



MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

UGANDA'S SUSTAINABLE ENERGY FOR ALL (SE4All) INITIATIVE ACTION AGENDA

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MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

UGANDA'S SUSTAINABLE ENERGY FOR ALL INITIATIVE – ACTION AGENDA

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Table of contents

Chapter Pages

NOTICE	1
Acknowledgements	2
EXECUTIVE SUMMARY	8
1. PREAMBLE	14
1.1. The Sustainable Energy for All (SE4ALL) Initiative	14
1.2. The SE4ALL Initiative in Uganda	16
1.3. Uganda's AA Context	16
1.4. Objectives of Uganda's AA	17
2. INTRODUCTION	19
2.1. Country Overview	19
2.2. Uganda's Energy Sector	20
2.2.1. The Power Sector	20
2.2.2. The Process Heat Sector	21
3. PART I – VISION AND TARGETS THROUGH 2030	23
3.1. Energy sector trajectory	23
3.1.1. Electricity	23
3.1.2. Cooking energy	24
3.2. Uganda's SE4ALL targets for 2030	25
3.2.1. Energy access towards SE4ALL	26
3.2.2. Renewable Energy towards SE4ALL	27
3.2.3. Energy efficiency towards SE4ALL	28
4. PART II – PRIORITY ACTION AREAS	30
4.1. Energy Access	30
4.1.1. Current Status and Trajectory	30
4.1.2. Existing plans, strategies and gaps	30
4.1.3. Actions needed to achieve the overarching objective in the field of energy access	37
4.1.3.1. Universal Access - Electricity	37
4.1.3.2. Universal Access – Clean Cooking	40
4.1.4. Other issues concerning energy access	41
4.2. Renewable Energy	42
4.2.1. Current Status and Trajectory	42
4.2.2. Existing plans and strategies	43
4.2.2.1. Renewable Energy Strategy	43

Uganda's SE4ALL Action Agenda

4.2.2.2. Biomass Energy Strategy (BEST)	43
4.2.2.3. Adoption of Improved Charcoal Production Technologies and Sustainable Land Management Practices	43
4.2.2.4. Biomass Energy Technologies	44
4.2.2.5. UECCC Support for Renewable Energy	44
4.2.3. Existing Gaps	45
4.2.4. Actions needed to achieve the overarching objective of renewable energy	45
4.2.5. HIOs and Other issues concerning renewable energy development	52
4.3 Energy Efficiency	54
4.3.1 Current Status and Trajectory	54
4.3.2. Existing plans/strategies	55
4.3.3. Existing Gaps	56
4.3.4. Actions needed to achieve the overarching objective of energy efficiency	57
4.3.5. Other issues concerning energy efficiency	61
4.4. Additional Nexus Actions	61
4.4.1. Current Status and Trajectory	61
4.4.2. Existing plans/strategies	62
4.4.3. Relevant High-Impact Opportunities	62
4.5. Enabling action Areas	62
4.5.1. Energy Planning and Policies	62
4.5.1.1. Critical Areas	62
4.5.1.2. Actions Needed	62
4.5.2. Finance and Risk Management	63
4.5.2.1. Critical Areas	63
4.5.2.2. Actions Needed	63
4.5.3. Capacity Building	64
4.5.3.1. Critical Areas	64
4.5.3.2. Actions Needed	64
4.5.4. Awareness and knowledge management	64
5. PART III – COORDINATION AND FOLLOW-UP	66
5.1. Action Agenda's Implementation	66
5.2. Implementing Challenges and Proposed Risks Mitigation Measures for Uganda	66
5.3. Implementation Methodology	67
5.3.1. Overview	67
5.3.2. Implementation Timeline	67
5.4. Coordination	69
5.4.1. Uganda's SE4ALL Task Force	69
5.4.2. Uganda's SE4ALL Secretariat	69
5.4.2.1. Organizational structure of Uganda's SE4All Secretariat	69
5.4.2.2. Responsibility of Uganda's SE4ALL Secretariat	71
5.4.2.3. Advocate for Uganda's SE4ALL implementation	71
5.4.2.4. Monitor Uganda's progress of its SE4ALL Action Agenda	71
5.4.2.5. Information Dissemination and Knowledge Sharing	71
5.5. Monitoring and Accountability Framework	72
5.5.1. Guidelines	72
5.5.2. General Performance Monitor Indicators	72
5.6. Action Agenda Review Process	74
5.6.1. Principles	74
5.6.2. Annual Performance Assessment	75

5.6.3. Impact Assessment of each Major Milestones

75

Abbreviations

AA	SE4ALL Action Agenda
AfDB	African Development Bank
AFD	Agence Française de Développement
BECS	Bundibugyo Energy Cooperative Society
BEETA	Biomass Energy Efficient Technology Association
BEST	Biomass Energy Strategy
CIREPS	Community Initiated Rural Electrification Projects
CSOs	Civil Society Organizations
DANIDA	Danish International Development Agency
DSM	Demand Side Management
DFID	Department for International Development, UK
EAC	East African Community
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, and Construction
ERA	Electricity Regulatory Authority
EU	European Union
EUD	European union Delegation
FERDSULT	FERDSULT Engineering Services
FIT/RE-FIT	Feed-in-Tariff/ Renewable Energy Feed-in-Tariff
GACC	Global Alliance for Clean Cooking
GDP	Gross Domestic Product
GEF	Global Environment Facility
GET-FIT	Feed-in-Tariff supplemental program
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GOU	Government of Uganda
GVEP	Global Village Energy Partnership
GWh	Gigawatthour
HEP	Hydroelectric plant
HIOs	High-Impact Opportunities
HV	High Voltage
ICS	Improved Cookstoves
IEA	International Energy Agency
IEC	International Electrotechnical Committee
IPPs	Independent Power Producers
IP	Investment Prospectus
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
KIL	Kilembe Investments Ltd.
Kton	1000 tons
kWh	kilowatt hour
LPG	Liquefied Petroleum Gas
LV	Low Voltage
MAAIF	Ministry of Agriculture, Animals, Industry and Fisheries
MDGs	Millennium Development Goals
MEMD	Ministry of Energy and Mineral Development
MJ	Mega Joules
MoFPED	Ministry of Finance, Planning and Economic Development
MW	Megawatt
MWp	Megawatt peak
MWE	Ministry of Water and Environment
M&E	Monitoring and Evaluation
NAMA	National Appropriate Mitigation Action
NORAD	Norwegian Agency for Development Cooperation

Uganda's SE4ALL Action Agenda

NDP	National Development Plan
NGOs	Non-Governmental Organisations
MEPS	Minimum Energy Performance Standards
NWSC	National Water and Sewage Corporation
PACMECS	Abim Community Multipurpose Electric Co-operative Society
PPAs	Power Purchase Agreements
PPP	Purchasing Power Parity
PPPs	Public Private Partnerships
PREPS	Priority Rural Electrification Projects
PREEEP	Promotion of Renewable Energy & Energy Efficiency Program
PV	Photovoltaic
RAGA	Rapid Assessment and Gap Analysis
RE	Renewable Energy
REA	Rural Electrification Agency
REB	Rural Electrification Board
REF	Rural Electrification Fund
REIP	Renewable Energy Investment Plan
RESP	Rural Electrification Strategy & Plan
RETs	Renewable Energy Technologies
SE4ALL	Sustainable Energy for All
SFM	Sustainable Forest Management
SHS	Solar Home Systems
SIDA	Swedish International Development Agency
SLM	Sustainable Land Management
SMEs	Small and Medium scale Enterprises
TS4REG	Technology Strategy for Renewable Energy Generation
TWh	Terawatt-hour
UBOS	Uganda Bureau of Statistics
UEB	Uganda Electricity Board
UECCC	Uganda Energy Credit Capitalization Company
UEDCL	Uganda Electricity Distribution Co. Ltd.
UEGCL	Uganda Electricity Generation Co. Ltd.
UETCL	Uganda Electricity Transmission Co. Ltd.
ULPGAs	Uganda LPG Association
UN	United Nations
UNBS	Uganda National Bureau of Standards
UNF	United Nations Foundation
UNACC	Uganda National Alliance for Clean Cooking
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
UNREEEA	Uganda National Renewable Energy & Energy Efficiency Association
USh	Uganda Shilling
WB	World Bank
WENRECO	West Nile Rural Electrification Company
WWF	World Wide Fund for Nature

Executive summary

Access to modern and clean energy services is a necessary precondition for achieving development goals that extend far beyond the energy sector, such as poverty eradication, access to clean water, improved public health and education, women's empowerment and increased food production. The United Nations (UN) Secretary General launched the SE4ALL Initiative in September 2010 to achieve three inter-related goals by 2030:

- Ensuring universal access to modern energy services
- Doubling the rate of improvement in energy efficiency
- Doubling the share of renewable energy in the global energy mix

SE4ALL recommends that, to achieve the initiative's objectives, all stakeholders need to play a leadership role:¹

- National Government must design and implement a set of integrated country actions (i.e. action agendas and investment prospectus)
- Private sector provides business and technical solutions and drives investment
- Civil society organizations advocates monitor public policy and businesses actions

To design and implement integrated country actions, after a country opted-in, national Governments start the process of developing their Action Agenda.

Uganda opted-in and became one of the 14 early movers for Africa in 2012, and started the process for developing an AA. Uganda's SE4ALL's AA seeks to integrate the multi-tier efforts that the country is implementing towards providing universal access to energy, increased energy efficiency and increased use of renewable energy.

The SE4All Initiative requires countries to set quantitative objectives for each of the three goals. Uganda's SE4ALL goals are set as following:

Universal access to modern energy services		Doubling global rate of improvement of energy efficiency		Doubling share of renewable energy in global energy mix	
Percentage of population with electricity access	Percentage of population with access to modern cooking solutions	Reduce national wood consumption by 40% and improve energy efficiency of power users by min 20%		Renewable energy share in Total Final Energy Consumption	
				Power	Thermal
>98%	>99%			>90%	36%

Energy access

UBOS's survey of 2012² assessed that 14.88% of the population have access to grid services, out of which 54.8% reside in urban areas and 7% in rural areas. Considering rural households using Solar home systems and diesel generators, 19.9% of rural households have access to electricity and the national electrification access rate turns to 26.1%. This means that 618 000 households in urban areas and 4.85 million households in rural areas don't have access to electricity, the total households being 7,416,343 in 2014. In Uganda, the

¹ Adapted from Sustainable Energy For All – A Global Action Agenda, April 2012, page 7

² Published in 2013

thermal process depends heavily on the non-sustainable use of biomass, which accounts for over 89.9% of the energy generated in the country. In contrast, renewable energy dominates the country's power sector (~90%). Based on these baselines and assuming a population of 56.2 million (11,956,636 households) in 2030, the pace to reach universal access by 2030 will be in average 670,000 new access to electricity per annum, which is a big challenge for Uganda given that the current rate of new connections to electricity is below 100,000/year. Under the base case scenario whereby current electricity access policy is driven by grid expansion and densification, universal access might be difficult to achieve because of the low power consumption and the capacity to pay of Ugandans living below the poverty line (34% in rural and 11% in urban areas). AA suggests "a new policies scenario" with increased implementation of off-grid solutions. Taking into account ongoing projects and existing plans to enhance access to electricity, new interventions are suggested in this AA targeting about 3.17 million households with off-grid solutions, while 3.95 million will be connected to the expanded national grid. Off-grid solutions include solar home systems for households living under the poverty line³, distributed mini- and micro-grids anchored on productive uses of energy in agriculture, water supply and mobile telecommunications in rural areas. The cost of achieving SE4ALL goals is also cheaper, 5.28 billion US\$ compared to 5.68 billion US\$ under the base case scenario. This estimation neither includes costs for grid expansion, internal wiring and connection fee, nor replacement cost of Solar Home Systems whose lifespan is about 5 years. The new policies scenario has the advantage of a quick implementation especially for those households who may not be reached by the grid in the next 10 years.

As far as access to modern cooking energy is concerned, UNACC estimated that in 2012, only 500,000 households (7% of the population) were using clean and efficient cookstoves while Uganda LPG Association estimates the number of households using LPG stoves in 2014 at 35,000. The major existing plan is rolled out by UNACC to provide 5 million new households with clean and efficient stoves by 2020; reaching by then 64% of the projected population. To target universal access by 2030, AA suggests additional interventions targeting 60,000 domestic biogas plants for rural households, 1 million urban households with LPG stoves, and approximately 5.4 million households with improved wood and charcoal stoves by 2030. Considering the lifespan of domestic improved wood/charcoal cookstoves between 2 and 3 years, the Ugandan market can be estimated at 20.2 million units towards 2030, thus a need to produce in average 1.35 million clean cookstoves annually. This is quite a big challenge for Uganda given that the current production capacity of quality improved stoves vary between 240 and 300,000/year⁴ and the distribution is poor.

Renewable energy

Uganda is endowed with renewable energy sources especially hydro, biomass and solar. Hydroelectric and biomass cogeneration plants contribute already to 90% of Uganda's electricity mix. AA suggests a diversification of renewable technologies and that these should continue playing a good role in Uganda's electricity mix in combination of mini and micro-grids, which are relevant High-Impact Opportunities. Mini- and micro-grids are an ideal alternative to grid electricity in remote villages, because mini/micro grids are independent entities, which can also be controlled and managed easier than conventional grid, providing reliable electricity, outages or interruptions to electricity supply being quickly identified and corrected.

Table (i) shows the contribution of suggested renewable energy power projects to Uganda's future electricity consumption, estimated at 10,099 GWh in 2030. The last column expresses in percentage the share of each intervention to the projected consumption. While large and small hydroelectric plants will be mainly connected to the grid, solar PV will be the main contributor to electricity in off-grid areas, powering mini-grids and providing energy to schools and health centers as well as individual households.

The total installed capacity would be 4.17 GW, doubling the projected peak demand of 2 GW by 2030 while the installed capacity of renewable energy based power plants will be above 3 GW, out of which 2.81 GW will be connected to the national grid. Total electricity generated is estimated in 2030 at 18.9 TWh, renewable energy sources contributing at 96% (18 TWh) to the total electricity generation mix. The additional cost for AA interventions in renewable energy generation is estimated at 2.66 billion US\$.

³ In economics, the bottom of the pyramid is the largest, but poorest socio-economic group.

⁴ Estimation from a GIZ expert

Uganda's SE4ALL Action Agenda

Given that 1.7 million tons of wood were consumed in schools premises for cooking, AA suggests that 600 to 700 schools and health centers should be provided institutional biogas stoves, complementing other existing programs.

		Additional installed capacity by 2030 [MW]	Estimated electricity generation [GWh/year]	Share of projected electricity sales in 2030
On-grid	Large HEP	2410	9643 – 12050	95.4 – 119 %
On-grid	Small HEP	383	1330 – 1900	13.3 – 19 %
On-grid	PV grid connected	20 MWp	24 - 30	0.24 – 0.3%
Off-grid	PV minigrid	26 – 32	40 - 70	0.4 – 0.7 %
Off-grid	PV microgrid	36 – 60	80	0.8 %
Off-grid	Solar street lights	5 – 10	10 – 14	0.1 – 0.14 %
Off-grid	9000 PV plants for water pumping and lighting (schools, health centers)	4-9		
Off-grid	PV Home systems	140	103	1.02 %
On-grid	Biomass cogeneration	16.5	100	1%
	Total	3,040 – 3,080	11,330 – 14,347	113 – 143 %

Table i: Contribution of new renewable energy projects to Uganda's electricity mix by 2030

Energy efficiency

SE4ALL goals for Uganda regarding energy efficiency build on analysing energy savings potential in different sectors of the country's economy (households, commercial enterprises, industries and buildings). Suggested interventions aim at reducing specific electricity consumption by 15-25% in industries, disseminating LED lamps among urban households, reducing wood and charcoal consumption in industries, social institutions, households and commercial enterprises. Table ii shows potential energy savings expected by completion of AA's interventions.

Suggested actions	Sector	Estimated savings
Energy efficiency actions in 100 most energy intensive industries	Multiple	200 – 400 GWh electricity/year
Dissemination of 3,000,000 LED and efficient appliances	1 million urban households	1000 - 1600 GWh electricity/year
Dissemination of improved kilns	Bricks making, Small scale lime production Fish smoking	2400 ktons wood/year
Using wood chips or briquettes instead of wood logs	Tea industry	14.2 ktons wood/year
Using briquettes and new burner technology	Vegetable oil processing	61 ktons wood/year
Replacing inefficient technologies	Local distilleries	120 ktons wood/year
Dissemination of improved cookstoves	Hotels restaurants	80 ktons wood/year
Dissemination of improved cookstoves	Households (5.4 million by 2030)	1520 ktons wood 2890 ktons charcoal/year
Dissemination of improved charcoal production systems	Charcoal production (30 000 units by 2030)	420–720 ktons wood/year

Other priority actions

The AA includes the following additional priority actions:

Electricity

- Improve the structure of the energy sector towards a better interaction with all stakeholders, including donors and civil society organisations.
- Design and Implement Uganda's SE4ALL Access to Modern Energy Investment Prospectus
- Implement renewable energy based distributed power generating solutions

Clean Cooking

- Developing better and innovative technologies, providing a longer lifespan
- Promoting international affordable standards and rigorous testing protocols and enhancing monitoring and evaluation
- Supporting the Green charcoal Initiative, and dissemination of alternative viable fuels (LPG, ethanol, etc.).

Renewable Energy

- Renewable Energy Data Center to improve market data for planning and investment purposes.
- Investment in efficient biomass energy technologies
- Renewable Energy Resource Assessments to develop programs and strategies for each technology
- Renewable applications in the mining sector
- Design and Implement Uganda's SE4ALL Investment Prospectus.

Energy Efficiency

- Strengthen Policy and Institutional framework
- Implement a voluntary labelling program.
- Expand the reach of the Minimum Energy Performance Standards (MEPS).
- Scale up certification processes for residential and commercial cookstoves.

Cross-cutting issues

- Awareness raising of potential users to enhance the demand
- Develop innovative funding mechanisms such as grants, challenge funds and use of carbon credits as collateral to support both supply and demand sides
- Build human and institutional capacity
- Foster an enabling environment by engaging national and local stakeholders
- Strengthen and institutionalize the SE4ALL Secretariat

Implementation

Lead by Uganda's SE4ALL Secretariat, the implementation of the AA is to be done in three stages:

- *Transition* (2015 – 2018). During this period, the country continues with its current strategies and the national dialogue toward the adaptation, update and alignment the existing interventions under the country's SE4ALL agenda. During this period, all new strategies and interventions will have to be consistent with Uganda's SE4ALL AA.
- *Consolidation* (2018 – 2022). This period will see the implementation of an updated AA based on the milestones accomplished by the plan and strategies in place before and during the transition. This period will start with the Secretariat leading the implementation of a Mid-Term Review, which will allow Uganda to make the adjustments needed to reach its SE4ALL goals

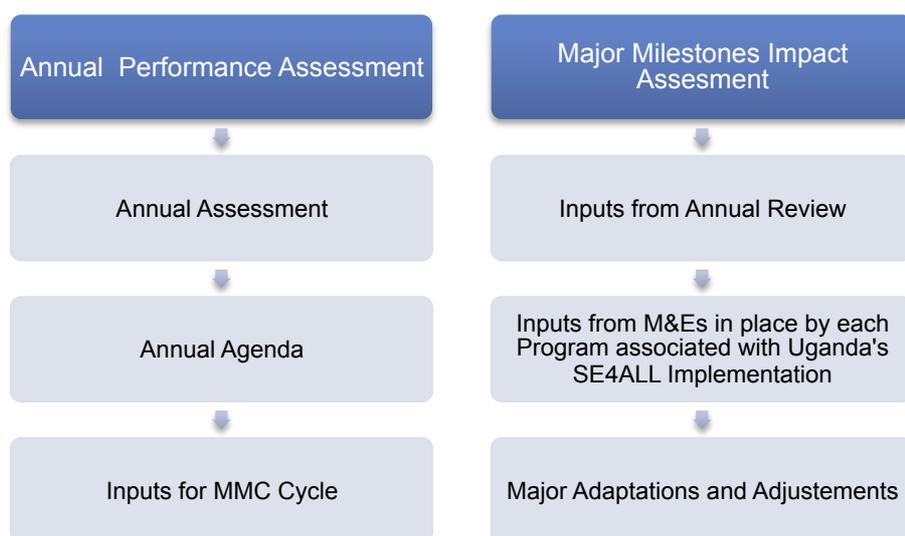
Uganda’s SE4ALL Action Agenda

- *Acceleration* (2022 – 2030). The sustainability and update of the actions and strategies will accelerate the process of achieving Uganda’s SE4ALL energy efficiency, access and renewable energy goals.

The Secretariat is responsible for realizing Uganda’s SE4ALL goals, as it coordinates multi-stakeholder initiatives, programs and projects; it creates and increases awareness, monitors and reports on the country’s progress towards the SE4ALL goals. The Secretariat is responsible and accountable for managing the implementation of the Action Agenda, the Investment Prospectus and the M&E plan. The Secretariat is Uganda’s focal point for exchanging information with the SE4ALL global initiative, especially with the SE4ALL Global Facility Team, the SE4ALL Africa Hub, the SE4ALL Thematic Hubs and each HIO’s coordinator or coordinating group.

A SE4ALL Steering Committee will be based on the current structure of the SE4ALL Task Force, to which it will incorporate private sector and civil society representative(s). This Steering Committee will continue meeting monthly and providing support and advice to the SE4ALL Secretariat.

The Monitoring and Evaluation (M&E) Plan is an essential tool for assessing and reporting progress towards achieving the desired outputs and identifying key questions whose responses allow evidence-based decision. Based on its reports, the Secretariat will present for approval to the MEMD’s Permanent Secretary the draft modifications to the AA and propose any other “mid-course” adjustments that may be needed to keep Uganda on its critical path to achieve its SE4ALL goals. The following diagram illustrates the review and assessment cycles:



This AA is conceived as a living document that will be changing along its implementation. Impact assessment will complement the M&E plan producing updates of Uganda’s RAGA, based on the one of 2012, needs assessments and stakeholders’ analysis and SE4ALL compliance assessment of the government and donor led interventions.

The following timeline presents a suggested sequence of key activities and interventions that need to be implemented before, and immediately after, the national consultation and validation of the AA. Failing to provide continuity to the efforts that led to this AA will put at risk Uganda’s ability to reach its SE4ALL goals.

Uganda's SE4ALL Action Agenda

Activity	IIQ 2015	IIIQ 2015	IVQ 2015	2016	2017	2018
Securing a Technical Advisor to coordinate and lead activities for the follow-up of the AA and IP, provide lead and technical support to the Secretariat through the first half of the transition period						
SE4ALL Secretariat institutionalization - define the implementation and operational program and secure funding for personnel, equipment and execution of activities						
AA consultation and validation process and finalizing Uganda's AA						
Development, consultation and validation of Uganda's SE4LL IP						
Piloting a need assessment and gap analysis for three districts to build a bottom-up approach to improve and update actions under the AA and identification of interventions suitable for funding						
Review and update the policy and mechanisms associated to subsidies and incentives for the energy sector, especially those that will have an impact on the IP						
Development and implementation of the communication, awareness, sensitization campaign(s)						

1. Preamble

1.1. The Sustainable Energy for All (SE4ALL) Initiative

SE4ALL pursues a pro-poor multi-tier stakeholder approach to facilitate investment in energy systems, eradicate energy poverty and accelerate development. SE4ALL emphasizes the importance of energy issues for sustainable development and for the elaboration of the post-2015 development agenda. In support of this initiative, on December 21, 2012, the UN General Assembly declared 2014 – 2024 the Decade of Sustainable Energy for All.

