

Chapter 13

Promoting Regional Energy Co-operation in South Asia

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13.1 Introduction

It is well established that supply of adequate, reliable and reasonably priced energy is one of the key inputs for sustainable socio-economic development of any region. South Asia is not only the second fastest growing region in the world; it is also one of the poorest, which puts energy at the very heart of the development process in the region. According to the United Nations (UN) World's Economic and Social Situation and Prospects 2013, the region registered a growth rate of 8.3 per cent and 5.8 per cent in the years 2010 and 2011 respectively, with projections of 4.4 per cent in 2012. Despite this, significant progress remains to be made. With a population of over 1.6 billion, the region is home to half of the world's poor. This huge population growth coupled with expanding economies has spurred ever-increasing pressures of energy demand for countries in the region. The International Energy Agency (IEA) has projected that South Asia could have the highest growth rate of energy consumption in the world by 2020.

This chapter looks at the developmental challenges faced by the South Asia Subregional Economic Cooperation (SASEC) formed by Bangladesh, Bhutan, India and Nepal, and builds a case for stronger regional energy co-operation to accelerate the development process. Section 13.2 highlights the developmental challenge faced by the region and brings out the urgent need to intensify efforts to develop the energy market. Section 13.3 presents a discussion of historical and ongoing efforts of regional co-operation. Finally, Section 13.4 puts forth areas of possible future co-operation and suggests ways in which this can be achieved.

13.2 Challenges faced by the subregion

13.2.1 Income and energy poverty

The majority of South Asia's 1.6 billion population is concentrated in the eastern subregion formed by four SASEC countries, i.e. Bangladesh, Bhutan, Nepal and India. The four countries not only share important social-economic characteristics but they also face similar challenges in terms of the provision of energy services. In 2011, the average Human Development Index (HDI) for the region, based on three measurable dimensions of human development: living a long and healthy life, being educated and having a decent standard of living, stood at 0.548 against a world average of 0.682 (Table 13.1). Poverty levels in the region, as defined by National Poverty Lines, have

Table 13.1 Key indicators – SASEC region

| Indicator | Bangladesh | Bhutan | India | Nepal |
|---|------------|--------|---------|-------|
| Total population (million) (2011) | 150.5 | 0.70 | 1,241.5 | 38.5 |
| Rural population as % of total population (2011) | 71.4% | 64.5% | 60.7% | 80.8% |
| GDP per capita (US\$) (2010) | 1,810 | 6,200 | 3,400 | 1,210 |
| Population below poverty line (National Poverty Line) | 31.5% | 23.2% | 29.8% | 25.2% |
| Population below US\$1.25 a day (2009) | 50.5% | 26.2% | 42.2% | 55.1% |
| Growth rate of GDP (2010–11) | 6.1% | 5.9% | 7.2% | 3.5% |
| Human Development Index (HDI) Rank (2011) | 146 | 141 | 134 | 156 |
| Human Development Index Value (2011) | 0.50 | 0.522 | 0.547 | 0.458 |
| Traditional fuel consumption as % of total energy requirements (recent available figures) | 30% | 78% | 24.5% | 85.8% |
| Access to electricity as % of population (2009) | 41% | 61% | 66.34% | 43.6% |
| Per capita electricity consumption in kWh (2010) | 148.6 | 256.6 | 498 | 162 |

Sources: Human Development Report 2011; World Development Indicators 2012; UN's World's Economic and Social Situation and Prospects; www.indexmundi.com; <http://data.un.org>; www.nationmaster.com

come down from as high as 49.8 per cent in Bangladesh, 30.9 per cent in Nepal, 26.1 per cent in India and 25.3 per cent in Bhutan (ADB 2006) to 31.5 per cent, 25.2 per cent, 29.8 per cent and 23.2 per cent, respectively, in the year 2010 (World Bank 2012). Per capita income (in purchasing power parity terms) varies from as low as US\$1,210 for Nepal, US\$1,810 for Bangladesh, and US\$3,400 for India against a world average of US\$11,066 (World Bank 2012). Providing energy to its vast population remains a massive challenge for the entire region. A significant proportion of the population in the region still does not have access to modern means of energy and continues to depend on traditional sources such as biomass and fuelwood for most energy needs. High use of biomass fuels is not only associated with the depletion of scarce natural resources but also causes serious environmental and health concerns. Each year, about 2 million women and children in developing countries are killed by the fumes from indoor biomass stoves (IEA 2012). Many of these are in the SASEC countries. Per capita commercial energy consumption in the region is dismally low, ranging from 201 Kgoe for Bangladesh to 560 Kgoe for India and 338 Kgoe for Nepal, while the world average stood at 1,788 Kgoe in 2009 (World Bank 2012). The percentage of the population in the region with access to electricity is also one of the lowest in the world. Access to electricity in Bangladesh has increased from a mere 28 per cent in 2006 to 41 per cent in 2009. Eighty-five per cent of Bhutan's total population still live in villages and continue to be dependent on biomass for meeting their energy needs. About 39 per cent of the total Bhutanese population do not have access to electricity. Bhutan has the highest per capita fuel wood consumption in the world as a significant share of the total primary energy supply is met through traditional fuels. As per Bhutan's Ninth Five-Year Plan,

annual consumption of fuel wood is 1.2 million cubic metres or 1.9 cubic metres per capita (Ninth Five-Year Plan, RGoB). In Bhutan, fuel wood accounts for nearly 78 per cent of the total energy consumption in the country. Approximately 69 per cent of India's population lives in rural areas, and 55 per cent of the total rural population does not have adequate access to electricity (Census of India 2011). According to official statistics, 84 per cent of the villages in the country are electrified (CEA 2011). However, with 100,000 villages still without electricity connection, much remains to be done. According to the Census of India (2011), 56 per cent (74 million) of rural households had access to electricity. Nearly 75 per cent of the rural population in India still depends on traditional biomass for cooking and heating (Census of India 2011). Rural-urban disparities within these countries also pose a challenge.

