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## **Sustainable Energy for All in South Asia: Potential, Challenges, and Solutions\***

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## **Abstract**

Sustainable Energy for All (SE4ALL), a global initiative launched by the United Nations in 2011, has considerable relevance to the current energy situation in South Asia. In 2010, approximately 417 million people in South Asia lacked access to electricity, equivalent to more than a third of the world's population without access to electricity. The challenge of meeting energy demand is likely to get more complex, as it is growing to keep pace with the population growth and expanding economy. However, projected demand could be reduced substantially if energy efficient technologies are introduced and renewable energy potential is exploited. Regional cooperation and trade may also enhance energy security in the area; energy deficient economies could benefit by importing energy from neighbouring countries, and renewable resource rich countries could gain by attracting much needed capital investments to harness indigenous resources. This chapter describes the current energy scenario, highlights renewable energy potential in South Asian countries, discusses the challenges being faced in promoting energy efficiency and renewable energy, and recommends how governments, private sector, civil society and international development partners can contribute further to enhance access to more equitable, sustainable, and efficient energy throughout the region.

## **1. Introduction**

Access to clean and affordable energy has a cross-cutting role in the process of economic development of any society. Not only does it help spur economic growth, enhance job creation, and boost business activity, it also contributes to poverty eradication, food security, and environmental protection. In fact, experience has proven that access to modern energy is a requisite for achieving the Millennium Development Goals (UNDP 2013). Despite its undeniable relevance for socio-economic prosperity, there are still many regions struggling to meet energy demand. Millions of people are left in the dark and still dependent on traditional fuels to fulfil their basic energy needs. There is a need to promote the development of sustainable energy that meets present demand without compromising the needs of future generations. Cognizant of this gap, in 2011, the secretary-general of United Nations launched Sustainable Energy for All (SE4ALL) – a global initiative focusing on three main objectives: universal access to energy, doubling the rate of improvement of energy efficiency, and doubling the share of renewable energy in the global energy mix.

The pertinence of SE4ALL to the South Asian region<sup>1</sup> is substantial. As of 2010, 26% of South Asia's population did not have access to electricity. This totalled approximately 417 million people, which constituted more than a third of the 1.2 billion people worldwide without access to electricity. Furthermore, 62% of the region's population did not have access to non-solid cooking fuels in 2010 and were, therefore, forced to use other sources of fuel such as wood and coal, which have been proven to be deleterious to human health because they cause indoor air pollution (Portale and de Wit 2014).

Furthermore, the challenge is likely to get more complex as energy demand is growing to keep pace with an expanding population and economy. However, this demand could be reduced by 230 million tonnes of oil equivalent (Mtoe) and become more manageable if energy efficient technologies are introduced and renewable energy potential is exploited (ADB 2013). Regional energy trade could also be the key to energy security throughout South Asia. For example, Nepal alone has a hydropower potential of 83,000 MW. Even if energy demand increases at a rate of 10% in Nepal, domestic demand will reach only 3,500 MW by 2025, which is miniscule compared to the country's hydro-potential. This presents a lucrative opportunity for Nepal in terms of energy trade, which will also help enhance energy security of the South Asian region (Rahman et al. 2012). Apart from this aggregate position, the energy situation varies across different countries in the region.

This chapter aims to highlight South Asia's potential towards achieving SE4ALL goals, and recommendations for institutionalisation of SE4ALL through actions needed from various stakeholders, i.e. the national governments, private sector, international development partners and civil society. The following section will give an overview of SE4ALL and its benefits. Section 3 will summarise South Asia's socio-economic characteristics, while Sections 4 and 5 will shed light on South Asia's energy situation and the progress so far viz-a-viz the goals of SE4ALL. This will lead up to a discussion on regional energy trade in Section 6 and Section 7 on the challenges currently being faced, followed by Section 8 on policy recommendations.

## **2. Sustainable Energy for All**

### **2.1. Overview**

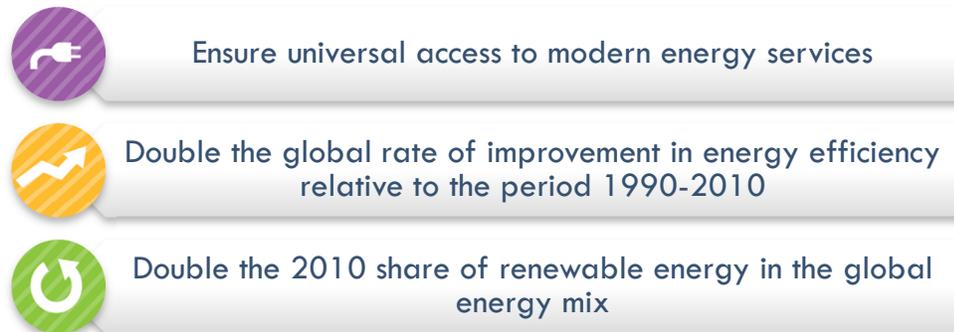
In 2011, the UN secretary-general launched a global campaign 'Sustainable Energy for All' (SE4ALL) to stimulate concrete international action towards granting more equitable, more sustainable and safer access to energy for all. It articulates a global vision under

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<sup>1</sup> This paper assumes that eight countries constitute 'South Asia': Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

which governments, civil society and the private sector must work together to achieve three intertwined goals by 2030.

Figure 1: SE4ALL Goals source: “Our Objective – Sustainable Energy for All”<sup>2</sup>



Countries, regions and stakeholders are encouraged to develop their own roadmaps to achieve these objectives according to their unique local and regional circumstances. Since the announcement of SE4ALL, about 85 developing countries have already opted in to the SE4ALL initiative, and multiple corporations have invested billions of dollars towards achieving its objectives (World Bank 2013; SE4ALL 2014). These goals are closely related and reinforce one another.

## 2.2. Benefits

The benefits of achieving these objectives are manifold and range from reducing poverty to mitigating macroeconomic instability.

Providing energy access can go a long way in achieving the Millennium Development Goals. It facilitates and opens up a variety of income generating activities, it provides lighting to cottage industries and shops, allows the refrigeration of perishable goods, delivers the power for pumping groundwater for crops, offers the mechanical energy for milling grain, etc. (UNDP 2013). The access to energy, hence, boosts the livelihood of poor families and helps push them towards a better standard of living.

Energy also has a profound impact on gender equality. In some developing countries the burden of collecting firewood falls mostly on women. The provision of modern energy can help save this valuable time and allow women to use it more productively. “In India, for instance, a typical woman spends 40 hours collecting fuel per month during 15 separate trips, many walking more than six kilometers round trip. This amounts to 30 billion hours spent annually” (UNDP 2013).

<sup>2</sup> <<http://www.se4all.org/our-vision/our-objectives>> accessed on May, 7, 2015

Energy access can also prevent the incidence of diseases. According to the World Health Organization (WHO), approximately 1.6 million deaths occur annually, mostly women and children, caused by household cooking fires and the inhalation of indoor smoke (WHO 2014). According to Epstein et al. (2013), the maternal use of 'high-pollution fuels' – coal, kerosene, and biomass – is significantly associated with increased chances of low birth weight and neonatal mortality as compared to the maternal use of low-pollution fuels. Improved access to energy also allows households to boil water and thus reduces the likelihood being inflicted by waterborne diseases. (IEA 2010).

