

# PERU

- *Peru is projected to be one of the fastest growing economies in the APEC region with GDP growing at 4.1 percent annually over the outlook period; buoyed mainly by increased trade and industrial growth (mining).*
- *Primary energy demand is projected to grow two-fold, at 2.7 percent annually from 12.7 Mtoe in 2002 to 26.7 Mtoe in 2030; with oil for the transportation sector and natural gas for electricity generation expected contribute the most to the increasing demand.*
- *Energy supply security, diversification of energy supply, lag in energy infrastructure development, and environmental protection remain as the major areas of concern.*
- *Between US\$29-38 billion in investment will be needed in new infrastructure to support Peru's energy demand growth.*

## RECENT ENERGY TRENDS AND ENERGY POLICY

Peru's primary energy consumption grew robustly at 6.1 percent between 2003 and 2004. Natural gas consumption, accounted for the largest share at 83 percent of the total incremental energy consumption growth over the period 2004 to 2005, as a result of strong expansion in the industrial sector, especially the export-oriented minerals mining and processing industries, fishing and agricultural sectors taking advantage of high commodity prices on international markets and fuel switching in the electricity sector from fuel oil to natural gas.

Peru is a net energy importer, mostly for oil and natural gas. An important energy resource is the Camisea gas field which has reduced the economy's oil import dependence over the last two years. Since August 2004 the field has substantially increased the domestic natural gas supply and allowed a large degree of fuel switching from oil to natural gas in the industrial and electricity sectors.

The high growth in energy consumption and constraints in domestic energy supply prompted the economy to diversify the energy supply mix, shifting from oil to natural gas. The economy also has improved electrification level to 77 percent in 2005, and plans to increase this further to 90 percent in 2010.

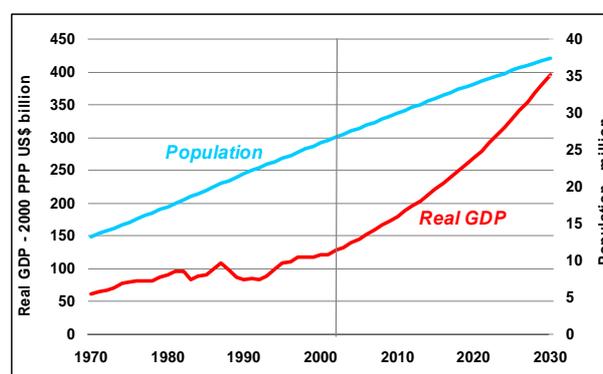
Peru's high dependence on hydro for electricity generation has also become a problem in last five years as a result of changes in rainfall distribution patterns due to the climatic conditions La Niña and El Niño. To address this problem Peru has recently established an energy policy aimed at increasing the use of natural gas for the industry and electricity sectors, while advocating improvement of energy efficiency and regulating energy development such that protection of the environment is achieved.

## ENERGY DEMAND DRIVERS

Peru's high economic growth of 4.1 percent over the outlook period (one of the fastest in the APEC region) is expected to underpin the economy's energy demand growth. Increasing population at a rate of 1.2 percent per year until 2030 will most likely contribute to further growth in the energy demand.

Further growth in the mining sector is projected with such prospects as Las Bambas, Michiquillay, La Granja, San Antonio de Poto, Galeno, and Pashpap among others which are expected to begin production over the outlook period. In addition the signing of the US-Peru free trade agreement in 2006 will not only increase trade flows and volumes, but also expand Peru's export market. Despite the potential growth, there are risks surrounding the development of Peru's economy. In the short to medium term, possible changes in the economy's leadership will remain a major constraint for investors concerned about the risk of changing government policies.

Figure 80 GDP and Population



Source: APERC Analysis (2006)

Peru is an increasingly urbanised economy with most of the population living in cities. According to the Peruvian National Statistical Institute, 74 percent of the population lived in cities in 2004 and this is expected to reach 81 percent by 2025. This growth

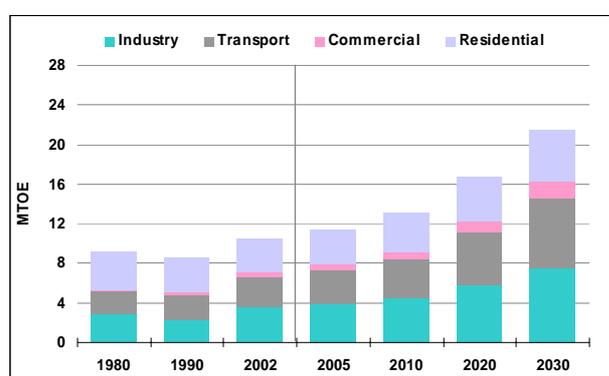
has resulted from internal migration prompted by economic expansion associated with the growth of coastal cities.

