

Executive Summary of APEC Energy Demand and Supply Outlook

This report contains the results of the Asia Pacific Energy Research Centre's (APERCO's) first major project that assesses the energy demand and supply outlook of the Asia-Pacific Economic Cooperation (APEC) economies. The project was the first priority task assigned to the Centre under the APEC Energy Action Programme adopted by APEC Leaders in November 1995.

The APEC Energy Demand and Supply Outlook (referred to simply as the Outlook) was first released as a highlights document in December 1997. This report provides more detailed description of the methodology and data used, and a more thorough coverage of the forecast results. It is hoped that the Outlook will serve as a valuable resource for APEC policy makers in addressing key energy policy issues.

Key considerations

Energy demand is strongly related to economic activity and population growth. These were, therefore, key factors considered in developing the energy demand forecasts. The consideration of energy prices, which are also important factors affecting energy demand, was restricted due to data limitations.

The APEC member economies are very diverse in their stage of economic development, size, geography and climate, and in terms of energy demand and supply. The APEC Energy Database provides a comprehensive set of data covering both energy and macroeconomic data for all APEC economies and was the major source of data used in the Outlook. Where the APEC Energy Database did not contain sufficient information, it was supplemented from other sources. Despite this, the availability of data still imposed constraints in some cases, and particularly in the case of new and renewable energy (NRE).

To maintain reasonable consistency across the 18 APEC economies, and because of the data limitations, a hybrid methodology including econometric and energy intensity

modelling approaches was used for the demand forecasts. The supply forecasts were largely based on surveys.

The energy demand and supply forecasts, which cover the period from 1995 to 2010, made for the 18 member economies are aggregated into four regional groupings in this report, Americas, East Asia, Southeast Asia and Oceania. Energy Balance Tables (EBTs) for the 12 larger APEC economies are included in Attachment D. The EBTs of the remaining six member economies will be made available at a later date.

GDP and population prospects

It was considered important that a consistent and reliable set of forecasts for GDP and population be used. To this end, the forecasts of GDP (in constant prices, in total and by sector) and population growth, by economy, were obtained from ABARE's MEGABARE model of the world economy.

Key assumptions

By 2010,

- APEC GDP to increase by 60 per cent
- APEC population to increase to 2528 million

In the set of MEGABARE projections, GDP is forecast to increase by 60 per cent over the forecast period (3.2 per cent pa). Southeast Asia is the fastest growing region and China the fastest growing economy with GDP forecast to increase by 143 and 170 per cent, respectively. Across APEC, population is forecast to increase by 16 per cent compared to an increase of 23 per cent over the historical period, 1980-1995.

Alternative Scenarios

In addition to a business-as-usual (BAU) case, two alternative scenarios were prepared. Case A is a more environmentally friendly energy scenario, and was prepared because of increasing concern about the environmental impacts of energy use. Case B assumes lower economic growth to take into account the effects of the current economic downturn, particularly in Asia, and, in 4 economies, lower national projections of GDP growth compared to the MEGABARE projections.

Alternative assumptions

Case A

- No change in the GDP and population assumptions
- Increases in energy efficiency and the use of less carbon intensive energy sources

Case B

- No change in the population projections
- Low GDP growth for nine economies

Final energy consumption

Driven by the large economies in East Asia and the Americas, final energy consumption (FEC) is projected to increase by 44 per cent over the forecast period. East Asia accounts for 47 per cent of this increase and Americas 36 per cent. By 2010, however, the Americas will still account for the largest share of FEC with 51 per cent. Southeast Asia is forecast to experience the fastest growth (a 2.5 fold increase), followed by East Asia (a 58 per cent increase).

Across the fuels, oil will continue to be the major energy source (48 per cent in 2010) and is forecast to account for 47 per cent of the increase in FEC. The fastest growing energy sources are heat (almost tripling but from a very small base), electricity (65 per cent) and gas (44 per cent).

The industrial sector accounts for 45 per cent of FEC in 2010 and the fastest growing region is Southeast Asia. A rapid expansion is forecast for the energy intensive industries in the developing economies of APEC and particularly in East and Southeast Asia. China contributes 49 per cent of the increase in industrial sector energy demand and the United States 40 per cent of the increase in the transport sector. In the residential and commercial (ResCom) sector, the shares of electricity, gas and heat are all forecast to increase at the expense of oil and coal.

Final energy consumption highlights

- Total FEC to increase by 44 per cent
- FEC in Southeast Asia to almost triple
- The United States contributes 40 per cent of the increase in transport
- China contributes 49 per cent of the increase in industry
- In ResCom electricity, gas and heat increase shares at the expense of coal and oil

Under Case A, FEC is forecast to be 8 per cent lower than BAU. ResCom energy consumption is 11 per cent lower (the highest decline among the sectors), with the largest decrease forecast for Southeast Asia. Among the fuels, coal experiences the

largest decline (14 per cent). Under Case B, FEC is 4 per cent lower with Southeast Asia again experiencing a significant reduction in energy demand.

Primary energy supply

Primary energy supply in APEC is projected to increase by 46 per cent over the forecast period to meet the increased demand for energy. Over this same period, however, production of primary energy in APEC is forecast to increase by only 29 per cent. As a result, the gap between energy production and energy requirements is expected to widen with net imports of energy forecast to more than double between 1995 and 2010. The ratio of net energy imports to primary energy supplies is forecast to increase from 16 per cent in 1995 to 26 per cent by 2010.

Over the forecast period, the production of gas is projected to increase by 41 per cent, coal 39 per cent, and oil 3 per cent. Nuclear, hydro and NRE are all expected to increase strongly but make a small contribution overall to primary energy supplies. NRE, is in fact, the fastest growing energy source, increasing by 49 per cent over the forecast period.