Reducing dependence on non-renewable resources is not only environmentally friendly but also economical and sustainable. Dependence on fossil fuels makes countries more vulnerable to oil price shocks and can lead to macroeconomic instability. Focusing on renewable energy will not only elude such instability but also lead to substantial savings and an improvement in the balance of payments due to a reduction of high cost imports (such as oil). At a household level too, renewable energy will limit the use of expensive fossil fuels for motorized equipment and machinery, and augment savings (UNDP 2013).

Implementation of SE4ALL shall also help reduce losses through transmission and generation, and promote energy conservation. "Each additional \$1 spent on energy efficiency in electrical equipment, appliances, and buildings avoids more than \$2, on average, in energy supply investments" (SE4ALL 2012).

Table 1 below summarises the benefits associated with renewable energy.

**Table 1: Benefits of Renewable Energy**

<i>Type</i>	<i>Application</i>	<i>Mitigation Benefits</i>	<i>Adaptation Benefits</i>	<i>Socio-economic development Benefits</i>
<i>Biomass</i>	Electricity generation and heat	Reduced use of charcoal and fuel wood, less pressure on natural resources	Reduces the likelihood of deforestation and desertification	Creation of jobs and livelihood opportunities, reduced drudgery, reduction of incidents related to Indoor Air Pollution and respiratory infections
<i>Wind</i>	Power generation, Crop processing, irrigation, and water-pumping	Decreased dependence on wood/biogas, avoidance of CO <sub>2</sub> emissions	Reduced vulnerability to water scarcity, more adaptation choices through irrigated agriculture	Income generation, improved quality of life, reduced risks of vector borne-diseases, improved water supply/food security, school attendance (especially for girls), reduced migration
<i>Biogas Plants</i>	Thermal energy; Production of sludge for fertilizer	Reduced use of charcoal, fuel wood, and Liquefied Petroleum Gas; Reduced use of pesticides and fertilizers	Reduces the likelihood of deforestation; Adapting to soil erosion, aridity, and environmental degradation	Reduced drudgery, reduction of incidents related to IAP and respiratory infections; Better prospectus for agricultural productivity and income generation
<i>Solar Home Systems</i>	Cooking, lighting, and water heating	Less consumption of fuel wood, kerosene and batteries, improved local air quality	Illuminated studying and access to information and communication technology	Improved quality of life as well as better health and sanitation through streetlights and boiled water
<i>Microhydro</i>	Lighting, agricultural processing	Reduced greenhouse gases, protection of land	Improved social resilience	Improved health, greater school attendance

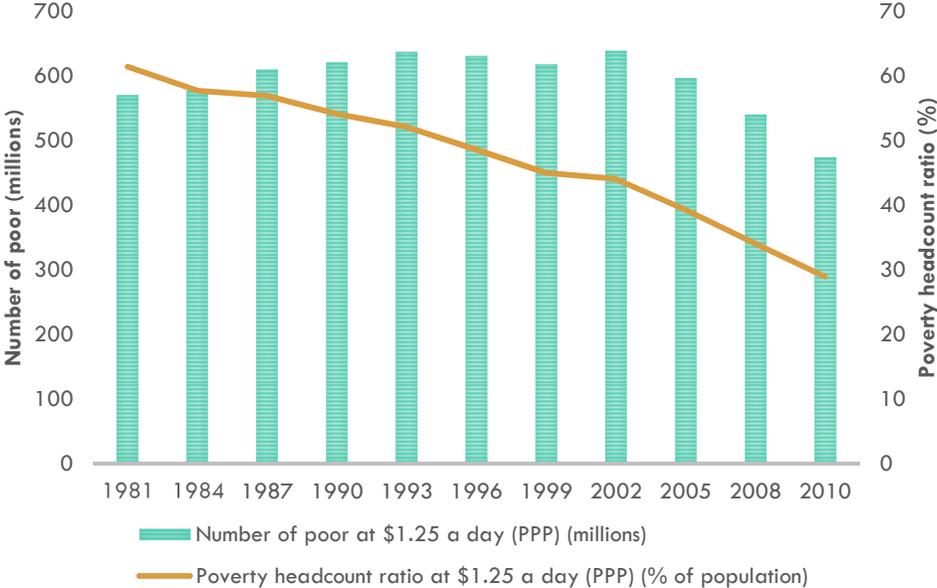
Source: UNDP (2013).

South Asia holds great potential for rapid progress in achieving the objectives of SE4ALL. According to the World Bank's Global Tracking Framework (2013), twenty high-impact countries in Asia and Africa (including five countries from the South Asian region) account for three quarters of those who use solid fuels for household cooking and heating, and two-thirds of those without access to electricity (World Bank 2013).

### 3. Socio-economic Profile of South Asian Region

South Asia is one of the fastest growing regions in the world. Regional Gross Domestic Product (GDP) growth has averaged at 6% for the past 20 years, and while the figure was below the average in 2013, it is projected to reach 6.4% in 2016 and take its place as the second fastest growing region in the world (World Bank 2014b). However, despite such encouraging figures, the facilities and services available in some South Asian countries, such as India and Pakistan, are inadequate to address the growing demands of their economy and population, thus increasing the strain on scarce resources and contributing to high poverty figures and a relatively low standard of living. While much progress has taken place over the past decades to tackle poverty (shown in Figure 1), about 493 million people in South Asia survived on less than USD 1.25 per day (PPP dollars) in 2010. This constituted 41.9% of the world’s poor in that year (PovcalNet Database).

**Figure 1: South Asia Poverty Estimates**



As can be gleaned from Table 2 below, a wide variation exists in the socio-economic profile of South Asian countries. Given the difference in land areas, a relevant indicator is population density – the number of persons per square kilometre of land. The density of population varied from 20 persons in Bhutan to 1,150 persons/square kilometre in Maldives in 2013. The per capita Gross National Income (on a PPP basis) fluctuated from USD 2,000 in Afghanistan to USD 9,890 in Maldives in 2013 (World Bank 2014a).

Human Development Index ratings illustrate that all South Asian countries, except for Sri Lanka, lag behind the global average of 0.702 (UNDP 2014). A similar trend can be observed regarding life expectancy, infant mortality, access to sanitation and education.

The Gender Inequality Index ratings (with 0 representing perfect gender equality; and 1 implying perfect inequality) are high in most countries in the region with the poorest rating belonging to Afghanistan (UNDP 2014). While Maldives and Sri Lanka seem to be ahead of the pack in human development and equality indices, much needs to be done to develop South Asia into a more egalitarian and developed society (World Bank 2014a).

