

# APEC Energy Outlook and Security Issues

Asia Pacific Energy Research Centre (APERC)

## Summary of APERC Presentation

- Energy demand in the APEC region is projected to rise by almost 60 percent between 1999 and 2020, at 2.1 percent per annum.
- Electricity demand is projected to rise at a rate of 3.2 percent per annum, mainly driven by rising income and increasing electrification in developing economies.
- Increasing demand for oil (2.1 percent per annum) is not likely to be met by increased production within APEC (projected to be only 0.5 percent per annum), and dependence on imports is seen increasing to 55 percent by 2020 from its current level of 36 percent.
- Strong energy demand growth in Asia and North America, geopolitical instability in key energy exporting economies, and constraints on infrastructure to deliver energy sources to the market, have exerted strong upward pressure on energy prices.
- Concern for energy security is looming larger in APEC. Rising energy price may cause growth in APEC economies to stall, due to high oil import dependency and an inflexible energy supply structure.
- APEC economies may need to increase flexibility in energy supply infrastructure to enhance security of energy supply at reasonable price.. Two options are to enhance technological innovation and to improve resource allocation efficiency through cross border cooperation.
- Robust energy demand growth in the APEC region will need substantial investment requirements for new energy infrastructure. APERC's analysis indicates that the equivalent of some US\$ 3.4 to 4.4 trillion will be needed to develop new energy infrastructure.
- Financing energy investment will pose challenges throughout the region. Challenges are arguably greater for developing economies of APEC where energy investment requirements relative to the size of economy are larger and their domestic capital markets are underdeveloped.
- Developed economies of APEC may face challenges in financing energy projects. Regulatory uncertainty may make it harder to attract capital to develop energy infrastructure.

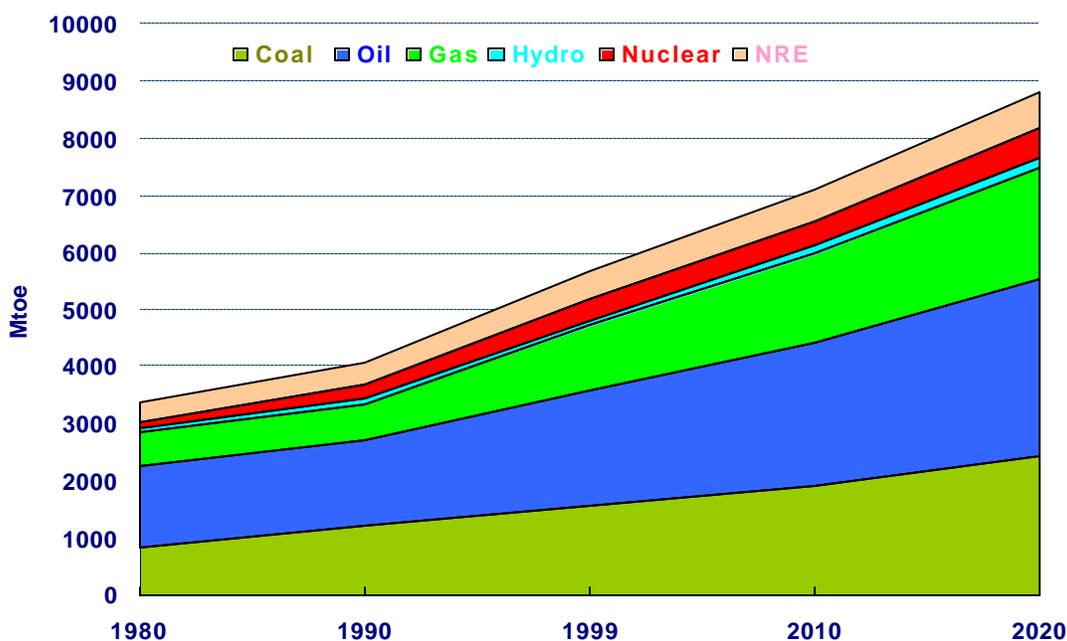
Source: APERC (2002), "APEC Energy Demand and Supply Outlook" and APERC (2003), "Energy Investment Outlook for the APEC Region".

