National Renewable Energy Action Plan (NREAP)

The Gambia

Period 2015-2020/2030

Within the implementation of the

ECOWAS Renewable Energy Policy (EREP)

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NATIONAL RENEWABLE ENERGY ACTION PLAN (NREAP) OF THE GAMBIA

1 INTRODUCTION

The ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP) were adopted by the ECOWAS Member States in October 2012 and the ECOWAS Heads of States on 18 July 2013. The policy documents were prepared with technical support of the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and a broad range of international partners (UNIDO, EUEI-PDF, GEF-SPWA, Austria, Spain). The policies include minimum targets and scenarios for renewable energy (RE) and energy efficiency (EE) as well as measures, standards and incentives to be implemented at both regional and national levels.

The EREP foresees the development of National Renewable Energy Action Plans (NREAPs) by the end of 2014 by all fifteen ECOWAS Member States. The five-year rolling NREAPs prepared by the ECOWAS Member States will contribute to the achievement of the regional EREP targets by 2020 and 2030. The NREAPs include attainable renewable energy targets based on national potential and socio-economic assessments. Moreover, they include an overview on concrete laws, incentives and measures to be implemented by the country to achieve the targets will be included. The implementation of the NREAPs will be monitored by the Ministry of Emergy of The Gambia and ECREEE on behalf of the ECOWAS Commission during a continued consultative process. The template for the NREAPs was prepared with technical assistance of ECREEE and UNIDO. The implementation process will be supported by a broad range of partners such as the GEF Strategic Programme for West Africa, GIZ, IRENA as well as the governments of Austria and Spain.

The definitions of energy terms and concepts used throughout this NREAP, are contained in Annex 1. The scenarios for the contribution of renewable energy sources to the electricity mix and for the cooking sector have been developed using a scenario tool provided by ECREEE.

According to The Gambia 2013 population and housing census, the population in The Gambia was 1,882,450 inhabitants in 2013 with a growth rate of 3.3% per year. The number of people per housing unit was estimated at 8.2, and the number of households in 2013 was 229,567. Households in The Gambia are still large given the fact that many people continue to live in traditional household settings in which members of different generations of households live. This kind of living arrangements still predominates in rural settings. However, in urban areas the size of households is declining due mainly to immigration. As the urbanisation trend is set forth, the size of households will be reduced in the long term. The population growth rate of 3.3% has been assumed to remain constant for the entire period until 2030. As for the number of persons per household, a slowly declining trend is assumed, reaching 6 persons per household in 2030. Population is expected to rise up to 3,269,105 inhabitants in 2030 and the number of households expected to substantially increase reaching 544,851 in 2030.

The National Renewable Energy Action Plan of The Gambia is based on existing national policies, strategies and programmes, as well as a vast number of national and international databases, studies and reports referenced throughout the document. The Government of The Gambia has set a number of national renewable energy targets for 2020 and 2030, which are to be achieved by implementing the proposed policies and measures, which were discussed with the national stakeholder group. The Plan will be periodically reviewed to take account of changes in national policies, strategies and programmes and relevant emerging trends in both national and international developments as reflected by the implementation monitoring and evaluation reports.

2 SUMMARY OF NATIONAL RENEWABLE ENERGY POLICY

Renewable energy policy objectives of The Gambia are expressed within the framework of an overall national energy policy, but no standalone renewable energy policy has been formulated. In 2014, a review of the 2005 Energy Policy - which hitherto provided the policy framework of the sector - has been completed and the resultant National Energy Policy (strategy) and National Energy Policy have been validated for adoption on 25th November 2014.

The new ''national energy policy (final)'' articulates two renewable policy objective strands with a clearly defined set of strategies. These include:

1. Promote the utilisation of renewable energy technologies through the following five policy elements:

a) Popularise the use of solar photovoltaic (PV), wind turbine technologies, and thermal systems in the Gambia to provide power for various applications particularly in rural areas;
b) Encourage the use of RE as alternative domestic fuel resources;
c) Facilitate donor intervention in the provision of grants, interest-free loans as well as fiscal incentives for the acquisition of renewable energy devices, including solar photovoltaic, wind turbine technologies, and thermal systems;
d) Implement RE law recommendations for feed-in-tariffs to attract investment in the RE power plants; and,
e) Publish and gazette FiT to give confidence to investors.

2. Regulate and promote the utilisation of renewable energy technologies as well as local manufacturing through the following two policy elements:

a) Formulate standards of equipment of RE imported into The Gambia; and,
b) Enhance institutional and human capacity in RE technologies.

These policy objectives and strategies are designed to ensure affordable, adequate, and security of supply, ensure sound environmental considerations and adequate economic and social benefits. The main actions to be taken in pursuit of these objectives are:

a) Encourage and expand the introduction of wind pumps, through local engineering firms or design and manufacture for irrigation especially for women's gardens
b) Regulate solar installers to ensure industry-wide standard installation, build consumer confidence on RE technologies and create employment
c) Promote local RE technology assembling and/or manufacturing and engineering such as wind mills for water pumping, solar dryers, etc.
d) Strengthen existing institutions like GREC GTTI and the University of The Gambia to enable them to introduce RE programmes, train installers and also raise RE awareness not only for the public but also for policy makers.
e) Promote the use of solar water heaters in institutional facilities, hotels and private households.
f) Create awareness of the benefits (economic and environmental) of using renewable energy technologies through public education (TV, radio and other media).
g) Promote adaptive research and development of renewable energy devices.
h) Encourage and support private sector participation in the promotion and development of RE technologies.

3 SUMMARY OF TARGETS

In 2013, electricity generation in The Gambia amounted to approx. 236 GWh and the available capacity for the same year was approx. 65 MW (PURA, 2013).[1] In The Gambia, the load growth is limited by the availability of supply. Under a business as usual development of the electricity subsector, electricity generation would grow at an average annual rate of 10%/year assuming that the non-served electricity demand will be gradually met over time[2]. Without further measures to support the deployment of renewable energy, electricity generation from renewable energy source (RES) would remain very limited. Renewable electricity generation from wind power accounted for 2 GWh in 2013, with no or negligible contribution from other renewable energy sources.

As a contribution to the attainment of the targets of the ECOWAS Renewable Energy Policy (EREP), the Gambia intends to achieve 24 MW and 70 MW of installed renewable energy capacity by 2020 and 2030 (excl. medium and large hydro), respectively. Due to the small slope of the lower Gambia River in the Gambian territory, there is no significant potential for hydropower in The Gambia. However, the Gambia is a party to both the Organization for the Development of The Gambia River Basin (OMVG) and the West African Power Pool (WAPP) programme. The WAPP master plan assumes that 15 MW from the Gambia River hydropower projects could benefit The Gambia in the long term. This capacity is assumed to be available to The Gambia as of 2018. Thus, the overall target for installed RES capacity, including medium and large hydropower, is expected to amount to 39 MW in 2020 and 85 MW in 2030.

Table 1: Targets for grid connected RE

Installed capacity (MW)	**2013**	**2020**	**2030**
Renewable energy installed capacity in MW (including large and medium scale hydro)	1	39	85
Renewable energy share of the total installed capacity in % (including medium and large hydro)	1	28	30
Grid-connected generation (GWh, %)	**2013**	**2020**	**2030**
Total renewable energy generation in GWh (including medium and large hydro)	2	110	210
Renewable energy share in the electricity mix in % (including medium and large hydro)	0.8	28	26

Table 2: Targets for off-grid applications

	2013	**2020**	**2030**
Share of rural population served with off-grid (mini-grids and stand-alone) renewable energy electricity services in %	2.3	19.7	37

The National Investment Program on Access to Energy Services (NIPAES) in The Gambia (MoE, 2012) focuses on the expansion of energy access to meet the targets set by the ECOWAS/UEMOA Regional Policy and covers:

- Access of urban, peri-urban and rural households to improved cooking systems (modern fuel and improved cookstoves);

[1] PURA (2013). Annual Report 2013. Public Utility Regulatory Authority. The Gambia. http://www.pura.gm/images/Annual_Reports/PURA%20Annual%20Report%202013_final_published.pdf

[2] According to PURA (2013), the electricity demand in 2013 was of 685.8 GWh/year, including the non-served demand. The demand growth rate in 2013 was 3% per annum. Demand has been growing rapidly during recent years. If this growth rate is maintained over the long term, the electricity demand will reach about 1,132 GWh/year in the year 2030. Following the SE4ALL target of reaching 100% access to electricity in 2030, the demand would have to be covered in its totality.

- Access of urban, peri-urban and rural households, communities and institutions to grid and off-grid electricity; and,
- Access of rural households and communities to mechanical power.

It defines targets for the number of rural households supplied with off-grid electricity services (mini-grid and solar PV) for the period 2013/2020, which have been integrated into the SE4ALL Action Agenda as well. Based on these, about 20% of the rural population are expected to be served with off-grid renewable electricity services in 2020, and 37% in 2030 (see Table 2).

Table 3: Targets for domestic cooking energy

	2013	2020	2030
Share of charcoal produced using efficient charcoal production technologies in %	5	40	100
Share of population with access to modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers)	8.9	100	100

The NIPAES defines target for access to sustainable production of biomass at 40% in 2020. The NIPAES target for modern fuel alternatives (improved fuels) was set at 100% in 2020. These targets were both adopted by the SE4ALL Action Agenda and the NREAP, and extended to 2030.

The 2020 and 2030 targets of the ECOWAS Renewable Energy Policy for solar water heaters for sanitary hot water and preheating of industrial process water for district health centres, maternities, school kitchens and boarding schools; and, agro-food industries were considered in this NREAP. Nationally set targets for hotels with solar thermal systems were adopted (see Table 4).

Table 4: Targets for solar water heaters

Solar water heaters for sanitary hot water and preheating of industrial process water:	2013	2020	2030
Share of district health centres, maternities, school kitchens and boarding schools with solar thermal systems in %	8	25	50
Share of agro-food industries (preheating of process water) with solar thermal systems in %	na	10	25
Share of hotels with solar thermal systems in %	15	30	50

na – not available

4 RENEWABLE ENERGY TARGETS AND TRAJECTORIES

4.1 Grid-connected Renewable Energy Targets

The status of renewable electricity generation capacity in 2013 and the targets for 2020 and 2030, which The Gambia intends to achieve as a contribution to achieving the targets of the EREP, are presented below.

In The Gambia, the load growth is limited by the availability of supply. Electricity generation has been assumed to grow at an average annual rate of 10%, assuming that the non-served electricity demand will be gradually met over time[3] (baseline scenario) and taking population growth, electrification programmes and rising income levels into account. Overall electricity generation is therefore expected to grow from approx. 236 GWh in 2013 (PURA, 2013) to 805 GWh in 2030.

The overall target for installed electric RES capacity, including medium and large hydropower, is expected to amount to 39 MW in 2020 and 85 MW in 2030 of which 15 MW is expected to be imported each year. Total renewable electricity generation is expected to have a share of 28% in overall electricity generation (393 GWh) in 2020. Due to the strong increase in expected overall electricity generation, rather moderate potentials for renewable electricity generation and limited national funds available for the deployment of renewable energy sources, the renewable energy share will slightly decrease to 26% in 2030. Nonetheless, total renewable electricity generation will increase from current levels of 2 GWh (2013) to 210 GWh in 2030. The targets for the installed capacity and electricity generation from grid-connected renewable energy systems in 2020 and 2030 are summarized in Table 5.

Table 5: ***Targets for grid-connected renewable energy, 2020 and 2030***

Installed capacity	**2013**	**2020**	**2030**
Installed renewable electric capacity in MW (excluding medium and large hydro)	1	24	70
Renewable energy share of the total installed capacity in % (excluding medium and large hydro)	1	18	24
Large- and medium scale hydropower capacity installed in MW (more than 30 MW)	0	15	15
Large- and medium scale hydropower (more than 30 MW) share of total installed capacity in %	0	11	5
Total renewable energy generation capacity in MW (including large and medium scale hydro)	1	39	85
Renewable energy share of the total installed capacity in % (including medium and large hydro)	1	28	30
Grid-connected generation	**2013**	**2020**	**2030**
Renewable electricity generation in GWh (excluding medium and large hydro)	2	50	150
Renewable energy share in the electricity mix in % (excluding medium and large hydro)	0.8	13	19
Large and medium scale hydropower generation in GWh (more than 30 MW)	0	60	60
Large and medium scale hydropower generation (more than 30 MW) as share of total electricity generation in %	0	15	7
Total renewable electricity generation in GWh (including medium and large hydro)	2	110	210
Renewable energy share in total electricity generation in % (including medium and large hydro)	0.8	28	26

[3] which is in line with the assumptions of the WAPP Master Plan

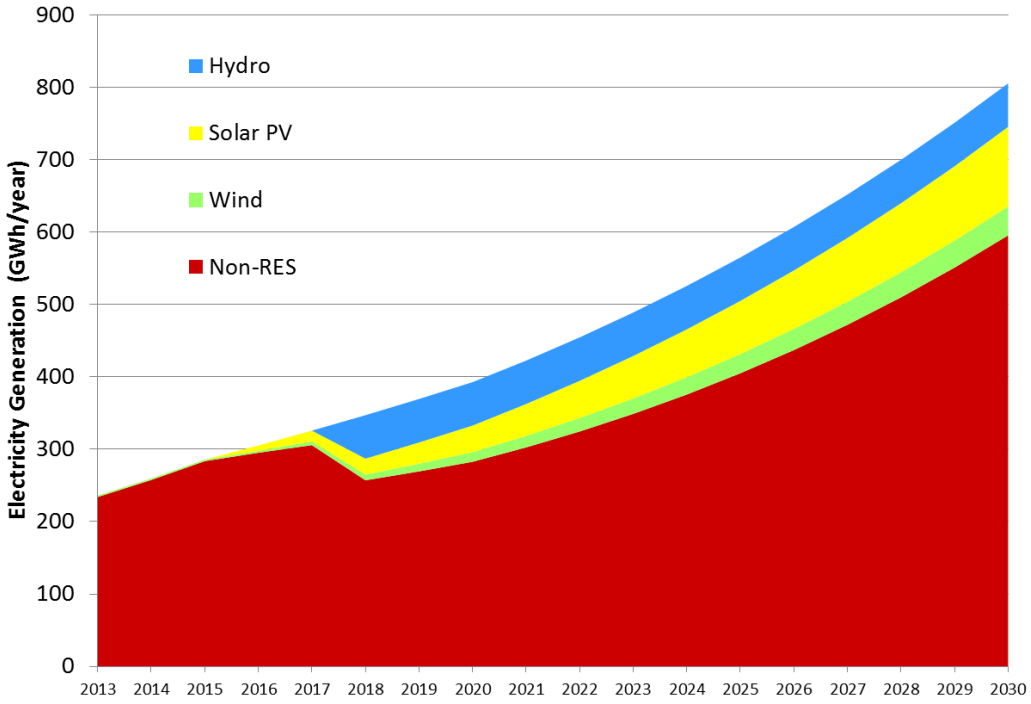

Figure 1: Electricity generation in The Gambia, NREAP/NEEAP scenario 2013-2030

Scenarios for the contribution of renewable energy sources to the electricity mix, for energy efficiency in the electricity sector and for cooking have been developed using a scenario tool provided by ECREEE. Two scenarios have been developed with the simulation tool:

1. A baseline scenario, representing developments under business as usual conditions, i.e. in the absence of measures foreseen by the NREAP and the NEEAP

2. A NREAP/NEEAP scenario, which portrays the overall combined impacts of the NREAP and NEEAP implementation.

The level of detail of the presented results is constrained by the level of detail in the treatment of the respective sectors in the scenario tool and by the availability of the corresponding data for The Gambia. The combined impact of the NREAP and NEEAP implementation exhibits a considerable reduction in electricity generation, and a significant contribution of renewable energy sources to the electricity mix in The Gambia as compared to the baseline scenario. Due to the focus of the NREAP on renewable energy sources, and with the constraint that the scenario tool does not allow for a detailed analysis of non-renewable sources, these have been estimated in bulk to account for the difference in overall electricity generation.