Overall, oil contributes 75 per cent of the increase in total imports of primary energy from 1995 to 2010, gas 18 per cent, with the remainder accounted for by coal. This increase in import dependence comes despite the fact that, within APEC, there are two of the world's largest producers of coal (the United States and China), the largest coal exporter (Australia), the largest exporter of LNG (Indonesia), and the second largest oil producer (the United States). This simply reflects the strong growth in energy demand requirements expected over the forecast period.

Primary energy supply highlights

- Oil imports to more than double
- Net energy import dependence increases 1.6 fold
- APEC becomes a net importer of coal
- Under Case A coal use declines by 22 per cent and net energy imports are almost halved

Under Case A, primary energy supplies in 2010 are forecast to be 11 per cent lower than BAU. Coal use declines by 22 per cent and APEC again becomes a net exporter of coal. Overall, net energy imports are 43 per cent lower in 2010 than under BAU. In Case B, primary energy supplies are only 4 per cent lower, but again this reduction is translated into lower energy imports.

Electricity generation

Electricity generation is forecast to increase by 65 per cent over the forecast period, and accounts for 66 per cent of coal use and 34 per cent of gas use in 2010. The fastest growth in generation by fuel is for gas, a 2.4 fold increase over the forecast period, followed by coal (78 per cent) and hydro (47 per cent). Nuclear increased three fold over the period from 1980 to 1995, and a marked slow down is expected in the period to 2010 due to the retirement and shutdown of plants in Canada and the United States.

Southeast Asia's growth in energy inputs for power generation is forecast to almost triple and East Asia's to double. Overall, input requirements for gas are expected to double, NRE to increase by 72 per cent, and coal to increase by 64 per cent.

In Case A, generation declines in line with reductions in demand, and is forecast to be 7 per cent lower than BAU in 2010. A shift to less carbon intensive fuels is also expected commensurate with the fuel switching assumptions included in this scenario. Coal use declines by 26 per cent and oil 21 per cent, compared to BAU. In Case B, electricity generation is forecast to be 4 per cent lower, with the largest reductions experienced in Southeast Asia (11 per cent).

Electricity generation highlights

- 65 per cent increase in electricity generation
- Three-fold increase in input requirements in Southeast Asia, and a doubling in East Asia
- Marked slowdown in nuclear
- In Case A, generation is 7 per cent lower than BAU with coal and oil use falling significantly

Policy issues

Import dependence and energy security

APEC is expected to become more dependent on energy imports, and by 2010 will be a net importer of the three key fossil fuels. Dependence on imports for oil supply is by far the highest of the primary energy sources, at 59 per cent in 2010. As a result, APEC will play an increasing role in international energy trade but also be more vulnerable to the risks associated with longer supply lines. In this regard, extending grid and pipeline connections both internally and externally are options increasingly being considered to diversify supply options.

Import dependence and energy security highlights

- APEC to play an increasing role in international energy trade
- Increased vulnerability to supply side risks
- Grid and pipeline interconnections being considered to diversify supply

Energy supply and regulatory reform

To keep up with growing demand, the commercial development of energy will require massive investment in supply facilities. Unless these facilities are developed in a timely manner, an "energy bottleneck" is likely to develop potentially jeopardizing future economic growth. Many economies in the APEC region, and particularly developing economies, however, lack adequate financial resources to undertake this investment. Therefore, international cooperation, as well as measures for creating a more favorable environment for energy investments, are important issues facing APEC.

Energy supply and regulatory reform highlights

- Opportunities for increased inter- and intra-regional cooperation need to be explored
- Energy sector regulatory reforms are essential to developing an attractive investment environment

Energy efficiency

In the BAU scenario, energy intensities in APEC are forecast to decline in almost all regions. Given the existence of subsidies and market distortions in many economies in the APEC region, however, there is a reasonable basis to assume that higher energy efficiency improvements are possible, particularly in some developing member economies. The results of the Case A scenario illustrate that achieving such energy efficiency improvements can deliver benefits in terms of a reduction in overall energy requirements (therefore improving energy security) and an improvement in environmental sustainability. An appropriate combination of technological and market based reforms, however, will be required to realise these benefits.

Energy efficiency highlights

- Greater emphasis should be placed in the importance of energy efficiency at the APEC regional level
- Improvements in energy efficiency generate economic and environmental benefits

Energy and environment

APEC CO₂ emissions are projected to increase by 47 per cent over the forecast period under the BAU case. Because of the substantial growth in energy consumption, in particular of fossil fuels use, in East Asia, its CO₂ emissions are forecast to almost reach those of the Americas by 2010, with shares of 43 per cent and 47 per cent, respectively. The fastest growth in emissions is expected in Southeast Asia, (136 per cent over the forecast period), however, the developed member economies in the Americas and Oceania will continue to have the largest CO₂ emissions per capita in 2010 by a substantial margin. For the five APEC member economies that have commitments under the Kyoto Protocol to reduce (or limit the growth in) CO₂ emissions, the forecasts presented here are substantially above their respective targets, even for the Case A scenario.

Energy and environment highlights

- The share of emissions from East Asia will rival those from the Americas by 2010
- Per capita emissions in the Americas and Oceania will remain significantly above those of the other APEC regions
- Based on these forecasts, the Kyoto commitments will be difficult to achieve

Follow up activities

- Improve energy data
- Pay greater attention to biomass and other NREs
- Take a closer look at pricing practices
- Examine the security implications of APEC's increasing energy import dependence
- Identify the potential for energy efficiency improvements in the region
- Explore the costs and benefits of energy sector regulatory reform
- Study the opportunities for regional cooperation in energy infrastructure development
- Pursue opportunities for reducing the environmental impacts of energy use on a priority basis