**Table 2: Key Socioeconomic Indicators for South Asia**

Countries	HDI Index	Population Density (people per sq. km)	Population (in millions)	Life Expectancy at birth (years)	Under-weight children below 5 years (%)	Under Five Mortality Rate (per 1,000 live births)	Access to improved sanitation (%)
<b>Year</b>	2013	2013	2013	2013	2007-13	2013	2011
<b>Afghanistan</b>	0.468	47	30.6	60.9	..	97	29
<b>Bangladesh</b>	0.558	1203	156.6	70.7	36.8	41	56
<b>Bhutan</b>	0.584	20	0.8	68.3	12.8	36	46
<b>India</b>	0.586	421	1,252.10	66.4	..	53	35
<b>Maldives</b>	0.698	1150	0.3	77.9	17.8	10	99
<b>Nepal</b>	0.54	194	27.8	68.4	29.1	40	35
<b>Pakistan</b>	0.537	236	182.1	66.6	30.9	86	47
<b>Sri Lanka</b>	0.75	327	20.5	74.3	21.6	10	91
<b>Global average</b>	0.702	55	36.54	70.8	15	45.6	63
Countries	Education Index	Gender Inequality Index	GDP per capita (% growth)	GNI per capita (in PPP \$)	GINI coefficient	Access to electricity (% of population)	Access to non-solid fuel (% of population)
<b>Year</b>	2013	2013	2013	2013	2003-12*	2010	2010
<b>Afghanistan</b>	0.517	0.705	1.8	2,000	27.8	41	15
<b>Bangladesh</b>	0.556	0.529	4.7	2,810	32.1	55	9
<b>Bhutan</b>	0.689	0.495	3.3	7,210	38.1	72	60
<b>India</b>	0.650	0.563	3.7	5,350	33.9	75	42
<b>Maldives</b>	0.706	0.283	1.7	9,890	37.4	100	92
<b>Nepal</b>	0.689	0.479	2.6	2,260	32.8	76	18
<b>Pakistan</b>	0.428	0.563	4.3	4,920	30.0	91	36
<b>Sri Lanka</b>	0.756	0.383	6.4	9,470	36.4	85	25
<b>Global average</b>	..	0.450	--	--	..	83	59

Source: World Bank 2014a; Portale and de Wit 2014, UNDP 2014.

Access to electricity remains insufficient as 26% of the population is not connected to the grid in 2010 (Portale and de Wit 2014). With a rising projected GDP growth trend, South Asian countries must work to meet the accompanying increased energy demand as they develop their industrial, business, transport, and services sectors.

## 4. Energy Situation in South Asia

### 4.1. Current Energy Scenario

Energy supply and security are major challenges on the road to development in the South Asian region. Table 3 summarises total electricity production in 2011 and its sources, and total energy used and its constituents.

**Table 3: Electricity Production and Energy Use (2011)**

<i>Electricity Production</i>							
	<b>Electricity production (kWh billions)</b>	<b>Coal (% of total)</b>	<b>Natural gas (% of total)</b>	<b>Oil (% of total)</b>	<b>Hydropower (% of total)</b>	<b>Renewable sources (% of total)</b>	<b>Nuclear power (% of total)</b>
<i>Afghanistan</i>	..	..	..	..	..	..	..
<i>Bangladesh</i>	44.1	1.8	91.5	4.8	2	0	0
<i>Bhutan</i>	..	..	..	..	..	..	..
<i>India</i>	1,052.3	67.9	10.3	1.2	12.4	5	3.2
<i>Maldives</i>	..	..	..	..	..	..	..
<i>Nepal</i>	3.3	0	0	0.1	99.9	0	0
<i>Pakistan</i>	95.3	0.1	29	35.4	29.9	0	5.5
<i>Sri Lanka</i>	11.6	8.9	0	50.2	39.7	1.2	0

**Energy Use and Production**

	<b>Energy Consumed (million tons of oil equivalent)</b>	<b>Fossil Fuels* (% of total use)</b>	<b>Combustible renewable and waste ** (% of total use)</b>	<b>Alternative and Nuclear energy*** (% of total use)</b>	<b>Energy Produced**** (million tons of oil equivalent)</b>	<b>Energy Use- Energy Production (Mtoe)</b>
<i>Afghanistan</i>	..	..	..	..	..	..
<i>Bangladesh</i>	31.3	71.5	28.2	0.2	26.1	5.2
<i>Bhutan</i>	..	..	..	..	..	..
<i>India</i>	749.4	72.3	24.7	3	540.9	208.5
<i>Maldives</i>	..	..	..	..	..	..
<i>Nepal</i>	10.4	12.5	84.1	2.7	9	1.4
<i>Pakistan</i>	84.8	60.9	34.6	4.5	65.1	19.7
<i>Sri Lanka</i>	10.4	48.7	47.4	3.9	5.3	5.1

Source: (World Bank 2014a)

**Notes:**

\*Includes coal, petroleum, natural gas, and oil

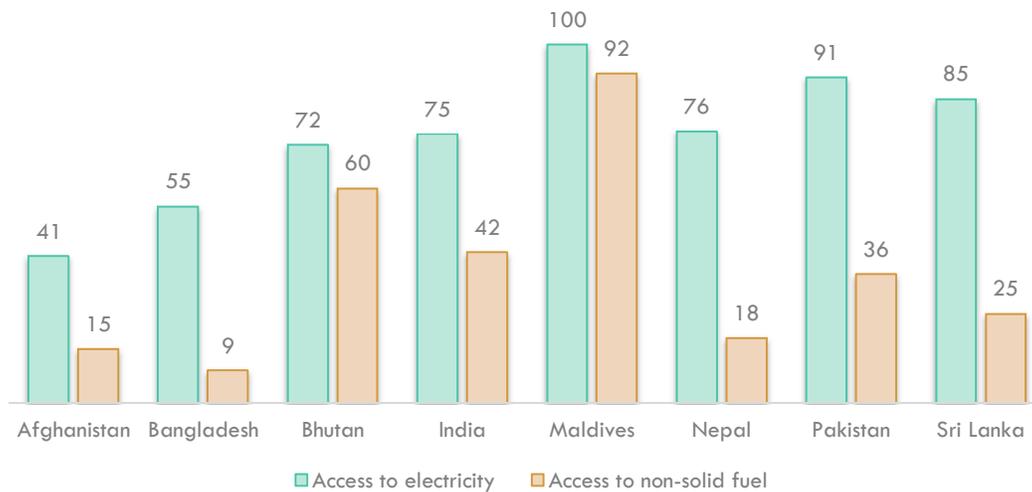
\*\*Includes solid biomass (such as firewood), liquid biomass, biogas, industrial waste, and municipal waste

\*\*\* Refers to clean energy that does not produce CO<sub>2</sub> gas. This includes geothermal, hydropower, solar power, and nuclear, among others.

\*\*\*\*Refers to forms of primary energy including petroleum, natural gas, solid fuel, combustible renewables and waste, and primary electricity.

