Study to Assess Renewable Energy Development in South Asia; Achievements and the Way Forward in the Perspective of Policies and Investment Opportunities

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Table of Contents

Foreword

In pursuance to the recommendations of 2nd Meeting of the Expert Group on Renewable Energy held in Islamabad on 11-12 June 2014, it was agreed that SAARC Energy Centre shall carry out a study in the FY-2015 on the assessment of Renewable Energy development in South Asia. Subsequently, an in-house study was carried out by Mr. Ahsan Javed, Research Fellow (Renewable Energy) to analyze Renewable Energy policies and programmes being carried out by the SAARC Member States, identify barriers and suggest measures for the promotion and development of Renewable Energy technologies and projects in the SAARC Region. It also identifies the available fiscal, non-fiscal measures and other incentives existing in the Member States, including their impact, and made appropriate recommendations. Moreover, the study also suggests way-forward for acquiring part funding for Renewable Energy projects through available Regional and International Climate Change funding mechanisms.

All Member States in SAARC region have huge and abundant resources of renewable energy which have not been harnessed to their actual potential. However, a few Member States have adopted various policies and implemented national programmes/projects of renewable energy in their respective countries. In this report, a number of potential barriers in deployment of Renewable energy Technologies in Member States have been mentioned, and measures for removal of these have been discussed. In South Asia, the deployment of Renewable Energy Technologies on a large scale shall provide increased energy security, less import of fossil fuel and usage of environmental friendly technologies.

I commend the efforts of Mr. Ahsan as this important research study will complement the overall mission of SAARC Energy Centre to mitigate energy poverty by using Renewable Energy Technologies within and across South Asia for a better tomorrow.

(Muhammad Naeem Malik)
Director
SAARC Energy Centre

List of Abbreviations

AEDB	Alternative Energy Development Board
AEPC	Alternative Energy Promotion Centre
AHEC	Alternate Hydro Energy Center
AKRSP	Aga Khan Rural Support Programme
ANDS	Afghanistan National Development Strategy
ANREP	Afghanistan National Renewable Energy Policy
ASPIRE	Accelerating Sustainable Private Investment in Renewable Energy
BEA	Bhutan Electricity Authority
BERC	Bangladesh Energy Regulatory Commission
BPC	Bhutan Power Corporation Limited
BPDB	Bangladesh Power Development Board
BREB	Bangladesh Rural Electrification Board
CCS	Carbon Capture and Sequestration
CDM	Clean Development Mechanism
CEB	Ceylon Electricity Board
CER	Certified Emission Reduction
CERC	Central Electricity Regulatory Commission
COD	Commercial Operations Date
CPPAGL	Central Power Purchasing Agency Guarantee Limited
DABS	Da Afghanistan Breshna Sherkat
DGPC	Druk Green Power Company
DISCO	Distribution Companies
DISCOMS	Distribution Companies
DOED	Department of Electricity Development
DPR	Detailed Project Reports
DRE	Department of Renewable Energy
EC	Energy Conservation
ECB	External Commercial Borrowings
EE	Energy Efficiency
EEZ	Exclusive Economic Zone
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement, Construction
ESMAP	Energy Sector Management Assistance Program
FDI	foreign direct investment
FIT	feed-in tariff

GCF	Green Climate Fund
GEEREF	Global Energy Efficiency and Renewable Energy Fund
GEF	Global Environment Facility
GHG	Greenhouse Gases
Hydel	Hydroelectric
IA	Implementation Agreement
ICS	Improved Cooking Stoves
IDCOL	Infrastructure Development Company Limited
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency Limited
IROA	Islamic Republic of Afghanistan
JNSM	Jawaharlal Nehru National Solar Mission
KfW	Kreditanstalt für Wiederaufbau
LECO	Lanka Electricity Co. (Pvt) Ltd.
MEA	Maldives Energy Authority
MEE	Ministry of Environment and Energy
MGF	Maldives Green Fund
MNEPS	Maldives National Energy Policy and Strategy
MNRE	Ministry of New and Renewable Energy
MoEA	Ministry of Economic Affairs
MPEMR	Ministry of Power, Energy & Mineral Resources
MRRD	Ministry of Rural Rehabilitation and Development
MW	megawatt
n/a	Not Available
NAMA	Nationally Appropriate Mitigation Actions
NBMMP	National Biogas and Manure Management Programme
NEA	Nepal Electricity Authority
NEPRA	National Electric Power Regulatory Authority
NGO	Non-governmental organization
NIWE	National Institute of Wind Energy
NREL	National Renewable Energy Laboratory
NRREP	National Rural and Renewable Energy Programme
NSP	National Solidarity Programme
NTDCL	National Transmission and Despatch Company Limited
PCRET	Pakistan Council for Renewable Energy Technologies
PGCB	Power Grid Company of Bangladesh Ltd
Power Grid	Power Grid Corporation of India

PPIB	Private Power Infrastructure Board
PUCSL	Public Utilities Commission of Sri Lanka
PV	Photovoltaics
RE	Renewable Energy
REC	Rural Electrification Corporation Ltd
RERED	Renewable Energy for Rural Economic Development
RETs	Renewable Energy Technologies
RGoB	Royal Government of Bhutan
ROE	Return on Equity
RPO	Renewable Purchase Obligation
RREP	Rural Renewable Energy Policy
SAARC	South Asian Association for Regional Cooperation
SEC	SAARC Energy Centre
SERCs	State Electricity Regulatory Commissions
SHP	Small Hydro Power
SHS	Solar Home Systems
SLSEA	Sri Lanka Sustainable Energy Authority
SME	Small and Medium Enterprises
SREDA	Sustainable and Renewable Energy Development Authority
STELCO	State Electric Company Ltd
SNAs	State Nodal Agencies
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value-added tax
WEC	Wind Energy Converter

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I am very grateful to several individuals and organizations from SAARC Member States for their cooperation and support during the course of this study. This study would not have been completed without their contribution.

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Finally, I am very thankful to Mr. Muhammad Naeem Malik, Director of SAARC Energy Centre for his support, guidance and for providing me the opportunity to embark on this study report.

Executive Summary

South Asia is endowed with abundant resources of Renewable Energy (RE) yet all the Member States of the region are facing acute shortage of energy. In the past, Member States by realizing the potential of Renewable Energy Technologies (RETs) had taken vigorous initiatives for its promotion and development. There were national and state level off-grid programmes/ projects using Solar (PV), Small hydro Power (SHP) and Bioenergy technologies. The Member States also undertook and implemented grid connected projects using mostly Solar (PV) and WEC with the aim to diversify their national energy mix and adopting environmentally friendly technologies.

The Member States have enacted national/provincial/state level policies, strategies and action plans with specific targets for each RE technology. The availability of requisite legislation helped the proliferation of RE based on-grid projects, increased electrification of rural areas through mini-grid/community based projects and off-grid stand-alone solutions.

The development and deployment of RE in Member States is hampered by a number of barriers. The investments in RE sector can be augmented by taking specific measures for removal of those barriers. All Member States have offered various types of economic and non-economic incentives to the public/private sector through targeted policies and strategies for accelerating the deployment of off-grid and on-grid RETs. The enabling environment created by different type of initiatives in the Member States was directly responsible for increased share of RE in the energy mix of Member States.

There is much to be gained for Member States in various areas of policy, regulation, projects with success stories and knowledge dissemination through cooperation within region. Also, there are countless benefits to achieve from the cooperation by expanding the development process to consider the inter-regional level. One of the major objectives of the SAARC is to promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields. In the RE sector, this can be achieved by close interaction and collaboration among the technical institutes of Member States working in the field of RE research and development, and joint/regional projects.

It has been observed that Member States are finding it very difficult to arrange funding for RE projects as most of the projects are capital intensive and with high upfront costs. The various funding mechanisms discussed in detail in Chapter 7 may help Member States in identifying the

available Regional and International Climate Change Funding mechanisms for acquiring part funding of RE projects and programmes in their respective countries.

This report consists of eight chapters. Chapter 1 gives the introduction of RE in Member States; Chapter 2 gives an overview of institutional structure of power sector in each Member State; Chapter 3 provides salient features of RE policies, projects and programmes in SAARC Region; Chapter 4 identifies various barriers and recommends measures for rectification; Chapter 5 gives details on the economic and non-economic incentives offered by the Member States; Chapter 6 gives recommendations for intra-regional and inter-regional cooperation for promotion of RE; Chapter 7 gives suggestions for regional cooperation and institutional partnerships in capacity building; Chapter 8 mentions Climate Change funding mechanisms and specific funds for part funding of projects in Member States.

Background

The global renewable energy (RE) markets have evolved rapidly over recent years motivated by the spirit to improve energy security, to protect the environment from the burning of fossil fuels, and to create green jobs. By the end of 2011, RE, including hydropower, comprised more than 25% of the world's power capacity (which was estimated at 5,360 Gigawatts in 2011) and supplied around 20.3% of global electricity.[1] Asian countries, particularly China, India, and Japan, are among the leading players in RE investment.

The development of RE in SAARC Region faces various barriers. One is the economic barrier, which relates to the relative higher cost of modern RETs compared with conventional energy technologies. The extent of this barrier varies from country to country, depending on the country's RE resource characteristics and local fuel prices. Other barriers which are equally important can be grouped as non-economic barriers. These include regulatory and policy uncertainty; administrative barriers such as slow or non-transparent approval processes; market barriers such as subsidies for fossil fuels; financial barriers; infrastructure barriers; lack of awareness, skilled personnel, and public acceptance.[2]

RE also provides an option for rural electrification. In isolated or remote rural areas with no access to electricity, extension of the national grid is not feasible. One of the technologies, Solar Home Systems (SHS), has already been used to provide electricity to rural households among SAARC countries. Combined with micro grids, biomass and biogas power generation or small hydro power stations are a clean solution for electrification on the village scale.

Early in the diffusion of renewable technologies, overcoming the economic barrier is often given higher priority. The cost of renewable technologies will decrease as the local market matures and with economies of scale. The supporting policies need to evolve accordingly as the effects of non-economic barriers emerge. The most commonly applied RE support mechanisms are feed-in tariffs (FIT) and renewable portfolio standard (RPS), which are often accompanied by tradable green certificates. However, both the FIT and the RPS mechanisms need to be implemented in conjunction with other support policies to deliver results.

[1] Global Status Report, Renewables 2012, REN21
[2] Policy considerations for deploying Renewables, IEA, 2011

Chapter - 1

1. Introduction

South Asia is endowed with abundant resources of RE yet all the Member States of the region are facing acute shortage of energy. The electricity supply shortages in rural areas and during peak times in urban areas have hampered the economic growth of Member States. The over reliance of many Member States on imported fuel such as coal, oil and LNG for generating electricity puts energy security at risk and was witnessed during increased oil prices in 2008.

In the past, Member States by realizing the potential of RE had taken vigorous initiatives for its promotion and development. There were national and state level off-grid programmes/projects using Solar (PV), Small hydro Power (SHP) and Bioenergy technologies. These programmes were mostly implemented for providing electricity in remote and far flung areas where extension of electrical transmission lines is not economically/technically feasible. The Member States also undertook and implemented grid connected projects using mostly Solar (PV) and WEC with the aim to diversify their national energy mix and adopting environmentally friendly technologies. The list of installed RE projects (off-grid and on-grid) using Solar (PV), WEC, SHP and Bioenergy in Member States are mentioned in Table 1 below:

Table 1: Installed Capacity of RE projects in Member States

Member State	Solar (PV) (MW)		Wind (MW)	SHP (MW)[3] [4]	Bioenergy (MW)[5]	
	Off-grid	on-grid	on-grid	off-grid	on-grid	off-grid
Afghanistan[6]	1.8	1	n/a	36.9	n/a	n/a
Bangladesh[7]	177	n/a	2	n/a	n/a	6[8]
Bhutan	n/a	n/a	n/a	9	n/a	n/a
India[9]	302	5,248	25,188	4,204[10]	4,887	927
Maldives[11]	1	n/a	n/a	n/a	n/a	n/a
Nepal[12]	7	n/a	n/a	70	n/a	n/a
Pakistan[13]	80	100	306	272	314[14]	n/a
Sri Lanka[15]	5	1.4	124	293[16]	23.5	n/a

It is however, felt that the actual potential still remains unharnessed in the Member States and RETs can play a vital role in providing sustainable energy services. This study report excludes big hydro projects and is focused exclusively to small hydro power (SHP) projects with a maximum installed capacity limit ranging between 10-50 MW. The classification of higher limit of SHP national standard varies from country to country. This study report may be helpful to policy makers, decision makers, regulators, practitioners and researchers working in the field of RE and rural energy supplies.