## OUTLOOK

### FINAL ENERGY DEMAND

Over the outlook period, final energy demand is projected to grow at 2.6 percent per year, compared with annual growth in the previous two decades of 0.6 percent. The industry sector will maintain the largest share at 35 percent, followed by transport (33 percent), residential (24 percent) and commercial (8 percent).

Figure 81 Final Energy Demand



Source: APERC Analysis (2006)

### Industry

Industry is the largest energy consumer in Peru, with the extraction of non-ferrous metals taking the largest share. Peru is the world's third largest copper producer and the second largest silver producer. Additionally with the commissioning of the Antamina Project (the third largest mining operation in the world), greater levels of zinc and silver production have been observed.<sup>89</sup>

Peru's industrial energy demand is projected to grow at an average annual rate of 2.7 percent until 2030, faster than its average annual growth of 1.0 percent over the past two decades. More than half of the energy required in the industrial sector will be used by heavy industry such as mining, chemicals, metals, non-metallic minerals, quarrying and fishing.

Petroleum products are projected to grow robustly at 1.7 percent per year, accounting for 41 percent of the total industrial energy consumption in 2030. Diesel demand for mining and quarrying, construction, agriculture and the fishing industry is

<sup>89</sup> The start-up of Compañía Minera Antamina S.A. represents the most significant investment in the history of Peruvian mining (approximately US\$2.26 billion) and shortly after initiating operations, Antamina swiftly became one of the leading national producers of copper and zinc concentrates.

also projected to contribute to the growth in industrial oil demand.

Natural gas is projected to grow rapidly at 9.8 percent per year over the outlook period. Despite its relatively fast growth, the share of natural gas to total industrial energy demand will reach only 1 percent in 2030. Currently, industrial gas use is limited to heat and electricity generation.

Over the outlook period, electricity is projected to grow at an annual rate of 3.2 percent. Mining would account for the largest proportion of the growth in electricity demand.

### Transport

Throughout the outlook period, the road transport sub-sector is projected to maintain the largest share in total transportation energy demand. Diesel will be the main fuel which will increase more than two-fold, while gasoline is expected to grow by almost two-fold boosted by the number of ownership to passenger vehicles due to continued income growth over the outlook period.

Government effort to build mass transport systems, starting in Metro Lima will have a significant impact on modal shifts, and the flow of goods and services. Some of the factors which are expected to contribute to the growth in this sector are, rising income and urban migration.

Another effort promoted by the government is the increased use of compressed natural gas (CNG) in buses and passenger vehicles in Lima city, because CNG has become cost competitive with oil due to increasing domestic natural gas production which is exempted from taxes. Also in 2005 the first CNG powered train started operating between Lima and Huancayo.

### Residential and Commercial

Over the outlook period, energy demand in the residential sector is projected to increase at an annual rate of 1.5 percent compared with a decreasing rate of 0.7 percent annually in the previous two decades. Electricity demand is projected to grow at an annual rate of 4.2 percent, increasing the share of electricity in total residential demand from 11 percent in 2002 to 24 percent in 2030. Petroleum products in the residential sector are projected to rise at an annual rate of 1.9 percent raising the share of petroleum in total residential demand from 31 percent in 2002 to 34 percent in 2030. LPG is expected to continue to replace biomass for cooking and heating in the residential sector. LPG is the dominant petroleum product consumed in the residential sector and is projected to grow by 3.0 percent throughout the

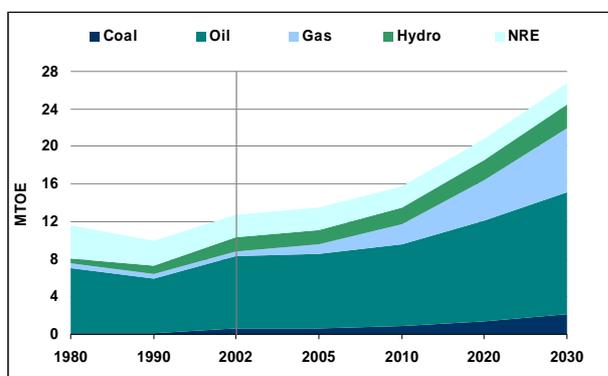
outlook period. Due to the implementation of the rural electrification program, biomass is expected to decline at 0.3 percent per year until 2030, with the share of biomass decreasing from 58 percent in 2002 to 35 percent in 2030.

The energy demand of the commercial sector is projected to grow annually at 4.5 percent over the outlook period as a result of growth in the value added for services industry. Demand for electricity, the main energy source for the commercial sector, is expected to grow at 5.9 percent per year with the increase in demand for cooling and lighting in commercial buildings, as well as for office equipment use during the outlook period. Electricity will maintain the largest share in the commercial sector from 58 percent in 2002 to 82 percent in 2030. On the other hand, demand for petroleum products are projected to grow by an annual growth rate of 1.3 percent – a slower rate than the previous two decades at 7.9 percent per year.