Note: All APERC research reports are downloadable at <http://www.ieej.or.jp/aperc/>.

## ENERGY OUTLOOK BY FUEL TYPE

Over the forecast period, **oil** is projected to grow from 2,023 Mtoe in 1999 to 3,107 Mtoe in 2020, an annual growth rate of 2.1 percent. Oil is expected to maintain the highest share in total primary energy demand (TPED) of APEC at around 36 percent throughout the outlook period. The transport sector will lead oil demand growth, contributing 72 percent to incremental oil demand growth in 1999-2020. The oil import dependency of the APEC region is forecast to increase from 36 percent in 1999 to 55 percent in 2020. For APEC economies in Asia including Oceania it will rise from an already high 60 percent in 1999 to 80 percent in 2020, most of which will be sourced from the Middle East. In other words, APEC Asia will become more vulnerable to oil supply disruptions.

**Figure 1: Primary energy demand in the APEC region**



**Table 1: Primary energy demand in the APEC region (Unit: Mtoe)**

	Coal	Oil	Gas	Hydro	Nuclear	NRE	Total
<b>1999</b>	1540	2023	1135	106	379	478	5660
<b>2010</b>	1905	2522	1536	146	425	539	7073
<b>2020</b>	2402	3107	1949	185	537	595	8775

Average Annual Growth Rate

	Coal	Oil	Gas	Hydro	Nuclear	NRE	Total
<b>1999-2010</b>	2.0%	2.0%	2.8%	3.0%	1.0%	1.1%	2.0%
<b>2010-2020</b>	2.3%	2.1%	2.4%	2.3%	2.4%	1.0%	2.2%
<b>1999-2020</b>	2.1%	2.1%	2.6%	2.7%	1.7%	1.1%	2.1%

Source: APERC (2002)

The second-largest energy source in TPED is projected to be **coal**, maintaining a 27 percent share throughout the outlook period. Coal shows annual growth of 2.1 percent

(1999-2020). Most of the increase in coal demand will come from power generation, accounting for 83 percent of incremental growth. By region, China is expected to continue to be a major coal consumer in the APEC region, accounting for 41 percent of TPED for coal in 2020. This is driven by coal's cost competitiveness relative to other fossil fuels, and to its availability.

Coal production in the APEC region is concentrated in the six economies with the largest reserves, Russia, USA, China, Australia, Canada and Indonesia. These six economies account for almost 99 percent of APEC's total coal reserves and production. Coal demand has increased substantially in recent years, a rise matched by increased production. However, APEC is expected to change from being a net coal exporter in 1999 to a marginal net importer of coal by 2020.

**Natural gas** is projected to constitute the third-largest part of TPED increasing from 20 percent to 22 percent over the forecast period. In the first half of the period it will experience faster growth at 2.8 percent per annum, followed by growth of 2.4 percent yearly in the second half. The Asian region, including Northeast Asia, Southeast Asia and China, is expected to see growth in natural gas demand of 4.6 percent per year. The current share of natural gas in TPES of Asia is low at 8 percent compared with North America (24 percent), Latin America (19 percent) and Oceania (18 percent). Rising per capita income combined with ease-of-use will be the key factor in its expansion. In future, technological development and environmental concerns will have a major influence on natural gas consumption.

To meet growing demand for natural gas, massive investment in supply infrastructure is crucial – transport either by pipeline or as LNG and distribution networks for industrial and residential use.

**NRE** (new and renewable energy) is defined to include biomass, solar, wind, tidal and wave energy. In the APEC region, the residential sector in rural areas of less-developed regions relies heavily on biomass for cooking and heating. The current share of biomass accounts for almost all of the NRE consumed in the APEC region. Over the coming two decades, NRE is expected to grow at 1.1 percent per annum, which is lower than the annual growth rate of TPED at 2.1 percent per annum. The share of NRE is expected to fall from 8.4 percent in 1999 to 6.8 percent in 2020 due to a shift to commercial fuel sources as a result of socio-economic development.

