



Energy Efficiency and Conservation Master Plan up to 2030



Sustainable and Renewable Energy Development Authority (SREDA)

Power Division

Ministry of Power, Energy and Mineral Resources
Government of the People's Republic of Bangladesh

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ABBREVIATION

Abbreviation	Meaning
AC	Air Conditioner
ACEA	Accredited Energy Auditor
ADB	Asian Development Bank
AFD	Agence Française de Development
APF	Annual Performance Factor
APP	Asia Pacific Partnership
BAB	Bangladesh Accreditation Board
BAU	Business as Usual
BBS	Bangladesh Bureau of Statistics
BCCF	Bangladesh Climate Change Resilience Fund
BCIC	Bangladesh Chemical Industries Corporation
BCSA	Bangladesh Cold Storage Association
BCSIR	Bangladesh Council of Scientific and Industrial Research
BDS	Bangladesh Standard
BEER	Building Energy & Environment Rating
BERC	Bangladesh Energy Regulatory Commission
BGMEA	Bangladesh Garment Manufacturers & Exporters Association
BJMA	Bangladesh Jute Mills Association
BNBC	Bangladesh National Building Code
BNBC [Revised]	New Version of Bangladesh National Building Code
BPC	Bangladesh Petroleum Corporation
BPDB	Bangladesh Power Development Board
BREB	Bangladesh Rural Electrification Board
BRESL	Barrier Removal for Energy Standards and Labeling
BRMA	Bangladesh Re-Rolling Mills Association
BSFIC	Bangladesh Sugar & Food Industries Corporation
BSTI	Bangladesh Standardization and Testing Institute
BTMA	Bangladesh Textile Mills Association
BUET	Bangladesh University of Engineering and Technology
CBM	Condition Based Maintenance
CCEB	Catalyzing Clean Energy in Bangladesh
CDM	Clean Development Mechanism
CEA	Certified Energy Auditor
CEM	Clean Energy Ministerial
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CNG	Compressed Natural Gas
COP	Co-efficient of Performance
COP	Conference of Parties
CP	Counter Part

Abbreviation	Meaning
CPP	Critical Peak Pricing
CSPF	Cooling Season Performance Factor
CSR	Corporate Social Responsibility
DB	Data Base
DNCRP	Directorate of National Consumer Rights Protection
DoE	Department of Environment
DSM	Demand-Side Management
EC	Energy Conservation
ECCJ	Energy Conservation Center, Japan
ECR	Environment Conservation Rules
EE	Energy Efficiency
EE&C	Energy Efficiency & Conservation
EE&CMP	Energy Efficiency & Conservation Master Plan
EER	Energy Efficiency Ratio
EGCB	Electricity Generation Company of Bangladesh
EIB	European Investment Bank
EM	Energy Manager
EMS	Energy Management System
ERD	Economic Relation Division (Ministry of Finance)
ESCO	Energy Service Company
EU-ETS	European Union Emission Trading System
FS	Feasibility Study
FY	Financial Year
GBG	Green Building Guideline
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German International Development Corporation)
GoB	Government of the People's Republic of Bangladesh
GoJ	Government of Japan
GW	Gigawatt
HBRI	Housing and Building Research Institute
HFO	Heavy Fuel Oil
HR	Human Resource
HSD	High Speed Diesel
HVAC	Heating, Ventilating, and Air Conditioning
IAP	Interim Action Plan
ICS	Improved Cooking Stove
ICT	Information Communication Technology
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IEC	International Electrotechnical Commission

Abbreviation	Meaning
IPCC	Intergovernmental Panel on Climate Change
IPEEC	International Partnership for Energy Efficiency Cooperation
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
ISO	International Organization for Standardization
JCC	Joint Coordination Committee
JCM	Joint Crediting Mechanism
JERI	Japan Economic Research Institute Inc.
JICA	Japan International Cooperation Agency
J-POWER	Electric Power Development Co., Ltd.
kgoe	kg of oil equivalent
KPI	Key Performance Indicators
ktoe	kilo ton of oil equivalent
LDC	Least Developed Country
LGED	Local Government Engineering Department
LCC	Life Cycle Cost
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAC	Marginal Abatement Cost
MDG	Millennium Development Goal
MEPS	Minimum Energy Performance Standard
METI	Ministry of Economy, Trade and Industry (Japan)
MGI	McKinsey Global Institute
MIC	Middle Income Country
MOA	Ministry of Agriculture
MOC	Ministry of Commerce
MOE	Ministry of Education
MOEF	Ministry of Environment and Forest
MOF	Ministry of Finance
MOHPW	Ministry of Housing & Public Works
MOI	Ministry of Industry, Ministry of Information
MOT	Ministry of Transportation
MRA	Mutual Recognition Agreement
MPEMR	Ministry of Power, Energy and Mineral Resources
MW	Megawatt
NBFI	Non-bank Financial Institution
NBNBC	New Bangladesh National Building Code
NCTB	The National Curriculum and Text Book Board
NGO	Non-government Organization
NPO	Non-profitable Organization
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OJT	On the Job Training

Abbreviation	Meaning
PF	Power Factor or Plant Factor
PFI	Participatory Financial Institution
PGCB	Power Grid Company of Bangladesh
PMU	Project Management Unit
PSCDP	Power Sector Capacity Development Program
PV	Photovoltaic
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha; Capital Development Authority of the Government of Bangladesh
RE	Renewable Energy
SAARC	South Asia Association for Regional Cooperation
SCADA	Supervisory Control And Data Acquisition
SDG	Sustainable Development Goal
S&D	Sales and Distribution
SED	Sustainable Energy Development
SHS	Solar Home Systems
SME	Small and Medium size Enterprise
SREDA	Sustainable and Renewable Energy Development Authority
SWH	Solar Water Heater
TA	Technical Assistance (Capacity Development)
TBM	Time Based Maintenance
toe	ton of oil equivalent
TOU	Time of Use
TPP	Technical Project Proposal
TSL	Two Step Loan
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
WB	World Bank

TERMS AND DEFINITION

Term		Meaning
Policy	EE&C policy	The general expression of EE&C policy, which includes EE&C programs and other measures, projects and systems for EE&C.
	EE&C program	The programs for EE&C implementation, which should be applied and is being organized.
	EE&C measure	The measure for EE&C, such as heat recovery, EE equipment, heat insulation, energy management, etc.
	EE&C project	The project for EE&C, in which one or multiple EE&C measures are introduced.
Energy	Primary energy	Energy form that is found in nature such as coal, oil, natural gas solar, and wind.
	Secondary Energy	The energy that has been converted from a primary form, either renewable or non-renewable energy, into another energy form, such as gasoline or electricity for distribution and use.
	Commercial energy	The energy such as coal, gas, electricity, etc., which are sold by energy suppliers to energy consumers.
	Non-commercial energy	The energy such as biomass, which is privately produced and consumed.
Party, Sector	Party	Groups of stakeholders such as individuals, business operators, consumers, governments, NGOs, etc.
	Sector	The categorized group of energy consumers, such as industrial sector, business sector, residence, transportation and utility (energy supply).
	Commercial sector	The group of energy consumers, which mainly use energy at the buildings, where the business operators use for their business, such as office, shop, school, theater, hall, airport, etc. The sector includes public and also commercial (private) sectors.
	Transportation Sector	The group of energy consumers, which mainly use energy for transportation vehicles such as car, train, ship and aircraft.
	Residential sector	The group of energy consumers, which mainly use energy at residence for household purpose.
	Energy supply side	The group of energy consumers, which mainly use energy for energy supply, converting or processing the energy, such as electricity supplier. The sector includes public and private sectors.
	Public sector and private sector	The terms are used only when the explanations distinguishing public (government) establishments and private (commercial) establishments are necessary.

Energy Efficiency and Conservation Master Plan

Foreword

Energy has become one of the most important factors for better economic growth and people's life in our country. After decades of dependency on domestic natural gas, we find ourselves not equipped with sufficient energy resources in our land, and will gradually rely on imported fuels. Also, we are well aware that the use of fossil energy increases Greenhouse Gas emission, which accelerates global warming and causes climate change, and suffers our country by natural calamities.

Energy efficiency and conservation is a cross-cutting issue for all the people. We hereby issue the Energy Efficiency and Conservation Master Plan (EECMP), and declare our unyielding commitment of its implementation.

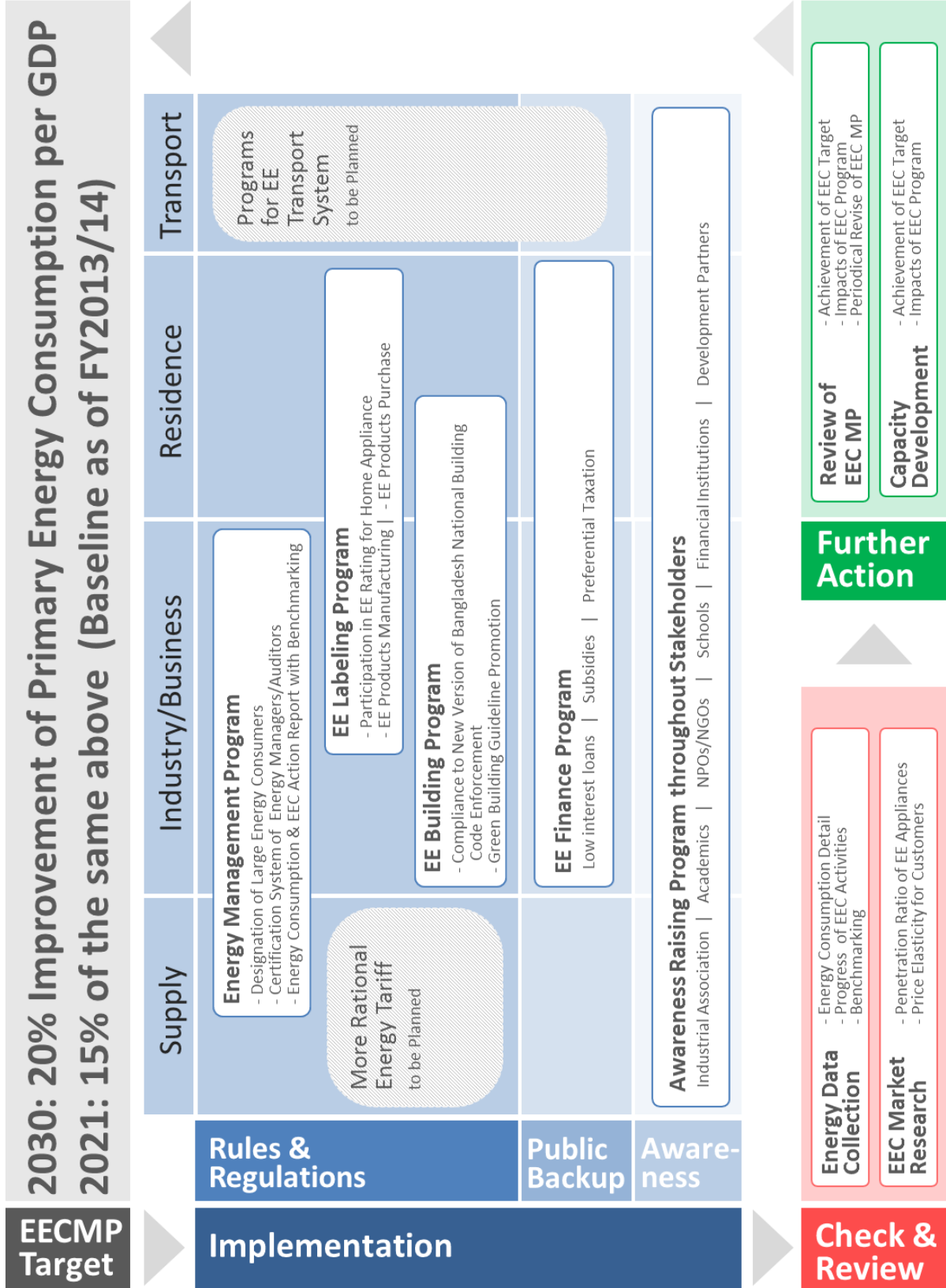
Md. Anwarul Islam Sikder *ndc*

Additional Secretary

Chairman

SREDA

Outline of EE&C Master Plan



Executive Summary

1. Background

1.1 Energy Demand

Bangladesh is a densely populated country with about 161 million people living in 147,570 square kilometers of land. In order to maintain a sustainable GDP growth of 7%/year up to 2020 and beyond, the Government of Bangladesh (GOB) needs to meet the essential energy needs of the people and industries. For this purpose, demand-side energy management is just as important as supply-side infrastructure development. The Sustainable & Renewable Energy Development Authority (SREDA) was thus established by Bangladesh Parliament in May 2012 as a national nodal organization for promoting demand-side energy efficiency and conservation (EE&C) in the country.

A rapidly growing country needs huge amount of energy to feed its large growth appetite. In the past decade, primary energy consumption increased over 100% and this trend will sure to continue. We have no room for wasting energy in this situation.

Besides the latest sector-wise energy consumption (industrial, residential, transport, agriculture and commercial) is shown in Figure 1-1: industry has the biggest share of 47.8%, followed by residential and transportation sector at 30.5% and 11.5%, respectively.

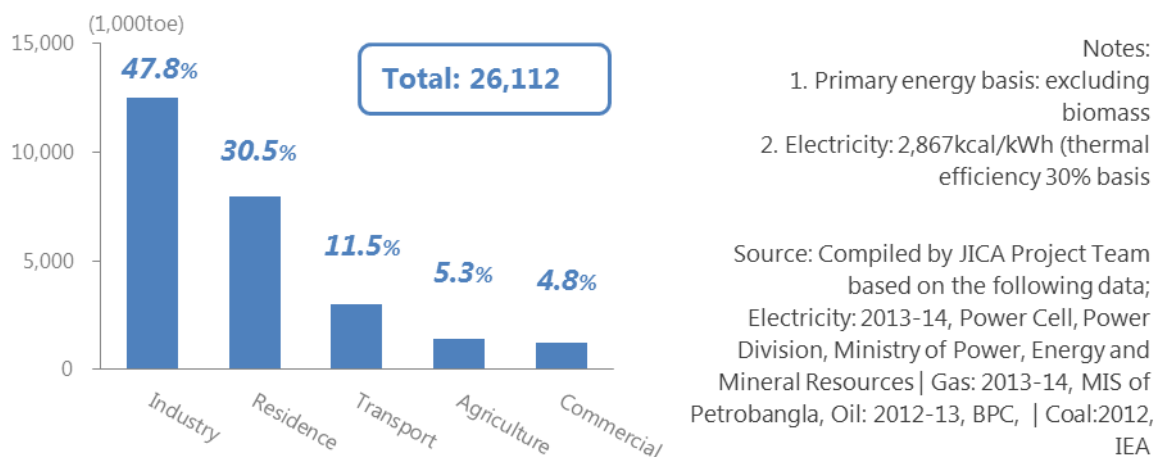


Figure 1-1 Primary Energy Consumption by Sector (as of 2013-14)

From the macro point of view, the amount of national energy production stands at 27,187 ktoe, while the amount of primary energy use was 33,550 ktoe, including imported fuel¹. As shown in Figure 1-2, the gap between national energy production and the amount of primary energy use is increasing in the last few years.

¹ IEA country statistics

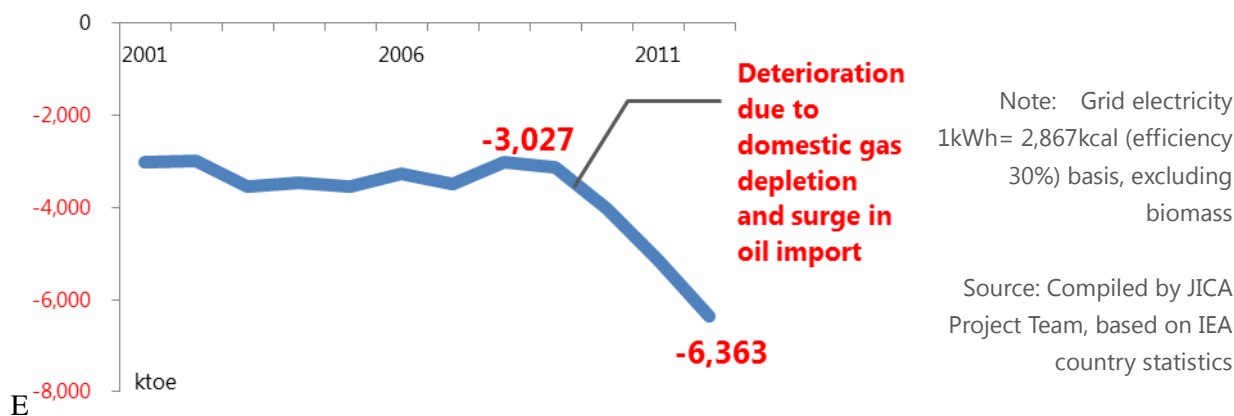


Figure 1-2 Gap between National Energy Production and Primary Energy Use (ktoe)

It is estimated that the primary energy consumption (excluding transportation and biomass) will increase approximately three-fold from 27,500 ktoe in 2015 to 71,600 ktoe by 2030 as shown in Figure 1-3. The composition of sector-wise share will not see a significant change; the consumption in the industrial sector will remain nearly half of the total consumption.

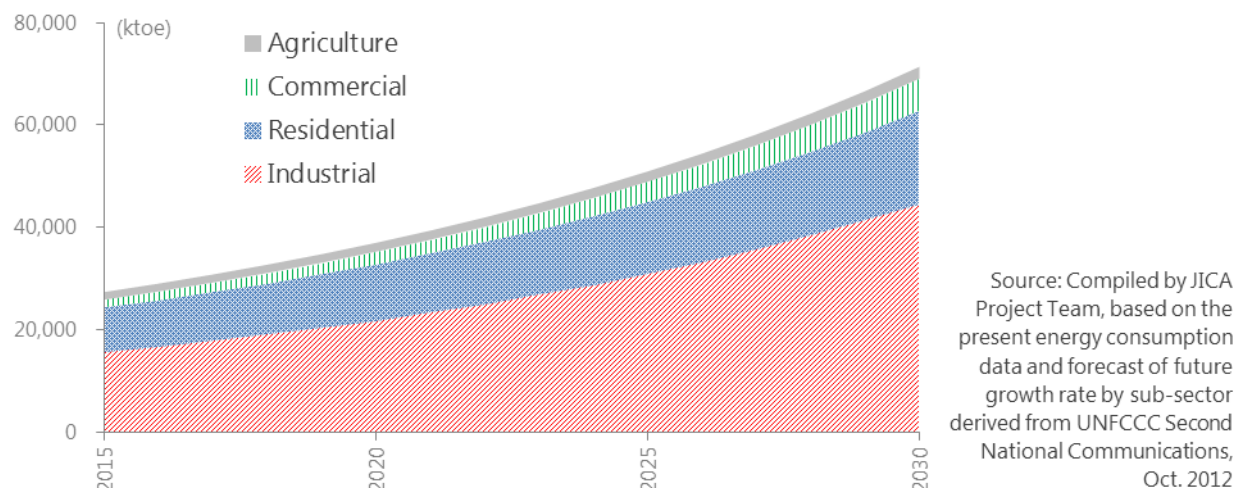


Figure 1-3 Forecast of Primary Energy Consumption in 2030 (BAU Case, Excluding Transportation and Biomass)

1.2 Energy Supply

Bangladesh was able to exploit its abundant natural gas reserves. Three-quarters of its energy supply depended on natural gas. It is anticipated, however, that the gas supply will reach its peak by 2018 and gradually decrease thereafter. Therefore, we cannot afford to build another gas fired power plant, rather resort to other natural resources for power generation, like oil, LNG and coal etc. The Government plans to develop the Matarbari Island area to build ports and facilities, which will allow imports of coals and liquefied natural gas (LNG) for power generations after 2021 and 2022, respectively. The development of other type of power generation (such as

nuclear and hydro power) awaits negotiation with partner countries and seems to start operation by 2030.

1.3 Energy Balance in Bangladesh

Bangladesh primary energy supply is 33,172 ktoe, of which 55% is dependent on domestic natural gas, followed by 27% of biomass & waste in rural area and 15% of imported oil. On the demand side, out of 24,445 ktoe final consumption, the industrial sector consumes 24% and residential sector (excluding biomass & waste) 15% on secondary energy basis.

1.4 Bangladesh's Vulnerability for Climate Change

Bangladesh is vulnerable to sea level rise, high tidal waves and river flood by cyclone potentially caused by the climate change through global greenhouse gas (GHG) emission due to fossil fuel consumption. The EE&C master plan implementation is not only for the economic benefit but also closely links to protecting the country from such disasters.

1.5 Necessity of EE&C Policy and Implementation

Energy Efficiency (EE) means high competitiveness; it means producing more with less energy. Thus earned "energy savings" can be wisely reinvested. Business establishments can reinvest them to expand their businesses. The households can reinvest them for their children's education and health care. The Government can invest less in energy subsidies and more in industrial development. As a result our country will grow up more strongly and rapidly.

EE is about national energy security; the Government can reduce import of expensive fuels, which is expected to increase in early 2020's, and improve the international balance of payments.

There is lack of urgency among the general public and industries to save energy under the current situation, where GOB highly subsidizes energy and power sector to lower the costs of fuel and electricity prices for the household and industries. Nevertheless, people and entrepreneurs are wise enough to know the importance of energy saving once they find out the magnitude of economic benefits they can earn, even under the current low energy prices.

It is thus important for all of us to facilitate the installment, execution and proliferation of EE&C Programs as well as to create the momentum to promote energy saving activities among all the general public through EE&C awareness-raising activities.

2. Master Plan

2.1 Objective of Energy Efficiency and Conservation Master Plan

2.1.1 Structure of EE&C Planning and Implementation

The Energy Efficiency & Conservation master Plan (EECMP) is the supreme plan of Bangladesh's initiative on energy efficiency and conservation, of which preparation requirement is stipulated in the Energy Efficiency and Conservation Rules (2014). The Plan declares our country's unyielding commitment for EE&C implementation to our people and to the world. Under the EECMP, all the policies, programs, legal documents (Act, Rules, Regulations, Circulars or Standards etc.) and frameworks are to be established. Figure 2-1 shows the basic structure of EE&C planning and implementation. The EE&CMP clearly indicate Roadmap up to 2030 with Action Plan, consisting of the outlines of legal, institutional and operational frameworks for the effective implementation of EE&C initiatives.

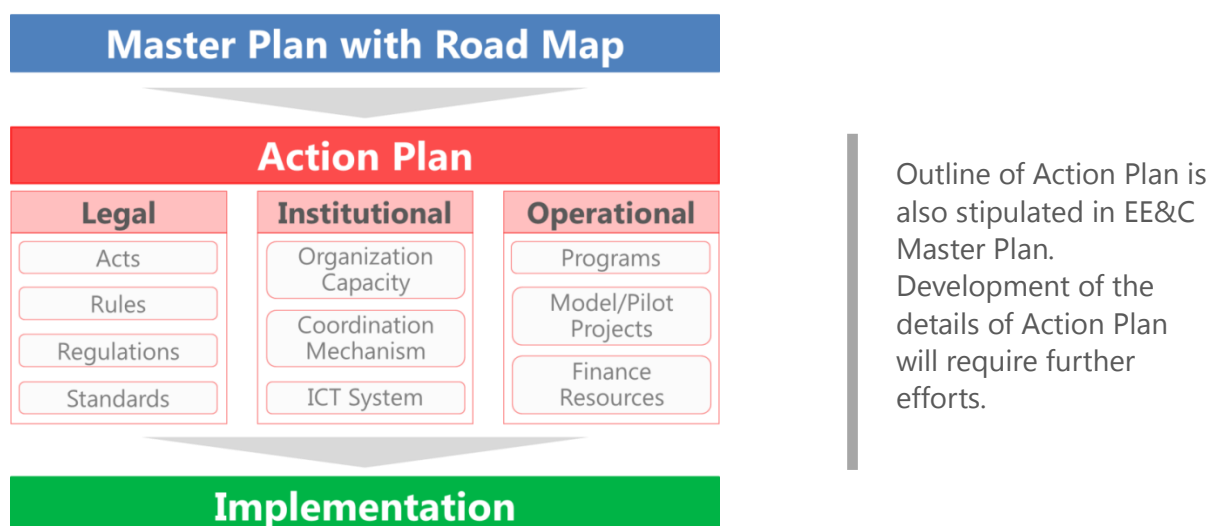


Figure 2-1 Structure of EE&C Planning and Implementation

2.1.2 Cross-cutting EE&C Policies and Actions

EE&C actions are to be taken by all the people and establishments, including governmental organizations and private sectors. EECMP shows a systematic structure of EE&C policies/programs and actions carried out by ourselves. More elaborated plan is to be implemented through cross-cutting discussions among the related stakeholders.

2.1.3 EE&C Potential

EE&C potential is defined as an expected amount or ratio of energy reduction, gained by introducing more effective energy management, EE equipment, insulation and solar control for buildings nationwide. Through the research, on-site surveys and interviews, EE&C potentials by sector were estimated as follows.

(1) Industrial Sector

Manufacturing industries in our country are not efficient in energy use, because of the continuous usage of old/ill-maintained machines and poor energy management. It is estimated that, through energy intensity comparison and actual on-site energy audits, the accumulating EE&C potential in industrial sub-sectors amount to around 21% of the entire industrial sector consumption. Considering the fact that about 50% of national primary energy is consumed in the industrial sector, the potential economic impact of EE&C measures is massive: almost 10.5% of the total energy consumption of the country can be reduced.

(2) Residential Sector

If all the existing home appliances in residences are to be replaced by higher efficiency products (as of today), huge energy reduction can be achieved. It is estimated that EE&C potential is 28.8% of the total energy consumption in the residential sector. Considering the fact that about 30% of national primary energy is consumed in the residential sector, the potential economic impact of EE&C measures is massive: almost 8.6% of the total energy consumption in the country can be reduced.

(3) Commercial Sector (Buildings)

Electricity is the main mode of energy in commercial buildings. In detail, nearly 50% of the total energy is consumed by ACs and 10-30% by lighting systems. It is expected that a simple replacement of ACs and lighting systems with high energy efficiency ones can save about 50% of total electricity consumptions in the commercial sector. However it is not easy to introduce EE&C measures for all the buildings. Thus as a realistic value, EE&C potential for buildings was estimated about 10%.

(4) Agricultural Sector

Electricity (incl. captive power) is the main mode of energy in agricultural sector. And the largest energy is used for irrigation pumps. EE&C potential for existing pumps is expected around 20%.

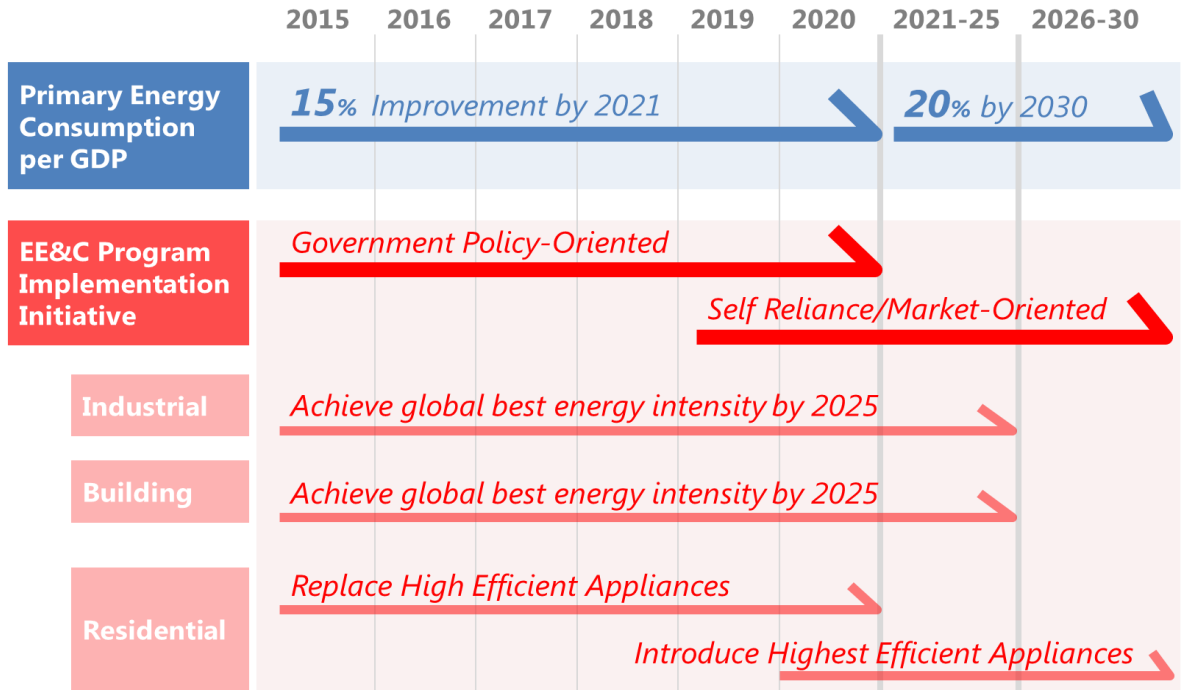
2.2 Toward “Self-Reliant EE&C Society”: Target and Implementation Roadmap

There are several indicators to evaluate the improvement of future national energy efficiency, such as, a) the actual reduction amount of energy consumption, b) reduction ratio (value) for future BAU value, c) energy consumption per capita and d) energy consumption per Gross Domestic Product (GDP), etc. However there is less data for structuring a) and b) values in Bangladesh. Evaluation in terms of energy reduction amount is not easy, since the national baseline has to be fixed for the future. Energy consumption per capita is not suitable for

developing countries like our country. Energy consumption per GDP can consider both energy efficiency and national economic growth. In this EECMP, therefore we have applied “**primary energy consumption per GDP**” as an indicator to set EE&C target and evaluate future national energy efficiency.

While identifying a huge EE&C potential, we must take practical approach to gradually realize it in a phased manner, since EE&C implementation requires a huge amount of money and time along with mentality to adopt it. With the formulation of suitable regulatory measures and incentive mechanisms in accordance with nationwide actions for energy conservation, “primary energy consumption per GDP” can be reduced below 2013 level. In the Master Plan, EE&C target and roadmap are set in Table 2 -1. The targets for 2021 and 2030 are set at 15% and 20% reduction, compared with 2013 value, respectively. The final goal of EE&C policies is to realize a self-reliant cycle in which people proactively and voluntarily save energy, rather than through compulsory EE&C activities. We aim to accomplish the target for realizing the self-reliant EE&C society by 2030.

Table 2-1 EE&C Implementation Roadmap (2015-30)



And in order to achieve the above mentioned target in 2021 and 2030, immediate actions are required under the leadership of the Government.

3. Action Plan

3.1 Overview

The Action Plan, containing the EE&C policies, programs, frameworks and organization structure, is prepared to show a practical methodology to achieve and accomplish the targets set in EECMP.

3.2 Roles and Responsibilities

EE&C implementation is a multi-sector issue, which should be tackled with the participation of all interested parties including the people and private/public establishments. Our EE&C activities are interconnected with each other. Some organizations have roles and responsibilities to support and enforce rules, and/or EE&C awareness and dissemination. Table 3-1 shows major roles and responsibilities of the participating parties.

Table 3-1 Roles and Responsibilities of Participating Parties

Party	Roles and Responsibilities
MPEMR	<ul style="list-style-type: none">■ Responsible ministry for EE&C policy planning and implementation■ Overall planning and development of electricity, gas and energy sector
SREDA	<ul style="list-style-type: none">■ Implementing body to promote EE&C nationwide■ Multi-sector / cross-cutting coordination of EE&C policies among all governmental organizations and non-governmental organizations■ Nationwide monitoring of energy consumption and EE&C implementation■ Reporting energy consumption status to the people and Government■ Green Building Guidelines implementation & approval
Local Governments	<ul style="list-style-type: none">■ Administration of New version of Bangladesh National Building Code (BNBC [Revised]) and Green Building Guideline (GBG)■ Initiatives on EE&C activities in office, projects and own procurement
Utility Companies (energy supplier)	<ul style="list-style-type: none">■ Energy conservation improvement in plants■ Transmission efficiency increase in supply system■ Functional tariff system formulation/introduction for EE&C incentives
Establishments, People and Society	<ul style="list-style-type: none">■ Compliance of EE&C Rules and regulations■ Preparedness / acceptance for future energy/power price increase and risks
Energy Experts, Academics and Researchers (including those at labs)	<ul style="list-style-type: none">■ Leading EE&C implementation initiative■ Network/community development among energy experts
Educational Institutions	<ul style="list-style-type: none">■ Awareness raising among students

3.3 EE&C Programs

Action Plan for the major EE&C programs is summarized in Table 3-2. Necessity of the programs, program outline and implementation methodology, stakeholders' roles and responsibilities, roadmap and expecting outcomes are introduced. These programs have been introduced in the advanced countries, as well as in our neighboring countries. EE&C programs for transportation and energy supply sectors and the issue of energy tariffs are not included in EECMP, and policies/programs on these remaining fields will be studied and revised EECMP will be issued in the near future.