**PRIMARY ENERGY DEMAND**

Peru’s primary energy demand is projected to grow at an annual rate of 2.7 percent over the outlook period, faster than the previous two decades at about 0.4 percent. Among the fossil fuels, natural gas will grow the fastest rate at 9.8 percent per year, followed by coal at 4.4 percent and oil at 1.9 percent.

*Figure 82 Primary Energy Demand*



Source: APERC Analysis (2006)

The transport and industry sectors will account for 52 percent and 25 percent respectively of the total incremental oil demand growth between 2002 and 2030. With the rising demand and decline in domestic production, Peru’s net oil import dependency is projected to increase from 36 percent in 2002 to 58 percent in 2030. Recognising the economy’s vulnerability to outside shocks, Peru has been trying to secure oil supply by intensifying exploration and development efforts in the upstream oil and gas sectors and promoting investment activities in forest areas.

Aside from investment in upstream projects, Peru has also started to promote replacement of oil for natural gas in an effort to change the overall energy mix. Through the “Plan Nacional de Transformación de la Matriz Energética”, the Peruvian government plans to promote greater usage of natural gas and targets 25 percent of total primary energy demand in 2030 to come from natural gas, up from 4 percent in 2002.

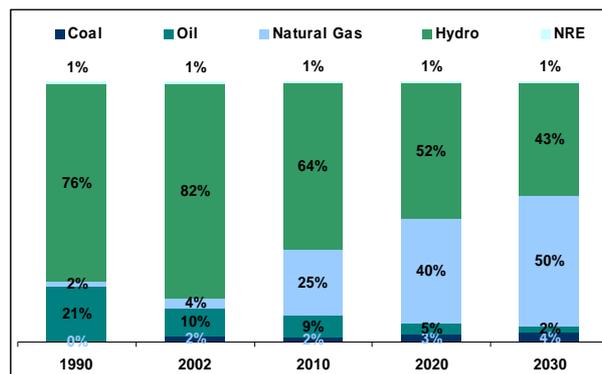
**ELECTRICITY**

Peru’s electricity demand is expected to increase by 4.0 percent per year over the outlook period, to almost triple that of 2002. Despite substantial growth, per capita electricity demand will reach 1,632 kWh in 2030 less than one-fifth of that of the APEC average.

To meet the increasing electricity demand, Peru will continue to rely on natural gas as the most cost competitive option among all other fuel types. Peru is expected to increase the installed capacity of natural gas-fired electricity generation from 0.3 GW in 2002 to 6.0 GW in 2030.

By 2025 hydro is projected to maintain the dominant share in the electricity generation mix. However, from 2026 natural gas will surpass hydro and reach 44 percent in 2030, compared with hydro’s 37 percent share in the same year. In Peru’s short term electricity plan the government will continue to construct hydro power plants. However, over the outlook period, the construction of combined cycle gas-fired power plants will be promoted which should result in lower electricity tariffs.

*Figure 83 Electricity Generation Mix*



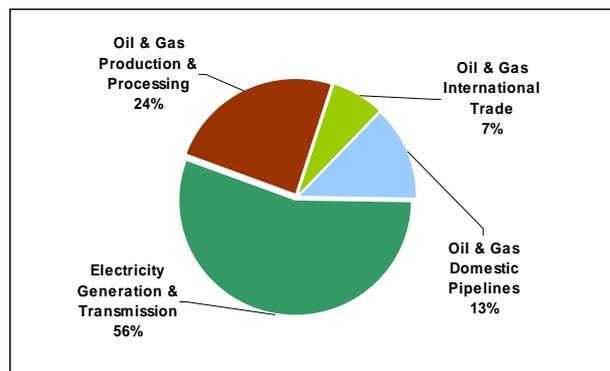
Source: APERC Analysis (2006)

**INVESTMENT REQUIREMENTS**

Total investment requirements are projected to reach between US\$29-38 billion. Investment in electricity generation and transmission will have the largest share of 56 percent, followed by oil and gas production and processing (24 percent), oil and gas

domestic pipeline (13 percent), and oil and gas international trade (7 percent).