[3] Data for SHP for all countries except Afghanistan, India and Sri Lanka were taken from World Small Hydro Power Development Report by UNIDO, 2013

[4] Classification of SHP projects varies from country to country with maximum installed capacity limit ranging between 10-50 MW

[5] Bioenergy statistics here excludes traditional biomass use (cooking and heating purpose)

[6] Afghanistan Renewable Energy Database, Minister of Energy and Water website, Kabul (accessed on 15.12.2015)

[7] Power Cell, Ministry of Power, Energy & Mineral Resources website, Dhaka (accessed on 15.12.2015)

[8] Present Status, Sustainable & Renewable Energy Development Authority website,Dhaka(accessed on 15.12.2015)

[9] Physical progress (Achievements), MNRE website, New Delhi (accessed on 15.12.2015)

[10] This includes installed capacity of on-grid SHP (4187 MW) and off-grid SHP (17 MW)

[11] Maldives SREP Investment Plan 2013-2017, Ministry of Environment and Energy

[12] Alternative Energy Promotion Centre website, Nepal (accessed on 15.12.2015)

[13] Alternative Energy Development Board website, Islamabad (accessed on 15.12.2015)

[14] Renewable Energy Capacity Statistics 2015, IRENA

[15] Long Term Generation Expansion Plan 2015-2034, CEB, Sri Lanka

[16] In Sri Lanka, Mini-hydro connected to national grid is 293 MW and is included in RE

Chapter - 2

2. Overview of Renewable Energy Power Sector in SAARC Region

In South Asia, each Member State has a unique institutional structure of RE sector that was established to satisfy local requirements. The Member States by realizing the importance of Renewable Energy (RE) had set up dedicated institutional arrangements for promotion and development of Renewable Energy Technologies (RETs). The RE sector institutional arrangements in Member States are summarized in below mentioned table 2 and detailed overview of each institutions is explained later:

Table 2: RE institutions in SAARC countries

Country	Ministry	Federal Institute	Regulator	Financing Institute
Afghanistan	Ministry of Energy and Water	Renewable Energy Department	Ministry of Energy and Water	Non-existent
Bangladesh	Ministry of Power, Energy & Mineral Resources	Sustainable and Renewable Energy Development Authority	Bangladesh Energy Regulatory Commission	Infrastructure Development Company Limited
Bhutan	Ministry of Economic Affairs	Department of Renewable Energy	Bhutan Electricity Authority	Non-existent
India[17]	Ministry of New and Renewable Energy	Energy Efficiency & Renewable Energy Management Centre	Central Electricity Regulatory Commission	• Indian Renewable Energy Development Agency Limited • Rural Electrification Corporation Ltd
Maldives	Ministry of Environment and Energy	State Electric Company Ltd	Maldives Energy Authority	Non-existent
Nepal	Ministry of Energy	Alternative Energy Promotion Centre	Nepal Electricity Authority	Non-existent
Pakistan[18]	Ministry of Water	Alternative	National Electric	Non-existent

[17] RE sector institutional arrangement in States/Union Territories of India are mentioned in table 2(a)

	and Power	Energy Development Board	Power Regulatory Authority	
Sri Lanka	Ministry of Power and Energy	Sri Lanka Sustainable Energy Authority	Public Utilities Commission of Sri Lanka	Non-existent

Table 2 (a): RE institutions in States/Union territories of India

No.	State/ Union Territory	State Nodal Agency	Regulator
1.	Andhra Pradesh	New & Renewable Energy Development Corporation of Andhra Pradesh (NREDCAP) Ltd.	Andhra Pradesh Electricity Regulatory Commission
2.	Arunachal Pradesh	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh Electricity Regulatory Commission
3.	Assam	Assam Energy Development Agency	Assam Electricity Regulatory Commission
4.	Bihar	Bihar Renewable Energy Development Agency	Bihar Electricity Regulatory Commission
5.	Chhattisgarh	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh State Electricity Regulatory Commission
6.	Delhi	Energy Efficiency & Renewable Energy Management Centre	Delhi Electricity Regulatory Commission
7.	Gujarat	Gujarat Energy Development Agency (GEDA)	Gujarat Electricity Regulatory Commission
8.	Haryana	Haryana Renewal Energy Development Agency (HAREDA)	Haryana Electricity Regulatory Commission
9.	Himachal Pradesh	Himachal Pradesh Government Energy Development Agency (HIMURJA)	Himachal Pradesh Electricity Regulatory Commission
10.	Jammu and Kashmir	Jammu & Kashmir Energy Development Agency (JAKEDA)	Jammu & Kashmir Electricity Regulatory Commission
11.	Jharkhand	Jharkhand Renewable Energy Development Agency	Jharkhand Electricity Regulatory Commission

[18] RE sector institutional arrangement in provinces of Pakistan are mentioned in table 2(b)

12.	Karnataka	Karnataka Renewable Energy Development Agency Ltd.	Karnataka Electricity Regulatory Commission
13.	Kerala	Agency for NonConventional Energy and Rural Technology (ANERT)	Kerala Electricity Regulatory Commission
14.	Madhya Pradesh	MP UrjaVikas Nigam Ltd.	Madhya Pradesh Electricity Regulatory Commission
15.	Maharashtra	Maharashtra Energy Development Agency (MEDA)	Maharashtra Electricity Regulatory Commission
16.	Manipur	Manipur Renewable Energy Development Agency (MANIREDA)	Joint Electricity Regulatory Commission for the States of Manipur & Mizoram
17.	Mizoram	Zoram Energy Development Agency (ZEDA)	
18.	Meghalaya	Meghalaya Non-conventional & Rural Energy Development Agency	Meghalaya State Electricity Regulatory Commission
19.	Nagaland	Department of New and Renewable Energy	Nagaland Electricity Regulatory Commission
20.	Odisha	Odisha Renewable Energy Development Agency	Orissa Electricity Regulatory Commission
21.	Punjab	Punjab Energy Development Agency	Punjab State Electricity Regulatory Commission
22.	Rajasthan	Rajasthan Renewable Energy Corporation Limited	Rajasthan Electricity Regulatory Commission
23.	Sikkim	Sikkim Renewable Energy Development Agency	Sikkim State Electricity Regulatory Commission
24.	Tamil Nadu	Tamil Nadu Energy Development Agency (TEDA)	Tamil Nadu Electricity Regulatory Commission
25.	Telangana	New & Renewable Energy Development Corporation of Telangana Ltd.	Telangana State Electricity Regulatory Commission
26.	Tripura	Tripura Renewable Energy Development Agency	Tripura Electricity Regulatory Commission
27.	Uttar Pradesh	Non-conventional Energy Development Agency (NEDA)	Uttar Pradesh Electricity Regulatory Commission
28.	Uttrakhand	Uttrakhand Renewable Energy (UREDA) Development Agency	Uttarakhand Electricity Regulatory Commission
29.	West Bengal	West Bengal Renewable Energy Development Agency	West Bengal Electricity Regulatory Commission

30.	Goa	Goa Energy Development Agency	Joint Electricity Regulatory Commission for the state of Goa and Union Territories
31.	Andaman & Nicobar Islands	Electricity Department	
32.	Chandigarh	Chandigarh Renewal Energy and Science & Technology Promotion Society (CREST)	
33.	Dadra & Nagar Haveli	Electricity Department	
34.	Daman & Diu	Electricity Department	
35.	Lakshadweep	Electricity Department	
36.	Pondicherry	Renewable Energy Agency of Pondicherry	

Table 2(b): RE institutions in provinces of Pakistan

No.	Province	Department
1.	Azad Jammu and Kashmir (AJK)	Azad Jammu & Kashmir Electricity Department (AJKED)
2.	Balochistan	Department of Energy
3.	Gilgit Baltistan (GB)	Department of Energy
4.	Khyber Pakhtunkhwa (KPK)	Pakhtunkhwa Energy Development Organization (PEDO)
5.	Punjab	Punjab Power Development Board (PPDB)
6.	Sindh	Directorate of Alternate Energy

2.1 RE Sector of Afghanistan

Ministry of Energy and Water is responsible and is engaged directly with generation, transmission and distribution of electricity in the country. In addition to providing gird power, it is also engaged in electrification of rural areas through use of RETs.

Ministry of Rural Rehabilitation and Development (MRRD) was established for development and implementation of RE programs in rural areas for the social uplift and financial growth.

Renewable Energy Department which works under Ministry of Energy and Water is responsible for coordination and promotion of RETs.

Da Afghanistan Breshna Sherkat (DABS) is an independent and autonomous company owned by the Government of Afghanistan (GoA) as the national power utility. DABS will operate and manage electric power generation, import, transmission, and distribution throughout Afghanistan on a commercial basis.

2.2 RE Sector of Bangladesh

In year 2005, Government of the People's Republic of Bangladesh (GOB) created Power Cell under Power Division of Ministry of Power, Energy & Mineral Resources (MPEMR) for carrying out power sector reform activities in the country.

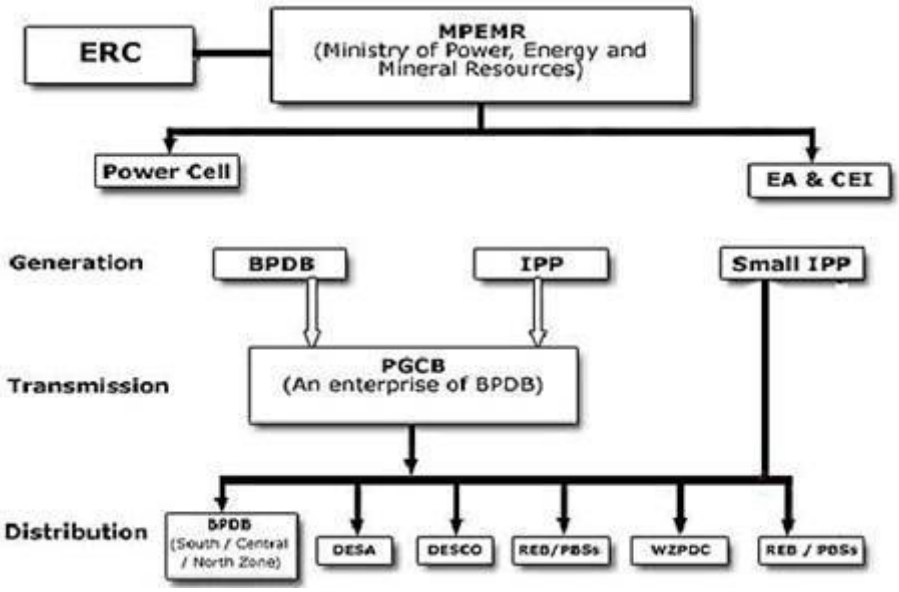

Fig 1: Power sector of Bangladesh

Bangladesh Power Development Board (BPDB) is a statutory body and works under the Power Division of the MPEMR. The Board is responsible for Generation and Distribution of electricity in major portions of the country except Dhaka city and West zone of Bangladesh.

Power Grid Company of Bangladesh Ltd (PGCB) is an enterprise of BPDB and was created to operate and expand the national power grid. It is also entrusted with the responsibility of maintenance and development of the power transmission system across Bangladesh.

GOB in the year 2003, through a legislative act established the Bangladesh Energy Regulatory Commission (BERC). BERC was established as an independent and impartial regulatory commission for Electricity, Gas and Petroleum products all across the country.

Sustainable and Renewable Energy Development Authority (SREDA) was formed through SREDA Act, 2012 to promote, facilitate and disseminate RE for ensuring energy security of the country. SREDA works under Power Division of the MPEMR as a coordination body among public departments including BPDB, BREB, IDCOL and the private sector. SREDA through its approved Renewable Energy Policy 2008 aims to facilitate both public and private sector investment in RE projects and to scale up production of RE based electricity generation in the country.

Bangladesh Rural Electrification Board (BREB) established through an act in 2013 and was previously working as Rural Electrification Board from 1977. It has been providing electricity services to rural areas through support from GOB, Donor agencies and others.

Infrastructure Development Company Limited (IDCOL) was established by GOB as a financing institute to meet the required financing for RE projects of medium to large scale. It provides financing through donor agencies to private sector energy and infrastructure projects in the country.

2.3 RE Sector of Bhutan

Ministry of Economic Affairs is the policy making body on energy sector with three relevant departments I.e., (i) Department of Hydropower and Power Systems; (ii) Department of Renewable Energy; and (iii) Department of Hydromet Services.

Department of Power (DOP) under the Ministry of Trade and Industry was bifurcated into three separate entities namely (i) Bhutan Power Corporation Limited, a public utility; (ii) Department of Energy, a government department; and (iii) Bhutan Electricity Authority, Regulatory body under the Department of Energy.

