National Energy Efficiency Action Plan (NEEAP)

Ghana

Period [2015-2020]

Within the implementation of the

ECOWAS Energy Efficiency Policy (EEEP)

Date: November, 2015

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ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

Supported by:

Within the framework of

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ABBREVIATIONS AND ACRONYMS

BOT	Build-Operate-Transfer
CC	Climate Change
CEPS	Customs, Excise and Preventive Service
CFL	Compact Fluorescent Light
CRSO	Collection and Recycling Service Organisations
DP	Development Partners
DSR	Direct Solar Radiation
EA	Energy Access
EC	Energy Commission
EE	Energy Efficiency
ECG	Electricity Company of Ghana
ECREEE	ECOWAS Center for Renewable Energy and Energy Efficiency
EDEEB	ECOWAS Directive on Energy Efficiency in Building
EDMF	Electricity Demand Management Fund
ESM	Environmental Sound Management
ESPC	Environmental Service Performance Contract
ESCOs	Environmental Service Companies
GCMC	Ghana Cylinder Manufacturing Company
GEDAP	Ghana Energy Development and Access Projects
GRIDCO	Ghana Grid Company
GSA	Ghana Standards Authority
GSGDA	Ghana Shared Growth Development Agenda
GWh	Gigawatt-hour
ha	hectare
KNUST	Kwame Nkrumah University of Science and Technology

ktoe	kilotonne of oil equivalent
kV	kilo Volt
kVA	kilo Volt Amperes
kW	kilo Watt
kWh/m^2	Kilo Watt hour per square meter
LED	Light Emitting Diode
LI	Legislative Instrument
LPG	Liquefied Petroleum Gas
MEPS	Minimum Energy Performance Standards
MMDA	Metropolitan, Municipal and District Assemblies
m	Meter
MoEP	Ministry of Energy and Petroleum
m/s	meter per second
MVE	Monitoring Verification and Enforcement
MW	Mega Watt
MWRWH	Ministry of Water Resources, Works and Housing
NCTE	National Council for Tertiary Education
NEDCo	Northern Electricity Distribution Company
NEEAP	National Energy Efficiency Action Plan
NES	National Electrification Scheme
NITS	Network Integrated Transmission System
NPA	National Petroleum Authority
NREAP	National Renewable Energy Action Plan
PSFM	Participatory and Sustainable Forest Management
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PURC	Public Utilities Regulatory Commission
PUE	Productive Use of Energy

RE	Renewable Energy
RET	Renewable Energy Technology
SE4AII	Sustainable Energy for All
SHS	Solar Home System
SMEs	Small to Medium Enterprises
SNEP	Strategic National Energy Plan
SPPD	Strategic Planning and Policy Division
TPES	Total Primary Energy Supply
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VRA	Volta River Authority

1 INTRODUCTION

The ECOWAS Commission has developed the ECOWAS Energy Efficiency Policy (EEEP) which includes targets, measures, standards and incentives for energy efficiency (EE), to be implemented at both regional and national levels. It was adopted by the ECOWAS Heads of State and Government in July 2013. According to the EEEP, all fifteen ECOWAS countries shall adopt, by the end of 2014, five-year rolling NEEAPs that will contribute to the achievement of the regional ECOWAS targets in the next two decades.

The NEEAP has been prepared by Ghana (ECOWAS member state) in accordance with a template provided by ECREEE. It includes baseline data on the status of energy efficiency development, and proposes attainable energy efficiency targets, including gender disaggregated indicators, where available, based on national potential and socio-economic assessments. Moreover, an overview of concrete laws, incentives and measures to be implemented by the country to achieve the targets is included. The implementation of the NEEAP will be monitored by the Ministry of Power and ECREEE on behalf of the ECOWAS commission during a continued consultative process. The NEEAP template was prepared with technical assistance from ECREEE and UNIDO. The NEEAP development process has been supported by a broad range of partners including the GEF Strategic Programme for West Africa, GIZ, the Austrian Energy Agency and the Government of Spain.

2 SUMMARY OF NATIONAL ENERGY EFFICIENCY POLICY

Energy efficiency and conservation is regarded as the "low hanging fruit" in protecting the energy resources available in Ghana. Ghana has adopted this position and has built its policies, strategies and programmes around it because it is cheaper to conserve than to build. In this regard, the Energy Commission (under the Ministry of Energy and the Ministry of Power) has elaborated rules and regulations that feed into the national policy of energy efficiency and conservation. Since 2005, the government through the Energy Commission (EC) has enacted policies and implemented landmark programmes that have saved Ghana a lot of investment which would have otherwise gone into the construction of power plants. The landmark programmes include the distribution of 6,000,000 energy efficient lamps that led to a 124MW reduction in peak load annually and the exchange of inefficient refrigerators for efficient ones which reduces electricity consumption by 160.8 MWh per year.

The enabling policies and regulations enacted so far include[1] those listed in Table 1. These policies touch on the economic, environmental and social benefits and security of the supply of energy. For example, they may provide sources of funding (EDMF 2011) and also fiscal policy (VAT Act 870 2013). Others also ensure minimum standards of energy equipment performance, labelling and standardization as well as a refrigerator rebate scheme which promotes energy efficiency in domestic appliances.

Table 1: National policies[2], plans and programmes on Energy Efficiency

Name	Law, Act, Regulation Year	Description	Implementing Government Body
Electricity Demand Management Fund (EDMF)	Policy 2011	Provides funding for energy efficiency activities in the industrial, commercial, and residential sectors	Energy Commission
Value Added Tax (VAT) Act 546, Act 870	Act 1998, 2013	Tax applied to goods and services at each stage of the production and distribution chain but exemptions for petrol, diesel and kerosene	Ghana Revenue Authority
Legislative Instrument (LI) 1815, LI 1958, 1970	Regulation, (2005), (2008)	Labelling for standardization (refrigeration, air-conditioning and lighting)	GSA, EC
Legislative Instrument (LI) 1815, LI 1958, 1970	Regulation, (2005), (2008)	Minimum energy performance standards (refrigeration, lighting and air-conditioning)	GSA, EC

[1]The policies listed in the table are those exclusively related to Energy Efficiency. There are others that relate to RE and EA and these are excluded from this table.

