PRESENTATION ON THE STATUS OF SOLAR WATER HEATER IN NIGERIA

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AT

ECREEE REGIONAL WORKSHOP ON MONITORING AND REPORTING FRAMEWORK
14TH – 15TH NOVEMBER, DAKAR SENEGAL

SUSTAINABLE ENERGY FOR ALL

Background

A multi-stakeholder partnership between governments, the private sector, and civil society. It was launched by the UN Secretary General in 2011. The 3 integrated objectives of the agenda are:

1. Ensure universal access to modern energy services
2. Double the global rate of improvement in energy efficiency
3. Double the share of RE in global energy mix

Background ..cont

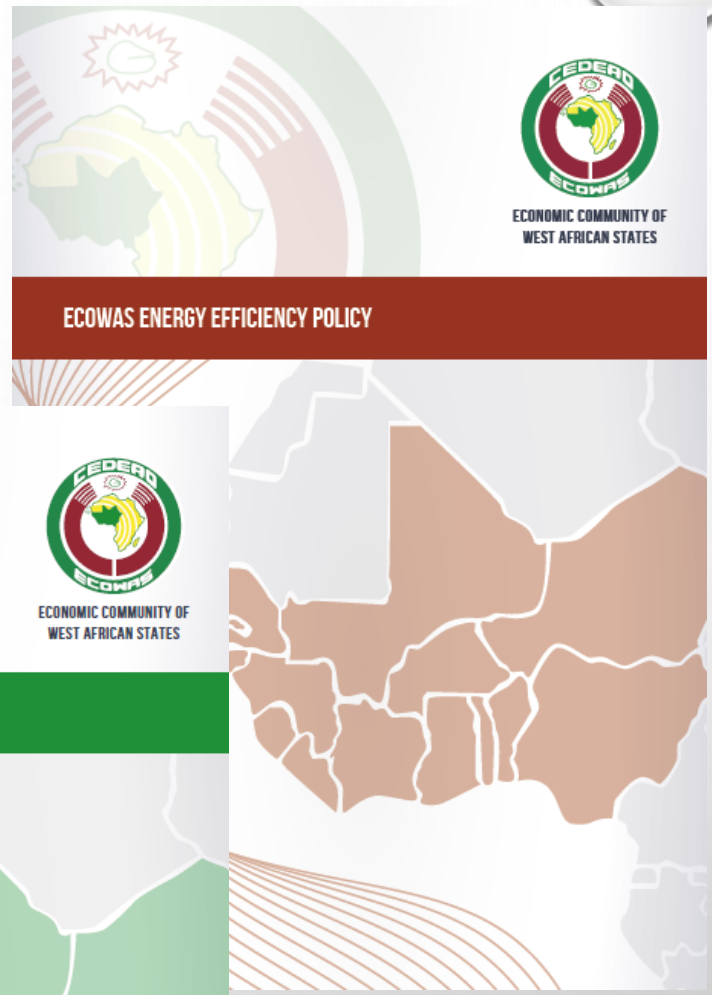
In July 2013 the Authority of ECOWAS Heads of States and Government renewed commitment to SE4All and Approved Regional RE and EE Policy with the following regional energy targets:

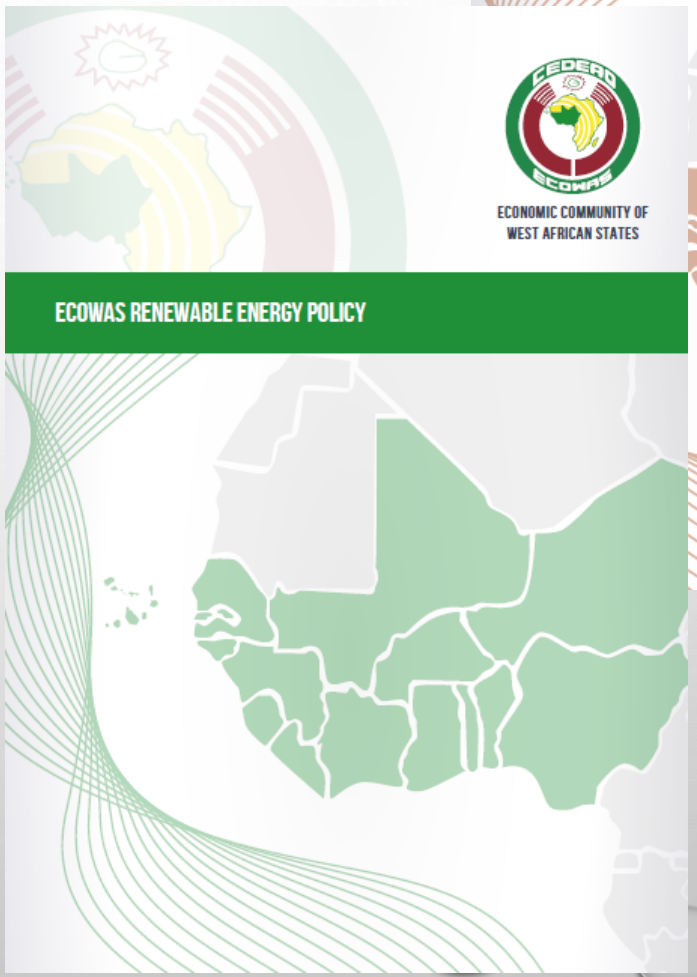
- Universal access to safe, clean and affordable energy for clean cooking by 2030
- On-grid RE to reach 35% by 2020 48% by 2030
- Decentralized RE (mini-grid & standalone) to reach 22% by 2020 and 25% by 2030
- Free 2000 MW from EE measures by 2020

