ENERGY STATUS AND FUTURE OUTLOOK: PAKISTAN AND AFGANISTAN

Chandrabhanu Opathella, Memeber SLEMA

The 3rd meeting of the Energy Ministers and Senior Officials of SAARC Countries was held in Colombo over January 28-29, 2009. Discussion on the prospects for regional cooperation in Energy was one of the key items in the agenda. This article describes the energy situation in Pakistan and Afganistan, and the prospects for cooperation with other SAARC countries.

1. Pakistan

1.1 Area, Geography, Population and Economy

Pakistan, with a land area of 803,940 square kilometres, is the second largest country in the South Asian region. Pakistan is bordered by India and China to the east, Afghanistan and Iran to the west, and Arabian Sea to the south. Pakistan's population was estimated at 168 million in 2008. The economy grew at more than 6.5% annually for the last five years. The 2007 per capita GDP on a Purchasing Power Parity (PPP) basis was US$ 2,594. With the expected high economic growth, a correlated growth in energy demand is also expected.

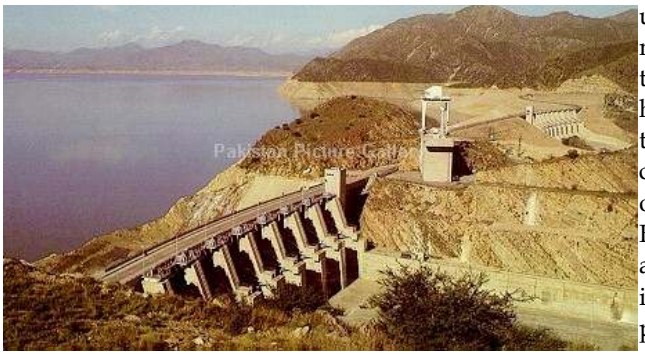

Figure 1: Tarbela Dam - Pakistan

1.2 Energy Resources and Use

The Ministry of Water and Power oversee the electricity sector with several regulating authorities and electricity companies operating under this ministry. In addition to the public sector organizations, independent power companies are also operational within the sector. The Petroleum sector functions under the control of Ministry of Petroleum and Natural Resources. Similar to the electricity sector, regulating authorities and public and private sector organisations operate under the supervision of the line ministry.

Pakistan is rich in natural resources. These include fossil fuel resources such as oil, gas and coal and renewable resources such as hydropower and wind. Pakistan has the sixth largest coal resource in the world. The coal deposits discovered up to 2006 amounts to 185,175 million tonnes. Though smaller in energy quantity compared with coal resources, the oil reserves in Pakistan also play an active role in the energy supply. By mid 2006, about 560 million barrels of petroleum had been used out of the estimated total deposits of 880 million barrels. By the same time, a cumulative total of 20.1 trillion cubic feet (tcf) of natural gas had been used out of the proven reserves of 54.7 tcf. Despite hydro power potential also being considerably large (approximately 40,000 MW), only 6,460 MW have been developed by 2005. However, most of the identified hydro resources are at different stages of development. This includes 14,220 MW of major hydro power projects along the Indus River at planning stage and 735 MW of medium sized hydro power projects at implementation stage. Apart from the hydroelectric energy, there is a considerable potential for wind power and other renewable energy resources, which await development.

In 2006, the industrial sector was the major energy consuming sector in Pakistan with a share of 43%. Shares of transport and domestic sectors were also significant (28% and 21%, respectively). Commercial and agricultural activities contributed to the balance share of 8%. This total energy demand was mainly supplied by natural gas (indigenous) and oil. Respective shares of these two energy supply sources were 39.3% and 32.0%. Imported coal, nuclear and hydropower collectively accounted for the balance portion of energy supply.

1.3 Challenges and Growth of Energy Sector

According to the power development plan, Pakistan's electricity generation is expected to be

more diversified in the future. By 2030, the total electricity generation capacity is planned to be increased to 162,590 MW with contributions from Gas-83,760 MW, Coal-19,910 MW, Nuclear-8,800 MW and Oil-7,760 MW. Along with these thermal power generation facilities, development of renewable energy resources is planned in the form of Hydroelectricity-32,660 MW and other renewable forms- 9,700 MW. Pakistan is planning to increase the combined capacity of the refineries from 12.73 million tons per annum to 18.73 million tons per annum.

Rapidly increasing energy demand of Pakistan makes timely implementation of the existing resource development plans extremely important to ensure adequate and secure energy supply to the country.

2. Afghanistan

2.1 Area, Geography, Population and Economy

Afghanistan is the latest member to join SAARC. The land area of Afghanistan is 652,000 square kilometres and is estimated to have on a population of 32.7 million in 2008. Most parts of Afghanistan are mountainous and the altitudes vary from 400m to 5,600m. The per capita GDP of Afghanistan in PPP basis was US$ 733 in 2007 and the economy grew at 7.4% in 2007.