The table above shows that many South Asian countries depend on a single source to provide more than 50% of total electricity generation including Bangladesh (natural gas-91.5%), India (coal-67.9%), Nepal (hydropower-99.9%), and Sri Lanka (oil-50.2%). Such dependence is not sustainable. For example, Bangladesh is unlikely to sustain economic activity beyond 2016 if its high consumption of natural gas remains unchanged (GoB, 2011). Energy use traces the total amount of energy consumed by the end user. This includes domestic production as well as imports, etc. While Indian and Pakistani consumers rely heavily on fossil fuels, a significant share of energy use in Nepal and Sri Lanka can be traced to combustible renewables and waste (which includes solid fuels such as firewood). Additionally, as of 2010, Maldives derived all its primary energy consumption from imported oil (ADB 2013). It is important to note that in many countries less than 5% of energy consumed came from renewable sources. The gap in total energy use and production is calculated in the last column.

**Figure 2: Access to Electricity and Non-Solid Fuels (% of Population)-2010**

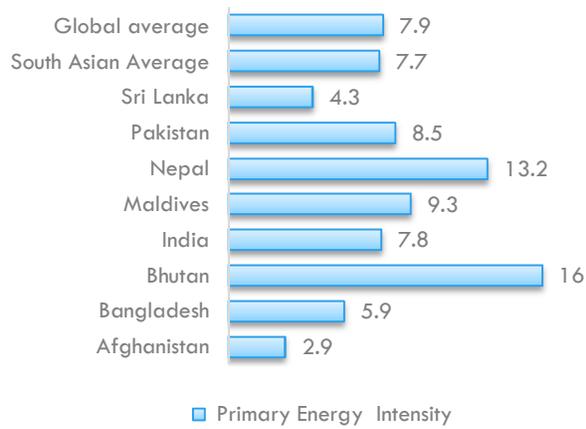


Source: Portale and de Wit 2014, page 3-4.

As shown in Figure 2, access to electricity (as percentage of population) varies from 41% in Afghanistan to 100% in Maldives in 2010. The average electrification rate in the region was 74%, which translated to 417 million people without electricity, constituting more than a third of the world's 1.2 billion people lacking access. Furthermore, access to non-solid fuels is low in the region, averaging at 38% in 2010. Hence, more than 1 billion people used solid fuel for cooking, compared to 2.8 billion world-wide. Access to non-solid fuel varies across countries in South Asia; Maldives, and Bhutan report high figures 92% and 60% respectively, above the global average of 59%, while Bangladesh reported a level of 9%.

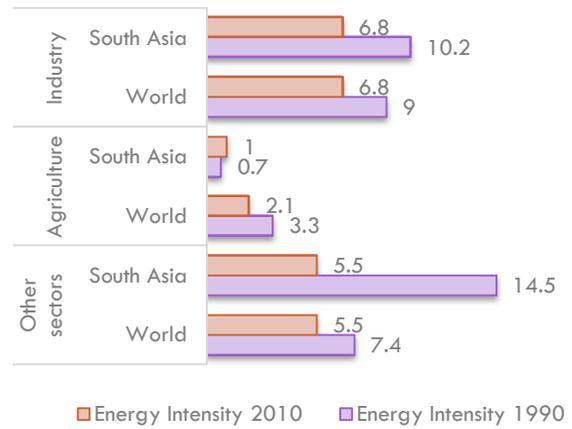
Energy efficiency has been gauged in this chapter using the measure of energy intensity. Figure 3 depicts an aggregate picture of energy intensity, where the South Asian average of 7.7 Mega Joules (MJ)/\$ was slightly behind the global average of 7.9 MJ/\$ in 2010 (Portale and de Wit 2014). The level for primary energy intensity has been used at an aggregate level so that trends in efficiency can be analysed at both the demand and supply side, and primary energy could also be accounted for. Figure 4 and 5 below shed light on trends in energy intensity in the region. Figure 4 indicates that energy intensity in the industry and other sectors – including residential, transport, and services – converged to global average levels, while energy intensity in the agricultural sector remained less than 50% of the global average.

**Figure 3: Level of Primary Energy Intensity in 2010 (MJ/\$2005 PPP)**



Source: Portale and de Wit 2014, page 7

**Figure 4: Energy Intensity across Sector (MJ/\$2005 PPP)**



Source: Portale and de Wit 2014, page 7

**Figure 5: Rate of Primary Energy Intensity Improvement CAGR (%)-1990 to 2010**



Source: Portale and de Wit 2014, page 7.

Figure 5 shows the rate of improvement in energy intensity. Within South Asia, Maldives is the only country, which experienced an increase in energy intensity, that too at a dramatic rate of 6.5% per year. All other countries showed a reduction in intensity, especially Afghanistan and Bhutan.

#### 4.2. Potential for Sustainable Energy for All in South Asia

The South Asian region has huge potential for renewable energy. Table 4 summarises the potential for hydro, solar, and wind power. Nepal alone has a hydropower potential of 83,000 MW, and even if energy demand increases at a rate of 10%, domestic demand will reach only 3,500 MW by 2025. This presents a lucrative opportunity for Nepal for energy trade that will also help in enhancing the energy security in the South Asian region as a whole (Rahman et al. 2012). Similarly, the massive wind power potential in Afghanistan and solar power potential in India can help the South Asian region go a long way in fulfilling its energy needs.

**Table 4: Renewable Energy Potential**

Country	Hydro Power Potential MW	Wind Power Potential MW	Solar Power Potential (Averages in kWh/m <sup>2</sup> /day)
Afghanistan	25,000	158,000	6.5
Bangladesh	330	..	5.0
Bhutan	30,000	..	4.0
India	150,000	102,778	5.0
Maldives	0	..	4.9
Nepal	83,000	..	4.0
Pakistan	59,000	131,800	5.3
Sri Lanka	2,000	24,000	5.0

Source: IRADe 2013; Sri Lanka 2012; Islam 2002; Renne et al. 2003; CWET (n.d), Elliot (2011), SARI/El (n.d)

#### 4.3. Projected Energy Demand in South Asia

Under the business-as-usual (BAU) case – which uses current trends in the development of renewable resources, the current level of technology applications, and existing policies on future energy choices and demand – projections for primary energy demand have been calculated for the future. These projections have been juxtaposed to an alternative scenario, which assumes the use of energy efficient technologies by generation plants and the end consumer, and the deployment of renewable and nuclear power based on current government plans (ADB 2013). The study suggests that if the alternate path is followed,

there is a potential for 230 Mtoe reduction in primary energy demand across South Asia. This is a 13.5% reduction from the BAU case.