The SE4ALL Global AA was issued in April 2012 and it is based on a framework proposing a global AA for universal energy access, foster energy efficiency and boost investment in renewable energy. The global agenda is based on initiatives that drive countries to meet their SE4ALL objective.⁵



This global agenda is disaggregated into the following eleven action areas, seven related to sectorial areas and four addressing the enabling environment⁶:

Sectoral Action Areas	Enabling Action Areas
Modern Cooking Appliances and Fuels	Energy planning and policies
Distributed Electricity Solutions	Business model and technology innovation
Grid infrastructure and supply efficiency	Finance and risk management
Large scale renewable power	Capacity building and knowledge sharing
Industrial and agricultural process	
Transportation	
Buildings and appliances	

The Global AA relies on the full participation of all stakeholders, and High-Impact Opportunities (HIOs); both making a direct impact towards reaching and sustain the SE4ALL objectives. The HIOs can accelerate action, mobilize resources and drive outcomes by building strong partnerships, fostering common actions and shaping sustainable commitments. Working together, stakeholders increase efficiency and economies of scale that

⁵ Sustainable Energy For All – A Global Action Agenda, April 2012, page 7

⁶ Adapted from Sustainable Energy For All – A Global Action Agenda, April 2012, page 8

Uganda's SE4ALL Action Agenda

drives and consolidates interventions. Energy is not a goal in itself, but a key driver for development. The graphic representation below shows how the SE4ALL objectives and the interventions included under the HIOs drive sustainable development.⁷



SE4ALL proposition is that to achieve the initiative's objectives all stakeholders need to play a leadership role.⁸

- National Government must design and implement a set of integrated country actions (i.e. country action plans)
- Private sector provides business and technical solutions and drives investment
- Civil society organizations advocates monitor public policy and businesses actions

To design and implement integrated country actions, after a country opted-in, national governments start the process of developing their AA. This process is reflected in the following diagram⁹:



⁷ Sustainable Energy For All – A Global Action Agenda, April 2012, page 5

⁸ Adapted from Sustainable Energy For All – A Global Action Agenda, April 2012, page 7

⁹ As presented in Sustainable Energy For All, presentation by Venkata Ramana Putti, ESMAP-World Bank - 2012

1.2. The SE4ALL Initiative in Uganda

The ultimate goal of Uganda's National Development Plan and Uganda's Vision 2040 is "to meet the energy needs of the Ugandan population for social and economic development in an environmentally sustainable manner."¹⁰ Consequently, in 2012 the Government of Uganda (GoU) decided to become one of the "early movers" and opted-in the SE4ALL Initiative. Since then, and with the SE4ALL Initiative as its framework, the GoU continues its commitment for the transformation of its energy sector, and deepen the reforms needed to scale up public and private investments in the energy sector to meet its SE4ALL 2030 targets.

Through an initial mobilization phase, the GoU put in place Uganda's Sustainable Energy for All Secretariat (the Secretariat), within the MEMD, to coordinate the country's SE4ALL activities, and with the development partners, active in the energy sector, established the SE4ALL Task Force to steer the activities related to Uganda's SE4ALL implementation. The members of this Task Force are EU Delegation, UNDP, KfW, as the chair of Development Partners Working Group and MEMD. The Task Force's first task was to coordinate the process of developing the SE4ALL documentation in preparation for RIO+20.¹¹ After RIO+20, it coordinated the preparation of the SE4ALL RAGA for Uganda, and has been supporting the preparation of this AA. The Task Force is expected to continue its role as a Steering Committee, to deepen the coordination between the GoU, donors and civil society, and to provide support to the implementation of Uganda's SE4ALL AA.

The GoU considers that the current AA is a part of a wider agenda, and, according to the RAGA, given the country's current energy policy and regulatory framework "it will be most effective by supporting either on-going or well-developed pipeline activities that fit in to the SE4ALL objectives, rather than start from a clean slate."¹²

1.3. Uganda's AA Context

"The Action Agenda provides the long-term vision which ensures the overall sector-wide coherence and synergy of the accumulated efforts towards the three goals of SE4All in the country. (...) The Action Agenda will have to be endorsed by Government and national stakeholders. It should naturally serve as the basis for donor co-ordination and assistance on energy and as a reference document for the private sector and civil society."¹³

Uganda's AA follows the SE4ALL country AA template with the purpose of framing the current country development strategy and focus on the priority areas identified in the RAGA¹⁴ by the SE4ALL Task Force, by priority HIOs, and by the sectors where private sector and civil society are actively participating. It also includes inputs from the drafts of the action plans associated to Uganda's sector strategy like the BEST, Energy Efficiency Bill and RESP.¹⁵

The Secretariat received technical assistance to develop the country's AA. This AA is the result of the support put in place to ensure proper technical rigor and appropriate levels of consultation among key stakeholders. An interactive and participatory approach was adopted, and progressed in stages:

- Initial round of meetings and discussions to gather background information and increase awareness on the activity and the country's SE4ALL commitment;
- A desk review of national policy documents, reports and roadmaps was undertaken, covering universal access to energy, renewable energy and energy efficiency;

¹⁰ MEMD The Uganda Energy Policy, 2002

¹¹ Rio+20 or the United Nations Conference on Sustainable Development took place in Rio de Janeiro, Brazil on 20-22 June 2012.

¹² Energy Rapid Assessment and Gap Analysis – Uganda, MEMD, June 2012 (Appendix 1)

¹³ Excerpt from General comments on purpose, scope and content of the SE4ALL Country Action Agenda Template, 2014

¹⁴ Energy Rapid Assessment and Gap Analysis – Uganda, MEMD, June 2012 (especially page 11 and Appendix 1)

¹⁵ At the time this AA was developed, Energy Efficiency Action Plan and RESP interventions were in draft form

Uganda's SE4ALL Action Agenda

- Once the desk review was completed, the SE4ALL Secretariat, with the support of the technical assistance team, developed a series of meetings with stakeholders to define key interventions, identify bottlenecks and find solutions;
- Once the consultations were concluded, the SE4ALL drafted the AA for validation by the MEMD and the SE4ALL Task Force;
- Upon validation and review, the AA is presented to a wider audience to enhance ownership by engaging multiple stakeholders drawn from key sector ministries, civil society organizations, private sector as well as the EU Delegation and development partners involved in supporting energy sector interventions.

Table 1.1 shows the priorities by sectorial action areas and how they link with the SE4ALL objectives for the case of Uganda:

Sectorial Action Areas	Uganda's Priority Action Areas	In Support of SE4ALL Goals on
Modern Cooking Appliances and Fuels	↑	Access and Energy Efficiency
Distributed Electricity Solutions	↑	Access and Renewable Energy
Grid infrastructure and supply efficiency	↑	Access and Energy Efficiency
Large scale renewable power	↑ ¹⁶	Access and Renewable Energy
Industrial and agricultural process	↑	Access and Renewable Energy
Transportation	→	Energy Efficiency
Buildings and appliances	→	Energy Efficiency

Table 1.1: Priority areas and SE4AA - ↑ High priority → Low priority

1.4. Objectives of Uganda's AA

Uganda's SE4ALL's AA comes at a critical time, seeking to integrate the multi-tier efforts that the country is implementing towards providing universal access to energy, increase energy efficiency and increase the use of renewable energy. Uganda's SE4ALL Task Force has defined specific priorities for the country's implementation of SE4ALL activities, by focusing on universal access to modern electricity services for residential and productive uses, and improving energy efficiency, with special emphasis on clean cooking.

Based on the principles of sustainability, transparency and pro-poor economics, the goal of the AA is to consolidate and accelerate the implementation of SE4ALL in Uganda as a result of:

- Reviewing existing policies and interventions in the energy sector;

¹⁶ For the purpose of this AA, large scale renewables refers to generation capacity of >20MW

Uganda's SE4ALL Action Agenda

- Identifying energy sector key bottlenecks;
- Identifying gaps and overlaps in existing policies and interventions;
- Integrating on-going interventions under an action plan to improve planning, to increase efficiency of interventions and to coordinate actions and secure funding to attain the SE4ALL goals;
- Design of an implementation mechanism capable of sustaining interventions, coordinate and monitor progress across stakeholders and assess results to regularly adjust the AA to ensure progress towards achieving national development and SE4ALL goals;
- Developing nexuses with other sectors;
- Defining the role and responsibilities of Uganda's SE4ALL Secretariat.

Uganda's AA outlines challenges to overcome, the goals and the actions to meet SE4ALL objectives. The AA is the guiding instrument for integrating under a single agenda the different elements of the enabling environment and on-going actions and for aligning sector policies and strategies in a systematic manner that expedites Uganda's path towards achieving its SE4ALL goals. Uganda's AA covers the 2015-2030 period broken down into three phases, which reflects strategies and interventions that are already in place:

- *Transition* (2015 – 2018). During this period, the country continues with its current strategies and the national dialogue toward the adaptation, update and align the existing interventions under the country's SE4ALL agenda. During this period, all new strategies and interventions will have to be consistent with Uganda's SE4ALL AA.
- *Consolidation* (2018 – 2022). This period will see the implementation of an updated AA based on the milestones accomplished by the plan and strategies in place before and during the transition. This period will start with the Secretariat leading the implementation of a Mid-Term Review, which will allow Uganda to make the adjustments needed to reach its SE4ALL goals
- *Acceleration* (2022 – 2030). The sustainability and update of the actions and strategies will accelerate the process of achieving Uganda's SE4ALL energy efficiency, access and renewable energy goals.

2. Introduction

2.1. Country Overview

Uganda is a landlocked East African country with an area of 241,038 square kilometres, but the actual land area is 199,810 square kilometres. Uganda's population in 2014 is 34,856,813, of which 81.6% is considered rural population¹⁷, with a per capita GDP of US\$547.¹⁸ Uganda is the second most populous landlocked country and remains one of the poorest countries of the world, with 37.7% of the population living on less than \$1.25 a day.

Annual GDP growth has been around 6% for the last few years, but surprisingly dropped to 3.14% for 2013.² However, short-term forecast suggests that Uganda will return to its recent average GDP Growth in 2014/2015.¹⁹

Agriculture is the most important sector of the economy, employing over 80% of the work force. Coffee accounts for the bulk of export revenues. Economic growth in recent years has been constrained by the inadequacies of the infrastructure, including electric power sector infrastructure. Uganda has substantial natural resources including fertile soils, regular rainfall, recently discovered oil, and small deposits of copper, gold, and other minerals.

While Uganda has a mature regulatory framework for the energy sector, private sector investors still face constraints because the cost of doing business is perceived as high due to the high cost of electricity and other fixed cost items, market risks and bureaucratic and procedural constraints.²⁰ It is expected that Government initiatives, like the land tenure reform, RESP and BEST, and the full implementation of the regional common market under EAC may revert this perception and improve Uganda's doing business performance and lower investment risks.

Uganda has a series of development and sector strategies, which supports the country's progress toward the three SE4ALL goals of universal access, increasing the renewable energy share, and enhancing energy efficiency.

While the core set of strategies and interventions are driven by the GoU and the Donors, the private sector is organizing itself to address Uganda's challenges under SE4ALL too. These strategic documents and activities, developed by key stakeholders, include:

- Government Driven Strategies
 - National Development Plan (2010)
 - Uganda Vision 2040
 - Uganda Energy Policy (2002)
 - Rural Electrification Strategy & Plan for 2013 – 2022 (2013)
 - Biomass Energy Strategy (2013)
 - Renewable Energy Policy (2007)
 - Renewable Energy Investment Plan (2011)
 - Power Sector Investment Plan (2011)
- Private Sector Strategies
 - Uganda National Alliance for Clean Cooking Master Plan
 - Uganda National Renewable Energy and Energy Efficiency trade association
- Key technical documents supported by Donors
 - Master Plan Study on Hydroelectric Development (2011, JICA)

¹⁷ UBOS, National Population and housing Census : provisional report, November 2014

¹⁸ Estimated for 2013, World Bank Country Data

¹⁹ An acceleration of the GDP Growth is expected once oil production starts

²⁰ Based on Uganda's ranking in the "Doing Business" surveys by the World Bank

- Solar Energy Market Study (2014, GIZ)

2.2. Uganda's Energy Sector

2.2.1. The Power Sector

With the enactment of the Electricity Act in 1999, the unbundling of the former Uganda Electricity Board (UEB) and the creation of the Electricity Regulatory Authority (ERA), Uganda's electricity sector was reformed and began a fourteen years of continuous reforms. At the centre of these reforms lay the goals of making the power sector financially viable and efficient enough to meet the country's growing demand for electricity, expand geographic coverage and improve the quality of supply. The result of this reform was the creation of three operational entities: Uganda Electricity Generation Company Limited (UEGCL) - generation; Uganda Electricity Transmission Company Limited (UETCL) - transmission and single electricity buyer and Uganda Electricity Distribution Company Limited (UEDCL) - distribution. Generation and distribution assets were subsequently transferred to concessions through a competitive bidding process.

Today, Uganda's generation capacity in 2012 was 868.9 MW (862.5 MW on grid and 6.39 MW off-grid), consisting of 630 MW of large hydropower, 56.8 MW of small hydropower, 153.1 MW of thermal generation, and 29 MW of bagasse cogeneration²¹. Since the Bujagali hydropower station was completed by mid-2012, the generating capacity has been sufficient to avoid load shedding. Nevertheless, Uganda still faces the challenge of accelerating access to electricity to unconnected people. UECTL sales grew from 2,744 GWh in 2012 to 3,098 GWh in 2014 while UMEME sales grew from 1,938 GWh to 2,277 GWh during the same period. This suggest a yearly growth rate of 6% for UECTL and 8% for UMEME, the largest energy supplier at distribution level

The expansion of the generation capacity and the number of electricity connections are not only the result of GoU led interventions. The private sector plays already a significant role in the power sector, with the largest Power generating infrastructure (a total of 380 MW of installed capacity) owned by UEGCL but currently under concession to ESKOM, a private entity from South Africa, and another 200MW down-stream plant built, owned and operated under a concession by Bujagali Energy Limited (BEL). UETCL has in place or under development over 20 PPAs with licenced IPPs, mostly small (<20MW) hydropower plants.

The sector's reform also saw a private entity, UMEME Ltd, being assigned (through a lease and assignment agreement) the main distribution segment of the grid by UEDCL, the distribution company that owns the main distribution assets. There are other distribution concessions in place in different regions of the country.

To continue the sustainable development of the sector, Uganda has been working in two key areas:

- *Infrastructure development.* Uganda's National Grid is being upgraded to change from a predominantly radial system into a ring design, which will increase delivery and system wide efficiency. This is expected to be achieved through UETCL's grid expansion strategic plan. In addition, under the RESP, REA is expected to support grid expansion and densification, to meet its goal of adding 1.28 million new connections, while providing additional 140,000 off-grid services, by 2022.
- *Renewable Energy Policy and Private Sector Participation.* In support of expanding energy services through IPPs and regional concessions, the GoU introduced RE-FIT, a feed-in-tariff program, which was initially envisioned as a fast tracking mechanism of enhancing renewable energy projects. Hitherto, the mechanism of REFIT has not lived up to its expectation, as the escalating capital costs for the renewable energy technologies did not help matters for the attainment of fast tracked investments in renewable energy. To address the shortcomings of RE-FIT, a new initiative, providing for a premium on the RE-FIT for the first couple of years, known as GET-FIT is in place, to fast track investments that would ordinarily not qualify for being licensed under the published RE-FIT mechanism, creating a pipeline of up to twenty new PPAs.

²¹ MEMD, 2012 Statistical Abstract

Uganda's SE4ALL Action Agenda

After the shortcomings of the first RESP that expired in 2012 a new phase was approved by the Cabinet in 2013, which calls for REA to assume the lead in electrifying the country through thirteen energy service territories. Some of these energy service territories have concessions in place, like with UMEME, FERDSULT, BECS, PACMECS, KIL and WENRECO; others have UEDCL and private mini-grid schemes as power suppliers. This new ten-year-RESP aims to add a total of 1.43 million connections in rural areas by 2022, 1.29 million households on-grid and 140 653 households off-grid solutions.

Uganda has a growing market of solar power home systems. This market is exclusively served by private sector, with estimated sales of about 10,000 SHS/year throughout Uganda not only for residential, but also for productive (mostly water pumping) and social uses (hospitals and schools).²²

Civil society organisations are also engaged in the power sector in different ways. WWF has been working at district level to develop local capacity on how to assess gaps and needs and develop power access strategies, like the Renewable Energy Strategy 2013 – 2020 for Kasese. Foundation Rural Energy Services has in place a fee-for-services through a SHS Service Centres (mini-grid) model, reaching 2,655 customers in Southwest Uganda, after only two years of operation.²³

Based on the latest information available,²⁴ 14.8% of Ugandans have access to grid electricity (54.8% in urban areas, where about 18.4% of Ugandans live, and 6.9% in rural areas). Taking into account SHS and generator users, the electrification access rate in Uganda has been calculated to 26.1% at national level, 54.8% in urban and 19.9% in rural areas²⁵. This means that only 1 033 825 households out of the country's 6 947 749 households had access to electricity by the end of 2012. Considering that the new RESP plans to add 1.29 million connections in rural areas and that currently concessions are adding less than 60,000 connections annually, additional investment in on-grid and off-grid solutions are needed to close the gap towards universal electricity access.

2.2.2. The Process Heat Sector

Biomass to energy, mostly heat processes, is responsible for more than 89.9% of the energy generated in Uganda. More than 90 percent of the population depends on non-sustainable charcoal and firewood as the primary source of cooking fuel.²⁶

The 2012 Uganda Energy Balance²⁷ shows following primary and secondary balance:

Type of Fuel	% of All primary energy	% of all secondary energy
Fuel-wood	89.1%	78.6%
Charcoal	0.0%	5.6%
Residues	4.7%	4.7%
Gasoline	3.2%	3.2%
Aviation fuel	0.9%	0.9%
Kerosene/Paraffin	0.3%	0.5%

²² Estimate is for basic lighting and phone charging, based on interviews with vendors

²³ Foundation Rural Energy Services 2013 Annual Report

²⁴ UBOS Energy Survey 2012

²⁵ UBOS-MEMD, Uganda rural-urban electrification survey, 2012

²⁶ GIZ (2011). Energy Policy Advice Component, Uganda.

²⁷ MEMD, 2013

Diesel	3.0%	4.6%
Fuel Oil	0.3%	0.4%
LPG	0.0%	0.1%
Electricity	1.4%	1.4%

While the primary demand of biomass is for cooking purposes, a significant number of key industries in Uganda are also biomass consumers, namely²⁸:

- **Brick making facilities.** Between 2005 and 2010 the number of houses built using bricks is estimated to have increased by 6% in the rural areas and 10% in urban areas. Based on these trends, Uganda is estimated to be using about 6 million tons of wood in the brick burning industry. Individuals or small groups of artisans produce all the baked bricks used in the construction industry, often on site or nearby the construction, through highly inefficient methods;
- **Tea industry.** The tea industry in Uganda has been growing at a rate of 2-4% for the last decade with average tea production of about 35,000 tons/year that requires about 71,000 tons of wood for the drying process. Most well established companies can satisfy up to 70% of their fuel requirements through their own forest plantations;
- **Lime industry.** Small and inefficient lime production demands large quantities of wood, a ratio of 1.5 tons of wood for each ton of lime produced. Vertical fuel-wood driven kilns are used by 90% of the industry, with the balance using charcoal kilns. The volume of biomass consumed by this industry is estimated at 270,000 tons of wood and 75 tons of charcoal annually;
- **The tobacco industry** dries their product using approximately 200,000 tons annually;
- **Sugar industry.** Bagasse is utilized by the sugar industry to produce electricity, but sugar jaggeries in Uganda consumes about 500 tons of wood and 2,000 tons of bagasse in their production processes;
- **The cement industry** has been switching fuels using coffee husks and other waste streams from agroindustry;
- **Food industry.** It is estimated that about 20,000 tons of fish are smoked annually consuming 22,400 tons of wood annually. The vegetable oil industry averages 40,000 tons of oil production per year, consuming 170,000 tons of agricultural waste and 75,000 tons of wood. Total fuel-wood energy consumed in the confectionery industry is estimated at 313,000 tons of wood.

The 2013 BEST aims at streamlining the institutional mandates and harmonise the regulatory framework of the biomass sector, by enhancing collaboration among the stakeholders and coordinating implementation of activities in support of Uganda's sustainable energy development, as it recognized by the Renewable Energy Policy.

²⁸ MEMD, Biomass Energy Strategy (BEST), 2013

3.Part I – Vision and targets through 2030

3.1. Energy sector trajectory

3.1.1. Electricity

AA baseline year for electricity access is 2012, with 14.88% of the population having access to grid electricity, i.e 1 033 825 households out of 6 947 749, of which 18.4% reside in urban areas and 81.6% in rural areas. Taking into consideration grid, solar and generator power, the national electrification access rate for households is 26.1%, with 54.8% in urban and 19.9% in rural areas. Assuming the same electrification access rate in urban and rural areas of Uganda, the situation at the end of 2014 is given in table 3.1, resulting in about 123 400 connections in 2013 and 2014.

Population 2014			Electrification access rate	Population with access	Household size	Households with access	Households w/o access
urban	6426013	18,4%	54,8%	3521455	4,7	749246	617991
rural	28430800	81,6%	19,9%	5657729	4,7	1203772	4845334
Total	34856813	100,0%	26,3%	9179184	4,7	1953018	5463325

Table 3.1: Estimated electrification status at the end of 2014

Still about 618 000 households in urban areas and 4.85 million households in rural areas do not have access to electricity yet.

Uganda's electricity access challenges face two demand-side problems. Based on UBOS's Household Surveys, over 34% of rural households and around 11% of urban households live under the poverty line. Considering that 18.4% of the population lives in urban areas, a significant portion of low-income population has no access to energy services, which presents a significant challenge towards reaching high connectivity rates under SE4ALL's global tracking framework.

Uganda's Power Sector Investment Plan of 2011 projected that:²⁹

- "The total electrical energy sales in Uganda were to grow on average by 6.8% per year from 1807 GWh energy sales in 2008 to 7679 GWh in 2030. The peak demand is forecasted to grow an average of 5.9% per year from 528 MW in 2008 to 1873 MW in 2030."
- In the scenario with high electricity export demand from DRC, Sudan, Tanzania, Kenya and Rwanda, estimated at 500 MW and 2,560 GWh by 2030, "the total energy sales were to grow on average by 8.1% per year from 1,807 GWh in 2008 to 10,099 GWh in 2030. The peak demand is forecasted to grow an average of 7.0% per year from 528 MW in 2008 to 2331 MW in 2030."
- For the high case scenario, energy sales were forecasted to grow to 13,101 GWh by 2030, which suggests an annual growth of 9.2%.

In 2012, total generated power amounted to 2765 GWh while UECTL power sales stood at 2744 GWh and UMEME sales at 1938 GWh respectively on the transmission and distribution grid. Electricity imports and exports stood respectively at 34.6 and 413.7 GWh. UECTL sales grew from 2,744 GWh in 2012 to 3,098 GWh in 2014 while UMEME sales grew from 1,938 GWh to 2,277 GWh during the same period. This suggests an annual growth rate of 6% for UECTL and 8% for UMEME. Overall, UECTL power sales have grown by 36% since 2008 while UMEME's sales have grown by 52%. Detailed comparison between projected and real data from 2008 to 2012 shows that power demand is following the base case situation with high electricity exports levels while medium and large industries are growing faster than expected, domestic and commercial consumption growing slowly. Table 3.3 shows the demand trend for this scenario. As long as this investment

²⁹ Power Sector Investment Plan, MEMD 2011, pp 57- 67.

plan is implemented, the required capacity and universal access achieved by 2030, the electricity per capita consumption could reach 180 kWh, for a projected population of 56,2 million by 2030, compared to 84 kWh for 2012, for a population of about 32.6 million.

From the 2014 population census³⁰, Uganda has 7 353 427 households and a population of 34 856 813 inhabitants. The mean household size is thus 4.7, and has not changed for the past four decades. Compared to 2002, the population has increased by 3.03% annually. Table 3.2 shows the population trend for 2015, 2020 and 2025 as estimated by UBOS whereas the population for 2030 has been extrapolated assuming the same growth rate for the next decade.