In the NREAP/NEEAP scenario, total renewable electricity generation (including medium and large-scale hydropower), will amount to 110 GWh in 2020, and 210 GWh in 2030, which corresponds to 28% and 26% of total electricity generation, respectively (see Figure 1). In 2030, grid-connected solar PV generation is expected to reach 110 GWh, wind generation 40 GWh, and hydropower generation 60 GWh. Considering existing wind and solar potentials in The Gambia, national wind and solar PV generation is assumed. Due to the small slope of the Gambia River in the Gambian territory, no significant hydropower potential exists in The Gambia. Through the OVMG, the Gambia is expected to profit from 12% of the power of the hydroelectric plants of Sambangalou around 2017, which is 15 MW (WAPP Master Plan). Therefore, in line with the WAPP Master Plan, it is assumed that 15 MW of installed capacity from the Gambia River hydropower projects (OVMG) could benefit The Gambia in the medium term, i.e. as of 2018.

Based on the 2020 and 2030 targets for grid-connected renewable electricity, the estimated trajectories for installed renewable electricity capacity (MW) and renewable electricity generation (GWh) are presented in Tables 6 and 7.

Table 6: National 2020 and 2030 targets and estimated trajectory of grid-connected installed renewable energy generation capacity (MW)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Medium and large hydro (more than 30 MW)	0	0	0	0	0	15	15	15	15	15	15	15	15	15	15	15	15	15
Solar (PV)	0	0	0	3	7	10	13	17	20	23	27	30	33	37	40	43	47	50
Wind	1	1	1	2	4	5	6	7	9	10	11	12	14	15	16	17	19	20
Total	1	1	1	5	10	30	34	39	44	48	53	57	62	67	71	75	81	85

Table 7: National 2020 and 2030 targets and estimated trajectory of grid connected renewable energy generation (GWh)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Medium and large hydro (more than 30 MW)	0	0	0	0	0	60	60	60	60	60	60	60	60	60	60	60	60	60
Solar (PV)	0	0	0	7	15	22	29	37	44	51	59	66	73	81	88	95	103	110
Wind	2	2	2	3	5	8	11	13	16	19	21	24	27	29	32	35	37	40
Total	2	2	2	10	20	90	100	110	120	130	140	150	160	170	180	190	200	210

4.2 Electricity Access Targets (Grid-connected and Off-grid)

In the base year 2013, the rate of access to grid-connected and off-grid electricity services accounted for 40%, which is expected to exhibit a constant growth rate of 4% per annum between 2016 and 2030. The Gambia intends to achieve universal access to electricity by 2030.

The number of new connections to the grid and the number of new off-grid services were developed based on the total number of households, annual increase in the rate of access to electricity and the rate of access in the base year. Thus, each new connection to the grid or off-grid service unit is assumed to correspond to one household. An increase in the rate of access was first assumed starting with the first year of implementation of the action plans, i.e. 2016.

The NIPAES (MoE, 2012) sets annual targets for the number of rural households supplied with off-grid electricity services (mini-grid and stand-alone solar PV) for the period 2013/2020, which have been integrated into the SE4ALL Action Agenda as well. Based on these, about 20% of the rural population are expected to be served with off-grid renewable electricity services in 2020, and 37% in 2030.

Table 8: Electricity Access Targets (grid-connected and off-grid services)

	2013	2020	2030
Share of population with access to electricity (%)	40	60	100
No. of electrified households	91,827	194,359	544,851
No. of remaining households without access to electricity	137,740	129,573	0
No. of new connections to the grid	n.a.	5,183	11,417
Annual investment for grid connections (000 Euro)	0	1,555	3,425
New off-grid services	n.a.	7,774	17,125
Annual investment for off-grid services (000 Euro)	0	2,332	5,138
Share of rural population served from off-grid (mini-grids and stand-alone) renewable energy electricity services in %	2.3	19.7	37

The annual investment for grid connections and off-grid services in Table 8 displays how much funding shall be made available using all possible means to finance the intended new connections to the grid and off-grid services. Table 9 describes the targets and trajectory for grid-connected and off-grid electricity access up to 2030. Based on current population trends, the number of electrified households is expected to rise from 91,827 in the base year 2013 to 544,851 in 2030. Necessary annual investments for grid connections will amount to roughly 1.6 million Euros in 2020 and 3.4 million Euros in 2030. Investments for off-grid services are expected to be even higher, with about 2.3 million Euros in 2020 and 5.1 million Euros in 2030 (see Table 8). The estimated trajectories for electricity access (grid and off-grid) were developed using a scenario tool provided by ECREEE.

Table 9: Estimated trajectory for energy access (grid-connected and off-grid)

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Share of population with access to electricity (%)	40	40	40	44	48	52	56	60	64
No. of electrified households "	91,827	96,378	101,181	116,877	133,928	152,445	172,545	194,359	218,026
No. of remaining households without access to electricity	137,740	144,567	151,772	148,752	145,089	140,718	135,571	129,573	122,639
No. of new connections to the grid	n.a.	n.a.	n.a.	4,250	4,464	4,691	4,930	5,183	5,451
Annual investment for grid connections (000 Euro)	0	0	0	1,275	1,339	1,407	1,479	1,555	1,635
New off-grid services	n.a.	n.a.	n.a.	6,375	6,696	7,036	7,395	7,774	8,176
Annual investment for off-grid services (000 Euro)	0	0	0	1,913	2,009	2,111	2,218	2,332	2,453

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share of population with access to electricity (%)	68	72	76	80	84	88	92	96	100
No. of electrified households	243,699	271,544	301,743	334,494	370,012	408,535	450,322	495,657	544,851
No. of remaining households without access to electricity	114,682	105,600	95,287	83,623	70,479	55,709	39,158	20,652	0
No. of new connections to the grid	5,734	6,034	6,352	6,690	7,048	7,428	7,832	8,261	11,417
Annual investment for grid connections (000 Euro)	1,720	1,810	1,906	2,007	2,114	2,228	2,350	2,478	3,425
New off-grid services	8,601	9,051	9,529	10,035	10,572	11,142	11,748	12,391	17,125
Annual investment for off-grid services (000 Euro)	2,580	2,715	2,859	3,010	3,172	3,343	3,524	3,717	5,138

4.3 Renewable energy applications for domestic uses

4.3.1 Domestic cooking energy targets

According to the NIPAES, The Gambia shall reach domestic cooking energy targets by 2020 as presented in Table 10. The SE4All action agenda for The Gambia extended these targets until 2030.

Table 9: Domestic cooking energy targets for 2020 and 2030[4]

	2013	2020	2030
Share of charcoal produced using efficient charcoal production technologies in %	5	40	100
Access to modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) - % of population/households	8.9	100	100

Since the choice of technology and fuel for cooking is a very personal one, involving, amongst others, aspects of affordability and personal preference, the domestic cooking energy targets contained in the NIPAES are defined in terms of household access. This implies that, by the year 2020, the whole population of the country shall have access to both improved cookstoves and modern cooking fuels, both in terms of availability and affordability. Universal access to charcoal produced using efficient charcoal production techniques shall be attained in 2030. Having access to these modern technologies for cooking, however, does not mean that the entire population will actually be using improved cookstoves and modern cooking fuels at the same time.[5] Regardless of the achievement of the domestic cooking energy targets, the specific percentage allocation of the use of improved cookstoves and modern fuel alternatives by the year 2030 will therefore to a large extent depend on affordability and consumer choices.

Table 10: Estimated trajectory for the development of the actual use of domestic cooking energy fuels and technology

	2013	2014	2015	2016	2017	2018	2019	2020	2021
No. of households using improved cookstoves ('000)	87	91	96	104	113	122	132	143	150
Share of population using improved cookstoves (%)	37.9	37.9	37.9	39.1	40.3	41.6	42.8	44.0	44.0
No. of households using LPG ('000)	11	11	12	36	64	93	126	162	170
Share of population using LPG (%)	4.6	4.6	4.6	13.7	22.8	31.8	40.9	50	50
No. of households using modern cooking fuel alternatives (biogas, solar cookers) ('000)	10	10	11	12	14	16	17	19	20
Share of population using modern fuel alternatives for cooking (e.g. biogas, solar cookers) (%)	4.3	4.3	4.3	4.6	5.0	5.3	5.7	6.0	6.0

[4] For want of a holistic picture of the domestic cooking energy sector, the number of households using improved cookstovess is reflected in the analyses in this sub-section of the NREAP, however the set national targets for improved cookstoves and the measures to achieve them are considered efficiency issues and therefore, treated in Table 7 and 9.5.3 of the NEEAP respectively.

[5] Despite the fact that with common practice in The Gambia, some households may have two or more cooking devices using different fuels (e.g. LPG and charcoal), in order to hedge against price and availability risks of the corresponding fuels.

	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. of households using improved cookstoves ('000)	158	166	175	184	194	204	215	227	240
Share of population using improved cookstoves (%)	44	44	44	44	44	44	44	44	44
No. of households using LPG ('000)	179	189	199	209	220	232	245	258	272
Share of population using LPG (%)	50	50	50	50	50	50	50	50	50
No. of households using modern cooking fuel alternatives (biogas, solar cookers) ('000)	22	23	24	25	26	28	29	31	33
Share of population using modern fuel alternatives for cooking (e.g. biogas, solar cookers) (%)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0

Considering the actual use of domestic cooking energy fuels and technologies, the share of the Gambian population using improved cookstoves is expected to reach 44% in 2020 and to remain constant up to 2030. 50% of the population are expected to use LPG from 2020 onwards, and the the share of the population using other modern fuel alternatives for cooking such as biogas or solar cookers is expected to reach 6% in 2020. The total number of households using these domestic cooking energy fuels and technologies, however, is expected to rise from 230,000 in the base year 2013 to 545,000 in 2030.

Figure 2 below presents the results for the cooking sector in the NREAP/NEEAP scenario up to 2030. As of 2020, the entire population of The Gambia is expected to have access to improved cookstoves, modern fuel alternatives for cooking and efficiently produced charcoal. Inefficient, obsolete technologies would be phased out from the marketplace by then.
In terms of actual use in the year 2030, 272,000 households are expected to use LPG, 240,000 households are expected to use an improved cookstove and 33,000 households are expected to resort to an alternative technology.

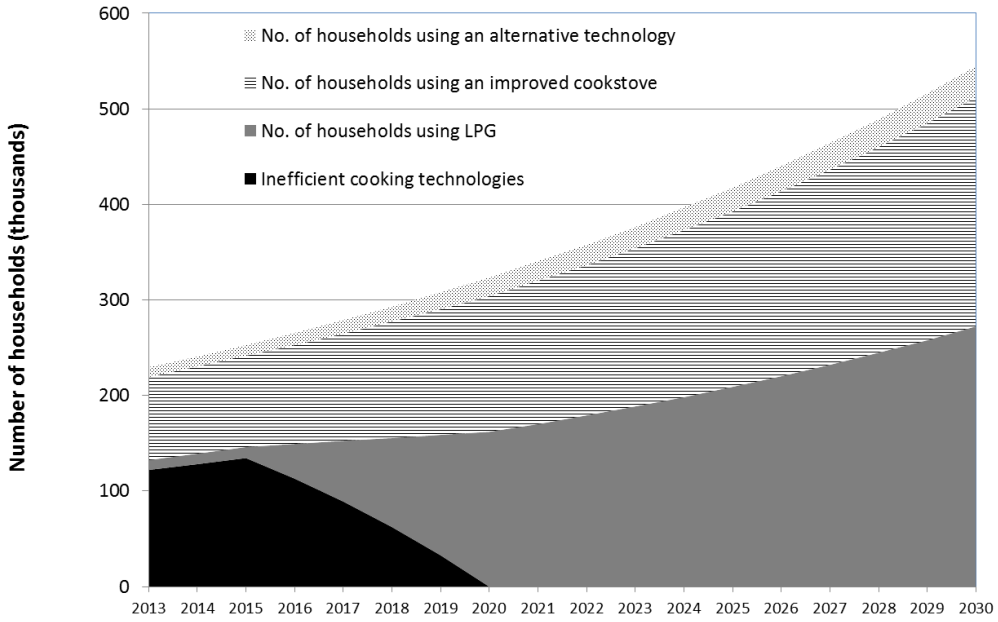

Figure 2: Estimated trajectory for domestic cooking energy development in The Gambia, 2013-2030

Figure 3 shows the necessary annual investment in clean cooking devices (million Euro, 2013-2030). Calculations of necessary annual investments were based on the ECREEE scenario tool and comprise necessary investments in LPG, improved biomass cookstoves and alternative technologies. In line with the scenario tool, the costs were estimated as

costs per household for the equipment for LPG cooking, cost per household for an improved cookstove and cost per household for an alternative modern cooking technology, and projected with the average lifetime of the respective equipment and the number of households using these devices.

Projections show necessary investments to peak in the year 2020 at about 2.68 million Euros, when inefficient cooking devices are finally completely phased out.