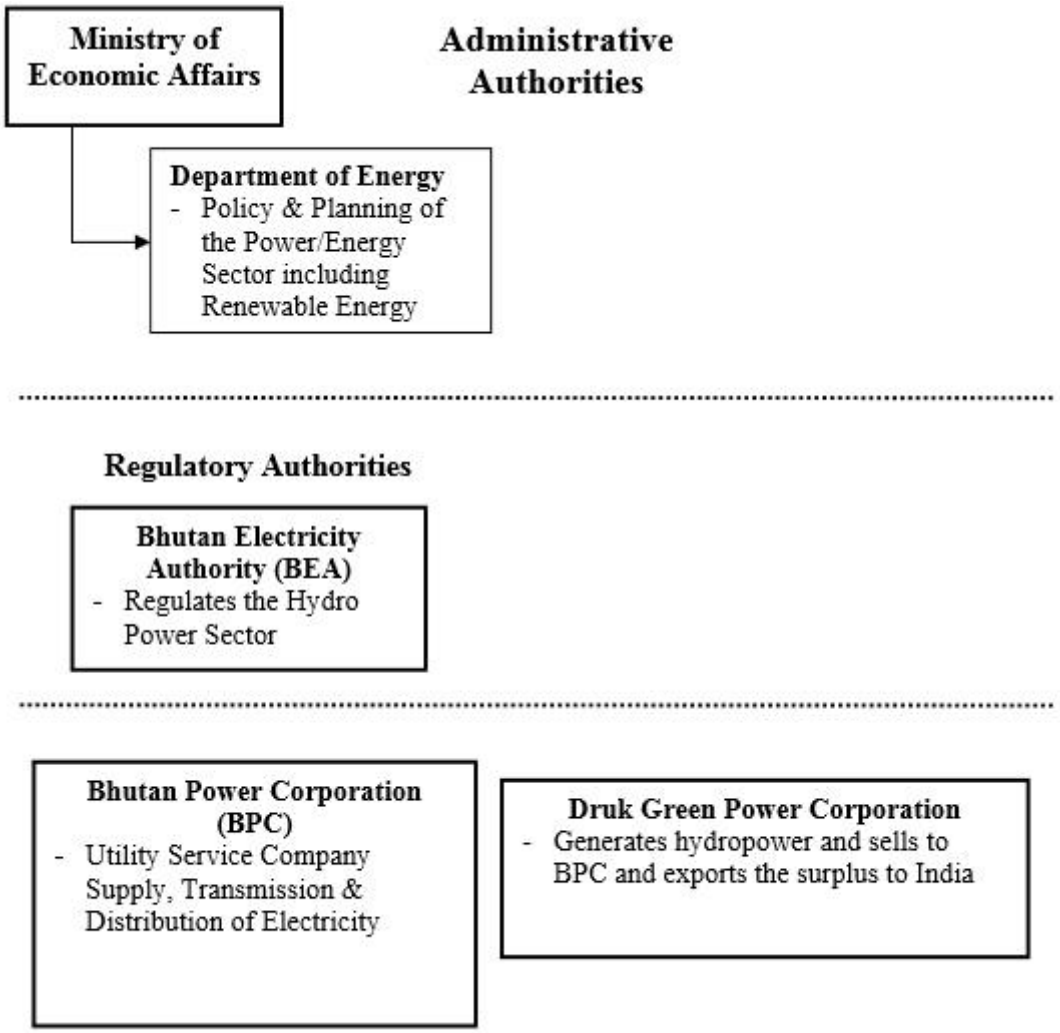

Fig 2: Power sector of Bhutan

Bhutan Power Corporation Limited (BPC) is a public utility with the mandate of transmission and distribution of electricity services throughout the country. It is the sole provider of electricity in the country.

Bhutan Electricity Authority (BEA) was established to restructure and regulate the electricity supply industry by developing regulations, standards, procedures, and to facilitate private sector participation. It is responsible for compliance of Electricity Act and the tariff determination/approval for licensees of power projects.

Department of Renewable Energy (DRE) under Ministry of Economic Affairs (MoEA) was established in 2011 and serves as central focal point on coordination and other matters related to RE development in the country.

2.4 RE Sector of India

Ministry of New and Renewable Energy (MNRE) functions as a nodal ministry and facilitator in research, manufacture, development and deployment of new and RE systems for applications in rural, urban, industrial and commercial sectors. It is the nodal agency at the central level for promotion of grid-connected and off-grid renewable energy in the country. The programmes of MNRE are implemented through the State Nodal Agencies.

Energy Efficiency and Renewable Energy Management Centre was established to implement the programmes of MNRE by enhancing total energy efficiency and application of RE and environment friendly energy systems in the state of Delhi. It formulates policies and programmes for the promotion, development and implementation of renewable and alternate energy devices and technologies.

State Nodal Agencies (SNAs) were established by MNRE in different states and union territories of India to promote and expand the growth of RE in their respective states. The primary objective of a state nodal agency under MNRE is to develop, co-ordinate, finance and promote research projects in the new and RE field.

Central Electricity Regulatory Commission (CERC) is a body that regulates tariff of generating companies that are controlled or owned by Central Government and regulates the tariff of generating companies that are involved in electricity generation and sale in more than one state. Apart from that, CERC also regulates inter-state electricity transmission and determines tariff of inter-state electricity transmission.

State Electricity Regulatory Commissions (SERCs) are regulatory bodies in their respective states for determining tariff of electricity wholesale, bulk, grid or retail; to determine the tariff payable for use by the transmission facilities, to regulate power purchase and procurement process of transmission utilities and distribution utilities.

Power Grid Corporation of India (POWER GRID), the Central Transmission Utility (CTU) of the country under Ministry of Power is one amongst the largest Power Transmission utilities in the world. It is responsible for establishing and operating Regional and National Power Grids to facilitate transfer of power within and across the Regions in the country.

Rural Electrification Corporation Ltd. (REC) working under MoP aims to promote and finance rural electrification projects all over India. It dispenses financial support to State Government Departments and State Electricity Boards for rural electrification projects.

Indian Renewable Energy Development Agency Limited (IREDA) was established to develop, promote and extend financial assistance for RE and energy efficiency/conservation projects. It is a lending organization to provide financing for RE and EE/EC projects.

2.5 RE Sector of Maldives

Ministry of Environment and Energy (MEE) is responsible for policy formulation and implementation relating to climate change and energy sector. MEE also deals with the power sector development in the country.

Maldives Energy Authority (MEA) is regulatory body which advises relevant government organizations regarding energy sector and assists in decision-making process.

State Electric Company Ltd (STELCO) is responsible for power generation, distribution and retail services in Maldives. It provides electricity to 43% of the population of the country.

2.6 RE Sector of Nepal

Ministry of Energy is responsible for utilization and management of hydro power potential by production of energy for the expansion of industrial and economic activities. The Rural and Alternative Energy section works under Policy & Foreign Coordination Division of the Ministry of Energy.

The primary mission of Nepal Electricity Authority (NEA) is to generate, transmit and distribute adequate, reliable power by managing all generation, transmission, and distribution facilities in both interconnected and isolated power system in the country.

Department of Electricity Development (DOED) is responsible to develop and promote electricity sector and for implementation of overall government policies related to power/electricity sector. The major functions of the Department are to ensure transparency of regulatory framework, accommodate, promote and facilitate private sector's participation in power sector by providing "One Window" service and license to power projects.

Alternative Energy Promotion Centre (AEPC) was established as a national focal agency with the objective of developing and promoting rural and RETs in Nepal.

2.7 RE Sector of Pakistan

Ministry of Water and Power is the Government of Pakistan's executive arm for all issues relating to electricity generation, transmission and distribution. It exercises this function through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

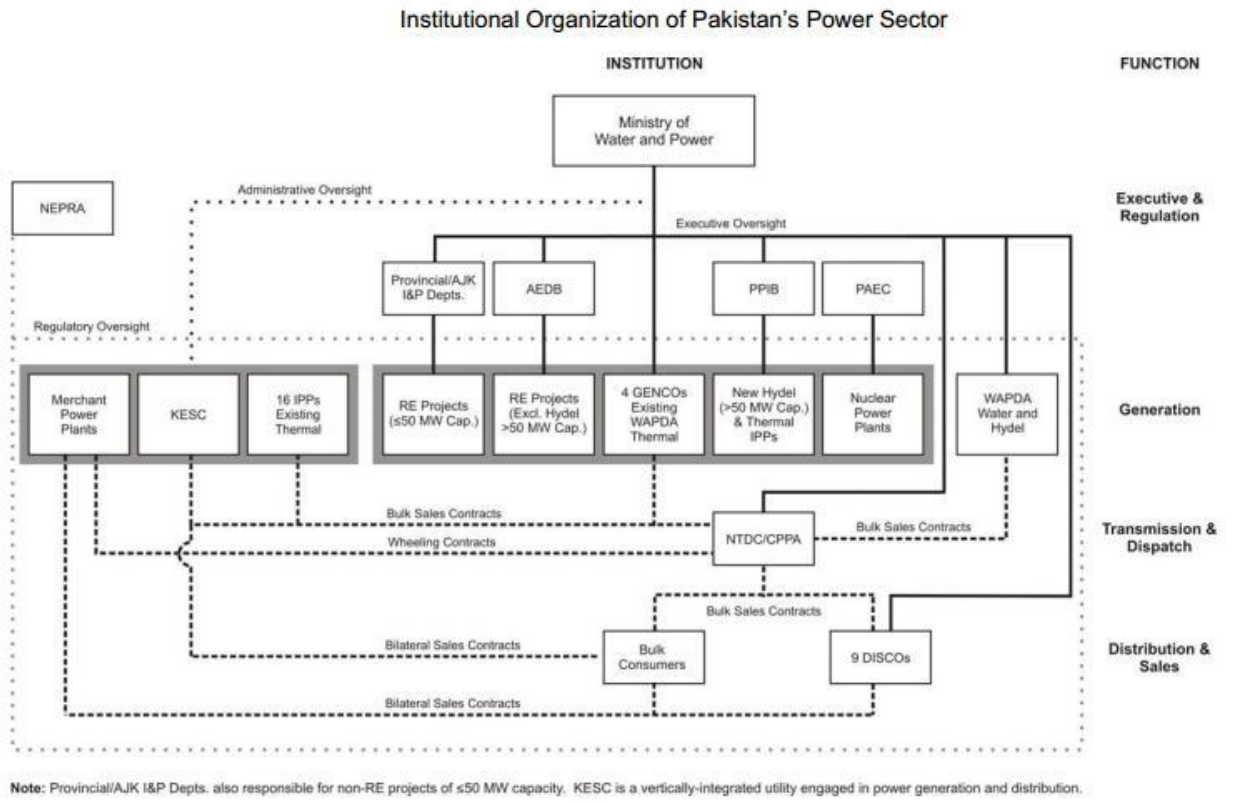

Fig 3: Power sector of Pakistan

Alternative Energy Development Board (AEDB) is the sole representing agency at federal level for the promotion, facilitation and development of RETs in the country. AEDB deals with all RE generation projects except for hydel projects with installed capacity larger than 50 MW.

The provinces/AJK/GB governments have established their own dedicated provincial departments for promoting and encouraging private sector investment in RE sector. The

provincial departments are responsible for harnessing RE resources, preparing RE Policy, addressing issues/matters at provincial level, facilitating local and foreign investors, promotion and implementation of RE projects in their relevant province.

National Electric Power Regulatory Authority (NEPRA) acts as an independent regulator and makes efforts for competitive, transparent and commercial-oriented power market in Pakistan. The determination of tariff for electric power services is one of the primary responsibilities of NEPRA.

National Transmission and Dispatch Company Limited (NTDCL) deals with transmission network in Pakistan and owns and operates transmission network of 220 kV and 500 kV level.

Central Power Purchasing Agency Guarantee Limited (CPPAGL) is sole electricity purchasing agency of the Government of Pakistan, which purchase electricity from the public and private sector power generators on behalf of NTDCL and Distribution Companies (DISCOs) and sell these to the DISCOs.

Eleven DISCOs are established for distribution of electricity to the consumers. Ten DISCOs are in public sector whereas K-Electric is the private sector DISCO. K-Electric is unique as compared to other DISCOs as it is the only DISCO that deals with electricity generation, transmission and distribution in Karachi.

2.8 RE Sector of Sri Lanka

Ministry of Power and Energy of Government of Sri Lanka deals with policy formulation and implementation regarding generation, transmission and distribution of Power in Sri Lanka.