Here, Energy Management Program is mainly focused on the promotion of energy efficiency in the industrial sector, EE Labeling Program in residential sector and EE Building Program in buildings. Other EE&C programs (such as those of finance and data collections) concern all industrial, residential and commercial sectors.

Table 3-2 Summary of EE&C Programs in Action Plan

Program	Target	Methodology
Energy Management Program (EMP)	Large Industrial Energy Consumers	<ul style="list-style-type: none"> ■ Large energy consumer designation ■ Energy Manager, Certified Energy Auditor and Accredited Energy Auditor certification with qualification and examination system ■ Energy audit (mandatory/voluntary) ■ Energy consumption reporting (mandatory) ■ Benchmarking
EE Labeling Program (EELP)	Residential Consumers	<ul style="list-style-type: none"> ■ Label certification / Laboratory accreditation system ■ Standardization of EE measurement method and Star Label Rating criteria ■ Star Label Standardization (Unification) ■ Participation of manufactures, importers and retail shops (mandatory/voluntary) ■ MEPS (Minimum Energy Performance Standard) ■ Effective means to be developed to stop entry of bellow standard and energy inefficient products/items in the market.
EE Building Program (EEBP)	Buildings	<ul style="list-style-type: none"> ■ New version of BNBC [Revised] Implementation ■ GBG development ■ Manual and Rating system introduction ■ Incentive mechanism to be developed for following GBG and its implementation ■ Certification of GB
EE&C Finance Incentive Program	Private Companies	<ul style="list-style-type: none"> ■ Low-interest loan for EE&C investment ■ Preferential taxation on high efficiency equipment/appliances and/or EE&C investment ■ Subsidy for EE&C investment ■ Other incentive mechanisms
Government's Own Initiatives	Government	<ul style="list-style-type: none"> ■ Green Purchase Program for Eco-friendly public procurement ■ Obtain ISO14001 and 50001 certification
Energy Consumption Data Collection	Government	<ul style="list-style-type: none"> ■ Energy consumption data by fuel ■ Energy consumption data by sector and sub-sector ■ Energy intensity data
Global Warming Countermeasure	All	<ul style="list-style-type: none"> ■ Formulation and quantification of national carbon market ■ Carbon abatement project as capacity development ■ Awareness raising

3.4 Monitoring and Review of EE&C Programs

3.4.1 Monitoring and Data Collection

Periodical monitoring and data collection of indicators on the energy consumption in various sectors are key factors of success in EE&C implementation. The web-based information collection mechanism proposed under this EECMP will ensure a smooth data accumulation which enables appropriate PDCA (Plan-Do-Check-Act) cycle of the entire EE&C policies.

3.4.2 Review of EECMP

All the data are maintained by SREDA as a regulatory authority for EE&C initiative. SREDA is mandated to analyze the data in order to review the progress of EECMP and its subordinate programs. The annual reporting is conducted as the follow-up of EECMP to the Joint Coordination Committee, which is chaired by the Chairman of SREDA with participation from all the relevant ministries/agencies. Results of the review will be reflected in details in Action Plan. The annual report will be uploaded on SREDA website for disclosure to the public.

3.4.3 Revision of EECMP

EECMP will be periodically revised along with the progress of EE&C initiatives in accordance with the development of EE&C programs. The Government intends to make the next revision in five years: i.e., in the year 2020.

4. Economic Analysis

4.1 Overview

Economic viability of each EE&C measure has to be verified by the cost-benefit analysis; clarifying and comparing its costs and benefits. Although energy consumption reduction is the primary and direct benefit of EE&C measures, secondary and indirect benefits should, in some cases, be taken into consideration in order to justify the costs involved. From the viewpoint of effective allocation of limited resources, the Government will compare candidate EE&C measures and projects according to their cost effectiveness (or costs per unit of energy saved), since the Government has a responsibility in prioritizing allocation of limited resources to economically viable projects and to avoid implementation of projects with less economic values.

4.2 Economic Impact of EE&C Programs as a Whole

By achieving the target of 20% improvement of primary energy consumption per GDP, a total of approx. 66 Mtoe (or 78 billion m³ of gas equivalent) is expected to be saved within the 15 years between 2016 and 2030. The total energy savings in monetary terms will amount to approx. BDT 530 billion in the period or an annual average of BDT 35 billion, at the current weighted average natural gas price². The energy intensity in 2030 will be improved by 20% compared to the 2013 level and the energy consumption in 2030 will be reduced by 17% (or by 12 Mtoe) compared with the BAU case.

² Based on the recent gas tariff proposal, weighted average tariff is calculated as 195BDT/MCF, raised from the current 140.6BDT/MCF. 195BDT/MCF is equal to 6.8BDT/m³ (1MCF = 28.3m³)

4.3 Cost Effectiveness Analysis of EE&C Programs

Energy-saving activities promoted under EECMP will directly affect power supply through reduced power demand. If the power demand can be gradually reduced in the period between 2015 and 2030 to reach 20% reduction in 2030 compared with BAU (i.e., a total of 42 GW reduction), power supply can be saved by 48 GW, which implies that the necessary development of additional power supply capacity can also be reduced by 8 GW from 27 GW to 19 GW. As a result, the amount of imports of expensive fuels for power generation will decrease remarkably: The total energy savings would amount to BDT 2.3 trillion (or an annual average of BDT 135 billion), which is equivalent of 6% of national budget and 1% of GDP (2013).

5. Capacity Development and Awareness Raising

For successful implementation of EE&C initiatives, all the stakeholders such as governmental organizations, private sectors and energy experts should correctly understand the urgency and necessity of EE&C. Close cooperation/collaboration among them is essential as well. Thus, the Government will promote the provision of EE&C awareness raising and information dissemination programs.

The Government will initially lead and take the primary responsibility for the capacity development and awareness raising on the EE&C policies/programs for all the stakeholders. Considering the importance of EE&C for our country, however, such roles can also be taken by relevant private sectors, NPO/NGO and individuals in the long run.

The final goal is for all the people and the establishments to take voluntary take maximum EE&C actions.

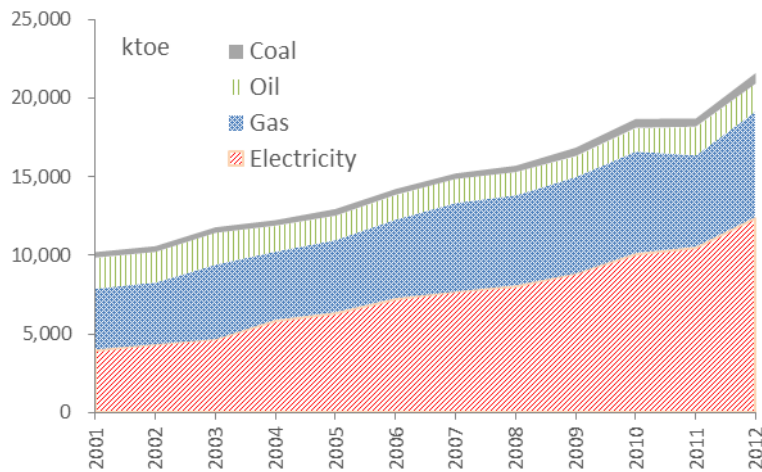
Chapter 1 Introduction

1.1 Background

1.1.1 Energy Demand

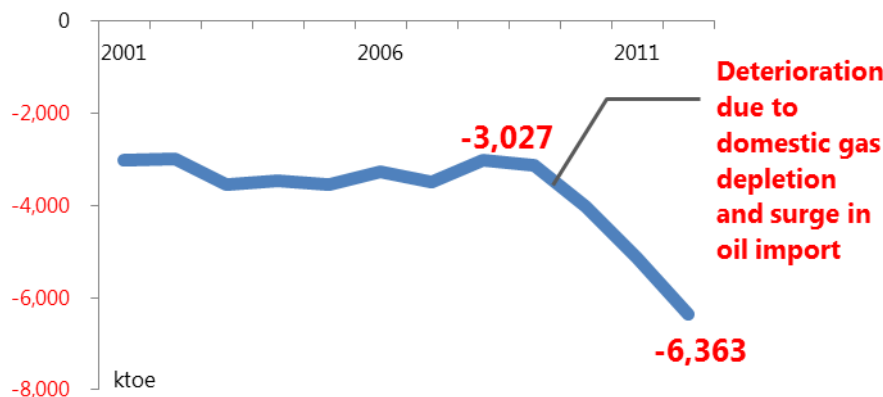
(1) Overall

Per capita energy consumption of Bangladesh was one of the lowest in the world. However, from the macro point of view, the primary energy consumption is increasing steadily, as shown in Figure 1.1-1. The amount of national energy production stands at 27,187 ktoe, whereas the amount of primary energy use was 33,550 ktoe including imported fuel³. As shown in Figure 1.1-2, from the last few years this gap between national energy production and the amount of primary energy use is becoming larger. Along with improvement of Country's economy the industrialization will accelerate which may further deteriorate this situation. Therefore, it is an utmost importance for the Government to take appropriate energy efficiency and conservation measures to reduce the energy intensity.



Source: Compiled by JICA Project Team, based on IEA data, excluding transportation and biomass electricity
1kWh=2,867kcal thermal & efficiency at 30%

Figure 1.1-1 Trend of Primary Energy Consumption by End-use



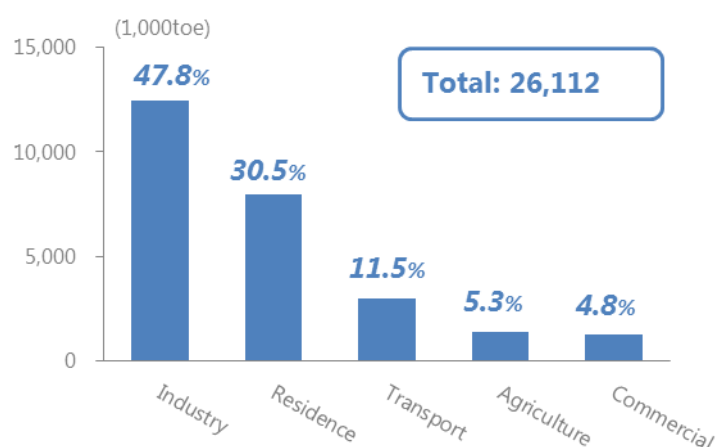
Note: Grid electricity 1kWh= 2,867kcal (efficiency 30%) basis, excluding biomass
Source: Compiled by JICA Project Team, based on IEA country statistics

Figure 1.1-2 Gap between National Energy Production and Primary Energy Use (ktoe)

³ IEA country statistics

(2) Energy Consumption by Sector

Sectorwise (industrial, transportation, commercial and residential sectors) energy consumption in Bangladesh is shown in Figure 1.1-3. The largest energy consuming sector is industry, followed by residential and transportation sectors. Transport sector energy efficiency & conservation issues may be looked after by SREDA at a later stage when it will be equipped with sufficient logistics and man power to work on it.



Notes:
 1. Primary energy basis: excluding biomass
 2. Electricity: 2,867kcal/kWh (thermal efficiency 30% basis)

Source: Compiled by JICA Project Team based on the following data;
 Electricity: 2013-14, Power Cell, Power Division, Ministry of Power, Energy and Mineral Resources | Gas: 2013-14, MIS of Patrobangla, Oil: 2012-13, BPC, | Coal: 2012, IEA

Figure 1.1-3 Primary Energy Consumption by Sector

(3) Energy Consumption by Energy Type and Sector

Gas and petroleum are the main sources of primary energy to meet the energy demand of Bangladesh. Of the total gas consumption, the share of industrial and residential sector are 56.3% and 29.3% respectively. On the other hand, transport sector has the largest share (59.8%) in petroleum (oil) consumption, followed by agriculture (25.8%) and residential sectors (9.0% in the form of kerosene oil). (See Table 1.1-1) The electricity consumption by sector is shown in Table 1.1-2. The residential and industrial sectors occupy the largest shares. Table 1.1-1 Gas and Petroleum Use (Excluding Grid and captive power)

	Industry	Transport	Residence	Commercial	Agriculture
Gas	56.3%	11.6%	29.3%	2.6%	0.2%
	Industry	Transport	Residence	Commercial	Agriculture
Oil	4.9%	59.8%	9.0%	0.5%	25.8%

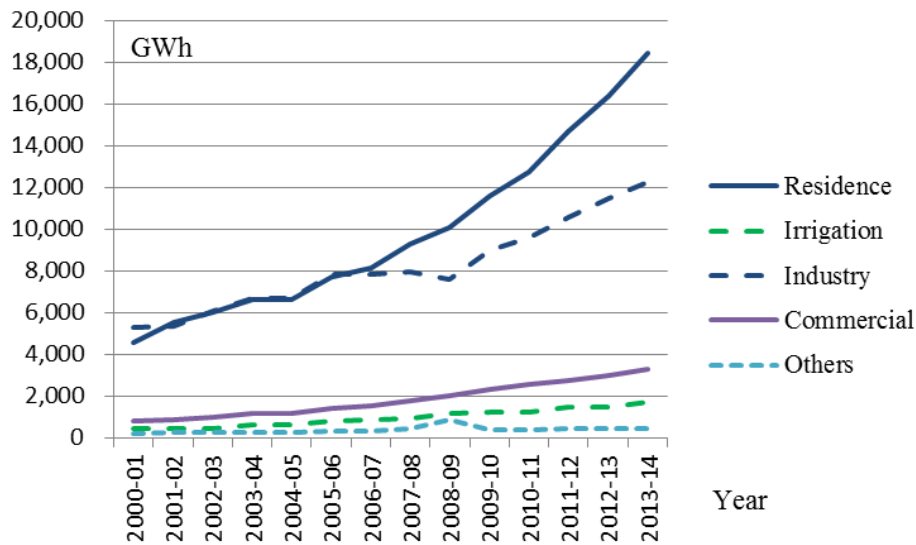
Source: Gas MIS of Petrobangla, 2013-2014, Petroleum BPC, 2012-2013

Table 1.1-2 Grid Electricity Consumption by Sector

	Industry	Transport	Residence	Commercial	Agriculture
Electricity	34.3%	0.0%	51.0%	9.9%	4.8%

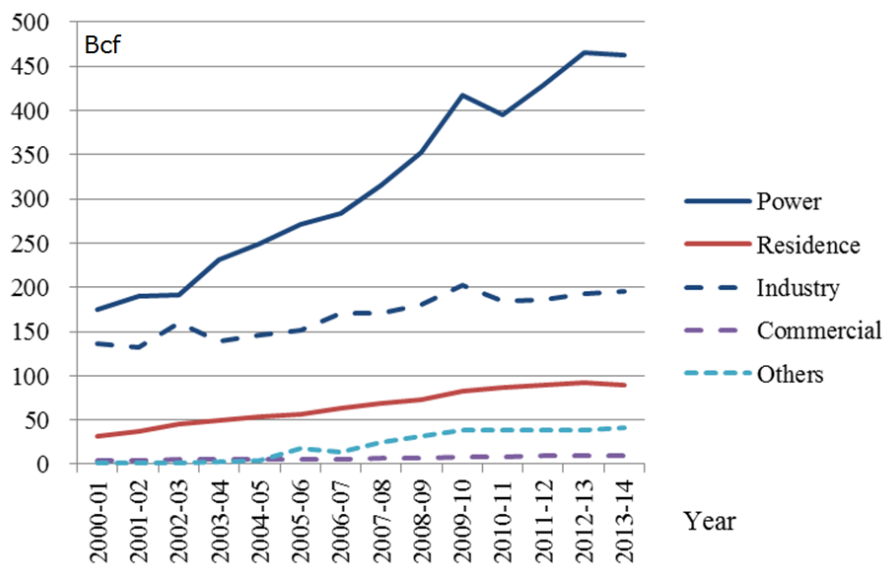
Source: Power Cell, Power Division, MPEMR, 2013-14

Energy supply companies (energy and power suppliers) and industrial sectors are the main consumers of energy and responsible for the increase of primary energy consumption as shown in Figure 1.1-4 and 1.1-5.



Source: System Planning Directorate, BPDB

Figure 1.1-4 Trend of Consumption of Grid Electricity by Sector



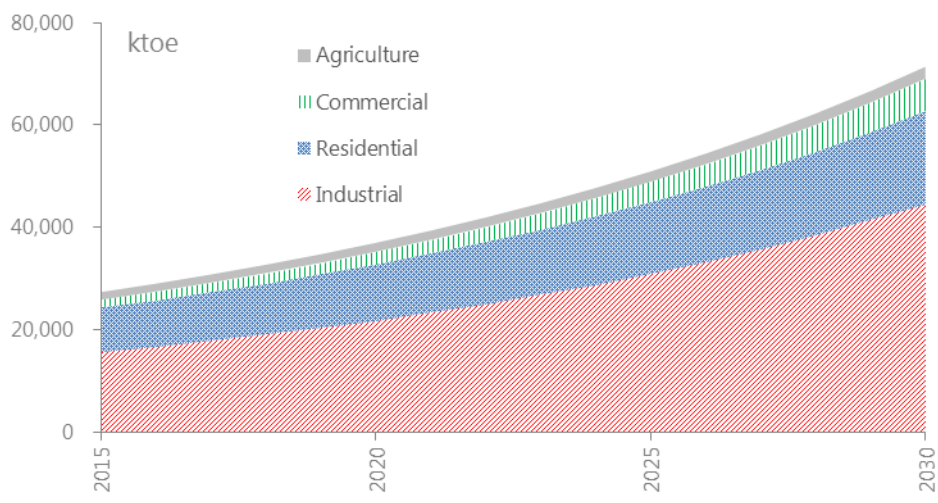
Note: Power includes captive, others includes tea estate, brick field and CNG
Source: Petrobangla database

Figure 1.1-5 Trend of Natural Gas Consumption by Sector

(4) Energy Consumption Forecast up to 2030

The energy consumption

Figure 1.1-6 shows the forecast of primary energy consumption by sector up to 2030 which will be around three times as that of 2013-14.



Source: Compiled by JICA Project Team, based on the present energy consumption data and forecast of future growth rate by sub-sector derived from UNFCCC Second National Communications, Oct. 2012

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Industrial	15,678	16,724	17,854	19,075	20,394	21,822	23,366	25,038	26,849	28,812	30,940	33,247	35,751	38,469	41,421	44,627
Residential	8,772	9,187	9,625	10,088	10,577	11,094	11,640	12,218	12,829	13,475	14,158	14,881	15,646	16,456	17,313	18,219
Commercial	1,516	1,667	1,834	2,017	2,219	2,441	2,685	2,954	3,249	3,574	3,931	4,324	4,757	5,232	5,756	6,331
Agriculture	1,581	1,629	1,678	1,728	1,780	1,833	1,888	1,945	2,003	2,063	2,125	2,189	2,255	2,322	2,392	2,464
TOTAL (BAU)	27,548	29,207	30,991	32,908	34,970	37,190	39,580	42,155	44,930	47,924	51,154	54,642	58,409	62,480	66,881	71,642
TOE/GDP	184	183	181	180	178	177	177	176	175	175	174	174	174	174	174	174

NB. (on table)

Figure 1.1-6 Primary Energy Consumption Forecast for 2030 (BAU Case)

(5) Daily Electricity Load Curve

The daily load curve of electricity has seasonal variation. However, throughout the year the peak appears in the evening. Lighting, TV and the use of other electric appliances in the residential sector may cause the evening peak as shown in Figure 1.1-7. Therefore, the introduction of efficient lighting and electrical devices or gadgets will lead to energy conservation in the evening which will reduce the Peak demand of electricity..

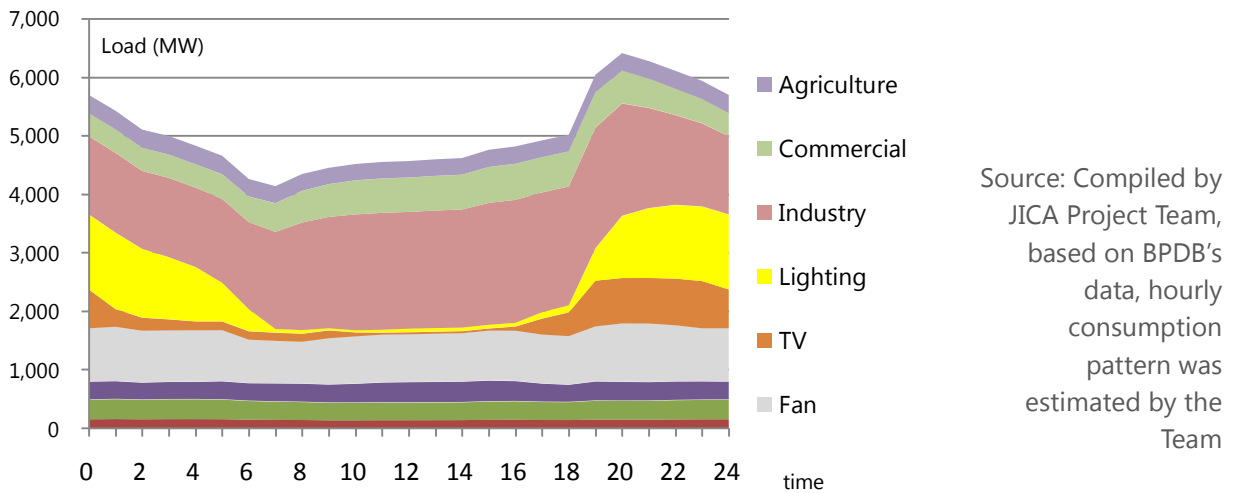


Figure 1.1-7 Estimated Breakdown of Grid Electricity Daily Load Curve (31 May 2014)

1.1.2 Energy Supply

(1) Overall

Bangladesh to date has been able to use its abundant natural gas reserves. As shown in Figure 1.1-8. Around ¾ of our total primary energy consumption comes from natural gas.

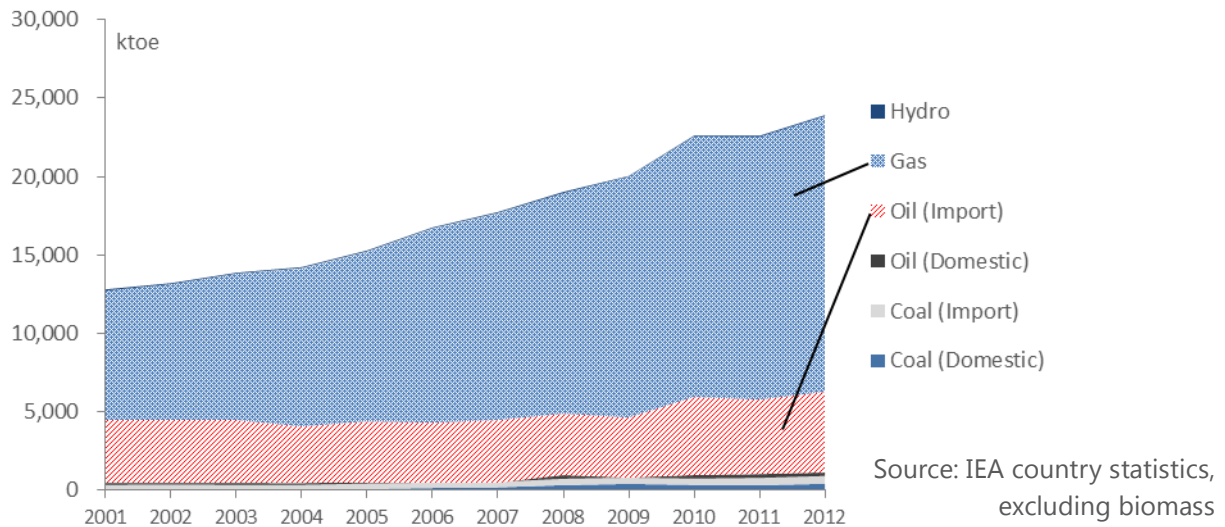


Figure 1.1-8 Trend of Source of Energy Supply

(2) Electricity Supply Trend

Previously the peak load deficit (shortage) resulted in regular load shedding (cut) during the peak hours which were however minimized by substantial increase in generation along with infrastructure development in recent days. Average electricity demand is growing at over 10% per year, owing to rapid economic growth, industrialization, expansion in grid connection and inclusion of new electrical devices and appliances. Due to this rapid increase in power demand, the present peak load deficit

(shortage) might increase in future due to primary energy supply deficit. Introduction of energy efficiency & conservation measures can minimize that adverse situation.

(3) Electricity Generation Fuel Mix

Table 1.1-3 shows the present fuel mix used for electricity generation in our country. As noted, present energy mix for electricity generation strongly relies on fossil fuels.

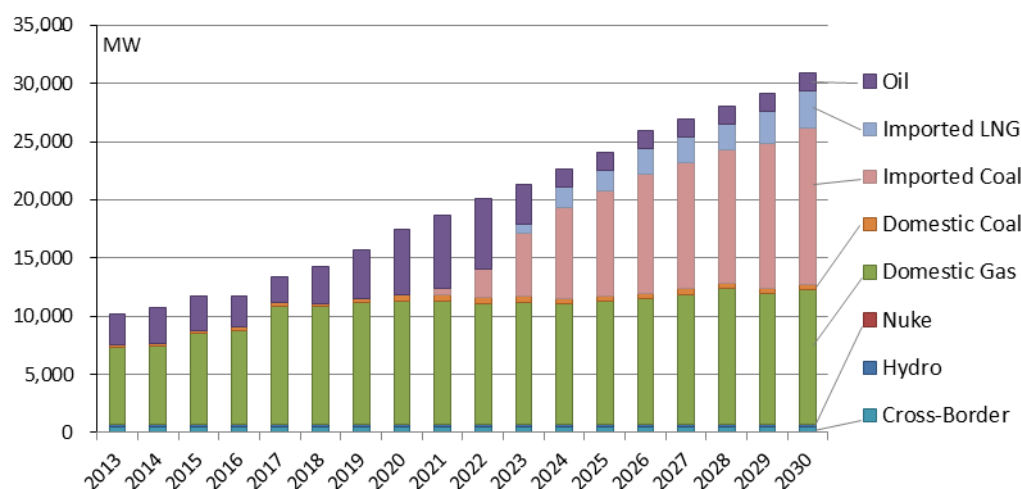
Table 1.1-3 Electricity Generation Fuel Mix (2013-14)

Total	Type	Share
Electricity generation: 42,195 GWh	Hydro	1.39%
	Gas	72.42%
	HFO	15.44%
	HSD	2.91%
	Coal	2.46%
	Import from India	5.37%

Source: System Planning Directorate, MPEMR

(4) Electricity Supply Expansion Plan

It is anticipated that the gas supply will reach its peak in 2018 and gradually decrease thereafter. Therefore, Bangladesh should not go for further gas fired power plants without sourcing the LNG supply or discover new gas reserve. At the same time has to resort to other sources of power generation like oil, coal, renewable and new energy sources as shown in Figure 1.1-9. The Government plans to develop the Matarbari Island area to build ports and facilities which will allow import of coal and LNG for power generations from and after 2021, respectively. The development of other type of power generation (such as nuclear and hydro power generation) awaits negotiation with the neighboring and other partner countries, and seems to come in operation soon. The Government has prepared Power System Master Plan 2010 (PSMP) to improve and expand electricity supply, which is under revision.

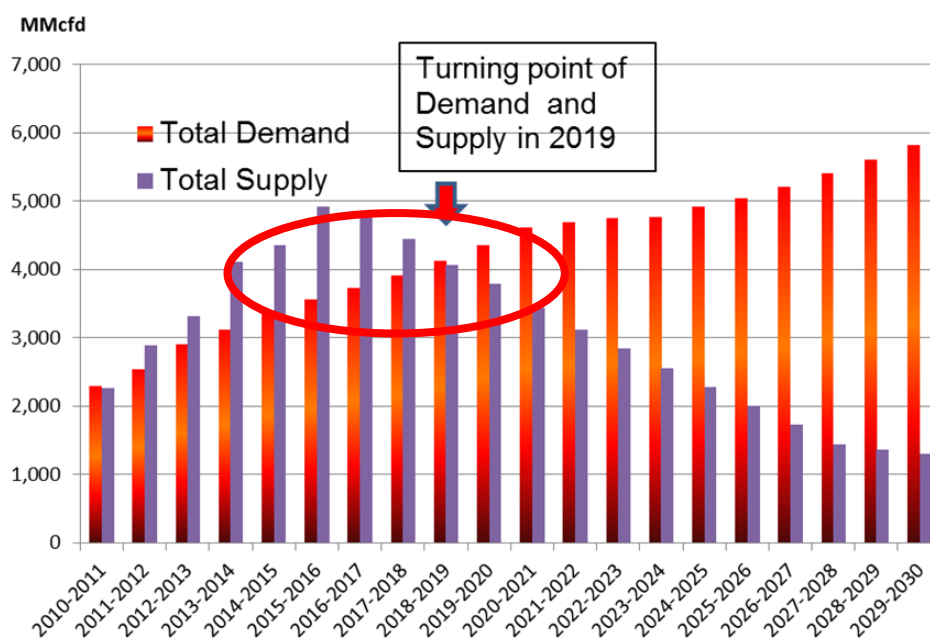


Source: Estimation of JICA expert revising the forecast in Power System Master Plan, 2010

Figure 1.1-9 Forecast of Transformation of Power Generation Resources

(5) Natural Gas Production

Domestic gas supply is expected to increase in the next few years, however it is estimated that it will soon reach the peak production and then decline and the demand will exceed the supply as shown in Figure 1.1-10. This means, country will have to import more energy from abroad in BAU case.



Source: Compiled by JICA Project Team based on the data from

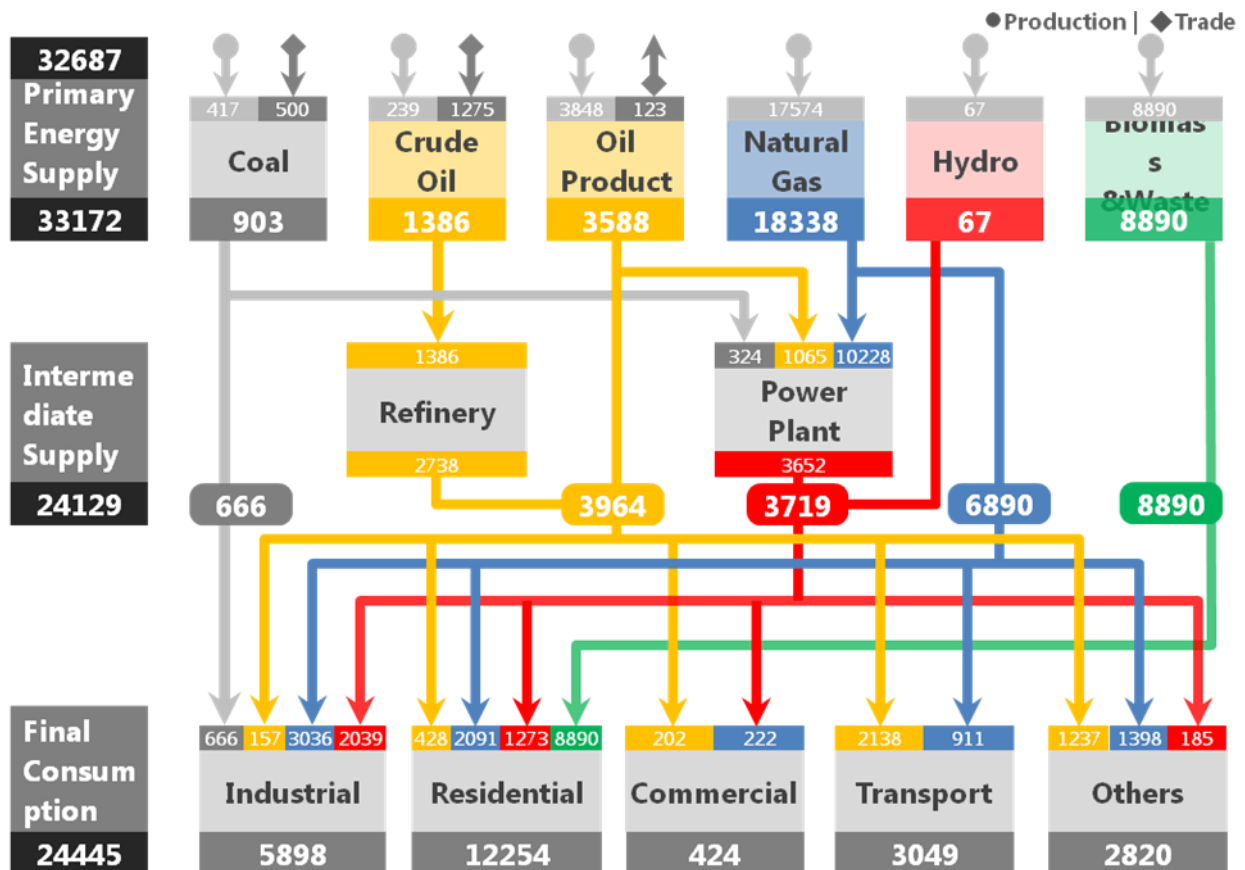
Data collection survey on Bangladesh natural gas sector", 2012, JICA

Figure 1.1-10 Domestic Natural Gas Production and Demand

It is expected that in the EE&C scenario (20% energy efficiency improvement by 2030), the electricity demand by 2030 will be reduced by approx 7 GW compared to the BAU case and cumulative power demand reduction in the period between 2015 and 2030 will amount to 42 GW, with an additional power generation capacity development of 8 GW saved. This will lead to reduce the import of primary fuel for power generation, resulting in a cumulative savings of BDT 2.3 trillion (or an annual average of BDT 135 billion) from 2015 to 2030. This average annual savings is equivalent to 6% of national budget and 1% of GDP (2013).