The share of **nuclear** energy in TPED is expected to decline slightly from 6.7 percent in 1999 to 6.1 percent in 2020. In terms of growth rate, nuclear power will expand at an annual rate of 1.7 percent per year. Northeast Asia (Japan, Korea and Chinese Taipei) will contribute to 70 percent of total incremental growth of nuclear power (1999-2020) to meet the rising electricity demand. By contrast, North America will see a decline in nuclear power of 0.3 percent per annum as a result of the retirement of existing reactors.

**Hydropower** shows the fastest growth in TPED at 2.7 percent per annum (1999-2020), though its share is expected to be low at two percent for the entire forecast period. Endowed with the largest potential for hydropower, China will see the fastest annual growth of 6.9 percent, accounting for around 70 percent of the total incremental growth of hydropower in APEC.

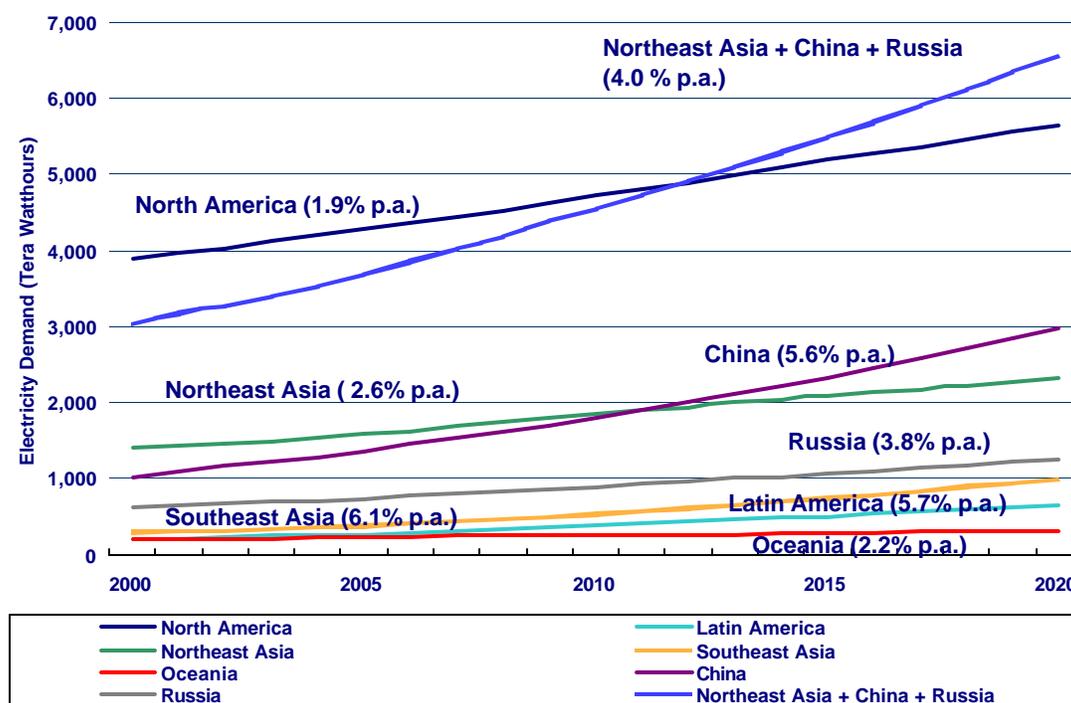
## OUTLOOK FOR ELECTRICITY

Electricity is the fastest-growing sector. Over the forecast period, demand for electricity in APEC is projected to grow at an annual rate of 3.2 percent. Electricity is a key component of industrialisation and improvement of living standards. As economies become industrialised, their growth is increasingly fuelled by advanced industrial technologies and less energy intensive services that require electricity. As income levels rise, people seek greater convenience and comfort in their life, which adds to electricity demand.

So as developing economies industrialise, their electricity demand is expected to grow rapidly – 6.1% annually in Southeast Asia, 5.7% in Latin America and 5.6% in China.