•Phase out incandescent light by 2020

ECOWAS RE & EE POLICIES

- ADOPTED BY THE ECOWAS AUTHORITY OF HEADS OF STATE AND GOVERNMENT, JULY 2013, ABUJA
- ECREEE IS COORDINATING THE IMPLEMENTATION OF THE RE AND EE POLICIES
- ECREEE IS THE SE4ALL FOCAL INSTITUTION FOR ECOWAS
- SUSTAINABLE ENERGY COUNTRY ACTION PLANS DEVELOPED ACROSS THE 15 MEMBER STATES





Developed in Partnership with UNIDO, Austria, Spain, European Union, RECP, EUEI-PDF

Development of National RE and EE Action Plans and the SE4ALL Action Agenda in ALL Member States

Regional RE and EE Policies and SE4ALL

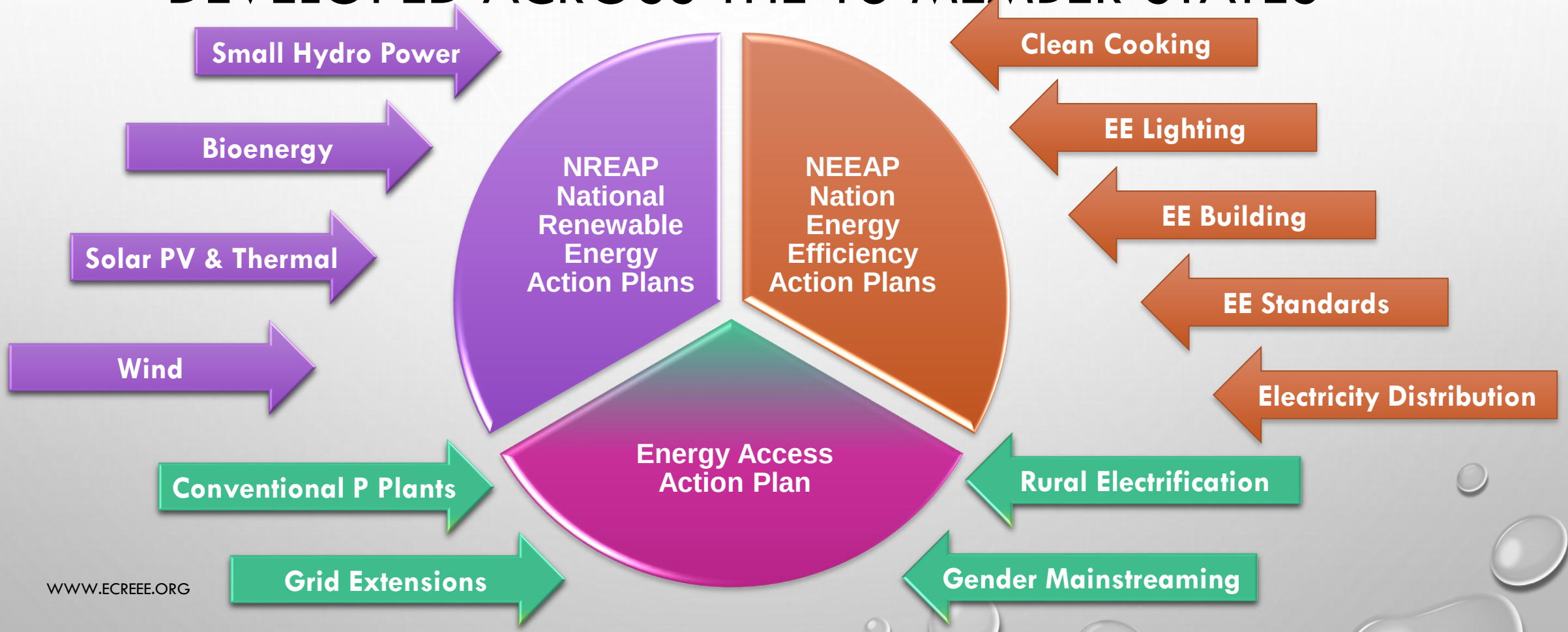
National RE, EE and SE4ALL Action Plans and Policy Framework

Implementation on the national and regional level

ECREEE SUPPORT TO THE Action Plan PROCESS

- **Development of the Action Plan Templates;**
- **15 national consultants to assist Member States with the development of the Action Plans;**
- **Team of international experts to provide on-going support;**
- **Support towards the organisation of national Kick Off and Validation meetings;**
- **Review and quality assurance**
- **Organization of Regional Concerted Actions to facilitate regular exchange and collaboration among the Member States;**
- **Support towards formulation/revision of national RE & EE policies, laws, regulations;**
- **Support towards detailed resources assessment and grid capacity;**
- **Assist in the development of portfolios of bankable projects, project preparatory activities and mobilisation of investment.**