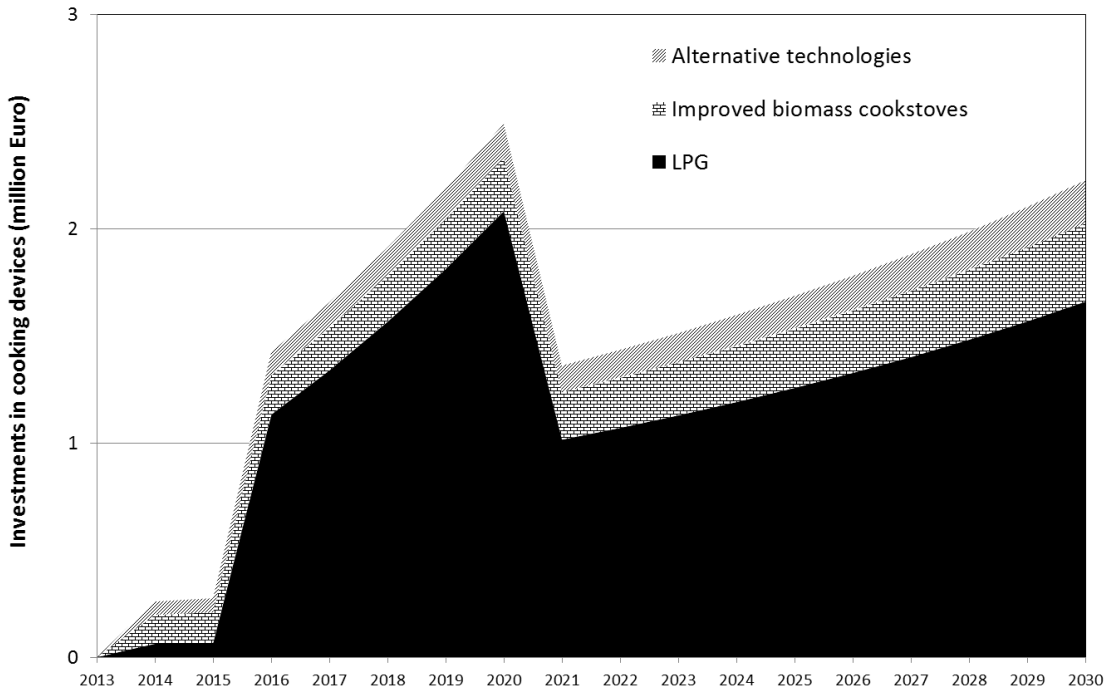

Figure 3: Annual investment in clean cooking devices (million Euros, 2013-2030)

4.3.2 Solar thermal water heating

While both cooking systems and mechanical power for water pumping and productive uses have been extensively considered by the NIPAES, no specific targets have been set for solar thermal water heating technologies. The EREP targets for solar water heater technologies, for sanitary hot water and preheating of industrial process hot water in district health centres, maternities, school kitchen and boarding schools and agro-food industries were considered by The Gambia. Nationally set targets for hotels, which are substantially higher than those of the EREP, were adopted (see Table 12).

Table 11: Solar thermal water heating targets for 2020 and 2030

Solar water heaters for sanitary hot water and preheating of industrial process hot water:	2013	2020	2030
Share of district health centres, maternities, school kitchens and boarding schools with solar thermal system in %	8	25	50
Share of agro-food industries (preheating of process water) with solar thermal systems in %	na	10	25
Share of hotels with solar thermal systems in %	15	30	50

The estimated trajectory for solar thermal water heating applications between 2013 and 2030 is described in Table 14 below.

Table 12: National 2020 and 2030 targets and estimated trajectory of solar thermal water heating applications

	2013*	2015	2016	2017	2018	2019	2020	2021
Share of district health centres, maternity clinics, school kitchens and boarding schools with solar thermal systems in %	8	13	15	18	20	23	25	28
Share of agro-food industries with solar thermal systems (preheating of process water) in %	NA	2	4	5	7	8	10	12
Share of hotels with solar thermal systems in %	15	19	21	24	26	28	30	32

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share of district health centres, maternity clinics, school kitchens and boarding schools with solar thermal systems in %	30	33	35	38	40	43	45	48	50
Share of agro-food industries with solar thermal systems (preheating of process water) in %	13	15	16	18	19	21	22	24	25
Share of hotels with solar thermal systems installed in %	34	36	38	40	42	44	46	48	50

4.4 Biofuels

Although fairly good potentials exist for the production of biofuels, especially ethanol from energy crops, no convincing records of their production are available. Therefore, since their production does not appear to be of a medium proposition for The Gambia, no biofuel usage targets by 2020 and 2030 have been set for the Gambia.

However, given the important role of petroleum products - especially gasoline and diesel in the transport sector – it has been estimated, that total national gasoline consumption (18.25 million litres in 2010) will reach about 20.13 million litres in 2020 and 24.83 million litres in 2030, while diesel consumption is expected to account for 188.17 million litres in 2020 and 626.19 million litres in 2030 (starting from 67 million litres in 2010).

4.5 Market Development Indicators

The renewable energy market currently only comprises of solar and wind options. A significant number of potential investors in renewable energy technologies exist in this market, including firms dedicated to developing renewable

projects, such as Gamwind, a number of solar system installers, businesses with electricity requirements like the telecommunications company Qcell, and community projects developed under the GEF-UNIDO micro grid scheme.

Despite its considerable potential, commercial banks have not been strongly involved in the renewable energy market so far. To raise awareness and sensitize the banking sector to the potentials of co-financing opportunities of RES investments, the management of the GEF/UNIDO project of MOE established a ''RE Breakfast Forum for the Bankers' Association'' under its GEF4 sub-project. The programme appears to be effecting positive changes in the perception of bankers. The perception of RE technologies changes from a long-term investment proposition requiring a syndicate of two or more banks, which may be a complex venture to manage, to a potentially lucrative and rather secure investment proposition.

The civil society, particularly Non-Governmental Organizations, is a major development partner of the government. The NGO community has set up a micro-finance network called the Gambia Micro-Finance Network (GAMFINET) with 17 NGO member organizations. Although there are no records of its financial intermediation activities in the energy sector, GAMFINET provides a potential avenue of credit resources for purchase of renewable technologies by their individual members and a potential channel for the RE Fund, following its establishment. Some NGOs are currently engaged in the production and promotion of solar cookers, the manufacturing of briquette and briquette cook stoves and training of artisans in the production of cook stoves.

Currently the bulk of the energy sector investment resources arise mainly from donor assistance, which is unlikely to change in the very near future. Almost all energy projects in The Gambia are implemented with the financial support of the donor partners in the form of grants from multilateral agencies such as the EU, UNDP, GEF and UNEP as well as bilateral donors such as DANIDA and GIZ. In addition to its contributions towards donor assistance projects, the Government also regularly borrows from the international and local financial markets to finance energy projects.

For achieving the renewable energy targets in the Gambia described in this action plan, considerable investment has to be mobilised for the deployment of renewable energy sources (see Table 15). The necessary investments in renewable energy technologies (wind and solar PV) are shown in Figure 4 below.

For reasons of simplification a linear trend for capacity growth has been assumed, so the resulting investments per year are constant. Due to this linear growth trend, the incremental capacity additions are the same over the whole period. The investments in the OVMG hydropower project by the Gambian government have not been considered here.

Table 13: Necessary renewable energy investment in The Gambia

Necessary annual investment in newly installed capacity (million Euro)	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Wind energy	0	0	0	3	3	3	3	3	3
Solar PV	0	0	0	8	8	8	8	8	8

Necessary annual investment in newly installed capacity (million Euro)	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Wind energy	3	3	3	3	3	3	3	3	3
Solar PV	8	8	8	8	8	8	8	8	8

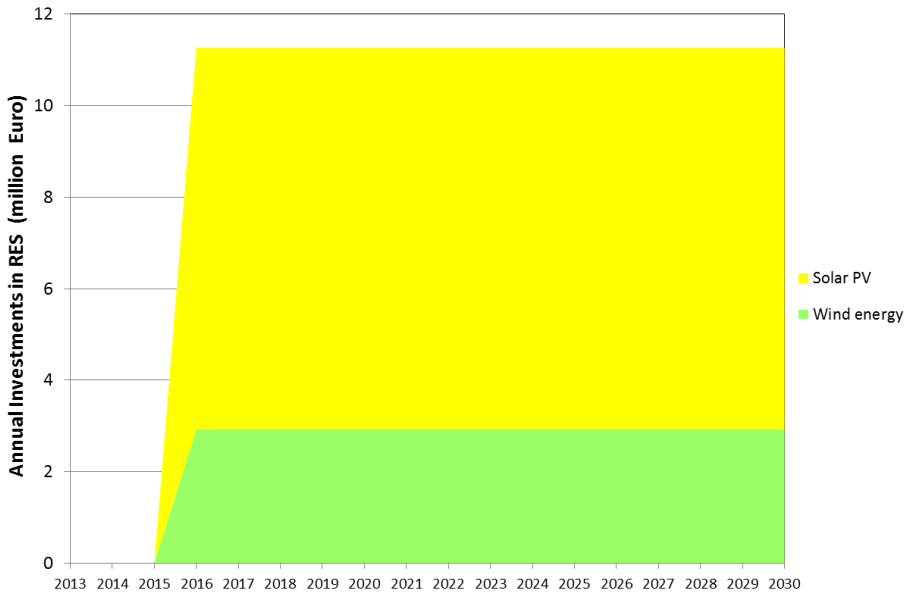

Figure 2: Necessary investments in wind energy and solar PV for electricity generation in the NREAP scenario

5 MEASURES FOR ACHIEVING THE TARGETS

The extent to which The Gambia will realize its renewable energy targets and trajectories that it intends to achieve by 2020 and 2030 as a contribution to the attainment of the EREP targets will depend on the successful adoption and implementation of the measures and activities to create an enabling environment. Some of the key elements of such an enabling environment include a well conceived policy regime; a vibrant institutional, legal and regulatory framework; awareness raising and capacity building measures; responsive organizational arrangements; and a well designed regime of inducements and deterrents for individual actions.

5.1 Summary tables of all policies and measures to promote the use of renewable energy resources for grid connected and off-grid electricity generation, domestic cooking energy, solar water heating and biofuels

Table 14: Overview of policies and measures for grid connected RE

Name of the measure	Type of measure	Expected results	Target group And/or activity	Existing or planned	Start and end dates of the measure
1. National Energy Policy and National Energy Policy Strategy	Policy	Create an orderly development of the energy sector in guiding the selection of priority investment areas	All stakeholders of the energy sector (RE/EE/EA) in The Gambia	Existing	2014 - 2018
2. National Investment Program on Access to Energy in The Gambia	Financial	Increasing access to energy services for rural, urban and peri-urban populations by 2020	Public administration, international and national investors, population; areas covered: RE/EE/EA	Planned	2013 – 2020
3. Renewable Energy Act	Regulatory	Promote the use of RES in order to achieve greater energy self-reliance which will thus reduce the nation's exposure to fossil fuels, harmful emissions and the demand burden in regards to the supply of electricity; establish a Renewable Energy Fund; encourage investment into the RE sector; ensure appropriate training and certification of installers of RE equipment and provision of guarantees to clients;	Public administration, private sector, investors; area covered: RE	Existing	2014 – Review as and when necessary.
4. Forest Act of 1998	Regulatory	Introduce and regulate participatory forest management with the objective of establishing community ownership as far as possible	Public administration, private sector, rural population; area covered: RE	Existing	1998 – Review as and when necessary
5. Two Feasibility Studies: Solar Home System Program and Small Scale Wind Park	Scientific/financial	Guide the deployment of solar and wind energy resources of the country	Public administration, investors, population of The Gambia; area covered: RE	Planned	Proposed a 20-year life
6. Renewable Readiness Assessment 2013	Scientific	The Renewable Readiness Assessment is a holistic evaluation of the conditions in The Gambia, and identifies seven recommended actions to overcome	All stakeholders of the energy sector (RE/EE/EA) in The Gambia	Existing	2013

		barriers to renewable energy deployment.. A detailed list of actions is annexed to the RRA.			
7. SE4ALL Action Agenda and Investment Prospectus	Policy	The SE4ALL Action Agenda for The Gambia is the country plan of action to achieve the country set of SE4ALL goals by 2030. The Investment Prospectus is designed to operationalize the SE4ALL Action Agenda for The Gambia by identifying and developing a set of implementable programs and projects, including their investment requirements, which can be presented to potential investors.	All stakeholders of the energy sector (RE/EE/EA) in The Gambia	Existing	2015-2030

5.2 Specific measures to fulfil the requirements under the EREP

5.2.1 Administrative procedures and spatial planning

a) List of existing national and, if applicable, regional legislation concerning authorisation, certification, licensing procedures and spatial planning applied to plants and associated transmission and distribution network infrastructure:
Key legislation in the Gambia includes the following acts:

i. National Energy Policy and Policy Strategy (2014-2018), which updates the 2005 Energy Policy, has been validated and adopted in November 2014
ii. Electricity Act of 2005
iii. Renewable Energy Act of 2014:

The Renewable Energy Act was enacted by the National Assembly in December 2013 with the key objective of promoting the use of Renewable Energy resources in order to achieve greater energy self-reliance which will thus reduce the nation's exposure to fossil fuels, harmful emissions and the demand burden currently on NAWEC in regards to the supply of electricity.

The Act calls for an establishment of a Renewable Energy Fund, the management of which will fall under the purview of PURA in ensuring the promotion, development, sustainable management and utilisation of Renewable Energy Resources with key emphasis on community based projects. The sources of money for the fund shall range from funds appropriated by the National Assembly to donations, grants and gifts received for Renewable Energy Activities.

In encouraging investment into the Renewable Energy Sector, the Act also introduces General Incentive provisions which provide exemptions on paying import tax and duty on Renewable Facilities. There is also a corporate tax and retail tax exemption on all Renewable Energy facilities for a period of 15 years after commissioning.

The Act also tasks the Ministry of Energy to coordinate with other authorities such as PURA and National Environment Agency (NEA) in developing streamlined licensing/permitting processes to create better certainty and investor confidence for prospective developers of systems using Renewable Energy Resources.

It is also a requirement under the Act that Installers of Renewable Energy Equipment are appropriately trained with certification. Installers are required to provide guarantees to clients to denote proper installation and for warranty purposes. The guarantee period as provided by the Act is at least 6 months or any such period as determined by PURA.

iv. Gambia Public Utilities Authority Act 2001

v. Forestry Act of 1998

b) Responsible Ministries / authorities and their competences in the field:

The **Office of the President** receives information from all ministries related to each specific energy objective, and has final authority over the regulations, tariffs, and on contracting of any IPPs; it further has responsibility for enacting forestry policies and legislations. It is aided by the Forestry Department in all matters related to forestry.

The Ministry of Energy (MOE) has responsibility for enacting policies aided by the Energy Unit (EU) and the Gambia Renewable Energy Centre (GREC) as its technical arms. It provides support to NAWEC to provide energy related tariffs to the President. MOE's competence is constrained by the limited number and qualification of staff.

The **Ministry of Finance** receives recommendations by PURA, evaluates the financial implications and makes recommendations to the President. The Ministry is deeply involved in the pricing of petroleum products especially for the transport sector. Liquid petroleum products provide a significant revenue stream for the national budget.

The **Ministry of Petroleum** has oversight function for upstream and downstream activities in petroleum resources - exploration and marketing. The Ministry oversees the quality of service and safety standards within the petroleum sub-sector. It is, however, not clearly regulated which Ministry has oversight responsibility for LPG.

The **Ministry of Environment, Climate Change, Water Resources and Wildlife (MoECCWRW),** has overall responsibility for all policy issues relating to the environment and the environmental resources of water and wildlife. It also serves as the line ministry for matters related to the Organization for the Development of The Gambia River Basin (OMVG).

The **Public Utilities Regulatory Authority (PURA)** is the authority which regulates the activities of the country's public utility sectors (electricity, water and telecommunications).

The **National Environment Agency** is the technical arm of MoECCWRW for all matters relating to the environment. It is responsible for environmental impact assessment of all investment programmes and projects in the country.