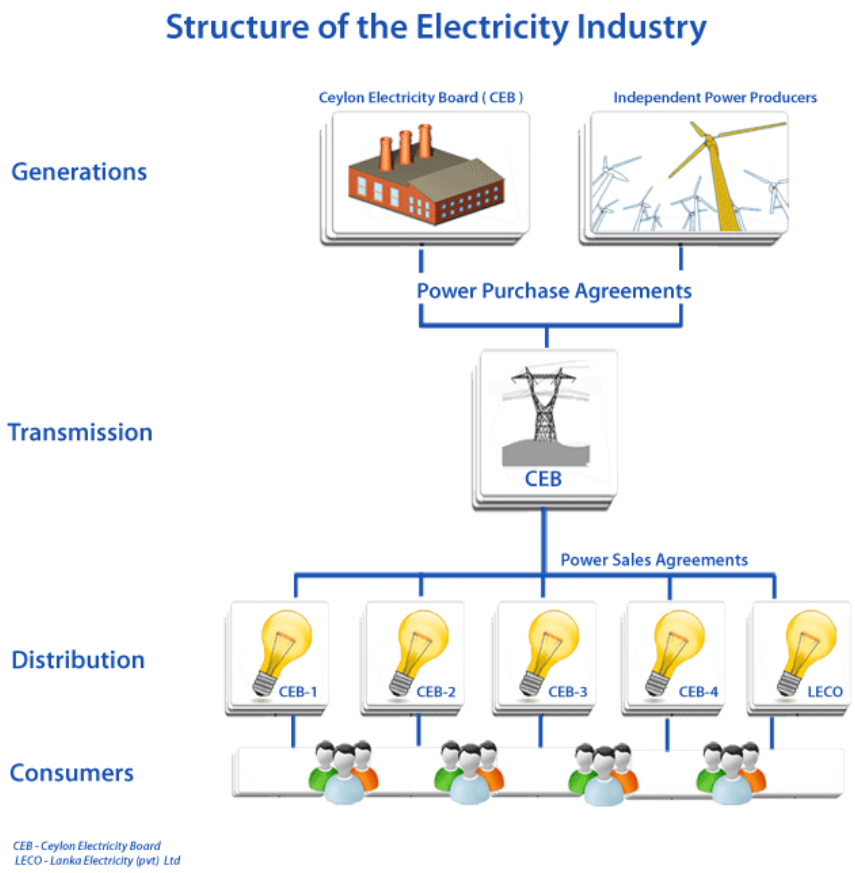

Fig 4: Power sector of Sri Lanka

Ceylon Electricity Board (CEB), a main body, is empowered to generate, transmit and distribute most of the electrical energy in Sri Lanka. CEB has been promoting electricity generation using RE resources by providing assistance to private sector that includes training, capacity building and feasibility reports.

Sri Lanka Sustainable Energy Authority (SLSEA) was formed in 2007 for the promotion and facilitation of RE to ensure energy security and efficiency in the country. SLSEA started working under the Ministry of Environment and Renewable Energy from 2012.

Public Utilities Commission of Sri Lanka (PUCSL), established in 2002 is the economic, technical and safety regulator of the electricity industry in Sri Lanka.

Lanka Electricity Co. (Pvt) Ltd. (LECO) is a private limited company that deals with the distribution of electricity in Sri Lanka.

Chapter - 3

3. Renewable Energy Policies and Programmes in SAARC Countries

In the past two decades, the Member States of SAARC Region have given paramount importance to RETs. The policy makers were quick to realize the enormous potential of Renewable Energy (RE) resources in their respective countries and have shown eagerness to support, facilitate and develop already matured technologies. The Member States have enacted national/provincial/state level policies, strategies and action plans with specific targets for each RE technology.

The availability of requisite legislation helped the proliferation of RE based on-grid projects, increased electrification of rural areas through mini-grid/community based projects and off-grid stand-alone solutions. The salient features of available policies and nationally implemented programmes of RE in each Member States are stated below:

3.1 Afghanistan

3.1.1 Afghanistan National Development Strategy (ANDS), 2008-13

Islamic Republic of Afghanistan (IROA) had prepared detailed ANDS for all sectors of the economy for next five years with the target of providing access to electricity to the rural population by 2020 and providing high quality services to all rural areas by 2050. The Energy Sector Strategy which is one of the pillars of ANDS aims to utilize the enormous potential of RETs such as Solar, Wind, Hydel, Biomass, Geothermal and Wood for providing electricity to rural areas in the country.

The objective of the energy sector strategy is the provision of reliable, affordable energy based on investments by private sector and overseen by public sector. It also gives emphasis on role of IROA for providing policy and regulatory frameworks that may encourage and facilitate the participation of private sector and civil society specifically in rural electrification through application of RETs.[19]

3.1.2 Rural Renewable Energy Policy (RREP),2013

The policy aims to harness power from Renewable resources through utilization of available local resources in the rural area and off-grid locations. It shall help in providing an enabling

[19] Energy Sector strategy, Afghanistan National Development Strategy, 2008-13

environment for donor agencies and private sector investments in the development of rural energy technology. The salient features of the policy are mentioned below:[20]

a. To provide support for development and management of RETs.
b. Development of legal and regulatory frameworks for development of energy sector.
c. Establishment of certification, testing and enforcement unit for RETs.
d. The private sector may develop commercially viable generation projects using RE. The private sector may also develop distributed grids associated with the projects.
e. The development of rural energy systems connected through village mini-grids by the private sector shall be facilitated by Government through capital cost subsidies, power sector tariffs and provision of credit.

3.1.3 Afghanistan National Renewable Energy Policy (ANREP),2014

The policy covers all RE resources and technologies that can be deployed across the country in techno-economically and environmentally sustainable manner. It aims to increase the deployment of RETs to 10% of the total energy mix of 3500-4500 MW in year 2032. This shall be achieved by creating and supporting atmosphere for development and growth of RE sector by public-private partnership from year 2015-2020 and through commercially deploying RETs from year 2021-2032. The salient features of the Policy are mentioned below:

a. supports detailed mapping of RE resources and preparation of RE Atlas for the country.
b. encourages private sector involvement by providing financial incentives and other facilitation.
c. specifies guidelines for setting tariffs for different categories of RE projects and lays foundation for setting up "basket-funds" for them.
d. allows project developers to set up RE projects both for captive and for third party sale of electricity.
e. The Utility company (DABS) must evacuate and utilize electricity generated through RE projects.[21]

3.1.4 Status of Renewable Energy generation

The RE projects implemented in rural areas is supported by Donor Agencies in Afghanistan. Bamyan Renewable Energy Programme is donor funded project of 1 MW Solar installation that

[20] Afghanistan Rural Renewable Energy Policy, 2013
[21] Afghanistan National Renewable Energy Policy, Ministry of Energy and Water, 2014

provides electricity services to 2,500 households, businesses and government buildings. There were Solar and Micro hydel projects of total tune of 2.2 MW installed in Takhar and Badakhshan provinces. Currently, a total of 4,601 RE projects with total installed capacity of approximately 38 MW were completed consisting of MHP, wind and solar technologies in the whole country.[22] [23]

3.1.5 National Solidarity Programme

National Solidarity Programme (NSP) is a community driven national development programme that works in rural areas under auspices of MRRD. The programme had installed Solar (PV) systems to 650 villages and funded 500 micro hydel plants in the country.[24]

3.2 Bangladesh

3.2.1 RE Policy, 2008

The Renewable energy Policy of Bangladesh approved in 2008 aims to meet 5% of the total power demand by 2015 and 10% by 2020 from RE sources. The policy encourages and facilitates both public and private sector investment in the RE projects. It aims for harnessing potential of RE sources and dissemination of RE technologies in rural and urban areas of the country.

The policy envisioned establishment of a focal agency for development and promotion of RE development in the country. Consequently, SREDA was formed through SREDA Act 2012. The responsibilities of SREDA included in the RE Policy 2008 were to promote awareness of RE, financially support Research and development of RE Technologies, development of RE projects, and solicit & processing of grid connected RE projects in the country. The salient features of RE Policy 2008 are given below:[25]

a. Scale up contribution of electricity production from existing RE projects.
b. Power utilities or any consumer may purchase electricity generated by RE projects (both in public and private sectors) with installed capacity less than 5 MW through mutual agreement.

[22] Afghanistan National Renewable Energy Policy, Ministry of Energy and Water, 2014
[23] Afghanistan Renewable Energy Database, Minister of Energy and Water website, Kabul (accessed on 15.12.2015)
[24] Energy Sector strategy, Afghanistan National Development Strategy, 2008-13
[25] Renewable Energy Policy of Bangladesh, MPEMR, 2008

c. RE project sponsors on payment of Wheeling charges to owner of transmission/ distribution systems through mutual agreement may supply electricity using existing electricity transmission and distribution systems to its customers.
d. Promote development of indigenous technology in RE sector.

3.2.2 Status of Renewable Energy generation

Government and Private sector are both involved in the development of large scale gird connected RE projects and off grid based RE projects/technologies. The total installed capacity of RE based projects in the country is nearly 185 MW[26] (SHS/solar Irrigation 177 MW, on-grid Wind Energy 2 MW and off-grid Bioenergy 6 MW). The installed capacity of Hydro Power in the country is 230 MW[27].

3.2.3 Rural Electrification Programme by BREB

BREB has been implementing rural electrification projects/network through RE technologies across the country. The Board has well established 72 Palli Bidyut Samities (Rural Electric Societies) which work as its wing in Bangladesh. BREB is responsible for planning, financing and installation of the rural electricity network while PBS is responsible for its retail service and operation & maintenance. BREB generates electricity through its own small scale power generation projects and purchases electricity from national grid and IPPs. BREB has implemented Solar (PV) projects at the premises of Government buildings, schools, offices and domestic households in the rural areas of Bangladesh. The Solar Home Systems (SHS) and solar powered irrigation pumps projects were mostly financed by GOB and donors, and were the first of its kind in the country. BREB has installed various solar powered projects with installed capacity of 4.032 MW in rural villages of the country.[28]

3.2.4 RE Programme/Projects by BPDB

BPDB had installed a total of 395.26kW$_p$ Solar (PV) Systems across the country including urban cities and rural villages. The off-grid Solar (PV) Systems installed in the rural areas include Solar Home Systems, Street lights, submersible water pumps and vaccine refrigerators. However, on-grid Solar (PV) Systems were installed at government building, commercial and residential areas. It also included Solar (PV) Power plants for sale of energy to national grid. In addition to

[26]Power Cell, Ministry of Power, Energy & Mineral Resources website, Dhaka (accessed on 15.12.2015)
[27]Kaptai Dam with installed capacity of 230 MW is the only hydro power plant in Bangladesh. It is considered non-renewable energy project.
[28] Renewable Energy Program in BREB, website BREB, Dhaka (accessed on 15.12.2015)

Solar (PV), BPDB also installed WECs with total installed capacity of 1.9 MW at Muhuri Dam, Sonagazi, Feni and Kutubdia Island. A micro hydro project with installed capacity of 50 kW_p was installed in Rangamati district.[29]

3.2.5 RE Programme/Projects by IDCOL

A total of nearly 3.3 million Solar Home Systems (SHS) have been installed by partner organizations and financed through IDCOL in the rural areas of Bangladesh. The total installed capacity of SHS program by IDCOL is above 150 MW. The Biogas program of IDCOL had constructed 34,880 domestic biogas plants across the country.[30]

3.3 Bhutan

3.3.1 Alternative Renewable Energy Policy, 2013

RGoB approved Alternative and Renewable Energy Policy in the year 2013. The policy aims to promote RE sources in the country and to diversify the energy mixture through use of domestic sources of Solar (PV), Solar Thermal, Wind, Biomass, Geothermal, pico/micro/mini/small hydro and waste to energy technologies. The implementation of RETs will be covered through areas of Stand Alone systems, Decentralized Distributed Generation, grid connected and fossil fuel substitution.

The Policy sets out an overall target of 20 MW of energy through RETs by the year 2025. All RE projects shall be governed by Alternative Renewable Energy Policy 2013, and DRE under MoEA shall be the nodal agency for implementation of the policy.[31] The salient features of the policy are given below:

a. Regulatory framework for RE sector shall be created by BEA to encourage electricity generation from RE sources;
b. DRE shall develop RE Master Plan which includes resource analysis, identifying potential project sites and estimated project scale for RETs;
c. DRE shall facilitate project developers by undertaking preparatory studies for its identified projects and in acquiring necessary clearances from various Government agencies;

[29] Development of Renewable Energy Technologies by BPDB, website BPDB, Dhaka (accessed on 15.12.2015)
[30] Annual Report 2013-14, IDCOL
[31] Alternative Renewable Energy Policy 2013, Royal Government of Bhutan

d. The policy mentions the allotment process for grid connected small hydro and other RE projects identified by DRE;
e. Private sector is encouraged to identify and prepare studies following guidelines by DRE for hydro power projects (all except Large) to a maximum of 5 MW;
f. Stand Alone RE projects shall be undertaken and/or supported by DRE. Private Sector, NGOs Communities and others are invited to undertake such projects;
g. The policy for promoting the use of electric and hybrid vehicles shall be explored and Research & Development shall be undertaken for substitution of fossil fuels by clean energy technologies;
h. The established Renewable Energy Development Fund shall be used for creating favorable investment climate for RE projects in the country;

3.3.2 RE Programmes/Projects

The availability of medium and large size hydro power resources in most parts of the country hinders the development of off-grid mini/micro hydro and solar energy technologies. RETs have not been deployed at any significant scale in Bhutan.