SUSTAINABLE ENERGY COUNTRY ACTION PLANS DEVELOPED ACROSS THE 15 MEMBER STATES

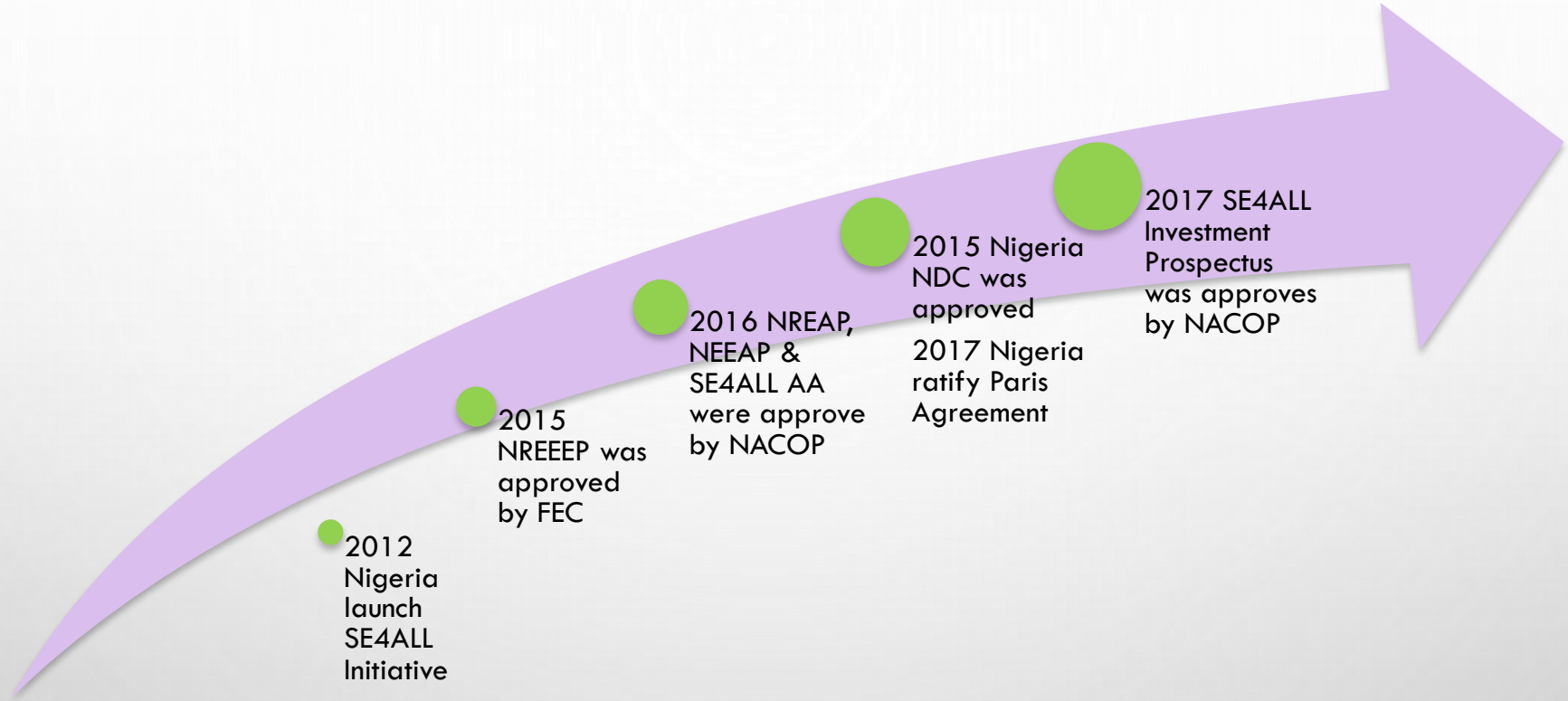


ECOWAS INVESTMENT PROSPECTUS FRAMEWORK

STRUCTURED INTO 4 PIPELINES AND THE ENABLING ENVIRONMENT

Pipeline 1	Pipeline 2	Pipeline 3	Pipeline 4
• Generation, transmission and distribution (on –grid)	•Off-grid (Mini-Grids and standalone systems)	•Bioenergy and Cooking Projects	• Energy Efficiency

NIGERIA'S SUSTAINABLE ENERGY VISION



2011, UN SG launched SE4ALL as a global Initiative;
2015 UN Member States adopted SDG and post 2015 agenda (SDG 7);
2015 NDC & 2017 Paris Agreement COP 22

NIGERIA'S ENERGY POLICIES

- *Nigeria Electric Power Policy (NEPP) – 2002.....75% electricity supply coverage by Y2020*
- *National Energy Policy (NEP) – 2003…..The nation shall commercially develop its renewable energy resource and ensure a balanced energy mix.*
- *Electric Power Sector Reform Act (EPSR) – 2005….Established the Regulator to ensure an efficient and competitive electricity Industry; NEMSA Act, 2014 ….Enforcement of Regulationss*
- *Rural Electrification Policy Paper – 2009….. at least 10% of renewable energy mix by 2025*
- *Power Sector Reform Roadmap – 2010…… Demand a National Energy Efficiency and Conservation policy to be developed*
- *National Renewable Energy & Energy Efficiency Policy - 2015 ….. Dedicated to Sustainable Energy Development*
- *National Determine Contribution (NDC)- 2015 ….. Require development of 13 GW RE by 2030*
- *Power Sector Recovery Plan ….. To Reset the Power Industry by 2020 to address financial viability via policy action, operationall & financial interventions*

NIGERIA'S RE & EE POLICY

NATIONAL RENEWABLE ENERGY AND ENERGY EFFICIENCY POLICY (NREEEP), 2015

SUMMARY OF THE POLICY OBJECTIVES

- TO ENSURE THE DEVELOPMENT OF THE NATION'S ENERGY RESOURCES.
- TO GUARANTEE ADEQUATE, RELIABLE, AFFORDABLE AND SUSTAINABLE SUPPLY OF RENEWABLE ENERGY AT COST-REFLECTIVE
- TO ENSURE EFFECTIVE COORDINATION AND COLLABORATION AMONG ALL PLAYERS IN RENEWABLE ENERGY AND ENERGY EFFICIENCY ACTIVITIES IN NIGERIA
- TO FOSTER INTERNATIONAL COOPERATION IN TRADE IN TRADE AND PROJECT DEVELOPMENT IN THE ECOWAS REGION, AFRICAN REGION AND THE WORLD AT LARGE.
- TO PROMOTE INCREASE INVESTMENTS AND DEVELOPMENT OF RENEWABLE ENERGY AND ENERGY EFFICIENCY SECTOR, WITH PLANS AND PROGRAMMES FOR EFFECTIVE DEVELOPMENT.