The **Gambia Investment and Export Promotion Agency (GIEPA)** was created in 2010, with the primary role to promote investment in The Gambia by projecting its image as an investor friendly country.

The **National Water and Electricity Company (NAWEC)** owns all the power plants and operates the transmission and distribution network for the country. NAWEC is responsible for establishing and collecting electric tariffs, also establishes and administers Power Purchase Agreements (PPA) with private power producer and implements Rural Electrification Projects.

The **Gambia Standards Bureau** established by The Gambia Standards Bureau Act in 2010 under the Ministry of Trade, Industry and Employment, the Bureau is responsible for the development of standards and labels which inter alia include energy efficiency standards and labelling initiative, for the government's consideration for approval.

The **Forestry Department** under MoECCWRW is responsible for the management of the nation's forest resources, of which fuel wood is a very important component. The Department plays a lead role in the fuel wood sector both in terms of policy formulation and regulation and in the promotion of community forestry as a sustainable way to exploit forest resources for fuel wood. The main constraints to the competence of the Department are the limited number and qualification of staff.

The **Department of Water Resources** in the Ministry of Environment, Water Resources, Climate Change and Parks & Wildlife is actively involved in rural water supply using solar energy (renewable). The institutional capacity of the Department of Water Resources is also constrained by the number and qualification of staff.

The Department of Community Development, operating under the Ministry of Local Government and Lands, is responsible for promoting the efficient management of fuel wood resources through the promotion of substitutes and improved end-use appliances for firewood at the household level. The Department is further involved in community training activities in a wide range of sectors as well as in research and dissemination of new and appropriate technology.

c) Summary of the existing and planned measures at regional / local levels:

In order to improve administrative procedures and spatial planning, the measures proposed for implementation in The Gambia include to:

i. Identify unnecessary obstacles related to authorization, certification and licensing procedures applied to renewable energy power plants with a view to eliminate them and streamline the permitting process for timely development of these facilities including where applicable on environmental impact, generation, distribution, land use, water use and construction;
ii. Create procedures and a one-stop-shop for coordinating all steps in the permission process;
iii. Build capacity and create awareness of different actors involved in the authorization, certification, and licensing activities on the procedures and standards to be applied;
iv. Set up guidelines for attracting private sector investment in the electricity sector:
    a. Guidelines for setting up grid-connected RE projects;
    b. Guidelines for setting up projects for distributed generation with local grid;
    c. Guidelines for setting up off-grid stand-alone projects;
v. Review the Land Planning Policy to include reserved areas for the development of renewable energies (Renewable Energy Development Areas – REDA);
vi. Review the existing Forest Policy with a view to lifting the ban on charcoal production at least within the established community managed forests under the Community Forest Management (CFM) concept; and,
vii. Biomass Strategy: Carry out an impact assessment for the use of biomass for electricity and other energy purposes (heating, cooling and transport fuel) within one year of the RE Act coming into force (MoE responsibility).

5.2.2 Measures under the Renewable Energy Act

Support for renewable energy systems and electricity generated from renewable sources shall be provided through the following measures:

a) Support for on-grid renewable electricity (feed-in-tariff; FIT) for electricity produced from eligible RE sources (RES): A FIT to integrate electricity generated from renewable energy sources by hybrid systems shall be introduced. A draft FIT definition prepared by PURA in fulfilment of this provision is currently under review by MOE and likely to approved by the end of this year,
b) Support for on-grid renewable electricity not qualifying for the FIT: Provided the Responsible Network Utility ensures the safety and technical capability of the grid to integrate the project, the electricity produced may be purchased at a negotiated rate which shall not be higher than the alternative cost of electricity generation;
c) Support for off-grid renewable electricity: Electricity generation from RES or hybrid systems in off-grid areas ("Private Wire Network") will be allowed to charge electricity tariffs to end consumers up to the current national retail tariff rates ("Approved Electricity Tariffs"), provided the capacity of the generating facility is not greater than 200 kilowatts; facilities greater than 200 kilowatts wishing to charge higher tariffs may be permitted to do so with an acceptable justification;
d) General incentives: The operators of facilities using RES, including hybrid systems in proportion to and to the extent of the RE component, for both power and non-power applications shall be entitled to – import tax exemption; profit tax holidays for a period of 15 years from commissioning; value added tax and retail tax exemption for a period of 15 years from commissioning; and, tax exemption of carbon credits;
e) Quality of Installation: Installers of systems using RES shall be appropriately trained with appropriate certification where relevant, and shall provide a quality guarantee for the proper installation according to best practice for a minimum period of six months;

f) Reporting under the Renewable Energy Act: The authority has to publish its quarterly report on an appropriate website; the Responsible Network Utility shall make available all information and data required by the authority without delay; and developers of systems using RES have to register their facilities with MOE; and,
g) Miscellaneous: MOE is the lead agency mandated to implement the Renewable Energy Act and will work closely with the authority on aspects that pertain to electricity generation.

5.2.3 Buildings

The following measures aim to enhance the use of renewable energy in buildings:

i. Development of legislation that creates an obligation for minimum levels of RES in new and newly refurbished buildings, in accordance with the ECOWAS Directive on Energy Efficiency in Buildings (EDEEB).
ii. Develop and implement a system to award energy performance certificates for public buildings in The Gambia in line with the EDEEB. This shall include:
    a. Development of an accreditation process to accredit bodies that will issue the energy performance certificate;
    b. Development of a standard for energy performance certificates establishing reference values such as minimum energy performance requirements for relevant categories; and,
    c. Development of a national building energy performance register: Where an energy performance certificate is issued, such information contained in the energy performance certificate will be required to be recorded in a national building energy performance register to be established and maintained by the pertinent authority
iii. Capacity building, institutional strengthening and training measures on the use of RES in buildings and development of local industries to manufacture equipment.

Currently, there are no minimum levels for the use of renewable energy in building regulations and codes, and obligations for minimum levels of renewable energy in new and newly refurbished buildings have so far not been considered in national policy in The Gambia.

Although practical examples of renewable energy installations in hospitals and schools exist, there are no plans for ensuring the exemplary role of public buildings at national, regional and local level by using renewable energy installations.

5.2.4 Information provisions

The ensuing measures are targeted at future information and awareness raising campaigns and programmes. The MOE will be responsible for monitoring and reviewing the effects of the programmes. The 2014 RE Law contains rules on reporting concerning information requirements for various stakeholders and the public. PURA and NAWEC are the responsible bodies for dissemination of information at national / regional / local levels as deemed necessary:

Existing and planned measures at regional / local levels to include:

i. Raise public awareness of the economic and environmental benefits of using RE technologies (e.g. through TV, radio, other media) and disseminate project information, promotional materials on economically viable projects and available financing opportunities for homeowners, businesses and private sectors in the country;
ii. Encourage local banks through capacity building, training and incentives, to provide loans and equity for the installation of small RE technologies to homeowners and small businesses;
iii. Develop and implement demonstration and awareness raising programmes in schools and include RE/EE/EA subjects in technical and tertiary curricula; and,
iv. Develop linkages and networks between local and international research institutes

5.2.5 Certification of installers for RE equipment

The national certification of installers of RE equipment shall be enhanced through the following measures:

i. Define national qualification standards for installers of RE equipment;
ii. Set up a system for certifying installers and a mandate that all RE equipment has to be deployed by certified installers to ensure high quality work during project implementation;
iii. Develop a database containing offered certified training courses for installers and equivalent measures; and,
iv. Establish procedures and conditions for installers necessary to obtain the certificate (for RES installation including solar thermal systems), as well the conditions for equivalency of training courses.

5.2.6 Electricity infrastructure development

The Gambia plans to enhance the development of the electric infrastructure through the following measures:

i. Revise or create a grid investment plan that integrates RE;
ii. Set out minimum targets for incorporation of RE in grid-connected electricity generation including obligation of the national grid system to accept electricity generated from RES;
iii. Establish and use appropriate procurement guidelines to secure best terms and conditions for long-term contracts for energy supply;
iv. Establish priority connection rights or reserved connection capacities to be provided for new installations producing electricity from renewable energy sources. and,
v. Continuously monitor and revise existing regulations to include provisions that ensure adequate inventory levels to cushion any short-term disruption in supply.

5.2.7 Renewable energy applications for domestic uses

Efficient Charcoal Production

There are currently no standards and processes for efficient charcoal production adopted in The Gambia. The country intends to apply the ECOWAS standards and processes technologies for efficient charcoal production as envisaged in the specific measures for the promotion of efficient charcoal production herein. Compliance with these standards and processes will be ensured through strict monitoring and enforcement by the concerned institutions including the Ministry of Energy (GREC), the Gambia Standards Bureau and Departments of Forestry and Community Development.

Specific measures for the promotion of efficient charcoal production are contained in chapter 5.5.

Use of modern fuel alternatives for cooking

In the domestic fuel sector, the National Energy Policy (2015-2020) aims to reduce the heavy dependence on wood and charcoal as a source of energy, and to strengthen the role of LPG as a cooking fuel with a number of strategies. It further contains specific development objectives for LPG, domestic fuels/household energy, as well as concrete policies and strategies in both areas. The NIPAES also contains a number of energy access initiatives and programmes in the Gambia, dedicated to improved cooking systems (access to LPG, promotion of improved charcoal and fuelwood stoves, production and use of briquettes). Moreover, a number of research/training institutions, NGOs and individual business have set in place promotion programmes for specific modern fuel alternatives.

Specific measures for the promotion of modern fuel alternatives for cooking are described in chapter 5.6.

5.3 Support schemes to promote the use of energy from renewable resources in electricity applied by the Member State or a group of Member States

Although not yet fully operational, the RE Act 2014 provides for the following support schemes to promote the use of energy from renewable resources in electricity:

i. The Establishment of the RE Fund: To provide financial resources for the promotion, development, sustainable management and utilization of renewable energy sources. In this regard, the Act defines: its objectives, use of its moneys, sources of its money, its management by PURA, its internally generated funds, tax exemption, administration expenses of the fund, accounts and audits and, annual report and other aspects;
ii. Support for on-grid renewable electricity (feed-in-tariff) for electricity produced from eligible RES: A FIT to integrate electricity generated from renewable energy sources by hybrid systems shall be introduced.
iii. Support for on-grid renewable electricity not qualifying for the FIT: Provided the Responsible Network Utility ensures the safety and technical capability of the grid to integrate the project, the electricity produced may be purchased at a negotiated rate which shall not be higher than the alternative cost of electricity generation;
iv. Support for off-grid renewable electricity: Electricity generation from RES or hybrid systems in off-grid areas ("Private Wire Network") will be allowed to charge electricity tariffs to end consumers up to the current national retail tariff rates ("Approved Electricity Tariffs"), provided the capacity of the generating facility is not greater than 200 kilowatts; facilities greater than 200 kilowatts wishing to charge more may be permitted to do so with an acceptable justification;
v. General incentives: The operators of facilities using RES, including hybrid systems in proportion to and to the extent of the RE component, for both power and non-power applications are entitled to – import tax exemption; profit tax holidays for a period of 15 years from commissioning; value added tax and retail tax exemption for a period of 15 years from commissioning; and, tax exemption of carbon credits.

Regulation for grid connected RE

With regards to grid-connected renewable energy sources, The Gambia intends to

i. Assess the impact of incorporating RES into the grid (grid stability study);
ii. Create or revise the power sector policy and strategy to:
    a. Set out minimum binding targets for incorporation of RE in grid-connected electricity generation;
    b. Highlight how the utility (NAWEC) will achieve the RE targets in the electricity supply mix (it should clearly highlight the role on IPPs in the achievement of its targets); and,
    c. Identify the process for IIPs to request licences to the utility for grid connection.
iii. Ensure a secure and reliable supply of electricity through:
    a. Regular inspection of lines to identify and remove illegal, unsafe connections, and to encourage all users to become paying customers;
    b. Regular preventive maintenance of all components of the distribution system in order to assure reliable power supply. This includes, notably upgrading of lines and transformers that are operating near capacity that show signs of weakness or that are outdated and inefficient;
    c. Installation of a high voltage distribution system that improves power quality and reduces theft; and,
    d. Power factor correction to reduce losses through the installation of capacitor banks on client premises where they are needed.
iv. Improve and maintain accurate billing systems:
    a. Introduce management practices related to billing and maintenance such as optimised billing and regular inspection of lines;
    b. Shortened billing cycle, including thorough tools that produce a billing immediately upon meter reading; and,
    c. Installation of pre-paid meters to improve bill collection and relations with clients.

Regulation for rural electrification

The Gambia intends to substantially raise the rate of rural electrification in the coming years up to 2030. Planned measures include to:

i. Develop national policies and strategies to encourage the installation of mini-grids:
   a. Strengthen the capacity of state agencies and local/regional energy body for the planning and implementation of mini-grids based on renewable energy sources; and,
   b. Adopt international standards for mini-grids.
ii. Develop suitable business models:
   a. Provide sustainable finance models (mix of subsidies and revenues) of mini-grids;
   b. Strengthen policy planning mechanisms and nation infrastructures to promote public private partnerships (PPP) in the renewable energy sector; and,
   c. Encourage cooperation between local/regional partners to bundle projects in order to increase effectiveness to and allow for additional funding possibilities and to overcome fixed lending costs.
iii. Set up and implement capacity building and awareness raising programmes for mini-grids:
   a. Train local agencies to ensure operation and maintenance of mini-grids based on renewable energy sources;
   b. Sensitize local communities at district and village levels on the benefits of mini-grids projects based on renewable energy sources; and,
   c. Strengthen the capacity of private service providers to maintain mini-grids equipment.

5.4 Specific measures for a National Cooking Energy Stakeholder Group (NCESG)

The Gambia intends to form a National Cooking Energy Stakeholder Group (CESG) – headed by the Ministry of Energy with participation from all key government development partners, NGO/ CBO and private sector groups to be responsible for the following measures for promotion of orderliness in the cooking energy sub-sector:

i. To ensure that sector players are working towards in a cohesive coordinated strategy and are learning from each other leveraging each other's work not duplicating efforts;
ii. To act as an advocate for the sub-sector as one unified voice;
iii. To support cross-sectoral coordination through the inclusion of clean cooking across sectors (health, energy, environment, gender, economic development, education and training, forestry, rural development etc.); and,
iv. To harmonize donor funding and resource mobilization.

5.5 Specific measures for the promotion of efficient charcoal production

The Gambia intends to implement the following measures for the promotion of efficient charcoal production:

i. To establish coherent and transparent policy and regulatory framework to lift the ban and permit efficient charcoal production in forests under Community Forest Management;
ii. To carryout public education and sensitization campaigns on charcoal production through gender-based knowledge products;
iii. To minimize kilns' technical inefficiencies that characterize the entire charcoal production value chain by using technically efficient kilns, improved technique and increased technical skills know-how through training.
iv. To establish Standards, Certification and Label on charcoal production and products information for end users to make informed decision on purchase (durability, user friendliness, emissions factors);

5.6 Specific measures for the promotion of modern fuel alternatives for cooking

Modern fuel alternatives for cooking shall be promoted by means of the following measures:

i. Ensure inclusion of modern fuel alternatives in national cooking policies, strategies and targets, including legal and regulatory mechanisms, in line with the existing ECOWAS regional policies and initiatives;
ii. Monitor to discourage commercial malpractice as well as raise public awareness;
iii. Implement programmes and incentive schemes to foster the use of modern fuel alternative for cooking, especially to encourage private LPG retail/service companies to build up distribution network and retail outlets;
iv. Develop standard and labelling for modern fuel alternative for cooking; and,
v. Develop programmes for modern fuel alternative for cooking to enhance access to finance and increase the use of carbon financing. This includes the mobilization of private investment.