3.4 India

3.4.1 National Electricity Policy, 2005

National Electricity Policy provides policy guidance to the Electricity Regulatory Commissions and to the Central Electricity Authority for preparation of the National Electricity Plan. The Policy aims at accelerated development of the power sector, providing supply of electricity to all areas keeping in view availability of energy resources, technology available to exploit these resources, economics of generation using different resources, and energy security issues. Salient features of the policy are given below:[32]

a. Share of electricity from renewables to be increased progressively; purchase by Distribution Companies (DISCOMS) through competitive bidding till RE sources competes with conventional sources; Feed-In Tariffs to be announced by state regulators.
b. To increase share of RE sources in electricity mix, efforts to encourage private sector participation through suitable promotional measures.

[32]National Electricity Policy 2005, Central Government, India

c. Involve private sector's participation in generation, transmission/distribution and sale of power.

3.4.2 Strategic Plan for New and Renewable Energy sector, 2011-17

MNRE through Strategic Plan intends to enhance the contribution of RE to 6% and 10% in total energy mix and total electricity mix of the country respectively by the year 2022. It also aims to develop, demonstrate, and commercialize technologies for harnessing new and renewable energy sources. MNRE had formulated Strategic Plan for RE Sector in the year 2011 which gave quantifying targets for different renewable resources and applications for the next six years. The following targets were set in Strategic Plan:[33]

a. Additional installed capacity of 21,700 MW (13400 MW through Wind, 4000 MW through Solar, 1960 MW through small hydro power, 240 MW through urban/municipal waste, 1600 MW through bagasse and 500 MW through biomass/agri waste) power using grid interactive RE;
b. Electrification of 500 remote villages using off-grid RE applications;
c. Installation of 1.1 million family biogas plants, 6.8 million solar lights, 1950 micro hydro power mills and 850 biomass gasifiers in remote villages across country using off-grid RE applications.

3.4.3 National Offshore Wind Energy Policy, 2015

The policy will enable optimum exploitation of offshore wind energy by deployment of wind farms in the Exclusive Economic Zone (EEZ) of the country. The salient features of the policy are mentioned below:[34]

a. MNRE has been authorized as the Nodal Ministry for use of offshore areas within the Exclusive Economic Zone of the country & the National Institute of Wind Energy (NIWE) has been authorized as the Nodal Agency for development of offshore wind energy in the country and to carry out allocation of offshore wind energy blocks, coordination and allied functions with related ministries and agencies.
b. The approval paves way for offshore wind energy development including setting up offshore wind power projects, and research & development activities, in waters, in or

[33]Strategic Plan for New and Renewable Energy sector for the period 2011-17, MNRE, Government of India
[34]National Offshore Wind Energy Policy, 2015, MNRE, Government of India

adjacent to the country, up to the seaward distance of 200 Nautical Miles (EEZ of the country) from the base line.

c. The policy would be applicable throughout the country depending upon offshore wind potential availability & shall provide a level playing field to all, domestic and international investors and beneficiaries.

3.4.4 National Policy on Biofuels, 2009

National Policy on Biofuels aims to facilitate development and utilization of indigenous biomass feed stocks for production of biofuels. The salient features of the policy are mentioned below:[35]

a. Achieving target of 20% blending of biofuels (bio-diesel and bio-ethanol) by the year 2017.
b. Announcement of a minimum support price for oilseeds and implemented with a revision provision for ensuring fair price to farmers.
c. Encouragement of setting up processing units for bio-oil expelling/extraction and trans-esterification by industry for production of bio-diesel.

The policy proposes interventions in areas of plantation, processing, distribution and marketing of biofuels, financing, financial and fiscal incentives, research & development, and demonstration which may help in promoting Biofuels in the country. States were asked to designate power to an existing agency or establish a new agency for the promotion and development of biofuels in respective states while MNRE is responsible for policy and overall coordination regarding biofuels.

3.4.5 State's Renewable Energy Policies

India consists of 29 states, seven Union Territories, and one National Capital Region. National policies and strategic plan gives guidance to the States for promotion and development of RE sources in their respective region. The development of RE depends largely on each state's own policy and regulatory support.

Many States have developed their own policy on RETs and also established nodal agencies for implementation of programmes and projects. The respective Nodal Agency from the State facilitates, develops and promotes RE projects. Majority of the States have a Regulatory commission (State Electricity Regulatory Commission) which determines tariff for cost-plus basis projects, develops feed-in-tariff and issues regulation for RE sector.

[35] National Policy on Biofuels, 2009, MNRE, Government of India

3.4.6 Status of Renewable Energy generation

The contribution of RE in the electricity grid is approximately 13%[36] of the total installed electricity capacity in the country as of Dec 2015. In terms of grid-interactive RE installed capacity, the proportion of Wind, Solar, SHP and Bioenergy is approximately 64%, 13%, 10% and 13% respectively taking the total installed capacity of renewables in the country to 39,511 MW.[37]

In the case of off-grid/ captive power projects, installed capacity of waste to energy, biomass co-gen, biomass gasifiers, hybrid systems, Solar (PV) and micro hydro is approximately 146 MW, 602 MW, 179 MW, 2 MW, 302 MW, 17 MW respectively making the total capacity 1,249 MW.[38]

3.4.7 On-grid Jawaharlal Nehru National Solar Mission (JNSM)

JNSM is a significant initiative by the Government of India and State Governments to address energy security challenges in India. JNSM envisages achieving parity with coal-based thermal power by 2030 and it aims to increase solar power share in the country both at centralized and decentralized levels. The primary target is deployment of 100,000 MW of on-grid solar power by year 2022. It shall promote on-grid Solar (PV) power through Renewable Purchase Obligation (RPO) mandated for power utilities. It plans to provide stand-alone Solar (PV) systems to 10,000 villages and hamlets through 90% subsidy under remote village electrification programme of MNRE. The Small and Medium Enterprises (SME) shall be supported through soft loans for manufacture of various components of Solar (PV) systems.[39] The total installed capacity of on-grid Solar (PV) in the country under JNSM and other national/state programmes is 5,248 MW.[40]

3.4.8 On-grid Wind Energy Programme

The grid connected Wind Energy programme is the most successful and fastest growing renewable energy technology amongst various other RE options in the country. The programme which is implemented through MNRE and other State nodal agencies covers assessment of wind resources, implementation of demonstration projects and facilitation in development of

[36] http://powermin.nic.in/power-sector-glance-all-india
[37] Physical progress (Achievements), MNRE website, Government of India (accessed on 31.12.2015)
[38] Physical progress (Achievements), MNRE website, Government of India (accessed on 31.12.2015)
[39] Jawaharlal Nehru National Solar Mission, Press Information Bureau website, Government of India (accessed on 15.12.2015)
[40] Physical progress (Achievements), MNRE website, Government of India (accessed on 31.12.2015)

commercial private sector projects. National Institute of Wind Energy (NIWE) in association with State Nodal Agencies is coordinating wind resource assessment programme by establishing dedicated wind monitoring stations in the country.[41] As of Dec 2015, the total installed capacity of wind turbines commissioned in the country is 25,188 MW.[42]

3.4.9 On-grid Biomass Power and Bagasse Co-generation Programme

MNRE's Biomass Power and Bagasse Co-generation Programme were initiated to efficiently utilize biomass such as agro residue, agro-industrial residues and wood from dedicated energy plantations for power generation. The States producing sugar have the highest potential for bagasse cogeneration. The total installed capacity of biomass power and Bagasse cogeneration projects in the country is 4,887 MW.

3.4.10 On-grid Small Hydro Power Programme

MNRE undertook a national programme for developing Small Hydro Power (SHP) projects to the maximum capacity of 25 MW each. It is providing financial assistance to State Governments and private sector for setting up small/mini hydro power projects. The support is also extended towards survey and investigation, preparation of Detailed Project Reports (DPR), project monitoring and training through technical institutes such as Alternate Hydro Energy Center (AHEC), IIT, Roorkee, etc. The total aggregate capacity of SHP projects installed in various parts of the country is 4,187 MW.

3.4.11 Off-grid Rural Electrification programme

MNRE is implementing a programme to provide financial assistance for the electrification of remote villages which are un electrified and where grid-extension is not feasible. The villages are electrified through off-grid RE sources such as solar (PV) system, Small hydro and biomass gasification.[43] The total numbers of villages/hamlets which have been electrified under the programme since its inception are 8,979.[44]

3.4.12 Off-grid National Biogas and Manure Management Programme (NBMMP)

Under MNRE's Renewable Energy for Rural Applications, NBMMP aims to provide family type Biogas plants to rural and semi-urban households in India. The State Nodal Agencies were

[41] Annual report 2014-15, MNRE website, Government of India
[42] Physical progress (Achievements), MNRE website, Government of India (accessed on 31.12.2015)
[43] http://mnre.gov.in/schemes/offgrid/remote-village-electrification/
[44] http://mnre.gov.in/file-manager/annual-report/2014-2015/EN/Chapter%201/chapter_1.htm

allocated the target by MNRE of installing 0.11 million family type biogas plants during the year 2014-15. A total number of 45,000 biogas plants were installed across India in year 2014, which took cumulative installation of such plants to 4.7 million.[45]

3.4.13 Off-grid Programme on Energy from Wastes/Residues

MNRE through this programme is exploring technology options such as Pyrolysis and Gasification for recovery of energy from urban, industrial and agriculture wastes/residues. The financial assistance is provided to various types of power generation projects using wastes/residues. A total installed capacity of 8.54 MW off-grid waste to energy projects were installed in the year 2014.[46]

3.5 Maldives

3.5.1 National Energy Policy & Strategy, 2010

Maldives National Energy Policy & Strategy (MNEPS) was adopted in 2010 amid energy crisis in the country. MNEPS was initiated for environmental protection, and to reduce reliance on fossil fuels that were being imported from other countries. Guiding principles of MNEPS contained:[47]

a. creating suitable environment for development of sustainable energy sector;
b. reducing excessive dependence on fossil fuels for energy production;
c. encouraging usage of low-carbon technologies for power production;
d. exploiting RETs and indigenous energy resources;
e. engaging private sector in energy sector development.

3.5.2 ASPIRE Project

Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE) project was approved in June 2014 and funded by Climate Investment Funds of World Bank in cooperation with MEA. The project aims to commission 20-30 MW (PV) generation through private investment in the country.[48]

[45] Annual report 2014-15, MNRE website, Government of India
[46] Annual report 2014-15, MNRE website, Government of India
[47] Maldives National Energy Policy & Strategy, 2010, Ministry of Housing and Environment
[48] http://www.worldbank.org/en/news/press-release/2014/07/17/maldives-private-investments-scale-up-renewable-energy-program , http://www.worldbank.org/projects/P145482?lang=en

3.6 Nepal

3.6.1 Rural Energy Policy, 2006

Rural Energy Policy aims to contribute to rural poverty reduction and environmental conservation by ensuring access to clean, reliable and appropriate energy in the rural areas of the country. The salient features of the policy are mentioned below:[49]

a. Development of Rural (renewable) energy technologies.
b. The local body, cooperatives, private sector, user organization or community management will be encouraged to purchase and distribute electricity from electricity production.
c. Arrangement will be made for bulk purchase of electricity by the community, cooperatives and user groups from the national grid for retailing electricity to the consumers. This applies to micro and small hydro power projects only.
d. Emphasis will be given on research, development and dissemination of community and institutional biogas plants.

3.6.2 Subsidy Policy for Renewable Energy, 2013

The policy was formulated to promote affordable RETs by providing subsidy and by reducing the initial upfront cost. It aims to increase access to RE technologies in the rural areas by development and extension through attracting private sector entrepreneurs. The policy mentions various subsidy categories with relevant subsidy amount for all type of community/ cooperative owned off-grid and on-grid renewable energy technologies/ projects.[50]

3.6.3 National Rural and Renewable Energy Programme (NRREP)

National Rural and Renewable Energy Programme (NRREP) is a 5 year programme started in 2012 which includes all projects implemented by AEPC and with support of Government of Nepal and other development partners. The NRREP programme gives specific targets for different RETs including Mini/Micro hydel, Solar (PV), Improved Cooking Stoves (ICS), Biogas Plants etc for the year 2012-2017.