SUMMARY OF SPECIFIC NATION'S POLICY ON SOLAR SYSTEMS

- The nation shall effectively harness solar energy resources and integrate them with other energy resources.
- The nation shall promote the use of efficient solar energy conversion technologies, such as use of photo-voltaic and concentrated solar panels for power generation.
- The nation shall promote solar energy generation for productive use.
- The nation shall intensify efforts to increase the percentage of solar energy in the present energy mix.
- The nation shall promote the development of energy storage technologies.
- The nation shall compliment solar power development with energy efficiency programmes

KEY STRATEGIES TO ADOPTED IN THE IN THE POLICY FOR SOLAR IN NIGERIA

- SOURCING AND PROVIDING ADEQUATE INCENTIVES TO LOCAL ENTREPRENEURS FOR THE PRODUCTION OF SOLAR ENERGY CONVERSION SYSTEMS.
- ORGANIZING SYSTEMATIC PUBLIC ENLIGHTENMENT CAMPAIGNS ON THE BENEFITS OF USING SOLAR HOME SYSTEMS.
- ESTABLISHING INCENTIVES FOR THE DOMESTIC DEVELOPMENT AND DEVELOPMENT OF ENERGY STORAGE TECHNOLOGIES.
- TRAINING OF SKILLED MANPOWER FOR THE MAINTENANCE OF SOLAR ENERGY CONVERSION SYSTEMS.
- DEVELOPING SKILLED MANPOWER AND PROVIDING BASIC ENGINEERING INFRASTRUCTURE FOR THE LOCAL PRODUCTION OF COMPONENTS AND SPARE PARTS FOR SOLAR ENERGY CONVERSION SYSTEMS.
- IMPLEMENTING A WEB-BASED SOLAR PROSPECTING TOOL THAT TRANSLATES SOLAR RESOURCES INTO POTENTIAL POWER GENERATION AT THE LOCAL LEVEL. THIS WOULD REQUIRE UPDATED RENEWABLE ENERGY RESOURCE ASSESSMENTS.
- PROMOTE USE OF SOLAR WATER SYSTEMS IN SCHOOLS, HOSPITAL, HOTELS AND PUBLIC BUILDING OF ELECTRICITY PEAK LOAD AND CO2 REDUCTION