(6) Energy Balance in Bangladesh

Figure 1.1-11 shows the energy balance of Bangladesh in 2012, based on the data from International Energy Agency (IEA). Primary energy supply of Bangladesh is 33,172 ktoe, of which 55% is dependent on domestic natural gas, followed by 27% of biomass & waste in rural area and 15% of imported oil. On the demand side, out of 24,445 ktoe final consumption, the industrial sector uses 24% and residential sector (excluding biomass & waste) 15%.



Source: Compiled by JICA Project Team based on IEA country statistics (2012 data)

Figure 1.1-11 Energy Balance in Bangladesh (2012)

1.1.3 Global Warming and Bangladesh's Vulnerability to Climate Change

(1) Global Warming Issues

Release of CO₂ is the major drive of Global warming, mainly due to the burning of fossil fuels. The consequence of such warming is being anticipated as a very serious global issue for several decades and has started to raise global awareness mainly after the United Nations Conference on the Human Environment, held at Stockholm from 5 to 16 June 1972.

Since 1988, United Nations created a technical unit, called as the Intergovernmental Panel on Climate Change (IPCC) to study, analyze and make recommendations on how to mitigate global warming, how to adapt human society to live in a warming world, develop means for mitigation and finally how to precisely understand all scientific aspects of climate.

Now a days, significant number of scientific work dealing with Climate Change, has been taken and are available as free literature. Five complete assessments covering Climate Change science, Climate Change adaptation and Climate Change mitigation have been officially published by the UN designated body (IPCC), and several national and international policies are implemented, mostly to mitigate Climate

Change. Unfortunately, as reported in the latest IPCC report⁴, published in early 2014, the world is still following an unsustainable path, regarding the Global Warming issue. In the decade of 2001-2010, CO₂ equivalent emissions have grown faster than in all the previous decades where emission data are available. Keeping the present trend, by the year 2100, average global temperature may be around 4°C above pre-industrial figure, which is by far above globally agreed pledges set at the Cancun COP (Conference of the Parties), which requires global temperature should not increase by more than 2°C above the pre-industrial average, in any date in the future.

Some of the most relevant international action plans, like the Kyoto Protocol, which had its first committed period concluded by the end of 2012, achieved some partial success on GHG mitigation, but shall achieve more modest results under the second period, which are presently in effect. Future international and/or national agreements on a more ample action plan has been agreed, by all participants of the UNFCCC⁵ to be set until the end of 2015, and become effective by 2020. Huge expectations exist that in the COP⁶ to be held in Paris, at the end of 2015, the new agreement will be finalized.

In reality, EE&CMP, is naturally aligned with Climate Change mitigation, which is one of the five mitigation options⁷, identified by IPCC, that is energy efficiency either when using or producing it. What has to be considered in the EE&CMP is how to manage potential conflicts due to the higher cost of clean technologies when compared with traditional ones. Such costs include investment and operational expenses, as well as indirect costs due to social and environment improvements, usually associated with the practice of clean technologies. When performing the full cost evaluation, it is necessary to add investment cost, which probably occurs immediately, with operational, social and environmental costs distributed many years, during the full life of the project.

Furthermore, political and strategic consideration must be included, on top of cost evaluation, for the final decision when embracing a project. The political aspect includes items like the prestige of the country regarding its action on minimizing a global issue, as is the case for Global Warming, the reaction of its population to certain technology or policy and, the possibility of receiving financial reward, from the international community. Strategic decisions shall consider the relevance of a new technology regarding the economic contribution for the country development through creation of new jobs and activities in the country.

In conclusion, it is transparent from the above discussion that all suggested actions must include Climate Change impact analysis, even for countries where the GHG emissions are small compared with the major emitter countries, and that are well recognized internationally as deserving further supply of energy to guarantee its development to reasonable pattern, as is our country's case.

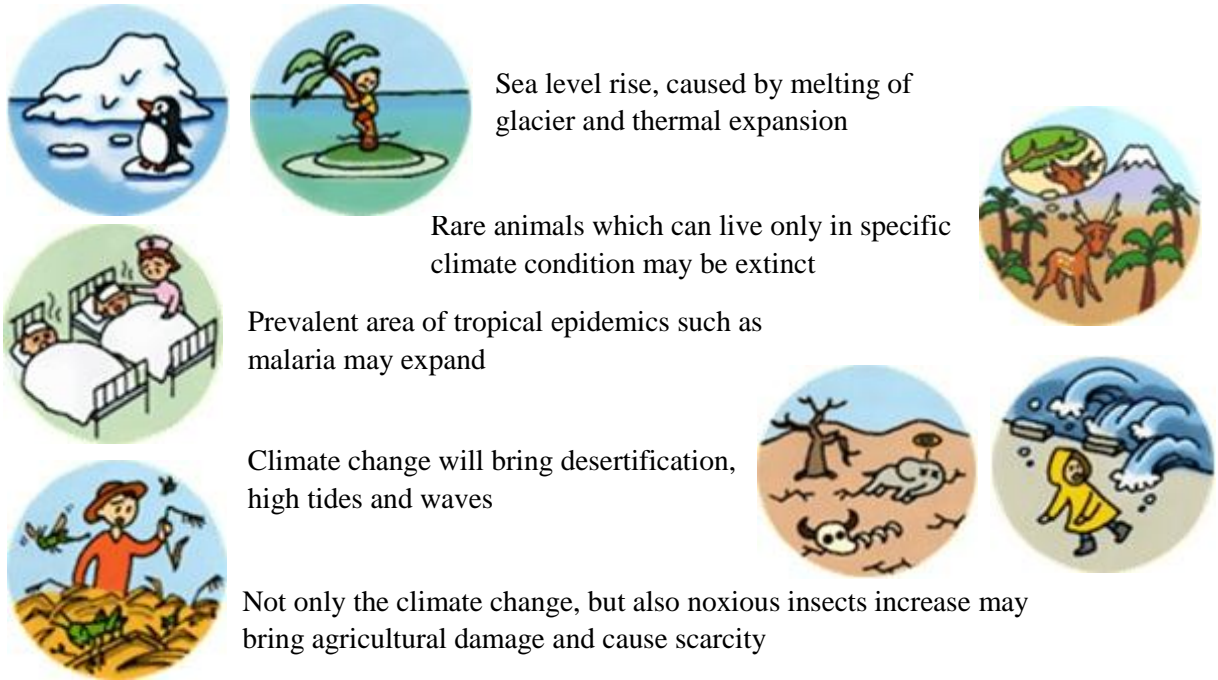
⁴ The Fifth Assessment Report – Working Group III - Mitigation

⁵ UNFCCC = United Nations Framework Convention on Climate Change

⁶ COP = Conference of the Parties is the supreme forum for decisions regarding actions between the more than 190 countries and parties signatories of the UNFCCC.

⁷ The other 4 are: Decarbonisation of fossil fuels, Biological carbon sequestration, More use of renewable energy resources, and Reducing other greenhouse gases from industry, agriculture, waste management

(2) What is Impact of the Global Warming?



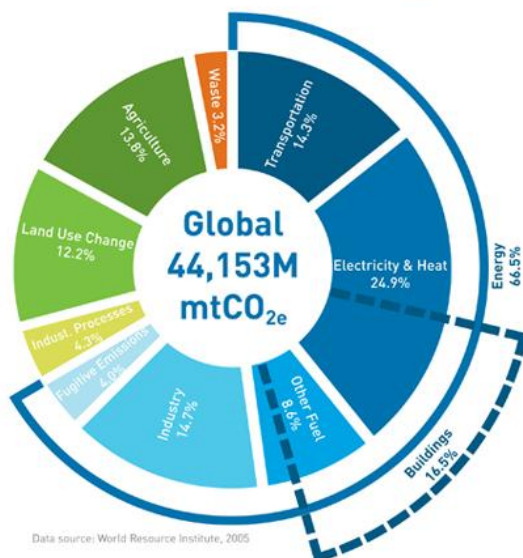
Source: JCCCA (Japan Center for Climate Change Actions) <http://www.jccca.org/english/>

Figure 1.1-12 Impact of Global Warming

(3) GHG (CO₂) Emission in the World

70% of GHG in the world comes from energy consumption. Therefore, EE&C will mostly contribute to global warming countermeasure.

Global Greenhouse Gas Emissions per Sector



Source: <http://greenblog.typepad.com/d41e/global/>

Figure 1.1-13 GHG (CO₂) emission in the world

1.1.4 Necessity of EE&C Implementation and Policy/Program Establishment

There is lack of awareness regarding urgency to save energy among the public and industries under the current situation as GOB subsidizes energy and power sector to lower the costs of fuel and electricity prices for the household and industries. Nevertheless, people and entrepreneurs are wise enough to know the importance of energy saving once they find out the magnitude of economic benefits they can earn, even under the current low energy prices.

It is therefore important for the Government to facilitate the approval, implementation, execution and proliferation of EE&C Programs as well as to create the momentum to promote energy saving activities among all sphere of society through EE awareness raising activities.

Under this EE&CMP, three EE&C programs will be promoted, namely, Energy Management Program, EE Labeling Program and EE Buildings Program, which will be targeted at large energy consuming establishments and equipments in the industrial, residential and commercial sectors. **During the period between 2015 and 2030, a total of 4.4Mtoe/year or an energy saving of over BDT 135 billion/year based on end user energy prices can be achieved through the adoption and implementation of the three EE&C Programs.**

In addition, the Government also consider that, it is important to facilitate EE Finance Program to ensure rapid implementation of EE&C measures by industries & commercial entities as well as residential and building sectors to boost their investments in EE products. Financial incentives such as low interest loans, subsidies and preferential tax will be provided to lessen the financial burden (initial cost) of end users who will purchase high energy efficient appliances and industrial equipments.

1.2 Objective for the preparation of Energy Efficiency and Conservation Master Plan

EE&CMP was drafted to realize the following objectives.

(1) National plan under EE&C Rules

EE&CMP is the supreme plan of national policies on EE&C measures EE&CMP which are indicated in EE&C Rules.

(2) Commitment to implement EE&C measures

EE&CMP shows our country's commitment for EE&C implementation to the nation and also to the world. Therefore, clear EE&C targets, roles and responsibilities of all parties are presented.

(3) EE&C Awareness and Dissemination Tool

EE&CMP should circulate widely, so that Government as well as private sectors can get access and go through this report. For this purpose, the contents are written in easy terms with explanations.

(4) Sorting of Cross-cutting EE&C Policies/Programs and Actions

EE&C actions are to be taken by all relevant establishments including government organization and individuals. EE&CMP shows a systematic structure of EE&C policies/programs, actions and a sorting of cross-cutting EE&C measures.

1.3 Existing Policies on Energy Supply and Energy use Including Acts, Rules, Regulations, Standards, Guidelines and Projects

1.3.1 Overview of Policies Issued

MPEMR, which is the authority to deal with the issues on energy, has issued plans and regulations related to energy & power production, renewable energy, energy efficiency and sector development are shown in Table 1.3-1.

Table 1.3-1 Plans and Regulations Issued by MPEMR

Name of plan/ regulation	Issue date
1. Sustainable and Renewable Energy Development Authority Act, 01 (Act No. 48 of 2012)	10 Dec. 2012
2. Energy Efficiency and Conservation Rules	Initial Draft 22 October 2012
3. Interim Action Plan for Improvement of Energy Efficiency & Conservation (2012-2016)	Final Draft 14 Oct. 2012
4. Action Plan for Energy Efficiency and Conservation	Power Division, MPEMR,
5. The Electricity Act	1910 (under revision)
6. The National Energy Policy	1996 (under revision)
7. Policy Guidelines for the Enhancement of Private Participation in the Power Sector 2008	2008
8. Renewable Energy Policy of Bangladesh	2008 (under revision)
9. Power System Master plan-2010	2010
10. Gas Act 2010	2010

Other government organizations also have issued plans and regulations related to energy and EE&C as shown in Table 1.3-2.

Table 1.3-2 Plans and Regulations Issued by Other Government Organizations

Name	Issued by, date
1. Environment Conservation Rules (ECR) 1997	1997
2. Bangladesh Energy Regulatory Commission Act 2003	2003
3. Bangladesh Climate Change Strategy and Action Plan 2009	2009
4. Sixth Five-year Plan (2011-15)	2010
5. BSTI Ordinance	BSTI
6. GHG emission	MOEF
7. National Building Code	MOHPW

1.3.2 On-going EE&C Programs and Projects

In accordance with the EE&C plans and regulations mentioned above, several programs and projects are on-going as listed in Table 1.3-3:

Table 1.3-3 On-going Programs and Projects

1. National Building Code
2. Text Book Curriculum of schools, madrasas and colleges
3. CFL, T- 5 tube light, electronic ballast
4. Free CFL Distribution program
5. Energy Star Labeling Program (fan, AC, refrigerator, CFL bulb, ballast and electric motors)
6. Efficient Rice husk Parboiling Program
7. Improved Cook Stove Program
8. Improving Kiln Efficiency in the Brick Manufacturing Industry
9. Power & Energy Week program
10. Energy audits by Energy Audit Cell under Electrical Advisor and Chief Electrical Inspector

1.4 Stakeholder's Participation in EE&C Planning and Policy Making

Nobody can live without energy, and all of us have responsibility on rationale use of energy. In order to mobilize EE&C activities nationwide, EE&C policies and programs should be prepared getting as much as opinions and ideas from all concerned stakeholders and building a consensus among them; such as government organizations, individuals, establishments, residences, schools and industries etc.

It is important to hold not only government officials meetings but also open discussion meetings inviting related stakeholders, including those from private sectors. Such manner will shorten the time for wider dissemination of the EE&C plans and regulations to the people and businesses.

For that purpose, the Joint Coordination Committee (JCC) and Working Groups (WGs) for specified EE&C programs, as shown in Figure 1.4-1 were held with the presence of invited stakeholders' representatives. These committees and WGs are expected to hold meetings in the monitoring and reviewing stage, during the program implementation and give further suggestions for effective implementation of EE&CMP. Moreover, open seminars to discuss EE&C measures for wider participants are also effective to raise people's awareness.

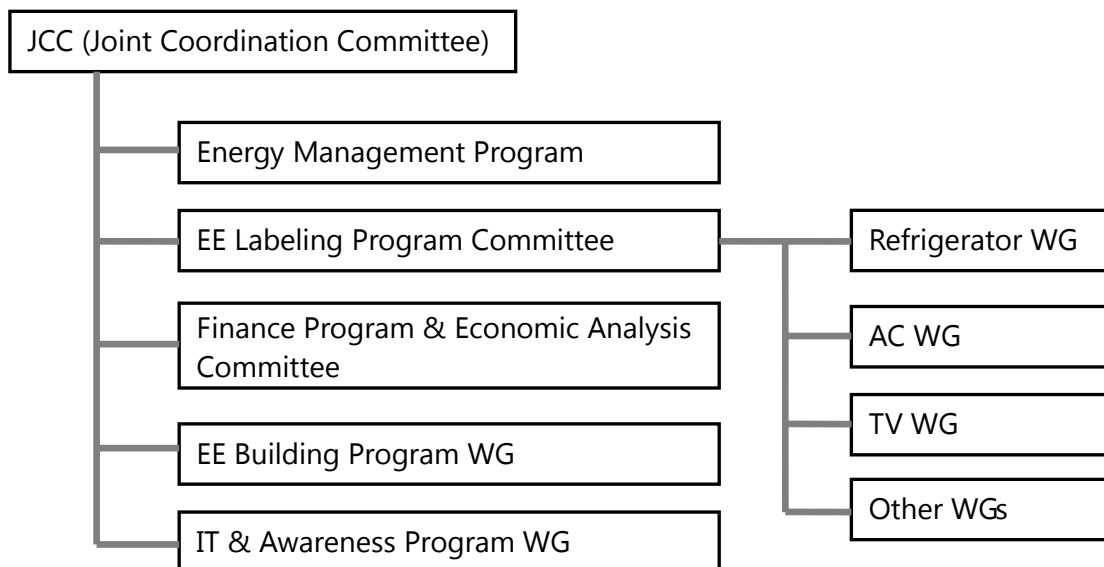


Figure 1.4-1 Structure of JCC, Committees and WGs



1st Seminar (19 Feb. 2014)

1st Energy Management Program Committee (18 May, 2014)

Figure 1.4-2 Scenes of a Seminar and a Committee

1.5 Reference: Energy Conversion, Primary Energy and Secondary Energy

Table 1.5-1 shows energy conversion factors for grid electricity, crude oil and major units to measure heat quantity. The energy balance is mainly checked and discussed not on the secondary but the primary energy⁸ basis. The conversion ratio from the secondary to primary energy is calculated by considering the average conversion efficiency. All types of energy (gas, electricity, coal and petroleum) must be discussed on the primary energy basis by converting energy units into tons of oil equivalent (toe). Table 1.5-2 shows the primary energy conversion factors. Grid electricity heat value is based on end-users' thermal efficiency: 36% (at plant) minus 6% (transmission and distribution loss) = 30%

The table will be reviewed by SREDA from time to time or as and when required.

Table 1.5-1 Heat Value Table (Primary Energy Basis) (Draft)

⁸ Primary energy is a natural energy; such as fossil, hydro, solar and geo-thermal energy. Besides secondary energy is an artificially converted energy; such as electricity, gasoline etc.

	MJ (MJ=10 ⁶ J)	kWh	kcal	kilo liter crude oil equivalent (kl)	ton of oil equivalent (toe)	British thermal unit (BTU)
MJ	1	0.278	239	0.0258×10 ⁻³	0.0239×10 ⁻³	948
kWh (Grid electricity)	12.0	1	2,867 ⁹	0.31×10 ⁻³	0.2867×10 ⁻³	11,370
kcal	0.00419	0.00116	1	1.08×10 ⁻⁷	1×10 ⁻⁷	3.97
kilo liter equivalent crude oil	3.87×10 ⁴	1.08×10 ⁴	9.25×10 ⁶	1	0.925	3.67×10 ⁷
ton equivalent oil	4.19×10 ⁴	1.16×10 ⁴	1×10 ⁷	1.08	1	3.97×10 ⁷
British thermal unit	0.00106	2.93×10 ⁻⁴	0.252	2.72×10 ⁻⁸	2.52×10 ⁻⁸	1

Table 1.5-2 Primary Energy Conversion Factors (Draft)

Type of Energy Source	Unit	Conversion factor		Heat value	
		Numeric	Unit	Quantity	Heat value
Fuel and Heat ¹⁰	Petrol/ octane	kL	0.8295	toe/kL	10,900 Mcal/ton
	Naphtha	kL	0.7521	toe/kL	10,900 Mcal/ton
	Kerosene	kL	0.8248	toe/kL	10,500 Mcal/ton
	Diesel oil	kL	0.8956	toe/kL	8,956 Mcal/kL
	Furnace oil	kL	0.9546	toe/kL	9,546 Mcal/kL
	Liquefied petroleum gas (LPG)	ton	1.06	toe/ton	10,600 Mcal/ton
	Natural gas ¹¹	1,000 m ³	0.8454	toe/1000m ³	8,454 Mcal/1000m ³
	Coal (Domestic)	ton	0.61	toe/ton	6,100 Mcal/ton

⁹ Confirmed in the 2nd EM Committee based on the data from MPEMR: 860/0.30=2,867

¹⁰ Tentatively derived from Japanese conversion factor, and to be revised to Bangladesh ones

¹¹ Source: JICA Power Supply Master Plan 2010

Chapter 2 Master Plan

2.1 Master Plan

2.1.1 Overview

Energy Efficiency & Conservation Master Plan (EE&CMP) is positioned at the summit of all national documents on EE&C plan, regulation and implementation. Figure 2.1-1 shows the basic structure and relation of the policy documents, organization and action plans. We must note that rules and acts are not placed at the summit, but support the EE&CMP.

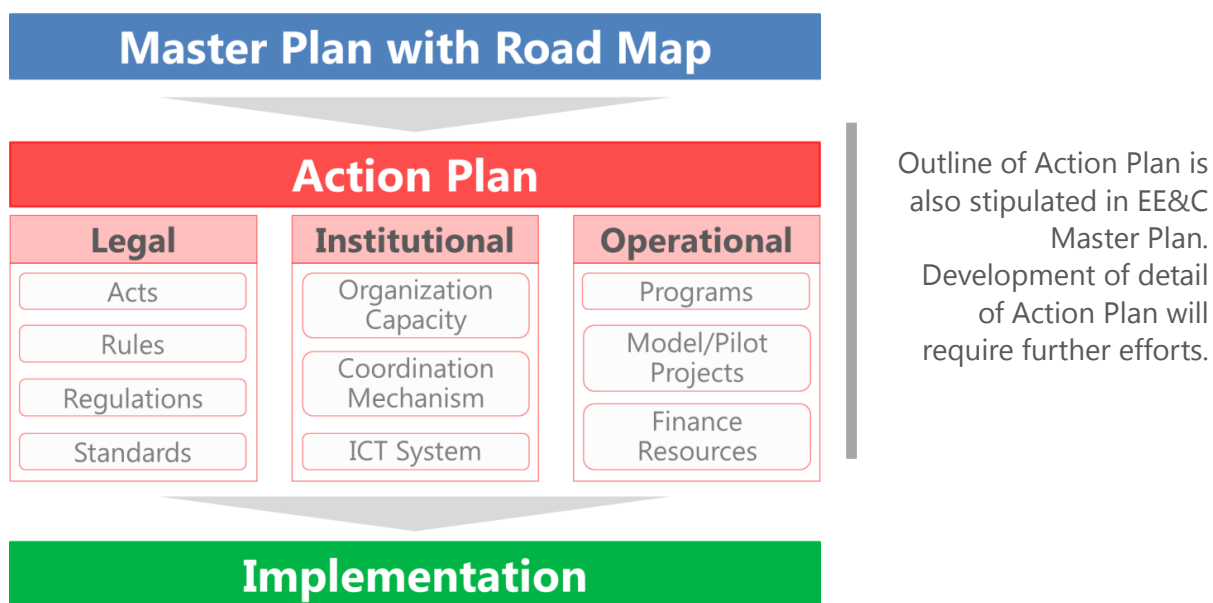


Figure 2.1-1 Structure of EE&C Planning and Implementation

EE&CMP, roadmap up to 2030 and action plans are described. Action plans consist of the basic methodology of EE&C policy implementation, frameworks of programs, outline of standards, rules and regulations, optimum organizational structures etc.

2.1.2 Scope of Plan

Originally, EE&CMP should be formulated, covering all energy consuming sectors in the country. However, in this EE&CMP, industrial, commercial and residential sectors are focused and the transportation sector, utilities (energy supply sector) and energy tariff are not included. These remaining areas will be studied and properly addressed in the next version of EE&CMP. (See Table 2.1-1)

Table 2.1-1 Remaining Areas in EE&CMP

Plan	Major issue	Planner	Issue schedule
Transportation	<ul style="list-style-type: none"> ■ Penetration of high efficiency vehicle ■ Mass transportation system in urban area ■ Energy efficient Electric vehicles 	Ministry of Road Transport and Bridges	TBD
Utilities	<ul style="list-style-type: none"> ■ High efficiency generation ■ Transmission loss reduction, power factor improvement ■ Energy management at energy supply plants 	Power Division, MPEMR BERC	2015
Energy tariff	<ul style="list-style-type: none"> ■ Subsidy reduction ■ TOU (Time of Use) ■ Measurement charge (provision of meters) 	MPEMR BERC	TBD

2.1.3 EE&C Potential

(1) How to Understand EE&C Potential

Before starting EE&C action and/or setting EE&C targets, we must know how we are wasting energy or how much EE&C potential we have. Table 2.1-2 shows the comparison between “Without EE&C” and “With EE&C” case in industrial, commercial and residential sectors. The comparison can be evaluated based on indicators shown in Table 2.1-2

Table 2.1-2 Comparison between Without EE&C Case and With EE&C Case

Item	Without EE&C	With EE&C	Indicator
Production	Inefficient process	Efficient process	Unit energy cost
Lighting	Incandescent lamp	Fluorescent lamp, LED	Lumen/watt
AC	Window type	Split type, inverter type	COP, EER
Thermal power generation	Conventional	Combined cycle, Co-generation	Thermal efficiency
Car	Heavy car	Hybrid car	Fuel efficiency
Life style	Sleep with lights on	Sleep with lights off & Sensor use	Household's electricity charge

Efficient products are increasing in the home appliance market; however their share is quite limited at present. If all existing home appliances in residences were replaced by the highest efficiency products, huge amount of energy reduction can be achieved. This amount is defined as “EE&C Potential”. The observation is similar for the industrial sector. Replacement by the latest EE type production equipment and implementation of perfect energy management will bring large scale of energy saving. Understanding EE&C potential is necessary for recognizing how much energy the country has been wasting and how reasonable and suitable is the EE&C targets.

EE&C potential includes an economically feasible potential and also economically non-feasible or theoretical potential, which cannot be paid back by energy cost reduction.

(2) EE&C Potential in Industrial Sector

The manufacturing industries in our country are not efficient in energy use due to old and poorly-maintained machines and poor energy management. Table 2.1-3 shows examples of energy intensity comparison between our Bangladesh and Japan, where almost all industrial production has the best energy intensity in the world.

Table 2.1-3 Comparison of Industrial Energy Intensities

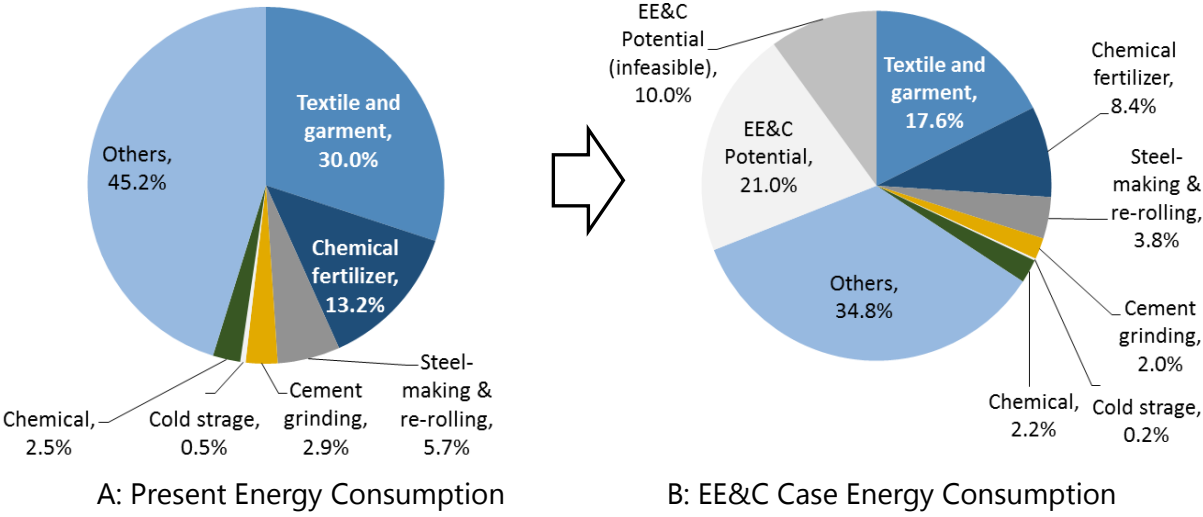
Sub-sectors	Criteria: energy intensity (kgoe/ton)		
	Japanese criteria	Best practice data of energy audit in Bangladesh	
Chemical fertilizer (Urea)	(750)	1,700	Average values of BCIC + KFCO in 2012-2014
Steel-making and re-rolling	130 (Arc furnace)	212 (Induction furnace)	Products: Bar steel
Re-rolling	50	64	Products: Bar steel
Cement kiln + mill	93	130	Material crushing + Rotary kiln + grinding
Cement mill	15	16 (Vertical-Roller mill)	23 (Ball mill)
Print paper	204	210	
Board paper	118		
Soda chemical	82	300	Caustic soda (NaOH)

With regard to EE&C potential in the industrial sub-sectors, through energy intensity comparison and actual on-site energy audits, it was found that our country has a large EE&C potential as shown in Table 2.1-4 and Figure 2.1-2. The EE&C potential is estimated to be around 21% of the entire sector consumption, excluding non-feasible EE&C potential. Considering that about 50% of the national primary energy is consumed in industrial sector, the potential impact of EE&C measures on the economy is massive and it is expected that the national primary energy consumption can be reduced by almost 10%.

Table 2.1-4 EE&C Potential by Industrial Sub-sector

Sub-sector and item	Energy consumption (1000toe/y)	EE&C potential (1000toe/y)
Textile and garment <ul style="list-style-type: none"> ■ Adoption/improvement of: spinning machine, air Jet Loom (Weaving machine), sewing machine, efficient lighting (HF TFL and LED lamp), gas engine waste heat recovery, gas turbine cogeneration, steam boiler waste heat recovery, steam boiler combustion control, once-through steam boiler etc. 	3,740	1,159

Sub-sector and item	Energy consumption (1000toe/y)	EE&C potential (1000toe/y)
Chemical fertilizer ■ Replacement of the old plants with 3rd generation technology plants ■ Waste heat recovery technology and rehabilitation in 4 plants	1,646.3	431
Steel-making & re-rolling ■ Reheating furnace: re-generative burner, combustion control unit, waste heat recovery, heat insulation with ceramic fiber ■ Replacement of induction furnace with arc furnaces	707	156
Cement grinding ■ Replacement with vertical roller mill	358	75
Cold storage ■ Renewal of gas compressor	60	31
Chemical ■ Improvement of caustic soda electrolytic process	310	5
Others	5,626	482
Energy management in all sub-sectors ■ Enforcement of energy management: DCs, EM, Energy audit		1281
Total	12,447	3,620 (-31%) Including Infeasible(10%)



Source: Compiled by JICA Project Team based on the data from gas and electricity distribution companies' data

Figure 2.1-2 Industrial Sector's EE&C Potential

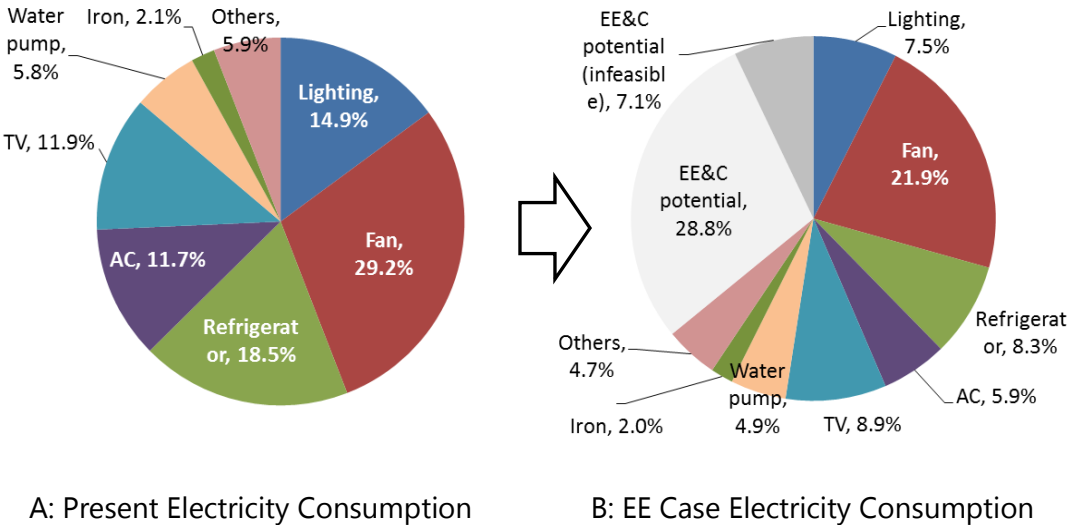
(3) EE&C potential in Residential Sector

Energy efficient home appliances are available at the market; however, their sales shares are still minor compare to inefficient and cheap similar product in the present market. If all existing home electric appliances in residences are replaced with the most efficient products of that kind, a huge scale of energy consumption reduction can be achieved. Table 2.1-5 shows a rough estimation of energy consumption reduction rates (EE rate) by appliance based on the current EE technologies; and Figure 2.1-3 shows the

present electricity consumption by home appliance (A) and EE case electricity consumption (B) using the EE rates given in Table 2.1-5. The total EE&C potential in the residential sector is estimated to be around 28.8%, excluding non-feasible potential. Considering that about 30% of the national primary energy is consumed in residential sector, the potential impact of EE&C measures on the economy is massive: it is expected that the national primary energy consumption can be reduced by almost 9%.