[49] Rural Energy Policy, 2006, Ministry of Environment, Government of Nepal

[50] Subsidy Policy for Renewable Energy, 2013,Ministry of Science, Technology and Environment, Government of Nepal

Under this programme, a total installed capacity of 8.6 MW of Mini/Micro/Pico hydel plants have been installed across the country. In addition, the total numbers of installed off-grid Solar (PV) systems, ICS, biogas plants are approximately 0.28 million, 0.57 Million and 0.064 million respectively.[51]

3.7 Pakistan

3.7.1 Policy for development of Renewable Energy for Power Generation, 2006

Policy for Development of Renewable Energy for Power Generation was formulated in 2006. Policy was devised to mainstream RE development in Pakistan. Policy aims to promote and facilitate private investment in RE for power sector development in the country. Policy envisaged energy supply of minimum 9,700 MW using RETs by 2030.

The Government of Pakistan has tasked AEDB to generate 5% of total power generation in the country by using RE resources and technologies. The salient features of the policy are mentioned below:[52]

a. It invites investment from the private sector for Independent Power projects, Captive cum grid spillover power projects, Captive power projects, and isolated grid power projects.
b. It allows mechanisms of Net-metering, Banking and Wheeling for investors.
c. Mandatory for the power distribution utilities to buy all the electricity offered to them by RE projects.
d. In case of grid connected Wind/hydro IPPs, The risk of variability in wind speed and water flows shall be borne by the power purchaser.
e. Implementation of projects and programs through private sector in the area of RE.

3.7.2 On-grid wind Programme

A total of six wind power projects (4 in Jhimpir, 2 in Gharo) have been commissioned with the total installed capacity of 306 MW. There are eight wind energy projects (7 in Jhimpir, 1 in Gharo) with the total capacity of 428 MW under construction and have achieved financial close.[53]

[51] Annual progress report, 2015, NRREP, Alternative Energy Promotion Centre, Nepal
[52] Policy for development of Renewable Energy for Power Generation, 2006, AEDB, Government of Pakistan
[53] Information gathered from AEDB office, Islamabad

3.7.3 On-grid solar Projects

A total installed capacity of 100 MW was installed in Quaid-e-Azam Solar Park Cholistan, Punjab, additional 300 MW for the same project have achieved financial close and is under construction. Also, AEDB is in process of developing 31 projects with total installed capacity of 1,000 MW.

"Introduction of Clean Energy by Solar Electricity Generation System" was a grant aid project by Japan International Cooperation Agency through which solar power generation system of 178 kW each were installed in the premises of Pakistan Engineering Council and Planning Commission of Pakistan.

More recently, under the "Greening the National Assembly of Pakistan" initiative, 1 MW solar PV has been installed at the premises of Pakistan's National Assembly in Islamabad on net metering basis. The project has been installed on grant-aid basis from Government of People Republic of China. Similarly, under various initiatives, more than 50 MW solar PV has been installed in private sector commercial buildings for the purpose of meeting their electricity needs.

3.7.4 On-grid Bioenergy Projects

At present, Bioenergy projects with installed capacity of 314 MW are operational in Pakistan. All the projects were installed by privately owned Sugar industries through cogeneration for captive use and selling excessive power to national grid.

3.7.5 Off-grid Programme

Small hydro sector is predominantly handled by provinces and Aga Khan Rural Support Programme (AKRSP). Currently, 272 MW installed capacity of SHP projects are in operational while projects with 221 MW installed capacity are in construction phase.[54] The Community based RE projects comprising micro and mini hydro projects have been installed and maintained by Aga Khan Rural Support Programme (AKRSP) at various sites in the federally administered Northern Areas and Chitral District of Khyber Paktunkhwa, Pakistan. Mini-grids powered by micro and mini hydro projects (MHPs) provide a large number of rural households in mountainous areas with electricity for both domestic and productive applications.

[54]World Small Hydro Power Development Report by UNIDO, 2013

Approximately, 180 micro hydro projects (each unit with installed capacity of 20-100 kW) have been built in the northern areas which are maintained and managed by the local communities themselves.

Captive solar energy use in both urban and rural areas is promoted. Government has waived taxes and duties on RE equipment to promote these applications. In last five years, more than 80 MW solar (PV) has been installed in different applications like solar homes solutions, commercial lighting, commercial buildings, off-grid electrification, water pumping, Street lighting, billboard lighting etc. The Government has launched solar tube well programs to promote installing 10,000 solar water pumps in next two years. The number is expected to increase afterwards.

3.8 Sri Lanka

3.8.1 National Energy Policy, 2008

The Government of Sri Lanka introduced National Energy Policy in 2008 that envisions promoting energy efficiency, conservation and development of indigenous energy resources. The salient features of the policy relevant to RE are given below:[55]

a. It aims to reach a minimum level of 10% of the grid electricity bringing in use non-conventional RE by 2015.
b. It shall provide incentives to developers on competitive basis; developers shall bid for a share of the RE target subject to a price ceiling.
c. The incentives offered shall be technology specific and based on actual energy supplied to the electricity grid.

SLSEA was established after the introduction of National Energy Policy. The responsibilities of SLSEA included, among other things, raising awareness about RE, enhancing RE capacity for sustainable development using indigenous energy resources, promoting research and development related to RE and developing RE projects. SLSEA is working and coordinating with other departments dealing with energy sector to develop and facilitate RE projects, and implement strategies devised for the promotion of RE. SLSEA is in process of implementing National Energy Plan (2012-2016) with help of Ministry of Power and Energy that aims to achieve saving of 20% of total energy consumption of 2010, by 2020.[56]

[55] National Energy Policy, 2008, Ministry of Power & Energy, Democratic Socialist Republic of Sri Lanka
[56] Sustainable Energy Authority website, Sri Lanka

3.8.2 RE Programme/ Projects

Sri Lanka has attained grid connectivity of 98%, which is noteworthy in comparison to other South Asian countries.[57]

3.8.3 Status of on-grid Renewable Energy generation

The contribution of RE generation in the electricity grid is approximately 9% of the total electricity generation in the country.[58] In terms of grid-interactive RE installed capacity, the proportion of Mini hydro, Biomass, Solar and Wind is 293 MW, 23.5 MW, 1.4 MW and 124 MW respectively. This equals to approximately 442 MW of grid connected RE in the country.[59]

3.8.4 Off-grid Renewable Energy Programmes

Renewable Energy for Rural Economic Development (RERED) project, approved in 2002 by Government of Sri Lanka, was financially assisted by World and Global Environment Facility. The primary objectives of the project were provision and utilization of RE resources to improve the life of rural areas. RERED had commissioned 175 off-grid community based projects (mini hydro and Biomass technologies) with total installed capacity of 1.76 MW. The project helped to provide off-grid solar home systems with the total installed capacity of 4.8 MW.[60]

[57] Long Term Generation Expansion Plan, 2015, Ceylon Electricity Board, Sri Lanka
[58] Statistical Digest 2014, CEB, Sri Lanka
[59] Long Term Generation Expansion Plan, 2015, Ceylon Electricity Board, Sri Lanka
[60] RERED project statistics (http://www.energyservices.lk/statistics/details_shs1.htm)

Chapter - 4

4. Barriers and proposed measures for RE promotion

In the SAARC region, the existing huge subsidies for fossil fuel places RE at a disadvantage to them. The development and deployment of RE in Member States is hampered by a number of barriers. The investments in RE sector can be augmented by taking specific measures for removal of those barriers. There are various types of barriers which may directly or indirectly be responsible for hindering promotion of RE in any Member State. The details of each type of barrier with recommended measures for its removal are mentioned below:[61] [62]

4.1 Economic barrier

An economic barrier refers to the difference in cost of RE technology in comparison to the already matured conventional technology. The capital cost for power generation through RETs is higher than the conventional sources like fossil fuels and nuclear.

Measures

The type of instruments which may help in removing economic barriers for RE is through the introduction of feed-in-tariffs, tendering schemes and by offering tax exemptions to the imported/local RE equipment in the Member States.

4.2 Policy Barrier

The lack of explicit and specific policies for promotion of RE in Member States affects its development. This may indirectly be responsible for placing RE at a disadvantage relative to other forms of energy supply. In general, the policy makers lack required information and awareness about RE resources, commercial technologies available, skills for quantifying externalities of fossil fuels and benefits of RE, and development of a policy designed specifically in the perspective of South Asia.

Measures

Policy makers and planners from Member States may be encouraged to develop policies with specific targets which may enhance share of RE in the overall energy mix of the country. The scope of RE policies may be specific and should cover all RE resources. Also, Member States may incentivize RE sector and facilitate private sector by providing soft loans from lenders on low markup for RE projects.

[61] Policy considerations for deploying Renewables, 2011, International Energy Agency
[62] Renewable Energy Sources and Climate Change Mitigation, 2012, Intergovernmental Panel on Climate Change

4.3 Awareness Barrier

The deployment of RETs in SAARC Member States is also impeded by insufficient information in the general public about its knowledge and latest technological advancements. The lack of public support makes it repellent for policy makers to enact legislation for implementation of RE projects and technologies.

Measures

In the past, few Member States had initiated awareness campaign through informative programmes to promote RE. In future, the awareness campaigns launch may use print, electronic and social media platform for educating general public about the usefulness and benefits of using RETs.

4.4 Resource assessment Barrier

The abundant resource of RE in SAARC Region has not been realized in substantial number of projects and the biggest hurdle in this regard is absence of reliable and bankable data. Few Member States in SAARC region had taken initiatives with collaboration of international development agencies for developing Solar and Wind resource maps which were based on satellite data. However, Non-availability of bankable on-ground resource data makes it difficult for investors to secure financing of RE projects.

Measures

All Member States may carry out nationwide Solar and Wind Energy resource mapping by installing ground based measuring stations of Solar and Wind energy at 5-6 identified locations with good resource. The data obtained by the measuring stations at specific identified sites shall ideally be at least 2 years old and may in-future facilitate private sector in acquiring financing for their RE projects.

4.5 Technical Barrier

The absorption of electricity from RE power plants by the electric grid network is one of the most critical issues faced by the transmission/distribution utility. Apart from India, the power sector in all Member States lack requisite knowledge and tools to cater the intermittent power generated from RE resources.

Measures

Energy Storage may be considered as one of the options for supporting reliable, efficient and sustainable power sector by facilitating deployment and integration of Renewables.

4.6 Regulatory Barrier

The absence of an independent energy regulator and consequent legal framework in many SAARC Member States restricts private sector to invest in RE projects. Also, the process of determining cost plus tariff for RE projects takes much longer time than the conventional fossil fuel projects, which makes it difficult for the project developers to keep the EPC costs intact.

Measures

Keeping in view above constraints, All Member States may create an electricity regulator or empower the existing one with the charge of regulating electricity tariffs, transparent policies regarding subsidies, and for ensuring provision of safe, reliable and affordable electric power to the consumers in their respective jurisdiction areas. The Energy Regulator may develop uniform guidelines for Power off-take and Grid Interconnection codes for integration of RE projects with the electricity grid. Also, a set of standard and bankable project documents (such as EPA, IA and others) may be developed and made available to project developers for speedy processing of their projects.

4.7 Institutional Barrier

The evaluation and approval of various documents of RE projects by ministries/authorities require skills and information about the novel technology. The various steps in project cycle include approval of Grid Interconnection studies, environmental studies, negotiation on Energy Purchase Agreement (EPA)/Implementation Agreement (IA), and awareness about technical, legal and financial instruments of RE projects. The approval processes by the Government authorities takes un-necessary long time period because of lack of expertise in RE.

Measures

Member States may appoint a dedicated authority/institute as "one-window facility" for facilitation and development of Renewable energy projects/ technologies in their own respective countries. The manpower in the relevant authority may be educated and well equipped with the required and necessary tools for evaluating the RE projects. The skill development of manpower should be done through regular training in various aspects of RE projects such as technical, financial and regulatory etc.

4.8 Infrastructure barrier

Mostly in locations where RE projects are planned to be implemented, the grid infrastructure over there is not capable of evacuating power from those projects. One of the primary barriers to the development of RE projects is the lack of transmission capacity serving areas of high resource potential. The access to high voltage transmission lines at door step is critical for the energy delivery from RE projects.

Measures

Member States may have to make huge initial investments on building required grid infrastructure for transmission of electric power from generation sources to the end user. This includes construction of transmission lines along with the associated network for evacuation of power. Moreover, the transmission planning for any future RE projects in a specific location must be done in advance and implemented at a tight schedule for timely evacuation of power.

4.9 Market Support barrier

Apart from India and Pakistan, the local market in all the Member States lacks engineering base, understanding of the technology, and capability of indigenous development. Due to non-availability of local components, the private sector has to import the components at a higher cost which increases the overall cost of RE projects.

Measures

Member States may facilitate the collaboration of local manufacturing industries in each country for sharing knowledge, capacity building and transfer of technology among themselves. The lead role may be given to SAARC Chamber of Commerce and Industry or any other forum.