NIGERIA'S SUSTAINABLE ENERGY FOR ALL (SE4ALL) TARGETS

ELECTRICITY VISION

30 – 30 – 30

30GW BY 2030 WITH 30% RENEWABLE ENERGY

ELECTRICITY VISION: 30-30-30: 30GW BY 2030 WITH 30% RENEWABLE ENERGY

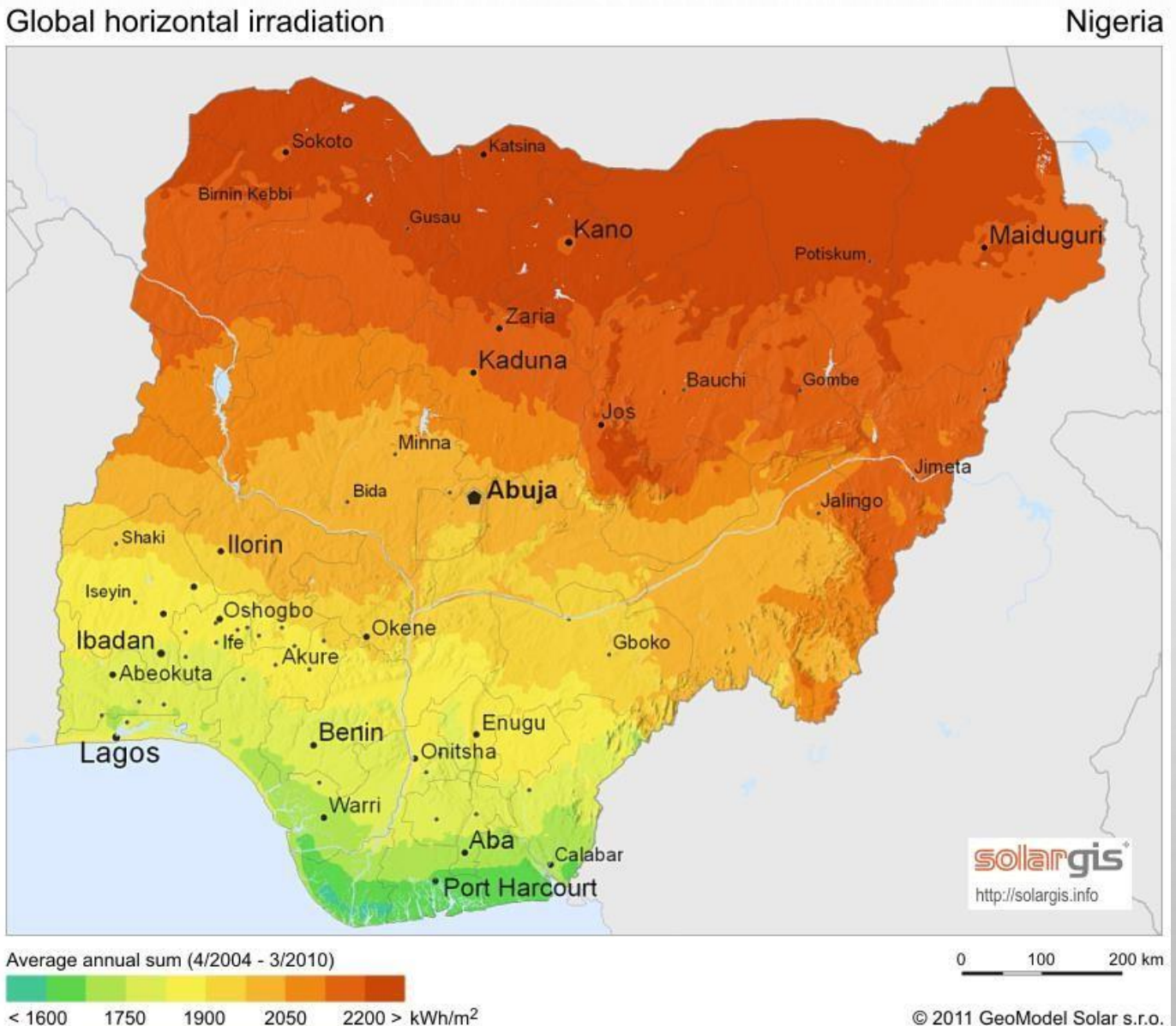
EOY	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ON-GRID CAPACITY MWH/H																	
Fossil Fuel (FF)																	
Gas	2,800	3,076	3,121	3,913	4,172	4,259	4,524	4,867	5,286	5,889	6,684	7,581	8,646	9,714	10,957	12,429	13,000
Coal	0	0	0	0	0	255	424	628	871	1,060	1,203	1,408	1,582	1,958	2,388	2,846	3,200
Nuclear	0	0	0	0	0	0	0	0	0	0	0	1000	1000	1000	1500	1500	2000
Sub Total FF	2,800	3,076	3,121	3,913	4,172	4,514	4,948	5,495	6,157	6,949	7,887	9,989	11,228	12,672	14,845	16,775	18,200
Renewables (RE)																	
LHP	916	1,097	1,200	1,650	1,920	2,200	2,540	2,800	3,100	3,400	3,700	4,000	4,200	4,500	4,600	4,700	4,700
SMHP	0	15	45	125	205	285	265	325	405	485	565	625	705	785	865	945	1,200
Solar PV	0	0	100	500	1,200	1,600	2,000	2,300	2,600	2,900	3,200	3,500	3,840	4,180	4,520	4,860	5,000
Solar Thermal	0		0	0	0	0	50	200	300	400	500	600	700	800	900	950	1,000
Wind (Max)	0	0	10	50	90	130	170	210	250	290	330	370	450	530	610	750	800
Biomass	0	0	0	50	180	240	300	360	420	480	540	600	720	840	960	1,080	1,100
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total RE plus LHP	916	1,112	1,355	2,375	3,595	4,455	5,325	6,195	7,075	7,955	8,835	9,695	10,615	11,635	12,455	13,285	13,800
Sub Total RE less LHP	0	15	155	725	1,675	2,255	2,785	3,395	3,975	4,555	5,135	5,695	6,415	7,135	7,855	8,585	9,100
%RE plus LHP	25	27	30	38	46	50	52	53	53	53	53	49	49	48	46	44	43
%RE less LHP	0	0	3	12	22	25	27	29	30	31	31	29	29	29	29	29	28
TOTAL ON-GRID (FF+RE) MWH/H	3,716	4,188	4,476	6,288	7,767	8,969	10,273	11,690	13,232	14,904	16,722	19,684	21,843	24,307	27,300	30,060	32,000
OFF-GRID CAPACITY MWH/H																	
Mini-Grid	1	1	5	50	125	150	180	270	405	608	911	1,367	2,050	3,075	3,691	4,429	5,314
SHS + Street Lights	10	30	50	100	150	300	360	540	648	778	933	1,120	1,344	1,612	1,935	2,322	2,786
TOTAL OFF-GRID MWH/H	11	31	55	150	275	450	540	810	1,053	1,385	1,844	2,487	3,394	4,688	5,625	6,751	8,101
SELF GENERATION (CAPTIVE)	13,800	13,800	12,500	12,000	11,500	11,000	10,500	10,000	9,500	9,000	8,500	8,000	7,500	7,000	6,500	6,000	5,000
GRAND TOTAL MWH/H	**17,527**	**18,019**	**17,031**	**18,438**	**19,542**	**20,419**	**21,313**	**22,500**	**23,785**	**25,290**	**27,067**	**30,170**	**32,737**	**35,995**	**39,426**	**42,811**	**45,101**

Implementation Status

Policies Instrument	Support Regulations	Responsible Institutions	Status of Implementation
Unsolicited Projects	Bulk Procurement Regulation	NBET	1,125MW PCOA being signed
Competive Procurement	Bulk Procurement Regulation	NBET	Bidding Process underway
REFIT	REFIT Regulation	NBET/DisCo	2,000MW allocated
Mini-grid (Off-grid)	Mini-grid Regulation & RESIP Approved	REA/SREA	Off-grid RE project implementation by private sector (8,100MW)

Nigeria is located close to the equator between Latitudes 4ºN and 14ºN, where solar radiation intensity is very high. The country receives 3.5 - 7.0 kWh/m^2/day of solar radiation (REMP 2012), which can be converted using suitable solar thermal collectors and deployed for different applications such as water heating.

Solar radiation map of Nigeria (Source: Solargis http://solargis.info)



- **The country’s huge solar resource remains largely untapped, even though solar water heating systems are already commercially viable and, in some cases, already cost competitive.**

Solar water heaters utilize thermal energy from the sun to heat either water or a heat-transfer fluid in a collector. Solar water heating systems include storage tanks and solar collectors.