5.7 Support schemes to promote the use of biofuels

The Gambia intends to tap the existing biofuels potential and promote the use of biofuels with the following measures:

i. Assess and provide information on the areas that might be used for the production of biofuels: assess the issues of food security, land concern, environment concerns, water, benefit for small farmers and quality control;
ii. Ensure harmonization of biofuels policies and strategies with other sector policies and strategies at the national and regional level;
iii. Introduce a biofuel obligation policy in coordination with other sectors;
iv. Define sustainability criteria including support scheme for biofuels and bioliquids to be implement at national level;
v. Identify the national authority/body that is responsible for monitoring the compliance of the biofuel with sustainability criteria and for the certification of biofuels; and,
vi. Increase the use of carbon financing opportunities for biofuel production projects through capacity building, awareness raising and project development.

5.8 Specific measures for the promotion of the sustainable use of energy from biomass

The rational use of biomass shall be promoted through the implementation of the measures listed below:

i. Develop a national bioenergy strategy in line with the ECOWAS Bioenergy Strategy;
ii. Define and agree on sustainability criteria and indicators for bioenergy in line with regional and international standard taking account of all three dimensions of sustainability and ensuring the participation of all relevant stakeholders in the process;
iii. Establish an inter-ministerial body or institutionalized mechanism to coordinate bioenergy activities between interested stakeholders (e.g. from the agriculture energy, rural development, finance, commerce/trade and environment sector);
iv. Conduct studies for the analysis of biomass supply and use if it is not available as well as on future trends and biomass resource availability:
    - Strengthen local data availability and gather case studies on best practices and examples of successes/failures;
    - Review the current national solid waste management system and assess the potential of waste to energy solutions from municipal solid waste; and,
    - Promote the use of the biomass from agriculture waste and invasive plant species to be used as a RE source of energy in articulation with the ECOWAS bioenergy programme;
v. Promote research, development and long-term international cooperation network in bioenergy potential and cooking technologies and fuel as well a s investigation of the potential of municipal agricultural and food industrial waste for the production of energy;
vi. Develop appropriate capacity building programmes for all actors in the biomass energy value chain especially research, innovation and finance institutions; engineers and technicians; and, end-users;
vii. Explore opportunities for carbon finance (including CDM, REDD+ and NAMAs development);

5.8.1 Measures to increase biomass availability

Mobilisation of new biomass sources:

There is only little potential to mobilize new biomass sources in The Gambia. However, potential for mobilizing substantial additional biomass sources lies in reactivating the concept of village woodlots, in intensifying the planting of wind breaks and live fencing, and in expanding agro-forestry.

Reactivating these biomass sources would require a well organized supply chain of suitable planting materials. The production of such planting materials in adequate quantities will require substantial investment in terms of copious water supply and protective fencing.

Biomass from forestry residues:

Although forest based biomass ranks first in the country's biomass energy mix and the national energy mix, it is difficult to find precise data on total fuelwood resources in The Gambia, as most of the available data are estimates or projections from previous studies.

The country has lost more than 50% of the forest cover between 1946 and 2005. However, the projections to 2015 show a lower rate of degradation, which could be attributed to the interventions in implementing a more aggressive forestry policy. Some of the salient features of the policy are the development of 30% of the total land area into forest, of which 75% should be managed and protected to increase the forest resource base through forest rehabilitation and the establishment of fast growing plantations and woodlots. The 30% forest land will be achieved through two main strategic actions to implement an overall forest management strategy code named the Gambia Forest Management Concept (GFMC) and educating the public on the importance of forest resources. The GFMC has three variances of active community participation in forest management: Community Forest Management (CFM), Community Controlled State Forest Management (CCSFM) and Joint Forest Park Management (JFPM) concepts. In the CFM arrangement the community owns the forest and all benefits accruing from it, the CCSFM entails a 50/50% share basis between the community and Forestry Department whereas the JFPM is just conservation and protection with no benefits accruing to the community. So far no community has opted for either the CCSFM or indeed the JFPM arrangement whilst 25,500 ha of CFM forest involving 319 communities has been established as at 2009. Thus in parallel with expanding the CFM the following general measures will be adopted to increase biomass from forestry residues:

i. Improve and maintain forest resources through the effective management of existing natural forest cover and protected areas;
ii. Strengthen and expand Participatory and Sustainable Forest Management (PSFM) in production forest areas: and,
iii. Equipping each of the participating communities/villages with patrol and bush-fire fighting equipment.

Biomass from Municipal Waste

Municipal residues are wastes comprising solid wastes, waste water and human excrements. The government enacted the Waste Management Act 2007 and Anti-Littering Regulations 2007. Under the latter, the ''local authority'' including Municipal and Area Councils are charged with the responsibility of designating garbage disposal sites and day-to-day implementation of the provisions in the Act within their respective jurisdictions.

Municipal solid waste is currently partially collected and dumped in landfills or other designated sites. There are two main landfills – Banjul and Kanifing. The total input material for the landfill at Banjul is estimated at about 20,000 t/a, and for the one at Kanifing at 40,000 t/a. There are also two waste water collecting systems, one in Banjul and the other at the Atlantic coast where the hotels are located. The capacity of the Banjul system is estimated at 6,000m³/d. No information is available about the other system, especially measurements about the system's capacity and organic content in the waste water. In specific cases for human excrements, a centralized collection point in big schools, hospitals, prisons, barracks or other accumulations of many people is a potential management approach.

No information on past experiences in exploiting the biogas potentials of municipal wastes is available. Therefore, the following measures to increase their supply with a view to enhancing their use for biogas production under the existing legal framework are proposed:

i. Review the current national solid waste and waste water management systems to allow for recycling development and electricity generation from solid waste residues (WTE) and methane;
ii. Investigation of the energy potential in waste disposal sites (municipal waste, waste water treatment);
iii. Implement capacity building programmes on the use of biomass from municipal waste for energy generation and training programmes for biogas technologies (installation, operation and maintenance skills) in collaboration with relevant training/research institutions;
iv. Implement demonstration projects to show how municipal waste and food production residues can be used to produce energy; and,
v. Promote the use of biogas as an alternative to wood fuel and kerosene for domestic and commercial use by highlighting the health benefits.

Biomass from agricultural waste

The government with an IDB funded project has spent US$30 million to rehabilitate the groundnut processing and marketing infrastructure of the Gambia Groundnut Corporation. This project shall greatly enhance the supply of groundnut shell, which is the most important agricultural waste for energy production.

To consolidate the gains from this development for increased agricultural waste supply for other crops, the following additional measures will, inter alia, be rigorously pursued:

i. Intensification of agricultural production through better access to improved farm inputs and agronomic practices:
ii. Mitigation of major constraints arising from irrigation and water management through the construction of new irrigation schemes;
iii. Promote the development and use of sustainable and adequate power supply sources including renewable energy for different farm operations;
iv. Improve the availability of adequate supply of spare parts for successful mechanized farm operations to increase crop production; and,
v. Intensify NARI's activities to promote the use of biomass from agricultural waste and invasive plant species as a RE source of energy in articulation with the ECOWAS bioenergy programme.

5.8.2 Specific measures for an entrepreneurial network of rural micro-enterprises for delivery of improved biomass fuels

A copious supply of improved biomass fuels creation of a self-sustaining entrepreneurial network of rural micro-enterprises for delivery of improved biomass fuels

i. Organize existing rural micro-enterprises for delivery of improved biomass fuel into self-sustaining entrepreneurial network;
ii. Conduct training courses for new entrepreneurs wherever required;
iii. Promotion and marketing activities e.g. village level awareness camps and programmes organised to create marketing opportunities for the new enterprises; and,
iv. Encouraging local banks and financing institutes to support the new businesses

5.9 Specific measures for the promotion of electricity from renewable energy sources

5.9.1 Measures for the promotion of wind power

Electricity generation from wind power shall be promoted through the following measures:

i. Promote the use of wind power through incentive mechanisms
ii. Enhance the institutional capacity to promote the widespread use of wind power
    a. Designate a responsible entity (one stop-shop for information and guidance to investors and stakeholders)
    b. Purchase wind energy technologies that are in accordance with international minimum quality standards

c. Provide a framework for connection of electricity generated from wind energy to national and isolated grids (through direct sale or net metering)
d. Develop zoning and regulatory wind energy guidelines to prevent inappropriate public outcry against deploying wind energy installations
e. Train manpower for the provision of basic engineering infrastructure for wind power systems and ensure the operation and maintenance of wind energy systems

5.9.2 Measures for the promotion of solar energy

i. Promote the use of solar thermal energy for domestic and productive activities
   a. Ensure that agricultural units make use of solar thermal energy e.g. promote the use of solar thermal for the drying of fruits (solar drying) or for water heating
   b. Set a required solar thermal contribution for new and renovated building (e.g. at least 60% of hot water energy consumption should be provided through solar thermal technologies) in accordance with the ECOWAS Directive on Energy Efficiency in Buildings (EDEEB)
ii. Set up technical assistance programmes on solar thermal energy and strengthen the institutional capacities at all levels
   a. Develop workshops/trainings in order to train locals in the use of solar thermal collectors.
   b. Install demonstration solar thermal system and share best practices for water heating in social institutions (e.g. libraries hospitals, orphanages, homes for senior citizens) with the goal of reducing cost for water heating
   c. Develop skilled manpower and provide basic engineering infrastructure for the local production and maintenance of components and spare parts for solar energy conversion
   d. Establishing and implementing a national solar thermal technology platform (STTP), with links to similar platforms in other African countries in order to facilitate information exchange and international cooperation
iii. Promote the use of solar and hybrid solar electricity systems
   a. Develop a programme for rolling out installations of solar PV home system
   b. Provide a framework for connection of electricity generated from solar energy to national and isolated grids (through direct sale or net metering)
   c. Promote the use of hybrid power generation systems involving solar and other energy sources to manage the effect caused by the intermittent nature and availability of solar energy
   d. Distribute solar lanterns as substitutes for other lighting sources
   e. Start a programme to convert diesel stations to hybrid power generation systems harnessing solar energy
iv. Raise awareness on the benefits of solar energy (solar thermal and solar PV)
   a. Promote the widespread use of solar energy while enforcing regulations and quality standards for the technologies
   b. Conduct awareness campaigns on solar thermal systems to inform all relevant stakeholders and the interested population about the different applications of solar thermal energy and the related economic benefits

5.10 Gender-specific measures

Specific measures to ensure an appropriate consideration and integration of gender-aspects in all national policies, strategies and activities in The Gambia include:

i. Integrate gender aspects in national energy planning development and implementation of gender responsive action and measures for the economic empowerment of women;
ii. Involvement of women in the conceptualization development and implementation of energy policies, projects and programmes;
iii. Produce promotional messages to address the gender issue;
iv. 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 (e.g. related to different production modes);

v. Development of practical guidelines for mapping gender in the cooking energy value chain;
vi. Provide capacity building for women to develop entrepreneurial skills through productive uses of renewable energy technologies; and,
vii. Develop career guidance programmes at schools to encourage more women (and men) to acquire appropriate skills.

5.11 Specific measures to support a comprehensive nexus approach

5.11.1 Specific measures to accommodate the energy-water-food nexus

In order to account for the intrinsic linkages of the energy sector with the water and food sectors, the use of RES technologies in the water supply infrastructure and in the agro-food sector shall be promoted through the following measures:

i. Ensure policy coherence (including investment policy coherence) in all related sectors (bioenergy, food security, rural development, forestry etc);
ii. Promote the use of photovoltaic water pumps including irrigation systems;
iii. Promote the use of animal waste and manure for biogas production;
iv. Reduce the use of non-renewable energy in agro-food systems by using agricultural waste and solar energy to produce the energy needed for the food processing;
v. Support the use of solar and wind energy to provide adequate power supply for agricultural production and post-harvest activities.

Pursue an active cross-sector and international coordination of the multiple uses of water resources:

i. Set up a permanent dialogue process among stakeholders responsible for long term strategies and planning of different water uses
ii. Actively participate in river basin scale policy dialogues on water and water-centred regional dialogues with neighbouring countries with which Sierra Leone share river basins
iii. Improve understanding and systematic analysis of cross-sectoral interdependencies and the growing demand for water energy land resources and agriculture

5.11.2 Specific measures to accommodate the energy-health nexus

i. Equip hospital with solar energy technologies (e.g. solar photovoltaic power plant, solar water heating installations, solar-powered vaccine refrigerators), efficient light bulbs {replacement of regular light bulbs with compact fluorescent lights (CFLS)} and ceiling fans. This will be in line with the Health Strategic plan 2010-2014, which envisages to rehabilitate /reconstruct existing health centres and build new health centres and hospitals
ii. Design and install mini-grid such that the health clinic is the centrepiece of the village mini-grid
iii. Plan regular training and information sessions to provide system designers and field technicians with the know-how and skills for the installation of RES in health centres and hospitals
iv. Disseminate information about the successful implementation and the economic and environmental benefit of retro-fitting hospitals with energy-efficient of RES-based technologies. This will help increase confidence of national regional and local governments and lead to replication in nearby villages. RES could provide alternative sources of energy for emergency services during power shortages
v. Promote the use of medical and related equipment in hospitals and health centres powered by RES e.g.
    a. Vaccine refrigeration and ice pack freezing using solar and wind energy generated on site (temperature control is more accurate than with kerosene-fuelled absorption refrigeration)
    b. Lighting from renewable energy sources (substitute for other lighting sources which do not pollute indoor air quality)
    c. Solar-based radio and radiotelephone communication (facilitate emergency medical treatment and provide reliable communications to other health clinics and facilities in the region

d. Enable medical appliances to operate with RES (incorporate inverters that are powered by RE into the system)
e. Sterilization (sterilize with thermal energy rather than electricity due to lower cost)
f. Water treatment (endorse alternatives to chemical disinfection like UV or ozone treatment using RE sources)
g. Water supply (e.g. water pumping)
h. Solar thermal technologies (e.g. solar water heating distillation and pasteurization)

vi. Support energy storage technologies in combination with RES electricity generation for medical facilities.

6 ARTICULATION WITH REGIONAL INITIATIVES

The ECOWAS region has a series of on-going regional initiatives on the field of renewable energy:

- The ECOWAS White Paper on a Regional Policy for Increasing Access to Energy Services in Peri-Urban and Rural Areas by 2015;
- Establishment of ECREEE;
- Adoption of the ECOWAS Renewable Energy Policy (EREP) with targets for 2020 and 2030;
- The ECOWAS Small Scale Hydropower Programme;
- The ECOWAS Solar Thermal Program
- The ECOWAS Bioenergy Strategy Framework; and
- The ECREEE Rural Electrification Programme.