**Table 5: Projected Primary Energy Demand**

	Projected Primary Energy Demand (BAU) (in Mtoe)	Projected Primary Energy Demand (Alternative case) (in Mtoe)
	2035	2035
<i>Afghanistan</i>	4.3	3.8
<i>Bangladesh</i>	77.6	68.8
<i>Bhutan</i>	1.7	1.46
<i>India</i>	1,441.6	1,239.2
<i>Maldives</i>	0.64	0.55
<i>Nepal</i>	16.6	16.3
<i>Pakistan</i>	145.8	130.9
<i>Sri Lanka</i>	20.3	17.5
<i>Total</i>	1,708.54	1,478.51

Source: Asian Development Bank (2013) Energy Outlook for Asia and the Pacific

Not only will total primary energy demand be greater in the BAU case, the share of fossil fuels in the primary energy mix is also likely to increase by 2035. Based on the aforementioned assumptions, the following projections have been made under the BAU scenario (ADB, 2013):

- The share of oil in **Afghanistan's** energy mix will reach 73.3% by 2035, which is almost double than what it was in 2010.
- The prevalence of oil in **Nepal's** energy generation shall rise to 12.4%. As Nepal does not have indigenous reserves, this upswing in demand will be met through imports.
- Natural gas will maintain its dominance in **Pakistan's** primary energy mix at 43.8% by 2035. As domestic production is expected to decline from the current 38.4 billion cubic meters (bcm) to 13 bcm by 2035, Pakistan will have to rely more on imported gas.
- **Maldives'** energy mix, which relies completely on imported oil, will not change substantially; the dominance of oil will be reduced slightly to 97.6%, while energy from solar, wind, and municipal waste will increase marginally to 2.4% by 2035.
- In **Sri Lanka**, coal demand will experience an incremental growth of 4.9 Mtoe from 2010 to 2035, and oil will remain as the dominant source of energy with 42.9% share in the primary energy mix.
- Coal will continue to constitute the largest share of the energy mix in **India**, followed by oil at 24.4%, and natural gas at 11.7% in 2035. Although India possesses indigenous reserves for all these fossil fuels, the increase in demand will outstrip domestic production leading to greater dependence on imports. The net import ratio for coal is likely to almost double that in 2010 to 33.2% by 2035. The net import ratio for oil is projected to be above 90%, and that for natural gas will rise from 19.5% in 2010 to 36.1% in 2035.

- **Bangladesh's** dependence on natural gas will be reduced to 35.5%, while the share of coal in the primary energy mix will grow to 24.2% compared to 2.0% in 2010. The share of renewables is likely to decline.
- In **Bhutan**, the use of fuels such as kerosene and liquefied petroleum gas (LPG) in household use is expected to grow due to a ballooning urban population and rising disposable incomes. The shares of oil and coal will also increase to 9.9% and 11.6%, respectively, in 2035 from the 2010 levels of 5.7% and 9.4%. However, hydropower is likely to decline from 43.8% in 2010 to 42.2% by the end of the overlook period.

Hence, under BAU conditions, it is likely that dependence on fossil fuels will increase by 2035. Not only is this a threat to macroeconomic stability – as it makes these countries more vulnerable to the fluctuating prices of fossil fuels – it will also contribute to increased CO<sub>2</sub> emissions which are detrimental for the environment. Increasing the share of renewable energy sources and introducing efficient technologies will reduce the overall energy demand, improve energy security, and spare the emission of GHGs.

## 5. Country Initiatives vis-à-vis Objectives of SE4ALL

Given the strong link between energy security and socio-economic development, South Asian countries are working to achieve the goals of SE4ALL at various levels. In Afghanistan, the government has initiated projects including North East Power System in 2006 and the Western Urban Energy Program. These projects are addressing energy needs through imports in the short-run and harnessing indigenous resource based power in the long-run by tapping hydro and wind power potential and establishing thermal and diesel based power plants (SARI/EI).

In Bangladesh, the government has issued a vision statement to provide electricity to all citizens by 2021. The Power System Master Plan 2010 outlined a time bound reform plan in this regard. The plan sets a mandatory energy efficiency target of 10% by 2015 (GoB 2012). Efforts to tap renewable energy potential are also ongoing. Programmes to improve the rice parboiling systems through which rice husks generate energy have commenced, and wind resource assessment programmes are in progress in the coastal areas of Bangladesh (GoB 2012).

The Royal Government of Bhutan (RGoB) intends to employ off-grid solutions to improve the electrification rate as per their 10th Plan. With regard to renewable energy, the country plans to take on large and small-scale projects to tap renewable resources. The RGoB has also prepared a draft Renewable Energy (RE) Policy and intends to develop a RE roadmap for each of the RE technologies by determining capacity, generation potential and cost of generation, and accordingly implement appropriate tariffs to incentivize private sector participation (RGoB 2012).

India is working to increase the access to electricity by improving Energy Efficiency (EE) and tapping renewable energy potential. The Energy Conservation Act of 2002 introduced energy consumption labels and performance standards for electrical appliances and made it mandatory for large energy consumers to conserve energy. The National Action Plan on Climate Change was geared towards attaining annual savings of at least 23 Mtoe, a cumulative electricity capacity addition of 19,000 MW by 2014-15. The government has planned to install renewable power capacity of 14,500 MW – out of which 10,500MW shall be from wind energy – as per their 11th plan (2007-2012) and aims to increase solar energy capacity to 20 GW by 2022 according to their 13th Five Year Plan (India Energy Efficiency Report 2011).

While Maldives had a 100% electrification rate in 2010, its power generation cost is the highest in South Asia at USD 0.30 per kWh (ADB 2013).The National Energy Policy was launched in 2005 with the goal to (i) increase access to more affordable energy, (ii) achieve carbon neutrality by 2020, (iii) promote energy conservation and efficiency, and (iv) promote Renewable Energy Technologies (RET), among others. To reduce carbon consumption, the goal is to achieve 50% energy supply by renewable sources by 2015, reduce GHG emissions by 50% by 2015, and reach energy saving of 7.5% of the final energy demand by 2020 (GoM n.d.).

The Nepali Government has taken multiple steps towards increasing access to greener, safer, and more efficient energy. The National Water Plan 2005, Ten-Year Hydropower Development Plan, 2009, Twenty Year Hydropower Development Plan 2009, and Three-Year Plan of 2013 are just a few examples of the initiatives undertaken by the Nepali government to tap the country's substantial hydropower potential. They also target to reduce the use of fuel-wood, install improved cook stoves, and replace incandescent bulbs with Compact Fluorescent Lamps (an energy saving alternative) (GoN 2013).

Pakistan has commenced multiple initiatives to increase the share of wind, solar, and hydropower in the energy mix. National Power Policy 2013 and Vision 2025 of the Government envisage considerable increase in access to energy and addition of clean energy in the national grid system. Supportive measures have resulted in creating an enabling environment and building confidence of investors, developers and lenders (GoP 2015). The Government is in the process of finalising the draft Pakistan Energy Efficiency and Conservation Act. The Act will include equipment performance standards, and shall cover key electrical and gas equipment and appliances. Private investment is also being incentivised to expand existing capacity to generate an additional 2,000 MW by 2016 (GoP 2014).