[2]There are other policies such as Ghana Standards Code of Practice which prescribes the quality of building materials but these policies are not necessarily regulations for energy efficiency

Legislative Instrument (LI) 1815, LI 1958, 1970	Regulation, (2005), (2008)	Comparison labeling (refrigeration, air-conditioning and lighting)	GSA, EC
Legislative Instrument (LI) 1815, LI 1958, 1970	Regulation, (2005), (2008)	Endorsement labeling (refrigeration, air-conditioning and lighting)	GSA, EC
Refrigerator rebate scheme	Policy 2012	Promotion of energy efficient refrigerators for domestic use	Energy Commission
Promotion of EE in public buildings	Policy 2009	Installation of capacitor banks in public institutions	
Legislative Instrument (LI) 1815	Regulation (2005)	Energy efficiency standards and labelling (Refrigeration, lighting and air-conditioning)	EC; GSA
Energy efficiency regulation LI 1932	Regulation (2008)	Prohibition of the sale of incandescent lamps	EC
Energy Efficiency standards and labelling LI 1958, 1970	Regulation (2008)	Household refrigeration appliances conforming to energy efficiency standards for imports and locally made goods	EC
The National Building Regulations LI 1630	Regulation (1996)	Ensuring improvements in housing durability and habitability	MWRWH
Ghana Building Code, 1970 & Revised (Draft) 2011	Regulation	Establishing standards in terms of material within the built environment	MWRWH, EC
Ghana Green Building Council (est. 2009)	Energy Efficiency certification and labelling	Promoting the use of energy efficient building materials	EC, GGBC

In implementing these policies, notable achievements have been made in the following areas:

i. Automatic capacitor banks: In 2009, automatic capacitor banks were installed in six public institutions: Osu Castle, Parliament House, Accra Sports Stadium, Food and Drugs Board, Korle-bu Teaching Hospital and the Ministry of Defense. A total of 1,851 kVA was saved monthly. As of 2012, 26 other public institutions were selected and equipped with automatic capacitor banks, saving 1,875 kVA monthly.

ii. Energy efficient refrigerators: The Government has embarked upon a refrigerator energy efficiency project. It is estimated that there are over 2 million inefficient refrigerators each consuming 1,200 kWh yearly compared to 250 kWh yearly for high energy efficient modules. The project seeks to gradually phase out old and inefficient refrigerators and to provide rebates for people who purchase efficient refrigerators. The programme was launched in July 2012 and has so far (2014) bought back 4,000 old and inefficient refrigerators, saving 2,400,000 kWh per year. The project is expected to replace about 50,000 old energy inefficient refrigerators with energy efficient ones within a three year period with expected total energy

savings up to 27,000 MWh per year. The old refrigerators are not recycled; the metal parts and the compressors are removed and sold as scrap to defray the cost of the rebate[3].

A law has also been passed mandating that only refrigerators with a minimum energy performance level can be imported into the country. The maximum allowable limit of consumption is 600 kWh in a year. Through this scheme the importation of used refrigerators dropped from 420,000 units in 2012 to 152,000 in 2013. This is translated into savings in electricity consumption of 160.8 MWh per year.

iii. Compact Florescent Lamps: The Energy Commission led the compact fluorescent lamps (CFL) exchange programme in 2007 which led to the reduction of 124 MW in peak load and to energy cost savings of US$ 33,000,000 annually. Further, the commission in collaboration with Ghana Standards Authority has developed standards for LED street lights in which each 100-watt LED light has the capacity to replace a 400-watt sodium light.

iv. Appliance standardisation: Ghana is now operating in an appliance standardization region that ensures that electrical appliances imported or manufactured for use in Ghana meet certain minimum efficiency standards. In addition, these appliances should be well labelled to enable consumers to make informed decisions on their purchases. Currently, appliance efficiency standards in labelling are being implemented for non-ducted air-conditioners and self-ballasted CFLs.

v. Regulations: Legislation for refrigeration appliances, Energy Efficiency Standards and Labelling Regulations 2009, LI 1958 and its amendments LI 1970 have been passed. These laws support the implementation of the projects.

vi. Efficient cookstoves*:* As part of the efforts to improve energy efficiency, improvedcook stoves have been introduced in the Ghanaian market. The national plan is to introduce two million improved clean cookstoves onto the Ghanaian market by 2020. There are three types, namely: household, institutional and fish smoking stoves. The production and distribution of these stoves are undertaken by tenGhanaian companies. Two other Ghanaian companies import and distribute similar stoves. These stoves are made up of various materials such as clay, metal, bamboo, cement and promote the efficient use of fuel.

Besides these achievements, provision of $25.4 million has been made in the Ghana Power Compact to help improve energy efficiency and demand-side management policies and to support investments to cost-effectively bridge the gap between supply and demand. The project will support the development and the enforcement of energy-efficient standards and labelling, build capacity for improved auditing and to promote public awareness of energy efficiency through campaigns (Source: Ghana Compact II, Aug 2014).

These combine to show the government's determination to attain an energy efficiency target as a part of achieving the entire SE4ALL initiative.

[3]Private companies are in partnership with the Energy Commission; the exchange takes place in their shops. It is the private companies that dismantle the old fridges and sell them as scrap.

3 ENERGY EFFICIENCY POTENTIALS

A conscious effort is being made by the Government to ensure that a higher level of energy efficiency will be achieved given all the plans and programmes that have been made. However, the total potential available has not been universally estimated yet, neither historically or into the future. For example, in buildings, public, residential or industrial, much preparatory work is being conducted in the background but has yet to be implemented. On domestic appliances, however, a project to replace old and inefficient refrigerators was launched in 2012. The estimation is that the removal of 50,000 inefficient refrigerators in a 3-year-programme has the potential to save the country up to 27,000 MWh per year. The project has yet to be extended to nine (9) other domestic appliances including air conditioners, electric water heating and washing machines.

4 SUMMARY OF TARGETS[4]

This document provides targets up to 2020. This is because the national targets for 2030 are yet to be defined by the Strategic National Energy Plan which is currently under review. Therefore, Energy Efficiency targets between 2010 and 2020 only are presented topically below. Within each section the status achieved and the projected targets have been indicated.

4.1 Targets for energy efficient lighting

In 2007, the Government imported and distributed 6 million CFLs in exchange for incandescent filament lamps for households. The penetration rate of CFLs increased from 20% in 2007 to 79% in 2009 as a result of the programme which led to the reduction of 124 MW in peak load and cost savings of US$33,000,000 per year.