13.2.2 Need for power market development

Poor state of power supply

Rapidly growing power demand coupled with inadequate power supplies is a challenge throughout the SASEC region. The region's average per capita electricity consumption is far below the world average of 2892 kWh. (HDR 2011). Time and again availability of power has been falling short of the demand, which might prove to be a major roadblock for the overall growth prospects of the region. Power losses due to theft and poor-quality transmission and distribution are high. At 31.45 per cent, Nepal had the highest transmission and distribution losses in South Asia followed by India at 24.4 per cent for the year 2009. Inadequate investment in the transmission and distribution network and outright theft are the main reasons for high transmission and distribution losses in India. The associated financial losses have been estimated at 1.5 per cent of the national GDP for India. A study prepared as a background on the Poverty Reduction Strategy Paper (PRSP) for the World Bank showed that Bangladesh loses an equivalent of US\$1 billion each year because of power supply interruption and shortage which, in turn, results in a 0.5 per cent reduction in its annual GDP growth (Tamim and Gulen 2004). Another study carried out by USAID in 2002 valued lost production from power outages at US\$772 million a year, equivalent to 11.5 per cent of industrial production and 1.7 per cent of the 2001-02 GDP. Given the situation, it doesn't come as a surprise that an assessment of the investment climate in Bangladesh found that the erratic and poor quality of the electricity supply was the dominant constraint to business development and growth (World Bank 2004). India's Ministry of Power has estimated that, in order to support a GDP growth rate of around 7 per cent per annum, the rate of growth of the power supply needs to be over 10 per cent annually. The country, however, continues to struggle to meet the immense challenge of meeting its increasing electricity demand. The demand for power in India was growing at a rate of 7.6 per cent in the late 2000s. During 2011-12, the demand was 858 BU in terms of energy and 130 GW in terms of peak power requirements. During the same period, power shortage was 8.5 per cent in energy and 10.6 per cent in peaking power (CEA 2013a). Nepal too is plagued by power shortages. The situation is all the more distressing given that the country has tremendous hydropower potential which holds immense economic growth opportunities. Nepal has hydropower potential of 83,000 MW, of

which economically feasible potential is estimated at 40,000 MW. A mere 600 MW of this potential has been developed to date.

Ambitious electrification programmes

All SASEC countries have embarked on ambitious universal electrification programmes. The Government of Bangladesh has the vision to electrify the whole country by 2020. Bhutan's Tenth Five Year Plan (2008–13) set a target of providing electricity access to all and achieving universal electrification by 2013 to improve quality of life and reduce poverty. Particular attention is given to harnessing renewable energy for providing access to those households (around 12 per cent) that will not be connected to the national electricity grid. The development of solar energy resources, micro-hydro, alternative energy experimental activities and institutional strengthening and capacity building in these relevant areas comprise some of the priority activities under the renewable energy programme (Tenth Five-Year Plan, RGoB). The Government of India introduced the scheme Rajiv Gandhi Grameen Vidhyutikaran Yojana (RGGVY) in April 2005, which aimed at providing electricity to all villages and habitations within four years and providing access to electricity to all rural households. Although there have been no shortfalls in achievement of financial targets set for RGGVY during the Tenth and Eleventh Five-Year Plans, time overrun has been observed in the implementation of RGGVY projects. Even after completion of the project and the energisation of newly connected habitations, it has been noticed that certain regions do not get power for the sufficient duration of 6–8 hours per day due to overall shortages of power (Government of India 2012). Nepal's Water Resources Strategy 2002 has set the target of providing 38 per cent of households with access to electricity by 2017 and 60 per cent of households with access to electricity by the year 2027. Successful implementation of these goals calls for co-ordinated action by all agencies and stakeholders involved in the electrification process right from the central government, donor agencies, local bodies, and non-governmental organisations (NGOs) to the community levels. Designing, developing and implementing financially viable institutional models will be critically important. Substantial funds need to be ring-fenced for achieving these goals. Concerted efforts will also be required for the monitoring and benchmarking of schemes so that long-term access goals are achieved.