Table 2.1-5 EE Rate and EE&C Potential of Home Appliances

Appliance	EE Technology	Currently Energy Consumption (GWh/year)	EE Rate	EE&C Potential (GWh/year)
Lighting equipment	LED, high frequency FL	3,724	-50%	1,862
Fans	High efficiency motor	6,181	-25%	1,545
Refrigerators /freezers	Variable speed compressor, high performance heat insulation	2,299	-55%	1,264
ACs	High COP with large heat exchanging coil and variable speed compressor	2,237	-50%	1,119
TVs	LCD with LED back light	2,105	-25%	526
Water pumps	High efficiency motor	298	-15%	45
Irons	Thermostat	181	-5%	9
Others		546	-20%	109
Total		17,570	-35.9%	6,479



Source; Surveyed data by JICA Project Team, EE potential is estimated by the Team

Figure 2.1-3 EE&C Potential of Home Appliances

”Others” include home appliances, such as micro wave ovens, personal computers, audios and home-automation appliances, the share of which is still small, but eventually will consume additional electricity. It is important to guide the people to choose energy efficient products when we buy new ones.

(4) EE&C Potential in Commercial Sector (Buildings)

Electricity is the main source of energy consumed within buildings. Around 50% of the total energy is consumed in air conditioning and from 10 to 30% is consumed in lighting. The expected energy-saving potentials under these two categories are as follows:

- Air conditioning: 50% by applying high efficient air conditioners (ACs) with inverter technology
- Lighting: 50% by applying high efficient lighting system, such as LED lamp, T5 fluorescent lamp with electronic ballast or utilizing sun light

It is expected that a simple replacement of ACs and lighting systems with high energy efficient ones can save about 50% of total electricity consumptions in the commercial sector. However it is not easy to introduce EE&C measures for all the buildings. Thus as a realistic value, EE&C potential for buildings was estimated about 10%.

EE&C Potential in Agricultural Sector

Electricity (including captive power) is the main mode of energy in agricultural sector. The largest energy is used for irrigation pumps. EE&C potential for existing pumps is expected as around 20%.

2.1.4 Target for 2030

(1) Indicator to Evaluate EE&C Progress

There are several indicators to evaluate the improvement of future national energy efficiency, such as (a) the actual reduction amount of energy consumption, (b) reduction ratio (value) for future BAU value, (c) energy consumption per capita and (d) energy consumption per Gross Domestic Product (GDP). However there are insufficient data available for structuring (a) and (b) values for our country. Evaluation in terms of energy reduction amount is not easy since the national baseline has to be fixed to assess the future situation. Energy consumption per capita is not suitable for developing countries like our country. Energy consumption per GDP can consider both energy efficiency and national economic growth. In this EE&CMP, the “Primary energy consumption per GDP” is set as an indicator to set EE&C target and evaluate future national energy efficiency.

(2) Present Energy Consumption as the “Baseline”

Present energy consumption situation is summarized in Chapter 1.1.1. A baseline, which indicates nationwide energy consumption, was fixed in order to set EE&C target. The baseline was set on energy intensity basis, which is calculated by “Primary energy consumption and GDP in 2013-14” as shown in Table 2.1-6.

Table 2.1-6 GDP and Primary Energy Consumption in 2013-14

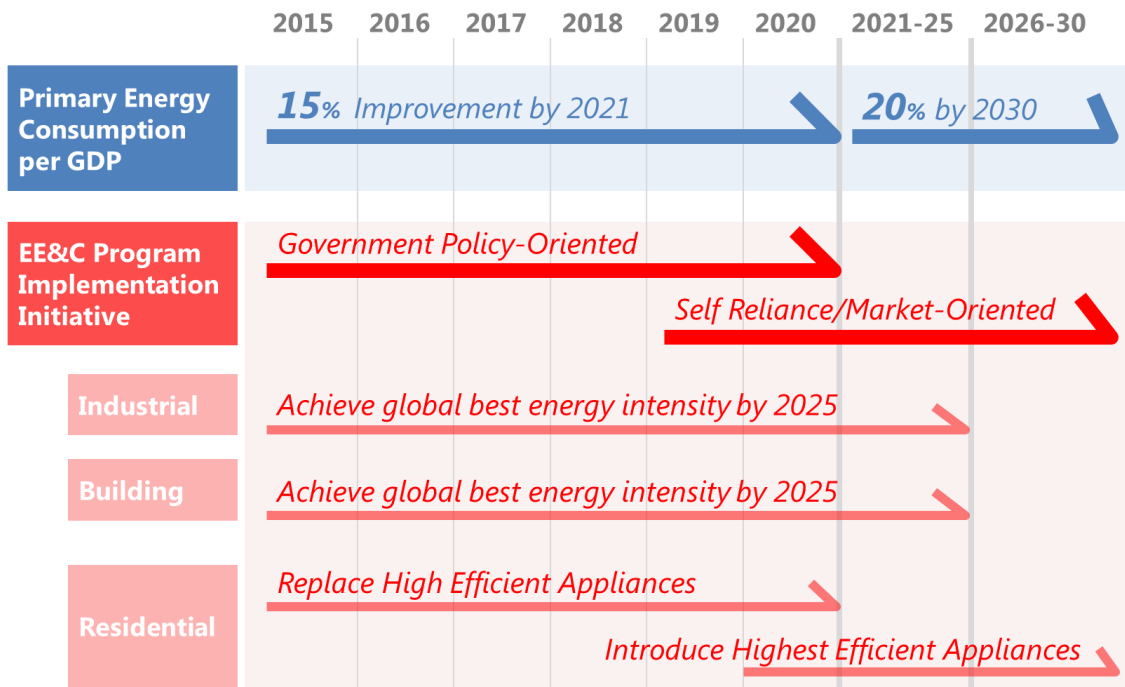
GDP in 2013-14 (billion DBT)	Final energy consumption in 2013-14 (primary energy basis, excluding transportation & biomass) (1,000toe)	Final energy consumption/ GDP (ktoe/ billion BDT)
0,380	24,562	2.37

Source: Compiled by JICA Project Team based on the following data sources: GDP from WB website, energy consumption from mainly distribution companies' data (Oil & coal: 2012-13 data)

(3) Target for 2030

While identifying a huge EE&C potential, practical approach to gradually realize it in a phased manner was taken, since EE&C implementation requires a huge amount of money and time. With the formulation of suitable regulatory measures and incentive mechanisms in accordance with nationwide actions for energy conservation, “primary energy consumption per GDP” can be reduced below 2013-14 level. Here in EE&CMP, EE&C target and roadmap are set as Table 2.1-7. The targets for 2021 and 2030 are set with due consideration of the EE&C potential and current energy consumption status: low electrification ratio, industries’ consumption, insufficient environmental protection measures, improvement in work conditions and modernization of life styles, etc. The final goal of EE&C policies is to realize a self-reliant cycle in which people proactively and voluntarily save energy, rather than through compulsory EE&C activities. It is aimed to accomplish the target for realizing the self-reliant EE&C society by 2030.

Table 2.1-7 EE&C Implementation Roadmap (2015-30)



It is expected that the primary energy consumption per GDP will slightly decrease until 2021 and then gradually increase up to 2030. And in order to achieve the above mentioned target in 2021 and 2030, the following scenarios are to be recognized.

Table 2.1-8 shows the outline of investigated EE&C Scenarios

Figure 2.1-4 shows the forecast of estimated values of primary energy consumption per GDP (toe/million BDT) for both scenarios. EE&C realization rate for the EE&C potential and expected EE&C amount by sector is summarized in Table 2.1-9.

Table 2.1-8 Outline of Investigated EE&C Scenarios (2015-30)

Scenario	Conditions
Target Scenario	In 2016, EE&C regulations will be enforced by the Government, and EE&C measures will be implemented gradually. In 2021 and 2030, primary energy intensity (toe/GDP) will be 15% and 20% less than that in 2013-14 basis, respectively. EE&C realization rates for the EE&C potential is 20-30% and 60-80% in 2021 and 2030, respectively.
Stretch Scenario	In 2016, EE&C measures will be implemented gradually. EE&C realization rates for the EE&C potential is 50% and 100% in 2021 and 2030, respectively (ideal case).

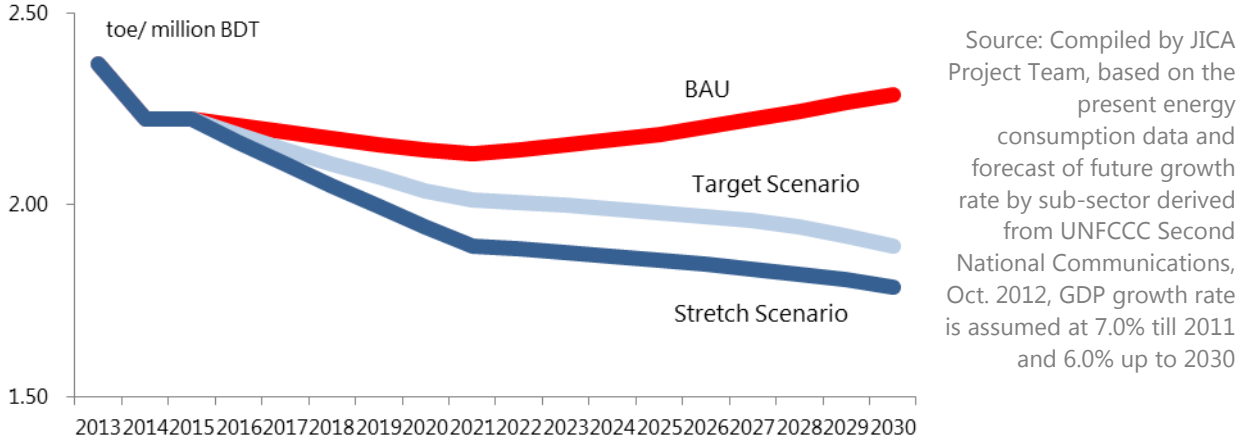


Figure 2.1-4 Future Scenarios of Primary Energy Consumption in 2030 (BAU Case, Excluding Transportation and Biomass)

Table 2.1-9 Efforts Needed to Achieve EE&C Target**Target Scenario**

Sector	Realization rate for EE&C potential		EE&C amount (ktoe)	
	2021	2030	2021	2030
Industrial	30%	80%	1,474	7,497
Residential	20%	80%	670	4,197
Commercial	20%	80%	54	380
Agriculture	20%	80%	75	296
Total			2,273	12,370

Stretch Scenario

Sector	Realization rate for EE&C potential		EE&C amount (ktoe)	
	2021	2030	2021	2030
Industrial	50%	100%	2,453	9,372
Residential	50%	100%	1,676	5,247
Commercial	50%	100%	134	633
Agriculture	50%	100%	188	493
Total			4,451	15,745

2.1.5 Basic policy of EE&C programs to meet target**(1) Approaches to be considered**

Although every member of the society is responsible for energy use, EE&C policies and programs may represent heavy burdens on some establishments and individuals. Following points are taken into account:

- EE&C policies should be applied first on large energy consumers and eventually include small and medium sized enterprises (SMEs).
- The policies should start in a limited scope (narrow range) and expand to wide range, as administrative capacity building fostered.
- EE&C policies should start on voluntary basis and will be shifted to mandatory basis.
- EE&C policies should not be prioritized and enforced without providing basic regulations and measures for ensuring safety for life, health and environment. For example, the pollution control in the industrial sector has not yet been carried out at sufficient level, though environmental equipment (water pollution control equipment) consumes energy. Thus, before applying mandatory energy efficiency label on home appliances, regulation for assuring safety and minimum performance should be provided.
- Keyword is not “reduction of energy,” but “rational energy use.” People need more energy for better and convenient life but without misuse.
- Try all means to assure that correct EE&C goals will be set and achieved by all parties.

(2) EE&C Policy/Program Mix

An efficient EE&C policy/program mix is required to achieve the EE&C target, as shown in Table 2.1-10. These policies and programs have been introduced in advanced and neighboring countries.

Table 2.1-10 EE&C Policy Mix

Policy/Program	Target	Methodology
Energy management by energy consumers	Large energy consumers	<p>“Energy Management Program” includes:</p> <ul style="list-style-type: none"> ■ Designation of large energy consumers ■ Certification of energy managers, certified energy auditors and accredited energy auditors, including their qualification and examinations ■ Mandatory/voluntary energy audits ■ Energy consumption reporting (mandatory) ■ Benchmarking <p>The program will be administrated by the Government</p>
Penetration of high efficiency home appliances/equipment in the market	Residences and commercial sector	<p>“EE Labeling Program” includes:</p> <ul style="list-style-type: none"> ■ Label certification system and laboratory accreditation system ■ Standardization of energy efficiency (EE) measurement method and star rating/labeling criteria ■ Unification and standardization of the EE labels ■ Mandatory/voluntary participation of manufacturers, importers and retail shops in the program ■ Issuance of MEPS (Minimum Energy Performance Standard) <p>The program will be administrated by the Government in cooperation with testing institutes, etc.</p>
Penetration of EE buildings	Buildings	<p>Enforcement of “Bangladesh National Building Code (BNBC) [Revised]” and Introduction of Building Energy & Environment Rating (BEER) which includes:</p> <ul style="list-style-type: none"> ■ Promotion of energy efficiency and conservation in buildings ■ Application to all new constructed buildings, including residential buildings <p>The program will be administrated by the Government.</p>
EE&C financing to the private sectors	Private sector EE&C investments	<p>Provision of financial incentives for EE&C investments, such as:</p> <ul style="list-style-type: none"> ■ Low interest loans for EE&C investment ■ Preferential taxation on EE&C investments including the purchase of high efficiency equipment/appliances ■ Subsidy for EE&C investments ■ Other incentive mechanisms <p>The program will be carried out by the Government jointly with private financial institutions</p>
Awareness raising	General public	<p>The following method will be introduced:</p> <ul style="list-style-type: none"> ■ EE&C awareness program on media, such as TV, publication, internet, etc. ■ Provision of EE&C tips and technologies ■ Intensive education maximizing motivation of educational institutions, and other administrative units etc.
	Students	<ul style="list-style-type: none"> ■ Environmental education at schools

Policy/Program	Target	Methodology
Government's own initiatives on EE&C implementation	Government	The central and local governments will implement EE&C by their own initiatives. The following program will be developed: <ul style="list-style-type: none"> ■ "Green purchase program" which specify the eco-friendly products for governmental purchase ■ Obtaining of ISO14001, 50001 and/or other relevant certification by governmental organizations
Global warming countermeasure	All parties	<ul style="list-style-type: none"> ■ Capacity development
Energy tariffs	Electricity companies and gas companies	Besides collecting the data on actual costs for energy supply, the following matters should be considered: <ul style="list-style-type: none"> ■ Incentives and motivations for effective EE&C implementation ■ Electricity supply peak load shift ■ Financial resources for EE&C implementation

2.2 Roadmap (from 2015 up to 2030)

Overall roadmap up to 2030 is shown in Table 2.2-1. We aim to accomplish the EE&C target, and realize the Self-reliant EE&C Society by 2030.

Table 2.2-1 Overall Roadmap

Fiscal year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30	
Economic growth			7% annual growth					Stable growth	
Primary energy Consumption per GDP			15% reduction				20% reduction		
EE&C implementation		Led by the government						Self-reliant EE&C	
Industrial production process		Catch up with the best energy intensity in the world							
Building energy use		Catch up with the best energy intensity in the world							
Residence		Deployment of high efficient appliance				Use the highest efficiency appliance			
EE&C targeting		Reduction of primary energy per GDP						Absolute value	

2.3 Monitoring and Review of Plan

2.3.1 Follow up Survey on Energy Consumption

Energy consumption data collection mechanism is to be established in order to monitor country's energy consumption accurately. Table 2.3-1 and Table 2.3-2 show the data and collection intervals.

Table 2.3-1 Collection of Energy Consumption Data (Primary energy)

Type	Data	Recommended frequency
Oil	<ul style="list-style-type: none"> ■ Domestic production ■ Import 	Every year
Gas	<ul style="list-style-type: none"> ■ Domestic production ■ Import 	Every year
Coal	<ul style="list-style-type: none"> ■ Domestic production ■ Import 	Every year
Electricity (renewable)	<ul style="list-style-type: none"> ■ Domestic production 	Every year

Table 2.3-2 Collection of Energy Consumption Data (Secondary energy)

Type	Data	Recommended frequency
Electricity (grid)	<ul style="list-style-type: none"> ■ Electricity supply (power generation and sales) ■ Fuel consumption 	Every year
Electricity (off grid)	<ul style="list-style-type: none"> ■ Generation ■ Fuel consumption 	Every 3 years

The data on energy consumptions, energy intensity, GDP, population and industrial production will be attained as shown in Table 2.3-3.

Table 2.3-3 Collection of Data for Energy Intensity

Type	Data	Data source	Recommended frequency
Common data	<ul style="list-style-type: none"> ■ Primary energy consumption ■ GDP ■ Population 	Energy sector's sales data, World Bank and Bangladesh Bureau of Statistics	Every year
Industrial data	Energy consumption and industrial production of the following industrial sub sectors: <ul style="list-style-type: none"> ■ Chemical industries ■ Fertilizer industries ■ Cement Manufacturers ■ Steel and Re-rolling Mills ■ Brick Manufacturing ■ Rice mills ■ Cold Storage ■ Frozen Foods ■ Sugar Mills ■ Paper Mills ■ Jute Mills ■ Textile Mills ■ Garment Industry ■ Sanitary & Tile Merchants 	Energy supply side's sales data and designated energy consumers reports	Every year

Type	Data	Data source	Recommended frequency
Buildings data	Number, floor area and use of buildings	BEER	Every year
	Energy consumption and floor area	Designated energy consumers	Every year
	Maintenance and conservation condition of buildings	Sample survey	Every 3 years
Residential data	Electricity consumption at households	Energy sector's sales data	Every year
	Electricity consumption by electric appliance	Sample survey	Every 3 years

2.3.2 Monitoring of EE&C Programs Implementation

Besides energy consumption data, indicators, which express EE&C programs implementation and achievement of the EE&C target will be collected as shown in Table 2.3-4.

Table 2.3-4 Monitoring for EE&C Programs Implementation

Program	Indicator	Data collection method	Recommended frequency
Energy Management Program	■ Number of designated energy consumers	DCs number, certification of EM, CEA and ACEA	Every year
	■ Number of energy managers and auditors certification		
EE Labeling Program	■ Penetration of EE label	Market researches	Every 3 years
	■ Sales of labeled products		
	■ Energy efficiency		
EE Building Program	■ Number, floor area and use of the buildings attending the building codes or Building energy & environment rating & certification	Research by MOHPW/ Research By (BEER) SREDA	Every year
	■ Energy efficiency	Energy audits	Every 3 years
EE&C Finance Program	■ EE&C investment	Financial institutes	Every year

2.3.3 Report and Review of EE&C Master Plan

The monitoring data will be reported by the Government (SREDA). The report will be uploaded on the SREDA's website.

JCC (Joint Coordination Committee), whose members consist of the governmental organizations and related stakeholders, will hold meetings to review the EECMP. Result of the review must be publicly disclosed on SREDA's website.

Chapter 3 Action Plan

3.1 Overview

EE&C action plan is prepared to describe practical methodology to achieve and accomplish the EE&C target fixed in EECMP, which contains EE&C programs framework and organization structure. The following points are taken into account:

- Distinction between plans and rules: Provision of rules (regulations) is one of the measures to realize the plan, which gives administrative power to the Government and/or clarifies roles and responsibilities of each party (stakeholder).
- Distinction between standards and rules: Rules have administrative power, but standards have no such power. Standard should be provided solely for defining terms and methodologies relating to EE&C programs.
- Universality, adaptability for future changes in social and technical conditions, including EE&C technology development and improvement.
- Document issuance approval processes, authority and responsibility of the governmental organizations in charge, and/or importance of the concerned document.

3.2 Roles and Responsibilities of Participating Parties

3.2.1 Organization Structure for EE&C Program

EE&C implementation program is a multi-sectoral issue and success of this program depends on wider participation of all Government and private sector organization as well as mass people of the country. Several organizations which have specific roles and responsibilities for support and enforcement of EE&C implementation and awareness program as shown in Figure 3.2-1.

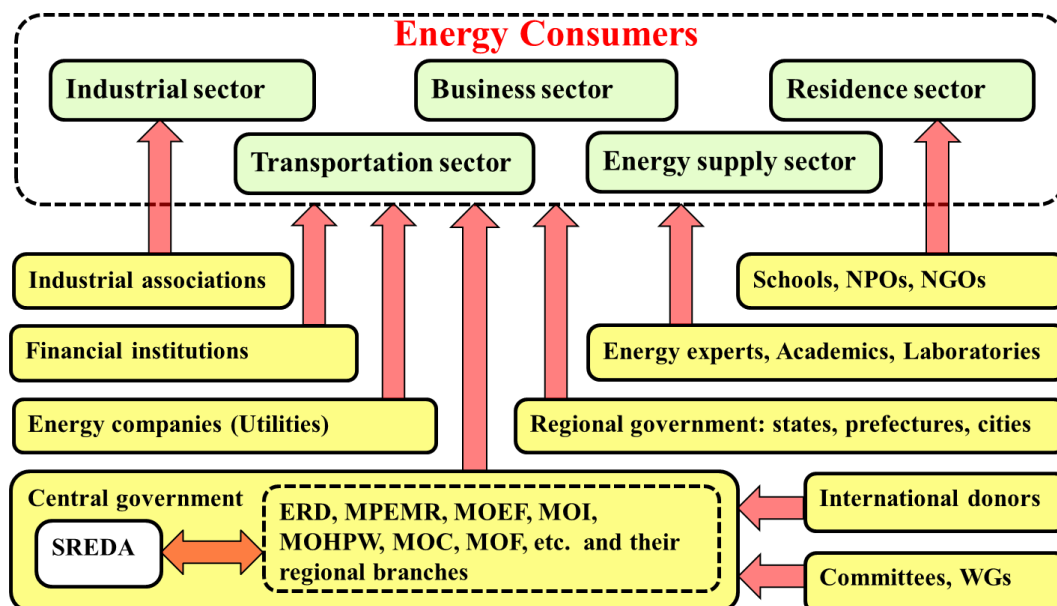


Figure 3.2-1 Organization Structure for EE&C Program

3.2.2 Ministry of Power, Energy and Mineral Resources (MPEMR)

(1) Comprehensive Energy and EE&C Policy Implementation

The Ministry of Power, Energy and Mineral Resources (MPEMR), has a responsibility for the overall planning and development of the energy and electricity sector. The ministry has two separate divisions namely: (i) Power Division and (ii) Energy and Mineral Resources Division, each headed by a Secretary. The Power Division is responsible for the electricity sector including implementation of energy efficiency and renewable energy programs. The Energy and Mineral Resources Division is responsible for up-stream energy activities including exploration and management of natural gas, oil, coal and other mineral resources.

MPEMR also has a responsibility for EE&C on energy/electricity supply and energy tariff as the remaining part of EECMP (for tariff along with BERC).

(2) Multiple EE&C Policies

MPEMR, in order to carry out its mandates, will identify different strategies for successful implementation of EE&C policies including voluntary, mandatory, financial and informational programs, in addition to environmental assessment and provision of infrastructure.

(3) Consideration of EE&C on Other Policies

MPEMR will consider EE&C measures in the process of discharging their duties and during the formulation of any new policies and program within the mandate.

(4) Government's Own Initiative on EE&C Implementation

MPEMR will lead the EE&C programs within and outside the government to achieve desired goal as stated in the EE&C Master Plan, which will ensure energy security of the country.

3.2.3 Sustainable and Renewable Energy Development Authority (SREDA)

(1) Establishment of SREDA

The Government recognized that, to ensure future energy security of the country it is necessary to promote renewable energy and eliminate or reduce the inefficient use of energy. Based on that, Government established the Sustainable and Renewable Energy Development Authority (SREDA) in 2012 as nodal organization to promote, develop, co-ordinate and implement the renewable energy and Energy Efficiency activities in the country.

(2) National Representative on EE&C Policies

SREDA will drive national EE&C programs as Government entity. The following activities will be carried out by SREDA in the process of implementing this Master Plan.

- National information center of energy and EE&C.

- Coordination of EE&C policy and measures among all governmental organizations and also non-governmental organizations.
- Formulation and implementation of Energy Management Program, EE Labeling Program, Building Energy & Environment Rating Program etc.
- Nationwide monitoring of energy consumption and EE&C implementation and its public disclosures.
- Advocacy and awareness raising.

(3) Relevant Activities on EE&C Implementation

Besides the above roles, SREDA will have the following relevant actions:

- Conduct studies, researches, development, piloting, demonstration project and dissemination program for all stakeholders.
- Provide trainings for capacity development at institutional levels.
- Provide advisory services to the private sector, government and non-government organizations.
- Promote local and international experience sharing activities in the field of RE, EE&C for capacity development.
- Arrange finance to promote innovative pilot projects in the country to enhance EE&C coverage in the country.
- Documentation and dissemination of results and information.
- Strengthening consultancy services in the field of EE&C.
- Establish close cooperation with the private sector by creating linkages with appropriate personnel in different establishments at root level and top level. Inter-ministerial focal points etc.
- Development of expertise for successive implementation of EE&C throughout the country.

3.2.4 Other Governmental Organizations

(1) Bangladesh Energy Regulatory Commission(BERC)

The Bangladesh Energy Regulatory Commission (BERC) was formulated under the Act of Parliament in March 2003, with the mandate to regulate the electricity, gas and petroleum sectors. Apart from the other activities, BERC is also empowered to ensure energy efficiency in generation, exploration, production, transmission and distribution levels of the related sectors.

BERC has the responsibility for formulating EE&C plan on electricity supply, which is not included in the EE&CMP.

(2) Bangladesh Standardization and Testing Institute (BSTI)

in absence of SREDA the Bangladesh Standardization and Testing Institute (BSTI) has provided Bangladesh Standards (BDS) on energy efficiency (EE) measures for the EE Labeling Program of 6 electrical appliances under a project financed by UNDP in 2009. The objective of that project was ;

- Issuance of BDSs related to the EE Labeling Program.
- Conduct of energy efficiency tests required for the EE Labeling Program.

(3) Ministry of Industries and Bangladesh Accreditation Board (BAB)

The Ministry of Industry (MOI) is the authority that administers the industrial sector, which is to be involved in the Energy Management Program, EE Labeling Program and other EE&C programs. MOI has the following roles and responsibilities:

- Cooperation in the enforcement of Energy Management Program with SREDA.
- Cooperation in the enforcement of EE Labeling Program with SREDA, especially on encouraging appliance manufacturers' participation on the program.
- Coordination and monitoring of industrial associations on EE&C activities.

Bangladesh Accreditation Board (BAB) belongs to MOI, and is an accreditation body for ISO 9000, 14001 and 50001, which have close relations with EE&C. BAB is expected to have the following roles and responsibilities:

- Accreditation of laboratories for energy efficiency measurement tests based on ISO17025, etc. for the EE Labeling Program (as per their own accreditation received from International organizations for International recognition).

(4) Ministry of Finance (MOF) and Government Financial Institutes

The Ministry of Finance (MOF) is responsible for making budgets for EE&C policy promotion activities. MOF allocates budgets to relevant ministries and governmental organizations which request for financial support. In order to promote EE/RE investments by private establishments, MOF provides on-lending programs through government financial institutions, namely, Bangladesh Bank (BB), Infrastructure Development Corporation Ltd. (IDCOL), Bangladesh Infrastructure Finance Facilities Limited (BIFFL) etc. As a financial vehicle to promote EE&C, the Sustainable and Renewable Energy Development Authority Fund (SREDA Fund) is another option. SREDA Fund can provide finance for EE/RE activities in both private and public sectors. SREDA Fund can be sourced from grants or loans obtained from the Government, local authorities and international donor agencies, as well as earnings from businesses (consultancy fees, etc.).

BB and other Participating Financial Institutions (PFIs) will be the key financial institutions to support EE&C who can handle funds budgeted from MOF and on-lend money to establishments or individuals who need money for investing in energy efficiency (EE) facilities and equipment. Both BB and IDCOL already have experiences as a financial promoter of RE investments. While BB is the central bank of Bangladesh, it also has the role of a development finance institution which provides loans to private-sector businesses via PFIs (Participating Financial Institutions).

(5) Ministry of Environment and Forests (MOEF)

The Ministry of Environment and Forest (MOEF) is the responsible ministry for global warming issues, which must be tightly dealt with energy and EE&C policies. MOEF has the following roles and responsibilities:

- Coordination between countermeasures for global warming and EE&C policies.
- Coordination between the policies related to ozone layer destructive material such as refrigerants used in AC, refrigerator and chilling machine, and high energy efficiency products.
- Provision of regulations on pollution control and waste disposal, applicable to EE&C policies implementation (eccentric EE&C implementation without human life and health care should be avoided).

(6) Ministry of Commerce (MOC)

Penetration of energy efficient products in local market is essential to ensure on time implementation of this Master Plan. For that purpose, The Ministry of Commerce (MOC) has the following roles and responsibilities:

- Encourage the trading of (high) energy efficient products, including removal of NTB (Non-Tariff Barrier) in collaboration with foreign countries.
- Awareness and dissemination to the traders, retail shops and consumers.

(7) Ministry of Housing and Public Works (MOHPW)

The Ministry of Housing and Public Works (MOHPW) has started the enactment of the New Version of Bangladesh National Building Code (BNBC), which can promote EE&C at buildings. Therefore, MOHPW is expected to take following roles and responsibilities:

- To implement BNBC steadily, including continuous updating the regulation.
- To coordinate EE requirement in the building codes with SREDA.
- Awareness and dissemination to the building owners, developers, designers and building users.
- To support SREDA for development and implementation of Building Energy & Environment Rating (BEER).

(8) Ministry of Road Transport and Bridges (MOT)

EE&CMP has been made excluding plans for EE&C on transportation sector. This Ministry of Road Transport and Bridges is expected to take the following roles and responsibilities and SREDA can coordinate and also be involved in the EE&C measures:

- To prepare EE&C plans on transportation sector and add them to the EE&CMP.
- To make coordination with SREDA especially on the level of EE&C requirement.

(9) Ministry of Education (MOE)

Awareness and dissemination of EE&C is the basic policy of self-reliant EE&C implementation. The Ministry of Education (MOE) is expected to be in charge of this field and have the following roles and responsibilities:

- Introduction of EE&C, as one of the themes for environmental education.
- Initial instruction of EE&C to teachers.

- EE&C improvement in schools.
- Promotion of EE&C activities in households through students.
- Promotion of self-reliant EE&C activities of the children.

(10) Ministry of Agriculture (MOA)

Modernization and mechanization in agriculture of the country will accelerate growth in energy consumption. The Ministry of Agriculture (MOA) is expected to take the following roles and responsibilities:

- Educate irrigation consumers as well as concerned organizations staffs.
- Introduce RE based irrigation system on massive scale.

(11) Ministry of Information (MOI)

Media is influential on EE&C awareness and dissemination. The Ministry of Information (MOI) is expected to have roles and responsibilities relating on media's activities in EE&C.

3.2.5 Local Governments

Local governments can play a vital role to formulate and implement EE&C activities and policies to achieve the target of EE&C Master Plan. They are expected to take the following roles and responsibilities:

- Plan, formulate and implement their EE&C policies, with due considerations to social and natural conditions and coordinate with SREDA.
- Plan “Low carbon city” and energy efficient transportation system at all city corporation and municipalities.
- Take initiatives and develop projects on EE&C activities in order to lead and motivate the people and establishments to follow suit. The same EE&C actions are expected to occur in public hospitals, schools and other institutes under the local governments.
- Take more advanced (progressive) EE&C policies .

3.2.6 Energy Supply-side

Energy supply companies are also large energy consumers. Therefore, they are expected to take the following roles and responsibilities:

- Improve energy efficiency through, efficient transmission and distribution systems.
- Give instruction and advisory services on EE&C to energy consumers.
- Collect/analyze energy consumption data and report to SREDA .
- Supply side EE&C measures are not included under EE&CMP.
- Formulate a functional tariff system, in order to provide incentives for EE&C and peak demand shifting.