**Figure 84 Investment Requirements**

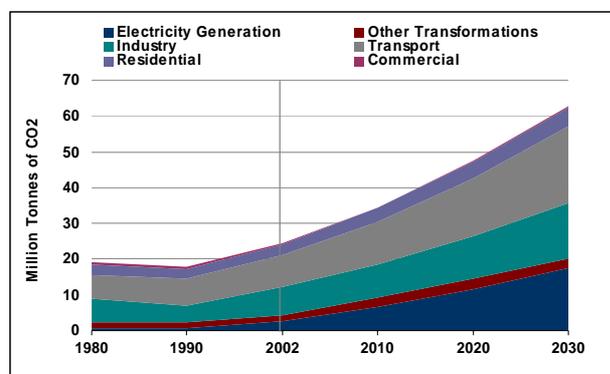


Source: APERC Analysis (2006)

## CO<sub>2</sub> EMISSIONS

Total CO<sub>2</sub> emissions from the energy sector will reach 62.9 million tonnes of CO<sub>2</sub> in 2030 which is about 3.5 times that of the 1990 CO<sub>2</sub> emissions level. The growing share of natural gas in the economy's electricity generation mix would slightly reduce total CO<sub>2</sub> emissions and will account for almost 26 percent of total CO<sub>2</sub> emissions while the transport sector will account for 37 percent of CO<sub>2</sub> emissions in 2030.

**Figure 85 CO<sub>2</sub> Emissions by Sector**



Source: APERC Analysis (2006)

## MAJOR ISSUES

### DEVELOPMENT OF THE NATURAL GAS MARKET

Peru has substantial reserves of natural gas. However, the development of a domestic natural gas market has been very slow. Plans to extend natural gas pipeline to other cities have not been realised because of lack of investment.

The government has also been promoting the utilisation of natural gas to replace oil in the energy mix and reduce oil dependency, but with increasing energy imports, combined with depleting domestic resources, concerns for energy supply security have

become a very serious concern. Other factors include delay in the development and construction of the Camisea LNG export facilities, expected to be completed in 2009.

### ELECTRICITY SUPPLY INFRASTRUCTURE DEVELOPMENT AND REGULATORY REFORM

Driven by economic development, Peru's electricity demand is projected to experience a three-fold increase from 22 TWh in 2002 to 66 TWh in 2030. As a result, the Peruvian electricity sector will have to invest US\$16.2-20.7 billion in electricity generation and transmission facilities to meet this expected demand.

Reforms have been undertaken to increase electricity supply security, facilitate investments by the private sector and to improve operational efficiency of the electricity industry. Restructuring of the electricity industry has been carried out since 1992.

### REFINERY MODERNIZATION

Since 2004, Peru's state oil company Petroperu has tried to hold international tenders to upgrade its 62,000 b/d North Coast Talara refinery. Petroperu was expected to meet the fuel standards recommended by the World Bank for South American Countries by 2005 but this has been delayed.

A law has been passed which mandates that the sulphur content in diesel fuel in Peru be reduced from the current 5,000 - 10,000 ppm (0.5 - 1 percent) to 50 ppm (0.005 percent) by January 2010. For imported diesel the current sulphur limit is 2,500 ppm. To reduce the sulphur content to 50 ppm will require substantial investment in Peru's refineries. The Ministry of Energy and Mines has indicated that for the two largest refineries, US\$ 300 million will have to be invested in each to satisfy the new sulphur standards to be introduced from 2010. These investments will also slightly increase the production capacity, in turn reducing the operating costs, although the degree to which these costs can be reduced is currently unknown. This is a challenging task, given the relatively short timeframe in which the refineries' need to carry out the necessary investments. Thus, it is unlikely that the refiners will be able to deliver the required low sulphur diesel by 2010.

## IMPLICATIONS

Growth in the Peruvian economy will translate into substantial growth in Peru's energy demand. Energy supply will be supported by domestic natural gas from the Camisea project and provision made for the development of an LNG terminal for natural gas exports. The biggest challenge therefore is to find a way to sustain growth in the coming years and balance growing energy needs with the economy's strong commitment to protect the environment.

In the electricity sector, elimination of barriers in the transmission network to decongest the system, including: a) enhancing the current development of insufficiently transmission network that culminates in the separation of the system into islands; and b) the improvement of the regulatory framework to reduce transaction costs and facilitate the entrance of new participants. The new regulatory framework should be capable of facilitating investment in new transmission capacity and be profitable for the investors, while also permitting complete access to the system for all users from generation companies through to distribution utilities.

Cross-border energy projects could also provide options to enhance the security of energy supply, through the utilisation of regional cooperation to construct electricity and pipeline interconnections. The establishment of a framework capable of facilitating legislative and technical coordination – similar to the electricity interconnection and trade agreement that was successfully opened between Peru and Ecuador in 2005 – is one method through which Peru could cooperate with neighbouring economies.

The resolution of issues and controversies in relation to maritime borders between Chile and Peru and access to the continental shelf of Bolivia could have very a big impact on regional energy security. Once resolved through regional energy integration; for example through the establishment of an “energy ring” among the neighbouring Latin American economies (Chile, Argentina, Bolivia, Brazil, Paraguay, Uruguay, Bolivia and Peru), energy supply stability could be achieved.

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