2.2 Energy Resources and Use

The Inter-Ministerial Commission for Energy is at the top of the organisational hierarchy of the country's energy sector. The energy sector responsibilities are distributed among Ministry of Energy and Water, Ministry of Economy and Ministry of Finance. Ministry of Energy and Water oversee the power sector of the country while Ministry of Commerce and Industries is in charge of the petroleum sector. Natural Gas and Coal developments are handled by the Ministry of Mines and Natural Resources.

Transport sector is the highest energy consuming sector and its share was 32% of final energy consumption in 2006. Shares of household, commercial, agriculture and industrial energy consumptions were 22%, 15%, 11% and 10%, respectively. Other sectors accounted for the balance 10%. At present, the national electricity grid covers only some urban areas and the coverage is around 6%-7% of all households. In the energy supply side, biomass accounts for more than 80% of the total energy consumption. The commercial energy supply

Figure 2: Afghanistan, a Land with Many Resources

composition of Afghanistan is less diversified. The share of petroleum products was 77% in 2005. Use of coal (17%) and natural gas (6%) were also significant.

Afghanistan is estimated to have 6,500 MW of hydroelectric potential. Around half of this potential is considered to be economically and technically un-attractive for development. At present, only about 5% of the total hydroelectric potential is being used. In addition to hydroelectric potential, Afghanistan also possesses considerable amounts of coal, oil and natural gas deposits. In 1978, reserves containing 2,876 million tonnes of coal were estimated to be available out of which about 150,000 tonnes were annually consumed to meet the energy needs of the country. Natural gas is the next significant fossil fuel source in Afghanistan. According to 1978 estimates, 1,585 million cubic meters of natural gas was available in the country. The present rate of consumption of natural gas is 285 million cubic meters per annum. In addition to the above, 41,000 tonnes of oil is produced annually from the Afghan oil reserves estimated to contain 165 million tonnes of oil in total.

2.3 Challenges and Growth of Energy Sector

Affected by war for more than two decades, and the continuing civil strife, Afghanistan faces many challenges in its development drive. Several projects are already in the pipeline for rehabilitation and expansion of the power grid and the gas pipelines. With proper infrastructure development, Afghanistan would be able to exploit its resource base and provide a secure energy supply to support the envisaged economic growth.

PROSPECTS FOR GREATER COOPERATION AMONG SAARC COUNTRIES ON ENERGY

Swetha Perera, Member SLEMA

The 3rd meeting of the Energy Ministers and Senior Officials of SAARC Countries was held in Colombo over January 28-29, 2009. Discussion on the prospects for regional cooperation in Energy was one of the key items in the agenda. Challenges and opportunities are many, as described in the article.

1. A glance at the Region

The eight member states of SAARC (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka) span a land area of 4,428,119 square kilometres with a population of 1,484 million people (2006 mid year population). As a region, in 2006, SAARC countries consumed 481 million tons of oil equivalent (toe) of commercial energy to produce a total Gross Domestic Product (GDP) of US$ 3.44 trillion. Among the eight nations, India consumed the most energy, 402.5 million toe, and contributed largely to the regional GDP, US$ 2.75 trillion. Pakistan and Bangladesh followed India with contributions of US$ 375.4 billion and 180.1 billion respectively, consuming 55 million toe and 18 million toe of commercial energy. India, Pakistan and Bangladesh, being geographically larger and highly populated (95% of the region's population lives in these three countries) compared with other member states uses 98.8% of regional energy consumption and produce 96.2% of the regional GDP. The region's GDP experienced an annual growth rate of 5.6% during the period 1995 to 2005.
In 2007, Bhutan recorded the highest per capita GDP on Purchasing Power Parity (PPP) basis among member states, with a per capita GDP of US$ 4,862. Maldives and Sri Lanka followed with US$ 4,603 and US$ 4,265 respectively while Afghanistan recorded the lowest of US$ 733.

The ASEAN region and the European Union are two regions with approximately the same land area as the SAARC region. But these two regions are far less populated than the SAARC, 566 million and 493 million respectively compared with 1,484 million of SAARC region in 2006. Furthermore, ASEAN and European Union regions have recorded higher per capita GDP figures of US$ 4,545 and US$ 31,020 in 2006 compared to US$ 2,318 of SAARC region.

2. Present Status of Region's Energy Sector

The SAARC region fulfils its energy requirement through fossil fuels, both imported and domestically produced, and renewable sources. The region as a whole has consumed 481 million toe of commercial energy in year 2006. Commercial energy consumption of the eight member countries and their per capita commercial energy consumption are as follows.