Year	2015	2020	2025	2030
Population (in millions)	35.8	40.4	46.7	56.2
Number of households	7 617 021	8 595 745	9 936 170	11 956 636

Table 3.2: Uganda's population trend

	domestic high consumption	rural areas	large industrial	Commercial	medium industrial	exports	Total
2014	747	274	1036	335	244	425	3061
2015	826	327	1125	365	244	510	3397
2016	913	384	1222	397	245	760	3921
2017	1006	445	1329	432	246	940	4398
2018	1109	509	1446	471	246	1300	5081
2019	1203	570	1542	501	247	1600	5663
2020	1301	608	1638	532	248	1800	6127
2021	1412	646	1743	566	250	1950	6567
2022	1528	685	1848	601	252	2200	7114
2023	1647	725	1955	636	255	2250	7468
2024	1772	766	2063	671	257	2450	7979
2025	1900	807	2172	707	259	2450	8295
2026	2034	849	2282	743	261	2550	8719
2027	2171	892	2393	780	263	2550	9049
2028	2313	935	2505	817	266	2550	9386
2029	2460	979	2618	855	268	2550	9730
2030	2611	1023	2732	893	270	2550	10079

Table 3.3: Estimated power demand prospect towards 2030 according to Power Sector Investment Plan³¹

3.1.2. Cooking energy

The 2012/2013 UNHS reveals that 75% of households in Uganda used firewood for cooking while 21% used charcoal. Combined, biomass fuels constitute the main fuel for cooking for 96 percent of the households. Majority of households in urban areas used charcoal for cooking (54%) compared to households in rural areas (8%). Use of electricity for cooking was negligible in both rural and urban.³² The GoU and Civil Society

³⁰ UBOS, National Population and housing Census : provisional report, November 2014

³¹ MEMD, Power Sector Development Plan, 2011

³² UBOS National Household Survey 2012/2013, Final report. 2014

organizations, with the support of donors, are working together to transform the way that Ugandans cook, by fostering clean cooking interventions. On cookstoves, the generally accepted baseline of clean cookstoves in Uganda is around 500,000 units by 2012, for a total of 6,947,749 households. Efforts to increase the use of clean cookstoves and improve the use of alternative fuels are underway under an umbrella entity, UNACC, which is chaired by the GoU. The UNACC has made a pledge and developed a strategic plan to provide 5,000,000 households with clean cookstoves by 2020.

LPG sales have globally increased in Uganda, from 8.44 million m³ in 2008 to 11.62 million m³ in 2012³³ and 11.9 million in 2014, about 90% of this being consumed for cooking. Urban households aspire to cook with kerosene and LPG (even electric stoves) as these are cleaner and more convenient, although negative perceptions around LPG like dangerousness and explosion risk exist. There appear to be opportunities for market expansion in these areas which would reduce pressure on biomass. But distribution is problematic, with the majority of distribution centres and LPG companies centralized in Kampala, so there is need to enhance the distribution network to support the dissemination of LPG into Uganda's market. The estimated number of LPG users in 2012 stood at about 33,000 households³⁴. The Uganda LPG association is targeting to achieve 20% of households by 2020³⁵, about 1.72 million households. Disan reported also a limited storage capacity (175 tons compared to the 500 tons used monthly)³⁶ which seems now to be better since the 13 specialized companies in LPG sales have built refilling stations. Another barrier is the cost of infrastructure for a beginner, on average Shs250 000 (US\$ 90) for a 12 kg cylinder of cooking gas³⁷ although LPG is cheaper on the long run. For example, a 13 kg of LPG can last a family of five people for about a month, unlike a 40 kg bag of charcoal which costs the same price as LPG but can last the same family for less than two weeks.³⁸

3.2. Uganda's SE4ALL targets for 2030

The SE4All Initiative requires countries to set quantitative objectives for each of the three goals of the initiative, as defined in table 3.4.:

Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global energy mix
Percentage of population with electricity access	Percentage of population with access to modern cooking solutions	Rate of improvement in energy intensity	Renewable energy share in Total Final Energy Consumption

Table 3.4: Global SE4ALL goals

Uganda's SE4ALL, goals are set as below:

³³ MEMD, 2012 Statistical Abstract

³⁴ Emmy Wasira, WeS at ULPGas Stakeholders' Conference, 2011

³⁵ <http://www.se4all.org/commitment/advancing-the-use-of-lpg-as-a-cooking-energy/>

³⁶ Disan Kiguli, ULPGas Status Report on LPG Usage in Uganda, 2011

³⁷ <http://www.monitor.co.ug/Business/Commodities/Consumption-of-liquefied-petroleum-gas/-/688610/1935002/-/mywdkrz/-/index.html>

³⁸ Interview of Dr Emmy Wasirman, Chairman of ULPGAS and CEO of Wana Energy solutions

Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global energy mix	
Percentage of population with electricity access	Percentage of population with access to modern cooking solutions	Reduce national wood consumption by 40% and improve energy efficiency of power users by min 20%	Renewable energy share in Total Final Energy Consumption	
			Power	Thermal
>98%	>99%		>95%	36%

Table 3.5: Uganda's SE4ALL goals

3.2.1 Energy access towards SE4ALL

Electricity to households

To achieve universal access in Uganda by 2030, 570 000 and 97000 new connections will be required yearly respectively in rural and urban areas, over the period 2015-2030 (table 3.6).

	2015	2020	2025	2030	Gap by 2030	connections 2015-2030
Households projection	7617021	8595745	9936170	11956636	10003618	666908
urban	1404233	1584665	1831778	2204261	1455015	97001
rural	6212789	7011080	8104392	9752376	8548603	569907

Table 3.6: Households projection and gap analysis for electricity access

The most significant challenge for Uganda is on how to accelerate the pace of adding new connections from under 100,000 a year to an average of 667,000 a year through 2030. Even if massive financial support is provided, are actors endowed with human and institutional capacity to achieve this goal?

Electricity access to social & community institutions

- Reliable electricity supply to schools and health centers
 - 30% of schools in urban areas as well as 48% in rural areas do not have access to electricity. In the health sector, these are only 7.7% and 10% respectively, showing GoU efforts under ERT 1 and ERT2. ERT3 targets to install solar PV systems in 100 post-primary schools, 276 health centers and 15 water pumping stations.
- Access to ICT services and mechanical energy such as Multifunctional Platform could not be assessed.

Cooking energy to Households

It was estimated in 2012 that about 500 000 households were already using improved stoves. Ending 2014, PREEEP and EnDEV had deployed modern electricity to 2690 households' through solar home systems, 19102

Uganda's SE4ALL Action Agenda

through pico-PV and 213 through grid connection, improved cooking stoves to 192 494 households, 66 SMEs and 139 social institutions, electricity for productive use to 480 small and medium businesses..

With the support of MEMD and Donors, Uganda has adopted the Global Alliance for Clean Cooking model, and created the UNACC. The UNACC seeks to integrate all the activities and stakeholders working on clean cooking related matters under a single cooperation and collaborative framework. In a way, UNACC is designed as a public private partnership, where public sector, private companies and civil society are addressing the challenges of clean cooking in Uganda. UNACC is rolling out a plan to reach over five million households sustainable using clean and efficient stoves by 2020. The number of households by 2020 is estimated to reach 8,595,170, meaning that if UNACC's goals are achieved, 64% of Uganda's households would have access to modern cooking solutions.

In addition, there are a number of on-going initiatives supported by the civil society, for example

Project	Developer	Activities	Financial opportunities
Energy Efficient Cookstoves	Impact Carbon	Disseminate domestic and institutional stoves	Stove subsidies
Up energy Project	Up Energy	Disseminate domestic wood stoves	Stove subsidies
Improved Cookstoves for East Africa	Uganda Carbon Bureau	Disseminate domestic wood stoves and develop voluntary carbon credits	Stove subsidies
Uganda Domestic Biogas Program	Heifer/Hivos	Disseminate 12000 digesters	30% subsidy on the construction of a biogas plant

The Uganda LPG association (ULPGAS) is working towards reaching 20% of households using LPG for cooking by 2020. 13 private companies are working in this market subsector. This activity is market driven but support is expected from the GoU to boost the growing LPG market.

Taking into account existing programs, the estimated gap to reach universal access to modern cooking energy by 2030 is estimated at 6.5 million households.

3.2.2 Renewable Energy towards SE4ALL

The second SE4ALL overall objective is to double the share of RE in the country's energy mix by 2030. In Uganda, renewable energy already dominates the country's power sector with 82.3% of the installed capacity and 90.1% of the on-grid's electrical energy generated in 2012 (table 3.7).

Electricity generated in GWh		
Hydro	2398,1	86,7%
Cogeneration	94,1	3,4%
Thermal diesel	275,3	9,9%
Total	2767,5	100,0%

Table 3.7: On grid power generation by source for 2012³⁹

³⁹ MEMD, 2012 statistical abstract, 2013

In contrast, the thermal process depends heavily on the non-sustainable use of biomass, which is responsible for over 89.9% of the energy generated⁴⁰.

Given these particular characteristics of Uganda's energy mix, the SE4ALL goal for renewable energy will be to keep increasing the share in the total final energy consumption, while diversifying RE sources, given the relative enormous resources of solar, biomass and hydro. Given the challenge presented by high impact of biomass use for cooking, the goal has been split into the use of renewable energy for power and renewable energy for thermal applications (table 3.8).

Renewable energy share in Total Final Energy		
Time Frame	Power	Thermal
Baseline (2012)	90%	18%
2030	>95%	36%

Table 3.8: Renewable energy targets towards SE4ALL

Under the base case scenario, where on-grid is the main driver for access to power, the PSIP shows that the predominance of renewable energy in the power generation mix might be reduced to below 50% by the introduction of new thermal capacity using the existing reserves of oil and gas in Uganda. Therefore, maintaining and increasing the use of renewable resources for power generation mix is being considered under the framework of the new policies scenario, when off-grid is the main driver for universal access. In off-grid rural areas, biomass, solar PV and small hydro plants powering micro, mini and regional grids combined with Solar Home PV systems will be promoted.

3.2.3 Energy efficiency towards SE4ALL

The global target of doubling the global rate of improvement of energy efficiency seems not to be appropriate to Uganda, since energy intensity will be difficult to capture and monitor. The following suggestions build on analysing energy efficiency savings potential in different sectors of the country's economy (households, commercial enterprises, industries and buildings).

Households: A combined UBOS-MEMD survey revealed that only 9% of Ugandan households have been sensitized on energy efficiency. Of these households, 80% adopted energy saving appliances⁴¹ such as LED bulbs, CFLs, air conditioners and, refrigerators. This suggests that awareness raising campaigns among Ugandans combined with a dissemination program of energy saving appliances will be successful. As per cooking energy, households' annual biomass demand totals 20.9 million tons of fuelwood and 1.5 million tons of charcoal, accounting for 74% of delivered biomass energy. Rural households are the largest biomass consumers because of their low average monthly income which has direct impact on their willingness to pay for energy consumed.

⁴⁰ Based on Uganda Energy Balance (heat and power) for the period 2009 – 2012, MEMD

⁴¹ MEMD, UBOS. Uganda rural-urban electrification survey, 2012.

Commercial enterprises: Table 3.9 shows annual wood consumption of selected commercial enterprises with a total of 2401 ktons, schools being the first contributor.

	annual wood consumption [ktons]	annual charcoal consumption [ktons]	% using inefficient equipments
Bakeries	313		70%
Hotels & restaurants	200	50	
local distilleries	180		100%
improved distillery-Buwembe	0,67		
schools	1700		93%
prisons	5,435		69%
health centers	1,9		
Total	2401		

Table 3.9: annual wood consumption of different enterprises

- Local distilleries in Uganda produce ca. 27 millions of alcohol, using highly inefficient technologies. Their specific wood consumption is the triple, compared to the improved distillery in Buwembe (Jinja Brewery).
- 1500 schools were using improved stoves for cooking in 2007.
- 35000 hotels and restaurants, mentioned in the BEST report, require for cooking ca 200 kton of fuelwood and 50 kton of charcoal annually.
- 31 prisons out of 100 have acquired 38 institutional rocket stoves and matching saucepans with the financial support of GIZ, resulting in reducing fuelwood intensity from 250 to 125 kg/inmates/year. Prisons department has a plan to equip the remaining prison units with energy saving stoves.

Industries: Large and medium industries' power consumption totalled 1450 GWh out of 2,276 GWh, sold by UMEME in 2014. This is almost 64%. The MEMD with the support of GIZ is implementing an energy efficiency and management program for high energy intensive industries, aiming at supporting them reduce their energy consumption. Key activities of the program will include:

- Baseline survey regarding energy consumption and production,
- Energy audits to identify energy saving opportunities,
- Training on energy management of key facility staff and
- Sensitization on the ISO 50001 – Energy Management Standard requirements and its implementation.

The GIZ-MEMD program has started an energy audits program targeting 50 energy intensive industries (2015-2017) which are part of the top 100 electrical energy consumers. Seven (7) audits are supposed to be completed by June ending and eight (8) more audits have been planned to take place in the second half of 2015. Audit reports will progressively establish the basis of energy efficiency actions in the industrial sector. Savings in electricity consumption are expected between 15 and 25%.

4. Part II – Priority Action Areas

4.1. Energy Access

4.1.1. Current Status and Trajectory

Although Uganda's average power consumption per capita is constantly growing, from 84 kWh in 2012 to 89 kWh in 2014⁴², it is still lower than 153 kWh which is the average for Sub Saharan Africa excluding South Africa. Uganda's consumption per capita is within the expected range for basic human needs (i.e. electricity for lighting, health, education, communication and community services)⁴³, it is still short of the count for productive use. A power sector investment plan and least cost strategy was undertaken and this indicates that for universal access goals to be achieved, there is a need for investment, mostly for generation,⁴⁴ US\$ 95.2 billion through 2030. As long as this investment plan is implemented and targets on generation capacity are met, the generation capacity could reach over 2,400 MW by 2030,⁴⁵ and the demand would be around 1,873 MW. Considering the power consumption prospects with an annual growth of 8% and a projected population of 56.2 million, the per capita electricity consumption might reach 189 kWh by 2030.

Uganda has seen progress in enhancing connectivity and reducing problems related to the post-paid metering system. The impact of pre-paid meters has reduced commercial losses and improved energy management by end users. UMEME has almost doubled from 2005 to 2014, reaching 800 000 customers at an average pace of over sixty thousand new connections per year. Recorded system losses (2014) were 3.6% on transmission grid and 21.3% on the distribution grid. Assigned targeted system loss factor for 2015 are respectively 3.68% and 18.3%.

Given the challenges in achieving the milestones set for the 2002 Rural Electrification Strategy, the GoU has updated the strategy, which was approved in 2013, aiming to support energy access outside the areas currently served by UMEME. The RESP gives REA the lead role on universal access in Uganda using the concept of energy services, and divides the country in thirteen energy service territories, some of them carved to mirror current concessions.

4.1.2. Existing plans, strategies and gaps

4.1.1.1. Electricity services

The most significant challenge for Uganda is on how to change the pace of adding new connections, from under 100,000 a year to an average of 670,000 a year through 2030. As a first step, the GoU will work with stakeholders to define annual new connection targets. In addition, during the transition period the GoU will keep working, with key stakeholders, on interventions and strategies that will accelerate the current new connection rates to a level consistent with the universal access target. The strategy of the Government to increase access to electricity services is based on the policies that supported the development of the PSIP and the REIP in 2011 and relies on on-grid electricity services, as the main driver for universal access goals (**Base case scenario**).

Through the expansion of transmission lines and grid densification, Uganda has in place more than nine large donor funded programs aimed to increase the number of connections. Some of these programs have specific targets; others are aimed to facilitate access and connections. The following table presents a summary of the key existing plans/strategies pertaining to electricity connections⁴⁶.

⁴² Using IEA's Energy Poverty methodology based on UETCL projection for 2013 and population estimates for 2012

⁴³ Energy for a Sustainable Future, The secretary-General's Advisory Group on Energy and Climate Change. Summary Report and Recommendations, page 13 UN, April 2010

⁴⁴ Power Sector Investment Plan, MEMD, January 2011

⁴⁵ An addendum to the PSIP of 2011 projected for a high-end scenario that capacity could reach over 20,000MW by 2030

⁴⁶ It may include grid related projects, which are included here only because they have a defined access target

Program/Project Name	Beneficiaries	Lead Agency	Implemented by	Funding Sources	Execution (Started in)
West Nile Grid Extension	7 towns, 40 commercial centers 6,000 customers Indirect beneficiaries approx. 40,000 people in households, businesses and social service providers such as schools and health centers	UEDCL	UEDCL	KfW, EU and GoU	2012
Switch to Prepaid (West Nile)	4,000 prepaid meters for existing customers; plus 2,000 new customer	WENRECo	WENRECo	KfW	2013
Grid based Output Based Aid Facility (OBA)	120,000 - 132,500 on grid connections over a period of 4 to 5 years	REA	UMEME, WENRECo, KIL, BECS, PACMECS	KfW, GPOBA EU and GoU	2010
Energy for Rural Transformation II	129,000 households 20,000 off grid SHS; 1434 schools; 142 large agribusiness farms	REA	REA, MEMD, MOES, MWE, PSFU UECCC, UCC, MOLG, MOH, MOFPED	World Bank, GEF and GoU	2016
Energy for Rural Transformation II (supplementary)	Increases the number of 109,000 households (ERT 2 without SHS) to 120,000 households	REA	REA	World Bank	2016
Energy for Rural Transformation III ⁴⁷	150,000 households	REA	REA, MEMD, MOES, MWE	World Bank	2016
Uganda Rural Electrification Project	50,000 potential customers, including small and medium sized enterprises	REA		AfDB, ITF, GoU	2014
Support to Construction of 6 Rural Distribution Projects	20,919 connections	REA	REA	NORAD and GoU	2011
Implementation and Construction of 2 Rural Electrification Distribution Projects	1,164 connections	REA	REA	NORAD	2010

⁴⁷ ERT III Project, World Bank report n° 89393-UG, April 2015

Program/Project Name	Beneficiaries	Lead Agency	Implemented by	Funding Sources	Execution (Started in)
RESP – On-Grid	1,290,102 connections, including the rural areas of UMEME's service territories	REA	REA		2014
RESP- Off-Grid	140,653 from SHS and mini grids	REA	REA		2014
Last 1 km program	1,438,590 grid connections	UMEME	UMEME	UMEME AFD & others	2015
EU Energy Facility 1	8,200 SHS	FRES	FRES	EU	2015
EU Energy Facility 2	50,000 SHS	Church of Sweden	Church of Sweden	EU	2015

Table 4.1: identified existing programs

Taking into account the existing programs, the gap to be filled by the “base case scenario” is to connect 5,481,430 additional customers on the grid by 2030 (Table 4.2). In reality, many of these programs are being implemented under RESP II and UMEME last mile connection programs.

Type of Connection	RESP	Last 1KM	Other On Grid	SHS and Other Off Grid	Added Connections (2015 - 2030)	Share
On-Grid	1, 290,102	1, 438,590	5,481,430		8,210,122	82%
Off-Grid	140,653			1,652,842	1,793,495	18%
					10,003,617	100%

Table 4.2: summary of actions for the base case scenario

Table 4.3 represents the progression and annual targets required for electricity access by 2030 in Uganda for the base-case scenario.⁴⁸

Projected costs for universal access is calculated as per RESP costs per household, based on the strategy's financial needs statement; include densification but exclude grid expansion costs, as⁴⁹

- Off-Grid \$393.90
- On-Grid \$678.20

Based on these assumptions, the cost for Uganda to offer universal electricity access to its population under the Base case scenario is about US\$ 6,274,562,421.⁵⁰ Some of the associated costs have partial funding,

⁴⁸ This table is consistent with the three phases of the AA implementation, were at inception we see small increments in the addition of connections, and the number of connections accelerates through time.

⁴⁹ This cost includes grid densification under RESP plan, but not grid extension (HV and MV lines, substations and transformers) under UETCL Plan (see 4.1.1 Grid Infrastructure below)

⁵⁰ In addition to the exclusion defined in the assumptions above, this exclude the cost per household to pay for connection access and internal wiring.

through existing programs like ERT II and the upcoming ERT III. These funds are assigned to the new RESP. According to REA's Deputy Executive Director, total funding commitments to date will assure the implementation 60% of RESP's targets, i.e approximately 858,000 households. This means, there is a need for additional funding for the balance of 7.4 million connections and 1.6 million households off-grid, almost 5.68 billion US\$.

	Existing access	RESP off-grid	RESP on-grid	UMEME Last 1 km	Added Offgrid	Added connections	Households with access	Population trend	Number of households	Electricity access rate
2014	1953018						1953018	34856813	7416343	26,3%
2015	1953018	17582	161263		103303	342589	2577754	35912974	7641058	33,7%
2016	1953018	35163	322526	143859	206605	685179	3346350	37001138	7872582	42,5%
2017	1953018	52745	483788	287718	309908	1027768	4114945	38122272	8111122	50,7%
2018	1953018	70327	645051	431577	413211	1370358	4883540	39277377	8356889	58,4%
2019	1953018	87908	806314	575436	516513	1712947	5652136	40467481	8610102	65,6%
2020	1953018	105490	967577	719295	619816	2055536	6420731	41693646	8870989	72,4%
2021	1953018	123071	1128839	863154	723118	2398126	7189327	42956964	9139779	78,7%
2022	1953018	140653	1290102	1007013	826421	2740715	7957922	44258560	9416715	84,5%
2023	1953018	140653	1290102	1150872	929724	3083304	8547673	45599594	9702041	88,1%
2024	1953018	140653	1290102	1294731	1033026	3425894	9137424	46981262	9996013	91,4%
2025	1953018	140653	1290102	1438590	1136329	3768483	9727175	48404794	10298892	94,4%
2026	1953018	140653	1290102	1438590	1239632	4111073	10173067	49871459	10610949	95,9%
2027	1953018	140653	1290102	1438590	1342934	4453662	10618959	51382564	10932460	97,1%
2028	1953018	140653	1290102	1438590	1446237	4796251	11064851	52939456	11263714	98,2%
2029	1953018	140653	1290102	1438590	1549539	5138841	11510743	54543521	11605005	99,2%
2030	1953018	140653	1290102	1438590	1652842	5481430	11956635	56196190	11956636	100,0%

Table 4.3: Projected interventions under Base Case scenario

4.1.1.2. Grid Infrastructure

Following its 2011 Power Sector Investment Plan, Uganda has undertaken a series of investments to strengthen the transmission network. These projects include the grid integration of upcoming power plants, to improve the electricity access, as well as updates and upgrades to improve the reliability and quality of supply to distributors and consumers. These projects include evacuation of power from Bujagali Hydro Power Station, small-hydro power plants in the Western region, a thermal power plant in Mputa near the Lake Albert oil fields, as well as a transmission line to Lira, to serve the growing energy needs of the north eastern region of the country.

Figure 4.1 presents the topology of the transmission system as of 2011 overlapping with population density. The grid extension and densification work aims to add 1600 km of lines by 2018 and additional work is expected to be completed 2027. In addition, the plan includes interconnectors and cross-border transmission.

Table 4.4 presents the summary of these projects and associated cost/funding gap⁵¹, some of which include related substations and transformers⁵²:

⁵¹ Data of costs were incomplete for one referred projects, another project had complete cost data but missing line type information

⁵² The list does not include projects for restringing or upgrades to HTLS lines.