Investment requirement

Meeting increasing electricity demand in the region is a huge challenge. The significant prospect of developing the huge hydropower potential of Nepal and Bhutan could help in meeting a significant portion of the growing electricity needs of the region but would call for huge investments. Resource mobilisation for transmission and distribution investment poses a huge challenge. The high technical losses in the region reflect the lack of investment in the distribution sector and its inability to mobilise adequate financial resources. Most countries in the region are looking at private and foreign investments for power sector development, which calls for stable and predictable policy and regulatory regimes conducive to investors. According to an estimate, Bangladesh requires an investment in the range of US\$6 to 8 billion over the next ten years for power sector development. The proposed projects under Bhutan's power

system master plan will require an investment of US\$3.36 billion over the 20-year period from 2003–22. As per the recent projections of the Working Group on Power for the twelfth Five-Year Plan (2012–17), an estimated investment of nearly US\$254 billion is needed by the Indian power sector during the said period. Nepal's combined investment needs for generation and transmission for the next ten years is estimated at US\$1.22 billion (Ystgaard 2005). These massive investment requirements pose a challenge not only for the respective countries but also for the development of the region as a whole and call for a co-ordinated strategy for power sector development.

13.2.3 Increasing oil import dependency

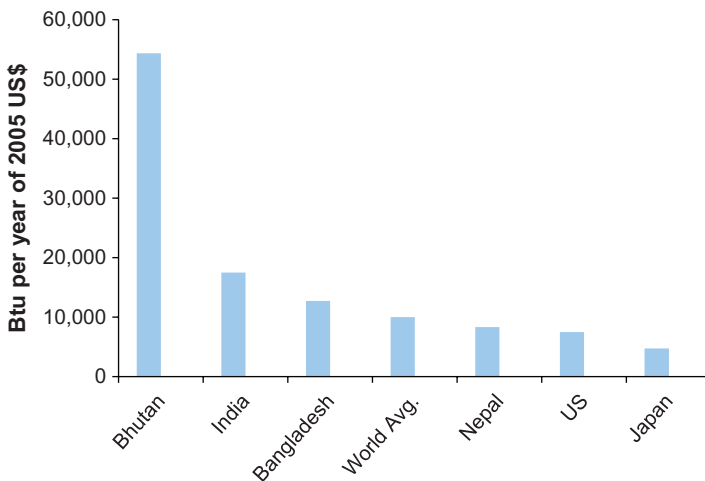
Steadily increasing oil import dependency in the region is another crucial concern from an overall energy security standpoint. Net energy imports of South Asia are expected to more than triple from 132.6 mtoe in 2005 to 447.6 mtoe in 2030 (IEA 2012), growing at an annual rate of 5 per cent. Oil imports have implications both in terms of physical supply of crude oil and various petroleum products and also in terms of their impact on the balance of payments and inflation. Unprecedented high oil prices are also reinforcing the energy vulnerability of the region. As per International Energy Agency (IEA) estimates, the loss of GDP average is 0.8 per cent in Asia and 1.6 per cent in very poor, highly indebted countries in the year following a US\$10 increase in oil price (IEA 2004). Petroleum is the single largest imported item in Bangladesh, and its oil import bill increased to nearly \$4.5 billion in 2011–12, posting a rise of nearly 45 per cent year on year. Given the availability of cheap hydropower in Bhutan, imports of petroleum products are primarily used to power motor vehicles. However, since Bhutan is an import-reliant country, and as most items in the consumer price basket are imported, the country is not isolated from the indirect effects of global oil price increases. From India's perspective, given its high oil import dependency, rising crude oil prices have an implication for the trade deficit, and thereby the currency, and also on inflation. In 2005–06, India imported 99.4 million tonnes of crude oil with a massive foreign exchange outgo of around US\$38.77 billion (Government of India 2006). In 2004–05, India's dependence on imported crude stood at 77 per cent of its crude processing requirement. While the total quantum of crude imports by the country grew at a CAGR (compound annual growth rate) of 15.72 per cent during the period 1997–98 to 2004–05, the total import bill shot up by more than double this rate (33.03 per cent) during the same period (Misra et al 2005). For the period 2012–13, India's oil import bill has risen 41 per cent to over US\$132 billion, which accounts for nearly one-third of all imports. India's oil consumption is projected to increase from 2.1 mbd in 2000 to 5.6 mbd in 2030, which would make its import dependency increase to 94 per cent. The situation in Nepal is also precarious because it is a landlocked country with no proven oil or gas reserves. Petroleum products accounted for 19.56 per cent of the total imports in the last fiscal year 2011–12. Rising energy needs has made petroleum products the number one import commodity. Nepal's gasoline import bill jumped 27.2 per cent in 2011. Dependence on energy import has put a burden on the foreign currency reserves of Nepal. Fuel imports absorb over one-quarter of Nepal's foreign exchange earnings. World Energy Outlook projects that South Asia's growing energy demand will have to be met by imports. Oil import dependency, in particular, is

expected to increase from 73 per cent in 2005 to 91 per cent in 2030. In absolute terms, South Asia's net energy imports are expected to more than triple from 132.6 mtoe in 2005 to 447.6 mtoe in 2030 (ADB 2009), growing at an annual rate of 4.7 per cent. In South Asia, India's expected increase in oil and gas demand will be increasingly met by imports. With international oil prices touching unprecedented levels and volatility in international energy markets, a well thought out strategy to ensure the energy security of the region has become more critical than ever before.