Table 3: RE barriers and proposed measures for its promotion

Barrier	Proposed measures
Economic barriers	
High Cost	Feed-in-tariffs, tendering schemes, tax exemptions to be introduced
Policy Barriers	
Scope	Scope of RE policies be enhanced to cover all RETs
Incentives	Incentives in form of soft loans to be provided to private sector
Targets	Specific targets for RE in total energy mix of each Member States
Awareness barrier	
Lack of information	Awareness campaign through print, electronic and social media
Resource Assessment barrier	
Assessment	Carry out nationwide on-ground measurement of solar and wind resource
Bankable data	Acquiring data from measuring stations for facilitating private sector
Technical Barriers	
Intermittent power	Using Energy Storage options
Regulatory Barriers	
Compliance / Enforcement of Regulatory regime	Mechanisms to be developed to enforce regulatory regime
Power Off-take and Grid Interconnection guidelines	Guidelines be developed and implemented
Bankable Project documents	Bankable standard project documents be prepared and make available
Institutional Barriers	
Institutional Capacity	Institutions be strengthened and manpower be trained
Infrastructure barrier	
Grid infrastructure	Transmission lines planning to be done in advance and construction to be completed
Market Support Barriers	
Capacity building	Sharing knowledge and understanding of RE among Member states
Local Manufacturing	Local manufacturing industry to be strengthened through regional cooperation

Chapter - 5

5. Economic and Non-economic supporting measures

In the SAARC Region, all Member States have offered various types of economic and non-economic incentives to the public/private sector through targeted policies and strategies for accelerating the deployment of off-grid and on-grid RETs. The enabling environment created by different type of initiatives in the Member States was directly responsible for increased share of RE in the energy mix of Member States. The economic and non-economic measures in the form of RE target, purchase obligation, fiscal/financial incentives, preferential tariffs, assessment of resource, climate financing mechanisms, infrastructure support, and capacity building & awareness in the Member States have been summarized in table 4 given below:

Table 4: Existing economic and non-economic incentives in SAARC countries

Measures	Economic			Non-Economic					
Impact	**Fiscal incentives**	**Subsidies/ Financial incentives**	**Preferential tariffs**	**Resource assessment**	**Climate related supporting mechanisms**	**Support in infrastructure development**	**Capacity building and awareness raising**	**RE target**	**RE purchase obligation**
Afghanistan[63]	All RE equipment exempted from custom duty or sales tax. All RE exempted from income tax for first 5 years.	Interest subsidies and Soft loans for RE projects.	Standardized framework for tariff will be developed by Govt by year 2016.	NREL developed solar and wind resource maps. Currently, on-ground measurement of wind	Clustering of installations shall be encouraged to produce carbon credits.	Develop infrastructure for larger sized generation and expansion of transmission and distribution	Rural entrepreneurs will be supported through training, marketing, feasibility studies, business planning, management, financing and linkages to	10% of total energy mix by year 2032.[64]	It is mandatory for Power distribution facility to buy electricity offered from RE projects achieving COD between 2022-

[63] Afghanistan Rural Renewable Energy Policy, 2013
[64] Afghanistan National Renewable Energy Policy, Ministry of Energy and Water, 2014

				speeds at specific sites is in process.		networks.	Community organizations.		2027.
Bangladesh[65]	All RE equipment exempted from VAT.	Micro-credit support system, subsidies to utilities for RE projects.	Incentive tariff for RE projects which may be 10% higher than the highest purchase price of electricity by utility from private generators.	Preparing and updating RE resources inventory.[66]	Develop financing mechanisms such as Carbon/CDM fund for investments.	Electricity may be supplied to customers by RE developers using existing electricity transmission and distribution systems.	support capacity building, technology development, and market development for RE technologies.	5% of total power demand by 2015 and 10% by 2020	RE projects may sell electricity (less than 5 MW) to power utilities or any consumer through mutual agreement.
Bhutan[67]	All RE projects exempted from import duties and sales tax during construction period. All RE projects (except small hydel plants) exempted from corporate/ business income tax for ten years after achieving COD.	All RE projects get Financial assistance provided by RE Development Fund. Capital subsidies and grants for small scale RE projects.	Feed-in-tariff to be designed and developed	RE master plan will be developed which includes resource analysis of potential project sites.	All RE projects shall be facilitated by Govt to avail benefits from CDM or any future international carbon market mechanisms.	The transmission access to RE project shall be provided by Transmission utility.	The support shall be provided by Govt. to organize publicity and awareness campaigns, seminars, workshops, symposia, business meetings, training programmes, studies and survey, etc.	20 MW by year 2025	The Energy generated from RE projects (except hydel power) for domestic supply is guaranteed for purchase by the Govt.

[65]Renewable Energy Policy of Bangladesh, 2008, MPEMR, Government of the People's Republic of Bangladesh
[66] The Sustainable and Renewable Energy Development Authority Act, 2012, Government of the People's Republic of Bangladesh
[67]Alternative Renewable Energy Policy 2013, Royal Government of Bhutan

India[68]	Specific goods require for RE projects exempted from Customs and excise duties by Central Govt. Reduced VAT (5-15%) provided by State Govts.[69]	IREDA to provide financing of RE projects. 100% FDI permitted for RE generation and distribution projects.[70] Relaxed norms for External Commercial Borrowings (ECB) for RE projects.[71]	Higher tariffs or Generation Based Incentives schemes to promote RE projects under IPP.	Create/ update/ validate database of RE resources.	National Clean Energy Fund created for supporting RE projects.	Central Govt may assist States in setting up transmission systems for RE projects.	Development of human resource, fostering international cooperation, public awareness campaign, and supporting Research & Development in New and RE sector.	6% in total energy mix and 10% in total electricity mix by year 2022. 20% blending of biofuels by year 2017.	Distribution companies, open access customers and captive customers are obligated to buy certain percentage of their power from RE.
Maldives[72]	All RE projects exempted from import duty.	Concessionary external funding allowed. Introduction of incentives and access to green funding allowed.	FITs for RE is already in place and MEA shall update it.	Collecting quality and credible RE resource data and supplying to RE stakeholders.	Carbon Capture and Sequestration (CCS) projects to be developed.[73] Maldives Green Fund (MGF) to be established	A feasibility study to be carried out for dispatching large scale RE power through inter-island connectivity.	Continuous capacity building and developing management capability of the energy sector institutions through appropriate training, empowerment and	Achieving carbon neutrality by year 2020.[74]	Although Government gave instructions to regional utilities to purchase electricity from RE sources but there isn't any obligation on

[68]Strategic Plan for New and Renewable Energy sector for the period 2011-17, MNRE, Government of India
[69] Taxes and incentives for Renewable Energy, KPMG International, 2014
[70]Strategic Plan for New and Renewable Energy sector for the period 2011-17, MNRE, Government of India
[71]Taxes and incentives for Renewable Energy, KPMG International, 2014
[72] Maldives SREP Investment Plan 2013-2017, Ministry of Environment and Energy, Republic of Maldives
[73]Maldives National Energy Policy & Strategy, 2010, Ministry of Housing and Environment, Republic of Maldives
[74]Maldives National Energy Policy & Strategy, 2010, Ministry of Housing and Environment, Republic of Maldives

					for the management of financing projects in areas of climate change and environment.		delegation of authority.		part of utilities.
Nepal[75]	All RE equipment exempted from all tax, concessionary 1% custom duty	All RE projects may mobilize financial resources through Rural Energy Fund.[76] Subsidy policy gives Detailed subsidy amount and soft loans mechanisms for RE projects.[77]	Feed-in-Tariff may be adopted for micro hydel power plants.[78]	Resource assessment of solar and wind to be conducted.[79]	Central Renewable Energy Fund may be established for providing funding for mini/micro RE technologies.[80]	Government in process of updating transmission master plan for off-taking free power from RE sources.[81]	Developing human resource capacity at central and local level bodies for formulating and management of rural energy programmes using RE technologies.	10% Share of RE in total energy supply by year 2030	Government will purchase small hydro power from all IPP with installed capacity up to 25 MW.

[75] Scaling-up Renewable Energy Program (SREP), Investment plan for Nepal, 2011
[76] Rural Energy Policy, 2006, Ministry of Environment, Government of Nepal
[77] Subsidy Policy for Renewable Energy, 2013, Ministry of Science, Technology and Environment, Government of Nepal
[78] Study on Feed-in-Tariff/PPA and Net Energy Metering including Policy Recommendations, AEPC, Government of Nepal
[79] Project appraisal document, Power Sector Reform and Sustainable Hydropower Development Project, 2015, The World Bank
[80] Subsidy Policy for Renewable Energy, 2013, Ministry of Science, Technology and Environment, Government of Nepal
[81] Rural Energy Policy, 2006, Ministry of Environment, Government of Nepal

Pakistan[82]	All RE equipment exempted from all taxes/ duties.	Corporate registered bonds permitted. Also, the risk in variability of wind speeds and water flows against notified benchmark level shall be purchaser's concern.	Upfront tariffs for renewables allowing 17-18% Return on Equity (ROE)[83]	Resource mapping of Solar, Wind and Biomass resources is being done by Govt with collaboration of world Bank. Solar and Wind data measure on-ground is available free of cost for investors.[84]	Govt shall encourage RE projects to register for Carbon credits or to avail any other available climate financing.	Electricity will be evacuated from the door step of RE power plant by the purchaser.	Institute of RETs may be established by AEDB for human resource development in RE sector.[85]	9,700 MW energy supply from RE by year 2030	Govt must purchase all the electricity offered by RE projects.
Sri Lanka[86]	All RE equipment exempted from VAT and import tax.	All RE technologies may receive funds through Energy Fund.	Developers may opt for Cost based and Technology specific three-tier or flat tariff announced for RE projects with installed	Solar and Wind energy resource maps developed by NREL. 3-4 years Wind and solar on-	RE projects will be facilitated to access climate funding through CDM and other Green	Energy Fund created by Govt will be used for strengthening transmission network for absorbing RE power.	Energy sector institutes shall enhance their capacity through training, empowerment and delegation of power.	10% of grid electricity from RE by year 2015 and 20% by year 2020.[89]	All energy produced by RE sources will be purchased by CEB and non-delivery shall not be penalized.

[82] Policy for development of Renewable Energy for Power Generation, 2006, AEDB, Government of Pakistan
[83] Information gathered from AEDB office, Islamabad
[84] Energy Sector Management Assistance Program website (https://www.esmap.org/re_mapping_pakistan), accessed on 15.12.2015
[85] Alternative Energy Development Board Act, 2010
[86] National Energy Policy, 2008, Ministry of Power & Energy, Democratic Socialist Republic of Sri Lanka

			capacity of less than 10 MW.[87]	ground measured data available for specific sites.[88]	funding mechanisms.				

[89]Long Term Generation Expansion Plan, 2015, Ceylon Electricity Board, Sri Lanka
[87] Report Feed-in-tariff in Sri Lanka, Energy Forum, Sri Lanka, 2012
[88]Long Term Generation Expansion Plan, 2015, Ceylon Electricity Board, Sri Lanka

Chapter - 6

6. Intra-regional and Inter-regional cooperation

The Governments of all Member States in SAARC Region are struggling to cope with the existing gap in energy demand and supply in their respective countries. They have been pursuing all available measures to counter the energy deficit problem which has been hampering the economic growth in their countries. There is much to be gained for Member States in various areas of policy, regulation, projects with success stories and knowledge dissemination through cooperation within region. Also, there are countless benefits to achieve from the cooperation by expanding the development process to consider the inter-regional level.

6.1 South Asian Association for Regional Cooperation

The South Asian Association for Regional Cooperation (SAARC) is an economic and geopolitical organization consisting of eight Member States of South Asia region. One of the major objectives of the SAARC is to promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields. In the RE sector, this can be achieved by close interaction and collaboration among the technical institutes of Member States working in the field of RE research and development, and joint/regional projects.

6.2 SAARC Framework Agreement on Energy Cooperation (Electricity)

The Heads of States of SAARC Member States signed SAARC Framework Agreement on Energy Cooperation (Electricity) in November 2014. Through this framework agreement, SAARC Member States have recalled the decision of the Sixteenth SAARC Summit held in Thimphu (2010), to enhance cooperation in the energy sector to facilitate energy trade, development of efficient conventional and RE resources including hydropower.

Further, the agreement in its article 14 states that Member States may enable and encourage knowledge sharing and joint research including exchange of experts and professionals related to, inter alia, power generation, transmission, distribution, energy efficiency, reduction of transmission and distribution losses, and development and grid integration of RE resources.

6.3 Institutional Partnerships and Regional Cooperation

In addition to technical problems, it has been observed that a failure in implementation of RE projects also happens due to lack of awareness and capable human resources. Capacity Building is a long term and continuous process which is highly dependent on the proactive participation and regular interaction between the relevant stakeholders including Government institutes, research and academia, and private sector from all Member States of SAARC region.