3.2.7 Establishments (Business Operators)

The establishments of both private and public sectors are expected to take the following roles and responsibilities:

(1) Compliance with EE&C Rules and Regulations

Establishments should keep and follow the EE&C rules and regulations, which will be introduced and scheduled to be officially issued by the Government, such as Energy Management Program, EE Labeling Program and Building Energy & Environment Rating (BEER) Program.

(2) EE&C as a Social Responsibility

Establishments must understand that energy is a social common resource, which should be used fairly and rationally for the general public. They are expected to make plans for efficient energy use, monitor their energy consumption and frequently review the progress of their EE&C Program implementation. They should instruct the employees about rational energy use and jointly improve the activities with the other establishments, associations, unions and central/local governments and also share the information and technologies with them.

(3) Culture and Life-style of EE&C

Establishments are expected to create EE&C culture and life-style and disseminate it to the people.

(4) Preparation for the Coming Energy Price-up

It will be impossible to keep the energy prices in future as cheap as the present which are mainly maintained by the governmental subsidy. Establishments should prepare the society for higher energy prices in near future.

(5) Specific Roles of Establishments

Relating to the EE&C programs introduced in this plan, the establishments should have the roles shown in Table 3.2-1.

Table 3.2-1 Specific Roles of Establishments

Organization	Expected role
Industry and industrial associations	<ul style="list-style-type: none">■ Voluntary energy management■ Appointment of Energy Manager■ Periodical energy audit■ Study and introduction of EE&C technologies■ Experts training■ Employees training

Organization	Expected role
	<ul style="list-style-type: none"> ■ Ensure compliance of benchmark energy usage by industrial sub-sectors and production process
Manufacturers and importers of appliance/equipment	<ul style="list-style-type: none"> ■ Development, promotion and sales of energy efficient products ■ Participation in the EE Standard and Labeling Program ■ Employees training
Building owners, designers and developers	<ul style="list-style-type: none"> ■ Compliance with building codes ■ Development of green building approach ■ Design buildings based on LCC (Life Cycle Cost) and LCCO₂ (Life Cycle CO₂) reduction
Energy importers, traders, dealers	<ul style="list-style-type: none"> ■ Submission of energy trade data to SREDA and/or other authorities
Media	<ul style="list-style-type: none"> ■ Supporting and dissemination of EE&C culture and life-style ■ Voluntary broadcast of EE&C news

3.2.8 People and Society

(1) Better Life with Rational Energy Use

Possession and use of home appliances, such as refrigerators, TVs, ACs, computers and automobiles are rapidly increasing due to economic growth. It is strongly recommended to purchase energy efficient products when people buy new ones. (Social system to mobilize people to choose highly efficient products is to be structured.)

(2) Preparation for the Coming Energy Price Increase

It will be impossible to keep the energy tariff in future as cheap as the present level, which is mainly maintained by the governmental subsidies. The Consumers should understand this situation and properly prepare themselves for higher energy prices in near future. EE&C is the most effective countermeasure.

3.2.9 NPOs and NGOs

- In Bangladesh there are large number of NPOs and NGOs whose functional activities influences people's life. Therefore the NPOs/NGOs need to be motivated to understand in depth EE&C and their capacities to achieve EE&C be utilized accordingly.

They are expected to take the following roles and responsibilities:

- Incorporate EE&C activities into their businesses, services and projects
- Develop new businesses, services and projects related to EE&C

3.2.10 Government and International Development Partners

Government and International Development Partners provide grants, loans, and/or technical assistance for promoting EE&C dissemination for the country. Their roles are defined as follows:

- Long-term and continuous technical and financial support for proliferation of EE&C policy measures.

- Capacity development for EE&C regulators and promoters: including ministry officials, staffs of public and private establishments etc.
- Coordination between government and development partners to guarantee synergism with EE&C activities.

Figure 3.2-2 shows the prospect of the project which have been supported by the development partners in Bangladesh, categorized by policy and financial supports (vertical axis) and demand-side and supply-side EE&C (horizontal axis). As shown at the bottom right of the figure, loans for the purpose of promoting demand-side EE&C seems not be implemented except some small components. Possibility of mobilizing private funds for these untouched areas utilizing policy-based finance will also be needed.

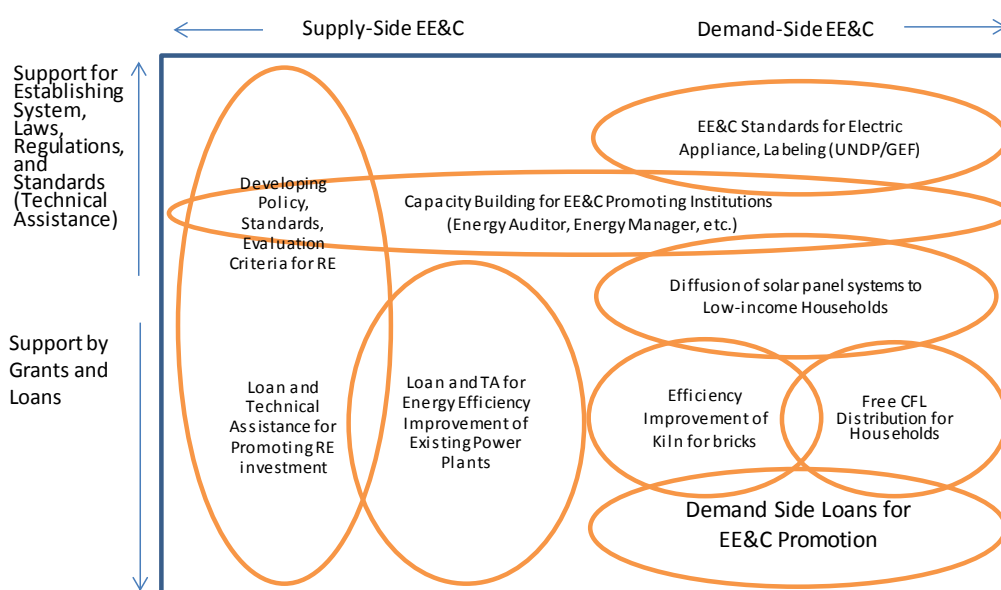


Figure 3.2-2 Projects Supported by International Development Partners (Perspective)

At present, several development partners are actively supporting EE&C activities. ADB (Asia), GIZ & KfW (Germany), JICA (Japan), World Bank, UNDP, and USAID (USA) are among few of them.

3.2.11 Energy Experts

Energy experts who have experiences to work at energy consuming industries and/or have knowledge about energy and EE&C are expected to take the following roles and responsibilities:

- Taking part in EE&C implementation activities.
- Learning and sharing the latest EE&C technologies and developing their own capacity.
- Networking and information sharing among the energy experts.
- Establishing the community of energy experts.

3.2.12 Academics, Laboratories and Researchers

Professionals and researchers who are interested to improve the energy situation of Bangladesh can carry out studies on EE&C issues. They are expected to take the following roles and responsibilities:

- To stimulate young generation to become energy experts.
- To participate in the committees and WGs for EE&C policy making and to give advices & opinions from a neutral point of view.
- To carry out researches and development on the themes for rational energy supply and EE&C.
- To take part in energy efficiency measurement and test for appliances/equipment in laboratory as 3rd party.

3.2.13 Committees and WGs

Several committees and working groups (WGs) will be formulated comprising relevant stakeholders, government organizations and academics to figure out an effective and feasible plan. Committees and WGs are expected to be continuously formulated focusing on the following roles and responsibilities:

- To monitor and review the implementation and achievement of EE&CMP periodically.
- To disseminate EE&CMP and EE&C programs taken by the committees and/or WGs through the industrial associations.

3.3 EE&C Programs (Overview)

Action plans for the major EE&C policies and programs are drafted in this clause. Necessity of policies and programs covering the related situation on energy consumption, program outline and implementation methodology, stakeholders' roles and responsibilities, roadmap and expected outcome are introduced hereinafter.

Action plan for the transportation sector, energy supply sector and the issue of energy tariffs have not yet been included in EE&CMP. Policies on these remaining fields will be studied and issued in future.

3.4 Energy Management Program

3.4.1 Overview

Due to inefficient and old boilers, furnaces and motors used in the industries, a huge amount of energy is being wasted. Recently the electricity consumption is increasing rapidly especially in the residential sector. This sector is responsible for about 50% of the total electricity use while the industrial sector share is 34% and the commercial sector shares 9%.

Gas consumption in industrial sector (including captive power) is increasing rapidly. Since the industrial sector is the largest energy consumer of natural gas and electricity, EE&C implementation in the industrial sector is the highest priority issue. EE&C can be achieved through “energy management”, which includes collection and analysis of energy consumption data, measurement of equipment energy efficiency, calculation of energy intensity, review of production process, plan and realization of EE&C measures etc.

In this context, nationwide promotion of energy management program for industries and buildings is necessary.

“Energy Management Program” is the nationwide EE&C program, enforcing mandatory energy management to the large energy consumers who are designated by the government. Such program has been introduced in many countries.

3.4.2 Overall Structure of Energy Management Program

Overall structure of planned Energy Management Program is summarized in Figure 3.4-1. Large energy consumers in industrial sector (factories) and commercial sector (buildings) will be named as “designated (large) energy consumers” (DCs) by the regulation. They are obliged to implement energy management system (EMS). The energy management system includes (a) establishment of energy management system, (b) appointment of energy manager, (c) compliance to benchmark (energy intensity target) and (d) EE&C reporting to the Government (SREDA). SREDA will develop necessary rules and standards, such as regulation of the program, DC’s designation criteria, energy manager’s/auditor’s certification system and benchmarks. SREDA will also conduct energy consumption data collection/analysis and other supporting services. As utilization of energy and EE&C experts, certified energy auditors and accredited energy auditors will provide commercial base EE&C services to the DCs and other energy consumers.

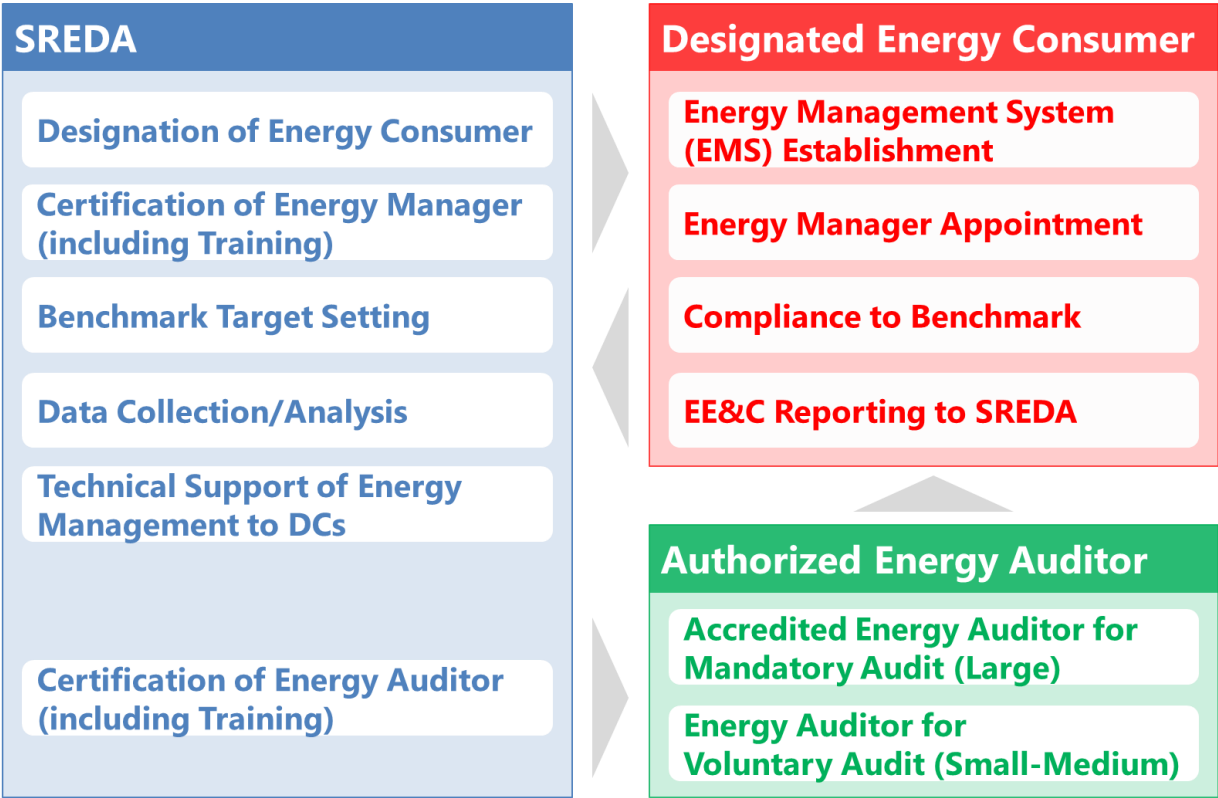


Figure 3.4-1 Overall Structure of Planned Energy Management Program

3.4.3 Designation of Large Energy Consumers

50% of primary energy is consumed in industrial sector and 30% of that is consumed by about 100 large factories. If these large factories can improve energy efficiency by 20%, then national energy consumption

will reduce by 3%. Designated energy consumers (DCs) program aims to improve energy efficiency in large designated energy consumers premises according to the provisions set by SREDA through relevant rules and regulations. The number of DCs is estimated about 100 at the beginning with an aim to increase subsequently.

Designated energy consumers (DCs) are defined by the regulation. Designation criteria of DCs are fixed on the basis of their annual energy consumption; are shown in Table 3.4-1. DCs, whose annual energy consumptions exceed the threshold value, must submit application sheets. DCs' annual energy consumptions are calculated by using the heat value of fuels and primary energy conversion factor of the grid electricity as shown in Table 1.3-4.

Table 3.4-1 Designation Criteria and Number of DCs by Category

No.	Category	Criteria for DCs (Annual energy consumption toe)	Number of candidates for DCs
01	Chemical fertilizer factories	10,000	10
02	Paper and pulp industries	6,000	8
03	Textile industries: - Spinning, Weaving and dyeing,	3,000	15
04	Garments industries	3,000	7
05	Cement factories and clinker grinding factories	10,000	14
06	Iron and steel (rerolling mills)	10,000	23
07	Chemical and pharmaceutical industries	6,000	9
08	Glass industries	6,000	5
09	Ceramic industries	6,000	9
10	Transportation terminals (including seaports, airports, stations)	3,000	2
11	Commercial and institutional buildings (including office buildings, hotels, shopping malls, hospitals, educational facilities)	3,000	10
99	Other Industries and installations as published by government notifications	3,000	1
Total			113

Source: Estimation by JICA Project Team

3.4.4 Energy Management in DCs and Other Energy Consumers

DCs are obligated to conduct “mandatory energy management” in their factories and/or buildings according to timeline set in the EE&C Rules, in order to implement EE&C measures. Other energy consumers are also expected to conduct energy management. The mandatory energy management consists of the following elements:

(1) Establishment of EMS (Energy Management System)

DCs must establish EMS, which includes the following actions:

- Setting up EE&C target and establishing energy management team (group).
- Appointment of full-time energy manager.
- Implementation of EE&C activities according to EE&C promotion plan.
- Conducting energy audits according to the provision of energy audit regulation .
- Following the EE&C target and certain criteria including benchmarks, minimum energy efficiency standards and specific technology requirements.
- Conducting training on EE&C activities for management and employees.
- Accreditation of ISO 50001 is welcome. It will be recognized as the establishment of EMS.

(2) Appointment of Energy Manager

Energy managers are responsible to run EMS and conduct EE&C actions in the factory and/or buildings including in-house energy audits. The energy manager in DCs must acquire a national certificate of “energy manager”.

(3) Energy Audit

Energy consumers will implement energy audit for their facilities or buildings periodically. DCs must submit energy audit reports to the Government (SREDA). The energy audit will be done by certified energy auditors. In case of large DCs, the energy audits must be done by “accredited energy auditors”.

(4) Annual Energy Report

DCs must prepare annual energy reports and submit them to the Government (SREDA). SREDA will evaluate the trend of energy efficiency improvement in terms of energy intensity as well as management for five consecutive years. The annual energy reports will contain the followings:

- Total energy consumption (by source of energy, i.e., fuel, heat and electricity).
- Name, outline, operating condition and modification of energy intensive equipment.
- Energy efficiency and productivity level (related to output measured through the production volume).
- Energy intensity trend for 5 years.
- Identification of appointed energy manager.
- Annual EE&C plan including the measures and targets as shown in Table 3.4-2.
- Medium term EE&C plan including the measures and targets as shown in Table 3.4-2.

Table 3.4-2 EE&C Improvement Plan

Type of plan	Target setting	Obligation
Annual EE&C plan and targets	Covers EE&C improvement plan of 12 month from the submission of the annual energy report containing the short term EE&C measures	To submit revised improvement plan to SREDA if the targets were not met for two consecutive years.
Medium term EE&C plan and targets	Covers EE&C improvement plan up to 36 months from the submission of the annual energy report	To submit revised improvement plan to SREDA if the target is not met or if downward revisions of the target

Type of plan	Target setting	Obligation
	containing the medium term EE&C measures. The plan may be reviewed and revised on rolling basis.	were to be made for more than three times during the planned term period.

3.4.5 Certification of Energy Manager, Certified Energy Auditor and Accredited Energy Auditor

The Government (SREDA) will establish the national certification system of energy managers, certified energy auditors and accredited energy auditors, the details of which include the followings:

- Training program
- Examination
- Setting eligibility criteria for energy manager, energy auditor and accredited energy auditor. .
- Disclosure and maintenance of personnel list of energy managers, certified energy auditors and accredited energy auditors.

Participation of a large number of eligible candidates to the national certification system is expected. Industrial sector, academics and relevant parties should identify and appoint the candidates.

3.4.6 Benchmarking

Benchmark is the target value of energy efficiency, which will be defined for the large energy consuming sub-sectors with specific processes, such as steel-making, cement, paper & pulp, soda chemical etc. Benchmark is described in kgoe/ton of production or floor area (m²). Since the manufacturing processes of these industries are the same as those of the other countries in the world, their energy intensity data are comparable to those of other countries in most of the cases.

Periodical energy consumption and production data will be reported to SREDA by an annual energy report. Factories which attained the remarkable progress in energy efficiency improvement will be awarded by the Government (SREDA).

The industries qualified for the benchmarking at the initial stage of implementation are shown in Table 3.4-3, with their benchmark indices and target levels. Target level figures in the table are the references based on international data. The real target levels for Bangladesh industries shall be decided through discussions between manufacturers and SREDA.

Table 3.4-3 Benchmark Target Level by Industrial Sub-sector

Sector	Benchmark index	Target level
Normal steel-making by high frequency induction furnace	(Energy consumption in steel-making) / (crude steel production) + (Energy consumption in rolling) / (rolled steel production)	212 kgoe/t or less
Normal	(Energy consumption in rolling) / (rolled steel	50 kgoe/t or less

Sector	Benchmark index	Target level
steel-making by re-rolling mill	production)	
Cement manufacturing with rotary kiln	(Energy consumption in raw material) / (clinker production) + (Energy consumption in burning) / (clinker production through burning) + (Energy consumption in finishing) / (Cement production) + (Energy consumption in delivery) / (Cement and clinker volume delivered)	93 kgoe/t or less
Cement manufacturing by grinding process	+ (Energy consumption in finishing) / (Cement production) + (Energy consumption in delivery) / (Cement and clinker volume delivered)	16 kgoe/t or less
Printing paper manufacturing	(Energy consumption) / (Production)	204 kgoe/t or less
Board paper manufacturing	(Energy consumption) / (Paper production)	118 kgoe/t or less
Soda chemical	(Energy consumption in electrolysis) / (Caustic soda weight in electrolysis bath) + (Steam consumption in condensation) / (liquid caustic soda weight)	82 kgoe/t or less

Source: Data provided by Prof. Ijaz, BUET

Target level will be changed with the increase of EE technologies

Finally, benchmark will be decided by SREDA in energy audit regulations including voluntary targets and the future mandatory targets (with penalty systems).

3.4.7 DCs' Energy Consumption Data Collection System

(1) Objective

DCs are obligated to report their annual energy consumption and EE&C actions to SREDA. SREDA will develop "Periodical Energy Consumption Reporting System (PRS)" which has the following objectives:

- To support DCs in making the reports, understanding their own energy consumption and reviewing EE&C actions.
- To monitor DCs' EE&C actions and make administrative instructions, if necessary.
- To aggregate energy consumption data by sector and sub-sector, calculate energy intensity and understand nationwide energy consumption and EE&C implementation trends.
- To utilize the data for the benchmarking program.
- To disclose accumulated data to raise awareness and ensure dissemination of EE&C actions.

(2) Energy Data Reporting

Energy data to be reported is shown in Table 3.4-4. Each datum listed in the table below is collected annually. Besides annual energy consumption, monthly consumption data will be also reported optionally.

Table 3.4-4 Reporting Items

Items	Content
Electricity	Grid generated, Captive power generated
Liquid fuel	Petrol/Octane, Naphtha, Kerosene, Diesel oil, Furnace oil
Gaseous fuel	Natural gas, LPG, LNG
Solid fuel	Coal
In the case of factories	Production or Service activity and their volume
In the case of buildings	Floor areas
Energy intensity	Energy consumption(toe) per unit production or floor area Changes in energy intensity data for the past 5 years
Main energy consuming equipment	Name, Specification, Present status

Figure 3.4-2 shows a reporting scheme of the periodical energy report

Energy managers will prepare annual energy report under the CEO's supervision. Energy manager can submit the report to SREDA by either of the following methods.

Method -1: Energy managers will login the Energy Reporting page of SREDA website with LN (login name) and PW (password), and input the energy data in the decided format of each establishment.

Method -2: Energy managers will send prepared paper report to SREDA directly or by mail. Submission by e-mail will be permitted. The data is fed to computer by SREDA officers after due checking.

Energy consumption data are sent to Data Base (DB) server and accumulate. The DB data are processed as statistical graphs and disclosed on the energy consumption statistics page of SREDA website. It will be accessible to anyone with a PC, tablet or smart phone.

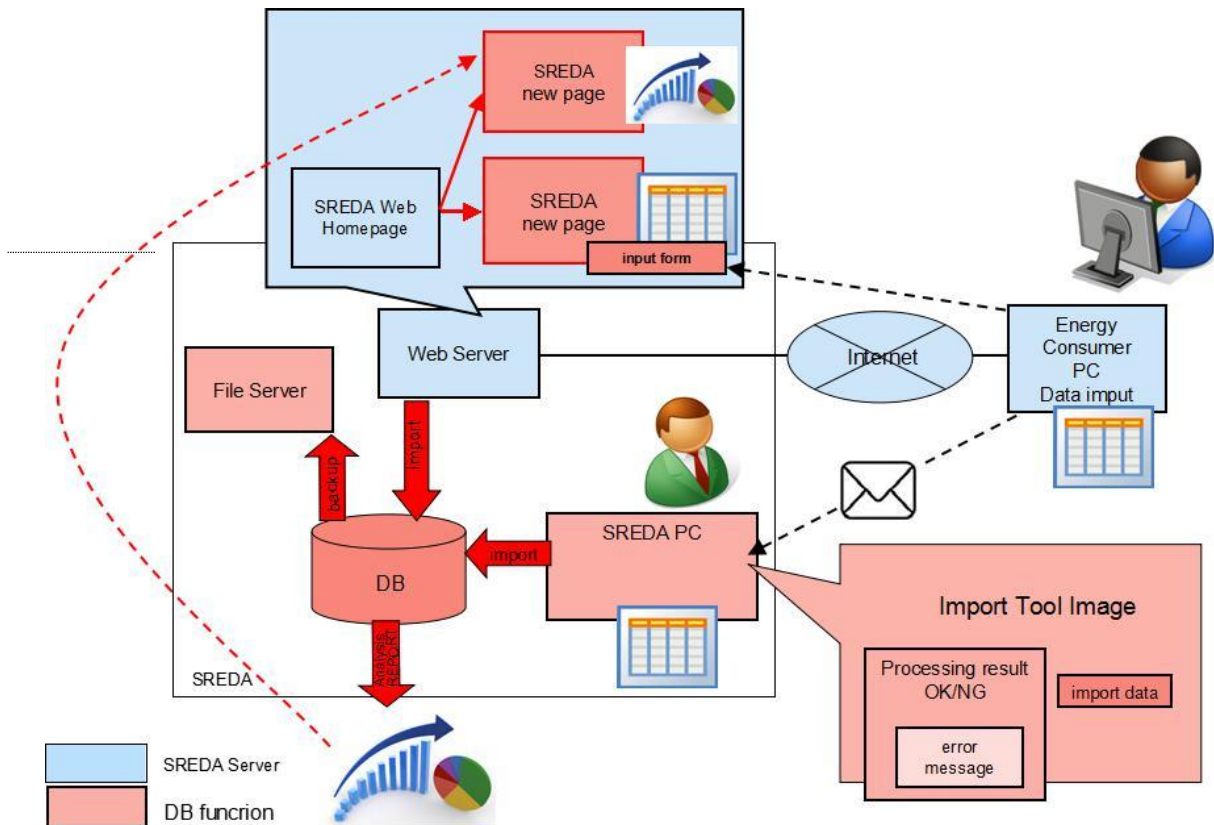


Figure 3.4-2 Periodical Reporting System in 2014

3.4.8 Roles and Responsibilities of Energy Management Program

Roles and responsibilities of each participating party in the program are summarized in Table 3.4-5.

Table 3.4-5 Roles and Responsibilities under Energy Management Program

Party	Roles and responsibilities	
SREDA	Legislation	<ul style="list-style-type: none"> ■ Issuance and enforcement of the regulation
	Designation	<ul style="list-style-type: none"> ■ Identify and declare the DC and monitor their energy consumption. ■ Collection of EE&C reports
	Energy manager/auditor	<ul style="list-style-type: none"> ■ Prepare Energy Manager and Auditor's Certification process ■ Issue Certificates ■ Provision of training programs
	Follow up	<ul style="list-style-type: none"> ■ Analysis of EE&C reports ■ Benchmarking process
	Support	<ul style="list-style-type: none"> ■ Rental of energy measuring instruments and tools
Establishments	Comply to designation	<ul style="list-style-type: none"> ■ Prepare Report on energy consumptions ■ Self-declaration as a DC ■ Submission of EE&C report to SREDA
	Energy management	<ul style="list-style-type: none"> ■ Assignment of energy managers ■ Establishment of EMS (Energy Management System) ■ Energy management including in-house annual energy audits ■ In-house training of energy management

Party	Roles and responsibilities	
	Follow up	<ul style="list-style-type: none"> ■ Reporting ■ Benchmarking results
Energy manager, Energy auditor, Accredited energy auditor	Certification EE&C implementation	<ul style="list-style-type: none"> ■ Issuance of certificates ■ Operation of EMS ■ Energy audits
Industrial association	■ Voluntary benchmarking	
Energy experts	■ Participation in the training and examination programs	

3.4.9 Check and Review

- Designation criteria of DCs will be reviewed every 3 years.
- Qualification criteria of energy manager and auditor will be reviewed on regular intervals (e.g., once in every 3 years)
- Examination of energy managers and auditors will be reviewed every year (or every alternate year)
- Benchmarks such as energy intensities will be reviewed every 3 years.

3.4.10 Roadmap up to 2030

Roadmap up to 2030 for the Energy Management Program implementation is shown in Table 3.4-6. Targeted coverage ratio (as a percentage share of the total energy consumption), which is expected to be achieved by introducing the regulatory measures below, is shown in Table 3.4-7.

Table 3.4-6 Energy Management Program Implementation Roadmap

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Formulation of rules and Regulations	→	<ul style="list-style-type: none"> ▼ Issue of EE&C Rules ▼ Issue of regulations on EM program 					
Designated large energy consumers (DCs)		→	▼ 100 factories		500 factories	1000 factories	
<ul style="list-style-type: none"> ■ Dissemination of the program ■ Designation of DCs ■ Appointment of EM ■ Submission of annual energy report ■ Energy audit by ACEA 				→	→	→	→

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30	
Benchmarking ■ Energy consumption data accumulation ■ Publication of result and awarding			→					
Certification of EM ■ Formulation of Certification Committee ■ Preparation of reference book, training, written test ■ Training, test and certification	→	→	→	→	→	→	→	
Certification of EA ■ Formulation of Certification Committee ■ Preparation of reference book, training, written test ■ Training, test and certification	→	→	→	→	→	→	→	
Certification of ACEA ■ Formulation of Certification Committee ■ Preparation of reference book, training, written test ■ Training, test and certification		→	→	→	→	→	→	
Periodical Energy Consumption Reporting System (PRS) ■ Development ■ Trial operation ■ Operation	→	→	→					

Table 3.4-7 Targeted Coverage Ratios of Energy Management Program by Industrial Sub-sector (shares in total energy consumption)

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Chemical soda			30%			50%	70%
EE&C measures			EMS				
					EE equipment		

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Chemical fertilizer			30%			50%	
Cement			30%			50%	
Steel-making & re-rolling			30%			50%	70%
EE&C measures			EMS			Heat recovery	
Brick (Factory size is small)							10%
Glass						50%	
Chilling food & cold storage						50%	
Pulp & paper				20%		50%	
Textile			30%			50%	
Garment			30%			30%	
Sanitary and tiles industry (Factory size is small)			20%			30%	20%

3.5 EE Labeling Program

3.5.1 General

The purpose of EE Labeling Program is to promote sales of energy efficient products in the market. The program is applied mainly on home appliances such as AC, refrigerator, TV, light, and fan. Due to the rapid economic growth, the number of home appliances, which will be purchased by the people, will expand remarkably in the coming years. In order to achieve the EE&C target by 2030, the average efficiency of each home appliance is expected to increase by 20-30%. And it is considered that the EE Labeling Program is the most effective measure to promote EE&C in the residential sector.

Penetration of energy efficient appliances contributes not only to the reduction of energy consumption (kWh), but also to the reduction of electricity demand (i.e., peak load demand in kW) as well as carbon emission.

Table 3.5-1 shows energy efficiency improvement rates of the latest EE&C technology on home appliances/equipment compared with the conventional technology.

Table 3.5-1 EE&C Technology of Home Appliances/Equipment

Appliance	EE&C technology	Improvement of efficiency
Room Air Conditioner	Large evaporation coil Inverter drive COP: more than 4.0 Efficient at partial load	Example: COP; 2.5 - 4.0

Appliance	EE&C technology	Improvement of efficiency
Refrigerator and freezer	High performance heat insulation, high efficiency compressor	Annual electricity consumption, comparing similar type 10 year old ;1:3
TV	LCD, LED back light, standby mode	Electricity consumption CRT: LCD = 2:1
3 phase induction motor	High efficiency motor	Efficiency gain: 10-50%
Lighting fixture	CFL, LED, T-8 FL	Electricity consumption Incandescent: CFL = 4:1

Note: COP means co-efficient of performance; consumed kW/ input kW
CFL means compact florescent lamp

Bangladesh has joined BRESL (Barrier Removal and Cost Effective Efficiency Standards and Labeling) Program under UNDP, and has already started EE Labeling Program. However, the current label program has limited impact on the market, because elements of the program, as shown in Table 3.5-2 has not yet been sufficiently and suitably prepared. SREDA should develop and prepare the missing elements promptly.



Source: BSTI

Figure 3.5-1 Bangladesh EE Label

Table 3.5-2 Elements for the EE Labeling Program

Element	Description
EE measurement method	Unified measurement method for energy efficiency (EE) is needed in order to evaluate and compare the EE performance of the products fairly. Measurement method includes EE indicator (unit), test protocol, test facility, measurement devices, and EE calculation method. The method must be issued as Bangladesh National Standards (BDS) or quoted by international standards such as ISO/IEC.
Star rating criteria/Energy Labeling Criteria	Criteria for giving star numbers/energy labeling on measured EE performance are necessary. The criteria must be designed according to EE&C policy and market condition. MEPS (Minimum Energy Performance Standard) can be included in the criteria. The criteria must be issued as governmental notice or Bangladesh National Standards (BDS).
EE verification system	Verification system to maintain credit of the labels is needed. EE data

Element	Description
	used in the labels must be checked by some authority.
EE testing laboratory	Capable laboratories, which can conduct EE measurement tests, are needed for the program. National laboratories, international 3 rd party laboratories and manufactures in-house laboratories can also be candidates (subject to fulfillment of all criteria).
Program operation body	Authority that conducts the label certificates issue, monitors labels in the markets, provides programs information, reviews star rating criteria and follow-up EE products market penetration.