Natural gas should become the “fuel of choice” for electricity generation, given a combination of price, thermal efficiency and environmental considerations. It increases from 373 Mtoe in 1999 to 873 Mtoe in 2020, a growth rate of 4.1 percent per annum. Its fuel share is projected to increase from 17.8 percent in 1999 to 24.8 percent in 2020, at the expense of oil and nuclear. Coal’s fuel share should remain stable at just over 47 percent. In many economies it is the preferred fuel based on price and availability. It will get the largest absolute increase in input energy, increasing from 989 Mtoe in 1999 to 1,659 Mtoe in 2020.

**Figure 2: Outlook of Electricity Demand in the APEC Region**



Source: APERC (2002)

## ENERGY SECURITY

Energy security has been one of the most important energy issues facing APEC member economies, and it will be increasingly so in the years to come. The APEC Outlook 2002 indicates that oil import dependency in the APEC region will continue to increase particularly in Asia, where most of the supply may come from the Middle East. In view of the growing demand for fossil fuels, environmental challenges are becoming an indispensable part of broadly defined energy security as well.

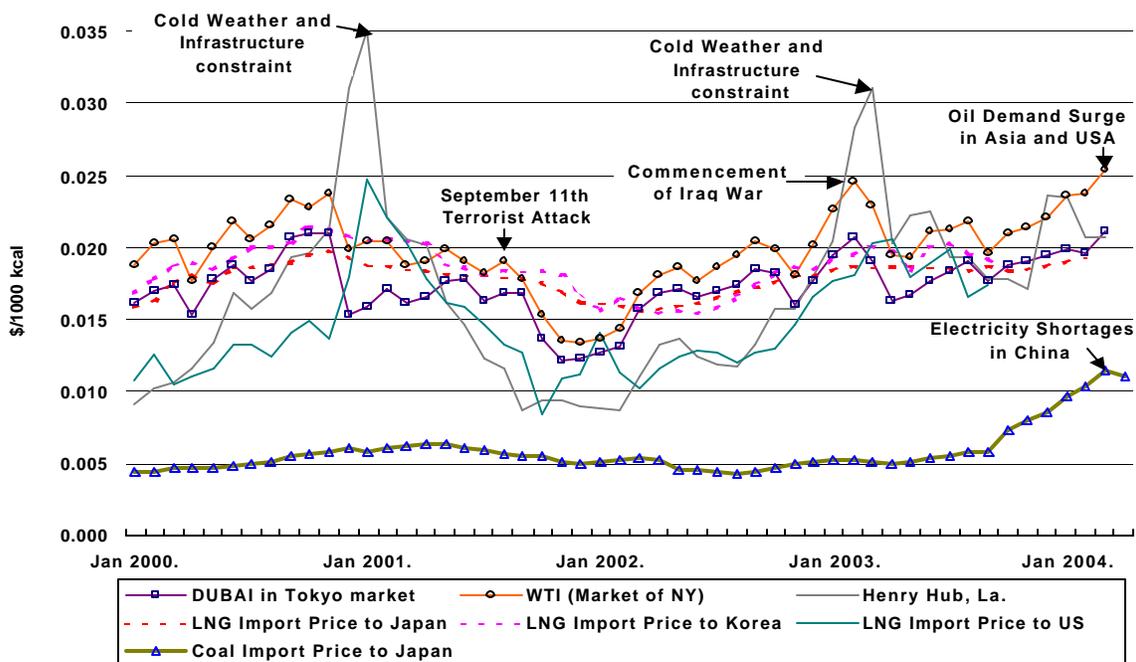
### *Rising Energy Prices*

We can see the impact of rising energy demand and oil import dependency on prices. In recent months, we have seen steadily rising prices for oil, natural gas and coal.

Figure 3 shows monthly trends of oil, natural gas and coal prices in different parts of APEC. Strong energy demand growth in Asia and North America, geopolitical instability in key energy exporting economies, and constraints on infrastructure to deliver energy sources to the market, have together exerted strong upward pressure on energy prices.

There is a fear that rising energy prices may cause growth in APEC economies to stall, due to high oil import dependency, slow turnover in vehicle stocks, and an inflexible energy supply structure.