The target is to reach 100% penetration by 2020 for off-grid energy efficient lights[5]. (Source: EC 2010) The objective of the lump project is to achieve a target reduction in electricity demand at the peak period between 200 MW and 220 MW by 2020[6].

Further, standards have been developed by the Energy Commission in collaboration with the Ghana Standard Authority to introduce LED street lights in which each 100 watt LED light has the capacity to replace each 400 watt sodium street light. This project was launched in 2011 with the goal of nationwide implementation, but has not yet been implemented nationwide due to financial constraints.

[4] Ghana prepared a 30-year Strategic National Energy Plan which ends in 2020. The plan has yet to be reviewed to enable targets beyond 2020 to be set.

[5] The programme was initiated and directly funded in 2007 to curb an extreme power (electricity) crisis. although it is being continued,it is now private sector-led with enabling policies provided by the government

[6] Source: Towards efficient lighting and appliance market: the case of Ghana, Hon. Fuseini, MoE, 2011

4.2 Targets for high performance distribution of electricity

The targets for high performance distribution of electricity are presented in **Error! Reference source not found.** below:

Table 2: Targets for high performance distribution of electricity

	2010	2020
Total losses in the power system, including technical and non-technical losses in both transmission and distribution (% of power available: generation + balance of imports and exports).	17.1	12.3
Transmission losses (%)	3.7	3.8
Total distribution losses (%)	13.4	8.5

Source: Energy Commission: SPPD 2015

4.3 Targets for energy efficiency standards and labels

The national targets for energy efficiency standards and labels for 2020 are presented in Table 3 below:

Table 3: Targets for Energy Efficiency standards and labels

	In force in 2010 (reference year)	By 2020
Total number of energy efficiency standards in force in the country	1	15[7]
Number of efficient lighting standards (on-grid / off-grid and street lighting)	1	3
Number of appliances standards in force (refrigerators, air conditioners, washing machines, electric water heaters, fans, transformers, etc.)	None	12
Total number of energy efficiency labels in force	1	15

[7]Energy efficiency standards and labelling are going to be applied to the following nine appliances in addition to the existing three by 2020 and these are: ceiling fans, motor, transformers, TV sets, solar, batteries, power converters, water heaters and washing machines.

Number of efficient lighting labels (on-grid / off-grid and street lighting)	1	3
Number of appliance labels in force (refrigerators, air conditioners, washing machines, electric water heaters, fans, transformers, etc.)	None	12

4.4 Targets for Energy Efficiency in buildings and industries

4.4.1 Targets for Energy Efficiency in buildings

The National Building Regulation LI 1630 (1996), the Ghana Building Code (in draft) and the Ghana Green Building Council have been formed to provide regulation and certification for energy efficiency in buildings. However, these are yet to be implemented and therefore no targets have been set for EE in buildings yet. When these codes finally become operational, the Ministry of Water Resources, Works and Housing (MWRWH), Ghana Green Building Council and the EC will supervise and certify the buildings.

4.4.2. Targets for Energy Efficiency in industries

Energy efficiency in the industrial sector is at the discussion stage. Among the issues being discussed are building the capacity of staff to undertake energy audits in this sector and also securing the funding sources for their capacity building. At this stage, not much has been done to set targets for the sector until 2016 when funding sources will have been secured and the process of energy auditing in buildings has begun. However, a fiscal mechanism was previously established (2012 - 2013) where industries with a power factor lower than 0.9 were targeted to be supported with equipment and payments made from the gains of energy efficiency improvements. This was being supervised by energy eervice companies (ESCOs) through energy service performance contracts (ESPC); but little interest was shown by the industrial operators and limited funding by the ESCOs has slowed down the implementation of energy efficiency measures. As a result, there is no baseline data available nor has a plan been developed or have any targets been set.

5 GENERAL INDICATORS

5.1 Demographic indicators

The 2010 population census of Ghana indicated that Ghana's total population stood at 24.7 million and it was estimated to be 25.9 million in 2012. The family size has decreased from 4.4 people in 2010 to 4.0 people in 2012 as presented in Table 4 below.

Table 4: General demographic indicators

	2010	2011	2012
Population (millions)	24.7	25.3	25.9
Population growth rate (%)	2.5	2.4	2,4
Family size	4.4	4.4	4.0

Source: Population and housing census of Ghana: 2010

5.2 Macro-economic indicators

The macro-economic indicators in relation to energy efficiency show that in 2006 the primary energy intensity was 3,254.2 kWh/1,000 Ghs. It improved by 18%, reaching a level of 2,673.1 kWh/1,000 Ghs in 2010 and it is expected to remain at this level until 2020. Final energy and electricity consumption per capita are expected to decrease slightly up until 2020, reaching a level of 2,671 kWh/a and 334.7 kWh/a respectively in 2020. Electricity intensity has improved by over 10% since 2006 and is expected to stand at 340.6 kWh/1,000 Ghs in 2020. All details are presented in the following table.

Table 5: Macro-economic indicators 2006

	Data from the past, where available					Targets for the future, where pertinent (define years)[8]	
Indicator	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010	Year 2015	Year 2020

[8]Projection is based on the calculated rate of increase between 2006 and 2010 at all levels and all things being equal the rate was applied between 2015 and 2020.

Primary energy intensity (Total primary energy consumption/GDP) kWh/Ghs 1,000 of GDP	3,254.2	3,021.8	2.789.3	3,021.8	2,673.1	2,673.0	2,672.9
Final energy consumption per year (kWh/capita/year)	2,789.3	2,789.3	2,673.1	2,789.3	2,673.1	2,671.9	2,670.7
Annual electricity consumption (kWh/capita/year)	337.7	288.8	315.3	318.5	336.7	335.7	334.7
Electricity intensity (final electricity consumption/GDP kWh/Ghs1,000 of GDP)	393.6	323.4	334.4	331.9	343.0	341.8	340.6
Electrification rate (%) (the ratio between the population served and the total population of the area)*	NA	54	55	NA	64.3	76.0	100

Source: EC National Energy Statistics 2000 – 2013[9]

*Source: Ministry of Energy

6 NATIONAL ENERGY EFFICIENCY TARGETS AND TRAJECTORIES

6.1 Efficient lighting

The government introduced efficient lighting systems (CFL) in 2007 and exchanged 6 million incandescent lamps with CFL. By 2009, the penetration rate had increased from 20% to 79% and it is targeted to reach 100% by 2020. At the end of this government sponsored programme, the importation and sale of efficient lighting systems are in the hands of the private sector; data on annual sales are yet to be estimated.