3.5.2 Overall Structure of EE Labeling Program

Overall structure of planned EE Labeling Program is summarized in Figure 3.5-2. Verification system assuring reliability of the label and product EE performance are to be included.

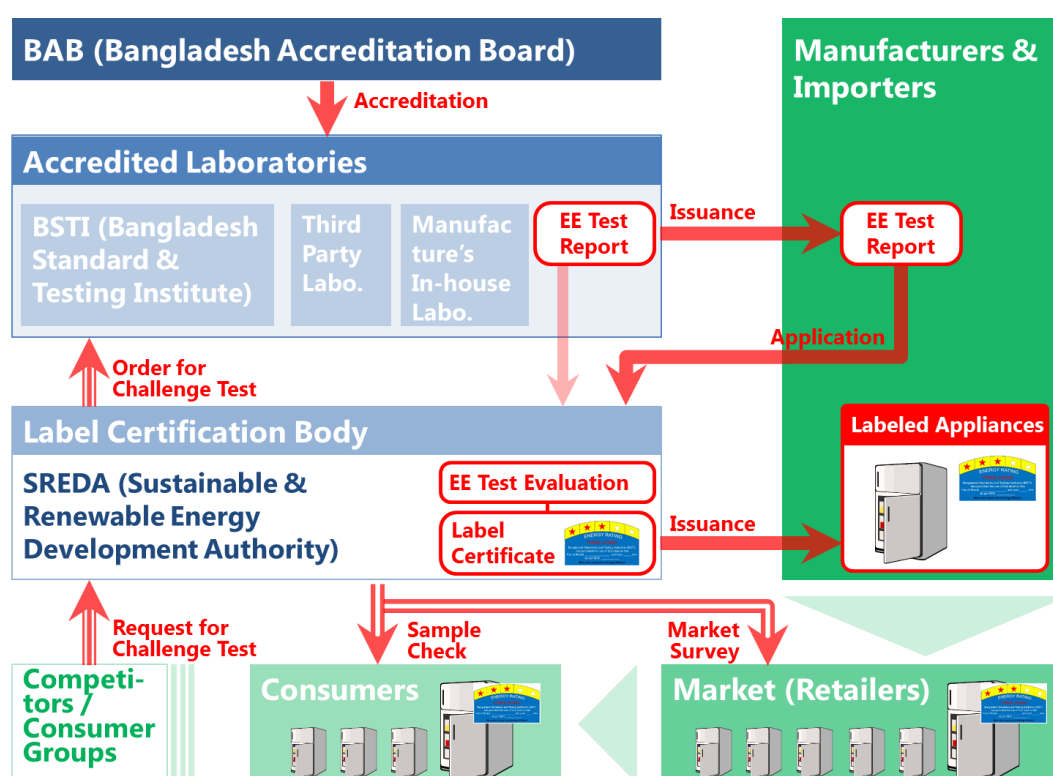


Figure 3.5-2 Overall Structure of Planned EE Labeling Program

Program operation procedure is as following:

- 1) Manufacturers/importers will get EE test on their products at accredited laboratories.
- 2) Accredited laboratories should have been accredited by BAB through ISO17025 etc.
- 3) Manufacturers/importers which have in-house laboratories can get EE test at their laboratories, provided laboratories are accredited by BAB.
- 4) Label certification body will evaluate the EE test report and issue label certificate on the product with star or similar kind of rating, and delivers it to the manufacturer/importer.
- 5) Manufacturers/importers will affix the label on the products or their packages, and deliver them to the markets.

- 6) Label certification body will carry out EE check tests for the products sold in the market collecting samples at random, in order to maintain labels reliability.
- 7) Anybody can claim challenge test to the label certification body with appropriate fee to cover the test and other administrative cost.

3.5.3 Laboratories Capacity Development and Accreditation

Sustainable participation of the testing facilities must be accompanied with periodical maintenance, calibration, skilled personnel and demand of EE tests. Capacity development for skilled personnel needs proper training and experiences, especially in case of refrigerator and AC. BSTI will develop its testing ability. On the other hand, BAB must issue accreditation for the eligible laboratories by accessing laboratories' test facility, staffs and quality. Therefore, BAB may be adequately equipped with knowhow/knowledge about testing procedures.

3.5.4 Products EE Database

In order to provide energy efficiency data of home appliances to customers, it is effective to construct a "product EE database", which shows not only energy efficiency and stars in label, but also capacity, size, performance and other product information. The database will be developed and maintained by SREDA.

3.5.5 Harmonization with International and/or Regional EE Labeling Programs

Many countries have their own EE Labeling Program and label design. Some countries have 5 star rating, 4 star rating, and others have 7-10 star rating. Also EE measurement methods (standards) are different by country. To break through this chaos-like situation, regional and/or worldwide discussion to harmonize the standard and labeling (S&L) has started. SREDA can join in this movement, analyzing neighboring countries' and world trends to establish their EE Labeling Program properly. Also, SREDA must study "mutual recognition agreement (MRA)", which can rationalize laboratory accreditation system in cooperation with other countries.

3.5.6 Roles of Parties (Stakeholders)

Many parties are expected to take parts in the EE Labeling Program. Their roles are summarized in Table 3.5-3.

Table 3.5-3 Roles of Parties (Stakeholders)

Party (stakeholder)	Role
SREDA	<ul style="list-style-type: none"> ■ Total management of the program ■ Issue of star rating criteria ■ Label certification, as requested by manufacturers ■ Provision of products EE database ■ Analyze neighboring countries trends, and join in the harmonization

Party (stakeholder)	Role
BSTI	<ul style="list-style-type: none"> ■ Provision and maintenance of BDS on EE measurement ■ Harmonization with other countries ■ EE test in 3rd party laboratory
Directorate of National Consumer Rights Protection (DNCRP) of MOC	<ul style="list-style-type: none"> ■ Promotion of EE products trading
Manufacturers and importers	<ul style="list-style-type: none"> ■ Join in the program ■ Compliance on the regulation of the program ■ Development of EE products ■ Instruction (explanation) of EE performance to customers
Retail shops, traders	<ul style="list-style-type: none"> ■ Understanding of the program ■ Instruction (explanation) of EE performance to customers
Customers	<ul style="list-style-type: none"> ■ Understanding of the program ■ Selection of EE products
3rd party laboratory	<ul style="list-style-type: none"> ■ Join in the program ■ Obtain accreditation on EE tests
BAB	<ul style="list-style-type: none"> ■ Accreditation of laboratories on EE test
EE Labeling Program Committee	<ul style="list-style-type: none"> ■ Review of the program ■ Recommendation on BDSs and renewal of star rating criteria

3.5.7 Check and Review

Sales data of the labeled and efficient products will be collected by market researches. The target monitoring items are shown in Table 3.5-4 and 3.5-5.

Table 3.5-4 Monitoring of Programs Implementation

Item	Indicator	Interval
EE Labeling Program	<ul style="list-style-type: none"> ■ EE labels penetration ■ Sales of labeled products ■ Energy efficiency achievements 	Every 3 years
People's awareness on EE label	<ul style="list-style-type: none"> ■ Is the meaning of label understood? ■ EE products procurement promotion 	Every 5 years
Energy consumption at households	<ul style="list-style-type: none"> ■ Energy consumption by appliance and equipment ■ Penetration of EE products 	Every 5 years

Table 3.5-5 Check and Review Points on Program Implementation

Item	Point
EE measurement method	<ul style="list-style-type: none"> ■ Comparison with other countries for harmonization
Star rating criteria	<ul style="list-style-type: none"> ■ Suitability of star rating criteria, relation to advanced EE technology, penetration of EE products and domestic manufacturers' capacity.

- The criteria will be gradually up-graded.

3.5.8 Roadmap up to 2030

The EE Labeling Program will initially start as voluntary program. Because mandatory program needs full provision of EE testing services, which is also requested by manufacturers and importers, who are obligated to get EE products data but do not have their own test facilities. It will require long time and budget for the provision of test facilities from the EE&C administration side. In case of the voluntary program, manufacturers and importers can join the program, if they have in-house laboratories or they can outsource EE test to some 3rd party laboratories. Roadmap up to 2030 for EE Labeling Program implementation is shown in Table 3.5-6. Targeted energy efficiency (EE) by appliance, which is expected to be achieved by EE Labeling Program, is shown in Table 3.5-7.

Table 3.5-6 EE Labeling Program Implementation Roadmap

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Regulation Framework		▼ Issue: July 2016					
Phase 1 : Room AC, refrigerator/freezer, 3 phase induction motor, CFL, electric fan, gas cook							
■ Standards	Development						
■ Laboratory capacity	Full-fledged for all market request						
■ Implementation	Voluntary		▼ Jan. 2018	Mandatory			
■ Label penetration	All products are labeled						
■ MEPS	Provision of MEPS if necessary						
■ High efficiency product penetration	Almost all appliances are efficient						
Phase 2 : Water pumps, Electric water heaters, Microwave ovens, Television sets, Clothes irons, Rice cookers, Blenders/mixers, Washing machine							
■ Standards	Development						
■ Laboratory capacity	Full-fledged for all market request						
■ Implementation	Voluntary		▼ Jan. 2019	Mandatory			
■ Label penetration	All products are labeled						
■ MEPS	Provision of MEPS if necessary						
■ High efficiency product penetration	Almost all appliances are efficient						
Phase 3: other appliances							
■ Standards	Development						
■ Implementation	Voluntary						

Table 3.5-7 Targeted EE Improvement by Appliance

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Room AC EE (COP, APF, SPF)	100%		125%		150%		200%
Refrigerant	R32 (ODP: 0, GWP: 675)				R1234yf (ODP: 0, GWP: 4)		
Refrigerator EE (kWh/year)	100%		125%		150%		200%
Refrigerant	R600 (ODP: 0, GWP: 4)						
TV EE (kWh/year)	100%		125%		150%		200%
Lighting LED sales	100%		125%		150%		200%
Motor	100%		115%		130%		

COP: Coefficient of Performance, APF: Annual Performance Factor, SPF: Seasonal Performance Factor
 ODP: Ozone Depletion Potential, GWP: Global Warming Potential, R32 & R600; refrigerant

3.6 EE Building Program

3.6.1 Overview

The amount of energy consumption in buildings is not so large compared with industrial and residential sectors at present. But the energy consumption is rapidly increasing in buildings of Bangladesh. Especially construction of large buildings are increasing in cities with modern immunities.. Therefore it is needed to implement an effective counter measures to mitigate energy consumption in buildings. The new version of Bangladesh National Building Code (BNBC [Revised]) is going to be published by Ministry of Housing and Public Works (MOHPW), considering EE&C in buildings as well. BNBC [Revised] is the mandatory provisions for promoting EE buildings. SREDA is also initiating Building Energy & Environment Rating for promoting green features in Buildings.

EE&C measures for buildings are as followings:

- Reduction of incoming heat by means of heat insulation, air-tight door/window and sun shine control.
- Introduction of energy efficient building equipment and appliances
- Appropriate use, operation and maintenance of the building and building equipment

However, these EE&C measures and rational energy use are not yet sufficiently implemented in Bangladesh.

Bangladesh National Building Code (BNBC) is the mandatory program which provides regulation and/or minimum requirement of building type (office, residence, commercial building, etc.), size (height, floor area), structure strength, indoor condition, construction material etc.

Currently, addition of energy efficiency requirement of buildings in the code is going on. Revised BNBC [including energy efficiency requirements will be issued by MOHPW which will be the basic program for promoting EE&C in Buildings and contain the following requirement on building energy efficiency:

- Heat insulation and/or ventilation performance of building envelope

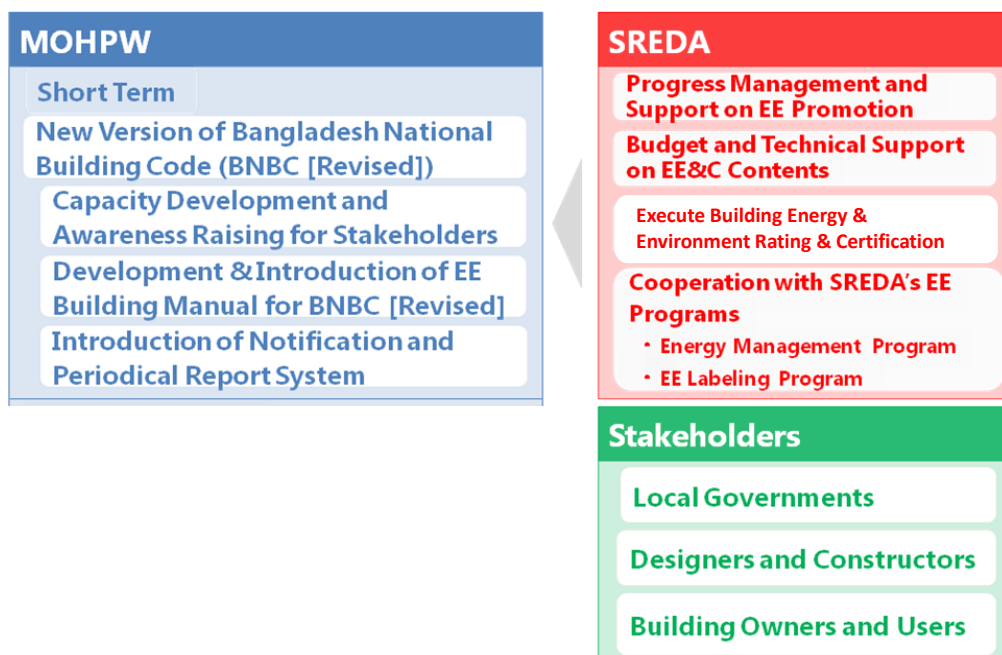
- Energy efficiency of building equipment (HVAC, lighting, fans, hot water supply, lift, escalator, renewable energy options etc.)
- Water efficiency and management

On the other hand, Green Building Guideline (GBG) is a voluntary program that provides recommendations not only on energy/water use efficiency but also on reduction of environmental impact caused by building construction, use and decommissioning. Preparation of GBG is expected to be completed by 2017.

EE&C requirement issues in BNBC [Revised] are the minimum standards. On the other hand, EE&C requirement issues in GBG will be recommended and effective since it allows obtaining upper-grade EE&C performance than the buildings fulfilling BNBC [Revised].

3.6.2 Overall Structure of EE Building Program

Overall structure of planned EE Building Program is summarized in Figure 3.6-1. Stakeholders' compliance with BNBC [Revised] and voluntary development of Green Buildings is expected. Local governments role on intermediation are important.



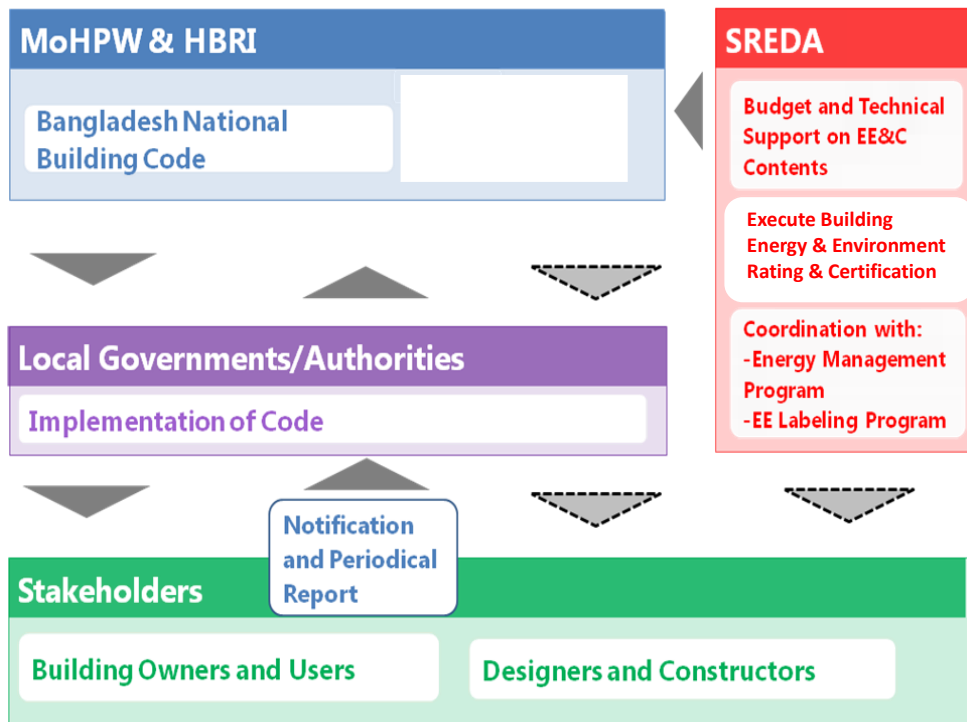


Figure 3.6-1 Overall Structure of Planned EE Building Program

3.6.3 New Version of Bangladesh National Building Code (BNBC [Revised])

(1) EE&C Requirement Issues in BNBC [Revised]

Provisions of EE&C requirements in BNBC [Revised] consist of minimum requirement, standard specification and recommendations on the design and construction method. Table 3.6-1 shows outline of the requirement.

Table 3.6-1 EE&C Requirement Issues in BNBC [Revised]

Category	Content
Building envelope	<ul style="list-style-type: none"> ■ Roof insulation and green roofing system ■ Window to wall ratio ■ Window opening ■ Shading
HVAC(Heating, Ventilation and Air-Conditioning)	<ul style="list-style-type: none"> ■ HVAC system ■ Ceiling and wall mounted fans
Hot water supply	<ul style="list-style-type: none"> ■ Solar hot water system
Lighting	<ul style="list-style-type: none"> ■ Day lighting and supplementary lighting system ■ Lighting power density ■ Occupancy sensors
Lift and escalator	<ul style="list-style-type: none"> ■ Energy efficient lift and escalator
Renewable energy	<ul style="list-style-type: none"> ■ Solar Power ■ Other renewable energy
Others	<ul style="list-style-type: none"> ■ Water management (Re-use of gray water, efficient fittings in

Category	Content
	toilets)

Some requirements in BNBC [Revised] quote the criteria from foreign building codes and standards. To make them more compatible to Bangladesh's climate, culture and manner and more acceptable for laws and regulations, they need to be reviewed and revised.

Also, EE&C requirements of building insulation materials will be introduced in accordance with EE&C materials to be presented in the GBG.

(2) Application of BNBC [Revised]

In order to promote EE&C for buildings widely in Bangladesh, application of EE&C requirement issues in BNBC [Revised] will be implemented and extended in a phased manner (under study by MOHPW). Table 3.6-2 suggests how the areas can be changed to expand the coverage of the code.

Table 3.6-2 BNBC [Revised] Coverage of Gross Floor Area in m² of Building Types

Categories	2015	2017	2019	2022
Office	≥5,000	≥5,000	≥3,000	All
Rental / Mercantile	≥10,000	≥5,000	≥3,000	All
Residential	≥10,000	≥5,000	≥3,000	All
Hospital	≥10,000	≥10,000	≥3,000	All
School	≥10,000	≥10,000	≥3,000	All
Hotel	≥5,000	≥5,000	≥3,000	All

Note: Year is a calendar year from January to December.

(3) Roles and Responsibilities for BNBC [Revised] Enforcement

For enforcing BNBC [Revised] and promoting EE&C in the buildings, all stakeholders must understand and carry out their roles and responsibilities as shown in Table 3.6-3. In order to disseminate the roles and responsibilities to all stakeholders, nationwide awareness raising programs and capacity development programs are needed.

Table 3.6-3 Roles and Responsibilities of Related Stakeholders

Party	Design	Construction	Operation	Demolition	Roles and responsibilities

Party	Design	Construction	Operation	Demolition	Roles and responsibilities	
GoB	MPEMR/ SREDA	*	*	*	*	<ol style="list-style-type: none"> 1) Comprehensive promotion of EE&C <ul style="list-style-type: none"> • Formulation of EE&C requirement, criteria and evaluation method in coordination with HBRI, BUET and other National and International Organizations 2) Initiatives on implementation of EE&C <ul style="list-style-type: none"> • Monitoring of program implementation • Review of the program • Promotion of the program 3) Information provision for MOHPW 4) Initiatives on implementation of EE&C on buildings 5) Project evaluation and Certification
	MOHPW /HBRI	*	*	*	*	<ol style="list-style-type: none"> 1) Comprehensive promotion of EE&C on buildings according to BNBC [Revised] <ul style="list-style-type: none"> • Review of the program with SREDA 2) Information provision for local governments, building owners & users, designers and constructors <ul style="list-style-type: none"> • Promotion of the program to building owners, users, designers and constructors • Instruction of the program to local governments and the related organizations • Monitoring of the program implementation, and reporting to SREDA
Local Government	*	*	*	*	<ol style="list-style-type: none"> 6) Promotion of EE&C on buildings in accordance with the local characteristics <ul style="list-style-type: none"> • Examination of the program suitability, considering local conditions • Promotion of the program for building owners, users, designers and constructors • Monitoring of the program implementation and reporting to SREDA and HBRI 7) Information provision for building owners, users, designers and constructors 	
Building Owner	*	*	*	*	<ol style="list-style-type: none"> 1) Implement EE&C measures <ul style="list-style-type: none"> • Compliance to the program regulation 2) Lifestyle modification for EE&C 3) Consideration of the lifecycle cost 	
Designer	*				<ol style="list-style-type: none"> 1) Implement EE&C measures <ul style="list-style-type: none"> • Compliance to the program regulation • Explanation to building owners • Documentation for application and approval of the local governments 2) Lifestyle modification for EE&C 3) Consideration of the lifecycle cost 	
Constructor		*			<ol style="list-style-type: none"> 1) Implement EE&C measures <ul style="list-style-type: none"> • Compliance to the program regulation • Explanation to building owners • Documentation for application and approval of the local governments 2) Lifestyle modification for EE&C 3) Consideration of the lifecycle cost 	

Party	Design	Construction	Operation	Demolition	Roles and responsibilities
				*	1) Implement EE&C measures 2) Consideration of 3R (reduce, recycle and reuse)
Building User			*		1) Implement EE&C measures • Compliance to program regulation • Voluntary efforts on EE&C • Cooperation with other stakeholders 2) Lifestyle modification for EE&C 3) Consideration of the lifecycle cost

(4) Check and Monitoring System to Ensure Building EE&C Performance

Building permit under the existing BNBC is the procedure to check and verify that if the buildings are surely designed in accordance with rules and regulations and are constructed following the original plan and design. However actual EE&C performance of the buildings cannot be assured by the current procedure. To ensure the EE&C in Buildings SREDA will develop the Building Energy & Environment Rating.

Additional check and monitoring system as shown in Table 3.6-4 will be provided in BNBC [Revised]. Submission of Notification and periodical report will be obligated for large scale building owners.

Table 3.6-4 Checking and Monitoring Systems under BNBC [Revised]

Stage	Check and monitoring system	
Design	Building Permit (existing)	Local governmental agency checks if the plan and design are made in accordance with the building codes and the relevant regulations. If the buildings are not planned and designed properly, the government organizations recommend and instruct their redesign. If the buildings are not redesigned, the local governmental agency does not permit construction of the buildings.
	Notification for EE&C measures	Building owners report Notification on EE&C measures to the local government agency, prior to start of the construction. If the EE&C measures are insufficient, the local government agency recommends or instructs the owners to improve measures. In case of disobedience to the instruction, publication of the company name and/or penalty are imposed.
Construction	Building Permit (existing)	Local governmental agency inspects if the buildings are constructed in accordance with the original plan and design. If the buildings are not constructed in accordance with the original plan and design, the local government agency recommends and instructs to modify them. If the buildings are not modified, the local government agency does not permit buildings use.

Stage	Check and monitoring system	
Operation	Periodical Report for EE&C measures	Building owners present Periodical Report to the local government agency. In the Periodical Report, the operation and maintenance conditions concerning the items described in the Notification are reported.

3.6.4 Green Building Guideline (GBG)

(1) Application of GBG

GBG is being developed as a guideline for the design and construction of upper-grade EE&C and low environment impact buildings rather than the buildings under BNBC [Revised]. The objects of GBG are offices, rental & mercantile (shopping malls), residential, industrial, public establishments (air-port, railway station, bus-station etc.), hospitals, schools and hotels in new large scale projects by both public and private sectors. SREDA will carry out project evaluation and certification system as well as awareness rising on the guideline for building designers and developers.

(2) EE&C Recommendation in GBG

The purpose of GBG is developed to reduce not only energy and water consumptions but also environmental impacts during construction, use and decommissioning of the buildings. GBG will give recommendation on use of energy and water, waste management, indoor environmental condition, material use at construction and other environmental issues.

3.6.5 Programs for Promoting EE&C in Buildings

(1) Development of Building Energy & Environment Rating Manual

In order to encourage proper and effective EE&C implementation, building energy & environment rating manual for, building owners and users, designers and constructors, will be developed and published by SREDA. The manual should include detailed explanations and concrete construction methods for EE&C measures. Also the manual will include not only general measures applicable to all buildings but also a variety of recommended measures appropriate and economically beneficial depending on the specific conditions of the individual building and location.

(2) Development of Building Energy & Environment Rating System

Building Energy & Environment Rating System will be developed by SREDA, in accordance with the GBG development which is compatible to prevailing climate, culture and manner and is acceptable for Bangladeshi laws and regulations. The system will start to be voluntarily applied for large scale development projects such as shopping malls, airport buildings, hotels and hospitals.

In future, the Building Energy & Environment Rating System with GBG will be used as an evaluation method for certification of “Green building” and/or “Net zero energy building”. Green building owners may be rewarded or incentivised according to their contribution.

(3) EE&C for Existing Buildings

In order to encourage energy efficient operation of existing buildings, retrofit with energy efficient technologies and other measures able to reduce energy consumption in existing buildings will be supported.

In the near future, large scale buildings classified as designated large consumers under the Energy Efficiency Program will implement EE&C activities or retrofitting under the program conducted by SREDA. SREDA will develop criteria and list of buildings, classified as designated large consumers under the Energy Efficiency Program in association with HBRI, BUET, National and International Organizations.

On the other hand, in the future, MOHPW and HBRI, in cooperation with SREDA, will expand EE&C measures in BNBC [Revised] to existing buildings.

3.6.6 Check and Review of Programs

(1) Check and Review of Programs

MOHPW and HBRI will regularly check and review the progress situations for BNBC [Revised] implementation and GBG development. If any delay and/or changes on the situations arise, MOHPW and HBRI, in association with SREDA, will review them. SREDA will provide supports and cooperation needed for BNBC [Revised] implementation and development of GBG.

(2) Preparation for Statistical Database

Building statistical database is necessary to check and review EE&C in buildings. However, the present database for buildings is not sufficient. Building statistical database should be updated regularly and properly maintained. The database will include not only existing/constructed floor areas and number of buildings by building type but also the energy consumption and conditions of EE&C equipment and facilities, which will be researched by consultants and/or be collected through the documentation systems produced under BNBC [Revised], GBG and the other programs like Energy Efficiency Program.

3.6.7 Roadmap up to 2030

Roadmap up to 2030 for Program Implementation of BEER is shown in Table 3.6-5. Expected energy savings in accordance with the predicted EE&C realization are shown in Table 3.6-6.

Considering that the current BNBC realization rate is low and BNBC [Revised] implementation is conducted in a phased manner, the predicted EE&C realization rate of BNBC [Revised] must be quite low at the beginning. Through the awareness raising and capacity development actions by the Government for local governments and the other stakeholders, it is possible to increase the realization rate step by step for wide use of BNBC [Revised].

The critical issue at the beginning is to identify the existing buildings that neglect the rules under BNBC.

Table 3.6-5 Program Implementation of BNBC [Revised] and GBG Roadmap

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BNBC [Revised]. (MOHPW)	Implementation Awareness Raising & Capacity Development		Effective Implementation													
EE&C Clauses in BNBC [Revised] (SREDA/MOHPW)	Implementation Awareness Raising & Capacity Development		Effective Implementation													
GBG	Development			Publication/Circulation												
EE&C Building Rating Manual (SREDA)	Development			Publication/Circulation												
Building Energy & Environment Rating (BEER) (SREDA)	Development			Voluntary Implementation												

Note: Calendar year from January to December is used on

Table 3.6-6 Expected Energy Savings in Accordance with Predicted EE&C Implementation Ratio

Year		2015	2016	2017	2018	2019	2020	2025	2030
Office	Realization rate	12.5%		25%		56.3%		100%	
	Savings (GWh/year)	0	6.1	12.2	24.4	36.6	64.0	265.3	509.3
Hospital	Realization rate	12.5%		25%		56.3%		100%	
	Savings (GWh/year)	0	3.5	7.0	14.1	21.1	37.0	153.2	294.0
School	Realization rate	12.5%		25%		56.3%		100%	
	Savings (GWh/year)	0	0.0	0.0	0.1	0.1	0.2	1.0	1.9
Residential	Realization rate	0.25%		1.5%		15.0%		100%	
	Savings (GWh/year)	0	1.7	3.5	14.2	25.0	133.0	2,509.8	6,111.1
Rental / Mercantile	Realization rate	12.5%		30%		56.3%		100%	
	Savings (GWh/year)	0	6.6	13.2	29.1	45.0	74.7	293.0	557.6
Hotel	Realization rate	12.5%		25%		56.3%		100%	
	Savings (GWh/year)	0	0.1	0.2	0.4	0.6	1.0	4.0	7.7
Total	Savings (GWh/year)	0	18.1	36.2	82.2	128.4	310.0	3,226.4	7,481.6

Note: Percentages in the table are the predicted EE&C realization rates for newly constructed buildings in each year, which are prepared based on the discussion in EE Building Programs WG held by SREDA and JICA and the follow-up discussion with HBRI in November, 2014, considering the increase of the BNBC [Revised], Compliance ratio and the increase of target buildings in a phased implementation manner

3.7 EE&C Financial Incentive Programs

3.7.1 Overview

Financial support is a key component to disseminate EE&C policies and activities. It motivates people to incorporate EE&C activities into their business and daily lives.

Financial incentives, in definition, are monetary rewards provided for performance of targeted objectives; and they can provide economic benefits for implementing EE&C projects to motivate people's behavior. Also, financial incentives in general have good effects on raising the people's awareness on EE&C. Financial incentives will bring a positive economic impact, which will help the government to adopt a market-based pricing system.

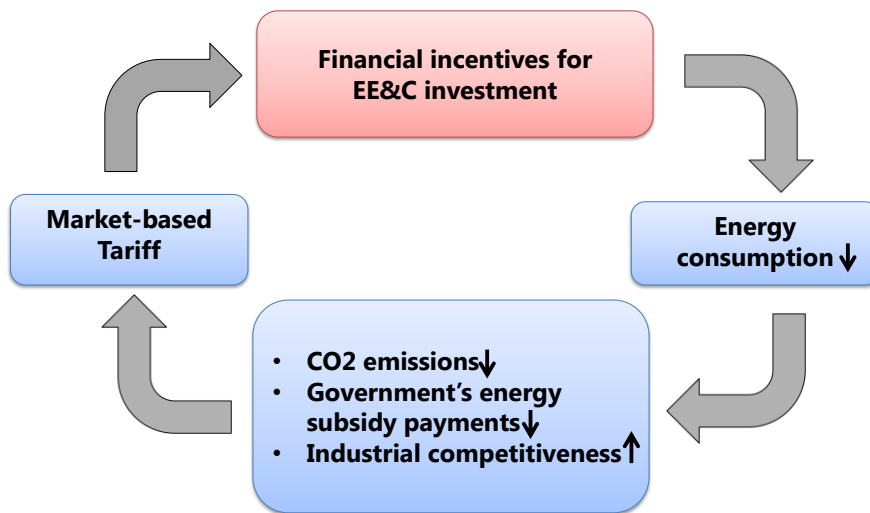


Figure 3.7-1 Virtuous Circle of Financial Incentives

For the nationwide dissemination of EE&C policies in Bangladesh, especially among industries, it is necessary to provide feasible financial support to be implemented in the local context. (See Figure 3.7-2)

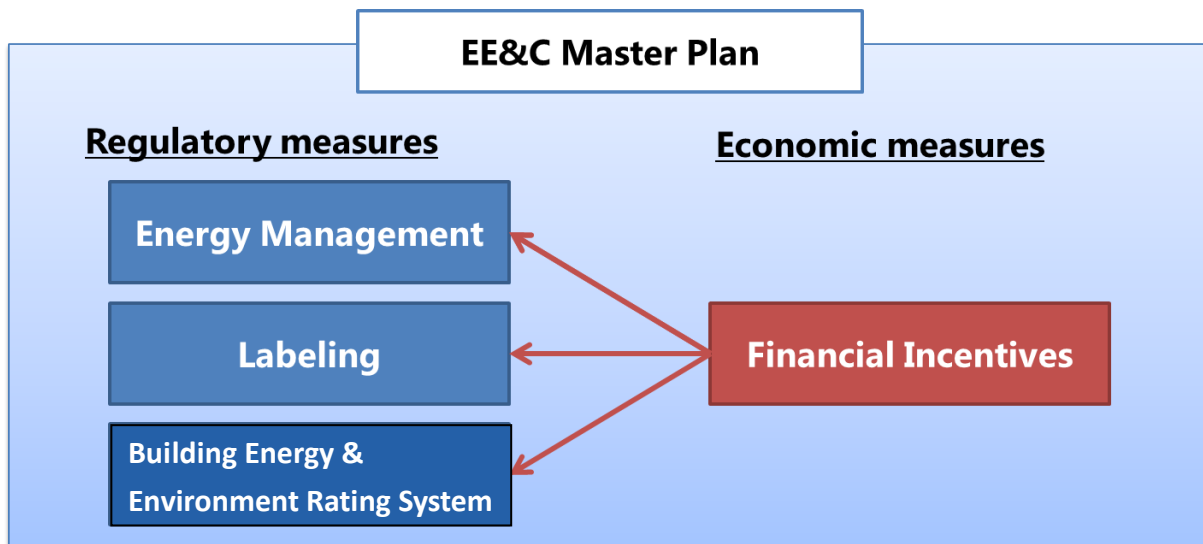


Figure 3.7-2 EE&C Policies and Financial Support/ Incentives

(1) Types of Financial Incentives

One of the bottlenecks, which have been preventing people from implementing EE&C activities is the fact that the price of EE equipment are generally higher than those of the conventional technology. In order to facilitate the execution and dissemination of EE&C activities in Bangladesh, it is effective to provide financial support. The major financial incentives include subsidies, preferential taxation and low interest loans, the details of which are described below:

1) Subsidies

For quick diffusion of EE facilities and equipment, subsidies can be an effective financial incentive measure since they directly reduce the initial costs of purchasing EE equipment and have long term positive benefits. Beneficiaries of these subsidies would be both individuals and establishments. By specifying the target EE appliances, subsidies could facilitate fast and quick nationwide installation. Subsidies are generally suitable in application for a limited period of time for early bird beneficiaries instead of long-term privileges.