**Figure 3: Rising Energy Prices of APEC**



Source: APERC Analysis (2004)

What options do we have to enhance energy security in the APEC region? How can we secure energy at reasonable prices? Part of the answer lies in greater efficiency of energy use, including vehicles with better fuel economy. And part of the answer lies in a more flexible energy supply infrastructure, which we can bring about through (1) technological innovation and (2) improvement of resource allocation efficiency with cross border energy cooperation.

Technological innovation should focus on enhancing the efficiency of proven power options like combined cycle gas turbines, mini-hydro, nuclear, and clean coal technology. It should also focus on renewable energy sources, non-conventional oil, and LNG. New technologies can help our energy supply systems deal more flexibly with environmental challenges, while reducing oil import dependency.

Cross-border cooperation can include power grid interconnections, gas and oil pipelines, and joint oil and gas stockpiling. By linking together economies with different resource endowments and demand patterns, such cooperation will expand our energy choices and reduce overall energy investment requirements. It will also help us respond more flexibly to short-term energy supply disruptions.

### INVESTMENT REQUIREMENTS

Robust energy demand growth of APEC will mean substantial investment requirements for energy infrastructure from upstream, midstream to downstream. Failure to make timely energy investment to secure energy supply can have serious socio-economic consequences.

A summary of the total estimated energy investment requirements in the APEC region is shown in Table 2. Some US\$3.4 trillion to US\$4.4 trillion of energy investment (at 1999 prices) will be required in APEC over the period from 2000 to 2020. Yearly investment needs are conservatively projected to be somewhere between US\$149 billion to US\$207 billion in 2000, between US\$168 billion and US\$217 billion by 2010, and US\$198 billion to US\$252 billion in 2020.

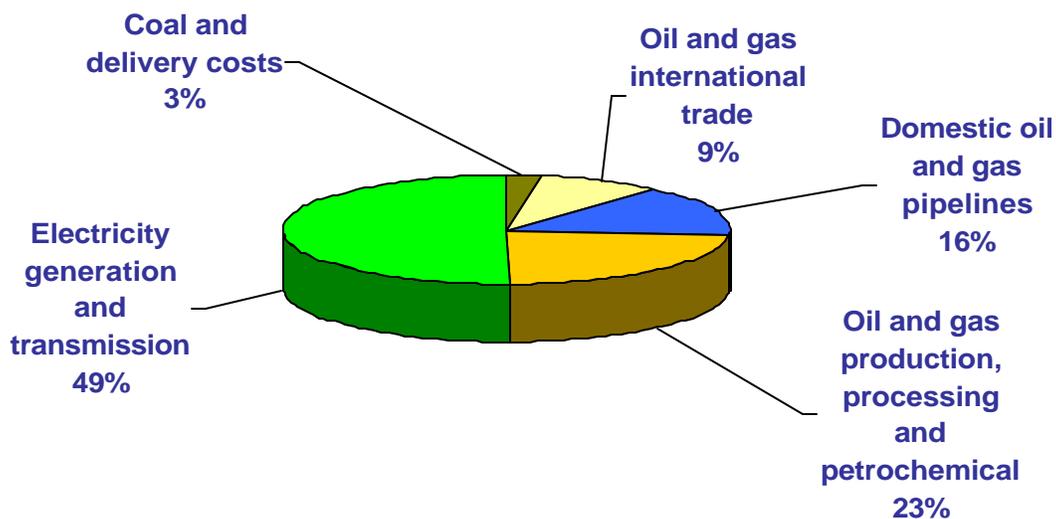
**Table 2 Annual and Total Energy Investment Requirements in the APEC Region by Category of Energy Investment, Billion 1999 United States Dollars**

Category of Energy Investment	2000	2010	2020	2000 – 2020
Coal production & transportation	\$10 – 12 B	\$4 – 5 B	\$5 – 6 B	\$90 – 114 B
Oil & gas production & processing	\$52 – 77 B	\$35 – 52 B	\$34 – 50 B	\$668 – 1,008 B
Oil & gas international trade	\$23 – 33 B	\$15 – 19 B	\$9 – 12 B	\$294 – 384 B
Oil & gas domestic pipelines	\$36 – 51 B	\$24 – 34 B	\$25 – 35 B	\$481 – 688 B
Electricity generation & transmission	\$28 – 34 B	\$91 – 108 B	\$125 – 149 B	\$1,866 – 2,219 B
<b>Total</b>	<b>\$149 – 207 B</b>	<b>\$168 – 217 B</b>	<b>\$198 – 252 B</b>	<b>\$3,419 – 4,412 B</b>