13.2.4 Need for greater energy efficiency

Though per capita energy consumption in the region is one of the lowest in the world, energy intensity, i.e. energy use per unit of GDP, continues to be very high. In 2010, average energy intensity in the region was higher than Japan's by five times and three times that of the USA, which indicates a low level of energy efficiency in the region (Figure 13.1). At 54,366 Btu per dollar of GDP, Bhutan has the highest energy intensity in the region followed by India with 17,514 Btu per dollar of GDP year, Bangladesh with 12,726 Btu per dollar of GDP and Nepal with 8,319 Btu per dollar of GDP (all figures are based on 2005 US\$ market exchange rates). Considerable scope for energy conservation through demand-side management and end-use energy efficient measures exists in all the countries of the region but remains to be realised. In India, for example, it has been assessed that at least a 23 per cent reduction of electricity consumption from the present level is possible in different sectors, without forgoing any of the end-use benefits of energy. This would entail savings of about 30 per cent in the agricultural sector, 30 per cent in the industrial sector, 20 per cent in transportation, and 30 per cent in the domestic sector (Powerline 2004 and TERI's estimates). Lack of awareness, proper ring-fencing of funds for dispute settlement mechanism (DSM) programmes and an absence of proactive policies are the main reasons for the huge untapped energy saving potential in the region.

Figure 13.1 Energy intensity in SASEC countries



13.3 Regional co-operation: Historical context and ongoing efforts

The quadrilateral formed by the SASEC countries Bangladesh, Bhutan, India and Nepal is well endowed with natural resources and there is tremendous scope for co-operation in the field of energy. The four countries are complementary not only in their geographical proximity, but also in terms of the basket of energy resources available, the seasonal characteristics of energy demand and supply, and the vast pool of institutional and technological expertise available within the region. These characteristics of the region make development and integration of energy infrastructure all the more feasible. There is much to be gained by each country by developing synergies in this important sector. Several studies have been undertaken to encourage energy co-operation in this subregion but these have lacked a holistic approach and were, hence, unable to pass political scrutiny. As a result, what we are seeing is the most basic form of co-operation, i.e. bilateral arrangements between countries. Bilateral energy co-operation exists between India and Nepal and India and Bhutan in the form of some energy exchanges. Most of this has been limited to some hydropower and there remains a lot of scope for further collaboration in the field of energy.

13.3.1 Co-operation between India and Nepal

India has been assisting Nepal in the development of its hydropower potential. Four hydroelectric schemes, namely Pokhara, Trisuli, Western Gandhak and Devighat, with an aggregated installed capacity of about 50 MW, have been implemented in Nepal with financial and technical assistance from the Government of India (GoI). The Pancheshwar Multipurpose Project (5600 MW) on river Mahakali, Sapta Kosi High Dam Multipurpose Project (3300 MW) on the river Sunkosi, and Naumure Hydro Electric Project (225 MW) on West Rapti river are under discussion and are being co-ordinated by the Ministry of Water Resources, Government of India. There is a good potential in exploiting the inherent load pattern diversity between India and Nepal to improve the overall system reliability of the two countries. The GoI nominated the Power Trading Corporation (PTC) as the nodal agency to deal with matters relating to power exchange with Nepal in July 2001. PTC is also the sole agency from the Indian side for finalising all commercial and technical arrangements/systems with the Nepal Electricity Authority (NEA) and co-ordination with associated Indian agencies. Sale of surplus power is to be dealt with by PTC and NEA directly on a commercial basis based on the market conditions. In order to have interaction at a higher level pertaining to the co-operation in the field of water resources, including implementation of various agreements and understandings, a Nepal–India Joint Committee on Water Resources (JSCWR) has also been set up (Ministry of Water Resources GoI 2006). The bilateral exchange of power at the borders between the two countries is at a level of 50 MW. As per the water resources strategy of Nepal, by 2017 Nepal aims to develop hydropower to meet the projected demand of 2,230 MW including 400 MW for export to India. Under a high-growth scenario, the strategy projects that by 2027 the country would earn significant

national revenue by developing a total hydropower capacity of 22,000 MW including 15,000 MW for exports (WRS 2002; CPD 2003). The power exchange between India and Nepal is made possible by interconnections at the voltages of 11, 33 and 132 kV at 22 interconnection points. In 2010, 75 GWh of electricity was supplied to India fetching revenue of INR 604 million to the country (Table 13.2). Considering India's increasing power demand and Nepal's tremendous hydropower potential, both the governments have set a target to extend transmission lines at three border points to enhance the exchange of electricity from the current level of around 50–150 MW. For this, three 132 KV interconnections are to be made, namely Butwal–Sunauli–Anandnagar, Parwanipur–Birgunj–Mothihari and Dhalkebar–Bhittamod–Sitamarhi.

Various viable projects have been identified for bilateral co-operation between India and Nepal and some initial steps have been undertaken in respect of projects such as West Seti (750 MW), Pancheshwar (6,480 MW), Karnali (10,800 MW) and Saptakosi (3,000 MW). Pancheshwar Multipurpose Project is the centrepiece of the Mahakali Treaty signed between India and Nepal in February 1996. The project will have power, irrigation and incidental flood control benefits for both the countries. A Joint Project Office (JPO) was established in Kathmandu in December 1999 to carry out additional investigations and for preparation of the detailed project report (DPR). The JPO was closed in July 2002. A draft DPR has been prepared by the Indian side, which is to be mutually agreed upon. A joint inception report to take up the joint field investigations, studies and preparation of a DPR has also been finalised for the Sapta Kosi High Dam Multipurpose Project and Sunkosi Storage cum Diversion Scheme. The salient feature of the project is its reservoir size, which can hold sufficient water for generation of one month of energy at full capacity and this makes the project capable of producing peaking power for 7–8 hours a day almost round the year. Besides the above, a number of other projects, such as Burhi Gandaki (600 MW) and Upper Karnali (300 MW), are also under discussion between India and Nepal. Joint