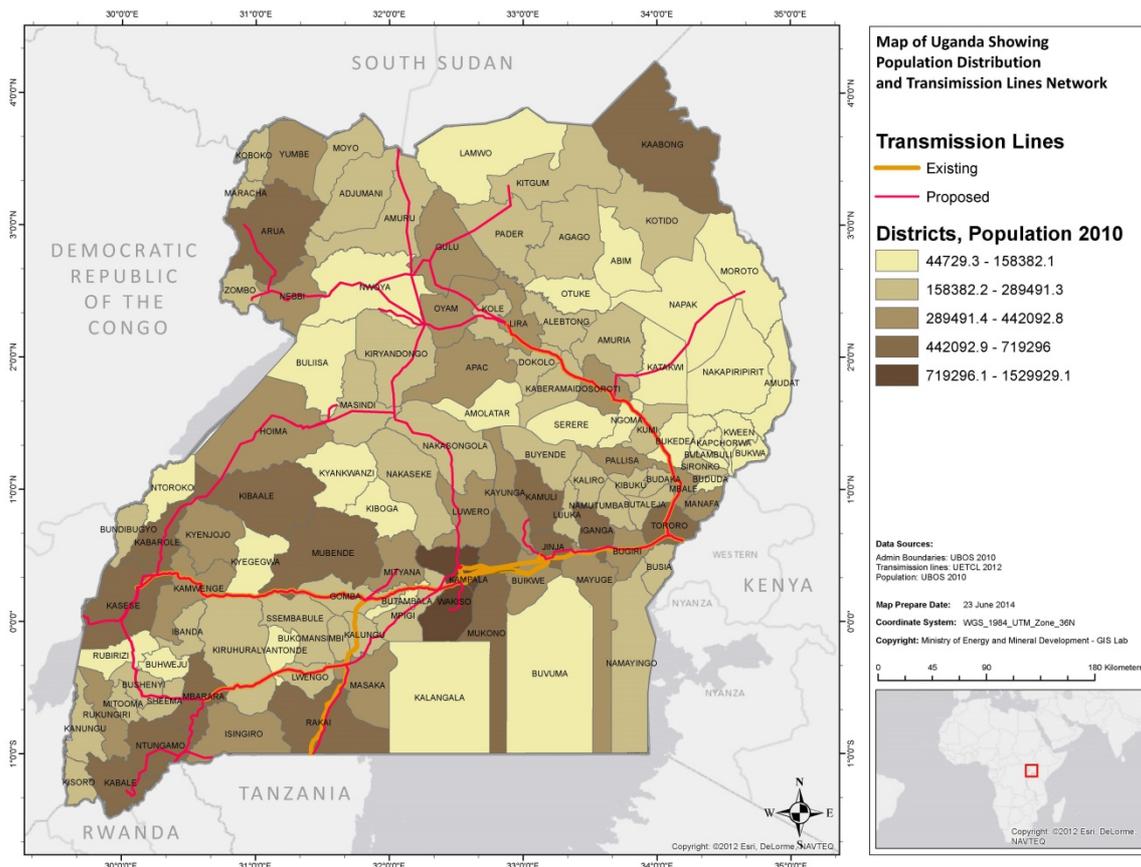


Fig 4.1: Population distribution and power transmission lines in Uganda

Type of Project/Type of line (kV)	Interconnectors to major Power Plants	Transmission Lines	Cross-Border - East Africa Power Pool	Transmission lines to be added by 2027
132 kV expansion	157 km	1,457 km		1,608 km
220 kV expansion	401.5	901 km	475 km	1,775 km
400 kV expansion	347,2 km	345 km	100 km	882,2 km
Costs in million US\$				
Cost	609.6	974.4	236.9	1,820.61
Funded	480	539.6	-	1,019.61
Gap	129.6	434.8	236.9	801.26

Table 4.4: Summary of grid infrastructure projects

The planned transformation will change the shape of the grid topology from radial to circular, which should improve grid management and secure adequate distribution. This grid expansion includes cross-border transmission lines to facilitate power exports and imports. Various 220 kV interconnection projects with Kenya and Rwanda are under development. In addition, a feasibility study for interconnection with Tanzania has been completed, while the feasibility study for interconnection with the Democratic Republic of Congo is on-going.

In addition to the work presented above, UETCL has a plan to network updates and upgrades of lines, software, communications and lines. Table 4.5 presents the type of projects and cost/funding gaps

Type of Project/Cost	Millions of US\$		
	Cost	Funded	Gap
SCADA/Communications	\$2.5	-	\$2.5
Substations	\$240.3	\$135.6	\$104.8
Smart Grid Implementation	\$8.7	-	\$8.7
<i>Grid Updates and upgrades</i>	\$251.53	\$135.56	\$116.0

Table 4.5: Funding gap for network update

Figure 4.2 presents the topology of UMEME's distribution lines as per 2013, and includes lines under construction and planned:

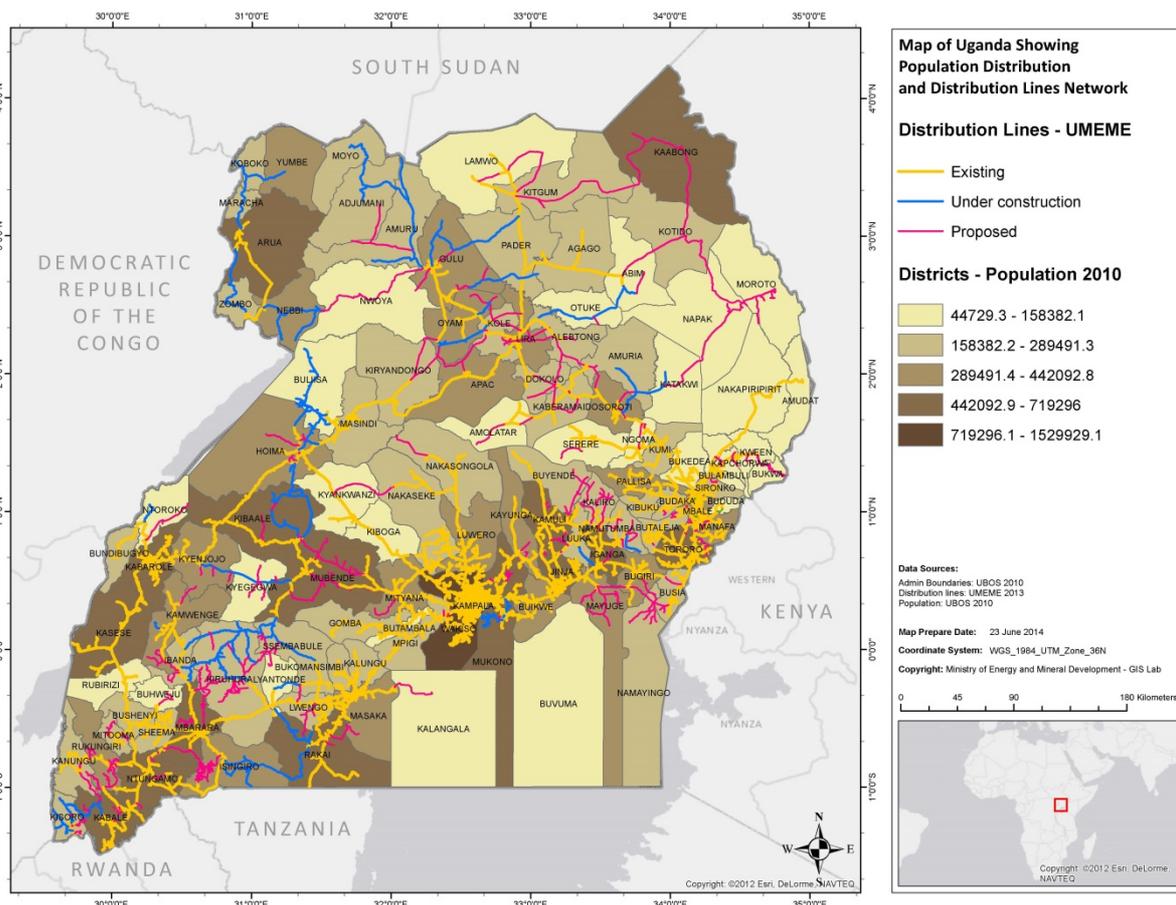


Figure 4.2: UMEME's distribution grid and projects

UETCL has a fifteen-year grid development plan, which due to the UETCL's mandate mainly focused on the HV transmission backbone and increases the reliability of the grid. While this transformation is set to occur ahead of 2030, two key issues remain key challenges: grid densification and households connected to electricity.

- UETCL has not fully identified funds for its grid expansion strategy, and this funding gap, without including cross border lines, amounts to US\$563.4 million;
- UETCL has not fully identified funds for network updates, software, communications and lines, this funding gap of US\$116.0 million;

Grid expansion strategy is based on the 2011 PSIP, which projected energy supply shortage, as forecasted in the investment plan, by 2018. There have been some delays in implementing key lines; UETCL needs to develop a contingency plan to avoid falling behind in the PSIP.

4.1.1.3. Clean Cooking

73% of the fuel-wood⁵³ consumed in Uganda is used by households for cooking; it shows the challenge of using alternative fuels for cooking. For Uganda, the binary approach of the global framework, which suggests that modern cooking solutions should be premised on the use of non-solid fuel, is not a realistic goal at least not for the near future. With this, Uganda's goals will not reach the highest tier (tier five) in the global framework tracking system by 2030, but they will definitively fall under tier four, as it will primarily be a combination of non-solid fuels, certified solid fuels and efficient cookstoves and appliances.

With the support of MEMD and Donors, Uganda has adopted the Global Alliance for Clean Cooking model, and created the UNACC. The UNACC seeks to integrate all the activities and stakeholders working on clean cooking related matters under a single cooperation and collaborative framework. In a way, UNACC is designed as a public private partnership, where public sector, private companies and civil society are addressing the challenges of clean cooking in Uganda.

UNACC is rolling out a plan to reach over five million households sustainable using clean and efficient stoves by 2020, achieving 64% of the projected households by 2020 using clean stoves, but the organization is yet to produce the specifics on which interventions and actions will be required to achieve their goals.

In addition, there are a number of on-going initiatives supported by civil society organisations, for example

Project	Developer	Activities	Financial opportunities
Energy Efficient Cookstoves	Impact Carbon	Disseminate domestic and institutional stoves	Stove subsidies
Up energy Project	Up Energy	Disseminate domestic wood stoves	Stove subsidies
Improved Cookstoves for East Africa	Uganda Carbon Bureau	Disseminate domestic wood stoves and develop voluntary carbon credits	Stove subsidies
Uganda Domestic Biogas Program	Heifer/Hivos	Disseminate 12000 digesters	30% subsidy on the construction of a biogas plant
Energy efficient cookstoves	Church of Sweden	50,000 households	Revolving fund

Table 4.6: Other ongoing clean cooking initiatives

The Uganda LPG association (ULPGAS) is working towards reaching 20% of households using LPG for cooking by 2020. 13 private companies are working in this market subsector. This activity is market driven but support is expected from the GoU to boost the growing LPG market.

Since only UNACC has a concrete goal, the gap to reach Uganda's SE4ALL goal regarding clean cookstoves is estimated at 6,456,636 households.

4.1.1.4. Interventions in support of Investment and Working Capital

In support of its Renewable Energy Policy, the Government has introduced RE-FIT, a renewable energy feed-in-tariff program. To address the shortcomings of RE-FIT, it was supplemented by GET-FIT, which provides a premium on RE-FIT for new renewable energy producers and fosters new projects. GET-FIT has signed contracts with RE projects totalling 135 MW and targets a portfolio of 175 MW.

⁵³ Measured in tons of oil equivalent as per Uganda Energy Balance for 2012, MEMD 2013

4.1.3. Actions needed to achieve the overarching objective in the field of energy access

4.1.3.1. Universal Access - Electricity

The achievement of universal access to electricity in Uganda is associated with two challenges:

- Off-grid strategy beyond RESP's SHS approach to meet their 140,653 off-grid access goal. The gap to be closed beyond RESP financial commitment is significant, either under the base case scenario, 1,703,103 households, or the new policies scenario, 3,231,838 households.⁵⁴
- Given that almost 30% of households are under the poverty line, actions need to be defined to mitigate the costs of connecting, the cost of internal wiring and monthly electricity bill.

High reliability in the expansion and densification of the national grid, as reflected in the PSIP and RESP II does not guarantee the possibility of overarching universal access by 2030. The access strategy needs to shift from on-grid, to off-grid (mini-grids, SHS, etc.) solutions. A second scenario is therefore suggested. This scenario is based on the idea that during the Transition Period, Uganda will refine its NDP, align its power sector related policies to the SE4ALL initiative, and deploy a strategy that presents a more balance approach between urban and rural electrification.⁵⁵ Therefore, this new policies scenario looks at universal access and its associated cost when Uganda follows a strategy that relies on a balanced approach, between on-grid and off-grid access.

Solar home systems

It is assumed in this scenario that population living under the poverty line are targeted with SHS because even if they are connected, they may not be able to pay for their energy bill. This may concern up to 34% of rural households and 11% of urban households living⁵⁶. Assuming this distribution is kept until 2030, the potential of households to be given SHS would be 160,052 urban and 2,906,525 rural households, i.e. a target of 195,062 SHS annually over the period 2015-2030, achieving 30% of the population. To achieve this, MEMD needs to continue the consultation process with development partners and in supporting the initial market intelligence survey and project preparation to develop a sustainable market for off-grid lighting products.

Mini- and micro-grids

This scenario includes also the development of mini and micro-grids combined with productive uses of electricity in agriculture (land irrigation, food transformation/conservation, fisheries landing sites), telecommunication etc. in rural areas, where feasibility studies show good results. Mini-grids are an ideal alternative to grid electricity in remote villages that do not have grid connectivity. And because mini/micro grids are independent entities, they can also be controlled and managed easier than conventional grid. Such distributed energy systems also provide reliable electricity, because outages or interruptions to electricity supply can be quickly identified and corrected. Additionally, distribution losses are reduced since the site of power generation closer to the load center. IEC has established a number of standards for micro-grids for decentralized rural electrification purposes. These standards cover micro-grids with low voltage AC (three-phase or single-phase) with rated capacity less than or equal to 100 kVA, which are powered by a single micro-power-plant and do not include voltage transformation⁵⁷.

In 2012, 3067 base stations sites were operated in Uganda, mainly by EATON, ATC Uganda, Airtel and Uganda Telecom. 1249 mobile communication towers were located in rural areas and powered by diesel generators and neighbouring rural communities are using paraffin and kerosene for lighting. Out of 1818 towers connected to the grid, 714 experienced power outages of more than 6h per day, forcing operators to install either batteries or diesel generators as backup⁵⁸. The concept of building a 30 kWp solar powered micro-grid anchoring on a mobile tower, has been successfully experienced by GIZ in Kabunyata (figure 4.3), leading to significant energy cost reduction for the tower operator, establishment of SMEs, provision of electricity to 100 households and jobs creation in the village. 1200 similar systems could be envisaged in rural Uganda in collaboration with mobile tower operators and would contribute to give access to 120 000 households or more.

⁵⁴ Based on the distribution of projected on-grid and off-grid connections by RESP

⁵⁵ Consistent with the "new policy scenario" as presented by IEA's Energy Poverty, 2010

⁵⁶ UBOS household survey 2012

⁵⁷ IRENA, Off-grid renewable energy systems: Status and methodological issues, 2014

⁵⁸ <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/10/GPM-Market-Analysis-East-Africa-v3.pdf>

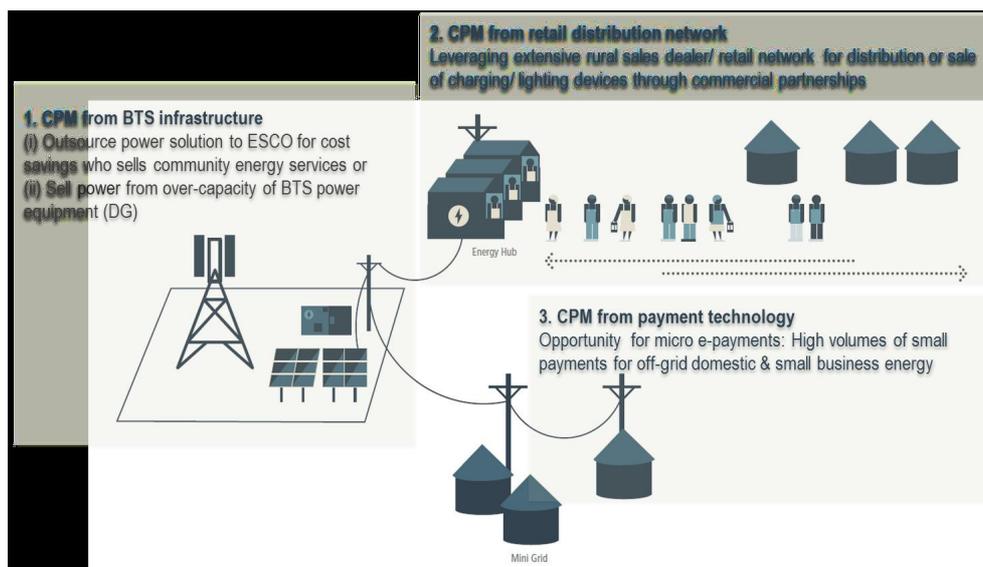


Figure 4.3: Microgrid electrification around a mobile communication tower

Solar mini-grids should be implemented in selected localities. They will be based on a 200 to 250-kWp PV array, a 1200 kWh energy storage system to generate a constant 60-kW output at night. Lead-acid or Lithium-ion batteries are good candidates for Uganda. The PV system will produce an excess of 1,200 kWh of energy during the day to charge the battery. Based on an average load demand of 160 W, such systems will be indicated for localities with 500 to 1000 households, depending on the energy demand for business and community services. Suggested action here is to install 10 solar power mini-grids per energy service territory by 2030, i.e. and installed capacity of 26 to 30 MWp, reaching 65 000 to 130 000 households. Feasibility studies will determine whether hybrid PV-diesel solution may be applicable. This strategy could be the basis for implementing a program to promote mini-grids and stand-alone energy systems in remote areas, especially using primarily Solar Power and Mini hydro. Generally, a countrywide renewable energy resource mapping should be realised in order to capture other sources like biomass or wind in the mini-grid program. MEMD and REA will work with local stakeholders, donors, regional organizations, like CLUB-ER and the Alliance for Rural Electrification, and the SE4ALL Clean Energy Mini-grids HIO coordination group to leapfrog this initiative by capturing experience and lessons learned from within Uganda and Sub Saharan Africa.

In this new policy scenario, minimum 33% of the population will have access to electricity towards 2030 through off-grid solutions (table 4.7).

Type of Connection	RESP	Last 1KM	Other On Grid	SHS and Other Off Grid	Added Connections (2015 - 2030)	Share
On-Grid	1,290,102	1,438,590	3,958,349		6,687,041	67%
Off-Grid	140,653			3,175,924	3,316,577	33%
					10,003,618	100%

Table 4.7: Access goals under new policies scenario

Table 4.8 shows the progression and annual targets required for electricity access by 2030 in Uganda under the new policies scenario.⁵⁹ Based on the assumptions indicated under 4.1.2.1 above, the cost for Uganda to offer universal electricity access to its population under the new policy scenario is about US\$ 5,841,550,886. 60% of the RESP targets are funded through existing programs. This means that while about 858,000 households are funded under RESP, there is a need for additional 5.28 billion US\$ to fund the remaining 9.1 million households or 4.3 billion US\$ if the last mile connections are considered to be totally funded by UMEME. This excludes transmission grid expansion costs, internal wiring and connection fee (117-137 US\$

⁵⁹ This table is consistent with the three phases of the AA implementation, where at inception we see small increments in the addition of connections, and the number of connections accelerates through time.

for a no-pole connection). The total cost will be higher if the replacement of SHS is taken into account since their mean lifespan can be considered around 5 years.

	Current situation	RESP off-grid	RESP on-grid	UMEME Last 1 km	Added SHS	Off-grid minigrids	Off-grid microgrids	Added connections	Households with access	Population trend	Number of households	Electricity access rate
2014	1.953.018								1.953.018	34.856.813	7.416.343	26%
2015	1.953.018	10.549	96.758						2.060.325	35.912.974	7.641.058	27%
2016	1.953.018	21.098	193.515	143.859	66.271	1.083	1.000	74.573	2.454.417	37.001.138	7.872.582	31%
2017	1.953.018	31.647	290.273	287.718	132.542	2.167	2.000	149.146	2.848.510	38.122.272	8.111.122	35%
2018	1.953.018	42.196	387.031	431.577	198.812	3.250	3.000	223.720	3.242.603	39.277.377	8.356.889	39%
2019	1.953.018	52.745	483.788	575.436	430.760	13.813	12.750	577.942	4.100.252	40.467.481	8.610.102	48%
2020	1.953.018	63.294	580.546	719.295	662.708	24.375	22.500	932.165	4.957.900	41.693.646	8.870.989	56%
2021	1.953.018	73.843	677.304	863.154	894.656	34.938	32.250	1.286.387	5.815.549	42.956.964	9.139.779	64%
2022	1.953.018	84.392	774.061	1.007.013	1.126.603	45.500	42.000	1.640.610	6.673.197	44.258.560	9.416.715	71%
2023	1.953.018	84.392	774.061	1.150.872	1.358.551	56.063	51.750	1.994.832	7.423.539	45.599.594	9.702.041	77%
2024	1.953.018	84.392	774.061	1.294.731	1.590.499	66.625	61.500	2.349.055	8.173.881	46.981.262	9.996.013	82%
2025	1.953.018	84.392	774.061	1.438.590	1.822.446	77.188	71.250	2.703.277	8.924.222	48.404.794	10.298.892	87%
2026	1.953.018	84.392	774.061	1.438.590	2.054.394	87.750	81.000	3.057.500	9.530.705	49.871.459	10.610.949	90%
2027	1.953.018	84.392	774.061	1.438.590	2.286.342	98.313	90.750	3.411.723	10.137.188	51.382.564	10.932.460	93%
2028	1.953.018	84.392	774.061	1.438.590	2.518.290	108.875	100.500	3.765.945	10.743.671	52.939.456	11.263.714	95%
2029	1.953.018	84.392	774.061	1.438.590	2.750.237	119.438	110.250	4.120.168	11.350.153	54.543.521	11.605.005	98%
2030	1.953.018	84.392	774.061	1.438.590	2.982.185	130.000	120.000	4.474.390	11.956.636	56.196.190	11.956.636	100%

Table 4.8: Implementation plan to achieve universal access to electricity for households

Figure 4.4 highlights for each year the number of households with access to electricity and the total number of households towards 2030.

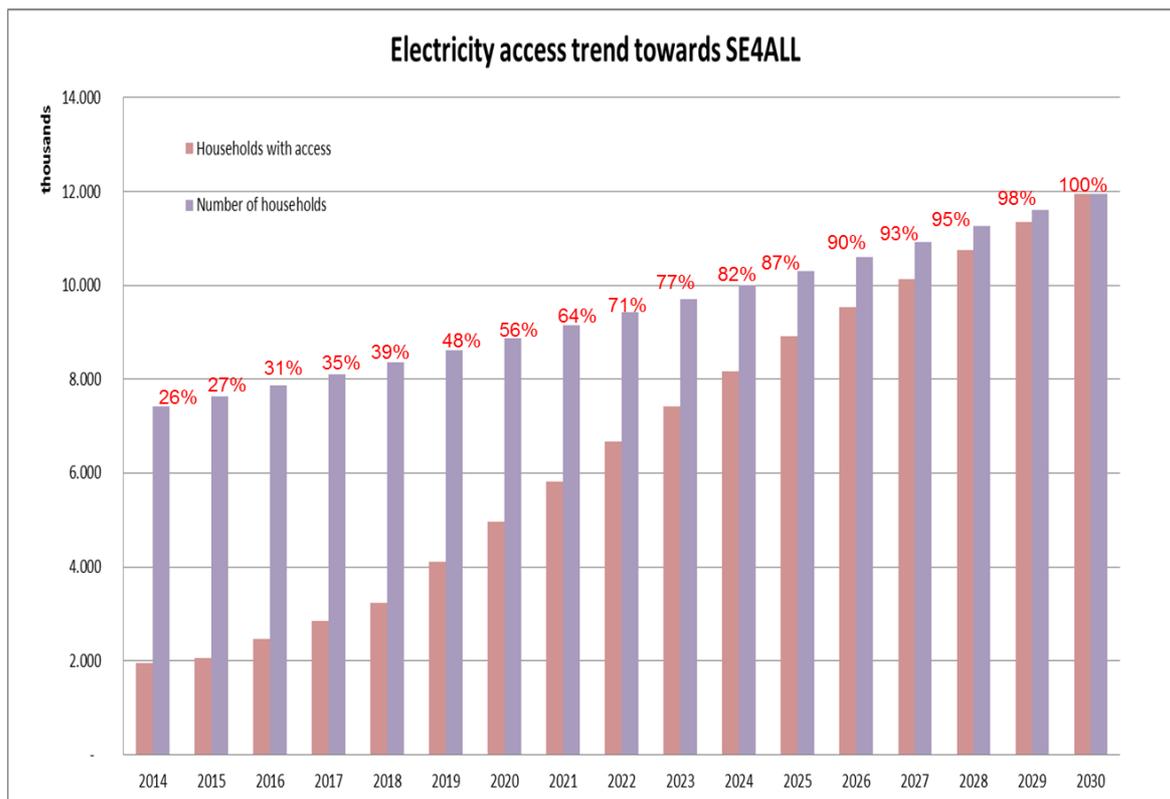


Figure 4.4: Electricity access trend in Uganda 2015-2030

4.1.3.2. Universal Access – Clean Cooking

Uganda's strategic approach to modern cooking appliances and fuels relies on UNACC's integrated approach to clean cooking in Uganda. UNACC's strategic goals are⁶⁰:

- Enhance demand by understanding and motivating potential users, developing better and more technology, providing consumer finance and creating innovative distribution models to reach remote consumers;
- Strengthen supply by attracting finance and investment, accessing carbon finance, enhancing market intelligence and creating inclusive value-chains;
- Foster an enabling environment by engaging national and local stakeholders, building the evidence base for the benefits of stoves, promoting international standards and rigorous testing protocols and enhancing monitoring and evaluation.