The Energy Commission in collaboration with the Ghana Standard Authority has developed standards for LED street lights in each 100-watt LED light has the capacity to replace a 400-watt sodium light. This project has yet to be implemented nationwide.

[9]The source data for the first two rows were in TOE but were converted into kWh where 1 toe: 11,622.22kWh. The conversion was to be in uniformity with the rest of the data from the same source.

6.2 High performance distribution of electricity

6.2.1 National 2010 and 2020 targets and estimated trajectory for losses in the electricity sector

The government has developed a policy goal for the energy sector. The policy recognises that 30% of electricity supply to consumers is wasted through transmission, distribution, inefficient electrical equipment, poor attitude towards energy conservation and theft[10]. The targets are to reduce transmission and distribution losses of 17.1% in 2010 to a projected level of 12.3% in 2020 as presented in Table 6 below.

Table 6: Estimated trajectory for electricity losses 2010 - 2020

	2010	2013*	2015	2016	2017	2018	2019	2020
Total losses in the power system, including technical and non-technical losses, in both transmission and distribution (% of power available: generation + balance of imports and exports).	17.1	15.3	13.0	12.9	12.7	12.6	12.5	12.3
Transmission losses	3.7	4.2	4	4	3.9	3.9	3.9	3.8
Total distribution losses	13.4	11.1	9.0	8.9	8.8	8.7	8.6	8.5

Source: Energy Commission SPPD, 2015Energy Efficiency Standards and Labelling

6.2.2 National 2010 and 2020 targets for energy efficiency labels

Between 2010 and 2015 the government introduced energy efficiency standards and labelling for three domestic appliances. These are for refrigerators, lighting and air conditioners. For example refrigerators consuming1200kWh per year are being replaced with more efficient ones that consume 250 kWh per year. These selected appliances have been attributed star-rated labels , where the number of stars corresponds to the appliance's level of efficiency. By the year 2020, nine other identified appliances will be standardized and labelled; these are ceiling fans, motors, transformers, televisions, solar systems, batteries, power convertors, water heaters and washing machines. Other appliances yet to be identified may be brought under standardization and labelling beyond 2020. The details are presented in

[10] Source: Energy Sector Strategy and Development Plan, 2010

Table 7 below.

Table 7: National 2020 targets for energy efficiency labels

	2010	2013	2015	2016	2017	2018	2019	2020
Total number of energy efficiency standards in force in the country	1	3	4	6*	8	10	12	15
Number of efficient lighting standards in force (on-grid / off-grid and street lighting)	1	1	1	2	2	2	2	3
Number of domestic appliance standards in force (refrigerators, air conditioners, washing machines, electric water heaters, fans, transformers, etc.)	None	2	3	4	6	8	10	12

Source: Energy Commission: Energy Efficiency Department: 2015 * The figures between 2016 and 2019 for all the indicators are projections for monitoring purposes while of the 2020 figures are the government's committed target.

6.3. Buildings

6.3.1. National 2020 targets and estimated trajectories for energy efficiency in buildings

Energy efficiency in buildings is still under priority consideration; so far, there is no baseline data available nor have projections been done. (See chapter 4.4 above).

6.4. Industry

Energy efficiency in the industrial sector is much at the discussing stage and not enough baseline data is available to develop robust projections. Awareness creation on energy efficiency and its benefits in the industrial sector have been part of the ongoing discussion towards finalization of policies to improve EE (see chapter 4.4 above).

7 NATIONAL PUBLIC INSTITUTIONS INVOLVED IN NEEAP IMPLEMENTATION

The public institutions involved in NEEAP implementation are listed in Table 8 below. It includes the lead ministries: Power and Energy, Energy Commission and Electricity Company of Ghana. Their various roles are also listed which include policy development, licensing and distribution of energy. They all play interconnected and complementary roles to ensure energy efficiency in the country. Apart from the Ghana Standard Authority and the Forestry Commission, all the others work under the two lead ministries.

Table 8: National public institutions involved in NEEAP implementation

	National Public Institution	Responsibilities
1	Ministry of Power	Power policy, regulation, power project and operations
2	Ministry of Energy	Energy policy, regulation, energy project and operations
3	Energy Commission	Licensing of operators in the power, natural gas and RE sectors, certain technical standards for their performance, sector planning and policy advice, the ministry of energy and ministry of power
4	Ghana Standards Authority	Develop standards for energy equipment,both imported and locally produced and pass them onto the regulatory agencies for enforcement
5	Forestry Commission	Forest management for woodfuel production and tree planting
6	GRIDCO	Transmission of electricity energy onto distribution lines
7	Electricity Company of Ghana	Distribution ofelectricity

The total number has been six (6) until 2015 when the Ministry of Energy and Power was split into two bringing the total number to seven (7). It is projected that the Ministry of Water Resources, Works and Housing may be added to the list in future when energy efficiency measures are implemented in buildings.

8 MEASURES FOR ACHIEVING THE TARGETS

The measures for achieving the energy efficiency targets are presented in fourteen (14) tables, Tables 9 - 22 below under different sub-headings. In almost all the measures some amount of work has been done but there is more to be completed to ensure the achievement of the targets.

8.1 Efficient lighting initiative

Ghana is implementing Minimum Energy Performance Standards (MEPS). Energy efficiency policy awareness raising campaigns have been launched and specific measures have been taken to ensure the realization of the objectives. Table 9 below provides the details of the activities planned to be undertaken towards achieving the energy efficiency lighting initiative's objectives – 2015 to 2020.