Like Bhutan, Sri Lanka is also using off-grid solutions to connect far-flung areas to the electricity grid. A mandatory energy labelling programme is being implemented with the goal of covering the most commonly used appliances by 2016. Code of Practice on Energy Efficient Buildings (2009) has been compiled to ensure energy efficiency features are included in the design and construction of large-scale buildings. National Energy Management Plan (2012-16) by the Government of Sri Lanka was drafted to further the cause of energy efficiency by establishing energy management cells, introducing standards and regulations, carrying out research and development, and rewarding achievements<sup>3</sup>. Regarding renewable energy exploitation, Sri Lanka is focusing on small-scale hydropower schemes and wind power projects (GoS 2012).

## **6. Regional Energy Trade**

Significant opportunities exist for energy trade due to the differing resource endowments, demand trends, and development needs among countries in the region. Potential exists for cooperation in the energy sector within South Asia, as well as with the neighbouring countries and regions. Energy resource surplus countries such as Nepal, Bhutan, Iran, and Central Asian economies could benefit from export-led growth, which would simultaneously meet demands in energy deficient countries such as India, Afghanistan, Pakistan and Bangladesh (World Bank 2008).

Regional energy trade in South Asia constitutes less than 5% of total trade within the region, and it is mainly limited to bilateral trade. India-Bhutan electricity trade began in 1974 with the construction of a hydroelectric plant in Bhutan – a joint project of the two countries – which allowed both countries to share the electricity produced. Gradually, trade in petroleum from India to Bhutan also commenced.

India-Nepal electricity trade started in 1971 given Nepal's immense hydropower potential. Such trade is an attractive option for both countries as Nepal is energy deficient in the dry season, but has an energy surplus in the wet season. Trade between the two countries is a step towards energy sustainability. Furthermore, joint ventures with India would help Nepal finance the high upfront costs of hydropower projects.

Trade in petroleum between India and Sri Lanka takes place through Lanka Indian Oil Corporation (IOC), Indian Oil's subsidiary in Sri Lanka. It operates to provide bulk supply to industrial users, carry out retail marketing of petroleum products, and establish petroleum storage facilities in Sri Lanka. Hence, trade with India not only helped ensure energy security but also

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<sup>3</sup> Sri Lanka Sustainable Energy Authority, source: [http://www.energy.gov.lk/sub\\_pgs/energy\\_managment.html](http://www.energy.gov.lk/sub_pgs/energy_managment.html) Date Taken May, 7, 2015

developed infrastructure for the home country at lower costs than would be possible if they operated independently (Rahman et al. 2012).

The first cross-border power connection between India and Bangladesh was completed in February 2014. The link connected the Western Grid of Bangladesh to Eastern India. The current transmission capacity is 500 MW but can be scaled up to 1,000 MW in the future (SIEMENS 2014).

Initiatives for regional energy cooperation are not new in the SAARC region. SAARC Inter-Governmental Framework Agreement (IFA) for energy co-operation was decided between SAARC nations to ease the electricity crisis in South Asia to realise the benefits of cross-border electricity exchange. Under the framework, SAARC member states have the provision to negotiate buying and selling terms, payment security mechanism, and tenure of power purchase agreement under normal commercial agreements. Similarly, national grid operators can jointly develop procedures for secure and reliable operations of the inter-connected grids, which include scheduling, transmission, energy accounting and settlement procedures for cross-border trades (Ahmed et al. 2011).

Furthermore, the 16th SAARC Summit held from 28-29 April 2010 in Thimpu, Bhutan, adopted a roadmap for the establishment of a regional market for electricity, based on India's proposal (Ahmed et al. 2011). In the first SAARC Energy Ministers' meeting held in Islamabad, the establishment of SAARC Energy Center (SEC) in Islamabad was recommended. The SEC is focused on advocating energy conservation and efficiency, and promoting the development of renewable and alternative energy in the region (SAARC Energy Center 2012).

More recently, all South Asian countries agreed on the establishment of a regional energy grid during the 18th SAARC Summit in November 2014. SAARC member states signed the framework agreement for sharing electricity through a common grid (Dawn 2014). The establishment of such a grid shall certainly go a long way to promote regional energy sustainability. While all countries have agreed on the basic idea of an electricity grid, the technicalities of realizing this objective still need to be resolved.

The potential for energy trade with Central Asian economies has also been an area of discussion to improve energy security in South Asia. Afghanistan exploited this potential and imported a total of 230.14 GWh of energy from Tajikistan, Turkmenistan, Uzbekistan, and Iran in FY 2006 (World Bank 2008). Turkmenistan-Afghanistan-Pakistan-India (TAPI) is a prospective project as Turkmenistan has the world's fourth largest natural gas reserves. Transporting that fuel through to India would do much to promote energy sustainability and security in the South Asian region.

Under the agreement, it is expected that Pakistan and India will receive 1.365 billion cubic feet of gas per day (bcfd), while Afghanistan shall get 0.5 bcfd. Negotiations are underway to discuss the construction of the pipeline (Bhutta 2014; Rahman et al. 2012).