Nigeria Energy Support Programme implemented by GIZ in partnership with Federal Ministry of Power, Works & Housing with funding from the German Government and European Union did a Technical and Economic market overview of Solar Water Heaters (SWH) in Nigeria and baseline studies for complementary data which provided additional information on the status of SWH in Nigeria as part of the NESP Energy Efficiency Component.

The objectives of this study are:

- To provide information about the status quo and the potential for the use of solar water heaters in Nigeria
  - To carry out a survey to determine the sources and cost of water in selected households, educational buildings, hospitals, and hotels in Nigeria;
  - To ascertain the prevalent methods of hot water preparation in these sectors;
  - To determine the cost implication of the chosen means of hot water preparation;
  - To allow for a better understanding of how water consumption and especially hot water consumption has developed during the past 10 years;
  - To provide a technical and economic market overview of solar water heating technologies;
  - To develop business cases for the use of solar water heaters in the sectors listed above;
  - To analyse barriers for the use of solar water heaters in Nigeria;

To collect good international examples of solutions to learn from

The aim of the work reported here is to develop a baseline that shows the current hot water generation and use profiles in Nigerian schools, hospitals, hotels, and homes. Information about energy consumption and costs is used to develop business cases for these different use profiles in order to provide a basis for decision making for possible intervention programmes to promote the use of SWHs. A technical and economic market overview of SWH in Nigeria and other complementary data provides additional information for drafting the SWH part of the NESP Energy Efficiency Component.

1.2 Sectorial energy consumption

The patterns of energy usage in Nigeria's economy can be divided into industrial, transport, commercial, agricultural, and household sectors (ECN, 2003). The share of electricity in final energy consumption is almost marginal at less than 2%.The household sector accounts for the largest share of energy usage in the country - about 78%. This is followed by industrial use at approximately 8.7% (Ley et al., 2014). This is largely due to the low level of development of the sectors. As shown in figure 1, the major energy-consuming activities in Nigeria's households are cooking (91%), lighting (6%), and use of other electrical appliances (3%) (ECN, 2005).

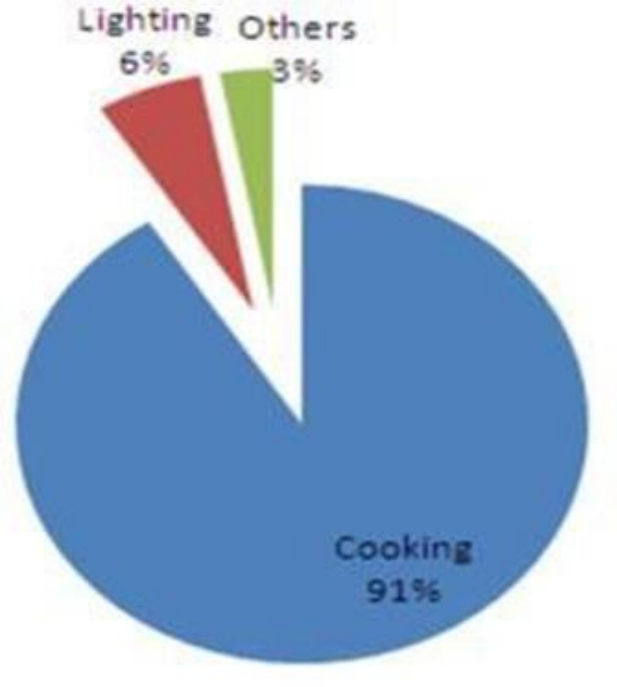


Figure : Household consumption pattern (Source: ECN, 2005)

Table : Electricity Prices for Abuja Distribution Company

Consumer Type	2015		2016		2017	
Residential	Fixed Charge (₦/month) (€/month)	Energy Charge (₦/KWh) (€/KWh)	Fixed Charge (₦/month) (€/month)	Energy Charge (₦/KWh) (€/KWh)	Fixed Charge (₦/month) (€/month)	Energy Charge (₦/KWh) (€/KWh)
R1	0.00 (0.00)	4.00 (0.02)	0.00 (0.00)	4.00 (0.02)	0.00 (0.00)	4.00 (0.02)
R2	702 (3.12)	20.10 (0.09)	843 (3.75)	20.09 (0.09)	1,011(4.49)	19.28 (0.09)
R3	53696 (238.65)	32.47 (0.14)	63,235 (218.04)	32.47 (0.14)	72,882 (323.92)	31.15 (0.14)
R4	136030 (604.58)	32.47 (0.14)	163,236 (725.49)	32.47 (0.14)	195,883 (870.60)	31.15 (0.14)
Commercial						
C1	702 (3.12)	23.77 (0.11)	843 (3.75)	23.77 (0.11)	1,011 (4.49)	22.80 (0.10)
C2	47772 (212.32)	30.18 (0.13)	57,326 (254.78)	30.18 (0.13)	68,791 (305.73)	28.95 (0.13)
C3	123321(5 48.10)	30.18 (0.13)	147,985 (657.71)	30.18 (0.13)	177,582 (789.25)	28.95 (0.13)
Industrial						
D1	1000 (4.44)	24.35 (0.11)	1,200 (5.33)	24.35 (0.11)	1,440 (6.40)	23.36 (0.10)
D2	25278 (112.35)	31.63 (0.14)	30,334 (134.82)	31.63 (0.14)	36,401 (161.78)	30.35 (0.13)
D3	123321 (548.09)	31.63 (0.14)	147,985 (657.71)	31.63 (0.14)	177,582 (789.25)	30.35 (0.13)
Special						
A1	702 (3.12)	23.31 (0.10)	843 (3.75)	23.31 (0.10)	1,011 (4.49)	22.36 (0.10)
A2	43125 (191.67)	23.31 (0.10)	51,750 (230)	23.31 (0.10)	62,100 (276)	22.36 (0.10)
A3	54375 (241.67)	23.31 (0.10)	65,250 (290)	23.31 (0.10)	78,300 (348)	22.36 (0.10)
Street lighting						
S1	600 (2.67)	19.24 (0.09)	720 (3.20)	19.24 (0.09)	864 (3.84)	18.46 (0.08)

rce: NERC, 2015

A combination of methodologies was used to scope with this task. These include desk research, interviews, and visits to buildings, and the administration of questionnaires.