Table 9: Minimum Energy Performance Standards (MEPSs) for off-grid lighting systems

No	**1**
Measure (title)	Enhance the penetration of energy efficient off-grid lighting systems
Type of measure	Developing standards and labels, education and enforcement of rules
Priority (1 to 5 from highest to lowest)	1
Existing or planned	Planned
Time frame (start year –end year)	2016 - 2020
Description of the measure	• Field survey must be undertaken to identify all the domestic electrical appliances in the system; • Undertake a laboratory test to ascertain the energy efficiency levels in all the appliances; • In relation to local market and inconformity to international standards, set the minimum and the maximum efficiency standards for all the identified appliances; • Design labels in response to the standards set for each appliance and apply them; • Educate the public on the advantages of minimum energy performance of the different forms of minimum standard; • Enforce compliance on importation and local manufacturers of all the systems; • Support the local market for the import, assembly and distribution of MEPs; • Build the capacity of local entrepreneurs who are into storage and wholesale marketing of MEPs lighting systems.

Target group	End users, equipment manufacturers, retailers and suppliers
Implementing body/parties	Energy Commission
Sector*	Residential, industrial and tertiary sector

8.1.1 Supporting policies and measures

The target is to set minimum energy performance standards and labels for 15 systems by 2020. In order to achieve this targets under the MEPSs, specific policy measures have been enacted. The policy measures include the following: Standards and labelling policy (LI, 1970) and minimum energy performance standard policy (LI, 1970), 2008. They set energy efficiency requirements for home appliances including energy efficiency labels. Taxes were removed from the importation of CFLs as a fiscal instrument to support energy efficient lighting policies. The table presents planned actions that need to be undertaken to support the implementation of the policy.

Table 10: Supporting policies and measures

No	**2**
Measure (title)	Supporting energy efficient lighting policy measures
Type of measure	Develop and adopt fiscal instruments to reduce prices of on-grid and off-grid efficient lighting
Priority (1 to 5 from highest to lowest)	1
Existing or planned	Planned
Time frame (start year –end year)	2017 - 2020
Description of the measure	• Conduct baseline market studies and cost benefit analysis of on-grid and off-grid efficient lighting products in Ghana to gather data for consultations with policy makers; • Conduct consultation with policy makers (including the Parliamentary Select Committee) on the establishment of fiscal instruments (including incentives and reduced taxes) to reduce prices of on-grid and off-grid efficient lighting products; • Adopt reduced taxes (including import duties, VAT) for on-grid and off--grid efficient lighting products; • Adopt incentive schemes (including tax holidays) to support local manufacturers of on-grid and off-grid efficient lighting products.

Target group	End users, investors, retailers
Implementingbody/parties	Energy Commission, Policy makers, Ministry of Energy, Ministry of Trade
Sector	Residential, industrial and tertiary sectors

8.1.2 Monitoring, Verification and Enforcement (MVE)

The importance of MVE in ensuring effectiveness of measures and compliance with policies and regulations is not left out in the NEEAP. The measures adopted in Ghana include market surveillance by an inspectorate division created at the Energy Commission where compliance is monitored and appropriate sanctions are applied including confiscation and destruction of non-compliant goods. In this exercise, the target groups are the importers and distributers and the implementing bodies are the EC and the Ghana Standard Authority (GSA). Other planned measures are detailed in Table 11 below.

Table 11: Monitoring, Verification and Enforcement measure

No	**3**
Measure (title)	Establish a system for Monitoring, Verification and Enforcement (MV&E) of Minimum Energy Performance Standards for lighting systems (MEPS).
Type ofmeasure	Market surveillance
Priority (1 to 5 from highest to lowest)	2
Existing or planned	Planned
Time frame (start year –end year)	2017 - 2020
Description of the measure	• Establish National Registries for on-grid and off-grid lighting products; • Create and make functional a national registry for lighting products; • Create and make functional a regional registry for lighting products; • Collate data on lighting products - country of origin, importers, quality, quantity, technical data sheets; • Conduct regular census of importers, wholesalers and distributors of efficient lighting products to update the number of persons involved and type of products on the market; • Conduct periodic checks on importers of lighting systems to know if they are complying with the specified products;

	• Resource GSA in terms of staff strength and equipment at the ports of entry to inspect and enforce compliance of imported lighting systems before they get into the market.
Target group	Ghana Standard Authority, Ghana Immigration Service, importers and retailers
Implementing body/parties	Energy Commission, Ghana Standards Authority
Sector	Residential, industrial and tertiary

8.1.3 Environmentally sound management

The National Energy Efficiency Action Plan does not negate environmental management. For example within the programme where incandescent lamps were/are exchanged with CFLs and the programme where inefficient refrigerators have been replaced, sound environmental measures have been planned to ensure safe disposal. A disposal strategy has been planned in which public education, some regulatory measures and national collection and recycling services will be provided. The details of the planned activities are presented in Table 12 below.

Table 12: Environmentally sound measures in energy efficiency

No	4
Measure (title)	CFL disposal strategy
Type of measure	Efficient waste management / awareness raising
Priority (1 to 5 from highest to lowest)	3
Existing or planned	Planned
Time frame (start year –end year)	2016 - 2020
Description of the measure	• Develop and adopt national regulations for environmentally sound disposal of spent on-grid and off-grid efficient lamps: ○ Conduct consultations at the national level with utilities, selected schools and shops and other identifiable stakeholders for the development of national collection systems of spent efficient lighting systems; ○ Enact the outcome into law with the appropriate LI for implementation and enforcement; ○ Meanwhile create an incentive based system to involve the informal sector in the collection and disposal of spent lighting systems. • Develop and implement national collection systems for spent on-grid and off-

	grid efficient lamps: ○ Procure consultancy services to provide commercially viable technical design for recycling and disposal facility for spent on-grid and off-grid efficient lamps; ○ Procure a set of contractors on BOT basis to run disposal and recycling facilities at the regional levels for spent on-grid and off-grid efficient lamps. • Organise public education and awareness campaigns on the rationale behind and methods for environmentally sound disposal of spent efficient or inefficient lamps: ○ Source for funding and advertise in national and local languages through radio, television, posters/leaflets, newspapers, SMS messages, at social events, markets and through celebrities; ○ Organize special education programmes for the youth in schools. • Adapt and implement ECOWAS Regional Regulation for environmentally sound disposal of spent efficient lamps; • Set up and support Collection and Recycling Service Organisations (CRSO).
Target group	End users, planners, Public Administration , NCCE
Implementing body/parties	Energy Commission, Ministry of Power, EPA
Sector	Residential, industrial and tertiary

8.2 Standards and labelling initiative

8.2.1 Policies and tools

Energy efficiency standards and labeling measures for CFLs and refrigeration have been implemented since 2007. The target is to develop standards and labels for twelve (12) additional domestic appliances by 2020 from the current (2015) level of three (3). Up to 2015, activities such as market assessment of key energy using appliances, laboratory testing of the appliances and consumer research to determine the standard and label to apply have been implemented. The details are presented in Table 13.