Source: APERC (2003)

Figure 4 shows the shares of investment requirements that are projected to be taken up by each category of energy investment. Electricity generation and transmission are projected to account for nearly half of total investment needs, or 49 percent of the total projected between 2000 and 2020. Oil and gas production and processing are projected to account for nearly a quarter of total investment needs, or 23 percent of the total projected for the period. Domestic oil and gas pipelines represent nearly a sixth of total energy infrastructure investments, or 16 percent of the total. Investments for the international trade of oil and gas, which include the costs of tankers, LNG facilities, and pipelines used for international trade, represent another 9 percent of the total. The coal industry has the smallest share, at only 3 percent of total investment requirements.

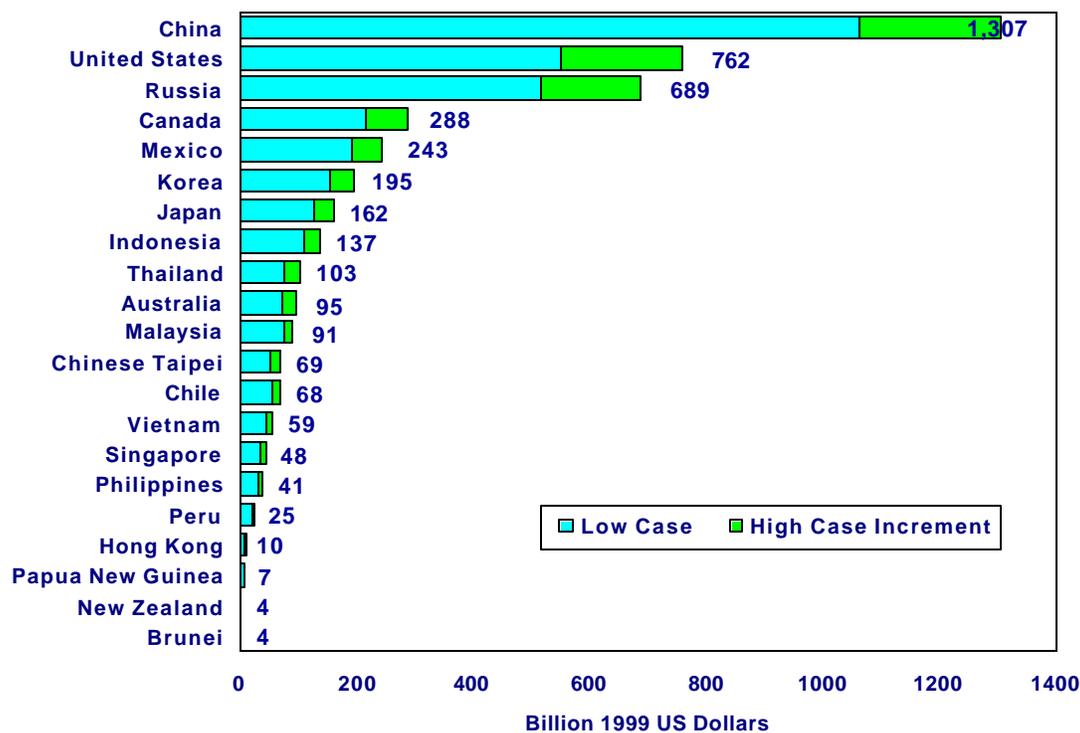
**Figure 4 Total Investment Requirements by Infrastructure Category, Percent**



Source: APERC (2003)

Figure 5 shows total energy investment requirements that are projected for each APEC economy for the two-decade period from 2000 through 2020. The lower estimate of investment needs along with the higher estimate of investment needs are indicated in each bar. The economies are shown in order from greatest to least projected investment requirements over the period.