The surveys were conducted within the months of September and October 2013, mainly in Enugu, Abeokuta and Minna (hospitals and hotels also in other cities including Abuja)

Abeokuta is the largest city and capital of Ogun State in southwest Nigeria. It is situated on the east bank of the Ogun River, near a group of rocky outcrops in a wooded savannah; 77 km north of Lagos by railway, or 130 km by water.

It lies on Latitude 8.03ºN and longitude 2.47ºE with a population of 352,735 according to 1991 census. The temperature is between 25ºC (lowest in August) and 29ºC (highest in March)[1].

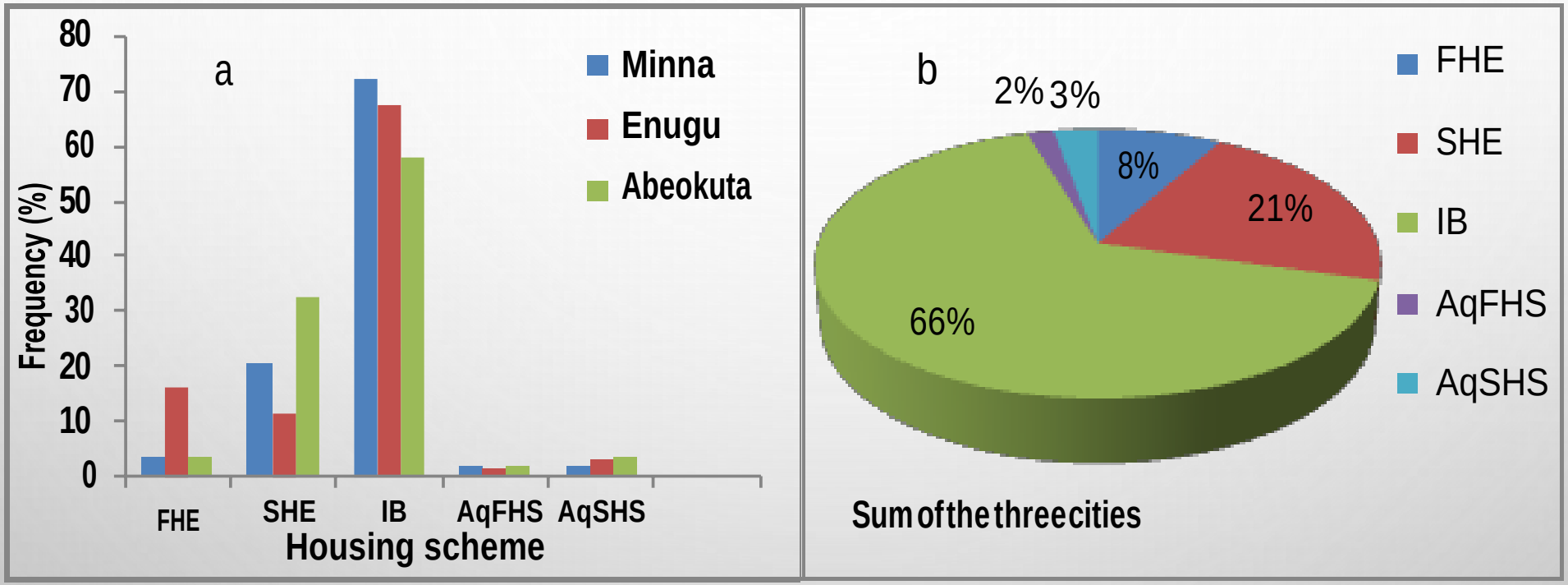
Minna is a city in the north central (middle belt zone) of Nigeria. It is the capital of Niger State, one of Nigeria's 36 federal states with an estimated population of 3,950,249 in 2006. The mean monthly temperature is highest in March with a value of 30.5°C and lowest in August at 22.03°C. Minna lies on latitude 9·61°N and longitude 6.56°E and is about 272 meters above sea level[2].

The three major hydro-electricity power stations situated at Kainji, Jebba and Shiroro are all in the Niger State hence there is tendency for the higher availability of grid power in Minna.

Enugu city is the capital of Enugu State, one of the states in the eastern part of Nigeria. It lies on latitude 6.50°N and longitude 7.50°E and is about 240 metres (732 ft) above sea level. Currently, the city has 465,000 inhabitants and its premises are spread over an area of 73 km^2.