Table 13: Standards and labelling initiatives

No	**1**
Measure (title)	Assessment of the implementation of energy efficiency standards and labels incl. product testing
Type of measure	Monitoring
Priority (1 to 5 from highest to lowest)	1
Existing or planned	Existing but requires continuous updating
Time frame (start year –end year)	2007 - 2020
Description of the measure	Market assessment: • Continue to collect and analyse data on key energy using household appliances with regard to their cost, market penetration, brands, energy consumption patterns and categorize them into energy efficiency potentials; • Conduct laboratory testing on the identified appliances (existing and new brands) and label them according to their energy efficiency categories and standards; • Conduct ex ante-evaluation assessment of the cost and benefits of the proposed standards and proposed pricing in consultation with the market players; • Review/amend policy decisions on standards and labelling of household energy using equipment based on findings and extend coverage of standards and labelling.
Target group	Equipment manufacturers, retailers and public administration
Implementing body/parties	Energy Commission, Ghana Standard Authority, Ministry of Energy
Sector	Residential, industrial and tertiary sector

8.2.2 Awareness raising

Awareness raising campaigns are key towards changing habits for the adoption of new energy using products. The new products have better health implications (e.g. improved cookstoves) and use less energy (e.g. CFLs). However, the people must be continuously educated to understand and adopt the new energy efficiency devices. Much has been accomplished by way of sensitization of the public: first the Customs, Excise and Preventive Service (CEPS) at the port of entry were sensitized about the need for energy efficient labelled appliances to ensure that energy inefficient appliances do not enter the country. In addition, special communication strategies including flyers, posters, and role plays on television were used to educate the public on the advantages of energy efficient household appliances. Technicians, distributors and importers of energy using appliances have also been specifically sensitized

to appreciate the value of energy efficient appliances. Table 14 identifies other planned measures that can be deployed to continuously raise the awareness and adoption of EE household appliances.

Table 14: EE Awareness raising measures

No	**2**
Measure (title)	Awareness raising about the use of new efficient products instead of second hand products
Type of measure	Improved awareness raising / information strategy
Priority (1 to 5 from highest to lowest)	2
Existing or planned	Existing but requires continuous updating
Time frame (start year –end year)	2011 -2020
Description of the measure	Evaluate sensitization programmes: • Conduct field surveys to identify which method of communication has had the highest impact of the communication strategies adopted so far; • Collect and analyze data according to the different target groups; consumers, importers, technicians etc. have been most responsive to the awareness creation and also identify those that have not been factored into the campaign; • Collect and analyze data to identify which energy efficient appliances have been accepted by the different target groups; • Use the information collected, design new communication and sensitization strategies specific to the target group and appliance.
Target group	General public, installers and retailers
Implementing body/parties	Energy Commission, Ghana Standard Authority
Sector	Residential, industrial and tertiary sector

8.2.3 Financial/fiscal measures

Financial and fiscal measures are important in ensuring energy efficiency. Newly introduced EE appliances must be affordable to attract purchase and use. This requires the reduction of taxes at the port of entry or providing rebates for the exchange of old appliances as happened within the refrigerator exchange programme. A number of such measures inlcuding exemption from Value Added Tax (VAT) have been implemented and are on-going. However,

other measures can be deployed to support the total adoption and use of EE household appliances as detailed in Table 15 below.

Table 15: Financial and fiscal measures in support of EE

No	**3**
Measure (title)	Changes in tax systems and subsidies to promote energy efficient appliances
Type ofmeasure	Improved financial / fiscal policies
Priority (1 to 5 from highest to lowest)	2
Existingorplanned	Existing but requires review and updating
Time frame (start year –end year)	2012 - 2020
Description of the measure	• Conduct an evaluation study on the impact of the financial and fiscal measures implemented so far; • Determine any other new fiscal and financial measures that can be adopted in addition to existing ones or which of the existing fiscal laws may require amendment/review; • Consult political bodies, utilities and the industry players to prepare new policy such as incentive schemes that can aid the promotion and purchase of energy efficient appliances; • Assess and develop innovative instruments to finance energy efficient appliances and equipment such as credit schemes and subsidies.
Target group	Distributers, retailers, end users
Implementingbody/parties	Energy Commission, Ministry of Finance
Sector	Residential, industrial and tertiary sectors

8.3 Energy efficient buildings initiative

The Ghana Building Code (Draft) which is tailored to local conditions and construction practices has been under revision since 2011, and will serve to recommend standard energy efficient building materials for construction. The Ghana Green Building Council (an NGO) was formed in 2009 to provide regulations and certification for energy efficient buildings. So far, one building in Accra (One Airport Square) has been certified as an energy efficient building by Ghana Green Building Council/South Africa. Additional government support and collaboration with the Green Ghana Building Council is required to promote the implementation of more energy efficient buildings. Measures to achieve this are proposed in Table 16.

Table 16: Energy efficient building Initiatives

No	**1**
Measure (title)	Energy efficient buildings
Type of measure	Promote energy efficiency in buildings and develop standards
Priority (1 to 5 from highest to lowest)	2
Existing or planned	Existing but requires completion
Time frame (start year –end year)	2011 - 2030
Description of the measure	• Complete the National Building Code and establish a working relationship with Ghana Green Council Building (NGO) which was founded in 2009; • Educate the public on attitudinal change towards reducing energy consumption in both public and private buildings by using energy efficient building materials; • Facilitate the development and promotion of local building materials that are energy efficient through capacity building and start-up capital; • Develop and disseminate a compilation of model designs of energy efficient and sustainable constructions from both public and private buildings of various sizes; • Build the capacity of the staff of EC, MWRWH and Ghana Green Building Council in building auditing, certification and accreditation of energy efficient buildings; • Train technicians and installers in the construction and maintenance of energy efficient buildings; • Introduce award systems for certified energy efficient buildings for both public and private constructions;
Target group	Public Administration, professionals in the built environment, end-users
Implementing body/parties	MWRWH, EC and Ghana Green Building Council
Sector	Construction industry

8.4 Electricity distribution initiative

Under this section, measures to improve the efficiency in electricity distribution are presented.