2) Preferential Taxation



Preferential taxation, tax reductions or exemptions, accelerated depreciation, can be applied to individuals and establishments. Tax incentives will be effective to stimulate people to purchase EE goods, as long as such goods are taxable. One good point about tax incentive is that there is no need to change or add new procedures to the present taxation processes when introducing these incentives. Accelerated depreciation, which allows companies to place the bulk of the costs of an asset in the first few years of its useful life is also profitable especially for the industrial and commercial sectors which are capital intensive.

3) Low-interest Financing (Loans)

In order to provide a long term financial support as well as to remove the first cost barrier for the promotion of EE&C policies, concessional loans are the most suitable and effective. It is especially effective for establishments which plan to introduce or replace large amount of machines and equipment with highly energy-efficient ones. The target beneficiaries for such loan program will be limited compare to the other two financial incentives (namely preferential taxes and subsidies). It has an advantage of easier implementation through ordinary bank loan procedures. Also, the administrator (such as the central and local governments) can adopt this incentive with less financial burdens compared with the other two financial incentives.

Table 3.7-1 shows major three types of financial incentives, which are suitable for EE&C promotion. Their advantages and disadvantages are also summarized in Table 3.7-1.

Table 3.7-1 Types of Financial Incentives for EE&C Promotion

	Examples	Pros 	Cons 
Subsidies	<ul style="list-style-type: none"> - Investment subsidy - Rebate program - Buy-down grants etc. 	<ul style="list-style-type: none"> - Available for anyone - Economic stimulus effects are expected 	<ul style="list-style-type: none"> - High transaction costs
Preferential taxation	<ul style="list-style-type: none"> - Tax exemption - Tax reduction - Accelerated depreciation 	<ul style="list-style-type: none"> - Available for anyone - Low transaction costs 	<ul style="list-style-type: none"> - Difficult to measure policy impacts
Low-interest loans	<ul style="list-style-type: none"> - Government support loans (e.g. SME loans supported by Bangladesh Bank, Refinance Line for Renewable Energy etc.) - ODA loans (loans provided by international donor agencies) 	<ul style="list-style-type: none"> - Less financial burden for the Government - Easy to implement for participating financial institutions (PFIs) - Long term financial support for end-user 	<ul style="list-style-type: none"> - Beneficiaries are limited to eligible entities

In a broad sense, preferential taxation and subsidy measures are implemented by the Government, whereas low interest loans are provided by financial institutions. Since loans are not gratuitous, and must be repaid thoroughly, beneficiaries are limited to those establishments that meet financial and technical eligibility criteria. This aspect of low interest loan has both disadvantage and advantage. Beneficiaries are limited in a sense that they are screened by eligibility criteria, but because of that, low interest loans can promote the intended policy more efficiently.

In contrast to this, the beneficiaries of both preferential tax and subsidy measures are not restricted by financial eligibility criteria. Any establishment and any individual can receive the support for their purchase of EE equipment and EE related investments.

With regard to disadvantages, the economic impacts of tax measures such as accelerated depreciation and tax reductions on EE&C are hard to measure, since they both are simply an accounting procedure to reduce taxable income. As for the disadvantage of subsidy measures, implementing EE&C promotion measures require high administrative and transaction costs which cannot necessarily be quantified.

(2) The Best Choice of Financial Incentives to Implement in Bangladesh

For the first step of effective and prompt implementation of EE&C activities in Bangladesh, low-interest loan program is the best choice. Here are the reasons:

- Long-term financial support for end-users: Encourage industries to work with energy efficient machineries with improved production quality and quantity (increasing industrial competitiveness).
- Easy to implement for banks and non-bank financial institutions (NBFIs): No need to create a new loan process - Adopting same credit appraisals as normal ones and using eligible lists/ criteria for technical appraisals).
- Less financial burden for the Government: The loan fund will be returned to the Government with interest from participating financial institutions (PFIs: banks and NBFIs)

3.7.2 Low-interest Loan Program: “EE&C Promotion Loan Program”

EE&C Promotional Loan Program and low-interest loan program will be implemented by setting goals below:

1. Promotion of the nationwide adoption, execution and proliferation of Energy Management Program, EE Labeling Program and EE Building Program.
2. Creation of new markets for investments in (a) industrial sector EE&C, (b) EE equipment/ appliances and (c) green buildings.

To achieve the goals, EE&C Promotional Loan Program will need to be designed into two phases, the first phase for implementing flagship EE&C projects to prove the economic viability of EE&C, and the second phase for the nationwide dissemination of EE&C investments.

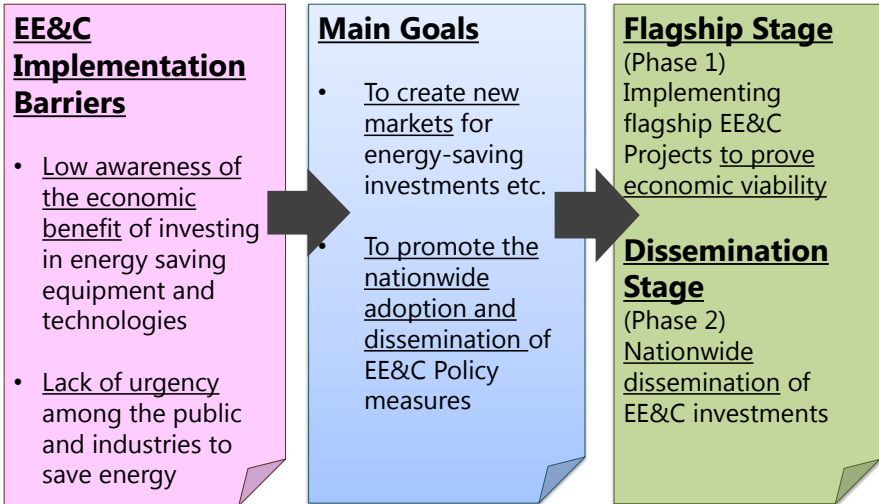


Figure 3.7-3 Low-Interest Loan Program

The primary beneficiaries of each program are large energy consuming establishments, wholesaler/ distributors/ manufacturers, building owners and developers. For the details, see Table 3.7-2.

Table 3.7-2 Expected Beneficiaries by EE&C Policy

Policy	Beneficiaries	Goals
Energy management program	Large energy consuming establishments and building owners who are able to appoint energy manager(s)	To reduce total energy consumption through energy audits and energy efficiency (EE) improvements
EE Labeling Program	Wholesalers/ distributors/ manufacturers which sell EE appliances to end-users on installments, and consumers (EE appliance users)	To promote installment sales of EE equipment/ appliances to consumers
Building Energy & Environment Rating Program	Building owners and developers	To promote construction of GBs and EEBs

(1) Flagship Stage

Flagship project stage is necessary to show the economic benefits of EE&C investments to enlighten the general public, especially in the industrial and residential sectors, which are the largest energy consumers in this country. In addition, flagship projects will contribute to the creation of viable and bankable energy efficiency markets for EE equipment/appliances, green buildings and industrial sector energy management which is indispensable to convince private sector investors namely financial institutions and establishments. In order to meet these objectives, it is important that flagship projects shall be selected carefully ensuring their technical viability as well as financial profitability.

(2) Dissemination Stage

Dissemination stage will be implemented in order to facilitate the execution and nationwide proliferation of the three EE&C policy measures. In this stage, participating financial institutions, namely, banks and non-bank financial institutions including leasing companies and ESCOs (See BOX 1) are urged to provide finance for EE&C investments by end users. In order to make this stage successful, the following activities need to be provided:

- Education of financial institutions (both executives and loan officers) on the economic benefits of EE&C financing (based on the results of flagship projects), financial appraisals method of EE&C projects taking into account the value of energy-saving benefits and the concept of life cycle costs (See BOX 2).
- EE awareness-raising of establishments in industrial sector by introducing the economic benefits of flagship projects, the concepts of simple payback period (See BOX 3) and life cycle costs.

According to survey, average EE improvement of 36% and 30% between 2015 and 2030 can be expected in residential and industrial sector respectively considering the current levels of technology in the country. Even under the current low energy prices there is obviously a huge energy saving potential. Adequate financial incentives therefore, will be needed to motivate financial institutions, establishments in industrial sector, owners of buildings and the households to save energy which unless otherwise will be wasted.

BOX 1 ESCO and quasi-ESCO services

ESCO (Energy Service Company) provides a comprehensive energy-saving services (including provision of energy-saving solutions, installation of EE equipment, maintenance and operation of installed equipment). ESCO engages in a performance based contract with a client firm guaranteeing certain level of energy efficiency (EE) improvements (i.e. reduction of energy consumption and/or costs) and in return, receives remuneration out of thus achieved energy savings.

The source of payments to such ESCO services derives from the energy-savings achieved, and the total payment amount will be arranged so as not to exceed the client's current total energy bill.

There are two major types of models in ESCO business: 1) the guaranteed savings mode in which ESCOs provide clients with performance guarantees, but no financing; and 2) the shared savings model in which ESCOs provide performance guarantees as well as financing.

In the former model, clients themselves procure funds from banks based on their credibility and make repayments out of energy cost savings. And in the latter, energy cost savings will be split between the client and ESCO based on a pre-determined rate. There are also cases where ESCOs are in alliance with banks and leasing companies.

There also exists quasi-ESCO businesses in which no one provides performance guarantees, but financial institutions (such as banks, leasing companies and ESCOs) agree to provide financing based on cash flow expected to be generated from their energy-saving projects. In a quasi-ESCO project, a client firm may enjoy an advantage of introducing EE equipment without any additional financial burden, but at the same time, unlike an ordinary ESCO business, it will have no risk hedge against underperformance due to incidents such as electricity price falls which make it impossible to achieve expected energy cost reductions. In such a case it is important to involve well established and trusted manufacturers which can provide high quality EE products with long warranty and good maintenance services.

BOX 2 The concept of lifecycle cost (LCC) and EE product

The costs of ownership of an asset involve various costs throughout the useful life of the asset.

- 1) Initial purchase costs
- 2) Operation and maintenance (O&M) costs
- 3) Disposal costs

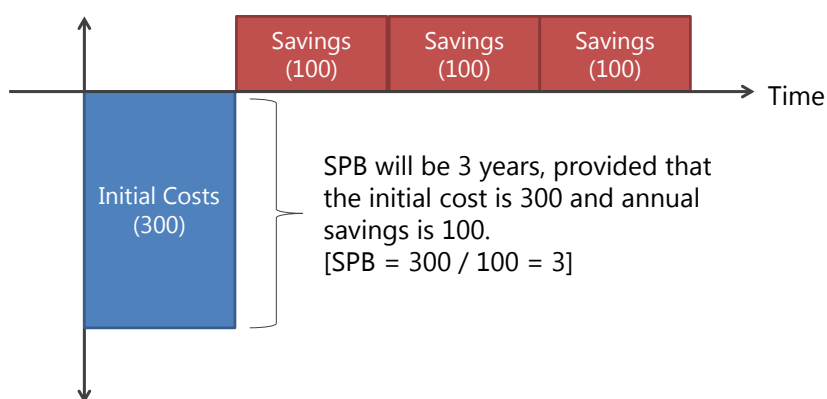
Especially when choosing over electric devices, one has to consider energy efficiency of the product, since it will directly affect the costs of operation and maintenance through monthly energy bills.

Therefore, it is wise for all investors, business entities, government and the households to always consider the LCC when taking a purchase decision. Highly energy efficient product may cost more at the initial purchase, however in the course of its useful life, O&M cost will be very small compared to non-efficient products.

BOX 3 Simple Payback Period (SPB)

By purchasing an energy efficient product, one can save money through reduced monthly energy bills.

Simple payback period is the number of year in which the initial costs of the product can be repaid by the annual energy savings generated from the ownership of the product. Therefore, the higher the energy efficiency, the shorter the simple payback period will be for the same investment cost.



(3) Timing to Move on to Dissemination Stage

With regard to the timing to move on to the dissemination stage, the Government should wait until the market interest rates start to pick up again. Under the current market situation, where interest rates are constantly slipping downwards, end user interest rates will not be attractive enough to encourage EE&C investments. PFIs would need to ensure certain amount of interest margins to cover the risks involved in

promoting EE&C loans, which will make the end-user interest rate high when the market interest rate is on the downward trend.

3.7.3 Check and Review of Loan Program

(1) SREDA’s Responsibility

SREDA is a nodal institution for identification, promotion, facilitation and overall coordination of all national renewable energy and EE&C programs. In other words, SREDA has to ensure its monitoring authority over EE&C activities in Bangladesh by receiving reports from relevant ministries, financial institutions and other organizations which are in charge of data collection related to EE&C. As example, financial institutions which provide policy promotion programs will report SREDA the total amount of money disbursed, what these incentives are used for, how the energy saving was achieved (e.g. replacing and/or installing EE equipment) etc. (See Figure 3.7-4)

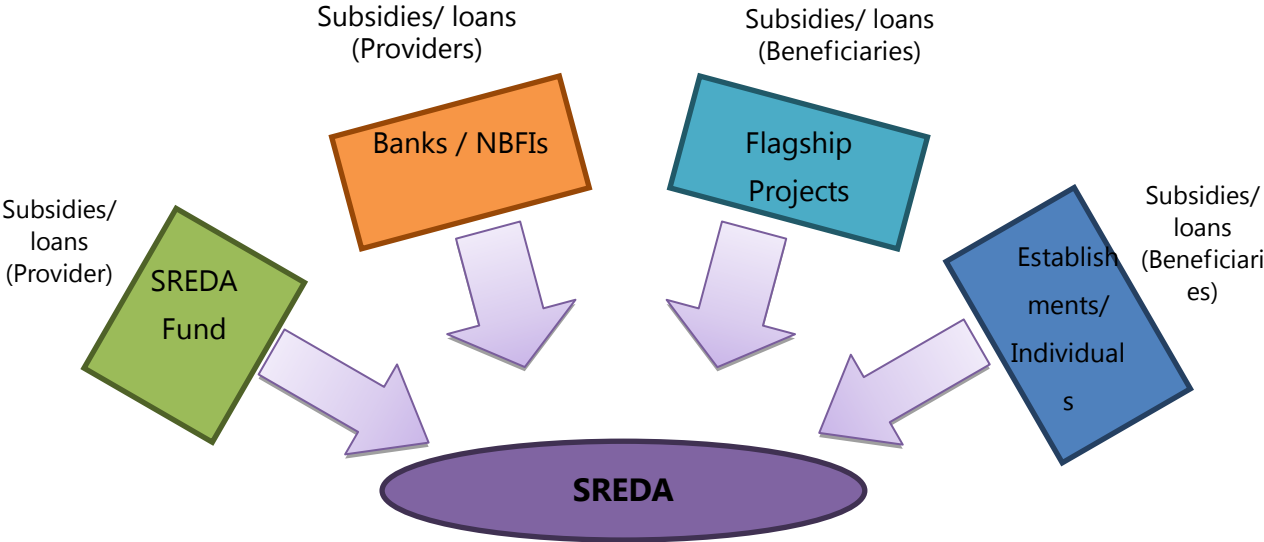


Figure 3.7-4 EE Effects Reporting to SREDA

(2) Technical Standard Committee

It is recommended that SREDA will establish an independent Technical Standard Committee for the implementation of the EE&C policy promotion loan program. Main roles and responsibilities of the Committee will be to compile the eligible EE equipment list/ EE standards and criteria for PFIs in order to support their technical appraisals of EE&C projects. SREDA as the secretariat of the Standard Committee will hold meetings on regular basis (for instance, every 6 months) to review and revise the list/standards/criteria reflecting the market trend by inviting technical experts from both private and public sectors.

3.7.4 Roadmap up to 2030

The roadmap up to 2030 for the establishment of EE&C finance program is shown in Table 3.7-3. In order to execute and disseminate EE&C policies, it is highly recommended that the Government will provide an EE&C policy promotion loan program starting as early as possible. Idealistically an adequate timing for the start of this program would be the year 2017, taking into account the enforcement processes of EE Rule and Regulations, Energy Management Program, EE Labeling Program and BNBC [Revised], GBG.

With regard to the implementation of the EE&C policy promotion loan program, it is recommended that the program will be implemented in two parts: the introductory phase where selected flagship projects will be financed as showcases; and the dissemination phase where the nationwide EE&C investments will be stimulated through financing via participating finance institutions (PFIs).

It is considered effective to finance flagship projects for a short and limited period of time (for three years between 2017 and 2019) in order to show the actual economic benefits of EE&C investments to the private sector investors, both financiers and establishments. On the second phase, the data on EE&C effects collected from flagship projects will be disseminated to private sector investors through financing via PFIs which is expected to start as early as in 2020, following the completion of the three-year loan disbursement for flagship projects. See Table 3.7-3 for the details of the establishment of EE&C policy promotion loan program.

During the nationwide EE&C policy dissemination phase, subsidy as a financial incentive can also be provided by utilizing the revolving loan fund (i.e. collected principal and interest payments from the first phase loans). Part of the fund earmarked for grants can be provided to support energy audits, EE electric appliances testing, interest subsidies for EE equipment investments etc.

In addition, as a supplementary financial incentive measure, the Government can also consider the adoption of tax incentives (tax reduction/ exemption) targeted at specific industrial manufacturers sector, which produce highly energy efficient products. As for the import duties of EE&C goods and materials, it is recommended that the Government will continue the already granted preferential treatment to industrial sector products (as low as 2%) as long as necessary.

Table 3.7-3 EE&C Finance Program Roadmap

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20 20	2020-25	2025-30
1. Low Interest Loans							
1.1 Loan preparations							
■ Financial mechanism (Design financial schemes)	→						
■ Flagship projects selection (For introductory phase)	→	→					
■ Identification of executing agencies/ PFIs (For dissemination phase)	→						
■ EE equipment list, technical criteria	→						
1.2 Loan disbursements							
■ Flagship Projects		→	→	→	→		
■ EE&C Policy Promotion Loans					→	→	→
1.3 Monitoring of EE&C		→	→	→	→	→	→
2. Subsidies							
2.1 Preparation							
■ Select targets methods of EE promotion (e.g. energy audits, building energy & environment rating, EE testing)	→	→	→	→	→	→	
■ Pool source of subsidies by collecting principals and interest payments from EE&C loan program			→	→	→	→	→
2.2 Provision of grants							
3. Tax Incentives							
3.1 Low Duties (2%) for all imported EE industrial machineries	→	→	→	→	→	→	→
3.2 Duty free for solar panels & materials, LED and raw materials	→	→	→	→	→	→	→
3.3 Add energy efficient (EE) products to the list of "Renewable Energy (RE) Products" for tax benefits	Submit proposals to NBR by mid-May	→	→	→	→	→	→
3.4 Income tax reductions for EE product manufacturers		→	→	→	→	→	→
3.5 Others (accelerated					→	→	→

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20 20	2020-25	2025-30
depreciation, etc.)							

To implement financial incentives, SREDA and the Government can utilize concessional loans and grants available from international development partners as well as its own tax revenues. In the future, for the country's sustainable energy supply and demand management, the Government may create a new source of fund such as tax on fossil fuels, part of which can be earmarked for promoting investments in EE&C activities as well as the overall reform of the energy supply and demand sectors.

3.8 Government's Own Initiative on EE&C Implementation

3.8.1 Overview

The Energy Management Program and EE Building Program mentioned above must be also applied on government organizations, which include local governments, state-owned companies, semi-government organizations and other public sectors. The government organizations will surely comply with the regulations of the EE&C programs and implement EE&C. Also the government organizations will take part in the voluntary EE&C programs, such as EE Labeling Program and GBG by adopting EE products on their purchase, design and construction of green buildings. The EE&C activities and results will be monitored and disclosed to all people in order to inspire and promote them to take EE&C actions.

Government facilities and activities include office buildings, schools, hospitals, military facilities, government provided or managed housing, vehicle fleets, roads, bridges, airports, other infrastructure and works/businesses etc.

3.8.2 Planning

At first, SREDA will develop a typical EE&C action plan which can be applied to all government organizations. Then government organizations will prepare their own EE&C action plan and submit to SREDA. The plan must include contents as shown in Table 3.8-1

Table 3.8-1 Government Organizations' EE&C Action Plan (Examples of Contents)

Item	Contents, example
EE&C target	Annual energy consumption, unit energy consumption per production etc.
Energy management	Appointment of energy manager
Monitoring	Energy consumption data collection mechanism
Check and review	Formulation of third party committee
Action plan	EE&C actions which are customized for each organization: Use of buildings, vehicle, office automation machine, etc.
Capacity development, awareness, training	Periodical implementation
Procurement, outsourcing	Consideration of EE&C and life-cycle on procurement and

	outsourcing
Other	Accreditation of ISO14000, ISO50001 by organization

3.8.3 EE&C Implementation

The government organizations must conduct EE&C actions according to the plan and make efforts to achieve the EE&C target.

3.8.4 Monitoring, Reporting and Disclosure

Government organizations must report their monitoring result on EE&C actions and disclose it to the public annually. SREDA will analyze the reports. If any negligence on EE&C implementation is found, SREDA must give necessary instructions to take corrective measures to those organizations .

3.8.5 Support Services by SREDA

SREDA will provide information on energy efficient products recommended for government procurement, energy efficient design features for new buildings, good practices for energy management and retrofit, and or advisory services for EE&C planning and implementation including energy audits.

3.8.6 Check and Review of Program

Check and review of the program must be done by the government organizations individually. SREDA will check and review nationwide performance of the Government’s own EE&C initiative.

3.8.7 Roadmap up to 2030

SREDA and relevant government organizations must start the program as shown in “Phase 1”. Table 3.8-2 shows the roadmap of the program implementation for the governmental organizations up to 2030. Table3.8-3 shows the targeted realization rate by program.

Table 3.8-2 Roadmap of Program Implementation by Governmental Organizations

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
SREDA	Typical EE&C plan	▼ Delivery to all governmental organizations					
Phase 1 : Ministries in central government							
■ Planning		→					
■ Implementation			→	→	→	→	→
■ Monitoring, reporting and check/review				→	→	→	→

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Phase 2 : Other government organizations and public sectors							
■ Planning		→					
■ Implementation				→			
■ Monitoring, reporting and check/review					→		

Table 3.8-3 Targeted Realization Rate by Program

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Energy audits for government facilities			100% →				
Appointment of energy managers and auditors selected from government staffs			10 managers →				
			3 auditors →				
Certification of green building		Trial Implementation →					
Accreditation of ISO14001/50001 in government organizations		Trial Implementation →					
Primary energy consumption		-15% →		-20% →			

3.9 Country's Energy Consumption Data Collection Mechanism

3.9.1 General

In order to carry out nationwide energy management, at first it is necessary to understand and monitor the total energy consumption of Bangladesh and break down the energy consumption by sector such as industry, business, transportation, residence and energy supply. Country's total energy consumption can be relatively easy to understand through the amount of domestic energy production and energy import from foreign countries.

3.9.2 Energy Data Collection in Bangladesh

The International Energy Agency (IEA) was founded in 1973 by 28 member states. It has been working for to plan energy policy with the balance on environmental protection, energy security and economic development. IEA performs statistical survey on manufacturing and energy around the world and has issued various books and reports. "World Energy Outlook" is the typical one which shows the forecast of the energy market over medium and long-term.

By analyzing the energy data of IEA, annual energy usage of each country including Bangladesh can be understood.

(1) Roles and Responsibilities

Table 3.9-1 shows the share of roles planned and existing databases, for formulating effective energy consumption data collection mechanism among the related government organizations.

Table 3.9-1 Roles of Parties for Energy Data Collection

Party (stakeholder)	Role
MPEMR	<ul style="list-style-type: none"> ■ Energy supply data collection for policy making
SREDA	<ul style="list-style-type: none"> ■ Energy demand data collection for policy making and awareness raising for consumers ■ Analysis of energy consumption including energy intensity
Bangladesh Bureau of Statistics	<ul style="list-style-type: none"> ■ Other national common data collection
Energy supplier (power companies, gas companies, importers etc.)	<ul style="list-style-type: none"> ■ Supply of energy sales data ■ Disclosure of data analysis (break down by sector etc.)
Industrial associations	<ul style="list-style-type: none"> ■ Supply of production data ■ Disclosure of data analysis (energy intensity etc.)

(2) Roadmap up to 2030

Roadmap up to 2030 for the establishment of energy consumption data collection mechanism is shown in Table 3.9-2.

Table 3.9-2 Energy Consumption Data Collection Mechanism Roadmap

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Designing and establishing energy data collection mechanism	→						
Operation of energy data collection mechanism		→					
Issue of data collection and analysis report			→				

3.10 Global Warming Countermeasure

3.10.1 Overview

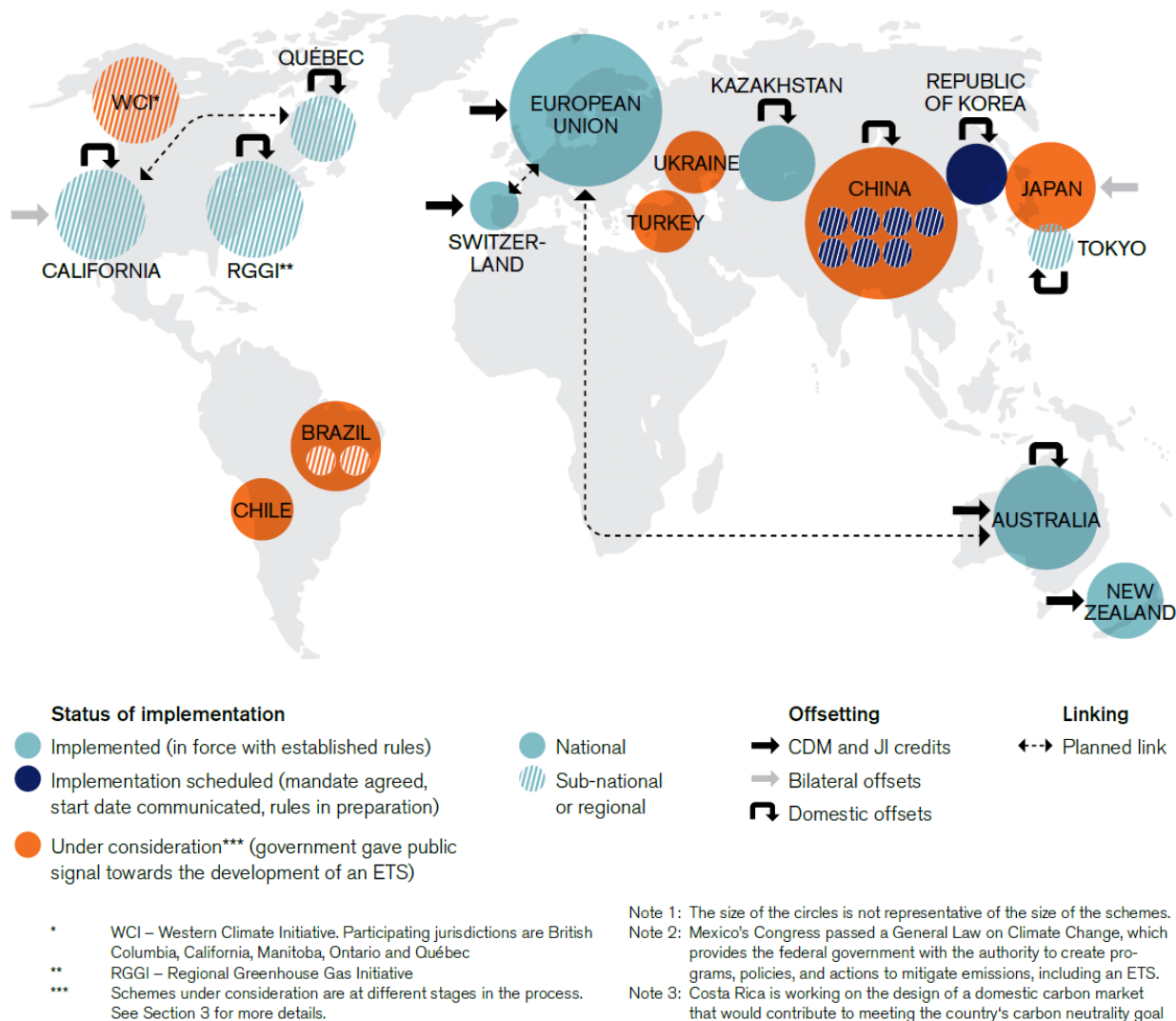
(1) Carbon Market

As discussed at the Introduction, the policies and actions are already established in many countries, as a way to stimulate Climate Change mitigation. Figure 3.10-1 shows the geographical distribution of operational and near operational programs at the end of 2013. Some of those, as shown by the straight black arrow are international, in the sense that these may provide revenue for Climate Change mitigation actions occurring in other countries.

By far the largest market for international carbon credit is the EU-ETS¹², shown at Figure 3.10-1 as the big blue ball. According to these carbon market rules, the Clean Development Mechanism (CDM) associates projects developed in DC and LDC to a certain amount of carbon credits. These carbon credits have a value at the market. Other carbon markets or similar rewarding markets exist and new ones may grow soon, as is the case of the California Cap and Trade Program and the Japanese Joint Cooperation Mechanism also shown in Figure 3.10-1.

New agreements about Climate Change will be set at the end of 2016. It will be dependent on the extension that the regulation covers a growing share of GHG emissions in all participating countries. It will be also dependent on the level of the cap defined and it is possible that further carbon credits or some equivalent reward will be shown up. An increase in the value of 1 ton of CO₂ equivalent avoided is widely expected if the reductions on global GHG emission shall follow the suggestion of IPCC, which will reduce it by 20% in the next few years and more than 50% by 2050.

¹² EU-ETS means European Union Emission Trade Scheme



Source: Mapping Carbon Pricing Initiatives – Development and Prospects 2013 World Bank Report2013.pdf

Figure 3.10-1 Map of Existing, Emerging and Potential Emission Trading Schemes

(2) Capacity Development as “Carbon Abatement Project”

All carbon abatement project associated with Climate Change mitigation requires monitoring, reporting and verification (MRV), considering that its purpose is the real abatement of a quantified amount of GHG emission. Even before expenses with MRV occur, usually a complete document has to be prepared explaining details of the project, which implies in more costs for the project owner. Furthermore, project implementation has its own cost. Table 3.10-1 lists all these costs for some of the most common project categories and it is important to comment that the values quoted may be underestimated since only a share of the presented projects are registered and qualified for carbon credits. Finally, not only money is necessary to register a project, but the availability of qualified personnel to design and implement is needed. Thus, EE&CMP proposes Capacity Development on this issue.

EE&CMP recognizes that considering extreme fragile situation of Bangladesh regarding Climate Change impacts, a good control about all actions and projects performed in the country yielding GHG emissions abatement shall be fully monitored and used as a marketing activity at global level.