A summary of these regional initiatives in renewable energy can be found in Annex I of this Plan.

Besides the activities in renewable energy, the ECOWAS region has also a series of on-going activities in energy access:

- The ECOWAS White Paper on a Regional Policy for Increasing Access to Energy Services in Peri-Urban and Rural Areas by 2015
- The ECOWAS Revised Generation and Transmission Master Plan ;
- The West Africa Gas Pipeline (WAGP);
- ECOWAS Rural Electrification projects.

A summary of the regional initiatives on energy access can be found in **Annex II.**

Synergies between these regional initiatives and the proposed measures in this Plan will be created.

7 PREPARATION OF THE NATIONAL RENEWABLE ENERGY ACTION PLAN AND FOLLOW-UP ON ITS IMPLEMENTATION

Key Gambian stakeholders contributed to the development of the National Renewable Energy Action Plan through their participation in the Technical Steering Committee, which supervised and reviewed the development of the plan. Regional and/or local authorities, on the other hand, were not involved in the preparation of this action plan, and for the time being, regional or local renewable energy strategies are not foreseen in the Gambia.

In order to provide for a public consultation process and ensure national ownership of the NREAP, a national Kick-Off Meeting has been organised at the beginning of the development process. This was followed by a National Review and Validation Workshop for the baseline report, which documents the status quo of renewable energy, energy efficiency and energy access in The Gambia.

The Ministry of Energy serves as the national contact point/ the national authority responsible for the follow-up of the Renewable Energy Action Plan. Both monitoring and reporting will be critical, to assess the efficiency of the actions and the fulfilment of the targets, and to give feedback to the international donors and private investors. The progress towards the accomplishment of the different targets, measures and activities outlined in the plan will be evaluated each year to assess their degree of achievement. At the same time the plan will be reviewed periodically based on worldwide technological developments in the RE sector.

MOE has the ultimate responsibility for monitoring and evaluating the implementation of the NREAP under the oversight of the National Multi-Sectoral Committee. A monitoring framework, including indicators for individual measures and instruments, to follow-up the implementation of the NREAP will be developed in due course with support from ECREEE. The development of the M&E system for renewable energy will include the following actions, among others:

a. Develop and establish a monitoring and evaluation unit/functions for renewable energy activities within the Ministry of Energy;

b. Develop a performance tracking scheme to monitor and evaluate the growth of installed MW by renewable energy technology;

c. Develop a performance tracking scheme to monitor and evaluate the percentage of energy from renewable energy sources in the energy supply mix;

d. Develop a performance tracking scheme to monitor and evaluate the GWh of electricity generated from renewable sources;

e. Develop a performance tracking scheme to monitor and evaluate renewable energy activities; and,

f. Implement the tracking schemes on a routine basis.

The annual assessment results of progress towards the accomplishment of the different targets, measures and activities as well as the recommendations obtained from analysis of the results, will be published in an annual report which will be submitted to the Cabinet by the Hon. Minister of Energy.

8 ABBREVIATIONS AND ACRONYMS

ATK	Aviation Turbine Kerosene
BANDES	Economic and Social Development Bank of Venezuela
CCSFM	Community Controlled State Forest Management
CDM	Clean Development Mechanism
CFMC	Community Forest Management Concept
CILLS	Permanent Interstate Committee for the Control of Drought in the Sahel
DANIDA	Danish International Development Agency
DCD	Deportment of Community Development
ECOWAS	Economic Community of West Africa States
EDEEB	ECOWAS Directive on Energy Efficiency Buildings
EE	Energy Efficiency
EREP	ECOWAS Renewable Energy Policy
EU	European Union
FIT	Feed-in-Tariff
GAMFINET	Gambia Micro-Finance Network
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GFMC	Gambia Forest Management Concept
GIEPA	Gambia Investment and Export Promotion Agency
GNPC	Gambia National Petroleum Company
GREC	Gambia Renewable Energy Center
GTTI	Gambia Technical Training Institute
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit
GWh	Giga watt hour
IPP	Independent Power Provider
JFPM	Joint Forest Park Management
KWH	Kilo Watt hour
LPG	Liquified Petroleum Gas

MOE	Ministry of Energy
NARI	National Agricultural Research Institute
NAWEC	National Water and Electricity Company
NGO	Non-governmental Organization
NIPAES	National Investment Program on Access to Energy Services
OMVG	Organization for the Development of The Gambia River Basin
PPA	Power Purchase Agreement
PURA	Public Utilities Regulatory Authority
PV	Photovoltaic
RE	Renewable Energy
REAGAM	Renewable Energy Association of The Gambia
RES	Renewable Energy Resources
SE4ALL	Sustainable Energy for All
TES	Total Energy Supply
TOE	Tonnes of Oil Equivalent
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNSO	United Nations Sahelian Office
UTG	University of The Gambia
WAPP	West African Power Pool

ANNEX I - Definition of terms used in the action plan

Agrifuels: Solid biofuels obtained from crops, and residues from crops and other agricultural products. Residues from agricultural production include animal solid excreta, meat and fish residues. Agrifuel is subdivided into bagasse, animal wastes and other biomass materials and residues (check definitions for bagasse, animal wastes and other agricultural residues).

Animal waste: Excreta of animals which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are under biogases (see biogas).

Bagasse: the fuel obtained from the fibre which remains after juice extraction in sugar processing

Biofuels: liquid or gaseous fuel for transport produced from biomass.

Other vegetable material and residues: biofuels not specified elsewhere and including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from maintenance, cropping and processing plants.

Solid biofuels: solid fuels derived from biomass.

Liquid biofuels: Liquids derived from biomass and generally used as fuels. Liquids biofuels comprise bio-gasoline, biodiesel and other liquid fuels (definitions of biogasoline, biodiesel and other liquid fuels are provided below).

Bio-gasoline: Liquid fuels derived from biomass and used in spark-ignition internal combustion engines. Common examples are: bioethanol; biomethanol; bio ETBE (ethyl-tertio-butyl-ether); and bio MTBE (methyl-tertio-butyl-ether).

Biodiesel: Liquid biofuels which are usually modified chemically so that they can be used as fuel in engines either directly or after blending with petroleum diesel. Biological sources of biodiesel include, but are not limited to, vegetable oils made from canola (rapeseed), soybeans, corn, oil palm, peanut, or sunflower. Some liquid biofuels (straight vegetable oils) may be used without chemical modification their use usually requires modification of the engine.

Biodiesel as a share of diesel and fuel-oil consumption (in %): The EREP sets conventional biofuels targets (1st Generation Biofuels) for the ECOWAS region as a whole, one of which is the biodiesel as a share of diesel and fuel oil consumption. In this template this is calculated by dividing the production of raw vegetal oil/biodiesel by the diesel oil/DDO/fuel oil consumption in the country.

Straight vegetable oil: When vegetable oil is used directly as a fuel, in either modified or unmodified equipment, it is referred to as straight vegetable oil (SVO) or pure plant oil (PPO).

Other liquid biofuels: liquid biofuels not elsewhere specified.

Biogas: gases arising from anaerobic fermentation of biomass. These gases are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases (check definitions for landfill gas, sewage sludge gas and other biogases). They are used mainly as a fuel but can be used as a chemical feedstock. . It is particularly relevante for cooking purposes or in the context of industrial uses (e.g. breweries, slaughter houses).

Landfill gas: biogas from anaerobic fermentation of organic matter in landfills.

Sewage sludge gas: biogas from anaerobic fermentation of waste matter in sewage plants.

Other biogases: biogases not elsewhere specified including synthesis gas produced from biomass.

Biomass: biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste. The uses of biomass for energy are very diverse: from the traditional, low-efficiency burning of wood in open fires for cooking purposes to the more modern use of wood pellets for the production of power and heat, and the use of biodiesel and bioethanol as a substitute for oil-based products in transport.

Base Load: Base load is the level below which electricity demand never drops, i.e. a site with a high maximum demand of

750 kVA whose demand never drops below 250 kVA would have a base load of 250 kVA. Large hydro power is an important renewable energy source for the provision of base load in the ECOWAS region. The significance will grow with the implementation of the WAPP hydropower project pipeline.

Charcoal: The solid residue from the carbonisation of wood or other vegetal matter through pyrolysis. The amount of biomass (usually fuelwood) necessary to yield a given quantity of charcoal depends mostly on three factors:

- *parent wood density – the principal factor in determining the yield of charcoal from fuelwood is parent wood density, since the weight of charcoal can vary by a factor of 2 for equal volumes*
- *moisture content - moisture content of the wood also has an appreciable effect on yields - the drier the wood, the greater is the yield - ; and*
- *the means of charcoal production: charcoal is produced in earth-covered pits, in oil drums, in brick or steel kilns and in retorts. The less sophisticated means of production generally involve loss of powdered charcoal (fines), incomplete carbonization of the fuelwood and combustion of part of the charcoal product, resulting in lower yields.*

Traditional non-efficient charcoal production methods: traditional charcoal production methods include open pits, oil drums and kilns with lower efficiencies. In the ECOWAS charcoal is mainly produced by traditional methods in the informal sector (e.g. open pits and kilns) which are inefficient (60-80% of the energy in the wood is lost) and has impacts on the health and on the environment.

Efficient charcoal production: efficient charcoal is the terminology used on this template for the charcoal produced by modern methods that are more efficient than traditional ones. The modern methods use sealed containers and have higher efficiencies and thus higher yields. Within the EREP, under the targets for domestic cooking, a target for efficient charcoal production is set: 60%/100% of the charcoal production should be by improved carbonisation techniques (yield >25% in 2020 and 2030, respectively. In this template the MS is asked to set out its target and trajectory for efficient charcoal production. This is calculated by dividing the quantity of charcoal produced by improved carbonisation techniques with yield superior to 25% in tonnes by the total charcoal production in tonnes.

Conservation: The reduction of energy usage through increased efficiency and/or reduced waste.

DDO: stand for Distillate Diesel Oil

Distributed and Microgeneration: This is when electricity is generated for local distribution and is not connected directly to the national grid. Microgeneration is typically used to describe smaller scale generating technology.

Energy Efficiency appliances: Electrical devices or appliances that perform their task, and use less electricity than lower-efficient devices. Electrical inefficiency in many devices is directly related to the heat they produce. For example, energy efficient light bulbs use most of the incoming electrical energy to produce light, not heat. Inefficient air conditioning is a major cause of peak hours in the ECOWAS region.

Electricity: The transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion. Electricity can be generated through different processes: e.g. by the conversion of energy contained in falling or streaming water, wind or waves or by the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels.

Electricity demand: The total electricity consumption in GWh or MWh consumed by a country annually. This includes the demand of the complete system including the incircuital consumption and the losses.

Electricity mix: The range of energy sources of a region/country (either renewable or non-renewable) that is used to produce electricity,

Energy access: A universal and affordable access to modern means of energy. It implies access to modern cooking solutions defined as relying primarily on non-solid fuels for cooking. It also implies access to electricity, defined as availability of an electricity connection at home or the use of electricity as the primary source of lighting that can provide non-served communities and households with a modern life and economic development.

Energy Efficiency: the ratio of performance or output of performance of services, goods or energy to input of energy. The energy efficiency of a process is improved if it produces the same service using less energy. Energy-efficient light bulbs produce the same amount of light but use up to 75% less energy to do so. Improving energy efficiency helps reducing energy use or bringing more energy services with the same amount of energy consumed.

EREP: ECOWAS Renewable Energy Policy

Ethanol: also called ethyl alcohol, pure alcohol, grain alcohol or drinking alcohol, is a volatile, flammable, colourless liquid that can be used for several different purposes, being one of them as fuel. As fuel, ethanol is used as a motor fuel and fuel additive (e.g. Brazil relies in Ethanol as a motor fuel). Ethanol is also used for household heating as a relatively safe fuels.

Ethanol as share of gasoline consumption: The EREP sets first generation biofuels targets for the ECOWAS region as a whole, one of which is the ethanol as a share of the gasoline consumption. This is calculated by diving the quantity of ethanol produced by the quantity of gasoline consumed in the country and it is show in %.

Fossil Fuel: An energy source formed in the Earth's crust from decayed organic material. The common fossil fuels are oil, diesel, coal, and natural gas. Some ECOWAS countries are highly dependent on diesel electricity generation.

Fuelwood, wood residues and by-products: fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. In the ECOWAS region fuelwood is the principal source of energy for cooking and heating, however statistics on fuelwood are generally poor as it is mainly produced and traded in the informal sector.

Grid-connected: a system (photovoltaic, hydro, diesel, etc.) that is connected to a centralised electrical power network (power grid).

Generation (electricity): This covers the production of electricity at power stations.

Heat: Heat is an energy carrier primarily used for warming spaces and industrial processes

Hybrid System: a power system consisting of two or more power generating subsystems (e.g. combination of a wind turbine or diesel generator and a photovoltaic system)

Improved cookstoves (also called clean/efficient cookstoves): is a device that is designed to consume less fuel and save cooking time, convenient in cooking process and creates smokeless environment in the kitchen or reduction in the volume of smoke produced during cooking against the traditional stove; and thus addressing he health and environmental impacts associated with traditional cookstoves. Traditional cookstoves (open fires and rudimentary cookstoves using solid fuels like wood, coal, crop residues and animal dung) are inefficient, unhealthy, and unsafe, and inhaling the acrid smoke and fine particles they emit leads lead to severe health problems and death. Traditional cookstoves also place pressure on ecosystems and forests and contribute to climate change through emissions of greenhouse gases and clack carbon. Within the EREP targets are set for improved cookstoves, as the pressure on the ECOWAS woodland will grow exponentially. Thus the policy includes the banning of inefficient stoves after 2020, enabling 100% of the population of the urban areas to use high efficient wood and charcoal stoves (with efficiencies higher than 35%) from 2020 onwards and 100% of the rural population to use high efficient charcoal stoves from the same date on. In this template the MS is asked to set a target for improved cookstoves measured in terms of the % of the population that uses efficient cookstoves. This is estimated by dividing the number of inhabitants that use improved cookstoves by the total number of inhabitants of the country.

Installed capacity: is the rated continuous load-carrying ability of a given electricity generation plant expressed in megawatts (MW) for active power

Kilowatt (kW): 1,000 watts

Kilowatt-hour (kWh): 1,000 watt-hours.

LPG: Liquefied petroleum gas

Load: In an electrical circuit, any device or appliance that uses power (such as light bulb or water pump)

Megawatt (MW): 1,000,000 watts

Megawatt-hour (MWh): 1,000,000 watt-hours

Mini-grids: set of electricity generators and, possibly, energy storage systems interconnected to a distribution network that supplies the entire electricity demand of a localized group of customers. This power delivery architecture can be contrasted with single customer systems (e.g. solar home systems) where there is no distribution network interconnecting customers,

and with centralized grid systems, where electrical energy is transmitted over large distances from large central generators and local generators are generally not capable of meeting local demand. Mini-grids are particularly relevant in the rural context of ECOWAS where renewable energy powered hybrids can be the more cost-effective alternative. The EREP includes mini-grid targets.