8.4.1 Policy and regulatory framework

In 2010 it was determined that as much as 17.1% of electricity is lost in transmission (3.7%) and distribution (13.4%) before reaching the consumer (Strategic Planning and Policy Division, Energy Commission 2015), due to various factors such as use of old equipment and theft. The target is to reduce losses to 7.5% in distribution and to 3.5% in transmission by 2030. Measures have therefore been included in the NEEAP to reach the target as detailed in Table 177 below. One such measure adopted was the installation of pre-paid meters which have improved the billing system considerably. This measure targets the residential, industrial and tertiary sector (commercial and services).

Table 177: Policy and regulatory framework to curb transmission and distribution losses of electricity.

No	**1**
Measure (title)	Reducing transmission and distribution losses- Improving management practices
Type of measure	Infrastructure development and awareness raising
Priority (1 to 5 from highest to lowest)	1
Existing or planned	Existing but requires updating
Time frame (start year –end year)	2006 – 2020
Description of the measure	• Increase the installation of prepaid meters which began in1995[11] to cover the entire nation in order to improve the billing system (only 30% were willingly paying the post paid bills); • Utility agency (ECG) should strengthen and set up the inspectorate division in all the 216 districts in Ghana to canvass areas in order to detect and remove illegal and unsafe connections; • Improve the rate of replacing faulty and old meters in order to reduce distribution losses; • Continue to install higher thermal capacity cables (330 kV) equipped with smart grid solutions to reduce transmission losses; • Provide tax incentives to enable more private institutions/organisations to participate in the training of Certified Electrical Wiring Practitioners (CEWP) to undertake quality installations at a cheaper cost to reduce illegal connections and distribution losses.
Target group	End users, public administration, energy suppliers
Implementing body/parties	Electricity Company of Ghana

[11]Source: Quayson-Dadzie John, September 2012:Consumer Perception and Acceptability on the use of prepaid metering system in Accra West of Electricity Company of Ghana, Thesis Commonwealth Executive Masters in Public Administration

Sector	Energy transmission and distribution

8.5 Energy efficiency in the industrial sector

8.5.1 Financial/fiscal mechanism

Energy efficiency in the industrial sector is at the discussion stage. As such, not much has been completed by way of policies and tools to ensure energy efficiency in the industrial sector. Capacity building and improving the energy efficiency in this sector is projected to be effective by 2016[12] when personnel will be qualified to undertake energy audits in the industrial sector. Awareness creation on energy efficiency and its benefits in the industrial sector has been part of the ongoing discussion towards finalization of policies to improve EE.

However, some financial/fiscal mechanisms are in place, such as industries with poor power factor i.e., performing below 0.9, are being identified and supported financially by Energy Service Performance Contracts (ESPC) through Energy Service Companies (ESCOs) to improve their efficiency. The industries are to pay back the support received through the energy savings made through the installation of the energy efficient equipment. However, lack of funding has reduced the impact of this mechanism. The details of the financial/fiscal mechanism measures are presented in Table 188.

Table 188: Financial/fiscal mechanism

No	**1**
Measure (title)	Fiscal mechanism
Type of measure	Financial Instrument for industrial Energy Efficiency
Priority (1 to 5 from highest to lowest)	3
Existing or planned	Existing but requires updating
Time frame (start year –end year)	2012 - 2030
Description of the measure	• Provide financial support to build the capacity of staff to undertake energy audits in industrial buildings; • Provide financing to resource ESCOs in order to perform ESPCs; • Educate and support industries with poor power factors to acquire the needed energy efficient equipment in order to improve EE; • Build the capacity of industrial operators for the installation and

[12]Funding source is under discussion and may be completed by 2016

	maintenance of EE equipment to improve PUE.
Target group	Industries with a power factor lower than 0.9
Implementing body/parties	Energy Commission
Sector	Industrial sector

8.6 Cross-cutting measures

Ghana has developed an energy sector plan which seeks to reduce energy losses from 17.1% in 2010 to 11% in the transmission and distribution of electric energy by 2030 (see section 8.4 above). In addition, attempts are underway to develop a building code, among other instruments, to promote the use of local materials in the building industry in order to improve the energy efficiency of buildings. With regard to petroleum products, measures such as banning the importation of over aged vehicles are in force to improve energy efficiency. In addition, old and inefficient refrigerators are being exchanged for new and efficient ones, a measure which has already begun yielding positive results in the area of energy efficiency.

Sustaining this momentum requires continued public education regarding the advantages of using efficient domestic and industrial appliances, vehicles, lighting devices, as well as the benefits of implementing energy efficiency measures in buildings, achieving overall attitudinal change etc. These educational efforts should also highlight the consequences for neglecting such directives. For this purpose measures for sustained general public education are proposed in Table 19.

Table 199: Public education regarding EE measures

No	**1**
Measure (title)	General public education regarding EE
Type ofmeasure	Increase awareness of energy conservation and management in residential, public, industrial and commercial facilities
Priority (1 to 5 from highest to lowest)	2
Existing or planned	Existing but requires updating
Time frame (start year –end year)	2015-2020
Description of the measure	• Conduct a survey to assess public perception and understanding of the advantages of energy efficiency of industrial, public and private(domestic) appliances and develop brochures and pamphlets to educate the public on the subject matter;

	• Introduce energy efficiency curriculum at all levels of education to bring public attention to energy efficiency; • Institute an energy efficiency month and educate the public through demonstrating energy efficient domestic appliances, vehicles, lighting devices, efficient building materials and industrial appliances; • Establish and advertise a website as repository for energy efficient technologies and designs and update regularly; • Introduce drama and the arts to further educate the public on the advantages of using energy efficient appliances; • Facilitate the sustenance of energy efficient projects such as the exchange of domestic appliances which include refrigeration, air conditioners and washing machines; • Sensitize institutions and train energy managers in energy efficiency.
Target group	General public
Implementing body/parties	Energy Commission, Ministry of Energy and Ministry of Information
Sector	All sectors

8.6.1 Promotion of gender equity

Gender equity in EE is not limited to access but extended into the economics as well. There is an ECOWAS programme on gender mainstreaming where capacities will be built in the realm of energy policies and projects. Ghana is to take advantage of this ECOWAS programme in the NEEAP.