Table 3.10-1 Total Cost of New Carbon Abatement Projects Registry in EU-ETS (CDM Projects), According with Technology Used.

Type	Abatement costs ²³ (€/tCO ₂ e) <i>Source: Table 2</i>	Transaction costs (€/tCO ₂ e) <i>Source: Table 5</i>	Total costs (€) <i>Sum abatement and transaction costs</i>	CER price band (€)
N ₂ O adipic acid	Around 0	Around 0.16	Around 0.2	Around 0
N ₂ O nitric acid	Around 0	0.27 – 0.34	Around 0.3	
Coal mine methane	Around 0	0.21 – 0.26	0.2 – 0.3	
EE own generation	Around 0	0.26 – 0.38	0.3 – 0.4	
Biomass energy	0 – 3.9	0.49 – 0.81	0.5 – 4.7	0 - 5
EE households	0 – 3.9	0.58 – 1.33	0.6 – 5.2	
Hydro large-scale	0 – 3.9	0.26 – 0.36	0.3 – 4.3	
Hydro small-scale	0 – 3.9	0.51 – 0.90	0.5 – 4.8	
Landfill gas	0 – 3.9	0.33 – 0.45	0.3 – 4.3	
Methane avoidance	0 – 3.9	0.54 – 1.00	0.5 – 4.9	5 - 10
Wind large-scale	3.9 – 7.8	0.92 – 1.58	4.2 – 8.3	
Wind small-scale	3.9 – 7.8	0.41 – 0.91	4.8 – 9.4	
Solar	>7.8	0.33 – 0.49	Above 8.1	> 10
Fossil fuel switch	Estimates vary ²⁴	0.21 – 0.24	Estimates vary	Estimates vary

Source: UNEP Risoe, CDM and PoA pipelines, March 2013

3.10.2 Capacity Development and Carbon Abatement Awareness Raising

(1) Capacity Development

All carbon value associated with Climate Change mitigation requires MRV. To perform MRV not only money is necessary, but the availability of qualified personnel for design and implementation is needed.

(2) Awareness Raising

It is necessary that the Government and major private establishments accurately understand about carbon impacts on Climate Change and the relevance to accurately quantify carbon abatement due EE&C projects. These evaluations can directly yield complementary resource of international monetary helping for the development of Bangladesh. Thus, awareness rising will be obtained through seminars, discussions etc. and folders, and notes prepared and distributed by SREDA.

3.11 Cooperation with Development Partners

There are several projects cooperated by development partners for supporting the effort of EE&C from the demand side: for example, ADB, GIZ, JICA, USAID, World Bank etc.

The EE&CMP will mobilize development partners' access to EE&C activities. The development partners are expected to communicate closely and cooperate with the Government in order to avoid duplication of their support and to create synergetic efforts.

Chapter 4 Economic Analysis of the EE&C Programs

4.1 Background and Objectives

Economic viability and benefits of EE&C measures are already well introduced and tested¹³. Nevertheless, when it comes to nationwide implementation of EE&C programs, it is not as easy and smooth as electricity supply side measures, such as the introduction of power plants utilizing renewable energy sources (i.e., wind, solar, geothermal and water). This is largely due to generally small investment size of each EE&C measure which implies relatively high transaction costs as well as to the general sense of insecurity towards the concept of Negawatt power, namely an amount of energy (measured in watts) saved through EE&C or the cash flow from EE&C which financiers (investors or lenders) do not know how to collateralize¹⁴.

One way to solve these problems and promote a nationwide EE&C implementation is to convince the interested parties by showing the economic benefits of EE&C programs which can generate Negawatt power, an alternative energy to the conventional power that can generate extra incomes.

4.2 Economic Impact of EE&C Implementation

The direct economic benefit of EE&C implementation is energy consumption reduction (toe). Without proactively implementing EE&C programs, the total energy consumption of this country may expand three folds from 25 million toe (Mtoe) in 2013 to 72 Mtoe by 2030. In order to fulfill the growing appetite of the economy, it is important for the Government to minimize the energy wastes and maximize the use of available energy, including the Negawatt power.

According to the EE&C target of EE&CMP, the Government aims to improve energy intensity (i.e., national primary energy consumption per gross domestic product/GDP) by 15% by 2020 and by 20% in 2030 compared to the 2013 level. This goal is considered attainable based on the estimation that the industrial, commercial and residential sectors currently have the potential to save energy by 21%, 10% and 28.8% respectively. The following are the two scenarios for the calculation of the economic benefits of energy savings expected to be generated through EE&C implementation in the period between 2015 and 2030: In Target Scenario (Moderate Case), the energy saving potential realization rate in 2030 will be 80% (i.e., 80% of expected energy savings by 2030 will be accomplished), whereas in Stretch Scenario (Ambitious Case), the potential realization rate will be 100% (or expected energy savings by 2030 will be fully accomplished). (Refer to 2.1.4)

For Target Scenario, a total of approx. 66 Mtoe (or 78 billion m³ of gas equivalent) is expected to be saved within the 15 years between 2016 and 2030. The total energy savings in monetary terms will amount to BDT 380 billion in the period or an annual average of BDT 25 billion approximately, at the

¹³ There are several reports published from International Energy Agency (IEA) on economic benefits of energy efficiency improvements and policies to promote them. <http://www.iea.org/topics/energyefficiency/>

¹⁴ OECD/IEA (2012), by Ms. Lisa Ryan, Ms. Nora Selmet, Mr. André Aasrud, "Plugging the Energy Efficiency Gap with Climate Finance"

current weighted average natural gas price¹⁵. The energy intensity in 2030 will be improved by 20% compared to the 2013 level and the energy consumption in 2030 will be reduced by 17% (or by 12 Mtoe) compared with the BAU case.

As for Stretch Scenario, a total of approx. 100 million toe (or 118 billion m³ of gas equivalent) is expected to be saved in the period. The total energy savings in monetary terms will amount to BDT 580 billion (or an annual average of BDT 39 billion) approximately. The energy intensity in 2030 will be improved by 24.6 % compared to the 2013 level while the energy consumption will be reduced by 22% compared with the BAU case. (See Figure 4.2-1)

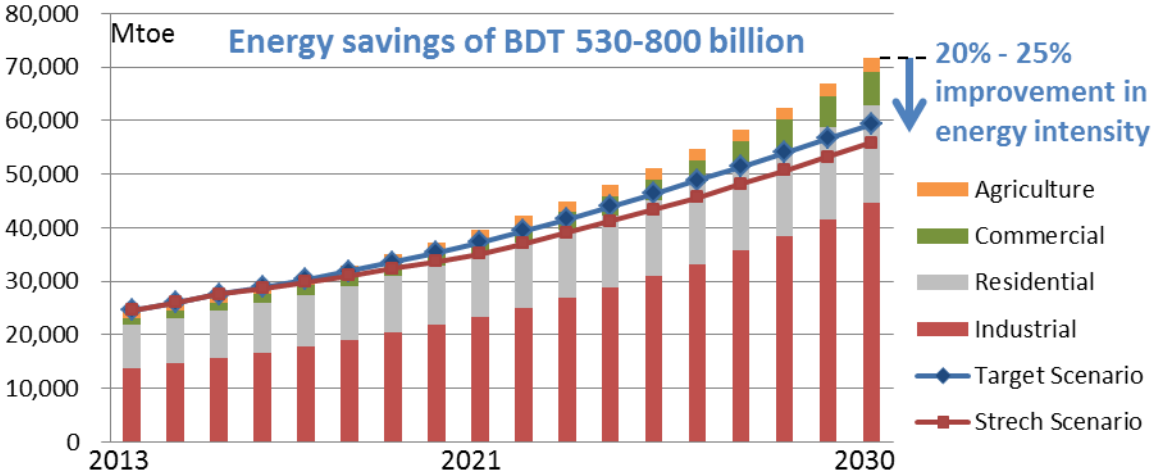
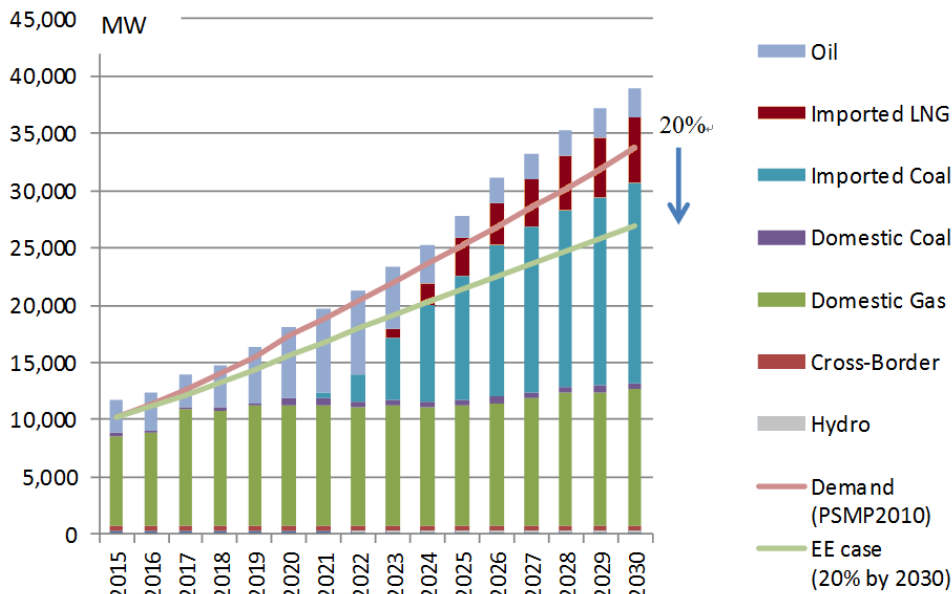


Figure 4.2-1 Realization of Energy Saving Potential by 2030

In addition, as shown in Figures 4.2-2, energy-saving activities promoted under EE&CMP will directly impact power supply through reduced power demand. If the power demand can be gradually reduced between the period 2015 and 2030 and to reach 20% reduction by 2030 compared with BAU (i.e., a total of 42 GW reduction), power supply can be saved by 48 GW, which implies that the necessary development of additional power supply capacity can also be reduced by 8 GW from 27 GW to 19 GW. As a result, the amount of imports of expensive fuels for power generation will decrease remarkably: The total energy savings would facilitate the monetary savings of amounting BDT 1.66 trillion (or an annual average of BDT 97 billion approximately), which is equivalent of 6% of national budget and 1% of GDP (2013).

¹⁵ Based on the recent gas tariff proposal, weighted average tariff is calculated as 195BDT/MCF, raised from the current 140.6BDT/MCF. 195BDT/MCF is equal to 6.8BDT/m³ (1MCF = 28.3m³)



Source: Power Supply/Demand Database compiled by Mr. Kazushige YASHIRO, JICA Expert (May 2014)

Figure 4.2-2 Impact on Power Demand and Supply

Besides the economic benefit of energy consumption reductions, EE&C could also bring about several other positive economic impacts to the energy demand side (namely, residential, industrial and commercial sectors) as well as to the energy supply side of the economy as shown in Figure 4.2-3.

- 1) For the residential sector, reduction in consumption of energy (gas and electricity) implies extra pocket money which contributes to poverty reduction that improves health and social conditions of daily life of the people.
- 2) For the industrial sector, EE&C implies less energy costs per unit of production which will increase industrial competitiveness and thus promote reinvestments in other productive activities that contribute to job creation.
- 3) For the commercial sector, EE&C implies an efficient energy management of buildings which contributes to appreciation of asset values.
- 4) For the electricity supply side, less electricity demand as a result of EE&C implies less fuel costs for electricity generation which contributes not only to the improvement of trade balance through decreased fuel imports, but also to the improvement of energy security of the country.
- 5) For the Government, less energy demand implies less public budgets for electricity generation, which contributes to less energy subsidies and thus better management of limited resources as well as better fiscal management.
- 6) Lastly, less energy demand implies less GHG emissions and thus climate change mitigation, which will contribute to the enhancement of environmental sustainability and therewith the accomplishment of the Millennium Development Goals.

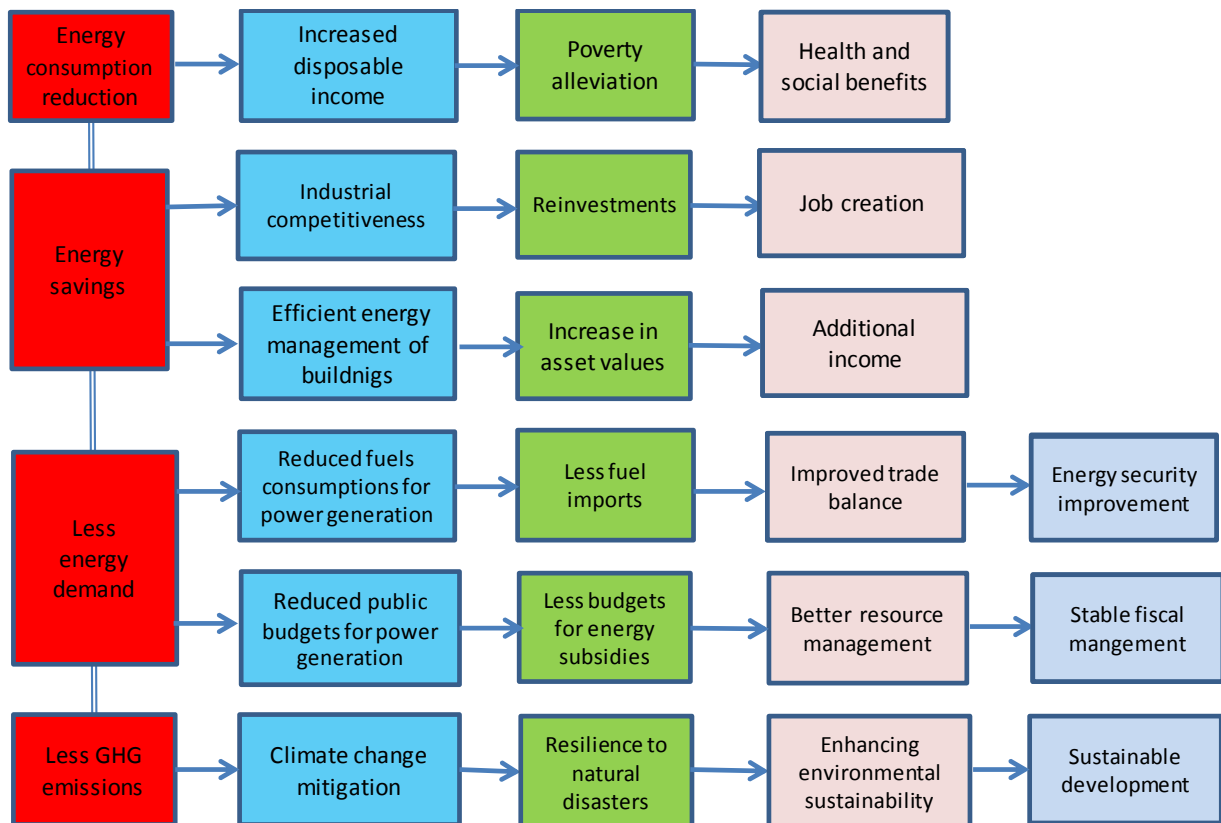
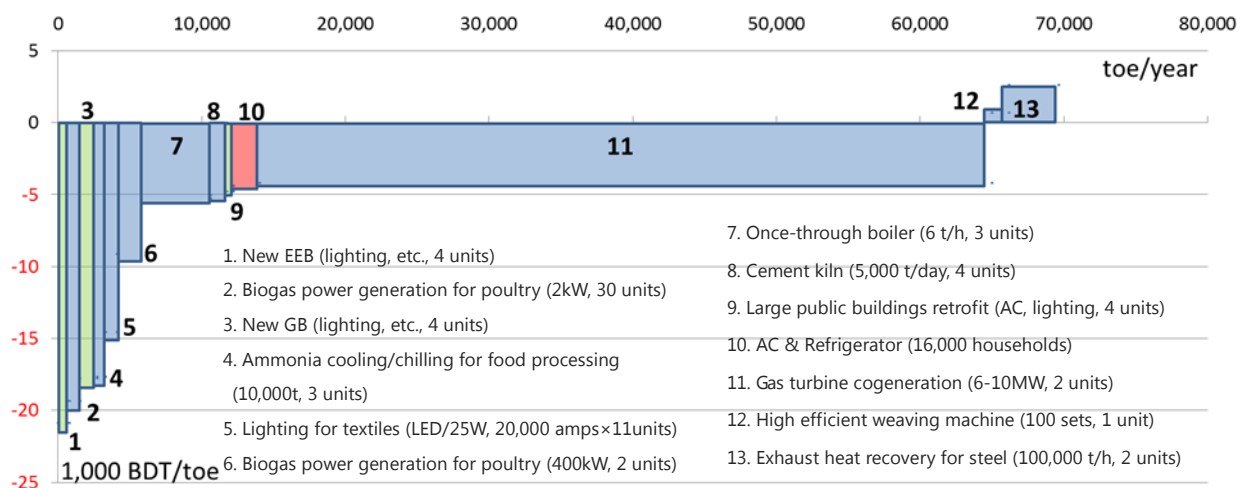


Figure 4.2-3 Economic Benefits of EE&C Implementation

4.3 Cost-Benefit Analysis

For the sake of effective utilization of limited public resources, it is important for the Government to prioritize implementation of EE&C programs and projects according to their cost effectiveness. Marginal Abatement Cost (MAC) curve can be drawn by plotting the data of costs (BDT) per unit of energy reduced (toe) and annual amount of energy reduced. In the MAC curve, the project which require the lowest costs (BDT) per unit of energy saved (toe) is placed at the lower left of the diagram and the project with the highest cost will be placed at the upper right of the diagram, as shown in Figure 4.3-2. In other words, those projects that appear below the horizontal axis can be implemented at a net benefit, while those above the horizontal axis can be implemented at a net cost. For the effective allocation of limited resources, it is wise for the government to prioritize the implementation of EE&C projects according to their cost effectiveness.



Source: Compiled by JICA EE&C MP Project Team based on independently collected data

Figure 4.3-1 MAC Curve of EE&C Flagship Projects

With regard to EE&C programs, namely EE Building Program, EE Labeling Program and Energy Management Program, it is also recommended for the Government to prioritize their implementation according to their cost effectiveness. Most of the projects to be promoted under these three Programs are cost effective and can be implemented with a net benefit.

Table 4.3-1 EE&C Projects (Examples) Representing Each EE&C Program

EE&C program	Content (EE&C measures, etc.)
Energy Management Program (Regulatory measures)	<ul style="list-style-type: none"> ■ Once-through boiler for manufacturing ■ Gas turbine cogeneration to textiles ■ Lighting (LED) for textiles ■ Ammonia cooling/chilling for food processing ■ Highly efficient weaving machine for textiles ■ Exhaust heat recovery for steel
EE Labeling Program (Regulatory measures)	<ul style="list-style-type: none"> ■ Lightings ■ ACs ■ Refrigerators ■ TVs ■ Washing machines
EE Building Program (Regulatory measures)	<ul style="list-style-type: none"> ■ New green buildings ■ New EE buildings
EE&C Finance Program (Financial measures)	<p>Low interest loans, subsidies and preferential taxes for the promotion of:</p> <ul style="list-style-type: none"> ■ Installment sales of EE type appliances to the residential sector ■ Purchase of EE type industrial machineries and equipment in the industrial sector ■ Production of EE type machineries and equipment in the industrial sector ■ Construction of new green buildings and EE buildings in the commercial sector and government sectors ■ Investments in EE retrofitting of old buildings in the government sector

Chapter 5 Capacity Development and EE&C Awareness Raising

5.1 Overview

5.1.1 Roles of the Government on Capacity Development and Awareness Raising

Initially, the Government leads and has a responsibility for capacity development and awareness raising to promote EE&C. Besides considering the importance of EE&C for Bangladesh, such roles are to be taken not only by the Government but also by relevant private sectors, NPO/NGO, individuals and other parties. Thus nationwide structure for EE&C awareness raising has to be formulated.

5.1.2 Capacity Development

For EE&C implementation, capacity development for government organizations, private sectors and energy experts is needed. It is important to cooperate with related organizations and programs to implement these activities effectively.

5.1.3 Awareness Raising

For nationwide EE&C implementation, it is necessary to understand the energy and natural resource issues accurately. In order to realize this effectively, the Government will promote an awareness raising and information provision for all stakeholders. The final goal is that all the people and establishment would take voluntary EE&C actions.

5.2 Roles of the Government on Capacity Development and Awareness Raising

SREDA is the leading agency on capacity development and awareness raising for EE&C. It carries out the following roles and actions in cooperation with the related government and/or private organizations and programs.

- Preparation of regulations and guidelines for EE&C implementation, specifying good practices and developing pilot and demonstration projects as a showcasing.
- Capacity development of the other government organizations.
- Capacity development of energy experts.
- Capacity development of private sectors.
- Awareness raising for residential sector.

Other government organizations will conduct capacity development and awareness raising for themselves and the organizations under them and related stakeholders such as schools, industrial associations etc.

5.3 Capacity Development for the Government

SREDA will lead overall issues to promote EE&C in Bangladesh. It has the responsibility to formulate capacity development programs for the government organizations (both central and local).

Nationwide EE&C cannot be realized only by SREDA but by the comprehensive cooperation and partnership among other government organizations and local government bodies will be necessary.

5.4 Capacity Development for Energy Experts

Energy experts, who have knowledge, experience and interest in EE&C, are the candidates for future energy managers, certified energy auditors and accredited energy auditors. SREDA will develop the capacity of these energy experts through training programs. Besides, because of the limitation of SREDA's capacity, not only SREDA but also social systems of Bangladesh should focus on the capacity development for energy experts; such as university curricula, internal training courses in establishments, publication of educational materials, introduction of success experiences from abroad etc.

5.5 Capacity Development and Awareness Raising for Private Sectors

5.5.1 Overview

Capacity development and awareness raising for private sectors will be implemented through National EE&C award, in accordance with the yearly Power & Energy Week, monthly seminar and monthly focus group seminar. Focus group seminars will be implemented focusing on the effective target sectors.

5.5.2 National EE&C Award and Yearly Power & Energy Week

National EE&C awards are given for the establishments and energy managers whose activities are worth being highly evaluated and to be good examples for the people. The targets of EE&C award consist of public buildings and commercial buildings.

National EE&C award ceremony, exhibition of energy technologies and equipment, and international seminars and workshop on EE&C can be held in the yearly Power & Energy Week, which takes place every year in early December. Educational materials such as leaflets, posters and booklets may be distributed during the event.

5.5.3 Monthly Seminar and Monthly Focus Group Discussion

SREDA is carrying out seminars and focus groups (important consumers to implement EE measures at time) discussion for target energy consumers on monthly basis. These activities must be improved and continued.

5.5.4 Efforts by Industrial Association

All industrial associations are conscious of cost reduction and sustainable operation of their business. In this context, the Government will communicate with them and make information exchanges on effective EE&C measures and imaginable future risks on energy supply etc. SREDA and related government organizations will lead to establish an EE&C focusing committee in each industrial sub-sector.

5.6 Awareness Raising for Residential Sector

5.6.1 Overview

Awareness raising for residential sector consists of EE&C school program initiative and media campaign.

5.6.2 EE&C School/University Program Initiative

The EE&C school program initiative will be formulated focusing on students. Through the discussion with their parents and knowing their present energy consumption condition, the children can understand what the energy consuming appliances are and how to save energy from them etc.

Initially, the Government will conduct EE&C school program, which will be a joint program with SREDA and Ministry of Education. The target of this school program is the students under 15 years age in primary and secondary school.

Educational curriculum on efficient use of energy and its conservation for primary, secondary and higher educational institutions, universities or autonomous bodies will be prepared by SREDA. Ministry of Education and related organizations will take appropriate steps to incorporate in their respective syllabus. The School/university Text Book Board will review the curriculum periodically.

The following actions will be adopted in school/university curriculums:

- Exhibition of video clips and documentaries on energy efficiency and conservation practices and their benefits.
- Organizing spot quiz.
- Introduction of appropriate posters in schools.
- Organizing thematic art competition.
- Motivational talks by experts or professionals.

5.6.3 Media Campaign

Media campaign will be implemented through effective media such as televisions, newspapers and advertising boards, discussions, street campaigns, school campaigns, competitions with prizes etc. The Government will conduct media campaign in cooperation with related government and/or private organizations being coordinated by SREDA.

5.7 Roadmap

Roadmap up to 2030 for awareness raising program implementation is shown in Table 5.7-1. Targeted people’s consciousness level is shown in Table 5.7-2.

Table 5.7-1 Awareness Raising Program Implementation Roadmap

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
Planning	Drafting →	Issue of the Awareness Plan					
Award							
■ Preparation of Guideline	→						
■ For establishments					→	→	→
■ For Energy Manager					→	→	→
Yearly Electricity Week (December)							
■ International Seminar		→	→	→	→	→	→
■ Workshop		→	→	→	→	→	→
■ Exhibition		→	→	→	→	→	→
Monthly Seminar		→	→	→	→	→	→
Monthly Focus Group Discussion		→	→	→	→	→	→
School/university Program							
■ Survey	→						
■ Regular Implementation			→	→	→	→	→
Media Campaign		→	→	→	→	→	→

Table 5.7-2 Targeted People’s EE&C Consciousness Level

Fiscal year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-25	2025-30
People’s EE&C conscious	Not so high						
			High				
						Very high	

Annex

1. Joint Coordination Committee

Position	Name	Status
Chairperson	Mr. Tapos Kumar Roy	Additional Secretary, Power Division
Member	Dr. Ahmad Kaikaus	Chairman, SREDA
Member	Mr. S. M. Shawkat Ali	Additional Secretary, Ministry of Commerce
Member	Mrs. Yasmin Sultana	Joint Secretary (Policy), Ministry of Industry
Member	Mr. Muhammad Ziaur Rahman	Joint Secretary (Development), Energy & Mineral Resources Division
Member	Mr. Siddique Zobair	Joint Secretary, Power Division
Member	Mr. SK. Md. Abdul Ahad	Joint Chief, Power Division
Member	Mr. Md. Shajahan	Additional Director General, Department of Environment
Member	Mr. Mohammad Bazlur Rahman	Deputy Secretary, Power Division
Member	Mr. Md. Sheikh Faezul Amin	Secretary, SREDA, Power Division
Member	Mr. Shah Zulfiquir Haider	Director (Energy Efficiency), SREDA
Member	Mr. Abdul Mannan	Deputy Director, BSTI
Member	Mr. Md. Aminur Rahman	Senior Assistant Secretary, BERC

Joint Coordination Consultant Team

Position	Name	Status
Member	Mr. Yushi Nagano	JICA Bangladesh office
Member	Ms. Minako Mochida	JICA Bangladesh office
Member	Mr. Zaki Md. Ziaul Islam	JICA Bangladesh office
Member	Dr. Yoshida	JICA Project Team (Leader)
Member	Mr. Takashima	JICA Project Team
Member	Mr. Fukushima	JICA Project Team
Member	Ms. Hashimoto	JICA Project Team
Member	Prof. Moreira	JICA Project Team
Member	Ms. Sato	JICA Project Team
Member	Mr. Saeki	JICA Project Team
Member	Mr. Shigetomi	JICA Project Team
Member	Mr. Nakagawa	JICA Project Team
Member	Mr. Hirayama	JICA Project Team

2. Energy Management Program Committee

Position	Name	Status
Chairperson	Mr. Siddique Zobair	Member, SREDA, Power Division, MPEMR (Chairperson of the meeting)
Member	Mr. Md. Sheikh Faezul Amin	Secretary, SREDA and Deputy Secretary PD, MPEMR
Member	Mr. Abdur Rouf Miah	Director, Sustainable Energy, Power Cell
Member	Professor Dr. Md. Zahurul Haq	Departmental Head, Mechanical Division, BUET
Member	Mr. Md. Aminur Rahman	Senior Assistant Secretary, BERC
Member	Mr. Shah Zulfiquir Haider	Director (Energy Efficiency), SREDA
Member	Mr. Kamrul Ahmed	Assistant Director, SREDA
Member	Mr. A.H.M. Mohiuddin	Executive Engineer, PS&P, DPDC
Member	Engr. Mohammad Nashir Uddin Miah	Executive Engineer, Agargaon BOB Division, DESCO
Member	Mr. Md. Rafiqul Islam	Assistant Director, Energy Audit Cell
Member	Mr. Q. A. Sharhan Sadique	Deputy Director, Power Cell
Member	Mr. S.M. Sanzad Lumen	Assistant Director, SREDA

Energy Management Program Consultant Team

Position	Name	Status
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Advisor	Mr. Norio Fukushima	JICA Project Team
Advisor	Mr. Yoshihiko Saeki	JICA Project Team
Advisor	Mr. Kiyoshi Takashima	JICA Project Team (Sub Leader)
Advisor	Mr. Norio Shigetomi	JICA Project Team
Advisor	Mr. Yoshio Hirayama	JICA Project Team
Advisor	Mr. Yukihiro Nakagawa	JICA Project Team
Advisor	Ms. Minako Mochida - Matsukawa	Energy Specialist, JICA Bangladesh

3. Labeling Program Committee

Position	Name	Status
Chairperson	Mr. Siddique Zobair	Member, SREDA, Power Division, MPEMR
Member	Mr. Md. Aminur Rahman	Deputy Secretary, Ministry of Industries
Member	Professor Dr. Mahbubul Alam	Professor, Mechanical Department, BUET
Member	Mr. Shah Zulfiquir Haider	Director (Energy Efficiency), SREDA
Member	Abdur Rouf Miah	Director, Sustainable Energy, Power Cell
Member	Md. Anisur Rahman Mollik	Senior Assistant Director, R&D, Refrigerator, Walton
Member	Mr. Kamrul Hasan	Assistant Director, R&D, Refrigerator, Walton
Member	Mr. Nurul Aktar	Director & CEO, Energy Pac Ltd
Member	Mr. Md. Abdul Mannan	Deputy Director, BSTI

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Advisor	Mr. Yoshio Hirayama	JICA Project Team

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Member	Mrs Sabiha Parbin	Deputy Secretary, Ministry of Housing & Public Works
Member	Engr. Md. Abdus Salam	Principal Research Engineer, Housing & Building Research Institute
Member	Professor Dr. Md. Zahurul Haq	Departmental Head, Mechanical Division, BUET
Member	Mrs Sameem Ara Hasan	Associate Professor, Department of Architecture, BUET
Member	Dr. Raquib Ahsan	Professor, Dept. Civil Engineering, BUET
Member	Engr. Md. Abdul Khaer Salim	Chairman & Managing Director, Nagar Design & Development Ltd. REHAB
Member	Mr. Shah Zulfiqur Haider	PEng. Director (Energy Efficiency), SREDA
Member	Mr. Monowar Hasan Khan	Senior Assistant Chief, Power Division, MPEMR
	Mr. Md. Atikur Rahman	Deputy Secretary, Wind Mapping Project, Power Division, MPEMR

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Advisor	Ms. Minako Mochida	JICA Bangladesh Office

5. Finance Program & Economic Analysis Committee

Position	Name	Status
Chairperson	Mr. SK. Md. Abdul Ahad	Joint Chief, Power Division
Member	Mr. Monoranjan Biswas	Deputy Secretary, Economic Relations Division (ERD), Japan-2, Sub Division MOF
Member	Ms. Mahfuja Akhter	Deputy General Manager, Research Division, Bangladesh Bank
Member	Mr. Pronob Kumar Ghose	Deputy Secretary, (Development-1 Sub-Division), Energy and Mineral Resources Division
Member	Mr. Md. Sheikh Faezul Amin	Deputy Secretary, Power Division, Secretary, SREDA
Member	Mr. Mahbubur Rahman	Deputy Secretary, Economic Relations Division, Japan-2, Sub-Division
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Member	Ms. Farzana Rahman	Unit Head (Investment), Renewable Energy, IDCOL
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Advisor	Mr. Yukihiro Nakagawa	JICA Project Team
Advisor	Mr. Yoshio Hirayama	JICA Project Team
Advisor	Mr. Norio Shigetomi	JICA Project Team
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6. IT and Awareness Program Committee

Position	Name	Status
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Member	Mr. Q.A. Sharhan Sadique	Deputy Director, Power Cell
Member	Mr. A.K.M. Rezaul Karim	ICT Officer, Power Division
Member	Mr. Kamrul Ahmed	Assistant Director, SREDA

IT and Awareness Program Consultant Team

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Advisor	Mr. Kiyoshi Takashima	JICA Project Team (Sub Leader)
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Advisor	Ms. Minako Mochida - Matsukawa	Energy Specialist, JICA Bangladesh

7. Editorial Team

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Member	Mr. Md. Abdullah Al Mamun	Assistant Director ((Energy Audit & Accreditation), SREDA
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