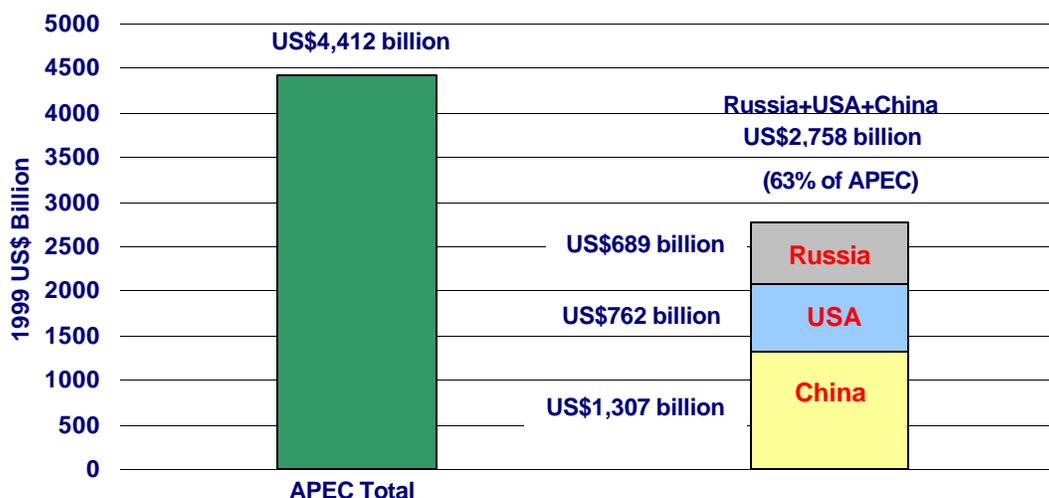
**Figure 5 Total Energy Investment Requirements by Economy 2000 – 2020**



Source: APERC (2003)

Three economies are likely to account for over three-fifths of the energy infrastructure investment requirements in the APEC region: China, United States and Russia. According to the high-case estimates of energy investment needs, these economies are projected to require as much as US\$2,758 billion for energy infrastructure in the period from 2000 through 2020, or 63 percent of the requirements for the region (Figure 6). High-case investment needs are projected at US\$1,307 billion for China, US\$762 billion for the United States and US\$689 billion for Russia.

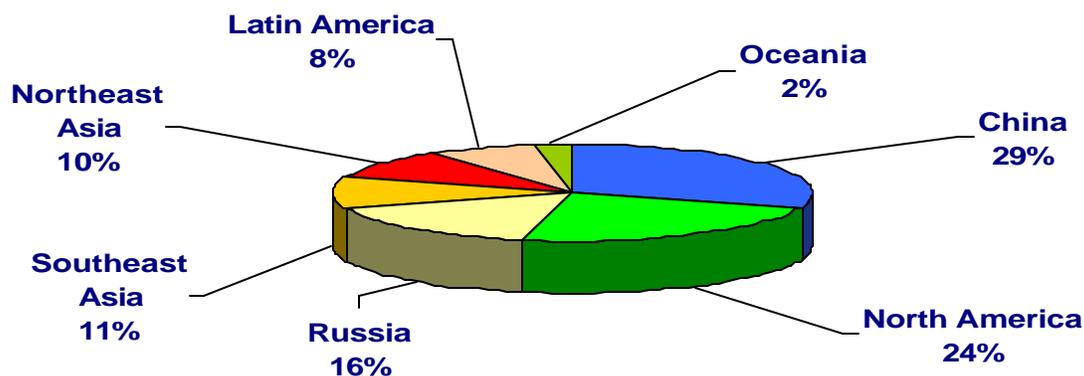
**Figure 6 Total Energy Investment Requirements of China, United States and Russia Compared with Total APEC Requirements: High Case (Billion 1999 US\$)**



Source: APERC (2003)

Canada, Mexico, Korea and Japan will together represent about another fifth of the total energy investment requirements from 2000 through 2020. In the high case, Canada is projected to require US\$288 billion, Mexico US\$243 billion, Korea US\$196 billion and Japan US\$163 billion. The final fifth of energy investment needs will be divided between the fourteen APEC economies with the smallest needs, ranging from Indonesia with US\$138 billion of energy investment requirements to New Zealand and Brunei Darussalam with around \$4 billion of requirements each.