Actions suggested to reach universal access to clean cookstoves for households include:

- Dissemination of one million LPG stoves for households to support ULPGAS's objective
- A domestic biogas project targeting 60,000 rural households areas,
- A new clean cookstoves project targeting 5,361,626 households by 2030, in average 357,442 households per year

Table 4.9 is based on the commitment assumed by UNACC with the GACC⁶¹ of reaching 5 million households with clean and efficient cookstoves by 2020⁶². It shows the level of access growing from 8.2% in 2014 to 100% in 2030 and the needed contributing interventions.

⁶⁰ UNACC's 2013 – 2022 Strategic Plan.

⁶¹ Which is consistent with the SE4ALL's Universal Adoption of Clean Cooking Solutions HIO

⁶² 2012 Baseline is based on documentation from UNACC's related to its business and action plans. The trajectory may change once UNACC adopts the implementation strategy for its action plan.

	Current situation	UNACC Project	Domestic biogas	LPG cookstoves now	LPG cookstoves new	New added clean wood stoves	Households using ICS	Population trend	Number of households	Level of access
2014	500.000	90.000		35.000			625.000	34.856.813	7.416.343	8,4%
2015	500.000	818.333		35.000	25.000		1.378.333	35.912.974	7.641.058	18,0%
2016	500.000	1.726.667	4.000	35.000	50.000	100.000	2.415.667	37.001.138	7.872.582	30,7%
2017	500.000	2.545.000	8.000	35.000	75.000	250.000	3.413.000	38.122.272	8.111.122	42,1%
2018	500.000	3.363.333	12.000	35.000	100.000	450.000	4.460.333	39.277.377	8.356.889	53,4%
2019	500.000	4.181.667	16.000	35.000	175.000	859.303	5.766.970	40.467.481	8.610.102	67,0%
2020	500.000	5.000.000	20.000	35.000	250.000	1.268.606	7.073.606	41.693.646	8.870.989	79,7%
2021	500.000	5.000.000	24.000	35.000	325.000	1.677.909	7.561.909	42.956.964	9.139.779	82,7%
2022	500.000	5.000.000	28.000	35.000	400.000	2.087.212	8.050.212	44.258.560	9.416.715	85,5%
2023	500.000	5.000.000	32.000	35.000	475.000	2.496.515	8.538.515	45.599.594	9.702.041	88,0%
2024	500.000	5.000.000	36.000	35.000	550.000	2.905.818	9.026.818	46.981.262	9.996.013	90,3%
2025	500.000	5.000.000	40.000	35.000	625.000	3.315.121	9.515.121	48.404.794	10.298.892	92,4%
2026	500.000	5.000.000	44.000	35.000	700.000	3.724.424	10.003.424	49.871.459	10.610.949	94,3%
2027	500.000	5.000.000	48.000	35.000	775.000	4.133.727	10.491.727	51.382.564	10.932.460	96,0%
2028	500.000	5.000.000	52.000	35.000	850.000	4.543.030	10.980.030	52.939.456	11.263.714	97,5%
2029	500.000	5.000.000	56.000	35.000	925.000	4.952.333	11.468.333	54.543.521	11.605.005	98,8%
2030	500.000	5.000.000	60.000	35.000	1.000.000	5.361.636	11.956.636	56.196.190	11.956.636	100,0%

Table 4.9: Implementation plan to achieve universal access to clean cooking for households

Considering the lifespan of domestic improved wood/charcoal cookstoves between 2 and 3 years, the Ugandan market can be estimated at 20.2 million units towards 2030, thus a need to produce 1.35 million clean cookstoves annually.

Additional initiatives targeting institutions (e.g. schools, health centers) and commercial enterprises (hotels, restaurants, etc.) are under energy efficiency.

4.1.4. Other issues concerning energy access

- Innovative Finance, to support financial closure and financing access to energy services and clean cookstoves
 - Develop financing schemes to provide credit to households that cannot afford the upfront costs of accessing modern energy services;
 - Provide regulatory support for scalable and sustainable business and financial models;
- *Access Acceleration Strategy*⁶³. The concept behind this new policies strategy is to bring energy solutions to communities and farms that may not be reached by the grid expansion and densification strategy for at least the next 10 years. This strategy should be designed by MEMD in partnership with private sector stakeholders and CSOs, and might have the following characteristics:
 - User based solutions. Based on interacting and surveying of the target users, defines the need, the willingness and the financial affordability of users.
 - Energy services and adequate technologies. The energy services approach is one that goes beyond the most evident need, and truly serves basic needs of the user, like electricity and water, as well as productive and community service needs. Services should be driven by a technology that is commercially ready, affordable and adequate for the solution that is pursued.

⁶³ Three initial programs are included under Distributed Energy Solutions below

- Adaptive business and financing models. Based on a review of business and financial models that have been experienced in Sub Saharan Africa and Best Practices from the developing world, a basket of business and financial models will be integrated into a guide to develop and invest in sustainable decentralized projects in Uganda.
- *Improving the structure of the energy sector.*⁶⁴ The goal of this strategy is to improve the interaction with all stakeholders, including donors and civil society. The SE4ALL Secretariat will lead efforts in support of private sector organization and within national and District Government institutions to organise and improve how the sector operates. Suggested sample initiatives are:
 - MEMD to take a pro-active role in support the acceleration of the organization and services by UNREEEA, as an umbrella of all private sector and NGOs working in the renewable energy sector;
 - As Chair of UNACC, MEMD to drive the implementation of UNACC's action plan and the coordination of efforts among all stakeholders to consolidate and accelerate the transition towards clean cooking.
- *Human and Institutional Capacity building:* The challenge that MEMD and other public agencies have is the limited number of personnel, which currently has a greater impact over institutional capacity and efficiency, than the need to improve human capital. Sample initiatives may be:
 - Training and Capacity Building of financial institutions to better understand the risks and how to better assist the development of private sector and community based energy projects;
 - Support activities to accelerate rural electricity connections) by providing capacity building to District Governments to improve their energy planning capacity.
- *Design and Implement Uganda's SE4ALL Access to Modern Energy Investment Prospectus.* Under the supervision of the SE4ALL Secretariat, the prospectus should:
 - Define an inventory of programs and develop the concept and assess funding needs and gaps;
 - Develop the portfolio of investment and funding needed for the inventory of programs;
 - Define matchmaking/identification of multi-stakeholders that will partner with each program
 - Design the resource mobilization strategy and implementation of the prospectus.

4.2. Renewable Energy

4.2.1. Current Status and Trajectory

Uganda has a substantial renewable energy potential capacity. Hydro and biomass are the main energy sources that, if exploited sustainably, could cover the energy needs of the country in the long term. Apart from the estimated electrical potential of biomass, the latter could as well be used as a cooking fuel. Furthermore, due to their maturity, the above-mentioned technologies are amongst the most economical technologies. Other technologies – solar, wind and geothermal – are at their initial stage. They are currently under investigation. Piloting projects in solar and wind are about to be initiated. Though the GoU shows strong interest in geothermal, no pilot project has yet been developed.

Uganda relies now largely on renewable energy resources. From the 855 MW installed capacity, 630 MW is from large hydropower (Nalubaale, Kiira and Bujagali), 65.84 MW is mini-hydropower, 51 MW is cogeneration and only 136 MW is from HFO fired plants. Currently, generation projects are set to add 1,888 MW of primarily clean energy installed capacity by 2030.

The PSIP and the REIP are supported by a series of inter-related studies combining different energy sources, comprising forecasting of the demand for electricity, development of the least cost generation, transmission and distribution plans that are required to reliably serve the demand and the costing, timing and financing plan for the generation, transmission and distribution projects — with a view to establish a long-term and integrated development strategy for Uganda's power sector since 2011. Yet, these studies fall short

⁶⁴ Energy information is vital and is addressed under Risks

of providing a resource assessment and potential of key renewable resources like wind, solar and geothermal.

4.2.2. Existing plans and strategies

4.2.2.1. Renewable Energy Strategy

The overall objective of the 2007 Renewable Energy Policy was to diversify the energy supply sources and technologies in the country. In particular, the policy goal was set to increase the use of modern renewable energy from 4% to 61% of the total energy consumption by the year 2017, with special focus on following areas⁶⁵:

- Create more favourable business environment with appropriately refreshed policies, regulations and energy plans;
- Establish an appropriate financing and fiscal policy framework for RET investments;
- Mainstream poverty eradication, equitable distribution, social services and gender issues in renewable energy strategies;
- Acquire and disseminate information in order to raise public awareness and attract investments in renewable energy sources and technologies;
- Promote research and development international cooperation, technology transfer and adoption and standards in renewable energy technologies
- Utilize biomass energy efficiently, so that it contributes to the management of the resource in a sustainable manner;
- Promote the sustainable production and utilization of biofuels;
- Promote the conversion of municipal and industrial waste to energy.

Since the inception of this strategy, Uganda accomplished the following:

- Standardized PPA and Implementation Agreement for hydro, bagasse, biomass and solar PV have been developed or are being finalized;
- RE-FIT and GET-FIT, implementation of a very successful Feed-In-Tariff Program which is expected to drive additional small renewable generation between 2014 and 2023;
- A Renewable Energy investment Plan, that has set the GoU priorities;
- Series of R&D studies on biofuels and other technologies;
- The Biomass Energy Strategy.

4.2.2.2. Biomass Energy Strategy (BEST)

In an effort to improve the enabling environment of the biomass sector and to define a way forward, the MEMD developed the Biomass Energy Strategy (BEST) 2013. BEST is based on the following six pillars:

- Specially targeted Awareness Creation
- Creation of a Biomass Resource Information System
- Enhanced Institutional Capacity to implement BEST
- Biomass demand Interventions
- Biomass Supply Interventions
- Cross cutting Issues such as innovative funding mechanisms to support disseminating improved biomass technologies.

4.2.2.3. Adoption of Improved Charcoal Production Technologies and Sustainable Land Management Practices

The UNDP/GEF funded "Addressing Barriers to Adoption of Improved Charcoal Production Technologies and Sustainable Land Management Practices" through an Integrated Approach project (2014 – 2018), looks to overcome the main barriers to transforming the current charcoal production practices into a sustainable one:

- Data collection and improved coordination and enforcement of regulations governing the biomass energy sector, in particular those related to sustainable charcoal.

⁶⁵ The Renewable Energy Policy for Uganda, MEMD 2007

- Dissemination of appropriate technologies for sustainable charcoal production in 4 selected charcoal-producing districts (Mubende, Kiboga, Nakaseke and Kiryandongo).
- Strengthening the capacity of key stakeholders in SFM and SLM best practices and establishment of sustainable woodlots.

4.2.2.4. Biomass Energy Technologies

Programmes have been undertaken in dissemination of improved Biomass Energy Technologies (BETs). To address the BETs dissemination, the GoU, in collaboration with GIZ formed the Uganda Biomass Energy Efficient Technologies Association (BEETA), as an umbrella body to enhance technology diffusion. Several initiatives have been undertaken with other development partners including UNDP targeting various aspects of the biomass sub-sector:

- Sustainable charcoal production and licensing systems in 2 charcoal producing districts;
- 28 enterprises equipped with skills in biomass energy technologies production;
- Organizing countrywide campaigns through events like annual Energy Efficiency Week;
- Support domestic biogas project to disseminate 1600 digesters;
- Registration of 8 biogas construction companies registered;
- Development of Draft legislation on biofuel blending with fossil fuels;
- Charcoal production improvement project supported by GEF

4.2.2.5. UECCC Support for Renewable Energy

- *The Connection Loan Refinance Facility.* In partnership with Centenary Bank and West Nile Rural Electrification Company (WENRECo), UECCC has put in place a Power Connection Loan facility to enable residents and businesses in West Nile region (Arua, Nebbi, Koboko, Packwach, Angal, Parombo, Panyimur, Nyapea, Warr, Zeu, and Zombo) to get access to electricity from WENRECo's 3.5 MW Nyagak Hydro Power plant. The objective of the Power Connection Loan is to ease access to electricity through addressing the affordability barrier arising from the upfront electricity connection costs, which include wiring of premises, conversions from diesel-powered to hydro-power connections, poles and the connection fee charged by the utility.
- *Solar Refinance Facility.* Through funding support from the World Bank under the Energy for Rural Transformation Project (ERT), UECCC currently extends concessional financing to Micro lending Participating Financial Institutions (PFIs) for on-lending in the form of Solar Loans for Domestic and Commercial Solar System acquisition. The objective of the Solar Loan Facility is to ease access to electricity in off grid areas through addressing the affordability barrier arising from the upfront costs of solar system acquisition. PFIs presently participating under this programme include: Centenary Bank at US \$250,000, Post Bank – US \$250,000, Pride Microfinance- US \$ 300,000 and Finance Trust Bank at US \$250,000.

In addition to the above efforts through PFIs, UECCC intends to selectively intervene through Solar Vendors who operate the hybrid model of both sales and lending. Such examples include Solar Now Ltd a Company with an outreach model which stocks, vends and administers a Micro finance Loan programme.

- *Transaction Advisory Services and other early stage support.* UECCC provides support for power generation project developers through an Early Stage Support programme funded by KfW. The objective of the Early Stage Support programme is to unlock projects that show high potential to move to an advanced level of project development and financial closure. The current support menu includes: Full Pre-feasibility Study, Technical Evaluation of Milestone project studies, Technical Validation of Environmental and Social Impact Statements and Resettlement Action Plan, Statements (RAP), Assistance in filling potential gaps in ESIA and RAP studies to bring projects in conformity with International best practices (e.g. World Bank/IFC Safeguards), Business Plan Development, Financial / Economic Modelling, Market and Risk Assessment, Marketing Projects to UECCC Participating Financial Institutions and other equity investors, and Valuing of Projects for sale.

4.2.3. Existing Gaps

Renewable energy issues in Uganda are not related to a low contribution to the energy mix, but rather a limited diversification among renewable energy technologies in the portfolio of power plants. Lack of diversification can be explained by the fact that Uganda has been blessed with hydro resources that are manageable.

The challenge is to increase the mix of renewable energy technologies, which faces the following constraints:

- Sector specific issues
 - No RET Data Base and technology vendors;
 - No RE resource assessments and mapping to support investment promotion, decision making and energy planning;
 - Limited diversification on policies to address specific issues and challenges associated to the different renewable energy technologies;
 - The implementation of the 2007 renewable energy policy has not been able to achieve the targets set for 2012, and most likely will miss the targets set for 2017.
- Investment incentives
 - High dependency on the RE-FIT/GET-FIT program, with no diversification or phase out options in the near future.
 - While standardization of PPAs and licensing procedures has been in place, there is still a need to further streamline permitting and licensing processes to accelerate investments in, and operations of, medium and small scale renewable electricity projects
- Private Sector Driven Projects. The private sector in Uganda is increasingly expanding its role in the power sector. The RE-FIT and GET-FIT programs, as well as the institutionalization process of UNACC and the trade associations that represent diverse aspects and technologies of the renewable energy sector have accelerated this. While those developers with signed PPAs are identified, there are numerous organizations that have already deployed solutions, mainly decentralized generation and distribution, but are not currently counted or integrated as part of the energy sector as a whole.
- UECCC's program in support of renewable energy have financial gaps that need to be addressed, before they can work in expanding their financial support to vendors and developers:
 - The Connection Loan Refinance Facility. Implementation support to the Participating Financial Institutions towards product development and initial marketing strategy. Funding requirement for this is estimated at US \$300,000
 - Solar Refinance Facility. UECCC intends to support two such Solar Vendors with revolving working capital facilities of UGX 3.0 Billion (US\$1,160,000) each repayable in 24 months and available for redrawing for subsequent tenor of 24 months. For each of the two (2) Solar Vendors, the proposed facilities will enable on-lending for 6,000 systems each over a 48-month period. Altogether, the targeted systems will be 12,000 systems over the 48-month period. The funding Gap for the proposed on-lending to the 2 Solar vendors works out at UGX 3.0 billion (US\$ 2,320,000)
 - Transaction Advisory Services and other support - The Early Stage Support. UECCC would like to develop a revolving feasibility Study Fund to support deserving power generation projects. It is proposed that the revolving fund is started with initial capital to support at least five (5) mini hydropower projects. At an assumed full feasibility study cost of US\$ 400,000 each, this works that the required funding to facilitate the start-up of the Revolving Fund is US \$2,000,000.

4.2.4. Actions needed to achieve the overarching objective of renewable energy

The second SE4ALL objective is primarily to double the share of RE in the country's energy mix by 2030. In Uganda, the thermal process depends heavily on the non-sustainable use of biomass, which is responsible for over 89.9% of the energy generated in the country. In contrast, renewable energy dominates the

country's power sector. The baseline for power generation is based on the installed capacity as of 2013, which is 80.5% hydropower, 2.5% cogeneration and 17% thermal (HFO/Diesel)^{66, 67}. The baseline for consumption of renewable energy resources for thermal applications is based UNFCCC's default value of Non-Renewable Biomass for Uganda, as presented in the 2013 Uganda's Charcoal NAMA.

Under the base case scenario, where on-grid is the main driver for access to power, the PSIP shows that the predominance of renewable energy in the power generation mix will be reduced by the introduction of new thermal capacity using the existing reserves of oil and gas in Uganda. Therefore, maintaining and increasing the use of renewable resources for power generation mix is being considered under the framework of the new policies scenario, when off-grid is the main driver for universal access.

Under the new policies scenario, following action areas can be suggested:

- **grid connected RE based power plants in collaboration with UETCL or UMEME depending on the generation capacity and the feeding station on existing and future grid.**
 - Licenses have been awarded for 4 Solar PV plants, each with a rated capacity of 5 MWp. Under GET-FIT as well, other small scale renewable energy projects with a total capacity of 115 MW will be gradually connected to the grid between 2016 and 2017.
 - Table 4.10 shows large hydroelectric projects that have been identified in the National Power Development Plan. By successful completion of the plan by 2030, 2,410 MW will be added on the grid and the expected electricity generation will vary between 9,643 and 12,050 GWh.

Large Hydroelectric plants	installed capacity [MW]	expected electricity generated [GWh]		expected date
Karuma	600	2400	3000	2018
Isimba	180	720	900	1st unit 2017
Oriang	450	1800	2250	2020
Kiba	340	1360	1700	2026
Ayago	840	3360	4200	2020
Total	2410	9640	12050	

Table 4.10: Prospects for large hydroelectric plants in Uganda

- Many small and medium hydropower projects have been identified and are at various stages of development. Some have completed the feasibility study and are in the process of negotiating PPA and licensing and PPA (Table 4.11). They total an installed capacity of about 30 MW and are expected to be connected between 2016 and 2020. In the second group, with an estimated total capacity of 49.4 MW, projects are still at the feasibility stage (table 4.12) and are expected to be connected before 2020.

⁶⁶ MEMD, Uganda Energy balance (Heat and power) for the period 2009-2012

⁶⁷ Uganda's Energy balance 2012, MEMD

Project name	Project developer	District	capacity	Location	expected date
Nyamwamba hydro Power Project GET-FIT	South Asia Energy Management Systems LLC	Kasese District	9.2MW	Nyamwamba	2016-2019
Rwimi Hydro Power Project GET-FIT	Rwimi EP Company Limited	Kasese District	5.5MW	Rwimi	2016-2019
Nyakizumba Hydro Power plant	Muvumbe Hydro (U) Limited	Kabale District	5.4MW	Nyakizumba/ Maziba	2016-2019
Lubilia Hpp GET-FIT	LubiliaKawembe Hydro Limited	Kasese District	5.4MW	Lubilia	2016-2019
Kakaka HPP	Greenewus Energy Africa Ltd	Kasese District	5.0MW	Rwimi	2016-2019
Nkusi Hpp	PA Technical Services	Kibale District	9.6MW	Nkusi	2016-2019
Nyabuhuka-Mujumbi Hpp	PA Technical Services	Kabarole-Forpotal	3.4MW	Nyabuhuka	2016-2019
Pachwa Hpp	Flow Power-1	Kibale	1.3Mw	Nkusi	2016-2019
Siti 1 HPP GET-FIT	Elgon Hydro Siti (Pvt) Limited	Bukwo District	5.0MW	Siti	2016-2019
Waki Hydro Power Plant GET-FIT	Hydromax (Nkusi) Limited	Hoima&Buliisa Districts	4.8MW	Waki	2016-2019
Maziba Power Station	UEGCL	Maziba, Kabale District	6.5MW	Maziba River	2020
Nengo Bridge Hydropower Station GET-FIT	Jacobsen Electro	Nengo-Rukungiri District	6.5 MW	Mirera	2017
Nyagak II Power Station	WENRECO/MEMD	Paidha, Zombo District	5.0 MW	Nyagak	2017

Table 4.11: Small and medium Hydroelectric projects with completed feasibility studies

Nyagak III Power Station	WENRECO/MEMD	Paidha, Zombo District	4.4 MW	Nyagak	2018-2020
Bukwa HPP	C&G Andijes Uganda Ltd	Bukwo District	9.0MW	Bukwa	2018-2020
Ngoromwo HPP	Ngoromwo Small Hydro Limited	Kapchorwa District	8.0MW	Atari	2018-2020
Sironko HPP	Eco clean Power	Sironko District	7.0MW	Sironko	2018-2020
Keere Small HPP	Keere Power Company Limited	Kween District	6.3MW	Keere	2018-2020
Sindoro HPP	Butama Hydro Electricity Company Ltd	Bundibugyo District	5.6MW	Sindoro	2018-2020
Nyabuhuka -Mujunju HPP	Network Civil Engineering Contractors Ltd	Kabarole District	3.2MW	Yerya	2018-2020
Muyembe-Sirimityo HPP	Mt. Elgon Hydropower Co	Sironko District	3.1MW	Muyembe	2018-2020
Mahoma HPP	Mahoma Uganda Limited	Kabarole District	3.0MW	Mahoma	2018-2020
Nyamabuye HPP	Elemental Energy Limited	Kisoro District	2.2MW	Kaku	2018-2020
Cresta Mini Hydro Power	Cresta Hydropower Limited	Rubirizi District	2.0MW	Buhindagi	2018-2020

Table 4.12: Small and medium hydroelectric projects undergoing feasibility studies

- **Geothermal power generation opportunities**
 - Uganda's geothermal resources show 4 major sites (Baranga, Katwe, Kibiro, Panyimur) and 24 other sites⁶⁸ with an estimated potential of 450 MW. The most advanced and promising project is the KATWE geothermal power project in Kasese District, whose estimated capacity may

⁶⁸ Vincent Kato, Development and investment opportunities in geothermal energy in Uganda, Power Africa Conference September 2014

reach 150 MW. A MoU has been signed between GoU and project developers, a consortium of a local IPP (KGPPL) and AAE Systems. Pre-feasibility studies have been completed and a non-financial PPA has been signed⁶⁹. The absence of a specific legal and policy framework for geothermal energy is stalling project development.