Modern fuel alternatives (for cooking): known as non-conventional or advanced fuels, these are any materials or substances that can be used as fuels for cooking, other than conventional solid fuels such as coal, fuelwood and charcoal. These alternatives cover Liquefied petroleum gas (LPG), biogas, ethanol, solar power (e.g. solar cookers) and kerosene. In this template improved cookstoves are not considered within the modern fuel alternatives, as they are object of a separate analysis in this template.

Non-technical losses: in electricity distribution include mainly electricity theft, but also losses due to poor equipment maintenance, calculation errors and accounting mistakes. Non-Technical losses are caused by actions external to the power system or are caused by loads and condition that the Technical losses computation failed to take into account. Non-Technical losses are more difficult to measure because these losses are often unaccounted for by the system operators and thus have no recorded information. A reduction of the losses can contribute considerably to the improvement of energy security in many ECOWAS countries.

Offshore wind: wind projects installed in waters off the coast.

Onshore wind: Wind farms installed on land.

Operating costs: the costs of using a system. For fuel-based systems these costs include all fuel costs over system lifetime.

Off-grid applications: is a designation for facilities that produce all their own energy and are not connected to any external source, such as the electrical power grid.

Peak Load: maximum value of necessary capacity to face peak demand. In terms of this template, peak load is characterised for a given year in MW (this includes the load of the complete system including the in circuital consumption and the losses).

Photovoltaic (PV) system: a complete set of interconnected components for converting sunlight into electricity by photovoltaic process, including array, balance-of-system components, and the load.

Power grid: a system of high-tension cables by which electrical power is distributed throughout a region

Renewable Energy (RE): 'Renewable energy' is used to describe the energy produced using naturally replenishing resources. This includes solar power, wind, geothermal, bioenergy, wave and tide and hydropower.

Renewable energy sources – in this template the renewable energy sources refer to the following renewable energy technologies:

- *Hydropower which includes:*
  - *Small scale hydropower (small-hydro or SSHP) up to a maximum installed capacity of 30 MW;*
  - *Medium (capacity between 30MW and 100MW) and large hydropower (capacity higher than 100MW);*

  In the EREP hydropower is defined as follows: up to 30 MW small-scale, 30 to 100 MW medium-scale, more than 100 MW large-scale.
- *Bio-energy covering three different fields:*
  - *Woodfuels (firewood and charcoal) used for domestic cooking purposes and commercial applications (restaurants, breweries, potteries, blacksmiths, brick makers). Excess woodfuels resources could be used for power generation with other biomass.*
  - *By-products from crops production for power generation (stalks, straw, husks, shells, kernels, etc.). These can serve as fuel for power generation when gathered together on an agro-industry site. Power can also be generated through biogas production using industrial or urban waste, manure and dung (resource concentration at dairies or slaughter houses or cattle and vegetable markets).*
  - *Energy crops for power generation or sustainable biofuels (e.g. jatropha) offer some interesting perspectives. EREP considers 2nd generation biofuels which do not compete with food crops for available land, and comply with the following minimum criteria; lifecycle GHG reductions, including land use change and social standards.*
- *Wind energy (on-grid and off-grid applications);*
- *Solar: PV, Concentrated Solar Power (CSP) and solar thermal water heating.*

- *Tide, wave and ocean and geothermal, although not considered in the EREP as renewable energy options, were included on the template as some of the countries have available potential for its use for generation of energy.*
- *Geothermal*

Renewable energy share in the electricity mix: - is the share of renewable energy electricity generation in the total electricity generation for a given year, measured in %. This is calculated in the template by dividing the electricity production from renewable energy sources (in MWh/year) by the total electricity production (in MWh/year) – renewable and non-renewable for the same year.

Rural Electrification: Provides a regular supply of electricity to rural residents. It implies the extension of power lines to rural areas, or the use of stand-alone, mini-grids or isolated power systems. The EREP includes targets for rural electrification.

Rural Population as referred for off-grid applications (mini-grids and stand-alone systems): Following EREP's definitions, it refers to the population for which the mini-grid and decentralised supply systems apply.

Share of rural population served with off-grid (mini-grids and stand-alone) renewable energy electricity services: this is the percentage (%) of the rural population as defined above that is served with mini-grids and stand-alone system. This is calculated by dividing the number of inhabitants served by off-grid applications by the number of rural inhabitants (as defined above).

Rural communities: These includes population living in rural centres and villages with population between 200 and 2,500 inhabitants and some larger cities that due to its peripheral geographical location are away from the national grid. The EREP refers as well that some of the off-grid rural localities supplied before 2020 might be included in the grid extension as they will potentially grow up.

Solar cookers: or solar oven, is a device which uses the energy of direct sun rays (which is the heat from the sun) to heat, cook or pasteurize food or drink.

Solar thermal water heating: or solar hot water (SHW) systems comprise several innovations and many mature renewable energy technologies that have been well established for many years. In these systems water is heated by the sun using collectors. These systems are designed to deliver hot water for most of the year. They can contribute to the reduction of peak hours in the urban context. Moreover, they can be an effective tool to save energy costs in hotels, hospitals and industrial processes (e.g. beverage industry)

Stand–alone power systems (SAPS): also known as remote area power supply, is an off-the-grid electricity system for locations that are not fitted with an electricity distribution system. Typical SAPS include one or more methods of electricity generation, energy storage, and regulation.

Support scheme: means any instrument, scheme or mechanism applied by a Country or group of Countries, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments.

Some support schemes for renewable energy:

- *Production based incentives:*
    - *Feed-in-Tariff ("FIT"): is an energy supply policy that promotes the deployment of renewable energy resources. A FIT offers a guarantee of payments to renewable energy producers for the actual electricity produced ($/kWh). These payments are generally awarded as long-term contracts.*
    - *Quota system: is an energy supply policy that awards the generator with certificates that can be sold into a market (with no price guarantee)*
    - *Quota systems with competitive bidding: is the fixation of mandatory production quotas for green electricity supply. These quotas are imposed on power generating utilities and / or electricity distribution utilities (calculated as a percentage of production/sales). Operators can meet these obligations in three ways: (i) by producing their own green electricity, (ii) by buying the electricity under long term contracts, and (iii) by acquiring on the financial market the "Green Certificates" corresponding to the amount of electricity required.*
    - *Decentralized quota system with green certificate market also called tradable green certificates (TGC): is the fixation of mandatory production quotas for green electricity supply. These quotas are imposed on*

power generating utilities and / or electricity distribution utilities (calculated as a percentage of production/sales). Operators can meet these obligations in three ways: (i) by producing their own green electricity, (ii) by buying the electricity under long term contracts, and (iii) by acquiring on the financial market the "Green Certificates" corresponding to the amount of electricity required.

- *Investment based incentives*
    - *Capital grants and loans: investment instruments in which government provide grants or loans for the development of renewable energy projects. Grants do not have to be repaid, while loans have to be repaid.*
    - *Microcredits: is the extension of very small loans (microloans) to impoverished borrowers who typically lack collateral, steady employment and a verifiable credit history.*
    - *VAT Exemptions: allows households or investors not to have to pay VAT on renewable energy or energy efficiency equipment*

Tidal And Wave (marine generation): The principle behind tidal generation is similar to wind turbines, except that instead of wind turning the turbine blades, the process uses underwater current caused by tides. One of the benefits of tidal power over wind power is the predictability of tidal currents, enabling the developers to know exactly when the turbines will be producing power. Electricity can also be generated by harnessing the energy waves. The aim is to capture the vertical movement in the water surface caused by waves and to convert that energy to electricity by turning a generator.

Technical losses: Losses in power system that are caused by the physical properties of the components of the power system. Technical losses are naturally occurring losses (caused by action internal to the power system) and consist mainly of power dissipation in electrical system component such as transmission lines, power transformers, measurement system, etc.

Watt-hour (Wh): a measure of electric energy equal to the electrical power multiplied by the length of time (hours) the power is applied.

Waste: in energy statistics waste refers to the part of the waste that is incinerated with heat recovery at installations designed for mixed wastes or co-fired with other fuels. The heat may be used for heating or electricity generation. Certain wastes are mixtures of materials of fossil and biomass origin.

Industrial waste: non-renewable waste which is combusted with heat recovery in plants other than those used for the incineration of municipal waste. Examples are used tires, specific residues from the chemical industry and hazardous wastes from health care. Combustion includes co-firing with other fuels. The renewable portions of industrial waste combusted with heat recovery are classified according to the biofuels which best describe them.

Municipal waste: Household waste and waste from companies and public services that resembles household waste and which is collected at installations specifically designed for the disposal of mixed wastes with recovery of combustible liquids, gases or heat. Municipal wastes can be divided into renewable and non-renewable fractions.

Wind power: The conversion of energy in the wind into electrical power using a wind turbine. Wind farms can be sited on land or at sea, with those offshore able to take advantage of the much stronger and consistent winds found off the coast.

ANNEX II – REGIONAL INITIATIVES IN RENEWABLE ENERGY

The ECOWAS White Paper on Increasing Access to Energy Services in Peri-Urban and Rural Areas by 2015

The ECOWAS White Paper was adopted in 2006 by the ECOWAS Heads of States and Government in recognition of the key role that energy plays in the achievement of the Millennium Development Goals (MDGs). The White Paper aims to provide access to improved domestic cooking fuels and sustainable electricity services for the majority of the population by 2015. Moreover, it foresees that at least 20% of new investments in electricity generation should originate from locally available renewable resources, in order to achieve self-sufficiency, reduced vulnerability and sustainable environmental development.

The ECOWAS Energy Protocol

The ECOWAS Energy Protocol is a legal text that formalises the juridical framework of enterprises in the energy sector that was modelled after the European Energy Charter Treaty. It promotes investment and trade by serving as a security for foreign direct investments in the energy sector. The ECOWAS Member States have completed the process of ratifying the Protocol which aims to provide a legal and regulatory framework for all regional energy integration initiatives and projects

The ECOWAS Bioenergy Strategy Framework

The ECOWAS Bioenergy Strategy Framework, adopted by the ECOWAS Council of Ministers in June 2013, aims to enhance the sustainable Bioenergy production and use within the Region that help address energy poverty, particularly in the rural and peri-urban populations, promotes food security, safeguard the environment, and enabling domestic and foreign investments. Development of National Action Plans should take into consideration the following objectives and initiatives:

- Universal access to modern energy services, especially in the rural and peri-urban areas by 2030 ;
- A more sustainable and safe provision of domestic energy services for cooking thus achieving the objectives of the White Paper for access to modern energy services by 2020 and
- Increasing food security within the region.
- Promote the transition from the traditional use of biomass towards a modern, efficient production and use of modern Bioenergy;
- Broaden regional dialogue and peer-to-peer learning to support the development of Bioenergy strategies in the ECOWAS Member States ;
- Promote regional policy planning for Bioenergy harmonized with national policies;
- Sensitize and share experiences on modern sustainable Bioenergy production that also promotes food security; and
- Create a vibrant and sustainable modern Bioenergy sector that promotes economic growth, rural development, and poverty alleviation.

The ECOWAS Small-Scale Hydropower Program

THE ECOWAS Small-Scale Hydropower Program, adopted by the ECOWAS Council of Ministers in June 2013, aims to contribute towards increased access to modern, affordable and reliable energy services by establishing an enabling environment for small-scale hydro power investments and markets in the ECOWAS region.

Between 2013 and 2018 the following specific program objectives will be achieved:

- At least six ECOWAS countries will have improved their legal framework (poverty reduction impact of SSHP evidence in their legal framework, feed-in tariff defined, transparent licensing procedure etc.);
- ECOWAS Member States integrate SSHP into their scenarios, planning documents and budgetary allocations;
- National SSHP initiatives and projects increasingly rely on local expertise from public and private sector (with limited international support). At least 1000 experts are trained.
- Quality guidelines are in use and quality of SSHP project proposals and feasibility studies improved.
- SHPP, planning tools and all other SHPP related publications are available on the ECREEE website.

- A least 35 additional SSHP projects per year are developed up to feasibility study level. The construction of 50 projects has commenced. The more funding is mobilized the more projects can be developed.
- At least 10 companies established to provide various SSHP related services (planning, operation, repair etc.).
- Sustainability criteria and biodiversity offsetting will be mainstreamed throughout the planning and construction of SHP plants.

ECREEE Rural Electrification Programme (ERuEP)

The implementation of ERuEP will be done based on the four main pillars of ECREEE work programmes:

- Policy support (P);
- Capacity development (C);
- Project Development and Financing (D);
- Knowledge management (K).

These four pillars are vastly interlinked, and their importance for programme development in ECREEE is that, it allows for planning to take into account all the aspects needed for a successful implementation. A feasible initiative must include policy mechanisms, capacity building initiatives, promote the development and financing of specific projects and appropriate knowledge management, starting with awareness raising and knowledge sharing.

The main activities to be undertaken in the rural electrification initiative include:

1 Support Member States in setting up the enabling environment and institutional framework for Mini-grids.

- Support MS in analysis and planning of rural electrification through GIS based rural electrification planning
- Support the identification of national tailored approach to rural electrification
- Support the establishment of appropriate institutional and legislative framework
- Promote an enabling environment for private sector involvement
- Promote regional policy on rural electrification

2 Strengthen the capacities on sustainable management, operation and maintenance of existing systems

- Technical and entrepreneurial training to build capacity on local manufacturing of components
- Mentorship to entrepreneurs
- Support project preparatory activities
- Support governments in fund mobilisation
- Direct support to implementation through EREF calls

The ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN)

The ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN) was established against the background that women's potential, in the ECOWAS region, as producers and suppliers of energy services is under-utilized and that empowering women to make significant contributions in the implementation of the adopted regional renewable energy and energy efficiency policies is necessary for the achievement of the Sustainable Energy for All (SE4ALL) goals in West Africa. Moreover, the programme is founded upon the principles of the ECOWAS Gender Policy which emphasizes the "need to develop policies and programmes to provide alternative energy sources which would contribute to women's health and also alleviate their time burden".

To stimulate the development of women-led business initiatives in the energy sector, ECREEE, through the support of the Spanish Agency for International Cooperation and Development (AECID), established the ECOWAS Women's Business Fund. ECREEE will work with Member States to identify and support, through the fund, innovative energy projects implemented by women groups and associations. In addition to this, ECREEE will assist Member States to establish similar funds in their respective

The ECOWAS Solar Thermal Program

The overall goal of the Solar Thermal Program (SOLTRAIN) in West Africa is to contribute to the switch from a fossil fuel based energy supply to a sustainable energy supply system based on renewable energies in general but based on solar thermal in particular. The overall project will be coordinated by ECREEE and technically implemented by AEE INTEC in cooperation with 8 institutional project partners from 7 West African countries (Cape Verde, Nigeria, Burkina Faso, Ghana, Mali, Senegal, Niger and Sierra Leone).