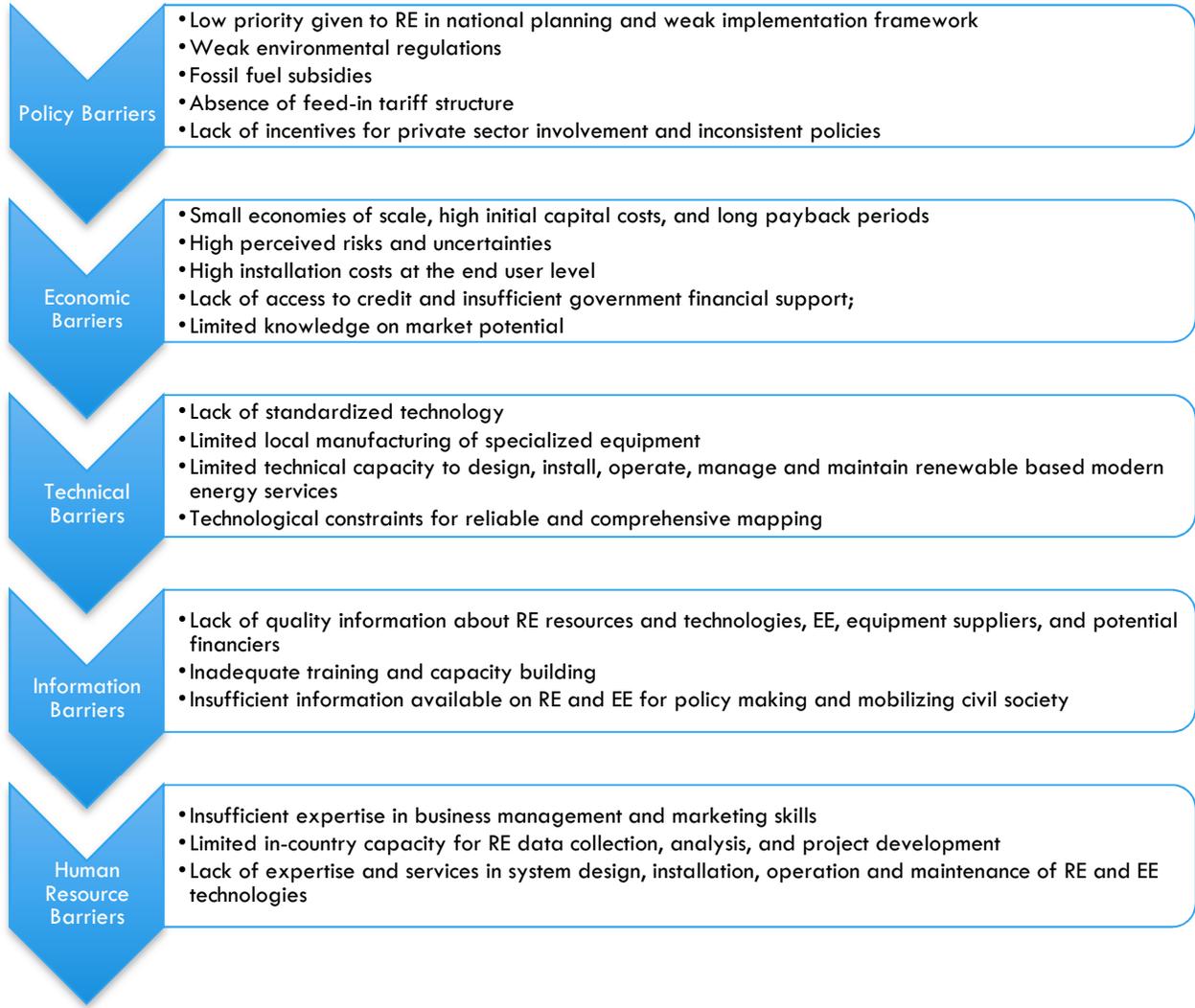
Additionally, Central Asia-South Asia 1,000 MW project, CASA-1000, involves the construction of more than 1,200km of electricity transmission lines and associated sub-stations to supply Pakistan and Afghanistan with hydropower from Tajikistan and the Kyrgyz Republic during summers. It aims to establish commercial arrangements for 1,300 MW of sustainable, regional electricity trade between the four countries (CASA-1000 2014; The News 2014). Central Asia Regional Economic Cooperation Programme began in 1997 as a partnership of 10 countries – Afghanistan, Azerbaijan, People's Republic of China, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan – supported by 6 multilateral entities, to promote regional cooperation in four priority areas: Transport, Trade Facilitation, Energy, and Trade Policy (CAREC 2013).

Other energy trade prospects include approaching Iran that has indigenous natural gas reserves of 971 trillion cubic feet (tcf), producing 3.5 tcf per year (tcf/y); oil reserves of approximately 132 billion barrels (bbl), producing 4.2 million bbl per year (bbl/y); and hydropower potential of 42,000 MW. Pakistan is already importing 39 MW of electricity from Iran to Balochistan and intends to increase power imports from Iran to 1,100 MW to meet demand in the port city of Gwadar (Rahman et al. 2012). Discussions are taking place regarding the Iran Pakistan Pipeline. However, it seems unlikely construction of the pipeline will take place unless US sanctions on Iran are lifted (The Express Tribune 2014).

## **7. Barriers and Challenges**

Despite the huge potential and benefits of promoting energy efficiency (EE) and increasing the share of renewable energy in the energy mix, there are obstacles at both the national and regional level, which must be overcome. One of the barriers is low investment in RE because it involves high initial capital costs, and the monetary benefits from such projects take time to materialize. There is also very limited knowledge regarding RE technologies (Bangladesh, 2012). At a political level, policies are often not conducive to business and do not incentivize private sector participation (Nepal 2013). A succinct collection of such issues have been highlighted in the figure below.

**Figure 6: Barriers and Challenges at a National Level**



Source: GoB 2012; RGoB 2012; GoN 2013; and GoS 2012.

While geopolitical and geographic constraints are not unconquerable, it is challenging to overcome these obstacles. Sensible and astute comprehension of current bilateral or multi-lateral trade game plans and the current limits of financial collaboration among the economies in the area is needed to develop feasible frameworks for energy trade. Particular attention must be given to India and Pakistan, to mitigate the distrust between the two nations because of their chequered past. The key here is to expand the existing bilateral framework for energy trade into a multi-lateral one, and work towards energy security and look into low-carbon solutions. Security concerns also impede regional energy trade. Political challenges include an agreement on the energy authority in the area, and deliberating options for energy trade with Central Asia and the Middle East to cover potential shortfalls in the SAARC region (Iqbal and Tabish 2012; Rahman et

al. 2012). 'Regional cooperation must address variables such as private sector participation, huge investment cost, affordability, political will, climate change, right of way and inaccessibility' (Iqbal and Tabish 2012, p. 4)

## **8. Recommendations for institutionalisation of SE4ALL in South Asia**

This section focuses on the roles of national governments, private sector, international development partners and civil society to promote the objectives of SE4ALL with respect to South Asian countries and the region as a whole.

### **8.1. The Role of National Governments**

#### *Top Level Commitment and Coordination*

National governments may express a strong commitment to achieve the goals of SE4ALL considering its wide-ranging impact on national economies and citizenry. Focal offices should be established at the federal/central level in each country, as there is a need to effectively coordinate between various agencies of national and sub-national governments. The same office may be declared as a liaison with international development partners, civil society and the private sector. Current and planned policies, programmes and projects may be reviewed to align them with the objectives of SE4ALL.

#### *Regional Benchmarking*

South Asian countries may share with each other the progress made towards achieving the objectives of SE4ALL. Successful initiatives by other countries may be taken as benchmarks for furthering the work of neighbouring countries in the same direction. Energy efficiency practices and standards are the most relevant areas in this regard as South Asian countries are struggling with improvement of energy inefficiencies on both demand and supply sides. By sharing ideas, they may address energy system losses and inefficient consumption at commercial and household levels. Energy regulators may consider regional benchmarks as one of the parameters for determining the cost plus tariffs for energy generation, transmission and distribution. Similarly, the comparative analysis of legislations and policies relating to demand side energy efficiency and conservation may be carried out in order to progress in this direction.

#### *Public Sector Energy Conservation Audit*

National governments may conduct third party energy conservation audits of all public sector organisations. This would convey a strong signal to the masses about the concern of

their respective governments towards energy conservation. Subsequently, concrete action plans may be developed, which should entail the gradual improvement in energy conservation through time bound and quantifiable key performance indicators (KPIs). The public sector can save substantial resources through this initiative and set a trend to be followed by private businesses and households in each nation.

#### *Promotion of Microfinance for Off-Grid Solutions*

Central banks may be assigned the task to develop frameworks to promote off-grid solutions for poverty stricken remote areas of the country. The costs associated with the development of transmission and distribution networks, especially in mountainous and other such remote parts, are huge and it is, therefore, advisable to promote off-grid solutions. The availability of microfinance for this purpose may contribute significantly to the promotion of off-grid solutions.

#### *National Energy Research Agenda*

Each country should prepare a national energy research agenda to be pursued by academia and other scientific research organizations. There is a tremendous need to foster research culture to develop cost-effective home grown solutions for renewable technologies, energy efficient appliances and energy conservation practices. The national energy research agenda may focus on these areas and progress may be incentivised by linking it with the public sector financing.