There are various research based RE agencies/departments in Member States of SAARC who are conducting Research & Development, and promotional activities in different RETs. List is given at table 5. Also, the focal Ministry/departments at the federal level in Member States responsible for RE sector are mentioned in table 6:

Table 5: Department responsible for Research and Development in RE

Department	City	Country
Renewable Energy Department, Ministry of Energy and Water	Kabul	Afghanistan
Department of Renewable Energy, Ministry of Economic Affairs	Thimpu	Bhutan
Directorate of Renewable Energy and Research & Development, Bangladesh Power Development Board	Dhaka	Bangladesh
The Energy and Resources Institute	New Delhi	India
Ministry of Environment and Energy	Male	Maldives
Alternative Energy Promotion Centre, Ministry of Science, Technology and Environment	Lalitpur	Nepal
Pakistan Council of Renewable Energy Technologies	Islamabad	Pakistan
Sri Lanka Sustainable Energy Authority	Colombo	Sri Lanka

Table 6: Ministry/ Focal Agency for Renewable Energy

Ministry/ Focal agency	City	Country
Renewable Energy Department, Ministry of Energy and Water	Kabul	Afghanistan
Department of Renewable Energy, Ministry of Economic Affairs	Thimpu	Bhutan
Power Division, Ministry of Power, Energy and Mineral Resources	Dhaka	Bangladesh
Ministry of New and Renewable Energy	New Delhi	India
Ministry of Environment and Energy	Male	Maldives
Alternative Energy Promotion Centre, Ministry of Science, Technology and Environment	Lalitpur	Nepal
Alternative Energy Development Board, Ministry of Water and Power	Islamabad	Pakistan

Ministry of Environment and Renewable Energy	Colombo	Sri Lanka

6.4 Recommendations

In the past, RE initiatives in the form of national level programmes and projects were launched in all Member States of SAARC with a focus to move towards a low carbon emission and indigenous resource. A number of areas have been identified which include huge scope for regional cooperation among the institutes and personals working in the field of RE. The following instruments may facilitate cooperation among Member States:

a. The Member States may jointly collaborate in the development of RE codes, standards for components/appliances, and labeling for the products encompassing the whole Region. Later, the implementation of mandatory minimum efficiency standards for appliances and equipment may be enforced through policy and regulatory mechanisms. The standardization of equipment may be regularly updated by a regional committee and must be effectively enforced by respective Governments. In parallel, the general public may also be informed about the energy-use characteristics of RE products through awareness campaign.
b. Globally, energy storage is emerging as potential means to support existing electricity network, improving distribution grid stability and meeting energy requirements of residential and commercial customers. The availability of cheap and reliable storage option is significantly vital for dwellers living in the rural areas of SAARC Member States who are using off-grid stand-alone Solar (PV) systems. The technology improvements and infrastructure investments in areas of energy storage are particularly important to tap the full potential of intermittent renewable resources. The Member States may focus on a joint project of research and development of energy storage technologies with assistance partly provided by private sector.
c. The development of RE sector in each Member State of SAARC is dependent on the implementation of an attractive policy, and regulatory framework that may spur private sector investment. The policies with supported legislation may help to stimulate promotion and development of RE. The Member States may collaborate with relevant departments of Bangladesh, Bhutan, India, and Pakistan in the field of Solar (PV), hydro, Wind and micro-hydro technologies respectively; these Member States have been able to develop strong base of the mentioned technologies by developing supportive regulatory mechanisms. The other Member States may discuss the effective policy

measures with them, and enact those nationally in the context of their own internal requirements.

d. The abundant resource of RE in SAARC Region has not been realized in substantial number of projects and the biggest hurdle in this regard is absence of reliable and bankable data. The private sector may not be able to actively participate in financing RE projects unless specific project sites with reliable data (2-5 years) are identified by the Member States. The satellite data for Solar and Wind Energy developed by National Renewable Energy Laboratory (NREL), United States Department of Energy for the Member States is available and may help to install Solar and Wind Energy measuring stations/ masts in high potential sites. The Member States may seek help from others, who in the past have successfully implemented ground based measurement projects.
e. The research based RE departments in Member States (listed in table 5) may offer hands on training to professionals from other Member States. It shall aim to increase knowledge and understanding among researchers of SAARC Member States on RE technology to consider for implementation.
f. The students and researchers may attend short courses on RETs offered by the national universities of Member States. The objective is to strengthen Human Resource of Member States by imparting RE knowledge and techniques in the perspective of Regional conditions of SAARC.
g. The conduction of technical training courses on RE through distance learning may be invaluable for junior and mid-level professionals. The training courses may be offered from the platform of distance learning providers already functional in South Asia.
h. A network forum may be formed which consists members from relevant departments and ministries dealing in RE. It shall strengthen interaction between policy makers by providing them with a communication and information platform to share experiences and best practices.
i. SAARC Energy Centre through its capacity building programme activities has been conducting workshops, seminars and Training courses in various fields of Energy sector. The same may be conducted for dissemination of information on commercially available technologies and techniques in field of Solar (PV), Wind, and Biomass etc.

The following recommendations have been formulated for the Member States with a holistic approach to the transition toward a sustainable energy future.

Chapter - 7

7. Climate Change funding mechanisms

The Member States of SAARC region have undertook measures to harness abundantly available RE potential in their respective countries for diversifying their national energy mix, meeting increased energy demand, exploiting indigenous resources, and the production of clean and environment friendly energy. It has been observed that Member States are finding it very difficult to arrange funding for RE projects as most of the projects are capital intensive and with high upfront costs. This chapter may help Member States in identifying the available Regional and International Climate Change Funding mechanisms for acquiring part funding of RE projects and programmes in their respective countries.

7.1 Background

Climate Change funding refers to national, regional or internationally available financing for public and private projects using environment friendly technologies. Climate finance is critical to addressing climate change because large scale investments are required to significantly reduce emissions, notably in sectors that emit large quantities of greenhouse gases.

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty that came into force in 1994. The ultimate objective of the Convention is to stabilize greenhouse gas (GHG) concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.

The Convention was complemented by the legally binding Kyoto Protocol in 1997 which has 192 Parties. Under this treaty, industrialized countries and the European Community have committed to reducing their emissions by an average of 5% by 2012 against 1990 levels. Industrialized countries must first and foremost take domestic action against climate change. However, the Protocol also allows them to meet their emission reduction commitments abroad through so-called market-based mechanisms. The Kyoto Protocol has had two commitment periods, the first of which lasts from 2005-2012, and the second 2012-2020.[90]

[90] UNFCCC website (http://cdm.unfccc.int/)

In accordance with the principle of common but differentiated responsibility and respective capabilities set out in the Convention, developed country Parties (industrialized countries) are to provide financial resources to assist developing country Parties in implementing the objectives of the UNFCCC. It is therefore, vital for the Member States of SAARC to understand and assess their own financial needs, and also to understand the sources of available financing.

There were three flexible mechanisms defined under the Kyoto Protocol which includes Emission Trading, Joint Implementation and Clean Development Mechanism. These mechanisms were intended to lower the overall costs of achieving emission targets. This would enable the developed countries to achieve their emission reductions targets cost effectively by indirect clean energy investment in other developing/under developed countries.

7.2 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) is one of the Flexible Mechanisms defined in the Kyoto Protocol that provides for emissions reduction projects which generate Certified Emission Reduction (CERs) units which may be traded in emissions trading schemes. It assists parties not included in Annex-I (developing/under-developed countries) in achieving sustainable development and to assist parties included in Annex-I (developed countries) in achieving compliance with their quantified emission limitation and reduction. The total numbers of registered projects under CDM at UNFCCC are 7,682 and the numbers of CERs issued as of 2nd December 2015 are approximately 1.6 billion. One CER unit equals one metric tonnes of CO_2 eq.[91]

7.3 Nationally Appropriate Mitigation Actions (NAMAs)

Nationally Appropriate Mitigation Actions (NAMAs) are one of the cornerstones of the international climate negotiations. The term was first introduced in the Bali Action Plan of 2007. Bali Action Plan called for "Nationally appropriate mitigation actions' (NAMAs) by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner". In Copenhagen in 2009, 114 countries agreed to the Copenhagen Accord and committed to undertaking mitigation actions as part of a shared responsibility to reduce

[91] CDM Insights, UNFCCC website (http://cdm.unfccc.int/Statistics/Public/index.html/)

greenhouse gas emissions, including an agreement that support should be provided to developing countries. The funding of NAMAs for the developing countries include technical and financial support for implementation of Policy, Strategies, Action Plans, large scale national/regional programmes for reduction of Greenhouse Gases (GHG) in the atmosphere.[92]

7.4 Green Climate Fund (GCF)

The Green Climate Fund (GCF) was adopted in 2011 as a financial mechanism of the UN Framework Convention on Climate Change (UNFCCC). The GCF was established to promote sustainable development by supporting developing countries in transition towards low carbon emissions, and is expected that GCF in future shall become the main multilateral financing mechanism to support climate action in developing countries.

The GCF will give financial support for projects and programmes in both public and private sectors in the developing countries. It will be financing activities eligible and related to adaptation, mitigation, technology development and transfer, and capacity building. It is intended to be the main fund for global climate change finance in the context of mobilizing USD 100 billion by 2020.[93]

7.5 Global Environment Facility (GEF)

The Global Environment Facility was established in the World Bank to assist in the protection of the global environment and for the promotion of environmental sustainable development. Later, GEF was restructured to become a permanent and separate institution, and entrusted to become the financial mechanism for the UNFCCC. However, World Bank now serves as the Trustee of the GEF Trust Fund and also provides administrative services.[94]

The GEF may provide Member States of SAARC region new and additional grants, and concessional funding to cover the incremental/additional costs associated with implementation of RE projects.

[92] NAMA Registry, UNFCCC website (http://unfccc.int/cooperation_support/nama/items/7476.php)
[93] Green Climate Fund website (http://www.greenclimate.fund/contributions/pledge-tracker#resource-mobilization)
[94] Global Environment Facility website (https://www.thegef.org/gef/whatisgef)

7.6 Other financing sources

Member States of SAARC region may also opt for available soft loans from multilateral lenders such as World Bank, Asian Development Bank, Kreditanstalt für Wiederaufbau (kfW) etc for the technical assistance and development of RE projects in their respective countries. Other sources of finances available for technical assistance are Global Energy Efficiency and Renewable Energy Fund (GEEREF) and Energy Sector Management Assistance Program (ESMAP).

7.7 Summary

Since start of the 21st century, climate change has emerged as one of the biggest threat to existence of humanity on the planet. The developed and developing countries have realized that adverse effects of climate change have affected the social and economic development of vulnerable communities. In this regard, the global community has established several mechanisms and funds for the projects and programmes that may contribute in reduction of GHGs and for protection of the environment. The various funding mechanisms and funds may help the Member States of SAARC region in acquiring part funding of their RE projects and programmes.

Chapter - 8

8. Conclusion

Globally, state of the art technologies for RE are used extensively for providing electricity in a sustainable manner. All the countries have started shifting from fossil fuels to RE with the aim to increase energy security, development of local resources and using environmentally friendly technologies. RE sector in the SAARC Member States still faces challenges in the form of economic and non-economic barriers. The huge amount of subsidies for fossil fuels offered by the Member States continues to deprive renewables with a level playing field.

There are types of instruments which may help in removal of economic barrier for RE i.e., introduction of feed-in-tariffs, tendering schemes and by offering tax exemptions to imported/local RE equipment in the Member States. The policy makers and planners from Member States may be encouraged to develop policies with specific targets which may enhance share of RE in the overall energy mix of the country. They should also initiate the awareness campaigns using print, electronic and social media platform for educating general public about the usefulness and benefits of using RETs.

All Member States may carry out nationwide Solar and Wind Energy resource mapping by installing ground based measuring stations of Solar and Wind energy at 5-6 identified locations with good resource. The data obtained may facilitate private sector in acquiring financing for their RE projects. Also, energy storage may be considered as one of the options for supporting reliable, efficient and sustainable power sector by facilitating deployment and integration of Renewables in electricity sector of Member States.

All Member States may create an electricity regulator or empower the existing one with the charge of regulating electricity tariffs, transparent policies regarding subsidies, and for ensuring provision of safe, reliable and affordable electric power to the consumers in their respective jurisdiction areas. They may appoint a dedicated authority/institute as “one-window facility” for facilitation and development of RE projects/technologies in their own respective countries. The manpower in the relevant authority may be educated and well equipped with the required and necessary tools for evaluating the RE projects. Member States may facilitate the collaboration of local manufacturing industries in each country for sharing knowledge, capacity building and transfer of technology among themselves.

The Member States may jointly collaborate in the development of RE codes, standards for components/appliances, and labeling for the products encompassing the whole Region.

It is anticipated that with increased level of support through enacting ambitious and realistic targets along with requisite policies and technology transfer may spur deployment of RETs in each Member State.