Table 1: Commercial energy consumption and per capita commercial energy consumption

Country	Commercial Energy Consumption (million toe)	Per Capita Commercial Energy Consumption (toe)
Afghanistan	0.72	0.03
Bangladesh	18.04	0.13
Bhutan	0.05	0.09
India	402.48	0.36
Maldives	0.17	0.58
Nepal	1.04	0.04
Pakistan	54.88	0.35
Sri Lanka	3.58	0.18

Coal, oil, natural gas and renewable sources supply the commercial energy needs of the regional countries. Except for India and Pakistan, all other countries heavily rely on a single form of energy. Sri Lanka, Afghanistan, Nepal and Maldives rely heavily on oil while Bhutan and Bangladesh rely on hydro power and natural gas, respectively. India and Pakistan have a better mix in their energy supplies.

India and Pakistan are the richest in terms of energy resources with the majority of coal and natural gas resources of the region being available within their territories. Being highly populated with a correspondingly higher energy use, energy needs of India and Pakistan are a lot more than what is locally available. Apart from the fossil fuels, the region has a vast hydropower potential. Due to geography, Nepal and Bhutan are the richest in hydropower

potential. At present, Nepal and Bhutan export electricity generated in hydropower stations to India, fulfilling some of India's electricity needs. Further exploitation of this would indeed, support the energy supplies, increasing energy security of the region.

It is estimated that Pakistan and India have coal reserves of 185 billion tons and 90 billion tons, respectively. The proven reserves of Pakistan though are much lower and are about 2 billion tonnes. Government of Pakistan has decided to introduce coal into power generation along with the development of coal fields. Furthermore, industries in Pakistan have switched to coal fired kilns from furnace oil kilns, increasing the demand for coal. Both Indian and Pakistan coal industries would need to invest in new technologies to harvest the resources better and improve the quality of coal. It is calculated that at the present rate of exploitation, Indian coal reserves will be exhausted within the next 45 years.

Afghanistan, Bangladesh, India and Pakistan have natural gas resources amounting to 95 trillion cubic feet (tcf). Natural gas production and consumption in India, Pakistan and Bangladesh are expected to grow. Transmission and distribution infrastructure is also growing along with the increasing number of natural gas users. Studies to investigate new natural gas reserves are being carried out by each country.

Among the regional countries, India and Pakistan account for the majority of oil reserves. India alone has almost 90% of the oil reserves of the region. Despite these oil reserves, India too depends heavily on oil imports. In 2005, 60% of the oil requirement of India was imported. Oil exploration activities are carried out across the region hoping to arrest this import dependence to some extent.

In the recent past, except in India, investments in refining capacities and technological upgrades in refineries have been overlooked, causing the oil sector of the region to lag considerably behind the rest of the world. Limitations in refining capacities have forced regional countries to import finished products, to some extent, instead of crude oil. This has adversely affected the economies in the SAARC region.

It is also important to draw our attention to the electrification levels of the SAARC countries, as electricity has become a vital energy source to meet day-to-day needs. Among the countries, Sri Lanka has the best electrification rate of 78% (2007) followed by Pakistan and India with rates of 60% and 56%. Electrification rates of Afghanistan and Nepal are as low as 20% and 25% while Bhutan and Bangladesh record figures of 40% and 42%. Low electrification level is a hindrance to the development activities of the region. Investments required for grid expansion, shortages in generating capacity and poverty are the main causes behind the low electrification levels.

3. Challenges to Growth in Energy Sector and Provision of Energy Services to People of SAARC Countries

Energy sectors of SAARC countries face many challenges that hold back their growths as well as development of respective countries. Lack of technology, infrastructure and finance are major obstacles faced by the region. The region is rich with renewable energy resources. Though some forms are abundantly available, harnessing to the optimum level is hindered due to cost and technological barriers. Solar energy and wind energy are two such forms of renewable energy, which are abundantly available but least harnessed. Most potential sites for hydro power plants are located in remote areas where road access and power transmission facilities are not available. Lack of infrastructure and high development costs have caused cleaner and more efficient projects based on indigenous resources to be less viable and has become the main barrier in delivering energy from such projects.

Rising dependence on imported fuels is another hurdle to growth in the energy sector. As mentioned earlier, the region highly depends on imported fossil fuels to fulfil energy needs. High import bills paid by SAARC countries consume most of the export earnings resulting in delays in infrastructure development and developments in other forms of energy sources. Also, import dependency makes the region vulnerable in terms of energy security.

