policy discussions.

Introduction

The compilation of an Asia-Pacific Economic Cooperation (APEC) regional energy outlook was one of the primary tasks assigned to the Asia Pacific Energy Research Centre (APERC) under the APEC Energy Action Programme adopted at the APEC Economic Leaders Meeting in November 1995.

Following the establishment of APERC in July 1996, work commenced on the Outlook by researchers from nearly all APEC economies. The Outlook was finalised in late 1997 and after an extensive review process it was delivered to the APEC Energy Working Group in March 1998. The Outlook incorporated a 'Case B' scenario that provided a preliminary assessment of the possible impacts of the emerging Asian financial crisis.

At the Seoul meeting of the APEC Energy Data and Outlook Expert Group (EDOEG), in February 1998, APERC was asked to continue its Outlook research and incorporate the changing economic climate of the APEC region. Particularly, APERC would examine the effects of the economic downturn in many Asian economies, and consider the likely regional repercussions for energy markets. Further, APERC would also provide a more detailed and consistent assessment of the production potentials for oil and natural gas.

This report presents the final analysis of this research, and concludes the work associated with the first APERC Outlook.

This Outlook models 18 APEC member economies which are grouped into six sub-regions including: United States; Other Americas (Canada, Chile, Mexico); China; Other East Asia (Hong Kong, China; Japan; Korea; Chinese Taipei); Oceania (Australia, New Zealand and Papua New Guinea) and Southeast Asia (Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand).

A new 1998 Baseline (B98) was developed and used to conduct a comprehensive assessment of energy demand and supply in the APEC region to 2010. B98 is based on the assumption that Asian economies recover from the current downturn in the period after 2000.

Two further scenarios have also been developed, a Protracted Crisis Scenario (PCS) and an Environmentally Friendly Scenario (EFS). The PCS case is more pessimistic than B98, assuming that economic growth in the Asian region stagnates as economies fail to stimulate growth. The result is a slower economic recovery in Asian economies, inducing lower rates of economic growth throughout the APEC region. The EFS case models the effects of accelerated improvements in energy efficiency and fuel switching towards less carbon intensive energy sources.

Lastly, this report reevaluates the key energy policy issues facing APEC economies including, energy security, energy and environment, energy efficiency, infrastructure requirements, and regulatory reform in the energy sector.

GDP Assumptions

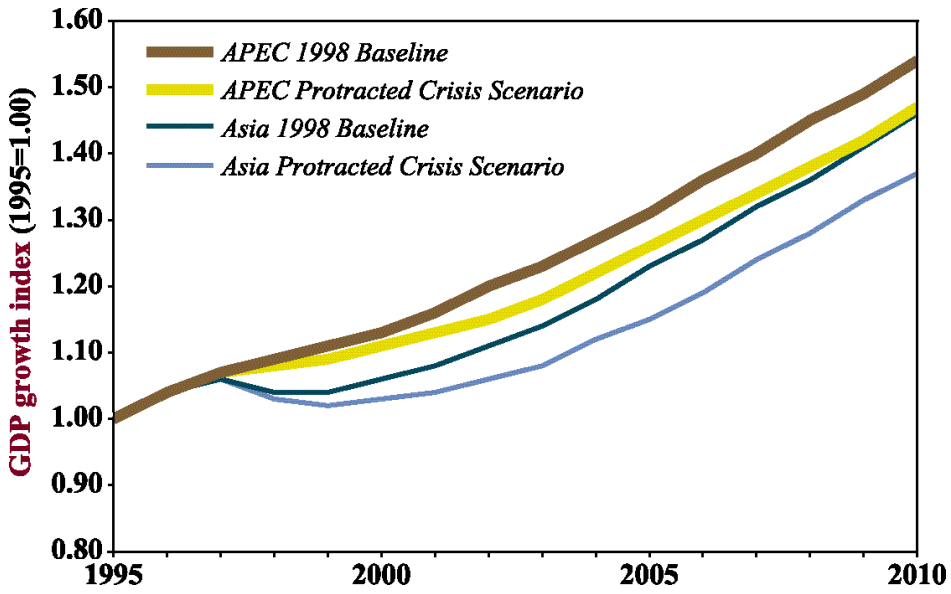
The GDP assumptions used in the Outlook report are provided by the MEGABARE general equilibrium model used by the Australian Bureau of Agricultural and Resource Economics (ABARE).

In the 1998 baseline projections, as of September 1998, the effects of the financial crisis in Asia slow the region's GDP growth between 1998 and 2000 (figure 1). In aggregate, the economic downturn in some Asian economies is compensated by positive economic growth in North America and Oceania. As the Asian region recovers in the period beyond 2000, APEC's aggregate GDP growth steadily accelerates over the remaining period to 2010 (figure 1). Aggregate growth rates for the APEC region are shown in figure 1, and provided in more detail in Appendices B and C.

Figure 1.

GDP growth index

Total APEC and Asia, B98 and PCS, 1995-2010



Note: Asia is defined as Other East Asia plus Southeast Asia.

The PCS represents a more pessimistic case where economic growth in Asian economies remains low for an extended period of time. Economic growth rates in other APEC economies are also affected, and in aggregate the APEC region's economic growth is stalled. In the period after 2000, strong economic fundamentals, combined with policies that facilitate long term growth, act to increase regional economic growth.

Final Energy Consumption by Sector

This section presents a brief overview of final energy consumption projections in the APEC region and also analyses the three components of final energy consumption-industrial, transportation, and residential/commercial energy consumption. Unless otherwise stated, numbers represent the 1998 Baseline scenario (B98).

Final Energy Consumption

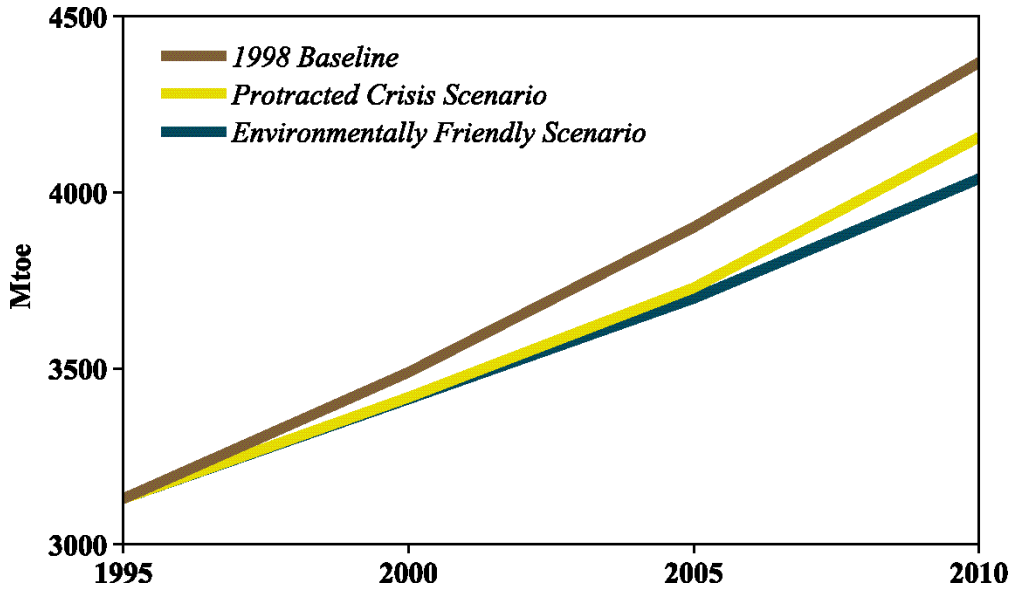
Final energy consumption is expected to increase by 40 per cent over the forecast period from 1995 to 2010, reaching 4369 Mtoe at an average growth rate of 2.2 per cent per annum (pa). In the more pessimistic PCS case, final energy consumption reaches 4157 Mtoe, at an average growth rate of 1.9 per cent pa. While this is significantly lower than the B98 baseline, it still represents a 33 per cent increase in final energy consumption relative to 1995.

Higher efficiencies and fuel switching achieved in the EFS case lower the final energy requirement. To generate the same level of GDP as in the baseline, a total of only 4039 Mtoe is needed at 2010 - a saving in energy consumption of 329 Mtoe over the 15-year projection period. Despite the savings, final energy consumption still grows by 29 per cent relative to 1995 (1.7 per cent pa). The EFS case also lowers carbon dioxide (CO_2) emissions throughout the region, relative to B98, by 14 per cent at 2010, a 670 tonne decrease relative to B98.

Figure 2.