Table 13.2 Revenue generated in Nepal from electricity sale to India

| Year | Bulk supply to India (GWh) | Revenue (in INR million) |
|-------------------|----------------------------|--------------------------|
| 2000 | 95.00 | 327.80 |
| 2001 | 126.00 | 396.06 |
| 2002 | 133.86 | 514.12 |
| 2003 | 192.20 | 809.00 |
| 2004 | 141.20 | 673.70 |
| 2005 | 110.70 | 608.51 |
| 2006 | 96.55 | 579.33 |
| 2007 | 76.87 | 428.93 |
| 2008 | 60.10 | 361.14 |
| 2009 | 46.38 | 295.49 |
| 2010 | 75.07 | 604.85 |
| 2011 ^a | 29.59 | 230.84 |

^aProvisional figure subject to final audit.

Source: Nepal Electricity Authority, Fiscal Year 2010/11 - A Year in Review

Technical Expert Groups have been constituted for the above projects for guidance in carrying out investigations and preparation of the DPRs (TERI 2006).

13.3.2 Co-operation between India and Bhutan

India has had a long association in providing technical and financial assistance to Bhutan in the development of its hydropower resources. India is also Bhutan's largest trading partner. Electricity is Bhutan's principal export commodity and the largest revenue earner. Bhutan's hydro-electricity power potential is estimated at about 30,000 MW, out of which about 16,000 MW is estimated to be technically and economically feasible.

In the late 2000s, Bhutan exported about 1,000–1,200 MW surplus power to India from its three hydro projects namely Chukha (336 MW), Kurichhu (60 MW) and Tala (1,020 MW). Chukha power is evacuated through 220 kV transmission lines – one S/C 220 kV Chukha (Bhutan)–Birpara (India) and one D/C 200 kV Chukha–Birpara line. Surplus power from the Kurichhu project is being exported through a 132 kV S/C transmission line from Gelephu (Bhutan) to Salakati (Assam). Another 132 kV link between Bhutan and India (Assam) is being commissioned for providing an alternate evacuation route for Kurichhu power through the North Eastern Grid. West Bengal State Electricity Board and Damodar Valley Corporation are beneficiaries of surplus power evacuated from this project on a 50:50 basis. The two 400 kV D/C transmission lines evacuate power from the Tala project at two different locations at the India–Bhutan border. The transmission system in India carries power from the border to a pooling point at Siliguri (West Bengal) and beyond to the Eastern and Northern Grid (Obaidullah 2010). Chukha hydropower project (336 MW) has been an important project developed as a joint venture between GoI and RGoB with GoI providing the funds for the project. About 84 per cent of energy generated from the Chukha plant is exported to India. Power Trading Corporation (PTC) has been made the nodal agency for India by the GoI and has taken over the trading of this power from 1 October 2002. PTC has entered into a long-term agreement with the Department of Energy in Bhutan and continues to import power from three hydroelectric projects, namely Chukha Hydroelectric Project (336 MW), Kurichhu Hydroelectric Project (60 MW) and Tala Hydroelectric Project (1,020 MW), in Bhutan under long-term bilateral trade. PTC's cross-border trade volume from Bhutan constitutes 25–30 per cent of its portfolio. During the year 2010–11 (up to 31 December 2011), a total of ~5,366 MU were traded with Bhutan. The total power transfer capacity between Bhutan and India through transmission interconnection is about 2,500 MW, which is sufficient to meet the requirements. With the commissioning of Tala hydropower project, electricity exports from Bhutan have increased significantly.

13.3.3 Co-operation between India and Bangladesh

With increasing pressure of power demand, Bangladesh has also been keen on importing electricity from Bhutan and Nepal. Bangladesh is surrounded by the Eastern region of India on the western side and by the North Eastern region of India on the eastern side and is in close proximity to Nepal on the north west side.

Discussions have been underway for several years about the possibility of Bangladesh connecting its electric grid to those of India, Nepal, and Bhutan.

A 400 kV transmission interconnection between India and Bangladesh is under various stages of development. This 125 km-long proposed transmission line will connect Behrampur in India and Bheramara in Bangladesh, which would enable the transfer of electricity from the former to the latter. Of the total line length, 40 km would fall in the Bangladesh territory while the rest would be in India. The transmission systems of India and Bangladesh, which are based on 400 kV alternate current (AC) and 230 kV AC respectively, are proposed to be synchronised by installing a back-to-back high voltage direct current (HVDC) link. The line will have an initial transfer capacity of 500 MW, which will later be upgraded to 1,000 MW. In June 2010, the Asian Development Bank (ADB) approved a US\$100 million loan for constructing the cross-border line. ADB's loan will finance the transmission and sub-station components of the project. A power purchase agreement is being discussed by the Northwest Territories Power Corporation (NTPC), which will involve an Indian supplier and the Bangladesh Power Development Board. The proposed transmission interconnection project will help in addressing the significant power shortages in Bangladesh.