- **Off-grid RE power generation for mini/micro-grids**
 - PV powered mini and micro-grids have been suggested under access with installed capacity reaching by 2030 :
 - 26-30 MWp, targeting villages with 500 to 1000 households,
 - as well as 36-60 MWp, targeting villages with 100 to 200 households in the neighborhood of mobile communication base stations.
 - Small and micro hydroprojects under prefeasibility studies (table 4.13) could be considered for off-grid electrification. The installed capacity is estimated at 4.8 MW
- **Solar PV for lighting and water pumping in schools, health centres, etc.**
 - 1279 secondary schools get their water from sources that are less than one (1) kilometer away from them while 1559 get water from a source located between 1 and 5 km from them⁷⁰. No information could be found on water availability in 22600 primary schools and 266 post-primary schools registered in 2013. Although the gap could not be precisely calculated, a potential of at least 9,000 solar pumped water facilities in Ugandan schools and health centers, equipped with solar water pumping system, a wellhouse and a 50,000 liters tank. Sizing the PV array could also take into account other electricity need of schools because 30% of schools in urban areas as well as 48% in rural areas do not have access to electricity. In the health sector, these are only 7.7% and 10% respectively.
- **Industrial Biomass cogeneration**
 - Biomass cogeneration from agricultural wastes is seen to hold particular promise as a technology for the country. 3 sugar industries crushed in 2012 2,662,657 tons of cane. Using the ratio of 35% bagasse to cane, the bagasse produced in 2012 was 931,929 tons, which could be used to generate 306 GWh of electricity⁷¹. MEMD reports that cogeneration unit fed only 94 GWh into the grid. Kinyara has got a 14.5 MW facility and has plans to increase it to 35 MW. Kakira has a 3 MW cogeneration plant and a 36 MW plant is under construction.
- **Peat:** a significant peat resource also exists, of which approximately 25 million tons is feasibly available for power generation. Using the best commercial available CFB technology with 16% conversion efficiency, the power generating potential from peat in Uganda would amount to 10,300 GWh. Further investigations need to be done to estimate the capacity to install, depending on the geographical distribution of this resource.
- **Biogas for cooking, lighting (households, institutions) and power generation (industries)**
 - The Renewable Energy policy estimates about 500 functioning biogas plants in the country and over 250,000 zero grazing farming households. These suggest the extent of the potential for small household biogas digesters in the country. The Uganda Domestic Biogas Program 2009-2014 targeted 12 000 biogas installations by 2013. Unfortunately, no report on this project could be assessed. Suggested intervention could be to target 60 000 domestic biogas installations by 2030. This could avoid using 39 ktons of firewood in rural areas as well as provide clean and smoke free cooking gas thus clean cooking environment and reduce indoor air pollution.

The MEMD signed a Memorandum of Understanding (MoU) with Kampala Capital City Authority (KCCA) to set up 10 demonstrational household systems, which will benefit 10 selected urban farmers⁷².

The MEMD has also constructed 10 pilot institutional biogas plants in selected schools, avoiding the use of 210,000 m³ of fuelwood per annum and school. 600 secondary schools were not

⁶⁹ Amanda Lonslade, Multi-Donor Strategy for Geothermal Development in East Africa (draft report), 2014

⁷⁰ Ministry of Education and Sports, Abstracts 2013

⁷¹ Karekezi&Kithyoma in http://www.afrepren.org/adb_finesse/Task%203/Background%20Material/Background%20Material%20-%20Cogeneration.pdf

⁷² Energy Resources Directorate report, May 2015

using biogas in 2013 and 84 were explicitly using wood, charcoal or others. An intervention could consist of installing 600 to 700 institutional biogas plants at schools and health centers.

In addition, commercial dairy farmers and piggeries could support several thousand larger biogas plants to cater for their own thermal and electricity needs.⁷³ Municipal waste, breweries and abattoirs are potential sites for biogas generation and conversion into energy but no feasibility study have been found yet.

- **Solar street lighting program**

- According to UBOS definition in the 2014 population census, Uganda has 197 urban centers including Kampala capital city, municipalities and town councils, the rest of sub-counties belonging to rural areas. The cost of LED based solar street lighting systems is also falling rapidly. Also the fact that they are easy to deploy even by low skilled personnel, makes them suitable for rural areas.

Suggested action may be to deploy by 2030 16760 solar street lights in the 197 urban centres and 47400 in rural sub-counties. We assume hereby that each sub-county will benefit from 40 street lights; equivalent to 1 to 1.5 km. For urban centers, a ratio of 1 pole per 500 inhabitants has been used. The deployment pace will be approximately 4280 per annum. If accomplished, the generated energy will reach 14 GWh in 2030, 0.13% of the projected national electricity consumption.

Based on the implementation of this scenario, table 4.14 shows:

- the total estimated generated electricity towards 2030, amounting to 18800 GWh in 2030
- the contribution of each identified power system
- the share of renewable electricity in Uganda's electricity mix, growing steadily from 90% to 96%
- the estimated electricity demand trend towards 2030 (*base case with high level of exports*) which shows sufficient reserve either to supply unexpected load growth or exports

⁷³ MEMD, Renewable Energy Policy for Uganda,

Data in GWh	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
current generation	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402	3,402
ISIMBA			473	946	946	946	946	946	946	946	946	946	946	946
KARUMA				2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891
ANAGO									4,047	4,047	4,047	4,047	4,047	4,047
ORLANG							2,168	2,168	2,168	2,168	2,168	2,168	2,168	2,168
KIBA												1,638	1,638	1,638
GET-FIT		234	468	702	702	702	702	702	702	702	702	702	702	702
PV On-grid		18	35	35	35	35	35	35	35	35	35	35	35	35
NWAGAK III				24	24	24	24	24	24	24	24	24	24	24
Adawa-Agago										463	463	463	463	463
Muzi							235	235	235	235	235	235	235	235
SHP group1		39	78	117	156	156	156	156	156	156	156	156	156	156
SHP group2				87	173	260	260	260	260	260	260	260	260	260
Mogembe-Simiyu						36	36	36	36	36	36	36	36	36
Latol								22	22	22	22	22	22	22
Okeere						33	33	33	33	33	33	33	33	33
Maziba				6	6	6	6	6	6	6	6	6	6	6
PV mini-grid			5	11	16	22	27	33	38	44	49	55	60	60
PV micro-grid		11	21	32	43	54	64	75	86	97	107	118	129	129
Off-grid SHS		11		32	43	54	64	75	86	97	107	118	129	129
PV street lights				1	1	1	1	1	2	2	2	2	2	2
Cogeneration			51	51	51	51	51	101	101	101	101	101	101	101
HomeAG PP					307	307	307	307	307	307	307	307	307	307
Diesel/HFO						88	88	88	175	175	175	175	175	175
KATIF-geothermal									138	138	138	138	138	138
Demand trend	3,271	3,533	3,805	4,121	4,451	4,807	5,191	5,607	6,055	6,540	7,063	7,638	8,238	8,838

Table 4.14

Figure 4.5 shows that by implementation of the new policy scenario, the country's installed capacity will reach 4,169 MW, of which at least 3,250 MW is on-grid, far beyond the expected peak demand (1873 MW in the base case and 2722 MW for high case scenario) in 2030.

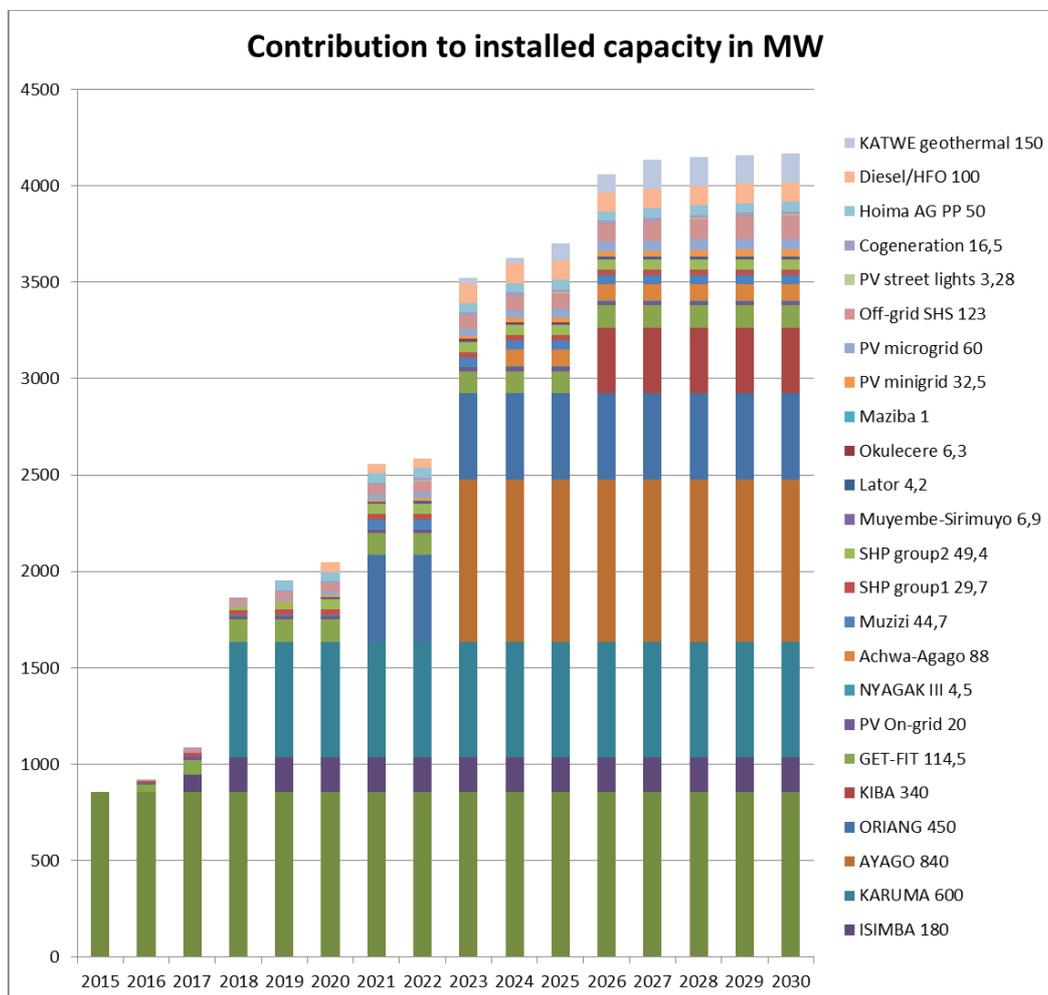


Figure 4.5: Trend of power generating installed capacity in Uganda towards 2030

Figure 4.6 depicts the information in table 4.14 whereby capacity factor were assumed:

- large hydro power plants: 55 – 60%
- small hydro power plants: 60 – 65%
- PV mini-grids: 25%
- PV micro-grids: 40%
- Cogeneration: 70%
- Hoima Associated Gas Power plant: 70%
- Geothermal: 60%
- Solar Home Systems: 15%
- PV street lights: 10%
- Diesel/HFO power plants: 20%

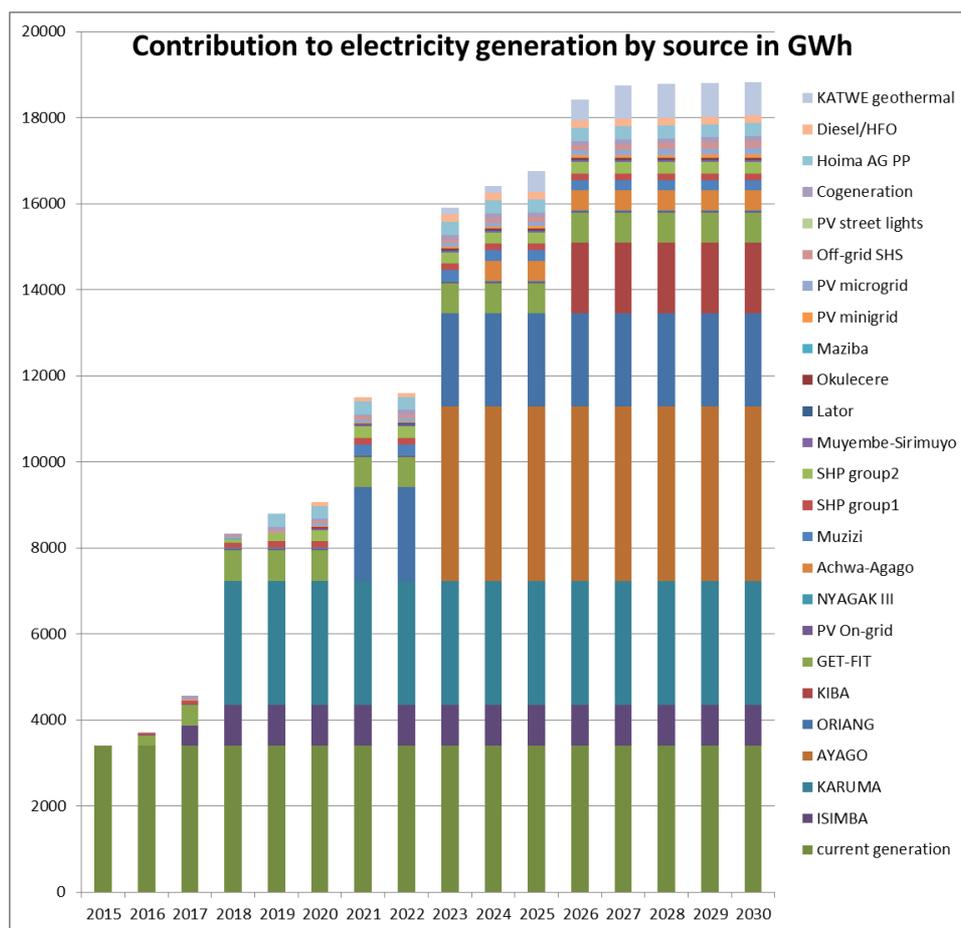


Figure 4.6: Trend of power generation in Uganda towards 2030

4.2.5. HIOs and Other issues concerning renewable energy development

- *Improve market data for planning and investment purposes at MEMD*
 - *RET Data Base and technology vendors.* This database should integrate information of vendors of technologies, systems and solutions by type of technology and service provided
 - *Biomass Information System (BIS).* The major purposes of the information system are to: (i) Keep track of the new biomass energy technologies and their success rates; (ii) Support continuous updating of the strategy; and (iii) Provide timely information for decision making and planning.
 - *Renewable Energy Resource System (RERS).* Will be the umbrella for the different renewable energy resources assessment and mapping, in order to confirm the potential of specific sites and accelerate project development by the private sector. This database may also be linked to or use the resources available under SE4ALL renewable energy hub at IRENA.
- *Investment Incentives.* Working together across Government Agencies and key stakeholders, the GoU will update and expand incentives, and limit subsidies by:
 - Developing a basket of investment incentive schemes to complement RE-FIT/GET-FIT program and develop a post-FIT program that is cost reflective and provides adequate investment incentives;
 - Providing TA to support the streamlining of regulatory requirements to accelerate investments in, and operations of, medium and small scale renewable electricity IPP projects;
 - Developing a guarantee program through UECCC, to lower financial risk and increase the

rate of financial closure of renewable energy projects under 20MW.

- Following the guidelines of BEST, the Biomass Energy Dialogue should continue to foster a number of innovative funding mechanisms such as grants, challenge funds and carbon credits. After attaining a dissemination of certain critical mass in terms of number of units and assemblers / manufacturers, the renewable energy industry, with the support of MEMD and other stakeholders, can become self-sustaining and subsidies can be gradually withdrawn without any adverse effects on continued dissemination of renewable energy technologies.
- *Knowledge Sharing and Awareness.* MEMD to develop a communication strategy for: (i) Fostering a common understanding and appreciation of Renewable Energy among the multiple actors in each renewable energy sub-sector; (ii) Making basic resource and technology information public through regular information dissemination, exchange and sharing; (iii) Engaging and promoting communication synergies with key stakeholders in the Renewable Energy sector.
- *Design and Implement Uganda's SE4ALL Renewable Energy Investment Prospectus*
 - Define program inventory of programs and develop beyond concept and assess funding needs and gaps
 - Develop the portfolio of investment and funding needed for the inventory of programs
 - Define matchmaking/identification of multi-stakeholders that will partner with each program
 - Design the resource mobilization strategy and implementation of the prospectus

To accelerate the deployment of all renewable technologies, Uganda would develop a technology strategy for renewable energy generation (TS4REG). The goal of this toolkit is to provide developers and investors of key information that will streamline the development of IPPs, especially small-scale renewables, and program framework where they can properly assess the risks, investment and operational costs and the return on investment on their project. TS4REG will also be a valuable input in a review and update process of the 2007 renewable energy policy and its REIP. The TS4REG may comprise the following:

- *National Solar Program.* This effort should be guided by current information on high potential areas to focus resources and maximize results, especially to support the development of a:
 - Comprehensive strategy for solar water heating for residential and commercial uses;
 - Develop a SHA strategy in support of interventions implemented by RESP and ERT III, Ministry of Health and Ministry of Education;
 - Identify and assess prime sites for solar farms to be connected to mini-grids and to the national grid.

To design this program, MEMD will undertake a survey to verify the average data in different regions of Uganda, to assess the best suitable sites, by using technical and non-technical criteria. This assessment should provide a balance approach for both on and off grid project prospects in high potential areas.

- *National Mini-Hydro Program.* A study of Uganda's river basins will identify and assess mini and small hydro potential (<20MW). This inventory of sites will allow developing a portfolio and prospectus of potential projects to be carried out by developers, investors or communities; to develop a comprehensive strategy for developing the Mini and Small Hydro Sector, especially for off-grid solutions and for transitional programs.
- *National Geothermal Program.* Expand geothermal assessments beyond Katwe, Buranga and Kibiro in west Uganda into other areas with potential due to their volcanic and tectonic features. MEMD will continue developing strategy for growing the Geothermal sector
- *National Wind Program.* Undertake a reconnaissance survey through metrological stations to assess the best sites to be used to install the equipment to undertake wind measurements. This effort should be guided by current information on high potential areas to focus resources and maximize results; develop a comprehensive strategy for wind farms

4.3 Energy Efficiency

4.3.1 Current Status and Trajectory

Legislation

Uganda has drafted an Energy Efficiency Strategy for 2010-2020 but requires the enactment of the EECB before its implementation. The Strategy is strongly programmed and activity oriented, categorizing the five main areas of intervention into *'Pillars' of Energy Efficiency*:

- Awareness & Information
- Training & Education
- Research and Development
- Financing and incentives
- Legislation & Framework

The Strategy determines appropriate program and for each of the targeted sectors (households and institutions, industry and commerce, transport, and power transmission and distribution) to achieve the Strategy's objectives, as well as horizontal activities needed for effective implementation of sector related activities, so called cross-cutting activities. The Energy Efficiency and Conservation bill has been drafted and shared with the top management of the Ministry for endorsement. These are to be tabled before Cabinet and Parliament for the next financial year's budget approval. The Bill and associated regulations are intended to provide the legal basis required for the elaboration and enforcement of the national policy targeting the efficient use of energy and a reduction in the waste of limited energy resources.

Minimum Energy Performance Standards (MEPS) have been developed for 5 appliances, which include refrigerators, air conditioners, motors, Lighting appliances, and freezers. Challenges include a lack of personnel to enforce these standards and regulations, unavailable financing for this intervention and a lack of testing equipment.

Energy Audits in the Industrial sub sector: MEMD with the support of GIZ is implementing an energy efficiency and management program for high energy consuming facilities. The objective of this program is to support high energy intensive facilities reduce their energy consumption. The key activities of the program will include:

- Baseline survey regarding energy consumption and production,
- Energy audits to identify energy saving opportunities,
- Training on energy management for key facility staff and
- Sensitization on the ISO 50001 – Energy Management Standard requirements and its implementation.

In the past, MEMD has offered support to small scale Industries/Enterprises and Institutions, medium and large scale Industries to implement energy audits, which identifies areas of EE improvement and potential energy savings.

Capacity Building for SMEs: In support of SMEs, MEMD has implemented the following activities:

- Training of Trainers (ToTs) and Hands-on Training and Identification of energy saving opportunities in SMEs;
- Support Implementation Phase, where the SMEs are guided in implementing energy efficient measures, Monitoring and Evaluation of the programme; Certificate award, energy efficiency, for the best performing enterprises

Capacity Building of Energy Auditors: MEMD and GIZ PREEEP conducted an Energy Management and Audit training program for staff in high energy consuming industries, hotels and energy consulting firms. The training comprised theoretical training modules and hands-on training in selected industries. The training objectives included:

- To enhance the capacity of staff responsible for energy as well as Consulting Engineers/Firms to develop and undertake sustainable & high-quality energy audits and energy management programs for industrial, institutional and commercial facilities.

- To sensitize staff in charge of energy in industry and high-energy consumption enterprises on measures to conserve energy through adoption of energy management techniques

Awareness Campaigns: Increased awareness of energy efficient best practices and technologies is a key aspect in achieving SE4ALL goals. MEMD carries out public awareness on energy efficiency through a number of activities such as media campaigns, events and the dissemination of materials to promote energy efficiency and conservation. While substantive progress has been made, there is a great need for a consistent awareness and sensitisation campaign in the country and this requires human, institutional and financial resources. One of the most successful campaigns to date has been the Energy Week which started in 2005 following the acute electricity supply shortage which the country faced due to drought, delayed construction of Bujagali Hydropower Project and limited investments in the energy sector. The Energy Week is one of the measures aiming sensitizing Ugandans on the efficient utilization of energy. Key activities include; energy exhibition, workshops, mass media campaigns, awareness materials, dissemination. A combined UBOS-MEMD survey revealed that only 9% of Ugandan households have been sensitized on energy efficiency. Of these households, 80% adopted energy saving technologies⁷⁴. This suggests how awareness raising campaigns among Ugandans combined with a dissemination program of energy saving appliances can be successful. ARE allowed UMEME to procure and distribute 1,000,000 LED lamps as a way of reducing energy demand by replacing CFLs and incandescent lamps.

Power transmission and distribution losses: UMEME has significantly improved his distribution grid reducing distribution losses from 26% (Table XX) to 21.3% in 2014. Target for 2015 is to further reduce at 18.3%. Specific investments should target the rehabilitation of the distribution grid in urban and sub-urban areas and intensification to connect more customers. Keeping the losses by 15% (international standard is 10% for technical losses) by 2030 would result in a saving potential of approximately 300 GWh, equivalent to 50% of 2014 domestic consumption, and subsequently in reduced investment needs for generation.

Transmission		
UECTL power purchases	2856,85	GWh
UECTL power sales	2744,15	GWh
UECTL losses	3,9%	
Distribution		
UMEME power purchases	2624,82	GWh
UMEME power sales	1938,01	GWh
UMEME losses	26,2%	

Table 4.15 Transmission and distribution losses in 2012

4.3.2. Existing plans/strategies

Energy Management in Industrial, Commercial, Agricultural sector, Households, Institutions & and Transport sector

- The GIZ-MEMD program envisages energy audits in 50 energy intensive industries (2015-2017) which are part of the 100 top electrical energy consumers. Seven (7) audits are supposed to be completed by June 2015 and eight (8) more audits have been planned to take place in the second half of 2015⁷⁵
- By implementation of the Energy Efficiency and Energy conservation Strategy, support will be given to Households, Institutions and Transport sector towards energy efficient investments.

⁷⁴ MEMD, UBOS. Uganda rural-urban electrification survey, 2012.

⁷⁵ Interview of GIZ technical officer

- A Sustainable Energy Management program in Industries plans also to hold Energy Awards every year.
- 31 prisons out of 100 have acquired 38 institutional rocket stoves and matching saucepans with the financial support of GIZ, resulting in reducing fuelwood intensity from 250 to 125 kg/inmates/year. Prisons department has a plan to equip the remaining prison units with energy saving stoves⁷⁶.

Financial Support for Energy Efficiency Programs: The French Development Agency is implementing SUNREF East Africa in Kenya and Tanzania. This program, which has not started in Uganda yet, aims at providing low interest loans to support investments in Energy Efficiency and renewable energy projects developed by the private sector. Similar programs need to be developed on a larger scale and include grants to conduct Energy Audits.

Regulation and Legislative Framework

- Technical regulation, legislation and statistics
 - Preparation and Implementation of the Associated Regulations.
 - Acquisition of Testing Equipment to Enforce EESL
 - Development and Implementation of Energy Efficiency Standards and Labels (EESL)

4.3.3. Existing Gaps

The GoU has implemented some initiatives in the area of Energy Efficiency, but there is no comprehensive legislation on the matter. This creates weaknesses in the sector and disincentives to improve the efficient use of energy, especially electricity, in Uganda. Other constraints include:

- Incomplete Regulatory Framework
 - Delays in approving Energy Efficiency and Conservation Bill continues the inadequacy of the regulatory framework;
 - Minimum Energy Performance Standards (MEPS) lack testing facilities, and implementation and oversight capabilities (monitoring and evaluation);
 - Limited up certification of cookstoves and dissemination of successful business models to scale up cookstoves switching.
- Insufficient awareness to the general public regarding energy efficient technologies and alternative and their associated benefits
- Insufficient baseline to serve as benchmark to capture energy efficiency actions
- There are inadequate financing mechanisms and other incentives to facilitate investment in Energy Efficiency.
- Inadequate technical capacity: there are limited professional or certified personnel such as Energy Auditors, Managers, Inspectors, Equipment testers which could be tackled through incorporation of energy efficiency and management short courses and diploma curricula in universities and technical schools

The building sector has not yet been sufficiently targeted by energy efficiency measures. This action area includes:

- Retrofitting of the building envelope to decrease consumption; appliance efficiency, including lighting, space cooling and refrigeration. Heating may be considered in region where it might be necessary;
- Promotion of new building materials
- New curricula for architects and civil engineers

⁷⁶ BEST

The briquettes market needs to be assessed properly since carbonized briquettes can replace charcoal in households, poultry farming, institutions and restaurants because they are smokeless and longer burning while non-carbonized briquettes can replace woody biomass in households, and industrial processes such as crop drying, tea drying, tobacco curing, ceramics/brick firing. Several middle scale units might be supplying larger towns while a larger industrial briquetting system using organic municipal waste around Kampala.