All the SAARC countries presently face difficulties in meeting their energy needs causing adverse effects in the economies, quality of life and social development. Development of locally available alternate fuels and promoting efficient use of energy will resolve this issue to some extent. In the long run, national and regional policies should be developed to promote and develop indigenous energy resources.

Lack of coherent energy policies, regulatory frameworks and competitive market environments in member countries are also obstacles for the development of the energy sector of the region.

4. Prospects of Regional Energy Trade

The first cross border electricity transfer in the region dates back to 1961, when Jaldhaka Hydroelectric Project of India supplied electricity to border towns of Bhutan. Since then India and Bhutan have been cooperating in developing hydroelectric projects and electricity infrastructure. The first major hydroelectric project in Bhutan, Chukha Hydroelectric Project with 336 MW installed capacity (commissioned in 1986), was initiated in 1974 with the assistance of the Government of India under a bilateral agreement to export the surplus to India. Confidence gained in Chukha Hydro Electric Project lead to the joint ventures between the two countries to develop Kurichhu Hydro Electric Project (60MW) and Tala Hydroelectric Project (1,020MW). Benefits reaped by India and Bhutan with the cross border electricity transfers are immense. Electricity export to India has earned a great amount of foreign exchange to Bhutan while India's power shortages were relieved considerably. Furthermore, India and Bhutan have signed agreements to develop Punatsangchhu-I hydroelectric Project (1,095MW) and studies are being carried out for many more projects with the objective of India importing a minimum of 5,000 MW of electricity from Bhutan by 2020. Another important characteristic of these developments is that they are being carried out under the clean development mechanism with expectations of arresting carbon emission levels of India.

Though, India's involvement in development of Nepal's electricity sector dates back to 1950s, first cross border electricity transfer between the two countries happened in 1971 with 5 MW. This figure gradually grew over the years to 150 MW by 2001. Nepal, despite being a country with a huge hydro potential, has an installed capacity of only 600MW. Studies have shown that projects of about 42,000 MW are economically feasible in Nepal. The main barrier at present for increased power transfer between India and Nepal is the limitations in transmission facilities. Developments in transmission network would help Nepal to export power to India during the wet season and import power from India in the dry months, during which time Nepal faces a shortage of about 100 MW. Identifying this, MoUs have been signed between the two countries to develop four 400/220kV transmission lines. In terms of new power generation, the 750 MW West Seti storage Hydroelectric Project in Nepal is under the development with the idea of exporting power to the north of India. Furthermore, Budhi Gandaki Project (600 MW), Upper Karnali (300 MW), Arun III (402 MW) and Lower Arun (300 MW) are under the consideration of development in Nepal with the objective of exporting power to India.

Sri Lanka and India are seriously looking at a 400kV HVDC 1,000MW transmission line between the two countries. The line would have an initial capacity of 500 MW and later another 500 MW would be added. This line connecting Madurai and New Anuradhapura substation is to be 385 km in length including a 30 km submarine cable. Though it is expected that this cable will mostly, carry power from India to Sri Lanka, the everse could also happen occasionally based on the seasonal variation and load profiles.

There are possibilities for Bangladesh to tie up with India for power transfers. Western grid of Bangladesh and eastern region of India can look into cross border transfers, which will benefit both countries immensely. The electricity peak demand time difference and the weekly and seasonal holiday difference make it possible for the two countries to exchange power. This allows Bangladesh to use power from Indian hydro and coal power plants as base load instead of more costly gas plants, and Bangladesh to contribute to India during peak hours using gas fired power plants. This way, Bangladesh could add more diversity to their electricity supply mix.

Apart from electricity, India supplies 100% of the petroleum products consumed in Nepal and Bhutan. Furthermore, Indian Oil Company is actively involved in petroleum products retailing and storing in Sri Lanka adding energy security to Sri Lanka.

SAARC region is surrounded by countries that are rich with energy resources compared to the SAARC countries. Energy supplies from surrounding countries will greatly increase the energy security of the SAARC region. Since 1990, pipelines to import natural gas from Iran, Myanmar and Turkmenistan to India have been considered. Recently, Iran and Pakistan have agreed to go ahead with the pipeline from Iran

up to Pakistan and Indian participation on this line would improve the economics of the project.

While striving for diverse energy supplies and interconnected transmission and distribution networks to improve energy security, the regional countries should work towards improving energy efficiency at the points of supply and use. Working out a regional policy for efficient use of energy, introducing novel technology to where conventional technologies are used such as in cooking, promoting energy efficient appliances and introduction of a building code system and a labelling system for appliances are some measures the eight countries can work together as a region. Soft options such as knowledge sharing will also have a significant role to play in the overall energy sector development in South Asia when moving towards more secure and cost effective energy supplies.

From the Sri Lanka National Energy Database: