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Policy review and recommendations on the promotion of renewable energy and energy efficiency

(1st Draft)

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Acronyms and Abbreviations

A

ACE	ASEAN Center for Energy
ADB	Asian Development Bank
AE	Alternative Energy
AEDB	Alternative Energy Development Board
AEDP	Alternative Energy Development Plan
AFD	Agence Française de Développement
AJK	Azad Jammu and Kashmir
APCMA	All Pakistan Cement Mills Association
APEC	Asia-Pacific Economic Cooperation
APTMA	All Pakistan Textile Mills Association
ARE	Alternative and Renewable Energy
ASEAN	Association of Southeast Asian Nations

B

BAU	Business as usual
BEE	Bureau of Energy Efficiency
BIPV	Building-Integrated Photovoltaic
BOI	Board of Investment
BOT	Build-Operation-Transfer

C

CDB	China Development Bank
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CIT	Corporate Income Tax
CNEA	China National Energy Administration
CNREC	China National Renewable Energy Center
CSP	Competitive Selection Process

D

DEDE	Department of Alternative Energy Development and Efficiency
DFI	Development Finance Institution
DISCO	Distribution Company
DNA	Designated National Authority
DOE	Department of Energy
DSM	Demand Side Management
DU	Distribution Utility

E

ECF	Energy Conservation Fund
ECNEC	Executive Committee of the National Economic Council
EDF	Energy Development Fund
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EECO	Energy Efficiency and Conservation Office
EEO	Energy Efficiency Obligation

EEP	Energy Efficiency Plan
EGAT	Electricity Generating Authority of Thailand
EMC	Energy Management Contract
EMS	Energy Management System
ENERCON	Energy Conservation Center
EPA	Environmental Protection Agency
EPC	Energy Performance Contract
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
ESS	Energy Storage System
EVN	Electricity of Vietnam

F

FERTS	Fuel Efficiency in Road Transport Sector
FICCP	Framework for Implementation of Climate Change Policy
FIT	Feed-in Tariff

G

GDP	Gross Domestic Product
GEF	Global Environment Facility
GEMP	Government Energy Management Programme
GENCO	Generation Company
GHG	Greenhouse Gas
GHI	Global Horizontal Irradiance
GIZ	Gesellschaft für Internationale Zusammenarbeit
GOC	Government of China
GOI	Government of India
GOP	Government of Pakistan
GOPH	Government of the Philippines
GOT	Government of Thailand
GOV	Government of Vietnam

H

HDIP	Hydrocarbon Development Institute of Pakistan

I

IA	Implementation Agreement
ID&T	Import Duty and Tax
IFC	International Finance Corporation
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency Ltd.
IRENA	International Renewable Energy Agency
IRR	Implementing Rules and Regulations
ISO	International Organization for Standardization

J

JICA	Japan International Cooperation Agency

K

KfW	Kreditanstalt für Wiederaufbau
KP	Khyber Pakhtunkhwa

L

LOA	Letter of Award
LOI	Letter of Intent
LOS	Letter of Support

M

MEA	Metropolitan Electricity Authority
MNRE	Ministry of New and Renewable Energy
MOCC	Ministry of Climate Change
MOE	Ministry of Environment
MOF	Ministry of Finance
MOI	Ministry of Industry
MOIT	Ministry of Industry and Trade
MOPD	Ministry of Planning and Development
MOPDR	Ministry of Planning Development and Reform
MOWP	Ministry of Water and Power
MSME	Micro, Small and Medium-Sized Enterprise
MSW	Municipal Solid Waste
MTDF	Medium Term Development Framework

N

NAMA	National Appropriate Mitigation Action
NCCP	National Climate Change Policy
NDRC	National Development and Reform Commission
NEECA	National Energy Efficiency and Conservation Authority
NEECP	National Energy Efficiency and Conservation Program
NEPRA	National Electric Power Regulatory Authority
NGCP	National Grid Corporation of the Philippines
NIRC	National Internal Revenue Code
NPO	National Productivity Organization
NREB	National Renewable Energy Board
NREDS	National Renewable Energy Development Strategy
NREP	National Renewable Energy Program
NTDC	National Transmission and Dispatch Company

P

PC	Planning Commission
PCRET	Pakistan Council of Renewable Energy Technologies
PEA	Provincial Electricity Authority
PEAC	Pakistan Atomic Energy Commission
PEPCO	Pakistan Electric Power Company
PIT	Personal Income Tax
PMVN	Prime Minister of Vietnam
PPA	Power Purchase Agreement
PPIB	Private Power and Infrastructure Board
PPPBMA	Pakistan Pulp Paper and Board Mills Association
PRF	Policy and Regulatory Framework
PRMA	Pakistan Rice Mills Association
PSA	Power Supply Agreement
PSMA	Pakistan Sugar Mills Association
PSP	Power Statistics of Pakistan
PV	Photovoltaic

R

RA	Republic Act
R&D	Research and Development
RD	Revenue Department
RE&EE	Renewable Energy and Energy Efficiency
REAP	Renewable and Alternative Energy Association of Pakistan
RE	Renewable Energy
REC	Renewable Energy Certificate
RET	Renewable Energy Technology
RPS	Renewable Portfolio Standard

S

S&T	Science and Technology
SBP	State Bank of Pakistan
SEPF	Sustainable Energy Promotion Fund
SGD	Sustainable Development Goal
SIDBI	Small Industries Development Bank of India
SMEDA	Small and Medium Enterprise Development Authority
SPP	Small Power Producer
SPPA	Standardized Power Purchase Agreement

T

T&D	Transmission and Distribution
TFEC	Total Final Energy Consumption
TIEB	Thailand Integrated Energy Blueprint
TPEC	Total Primary Energy Consumption

U

UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development

V

VAT	Value-Added Tax
VEPF	Vietnam Environmental Protection Fund
VNEEP	Vietnam National Energy Efficiency Program
VSPP	Very Small Power Producer

W

WAPDA	Water and Power Development Authority
WB	World Bank
WESM	Wholesale Electricity Spot Market

Units

kW	kilowatt
kWh	kilowatt-hour
MW	megawatt
MWh	megawatt-hour
GW	gigawatt
GWh	gigawatt-hour
TWh	tetawatt-hour
MJ	megajoule
GJ	gigajoule
tce	tonne of coal equivalent
Mtce	Million tonnes of coal equivalent
toe	tonne of oil equivalent
Mtoe	Million tonnes of oil equivalent
m^2	square meter
m^3	cubic meter

Currencies

EUR	Euro
INR	Indian Rupee
PHP	Philippine Peso
PKR	Pakistani Rupee
RMB	Renminbi (Chinese Yuan)
THB	Thai Baht
USD	United States Dollar
VND	Vietnamese Dong

1. Introduction

The industrial sector in Pakistan is characterized by high dependence on fossil fuels such as diesel, natural gas and coal for captive energy (heat and/or power) generation. In most cases, the fossil fuels are used in low-efficient and old machinery and technologies, thereby incurring high energy production costs for industries. In addition, the use of fossil fuels for energy generation is harmful to the environment. Therefore, the Pakistan's industries have a large potential to reduce their energy production costs and mitigate pollution emissions by increasing the efficiency of fossil fuels and electricity use as well as adopting renewable energy technologies.

Presently, UNIDO, one of the implementing agencies of the Global Environment Facility (GEF), is working with the Government of Pakistan (GOP) to promote inclusive and sustainable industrial development in line with its key thematic areas, one of which is energy and environment. Upon the request of GOP, UNIDO developed a project, namely, "Sustainable Energy Initiative for Industries in Pakistan", which seeks to promote market-based adoption of RE and EE technologies and services in industries of Pakistan. The ultimate goal of this UNIDO/GEF project is to mitigate GHG emissions by developing and promoting a market environment that will stimulate investments in RE and EE projects. The project consists of three components:

1) Developing a policy and regulatory framework for incentivizing and promoting RE and EE application in industries of Pakistan;
2) Promoting RE and EE investments in industry through supporting RE and EE demonstration projects, facilitating EE audits, ISO 50001 Energy Management System (EMS) and energy use optimization; and
3) Creating a robust and sustainable market for RE and EE investments through a series of capacity development and awareness initiatives for industrial establishments, energy service companies (ESCO), public sector organizations, financial institutions, academia, etc.

This study is related to component 1 of the project. Its objective is to develop and propose a set of appropriate RE and EE policies and their implementation roadmap, which could be included in existing government policies and regulatory framework or form a basis for formulating new legislation for promoting RE and EE adaptation in industries of Pakistan. The policy recommendations are formulated based on the review and analysis of the policy gaps between the existing RE and EE policies in Pakistan and the international best practices and lessons learned from five Asian countries in similar circumstances, namely China, India, the Philippines, Thailand and Vietnam.

2. Types and Objectives of RE and EE Policies

This study focuses on the state policies, i.e., RE and EE policies and regulatory framework (i.e., laws, regulations, decisions, guidance, plans, strategies, etc.) promulgated by government authorities. Furthermore, emphasis is placed on policies which impact on the RE and EE adoption in the industrial sector.

Policies and regulatory frameworks play an essential role in the promotion of RE & EE adoption in any country. They can support the RE & EE development by[1]:

- creating markets (e.g., feed-in tariffs (FITs), renewable portfolio standard (RPS), government/public procurement, setting government requirements, taxing negative externalities, subsidizing positive externalities, eco-labeling, and other voluntary approaches);
- establishing governance and the regulatory framework (e.g., setting targets, setting standards, taxing negative externalities, subsidizing positive externalities, eco-labeling and other voluntary approaches, and tradable permits);
- providing finance (e.g.,,, loan guarantees, "green" banks, and RE/EE funds);
- developing infrastructure (e.g., public-private partnerships, incentivizing private development, etc.);
- building competence and human capital (e.g., subsidies and incentives for education and training, fellowships, scholarships, etc.);
- ctreating and sharing new knowledge (e.g., subsidies and incentives for new research, contest and prizes, intellectual property protection, etc.); and
- creating collaborative networks (e.g., joining or initiating international cooperation, supporting industry associations, etc.).

There are best practices (success stories) as well as lessons learned from the deployment of policy instruments to support the development of RE and EE in different countries. Based on international experience, the key policy instruments for successful promotion of RE and EE are:

- Realistic and achievable targets for RE and EE adoption;
- Attractive FITs/premium for electricity generated from RE sources;
- Suitable financial support to RE and EE projects (e.g., subsidies, soft loans, grants, etc.)
- Appropriate fiscal incentive mechanisms applied to RE and EE projects (e.g., value-added tax (VAT), corporate income tax (CIT), import duty and tax (ID&T) exemption or reduction);
- Mandatory requirements (e.g., RE quota obligation/RPS, energy performance targets, mandatory energy management, audit and reporting, forced retirement of inefficient equipment, penalties/fines, technical standards, eco-labeling, etc.);
- Simplified and transparent licensing and permitting procedures;
- Prioritized dispatch and clear grid connection procedures for RE-based power projects;
- Gender mainstreaming in RE & EE policy.

The different types of policy instruments, their objective/expected impacts, and some examples policy instruments are summarized in Table 1 for RE and in Table 2 for EE.

[1] IRENA (2013)

Table 1: Types of RE policy instruments

Type of policy instruments	Objective/Expected impact of the policy	Example policy instruments
Price-based policies	To reduce cost and pricing-related barriers by establishing favorable price regimes for RE relative to other sources of power generation.	• Feed-in tariff regime/premium • Standardized power purchase agreement (SPPA) • Premium/incentive for use of local equipment • Reduced transmission and distribution (T&D) costs • Net metering/banking • Carbon/Clean Development Mechanism (CDM) credit transaction
Quantity-based policies and procurement mechanisms	To mandate the introduction of a certain percentage or absolute quantity of RE capacity or generation at unspecified prices.	• RE quota obligation / RPS • Renewable Energy Certificate (REC) market • Competitive bidding/Auction
Financial incentives	To reduce RE project investment costs for RE to be more competitive and at par with conventional energy technologies.	• Soft loan • Investment grant • Financial subsidy
Fiscal incentives	To help improve the financial performance of the RE projects and make them more commercially attractive to investors.	• Accelerated depreciation • Tax exemption/reduction (VAT, CIT, ID&T, etc.) • Exemption/reduction of fees (licensing fees, land use fees, etc.) • Exemption/reduction of electricity sale duty
Mandatory grid access and prioritized dispatch	To give renewable energy equal or favorable treatment for access to T&D grids.	• Mandatory grid access/Prioritized dispatch • Grid code/standards that facilitate RE integration
Other RE policy measures	To support the capacity development of local stakeholders such as research and development (R&D) institutions, academic instutions, consultants, equipment manufacturers, and service providers.	• R&D funds/subsidies and other supporting measures • Financial and other support for knowledge creation and sharing activities • Financial and other support for capacity building activities • Financial and other support for local equipment manufacturers • Financial and other support for local service providers
Gender mainstreaming	To include the considerations, needs and priorities of both men and women in RE development and involve men and women equally in all RE policies and programmes. Expected impact: gender-balanced involvement and optimal benefits equally for both men and women.	• Clearly stated goals, requirements, guidelines, roles and resource allocation for gender mainstreaming • Gender-sensitive targets and indicators for RE programs • Gender analysis as a required standard procedure in planning • Gender-separated monitoring and evaluation system • Earmarked human and financial resource allocation for gender mainstreaming and women-focused incentives • Capacity building and training of women in RE technology • Capacity building programs for women in RE business and management • Loan programs for female RE entrepreneurs

Sources: compiled from IRENA (2013), WB (2011)

Table 2: Types of EE policy instruments

Type of policy instruments	Objective/Expected impact of the policy	Example policy instruments
Financial incentives	To reduce EE project investment costs for EE technologies and activities to be more competitive and at par with conventional energy technologies and solutions.	• Soft loan • Investment grant • Financial subsidy • Carbon/CDM credit transaction
Fiscal incentives	To help improve the financial performance of the EE projects and make them more commercially attractive to facility owners and/or investors.	• Accelerated depreciation • Tax exemption/reduction (VAT, CIT, ID&T, etc.) • Exemption/reduction of licensing fees • Exemption/reduction of land use fees
Mandatory measures on energy performance and management	To mandate a certain percentage or absolute quantity of energy saved (especially for energy-intensive enterprises), and to mandate the minimum energy efficiency of EE products.	• Mandatory energy performance targets • Mandatory energy management, audit and reporting • EE product standards and labeling • Forced retirement of low efficient equipment • Penalties for non-compliance to energy saving/conservation obligations
Other EE policy measures	To support the capacity development of local stakeholders such as R&D institutions, academic instutions, consultants, equipment manufacturers, and service providers (ESCOs).	• R&D funds/subsidies and other supporting measures • Financial and other support for knowledge creation and sharing activities • Financial and other support for capacity building activities • Financial and other support for local equipment manufacturers • Financial and other support for local service providers (ESCO)
Gender mainstreaming	To include the considerations, needs and priorities of both men and women in EE development and involve men and women equally in all EE policies and programmes. Expected impact: gender-balanced involvement and optimal benefits equally for both men and women.	• Clearly stated goals, requirements, guidelines, roles and resource allocation for gender mainstreaming • Gender-sensitive targets and indicators for EE programs • Gender analysis as a required standard procedure in planning • Gender-separated monitoring and evaluation system • Earmarked human and financial resource allocation for gender mainstreaming and women-focused incentives • Capacity building and training of women in EE technology • Capacity building programs for women in business and management • Loan programs for female EE entrepreneurs

Sources: compiled from UNECE (2015), WEC (2013) and IDFC (2013)

3. Recent RE and EE Development in Pakistan

3.1 Brief of Pakistan power sector

Pakistan's power sector has passed through several development stages since independence in 1947. The generation capacity has increased significantly, but could not match the increasing electricity demand of the country. It has remained under-performing and inefficient since independence. Various problems emanating from the malfunctioning of economic, political, institutional, technological and organizational machinery have remained dominant to keep this sector below the mark. There is still a mismatch between supply and demand, prices and affordability, efficiency and sustainability of electric power in Pakistan. Currently, the country is facing a severe electricity crisis to the tune of 6,000 MW which has resulted in severe black-outs in urban and rural areas. The current shortfall in supply of energy has resulted in a massive negative impact both on societal as well as economic well-being.

Up till the restructuring of the power sector in 1998, the power supply to the country was managed by the Water and Power Development Authority (WAPDA) and the Karachi Electric Supply Corporation (KESC) (privatized in 2005 and later renamed as K-Electric). The Pakistan Power Sector Strategic Plan was approved in 1992 for restructuring the power sector and introducing reforms. Under this plan, in 1998, the Power wing of WAPDA was unbundled into the National Transmission and Dispatch Company (NTDC), four Generation Companies (GENCOs) and ten Distribution Companies (DISCOs). NTDC is responsible for the transmission of power across the country, except for the city of Karachi which is served by K-Electric[2]. A critical element of the Strategic Plan was the creation and establishment of a Regulatory Authority to oversee the restructuring process and to regulate generation and distribution companies.

The National Electric Power Regulatory Authority (NEPRA) was created in 1997 to introduce transparent and judicious economic regulations, based on sound commercial principals, to the electric power sector of Pakistan[3]. As part of restructuring process, the Private Power and Infrastructure Board (PPIB) was created in 1994 as "One Window Facilitator" to promote private sector participation in the power sector of Pakistan[4]. The Alternative Energy Development Board (AEDB) was established in May 2003 with the main objective to facilitate, promote and encourage the development of Renewable Energy in Pakistan and with a mission to introduce Alternative and Renewable Energies (AREs) at an accelerated rate[5].

As of June 2015, the total installed generation capacity was 24,906 MW. This capacity comprises 6,902 MW from WAPDA hydropower plants, 7,663 MW from GENCOs thermal power plants, 213 MW from IPPs hydropower plants, 9,085 MW from IPPs thermal power plants, 787 MW from PEAC nuclear power plants, and 256 MW from wind power plants. Most recently, a 100 MW solar PV power plant was also commissioned at Quaid-E-Azam Solar Park (QA solar) in Bahawalpur. It is supplying power to the national grid. As per the Power Statistics of Pakistan, the total electricity generation in the year 2014-15 was 97,478 GWh. The contribution by various sources is given in Table 3.

[2] http://www.saarcenergy.org/wp-content/uploads/2016/03/6.-Pakistan.pdf
[3] http://www.nepra.org.pk/nepra.htm
[4] http://www.ppib.gov.pk/N_about_ppib.htm
[5] http://www.aedb.org/

Table 3: Electricity generation in Pakistan (2014-2015)

Generation Source	Electricity Generation (GWh)	Share in Generation Mix (%)
WAPDA hydro	31,525.0	32.3
IPPs hydro	1,038.0	1.1
IPPs thermal	46,017.0	47.2
GENCOs thermal	13,303.0	13.6
Nuclear	4,996.0	5.1
Wind	156.0	0.2
Imports from Iran	442.6	0.5
Total	**97,477.6**	**100.0**

During 2014-15, the total electricity consumption by various sectors was 90,408 GWh. Table 4 presents the electricity consumption of various sectors.

Table 4: Electricity consumption by sector in Pakistan (2014-2015)

Electricity Consumer	Electricity Consumed (GWh)	Share (%)
Domestic	40,761	41.5
Commercial	6,442	7.1
Industrial	24,928	27.6
Agriculture	8,032	8.9
Public lighting	440	0.5
Bulk supply	4,377	4.8
Traction	1	0.001
Sold to K-Electric by NTDC[6]	5,427	6.0
Total	**90,408**	**100.0**

Pakistan Vision 2025 aims at ensuring uninterrupted access to affordable and clean energy for all sections of the population through elimination of the current electricity supply-demand gap by 2018, and catering to growing future demand by addition of 25,000 MW by 2025. It also aims at completing Gaddani Energy Park with 6,600 MW capacity and two major hydel projects: Diamer-Bhasha (4,500 MW) and Dasu (4,320 MW) dams[7]. Many energy projects are currently under construction under the China Pakistan Economic Corridor (CPEC).

3.2 Renewable energy development in Pakistan

Pakistan is blessed with abundance of renewable energy resources, such as hydro, solar, wind, geothermal and bio-fuel. The current energy crises in the country can be resolved to a major extent if these resources are explored, exploited and developed properly. Details of the potential and current utilization of various renewable energy resources are given below.

Hydro Energy

Hydropower is a well-known source of energy in Pakistan and the country has made significant progress in this sector to develop it indigenously. Pakistan is endowed with hydropower resources of about 60,000 MW, most of which lie in the Khyber Pakhtunkhwa (KP), Gilgit-Baltistan, Punjab and Azad Jammu & Kashmir (AJK) regions[8]. However, most of the hydropower potential still needs to be harnessed. The total installed capacity of the hydropower plants in the country is 7,248

[6] http://www.ntdc.com.pk/Files/power2015.pdf
[7] http://www.pc.gov.pk/wp-content/uploads/2015/05/Pakistan-Vision-2025.pdf
[8] http://www.ppib.gov.pk/HYDRO.pdf

MW, out of which 4,303 MW is in KP, 1,698 MW in Punjab, 1,114 MW in AJK and 133 MW in Gilgit-Baltistan[9].

The Energy Department of the Government of Punjab is currently installing five small-scale low-head hydropower plants with a combined capacity of 24 MW on various canals and the Government of KP has set a target of installing 1,000 small units across the province out of which 53 have already been installed[10]. As per AEDB report[11], there is a total potential of approximately 2,000 MW (to be implemented till the year 2030) for mini/micro hydro power projects (HPPs). At present, HPPs with a total capacity of 128 MW are operational whereas other projects with a total capacity of 877 MW are under implementation. A mega project of Nelum-Jhelum in AJK with a capacity of 969 MW is also in the final stages of completion. Twelve hydro IPPs having a combined capacity of 5,719 MW are planned to be completed by 2025[12]. Table 5 shows the future hydro projects to be implemented by WAPDA.

Table 5: Future hydropower projects to be implemented by WAPDA

Name of the project	Capacity (MW)	Present status/ Expected year of commissioning
Bunji Dam	7,100	Project has been principally cleared by CDWP on 2/12/2015 for approval of ECNEC.
Dasu hydro power plant	4,320	Bidding documents were issued on February 12, 2016
Diamer Bhasha Dam	4,500	2019-2020 as per approved PC-I. However, the project has been postponed.
Chitral Power. Enhancement Project	5	Revised PC-I submitted to the Ministry of Water & Power on 12/02/2015.
Lower Palas Valley Project	625	December 2022
Lower Spat Gah	496	December 2022
Tarbela 4th extension	1,410	30/06/2017
Thakot Hydropower Project	4,000	The Feasibility Study is in progress. It was expected to be commissioned on November, 2017.

Solar Energy

Pakistan is one of the countries that receive the highest solar radiation in the world. Solar irradiance levels in parts of Pakistan, particularly in the southwest, are at par with the best in the world with global horizontal irradiance (GHI) values over 1,500 kWh/m² in over 90% of the country's land area. Based on preliminary analysis by the World Bank, the annual mean value of GHI for the whole of Pakistan is 2071 kWh/m²[13].

Government of Pakistan is offering incentives to investors for solar power development in the country. At present, 28 projects with a total capacity of 956.8 MW are under development. 100 MW of QA Solar Park was commissioned in 2015. It is expected that additional capacities of 400 MW, 730 MW and 1,556 MW will be added to the national grid in 2016, 2017 and 2018

[9] http://www.ntdc.com.pk/Files/power2015.pdf
[10] http://www.siasat.pk/forum/showthread.php?435974-1000-Mini-Micro-HydroPower-Stations-will-be-constructed-in-Khyber-Pukhtunkhwa
[11] http://www.aedb.org/index.php/ae-technologies/small-hydro
[12] http://www.ppib.gov.pk/N_upcoming_ipps.htm
[13] http://www.ifc.org/wps/wcm/connect/b46619004b5e398cb8b5fd08bc54e20b/IFC+-+Solar+Developer%27s+Guide+-+Web.pdf?MOD=AJPERES

respectively[14]. AEDB has issued letters of intent (LOI) to 24 projects of combined capacity of 556.8 MW[15]. Seven projects of combined capacity 73 MW have achieved financial close and letters of support (LOS) have been issued by AEDB. AEDB has also issued LOS for three projects of 100 MW capacity each at Quaid-E-Azam Solar Park[16]. Furthermore, the provincial government of Punjab has also issued letters of intent for 600 MW of solar power capacity.

As per NEPRA's statistics, the electricity generation based on solar energy was 57.61 GWh in July 2016 and its share in the total power generation was 0.52%[17].

No official figures are available on the off-grid installation of small and medium sized power plants in various industries. However, due to frequent load shedding and souring electricity prices, some of the industries have shifted their partial loads on solar PV. Two solar PV systems (178 kW each) have been installed within the premises of the Planning Commission of Pakistan and the Pakistan Engineering Council in Islamabad that would cater to the needs of both buildings. The entire setup amounts to a total generation capacity of 356 kW. It is one of the first project of its kind in the government sector. The first-ever high quality, integrated solar energy system with a 10 kW power generation capacity and which is capable of grid tie-in has been installed at Beacon House Canal Side Campus in Lahore. This project is one of the first few projects implemented by the private sector in Pakistan.

Government of Punjab is planning several other projects to convert governmental building to solar energy. Some of these projects are:

- Zero Energy Building in Johar Town, Lahore, with $20 million ADB funding,
- Installation of grid-tied Solar PV systems on 50 governmental offices,
- Rooftop installations of PV solar for 4,500 schools,
- Solarization of 5,000 schools funded by the Government of Punjab,
- Installation of solar PV systems at 80 basic health units funded by ADB,
- Installation of a 72kW Rooftop Solar PV system at Planning & Development department funded by KfW.

Wind Energy

Wind energy is another important sector where Pakistan can benefit by exploiting it in an efficient manner. Pakistan has a 1,046 km coastline in the South. Average wind speed in majority of the areas, including Gharo Wind Corridor, is more than 7 m/s above 60m height. This corridor has estimated potential of about 50,000 MW[18]. Several locations in Baluchistan, Punjab and northern areas have also been identified to have favorable wind conditions. This sector is getting worldwide attention with the development and availability of inexpensive technology that allows its easy conversion to useful energy[19].

Six projects with a combined capacity of 308.2 MW are currently in operation, nine projects with a combined capacity of 477 MW are under construction and fourteen projects of combined capacity

[14] http://www.aedb.org/index.php/ae-technologies/solar-power/solar-current-status
[15] http://www.aedb.org/index.php/ae-technologies/solar-power/solar-project-requirements
[16] http://www.aedb.org/index.php/ae-technologies/solar-power/list-of-los-holders
[17] http://www.nepra.org.pk/Tariff/Ex-WAPDA%20DISCOS/2016/TRF-100%20FCA%20XDISCOs%2029-08-2016%2011813-32.pdf
[18] http://www.dawn.com/news/1227553
[19] https://www.scribd.com/document/82179086/Pakistan-Country-Report-renewable

with a 663 MW are in pipeline[20]. 156 GWh were generated from wind energy during 2014-15 and its share in the total generation mix was 0.2%[21]. As per NEPRA statistics, 129.85 GWh of wind power was generated in July 2016 alone and its share in the total generation mix was 1.18%[22]. As part of the Energy Security Action Plan 2006, GOP has set a target to generate at least 5% of total National On-Grid Power through wind energy by year 2030[23].

Biomass Energy

Pakistan is an agricultural country with a very promising potential to produce power from biomass. Being an agrarian economy, more than 60% of the population is involved in agricultural activities in the country. As per World Bank statistics, around 47 % of land is under cultivation. The major sources of biomass energy are crop residues and animal manure. Wheat straw, rice husk, rice straw, cane trash, bagasse, cotton sticks are some of the major crop residues.

Sugar cane is a major crop that has grown on a wide scale throughout Pakistan. Cane trash which constitutes 10% of the sugar cane is currently burned in the fields. There are 86 sugar mills currently operating in the country. About 2000 MW of power can be generated and exported to the national grid through installation of high pressure cogeneration systems in the sugar sector of Pakistan. For crop year 2014-2015, the annual sugar cane crushing for all the sugar mills in the country was 50.80 million tonnes. With 30% bagasse-to-cane ratio, the gross bagasse generation potential turns out to 15.24 million tonnes per year. Using the high pressure technology, this amount of bagasse has the potential to generate 28.65 million tonnes of high pressure steam which consequently could generate 5,209 GWh of electricity. Sugar mills can export 60% of the generated electricity to the national grid after meeting their in-house demand (40%). As per NEPRA statistics, the generation on bagasse was 68.84 GWh during July 2016 and its share in the generation mix was 0.63%. Four bagasse-based high pressure cogeneration power plants with a combined capacity of 139.6 MW are currently operational and exporting power to the National Grid[24]. AEDB has issued LOIs to 11 other projects with a combined capacity of 271 MW[25].

Cotton is another major crop in Pakistan. Cotton is grown on around 11% of the total cropped area. The major residue from cotton crop is cotton sticks which is the material left after cotton picking. It constitutes as much as 3 times the cotton produced with an estimated annual power generation capacity of 3,071 GWh[26].

Pakistan is the world's fourth largest producer of milk. The cattle and dairy population in Pakistan is around 67,294,000 heads. The annual animal manure generation is estimated at 368,434,650 tonnes. There is a high potential for biogas generation from animal manure. This biogas could produce 23,654 GWh of electricity. The Pakistan Council of Renewable Energy Technologies (PCRET) has installed numerous biogas plants of various sizes across the country[27].

Municipal Solid Waste

[20] http://www.aedb.org/index.php/ae-technologies/wind-power/wind-current-status
[21] http://www.ntdc.com.pk/Files/power2015.pdf
[22] http://www.nepra.org.pk/Tariff/Ex-WAPDA%20DISCOS/2016/TRF-100%20FCA%20XDISCOs%2029-08-2016%2011813-32.pdf
[23] http://www.aedb.org/index.php/ae-technologies/wind-power/wind-investment-opportunities
[24] http://www.ntdc.com.pk/Files/power2015.pdf
[25] http://www.aedb.org/index.php/ae-technologies/biomass-waste-to-energy/biomass-loi-holders
[26] http://www.bioenergyconsult.com/biomass-pakistan/
[27] http://www.bioenergyconsult.com/biomass-pakistan/

The generation of solid wastes in the nine major urban centers is around 7.12 million tonnes per annum. It is increasing by 2.5% per year due to a fast population growth and a high rate of industrialization. The average calorific value of MSW in Pakistan is 6.89 MJ/kg which implies a power generation potential of around 13,900 GWh per annum[28]. The government is showing interest in the development of the MSW management mechanism in the country and to replace the inefficient and outdated MSW collection and disposal system. In addition to the latest MSW management mechanism, the government also has a plan to utilize biogas/landfill gas energy from the disposed MSW. Currently MSW is dumped in open plots, road sides or dumping sites in some cities and it is not utilized for energy generation.

The Punjab Government is planning to construct more landfills in major cities such as Multan, Bahawalpur, Faisalabad, Rawalpindi, Gujranwala, etc. Other provincial governments are also implementing similar modern MSW collection and disposal mechanisms and implementing different waste to energy projects. Lahore Waste Management Company (LWMC) is currently constructing a modern landfill site and will install a landfill gas (LFG) capture system in order to use it for electricity generation[29].

As per recent studies, the gross quantity of MSW generated in the 11 major cities is 25,352 tonnes/day, out of which only 16,175 tonnes/day is collected by the municipalities. If all the MSW is collected, and assuming an organic fraction of 50%, it is expected that 6,221,000 m^3 of biogas can be generated for the first year which is sufficient to generate 27,373 MWh of energy generation. It is estimated that by 2030, around 50 MW of electricity will be added to the national grid through installation of biogas/landfill gas power plants at landfill sites across the country.

Tidal Energy

Theoretically, global ocean energy resources are estimated to be over 32,000 GW. Interestingly, the net potential of both wave and tidal power is greater than that of wind and solar on a global perspective.[30]Pakistan has various strategic locations with high tidal current velocities or strong ocean currents along its 1046 km coastline. According to a study conducted by the National Institute of Oceanography, creek network in the Indus deltaic region, extending over 70 km along the Arabian Sea, can alone generate about 900 MW of tidal power[31]. Grid-based or off-grid tidal power stations could be constructed, depending on site conditions. Off-grid power stations would be more advantageous for meeting rural needs of electricity.

Geothermal Energy

Most of the high enthalpy geothermal resources of the world are within seismic volcanic activity. A global seismic belt passes through Pakistan and the country has long geological history of geotectonic events. In Tibet, which occupies more or less the same geological position in Himalayan mountain ranges as Pakistan, more than 6000 surface indications of geothermal energy resources have been discovered with an estimated potential of 800 MW. The geotectonic framework suggests that Pakistan should not be lacking in commercially exploitable sources of geothermal energy. This view is further strengthened by the fairly extensive development of

[28] http://www.bioenergyconsult.com/biomass-pakistan/
[29]http://www.lwmc.com.pk/uploads/WORKING%20PAPER%20CONSTRUCTION%20OF%20LANDFILL%20SITE%20AT%20LAKHODAIR.pdf
[30] http://www.dawn.com/news/1041485
[31] http://www.jofamericanscience.org/journals/am-sci/am1010/008_26106am101014_40_43.pdf

alteration zones and fumaroles, presence of a fairly large number of hot springs in different parts of the country, and indications of Quaternary volcanism.[32]

Recent RE Development Initiatives in Pakistan

A comprehensive resource assessment and mapping project covering biomass, solar and wind is currently ongoing, with a Solar Atlas expected to be finalized in early 2017. The project is being implemented by The World Bank in cooperation with the Alternative Energy Development Board (AEDB), with funding from the Energy Sector Management Assistance Program (ESMAP) and the Asia Sustainable and Alternative Energy Program (ASTAE). The solar mapping component includes up to two years of high quality, ground-based solar measurements taken from nine sites across Pakistan. The measurement data is being published on The World Bank's Energy & Extractives Open Data Platform, and can be freely downloaded.[33]

The Global Environmental Facility (GEF) has also approved a project under its Climate Change Focal Area, entitled, "Promoting sustainable energy production and use from biomass in Pakistan." The overall objective of the project is to promote market based adoption of modern biomass energy conversion technologies for process heat and power generation in Small and Medium Scale Enterprises (SMEs) and electrify rural areas in Pakistan. Part of the process is to support the adoption of biomass gasification technologies in SMEs. The project is being implemented by UNIDO[34].

The GIZ's Renewable Energy and Energy Efficiency(RE&EE) project is working with a variety of partners with the main political partner being the Ministry of Water and Power, office of the secretary and several implementation partners such as the Alternative Energy Development Board (AEDB), provincial energy/power departments, the National Energy Conservation Centre (ENERCON) and other public and private stakeholders. The overall objective of the project is to improve capacities of the public and private sector to promote RE as part of rural electrification and to implement energy efficiency EE activities in small and medium-sized enterprises (SMEs)[35]. The project has supported AEDB in development of upfront feed-in tariffs for grid-connected power generation from renewable energy sources[36]. The project has helped define political targets for renewable energy and energy efficiency that have been adopted by Pakistan's cabinet. Likewise, the project is helping to implement RE & EE policies.

The United Nations Industrial Development Organization (UNIDO) is also implementing a Global Environment Facility (GEF) funded project entitled "Sustainable Energy Initiative for Industries in Pakistan". The project is aimed to stimulate investments in renewable energy and energy efficiency projects in industry[37].

The Alternative Energy Development Board (AEDB) has taken several initiatives for the promotion of renewable energy through organization of international and local conferences, exhibitions and road shows with active participation of media to address the issues of consumer

[32] https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2005/0650.pdf
[33] http://www.ifc.org/wps/wcm/connect/b46619004b5e398cb8b5fd08bc54e20b/IFC+-+Solar+Developer%27s+Guide+-+Web.pdf?MOD=AJPERES
[34] http://biomass-unido-nust.com.pk/
[35] https://www.climate-eval.org/sites/default/files/evaluations/399%20energy-efficiency-brief.pdf
[36] http://www.nepra.org.pk/Tariff/Upfront/UPFRONT%20SOLAR%20INFORMATION.PDF
[37] https://timesofislamabad.com/sustainable-energy-initiative-for-industries-launched-in-pakistan-by-gef/2016/07/25/

shyness and acceptability of RE technologies, to develop local capacities for EPC services. AEDB being the sole representative of the Government of Pakistan for the promotion of renewable energy is supporting the private sector in addressing their administrative issues and building capacities of the public sector institutions in solar power projects.[38]

The biggest challenge in promotion of renewable energy is to develop state of the art technologies which can generate energy at cost comparable to conventional sources. During the last two decades, Pakistan has not made quite significant advancement in manufacturing Renewable Energy Technologies. Photovoltaic panels are being used in Pakistan for rural electrification, telephone exchanges, repeater stations, highway emergency telephone centers, and refrigeration of vaccines. These panels are imported from America, Europe, China and also being fabricated at small scale in the country.

The Pakistan Council of Renewable Energy Technologies (PCRET) has designed and developed solar water-heaters, solar cookers, solar dehydrator and solar desalination plants. PCRET is the main agency involved in the installation of biogas plants in the country, which are locally manufactured. PCRET and Agha Khan Rural Support Programme (AKRSP) are also involved in the installation of micro hydel plants in the northern areas and Khyber Pakhtunkhwa. They have designed and developed micro hydel turbines, which are locally manufactured. Wind turbines are imported, but some micro turbine fabrication facilities are established in the country.

3.3 Energy efficiency development in Pakistan

Work on Energy Efficiency and Conservation in Pakistan started in 1986 through the establishment of the National Energy Conservation Centre (ENERCON) under the Ministry of Planning & Development (MOPD) with the assistance of USAID. Initially, it worked very well in different sectors of the economy. However, it could not continue its progress due to lack of institutional framework and financial resources. Therefore, the activities undertaken by ENERCON, i.e. Project BRESL (Barrier Removal to the cost-effective development and implementation of Energy Efficiency Standards and Labelling), FERTS (Fuel Efficiency in Road Transport Sector), RE&EE (Renewable Energy and Energy Efficiency), were based on the availability of donor funding with limited sectoral impacts.

Possible savings for Pakistan through energy conservation are estimated to be 5 billion USD a year. Energy conservation potential estimates in various sectors are 25% for industry, 20% for transport, 20% for agriculture, and 30% for buildings (30%)[39]. Official statistical data for the energy saved through various measures are not available in the country.

However, USAID has undertaken extensive projects for energy efficiency in the country. The USAID Power Distribution Program (PDP) was aimed to improve the performance of power distribution utilities across Pakistan. The project installed 71,000 smart meters in various distribution companies across the country. It also involved GIS Mapping, Load Flow Analysis and Feeder Rehabilitation Proposals of Distribution System. Rehabilitation of meters and service cable was also undertaken.

The Energy Efficiency and Capacity Project (EEC) was a three-year effort funded by USAID. The aim of the project was to improve the power supply situation in Pakistan by reducing losses and

[38] http://www.aedb.org/index.php/ae-technologies/solar-power/solar-current-status
[39] http://energyefficiency.gov.np/uploads/14promotion_of__1449654042.pdf

lowering demand for power. As demand side management measure, four Power Conservation Action Plans at four electricity DISCOs in Pakistan were prepared. An integral part of the EEC project was to demonstrate Demand Side Management practices through pilot initiative. Tubewell Efficiency Improvement Program (TWEIP) was designed to demonstrate the potential to significantly improve the efficiency of the use of electricity in the world's largest irrigation-based agricultural system. The project had a target to replace 11,000 inefficient tubewell pump sets with efficient ones across seven DISCOs in Pakistan. With 11,000 replacements, the project aimed to reduce peak demand for electricity by approximately 45 MW and generate annual energy savings of 115.5 GWh.

A component of the project was Replacement of inefficient Municipal Water Pumping Systems. This program aimed to replace inefficient motor pumpsets in the publicly-owned water and sewerage utilities. The project resulted in the replacement of 135 tubewell pump-sets at the Capital Development Authority (CDA) and 75 tubewell pump-sets at the Karachi Water and Sewerage Board (KWSB). Another component of the project was the Industrial Motors Replacement Program. This program was implemented across all nine power distribution companies of Pakistan and resulted in the replacement of 2100 inefficient industrial motors.

Another component of the project was the LT Capacitor Installation Program. The project aimed to install 150,704 Low Tension (LT) capacitors on agriculture tubewells connected to nine DISCOs. The USAID projects have resulted in total energy savings of 1,447 MW[40].

The European Union is also supporting the implementation of high pressure cogeneration projects for the sugar sector of Pakistan. The specific objective of the project is to promote sustainable production of electricity through replication of high pressure cogeneration technologies in the sugar sector. It is estimated that 2,000 MW power could be generated in sugar mills through high pressure cogeneration technologies[41].

The National CFL Project (co-financed by ADB & the AFD) aimed to replace 30 million inefficient Incandescent Lamps (40W, 60W and 100W) with efficient (23W) Compact Fluorescent Lamps (CFL) in the domestic sector of Pakistan resulting in energy savings of 1100 MW[42]. GIZ's RE&EE project was implemented in 42 units in the textile sector, 5 units in the foundry sector, 2 units in the steel re-rolling sector, 4 units in the edible oil sector, 1 unit in the dairy sector and in eight hospitals which resulted in overall energy savings of 9,340 TOE[43].

It must be noted that energy efficiency investment requirements for Pakistan are estimated at 8.16 billion USD over the ten-year period (2010-2019). Recently, energy efficiency improvement has been identified as one of the key elements for achieving energy security plan in the GoP's Vision 2030. It has been stated that an efficiency improvement programme will be undertaken with the aim of sustaining and improving the current activities in various sectors of the economy, with a primary focus on identification, demonstration, data gathering and systematic implementation of low and medium cost measures to achieve conservation.

In 2005, the ENERCON and the MOE issued the "National Energy Conservation Policy (NECP) 2006". It included guidelines and possible actions that could enhance end-use efficiency for various energy-consuming sectors of the economy. Based on the NECP, the GoP is now in the process of

[40] http://www.pitcopk.com/projects
[41] http://www.hpcogenpak.org/
[42] https://www.adb.org/projects/42051-023/main#project-pds
[43] http://energyefficiency.gov.np/uploads/14promotion_of__1449654042.pdf

establishing the policy framework for EE. Under this framework, ENERCON is being mandated to act as national coordinator for energy conservation measures and strategy. Recently, the National Energy Efficiency and Conservation Act, 2016 has been enacted by the National Assembly. ENERCON will soon be turned into the National Energy Efficiency & Conservation Authority (NEECA) which will act as focal Federal agency for initiating, catalyzing and coordinating the implementation of energy conservation activities in all sectors of the economy under the auspices of the Pakistan Energy Efficiency and Conservation Board (PEECB) headed by the Federal Minister for Water & Power.

So far, ENERCON has issued over 400 technical reports and project studies. It has undertaken 4000 energy audits and tune-ups across the country. It has trained over 7000 persons ranging from corporate managers, technical operators, to service providers and local consumers[44].

The FERTS project was undertaken by ENERCON in collaboration with UNDP. The objective of FERTS was to reduce greenhouse gas emissions and other pollutants through the improvement of fuel efficiency of road transport vehicles. The project established 50 tune-up centers and provided training to 895 workshop owners and 2075 mechanics. A targeted awareness campaign was also undertaken[45].

BRESL (Barrier Removal to the cost-effective development and implementation of Energy Efficiency Standards and Labelling) is a UNDP/GEF funded regional project. ENERCON, under the Ministry of Water & Power is the implementing partner in Pakistan. The project is aimed at rapidly accelerating the adoption and implementation of energy standards and labels (ES&L) in Asia, and, in so doing, generate energy savings through the use of energy efficient appliances/equipment. The project also facilitates harmonization of test procedures, standards and labels among developing countries in Asia, when appropriate[46].

UNIDO is also implementing a Global Environment Facility (GEF)-funded project in the industrial sector titled "Sustainable Energy Initiative for industries in Pakistan". One objective of the project is to stimulate investments in energy efficiency projects in industry, which in turn will support industrial development in the energy scarce country.

3.4 Existing RE and EE institutional framework in Pakistan

3.4.1 Existing RE institutional framework in Pakistan

The existing institutional framework for RE sector is presented in Figure 1.

1. Ministry of Water and Power

The federal Ministry of Water and Power is the GOP's executive arm for all issues relating to electricity generation, transmission and distribution, pricing, regulation, and consumption in the country. It exercises this function through its various line agencies as well as relevant autonomous

[44] http://eeasia.unescap.org/PDFs/Gap-Analysis-Pakistan.pdf

[45] http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiZze254J_PAhXMWRQKHXyOAIwQFggkMAE&url=http%3A%2F%2Fwww.pk.undp.org%2Fcontent%2Fdam%2Fpakistan%2Fdocs%2FEvaluationReports%2FFuel%2520Efficiency%2520in%2520the%2520Road%2520Transport%2520Sector.pdf%3Fdownload&usg=AFQjCNHqqWS77OLmbx9CMHviR_LtuDV4Dw

[46] http://bresl.net.pk/content.php?submanuid=25&manuid=11

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.

2. WAPDA and PEPCO

WAPDA, the Pakistan Water and Power Development Authority, was created in 1958 as a Semi-Autonomous Body for the purpose of coordinating and giving a unified direction to the development of schemes in Water and Power Sectors, which were previously being dealt with, by the respective Electricity and Irrigation Department of the Provinces. In October 2007, WAPDA was bifurcated into two distinct entities i.e. WAPDA and the Pakistan Electric Power Company (PEPCO). WAPDA is responsible for water and hydropower development whereas PEPCO is vested with the responsibility of thermal power generation, transmission, distribution and billing.

- WAPDA is fully responsible for the development of Hydel Power and Water Sector Projects.
- PEPCO is responsible for the management of all the affairs of corporatized ten Distribution Companies (DISCOs), four Generation Companies (GENCOs) and a National Transmission Dispatch Company (NTDC).

3. National Electric Power Regulatory Authority

The National Electric Power Regulatory Authority (NEPRA) was established under an act of the Parliament (Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, also known as the 'NEPRA Act') to function as an independent regulator and ensure a transparent, competitive, commercially-oriented power market in Pakistan.

The Authority's main functions include, inter alia, issuing licenses for generation, transmission and distribution of electric power; establishing and enforcing standards to ensure quality, safety, and proper accounting of operation and supply of electric power to consumers; approving investment and power acquisition programs of the utility companies; and determining tariffs for bulk generation and transmission and retail distribution of electric power.

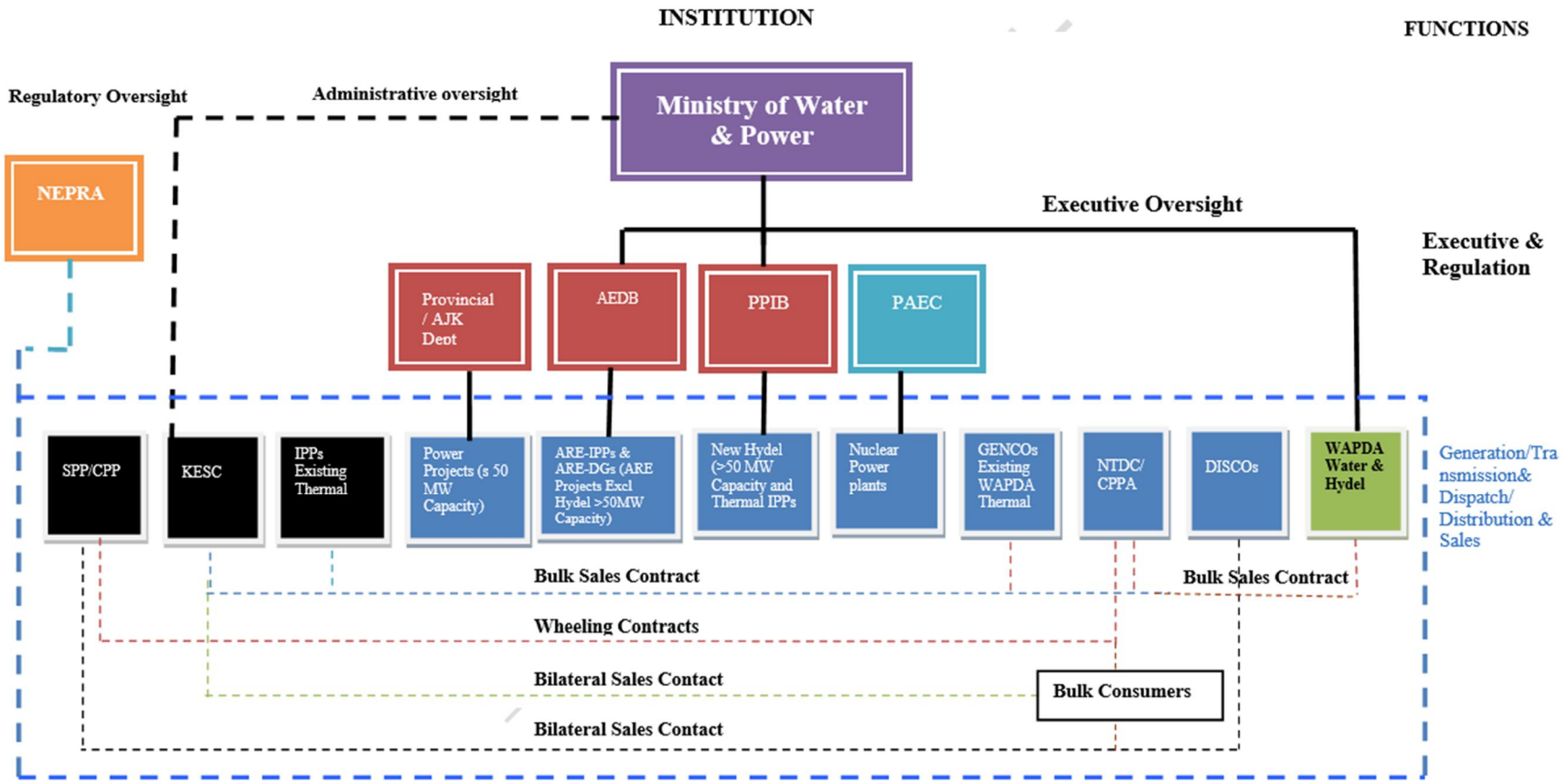

Figure 1: Existing institutional framework for RE sector in Pakistan

4. Alternative Energy Development Board

The Alternative Energy Development Board (AEDB) was established under AEDB act 2011 as an autonomous body, with the aim of promoting and facilitating the exploitation of renewable energy resources in Pakistan so as to achieve the GoP's RE deployment targets. The AEDB is tasked with implementing government policies and plans, developing projects, promoting local manufacturing, creating awareness and facilitating technology transfer, channeling international assistance, and coordinating all associated activities as the national facilitating agency for the development of RE in the country. It has also been designated as a 'one-window' facility for processing RE power generation projects (of all capacity sizes except hydel projects larger than 50 MW; for hydel projects below 50 MW capacity, consultation with and approval of the provinces is mandatory).

5. Private Power Infrastructure Board

The Private Power and Infrastructure Board (PPIB) was constituted under PPIB Act 2012. It has representation from each of the four provinces of Pakistan and AJK, acts as a 'one-window' facilitator for conventional private sector power generation projects, including RE hydel projects of more than 50 MW capacity.

6. Provincial and AJK Agencies

Provincial and Azad Jammu and Kashmir (AJK) governments support the implementation of RE projects within their geographical jurisdiction, either on their own or in collaboration with AEDB. They are in charge of expediting and facilitating allocation of land use rights (e.g.,,, for wind farms), permitting, creating awareness of RE use, and removing other impediments which may hinder progress in their development. The Pakhtunkhwa Energy Development Organization (PEDO) in KP province and the Irrigation and Power (I&P) Departments in Punjab, Sindh, Baluchistan, and AJK were created to manage water resources for agriculture and small power generation units of less than 50 MW. In the Northern Areas, the concerned organization is the Water and Power Department. Each of these departments has a Chief Engineer, who heads the department's technical management capacity with respect to provincial power projects.

7. Power Utilities

Electricity utilities in Pakistan comprise ten separately corporatized distribution companies (DISCOs: Lahore, Gujranwala, Faisalabad, Islamabad, Multan, Peshawar, Hyderabad, Sukkur, Quetta, and Tribal Areas) serving different regions of Pakistan and a private integrated company, the K-Electric, serving the Karachi metropolitan area.

In addition, there are four generation companies (GENCOs): Southern, Central, Northern, and Lakhra) and the Water and Power Development Authority (WAPDA) Hydel Wing. Control of power transmission and dispatch is allocated to the National Transmission and Dispatch Company (NTDC). These companies are established under companies (amendment) Act 1999.

3.4.2 Existing EE institutional framework in Pakistan

The existing institutional framework for EE sector is presented in Figure 2[47].

[47] Energy Efficiency and Conservation in Punjab, Energy Dept. Punjab, Oct 2015 by Iftikhar Randhawa

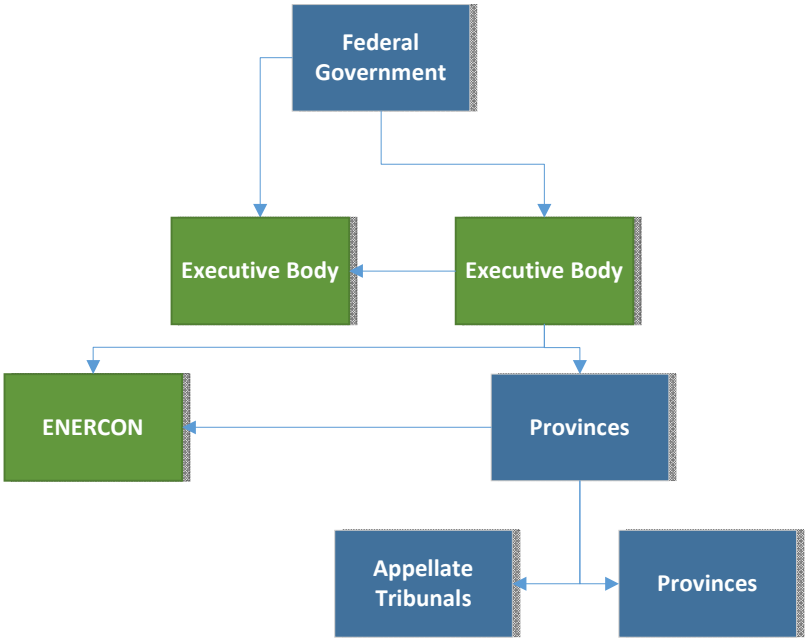

Figure 2: Existing institutional framework for EE sector in Pakistan

ENERCON/NEECA

The Government of Pakistan has mandated ENERCON to act as national coordinator for energy conservation measures and strategy. The organogram of ENERCON is provided in Figure 3. The roles and responsibilities of NEECA include:

- Formulation of National Policy,
- Enforcement of the Act,
- Create awareness,
- Prepare National Development plan for Energy Conservation,
- Approve & enforce EE standards,
- Promote investment,
- Institute awards,
- Administer ENERCON,
- Ratify the decision of Executive Committee,
- Create ENERCON Fund,
- Coordinate locally & internationally,
- Carry out energy audits.

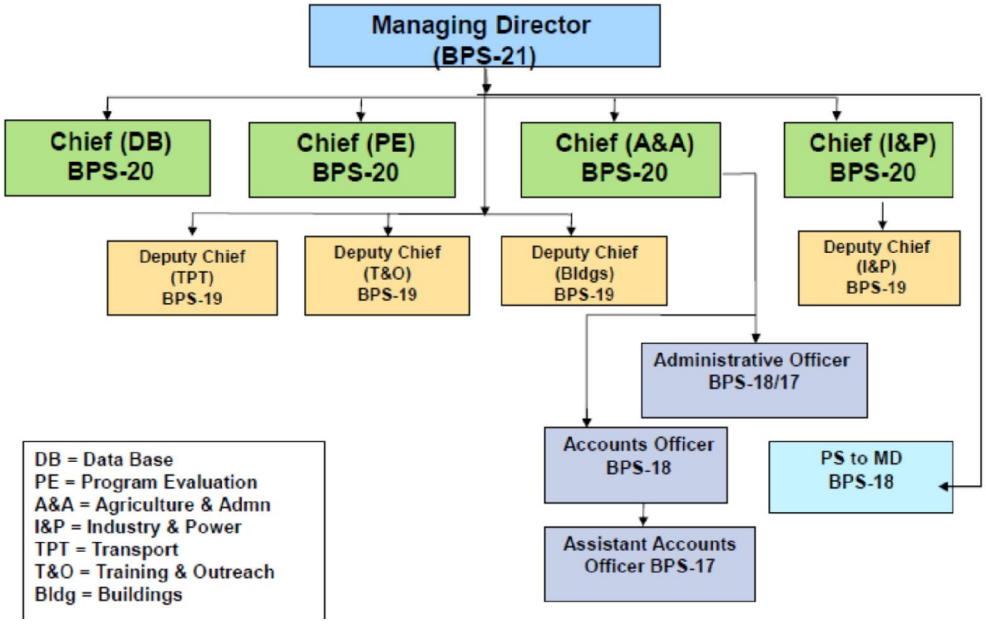

Figure 3: The organogram of ENERCON

Punjab Energy Efficiency and Conservation Agency

The energy policies and regulations have been a federal subject until recently. In 2011, the Energy Department (ED) was established by the Government of Punjab to administer the issues related to energy. The issue of energy efficiency was not given much priority in the beginning as the ED focused more on increasing the energy supply than on Demand Side Management. However, recently "Punjab Energy Efficiency and Conservation Agency" (PEECA), was established to carry out the project of "Punjab Energy efficiency and conservation Program"[48]. The organogram of PEECA is shown in Figure 4[49].

During the 8th meeting of Punjab Provincial Development Working Party (PDWP), financial commitments to the tune of 1209.84 Million PKR was approved under program "Punjab Energy Efficiency and Conservation Programme 2015-18 (PEECP)[50].

The roles and responsibilities of PEECA are:

- Certify laboratories,
- Establish enforcement mechanism,
- Accredit ESCOs,
- Establish mechanisms to enforce standards,
- Amendment in Energy Building code,
- Take compliance of Energy Building Code,
- Seek information from Designated Consumers,
- Establish Provincial Energy Conservation Fund,
- Make rules for implementation of EEC Act,

[48] http://www.energy.punjab.gov.pk/
[49] Energy Efficiency and Conservation in Punjab, Energy Dept. Punjab, Oct 2015 by Iftikhar Randhawa
[50] http://www.pndpunjab.gov.pk/8thPDWP

- Appoint a Designated Agency,
- Appoint Inspecting officers,
- Enquiries & Investigations[51].

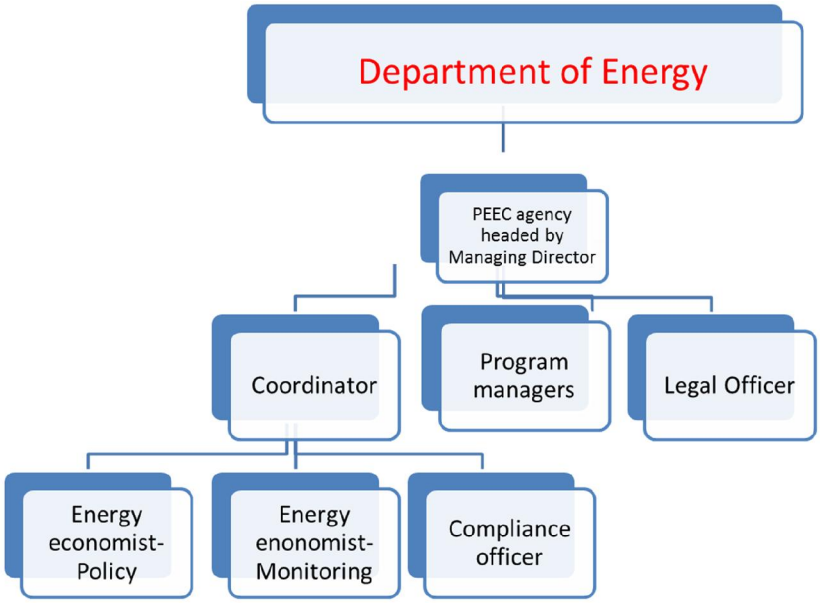

Figure 4: The organogram of PEECA

[51] Energy Efficiency and Conservation in Punjab, Energy Dept. Punjab, Oct 2015 by Iftikhar Randhawa

4. Review of existing RE & EE Policy and Regulatory Framework in Pakistan

4.1 Existing RE Policy & Regulatory Framework in Pakistan

Introduction

Pakistan has abundance of renewable energy resources, such as hydro, solar, wind, geothermal and bio-fuel. GOP is introducing measures to promote the use of RE.

The total (theoretical) power potential of RE in Pakistan is estimated to be around 3,334 GW. A detailed breakup is given in Table 6.

Table 6: Potential and actual power generation from RE sources in Pakistan

No.	Type of RE	Theoretical potential (GW)	Actual installed capacity by 2015 (GW)
1.	Wind power	340	0.3082
2.	Solar power	2,900	0.3090[52]
3.	Hydropower (including large-scale)	63	7.2480[53]
4.	Biomass (including MSW)	30	0.1396
5.	Geothermal	0.9	-
	Total	**3,333.9**	**8.0048**

As of June 2015, around 8,005 MW of RE-based power capacity was installed which account for 0.002% of the total RE potential. Hydropower plants (excluding off-grid small hydro power plants) have a combined installed capacity of 7,248 MW (90.5% of total RE-based installed power capacity), followed by solar power with 309 MW (3.86 %), wind power with 308 MW (3.85%), and biomass-based power with 140 MW (1.7%).

RE Targets and Planning

In order to harness power from renewable resources, GOP announced the Policy for Development of Renewable Energy for Power Generation in 2006 (RE Policy 2006). The Policy sets a 2030 target to add a minimum of 9,700 MW of RE-based electricity generation capacity as per the goals set in the Medium Term Development Framework (MTDF).

In order to achieve its target, RE Policy 2006 adopts a phased, evolutionary approach constituting a strategic policy implementation roadmap which consisted of three phases:

- **Short Term (2006-2008):** focused on commercially-proven technologies and resources such as small hydro, wind, solar, and biomass-based power generation by offering lenient policy measures and incentives.
- **Medium Term (2008-2012):** envisaged that a more comprehensive 'medium term' policy framework would be prepared for the systematic implementation of RE technologies and scaling up of capacity deployment.
- **Long Term (2012-onwards)**: envisaged that RE will be fully mainstreamed and integrated within the nation's energy planning process. During this phase, RE-based power producers will be gradually exposed to full competition from alternative sources.

[52] Figure based on NEPRA's generation figures in July 2017.
[53] This doesn't include off-gird small hydropower projects.

Based on the actual RE-based power capacity installed (8.0048 GW) in Pakistan, it is observed that the Policy has failed to achieve its objectives of RE capacity addition, as stated in the policy implementation roadmap. There was very little progress in the RE sector from 2006-2008. Moreover, the medium term policy framework could not be prepared. Instead, RE Policy 2006 was extended up to year 2018 through the *Framework for Power Cogeneration Bagasse and Biomass* announced in year 2013.

The National Sustainable Development Strategy: Pakistan's Pathway to a Sustainable and Resilient Future 2012 (NSDS 2012) is a report by UNDP which was adopted as strategy by the Ministry of Climate Change (MOCC) in 2012.[54] The Strategy sets a target to increase the share of Alternative and RE sources (small hydro, wind and solar) to at least 12% of the total energy mix by the year 2022.

As of July 2016, the total share of RE resources (except large-scale hydro) was 2.33% in the generation mix. It means that only 19.4% of the target has been achieved in 4 years and about 80% is still to be achieved in the remaining 6 years.

Vision 2025, prepared by the Planning Commission of Pakistan, was announced in 2013. The Vision sets a target to eliminate the current electricity supply-demand gap by 2018 and add 25,000 MW by 2025 to the national grid to cater for the future energy demands. This includes completion of two major hydel projects: Diamer-Bhasha dam (4500MW) and Dasu dam (4320 MW) and tapping Pakistan's huge potential for alternative energy.

Vision 2025 also envisages an integrated energy development plan that addresses the merits of our energy imports, the development of indigenous energy resources, a more diversified energy mix, and initiatives to achieve better EE (including assessing investment in efficiency improvements versus additional capacity) and management.

The target of adding 25,000 MW by 2025 is very ambitious. This corresponds to an average annual growth rate of 6 to 7%, more than twice the historical growth between 2000 and 2012. The cost to achieve this growth is staggering. As per information available on WAPDA website, bidding documents were issued on February 12, 2016 for Dasu dam and the expected year of completion of Diamer Basha dam was 2019-2020 as per approved PC1. However, reports states that both Diamer Basha dam has been delayed until 2037[55] and work on Dasu dam project is moving with slow pace.

RE Price-based Policies

Feed-in tariff / premium: Since the promulgation of the 2006 RE Policy, RE-based power plants have been guaranteed grid connection. The policy mandates NEPRA to determine tariffs for grid-connected RE-based power plants. NEPRA, under its 2011 Up-front Tariff (Approval & Procedure) Regulations, introduced the regime of up-front tariff/FIT.

To set the FITs, the following factors are taken into account: (i) techno-economic performance of different RE technologies, (ii) geographic location of the project, and (iii) availability of RE resources. The FITs for renewable electricity evolved over time and have been continuously reduced according to the cost of development. Table 7 presents the upfront tariff/FITs currently applied in Pakistan.

[54] http://www.brecorder.com/pakistan/general-news/130405-pakistan-kicks-off-strategy-for-sustainable-development.html
[55] https://www.thenews.com.pk/archive/print/639042-bhasha-dam-delayed-till-2037

Table 7: Upfront tariffs/FITs for grid-connected RE-based power projects in Pakistan

Type of RE sources	Upfront Tariff/FIT	
	Levelized Tariff (PKR/kWh)	Applicability
Small Hydro (1-25MW)	11.1016	Type of Project: Low head Tariff base: 100% foreign financing
	13.0297	Type of Project: Low head Tariff base: 100% local financing
	10.2559	Type of Project: High head Tariff base: 100% foreign financing
	12.0606	Type of Project: High head Tariff base: 100% local financing
Wind	12.7064	All
Solar PV	12.1093	Region: North Capacity: ≥ 1MW ≤20MW
	12.0183	Region: North Capacity: > 1MW ≤50MW
	11.9238	Region: North Capacity: >50MW ≤100MW
	11.4366	Region: South Capacity: ≥ 1MW ≤20MW
	11.3506	Region: South Capacity: > 1MW ≤50MW
	11.2614	Region: South Capacity: > 1MW ≤50MW
Biomass/Bagasse	10.7291	All

.

Many units have adopted these upfront tariffs. Details are given in Table 8 below.

Table 8: Status of adoption of upfront tariffs for RE in Pakistan

No.	Upfront Tariff	Adopted by (Number of Projects)	Combined Capacity (MW)
1	Wind	19	979.3
2	Solar	11	472.48
3	Bagasse/Biomass	8	298
4	Small Hydro	-	-

It can be seen from Table 7 that the upfront tariff adoption is highest in the wind sector followed by solar and biomass. Although the country is moving in the right direction regarding exploitation of its RE resources, there is still need for awareness raising of the industry to adopt more sustainable energy practices

SPPA: As part of its security package, the 2006 RE Policy makes it mandatory for the power purchaser to enter into a specific PPA, based on a standard model agreement, with the RE power producer. GOP shall also enter into an Implementation Agreement (IA) which will guarantee the payment obligation of the public sector power purchaser on account of power sales extending over the term of the PPA. The PPAs will be much simpler than those for thermal or large hydro IPPs, and shall be based on the purchase of all power generated at a per-kWh rate, i.e., there will be no capacity charge, capacity testing, no risk, and no penalty conditions implied.

Premium for use of local equipment: The Framework for Implementation of Climate Change Policy published in 2013 (FICCP 2013) encourages the promotion of local manufacturing of power generation equipment. However, currently there is no policy instrument that offers premium for use of locally manufactured machinery/equipment.

Reduced T&D costs: As per the upfront tariff regime for grid-connected RE-based IPPs, the grid connection costs shall be paid by the power purchaser (NTDC/DISCOs). However, grid operators (NTDC/DISCOs) in Pakistan have largely ignored these rules. Projects developers are asked to establish the interconnection facility by themselves and the cost will be reimbursed to them at later stages. Many project developers have complained about delayed payments.

Net metering/banking: The concept of net metering was first introduced in Pakistan in the 2006 RE Policy. It allowed setting up RE power projects (up to 1 MW capacity) for captive generation as well as selling the surplus (what is beyond the needs of the power generator) electricity to the national grid (i.e., DISCOs). Under the net metering regime, the power generator can also import electricity from the grid when it is not possible to cover its own demand.

NEPRA prepared the Net Metering Rules 2015 in consultation with AEDB. As per these rules, any person who meets the requirements of a Distributed Generator can sell surplus power to a DISCO. At the end of each Billing Cycle following the date of final interconnection of Distributed Generation Facility to the Distribution System of the DISCO, the latter shall net off the kWh supplied by Distributed Generator against the kWh supplied to it. In case the kWh supplied by the Distributed Generator exceed the kWh supplied by the DISCO, the net kWh shall be credited against Distributed Generator's next billing cycle for future consumption, or shall be paid by the DISCO to the Distributed Generator quarterly at off-peak tariff of the respective consumer category of the Distributed Generator for that month.

Carbon/CDM credit transactions: The 2006 RE Policy encourages all qualified RE-based power projects to register with the CDM Executive Board. It also states that the Government shall also strive, in collaboration with international development agencies, to facilitate project applications for such carbon credits in order to reduce the associated initial transaction costs for project sponsors.

In 2012, MOCC announced the *National Climate Change Policy* (NCCP 2012). It focuses on the utilization of the potential of CDM by designing zero-emission buildings through RE technology and development of biogas and manure digesters for methane generation and energy production. It also highlights the need for institutional strengthening and awareness raising in order to ensure access to CDM. FICCP 2013 also encourages the utilization of CDM in various sectors of the economy. The Policy also envisages the creation of an enabling environment to secure an appropriate share from the "Green Climate Fund".

Pakistan has ratified the Kyoto Protocol and has established a Designated National Authority (DNA) (CDM Cell of MOCC) for CDM related matters. Pakistan has been able to register 17 RE-based projects with a combined capacity of 719.22 MW amounting to 16.684 million CERs. Five RE-based project of a combined capacity of 1,510 MW amounting to 23.423 million CERs are under validation. Up to date, Pakistan has a total nine of NAMAs under development in different sectors. Out of these, eight have been submitted to UNFCCC[56].

Although the government has taken steps to promote carbon markets in the country, project developers remain solely responsible for the registration process and there are no incentives (grants or technical support) available for CDM project developers.

RE Quantity-based Policies and Procurement Mechanisms

Competitive bidding/Auction: Under the 2016 RE Policy regime, in the case of solicited proposals, bidders shall be invited by AEDB/Provincial/AJK Agency from IPPs to participate

[56] http://www.nama-database.org/index.php/Special:RunQuery/QueryData

in a competitive bidding process. After completion of the evaluation of the bids, an LOS shall be issued to the successful bidder to facilitate the project's financial close.

Feasibility studies undertaken by the public sector and donor agencies will be made available to all interested private entrepreneurs by the AEDB/Provincial/AJK Agency against a nominal administrative fee. The full cost of the feasibility study (up to a reasonable ceiling and as reflected on the books of the concerned agency as being the actual cost of the feasibility study), shall be indicated in the LOI and charged to the project developer at the time of issuance of the LOI, except in the case where such study was conducted under grant financing (e.g., donor funding, etc.). Wherever the GOP has obtained such a feasibility prepared by the public or private sector, preference would be given to the award of these projects through international competitive bidding (ICB).

Financial Incentives for RE Projects

Soft loans: The State Bank of Pakistan (SBP) has announced a financing scheme for RE aimed at borrowers and banks/development finance institutions (DFIs). SBP announced the Scheme for Financing Power Plants using RE in 2009, with a view to promoting RE projects in the country. Keeping in view the low utilization of the scheme, the scope and financial mechanism have been revised by SBP to make it more attractive to borrowers, banks and DFIs.

The scheme offers financing facilities under two categories. Category I cover projects beyond 1 MW up to 50 MW while Category II includes projects from 4 kW to 1 MW for own use and/or for supply to DISCO as per the rules set by NEPRA in 2015. Financing facilities under the scheme are provided through all commercial banks and DFIs.

For category I, the Scheme offers refinance for up to 100% of the financing (debt), provided by banks/DFIs to the eligible projects. However, the maximum refinance allowed under the Scheme is at 6 billion PKR for a single RE project. Financing under the scheme shall be provided by the banks/DFIs on first come first served basis within the overall amount earmarked for this purpose. Financing under Category I of the scheme is available for a maximum period of twelve years including a maximum grace period of two years from the date of first disbursement. The rate of service charge at which SBP provides refinance to the banks/DFIs is fixed for the entire duration of the loan. The principal amount of loans shall be repayable in quarterly or half yearly installments after the prescribed grace period.

For category II, financing under the Scheme is available for a maximum period of ten years with no grace period. Service charges and rates for end users of the Scheme have been fixed. The principal amount of loans and Mark-up is repayable in monthly/quarterly installments. Disbursements by banks/DFIs will not be made to the borrowers directly; instead payments are made to the manufacturers/suppliers/contractors.

Within two months after the announcement of the RE Refinance Facility in August 2016, SBP has received 13 loan applications from various SMEs, which shows that the scheme is attractive for investors/project developers

Investment grants: There are no government special funds available to provide investment grant or subsidy to RE projects. However, various donors such as the World Bank, ADB, JICA and the European Union are supporting development of RE-based power projects.

Financial subsidy: Currently no financial subsidies are offered to RE projects under any policy instrument. Instead, fossil fuel based power generation is subsidized through various power policies.

Fiscal Incentives for RE Projects

No policy instrument offers ***accelerated depreciation*** of RE projects in Pakistan. The 2006 RE Policy offers the following fiscal incentives to RE-based power projects:

- Exemption from CIT, including turnover rate tax;
- Exemption from withholding ID&T; and
- Exemption from customs duty or sale tax on machinery, equipment and spares utilized for RE based power generation.

Exempted/reduced licensing fees: Licensing fees are lower for RE projects than for thermal power projects. A comparison is given in Table 9 below.

Table 9: Licensing fee comparison between RE and non-RE power projects in Pakistan

No.	Activity	Fee, USD (Renewable)	Fee, USD (Fossil Fuel/Large Hydro)
1	Registration Fee	100	200
2	Prequalification Documents (PQDs) Fee	500	1,500
3	Request for Proposals (RFP) Fee	1,000	2,500
4	Bid Evaluation Fee		20,000
5	Project Processing Fee at issuance of Letter of Support (LOS) / Letter of Award (LOA)	• 1,000 for ≤ 5 MW • 5,000 for > 5 MW to 20 MW • 10,000 for > 20 MW to 50 MW • 20,000 50 MW (i.e., wind, solar w/o AEDB)	• 100,000 (Unsolicited Projects) • 80,000 (ICB Projects)
6	Legal fees	Subject to a cap of: • 100,000 USD for projects above 50 MW, • 50,000 USD for projects in the range of 6-50 MW, • 20,000 USD for projects in the range of 1-5 MW, and • no charge for projects of capacity below 1 MW	

Mandatory Grid Access and Prioritized Dispatch

Mandatory grid access: Electricity purchase by NTDC/CPPA from qualifying RE-based generation projects has been made mandatory by the 2006 RE Policy. It states that it shall be mandatory for DISCOs to buy all the electricity offered to them by RE projects in order to secure the market for RE projects.

The Net Metering Rules 2015 also makes it mandatory for the DISCOs to accept application from its consumers willing to install RE based distributed generation facilities and purchase all the electricity offered.

All RE based power plants commissioned so far are given grid access and supplying power to the national grid. However, DISCOs are reluctant to offer the net metering facility to its consumers due to technical constraints. So far only two DISCOs (IESCO and LESCO) have offered this facility to some projects.

Grid code to facilitate RE integration: Grid and Distribution Codes are in place in Pakistan since 2005. The Grid Code is an essential requirement of the regulation of the electric network supply and delivery system. The Grid Code sets out the operating procedures and principles between NTDC and all authorized Electricity Operators. The Grid Code approved by NEPRA is structured so as to ensure that NTDC's transmission system can be developed, operated, and maintained in an efficient, safe, reliable and coordinated manner from technical and commercial aspects.

The Distribution Code is also an essential part of the Regulatory Framework of the Pakistan Distribution Electric Supply System. The purpose of this code is to ensure that the DISCOs' networks are planned, developed, operated, and maintained in an efficient, safe, reliable, coordinated, and economical manner from the technical stand point. The Distribution Code, approved by NEPRA defines the technical and operational aspects of the relationship between DISCO and all those entities connected to the DISCO Distribution System.

The National Grid Code for wind power projects has been amended and the Grid Integration Plan 2010 -2015 for wind power projects has been developed by AEDB to support NTDC. AEDB has also taken initiatives to amend the Grid Code for solar and distributed generation[57].

The Net Metering Rules 2015 refer to grid and distribution codes for technical specifications of the interconnection facilities. As these systems are of very small scale, there should be specific guidelines and standards for these systems and best practice examples from across the world should be followed instead of "reinventing the wheel".

Other RE Policy Measures

R&D funds / subsidies: Pakistan provides financial support to research and development (R&D) of RE technologies, mainly biogas plants, small wind turbine and manufacturing of PV panels under the auspices of the Pakistan Council of Renewable Energy Technologies (PCRET). PCRET is involved in R&D and capacity building activities across the country. During the 2014-15 period, the electricity generated from various technologies installed by PCRET amounted to 438 MWh from solar PV and 52,560 MWh from small hydro power plants[58]. However, there are no funds/subsidies available for R&D activities in the private sector.

Support for knowledge creating & sharing: Various trainings, seminars and workshops are conducted by PCRET and AEDB for the promotion of RE technologies. Various donor agencies are also supporting the promotion of RE in the country. However, no funds are allocated for such activities to be undertaken in the private sector.

Single window clearance systems for licensing and permitting: Alternative Energy Development Board (AEDB) is the sole representing agency of the Federal Government to facilitate, promote and encourage development of Renewable Energy in Pakistan and with a mission to introduce Alternative and Renewable Energies (AREs) at an accelerated rate. As per RE Policy 2006, Letter of Intent (LOI) and Letter of Support (LOS) will be issued by AEDB and project developers has to approach NEPRA for generation license and tariff determination/acceptance of upfront tariff. In order to apply for generation license, a project developer has to get LOI from AEDB, conduct IEE/EIA study and get NOC from respective EPA and undertake grid interconnection study and get it approved by NTDC/DISCO. Due to involvement of different institution and lack of single window operation, the licensing and permitting process is very tedious which has delayed many projects.

[57] http://www.powerasia.com.pk/icaep2014/presentations/AEDB_Current_Status_Prospects.pdf
[58] http://www.pcret.gov.pk/energybook2015rev.pdf

For small scale distributed generation, Net Metering Rules 2015 has proposed single window operation as the Distributed Generator has to submit application to the DISCO only in order to install distributed generation facility and supply electricity to the national grid.

4.2 Existing EE Policy & Regulatory Framework in Pakistan

Introduction

The National Energy Conservation Center (ENERCON) serves as the main focal body for the EE&C sector in Pakistan. It was established in 1986 with the assistance of USAID. The Pakistan National Energy Conservation Policy was prepared by ENERCON. This policy was approved in 2006 providing broad guidelines for enhancing end-use efficiency in various sectors of the economy.

Currently, ENERCON is serving under the MOWP and is in a phase of transformation. After the enactment of 2016 National EE&C Bill, the Energy Conservation board will be the custodian of national policy for energy conservation and ensure proper utilization, planning and management of energy in all sectors of the economy. ENERCON will act as a National Energy Efficiency and Conservation Authority (NEECA) and will play a pivotal role in the EE&C sector. The 2016 EE&C Bill will provide a legal cover to the efforts aimed at stopping wastage of energy in the country.

After the 18th Amendment in the Constitution of Pakistan, the Department of Energy Punjab was established in 2011 to plan, oversee and administer the development, growth and regulation of the energy sector in Punjab. The Department of Energy Punjab has established the Punjab EE&C Authority (PEECA) under Punjab EE&C Program. This authority will work as implementation arm for NEECA.

Table 10: Energy consumption by sector in Pakistan (2014)

Sector	% Energy Consumption
Industry	35.5
Transport	31.6
Domestic	25.2
Commercial	4.1
Others (Government)	2.0
Agriculture	1.6

Source: Energy Year Book 2014 by HDIP. Excluded Fuels consumed in thermal power generation

The above table indicates that the highest share of energy consumption is in the industrial sector of Pakistan. The latter mainly comprises small and medium textile, leather, sugar, pulp and paper enterprises. The contribution of the industrial sector to GDP is around 19%. Thus energy efficiency has become a corner stone as far as achieving competitiveness in industry is concerned.

Table 11: Industrial energy consumption by type of fuel in Pakistan

Source	Share % (Including the Fertilizer Feed Stock)	Share % Excluding the Fertilizer Feed Stock)
Gas	51.86	40.33
Coal	25.68	31.83
Electricity	12.75	15.80
Oil	9.71	12.04

Source: Energy Year Book 2014 by HDIP

Table 11 shows that, in terms of industrial energy consumption split, natural gas holds the largest share, followed by coal and electricity. The industries in the province of Punjab are the largest consumer of electricity, followed by the industries in Sindh and KP.

Table 12: Province-wide industrial electricity consumption in Pakistan

Province	Consumption (GWh)	%
Punjab	17,678	71.47
Sindh	4,832	19.54
KP	2,083	8.42
Baluchistan	140	0.57
Total	24,733	100

Source: State of the Industry Report 2015 by NEPRA

EE Targets and Planning

In 2007, a preliminary assessment of EE&C sector was conducted by GOP under the ADB's EE initiative. Table 13 presents industrial energy consumption, realizable EE potential for various industrial sectors[59]. Total EE potential in industry sector was estimated at 14,912 ktoe for the 2008-2019 period. However, the realizable EE potential was expected to be 1,983 ktoe (13.3% of the total EE potential) only.

Table 13: Industrial energy consumption and realizable energy saving in Pakistan

Subsector	Energy Consumption (ktoe)				EE potential (ktoe)	Realizable EE potential (ktoe)
	Fuels	Electricity	Total FY 2008	Total FY 2019		
Iron & Steel	610	215	825	1,276	451	21
Pulp & Paper	1,197	47	1,244	2,517	1,273	170
Textile	2,519	433	2,952	5,977	3,025	339
Cement & Kilns	5,852	0	5,852	11,933	6,081	476
Other Industry	4,929	988	5,917	9,999	4,082	977
Total	**15,107**	**1,683**	**16,790**	**31,702**	**14,912**	**1,983**

Later on, the EE&C Sector Roadmap for the period of 2009 -16 was prepared with the assistance of ADB under the Sustainable Energy Efficiency Development Program. This roadmap does not only provide the potential energy saving at national level, but also gives comprehensive investment plan for the EE sector in the country. It was a first of its kind analysis done in the EE&C sector of Pakistan. The Planning Commission was designated as the focal agency for the Roadmap. The overall identified investment requirement is 8,518 million USD in the EE sector for the period of 2009-2016 with potential savings of 9,475 ktoe till 2020[60]. The share of DSM in potential savings is 7,145 ktoe.

The studies carried out by ENERCON and HDIP endorsed the potential of EE&C sector and estimated the saving potential at 11,160 ktoe[61].

ENERCON projects that annual energy savings of up to 25% are possible in all sectors which corresponds to approximately 3 to 5 billion USD/year[62,63]. Sector-wise energy saving potential is given as follows:

- 25% in industry;

[59] Based on ADB TA-7060 Pakistan Sustainable Energy Efficiency Development Program (2009)
[60] Sustainable Energy Efficiency Development Program, Final Report, by ADB
[61] Rapid Assessment Gap Analysis: Pakistan, 2014 by S4ALL
[62] http://energyefficiency.gov.np/uploads/14promotion_of__1449654042.pdf
[63] Rapid Assessment Gap Analysis: Pakistan, 2014 by S4ALL

- 20% in transport;
- 20% in agriculture; and
- 30% in buildings

The Pakistan Integrated Energy Model (Pak-IEM) developed by IRG indicates a net energy saving worth 41 billion PKR at user end[64].

Financial Incentives for EE Projects

GOP has signed a Framework Financing Agreement with ADB under the Energy Efficiency Investment Program. It is a multi-tranche financing facility (MFF) sponsored by ADB, AFD and GOP. This framework is an integral part of Pakistan's EE&C Roadmap and investment plan for the period of 2009-18. This MFF was devised to overcome financial barriers in materializing the EE&C Roadmap. The total volume of investment facility is 1,180 million USD for 2009-18. The requests for financing were entertained till December 2014. This Framework intends to finance industrial EE projects, improvement in heat rate of power plants, efficient lighting and appliances in the commercial and domestic sector. The final date of disbursement through this facility is 16th September 2019.

The Energy Conservation Fund (ECF) was initially part of ENERCON but later on ECF was registered as a corporate body with the Security & Exchange Commission of Pakistan (SECP), Islamabad in 2002. Funds amounting to 3 million USD was converted into PKR and parked with ECF. The main objective of the Company is "energy conservation through EE, use of alternative economical nonpolluting energy, better maintenance techniques for all types of vehicles, equipment, devices, machinery in use in Pakistan". The scope of ECF was previously limited to the leasing/financing of vehicle tune-up equipment. However, ECF decided to enhance its scope, and included all energy conservation initiatives under its mandate.[65]

MOWP has suggested MOF to provide import duty exemption on Silicon Electric Steel Sheet, a basic raw material for fans and motors which will enhance the capacity of local manufacturers to supply energy efficient fans and motors in the market at competitive prices.

SBP is following the Government's policy on SDGs. It is working with the Global Climate Fund and has recently launched very attractive refinancing schemes for the promotion of RE. SBP is also working on to launch financial scheme for EE projects in 2017. GIZ will support SBP to develop Green Financing Guidelines for commercial banks to promote EE.[66]

Under the recent legislation on EE&C, it is one of the functions of the relevant ministries and agencies (e.g., MOF, MOWP, ENERCON) to recommend GOP on the introduction of financial incentives for EE projects. A budgetary allocation of 1,209.84 million PKR for a period of 3 years (2015-18) is made under the Punjab EE&C Programme 2015-18.[67]

ENERCON has introduced National Energy Efficiency & Conservation Awards 2015-2016 to encourage the EE&C activities in the industrial sector under the Energy Conservation fund.

Fiscal Incentives for EE Projects

Exempted/reduced ID&T: The proposal for exemption of duties on import of LED bulbs/lights has been approved in the 2016 Finance Act. In order to provide a level-playing field to local LED bulb assembling companies and to compete with importers of LED bulbs, a reduction of

[64] Pakistan Integrated Energy Model, Model Design Report
[65] http://202.83.164.26/enercon/enercon.php?mc_id=36
[66] http://energyefficiency.gov.np/uploads/14promotion_of__1449654042.pdf
[67] http://www.pndpunjab.gov.pk/8thPDWP

duties has also been applied on imports of components used in LED bulbs. This measure will reduce the prices of LED lights and hence improve the EE in the local and industrial sectors.

Mandatory Measures on Energy Performance and Management

NEECA can carry out an energy audit of any facility, enterprise, factory, building by itself or through a designated auditor. Federal and provincial authorities are evaluating the capacity of ESCO's and have plans to introduce the certification course on energy management.

ENERCON has developed the Guidelines for Implementation of Energy Standards & Labeling Scheme in Pakistan through the assistance of JICA. Minimum Energy Performance Standard (MEPS) for AC Electric Fans, Self-Ballasted Fluorescent Lamps, AC Induction Motors (0.37-7.5 kW) and Air-conditioning Units (12,000-48,000 Btu/hr) has also been developed. In July 2016, an Energy Label Authorization was given to three qualified fan manufacturers.

Other EE Policy Measures

PEECA is providing financial support for EE-related capacity building activities. The funds of 64 million PKR are allocated by PEECA to the trainings and workshops. Under its RE&EE Programme, GIZ, in collaboration with SBP, is building the capacity of ESCOs and commercial banks on financial modeling of EE projects.

4.3 Gender Mainstreaming in RE and EE Policy in Pakistan

4.3.1 Gender in the National Policy

The Government of Pakistan state its 10-year development aims in the **Pakistan Vision 2025**, a plan that lays the ground for reaching the SDGs (Sustainable Development Goals[68]) before the target date of 2030. The *Vision* has seven priority areas, or *Pillars*, among them Pillar 1: People First - Developing social and human capital and empowering women (linking e.g. to SDG 1 on poverty eradication, SDG 3 on health and SDG 5 on gender equality) and Pillar 4: Security – energy, water and food security (linking e.g. to SDG 7 on affordable and clean energy).

The *Vision* rightly acknowledges the low ranking of Pakistan in the global Human Development Index (UN Human Development Report 2015[69] places Pakistan as 147 out of totally 185 countries) and the bottom place in the Global Gender Gap Index[70] (144/145 countries in 2015) measuring gender equality. Consequently, the *Pakistan Vision* realizes the unequal access between men and women to opportunities, resources and benefits, and the importance of legislative and policy measures for enhancing women's participation in different areas in society, including decision making and women's economic empowerment through access to education and enterprise.

As expressed in the *Vision*, the GOP is committed to achieving the targets of the 5th SDG on gender, building upon the previous pursuit of the MDGs (Millennium Development Goals[71]) up to 2015. Connecting both to the MDGs and the 1995 Beijing Platform for Action agenda for women's development[72], the 2002 **National Policy on Development and Empowerment of Women** (NPDEW) is a statement of intent of the GOP to ensure that gender perspective is

[68] http://www.un.org/sustainabledevelopment/sustainable-development-goals/
[69] http://hdr.undp.org/en
[70] http://reports.weforum.org/global-gender-gap-report-2015/
[71] http://www.undp.org/content/undp/en/home/sdgoverview/mdg_goals.html
[72] http://www.un.org/womenwatch/daw/beijing/platform/

reflected in all national policies and plans. Accordingly, the NPDEW strategy is to increase women's empowerment through mainstreaming of gender issues into all national development sectors. NPDEW promotes women's social, economic and political empowerment as a driving force for reducing social exclusion, accelerating poverty alleviation and ensuring more sustainable development results.

4.3.2 Gender in the RE & EE Policy

The National Sustainable Development Strategy (NSDS) (2012) which is "an attempt to define sustainable development and the pathway to *green economy* in Pakistan" identifies four key overall areas for development: (1) Sustainable and Inclusive Economic Growth; (2) Social and Human Development; (3) Environmentally Sustainable Development; and (4) the Emerging Issue of Climate Change and Sustainable Development. Among the general strategic social goals are poverty alleviation and promotion of social equity; extending social safety nets for the poorest and most vulnerable, especially women; and to productively enable the increasing young population and empowering women. Focus on empowerment of women through education and awareness raising and removing discrimination barriers to ensure productive interaction of women towards economic development are listed among the strategies of the sub-theme Population Dynamics and Sustainability within the first key area for sustainable development. Under the sub-theme Energy for Sustainable Development, introduction of awareness raising campaigns to explain benefits of energy efficiency and to change overall energy-use consumption behaviour is listed, but no specific population groups (such as rural men and women) are mentioned to be in focus for the information communication.

The *Social and Human Development* theme of the NSDS recognizes social vulnerabilities, and one of the strategies for poverty reduction is to initiate programs for low-cost and energy efficient housing. Women's empowerment and gender equality are recognized as fundamental conditions for sustainable development, accordingly one of the seven sub-areas for social and human development, *Gender Equality and Women Development*, has strategic goals of: (i) increasing the role of women and integrating gender balance into national sustainable development processes; (ii) enforcing protection and implementation of women's rights; (iii) providing equitable access to education, health, and work force; and (iv) introducing program for land allotments to empower women and improve their right to ensure family food security.

Under the key area of *Environmentally Sustainable Development*, women's empowerment is mentioned as one of the effects of the strategy to introduce clean cooking stoves and solar lanterns as part of the *Air Quality and Pollution* theme.

The implementation mechanism of the NSDS has ten core program areas, where *Promoting inclusive and sustainable growth through engaging the poor, women and youth* is one of the four programs within the *Economic development* theme. Two of the three social core programs mention specifically women: *Social protection and safety nets for the poorest and most vulnerable particularly women;* and *Productively enabling the expanding "youth bulge" present in the country as well as empowering women.* The core program on *Environment* also mention strengthening community-based interventions but without further specifying any groups like involving women.

The National Climate Change Policy (2012) has totally ten policy objectives, one of them *to focus on pro-poor gender sensitive adaptation while also promoting mitigation to the extent possible in a cost-effective manner.* Participation of women and female gender experts is recognized as crucial for policy development, initiatives and decision-making. The socio-economic policy measures contain (I) mainstreaming gender perspectives into climate change efforts at national and regional levels; (II) reducing vulnerability of women to CC impacts; and

(III) recognizing women's contribution in the use and management of natural resources and other activities impacted by CC. The more specific measures to be taken are to: (i) undertake a study on gender-differentiated impacts of CC with focus on capacity to cope with the adaptation and mitigation strategies; (ii) develop a gender-sensitive criteria and indicators related to adaptation and vulnerability; (iii) develop and implement CC vulnerability-reduction measures that focus particularly on women's needs; (iv) integrate women and give them a role in the decision-making process on CC mitigation and adaptation initiatives; and (v) develop CC adaptation measures based on local and indigenous knowledge particularly held by women.

The Framework for Implementation of Climate Change Policy 2014–2030 (2013) recognizes the gender differences to CC impacts and adaptation, and expresses the GOP determination to support gender integration into various efforts to address climate change. Yet there is no mention of gender or women's participation in the eleven different sector strategies and in the listed implementation actions of each sector.

Pakistan National Environmental Policy (2005) has no mention of social or gender issues in the nine sectoral guidelines (including energy efficiency and renewable), however it provides cross-sectoral guidelines on poverty, population, gender, health, trade, local governance and disaster management. The specific guideline on gender and environment demands gender sensitivity and promotion of women's empowerment in all environmental policies, projects and programs. Specific measures that the GOP may apply include: (i) compiling gender-disaggregated statistics of environmental goods and services; (ii) ensuring participation of women in environmental projects and programs; (iii) mainstreaming gender in all relevant policies and plans; (iv) addressing environmental issues that impact women more adversely than men (such as indoor air pollution and access to water sources); and (v) including *gender and environment* in the environmental education and training curricula.

The **Policy for Development of Renewable Energy for Power Generation:** Employing Small Hydro, Wind and Solar Technologies (2006) mentions as one of the strategy policy objectives to enhance income-generating opportunities, especially for currently marginalized segments of the population. *The RE development potential for poverty alleviation and for reducing the burden of rural women in biomass collection and use are specified as social equity objectives*. The guidelines for small off-grid RE projects development take up community contribution but allocate no specific role to women.

The four goals of the **National Energy Conservation Policy** (2006) are: (i) Sustainable development; (ii) Improve economic productivity and poverty alleviation; (iii) GHG mitigation and climate control; and (iv) *Gender mainstreaming*. Under the 4th goal it is stated that provision of energy to rural areas serves the goals of gender equality and mainstreaming. Energy conservation, especially integrated into rural development policies, is considered to contribute to gender mainstreaming and recognition of women's role in the rural development context and in local communities. Gender mainstreaming is one of the cross-sectoral guidelines of the energy conservation policy, highlighting its importance especially in the rural context. Energy conservation efforts may also lead to special interventions for reducing women's work burden, considering women's special needs and improving opportunities for female entrepreneurs. One of the policy interventions is Public Awareness, Training and Education, in which context training and awareness raising of general public and in particular housewives, working women and female students in energy savings and best practices in the household like cooking, washing and driving should be promoted.

The other reviewed Pakistan RE & EE policy documents (see the full list in **Annex 1**) do not mention any gender, poverty or social issues.

5. International Best Practices and Experience in RE & EE Policy Deployment

This chapter reviews the international best practices, lessons learned and experience in RE and EE policy development and deployment in five Asian countries in similar circumstances: China, India, the Philippines, Thailand and Vietnam.

5.1 International RE Policy Best Practices and Experience

5.1.1 China

Introduction

China has an abundant potential of all types of RE resources, especially hydropower, wind, solar, biomass, and geothermal. The Government of China (GOC) is well aware of these resources and has been introducing measures to tap them.

The total power potential of RE in China is estimated at 5,886 GW, of which 2,750 GW[73] (46.7%) is from wind power, 2,700 GW[74] (45.9%) from solar, 400 GW[75] (6.8%) from hydropower (including large-scale hydropower plants), 30 GW (0.5%) from biomass (including MSW), and 6 GW (0.1%) from geothermal.

Table 14: Potential and actual power generation from RE sources in China

No.	Type of RE	Potential (GW)	Actual generation by 2014 (GW)
1.	Wind power	2,750	115
2.	Solar power	2,700	28
3.	Hydropower (including large-scale)	400	280
4.	Biomass (including MSW)	30	10
5.	Geothermal	6	-
	Total	**5,886**	**433**

Source: CNREC (2012) and IRENA (2014)

By the end of 2014, 433 GW of RE-based power capacity had been installed which accounts for 7.4% of the total RE potential. Hydropower plants (excluded pumped-storage) have a combined installed capacity of 280 GW (64.7% of total RE-based installed power capacity), followed by wind power with 115 GW (26.6%), solar power with 28 GW (6.5%), and biomass-based power with 10 GW (2.2%).

RE Targets and Planning

In 2007, the National Development and Reform Commission (NDRC) promulgated the Medium and Long-Term Development Plan for Renewable Energy in China up to 2020. According to this plan, the share of RE in the total primary energy consumption is targeted at 15% by 2020.

[73] Based on CNREC's estimate, wind power potential in China was estimated at 2,750 GW, of which 190 GW are from offshore wind farms.
[74] IRENA (2014) reported that the total exploitable potential for solar power generation in China was estimated at around 2,200 GW for utility-based and 500 GW[74] for rooftop-based solar PV systems.
[75] CNREC (2012) reported that the total technical potential for hydropower generation is 542 GW with an annual electricity generation potential of 2,474 TWh. However, the economically feasible potential was estimated at 402 GW with an annual electricity generation of 1,753 TWh only.

The total installed power capacity of various types of RE sources was expected to reach 450 GW by 2020, of which 300 GW from hydropower (including 75 GW from small-scale hydropower), 100 GW from wind, 20 GW from solar PV, and 30 GW from biomass-based power. In addition, 30 million m^2 of solar water heating systems will be installed. For biofuels, 10 million tonnes of bioethanol, and 2 million tonnes of biodiesel are planned to be produced by 2020.

Based on the actual RE-based power capacities installed in China in 2014[76], the 2020 targets are almost achieved or surpassed. For example, installed capacity of wind power already reached 96.9% of its 2020 target while hydropower and solar PV power have surpassed their targets for 2020.

The China National Renewable Energy Center (CNREC) of the China National Energy Administration (CNEA) has proposed the new RE targets for 2020[77]. The new 2020 installed power capacity target for various RE sources is 660 GW (around 47% higher than the previous target). The hydropower installed capacity target is 350 GW (excluded pumped-storage hydropower plants). The total installed capacity of the grid-connected wind power plants is expected to reach 230 GW (including 200 GW onshore and 30 GW offshore wind power). Solar PV plants would add 50 GW by 2020, of which 23 GW from central solar power plants and 27 GW from distributed PV power systems[78]. The target for biomass-based power generation is 30 GW, which is unchanged compared to its target set in 2007.

RE Price-based Policies

Feed-in tariff: Since the 2005 China's Renewable Energy Law (REL), RE-based power plants have been guaranteed grid connection. The REL has been amended in 2009. According to this law, the purchase price of electricity generated from RE sources is determined by NDRC. Feed-in tariffs (FIT) have been adopted in China since 2005. To set the FITs, the following factors are taken into account: (i) techno-economic performance of different RE technologies, (ii) geographic location of the project, and (iii) availability of RE resources.

The FITs for renewable electricity evolved over time and have been continuously reduced according to the cost of development. Table 15 presents the FITs currently applied in China.

Table 15: FITs for grid-connected RE-based power projects in China

Type of RE sources	FITs (VAT-included)	
	RMB/kWh	USD/kWh[79]
Hydropower	0.2 - 0.3	0.030 - 0.045
Onshore wind	0.51 - 0.61	0.077 - 0.092
Offshore wind (Near shore)	0.85	0.128
Offshore wind (Intertidal)	0.75	0.113
Solar PV (Central solar power plants)	0.90 - 1.00	0.135 - 0.150
Solar PV (Distributed solar PV)	0.42	0.063
Biomass (Agricultural and forest biomass)	0.75	0.113
Biomass (Waste)	0.65	0.098

Source: Winston & Strawn (2014), IRENA (2014)

Reduced T&D costs: The grid connection costs shall be covered by the grid utilities. However, they will be awarded a subsidy from the Government to pay for such costs[80]. Depending on the

[76] http://www.energypost.eu/chinas-electricity-mix-changing-fast-co2-emissions-may-peaked/
[77] CNREC (2012)
[78] Grid-connected solar PV systems constructed in areas with high density of roof-area, such as industrial parks, economic development zones, large-scale public facilities, off-grid power systems, stand-alone power supply (e.g., urban lighting, traffic signal), etc.
[79] 1 RMB = 0.15 USD as of September 2016

distance of power transmission, the subsidy will be 0.01 RMB/kWh for within 50 km, 0.02 RMB/kWh for 50-100 km, and 0.03 RMB/kWh beyond 100 km.

Carbon/CDM credit transactions: In October 2011, China has announced seven Emission Trading Scheme (ETS) pilots. These pilots cover five cities (Beijing, Shanghai, Guangdong, Shenzhen and Tianjin) and two provinces (Hubei and Chongqing) which together account for 26.7% of China's 2014 GDP. Over 57 million tonnes of carbon have been traded under the ETS pilots until July 2015 with a value of 308 million USD. China has announced that in 2017, it will launch a national Emission Trading Scheme (ETS) which will include eight sectors and 18 sub-sectors which consume over 10,000 tce/year. These eight sectors include power, petrochemicals, chemicals, iron and steel, non-ferrous metals, building products and materials, pulp and paper, and aviation.[81]

RE Quantity-based Policies and Procurement Mechanisms

Renewable energy quota obligation: The NDRC introduced a mandatory market share (MMS) in 2007, linked to the country's mid-term (2007-2010) and long-term (until 2020) RE development plans. According to the plans, the share of power generation from non-hydro RE sources should reach 1% of the total by 2010, and 3% by 2020 in regions served by centralized power grids. Furthermore, power producers with a capacity larger than 5 GW must increase their power capacity of non-hydro RE sources to 3% by 2010 and 8% by 2020.

However, many aspects of this policy have yet to be put into practice. As of 2010, none of the six largest power producers in China had met the 3% RE target, partly due to the lack of monitoring and compliance requirements. To address these problems, NDRC began to develop an improvement plan in 2011. A draft of the amended plan was released in May 2012 for public consultation. However, the state-owned power utilities have so far resisted the new requirements, which were under debate until 2015.

According to a R100's analysis[82], China will soon implement its amended RE quota system to help accelerate the country's transition to a low carbon economy. Under the planned quota system, each of China's provinces will be responsible for ensuring that a certain percentage of their electricity consumption will come from non-hydro RE sources, primarily wind, solar and biomass. The quotas differ according to a province's RE resources (currently set between 2-10%). Provinces that are unable to meet their quotas may have to suspend or reduce their fossil fuel power generation projects. Once put into play, the RE quota system is expected to speed up the implementation of RE projects, especially in China's eastern provinces where electricity consumption rates rank highest in the nation. The quota system is also likely to encourage the country's two largest electric utility companies (State Grid Corporation of China and China Southern Power Grid Corporation) to improve the rate of connectivity of wind and solar to their power grids.

Competitive bidding/auction: China adopted the concession bidding programme for large-scale grid-connected RE-based power projects. The objective of this programme is to promote large-scale application and determine appropriate FITs for RE-based power projects. Current FITs for RE-based power projects are established based on the results of this concession bidding programme.

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[80] NDRC (2012)

[81] http://www.ieta.org/resources/China/Chinas_National_ETS_Implications_for_Carbon_Markets_and_Trade_ICTSD_March2016_Jeff_Swartz.pdf

[82] R100 (2015). R100 is a global campaign working with the world's most influential businesses on their journeys to become 100% powered by renewables.

Financial Incentives for RE Projects

Soft loans: Access to low-cost finance from state-owned banks has supported extraordinary levels of expansion of RE deployment in China. There are signs that the other financial institutions are starting to increase their involvement in the sector. For example, in 2012, the lowest interest rate available for a loan of more than one year from a Chinese state-owned bank was 5.9%. In 2013, China Longyuan Power Group raised 279 million USD from a loan from three banks at an interest rate of 3.75%[83].

Investment grants/subsidy: Special funds are made available to support RE projects relating to the following activities: (i) RE projects in rural and pastoral areas, (ii) Construction of stand-alone electricity generation system in remote areas and islands, and (iii) RE resource surveys, evaluation and construction of information systems.

The Chinese government supports RE-based power projects by providing financial subsidies. In 2009, the Ministry of Finance (MOF) initiated two national solar PV subsidy programmes to support and expand the local solar industry.

- An up-front subsidy for building-integrated PV (BIPV) systems and a subsidy of 50% of the bidding price for the supply of critical components are provided. Financial support has decreased substantially since the programme's inception, reflecting the declining cost of solar PV power. By 2012, the subsidy has fallen to 9 RMB/W for BIPV (compared to 20 RMB/W in 2009) and 7.5 RMB/W for rooftop systems (from 15 RMB/W in 2009);
- The Golden Sun Demonstration Programme provides direct subsidies for grid-connected and off-grid PV systems: 50% of the total cost for grid-connected systems and 70% for off-grid systems in rural areas. In 2012, grid-connected systems received 5.5 RMB/W, while off-grid systems received 7.0 RMB/W.

Fiscal Incentives for RE Projects

VAT exemption and reduction: Currently, there is a 50% VAT refund on the sales of wind power, and 100% VAT refund on the sale of biodiesel oil generated by the utilization of abandoned-animal fat and vegetable oil.

CIT exemption and reduction: A reduced corporate income tax (CIT) rate of 15% (instead of 25% as standard CIT rate) is presently granted to qualified advanced and new technology enterprises. Applicable fields include solar, wind, biomass, and geothermal energy. In addition, the projects related to biomass energy, synergistic development and utilization of methane will enjoy a three-year CIT exemption, followed by a 50% reduction for another three years.

Mandatory Grid Access and Prioritized Dispatch

Prioritized dispatch: The 2005 China's Renewable Energy Law, followed by the trial "Regulation on Energy Conservation Power Generation Dispatching" issued by NDRC in 2007, required that RE-based power generation has priority over other generation sources to be dispatched. However, grid operators in China have largely not implemented priority dispatch, citing concerns about grid security and reliability of electricity supply from variable RE sources.

In March 2015, the Chinese government issued a major policy announcement (known as Document 625) on RE, aimed at reducing the perennially high level of curtailment of electricity generated from wind, solar, hydro and other RE sources. The key statement of this document is

[83] IISD (2014)

a mandatory "guarantee" that grid companies have to purchase electricity outputs from RE generators, at least up to an allocated number of hours. Document 625 states that NDRC and the CNEA will be responsible for planning annual allocations of operational hours for each type of renewable generation in regions of the country that have been experiencing curtailment. The document stresses that purchase of the energy from these allocations will be guaranteed.

Document 625 also introduced a compensation mechanism for renewable electricity curtailment. If curtailment is due to non-renewable generators "infringing on absorption space and transmission capacity", then the non-renewable generators are responsible for paying compensation. Alternatively, if the curtailment is due to grid line failure or unplanned maintenance, then the grid company must take responsibility for compensation. However, given the difficulties that policymakers have apparently encountered thus far in ensuring priority for RE generation, enforcement of these new payments may still be a big challenge.

Grid connection standards: China has issued the T&D grid codes, and the technical standards for grid connection of RE-based power plants.

Other RE Policy Measures

Financial support for R&D: China provides financial support to research and development (R&D) of RE technologies, mainly wind turbines and advanced silicon technologies for solar PV. Among various publicly-funded Science and Technology (S&T) Programmes, the "863"[84] and "973"[85] programmes provide most of the financial support for RE technology research and development. In addition, the Ministry of Finance established a special fund to support the R&D of wind power equipment. The "863" Programme has invested 3 billion USD in R&D during the 2001-2005 period. Another 585 million USD (4 billion RMB) was approved in 2008 for both "863" and "973" programmes. Between 1998 and 2008, the "973" programme has funded 382 projects with a total investment of 1.3 billion USD[86].

Financial support for local RE equipment manufacture: For the purpose of promoting local manufacture of RE equipment, China provides local companies with import tax exemption for the imported technologies and materials used for production of RE equipment. In addition, the Chinese government and the state-owned banks also provide strong financial support to the RE equipment manufacturing industry. For example, the Chinese government has contributed around 80% of the total of 41.8 billion USD invested in the solar manufacturing industry in 2010. The China Development Bank (CDB) offers low-interest loans, while the Export-Import Bank of China (China Exim Bank) provides export credits at preferential rates for the local solar PV manufacturers.

5.1.2 India

Introduction

There has been a visible impact of RE in the Indian energy scenario during the last five years. The RE sector landscape in India has indeed witnessed tremendous changes in the policy framework with accelerated and ambitious plans to increase the contribution of solar energy.

[84] The "863" Programme, officially known as the "National High-Tech Development Plan", was established in March 1986. The proramme focuses on boosting innovation in the strategic high-tech sectors in order to help China gain a foothold in the world market.
[85] The "973" Programme, a National Basic Research Programme established in 1997, focuses on fundamental research, and thus complementing the "863" Programme.
[86] Richard J. C. (2014)

There is now a growing confidence in RE technologies and in the capacity of the Government of India (GOI) to do so.

Solar energy potential was estimated by the National Institute of Solar Energy at about 749 GW. Other estimates showed potential power generation for the various RE technology such as wind (103 GW), small hydropower (20 GW) and various types of biomass (25 GW). This brings the total RE potential capacity to 897 GW. A comparison of the potential and the actual installed capacity is shown in Table 16.

Table 16: Potential and actual power generation from RE sources in India

No.	Type of RE	Potential (GW)	Actual generation by 2016 (GW)
1.	Wind power	103	27.4
2.	Solar power	749	8.0
3.	Hydropower (only Small)	20	4.3
4.	Biomass (including MSW)	25	5.0
5.	Geothermal	0	0
	Total	**897**	**44.7**

Source: MNRE Annual Report 2015-2016

As of July 2016, the actual installed RE-based power capacity in India was 44.7 GW representing 5% of the total RE potential. Biomass power includes gasification, bagasse cogeneration and waste-to-power while hydropower excludes large-scale power plants above 25 MW. Wind power is most abundant and now at a mature stage comprising of 61% of the installed RE power plants. This is followed by solar (18%), biomass (11%) and hydropower (10%).

RE Targets and Planning

In 2008, GOI published the National Action Plan on Climate Change comprising of eight missions in which some of the purposes are focused on deploying appropriate technologies for both adaptation and mitigation of GHG emissions. The National Solar Mission aims to increase the share of solar energy in the total energy mix. The National Mission on Sustainable Habitat aims to improve the management of solid waste and conversion to power.

In 2014, GOI has enacted several policies designed to accelerate the installation of RE projects of various technologies and sizes. The centerpiece of this approach is an aggressive target of 175 GW of RE installed by 2022 which was announced in 2014. The breakdown of the target by RE technology is shown in Table 17.

Table 17: RE target by technology in India

No.	Type of RE	RE target by 2022 (GW)
1.	Wind power	60
2.	Solar power	100
3.	Hydropower (only Small)	5
4.	Biomass[87]	10
5.	Geothermal	0
	Total	**175**

Source: MNRE Annual Report 2015-2016

[87] Note: The target given for biomass includes gasification, bagasse cogeneration and waste-to-power generation

The wind power sector which slowed down to a halt due to the removal of accelerated depreciation scheme last 2012 showed resurgence since the latter was restored in 2014.

The capacity target of 100 GW set under the Jawaharlal Nehru National Solar Mission (JNNSM) will principally comprise of 40 GW rooftop and 60 GW through large and medium scale grid-connected solar power projects. The target, which looked very ambitious, now seems realistic with several states already witnessing a revolution on rooftop solar power generation with the launch of net metering in the country.

The GOI has taken up the following new projects/scheme in its effort to meet the RE target:

- Scheme for setting up over 2,000 MW of grid-connected solar PV power projects with viability gap funding (VGF) under the JNNSM. Projects are to be set up by solar power developers on Build-Own-Operate (BOO) basis, selected through a process of open and transparent competitive reverse bidding on the VGF amount, with a provision of reduction in tariff. These projects would be selected through a process of e-bidding followed by e-reverse auctioning.
- Creation of Intra State Transmission System in the States of Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan with the funding from GOI and from the National Clean Energy Fund (NCEF) in order to facilitate integration of large scale renewable generation capacity addition.
- Scaling up of budget from 90 million USD during the 12th Five Year Plan to 750 million USD for the Grid-Connected Rooftop and Small Solar Power Plants Programme over a period of five years up to 2019-20 under National Solar Mission (NSM).
- Setting up of 25 solar parks to be developed in the next 5 years in various States to accommodate over 20,000 MW of solar power projects.[88]

In February 2015, GOI launched the "Report on India's Renewable Electricity Roadmap 2030: Toward Accelerated Renewable Electricity Deployment". The RE Roadmap summarized the process and the results of a comprehensive stakeholder consultation exercise. It presented the opportunities and barriers to RE, based on inputs given by stakeholders. It also provided a summary of the rationale as well as benefits and costs of RE within the context of the Indian power system. The report suggested a framework for an integrated policy strategy for rapid RE implementation, particularly solar PV and wind power, that will complement both the existing and planned conventional power projects. The framework includes:

- A new comprehensive National RE Policy that will establish targets, identify financial support for achieving those target, undertake integrated energy resources planning, restructure and improve the Renewable Purchase Obligation (RPO) and implement mandatory net metering (NEM)/feed-in tariff (FIT);
- Support mechanisms to ensure speedy RE implementation by introducing a "One-Stop Shop" for standardized contracting, financial support and disbursal mechanism, streamlined project development and low-cost financing;
- Grid reforms to ensure smooth integration of RE through upgrade of grid technology and grid operation protocols, establish Grid Codes, implement 5-minute Scheduling and Dispatch and expand balancing areas by promoting flexible demand and supply resources.

In June 2016, the Ministry of New and Renewable Energy (MNRE) issued the "Thrust Areas with Action Plan for Research Development & Demonstration (RD&D)" For Technology Development in New and Renewable Energy in order to promote technology development and demonstration for widespread deployment of new and renewable energy for various applications in a cost effective manner across the country. RD&D efforts are directed towards

[88] MNRE Annual Report 2015-2016 Section 1.13-1.15 (2016)

process/ technology development and demonstration with emphasis on cost reduction and improving efficiency.

RE Price-based Policies

Feed-in tariff: In January 2010, JNNSM was officially announced by the Prime Minister of India. This program initially aimed to install 20 GW of solar power by 2022. This was recently increased to 100 GW. The first phase of this program targeted 1000 MW, by paying a tariff fixed by the Central Electricity Regulatory Commission (CERC) of India. The tariff for solar PV projects was fixed at 0.397 USD/kWh. Tariff for solar thermal projects was fixed 0.342 USD/kWh. The tariff was reviewed periodically by CERC. In 2015, the FIT was around 0.125 USD/kWh and mostly applicable at utility level.

Table 18: FITs for grid-connected RE-based power projects in India

Type of RE sources	FITs (VAT-included)	
	INR/kWh	USD/kWh[89]
Small Hydro (< 25 MW)	3.0 – 5.51	0.045 – 0.082
Wind	3.39 – 5.07	0.05 – 0.076
Solar PV		(average) 0.125
Biomass	1.995 – 5.26	0.03 – 0.079
Bagasse	1.995 – 4.61	0.03 – 0.069
MSW	4.26 – 4.5	0.064 – 0.067

Source: Indian Wind Energy Association, MNRE 2011-2012

The regulatory oversight in the power sector is provided by CERC and the State Electricity Regulatory Commissions (SERCs). However, at present, only grid-connected RE based systems come under the regulatory purview. For wind, the FIT, its validity, the RPS is dependent on the State. For small hydro, the FIT is usually dependent on the size which varies from 500 kW and below up to 25 MW. Bagasse-based and MSW generations are also distinguished from the biomass.

As of December 31, 2015, MNRE reports that India has achieved a total of 38.8 GW of grid connected RE installed capacity[90]. Compared to Table 16 which is the MNRE report dated July 2016, the capacity already increased by more than 6 GW. The latest data shows that solar almost doubled to 8 GW while the wind increased by more than 2 GW. Small hydro and biomass installed capacity is also steadily increasing. It is safe to conclude that the FIT implementation has been successful in India.

SPPA: Based on the National Tariff Policy of 2006, RE developers can sign a long-term PPA at fixed tariffs, which delivers a stable revenue stream. Solar power producers can also sign a long-term PPA with utilities at fixed tariffs, albeit these are determined through auction.

Net metering/banking: As of July 2016, SERCs of twenty States have announced a regulatory framework on net-metering and FIT to encourage rooftop solar plants. Net-metering schemes has been rolled out in a majority of States which will help in meeting 40 GW rooftop grid connected solar projects.

Carbon/CDM credit transactions: India is the second largest seller of carbon credits. The country is also a leading destination among non-Annex 1 countries with regards to CDM implementation. It has the highest rating of any CDM host country, with 32% of the world total of 1,081 projects registered with the CDM Executive Board.

[89] 1 INR = 0.01496 USD as of October 2016
[90] Source: MNRE Annual Report 2015-2016

RE Quantity-based Policies and Procurement Mechanisms

RE quota obligation: In 2011, GOI has approved amendments to the 2005 National Tariff Policy, positively impacting the RE sector, namely:

- Renewable Generation Obligation (RGO) - New coal/lignite based thermal plants after specified date shall also establish/procure/purchase renewable capacity as prescribed by GOI.
- To allow bundling of renewable power with power from thermal plants, whose PPAs have expired or plants which have completed their useful life subject to development through competitive bidding.
- Compulsory procurement of 100% power produced from all the Waste-to-Energy plants in the State by the Distribution Companies.[91]

The SERCs also provided preferential tariffs and Renewable Purchase Obligations (RPO) for Biomass Power Projects and Bagasse Cogeneration Projects.[92] RPO percentages are fixed by the SERCs as per Electricity Act of 2003 considering the resource availability and impact on retail tariff. By January 2013, 27 states had issued RPO regulations and 25 states had come out with regulations for Renewable Energy Certificates (RECs).[93]

In order to enforce the RPOs and RGOs, the MNRE is planning to introduce penalties for non-compliance as part of new energy policy.[94]

REC market: In order to achieve the RE targets and the RPOs, the National Action Plan for Climate Change (NAPCC) of 2008 mandated the REC. The developer sells electricity to utilities at a regulated price (average power purchase cost of utilities) or to third parties and receives RECs, which can be traded on the power exchange market. The buyers of REC are obligated entities, viz. utilities, open access consumers and captives that are not based on RE).

Competitive bidding/auction: Recently, the Power Finance Corporation Limited has issued draft Guidelines for Tariff Based Competitive Bidding Process for Grid Connected Solar PV Power Projects.

This is to facilitate the scale up of solar capacity addition and achieve economies of scale, promote competitive procurement of electricity from Renewable Energy Sources (solar) by distribution licensees, facilitate transparency and fairness in procurement processes, facilitate fulfillment of the Renewable Purchase Obligation (RPO) requirement of the obligated entities, facilitate reduction of information asymmetries for various bidders, protect consumer interests by facilitating competitive conditions in procurement of electricity, enhance standardization and reduce ambiguity and hence time for materialization of projects, provide flexibility to sellers on internal operations while ensuring certainty on availability of power and tariffs for buyers, bring uniformity in tendering by various agencies including state utilities which will facilitate investment and to ensure bankability.[95]

Financial Incentives for RE Projects

Soft loans: Several financing schemes have been established to finance RE projects in India. Most of these schemes are funded by the international development and financial organizations

[91] MNRE Annual Report 2015-2016, Section 1.16
[92] http://mnre.gov.in/schemes/grid-connected/biomass-powercogen/
[93] Krithika and Mahajan (2014) Background paper – Governance of RE in India Issues and challenges
[94] http://www.pv-tech.org/news/india_ramps_up_renewable_purchase_obligations_target
[95] http://mnre.gov.in/file-manager/grid-solar/draft-sbg-solarpv.pdf

(JICA, WB, AFD, UNIDO, etc.), and implemented by the GOI through the local banks and/or government organizations such as the Small Industries Development Bank of India (SIDBI), the Indian Renewable Energy Development Agency Ltd. (IREDA), etc. Public sector banks such as State Bank of India (SBI), Bank of Baroda and Industrial Development Bank of India (IDBI) as well as private sector banks such as YES Bank and Axis Bank have also funded RE projects. These local banks have so far funded mostly large scale grid-connected projects set up by independent power producers (IPPs). Some of the key financing schemes providing soft loans to RE projects are presented below.

- *IREDA-JICA Financing Scheme (2011-2017):* Since 2011, IREDA received two lines of credit of 30 billion JPY each from the Japan International Cooperation Agency (JICA). This concessional credit, coupled with technical expertise, has supported the growth of India's RE by almost 70% to around 40 GW in the last five years. The first line of credit was awarded for the years 2011-14 and the second line of credit (2014-17) is now under implementation.

- *IREDA's Solar Rooftop Financing Scheme:* The loan scheme, launched in 2015, is applicable to grid interactive, rooftop solar PV plants for industries, institutions and commercial establishments. Financing can be accessed for single or aggregated investments. The applicant's minimum capacity needs to be 1 MW. In case of aggregation, the smallest sub-project has to be at least 20 kW. The maximum repayment time is 9 years with an interest rate of 9.9% to 10.75%.

Investment grants: *Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) scheme* has been launched by the GOI to promote decentralized energy sources in off-grid areas. The target groups of the scheme include rural electricity generation and distribution, village electrification infrastructure and decentralized distributed generation systems. The scheme offers a 90% financial support as a grant, and 10% is provided as loan.

Fiscal Incentives for RE Projects

MNRE has been providing capital subsidy as Central Financial Assistance (CFA), which varies according to the type and the size of the plants and the category of institutions and areas to promote RES (grid-interactive). Besides the CFA, fiscal incentives such as 80% accelerated depreciation, concessional import duty, excise duty, tax holiday for several years, etc., are available for RES.[96]

Accelerated depreciation: In 1992 the accelerated depreciation was introduced with a depreciation rate of 100%. Among all RE technologies, wind power experienced unparalleled growth from less than 1 GW in 1997 to 27 GW in 2016. The accelerated depreciation was reduced to 80% in 1992 and the scheme was further reduced to 15% in 2012 for wind power, which greatly affected the sector. After significant harm was done to the wind sector, the accelerated depreciation was restored in July 2014. This decision of the GOI has helped in creating a robust manufacturing base for wind turbines in the country [97] However, a maximum limit of 40% from the previous 80% is being planned to be implemented by April 1, 2017.[98]

VAT exemption and reduction: Some of the state governments have provided incentives in the form of a VAT at a reduced rate (5%) whereas other states levy a VAT of 15%.

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[96] DTU (2009)
[97] MNRE Annual Report 2015-2016
[98] IISD (2016) https://www.iisd.org/blog/india-s-2016-budget-mixed-bag-clean-energy-alternatives
https://www.change.org/p/ministry-of-new-and-renewable-energy-continue-80-accelerate-depreciation-in-renewable-energy-projects

CIT exemption and reduction: Wind, biomass, small hydropower and solar power plants can avail 10 years of tax holiday.[99]

ID&T exemption and reduction: There are concessional customs and excise duty exemption for machinery and components for initial setting up of projects.

Mandatory Grid Access and Prioritized Dispatch

Prioritized dispatch: For large scale RE integration, GOI established Renewable Energy Management Centres (REMC) which are equipped with advanced forecasting tools, smart dispatching solutions, and real time monitoring of RE generation, closely coordinating with State Load Dispatch Centre (SLDCs)/ Regional Load Dispatch Centre (RLDCs). GOI is planning to establish one REMC in each region which will be connected through respective state REMCs. The Central REMC will be at the top, which will be maintained and run by the National Load Dispatch Centres (NLDCs). In view of the expected increase in RE penetration, there is a need to equip the power system operators with state-of-the-art tools along with real time data of RE generation. There will be a hierarchical connection between the SLDC, RLDC and NLDC.[100] The 2030 Roadmap emphasized the importance of RE grid integration and efficient grid operation. An upgrade of the grid technology is recommended to maximize the use of RE power plants. Hence, while RE power plants are given dispatch priority, the REMC will determine the right balance between RE and conventional power plants to maintain grid integrity.

Grid code to facilitate RE integration: The Central Electricity Authority (Technical Standards for Connectivity to the Grid) Amendment Regulations, 2013 specifies connectivity standards and the technical requirements from wind generators to be synchronized with the grid. Meanwhile, the Indian Electricity Grid Code 2010 provides some guidelines in the operation of solar and wind within the grid.[101]

Other RE Polciy Measures

R&D funds / subsidies: MNRE budgeted amount for research and development (R&D) of new and renewable energy technology totaled 5.132 billion INR (USD 77 million) in which INR 4.359 billion (USD 65.46 million) was actually spent from 2013-2016.[102]

Financial support for local equipment manufacturers: SIDBI and KfW is implementing the Innovation Finance Programme (IFP) with a budget of 53 million EUR. IFP provides financial assistance to innovative projects and SMEs that manufacture and supply innovative clean technologies (products, processes and services), including RE & EE technologies. The minimum assistance is generally not less than 10 lakh INR (around 13,000 EUR). The operational duration of the Programme is 2013-2016. As of September 2015, a total of 2,646 million INR (36 million EUR) has been committed to 28 innovative clean technology SMEs.

Financial support for local service providers (ESCO): Several local banks and financial institutions, in particular SIDBI and IREDA, are providing financial support to ESCOs in development of RE projects and in the provision of energy services.

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[99] DTU (2009)
[100] MNRE Annual Report 2015-2016 Section 1.27
[101] IDAM (2015)

[102] PIB.GOI (2016)

5.1.3 Philippines

Introduction

According to the World Resource Institute, the Philippines could be considered as one of the leaders in RE because of its abundant resources such as solar, wind, ocean, small hydro and geothermal. The Philippine Department of Energy (DOE) considers the Philippines as the second largest generator of geothermal energy next to the United States of America. With the country's untapped RE potential, the Philippines envisions to be the leader in geothermal, wind and solar equipment manufacturing hub in Southeast Asia according to the Philippine Development Plan 2011-2016.

From the study conducted by the National Renewable Energy Laboratory (NREL), the Philippines has 11,055 km^2 of windy land with good-to-excellent resource potential for wind energy. Potential for solar power is 5 $kWh/m^2/day$. As of 2014, only 23 MW of solar power plants was installed. All of the run-of river small hydropower plants are privately owned. Potential for small hydro power is estimated at 1,300 MW but only 135.5 MW were installed as of 2014.

In the Philippines, biomass resources, particularly agricultural and forestry residues, represent an opportunity for many areas of the country to produce sustainable bioenergy both for commercial use and for urban and rural communities. However, agricultural and forestry residues are currently under-utilized or simply wasted. They could generate up 500 MW of electricity. On average, geothermal energy accounts for the largest share of total RE in 2014 with an installed capacity of 1,918 MW. Table 19 shows the potential and actual power generation from RE sources.

Table 19: Potential and actual power generation from RE sources in the Philippines

No.	Type of RE	Potential (MW)	Actual generation by 2014 (MW)
1.	Wind power	76,600	282
2.	Solar power	5 $kWh/m^2/day$	23
3.	Small hydropower (≤10 MW)	1,300	135.5
4.	Biomass	500	131
5.	Geothermal	4,000	1,918
6.	Ocean Energy	170,000	-
	Total	**261,100**[103]	**2,489.5**

Source: The Energy Report, KPMG Global Energy Institute

RE Targets and Planning

According to the Renewable Energy Management Bureau, the RE targets were divided into three periods. The first period is by 2015 with a target of 1,088 MW. The second period is by 2020 with a target of 5,096.5 MW and the third period is by 2030 with a target of 3,746.8 MW. The total additional capacity is 9,941.3 MW. The expected total RE installed capacity by 2030 is 12,430.80 MW. Table 20 shows the RE-based installed capacity targets of the Philippines up to 2030.

[103] Total RE potential do not include solar power

Table 20: RE-based installed capacity targets of the Philippines up to 2030

Sector	2014 installed capacity (MW)	Target capacity addition (MW)			Total capacity addition (MW)	Total installed capacity by 2030 (MW)
		2015	2020	2030		
Wind power	282.0	200.0	700.0	1,445.0	2,345.0	2,627.0
Solar power	23.0	50.0	100.0	200.0	350.0	373.0
Small hydropower (≤10 MW)	135.5	341.3	3,161.0	1,891.8	5,394.1	5,529.6
Biomass	131.0	276.7	0	0	276.7	407.7
Geothermal	1,918.0	220.0	1,110.0	175.0	1,505.0	3,423.0
Ocean Energy			35.5	35.0	70.5	70.5
Total	**2,489.5**	**1,088.0**	**5,096.5**	**3,746.8**	**9,941.3**	**12,430.8**

Source: Renewable Energy Management Bureau

The National Renewable Energy Program (NREP) was launched in 2011 to steer the country in achieving the goals laid down under the Renewable Energy Act of 2008. The NREP sets targets for each RE source including solar, wind, geothermal, hydro and ocean technologies within the timeframe 2011 to 2030. The program also includes a roadmap that will guide efforts towards actualizing the market penetration targets of each RE source as well as the FIT for sustainable energy generation.

RE Price-based Policies

Feed-in tariff: The main policy that ensures a continuous, adequate, reliable, and economic supply of energy to keep pace with the country's growth and economic development is the RA 7638 or the "Department of Energy Act of 1992". The Act is supported by the Philippine Energy Plan. The guiding policy for the promotion of the development, utilization, and commercialization of RE resources and other purpose is part of the Biofuels Act of 2006 (RA. 9367) and the Renewable Energy Act of 2008 (RA. 9513). Under RA. 9513, a policy mechanism to enhance the competitiveness of RE utilization introduces the FIT for RE projects, offering guaranteed payments (fixed rate per kWh) and a Renewable Portfolio Standard (RPS) fixing a mandatory utilization of RE electricity in on-grid systems.

Four FITs are in place for run-of-river hydro, biomass, wind and solar power projects. The FIT rates approved by the Energy Regulatory Commission (ERC) are shown in Table 21.

Table 21: Current FIT rates for RE-based electricity in the Philippines

RE sources	Approved rates	
	(PHP/kWh)	USD/kWh[104]
Run-of-river hydro	5.90	0.1223
Biomass	6.63	0.1375
Wind	7.40	0.1534
Solar	8.69	0.1802

Source: Energy Regulatory Commission (ERC)

In order to ensure sufficient fund to pay all RE producers, the FIT Tariff Allowance (FIT-All) Fund was established. FIT-All is a uniform charge (in PHP/kWh) billed to consumers who are supplied with electricity through the distribution or transmission network. The FIT-All shall be established and set by the ERC on an annual basis upon petition by the National Grid Corporation of the Philippines (NGCP), which is tasked with the settlement of the FITs of the eligible RE plants. The FIT-All charge shall be collected by the NGCP from the consumers who are directly connected to the transmission network or by the distribution utilities (DUs)

[104] 1 USD = 48.23 PHP as of 6 October 2016 (http://www.xe.com/currencyconverter/)

from the consumers who are connected to their respective systems[105]. The FIT-All rate for 2015 is 0.04057 PHP/kWh[106].

Net metering: Net metering is the first non-fiscal incentive mechanism employed under RA. 9513. Home owners and commercial establishments can generate power through installation of solar PV panels (up to 100 kW) and deliver their excess power to the local distribution grid. That will be used to offset their consumption. As a consequence, end-users are able to generate savings on their electricity bills and protect themselves against rising electricity prices.

RE Quantity-based Policies and Procurement Mechanisms

Renewable Portfolio Standards: One of the policy tools established in RA. 9513 to promote the development of RE is the Renewable Energy Standard (RPS). It states that "All stakeholders in the electric power industry shall contribute to the growth of the RE industry of the country". The National Renewable Energy Board (NREB) has set the minimum percentage of generation from eligible RE sources and determine to which sector the RPS shall be imposed within one (1) year from the effectivity. The RPS has been discussed, negotiated and drafted by NREB. It is in its final stages of definition and approval. It is expected that the minimum incremental percentage of electricity sources from RE shall be no less than 1% per year over the next 10 years.

The Philippine energy sector continuously supports the restructuring and deregulation of the electric power industry as mandated by the RA. 9136 (2001)[107] which led to the liberalization of the power markets, including the privatization of government owned power plants, the sale of Transco to the private sector, the implementation of the electricity spot market in Luzon and the trials of the system in Visayas, the implementation of performance-based rate mechanism for distribution utilities. This let to almost 97% barangay electrification for Luzon, Visayas and Mindanao, private sector participation in missionary electrification and energy supply security and reliability. In addition, the RA. 9136 (2001) has enabled the implementation of retail open access allowing end-users to choose their power suppliers from whoever provides the most cost effective service. Power suppliers can able transact business directly with end-users.

Competitive Bidding/Auction: The Wholesale Electricity Spot Market (WESM) was set up as one of the reforms of the EPIRA to strengthen competition at the generation level modeled from the electricity markets of New Zealand and Australia. The Philippine Electricity Market Corporation (PEM) was established by the DOE at the end of 2003 to assume responsibility for WESM. The main emphasis for WESM is to trade all electricity flows through a power exchange that is binding for all participants. The computer-based system was implemented with the assistance of the ADB. The first major test run of the system, which also served to prepare the 53 participating companies for WESM, was conducted in Luzon between April and December 2005. The test run in Visayas began in March 2006.

A resolution directing all distribution utilities (DU) to conduct a competitive selection process (CSP) in the procurement of their supply to the captive market was initiated by the ERC. According to this resolution, the power supply agreement (PSA) shall be awarded to the winning generation company following a successful transparent CSP or by direct negotiation with the DU after at least two failed CSPs. A CSP is successful if the DU receives at least two qualified bids from entities with which the DU is not prohibited from entering into a contract for power supply. This resolution can be applicable to off grid RE projects such as solar and wind.

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[105] ERC (2010): Resolution no. 16 on adopting the feed-in tariff rules
[106] ERC's Order no. 2014-109 RC dated October 10, 2014. Downloadable at http://www.erc.gov.ph/ContentPage/28337
[107] Also known as the "Electric Power Industry Reform Act of 2001" (EPIRA)

Financial Incentives for RE Projects

Soft loans: Provision of financial packages for the development, utilization and commercialization of RE projects are recommended and endorsed by the DOE, provided that it is in accordance with and to the extent allowed by the enabling provisions of financial institutions respective charters or applicable laws. Government financial institutions that provide this financial packages are the Development Bank of the Philippines (DBP), Land Bank of the Philippines (LBP), Phil-Exim Bank.

Fiscal Incentives for RE Projects

Accelerated depreciation: RA. 9513 (2008) regulates that if, and only if, an RE project fails to receive an income tax holiday (ITH) before full operation, it may apply for accelerated depreciation in its tax books and be taxed based on such, provided that, if it applies for accelerated depreciation, the project or its expansion shall no longer be eligible for an ITH. The accelerated depreciation rate shall not exceed twice the rate which would have been used in accordance with the rules and rehulations prescribed by the DOF and the provision of the National Internal Revenue Code (NIRC) of 1997, as amended by RA. 9337 (2005).

VAT exemption and reduction: According to RA. 9513 (2008), the sales of power generated from RE sources shall be subject to zero percent (0%) VAT. All RE project developers shall be entitled to zero-rated VAT on its purchases of local supply of goods, properties and services needed for the development, construction and installation of its plant facilities. This provision shall also apply to the whole process of exploring and developing RE sources up to its conversion into power, including but not limited to the services performed by subcontractors and/or contractors.

CIT exemption and reduction: As regulated in RA. 9513 (2008), all RE project developers shall be exempt from CIT for the first seven (7) years of its commercial operation. After that, RE project developers shall pay a CIT of 10% on its net taxable income as defined in the NIRC (1997), as amended by RA. 9337 (2005), provided, that the developers shall pass on the savings to the end-users in the form of lower power rates.

ID&T exemption and reduction: Based on RA. 9513 (2008), the RE-based power projects are exempted from ID&T on imported goods for the first ten (10) years upon the issuance of a certification of an RE project developer. The imported goods (machinery and equipment, materials and parts, etc.) shall be eligible for ID&T exemption if they are directly and actually needed and used exclusively in the RE facilities for energy conversion and delivery of energy to the point of use and covered by shipping documents. The endorsement of the DOE on the ID&T exemption shall be obtained before the importation of the goods are made.

Other tax incentives: RA. 9513 (2008) also regulates the following tax incentives for RE projects:

- 1.5% special realty tax rate on civil works, equipment, machinery, and other improvements of a registered RE project, which are actually and exclusively used for RE facility;
- 7-year net operating loss carry-over;
- Cash incentive of RE developers for missionary electrification;
- Tax exemption on the sale of carbon credits;
- A tax credit equivalent to 100% of the value of VAT and ID&T that would be paid on the imported goods shall be given to an RE project developer who purchases similar goods from the local manufacturers.

Mandatory Grid Access and Prioritized Dispatch

Prioritized dispatch: According to the 2010 ERC's resolution adopting the FIT rules, all eligible RE plants shall enjoy priority connection to the transmission or distribution system if they comply with the pertinent standards and ERC rules governing such connection. Eligible RE plants shall be given priority to inject into the network they are connected and shall be paid the corresponding FITs based on their actual metered deliveries. For this reason, NGCP and DUs, in the case of embedded eligible RE plants, shall proportionately allocate among all their customers and consumers connected to them the RE covered by the FIT system flowing into their systems.

Grid code: An ERC resolution amended the Philippine Grid Code (PGC) to establish the required minimum connection and operational requirements applicable to non-conventional or Variable Renewable Energy (VRE) Generators for integration in the Philippine Grid Code and provide direction for existing and new VRE developers and manufacturers, fabricators and suppliers of RE equipment by setting the technical standards for wind and solar energy projects.

Other RE Policy Measures

One-Stop Shop for Licensing and Permitting: DOE envisioned a Renewable Energy One-Stop Shop to serve as the contact point within the department for the processing of applications for RE Service/Operating Contracts. The One-Stop Shop would integrate the RE services from concerned government agencies, integrate web-based RE systems infrastructure and database and automate RE applications. In lieu of the RE One-Stop-Shop at the current time, an Energy One-Shared System (EVOSS) is being developed for handling and processing service contracts issued by DOE. Starting with the RE Sector, the EVOSS is a web-based platform aiming to facilitate and streamline the process of RE applications.

The evaluation process of the Renewable Energy Service Contracts (RESC) shall not exceed 45 working days.

5.1.4 Thailand

Introduction

Thailand has a good potential for utilization of renewable energy (RE), especially from biomass residues from its agricultural sector and from solar energy. The Department of Alternative Energy Development and Efficiency (DEDE), under the Ministry of Energy, has conducted potential assessment on various RE resources. They can be summarized in Table 22.

Table 22: Potential of renewable energy in Thailand

No.	RE sources	Potential
1.	Solar	• Average annual radiation: 17.8 MJ/m^2-d • Potential for energy generation: 521,110 ktoe/year
2.	Biomass	• Annual potential of solid biomass: 38,191.53 ktoe (2015)
3.	Biogas	• Potential of biogas from animal waste: 264.17 ktoe • Potential of biogas from industrial waste water: 498.33 ktoe
4.	Municipal solid waste (MSW)	• Annual MSW generation: 26.78 million tonnes (2015) • Potential of MSW (combustion waste): 6,496.66 ktoe • Potential of MSW (landfill waste): 0.78 ktoe

Source: DEDE (2016): Thailand Alternative Energy Situation 2015

In 2015, the use of alternative energy (AE)[108] in Thailand accounts for 10,077 ktoe/year. This is equivalent to 12.94% of the total final energy consumption. This grew by 11.7% from the previous year (2014). Thermal applications of AE sources accounted for 65.3% of the total AE utilization, followed by biofuels (19.3%), and the use of AE sources for electricity generation (15.4%).[109]

RE Targets and Planning

In 2015, the Ministry of Energy introduced a new set of energy policies called Thailand Integrated Energy Blueprint (TIEB). The TIEB covers the timeframe of 2015-2036 which is aligned with the National Social and Economic Development Plan (2015 – 2036). It prioritizes three main aspects of the Thai energy sector:

- **Security:** sufficiency of energy supply, fuel mix diversification, etc.
- **Economy:** appropriate & affordable energy price/tariff, restructuring of fuel price, etc.
- **Ecology:** increased use of RE and clean energy technologies, etc.

There are five separate plans under the TIEB. They are:

- the Alternative Energy Development Plan or AEDP 2015,
- the Thailand Power Development Plan or PDP 2015,
- the Energy Efficiency Plan or EEP 2015,
- the Oil Plan, and
- the Gas Plan.

Key policies that are directly relevant to RE development will be the focus of this part of the report. They are the PDP and the AEDP. While the PDP addresses the role of RE specifically in the power sector, the AEDP addresses the role of RE or AE in a broader aspect, covering all forms of energy.

Thailand AE targets are defined by the Alternative Energy Development Plan (AEDP). The latest version is AEDP 2015, issued in September 2015 by the DEDE to replace AEDP 2012. Under AEDP 2015, the AE targets are defined for three forms of energy utilizations: (1) electricity, (2) thermal energy, and (3) bioenergy (fuels). The overall target for the share of all AE in Thailand final energy utilization is 30% by 2036. The detailed targets for each sector are summarized in Table 23.

Table 23: Overview of Thailand AE targets in three sectors

Energy form	AE Share in Final Energy Utilization in 2036	Sectoral Targets
Electricity	15-20 %	19.68 GW
Thermal energy	30-35 %	25,088 ktoe
Bioenergy (fuels)	20-25 %	8,712.43 ktoe
Total RE	**30 %**	**-**

Source: AEDP 2015-2036

Power sector: Thailand power sector relies significantly on natural gas. The PDP 2015 aims for the diversification of fuel mix in the electricity generation. Under the PDP, the share of natural gas shall be reduced from 64% to 30-40% by 2036. The AEDP 2015 projects the share of AE in Thailand power generation to be between 15 to 20% by 2036. That corresponds to an

[108] In Thailand policy context, the broader "alternative energy" term is used instead of "renewable energy". The traditional (non-commercial) biomass (e.g., firewood, charcoal, etc.) is not considered as AE.
[109] Source: DEDE (2015). Alternative Energy Development Plan 2015 - 2036

AE installed capacity of 19.7 GW. The majority of the RE installed capacity will come from biomass with around 5.6 GW.

The AEDP 2015 has prioritized AE technologies in Thailand with a clear focus on bioenergy. Merit order of AE for power generation are defined as follows: (1) Municipal solid waste, (2) Biomass, (3) Biogas from waste/wastewater, (4) Small hydropower, (5) Biogas from energy crop, (6) Wind, (7) Solar, and (8) Geothermal. The targets defined for specific AE technologies are described in Table 24. In 2036, most of installed capacity is expected to come from solar power at 6 GWp. The second largest installed capacity is to be from biomass with 5,570 MW.

Table 24: Thailand AE targets in the power sector

Energy Source	Installed capacity target by 2036 [MW]
Municipal solid waste (MSW)	500
Industrial waste	50
Biomass	5,570
Biogas (produced from waste/wastewater)	600
Small hydropower	376
Biogas (produced from energy crop)	680
Wind	3,002
Solar	6,000
Large hydropower	2,906
Total	**19,684**

Source: AEDP 2015-2036

To support the development of AE in the power sector, the Thailand Smart Grid Development Master Plan 2015-2036 was introduced in February 2015. It is under the PDP 2015 and plays an important role in preparing Thailand grid infrastructure to be able to be operated more efficiently and to become more RE integration friendly. The master plan defines key activities/technologies and classifies them into 4 phases with different timeframe (i.e. preparation phase, short-term, medium-term and long-term). Five strategic aspects were specified in the master plan: (1) Reliability, (2) Sustainability, (3) Service, (4) Interoperability, and (5) Economics (with key achievement indicators for each aspect).

Thermal energy: In 2036, around 25,000 ktoe or (25 Mtoe) of thermal energy utilization is expected to come from AE. Similar to the power sector, biomass will play a crucial role, contributing around 22 Mtoe of thermal energy by 2036. The remaining portions will come from the use of biogas, solar thermal, municipal solid waste (MSW), and other sources (see Table 25).

Table 25: Thailand AE targets in thermal energy utilization

Energy Source	Final thermal energy utilization target by 2036 [ktoe]
Municipal solid waste (MSW)	495
Biomass	22,100
Biogas	1,283
Solar	1,200
Others	10
Total	**25,088**

Source: DEDE (2015). Alternative Energy Development Plan 2015 - 2036

Fuels: AE as fuel is mainly aimed at the transportation sector which still relies significantly on petroleum products. Currently, biodiesel and ethanol-blended fuels are widely used in Thailand (so-called E10, E20, and E85). By 2036, the AEDP projects the use of biodiesel to be around 14 million litres per day and ethanol to be around 11.4 million litres per day. The AEDP also

aim at promoting use of compressed bio-methane gas (CBG) to replace the use of natural gas for vehicle (NGV) in areas far away from natural gas pipeline. According to the plan, the CBG production is expected to reach 4,800 tonnes per day which is equivalent to 2,023 ktoe in 2036 (see Table 26)

Table 26: Thailand AE fuel targets

Fuel	Target (2036)	
	Physical unit	[ktoe]
Biodiesel	14.00 million litre/day	4,404.82
Ethanol	11.40 million litre/day	2,103.50
Pyrolysis	0.53 million litre/day	170.87
Compressed Bio-methane Gas (CBG)	4,800 tonnes/day	2,023.24
Other alternative fuels	-	10.00
Total	**-**	**8,712.43**

Source: AEDP 2015-2036

RE Price-based Policies

Feed-in tariff: Thailand introduced the Adder Scheme in 2007 to promote the development of RE project for power generation with an attractive fixed amount ("adder") to be paid on top of the wholesale electricity tariff. This scheme offered very attractive and stable selling price for project developers as it was always linked to the variation of wholesale electricity tariff.

The adder scheme was phased out in 2014-2015 and replaced by a fixed FIT scheme that has no link with the wholesale electricity tariff. In addition to the base FIT, a bonus called "FIT premium" is applicable when a project meets some special conditions (i.e. project developed in the four southern provinces of Thailand, bio-energy project, etc.).

Currently, Thailand's FIT can be categorized into two types based on the energy source: (1) Natural Energy (i.e. wind, solar, hydro) and (2) Bio-energy (i.e. biomass, biogas, municipal solid waste). Table 27 summarizes the FIT for natural energy and Table 28 summarizes the FIT for bioenergy.

Table 27: Thailand Feed-in-Tariff – Natural Energy Category

RE Technology	FIT [THB/kWh]	Duration of support [yr]	FIT Premium - Southern provinces [THB]
Hydropower (up to 200 kW)	4.90	20	0.50
Wind	6.06	20	0.50
Solar PV			
Rooftop (0-10 kWp)	6.85	25	0.50
Rooftop (>10 – 250 kWp)	6.40	25	0.50
Rooftop (>250 – 1,000 kWp)	6.01	25	0.50
Ground-mounted (all size)	5.66	25	0.50

Table 28: Thailand Feed-in-Tariff – Bioenergy Category

RE Technology	FIT [THB/kWh]			Duration [yr]	FIT Premium [THB/kWh]	
	Fixed FIT	Variable FIT	Total FIT		Bio-energy project[110]	Southern provinces
MSW (integrated waste management)						
≤ 1 MW	3.13	3.21	6.34	20	0.70	0.50

[110] This part of FIT premium is available only for AE projects that uses bioenergy as an energy resources for power generation. This part is not applicable for natural energy category.

RE Technology	FIT [THB/kWh]			Duration [yr]	FIT Premium [THB/kWh]	
	Fixed FIT	Variable FIT	Total FIT		Bio-energy project[110]	Southern provinces
1 – 3 MW	2.61	3.21	5.83	20	0.70	0.50
> 3 MW	2.39	2.69	5.08	20	0.70	0.50
MSW (landfill)	5.60	-	5.60	10	-	0.50
Biomass						
≤ 1 MW	3.13	2.21	5.34	20	0.50	0.50
1 – 3 MW	2.61	2.21	4.82	20	0.40	0.50
> 3 MW	2.39	1.85	4.24	20	0.30	0.50
Biogas (waste water or solid waste)	3.76	-	3.76	20	0.50	0.50
Biogas (energy crop)	2.79	2.55	5.34	20	0.50	0.50

A new scheme for FIT is being developed. It is called "FIT Hybrid"[111]. It aims to promote the use of multiple RE resources or use of RE with energy storage system (ESS). The main objective is to make RE power plant more dependable despite variations in weather condition.

The development of AE in the power sector relies on investments by the private sector through two schemes:

- Small Power Producer (SPP) with a sale capacity of over 10 MW and up to 90 MW;
- Very Small Power Producer (VSPP) with a sale capacity of up to 10 MW.

For the development of AE project by VSPP, the form of power purchase agreement (PPA) is predefined by distribution utilities, i.e., Provincial Electricity Authority (PEA) and Metropolitan Electricity Authority (MEA), and all terms and conditions cannot be amended. For the AE project development by SPP, the form of PPA is predefined by transmission utility, i.e., the Electricity Generation Authority of Thailand (EGAT).

The net-metering scheme is under discussion. The government has launched the pilot solar rooftop project. This pilot project aims at promoting the use of solar rooftop system for generating electricity for self-consumption. The excess electricity, which should be minimized can be fed to the grid on a voluntary basis.

RE Quantity-based Policies and Procurement Mechanisms

RE quota obligation: Although there are AE targets, there is no RE Portfolio Standard for Thailand power sector. Power utilities are not forced to source certain percentage of their power generation from AE.

The Energy Regulatory Commission (ERC) is responsible for issuing the quota for AE development in particular region from time to time. At the moment, AE project development which apart from solar PV is allowed only in the 3 southern provinces. The current quota for AE project development in the power sector is summarized in Table 29.

Table 29: Current quota for AE projects in the power sector

RE Sources	Quota
Solar	• Solar farm under the Adder Scheme: 2,800 MWp *(already oversubscribed)* • Solar rooftop (Phase 1): 200 MWp, of which 100 MWp for residential sector, and 100 MWp *(fully subscribed)* for commercial/industrial sector:

[111] This scheme is not yet officially announced. It is under the public consultation (as of October 2016)

	• Solar rooftop – Phase 2 (own consumption only): 100 MWp • Solar farms developed by government agencies or agricultural cooperatives: 800 MWp
Biomass	• 36 MW, only in 3 southern provinces (Yala, Narathiwat, and Pattani) and 4 district in Songkla province
Biogas (Waste/ waste water)	• 10 MW, only in 3 southern provinces (Yala, Narathiwat, and Pattani) and 4 district in Songkla province

Source: ERC

Competitive bidding: The competitive bidding process have just been introduced in 2015. This is applicable for AE projects in the power sector except solar projects which different sets of procedure and criteria apply. For all non-solar AE project (e.g., wind, hydropower, bioenergy, etc.), developer must follow the competitive bidding procedures and regulations issued by the ERC.

In general, project developer who quote low selling price has higher possibility to be granted with quota in that area, providing that the grid capacity in that area is sufficient. The selling price must be quoted by specifying a percentage reduction of the fixed FIT (see column 2 of Table 27 and column 2 of Table 28). The feeder capacity is firstly allocated to a project with highest percentage reduction (lowest fixed FIT). After the first allocation, if the feeder capacity is still sufficient, the remaining capacity will be allocated to the running up project in the same area (project with the second highest percentage reduction). This process continues until the feeder capacity is fully subscribed or the overall quota is fully allocated.

Financial Incentives for RE Projects

The Energy Service Company Revolving Fund (ESCO Fund) was established in 2008 by DEDE with the objective to encourage investment in AE and energy efficiency and conservation (EE&C) projects. The fund can be used for the following activities: equity investment, equipment leasing, ESCO venture capital, GHG project facility, credit guarantee facility, and technical assistance. The fund has been managed by the Energy for Environment (E for E) Foundation

In 1992, the Energy Conservation Fund (ENCON Fund) was established under the framework of the Energy Conservation Act 1992. The purpose of this fund is to provide financial support to the introduction and promotion of AE and EE&C technologies. The fund was built from levies on petroleum products. As planned, in 2016, a total of 10.152 billion THB (292 million USD) is allocated by the fund to 149 projects, of which 1.855 billion THB (53 million USD) is for AE projects, and the remaining fund is for EE projects and policy development.

Soft loan: The Revolving Fund is providing soft loan to promote and push investments in RE projects, and to increase the confidence of financial institutions in lending for RE projects. A maximum of 50 million THB (1.43 million USD) with low interest rate of 4% per annum is lent to each project for a duration of 7 years.

Investment grants: The investment grants are provided by the ENCON Fund to encourage investments in biogas, MSW and solar thermal projects. Investor can apply to get an investment grant for design, consultants and partial investment under this scheme. The maximum invesment grant is 20-50% of capital invesment for biogas, 25-100% for MSW, and 30% for solar thermal (solar hot water) project, with a maximum capital grant of 50 million THB (1.43 million USD) per project.

Fiscal Incentives for RE Projects

The Announcement No. 2 (Year 2010) of the Board of Investment (BOI) introduced several investment promotion instruments for sustainable development industry activities. EE and AE are considered as priority activities under this BOI announcement. Therefore, in the implementation of such activities, the following incentives are provided:

- ***CIT exemption and reduction:*** an exemption of CIT for 8 years is provided for the generation of RE, and the manufacturing of RE equipment and machinery. Additionally, for another five years (the 9th through 13th), the BOI will also provide a 50% reduction of CIT on the profit generated from the investment;
- ***ID&T exemption and reduction:*** import duty and tax are exempted for imported equipment;
- ***Other incentives:*** double deduction for transportation, electricity and water supply costs for 10 years, and deduction of infrastructure installation and construction cost from net profit in addition to normal depreciation.

Mandatory Grid Access and Prioritized Dispatch

Mandatory grid access: Most AE power plants in Thailand are operated as "non-firm" SPP or VSPP. Therefore, there is no obligation for the power plant to ensure that certain power is generated at certain time. The power utilities, on other hand, are obliged to purchase all electricity produced from such power plants. This makes operating and managing the power grid by power utilities more complex. As mentioned earlier, the government is trying to assist the power utilities by introducing the concept of "SPP hybrid" which aims at using multiple RE resources with energy storage system to ensure more dependable of AE power plant. It is expected that this can change "non-firm" power plant to "firm" power plant. Currently, this concept is still under public consultation process.

Grid code: Power utilities at transmission level (EGAT) and at distribution level (PEA and MEA) are responsible to develop a grid code (transmission/distribution codes) to define the technical requirements in connecting, using, and operating the grid in the areas under their responsibility. Currently, a joint task force has been established to discuss and develop a grid code that accommodate certain requirements to integrate variable RE (VRE) into the system.

Other RE Policy Measures

Financial support for R&D: The ENCON fund remains a main financial source for research and development activities in the field of AE. Apart from that, all power utilities have allocated some budget for R&D activities in the field of AE utilization in the power system.

DEDE has promoted the use of hybrid solar hot water system. Use of solar collector in combination with waste heat recovery system is promoted. Technical support is provided (e.g., site survey, development of feasibility study, basic design and engineering, etc.). It is reported that the project enabled 47,686 m^2 of solar collector to be installed. Similarly, solar drying system has been promoted by DEDE. Technical standards and equipment are developed by the DEDE for such system to assist developers to procure a system with good quality. As a result, 284 solar drying systems were installed[112]. This is equivalent to 35,131 m^2.

Promotion of ESCO/private sector investments: The Government of Thailand (GOT) via E for E Foundation and the Energy Conservation Foundation of Thailand (ECFT) is using several

[112] DEDE (2016). Annual Report 2015

support programs and schemes to promote ESCO investments in RE sector. These include equity investment, support for equipment leasing, and credit guarantee facility (see Table 30).

Table 30: Incentives for the promotion of ESCO investments in RE sector in Thailand

Program	Objective	Size of investment and interest	Period	Organization
Equity investment	Investments in RE projects	• 10-50% of total investment cost • Not as a majority shareholder • Limited to 50 million THB per project • Return: annual dividend in the proportion of investment	5-7 years	E for E, and ECFT
Equipment leasing	Long-term leasing service in purchasing equipment for RE projects	• Support for 100% equipment cost • Limited to 10 million THB per project • Interest rate of 4% per annum	5 years	E for E, and ECFT
Credit guarantee facility	Guarantee commercial bank for project loans	• Depending on the project risk • Limited to 10 million THB per project • Project owner will be charged at 1.75% per annum of guarantee amount	Not more than 5 years	E for E, and ECFT

Source: IISD (2013)

5.1.5 Vietnam

Introduction

Vietnam has a substantial potential for power generation from renewable energy (RE). The total potential capacity of RE in Vietnam is estimated at 51,110 MW, of which 27,750 MW (54.3%) are from wind power, 13,000 MW (25.4%) from solar, 7,200 MW (14.1%) from small hydropower (<30 MW), 2,500 MW (4.9%) from biomass, and 660 MW (1.3%) from geothermal and municipal solid waste (MSW)[113].

Table 31: Potential and actual power generation from RE sources in Vietnam

No.	Type of RE	Potential (MW)	Actual generation by 2014 (MW)
1.	Wind power	27,750	135
2.	Solar power	13,000	4
3.	Small hydropower (<30 MW)	7,200	1,984
4.	Biomass	2,500	89
5.	Geothermal	340	-
6.	MSW	320	2
	Total	**51,110**	**2,214**

Source: ADB (2016) and ACE (2016)

By the end of 2014, only 2,214 MW of RE-based power were installed which account for 4.3% of the total RE potential. The small hydropower plants have a combined installed capacity of 1,984 MW (89.6% of total RE-based installed power capacity), followed by wind power with 135 MW[114] (6.1%), biomass-based power with 89 MW[115] (4.0%), solar power (4 MW) and MSW (2 MW).

[113] ADB (2016)
[114] Tuy Phong (30 MW), Phu Quy (6 MW), and Bac lieu (99.2 MW)

RE Targets and Planning

According to the National Power Development Plan for the 2011-2020 period with a vision to 2030 (PDP VII)[116], the amount of electricity generated from RE sources will be around 42 TWh/year, accounting for 6% of total annual electricity generation in 2030. The revised National Development Plan (PDP VII-revised) promulgated by the Prime Minister of Vietnam (PMVN) in 2016[117] has reduced the total electricity demand projection for 2030 from 695 to 572 TWh/year. However, the target for electricity generation from RE sources (excluding large-scale and pumped-storage hydropower plants) was increased from 42 TWh/year to around 61 TWh/year, making up 10.7% of total electricity generated and imported in 2030 (UNDP 2016). Solar power will account for 3.3% of the total electricity generation and import, followed by small hydropower (3.2%), wind power (2.1%), and biomass and MSW (2.1%).

By 2030, the installed capacity from wind and solar power is planned to reach 6,000 MW and 12,000 MW respectively. These targets are ambitious as an average of 430 MW of wind power capacity and 850 MW of solar power capacity have to be added to the national power system every year until 2030.

The targets for RE use for heat generation were set in the National Renewable Energy Development Strategy up to 2030 with a vision to 2050 issued in November 2015 (the 2015 NREDS)[118]. Under this strategy, by 2030, 16.8 Mtoe of heat demand (14% of country final energy consumption) shall be generated from biomass sources, and 3.1 Mtoe (2.6%) from solar energy. Biofuels produced from biomass sources will contribute 6.4 Mtoe (5.3%) to the final energy consumption.

RE Price-based Policies

Feed-in tariff and SPPA: The main policy instruments currently used for the promotion of RE in Vietnam are the feed-in tariffs (FITs) and the standardized Power Purchase Agreements (SPPAs) for grid-connected RE-based power projects. Four FITs and SPPAs are in place, for small hydropower (< 30 MW) promulgated in during 2008-2016 period[119], for wind power promulgated in 2011 and 2012[120], for solid waste-based power in 2014 and 2015[121], and for biomass-based cogeneration and power generation projects in 2014, 2015 and 2016[122]. The FIT for solar energy is under consideration (UNDP 2016).

The FITs are set on the basis of the avoided costs on the national power system when electricity is generated for the distribution power grid from the substitute RE-based power plants. Except hydropower projects, the FITs for other RE sources were set in USD/kWh. The payment (VAT-included) will be processed monthly in VND which is calculated by using the VND/USD exchange rate (selling rate) of the Vietnam Foreign Trade Bank at the time of payment. The FITs for different types of RE-based power projects are summarized in Table 32.

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[115] This is the total power capacity sold to the grid from bagasse-based cogeneration plants at six (6) sugar mills
[116] Decision 37/2011/QD-TTg (14/6/2011)
[117] Decision 428/QD-TTg (18/3/2016)
[118] Decision 2068/QD-TTg (25 November 2015)
[119] Decision 18/2008/QD-BCT (18/7/2008), Circular 32/2014/TT-BCT (9/10/2014), Decision 12086/QD-BCT (31/12/2014), Decision 14579/QD-BCT (30/12/2015) and Circular 06/2016/TT-BCT (14/6/2016)
[120] Decision 37/2011/QD-TTg (29/6/2011) and Circular 32/2012/TT-BCT (12/11/2012)
[121] Decision 31/2014/QD-TTg (5/5/2014) and Circular 32/2015/TT-BCT (8/10/2015)
[122] Decision 24/2014/QD-TTg (24/3/2014), Circular 44/2015/TT-BCT (9/12/2015) and Decision 942/QD-BCT (11/3/2016)

Table 32: FITs for grid-connected RE-based power projects in Vietnam

Type of RE sources	FITs (VAT-excluded)
Hydropower (<30 MW)	• 605-652 VND/kWh for electricity sales (depending on time of use, season and region) • 310-326 VND/kWh for surplus electricity (compared to contracted amount) • 2,242 VND/kWh for capacity sales (for the whole country, based on the amount of electricity sold to the grid in the peak hours during the dry season only)
Wind power	• 0.078 USD/kWh
Biomass-based cogeneration	• 0.058 USD/kWh for excess electricity
Biomass-based power generation	• 0.075551 USD/kWh for North region • 0.073458 USD/kWh for Central region • 0.074846 USD/kWh for South region
Solid wastes (Garbage) based power generation	• 0.1005 USD/kWh for direct combustion of solid wastes • 0.0728 USD/kWh for landfill gas (LFG) capture for power generation

The introduction of FIT and SPPA for small RE-based power projects in 2008 seems to have had an impact on the development of small hydropower projects. Although the FIT, based on avoided cost, was low[123], the incentives (tax exemption/reduction, VAT refund, etc.) and other preferential treatments offered by the Government of Vietnam (GOV) for the projects implemented in areas with difficult socio-economic conditions (e.g.,, the remote and mountainous areas) have stimulated the investments in small hydropower projects (ACE 2016).

The regulations promulgated in 2011 on FIT and in 2012 on the SPPA for wind power projects have had a limited impact on their development because of low FIT offered by the GOV. The analysis conducted by the ASEAN Center for Energy (ACE 2016) showed that the main drivers for the implementation of the three operating wind power plants were:

- the access of low-interest loans from the Vietnam Development Bank (VDB) and from the Export-Import Bank of the United States for the 99.2 MW plant in Bac Lieu, and
- higher tariffs, i.e., 0.13 USD/kWh specifically applied for the 6 MW wind power project in Phu Quy Island and 0.98 USD/kWh for the 99.2 MW offshore wind power plant.

The wind power producers, both local and foreign investors, are considering that the current FIT is not sufficient for them to recover their investments. According to EuroCham, a FIT of at least 0.115 USD/kWh is required for wind power projects in Vietnam[124]. The GOV is revising the FIT to become more attractive to the wind power investors.

The introduction of FIT and SPPA for biomass-based cogeneration projects in 2014 aims at the purchase of excess electricity from sugar mills. Before the introduction of FIT, only 6 out of 41 operating sugar mills sold excess electricity to the grid[125] from their cogeneration plants, with a combined capacity of 16 MW. The selling tariffs of electricity were low (0.04-0.05 USD/kWh) and the contracting period was short (1 to 3 years). The new FIT and SPPA offer a slightly higher selling tariffs of electricity (0.058 USD/kWh), but with a fixed contract term of 20 years.

[123] The FIT publicized in 2008 for small RE-based power projects (Decision 74/QD-DTDL dated 24 December 2008 of the Electricity Regulatory Authority of Vietnam) was 403-483 VND/kWh (0.0236-0.0283 USD/kWh) for electricity sales and 1,674 VND/kWh (0.098 USD/kWh) for capacity sales based on the amount of electricity sold to the grid in the peak hours during the dry season (from November 1 to June 30 of the following year). The calculated yearly-average FIT is low (616-638 VND/kWh depending on region) compared to the average electricity retail tariff of 871 VND/kWh (0.051 USD/kWh) in 2008.
[124] http://www.vir.com.vn/low-feed-in-tariffs-deter-foreign-wind-power-investors.html
[125] GIZ (2014)

However, the offered FIT is considered unattractive for the sugar mills to invest in high-pressure cogeneration technology in order to sell more excess electricity to the grid.

The late introduction of the policies (FITs and SPPAs) in 2015 and 2016 on the biomass-based and solid waste-based power generation projects does not show any impact on the development of these types of RE. Their impact can only be assessed after 2 to 3 years, which are usually needed for project development and implementation (ACE, 2016).

Reduced T&D costs: Under the existing regulatory framework, all costs associated with the grid connection shall be borne by the power project investors. However, according to the 2015 NREDS, in the future, the connection costs of the RE-based power plants shall be paid by the T&D power company.

Other price-based policy measures: The development of other price-based policy measures such as incentives for use of localally manufactured RE equipment, electricity tariff balancing, net metering mechanism, etc. was planned in the 2015 NREDS. However, until now, no concrete policy and regulatory framework on these measures is introduced.

RE Quantity-based Policies and Procurement Mechanisms

RE quota obligation: According to the 2015 NREDS, Vietnam will issue a Renewable Portfolio Standard (RPS) for power generation and distribution entities. However, until now, no concrete policy and regulatory framework on RPS has been introduced. The preliminary proposal is:

- For a power generation entity that has a total installed capacity of more than 1,000 MW (excluding BOT-invested projects), the percentage of electricity generated from RE sources (excluding hydropower plants with an installed capacity of 30 MW or above) shall not be less than 3%, 10% and 20% in 2020, 2030 and 2050 respectively;
- For a power distribution entity that generated and/or purchases electricity from RE sources, and for end-use customer who generates itself electricity from RE sources, the percentage shall not be less than 5%, 10% and 20% in 2020, 2030 and 2050 respectively;
- MOIT shall determine, on an annual basis, the minimum percentage of electricity generated from RE sources for each of power generation and distribution entities.

Financial Incentives for RE Projects

Financial subsidy: The Vietnam Environmental Protection Fund (VEPF) was established in 2002 to support the implementation of the environment related projects. For the renewable energy sector, VEPF is providing financial support in the form of price subsidies for grid-connected wind power and CDM projects. For example, VEPF is providing a price subsidy of 0.01 USD/kWh to the EVN to buy electricity generated from wind power projects[126].

Soft loans: In 2007, the GOV considered to establish an Energy Development Fund (EDF) to support the development of RE projects. The EDF intends to provide RE project developers with investment credits at favorable interest rate. However, this EDF is not established yet (ACE 2016).

Capital subsidy: In 2015, the GOV planned to set up the Sustainable Energy Promotion Fund (SEPF) to support RE development[127]. The fund will be financed from the State Budget, revenue from environmental fees levied on fossil fuels, various sources of funds and

[126] Circular 96/2012/TT-BCT (8/6/2012)
[127] Decision 2068/QD-TTg (5/5/2015)

contributions from local and foreign organizations/individuals as well as from other funding sources. The SEPF will provide the financial support to compensate the costs incurred by the power utilities on the investment in new or expanded power grids to connect with RE-based power sources, provided that these costs are unable to be paid back from the power transmission fees. However, until now, the SEPF has not been set up yet.

Fiscal Incentives for RE Projects

Accelerated depreciation: The accelerated depreciation of fixed assets is among the financial incentives offered to RE-based power projects in Vietnam. The accelerated depreciation rate is allowed to be 1.5 to 2.5 times higher than the standard straight line depreciation rate.

CIT exemption and reduction: According to the regulations and guidelines for the implementation of the Law on Corporate Income Tax[128], the exemption and reduction of corporate income tax are applied to the newly-established enterprises working on RE projects. Since the 1st of January 2016, these enterprises enjoy a preferential tax rate of 10% for 15 years from the first year of revenue generation instead of normal tax rate of 20%. Moreover, these enterprises enjoy additional tax incentives including tax exemption for 4 years after the enterprises first generates profits and 50% tax reduction for the 9 subsequent years (ACE, 2016).

ID&T exemption and reduction: The RE-based power projects are exempted from import duties and taxes on imported goods that would become fixed assets of the project and goods used as raw materials, input or semi-finished products for the project operation that are not available on the local market. This is according to the Law on Import and Export Taxes and other regulations on import and export duties (ACE, 2016).

Tax incentives for small hydropower projects: The water resource tax, forest environmental service fee and VAT are exempted for small hydropower projects. The electricity buyer, i.e. Electricity of Vietnam (EVN) or its authorized units shall pay these taxes and fee to the hydropower producers.

Mandatory Grid Access and Prioritized Dispatch

Mandatory grid access: Based on the existing policy and regulatory framework of Vietnam, the power utilities, i.e., EVN and its authorized units, shall be responsible for purchasing all electricity generated from grid-connected RE-based power generating projects within their jurisdiction. The power shall be purchased on the basis of the SPPAs promulgated by MOIT. RE-based power plants are given priority for the connection to the national power grid.

Grid code and technical standards for grid connection: The technical requirements for connecting RE-based power plants to the national power grid were promulgated by MOIT in 2006[129] and 2015[130]. Decision 37/2006/QD-BCN of the Ministry of Industry promulgated the detailed technical requirements for interconnecting of all types of power plants, including RE-based power plants connection to the national power grid. MOIT's Circular 39/2015/TT-BCT regulates the power distribution grid operation. This Circular has a separate article to address specific technical requirements for interconnecting thermal (including biomass, biogas and waste-to-energy), hydro, wind and solar power plants to the power distribution grid. Circular 42/2015/TT-BCT promulgated the regulations on the technical standards and criteria for electricity measuring system, and the responsibilities and obligations of the partners involved in power buying and selling activities (ACE 2016).

[128] Decree 218/2013/ND-CP (26/12/2013)
[129] Decision 37/2006/QD-BCN (16/10/2006)
[130] Circular 39/2015/TT-BCT (18/11/2015) and Circular 42/2015/TT-BCT (1/12/2015)

Other RE Policy Measures

In addition to the financial incentives, the SEPF will also provide grants for (i) studies on the formulation of the standards and demonstration projects using RE sources, (ii) the development and implementation of RE-based power projects in rural areas, (iii) the construction of independent RE-based power systems in remote/isolated areas and islands, (iv) the survey and assessment of RE resources and development of the information database, and (v) the R&D and promotion of local manufacture of RE equipment (ACE, 2016).

5.2 International EE Policy Best Practices and Experience

5.2.1 China

Introduction

The total primary energy consumption (TPEC) of China increased from 602.8 Mtce[131] in 1980 to around 4,260 Mtce in 2014[132]. The industry sector was the largest energy user, accounting for 65% of TPEC of the country, followed by buildings (16.4%), the transportation sector (15.2%), and agriculture (3.4%).

In China, the industry sector is divided between light and heavy industry, reflecting the relative energy-intensity of the manufacturing processes. In 2013, the heavy industry consumed around 80% of the total energy used in the industry sector. The largest industrial energy consumers are the chemical industry, the steel and iron industry, and the building material production industry. The industry sector has a great potential for EE&C improvement. According to the 12th Five-Year Plan (2011-2015), the potential for EE&C in the industry sector is 21% compared to the 2010 level.

EE Targets and Planning

In its 11th Five-Year Plan (2006-2010), the Chinese government set goals that would cut the country's primary energy intensity (energy use per unit of GDP) by 20%. The following 12th Five-Year Plan (2011-2015) called for a 16% reduction in energy intensity. The plans further allocated the targets to provinces as shown in Table 33.

Table 33: Regional targets for energy intensity reduction in China

Region	Energy intensity reduction (2006-2010)	Energy intensity reduction (2011-2015)
North China	20-22%	15-18%
Northeastern China	20-22%	16-17%
Eastern China	16-22%	16-18%
Central and South China	12-20%	10-18%
Southwestern China	17-20%	15-16%
Northwestern China	12-20%	10-16%

Source: Zhu Liu (2015)

The 12th Five-Year Plan has set EE&C targets for the nine key industries: 18% for each the steel and iron, non-ferrous metal, petroleum, and electronics & information industries; 20% for

[131] China typically converts all its energy statistics into "metric tons of standard coal equivalent" (tce). 1 tce equals to 29.31 GJ (LHV) or 31.52 GJ (HHV)
[132] Ying Chen (2015)

each the production of chemical products, production of building materials, light industry and textile industry; and 22% for the mechanical industry.

The energy intensity of China was decreased by 19.1%, as compared to the 20% target for the 2006-2010 period. For the period 2011-2015, the energy intensity was reduced by 18.2% as compared to the original16% target[133].

In March 2016, China has announced the 13th Five-Year Plan. According to this plan, the national target for energy intensity reduction will likely be set at 15% for the 2016-2020 period[134].

Financial Incentives for EE Projects

Soft loans and financial guarantees: Compared to other types of projects, EE projects in China are quite likely to receive preferential treatment in interest rates. However, attractive, low interest rates appear to be of secondary importance in the context of difficulties that the borrowers for EE projects are facing. Most of the difficulties are to achieve borrower eligibility and to meet collateral requirements. With the establishment of the government supportive policies, external support by international organizations, and the rising awareness of EE projects, more Chinese banks are seeking to expand their business in "green credit", especially in creating proper financial products for ESCOs. For examples[135]:

- *ESCO savings loan scheme* introduced by the Bank of Beijing (BoB), the Shanghai branch of the Shanghai Pudong Development Bank (SPDB), and the China Construction Bank (CCB) and Ping An Bank. In this scheme, the registered ESCO can collateralize the loan with its future receivables pledge, and the risk coverage depends on the quality and nature of those future receivables;

- *Low-interest loans to banks provided by the China CDM Fund:* The China CDM Fund had been built from the fees accumulated through the certification of GHG emissions reductions achieved under CDM projects in China. As of the end of 2011, the fund managed 10 billion RMB (1.58 billion USD) with the granting and investment portfolio of approximately of 285 million RMB (4.5 million USD) and 1.6 billion RMB (253 million USD) respectively. In line with the national regulations, the CDM Fund was used to support development of GHG emissions reduction projects through equity investments, on-lending loans by banks, financial guarantees, and capacity building. As of December 2011, the CDM Fund had provided concessional loans of around 1.54 billion RMB to 31 projects, of which 12 were EE projects.

- *The WB's China Energy Efficiency Financing (CEEF) project:* CEEF was set up by the WB as an international corporation project with the GOC to promote energy savings and emission reduction. The project was implemented from 2008 to 2011. In total, the WB has provided 400 million USD to three Chinese banks (China EXIM, Huaxia Bank and China Minsheng Bank) for them to finance EE projects. The three participating local banks were required to provide matching money from their own capital sources in proportions of 1:1 or 2:1 to the WB loans. CEEF provided eligible loans to EE projects[136] at a floating interest rate, usually 10-20% below conventional loan products and at or above the prime

[133] TERI (2016)
[134] CSIS (2016)
[135] IIP (2012)
[136] Under CEEF, eligible loan included medium and large-scale energy conservation investments in which the primary incremental benefits are cost savings associated with reduced energy consumption. The EE projects are not eligible for such financing if their incremental benefits are primarily derived from capacity expansion or non-energy related cost savings.

rate[137] level. The loan repayment term was 3 to 5 years. Collateral conditions were dependent on the requirements of the participating local banks. This financing was targeted to large-scale EE projects with an investment of 5 to 25 million USD, with the borrowers contributing not less than 30% of the investment cost.

- *The AFD's loan:* In March 2010, AFD lent 120 million EUR to GOC, which, in turn, on-lent to three local banks: SPDB, Huaxia Bank and China Merchants Bank, each with 40 million EUR for a term of 10 years at 6-months London Interbank Offered Rate (LIBOR). The local banks lent to the EE projects at a floating interest rate, usually 10-20% below conventional loan products and at or above prime rate level. The loan repayment term was 3 to 5 years. The borrowers shall meet the collateral conditions required by the participating banks. This financing focused on the medium-sized RE and EE projects.

- *The ADB's loan:* The ADB has implemented three EE loan projects with three Chinese provinces: Guangdong (2009), Shandong (2011) and Hebei (2012). ADB loans provided 100 million USD to each respective provincial government and were re-lent to EE projects through a financial intermediary that manages and reuses the funds during the 15-year loan term. The interest rate was floating, 10% discount from the prime interest rate. The loan repayment term was 3 to 5 years. Loan guarantee was required, typically from the local government. Medium-sized EE projects and ESCOs were eligible borrowers.

Financial subsidies: During the China's 12th Five-Year (2011-2015), the central government offered special subsidies to support the EE&C projects. In order to achieve the optimum energy conservation goals, the financial subsidies were closely linked to the quantity of energy saved on a project basis. The project companies would be granted financial subsidies if they would fully achieve the expected goals of energy conservation. For projects in the eastern regions of China, qualified companies were granted a one-time reward subsidy of 240 RMB/tce saved annually. For projects in the central and western regions, a one-time reward subsidy of 300 RMB/tce saved was granted.

Fiscal Incentives for EE Projects

CIT exemption and reduction: Presently, a three-year CIT reduction, followed by a 50% reduction for another three years of the standard CIT rate (25%) is granted to qualified EE&C projects. This reduction starts from the year in which the first revenue is generated. In addition, 10% of the amount invested in the qualified equipment is credited against CIT payable for the current year, with any unutilized investment credit eligible to be carried forward for five tax years. This applies only if such equipment is qualified as special equipment used in EE&C projects.

Mandatory Measures on Energy Performance and Management

EE obligation (EEO): EEO was first used in China in 2006 by the NDRC after experimenting with voluntary agreement schemes for energy conservation in the industry sector. Under China's EEO scheme, officially called the "Top 1,000 Energy-Consuming Enterprise Programme" (Top 1,000 ECEP), enterprises would be penalized for not meeting their assigned energy-saving targets. The programme targeted the 1,008 largest enterprises in nine energy-intensive industries with individual total energy consumption of 0.18 Mtce or more. Their combined energy use was 670 Mtce, which accounted for 33% of China's total energy use (47% of total energy consumption in industry) in 2005. The program was significantly expanded in 2011 and renamed the "Top 10,000 Energy-Consuming Enterprises Programme"

[137] In China, the loan prime rate (LPR) is the commercial banks loan rate providing to their best customers. The other loan rates are based on it.

(Top 10,000 ECEP). The "Top 10,000 ECEP" aimed to save 250 Mtce by 2015 in 15,000 industrial enterprises that use more than 10,000 tce/year, in around 160 large transportation enterprises (such as large shipping companies), and in public buildings that use more than 5,000 tce/year. The total number of enterprises covered by this programme reaches to around 17,000.

EEO proved to be effective in stimulating EE&C practices and investments among the regulated enterprises. By the end of 2010, 866 enterprises regulated by the "Top 1,000 ECEP" have met their EE targets. Overall, the "Top 1,000 ECEP" conserved 165 Mtce of energy, which was 183% of the original target[138]. According to an intermediary evaluation in 2012, about 10% of evaluated enterprises of the "Top 10,000 ECEP" failed to achieve their energy-saving targets[139].

Mandatory energy management, audit and reporting: The mandatory energy management, audit and reporting have been applied in China since 2006 for the largest energy-intensive enterprises included in the "Top 1,000 ECEP" and "Top 10,000 ECEP". The key elements of the "Top 10,000 ECEP" related to mandatory energy management, audit and reporting include:

- to set up an energy conservation working group in the enterprise;
- to establish an energy conservation targeting and accounting system;
- to conduct energy audits and develop energy conservation plans;
- to implement energy audit systems;
- to conduct energy efficiency benchmarking;
- to set up an energy management system (EMS) in the enterprise;
- to expand training pilots for energy managers; and
- to implement an energy conservation reporting system.

The guidelines were published for conducting energy audits and developing energy conservation plans[140] and for setting up an EMS[141] in the enterprise.

EE product standards and labelling: Since 2014, NDRC, the Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and the Standardization Administration carry out and streamline the "One Hundred Energy Efficiency Standard Promotion Programme". As of September 2015, a total of 105 compulsory energy consumption standards and 70 mandatory EE standards have been published.

China has adopted the first minimum energy performance standards in 1989 for products such as refrigerators, room air conditioners, clothes washers, and televisions. Since then, China has implemented additional minimum energy performance standards for other major appliances, lighting, cooling and heating equipment. In 1998, China has established a voluntary EE labelling programme. In 2005, the government has introduced the China Energy Label (CEL), a mandatory energy information label, adapted from the EU categorical energy label. The CEL categorizes appliances into five tiers (or three tiers, depending on the type of appliance), with Tier 1 being most efficient and Tier 5 (or Tier 3) being the least efficient. Tier 5 (or Tier 3) is also the minimum energy efficiency required for products to enter the Chinese market[142]. The catalogue of EE star product and the catalogues of recommended energy-saving electro-mechanical equipment were released in 2014.

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[138] Kevin Lo (2014)
[139] IEPD (Industrial Efficiency Policy Database). Online at http://iepd.iipnetwork.org/policy/top-10000-energy-consuming-enterprises-program
[140] GB/T 17166: Technical Principle of Energy Audits in Enterprises
[141] GB/T 23331: Energy Management Systems
[142] Yang Yu (2013)

Forced retirement of low efficient equipment/enterprises: In 1999, the Chinese government first began shutting down small low-efficient coal-fired power plants, although progress was slow because of the high electricity demand from 2002 to 2005. In 2006, the government renewed efforts and expanded the mandatory shut down to twelve other energy-intensive industries. In order to minimize the negative economic and social impacts of the forced closures, funding was made available to local authorities to support affected enterprises and workers. This policy was generally effective, although local governments have frustrated the central government in some instances by sheltering local factories from closure as they still contribute to local revenues and employment. In total, 72,000 MW of coal-fired power generators, 122 million tonnes of iron production capacity, 70 million tonnes of steel production capacity and 330 million tonnes of cement production capacity were retired during the 2006-2010 period. In 2011, the forced closure program was expanded to cover 19 industries.

Other EE Policy Measures

R&D incentives: The R&D incentives are offered in the form of income tax deductions and reductions in CIT. The R&D enterprises working in the field of new energy and energy conservation technology are eligible for these R&D incentives, including (i) reduced CIT of 15%, and (ii) VAT exemption/Zero-rated treatment for certain R&D services performed for foreign entities.

Promotion of ESCOs: China supports the use of ESCOs and third-party finance in EE&C. In 2013, there were 4,852 ESCOs providing EE&C services. In 2014, the total revenue of these ESCOs reached 265 billion RMB (43.1 billion USD). The total investment of ESCOs was 95.9 billion RMB (15.6 billion USD) in 2014, which helped to save about 30 Mtce of energy[143]. In order to support the ESCOs in their energy performance contracting (EPC) projects, the central and provincial government agencies provide them with financial subsidies and tax incentives. The standard rate of subsidies at the central level is 240 RMB/tce saved, and at the provincial level, it is not less than 60 RMB/tce saved[144].

NDRC and MOF jointly announce the qualified ESCOs. The list of qualified ESCOs is updated on a regular basis. These financial subsidies are rolled out under the jurisdiction of EPC and they should be taxable for CIT purposes.

The ESCO taking part in an EPC project enjoys the following tax incentives[145]:

- CIT exemption in the first three years and a tax reduction by half (an effective rate of 12.5% instead of 25%) for another three years, starting from the tax year in which the revenue from the project first arises;
- An ESCO that invests in special equipment for EE&C will obtain a credit against its tax payable that equals 10% of the investment amount in the year in which the investment is made. Where there is not sufficient tax payable to absorb the credit in the year, the excess credit may be carried forward up to five tax years;
- A qualified ESCO will be provisionally exempt from the Business Tax/VAT on revenues received from the EPC project;
- A qualified ESCO will be provisionally exempt from the VAT on the transfer to the energy user of goods related to the EPC project;
- When, at the end of the term of an energy management contract (EMC), the ESCO transfers to the energy user the assets that have materialized in the course of executing the

[143] Ying Chen (2015)
[144] KPMG (2013)
[145] KPMG (2013)

EPC project, the ESCO can do so as if these assets had been fully depreciated or amortized for CIT purposes. In the same way, when the energy user receives the project assets from the ESCO, the energy user can do so as if these assets had been depreciated or amortized;

- When the ESCO transfers the project assets to the energy user at the end of the term of the EMC, the ESCO will not have to declare any revenue from the contributions the energy user has made to the price of the assets; and
- An energy user in an EPC project can deduct reasonable expenses actually incurred in accordance with the EMC as, and when, they are incurred for CIT purposes. There is no need to differentiate between service fees and asset prices in claiming such a deduction.

Government procurement of energy-saving products: In 2007, NDRC has promulgated a compulsory mechanism on government procurement of energy-saving products selected from the list of certified/labelled EE products.

5.2.2 India

Introduction

Total final energy consumption (TFEC) of India was 503 Mtoe in 2011. It doubled from its 1990 level (250 Mtoe) with an annual average growth rate of 3.4% between 1990 and 2011. The TFEC per capita has increased by 43% since 1990. It was 297 kgoe in 1990, 316 kgoe in 2000, and 424 kgoe in 2011. Biomass is the main final source of energy used in India. It accounted for over 53% of the total final energy demand in 1990 and its share was gradually reduced to 34% in 2011.

In 2013, the building sector (residential and services) accounted for 41% of the final energy demand. Industry was already the second biggest final energy consumer with 35%, while the share of transport (14%), and agriculture (5%) were more modest.[146]

The industry final energy demand grew by 2% per year on average between 1990 and 2003, but soared between 2004 and 2011 (+7.3% per year on average).

There is great potential for Energy Efficiency and Conservation (EE&C) improvement. According to India's 11th Five-Year Plan, several EE improvement and energy consumption reduction objectives have been set. On the section related to the power sector including those of the industry sector, it states, "*Supply side and demand side efficiencies should be improved to effectively lower the primary energy demand by 5-7% during the Eleventh Plan period*".

EE Targets and Planning

In 2001, the Indian Energy Conservation Act (ECA) was issued in which GOI created the Bureau of Energy Efficiency (BEE), clarified the powers of the central government, State governments and the BEE regarding energy efficiency and conservation, established an Energy Conservation Fund, set up an energy standard and labeling policy, introduced an "Energy Conservation Building Code" and instituted compulsory periodic energy audits for power intensive industries.

In terms of energy consumption, the 11th Five-Year Plan (2007-2012) proposed setting 5% of the anticipated energy consumption level at the beginning of the 11th plan (2007) as a target for energy savings to be achieved by 2012.

[146] IEA (2015)

It has set the longer time frame goal of increasing energy efficiency, nationally, by 20% by 2016-17. This is one of the "27 monitorable targets" that have been set on a national level.

Energy Efficiency is a central element of the 11th Five-Year Plan. It introduced Demand Side Management (DSM), and created the Energy Conservation Information Center.

Building on the objectives of the 11th Five-Year Plan, the National Action Plan on Climate Change (NAPCC) of 2008 also focused on devising efficient and cost-effective strategies for end use DSM.

The National Mission on Enhanced Energy Efficiency (NMEEE) of 2009 targeted the following for 2014-15:

- Save 23 million toe or more annually;
- Avoid the addition of 19,000 MW of electricity generation capacity (which represents 8.6% of 2011 India's total installed electricity capacity, and approximately the increase in capacity between 2010 and 2011);
- Prevent the emission of 98 million tonnes of CO_2 per year.

The NMEEE also defined the Specific Energy Consumption (SEC) reduction targets by 2015 for the 478 designated consumers (DCs) covered by the Perform Achieve Trade (PAT) scheme.

Table 34: EE targets for key industries in India

Sector	No. of identified DCs	Annual energy consumption (Mtoe)	Share of consumption (%)	Apportioned energy reduction for PAT cycle (Mtoe)
Power (thermal)	144	104.56	63.38	3.211
Iron & Steel	67	25.32	15.35	1.486
Cement	85	15.01	9.10	0.815
Aluminum	10	7.71	4.67	0.456
Fertilizer	29	8.20	4.97	0.476
Paper & Pulp	31	2.09	1.27	0.119
Textile	90	1.20	0.73	0.066
Chlor Alkali	22	0.88	0.53	0.054
Total	**478**	**164.97**	**100.00**	**6.686**

Source: Chakavarti, 2012

The 12th Five-Year Plan (2012-2017) issued last December 2012 has identified several focus areas related to EE development and application. They are as follows: The Technology Improvement in Iron and Steel Industry, the Technology Improvement in Cement Industry, the Energy Efficiency Programmes in the Industry, Vehicle Fuel Efficiency Programme, Improving the Efficiency of Freight Transport and Lighting, Labelling and Super-Efficient Equipment.

Financial Incentives for EE Projects

Soft loans: There are several financing schemes providing soft loans for EE projects in India. Most of them are funded by international development and financial organization (JICA, WB, KfW, AFD, UNIDO, etc.), and implemented by local banks/institutions in partnership with international financial and development organizations. Local banks, such as the Industrial Credit and Investment Corporation of India (ICICI) Bank, Canara Bank, Bank of Baroda, etc. have also been providing specific lines of credit for EE projects. Some of the key financing schemes are described below.

- *SIDBI-JICA Energy Saving Line, Phase 1, 2 and 3 (2008-2019):* In 2008, SIDBI has entered into a partnership with the Japan International Cooperation Agency (JICA) to offer special financing for EE projects in India. The program has been implementing in three phases: Phase 1 (2008-10), Phase 2 (2011-14) and Phase 3 (Apr 2014 - Mar 2019). The total budget of the program is 90 billion JPY (30 billion JPY for each phase). The objective of the program is to offer medium and long-term soft loan for micro, small and medium enterprises (MSMEs) implementing energy-saving projects across different industrial sector.

  The maximum period of the loan repayment is 7 years. However, longer repayment period can be considered. The minimum financing amount is 1 million INR per project with a minimum contribution from MSME is 25% for existing units or 33% for new units. During Phase 1 of the program, a fixed interest rate of 9.5-10% p.a or a floating interest rate of 9.75-10.5% p.a was applied. During Phase 2 and Phase 3, the interest rate is between 0.75% to 1% below the normal lending rate as per credit rating[147]. SIDBI's financing scheme for energy-saving projects is one of the most successful programs in India. In Phase 1, the scheme financed more than 2,700 energy efficient projects[148]. In Phase 2, more than 3,000 MSMEs have been granted soft loans[149].

- *SIDBI-KfW Energy Efficiency Credit Line (2009-2014):* In 2009, SIDBI received a credit of 50 million EUR from KfW Development Bank for financing the EE projects. The financing scheme was operational from 2009 to 2014 and focused on providing loans for implementing EE projects in MSMEs. During this period, the loans were disbursed to more than 224 MSMEs. The loan is generally not less than 1 million INR (13,000 EUR) per project with a minimum contribution from MSME is 25% of project cost. The loan repayment period is normally not more than 7 years. The interest rate is between 0.75% to 1% below the normal lending rate as per credit rating[150].

- *SIDBI-WB/GEF Financing Scheme (2010-2016):* SIDBI, alongwith Bureau of Energy Efficiency (BEE) is also implementing a WB/GEF project with a total grant amount of 11.3 million USD. The project focuses on financing the EE projects at MSMEs in five targeted MSME clusters (Faridabad, Pune, Kolhapur, Ankleshwar & Tirunelveli). More than 1,100 walk-through energy audits and 650 detailed energy audits have been conducted. More than 600 Investment Grade Detailed Project Reports (IGDPRs) have been prepared and implementation of Energy Efficiency Measures is going on in more than 500 MSME units[151].

- *SIDBI-AFD Financing Scheme (2010-2014):* In 2010, SIDBI received a fund of 50 million EUR from French development agency (AFD) to finance EE projects. The fund was fully utilized to provide financial assistance to around 1,200 MSMEs.

- *IREDA Energy Efficiency Financing Scheme:* The Indian Renewable Energy Development Agency Ltd. (IREDA) receives financial and technical support from the KfW, AFD, Nordic Investment Bank (NIB), European Investment Bank (EIB), JICA, WB, ADB, and other international financial institutions, agencies and investors. From 2006 to 2010, IREDA's total funding grew by 70% from approximately 391 to 665 million USD. In addition to EE&C projects, IREDA also promotes and finances the delivery of EE

[147] http://www.sidbi.com/sites/default/files/Brochure_Industrial.pdf
[148] http://www.sidbi.com/sites/default/files/JICA%20Phase-II%20Scheme_Brochure.pdf
[149] http://sameeeksha.org/pdf/presentation/Energy_Efficiency_Financing_in_MSMEs.pdf
[150] http://sidbi.in/sites/default/files/products/KfW%20Financing%20Energy%20Efficiency%20Projects%20in%20MSMEs%20and%20Cluster.pdf
[151] http://knowledgeplatform.in/wp-content/uploads/2016/01/Small-Ind.-Dev.-Bank-of-India_1st-Prize.pdf

services, implementation of DSM and the development of ESCOs. Loan conditions are preferential compared to commercial loans. Credit lines offered through IREDA for energy efficiency and conservation projects must be a minimum of 5 million INR and offers an interest rate between 12.25% and 13%. Registration fee is charged between 10,000 to 60,000 INR depending on the loan amount. A front end fee of 0.5% to 1.25% of the loans amount is also charged[152].

- *IDBI Energy Efficiency Financing Scheme:* For more than six years (1994-2000), ADB carried out one of the earliest projects on EE financing in India. The project was called the Industrial Energy Efficiency Project. The Industrial Development Bank of India (IDBI) has received more than 150 million USD from ADB to promote efficient and environmentally sustainable industrialization through loan awarding and technical assistance[153].

- *UNIDO Project on Promoting EE & RE in Selected MSME Clusters (2011-2016):* The project, implemented by UNIDO, GEF, SIDBI and BEE, aims at developing a market environment for the introduction of energy-efficient technologies and the enhanced use of resource-efficienct technologies in process applications in energy-intensive SMEs. With a total budget of 6.1 million USD, the project is providing various financial support to the EE projects in five SME groups: ceramic production, hand tool production, foundries, brass production and dairy production.

- *Energy Saving Loan Scheme for SMEs (ongoing):* The scheme is introduced and managed by Canara Bank. It provides soft loan to support the acquisition and/or adoption of equipment and/or measures related to energy saving. It does not include ESCO projects. The scheme covers up to 90% of project costs of up to 1 million INR. The maximum loan is 10 million INR per project with an interest rate of 1% less than the applicable rate. Collateral free is applied for a loan amount of up to 5 million INR. For a loan amount of over 5 million INR, collateral is required as determined by the bank.

- *Scheme for Fanancing Energy Efficieny Project (ongoing):* The scheme is introduced and managed by the Bank of Baroda. It provides loans to SMEs for acquisition of equipment, services and adopting measures for enhancement of EE&C. The scheme provides up to 75% of the total project cost, subject to maximum amount of 10 million INR (minimum amount of loan is 0.5 million INR). The applicable interest rate is base rate plus 4.0% p.a. Maximum repayment time is 5 years, including moratorium, if any.

There were also the programs for EE financing managed by the GOI through national government-sponsored agencies or local financial institutions[154].

- *Technology Upgradation Fund Scheme (TUFS)* is a government subsidy scheme that supports the adoption of EE projects in small and medium enterprises (SME). It focuses on the textile and jute industries. The scheme was first launched in 1999, last revised in March 2013, and prolonged until March 2017. TUFS provides concessional loan for a period of 7 years, including 2 years of implementation/moratorium period.

Investment grants: The Technology and Quality Upgradation Support to MSMEs (TEQUP) is a government subsidy scheme. It was operational since 2006. TEQUP provides both capital subsidy and concessional loan to the EE technology development projects in SME clusters. A capital subsidy of 25% total project cost or a maximum amount of 1 million INR is provided to the projects which introduce the well-established and improved EE technologies.

[152] http://iepd.iipnetwork.org/policy/financing-schemes-ireda
[153] IISD (2015b)
[154] Switchasia (2016)

Loan guarantee credit: The Credit Guarantee Trust Fund for Micro and Small Enterprises (CGTMSE), implemented by GOI through SIDBI, provides funds for guarantees to lending institutions. These lending institutions then provide collateral-free loans to MSMEs. The fund was in force since 2000. The usual guarantee granted to the lending institutions is 75-80% of the sanctioned loan amount. The existing and new MSMEs can borrow the loan guarantee at an interest rate of maximum 3% above the prime lending rate of the member lending institution.

Fiscal Incentives for EE Projects

The GOI is providing fiscal incentives for EE projects in the form of accelerated depreciation. The project developers are eligible for up to 100% tax deduction for the recovery of depreciated property in the first year of the project on specified equipment. They are also exempt from import and excise taxes on energy efficiency technology. Some state governments provide tax exemptions for power generation projects.

Mandatory Measures on Energy Performance and Management

EE obligations: The PAT (Perform, Achieve, Trade) scheme is an energy saving certificate trading system. This market based mechanism was made possible by an amendment of the Energy Conservation Act in 2010 and launched in 2012 by the Ministry of Power.

PAT covers 478 industrial units, in eight sectors defined as energy intensive industries under the Energy Conservation Act. For each unit, a target is defined, specifying by what percentage energy intensity must be reduced in a 3-year period. If the unit achieves more savings than the target, it is allocated Energy Saving Certificates (ESCert) by the GOI. One ESCert is issued for each MWh (about 0.1 toe) of energy saved over the set target. The PAT scheme enables companies to trade ESCerts in order to attain their own targets: if a unit fails to meet its target, it can buy ESCerts from over-performing units. The first targets must be achieved by the end of the first cycle (from 2012-2013 to 2014-2015). The projected energy saving attributed to the scheme are approximately 6.6 Mtoe by the end of 2014-15. Currently, the 478 units covered by the scheme consume about 165 Mtoe annually as shown in Table 34.[155]

Mandatory energy managers and energy audits: The 2001 ECA, as amended in 2010, has assigned energy intensive industries and other large consumers as designated consumers (DCs), and requires them to have energy audits carried out by an accredited energy auditor, to designate or appoint an energy manager and to report annually on energy consumption.

The BEE provides support to these companies in implementing energy management and energy auditing by providing certified examinations for energy auditors and energy managers. To become a certified energy manager, candidates should score at least 50% in three papers: general aspects of energy management and energy audit, EE in thermal utilities, and EE in electrical utilities.

Candidates who score at least 50% on the fourth paper (energy performance assessment for equipment and utility systems) are certified energy auditors and can function as certified energy managers. Study guides covering each of the examinations are available to registered candidates. Energy audits are also subsidized by the Indian government. At the end of every year, DCs are required to report energy consumption and other energy performance data.[156]

[155] AFD (2013
[156] UNEP (2016)

***Energy Performance Standards and EE labeling Program**:* In line with the 2001 ECA, the BEE launched the energy performance standards and EE labeling program in 2006. The program's goal is "to provide the consumer informed choice about the energy saving and thereby the cost saving potential of the relevant marketed product". This program also covered industrial equipment such as industrial fans, blowers, diesel generating sets, boilers, compressors and diesel pump sets.

Penalties: Financial penalty can be imposed on a designated consumer in case it does not implement an energy management system as required by BEE.

Other EE Policy Measures

R&D incentive: Supported by the GOI, the Technology Innovation Fund provides EE lending using commercial banks. The Ministry of Science and Technology (MOST) has offered 300 million INR (4.85 million USD) in the form of soft loans to MSMEs willing to deploy upscaling, demonstration and commercialization of innovative-based projects, including EE. The project started in 2011 and remains active. It provides up to 80% of a project's funding requirements, with promoters contributing a minimum 20%. The appointed entity for managing, analyzing and disbursing the loans is SIDBI.

Financial support for capacity building activities: BEE provides support to the DCs and other companies in implementing energy management systems in the form of technical support and through training and accreditation of energy auditors. Audits are subsidised by the government.

Financial support for local equipment manufacturers: Several funds such as SIDBI and KfW (through the Innovation Finance Programme, 2013-2016) are providing financial support (concessional loans, capital subsidy) to local EE equipment manufacturers. The financial assistance in form of soft loan is generally not less than 1 million INR per project. The venture capital funds managed by various companies such as the Venture East Fund Advisors (India) Ltd., Blume Venture Advisors Pvt. Ltd., and INFUSE Ventures are also supporting the local EE equipment manufacturers.

Financial support for local service providers (ESCO): In India, there are different types of ESCOs providing services to EE projects as presented in Table 35.[157]

Table 35: Types of ESCOs operating in India

No.	Type of ESCO	Services provided and repayments
1.	Full service ESCOs	• Design, finance and implementation of EE projects • Measurement and verification of the actual energy savings • Sharing of the actual energy savings on a pre-agreed sharing model over a fixed period
2.	ESCOs with third-party financing	• Design and implementation of EE projects • Measurement, verification and providing guarantees that the actual energy savings over a fixed period will cover the repayments
3.	ESCOs with equipment supplier credit or equipment leasing	• Design and implementation of EE projects • Measurement and verification of the actual energy savings • Payments linked to performance (i.e., actual energy savings)
4.	Technical consultancy services (Performance-based)	• Conduct of energy audits, design of EE projects, and advisory services during project implementation • Consultancy fees linked to performance

[157] http://indien.ahk.de/fileadmin/ahk_indien/Bilder/2013_Upcoming_events/energy_efficiency/Presentations_26Nov2013/08Honeywell_Agarwal_ESCO_Market_in_India.pdf

		• Bonus on energy audit and advisory services in case of excess savings and penalty in case of savings shortfall
5.	Technical consultancy services (Fee-based)	• Conduct of energy audits, design of EE projects, and advisory services during project implementation • Consultancy fees are paid as pre-agreed • No bonus or penalty for actual savings performance

Several financial institutions and local banks (IREDA, YES Bank, etc.) is providing financial support to ESCOs, especially full-serivce ESCOs. The public sector company, Energy Efficiency Service Limited (EESL), has established by the GOI to assist the growth and development of the existing ESCO sector in India[158]. EESL also function as resource and expert center and may take the role of an ESCO. EESL is managing the Partial Risk Guarantee Fund (PRGF) and the Venture Capital Fund for Energy Efficiency (VCFEE). The VCFEE increases the availability of risk capital to the ESCOs and other companies who invest in the supply of EE goods and services. This instrument targets several sectors, including industry.

5.2.3 Philippines

Introduction

The TPEC of the Philippines in 2012 was 30.2 Mtoe. Most of this energy came from fossil fuels. The Philippines average GDP growth rate from 2011 to 2015 was 6.1%. The energy-intensive manufacturing and retailing industries are driving the Philippines economic growth. Given its large population and rapidly growing economy, the country's energy needs are growing rapidly. According to DOE, the Philippines needed 75,266 GWh of electrical energy in 2013. Of this figure, 27 % went to powering residential areas, while 24% went to commercial establishments and 28% to the industrial sector.

The fastest growth in energy demand is in the transport sector at a rate of 3.5% per year. It is planned to account for 38% of final energy demand by 2035. The sector's energy demand will reach 18.8 Mtoe in 2035, increasing from 8.4 Mtoe in 2010. Oil products will remain the main fuel for the transport sector, accounting for 96% in 2035, with the remainder taken up by natural gas. Figure 5 provides an average share of TPEC in different sectors from 2005 to 2011[159].

[158] http://www.asiaesco.org/pdf/presentation/2-2.pdf
[159] Accelerating Energy Efficiency: Initiatives and Opportunities – Southeast Asia, Copenhagen Centre on Energy Efficiency

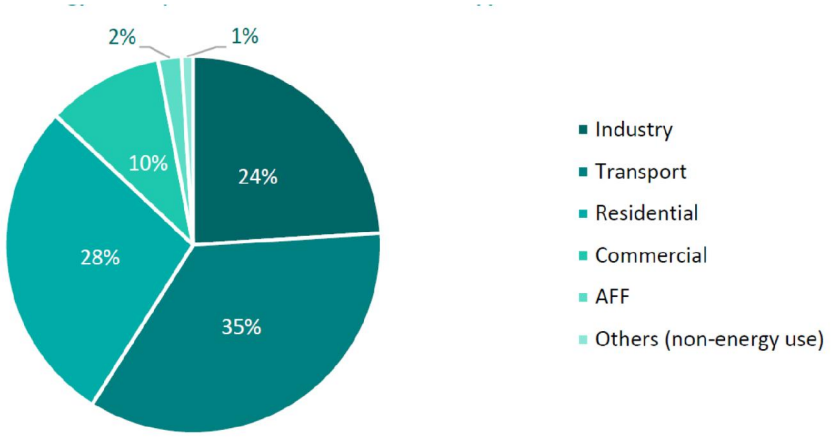

Figure 5: Average share of TPEC by sector in the Philippines (2005-2011)

The energy consumption in the industry sector is about one-quarter of the national consumption. It will grow at about 3% per year from 2010 to 2035 under the business-as-usual (BAU) scenario. The food, tobacco and non-metallic minerals subsectors are responsible for most of the energy consumption in the industry sector. The energy demand of the industry sector is largely met by coal.

EE Targets and Planning

DOE's Act of 1992 is still the main policy that ensures a continuous, adequate, reliable and economic supply of energy. The mandate of the department is indeed to provide adequate, reliable and affordable energy to industries to enable them to provide continuous employment and low cost of goods and services and to enable the ordinary citizen achieve a decent lifestyle.

In 2014, DOE formulated a new comprehensive energy roadmap, the Philippine Energy Efficiency Roadmap 2014-30, to provide guidance for an economy-wide and sectoral improvement. The vision, objectives and targets of the roadmap is to guide the Philippines in building an energy-efficient nation, and in making energy efficiency and conservation a way of life for all Filipinos. Energy efficiency will advance economic development and help ensure energy security, protection of the environment, optimal energy pricing, and sustainable energy systems.

The objectives of the roadmap are energy efficiency as a resource to bolster the energy security supply of the economy, promote energy-efficient, cutting-edge technologies, increase public awareness on energy efficiency and conservation measures and promote the best practices, cushion the impact of oil price volatility on the economy and curb the generation of greenhouse gases emissions to help mitigate climate change.

The energy efficiency targets are set in a context of strong economic and energy demand growth during the period. Demand has been forecasted to increase by 78% between 2014 and 2030, a 3.5% average annual rate. In this context, the action plan states a 24% energy saving by 2030, compared to the BAU scenario. This is the result of a targeted 3% per year improvement in per-GDP energy intensity.

Targets are based on an assessment of an achievable potential, grounded in international experience and knowledge of existing levels of efficiency in the economy. The targets are stated in terms of percentage of improvements in energy intensity.

The Philippine energy efficiency target are shown in Table 36.

Table 36: Philippines energy efficiency targets (2014-2030)

Sector	Implied annual % savings (total savings by 2030)	Annual energy saved by 2030 (ktoe)
Transport	1.9% (25%)	4,861
Industry	1.3% (15%)	3,088
Residential Buildings	1.2% (20%)	1,432
Commercial Buildings	1.9% (25%)	1,206
Agriculture	0.8% (10%)	78
Total	**1.6% (24%)**	**10,665**

Source: Energy Utilization Management Bureau, DOE

The National Energy Efficiency and Conservation Program (NEECP) is a two-pronged program that focuses on power conservation, demand management, fuel efficiency, and fuel conservation. Through the NEECP, the goal is to make energy efficiency and conservation a way of life for every Filipino.

In line with this program, the Energy Efficiency and Conservation Division, under the DOE, implements a wide range of energy efficiency and conservation projects, programs, and activities involving various stakeholders. The aim is to facilitate an economy-wide approach of ensuring that access to cost-effective and quality energy is provided to Filipinos. DOE pursues the aggressive implementation of existing energy efficiency and conservation programs by promoting awareness on efficient energy utilization in the economy and rationalizing energy consumption, particularly of petroleum and electricity.

DOE Administrative Orders also ensures a continuous, adequate, reliable and economic supply of energy through EE&C via the institutionalization of the Government Energy Management Programme (GEMP) and the adoption of austerity measures for government offices (both for fuel and electricity), e.g., the use of energy efficient lighting systems in government facilities.

The Philippine Energy Plan 2012-2030 has a target of 10% savings on the annual total energy demand by promoting EE&C measures as follows:

- Conducting information and education campaigns on benefits of efficient use of energy and best practices;
- Promoting the use of energy efficient appliances as well as introducing energy efficient technologies
- Providing technical and energy management advisory assistance.
- Establishing a recognition system for those who consciously apply the concepts, systems and technologies of EE&C.

Financial Incentives for EE Projects

Soft Loans: Financial loans for energy efficiency improvement programs are being provided by local commercial banks, in cooperation with other foreign financial and lending institutions such as the World Bank-IFC, the Asian Development Bank (ADB), and local banks. However, interest loans remain at the prevailing commercial rate.

Fiscal Incentives for EE Projects

ID&T exemption and reduction: According to the Department of Finance, tax incentives that cover 100% of the import duty by the Bureau of Customs are given for energy-efficient technology, especially for capital equipment. Government banks, including other private banks with loan windows for energy efficiency projects do not provide a special loan scheme.

Under the new guidelines of the Board of Investment (BOI) regarding its 2014–2015 Investment Priority Plan (IPP), companies that apply for tax incentives on pioneering energy projects will be given appropriate incentives. However, certain requirements must be met such as an endorsement from DOE attesting the technology adopted. As stated earlier, tax incentives that cover 100% of the import duty are given for energy-efficient technology, especially for capital equipment.

Mandatory Measures on Energy Performance and Management

EE Product Standards and Labelling: Mandatory Energy Efficiency Labeling applies only to selected home appliances such as window-type air conditioners, refrigerators, and compact fluorescent lamps. Most of these are used in the household sector.

Other EE Policy Measures

Promotion of ESCOs: An ESCO, or energy service company, is a business that develops, installs, and finances projects designed to improve energy efficiency and reduce operations and maintenance costs for its customers' facilities. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project. What sets ESCOs apart from other firms that offer energy efficiency improvements is the concept of performance-based contracting. When an ESCO undertakes a project, the company's compensation is directly linked to the amount of energy that is actually saved.

The comprehensive energy efficiency retrofits inherent in ESCO projects typically require a large initial capital investment and may offer a relatively long payback period. The customer's debt payments are tied to the energy savings offered under the project so that the customer pays for the capital improvement with the money that comes out of the difference between pre-installation and post-installation energy use and other related costs.

In 2008, DOE issued a Department Circular[160] which enforces the requirement for an Energy Service Company (ESCO) to apply for a certificate of accreditation with the DOE while engaging in any energy efficiency related performance contracting projects. The objectives of the Circular are the following:

- to promote and expand ESCO business as new emerging business industry in the local market;
- to classify ESCOs in the market according to their area of expertise and financial capability;
- to help inefficient companies avail of ESCO services with least to no-cost investment in energy efficiency project;
- to be able to create more jobs and stable ESCO business sector to help contribute to the country’s economic development and poverty alleviation program of the government;
- to promote and build-up the networks of the DOE accredited ESCOs in the local market as well as in the ASEAN region market; and
- to be able to accelerate implementation of energy efficiency projects and programs within the context of the government thrust on energy security, soaring energy prices and climate change mitigation.

5.2.4 Thailand

[160] Department Circular–DC-2008-09-0004

Introduction

The final energy consumption Thailand was 77,881 ktoe in 2015. The largest consumer in Thailand is the transportation sector with energy consumption of 28,501 ktoe in 2015. This is equivalent to 36.6% of the final energy consumption. The industrial sector is the second largest consumer[161] with 27,696 ktoe of energy consumption. This is equivalent to 35.6% of total final energy consumption. Energy consumption in industrial sector decreased 0.6% from the previous year. The major energy consumed in this sector were alternative energy (AE), shared 23.5% of its energy consumption, followed by electricity, petroleum products, coal & lignite, natural gas and traditional renewable energy which shared 23.4%, 21.0%, 15.8%, 11.9% and 4.4% respectively[162].

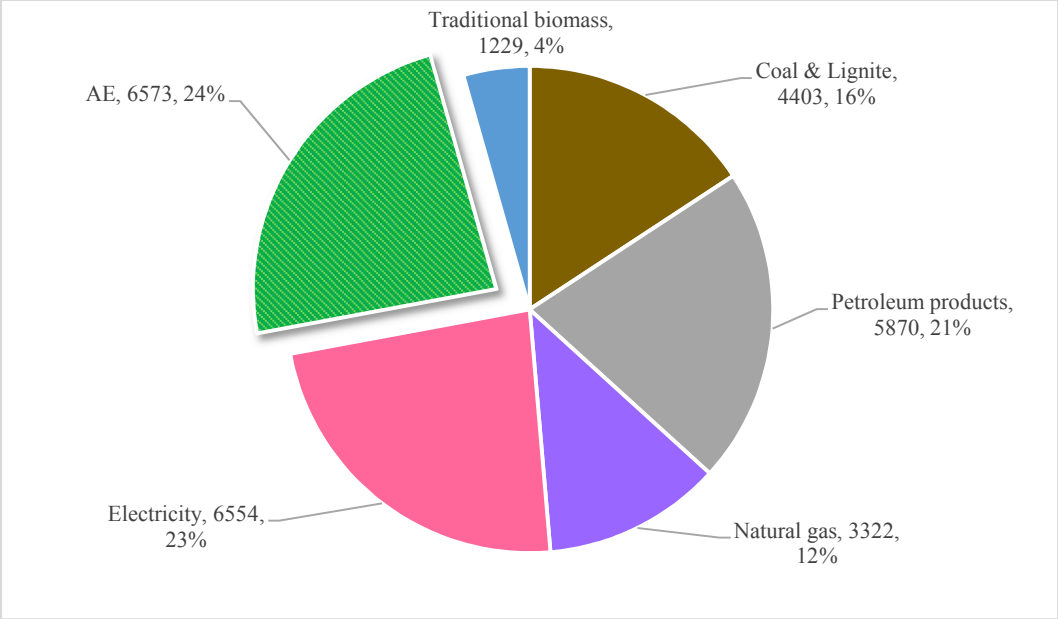

Figure 6: Final Energy Consumption in the Industrial Sector (2015)

In 2015, DEDE reported that 3,011 ktoe of energy consumption has been avoided from the implementation of EE measures[163]. The energy intensity (EI) is reported at 8.22 ktoe/ billion THB. This is around 4% reduction, compared to the 2010 EI (base year).

EE Targets and Planning

The Energy Efficiency Plan 2015-2036 (EEP 2015) is one of the plan under Thailand Integrated Energy Blueprint (TIEB). It indicates the EE target for Thailand and set the framework for implementation.

EEP 2015 projected the baseline final energy consumption in 2035 to be 187,142 ktoe. Thailand EE target aims at reducing energy intensity of 30% in 2036 (compared to 2010). This is equivalent to reducing energy consumption of 56,142 ktoe. Therefore, the EEP 2015 aims at the final energy consumption of Thailand to be 131,000 ktoe in 2036.

[162] DEDE (2016). Energy Efficiency Situation 2015
[163] DEDE (2016). Energy Efficiency Situation 2015

It is estimated that total THB 2,366,871 million is required under the EEP from 2015 to 2036. THB 1,600,821 million will come from the government and its agencies, while THB 766,050 million will be from the private sector.

Financial Incentives for EE Projects

Similar to the AE sector, the ENCON Fund is an important financial source for development of EE projects. In 2016, 8,146 million THB (USD 235 million) is allocated by the fund to support EE projects.

Soft loans: Energy saving loan is a special financial tools to assist small and medium enterprises (SME). A 3.5% soft loan is provided for changing of inverter, LED, etc. The focused sectors ice making industry, food and animal food processing industry, etc.

Investment subsidy: Direct subsidies at the rate of 20-30% of total investment cost are provided for EE projects.

Fiscal Incentives for EE Projects

Energy efficiency tax incentives have been established with the Revenue Department (RD) and the Board of Investment (BOI).

CIT exemption and reduction: The provided incentives include a 25% CIT credit for the purchase of electrical appliances and other products labeled as meeting energy efficiency standards under the RD scheme. The equipment that can be granted with this incentive must be certified by DEDE.[164]

ID&T exemption and reduction: Thai Customs, under the Ministry of Finance, has introduced the import duty reduction for energy efficiency equipment in 2005. 50% import duty reduction for energy efficiency equipment can be obtained for importing EE equipment that are typically subjected to 10% import duty or higher.

Mandatory Measures on Energy Performance and Management

Mandatory energy management, audit and report: Thailand has introduced the Energy Conservation Promotion Act in 1992. This was amended in 2007. Under the requirements of this act, all designated factories[165] and designated buildings[166] must submit the energy management report to DEDE every year. The act mandates that controlled factories and controlled building must appoint person responsible for energy (PRE). PRE is responsible for coordinating with other relevant agencies and assisting factory/building owners to supervise, inspect, and improve efficiency in machinery and equipment. He/she also develop a plan with detailed targets for energy conservation, accredit, and certify the work implemented as planned.

In 2015, DEDE developed the electronic system (E-form) for energy management report submission. This aims to provide efficient means of energy conservation data submission from designated factories/buildings.

EE standards and labeling: EGAT, a transmission utility, has introduced the "Energy Saving Label no. 5" since 1993 to promote using of high efficiency energy appliance. The label no. 5 is

[164] The Revenue Department, Thailand
[165] "Designated factory" is defined as a factory with installed transformer(s) of 1,000 kW or 1,175 kVA or more, or consumes energy of 20 million MJ or more.
[166] "Designated building" is defined as a building with installed transformer(s) of 1,000 kW or 1,175 kVA or more, or consumes energy of 20 million MJ or more.

given to electrical appliances with best rating in term of energy efficiency. This programme is conducted through a close collaboration with several electricity appliance manufacturers. Currently, there are 23 appliances that can be certified to have the label. This programme has been developed overtime. The energy efficiency test of the label no. 5 air-conditioner inverter was now improved to Seasonal Energy Efficiency Ratio (SEER).

Other EE Policy Measures

Promotion of ESCO: The Energy Service Company (ESCO) Revolving Fund is another financial source for EE project. Currently, this fund is in its 4th Phase. It is managed by the Energy for Environment (E for E) Foundation. In the 2015 fiscal year, THB 300 million (USD 8.65 million) were provided. There are six supporting approaches that can be applied under the ESCO fund (see Table 37).

Table 37: Incentives for the promotion of ESCO investments in EE sector in Thailand

Program	Objective	Size of investment and interest	Period	Organization
Equity investment	Investments in EE projects	• 10-50% of total investment cost • Limited to 50 million THB per project • Not as a majority shareholder • Return: annual dividend in the proportion of investment	Up to 7 years	Revolving Fund
Equipment leasing	Long-term leasing service in purchasing equipment for EE projects	• Loan support for up to 100% equipment leasing cost • Limited to 25 million THB per project • Interest rate of 3.5% per annum • 6-month grace period	5 years	Revolving Fund
ESCO venture capital	Partner with (ESCOs) to raise capital for investments in EE projects of the ESCO	• 10-30% of registered capital • Limited to 50 million THB per project • Not as a majority shareholder • Return: annual dividend in the proportion of investment	Up to 7 years	Revolving Fund
GHG project facility	Provide support in project proposal development and coordination with relevant authorities			
Credit guarantee facility	Guarantee commercial bank for project loans	• Depending on the project risk • Limited to 10 million THB per project	Not more than 5 years	Revolving Fund
Technical assistance	Provide financial support for technical assistance, e.g., energy audit, feasibility study.	• Provide walk-through audit free of charge		

Support for capacity building: DEDE conducts awareness-raising campaigns through energy display centers, public relation initiatives, and national energy awards. The Bureau of Energy Human Resource Development (BEHRD) has been established since 1965, originally as the Electrician Training Centre. It serves as the DEDE organizational arm to train, develop, transfer

the knowledge, and skill on energy management to personnel from various sectors. Currently, the BEHRD organizes several trainings on specific industrial sector in planning, monitoring, and implementing energy management system.

5.2.5 Vietnam

Introduction

Based on the report of the Asia-Pacific Economic Cooperation (APEC)[167], the total final energy consumption (TFEC) of Vietnam was 50.6 Mtoe in 2013, up 2.6% from 2012 and 36% higher than 2005 level. The industry sector represented the largest share of TFEC with 43% in 2013. This sector consumed coal (41%), electricity (24%), renewable energy, mainly non-commercial biomass (17%), petroleum products (11%), and natural gas (7%). During 2005-2013, the industrial energy demand growth was the second fastest with 6% per year in average, behind the transport sector.

Vietnam's TFEC is projected to increase to 80 Mtoe by 2020 and 120 Mtoe by 2030. Industry remains the highest energy-consuming sector throughout the forecast period, with its share increased to 46% in 2030.

According to the estimate of MOIT's Energy Efficiency and Conservation Office (EECO)[168], the energy saving potential in key energy-intensive sectors of Vietnam was large for the period 2006-2015:

- 20-25% for steel industry,
- 10-40% for cement,
- 10-15% for buildings,
- 25-28% for transport, and
- 20-30% for public lighting sector.

The Institute of Energy (IE)[169] provided further estimates of energy savings in some industries for the period 2012-2025:

- 30.7% for steel,
- 4.1% for cement,
- 9.1% for paper and pulp,
- 3.8% for refinery, and
- 9.8% for nitrogenous fertilizer production sector.

Based on the EECO report, Phase 1 of the VNEEP (2006-2010) has achieved the following key results:

- Energy audits conducted for 243 enterprises and the EE measures implemented in 50 enterprises;
- EMS established in 250 designated enterprises;
- 350 energy managers and 60 energy auditors certified;
- EE labels granted to 147 products;

[167] APEC (2016)
[168] http://vneec.gov.vn/
[169] Vietnam Low Carbon Options Assessment for Energy Sector Components (started in 2012 and still under way), http://ievn.com.vn/tin-tuc/Vietnam-Low-Carbon-Oprions-Assessment-5-1072.aspx

- Total energy saving estimated at 4.9 Mtoe, equivalent to 3.4% of total energy consumption (compared to BAU scenario);
- Electricity saving achieved 1.43% by 2011 compared to 2006 level.

EE Targets and Planning

In 2003, the first Decree on Energy Efficiency and Conservation[170] was issued. In addition, in July 2004, the Ministry of Industry (MOI) issues a circular[171] providing the guidance for implementation of EE&C in buildings and in the industry sector.

In 2006, the Prime Minster of Vietnam approved and enforced the Vietnam National Energy Efficiency Program (VNEEP) for the period 2006-2015[172]. The VNEEP was the first-ever long-term comprehensive program established under MOIT to institute measures for improving energy efficiency and conservation in all economic sectors of Vietnam. The Program was implemented in two phases. Phase 1 (2006-2010) aimed to actively start up all components of the Program, and Phase 2 (2011-2015) aimed at intensive and large-scale implementation of the Program based on the lessons learned from Phase 1.

VNEEP set the overall national goals for energy efficiency and conservation for the 2006-2015 period:

- to save 3-5% of total energy consumption (compared to BAU scenario) in the 2006-2010 period and 5-8% of total energy consumption in the 2011-2015 period;
- to establish the models for energy management;
- to popularize the use of high-efficient equipment;
- to introduce the Energy Efficient Building Code; and
- to promote energy efficiency in the transport sector.

The specific targets of VNEEP by the end of 2015 were as follows:

- Energy audits conducted in 300 large enterprises and 12 power plants;
- Energy audits conducted in 300 SMEs and commercial buildings;
- Energy Management System (EMS) established in 1,024 designated enterprises;
- 2,500 energy managers and 200 energy auditors certified;
- 100% of new buildings complying with Energy Efficient Building Code;
- Energy savings of 1,750-2,800 ktoe173 achieved in 3 targeted sectors (industry, buildings and transport).

In 2010, the Law on Economical and Efficient Use of Energy[174] was issued, followed by the detailed guidance on its implementation promulgated by the GOV in 2011[175]. Under the Law, MOIT is assigned to be responsible for the state management of EE&C activities in Vietnam. The Law also indicated that VNEEP shall provide financial support to EE&C projects. MOIT is responsible for issuing the regulations and guidelines on the financial support mechanism.

The National Power Development Plan for the 2011-2020 period with a vision to 2030 enforced in 2011 has set an electricity savings target of 5-8% of total electricity consumption by 2015 and 8-10% by 2020, as compared to BAU scenario. The Plan envisaged the extensive

[170] Decree 102/2003/ND-CP (3/9/2003)
[171] Circular 1/2004/TT-BCN (2/7/2004)
[172] Decision 79/2006/QD-TTg (14/4/2006)
[173] kiloton of oil equivalent (1ktoe = 41.868 TJ)
[174] Law 50/2010/QH12 (17/6/2010)
[175] Decree 21/2011/ND-CP (29/3/2011)

use of high energy efficient equipment and advanced technical standards to achieve at least 10% savings in energy-intensive industries.

The EE&C plans and measures for specific sectors such as construction[176], agriculture[177], and industry[178] were also enforced.

Financial Incentives for EE Projects

Investment grants/subsidy: In 2007, a Circular[179] was jointly issued by the Ministry of Finance (MOF) and MOIT to regulate the financial support from VNEEP for implementing EE&C projects. For implementation of energy management system in buildings and industrial enterprises, the financial support shall be 30% of the total investment cost, but not more than 70 million VND (3,500 USD)[180] per project. For energy audit activities, 50% of the auditing cost with a maximum of 50 million VND (2,270 USD) shall be granted for each project. For EE product labeling, the grant will be 30% of the total cost with a maximum of 60 million VND (2,730 USD) per enterprise.

Carbon market: In 2015, the Prime Minister of Vietnam approved the carbon market plan that includes setting up a pilot cap-and-trade scheme in Vietnam's steel industry, as well as accredited Nationally Appropriate Mitigation Actions (NAMAs). Under the plan, Vietnam will build GHG emission databases, develop a Measuring, Reporting and Verification (MRV) system and undertake capacity-building among policy makers to help develop market-based policies to cut emissions. It plans to introduce NAMAs in the steel and waste sectors from 2018 that will generate carbon credits, and launch an emissions trading scheme for the steel sector after 2020. The budget for implementation of the plan is 3.5 million USD, of which 3 million USD was a contribution from the World Bank.

Fiscal Incentives for EE Projects

CIT exemption and reduction: Since 2016, enterprises investing in the production of new EE&C products enjoy a reduced corporate income tax (CIT) rate of 17% for 10 years from the first year of revenue generation instead of the normal tax rate of 20%. In addition, these enterprises enjoy additional tax incentives including CIT exemption for 2 years after the enterprises first make profits and 50% tax reduction for the next 4 years.

ID&T exemption and reduction: The EE&C projects are exempted from import duties and taxes on imported goods that would become fixed assets of the project and goods used as raw materials, input or semi-finished products that are not available on the local market for the project operation.

Mandatory Measures on Energy Performance and Management

Mandatory energy management, audit and reporting: In 2011, the GVO issued a guidance[181] on implementation of the Law on Economical and Efficient Use of Energy. In accordance with this guidance, designated energy users (including industrial facilities) are required to apply the EMS that will be implemented as follows:

- to announce targets, policies, solutions/measures for EE improvement;

[176] Decision 377/QD-BXD (14/3/2008)
[177] Circular 19/2013/TT-BNNPTNT (15/3/2013)
[178] Circular 02/2014/TT-BCT (16/1/2014)
[179] Circular 142/2007/TTLT/BTC-BCT (30/11/2007)
[180] 1 USD = 22,000 VND
[181] Decree 21/2011/ND-CP (29/3/2011)

- to develop annual plan and five-year plan on EE&C;
- to nominate an energy manager to be in-charge of EMS implementation;
- to carry out regular check-ups, follow-ups on energy consumption of machinery and equipment of the whole production chain;
- to carry out energy audits to identify EE opportunities and measures;
- to organize periodic training and coaching courses on EE&C for employees; and
- to have a reward and penalty system to promote the EE&C in the entity.

In 2012, MOIT has promulgated a Circular[182] to regulate the mandatory EE&C planning, reporting and energy audit in the key energy-consuming entities (KECE). KECEs refer to (i) industrial and agricultural production facilities and transport establishments which have an annual energy consumption of 1,000 toe or above, and (ii) office and apartment buildings; educational, medical, entertainment, physical training and sport complexes; hotels; supermarkets; restaurants and shops which have an annual energy consumption of 500 toe or above. KECE shall register its EE&C plan and submit the report on implementation results online through electronic portal of the National Energy Database System (NEDS). Each KECE is provided with address and ID number to access to NEDS.

According to the current regulation[183], energy managers and energy auditors have to obtain professional certificate from any of MOIT-recognized training centers.

EE product standards and labelling: The guidance on the process and procedure for registration, evaluation, certification and *labeling of EE products* was promulgated in 2006 by the Ministry of Industry (MOI)[184] and revised in 2012 by MOIT[185]. This applies to locally manufactured and imported EE products which fall under the mandatory energy labeling list or under the voluntary scheme. Local manufacturers or importers can request MOIT to proceed with the evaluation and certification for labeling of their EE products, provided that they meet the energy performance standards regulated by MOIT. The guidance also prescribes the relevant requirements for initial performance check, for after-certification supervision, and for the process applicable to suspension and revocation of the EE certificate. Such suspension or revocation will take place when manufacturers and/or the certified EE products cease to comply with the relevant requirements. MOIT's Department of Science and Technology was assigned as the executive agency to implement the EE certification and labeling program in Vietnam.

A list of devices and equipment required EE labeling was issued in 2011[186] and then revised in 2013[187] by the GOV. It includes:

- household appliances, including tubular fluorescent lamps (FLs), compact FLs, electromagnetic and electronic ballasts for FLs, air conditioners, refrigerators, washing machines, electric cookers, electric fans and television receivers,
- office and commercial equipment, including photocopiers, computer monitors, printers and commercial refrigeration cabinets,
- industrial equipment, including distribution power transformers and electric motors, and
- means of transport, including passenger cars of 7 seats or less.

Forced retirement of low efficient equipment: Several technical standards including minimum values of energy efficiency for various energy equipment were promulgated in 2013 by

[182] Circular 09/2012/TT-BCT (20/4/2012)
[183] Circular 39/2011/TT-BCT (28/10/2011)
[184] Circular 08/2006/TT-BCN (16/11/2006)
[185] Circular 07/2012/TT-BCT (4/4/2012)
[186] Decision 51/2011/QD-TTg (12/9/2011)
[187] Decision 03/2013/QD-TTg (14/1/2013)

MOIT[188]. All the existing devices and equipment which do not meet these technical standards had to be be retired by 1 January 2015. Moreover, new investments in low efficient power generating units are prohibited since 10 February 2014[189].

Penalties: The *penalties* for administrative violations in EE&C are regulated by two decrees[190] promulgated by the GOV. The penalties are applied for violations in six areas of EE&C, including:

- energy audit,
- EE&C in industry, building, transport and agricultural activities,
- EE&C in the designated energy users,
- labelling,
- production, import, export and use of to-be-eliminated vehicles and equipment, and
- obstructing public servant in performing their EE&C inspection.

The maximum fine for violations in EE&C activities is 100 million VND (4,550 USD) for individuals and 200 million VND (9,100 USD) for organizations and companies.

Other EE Policy Measures

Financial support for capacity building activities: VNEEP provides support to the KECEs and other companies in implementing energy management systems in the form of technical support and through training and accreditation of energy auditors. VNEEP also organizes a number of free-of-charge capacity building activities (seminars, workshops, trainings, etc.) for various EE-related local stakeholders such as equipment manafacturers and suppliers, service providers (ESCOs), banking officers, consultants, etc.

5.3 Gender in RE and EE Policies and Programmes in Asian Countries

5.3.1 Gender in national policies in Asia

Gender equality and women's participation are generally recognized as crucial for sustainable development in national development strategies in South and South-East Asian countries. Gender inclusion, enhancement of women's involvement and narrowing the gender gap are included as overall intentions and aims in national development policies. National laws and policies guarantee men and women equal rights, and the overall political, institutional and legal frameworks for gender equality and women's development are in place.

Gender exists as a cross-cutting theme in national policies, and most countries have separate or joint ministries and gender focal points in different ministries addressing gender and women's development issues. However, implementation of gender policies is often weak due to lack of financial and human resources. The practical policy incentives and guidelines for gender mainstreaming and for reaching the goal of increased gender equality remain vague, and are left to be assessed in the sector policies and strategies by different ministries, where consequently gender issues appear to a varying extent or may be absent depending on each individual sector.

[188] Decision 1559/QD-BCT (14/3/2013)
[189] Decision 78/2013/QD-TTg (25/12/2013)
[190] Decree 73/2011/ND-CP (24/8/2011) and Decree 134/2013/ND-CP (17/10/2013)

Asian countries today have specific national policies and/or strategies for gender equality and women's development. The practical implementation of gender mainstreaming is yet often weak, and gender is not an appearing issue in most sectors' policies. Gender incentives are most commonly focused on improving women's educational and economic status, health, and political empowerment. Gender mainstreaming[191] as a strategy is accordingly implemented in the policies and strategies of the education, health and labour sectors, but also in rural development including the agriculture and livestock development sectors. Women's political and governance power is often increased through gender quotas in different level government organizations and representative bodies.

Despite the established gender policies and frameworks for women's rights and gender equality across the Asian countries, the Philippines is the only country with high ranking in the Global Gender Gap Index[192] (7/145 countries in 2015). The Philippines launched a 30-year strategic Plan for Gender-Responsive Development in 1995, and gender equality principles were included in all development programs and legislative reforms. The Plan has been implemented through a Gender and Development Mainstreaming Strategy with guidelines for preparation of agency specific agendas and use of a gender budget: It is especially significant that the Philippines is one of the few countries in the world that has adopted a Gender Budget (since 1995) that requires all government (including local government) units to use at least 5% of their total budgets for programs, projects and activities addressing women's need and focusing on women's rights. Moreover, the Framework Plan for Women in 2001 channelled focus on three priority areas: (i) women's economic empowerment, (ii) protection and advancement of women's rights, and (iii) promotion of gender responsive government.[193]

Even if large differences exist both geographically and between different population groups in the Philippines, some still living in poverty, the important lessons that can be drawn from the gender equality development in the country with relevance for any sector policy development (even for RE& EE policies) show that gender mainstreaming in all legislative and development initiatives should take place not only at a general policy intention level but through a clear strategy with requirements, guidelines and, importantly, ear-marked financial and human resources.

5.3.2 Gender in Renewable Energy Policies in Asia

Reliable and affordable access to energy is globally recognized as a fundamental driver of development, a crucial prerequisite for poverty reduction and economic development, improved health and education standard, and for women's economic and social empowerment. Women traditionally bear a disproportionately great burden of household level energy production, therefore energy initiatives have a direct impact on their lives and livelihoods that will further benefit their entire households.

However, gender is virtually absent in national renewable energy sector policies and strategic documents across the Asian countries. Inclusion of women is found only at project level in women-focused clean energy projects, a great majority of which are concentrated on clean cooking solutions and household lighting with income generation development as a potential additional activity.

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[191] According to the formal definition by UN Economic and Social Council, *mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programs in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality.*

[192] World Economic Forum 2015

[193] (Lumampao, Lopez & Go, N.D)

The RE and EE policy documents reviewed provide technical and financial principles and incentives for the sector, but do not recognize gender or social issues related to energy needs and priorities, access, supply or services.