Table 200: Measures in gender equity for EE

No	**2**
Measure (title)	Gender equity
Type of measure	Gender mainstreaming
Priority (1 to 5 from highest to lowest)	3
Existing or planned	Planned
Time frame (start year –end year)	2015 - 2020
Description of the measure	• Involve women in the conceptualization, development and implementation of energy

	efficiency policies, projects and programmes; • Integrate gender indicators in all baseline studies; • Conduct gender analysis of business models to evaluate economic implications for women in the value chain as well as social benefits and barriers for women related to different production modes; • Ghana is to take advantage of the ECOWAS training programme on Gender Mainstreaming in energy access (ECOW-GEN).
Target group	Public administration, investors and women
Implementing body/parties	Energy Commission
Sector	Agriculture, fisheries and residential sectors

8.6.2 Capacity building

Management capacity, in the areas of production and promotion of local materials, entrepreneurship and resource financing, has been considered one of the major challenges to the promotion of energy efficiency in the building industry.. To overcome this, there is the need to increase the intake of science and engineering students at the tertiary level and to expand the educational curriculum from the basic level to the tertiary to include energy efficient management and entrepreneurship. Further measures are proposed in Table 21.

Table 211: Measures to improve capacity in EE in buildings

No	**3**
Measure (title)	Improving science and engineering manpower
Type of measure	Management training in EE
Priority (1 to 5 from highest to lowest)	1
Existing or planned	Existing but requires expansion and improvement
Time frame (start year –end year)	2010 – 2020
Description of the measure	• Introduce the subjects of energy efficiency management and entrepreneurship in buildings industry into science education institutions; • Build the entrepreneurship capacity of practitioners in the area of sales and marketing of EE building materials;

	• Identify and support entrepreneurs in strategic locations to establish the supply chain of energy efficient building materials; Train EE project financing for both private and public construction managers.
Target group	Ministry of Education, Ministry of Power, Ministry of Energy and Energy Commission
Implementing body/parties	Science and engineering institutions
Sector	Tertiary

8.7 National public Institution

The KNUST Center of Energy was formally established in 2009 with a vision to undertake research, both contract and academic, in order to give advice on and demonstrate new sustainable energy systems. It also provides training in sustainable energy to the general public, professionals and students. The details are provided in Table 222.

Table 22: Public research and development Institution

No	**1**
Measure (title)	Research and Development (R&D), training
Type of measure*	Introduce innovative production technologies
Priority (1 to 5 from highest to lowest)	1
Existingorplanned	Existing but needs updating
Time frame (start year –end year)	2009 - 2020
Description of the measure	• Provide funding for theoretical and operational R&D into RETs, energy saving devices, energy efficient building materials, wind and solar energy development; • Research, develop and promote locally assembled RE and EE domestic and industrial appliances; • Create awareness among SMEs and larger industries and policy makers on new RETs and their energy saving benefits;

	• Organize seminars and networking meetings on sources of financing for industrial energy management and energy optimization projects; • Research and promote efficient carbonisation technologies; • Establish two test and expertise centres for cookstoves by 2015; • Convert single cycle plants to combine cycle plants.
Target group	Public and private science and technology (RE and EE) Institutions
Implementing body/parties	Ministries of Energy and Power
Sector	All sectors

9 ARTICULATION WITH REGIONAL INITIATIVES

The ECOWAS region has a series of on-going regional policies and initiatives in the field of energy efficiency:

- The ECOWAS Energy Efficiency Policy (EEEP);
- ECOWAS Energy Efficiency Programme (SEEA-WA);
- The West Africa Clean Cooking Alliance (WACCA);
- The ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN);
- The ECOWAS Solar Thermal Programme;
- Specific EE Initiatives;
    - Standards and labelling initiative;
    - Efficient lighting initiative;
    - Energy Efficiency in buildings initiative;
    - High performance of distribution of electricity initiative;
    - Safe, sustainable and clean cooking initiative.

10 PREPARATION OF THE NATIONAL ENERGY EFFICIENCY ACTION PLAN

The preparation of the National Energy Efficiency Action Plan began following the process agreed upon during a regional kick off workshop in Abidjan from 17th - 19th March, 2014. Based on the process, an inception report (with contents defined) was submitted on schedule.

According to the schedule, a 7-member expert group was formed increasing the personnel of the existing group at the Energy Commission. The commission had the full mandate of the Ministry of Energy. The members of the working group are listed below:

1) Mr. K A. Otu Danquah — Head, Renewable Energy Division - Chairman
2) Mr. Anthony Bleboo — Head, Technical Regulation Division
3) Mr. Julius Nkansah-Nyarko — Snr. Programme Officer, RE Division (Bio Energy)
4) Dr. Joseph Essandoh-Yeddu — Chief, Strategic Planning and Policy Division
5) Mr. Kofi Agyarko — Head, Energy Efficiency Promotion
6) Miss Paula Edze — Coordinator, SE4ALL
7) Mr. Kwasi Opoku — Consultant

With the support of the expert group a baseline report was prepared. During the preparation of the baseline report, there were other stakeholder institutions identified to provide input for the study. These included: the Ministry of Agriculture, Forestry Commission, Aviation Department of the Ministry of Transport, Railways Corporation, Electricity Company of Ghana, GRIDCO, VRA, National Council for Tertiary Education, Ghana Standards Authority and the Ministry of Women and Children Affairs. These institutions and departments were individually contacted for the relevant data that completed the report.

According to the process agreed upon in Abidjan, an international team of experts were contracted by ECREEE to support the development and review of the action plans which included NREAP, NEEAP and the SE4ALL Action Agenda. The baseline report provided the basic information for the preparation of all the plans.

With the NEEAP, as with the other plans, draft reports were circulated by the consultant to the local and the international team of experts (the Ministry of Energy was also copied) for comments and suggestions that were integrated into the final draft for a national validation workshop.

10.1 Inter-ministerial implementation committee

An inter-ministerial committee has been inaugurated to implement the SE4ALL Agenda (specifically the high impact opportunities for Ghana). The committee is made up of the Ministry of Power, the Ministry of Trade and Industry, the Ministry of Food and Agriculture, the Ministry of Fisheries and Aquaculture Development, the Ministry of Health, the Ministry of Environment, Science and Technology and Innovation and the Ministry of Gender, Children and Social Protection. This committee is chaired by the Ministry of Power.