APEC Final Energy Demand

By scenario, 1995-2010

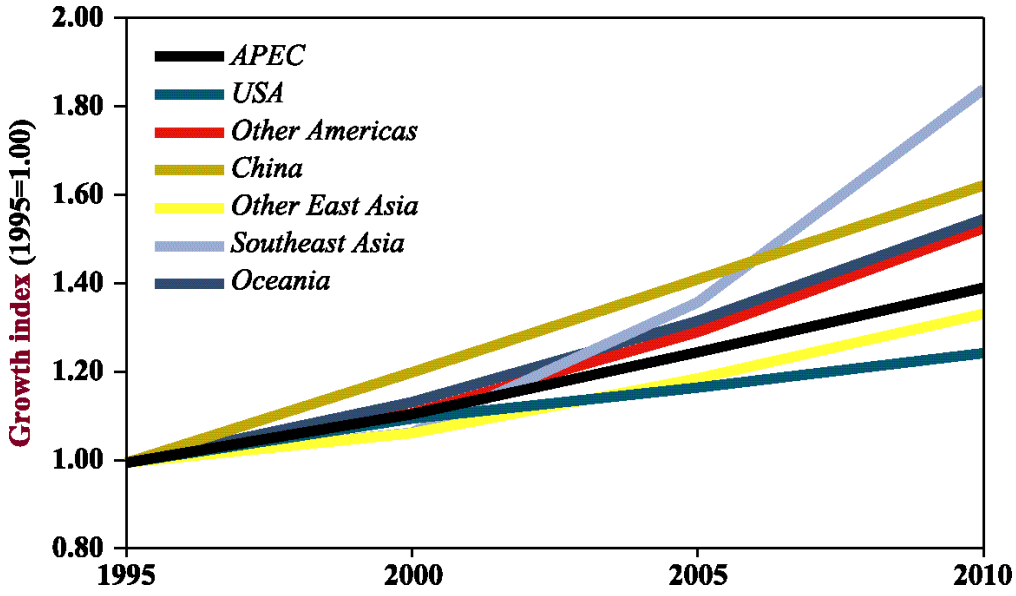


In absolute terms, the largest growth occurs in the 'big three' APEC economies' of the United States, China and Japan which contribute 66 per cent of the region's growth in final energy consumption. Economies in Southeast Asia are projected to recover from the current downturn, with final energy consumption increasing 1.3 per cent pa between 1995 and 2000 (a 7 per cent increase), and rising to the highest growth among the APEC region of 6.2 per cent pa (a 35 per cent increase) between 2005 and 2010 (figure 3).

Figure 3.

Final Energy Consumption growth

B98, 1995-2010



Oil remains the largest component of regional energy demand, contributing 46 per cent of the total increase in energy demand. However the most rapid growth occurs in natural gas and electricity demand, increasing 41 per cent (2.3 per cent pa) and 60 per cent (3.2 per cent pa) respectively over the projection period. The growth in gas demand is evenly spread between the industrial and the residential and commercial sectors, while the increase in electricity demand is primarily associated with the rapid economic development taking place in developing economies.

Industrial Sector

The industrial sector is the largest energy-consuming sector in most APEC economies, accounting for 45 per cent of APEC's final energy demand in 1995. Between 1980 and 1995, energy consumption in the industrial sector grew 31 per cent (1.8 per cent pa), reaching 1416 Mtoe. This growth is expected to continue over the period to 2010 where it is projected to reach 1943 Mtoe, increasing 37 per cent (2.1 per cent pa).

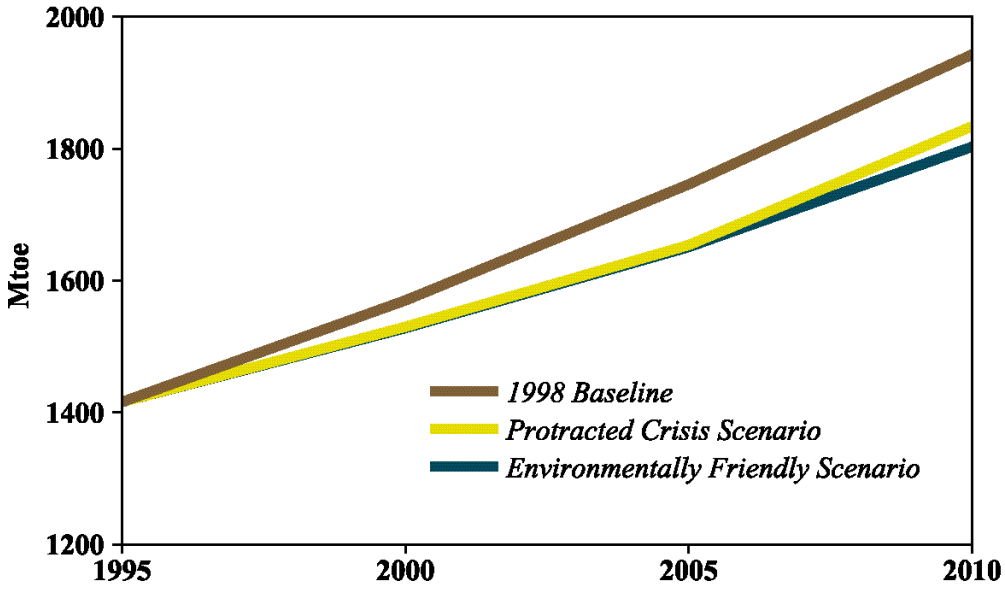
In the PCS case, industrial sector energy consumption increases by almost 30 per cent

(1.7 per cent pa) over the period to 2010. The majority of this growth is based in later years as economies recover from the current economic downturn. The five year percentage growth between 1995 and 2000 is 8 per cent (1.6 per cent pa) rising to 11 per cent (2.2 per cent pa) between 2005 and 2010. This later growth rate is comparable with the B98 baseline. Efficiency improvements and fuel switching in the EFS case significantly lower the energy requirement of the industrial sector, relative to B98 (figure 4). Between 1995 and 2010, industrial sector energy consumption in the APEC region increases by 27 per cent (1.6 per cent pa) -a saving of more than 7 per cent relative to the B98 baseline. While the gains in the EFS scenario are impressive, it should be noted that no account is taken of the economic costs of achieving these outcomes.

Figure 4.

APEC Industrial Sector Energy Demand

By scenario, 1995-2010



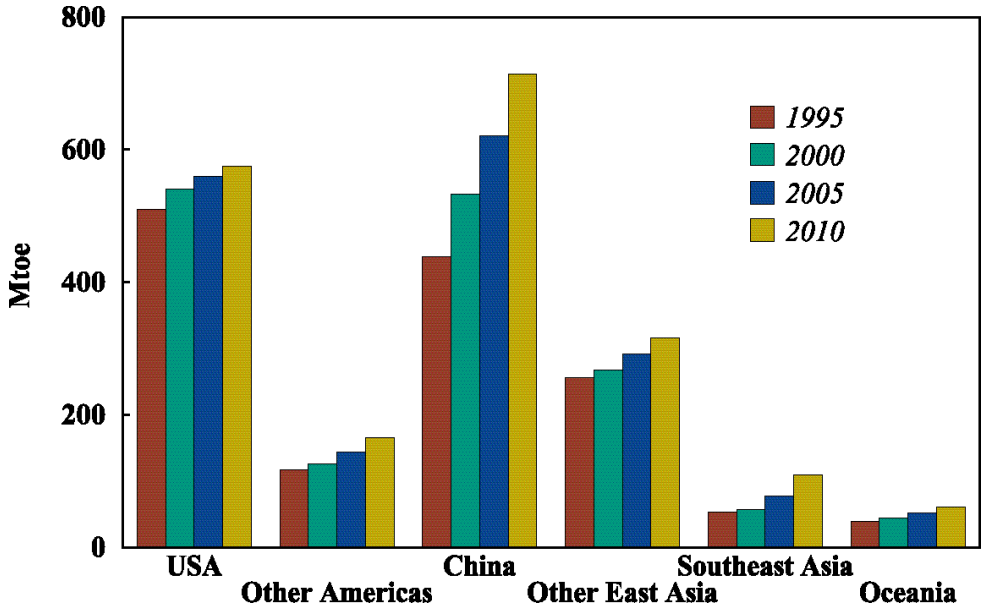
The largest industrial sector energy demand growth occurs in China, increasing 63 per cent (3.3 per cent pa) and reaching 714 Mtoe by 2010. China accounts for 52 per cent of the total growth in the APEC region, reflecting the strong economic growth, and industrial size of the Chinese economy. Southeast Asian economies recover from low growth in the early periods to the highest growth of 104 per cent (4.9 per cent pa) over the period to 2010, requiring 110.2 Mtoe of energy (figure 5).

Trends in the industrial sector's fuel mix are expected to continue along the trends established in the period from 1980 to 1995. Accordingly, the reliance on coal and oil is expected to decline moderately due to the strong growth in electricity demand. Nevertheless, coal and oil dominate fuel consumption in the industrial sector, accounting for 27 and 30 per cent respectively in 2010, compared with electricity's 20 per cent share.

Figure 5.

Regional Industrial Sector Energy Demand Growth

B98, 1995–2010



Growth in the industrial sector is led by energy intensive industries, particularly non-ferrous metals, iron and steel, petrochemicals, and cement and ceramics, mainly in the developing economies including China. Energy intensive industries increase their energy requirement by 48 per cent (2.7 per cent pa) between 1995 and 2010, and comprise 62 per cent of the total industrial energy demand at 2010. In the EFS case, higher efficiencies lower this increase to 35 per cent (2.0 per cent pa).