4.3.4. Actions needed to achieve the overarching objective of energy efficiency

SE4ALL goals for Uganda regarding energy efficiency build on analyzing energy efficiency savings potential in different sectors of the country's economy (households, commercial enterprises, industries and buildings).

Industries

The Energy efficiency Baseline study reported specific energy consumption for few sectors of the economy (table 4.16). There is a need of establishing such baselines for mains sectors of Uganda's economy, especially the most energy intensive ones, in order to set energy reduction targets which would serve as benchmark to monitor future efforts.

Facility/industry	Specific power consumption
Sameer Agriculture & livestock	0.079/kWh per liter of milk
Coca-Cola	0.066 kWh per liter of beverage
National Water and Sewerage Corporation Ggaba	0.9 kWh per m ³
National Water and Sewerage Corporation Entebbe	0.701 per m ³
Luuka Plastics	0.88 kWh per ton
Mukwano Industries	80 kWh per ton
NSSF building	149 kWh per m ²
Crested Towers	420.1 kWh per m ²

Table 4.16: Specific electricity consumption of selected enterprises

The 18 facilities which benefited from the MEMD-GIZ/PREP baseline study totalled in 2013 a power consumption of 282 GWh. Large and medium industries increased their electricity consumption from 1354 GWh in 2013 to 1450 GWh in 2014. Assuming that energy efficiency actions, resulting from ongoing energy audits, might lead to 15-25% savings, the estimated energy savings might reach 200 to 400 GWh, considering there is no increase of production. **To avoid misunderstandings by production changes in targeted industries, specific energy consumption will be the indicator to monitor and evaluate the implementation of energy efficiency measures.** Other energy patterns (gasoil, wood, etc.) should be considered as well.

Households

While pursuing universal access to electricity towards 2030, there is an urgent need to sensitize people on those appliances developed by the Minimum Energy Performance Standards, which include refrigerators, air conditioners, motors, Lighting appliances, and freezers). An additional SE4ALL program could target 1 million urban households who have high level of power consumption, because their number is expected to rise from 1.4 to 2.2 million between 2015 and 2030. Off-grid solutions in rural areas always consider energy efficient appliances in order to reduce the capacity of the generating plant. The distribution 3,000,000 LED lamps would results in reducing evening peak power by 35 to 60 MW, and energy consumption by 1,000 to 1,500 GWh. Other appliances like refrigerators, freezers may reduce another 100 GWh per annum.

Table 4.17 summarizes the electricity saving potential in industries and households, equivalent to 2012 UMEME's sales.

Suggested actions	Sector	Estimated savings
Energy efficiency actions in 100 most energy intensive industries	Multiple	200 – 400 GWh/ year
Dissemination of 3,000,000 LED and efficient appliances	1 million urban households	1000 - 1600 GWh/year

Table 4.17: Electricity saving potential in households and industries

Energy efficiency actions in biomass consumption

Table 4.18a shows for different industrial sectors the actual fuelwood use, actions improving energy efficiency and potential saving. Combustion of biomass fuels in these industries and elsewhere results in the emissions of particulate matter (PM), including black carbon (BC), sulphur dioxide (SO₂), oxides of nitrogen (NO_x), and carbon monoxide (CO). The emission of these pollutants has adverse effects on the health of workers and vegetation around the kilns.

Industrial sectors	annual wood consumption [ktons]	annual energy consumption [PJ]	specific wood consumption [kg/kg]	benchmark	annual production [ktons]	how to improve efficiency?	estimated gain	wood saved [ktons]
Bricks making industry	6000	90	0,65		9231	modern clean kilns	40%	2400
Tea industry	71		2	1,5	35	wood chips instead of logs	20%	14,2
small scale lime production	270		1,5			improved kilns for 70% traditional kilns	30%	81
Tobacco industry	200		8		25	wood chips instead of logs, new burner technology	25%	50
vegetable oil processing	245				40	briquettes, new burner technology	25%	61,25
smoked fish sector	22,4		1,2	0,4	20	improved kilns for 70% pitkilns	50%	11,2
Total	6808,4							2617,65

Table 4.18a: wood consumption of selected industries

Efficient cooking in households, institutions and commercial enterprises

Table 4.18b shows annual wood consumption of selected commercial enterprises with a total of 2401 ktons, schools being the first contributor.

- Local distilleries in Uganda produce ca. 27 millions of alcohol, using highly inefficient technologies. Their specific wood consumption is the triple, compared to the improved distillery in Buwembe (Jinja Brewery). There is a potential of reducing the firewood consumption in this subsector by 120 ktons or even more if alternative fuels (briquettes from agricultural waste or chipped plastic bottles) could be burned.
- MEMD recently successfully installed twin improved cookstoves in 24 targeted educational institutions. These institutions consume approximately 210,000 m³ woods per annum and new efficient stoves have reduced their wood consumption by 50%. 2238 out of 2838 secondary schools were using biogas for cooking in 2013 while 84 were relying either on firewood, or charcoal or other sources of energy⁷⁷. 1683 primary schools are half and 82 are full boarding facilities i.e they have to provide food for pupils. Unfortunately no information on their energy sources could be found.
- 35,000 hotels and restaurants, mentioned in the BEST report, require for cooking ca 200 kton of fuelwood and 50 kton of charcoal annually. Dissemination of improved cookstoves and barbecue systems would reduce their energy need by 50%.

	annual wood consumption [ktons]	annual charcoal consumption [ktons]	% using inefficient equipments
Bakeries	313		70%
Hotels & restaurants	200	50	
local distilleries	180		100%
improved distillery-Buwembe	0,67		
schools	1700		93%
prisons	5,435		69%
health centers	1,9		
Total	2401		

Table 4.18b: wood consumption of selected commercial enterprises⁷⁸

- With a per capita consumption of 120 kg wood and 4 kg charcoal per annum in rural areas and respectively 240 and 680 kg in urban areas⁷⁹, Uganda households annual biomass demand amounted in 2012 to 20,9 million tons of fuelwood and 1,5 million tons of charcoal. Rural households are the largest biomass consumers because of their numbers and low average monthly income which has direct impact on their willingness to pay for energy consumed. It is estimated that 500 000 households are already using improved stoves. Ending 2013, PREEEP and EnDEV had deployed modern electricity to 4468 households through Solar home systems or grid connection, improved cooking stoves to 42 550 households and 200 social institutions, energy for productive use to 390 small and medium businesses. Targets by March 2016 are respectively 7230 households, 106 500 households and 275 social institutions with improved cookstoves as well as energy for productive uses to 445 SMEs. The intervention aiming at disseminating clean wood/charcoal stoves among 4.5 million households will lead to the reduction of 1,520 ktons of wood per annum.

Promotion of efficient technologies in charcoal production (Mubende, Kiboga, Nakaseke and Kiryandongo)

⁷⁷ Ministry of Education and Sports, Statistics 2013

⁷⁸ Compiled from Biomass Energy Strategy report, Uganda, 2013

⁷⁹ MEMD, Renewable Energy Policy 2007

BEST reports that 1.8 million tons of charcoal was consumed in Uganda equivalent to a consumption of 16 million of wood. This suggests that the mean efficiency for charcoal production is 11.25%, which is in the range 10 – 15% found in the literature. The **Improved Charcoal Production System (ICPS)** adopted in the MEMD's Green Charcoal Project works in **2 phases**. In the first phase the wood in the retort chamber is dried by hot flue gases and the carbonization is initiated. Hot flue gases are produced with cheap waste wood in an external fire chamber. By waste wood we understand **branches, crust, charcoal dust** and other residual products from agricultural processes, such as coffee husks. The global efficiency of this system is about 30% i.e per ton of charcoal produced; 7 to 12 tons of wood can be saved. Moreover, the ICPS allows at least 2 batches per week, whereas traditional kilns need 4-14 days per batch. About 100,000 ICPS (3 m³ standard) would be necessary to meet the charcoal demand in Uganda to date. Under the Green Charcoal Initiative, the Nationally Appropriate Mitigation Action (NAMA) Study on Sustainable Charcoal in Uganda,⁸⁰ recommended the possibility to convert 75% of the charcoal produced into green charcoal by 2030 by implementing a program to introduce and use kilns for charcoal production. The NAMA's estimated cost for this approach is of \$500 million without including the costs associated to capacity building programs, sustainable forestry practices and improvement of the charcoal value chain⁸¹. Suggested intervention could target 2000 units per annum, i.e. 30, 000 units by 2030. This conservative assumption considers fuel switch to LPG and biogas as well as the dissemination of improved cookstoves. Expected wood saving is 420 to 720 kton per annum.

Suggested actions	Sector	Expected savings
Dissemination of improved kilns	Bricks making, Small scale lime production Fish smoking	2400 ktons wood/year
Using wood chips or briquettes instead of wood logs	Tea industry	14.2 ktons wood/year
Using briquettes and new burner technology	Vegetable oil processing	61 ktons wood/year
Replacing inefficient technologies	Local distilleries	120 ktons wood/year
Dissemination of improved cookstoves	Hotels restaurants	80 ktons wood/year
Dissemination of improved cookstoves	Households (4.5 million by 2030)	1520 ktons wood 2890 ktons charcoal/year
Dissemination of improved charcoal production systems	Charcoal production (30 000 units by 2030)	420–720 ktons wood/year

Table 4.19: Energy efficiency interventions and expected savings

Table 4.19 summarizes the energy efficient actions and the expected wood savings, totalling by 2030 4.6 to 4.9 million tons of wood and about 3 million tons of charcoal per annum. Taking into account that a

⁸⁰ UNDP, 2013

⁸¹ Additional details about sustainable/green charcoal are found under section 5.2

Eucalyptus grandis plantation yields in Uganda 40 to 60 m³/ha/year⁸² (20 to 30 tons of wood/ha/year), this means that the calculated wood savings equals the annual growth on 160 – 230,000 ha

4.3.5. Other issues concerning energy efficiency

- *MEMD to establish a dialogue and collaboration with the SE4ALL Energy Efficiency Hub.* The Copenhagen Centre on Energy Efficiency (C2E2) is the thematic hub for energy efficiency; with the prime responsibility to support action towards the SE4ALL energy efficiency target.
- *MEMD to work across Government Agencies and with stakeholders to:*
 - Strengthening Policy and Institutional framework Policy support and policy framework. Approve the Energy Efficiency Bill and develop an adequate regulatory framework for its implementation;
 - Implement a voluntary labelling program. Awareness creation, knowledge build up and capacity building. Awareness raising campaign for standards and labels, targeting distributors, retailers and end-users;
 - Expand the reach of the Minimum Energy Performance Standards (MEPS), and provide adequate support for its implementation and oversight, including the development of voluntary agreements for efficient refrigerators and air conditioners;
 - Adopt the Global Energy Efficiency Accelerator Platform, which was announced as part of the Energy Efficiency Committee Report to the Advisory Board of the SE4ALL Initiative on June 1, 2014
- Procure and install testing energy efficiency equipment for all the appliances;
- Establish an M&E mechanism to assess the impact of the EE programs such as the Standards Labelling programme, Energy Audits, Awareness Campaigns, Capacity building;
- Continuous capacity building for Energy Efficiency programmes in this initiative
- Design and Implement Uganda's SE4ALL Energy Efficiency Investment Prospectus:
 - Define program inventory of programs and develop beyond concept and assess funding needs and gaps;
 - Develop the portfolio of investment and funding needed for the inventory of programs.
 - Define matchmaking/identification of multi-stakeholders that will partner with each program.
 - Design the resource mobilization strategy and implementation of the prospectus

4.4. Additional Nexus Actions

4.4.1. Current Status and Trajectory

Energy is one of the key drivers of development. Uganda understands that this is a precondition for achieving development goals. It has a direct nexus with related actions regarding to access to clean water, improve public health and education, women's empowerment and increase food production. As part of Energy for Rural Transformation program, Uganda has expanded access to energy to schools and hospitals.

Under Energy for Rural Transformation, grants were provided by the Ministries of Education, Health and Water to supply solar PV packages for health centers, educational institutions and water pumping in designated districts. At the end of ERT I, the solar systems installed were as follows⁸³:

⁸² Tree planting guidelines for Uganda.

<http://www.sawlog.ug/downloads/Why%20Invest%20in%20Tree%20Plantations%20in%20Uganda.pdf>

⁸³ Energy Rapid Assessment and Gap Analysis – Uganda, MEMD, June 2012

- Health: 378 systems: HC IV – 8; HC III – 68; HC II – 79. The following 12 districts were covered: Arua, Terego-Maracha, Koboko, Yumbe, Nebbi, Pallisa, Bukedea, Abim, Kotido, Kumi, Budaka and Kaabong.
- Education: Systems for 129 post primary institutions in districts of Apac, Arua, Luwero, Mubende/Mityana, Kasese, Bushenyi, Kibale, Kamuli, Pallisa and Mbale.
- Water Pumping: 15 Solar PV pumping systems in districts of Yumbe, Terego-Maracha, Nebbi, Adjumani, Moyo, Kotido, Moroto, Katakwi, Kamwenge, Kibale, Bundibugyo, Kyenjojo and Kalangala

Under the ongoing ERT II, these activities continue and the number of solar systems deployed for health, education, productive use and water pumping keeps growing. Targets include additional 1400 schools and 142 agribusiness farms.

Under EnDEV implemented by GIZ 370 SHS and 34 grid connections have been deployed for social institutions between 2012 and 2014 while 379 SHS and 101 grid connections were deployed for productive use.

4.4.2. Existing plans/strategies

The MEMD and the World Bank have recently agreed on ERT III, targeting 150,000 grid connections, 100 schools, 276 health centers and 15 water pumping stations.

4.4.3. Relevant High-Impact Opportunities

- Energy and women's health: access to modern clean energy cooking and lighting by households reduces indoor pollution and thus improve women's health.
- The agriculture-water-energy nexus is being addressed through the development of small scale renewable solutions powering mini- and micro-grids,
- Advocate for and educate consumers about the importance of health, environment and gender benefits of clean cooking.

4.5. Enabling action Areas

On-going and potential future projects seem to face similar challenges on governance and policy issues across different stages of project development, limited access to project financing, increasing thus the investment risk in Uganda's energy sector.

4.5.1. Energy Planning and Policies

4.5.1.1. Critical Areas

- National coordination to produce effective and comprehensive planning and define adequate funding. While the dialogue and coordination across national Government Agencies exist, Uganda lacks an effective communication mechanism between districts and national Government. This results on energy planning, implementation and monitoring centralized by national Government Agencies with limited or no contribution of district authorities and other local/regional stakeholders;
- Information dissemination, awareness and knowledge sharing is limited, affecting adequate access

4.5.1.2. Actions Needed

- *The GoU to develop a governance and regulatory strategy to address the critical areas associated to energy planning and policies.* It is expected that under the SE4ALL framework MEMD will proceed to do a regulatory framework review to assess the need to appropriately refreshed (or new) policies, regulations and energy plans;
- *Integration of districts in the energy planning process.* Increase the reliance on district planners and district authorities to assess district, sub-counties and parishes needs and gaps; as well as locally based solutions, resulting from a dialogue with local stakeholders. This will increase effectiveness of

the strategies, planning and actions by Government institutions, like UEDCL and REA, developers and investors.

- *Design and implement a stream lined mechanism for the district inputs, to feed into the national planning and decision-making process in the central Government.* While keeping this process local, the aggregation process will look into regional opportunities for energy resource utilization, service integration, and economies of scale across district lines.
- *Develop local human and institutional capacity.* Increasing the capacity of district to take on responsibilities as the stepping-stone for energy planning, implementation oversight and monitoring.

4.5.2. Finance and Risk Management

4.5.2.1. Critical Areas

- Access to Finance
 - High dependency on Donor funding in support of pilot projects with short-term funding
 - Partial involvement of banks in formulation and implementation of sectorial financial schemes
 - No support for early stage project needs (prefeasibility and feasibility analysis costs)
 - Limited capacity of developers to present small and medium size bankable projects
 - High cost and collateral requirements to finance household access to energy needs
- Risk Issues
 - Lack of satisfactory track record by some of the key stakeholders in the sector
 - Typical issues related to an electricity market with a single off-taker
 - Land-lock country add-on-costs and associated high capital costs for energy projects
 - Low economies of scale in the energy sector
 - Inadequate capacity of key actors
 - Project development barriers
 - Slow licensing and permitting process
 - Land Tenure, mainly compensation resolution, transfer consents and titling issues
 - Slow EIA review process

4.5.2.2. Actions Needed

- ERA to develop levelised cost studies for power generation above 20 MW in Uganda to assess comparative cost at kW levels across technologies, and below 20 MW to support developers in the early stages of their projects.
- Project development support by MEMD, in collaboration with MoFPED, Uganda Invest Authority and private sector stakeholders for:
 - Early Stage projects Support Mechanism. The goal is to increase the number of bankable projects that can move along the development cycle towards financial closure. The mechanism can include access to regional institutions like SEFA and CTI-PFAN.
 - Late Stage project Supporting Mechanism. This will focus on streamlining the process for review of Environmental Impact Assessments, licensing and permitting, land tenure issues (especially compensation) and PPA negotiations.
- Uganda's SE4All Resource Data Base to include key Statistics; Sector Information, including maps, atlases, measurement records, legislation, development plans, policy documents); Project preparation reports (preliminary assessment, pre-feasibility, feasibility reports, project appraisal reports of Development Partners, EIAS, EIAP) and project data amongst development partners involved in USE4All and to the wider public.
- Energy Information Centre (EIC). Appoint an official source of information on energy related topics in Uganda. Agencies will be mandated to report to the EIC, which with statistically approved methods will verify information and develop reports becoming a reliable source of data to policy makers, investors, donors and international organizations.
- Consistent with UECCC objective of introducing "...into the Ugandan financial market new and innovative financing modalities including credit enhancement instruments directed at reducing real or

perceived risks faced by primary lenders and other financial intermediaries..." , its current basket of financial products should be expanded to households, small and medium enterprises in need to get financing for paying for connecting to the grid, internal wiring and for the purchase of power home systems, of power systems for productive uses and of clean and efficient stoves. These financial products to be then offered by banks and non-banking financial institutions, including cooperatives and microfinance institutions (SACCOs);

- Create a guarantee mechanism and introduce innovative financial products to lower the investment risk and accelerate the implementation of energy projects on a country-specific and project-specific basis.

4.5.3. Capacity Building

4.5.3.1. Critical Areas

- Limited institutional and human proficiency on energy planning in districts, sub-counties and parishes.
- Limited human resources at the MEMD. Unless this is addressed, the assessment and the design of adequate human capacity building cannot be done.
- SE4ALL Secretariat needs to be formalized and become part of the organization structure of MEMD.

4.5.3.2. Actions Needed

- Developing institutional capacity to close the gap between responsibilities/commitments and management capacity to follow and monitor them;
- MEMD Improve Performance Plan. The goal is to develop institutional capacity to close the gap between responsibilities and management capacity to follow and monitor them.
- Institutionalization of the SE4ALL Secretariat, assigning it as the coordinating unit for all energy interventions and programs impacting Uganda's SE4ALL Implementation.
- District Energy Planning. This program aims to create planning capacity at District level for the purpose of increasing coordination and planning of energy related activities, investment strategies and monitor progress of SE4ALL and other energy related interventions. Currently there are two initiatives, one led by WWF and the other by GIZ. These should provide lessons learned and inputs that will make the program more efficient.
- Piloting SE4ALL Action Plans at District Level to commence immediately after AA is adopted. The SE4ALL Secretariat will coordinate with the districts of Kasese, Kaabong and Jinja in order to implement a quick gap analysis, a needs assessment and a stakeholder analysis to identify challenges, constraints and opportunities for SE4ALL implementation at district level. Upon lessons learned, the program will scale up to all Districts in Uganda.

4.5.4. Awareness and knowledge management

- SE4All Information Data Base.⁸⁴ Develop a methodology and implementation plan for creating and maintaining the SE4ALL Energy Data Base. Design of data collection and processing process should apply rigorous methods (such as individual program evaluations, cross-national quantitative studies, systematized expert interviews, and sectorial surveys) and be capable of producing timely data suitable for Uganda's implementation of SE4ALL's Global Tracking framework and country reporting to the International Energy Agency's.
- Uganda's SE4All web site. The web site is conceived as a portal for stakeholders to access the critical information and links, as well as for dissemination of information, reports and the gathering of comments/suggestions through a blog or on-line contact form;
- Social Media and other engagement activities (SMS campaign) Given the low penetration of Internet

⁸⁴ The implementation of this data base can be funded under the ERTII which expected to support the creation of ESDP, the energy information center

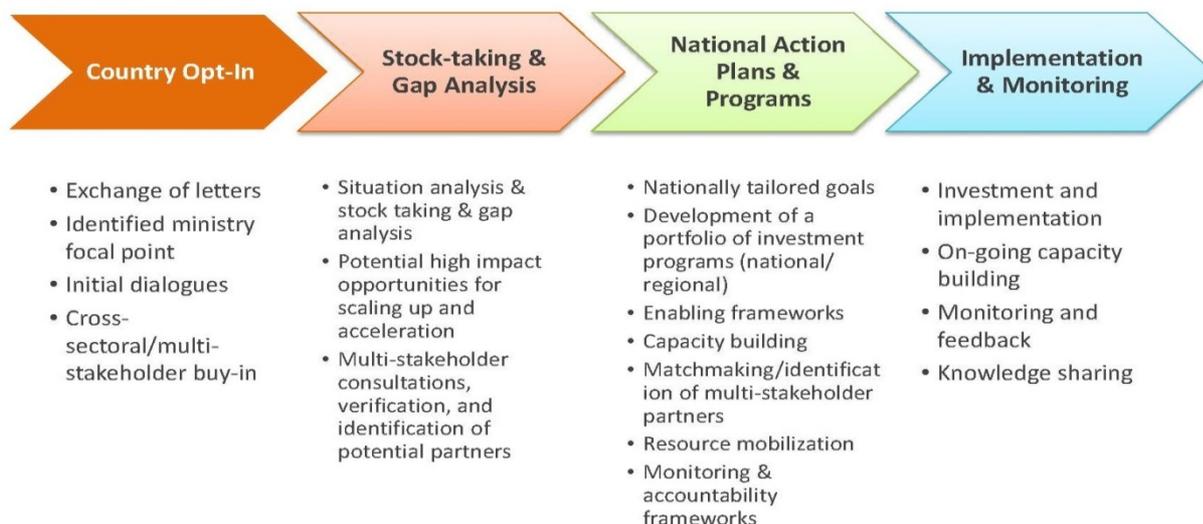
Uganda 's SE4ALL Action Agenda

- in Uganda, and the high penetration of mobile phones and radio, the use of social media and radio has been successful in socialization campaigns and surveys on different topics in Uganda;
- SE4ALL and regional integration. Power pooling and cross-border projects and programs, standardization and other infrastructure guidelines and strategies developed through EAC.

5. PART III – Coordination and Follow-up

5.1. Action Agenda's Implementation

The overall SE4ALL Action Process has been conceived as four stages as follows⁸⁵



Uganda opted-in the SE4ALL Initiative in 2012 and started the development of its RAGA. The RAGA was completed in 2013 and stocktaking and meetings with different key stakeholders took place through the first half of 2014 for the development of this AA. Currently, Uganda is currently on the third stage of its SE4ALL Action Process.

This AA has defined national goals, the conditions and needs for the enabling framework and capacity building. Following the adoption of this AA, the GoU will need to continue its SE4ALL related work immediately after the adoption of this AA.

5.2. Implementing Challenges and Proposed Risks Mitigation Measures for Uganda

The AA is comprehensive and includes programs involving different stakeholders, technologies, regulatory and enabling environments, which present different kinds of challenges. Some programs are ready for implementation; others would require first a clearer policy or enabling environment, prefeasibility/feasibility studies, implementation plans, etc.