**Figure 7 Shares of Energy Investment Requirements by APEC Economy Group**



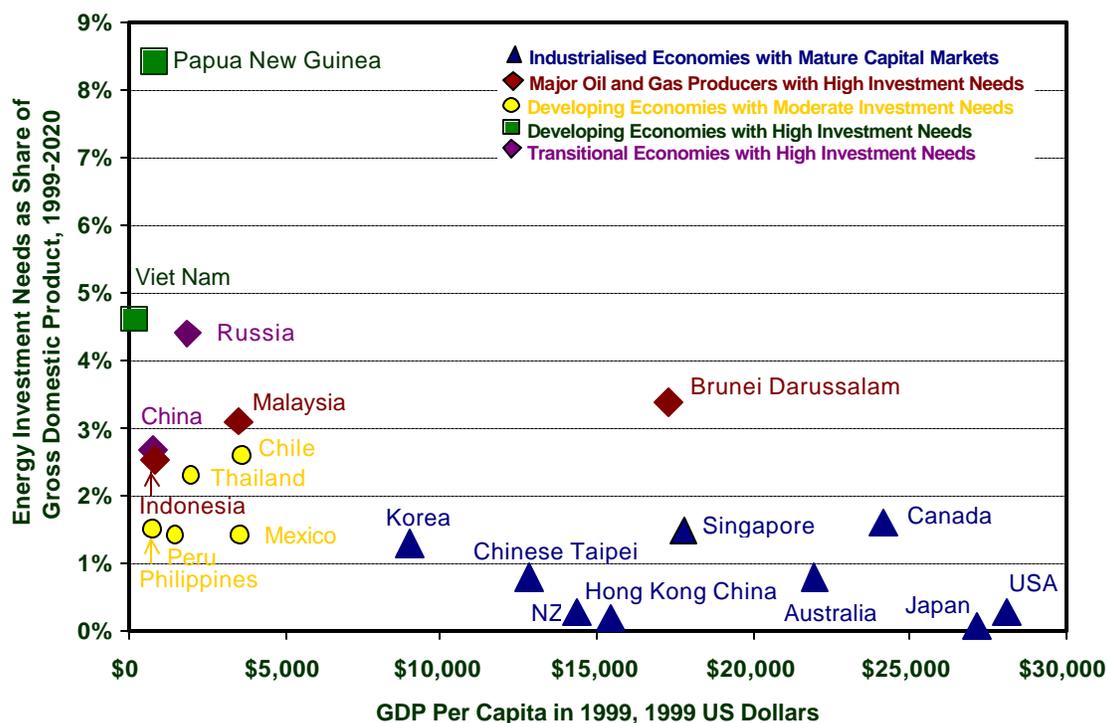
Source: APERC (2003)

### *Hurdles for Financing Energy Projects*

The burden of energy investment is often greatest for developing economies. Figure 8 compares the share of gross domestic product that is taken up by projected 20-year total energy investment requirements in each APEC economy. It shows that investment requirements as a share of economic output decline as output per capita increases.

The most developed economies with highest GDP per capita, have low investment requirements relative to their size. But developing economies often have high investment requirements as a share of GDP.

**Figure 8 Energy Investment Burdens and Development in APEC Economies**



Source: APERC (2003)

Financing energy investment will be challenging for developing economies, not only because their investment requirements are large relative to GDP, but also because financial flows diminished following the Asian financial crisis. Furthermore, financial markets in developing economies are generally at an early stage of development.

Many developing APEC economies have high savings rate, representing 20 to 30 percent of GDP. Several also have large underdeveloped energy resources that can be leased or used as collateral. So if they work to develop their capital markets, especially corporate bond markets, they should be able to better attract the domestic and foreign capita they need to develop their energy sectors.

For developed economies of APEC, the challenge is more regulatory than strictly financial. As many energy markets are becoming more competitive the returns on investments are becoming less certain. In addition, environmental and land use regulations often make it difficult and time consuming to site and build needed facilities, making it harder to secure financing for their construction.