Transportation Sector

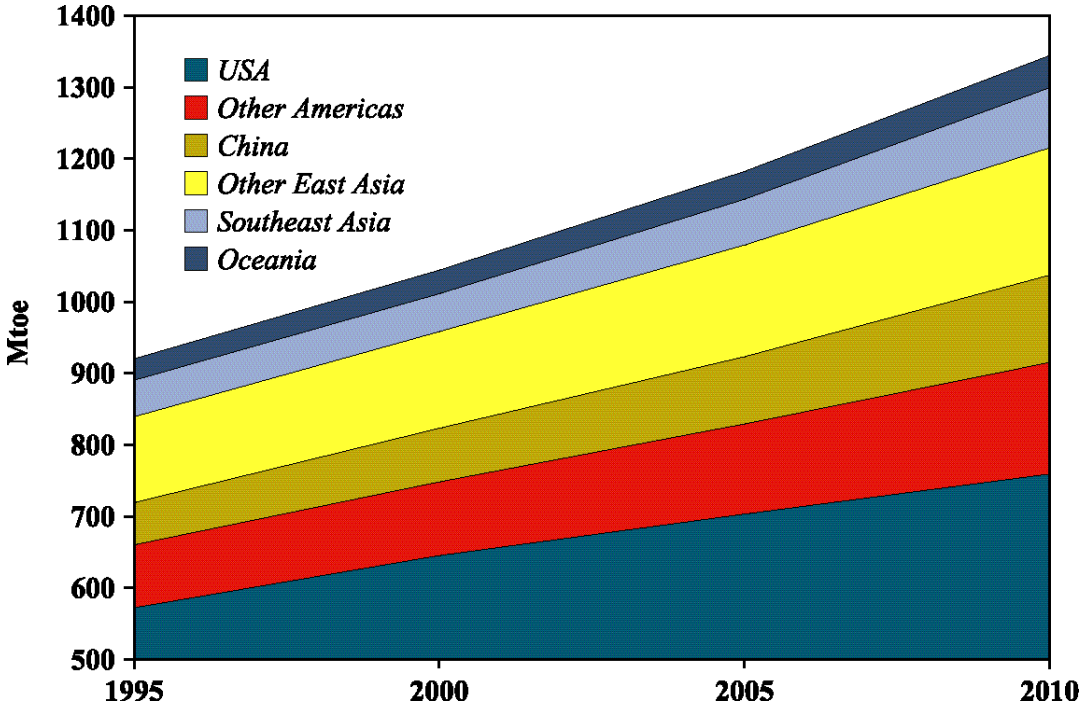
The transportation sector is expected to show the fastest growth among final consuming sectors, induced by economic growth and improvements in living standards. In the B98 case, transportation energy demand is projected to reach 1344 Mtoe, increasing 46 per cent (2.6 per cent pa) between 1995 and 2010. This is slightly higher than the 41 per cent growth (2.3 per cent pa) over the previous 15-year period. Over 95 per cent of the growth in the transportation sector occurs in oil products.

The United States accounts for over 44 per cent of absolute transportation demand growth, increasing 33 per cent (1.9 per cent pa) to 2010 (figure 6). Growth is fastest in developing economies as income levels and living standards rise rapidly. China and Southeast Asian economies maintain the strongest growth over the period, increasing 107 per cent (5.0 per cent pa) and 65 per cent (3.4 per cent pa), albeit from small bases.

Figure 6.

Transport Sector Energy Consumption Growth

B98, 1995–2010



Residential and Commercial Sector

Energy consumption in the residential and commercial sector is projected to grow by 40 per cent (2.3 per cent pa) over the period to 2010, reaching 1082 Mtoe in 2010. While this grow is concentrated in economies experiencing high income growth and rapid rates of urbanisation, developed economies continue to consume the majority of residential and commercial energy.

Southeast Asian economies record the strongest growth of 83 per cent (4.1 per cent pa) from a small base, while the United States contributes 39 per cent of the total APEC growth, increasing 29 per cent (1.7 per cent pa) to 2010.

There is an indication in a number of developed economies that the residential and commercial fuel mix is shifting away from oil and coal into electricity, gas and heat. This trend is accentuated under the EFS case, and is also expected to become more apparent in other APEC economies as they continue to develop.

Energy Demand and Supply by Fuel

This section provides a brief overview of primary energy supply and its components, indigenous production and net imports, by energy source. Primary energy supply equals primary energy required, or consumed, and these terms are used interchangeably in this section. Unless otherwise stated, numbers represent the 1998 Baseline scenario (B98).

Primary Energy Supply

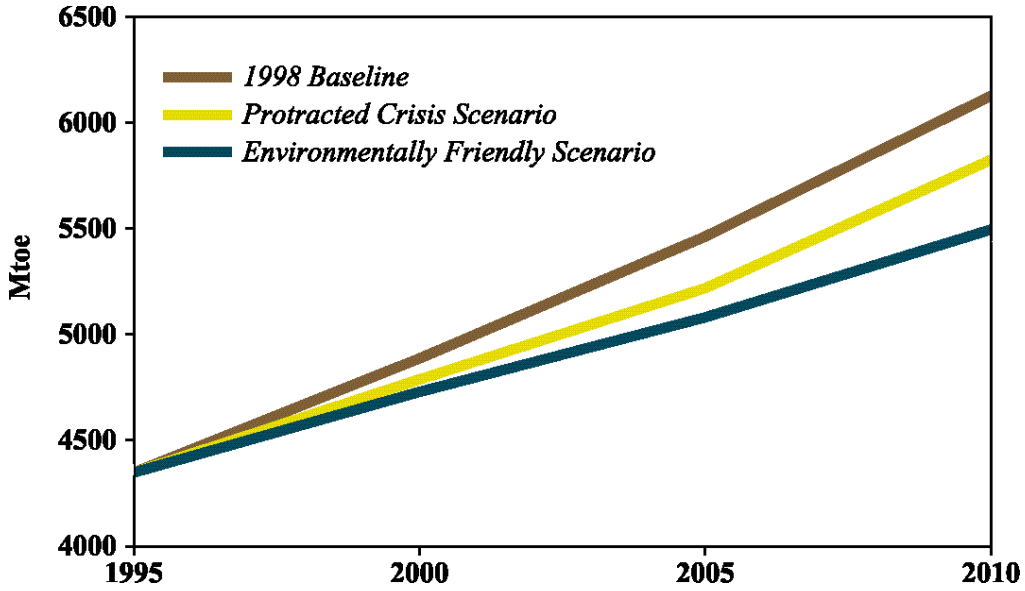
Primary energy supply (demand) in the B98 case is projected to increase 41 per cent (2.3 per cent pa) from 4348 Mtoe in 1995 to 6121 Mtoe in 2010. Oil remains the dominant fuel although its share falls slightly over the forecast period. Oil is expected to contribute the largest increase from 1995 to 2010 but only slightly more than coal. Natural gas grows at the fastest percentage rate (excluding electricity). Despite the current crisis, Southeast Asia grows at the fastest rate, 75 per cent (3.8 per cent pa) from 1995 to 2010.

In the PCS case, primary energy supply grows by 34 per cent (2.0 per cent pa) from 1995 to 2010, 5 per cent lower than the B98 case. In the EFS case, supply increases 26 per cent (1.6 per cent pa) in the forecast period, 10 per cent lower than B98.

Figure 7.

Total Primary Energy Supply

By scenario, 1995–2010

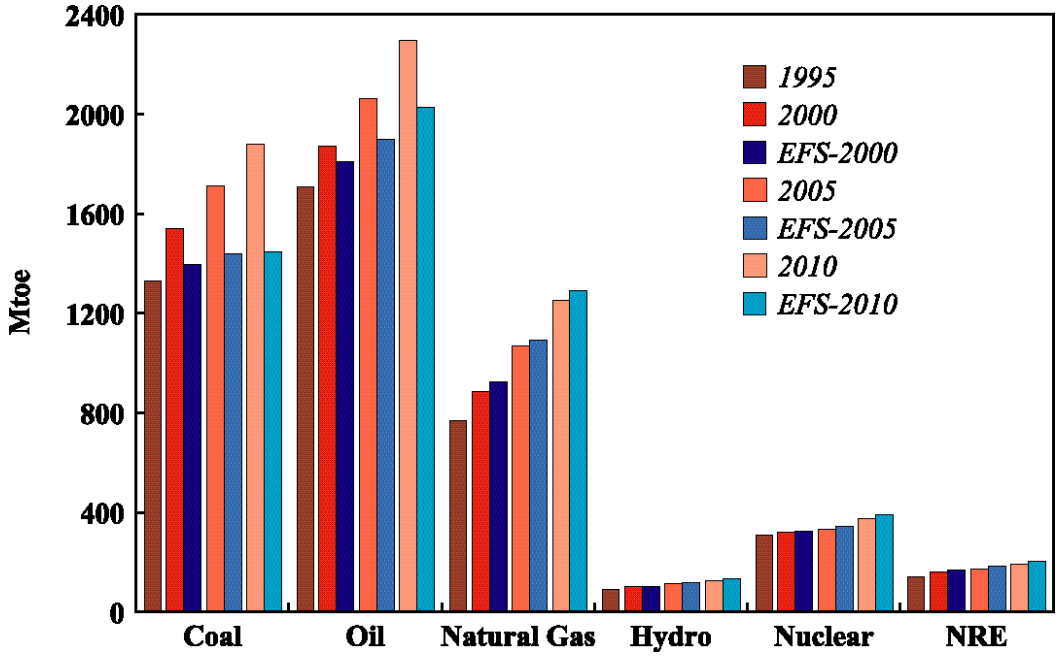


Indigenous production in APEC is projected to increase 31 per cent (1.8 per cent pa) over the forecast period, from 3657 Mtoe in 1995 to 4793 Mtoe in 2010. Natural gas is expected to grow at the most rapid rate, 44 per cent (2.5 per cent pa).