An exception of energy sector policy that does emphasize gender and women's inclusion is Nepal's Rural Energy Policy. The 2006 policy recognize women's primary role in management of traditional energy sources and the implications for their health. Women are included in community management of RE systems and energy is linked with other sectors to support women. However, the policy fails to address the barriers women face in rural energy projects such as difficulties to access project benefits, get employed or influence decisions made by construction companies and users' committees. The Nepalese RE subsidy policy is another example of a policy paying attention to women and allocating special targeted subsidies to women and socially excluded groups.[194]

At programme level, the 2012 started 5-year National Rural Renewable Energy Programme in Nepal provides an example of clear definition of gender issues that are supported by practical institutional mechanisms. Gender Equality and Social Inclusion (GESI) is mainstreamed with affirmative action over all the programme components. GESI is integrated in all the programme elements and phases, clear targets are defined and indicators identifies for monitoring. A number of institutional mechanisms have been put in place to incorporate GESI into the programme.[195]

Gender-disaggregated data in the renewable energy sector is generally scarce. There are, however, programme and project level experiences of gender mainstreaming, women-focused activities and their development impacts. Lessons from such experiences point out issues for policy development and strategies needed for gender mainstreaming and women's enhancement in RE & EE development.

[194] ENERGIA 2015
[195] *ibid.*

6. Policy Gap Analysis

6.1 Barriers to RE and EE Development in Pakistan

6.1.1 Barriers to RE Development in Pakistan

Although the government has taken several steps to promote RE technologies in Pakistan, their increased uptake has been hampered due to the following issues:

- Regulatory barriers
- Technological barriers
- High upfront costs
- Financial barriers

Regulatory barriers

In order to understand the regulatory barriers associated with the RE sector, it is essential to first provide a summary of the regulatory and legal frameworks. The following step-wise approach for adoption of RE technologies, i.e. Solar, Wind and Biomass (more specifically bagasse-based high pressure cogeneration projects in the sugar sector) have been elaborated by AEDB:

1) Request to be made by the project proponent/sponsor to AEDB for issuance of a Letter of Intent (LOI);
2) Issuance of LOI by AEDB;
3) Submission of Grid-Interconnection Studies by the project sponsor to NTDC for approval;
4) Submission of Initial Environmental Examination Report by the project sponsor to the Provincial Environmental Protection Authority for approval and issuance of a No Objection Certificate (NOC);
5) Submission of application by the project sponsor to NEPRA for issuance of a Generation License, and for opting for Upfront Tariff;
6) Submission of Performance Guarantee by the project sponsor to AEDB;
7) Issuance of Letter of Support (LOS) by AEDB; process subsequent to issuance of LOS includes signing of following agreements/contracts by the project sponsor: Implementation Agreement (IA) with AEDB, Energy Purchase Agreement (EPA) with Purchaser of Power, and Contract with EPC Contractor;
8) Financial Closure;
9) Notice to proceed (NTP) to be issued by the project sponsor to the EPC Contractor, with 7% advance payment. After the issuance of NTP, the following EPC activities begin: Engineering, Procurement, and Civil Works, Erection & Commissioning;
10) Commercial Operation Date of RE plant.

Although the regulatory framework has been very well elaborated, its proper implementation has been far from satisfactory. For instance, a recent survey carried out by EU-Switch Asia HP Cogen Pak project reveals that the project sponsors in the sugar sector (with the exception of only one sugar mill) have faced/been facing several barriers. The following figure provides a comparison of stipulated vs actual time with regard to implementation of HP Cogen projects:

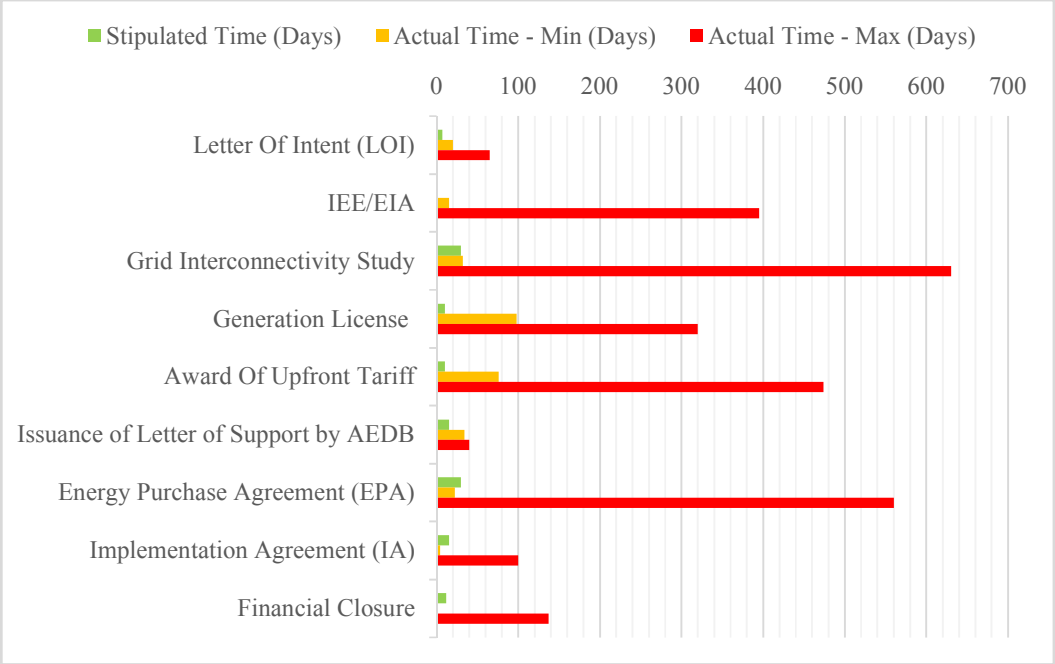

Figure 7: Stipulated vs actual time in HP Cogen approval process

It may be seen that the grid interconnection study (GIS) approval process is the biggest bottleneck. Grid interconnectivity studies are time consuming and slow down the process of implementation of HPC Plants (especially the issuance of the generation license by NEPRA for which LOI, IEE/EIA and GIS are pre-requisites). There are only two service providers, NTDC itself and Power Planner International (PPI), that conduct these studies. As there is no standardized design for grid connectivity, a lot of revisions are required which further increase the timeframe for implementation of a HPC plant.

EPA also takes very long to issue the NOCs to the project sponsor. Strangely, there is no stipulated time-line for approval of IEE/EIA.

The figure also reveals that the award of upfront tariff is also a big hurdle. The major reason for this delay is that consent of CPPA is required for filing the application for Upfront Tariff Acceptance which takes time and there is no stipulated timeline for CPPA to issue the consent letter.

Signing of energy purchase agreement turns out to be a big hurdle as well. The reasons for delays are given below:

- Project proponents/sponsors/owners require extensive negotiations with CPPA and NTDC (relevant sections/departments at NTDC are Transmission Network Operator and System Operator) before the energy purchase agreement can be signed.
- Approval from Board of Directors of AEDB also takes time.
- Late Approval of Interconnection Study Report and Lengthy Discussion of Technical Schedules by CPPA.
- CPPA considers that the responsibility to approve the Technical Schedules lies with NTDC and vice versa.

It should be noted that the barriers presented above are equally applicable to solar and wind power plants. In addition to these barriers, the wind and solar power projects face the following barriers:

- Land acquisition for wind/solar power plants requires approval from various authorities which is a tedious and long process, hence a cause of delay.
- Due to their intermittency (intermittent generation of power), the wind/solar RE plants face a power evacuation barrier as the power purchaser is reluctant to sign contract with an RE plant which cannot serve the base load and due to its intermittency may destabilize the grid.

And last, but not the least, barrier is the lack of coordination among policy level stakeholders (NEPRA, AEDB, CPPA, MOWP, NTDC, etc.) which causes a lot of delays with respect to implementation of RE projects.

Technological barriers

Risks of technology failure: Every new technology has potential risks. In case of bagasse based HPC, unavailability of operation and maintenance staff, which is well-trained in carrying out O&M of high pressure technology, poses a big risk and which can eventually discourage sugar mill owners to install and operate a HPC power plant.

Safety risks: High pressure technology is more sophisticated than conventional low pressure technology and requires additional safety parameters which are not being covered by local vendors.

High upfront costs of RE projects

Upfront costs include capital costs for construction of plant and cost for major maintenance that needs to be carried out during the lifetime of the plant beyond typical operating expenses. Operating costs include expenditure for normal operation, maintenance, and fuel. Due to a lack of capacity of local manufacturers/technology providers, the project developers have to import most of project equipment from other countries, thus resulting in high upfront costs which constitute a major barrier to adoption of RE technology.

Financing barriers

Another important barrier is a lack of adequate financing sources for RE projects in Pakistan, particular for small-scale projects. This barrier mainly stems from:

- *A lack of awareness among financial institutions* about the reliability and benefits of RE technologies, making them reluctant to offer loans or invest funds in these projects.

- *The unavailability of credit enhancement instruments* for the accelerated uptake RE technologies**.**

Lack of local competence and human capital

A skilled workforce is required for successful development and deployment of RE projects. At present, there is lack of trained personnel and training facilities for design, installation, operation and maintenance of RE projects. There is also lack of skilled individuals from academic institutions for R&D activities and a lack of capacity of local manufacturers to provide the latest technology. For instance, in the case of sugar mills there is not a single local manufacturer of steam turbines and only two companies have experience in manufacturing high pressure boilers. Likewise, with the exception of only one solar manufacturing facility, there are no local wind or solar equipment manufacturer. This results in a high upfront cost barrier.

Lack of social awareness and acceptance

There is lack of awareness regarding RE technologies and the benefits they can provide to local communities. The general public is not educated about the advantages of RE technologies. Land availability is another social barrier of potentially significant consequence. RE projects, such as wind and solar power plants, are often located on communal lands. Gaining community confidence and acceptance can result in extensive negotiations and can require significant compensation payments.

6.1.2 Barriers to EE Development in Pakistan

The general level of awareness about policies on industrial EE is quite low in the industry and government organizations. There exist various economic, technical and organizational barriers within the industry, such as a lack of Minimum Energy Performance Standards (MEPS) and institutional barriers within the regulatory bodies, which explain to low adoption of EE. The following barriers in each category are ranked in descending order with regards to their importance/level of impact.

Economic barriers

The economic barriers include the following:

- Lack of access to capital for investing in energy efficient technologies;
- Different priorities for capital investment;
- Financial loss due to disruption in production;
- Cost associated with identification of energy efficiency measures.

Technical barriers

The technical barriers include the following:

- Risk of disruptions in the production process;
- Lack of technical details and energy consumption data of purchased equipment;
- Lack of technical skills.

Risk of disruptions in the production process is one of the biggest barriers for the industry. This can be attributed to management focus on production as the core business rather than on energy efficiency.

Organizational barriers

The organizational barriers consist of:

- Lack of integration of energy objectives into operation, maintenance and purchase plans of the enterprises;
- Lack of awareness on EE measures;
- Low priority of energy management;
- Lack of accountability on energy use.

Lack of minimum energy performance standards (MEPS)

Adoption of energy management standards in industry is one of the most effective mechanisms for implementing policies on EE in Pakistan. However, a low awareness of industries on MEPS

and the absence of laws and regulations are one of the major reasons for the lack of MEPS in Pakistan. Pakistan has EE standards for the following equipment: (i) AC Electric fans, (ii) CFL, (iii) Induction motors (0.37 - 7.5 kW) Single Phase, and (iv) Window and Split Air Conditioners. However, similar standards for industrial equipment are still lacking.

Institutional barriers

- The relevant regulatory institutions/bodies (such as NEECA and PEECA) lack the technical capacity to undertake EE projects/measures.
- There is lack of coordination among the federal and provincial departments (responsible for implementing EE policy) to successfully launch, execute and implement EE measures.
- On top of all, EE policy and measures require a robust M&E mechanism to monitor the progress of EE projects and gauge the level of enforcement of EE policies/measures. Effective M&E mechanisms are generally lacking both at the federal and provincial level.

6.2 Comparative analysis of RE and EE Policies in Pakistan and five Asian Countries

The RE policy gap analysis between Pakistan and the five reference Asian countries is based on the comparison between the existing RE policy instruments in those countries. This comparison is provided in Table 38.

Table 38: Comparison of RE policies in Pakistan and five other Asian countries

RE policy instruments	CN	IN	PH	TH	VN	PK
RE targets	X	X	X	X	X	X
Price-based policies						
• Feed-in tariff regime/premium	X	X	X	X	X	X
• SPPA	X	X	X	X	X	X
• Premium/incentive for use of local equipment	X	X				
• Reduced T&D costs	X				O	X
• Net metering/banking		X	X	O	O	X
• Carbon/CDM credit transactions	O	X		O	O	
Quantity-based policies/procurement mechanisms						
• RE quota obligation / RPS	X	X	X	X	O	
• REC market		X				
• Competitive bidding/Auction	X	X	X	X		X
Financial incentives						
• Soft loan	X	X	X	X	X	X
• Investment grants/subsidies	X	X		X		
• Financial subsidy (loan guarantee, etc.)		X				
Fiscal incentives						
• Accelerated depreciation		X	X		X	
• Exempted/reduced VAT	X	X	X		X	
• Exempted/reduced CIT	X	X	X	X	X	X
• Exempted/reduced ID&T		X	X	X	X	X
• Exempted/reduced licensing fee						X
• Exempted/reduced land use fee					X	
• Exempted/reduced electricity sale duty						
Mandatory grid access and prioritized dispatch						
• Mandatory grid access/Prioritized dispatch	O	X	X	O	X	X
• Grid code/standards that facilitate RE integration	X	X	X	O	X	X
Other EE policy measures						

• R&D funds/subsidies and other supporting measures	X	X		X	O	
• Financial and other support for knowledge creating/sharing	X	X	X	X	X	X
• Financial and other support for capacity building activities	X	X	X	X	X	X
• Financial and other support for local manufacturers	X	X			O	
• Financial and other support for local service providers	X	X		X	O	
• Single-window clearance system for licensing			X			X

"X" – policy already deployed; "O" – policy under development

Table 38 shows that all studied countries, including Pakistan, have set RE targets, FITs and SPPAs. They also offer soft loans and fiscal incentives to RE project developers. Special funds are also available for knowledge development and capacity building.

India has been a pioneer in promoting the use of RE with the creation of the Ministry of Non Conventional Energy Sources in 1992. Policy instruments have been in place and fine tuned over the last two decades. India has indeed the most comprehensive package of RE policy instruments, closely followed by China. Both countries have achieved great results with over 40 GW and 153 GW of RE implemented capacity, respectively. An important supporting factor, when compared to other countries, is the provision of incentives for the use of local equipment and financial support to local manufacturers.

India has also introduced RE Certificates and established CDM/Carbon credit transactions facilities and provides loan guarantees to RE project investors.

Thailand is considered as the most successful country in ASEAN for its effective support to the development and implementation of RE projects. It all started in 1992, when the SPP programme and the ENCON Fund were established, allowing biomass energy projects to sell electricity to the grid.

Vietnam is catching up very fast, putting in place some more RE policy tools to be able to fully tap its RE potential. The Philippines are lagging behind, except in the geothermal sector where they are one of the leaders in the world.

Pakistan has got many policy instruments in place already. Some have been mentioned already, such as the RE targets, FITs, SPPAs, fiscal incentives and support to awareness raisng and capacity building. However, some additional supporting instruments should be envisaged such as a RPS, additional financial and fiscal incentives to investors and to local equipment and service providers.

The EE policy gap analysis between Pakistan and the five reference Asian countries is based on the comparison between existing EE policy instruments in those countries. This comparison is provided in Table 39.

Table 39: Comparison of EE policies in Pakistan and five other Asian countries

EE policy instruments	CH	IN	PH	TH	VN	PK
EE targets	X	X	X	X	X	X
Financial incentives						
• Soft loan	X	X	X	X		X
• Investment grant/subsidy		X		X	X	
• Financial subsidy (Loan guarantee, etc.)	X	X				
• Carbon/CDM credit transactions	O	X			O	
Fiscal incentives						
• Accelerated depreciation		X				
• Exempted/reduced VAT						
• Exempted/reduced CIT		X		X	X	

• Exempted/reduced ID&T	X	X	X	X	X	X
• Exempted/reduced licensing fee						
• Exempted/reduced land use fee						
Mandatory energy performance and management						
• EE obligation	X	X				
• Mandatory energy management, audit & reporting	X	X		X	X	
• EE product standards and labeling	X	X	X	X	X	X
• Forced retirement of low efficient equipment	X				X	
• Penalties for non-compliance to energy saving/conservation obligations	X	X			X	
Other EE policy measures						
• R&D funds/subsidies and other supporting measures	X	X			O	
• Financial and other support for knowledge creation/sharing	X	X	X	X	X	
• Financial and other support for capacity building activities	X	X	X	X	X	X
• Financial and other support for local manufacturers		X			O	
• Financial and other support for ESCOs	X	X	X	X	O	

"X" – policy already deployed; "O" – policy under development

Table 39 shows that all countries, including Pakistan, have set EE targets, provide ID&T exemption or reduction on EE equipment, have established energy performance standards & labelling for EE products and provide financial support for capacity building activities.

As for RE, India has developed the most comprehensive package of EE policy instruments. China has also got a solid package that has helped significantly reduce its energy intensity.

It should be noticed that both India and China have established powerful tools to support the enforcement of the EE regulations such as EE obligations and penalties for non compliance. They also offer financial support in the form of loan guarantees to investors. Other countries have adopted softer measures which have not necessarily allowed them to achieve the same level of results as China and India.

Since the creation of the ENCON Fund, Thailand has been actively reducing its energy intensity thanks to a broad package of EE measures. Vietnam is catching up and is in the process of offering the largest EE policy package of ASEAN with stringent EE rules, comparable to those of India and China. Vietnam, like China force users to retire equipment which are not meeting EE standards.

ESCOs are playing a growing role in the implementation of EE measures in various sectors, but still require support from the governments. However, Pakistan does not seem to have any plan to support ESCOs.

Pakistan is lagging far behind the reference countries. Financial support to EE activities is still soft. Though there are energy performance standards, they are not enforced as there is no compulsary EE measures such as energy management, audits and reporting.

6.3 Policy Gap Analysis

The gap analysis method will be used for analyzing the inadequacies and gaps of the existing RE and EE policy and regulatory framework of Pakistan compared to the best practices and lessons/experience from five studied countries.

The policy gap analysis consists of the following steps:

- Determine the goals/targets for RE and EE application in industries in Pakistan based on the review of existing policy and regulatory framework. These goals include quantitative targets for RE and EE application in industries (i.e., units of energy generated from RE sources or saved from EE applications).

- For each goal, assess the actual achievements in comparison with the targets.

- Conduct an analysis to identify the key barriers to a successful application of RE and EE in industries. These include legal (e.g., licensing and permitting); technological, economic and financial (e.g., technology costs, electricity tariff, access to financing sources, lending rates, etc.); social, gender and environmental (e.g., inclusion, capacity, opportunities and obstacles of different stakeholder groups, both male and female, to participate and benefit); and operational (e.g., maintenance and operation of RE and EE projects) barriers.

- Assess the existing policy and regulatory framework of Pakistan vis-à-vis the identified barriers.

- Consider the best practices/success factors and lessons learned from the five studied countries, and identify the inadequacies and gaps of the existing RE and EE policy and regulatory framework of Pakistan.

- Finally, propose suitable policy measures and instruments to overcome the barriers and fill in the identified gaps.

Table 40 and Table 41 summarize the analysis of RE and EE policy gaps in Pakistan.

Table 40: Analysis of RE policy gaps in Pakistan

RE targets of Pakistan	Actual achievemnts of Pakistan	Barriers	Assessment of policies deployed in Pakistan vis-à-vis the barriers	International policy best practices to overcome the barrier	Policy gaps and proposed solutions for Pakistan
RE sources (small hydro, wind and solar) account for 12% of total generation mix by 2022	RE sources (except large hydro) accounted 2.33% of total generation mix by July 2016.	Regulatory barriers	Pakistan already deployed single-window clearance system, but the licensing procedure is still complicated	Single window and simplified licensing system	Need for a policy to simplify the licensing procedure
		Technological barriers	Mandatory requirement on training of RE plant operators	Mandatory requirement on training of RE plant operators	No policy gaps.
		High upfront costs for RE projects	Some fiscal incentives (exempted/reduced CIT, ID&T and licensing fee) are providing	Financial and other support for capacity development of various local stakeholders, especially R&D institutions, equipment manufacturers and ESCOs. In addition, fiscal incentives are provided to help improve the financial performance of RE projects	Need for a policy on additional financial incentives (e.g., investment grants, loan guarantees) and fiscal incentives (e.g., accelerated depreciation, VAT exemption / reduction) for RE projects
		Financial barriers	Soft loans are provided by SBP through the RE Refinance Facility	A comprehensive package of financial incentives (soft loans, investment grants and financial subsidy) are provided	Need for a policy on additional financial incentives (e.g., investment grants, loan guarantees) for RE projects
		Lack of local competence and human capital	Only support for knowledge creating/sharing and capacity building activities is provided	Financial and other support for capacity development of various local stakeholders, especially R&D institutions, equipment manufacturers and ESCOs	Need for a policy to support R&D institutions, local equipment manufacturers and ESCOs
		Lack of social awareness and acceptance	No policy deployed	Support to awareness compaigns regarding RE technologies	Need for a policy to support awareness compaigns

Table 41: Analysis of EE policy gaps in Pakistan

EE targets of Pakistan	Actual achievemnts of Pakistan	Barriers	Assessment of policies deployed in Pakistan vis-à-vis the barriers	International policy best practices to overcome the barrier	Policy gaps and proposed solutions for Pakistan
Energy saving potential is estimated at 9,475 ktoe in 2020. Sector-wide energy saving potentials are 25% for industry, 20% for transport, 20% for agriculture, and 30% for buildings	No information	Economic barriers	Only few incentives (e.g., soft loan and exempted/ reduced ID&T) are provided	A full package of financial and fiscal incentives is provided	Need for a policy on additional financial incentives (e.g., investment grants, loan guarantees) and fiscal incentives (e.g., accelerated depreciation, VAT exemption/ reduction, CIT exemption/ reduction) for EE projects
		Technical barriers	PEECA and few international programs are providing support for capacity building	Support for knowledge creating/sharing, and capacity building and training.	Need for a policy to support capacity building and training
		Organizational barriers	No mandatory requirements are deployed	EE obligation, mandatory energy performance, audit and management	Need for a policy on EE obligation, mandatory energy performance, audit and management, and penalties for non-compliance to energy saving/conservation obligations
		Lack of minimum energy performance standards	Only few EE products have standards. No labelling.	Enforcement of EE product standards and labelling. Also, use of penalties to force retirement of low efficient equipment and plants.	Need for a policy on EE product labelling, and forced retirement of low efficient equipment
		Institutional barriers	No adequate support for capacity building for policy makers.	Support for capacity building for policy makers in both development and enforcement of the policies	Need a detailed assessment of the existing institutional arrangement and support for capacity building for policy makers

Gaps and Lessons for Gender Mainstreaming in RE & EE Policy

Gaps remain between the RE & EE policy and the practical context of men and women who need and use energy, women in the key role as major household energy managers, livelihoods providers and micro- and small entrepreneurs. Some systematic barriers for gender mainstreaming and women's participation appear prevalent in the sector, affecting women's ability to fully benefit from the available interventions.

The needs and priorities of energy access and use

Renewable energy policies and development initiatives tend to have a technology-focused approach. RE development strategies and, consequently, programmes and projects are formulated from the supply perspective and not from ***the needs and priorities perspective*** of the target groups that need reliable and affordable energy for their social and economic development. Women's and men's needs and priorities related to energy access and use are different, based on their different roles and responsibilities in society. Gender perspective should therefore be mainstreamed into the assessment of needs and priorities for formulation of policies leading to RE initiatives that will meet both men's and women's energy needs and priorities of access and use through technology that is best suitable for the different target groups. Initiatives that are based on the needs and priorities of both men and women will be best suitable for enhancing their social and economic development.

Inclusion of women as potential RE entrepreneurs and employees

Women are generally considered to be less adept than men to work in technological branches such as energy business, and far more men than women are engaged in the renewable energy sector[196]. Despite the fact that women in rural and poor urban households are usually the main providers of household energy, in different renewable energy development initiatives they are typically given merely an end-user role, and ***women are seldom considered as potential suppliers and maintainers of energy services***.

The women-focused RE projects have been largely focused on basic household energy such as improved cooking stoves and home lighting, biomass-based energy production and related micro-business. Little attention has been paid to women's potential as entrepreneurs and labourers in energy production, distribution and maintenance, and the economic opportunities these roles could provide them.[197] Projects supporting women's small-scale entrepreneurship in RE sector have shown successful in enhancing local economic, social and living standards development.[198]

Women are typically engaged in the informal sector, and agriculture accounts for more than 60% of female employment in South Asia[199]. The benefits of improved energy access, such as rural electrification for women in terms of saved time and costs are significant, added with new income earning opportunities. Electrification of rice mils and other grain, oil and food processing facilities are usually the first rural industries to be electrified after grid access. Further encouragement of women to become energy entrepreneurs rather than only consumers has shown to have multiple development effects through e.g. home-based women-run micro-enterprises, expansion of economic activities and diversification of production options, energy access enabling new sources

[196] IRENA 2013
[197] Lumampao, Lopez and Go, N.D
[198] Sarkar 2016
[199] Dutta, S. In ADB 2016

of income to support family investments in education, health and living standards. Women-owned businesses are a significant source of self-employment and economic growth, but majority of them are small and micro enterprises in trade and services. However, across the world women are establishing RE enterprises such as small electricity production and distribution networks, charcoal production and solar businesses.[200] ***Energy policies that support development of entrepreneurial energy activities and business approaches that involve and benefit women, have shown to have positive impacts beyond the energy sector***, such as improved health and education, reduced household poverty, and women's empowerment among others.[201]

Gender-disaggregated data in the renewable energy sector is scarce. RE and EE sectors provide for both men and women not only entrepreneurial but also considerable ***labour opportunities.*** The International Renewable Energy Agency (IREN) estimates that there are approx. 8,079 million direct and indirect jobs in the RE industry worldwide, one third of them in the solar industry. IREN further estimate that doubling the share of renewables in the global energy would result in over 24 million jobs worldwide by 2030.[202]

Women, being worldwide the major household energy providers, are involved in numerous sustainable bioenergy projects, for example the partners of the Global Alliance for Clean Cookstoves manufactured almost 10 million cookstoves in 2012, employing 76.000 people of whom 54% were women[203].

A recent analysis ***of women's economic participation and empowerment in Pakistan***[204] identifies women's total share in the labour force to be low at 26% of all women in ages 15-64 years, more than 2/3 of them working in agriculture. Of the total industrial sector labour force, women make only 20%. ***Technical and vocational training*** for women is occasional, and the training provided is within traditional skills such as knitting, sewing and embroidery which will generate income under the minimum wage level. Lack of ***access to finance*** appears as another major fall-back for women's economic development; only 5% of women own a bank account and 13% of women have access to loans from microfinance organizations.

Women as entrepreneurs and employees in the RE & EE sector face many barriers such as lack of access to information about new forms of energy, lack of knowledge, education and technical training in renewable energy technology, lack of training in business management, and lack of access to financial sources and services that are necessary for business start-up.[205] For gender mainstreaming in the RE& EE sector, specific women-focused policy incentives are needed for encouraging and enhancing women in energy production and services, as entrepreneurs and employees, with targeted programmes providing required technical and entrepreneurial skills as well as funding mechanisms.[206]

A funding option that could be implemented through policy measures is a requirement for project owners (government or private developers) to allocate a certain percentage (such as 1-1.5%) of the total project costs and of the annual electricity sales for a fund to be administered by local

[200] IRENA 2013
[201] Dutta, S. 2003
[202] IREN 2016. Data is reported to be based on information from national agencies and on global and regional studies. Probably a great number of local jobs created through donor, NGO and other programmes and projects are not included in the estimate.
[203] Global Alliance for Clean Cookstoves 2013
[204] Zaidi Y., Farooq S. et al. 2016
[205] UNIDO 2014, IRENA 2013
[206] ADB 2016, IRENA 2013, ENERGIA 2015, Sarkar 2016

electricity users (men and women) for energy-based income generation such as micro and small enterprises and cooperative enterprises, especially those started, driven and benefitting women.[207]

Government policy measures can encourage both the government and private sector to ***promote women's employment*** leading to improved gender balance in the RE sector. Policy incentives may include e.g. quotas and economic benefit measures for female employment, training, core labour standards, non-discriminatory practices and safety in workplace.

Inclusion of women in policy formation, planning and decision making

Representation of women is generally low in decision-making bodies in the energy sector and in the formal governance systems. Few women are involved in the male-dominated RE & EE sector policy development, planning and decision making. Consequently, women's perspectives in energy needs, access and use priorities, women's knowledge, capacities and economic development options are not considered in the planning of policy incentives, strategies, programmes and investments. As women to a greater extent than men hold a less technology and more socio-economic and community-focused perspective, the male-dominated RE & EE planning remains rather top-down, technical and supply-driven.[208]

In most countries energy sector management is more centralized compared to other sectors, and less open to input from stakeholders representing local communities and small businesses. Procedures for setting national energy priorities often do not take into account gender-separated needs and use of energy in both household, service and productive sectors.[209] Gender mainstreaming could contribute to increasing effectiveness of RE & EE policy, and increased female representation in policy formation, planning and decision-making bodies could enhance the cross-sectoral and cumulative effects of RE strategies. Connecting RE policy initiatives with those in other sectors like social policy, healthcare, agriculture and rural development have further potential to increase the positive effects.

[207] There are good experiences of this measure in other countries
[208] ENERGIA 2015, ADB 2016
[209] ENERGIA 2015

7. Preliminary Policy Recommendations for the Promotion of RE&EE in Industries in Pakistan

7.1 Preliminary policy recommendations for RE promotion

Based on the initial comparative and gap analyses of the existing RE policy framework in Pakistan and five Asian countries, the following RE policy improvements are recommended:

- Establishing a Renewable Portfolio Standard (RPS);
- Simplifying the licensing procedures for RE projects;
- Policy on additional financial incentives for RE projects (e.g., investment grants, loan guarantees);
- Policy on additional fiscal incentives for RE projects (e.g., accelerated depreciation, VAT exemption/reduction);
- Establishing funds to provide financial support for R&D institutions, local equipment manufacturers and ESCOs in RE sector;
- Establishing funds to provide financial support for knowledge creating/sharing and capacity building activities, and awereness compaigns.

7.2 Preliminary policy recommendations for EE promotion

Based on the initial comparative and gap analyses of the existing EE policy framework in Pakistan and five Asian countries, the following EE policy improvements are recommended:

- Policy on EE obligation, mandatory energy performance, audit and management, and penalties for non-compliance to energy saving/conservation obligations;
- Policy on EE product labelling, and forced retirement of low efficient equipment;
- Provision of additional financial incentives for EE projects (e.g., investment grants, loan guarantees);
- Provision of additional fiscal incentives for EE projects (e.g., accelerated depreciation, CIT exemption/reduction);
- Establishing funds to provide financial support for R&D institutions, local equipment manufacturers and ESCOs;
- Establishing funds to provide financial support for knowledge creating/sharing and capacity building activities, and awereness compaigns.

7.3 Preliminary Recommendations for gender mainstreaming in RE&EE Policy

Based on the review of the current RE & EE sector policies in Pakistan and drawing experiences and lessons learned from other countries, some preliminary recommendations for gender mainstreaming in RE & EE policy are suggested below, especially with focus on the industry potential:

- Gender mainstreaming through policy incentives to be specified through clear goals,

requirements, guidelines, roles and resource allocation

- Policy to support women's economic opportunities (e.g., support to education and training of women, targeted loan programmes for female entrepreneurs in RE & EE development, etc.)
- Gender balance in policy planning, decision-making and leadership (e.g., increase of the number of women in RE policy development and decision-making bodies, target recruitment of women into management and leadership positions in the RE & EE sector, etc.)

Annexes

Annex 1: List of existing RE & EE Policy and Regulatory Framework in Pakistan

No.	Title of the document	Issuing Institution	Issuing Date
1.	Pakistan Energy Efficiency and Conservation Act, 2016	ENERCON	2016
2.	Decision of the Authority in the matter of Motions for Leave for Review in the matter of Upfront Solar PV Tariff dated 16.12.2015 (Upfront Tariff for Solar)	NEPRA	2016
3.	SBP Renewable Energy Refinance Facility	SBP	2015
4.	National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations, 2015	NEPRA	2015
5.	Decision of the Authority in the matter of Adjustment of Upfront Tariff for New Bagasse Based Co-generation Projects (Upfront Tariff for Bagasse)	NEPRA	2015
6.	Determination of National Electric Power Regulatory Authority in the Matter of Upfront Tariff for Wind Power Generation (Upfront Tariff for Wind)	NEPRA	2015
7.	Quality standards for import of solar PV equipment into Pakistan	AEDB	2015
8.	Vision 2025	MOPDR	2014
9.	Framework for Implementation of Climate Change Policy (2013)	MOCC	2013
10.	National Power Policy 2013	MOWP	2013
11.	Framework for Power Cogeneration 2013 Bagasse and Biomass	AEDB	2013
12	National Sustainable Development Strategy (2012)	MOCC	2012
13.	National Climate Change Policy (2012)	MOCC	2012
14.	Policy for Development of Renewable Energy for Power Generation (2006)	AEDB	2006
15.	National Energy Conservation Policy (NECP), 2006	MOE (Now MOCC)	2006
16.	Punjab Power Generation Policy - Year 2006 (amended 2009)	PPDB	2006
17.	National Environmental Policy 2005	MOE (Now MOCC)	2005
18.	Policy for Power Generation Projects (2002)	MOWP	2002
19.	IEE and EIA Guidelines (Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000)	EPA	2000
20.	Pakistan Environmental Protection Act (PEPA), 1997	EPA	1997

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