However, there are no links between India and Bangladesh. To tap the hydropower resources of Bhutan and Nepal, Bangladesh would have to explore opportunities through co-operative arrangements with India, such as the joint development of hydropower projects or in the form of swap deals for exchange of power with the Eastern and North Eastern states of India.

Given the potentially large natural gas reserves in Bangladesh, India has been keen to source gas from Bangladesh. Following the discovery of world-class gas fields at Bibiyana, Moulvibazar, Jalalabad and Sangu fields in Bangladesh, Petrobangla, along with other exploration and production players in Bangladesh, was considering a gas-export pipeline along with the GoI from North Eastern Bangladesh to the markets in West Bengal and Central and Northern India. However, these plans have been stalled due to various concerns of Bangladesh about the actual size of these finds and the demand for gas in the domestic market.

India has also been keen to import hydrocarbon resources from Myanmar and more so with the discovery of between four and six TCF gas fields in Myanmar's Rakhine State in early 2004. The discovery was made by the consortium headed by South Korea's Daewoo International, which has a 60 per cent share in the venture. State-owned Indian companies Oil and Natural Gas Corporation and Gas Authority of India have 20 and 10 per cent shares respectively. South Korea's Korean Gas Corporation (KOGAS) also has a 10 per cent share. One option to export this gas to India is to set up a pipeline that would link the gas field to the Indian state of Tripura before crossing Bangladesh to West Bengal in India. According to an estimate, Bangladesh would have received US\$350 million in investment and earned US\$100 million in annual transmission fees from the project. In addition, Bangladesh also expected to get another US\$100 million as a one-off right of way charge from the project and US\$25 million each year for sharing management. Despite the win-win

situation for all the countries involved, the pipeline project has not come through. In exchange for the passage, Bangladesh wanted India to reduce the huge bilateral trade deficit, allow transit to Nepal and Bhutan and the sale of electricity from these countries to Bangladesh through Indian territory. After a long period of negotiations, no common ground could be reached on terms of agreement. India has now decided the pipeline will bypass Bangladesh. The failure of negotiations is a big loss to both India and Bangladesh. Bangladesh has lost a lucrative opportunity to earn huge revenue. At the same time, the pipeline could have been used to carry gas within the country and Bangladesh wouldn't have to lay separate pipelines to take gas to the Northern region. The longer route will inflate the estimated cost of the pipeline for India by US\$3 billion (*Financial Express* 2006). In another instance, India's Tata Group had submitted a US\$3 billion investment proposal for developing a steel plant with 2.4 metric tons per annum (mtpa) capacity, captive and IPP power plants, an open cast coal mine, and a urea fertiliser plant with one mtpa capacity in Bangladesh (*The Daily Star* 2006). However, the proposal was recently shelved by the Tata group on account of political uncertainty and delay by the Bangladesh authorities in taking a final decision on the proposal.

13.4 Encouraging the potential for subregional energy co-operation: A suggested approach

The subregion formed by Bangladesh, Bhutan, India and Nepal is extremely complex with peculiar geographic and market characteristics that challenge regional co-operation in energy. The previous section brought out the limited progress that has been made so far. The need of the hour is to pursue a multipronged strategy for subregional energy co-operation encompassing softer options aimed at confidence building to more substantial and larger-scale co-operation. The following section suggests various efforts required to make this possible.

13.4.1 Information collection and sharing

Lack of comprehensive and quality data is a serious constraint for development of the energy sector in the region. All countries of the region have a poor database, which makes it difficult to undertake effective energy planning. There is an urgent need to undertake an exhaustive exercise in resource mapping and to understand the drivers of energy demand and supply in the region. This would require a combination of aerial mapping and ground-level surveys to be undertaken. Technological and technical experience should be pooled in order to ensure a good database across the region.

Yet another area of weakness that constrains optimal development of the sector in the region is a reliable estimation of demand and loads. Building on the above database, designated institutions across the SASEC countries should work together to develop a common understanding of energy demands and an optimal exploitation of resource potential that would enhance energy security in the subregion as a whole. A detailed exercise in this area would provide a sound basis for defining subregional energy co-operation projects, while highlighting the economic costs and benefits, by country, of the same.

13.4.2 Knowledge networking and technology co-operation in rural energisation

As discussed in Section 13.2, a large percentage of the population in South Asian countries is rural based and does not have access to commercial energy forms. While Bangladesh has had a very successful institutional and revenue model for rural energisation, India is embarking on a huge programme for rural energisation based on a combination of grid extension and decentralised/distributed generation options. The sheer size of India's market would go a long way in reducing the costs of rural technologies (through scale economics) and a judicious selection of technologies based on demand aggregation across the SASEC countries could further the gains to all countries. Considering the dispersed nature of the rural population in the region and the difficult terrain, distributed generation based on locally available renewable resources also merits consideration and needs a planned approach. Apart from technology access, as understood by all experts in these countries, the design of markets and institutions is critical for effective rural energisation. Sharing of ideas and experiences in this sphere would be enormously beneficial to all countries in terms of not only energy access but also the related social and economic progress that could contribute to the overall stability of the region.

Governments, NGOs and donor agencies must promote holistic energy-driven rural development. This would call for compiling comprehensive information on the rural energisation policies in the countries of the region and their relative effectiveness. At the same time, a systematic study for estimating rural energy demand in the region needs to be carried out. Moreover, a knowledge management system should be established with information on existing grid-based as well as decentralised rural energy programmes, financing mechanisms, available technologies, manufacturing capabilities and commercial viability.