Oceania is the fastest growing region in terms of energy production. The United States is the largest producing region although its share is expected to decline over the

forecast period. China is projected to contribute 39 per cent of APEC's production increase.

Figure 8.
APEC Primary Energy Supply
B98 and EFS, by fuel, 1995-2010



As a result of the more rapid growth of demand relative to production, net imports into APEC are projected to increase 92 per cent (4.5 per cent pa), from 691 Mtoe in 1995 to 1328 Mtoe in 2010. Oil imports are projected to rise 65 per cent while gas will increase 13 times (18.4 per cent pa). Import dependence (net imports divided by total primary energy supply) for total energy will rise from 16 per cent in 1995 to 22 per cent in 2010. Import dependence in Other East Asia will decline slightly but remain a very high level. Other Americas, Oceania and Southeast Asia will remain net exporters.

In the PCS case, net imports are projected to increase 54 per cent (2.9 per cent pa) from 1995 to 2010, a decrease of 20 per cent from the B98 case. In the EFS, net imports are expected to decrease 6 per cent (0.4 per cent pa) in the forecast period, 51 per cent lower than B98. Under this scenario, import dependence declines from the 1995 level.

Oil

Oil consumption is projected to increase 34 per cent (2.0 per cent pa), from 1708 Mtoe in 1995 to 2297 Mtoe in 2010, compared to a rise of 21 per cent (1.3 per cent pa) from 1980 to 1995. Oil demand in the PCS is expected to be 5 per cent lower than B98, rising 28 per cent (1.6 per cent pa) over the forecast period. In the EFS, oil consumption rises 19 per cent (1.2 per cent pa) from 1995 to 2010, 12 per cent lower than B98.

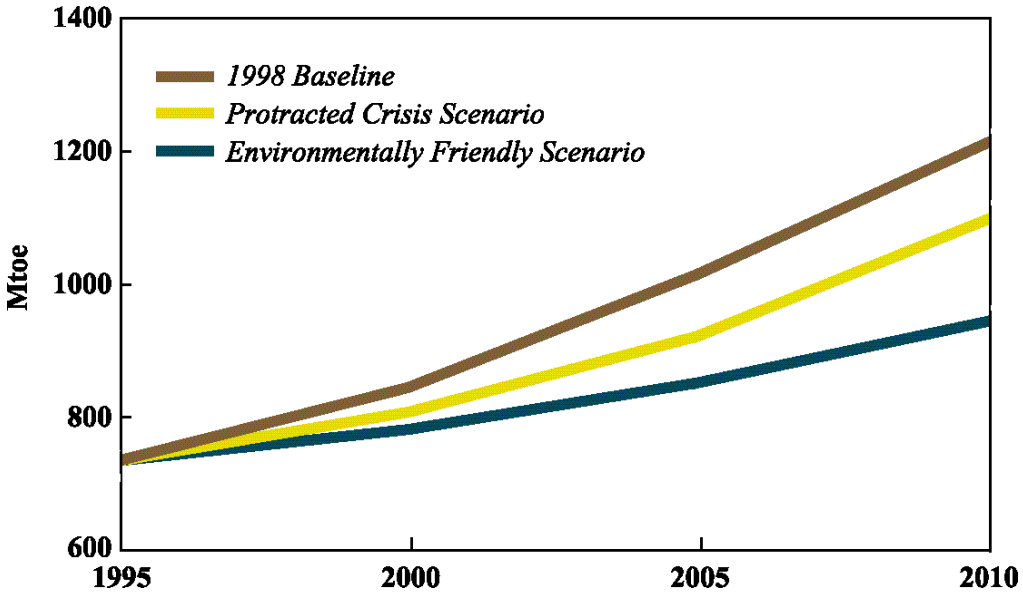
The fastest growth is expected in China at 118 per cent (5.3 per cent pa). Other East Asia contributed 39 per cent of the 1980 to 1995 increase but China is projected to contribute the most, 31 per cent, from 1995 to 2010. The transport sector in APEC is projected to continue to dominant oil consumption, contributing 69 per cent of the increase in the forecast period.

Oil production is projected to increase 12 per cent (0.7 per cent pa) from 973 Mtoe in 1995 to 1085 Mtoe in 2010. This compares to an increase of 7 per cent (0.5 per cent pa) from 1980 to 1995. The fastest growth will take place in the Oceania region while Other Americas will contribute the most, 63 per cent, to the projected increase. The United States is the largest oil producing economy although its share is expected to decline over the forecast period.

Figure 9.

APEC Net Oil Imports

By scenario, 1995-2010



Net oil imports in APEC are projected to increase 65 per cent (3.4 per cent pa) in the forecast period in B98, from 735 Mtoe in 1995 to 1211 Mtoe in 2010, compared to 45 per cent (2.5 per cent pa) from 1980 to 1995. The United States and China will together contribute 72 per cent of the increase in net imports. Oil import dependence for the APEC region will rise from 43 per cent in 1995 to 53 per cent in 2010. Oil import dependence in Other East Asia remains at nearly 100 per cent. Net imports in the PCS case are projected to increase 49 per cent (2.7 per cent pa) from 1995, 9 per cent lower than B98 in 2010. In the EFS case, net oil imports are projected to increase 28 per cent (1.7 per cent pa) over the forecast period, a decline of 22 per cent from B98 in 2010.

Natural Gas

Gas consumption is projected to increase 63 per cent (3.3 per cent pa) from 770 Mtoe in 1995 to 1253 Mtoe in 2010, more than twice the rise from 1980 to 1995. In the PCS case, gas consumption increases 54 per cent (2.9 per cent pa) from 1995 to 2010, 5 per
cent lower than B98. The EFS case is 3 per cent higher than B98 in 2010, an increase of 67 per cent (3.5 per cent pa) from 1995.

China is expected to show a 3.7-fold (9.1 per cent pa) increase over the forecast period, the largest increase among the APEC economies. The United States remains by far the largest consumer and producer of gas. Gas consumption for power generation in APEC is projected to more than double from 1995 to 2010, contributing 48 per cent of the increase in gas demand.

Gas production rises more rapidly in the forecast period (44 per cent, 2.5 per cent pa) than in the historical period (26 per cent, 1.5 per cent pa). China is expected to show the largest percentage increase, rising 3-fold (7.6 per cent pa) over the forecast period, while the United States has the largest absolute increase.

Net imports in B98 are projected to increase 13-fold (18.4 per cent pa) by 2010. Net imports comprised less than 2 per cent of supply in 1995 but are projected to make up nearly 13 per cent in 2010. Other East Asia will show the largest increase in net imports (70 Mtoe). Southeast Asia and Oceania will increase net exports by a total of 28 Mtoe. Net imports in PCS are expected to be 32 per cent lower than B98 in 2010, a 9-fold (15.4 per cent pa) increase from 1995. Net imports in the EFS case are expected to increase 14-fold (19.3 per cent pa) from 1995 to 2010, 12 per cent higher than B98 in 2010.

Coal

Coal consumption is projected to increase 41 per cent (2.3 per cent pa) from 1995-2010 compared to 66 per cent (3.4 per cent pa) from 1980 to 1995, from 1329 Mtoe in 1995 to 1878 Mtoe in 2010. In the PCS case, coal consumption is projected to increase 34 per cent (2.0 per cent pa) from 1995 to 2010, 5 per cent lower than B98 in 2010. In the EFS case, a 9 per cent (0.6 per cent pa) increase is expected for the forecast period, resulting in coal demand that is 23 per cent lower than B98 in 2010.

China is the largest consumer and producer of coal in APEC and is expected to contribute 52 per cent to coal demand growth from 1995 to 2010. Southeast Asia is expected to show the most rapid growth, rising 3.4-fold (8.6 per cent pa) over the forecast period. Coal is used predominately for power generation in APEC and power generation's share is projected to rise from 58 per cent in 1995 to 66 per cent in 2010.

Coal production is projected to increase 39 per cent (2.2 per cent pa) from 1385 Mtoe in 1995 to 1921 Mtoe in 2010. China is expected to contribute 57 per cent of the 1995-2010 increase. APEC is a small net exporter of coal although the level declines slightly in B98. Coal net exports increase in both the PCS and EFS cases.

New and Renewable Energy Sources (NRE)[1]

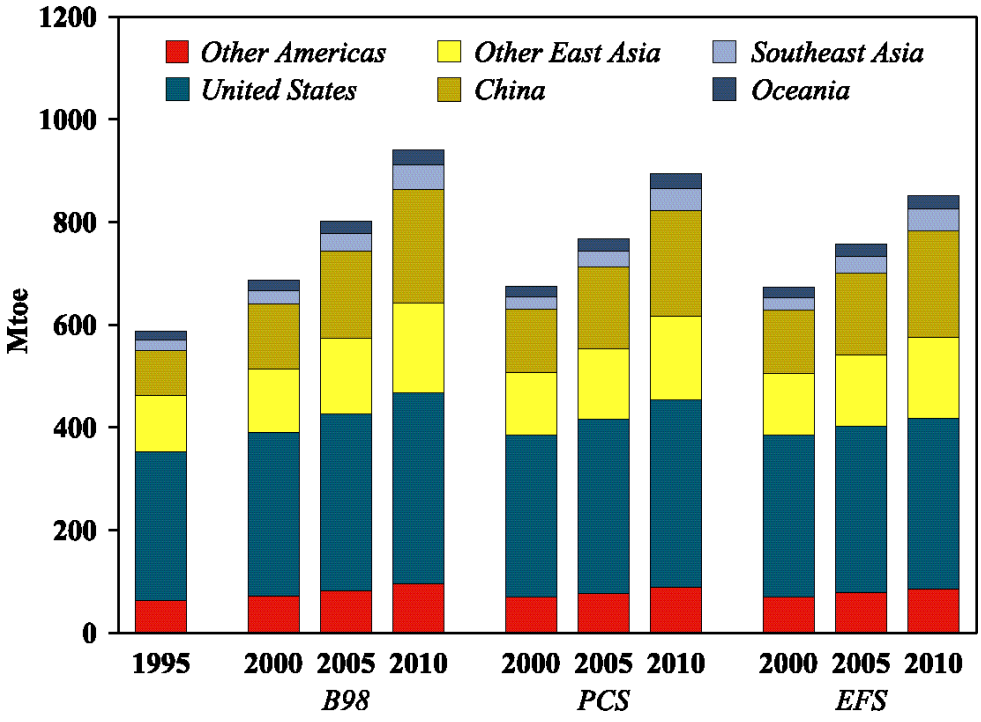
NRE consumption is projected to increase from 142 Mtoe in 1995 to 193 Mtoe in 2010, a rise of 35 per cent (2.0 per cent pa) in the forecast period compared to a 4-fold increase (9.8 per cent pa) in the historical period. In the PCS case, NRE demand is projected to increase 31 per cent (1.8 per cent pa), 4 per cent lower than B98 in 2010. The increase in the EFS case is projected to be 44 per cent (2.5 per cent pa) from 1995 to 2010, 6 per cent higher than B98 in 2010.

Southeast Asia is projected to have the highest growth rate, 115 per cent (5.2 per cent pa). NRE in power generation is projected to increase by 46 per cent (2.6 per cent pa), from 72 Mtoe in 1995 to 105 Mtoe in 2010.

Electricity

Electricity consumption is projected to increase 60 per cent (3.2 per cent pa) from 588 Mtoe in 1995 to 941 Mtoe in 2010. This compares to a rise of 74 per cent (3.8 per cent pa) from 1980 to 1995. In the PCS case, electricity consumption grows 52 per cent (2.8 per cent pa) from 1995 to 2010, 5 per cent lower than B98. In the EFS case, the increase over the forecast period is 45 per cent (2.5 per cent pa), down 10 per cent from the B98 case.

Figure 10.
Electricity Consumption
By region and scenario, 1995-2010



Note that some of NRE, such as non-commercial residential NRE in developing economies, are not reported in the APEC Energy Balance Tables

China is projected to show the largest growth in electricity use, 2.5-fold (6.4 per cent pa), over the forecast period. China will make the largest contribution to the increase in electricity demand, 38 per cent. For APEC as a whole, the residential and commercial sector remains the largest electricity consuming sector.

Coal will remain the dominant energy source for electricity generation and will contribute 56 per cent of the increase in fuel consumption. Gas consumption for power generation is projected to more than double (5.2 per cent pa). Nuclear will increase 21 per cent (1.3 per cent pa), although its expansion is limited to China and Other East Asia.

Energy Policy Issues

Energy Security

Even with the current economic slowdown in Asia and projected lower energy demand growth, the gap between the APEC region's energy production and consumption is widening. While APEC's total primary energy consumption (TPEC) is expected to grow 41 per cent, energy production is expected to grow only 31 per cent over 1995-2010. As a result, the region's dependence on imported energy will grow from 16 per cent in 1995 to 22 per cent by 2010. Even in the PCS case, energy import dependence is still projected to increase to 18 per cent by 2010. In particular, import dependence in oil and natural gas is expected to increase from 43 percent and 1.6 per cent, respectively, in 1995 to 53 per cent and 13 per cent in 2010.

The region's growing energy demand and the declining share of production point to the need to increase domestic energy production and broaden energy supply sources. APEC economies should be encouraged to increase their activities in exploration and production of indigenous energy sources; expand and facilitate energy trade both within and outside the region to diversify energy sources; and invest in research and development of alternative sources of energy and energy technologies.

Energy import dependence, and, in particular, growing oil import dependence, even taking into account production from hitherto less accessible sources, is likely to increase the region's vulnerability to supply disruptions. For example, imports of crude and petroleum products will account for 53 per cent of total oil supply in the APEC region, and over 76 per cent in East Asia (including China) by 2010. Asia's growing dependence on Middle East oil (Energy Information Administration, 1998) could make the region even more vulnerable due to extended supply lines from the Persian Gulf and the political instability of the region. In particular, extended supply lines such as increased tanker traffic through the Straits of Malacca could become a bottleneck in oil flow from the Middle East into Asia.

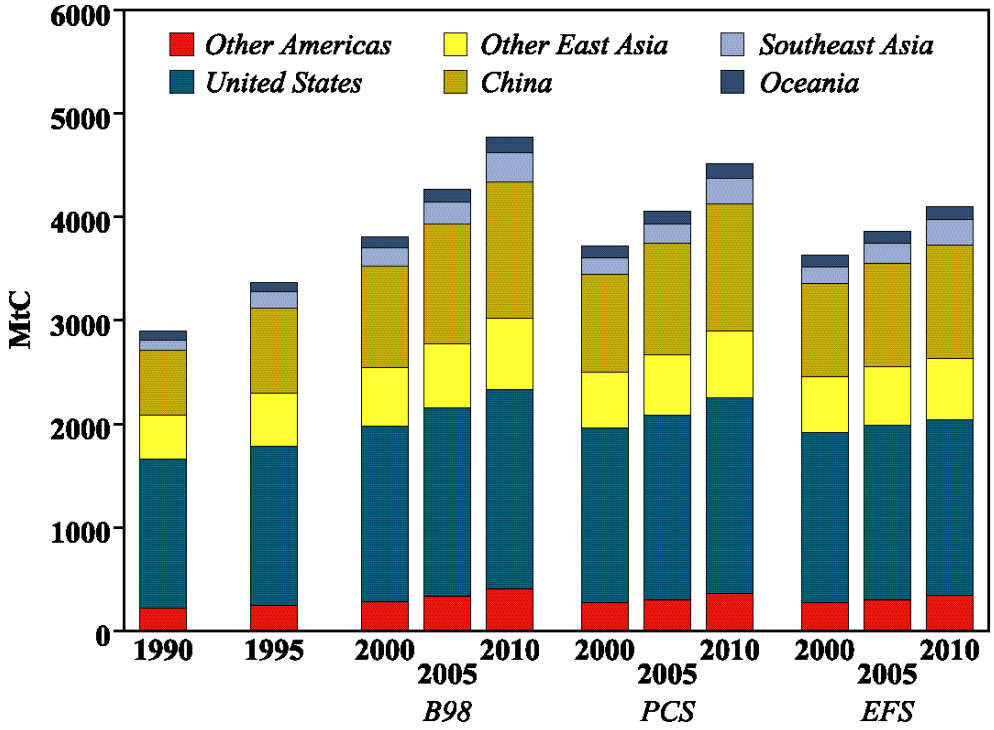
Sharp increases in oil prices following supply disruptions have in the past resulted in large economic losses, including inflation, lower GDP and high unemployment in many parts of the global economy. Various emergency response mechanisms could limit economic losses resulting from disruptions, but maintaining sufficient emergency oil stocks by oil importers could supplement supply shortages and alleviate economic damage during emergencies.

Energy and Environment

The production, distribution and consumption of energy have wide-ranging environmental effects. Fossil fuels are the major source of environmental pollution including SO_x, NO_x and CO_2 emitted through combustion and processing. Projected higher fossil fuel consumption in the region implies higher pollutant emissions. APERC's outlook projects CO_2 emissions to increase 42 per cent in the period to 2010 and increase by 22 per cent under the more energy efficient EFS case.

The fastest CO_2 emissions growth is expected in Southeast Asia, while the Americas and Oceania continue to have the largest CO_2 emissions per capita. The share of emissions from East Asia including China, on the other hand, is expected to come close to that of the Americas including the United States by 2010.

Figure 11.
Carbon Dioxide Emissions
By region and scenario, 1995-2010



Reducing environmental pollution might be costly, but it may be achieved through energy efficiency improvements, fuel switching towards less polluting fuels, and effective treatment of pollutants. It would be a challenging task for the five APEC economies committed to reducing (or limiting) CO_2 emissions under the Kyoto Protocol to achieve their commitments.

Energy Efficiency

Improving energy efficiency could achieve energy security and environmental quality by reducing reliance on fossil-fuel energy as well as economic benefit. The EFS case highlights the gains from energy efficiency improvements across the APEC region with reductions in TPEC in 2010 of 10 per cent, net energy imports of 51 per cent and CO_2 emissions of 14 per cent. Under the EFS case, TPEC per dollar of GDP declines by 11 per cent for the APEC region as a whole. By region, decreases in TPEC/GDP ranges from 13 per cent for Oceania and China to 9 per cent for the U.S., with the rest of the regions in between. It should also be pointed out that when APEC economies use energy resources more efficiently, they stand to gain economically.

There is a strong need and a large opportunity for improving energy efficiency in the APEC region although potential gains from improving energy efficiency vary considerably among APEC economies. Needless to say, the APEC forum is ideally suited for developing cooperative policies that encourage investment in energy conservation practices and facilitate the introduction of new and more efficient technologies.

Table 1: Energy Intensity by region

TPEC/GDP (toe per million 1987 US$)

		B98			EFS		
	1995	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**
APEC	0.39	0.39	0.38	0.36	0.38	0.35	0.32
United States	0.39	0.37	0.35	0.33	0.36	0.33	0.30
Other Americas	0.57	0.55	0.52	0.51	0.53	0.49	0.45
China	1.20	1.02	0.88	0.77	0.94	0.78	0.67
Other East Asia	0.20	0.21	0.20	0.19	0.20	0.19	0.18
Oceania	0.36	0.39	0.37	0.37	0.37	0.34	0.32
Southeast Asia	0.53	0.56	0.53	0.52	0.54	0.50	0.47

Infrastructure Requirements

The APEC region's growing energy demand will require new investments in energy production and, in particular, infrastructure development, to secure supply. The areas requiring investments include: liquefied natural gas (LNG) facilities and pipelines networks; electric power generation, transmission and distribution facilities, including interconnected grids (especially in Southeast Asia, and potentially in East Asia); and oil transportation facilities, including double-hulled tankers, upgrading and expanding sea ports and oil refineries. Large capital investment would also be required for possible construction of trans-boundary pipelines supplying oil and natural gas from Russia and Central Asia to East Asia and also in Southeast Asia .

Development of energy supply infrastructure requires massive investments and long lead times. The current lower energy demand would moderate the need for building infrastructure somewhat, at least, in the short run. But, in view of the projected sharp increase in energy demand in the latter half of the first decade of 21st century, unless capacity expansion is carried out in a timely manner, bottlenecks are likely to develop in energy supply systems, as the regional economies rebound.

Unfortunately, the current economic slowdown in Asia is not likely to generate sufficient internal funds for investment in energy infrastructure, and therefore there is a need for external funds while encouraging use of untapped domestic sources. The added benefit of infrastructure investment now is that it could stimulate APEC economies thereby hastening the recovery from the current economic crisis.

Regulatory Reform in the Energy Sector

Achieving the energy policy goals of securing adequate energy supply for sustaining economic growth, while protecting the environment, and promoting efficient use of energy and adequate investment in infrastructure development would require institutional and regulatory reform in the energy sector. APEC economies should strive to create transparent and competitive energy markets by removing less transparent regulations and distortionary subsidies. Transparent and competitive energy markets are essential for attracting both domestic and international investment in the energy sector, as they allow investment capital to move more freely among APEC economies. Competitive energy markets also promote trade and facilitate the transfer of technologies. On the other hand, less transparent regulatory regimes and subsidies tend to create market distortions resulting in inefficient allocation and use of energy resources. While promoting competitive energy markets, it is important to provide institutional frameworks to reduce or diversify risks.

Financial aid packages agreed to between the International Monetary Fund (IMF) and Indonesia, Korea, Philippines and Thailand could accelerate regulatory reforms in the energy sector. At the same time, the current economic difficulties could also hinder speedy implementation of regulatory reforms such as privatising state energy entities.

Conclusions

In spite of the current economic downturn in Asia, and projected slower growth in energy demand, the region's demand for energy is expected to outpace its energy production by a wide margin underscoring the APEC region's growing energy import dependence.

The key energy policy issues facing the region remain: securing adequate energy supplies to meet growing energy demand when APEC economies recover from the economic slowdown; minimising environmental degradations resulting from energy production and use; using energy resources efficiently; and promoting infrastructure investment and regulatory reform in the energy sector.

Energy policies formulated by APEC economies to address these issues should also contribute toward a rapid economic recovery of the region.

APERC is currently pursuing a wide range of research themes addressing the issues identified in the Outlook. They include the value of holding stocks for securing oil supply, the development of energy efficiency indicators for industry, the feasibility of trans-boundary natural gas and electric delivery infrastructure, studies on energy pricing practices and electricity sector deregulation. APERC will continue to provide relevant analytical inputs for APEC member economies' policy discussions.

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Appendix A: Model Modifications, Definitions, and Conversion Factors

Model modifications

The model used for this updated Outlook is basically the same as that used to develop the projections published in March 1998. Several modifications were made in the intervening months and are summarised briefly below.

- Power generation fuel shares were revised and updated.
- Oil production projections were re-assessed and updated.
- Natural gas production was revised based on expected levels of imports and exports in various economies.
- The Japanese transportation model was revised.

Definitions

The Outlook is presented in the form of standard Energy Balance Tables (EBTs) as used for the APEC Energy Database . A number of modifications were made to this format and include:

- Coal and coal products were merged into one category referred to as 'Coal'.
- Crude oil and petroleum products (such as LPG, naphtha, fuel oil, etc.) were merged into one category referred to as 'Oil'.
- Natural gas and town gas were merged into one category referred to as 'Gas'.

Final energy is defined to include coal, oil, natural gas, NRE, electricity and heat.

The supply sectors are defined to include (indigenous) production and net imports of oil, natural gas, coal, hydro, nuclear and NRE. Net imports were defined as primary energy supply less production.

The transformation sector is defined to include power generation, petroleum refineries, other transformation industries, and own use and losses. For the transformation sector, power generation is defined to include both public utility power generation and auto- production of power. 'Other' is defined to include both coal transformation and gas processing.

The end-use demand sectors are defined to include the industry, transportation, and residential and commercial (combined) sectors.

Conversion Factors

All the energy data presented in the Outlook are shown in net calorific value and are expressed in million tonnes of oil equivalent, Mtoe (1013 kcal). The conversion factors used are consistent with those used in the APEC Energy Database. Most thermal conversion factors applied in the APEC database were provided by the authorities in each member economies. For some thermal conversions, the unified conversion factors were adopted such as follows.

Conversion factors for primary electricity efficiency

Hydro power:	100%
Nuclear power:	33%
Geothermal power:	10%
Other new power:	100%

Conversion factor for electricity

1 kWh = 860 kcal = 0.000086 toe = 3.6 MJ

Conversion factor between calorific value and oil equivalent value

1 Mtoe = 10^{13} kcal = 42×10^{9} MJ

1 ktoe = 10^{10} kcal = 42×10^{6} MJ

Carbon emission factors

Coal:	1.08 tC/toe
Gas:	0.64 tC/toe
Oil:	0.84 tC/toe

Appendix B: Regional GDP Growth Rates

Table B1: Regional GDP Growth Rates –B98 and EFS

Average percentage change per annum

	APEC	United States	Other Americas	China	Other E.Asia	Oceania	SE Asia
1998	1.3	2.8	3.4	6.0	-1.7	3.4	-7.9
1999	2.0	2.2	2.6	6.5	0.7	2.5	-1.9
2000	2.3	2.0	3.0	7.0	1.4	3.3	1.9
2001 - 2005	2.3	1.7	3.2	4.6	2.2	2.8	4.3
2006 - 2010	2.4	1.7	3.1	4.4	2.4	2.7	4.3

Table B2 : Regional GDP Growth Rates-PCS

Average percentage change per annum

	APEC	United States	Other Americas	China	Other E.Asia	Oceania	SE Asia
1998	0.9	2.7	3.1	5.9	-2.4	3.3	-9.7
1999	1.0	1.7	0.4	5.0	-0.5	2.0	-4.5
2000	1.5	1.5	0.8	5.0	0.7	2.8	-0.8
2001 - 2005	2.2	1.7	2.8	4.3	2.0	2.8	3.8
2006 - 2010	2.3	1.7	3.0	4.3	2.4	2.7	4.4

Appendix C : GDP Growth Rates

Table C1 : GDP Growth Rates – B98 and EFS

Average percentage change per annum

	Australia	Brunei	Canada	Chile	China	HK,China
1998	3.8	5.0	3.0	5.0	6.0	-4.0
1999	2.5	5.1	2.0	4.0	6.5	0.0
2000	3.3	5.2	2.5	4.0	7.0	2.0
2001 - 2005	3.8	4.1	2.4	4.6	4.6	4.0
2006 - 2010	3.5	5.9	3.0	5.9	5.9	5.5
	Indonesia	**Japan**	**Korea**	**Malaysia**	**Mexico**	**NZ**
1998	-15.0	-1.7	-6.0	-5.0	4.0	1.0
1999	-5.0	0.5	0.0	-2.0	4.0	2.0
2000	2.0	1.0	2.0	1.0	4.0	3.0
2001 - 2005	4.4	1.9	3.8	4.5	4.8	2.7
2006 - 2010	6.3	3.0	4.2	5.9	6.2	4.1
	PNG	**Philippines**	**Singapore**	**CT**	**Thailand**	**USA**
1998	4.7	0.0	0.5	5.0	-7.0	2.8
1999	4.9	0.0	0.5	5.0	0.0	2.2
2000	5.6	2.0	2.0	5.5	2.0	2.0
2001 - 2005	3.5	4.0	3.9	3.3	4.2	1.7
2006 - 2010	5.3	6.3	4.3	3.4	6.2	2.2

Table C2 : GDP Growth Rates –PCS

Average percentage change per annum

	Australia	Brunei	Canada	Chile	China	HK,China
1998	3.7	5.0	2.9	4.0	5.9	-5.0
1999	2.0	5.1	1.5	-2.0	5.0	-2.6
2000	2.8	5.2	2.0	-2.0	5.0	-1.0
2001 - 2005	2.8	4.1	2.8	3.7	4.3	3.9
2006 - 2010	3.5	5.9	3.0	5.9	5.8	5.6
	Indonesia	**Japan**	**Korea**	**Malaysia**	**Mexico**	**NZ**
1998	-17.0	-2.5	-6.0	-5.5	3.5	0.9
1999	-7.0	-0.7	-2.0	-4.5	-2.0	1.5
2000	-1.0	0.5	1.0	-2.0	-2.0	2.5
2001 - 2005	3.8	1.7	3.2	3.7	3.8	2.6
2006 - 2010	6.2	3.0	4.3	5.9	6.2	4.0
	PNG	**Philippines**	**Singapore**	**CT**	**Thailand**	**USA**
1998	4.7	-1.0	-1.0	4.9	-10.0	2.7
1999	4.9	-0.5	-1.0	4.5	-5.0	1.7
2000	5.6	0.0	1.0	4.2	-1.0	1.5
2001 - 2005	3.5	3.8	3.6	3.0	4.0	1.7
2006 - 2010	5.3	6.2	4.8	3.5	6.2	2.2

Source : MEGABARE Model, ABARE, Australia. Further documentation of the MEGABARE model is available from ABARE's website (http://www.abare.gov.au).

Appendix D : Total Primary Energy Supply

Table D1 : Total Primary Energy Supply - B98

Mtoe

	1995	2000	2005	2010
APEC	4,347.6	4,885.5	5,462.7	6,121.1
United States	2,105.2	2,298.2	2,442.9	2,579.2
Other Americas	381.9	432.9	505.2	598.0
China	829.4	1,014.7	1,203.7	1,402.2
Other East Asia	709.2	774.1	870.6	986.9
Oceania	112.7	138.8	160.9	188.9
Southeast Asia	209.2	226.6	279.3	366.0

Table D2 : Total Primary Energy Supply - PCS

Mtoe

	1995	2000	2005	2010
APEC	4,347.6	4,787.8	5,219.0	5,824.8
United States	2,105.2	2,282.9	2,401.7	2,534.2
Other Americas	381.9	416.3	461.0	540.9
China	829.4	978.7	1,122.4	1,306.4
Other East Asia	709.2	757.4	828.3	935.1
Oceania	112.7	137.6	158.0	185.1
Southeast Asia	209.2	214.8	247.6	323.1

Table D3 : Total Primary Energy Supply - EFS

Mtoe

	1995	2000	2005	2010
APEC	4,347.6	4,729.9	5,081.8	5,496.7
United States	2,105.2	2,260.5	2,317.7	2,358.1
Other Americas	381.9	420.6	471.0	528.3
China	829.4	939.5	1,064.2	1,223.5
Other East Asia	709.2	754.1	818.3	892.7
Oceania	112.7	133.9	147.0	163.5
Southeast Asia	209.2	221.2	263.6	330.6

Appendix E : Total Final Energy Consumption

Table E1 : Total Final Energy Consumption - B98

Mtoe

	1995	2000	2005	2010
APEC	3,130.2	3,486.8	3,901.2	4,368.5
United States	1,507.3	1,651.0	1,766.3	1,880.9
Other Americas	284.5	316.3	368.6	435.4
China	623.4	750.9	882.1	1,014.3
Other East Asia	505.0	538.3	601.3	675.1
Oceania	83.9	95.4	110.8	130.1
Southeast Asia	126.1	134.8	172.0	232.8

Table E2 : Total Final Energy Consumption - PCS

Mtoe

	1995	2000	2005	2010
APEC	3,130.2	3,418.3	3,729.4	4,157.0
United States	1,507.3	1,640.4	1,737.2	1,845.4
Other Americas	284.5	305.8	338.8	396.3
China	623.4	724.3	823.2	945.6
Other East Asia	505.0	527.2	573.5	642.5
Oceania	83.9	94.6	108.9	127.6
Southeast Asia	126.1	125.9	147.8	199.7

Table E3 : Total Final Energy Consumption - EFS

Mtoe

	1995	2000	2005	2010
APEC	3,130.2	3,412.8	3,699.2	4,039.4
United States	1,507.3	1,632.8	1,700.9	1,767.3
Other Americas	284.5	307.9	345.9	392.2
China	623.4	716.6	808.9	922.3
Other East Asia	505.0	530.1	577.6	629.6
Oceania	83.9	93.5	104.3	116.8
Southeast Asia	126.1	131.8	161.7	211.3

Appendix F : Oil Consumption

Table F1 : Oil Consumption - B98

Mtoe

	1995	2000	2005	2010
APEC	1,707.9	1,871.6	2,063.9	2,296.6
United States	832.7	906.4	954.5	1,010.4
Other Americas	166.7	186.0	215.9	258.0
China	156.5	216.9	277.5	341.0
Other East Asia	391.5	400.8	428.7	456.1
Oceania	40.6	45.6	52.2	60.1
Southeast Asia	119.8	116.0	135.1	170.9

Table F2 : Oil Consumption - PCS

Mtoe

	1995	2000	2005	2010
APEC	1,707.9	1,835.4	1,970.6	2,182.6
United States	832.7	901.5	939.6	991.5
Other Americas	166.7	178.0	193.9	229.1
China	156.5	210.3	259.3	317.6
Other East Asia	391.5	390.7	406.8	436.1
Oceania	40.6	45.1	51.4	59.2
Southeast Asia	119.8	109.7	119.6	149.1

Table F3 : Oil Consumption - EFS

Mtoe

	1995	2000	2005	2010
APEC	1,707.9	1,808.5	1,900.4	2,028.9
United States	832.7	878.7	887.8	913.9
Other Americas	166.7	175.2	190.5	214.2
China	156.5	214.4	260.0	313.7
Other East Asia	391.5	385.4	391.4	390.2
Oceania	40.6	43.7	47.9	53.0
Southeast Asia	119.8	111.2	122.8	143.9

Appendix G : Net Energy Imports by Region

Table G1 : APEC Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-56.4	-40.0	-27.4	-42.5
	Oil	734.9	844.7	1,015.1	1,211.5
	N. Gas	12.6	25.1	76.9	158.8
	Total	**691.1**	**829.8**	**1,064.6**	**1,327.8**
PCS					
	Coal	-56.4	-82.7	-119.1	-141.0
	Oil	734.9	808.4	921.8	1,097.4
	N. Gas	12.6	12.4	36.9	107.9
	Total	**691.1**	**738.1**	**839.6**	**1,064.3**
EFS					
	Coal	-56.4	-185.2	-297	-474.8
	Oil	734.9	781.6	851.5	943.7
	N. Gas	12.6	60.1	99.7	178.1
	Total	**691.1**	**656.5**	**654.2**	**647.0**

Table G2 : United States Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-50.0	-56.1	-50.4	-61.8
	Oil	416.3	504.4	562.5	619.9
	N. Gas	73.1	83.0	116.9	150.3
	Total	**439.4**	**531.3**	**629.0**	**708.4**
PCS					
	Coal	-50.0	-60.0	-60.2	-68.4
	Oil	416.3	499.5	547.6	601.0
	N. Gas	73.1	78.8	105.4	136.3
	Total	**439.4**	**518.3**	**592.8**	**668.9**
EFS					
	Coal	-50.0	-102.0	-120.2	-194.9
	Oil	416.3	476.7	495.8	523.4
	N. Gas	73.1	115.7	123.1	154.0
	Total	**439.4**	**490.4**	**498.7**	**482.5**

Table G3 : Other Americas Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-11.4	-3.1	2.9	10.4
	Oil	-92.2	-110.6	-96.9	-71.0
	N. Gas	-65.0	-71.6	-64.1	-48.0
	Total	**-168.6**	**-185.3**	**-158.1**	**-108.6**
PCS					
	Coal	-11.4	-5.3	-2.9	3.3
	Oil	-92.2	-118.5	-118.9	-100.0
	N. Gas	-65.0	-76.6	-77.3	-65.6
	Total	**-168.6**	**-200.4**	**-199.1**	**-162.3**
EFS					
	Coal	-11.4	-6.4	-9.0	-12.6
	Oil	-92.2	-121.4	-122.3	-114.8
	N. Gas	-65.0	-70.2	-62.2	-52.5
	Total	**-168.6**	**-198.0**	**-193.5**	**-179.9**