The main challenge and risk in executing the AA is related to the ability of the MEMD, as leader of Uganda's SE4ALL implementation, to continue the current thrust of activities and by immediately implementing those actions thought to start upon the AA's adoption. Other important challenges and risks are related to: (a) its extent, which reflects a combination of multiple strategies and programs (b) the absence of human and institutional capacity to address energy issues at district, country, sub-county and community level; (c) the different energy topics, technologies and issues at play, and therefore different implementers and stakeholders; and (d) different technical, financial and institutional implementation, reporting and M&E mechanisms.

Critical mitigating factors and actions include: an institutionalized and funded SE4ALL Secretariat⁸⁶ with a strong coordination mechanism; and having in place funding, human resources and technical assistance to

⁸⁵ As presented in Sustainable Energy For All, presentation by Venkata Ramana Putti, ESMAP-World Bank - 2012

successfully (a) develop baseline documentation, including energy resources assessments and programs, and dissemination mechanism for awareness and knowledge sharing; (b) foster adequate policy and enabling environment; and (c) establish a well-functioning and resourced monitoring, evaluation and adjustment mechanism.

5.3. Implementation Methodology

5.3.1. Overview

This AA comes at the time where numerous programs falling under the framework of the SE4ALL Initiative, are at early stages, well under way, or already approved in a pipeline of interventions. The AA integrates all these interventions into a single framework and adds complementary interventions to accelerate the Uganda's SE4ALL implementation.

The integration of these interventions presents some challenges to the early stages of implementation of the AA, among them:

- Interventions have different M&E and reporting requirements
- May overlap between them
- May have a different area of impact (Region, district or service territories)
- Key stakeholders differ at leading and implementing roles, sometimes for cases where interventions are comparable or the same
- No central coordinating unit for all these interventions

To overcome these challenges key actions, will need to be addressed early in implementation and they should culminate with the first Major Milestones Impact Assessment that will be carried out in the FY 2018/19.

It is expected that the institutionalization of the Secretariat will increase the capacity of MEMD to improve coordination of activities across interventions funded and implemented by key stakeholders. As a result of this process, it is expected that an integration process will occur, improving the planning capacity of MEMD towards defining additional interventions that will follow those currently in the AA. Given the commitment of the GoU to SE4ALL implementation, it is expected that the consecutive reviews and upgrades to the AA will integrate SE4ALL related activities in to Uganda's NDP by 2030. As presented under Uganda's AA objectives, the countries SE4ALL related activities are set under blocks phases:

- *Transition* (2015 – 2018). During this period, the country continues with its current strategies and the national dialogue toward the adaptation, update and alignment of the existing interventions under the country's SE4ALL agenda. During this period, all new strategies and interventions will have to be consistent with Uganda's SE4ALL Action Agenda.
- *Consolidation* (2018 – 2022). This period will see the implementation of an updated AA based on the milestones accomplished by the plan and strategies in place before and during the transition. This period will start with the Secretariat leading the implementation of a Mid-Term Review, which will allow Uganda to make the adjustments needed to reach its SE4ALL goals.
- *Acceleration* (2022 – 2030). The sustainability and update of the actions and strategies will accelerate the process of achieving Uganda's SE4ALL energy efficiency, access and renewable energy goals.

5.3.2. Implementation Timeline

The proper implementation of the interventions suggested in this AA is subject to the development of the projects and the securing of the necessary funding. The Uganda SE4ALL Investment Prospectus (IP) will play a very important role in this process. In preparation to this prospectus and pursue of investment and funding, Uganda needs to accomplish key milestones during the transition phase of its business-as-usual into the SE4ALL agenda. Therefore, the timeline defined here is focused exclusively in the key actions that

⁸⁶ With a high level of commitment on the part of their members

the GoU and other stakeholders will need to accomplish to fully implement the AA and accelerate progress to reach the SE4ALL goals by 2030. It is therefore limited to activities to be developed during the transition period. Failing to provide continuity to the efforts that led to this AA will put a risk to Uganda's ability to reach its SE4ALL goals.

Activity	II Q 2015	III Q 2015	IVQ 2015	2016	2017	2018
Securing Technical Advisor to coordinate and lead activities for the completion of the AA and IP, provide lead and technical support to the Secretariat through the first half of the transition period						
SE4ALL Secretariat institutionalization, define the implementation and operational program, and secure funding for personnel, equipment and execution of activities						
AA consultation and validation process and drafting of Uganda's AA						
Development, consultation and validation of Uganda's SE4LL IP						
Piloting a need assessment and gap analysis for three districts to build a bottom-up approach to improve and update actions under the AA and the identification of interventions suitable for funding						
Review and refresh or update policy and mechanisms associated to subsidies and incentives for the energy sector, especially those that will have an impact on the IP						
Development and implementation of the communication, awareness, sensitization campaign(s)						
Design Energy Data Collection and Processing Plan						
Develop the SE4All Information Data Base and create the Energy Information Centre (EIC)						
Institutional and human capacity building of government institutions and private sector organization (i.e. trade associations)						
Scale up bottom-up approach to needs and gaps, and stakeholder dialogues to the fine the Agenda for the post transitional period ⁸⁷						
Renewable Energy Resource Assessments ⁸⁸						
Development of the Renewable Energy Programs for solar, wind, geothermal and mini-hydro ⁸⁹						
Design and implement a program for institutional and human resources at district level to increase the role of District Governments on local and regional energy planning needs and monitoring						
Design and implement mechanism(s) to support early stage renewable energy projects into maturity and late stage renewable energy projects into financial close						
Other Actions or Interventions that have been prioritize during the AA and IP consultation and Validation process						

⁸⁷ Continuous engagement of all stakeholders are key to the success of the SE4ALL implementation

⁸⁸ Some resources, like wind and geothermal, require a longer period to gather the required information needed to identify proper sites for project development

⁸⁹ These programs should be design and implemented as the results of the resource assessments are aggregated and evaluated

Activity	II Q 2015	III Q 2015	IVQ 2015	2016	2017	2018
Evaluation of Transitional period and propose agenda for the consolidation phase						

5.4. Coordination

Immediately after Opting-in, and through an initial mobilization phase, the GoU put in place the SE4ALL Secretariat, within the MEMD, has carried out stakeholder workshops, and established the SE4ALL Task Force to provide oversight and support to the GoU.

5.4.1. Uganda's SE4ALL Task Force

The SE4ALL Task Force was created to steer the activities related to Uganda's SE4ALL implementation. The members of this Task Force are the EU Delegation, UNDP, and KfW, as the chair of Development Partners Working Group, REA and MEMD. AFD and GIZ joint later.

Once the Action Plan is validated and adopted, the Task Force would become the SE4ALL Steering Committee. This Steering Committee will be based on the current structure of the Task Force, to which it will incorporate private sector and civil society representative(s). This Steering Committee will continue meeting monthly and provide support and advice to the SE4ALL Secretariat.

5.4.2. Uganda's SE4ALL Secretariat

The Secretariat is the AA's lead advocacy and managerial unit. All SE4All related projects and studies would remain under the responsibility of the relevant Ministerial Department and institutions.

The Secretariat is responsible for realizing Uganda's SE4ALL goals, as it coordinates multi-stakeholder initiatives, programs and projects; it creates and increases awareness, monitor and report on the country's progress towards the SE4ALL goals. The Secretariat is responsible and accountable for mainstreaming the implementation of the AA, the Investment Prospectus and the M&E plan. The Secretariat is Uganda's focal point for exchanging information with the SE4ALL global initiative, especially with the SE4ALL Global Facility Team, the SE4ALL Africa Hub, the SE4ALL Thematic Hubs and each HIO's coordinator or coordinating group.

Based on its reports, the Secretariat will present for approval to the MEMD's Permanent Secretary draft modifications to the AA and propose any other "mid-course" adjustments that may be needed to keep Uganda on its critical path to achieve its SE4ALL goals.

5.4.2.1. Organizational structure of Uganda's SE4All Secretariat

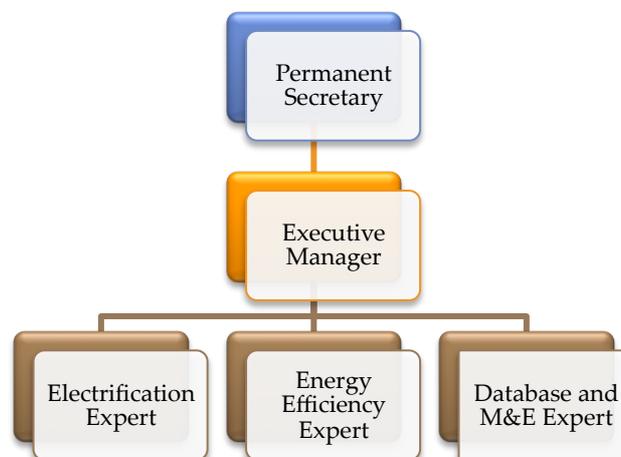
The Secretariat will be institutionalized within the MEMD, and will report directly to the Permanent Secretary, MEMD and inform to the Chair of the Energy and Minerals Development Sector Working Group (EMD-SWG) and the SE4ALL Task Force.

It will be led by an Executive Manager and supported by a Management Team. The personnel of the Secretariat will be employed by MEMD and if possible by other government entities. It is envisioned that a Technical Advisor will be secured to support the SE4ALL Secretariat through the first half of the transition period (i.e. until the end of 2016).

It is not envisaged that SE4All would have financial autonomy; rather, it would initially get its financial resources from a budgetary line under the Permanent Secretary's budget, and will incorporate additional funding from programs related to the Secretariat's activities.

An Executive Manager will lead the Management Team and will serve as lead programme manager of the AA. He/she will support implementing executive stewardship of the AA resources in general and advise the EMD-SWG and the SE4ALL Task Force where the best opportunities for delivering the SE4ALL outcomes are and how the required investments can be made and managed to ensure maximum returns. He will be responsible for the monitoring and working with project implementation partners identified in the AA.

The Executive Manager will facilitate project interventions, coordinate across agencies and institutions activities such as, but not limited to, project implementation, feasibility studies, consumer and end-user research, work plan preparation and monitoring of results.



The Technical Advisor will support the Executive Manager and the SE4ALL Secretariat. Among other issues, she/he will coordinate and lead activities for the completion of the AA and IP, provide lead and technical support for the three district piloting, design and implement energy data base and energy information center, develop the program document to frame the operation of the SE4ALL Secretariat. It is expected that this function will be filled in by an expert funded by a donor program and only be needed through first half of the transition period (i.e. until the end of 2016), therefore this position is not included in the organizational chart above.

The SE4ALL Management team will comprise at least three members⁹⁰:

- An Electrification Expert. She/He is tasked to provide the Executive Manager with the technical support needed to address the goal of Universal Access. She/He will work closely with the implementing partners and REA, on project planning and implementation associated to access to modern energy services. This work is consistent with SE4ALL guidelines on access, which includes not only connection, but also off-grid and distributed generation, mini-grids and grid densification.
- An Energy Efficiency Expert. She/He is tasked to provide the Executive Manager with the support needed to address the goal of Energy Efficiency. She/He works closely with MEMD's office of Energy Efficiency, with the implementing partners and private sector organizations to support the clean cooking undertakings, energy auditing and certification programs and increasing the energy efficiency in the electricity grid.
- Database and M&E Expert. She/He is tasked to provide the Executive Manager with the support needed to carry out the monitoring and evaluation needed to assess the progress of Uganda's SE4ALL Implementation. She/He will also recommend inputs for each annual review of the AA, identify gaps and suggest solutions that ensure the progress of the SE4ALL implementation. She/He will work closely with UBOS and other organizations in updating the SE4ALL Energy Database; defining the collection of data in a manner that is consistent with general statistical practices and the SE4ALL Global Tracking and Accountability Framework.

⁹⁰ This is the minimum required of team experts. A fourth expert, a communications/ICT expert should be also considered for the team at a later stage. The Secretariat's personnel will be required to focus their attention to SE4ALL related matters for no less than 80% of their time.

5.4.2.2. Responsibility of Uganda's SE4ALL Secretariat

The Secretariat will liaise across different Ministries, Government entities, development partners, district and national authorities to track the level of coverage in terms of access, energy efficiency and renewable energy at the local level and periodically update progress on each district and aggregate the districts' coverage to come up with the national performance of Uganda under SE4All.

5.4.2.3. Advocate for Uganda's SE4ALL implementation

- Establish contact with the private sector organizations and committees in the Chamber of Commerce, Chamber of Industry, NGO's, CSO's to learn about their plans and ideas for energy investment projects
- Organize seminars/workshops for all stakeholders at key moments of the implementation of the action plan to keep all sector of Uganda's civil society engaged, increase awareness and gather feedback that can be used by the Secretariat for the purpose of its annual review of the Action Plan
- Publish a pipeline of projects, which is updated permanently. Inform society about the Secretariat's actions on the pipeline projects and especially on successes
- Periodically inform the EMD-SWG and the SE4ALL Steering Committee about activities and progress
- Support the GoU in the mobilization of financing for the implementation of USE4All
- Facilitate exchange of information between GoU and the development partners concerning the investment and TA programs related to SE4All and enhance coordination between the various programs to increase the effectiveness and maximize the utilization of donor funded programs and activities

5.4.2.4. Monitor Uganda's progress of its SE4ALL Action Agenda

- Conduct the assessment of the baseline to document on the availability and use of energy at District and Municipal level to define the conditions of access to modern energy services, renewable energy use and improvement in energy efficiency
- Monitor progress in the implementation of each of the retained actions under the USE4All Action Plan;
- Define the monitoring framework for SE4All in Uganda at district and municipal level
- Coordinate the collection of data from the various Government Agencies and Development Partners to monitor progress
- Disseminate the monitoring data to all relevant stakeholders
- Recommend inputs for each annual review of the AA, identify gaps and suggest solutions that ensure the progress of the SE4ALL implementation

5.4.2.5. Information Dissemination and Knowledge Sharing

- Uganda's SE4All Resource Data Base:
 - Statistics;
 - Sector Information, including maps, atlases, measurement records, legislation, development plans, policy documents;
 - Project preparation reports (preliminary assessment, pre-feasibility, feasibility reports, project appraisal reports of Development Partners, EIAS, EIAP);
 - Collect and disseminate project data amongst development partners involved in USE4All and to the wider public;
- Uganda's SE4All web site
- Social Media and other engagement activities (SMS campaign)

5.5. Monitoring and Accountability Framework

5.5.1. Guidelines

The Monitoring and Evaluation (M&E) Plan is an essential tool for assessing and reporting progress towards achieving desired outcomes and identifying key questions whose responses allow evidence-based decision making for accountability and learning. A comprehensive M&E Plan ensures proper implementation of the AA, tracks achievement of results, and assesses the effectiveness and impact through the timely and consistent collection and analysis of comparable data. Ultimately, it will allow the GoU to review and update the AA in a way that maximizes the potential to achieve the SE4ALL goals.

Data Collection: The M&E plan includes performance measures to monitor each level of the SE4ALL Implementation logical framework and should identify data sources and collection methods, including baseline data to establish indicator values at a given point on or about the beginning of the implementation, as the basis for measuring change over time. Collection of baseline data will also enable rigorous evaluation of the project using evaluation designs that generate the most credible evidence. Where appropriate, social and environmental indicators, and impacts may also be integrated within the M&E Plan. The SE4ALL Secretariat leads M&E data collection, with shared responsibility with UBOS, REA, UEDCL and UETCL, electricity service providers, etc..

Ideally, the AA should be monitored under a self-contained M&E Plan. The large number of on-going Donor interventions, with their own M&E requirements challenges this requirement. Therefore, the SE4ALL Secretariat, with the support of the SE4ALL Task Force will work on the development of specific guidelines, which should develop into a self-contained M&E Plan coherent with the GoU M&E standards and compatible with Donor's monitor and data collection requirements.

5.5.2. General Performance Monitor Indicators

Goal Level: At the AA level, the SE4ALL Secretariat will track context indicators for economic growth including: levels of poverty, GDP, regional trade, and electricity consumption. Where appropriate, these broad indicators may include; other measures of inclusive social development to SE4ALL implementation.

Objective Level: At the Initiative level, the SE4ALL Secretariat will measure progress toward SE4ALL's goals through indicators, which assess the following objectives:

- Universal Access to Modern Energy Services.
- Increase the share of Renewable Energy in the Energy Mix
- Improve the rate of Energy Efficiency

Outcome Level: At implementation level, the SE4ALL Secretariat will assess outcomes that measure progress towards objective and goal achievement through quantitative and qualitative performance indicators.

Illustrative indicators for measuring SE4ALL implementation outcomes include:

- Total number of MWs of power generation installed capacity
- Net MWs traded (imports vs. exports)
- By-resource composition of Energy Matrix
- Reliability of grid electric power
- Number of MWs generated off-grid
- % of population with access to electric power
- Per capita residential electric power consumption (kWh/year.)

Uganda 's SE4ALL Action Agenda

- Number of connections to electric power (net new meters)
- Value of private capital investment in the energy sector
- Grid densification and expansion, measure in kMs
- Dissemination of improved cook stoves

The M&E will follow the SE4All Global Tracking Framework.⁹¹ The metric for evaluating the present situation in Uganda with respect with each of the indicators, the target performance by 2030 and annual progress will be as follows:

- For Access: introduce an energy quality dimension with five "tiers" in quality:

Access to electricity supply use of electricity services

Attributes	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Peak available capacity (W)		1-200	201-500	501- 2,000	>2,001	>2,001
Duration (hours)		4	4	8	16	22
Evening supply (hrs)		2	2	2	4	4

Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
	Task lighting and phone charging or radio	General Lighting, television and fan, if needed	Tier 2 plus any low-power appliances	Tier 3plus any medium power appliances	Tier 4 plus any high-power appliances

The lighting Access Index is then the sum of the percentage of the population falling in each tier, weighed by a quality index of 0 for Tier 0 and 5 for Tier 5. The index is therefore between zero (no access to electricity) to 5 (universal access).

- For cooking: recognize the contribution of improved stoves to modern access. A Modern Cooking index will be constructed as explained below.

Modern Cooking Index

Attributes	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Three-stone	X					

⁹¹ SE4All Secretariat, ESMAP World Bank, IEA SE4All Global Tracking Framework Vol. III, 2012 Chapters 2, 3 and 4

Self-made	X	X				
Certified Solid			X	X	X	
Non-solid					X	X

Tier 0 will be given a zero mark, Tier 1 a One mark, etc. The weighed modern cooking index will be sum of the percentage of households falling into each category multiplied by the mark of the said tier. The Index will therefore vary between zero (no access to modern cooking) to fixe (universal access to modern cooking).

- For Energy Efficiency
 - Measure specific energy consumption of different industries and institutions
 - Monitor the use of acquired clean cookstoves and consumption by sporadic monitoring survey both for households and institutions
- For Renewable Energy
 - For the purposes of the SE4All tracking framework, it is recommended that renewable energy be defined broadly as: “Energy from natural sources that are replenished at a faster rate than they are consumed, including hydro, bioenergy, geothermal, solar, wind, and ocean.”⁹² It is also proposed that, in the short term, sustainability criteria not to be applied, given the difficulties of making these distinctions based on currently available data. This implies that the traditional uses of biomass would be included in the definition of renewable energy.
 - In practice, only wood fuel and charcoal used in certified improved stoves would count as Renewable biomass.

5.6. Action Agenda Review Process

5.6.1. Principles

The AA is conceived as a live document that will be adapted and updated as progress is monitored and reported, and new actions become more relevant and others are completed or the gap that prompted such action has overcome.

To mitigate the challenge of monitoring and assessing the impact on SE4ALL Goals of the multiple programs run by different stakeholders, the SE4LL Secretariat will implement a review process based on the integration of the results of its own M&E procedures and inputs from mid-term and final M&Es of on-going programs and projects.

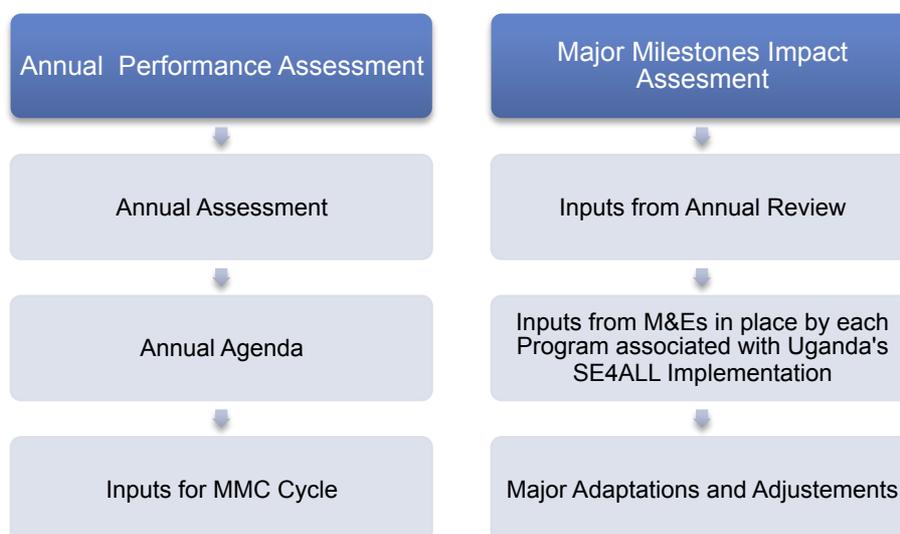
The AA will be subject to an annual performance assessment, which will focus on the progress of the specific activities being implemented each year. Its output will include recommendations for the annual agenda of the following year, and inputs for the impact assessments that will be done at the end of each of the major cycle of the AA. These four major reviews and updates are set to reflect strategies and interventions that are already in place:

- FY 2018/19 for the period Transitional phase. During this period, the country is set to undergo a major transformation on the national grid, reach substantive progress toward increasing generation capacity; will continue with its current strategies, and the national dialogue towards the adaptation and alignment of existing interventions under the country’s SE4ALL agenda.
- FY 2022/23 for the Consolidation phase. MEMD, REA and UNACC have major milestones to accomplish at the beginning of the 2020’s on access and clean cooking.

⁹² SE4All Secretariat, ESMAP World Bank, IEA SE4All Global Tracking Framework Vol.III, 2012, Chapters 4.

- FY 2030/31 for the Acceleration phase. Sustainability of the plans and strategies put in place on energy efficiency, access and renewable energy will be tested as the driver for reaching SE4ALL goals

The following diagram illustrates the review and assessment cycles:



Each time that the AA undergoes a major review, the Secretariat will implement a rollout strategy similar to the one presented for this AA, and update the logic framework and key indicators as needed.

5.6.2. Annual Performance Assessment

The following two reports, prepared by the SE4All Secretariat, will be submitted to the Permanent Secretary:

- A brief (mid-year) Progress Report will inform the stakeholders of the progress of each of the programs relative to the targets, explain the variances and describe the actions to be undertaken to meet the targets. Each District will prepare a Progress Report to the Secretariat.
- The Annual Report will provide a substantial analysis of the implementation of each program over the past 12-months (progress made, challenges, corrective measures, lessons learnt, etc.). It will be submitted soon after year-end, discussed with the stakeholders, and commitments made for the upcoming year. Like for the Progress Report, each District will prepare its Annual Report to the Secretariat.

5.6.3. Impact Assessment of each Major Milestones

To improve the reach and implementation of the AA, and for the purpose to prepare major updates and improvements to it, the Secretariat will be prepared an assessment of the impact of on-going and futures projects.

This impact assessment will be required to address the following issues per each review period defined above:

- Quick Gap Assessment Update. Using the SE4ALL guidelines for Gap Assessments, the Secretariat will update the 2012 Energy Rapid Assessment and Gap Analysis, with special focus on the actual interventions to properly measure progress with the necessary rigor to ensure reliability and support the decision process for priority interventions to be modified or added to the AA
- Need assessments and stakeholders analysis. This assessment is through a bottom-up assessment that relies in the reporting of gaps and needs at district level, rather than at aggregate level usually associated tot the Gap Analysis.
- Designing, compiling and maintaining database of projects and programs, with SE4ALL reach in place during each review period

M&Es Integration Report. This report should integrate those M&E reports from key stakeholders within the GoU, the Donors, and the MDBs. This may include the integration of assessments done by NGOs and other project/program implementing organizations.



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