13.4.3 Building greater energy efficiency

There is a strong case for a concerted effort in the area of energy conservation in the region which would reap multiple benefits in terms of bridging the gap between energy demand and availability, reducing the cost of generation in the short term and reducing the investment needs for electricity production in the long term. With rising international oil prices, it has become all the more critical for all the countries in the region to adopt energy-efficient practices. However, for any effort to increase the energy efficiency of the region to be successful it is critical to put sound legal frameworks in place, provide sufficient short-term and long-term financing arrangements, have co-ordinated technical standards and increase public awareness about the need and benefit of actively participating in such programmes.

13.4.4 Enhancing the role of the private sector in energy development and trade

All the countries of the region are inviting private participation in the development of energy resources and are engaged in reforming the energy sector to allow the sector to function along commercial principles. India, for example, has opened up

the electricity sector to allow trading entities to operate freely. It has designated the PTC to undertake trading activities in the region. PTC would probably find it easier than governments to enter into multilateral commercial transactions, which could potentially allow Bangladesh to source hydroelectricity from either Nepal or Bhutan by defining alternative commercial models that all parties could find acceptable. Such relationships could then be developed purely on commercial principles with each party determining for itself the costs and benefits of such transactions (not necessarily in monetary terms). Similarly, a situation could be envisaged wherein the corporate sector of one country could invest in the development of energy resources in a second country to benefit one or more countries of the subregion. However, for these kinds of arrangements to bear fruit, we would need reforms in the approach to regional co-operation and a conducive macro environment, as detailed below.

13.4.5 Evolution of co-ordinated legal and regulatory frameworks

The long-term success of regional co-operation efforts calls for the harmonisation of energy policies and the promotion of legal and regulatory frameworks conducive to regional trade. Traditionally the energy sector in the region was regulated and owned by various government agencies and organisations. The role and participation of the private sector was limited to specific areas of small jurisdiction and consumer base. The government performed the multiple roles of developer, promoter and regulator of the sector. With the reform process underway, this situation has changed considerably. The energy sector in the region has been undergoing significant changes in terms of restructuring, unbundling and commercialisation. There is much to be learnt by the sharing of expertise and experience. India has made significant headway in power sector reforms in terms of independent regulation, while the Bangladesh regulator is still at a nascent stage. Any successful regional co-operation effort would require due diligence on various issues related to tariff setting, as tariffs would play a key role in determining comparative advantages involved in regional trade negotiations. A logical start towards co-ordinating regional energy co-operation would thus be a review of legal and regulatory frameworks in region. This would entail a thorough analysis of their approach to private investment, tariff-setting principles, various interconnection issues and ways for harmonising energy regulations and standards throughout the SASEC region.

13.4.6 Back-to-back arrangements

As mentioned previously, we have a situation wherein Bangladesh is keen on importing electricity from Bhutan and Nepal. On the other hand, India is keen to utilise the hydroelectric potential in the Northeastern states. The needs of all these countries could be satisfied by a commercial entity (public or private), engaged in the business of electricity trading, setting up appropriate back-to-back arrangements.

The Four Borders Study prepared for the USAID-SARI Energy programme has identified that it is technically feasible to build transmission interconnection in the Four Borders area that would benefit all four countries in the region. By introducing an interconnection between Bangladesh, Bhutan, India, and Nepal, it will be possible

to plan a generation and transmission system expansion on a regional basis (Nexant 2001). Based on preliminary cost estimates, the study has identified the investment requirements for the various interconnection options to be in the range of US\$9.5 million to US\$52.4 million.

13.4.7 Lagged co-operation

Another option for co-operation could be lagged energy exchange arrangements between Bangladesh and India. Under such arrangements, Bangladesh could begin to provide gas to India for a stipulated period, in exchange for which India would be obligated to provide it with a contracted amount of energy in the future. Given Bangladesh's concerns about the size of its resources vis-à-vis the domestic demand and the development of new gas finds in India, this option could prove to be beneficial to both the countries. A detailed study needs to be carried out to assess the modalities of any such arrangements in terms of cost and to evaluate the discounted value of future benefits.

13.4.8 Assessment of externalities of regional energy co-operation

Energy is a fundamental input for economic growth, and access to reliable energy sources at reasonable cost is a critical factor for sustainable economic development. Energy co-operation in the SASEC region would not only reap several direct benefits but also several externalities in terms of indirect benefits associated with regional co-operation. Increased availability of modern means of energy for the vast rural population in the SASEC subregion, for example, will catalyse economic expansion, raise living standards and have implications for the large-scale environmental degradation, the costs of climate change and indoor pollution problems associated with the use of fuel wood. Moreover, there would be impacts on health, education and increased security of the region that need to be assessed. A thorough study is required to assess and quantify, to the greatest extent possible, various externalities associated with regional energy co-operation.

13.4.9 Joint research and development efforts

Another crucial area for possible co-operation in the region is joint research and development (R&D) efforts in the energy sector. There is much to be gained by all the countries through joint initiatives, from R&D efforts to product development to marketing of new and efficient technologies and policies suitable for these markets. India has been actively pursuing development of clean technologies. It has one of the world's largest programmes for renewable energy. Moreover, it has also made progress with waste-to-energy projects, bio-gasification and is now actively pursuing commercial development of bio-fuels. There is a need to undertake joint R&D initiatives to develop commercially viable and efficient technology options that would meet the growing energy needs of the region and increase self-sufficiency.