Table G4 : China Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-20.1	2.5	-3.0	-35.0
	Oil	8.1	46.9	97.5	146.0
	N. Gas	0.0	0.0	5.0	10.4
	Total	**-12.0**	**49.4**	**99.5**	**121.4**
PCS					
	Coal	-20.1	-24.2	-58.6`	-96.6
	Oil	8.1	40.3	79.3	122.6
	N. Gas	0.0	0.0	1.1	5.4
	Total	**-12.0**	**16.1**	**21.8**	**31.4**
EFS					
	Coal	-20.1	-75.7	-145.7	-228.5
	Oil	8.1	44.4	80.0	118.7
	N. Gas	0.0	0.0	19.2	41.8
	Total	**-12.0**	**-31.3**	**-46.5**	**-68.0**

Table G5 : Other East Asia Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	128.6	154.0	175.9	202.0
	Oil	390.7	400.2	428.1	455.5
	N. Gas	61.1	80.1	104.4	130.8
	Total	**580.4**	**634.3**	**708.4**	**788.3**
PCS					
	Coal	128.6	150.5	166.0	189.4
	Oil	390.7	390.1	406.2	435.4
	N. Gas	61.1	76.7	94.5	118.1
	Total	**580.4**	**617.3**	**666.7**	**742.9**
EFS					
	Coal	128.6	143.6	149.6	154.5
	Oil	390.7	384.8	390.8	389.6
	N. Gas	61.1	81.0	104.9	131.9
	Total	**580.4**	**609.4**	**645.3**	**676.0**

Table G6 : Oceania Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-91.1	-112.2	-124.7	-135.3
	Oil	4.7	1.3	3.3	5.3
	N. Gas	-8.3	-9.3	-18.4	-18.4
	Total	**-94.7**	**-120.2**	**-139.8**	**-148.4**
PCS					
	Coal	-91.1	-112.6	-125.8	-136.7
	Oil	4.7	0.9	2.4	4.4
	N. Gas	-8.3	-9.3	-18.4	-18.4
	Total	**-94.7**	**-131.0**	**-141.8**	**-150.7**
EFS					
	Coal	-91.1	-116.6	-134.7	-152.4
	Oil	4.7	-0.5	-1.1	-1.8
	N. Gas	-8.3	-9.3	-18.4	-27.5
	Total	**-94.7**	**-126.4**	**-154.2**	**-181.7**

Table G7 : Southeast Asia Net Energy Imports

Mtoe

		1995	2000	2005	2010
B98					
	Coal	-12.5	-25.1	-28.2	-22.7
	Oil	7.2	2.4	20.6	55.7
	N. Gas	-48.3	-57.2	-66.8	-66.2
	Total	**-53.7**	**-79.9**	**-74.4**	**-33.2**
PCS					
	Coal	-12.5	-31	-37.7	-32.0
	Oil	7.1	-3.9	5.1	33.9
	N. Gas	-48.3	-57.2	-68.4	-67.9
	Total	**-53.7**	**-92.1**	**-101**	**-66**
EFS					
	Coal	-12.5	-28.0	-37.0	-40.9
	Oil	7.1	-2.4	8.3	28.7
	N. Gas	-48.3	-57.2	-66.8	-69.5
	Total	**-53.7**	**-87.6**	**-95.5**	**-81.7**

Appendix H : Fossil Fuel Production by Region

Table H1 : APEC Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	1,385.2	1,581.8	1,738.1	1,920.7
	Oil	973.0	1,027.0	1,048.9	1,085.2
	N. Gas	757.8	860.5	990.5	1,094.3
	Total	**3,116.0**	**3,469.3**	**3,777.5**	**4,100.2**
PCS					
	Coal	1,385.2	1,585.4	1,741.9	1,923.0
	Oil	973.0	1,027.0	1,048.9	1,085.2
	N. Gas	757.8	856.2	982.3	1,081.9
	Total	**3,116.0**	**3,468.6**	**3,773.1**	**4,090.1**
EFS					
	Coal	1,385.2	1,581.8	1,738.1	1,920.7
	Oil	973.0	1,027.0	1,048.9	1,085.2
	N. Gas	757.8	865.9	994.4	1,111.9
	Total	**3,116.0**	**3,474.7**	**3,781.4**	**4,117.8**

Table H2 : United States Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	526.2	587.9	604.5	634.0
	Oil	416.4	402.0	392.0	390.5
	N. Gas	433.2	478.8	528.4	565.4
	Total	**1,375.8**	**1,468.7**	**1,524.9**	**1,589.9**
PCS					
	Coal	526.2	587.9	604.5	634.0
	Oil	416.4	402.0	392.0	390.5
	N. Gas	433.2	478.8	528.4	565.4
	Total	**1,375.8**	**1,468.7**	**1,516.9**	**1,589.9**
EFS					
	Coal	526.2	587.9	604.5	634.0
	Oil	416.4	402.0	392.0	390.5
	N. Gas	433.2	478.8	528.4	565.4
	Total	**1,375.8**	**1,468.7**	**1,524.9**	**1,589.9**

Table H3 : Other Americas Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	45.4	49.6	50.4	51.4
	Oil	258.9	296.6	312.8	329.1
	N. Gas	168.0	190.3	213.5	233.3
	Total	**472.3**	**536.5**	**576.7**	**613.8**
PCS					
	Coal	45.4	49.6	50.4	51.4
	Oil	258.9	296.6	312.8	329.1
	N. Gas	168.0	190.3	213.5	233.3
	Total	**472.3**	**536.5**	**576.7**	**613.8**
EFS					
	Coal	45.4	49.6	50.4	51.4
	Oil	258.9	296.6	312.8	329.1
	N. Gas	168.0	190.3	213.5	233.3
	Tota	**472.3**	**536.5**	**576.7**	**613.8**

Table H4 : China Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	646.4	724.7	829.6	949.6
	Oil	148.4	170.0	180.0	195.0
	N. Gas	15.0	25.8	35.0	45.0
	Total	**809.8**	**920.5**	**1,044.6**	**1,189.6**
PCS					
	Coal	646.4	724.7	829.6	949.6
	Oil	148.4	170.0	180.0	195.0
	N. Gas	15.0	24.4	35.0	45.0
	Total	**809.8**	**919.1**	**1,044.6**	**1,189.6**
EFS					
	Coal	646.4	724.7	829.6	949.6
	Oil	148.4	170.0	180.0	195.0
	N. Gas	15.0	28.6	35.0	45.0
	Total	**809.8**	**923.3**	**1,044.6**	**1,189.6**

Table H5 : Other East Asia Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	6.2	2.2	1.7	1.2
	Oil	0.8	0.6	0.6	0.6
	N. Gas	2.7	3.7	5.7	7.6
	Total	**9.7**	**6.5**	**8.0**	**9.4**
PCS					
	Coal	6.2	2.2	1.7	1.2
	Oil	0.8	0.6	0.6	0.6
	N. Gas	2.7	3.7	5.7	7.6
	Total	**9.7**	**6.5**	**8.0**	**9.4**
EFS					
	Coal	6.2	2.2	1.7	1.2
	Oil	0.8	0.6	0.6	0.6
	N. Gas	2.7	3.7	5.7	7.6
	Total	**9.7**	**6.5**	**8.0**	**9.4**

Table H6 : Oceania Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	130.7	163.4	181.0	200.1
	Oil	35.8	44.2	49.0	54.8
	N. Gas	29.1	37.9	55.6	64.2
	Total	**195.6**	**245.5**	**285.6**	**319.1**
PCS					
	Coal	130.7	163.4	181.0	200.1
	Oil	35.8	44.2	49.0	54.8
	N. Gas	29.1	37.6	54.9	63.2
	T**otal**	**195.6**	**245.2**	**284.9**	**318.1**
EFS					
	Coal	130.7	163.4	181.0	200.1
	Oil	35.8	44.2	49.0	54.8
	N. Gas	29.1	39.0	55.8	72.5
	Total	**195.6**	**246.6**	**285.8**	**327.4**

Table H7 : Southeast Asia Fossil Fuel Production

Mtoe

		1995	2000	2005	2010
B98					
	Coal	30.5	53.9	70.8	84.4
	Oil	112.7	113.6	114.5	115.2
	N. Gas	109.7	124.0	152.3	178.8
	Total	**252.9**	**291.5**	**337.6**	**378.4**
PCS					
	Coal	30.5	57.6	74.6	86.7
	Oil	112.7	113.6	114.5	115.2
	N. Gas	109.7	121.4	144.8	167.3
	Total	**252.9**	**292.6**	**333.9**	**369.2**
EFS					
	Coal	30.5	53.9	70.8	84.4
	Oil	112.7	113.6	114.5	115.2
	N. Gas	109.7	125.5	156.0	188.0
	Total	**252.9**	**293.0**	**341.3**	**387.6**