#### *Developing Energy Sector Markets*

Experiences have shown that the public sector alone cannot keep pace with the growing demands of investment in energy infrastructure. IEA (2011) has estimated that the global investment in energy infrastructure should be increased by 3% to achieve universal energy access by 2030. Hence, there is an urgent need to attract private sector investment in energy sector. Many countries have taken steps in this regard. There is a need to develop markets for energy trade within countries through public and private sector investors.

To this end, energy financing mechanisms, which are presently dependent on soft funding such as grants, need to be improved and commercial capital needs to be supported. This requires a robust regulatory framework, good governance and consistency in energy sector policies. Respective governments should a) restructure government owned utilities and introduce corporate governance in these companies, b) promote regional grid

integration leading to energy trade, c) establish feed-in mechanisms, d) invest in infrastructure, and e) incentivise private investment.

Stringent regulation in the energy sector may also help enhance energy efficiency standards in the market. There is also a need to build capacities of energy regulators in terms of technical knowledge of global developments in the energy sector including renewables.

#### *Increase Renewable Energy Share*

Doubling the share of renewable energy is one of the main components of SE4ALL. Numerous policy mechanisms have been adopted by the governments in the developed world to increase the share of renewable energy, such as Renewable Portfolio Standards (RPS) and Feed-in Tariff (FIT). Utilities should increase the share of renewable energies while governments should improve power purchase agreement frameworks along with other policy tools, which will incentivise power producers to invest in renewable energies.

#### *Energy Efficiency and Conservation*

Sustainable Energy Utility, or SEU, Model may be evaluated for relevance to South Asian countries. SEU has emerged as a pioneer model to address demand-side energy efficiency problems. The SEU solves the problem of end-users dealing with a fragmented array of distributors, contractors, and energy services companies. It also helps secure finances for the provision of sustainable energy services. SEU Model operations may turn into an independent and financially self-sufficient entity to enhance energy efficiency and conservation, and deliver customer-based renewable energy to end users. The SEU is all-inclusive as it targets all fuels types and all sectors of society. The model diverges from supply-side and demand-side policies, which address only certain types of fuels or certain types of end users categories (Sustainable Energy Utility n.d).

## **8.2. International Development Partners**

#### *Aid Effectiveness and Coordination*

There is a need to enhance aid effectiveness and coordination for the promotion of SE4ALL in South Asia. World Bank, Asian Development Bank, United States Agency for International Development (USAID), Department for International Development (DFID), Japan International Cooperation Agency (JICA), Gesellschaft für Internationale Zusammenarbeit (GIZ) and other agencies may coordinate closely in order to move in a coherent and coordinated fashion. The overall energy programmes of each country may

be jointly discussed with the respective countries for clear demarcation of roles and investments by different agencies. Hence, overlapping may be avoided to achieve a higher value for investment.

#### *Technical Assistance for Energy Trade*

Development partners can play an effective role regarding support to South Asian countries in terms of technical assistance to pursue regional and international energy trade. Scenario mappings and energy modelling are essential for an informed and evidence-based decision-making process. Additionally, legal and financial advisory services may also be provided through technical assistance programmes. Energy trade models and practices in other regions of the world may also be examined for relevance to South Asia.

#### *International Private Investment*

Development partners may also assist South Asian countries mobilise international private investments in the energy sector through capital markets or direct investments. They can help build cases for attracting private sector investment.

#### *Capacity Development of Energy Sector Organisations*

International development partners may help countries in the process of capacity development of their energy sector organisations including relevant ministries, research bodies, public sector utility companies and energy sector regulators.

### **8.3. Private Sector**

#### *Energy Efficiency and Conservation*

The efforts for energy efficiency and conservation can reap high dividends through strong advocacy within the private sector, as private businesses constitute a large share of total energy consumption. Chambers of Commerce and Business Associations play a significant role in this regard. Governments, development partners and civil society may develop partnerships with the private sector in order to help them enhance energy efficiency and conservation.

#### *Partnership with Academia and Research Community*

Private sector energy producers and consumers should develop partnerships with academia and research organisations to uncover modern and innovative technological designs and operational processes to enhance energy efficiency and conservation. South

Asian countries may develop, sustain and strengthen such partnerships for long-term benefits and sustainable businesses.

#### *Investments in Energy Sector Infrastructure*

Relatively low investment in the energy sector in South Asia may be partially attributed to unpredictable regulatory structures, inconsistent policies interface with the public sector. Private sector will have to play a proactive role to address these challenges through constructive engagements with the public sector.

### **8.4. Civil Society**

#### *Advocacy*

During the last two decades, South Asia has observed a promising surge in participation of the civil society in different areas of national and international importance. Hence, civil society has become a strong voice that must be raised for furthering the cause of SE4ALL in South Asia. Civil society may advocate the potential benefits of SE4ALL by building constituencies to support and implement the initiative. Moreover, research activities by the civil society may facilitate evidence-based decision-making by players involved in the energy sector.

#### *Independent Monitoring and Evaluation*

Civil society organisations may carry out independent monitoring and evaluations to assess the progress and pace of execution of SE4ALL in different countries. This will build pressure on participating agencies to remain on track and deliver results. These evaluations may also feed into policy making processes and project designs by public, private, international and civil society organizations.

#### *Regional Catalyst*

Civil society organisations are prominent in the South Asian region and can, therefore, act as catalysts to achieve the objectives of SE4ALL. Sustainable Development Policy Institute (SDPI) in Pakistan and The Energy and Resources Institute (TERI) in India have the capacity and motivation to champion this initiative in South Asia – at a national and regional level. They may strengthen partnerships across the region in order to promote sustainable energy throughout the region.

### **8.5. Regional Focus**

#### *Energy Exchange and Trade*

Energy trade between the South Asian countries is one of the policy recommendations to increase energy access and security in the region. Regional energy trade and co-operation may be advanced by individual national governments. Despite substantial trade potential, South Asia is one of the least connected regions in the world. The pressing matter of addressing energy needs through trade may motivate the countries to engage in multilateral energy trade. Energy trade may emerge as a cornerstone of regional integration and connectivity. South Asia is also advantageous in terms of its close proximity with natural resource rich Central Asia. There is a need to complete the ongoing energy trade projects expeditiously and initiate dialogue for further potential in this regard. Domestic energy market reforms will play a key role in facilitating energy trade within South Asia and with neighbouring regions and countries. The recommendations of “SAARC Energy Trade Study” (SRETS 2010) for the promotion of regional energy market may be deliberated in depth by the participating countries.

#### *SAARC Development Fund (SDF)*

SDF's component on energy infrastructure may be strengthened in terms of funding and focus on SE4ALL. The UNDP may carry out the deliberations with SDF for enhancing its capacity and financing to undertake initiatives relating to SE4ALL. South Asian countries and other interested investors may pool up resources to this fund.

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