The ECOWAS solar thermal capacity building and demonstration program therefore aims to remove existing awareness, political, technological, and capacity related barriers which restrict solar thermal energy deployment in ECOWAS countries. The program will also contribute to increase the grid stability and save national power reserves as solar thermal systems will significantly reduce the stress on electric grids due to the shift from electricity to solar energy. The program links precisely to the goals of the regional polices on Renewable energy and energy Efficiency adopted by the ECOWAS Authority of Heads of State and Government in 2013. The regional policies considered solar thermal as a least cost sustainable energy technology and set specific targets for its use to meet sanitary and industrial hot water needs in the region.

The goals of SOLtrain West Africa are:

- Capacity Building by theoretical and practical Train-the-trainer courses to selected universities and polytechnic schools in the area of solar water heating and solar thermal drying
- Identify, monitor, analyze and improve existing solar thermal systems together with the partner institutions (practical training).
- Technical support of local producers.
- Design and Install solar thermal systems on the partner institutions for teaching and demonstration purposes.
- The partner institutions will offer trainings to national companies, installers, producers and further training institutions within their countries.
- Installation of 200 Demonstration systems at social institutions as schools and hospitals engineered by the partner institutions and installed by national practitioners
- Trainings to administrative, political and financial stakeholders in each country
- Solar thermal testing facility in one of the countries

The ECOWAS GENERATION AND TRANSMISSION MASTER PLAN

The ECOWAS Renewable Energy Policy highlights renewable energy scenario that is fully complementary to the ECOWAS power supply strategy and conventional national supplies, both as a significant contribution to bulk power generation and as a prevailing contribution to universal energy access for rural areas. Projects to be developed under the renewable energy power generation are to be implemented by ECREEE.

The ECOWAS Generation and Transmission Master plan approved in September 2011, foresees 30 power generation projects selected as regional priority power projects with a total capacity of 10.3 GW and a cost of US$18 billion (€15 Billion). The major share of this new generation and transmission capacities is projected to be available from 2017 to 2019. The selected projects are based primarily on large hydro power (21) with 7,093 MW, on natural gas (3) with 1,300 MW, on coal (2) with 1,075 MW and on renewable energy (4) with 800 MW. It must be noted that some projects are already getting delayed, and, therefore, the proposed scenario will most likely not happen as scheduled. This would have serious consequences for the importing countries and countries relying on new large hydro. In this context, RE technologies might assume more competitive roles.

The tables below show the lists of projects (generation and transmission) earmarked for regional implementation or as a regional priority projects:

Table 1: REGIONAL PRIORITY GENERATION PROJECTS

Regional Project	Priority Capacity	Annual Energy Generation	Generation Cost	Year of Project Commissioning
Coal Power plant in Sendou-(**Senegal)**	875MW		2532 Million US $	2016
Gouina Hydroelectric Project: Interconnecting Kayes **(Mali)-**Tambacounda	140 MW	565 GWh	329 Million $	2017

(Senegal)				
Wind Farm(**Senegal-the Gambia)**	200 MW		318 Million $	2021
Hydroelectric plants of Boureya (OMVS) – Badoumbé (OMVS) – Balassa (OMVS) and Koukoutamba (OMVS) 1. Badoumbé 2. Balassa 3. Boureya 4. Koukoutamba (**Mali**)	 70 MW 181 MW 160 MW 281 MW	 410 GWh 401 GWh 455 GWh 455 GWh	 197 Million $ 171 Million $ 373 Million $ 404 Million $	 2017-2019 2017-2019 2021 2019-2021
Kaléta Hydro **(Guinea**)	240 MW- 3 x 80 MW	946 GWh	267 Million $	2015
Sambangalou Hydro (**Guinea**)	128 MW- 4 x 32 MW	402 GWh	433 Million $	2017
Digan Hydro (**Guinea**)	93.3 MW	243 GWh	112 Million $	2012
Souapiti Hydro (**Guinea**)	515 MW	2518 GWh	796 Million $	2017-2019
Amaria Hydro(**Guinea**)	300MW	1435 GWh	377 Million $	2019-2021
Grand Kinkon Hydro (**Guinea**)	291MW	720 GWh	298 Million $	2012
Kassa Hydro **(Guinea/Sierra Leone)**	135 MW	528 GWh	214 Million $	2019-2021
Mount Coffee Hydro (**Liberia**)	66 MW	435GWh	383 Million $	2015
Bumbuna Hydro(**Sierra Leone**)	400 MW – 1560GWh – 520 M$	1560 GWh	520 Million $	2017-2019
Félou Hydro **(Mali)**	60 MW	350GWh	170 Million $	2013
Solar project 150 MW **(Mali)**	150MW - 549 M$		549 Million $	2019-2021
Tiboto Hydro **(Cote d'Ivoire)**	225 MW	912 GWh	578 Million $	2021
Fomi Hydro ((**Guinea)**	90 MW	374 GWh	156 Million $	2017-2029
Soubré Hydro **(Côte d'Ivoire)**	270MW	1120 GWh	620 Million $	
Aboadze- combined cycle Thermal Plant **(Ghana)**	400 MW		356 Million $	2014
Hydro **Adjaralla (Togo)**	147 MW	366 GWh	333 Million $	2017
Project of combined cycle Thermal (**Togo)**	450 MW		401 Million $	2021

Project of thermal plant in Maria Gleta **(Benin)**	450 MW		401 Million $	2014
Solar project 150 MW **(Burkina Faso)**	150MW		549 Million $	2017-2019
Mambilla Hydro **(Nigeria)**	2600MW	11214 GWh	4000 Million $	2019-2021
Zungeru Hydro **(Nigeria)**	700 MW	3019 GWh	1077 Million $	2017-2019
Wind Farm 300 MW **(Nigeria)**	300 MW		477 Million $	2021
Coal plant of Salkadamna **(Niger)**	200 MW		573 Million $	

Table 2: REGIONAL PRIORITY TRANSMISSION AND INTERCONNECTION PROJECTS

Project	Length of Transmission line	Cost of project	Commissioning Year
Hydroelectric plant Gouina: 225 kV OMVG loop	280 km	65 Million $	2019
225kV OM VG double circuit loop Linsan (Guinea) -Manantali **(Mali**) Reinforcement of Manantali-Bamako-Sikasso (**Mali**) section		131 Million $ 151 Million $	1st circuit: 2017-2019; 2nd circuit: 2019-2021
225kV OM VG loop Bolgatanga (**Ghana**) – Bobo Diolasso (**Burkina**)- Bamako (**Mali**)	742 Km	230 Million $	2015
225 kV OMVG loop between Senegal, The Gambia, Guinea-Bissau.	1677 Km	576.5 Million $	2017
Grand Kinkon western section of OMVG loop		141 Million $	2012
CLSG 225kV OMVG double circuit loop.	1060 km	430 Million $	2015
Second circuit of CLSG line 225kV OMVG loop	1060	69 Million $	2017-2019
225kV OMVG loop Ségou (**Mali**) - Ferkessédougou (**Ivory Coast**)	370 km	175 Million $	2012
225kV OMVG loop Buchanan (**Libéria**) –San Pedro (**Ivory Coast**)	400 km	100 Million $	2019-2021
225kV OMVG loop Linsan-	1350 km	550 Million $	2017-2029

Fomi – Fomi-Nzerekoré – Fomi-Bamako			
225kV OMVG double circuit loop Fomi (**Guinea**) – Boundiali (**Ivory Coast**)	380 km	111 Million $	2019-2021
225kV OMVG loop Soubré-Taabo (**Ivory Coast**)	196 km	69 Million $	2017-2019
225kV OMVG loop Bolgatanga (**Ghana**) – Ouagadougou (**Burkina Faso**)	206 km	74 Million $	2013
330kV OMVG loop between **Prestea** and **Bolgatanga** (**Ghana)**	640 km	240 Million $	2017-2019
330 kV OMVG loop Niamey (**Niger**) - Birnin Kebbi (**Nigeria**) - Malanville (**Benin**) – Ouagadougou (**Burkina Faso**)	832 km	540 Million $	2017-2019
760 kV OMVG loop network through **Nigeria**	2700 km	2000 Million $	2019-2021
Median Backbone 330kV OMVG loop	713 km	238 Million $	2019-2021
330 kV OMVG double circuit loop Sakete (**Benin**) - Omotosho (**Nigeria**)	120 km	39 Million $	2021
225kV OMVG loop Salkadamna-Niamey (**Niger**)	190 km	72 Million $	2019-2021

4. ECOWAS-ACTION PLAN IMPLEMENTATION STRATEGIES AND STATUS

Regional Priority Projects planned for implementation **2011 – 2025:**

- **10 000 MW** to be installed of which **7 000 MW** will be hydro sources
- **16 000 km** of transmission lines

TOTAL INVESTMENT COST is **US$ 24 BILLION** with GENERATION COST of **US$ 18 BILLION** AND TRANSMISSION of **US$6BN**

Table 3: Status of implementation of ECOWAS transmission projects

Project	Status of implementation	Time of Commissioning
330 kV Riviera (Cote d'Ivoire) – Prestea (Ghana)	Projects on-going	Expected commissioning 2015
330 kV Aboadze (Ghana) – Volta (Ghana)	Operational since 2010	Completed
330 kV Volta (Ghana) – Lome "C" (Togo) – Sakete (Benin)	Under-implementation	Completed
330 kV PHCN/TCN **(Nigeria)**	At level of preparation	Expected to be completed 2017
330 kV ABOADZE – PRESTEA – KUMASI –BOLGATANGA , Tumu – Han – Wa	At level of pre-investment	Expected to be completed 2015
Han (Ghana) – Bobo Dioulasso (Burkina Faso) –Sikasso (Mali)– Bamako (Mali)	Pre-investment	Expected to be completed 2015
225 kV Nzerekore (Guinea) - Fomi (Guinea) – Bamako (Mali)	Pre-investment	To be completed 2016
330 kV Birnin Kebbi (Nigeria) - Bemberke (Benin) – Niamey (Niger) Ouagadougou (Burkina Faso)	Pre-investment	To be completed 2017
147 MW WAPP Adjarala Hydropower Facility	Pre-investment	To be completed 2017
60 MW Felou Hydropower Project	At level of implementation	To be completed 2014

a. INTER-ZONAL TRANSMISSION HUB SUB-PROGRAM

(Burkina Faso, OMVS via Mali, Cote d'Ivoire via Mali, CLSG via Cote d'Ivoire).

The main transmission hub sub-programmes for the region include:

- 225 kV Bobo Dioulasso (Burkina Faso) – Ouagadougou (Burkina Faso);
- 225 kV Bolgatanga (Ghana) – Ouagadougou (Burkina Faso);
- 225 kV Cote d'Ivoire – Mali;
- 330 kV Aboadze (Ghana) – Prestea (Ghana) – Kumasi (Ghana) – Bolgatanga (Ghana) + Tumu (Ghana) – Han (Ghana) – Wa (Ghana);
- Han (Ghana) – Bobo Dioulasso (Burkina Faso) – Sikasso (Mali) – Bamako (Mali);
- 225 kV Fomi (Guinea) – Bamako (Mali) – Nzerekore (Guinea) – Linsan (Guinea)
- 147 MW WAPP Adjarala Hydro Power Facility

Both the generation and transmission projects identified under the ECOWAS Generation and Transmission Master Plan have been spread between phases 1, 2 and 3 according to:

The implementation of this master plan has been scheduled to ensure the load supply throughout the region. This will be implemented in line with following phases of development:

- **Phase 1: Commissioning in the period 2017-2019**
- **Phase 2: Commissioning between 2019 and 2021**
- **Phase 3: Commissioning at long-term (2021-2023)**

THE WEST AFRICA GAS PIPELINE (WAGP)

The West African Gas Pipeline project is an International Gas transmission system that will transport clean, reliable and cheap natural gas from Nigeria to customers in Benin, Togo and Ghana. The proposal for a natural Gas Pipeline across West Africa was made in 1982 by the ECOWAS Commission ECOWAS as a key regional economic goal. The World Bank undertook a study on this in 1992 which confirmed the viability of a Natural Gas Pipeline based on ample reserves of Nigerian Natural Gas and Regional Energy needs. The plan calls for Chevron and its partners to build a 620-mile offshore line capable of initially shipping 180 million cubic feet of Nigerian gas per day for sale to power plants and other major gas users in Ghana, Togo and Benin.

The main objectives of the gas pipeline master plan were three folds:

- To encourage Royal Dutch Shell and Chevron to tap into a vast resource that since the onset of oil production in the 1960s has been wasted in the associated gas burning-off process known as flaring.
- To provide a cheap source of energy in a region starved of electricity, by serving as International Gas Transmission System that will transport clean, reliable and cheap natural gas from Nigeria to customers in Benin, Togo and Ghana.
- Foster regional economic and political integration that would support economic growth, and in particular the development of the West Africa electricity market.

1.1 Agreement on project

In 2000, the four nations involved signed an Intergovernmental Agreement for a harmonized fiscal and regulatory framework for cross-border construction and operation of the gas pipeline. The four Nations and the West African Pipeline Company (WAPCo) signed International Project Agreement (IPA) for the development of the pipeline in 2003. Construction of the WAGP therefore began in 2005 and by 2008, the Pipeline construction had completed and gas introduced into pipeline.

1.2 The Project benefit

The project is the sub-region's solution to bringing energy for economic growth and environmental benefits to Ghana, Togo, Benin and Nigeria. To help in the energy access challenges in the sub-region, the WAGP aims to achieve the following benefits:

- provide a long-term supply of abundant, clean, relatively cheaper fuel from Nigeria to Ghana, Togo and Benin;
- transfer technical knowledge and skills to relevant public agencies, local consultants, contractors and their employees across the four countries
- Employ over 100 skilled people from the sub-region, on competitive selection basis. This number has been far greater during construction
- provide a new level of regional co-operation and economic integration to enhance regional stability under the auspices of ECOWAS
- serve as a catalyst for direct foreign investment in the project countries
- Provide Nigerian producers with benefit from additional revenues accruing from the sale of associated gas to WAPCo
- To provide each of the four countries with some direct tax benefits
- Provide the three gas recipient countries with some fuel gains
- Enhance the regional environment by substituting natural gas for less desirable fuels. It will also lead to reduction in gas flaring in Nigeria, reduction in greenhouse gas emissions, and serve as a springboard in the efforts against deforestation.

1.3 Status of Project implementation

The initial phase of the project implementation was completed in 2008 linking mainly an off-shore pipeline from Alagbado (Nigeria) to Takoradi (Ghana). Commissioning of the pipeline began in late Nov 2008. Gas introduced into the offshore pipeline on Dec 6, 2008 from Nigeria to Takoradi. Commissioning successfully completed on Dec 14, 2008. Construction of the Takoradi Regulating and Metering Station has been completed.

1.4 The future prospects

The project has the prospect of being extended from Takoradi in Ghana to Senegal. This will mainly be an off-shore development project and will augment the electricity and generation and distribution projects earmarked for the region in the Master Plan.