13.5 Conclusions

Given the similar socio-economic structure of SASEC countries and the convergence of the challenges faced by their energy sectors, there is a strong economic case for

exploring greater integration within the SASEC region. To meet the increasing pressures of the growing energy needs of the region it is paramount to have significant investments in energy infrastructure. At the same time, there is a need to optimally harness the vast resource base available in the region that would call for sound energy demand and supply management strategies. Regional sharing and planned use of available resources would address many of the growing energy security concerns and accelerate economic development of the region. At the same time, it would open a window of new opportunities through greater levels of cross-border trade and investments, larger markets and higher social stability in the region as a whole. Despite tremendous benefits to be derived out of regional co-operation, the region has had limited energy co-operation in the past. It is high time for policy-makers, civil society, NGOs and financing institutions to push for a greater integration of the SASEC energy sector. It is also critical for all stakeholders to recognise that delays in decision-making to ensure stronger and mutually beneficial co-operation efforts are associated with high costs, not only to the energy sector but for the development agenda of the region.

Note

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References

- Asian Development Bank (ADB) (2006), *Basic Statistics 2006*, ADB, Philippines.
- ADB (2009), *Energy Outlook for Asia and the Pacific*, ADB, Philippines.
- Census of India (2011), *Provisional Population Totals*, Office of the Registrar General & Census Commissioner, India, New Delhi.
- Central Electricity Authority (CEA), Ministry of Power, Government of India (2011), 'All India Electricity Statistics: General Review 2011'.
- CEA, Ministry of Power, Government of India (2013a), 'All India Power Supply Position'.
- CEA, Ministry of Power, Government of India (2013b), 'Indo- Nepal Cooperation in Hydro Power Sector'.
- Centre for Policy Dialogue (CPD) (2003), CPD CASAC regional workshop paper on 'Regional cooperation in South Asia: Nepal Perspective'.
- Department of Energy (DOE), Royal Government of Bhutan (RGoB) (2003), '2003–2022 Power System Master Plan'.
- Department of Energy (DOE), Royal Government of Bhutan (RGoB) (2009), 'Overview of Energy Policies of Bhutan'.
- Financial Express* (2006), 'India-Myanmar gas pipeline to bypass Bangladesh', 3 August 2006 available at: www.financialexpress.com/fe_full_story.php?content_id=136082.

- Government of India (2006), *Report of the Committee on Pricing and Taxation of Petroleum Products*, Petroleum Planning and Analysis Cell (PPAC), New Delhi.
- Government of India (2012), *Report of the Working Group on Power for 12th Five Year Plan*, New Delhi.
- Human Development Report (HDR) (2011), 'United Nations Development Program', available at: <http://hdr.undp.org/>
- International Energy Agency (IEA) (2004), 'Analysis of the impact of high oil prices on the global economy May 2004', available at: www.iea.org/textbase/papers/2004/high_oil_prices.pdf.
- Ministry of Water Resources, Government of India (2006), available at: <http://wrmin.nic.in/international/mkalitreaty.htm>.
- Misra, N, R Chawla, L Srivastava and RK Pachauri (2005), 'Petroleum pricing in India: balancing efficiency and equity', TERI.
- Nepal Electricity Authority (2011), 'A Year in Review. Fiscal Year 2010/11'.
- Nexant (2001), 'The four borders project: Reliability improvement and power transfer in South Asia, A pre feasibility study', prepared for USAID-SARI/ Energy Program.
- Obaidullah, ANM (2010), 'Integrated Energy Potential of South Asia: Vision 2020', SAARC Energy Centre, Islamabad.
- Planning Commission, Royal Government of Bhutan (RGoB) (2009), 'Tenth Five Year Plan'.
- Powerline (2004), 'Energy saving potential', *Powerline*, Vol. 9 No. 3, 24 November.
- Tamim, M and G Gulen (2004), 'Perils of Bangladesh Energy Value Chain Energy and Power'.
- TERI (2006), 'Hydropower Development in India: A Sector Assessment by TERI', prepared for ADB, 2006.
- TERI (2005), *TERI Energy Data Directory and Yearbook 2004/05*, TERI, New Delhi.
- TERI (2012), *TERI Energy Data Directory and Yearbook 2011/12*, TERI, New Delhi.
- The Daily Star* Bangladesh (2006), 'Tata suspends pursuing investment proposal', 10 July 2006, available at: www.thedailystar.net/2006/07/11/d6071101011.htm
- UNDESA (2013), *World Economic Situation and Prospects 2013*, available at: www.un.org/en/development/desa/publications/wesp2013.html.
- Water Resources Strategy (WRS) (2003), 'Nepal'.
- World Bank (2004), Report No. 28848-BD, available at: www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/05/17/000012009_20040517103546/Rendered/INDEX/288480BD.txt.
- World Bank (2012), *World Development Indicators 2012*, available at: <http://data.worldbank.org/data-catalog/world-development-indicators>.
- Ystgaard, OK (2005), 'Power Sector Investment Needs in a Selection of Developing Countries Being Partners in Norwegian Development Cooperation', Norconsult, Norway, November.