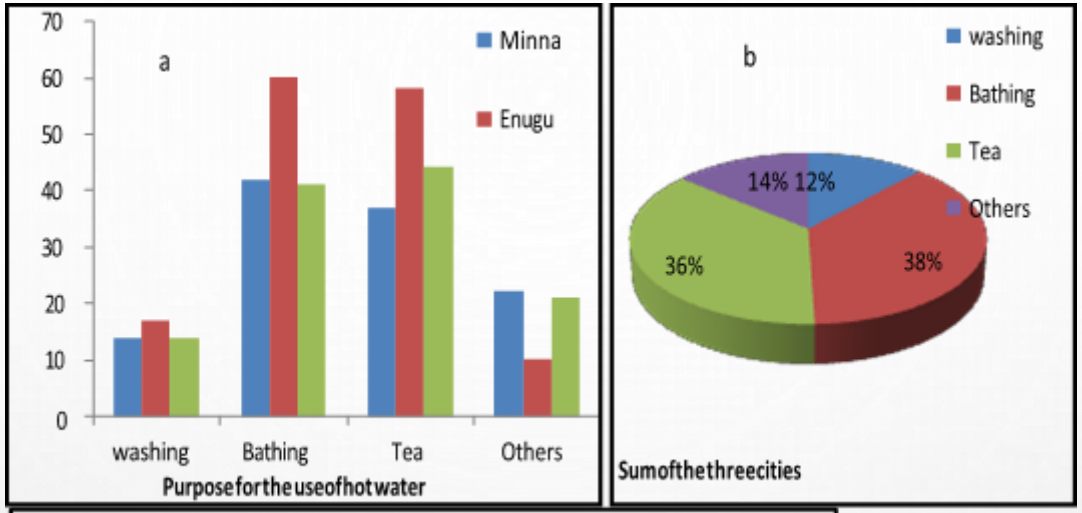
The mean temperature in Enugu in the hottest month of February is about 30.64°C, while the lowest temperatures occur in the month of November, reaching 15.86°C[3].

Distribution of the housing schemes covered
(a) distribution for the current year (b) distribution for the three cities



(Federal Housing Estate (FHE), State Housing Estate (SHE), Individually Built (IB), Acquired through Federal Housing scheme (AcFHS), Acquired through State Housing Scheme (AcSHS)

Purpose for hot water use, (a) distribution for the current year (b) distribution for the three cities (c) comparison with the last five and ten years



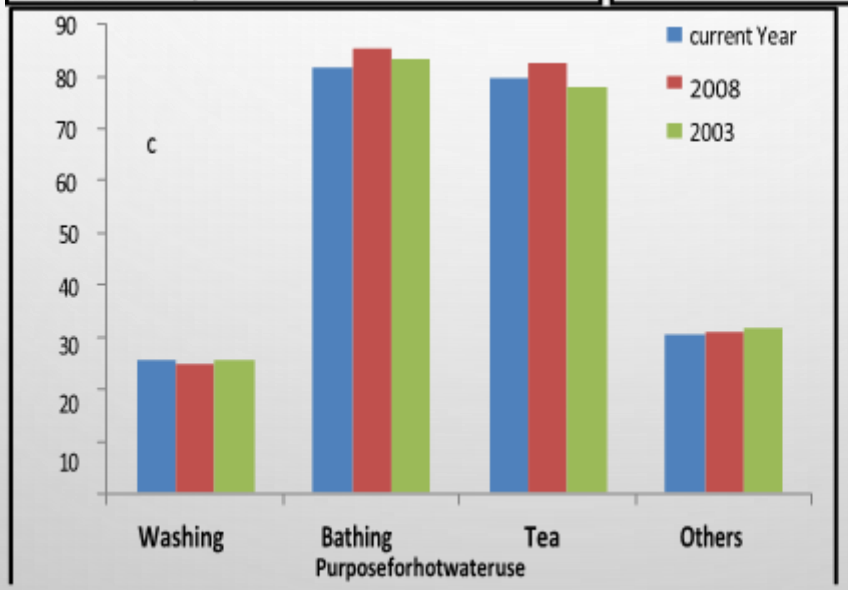


Table 3a: Mean daily quantity of water consumed per household

Year	Daily quantity of water per household (litres)			
	Minna	Enugu	Abeokuta	Average
Current year	104.15±21.03	119.19±19.05	80.00±16.76	101.27±11.11
2008	72.77±17.66	89.50±16.82	69.12±14.20	77.697±9.40
2003	67.86±16.57	75.54±15.46	57.32±12.27	66.82±8.52

Table 3b: Mean daily quantity of water consumed per person

Year	Quantity per person (litres)			
	Minna	Enugu	Abeokuta	Average
Current year	19.58	23.28	24.78	21.66
2008	14.49	19.53	23.89	18.84
2003	11.59	18.84	20.19	16.35

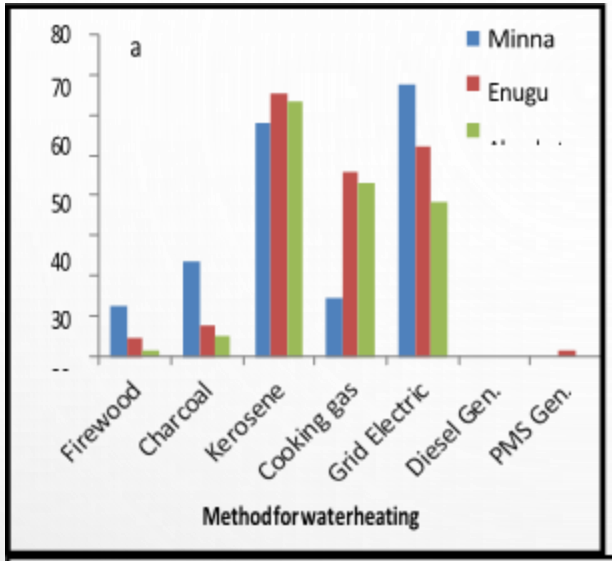
Summing the quantities indicated by respondents for the various purposes of hot water use and normalizing to 100ºC (to be then diluted to comfort temperature), we arrived at the mean values indicated in table 3 for the mean daily consumption per household.

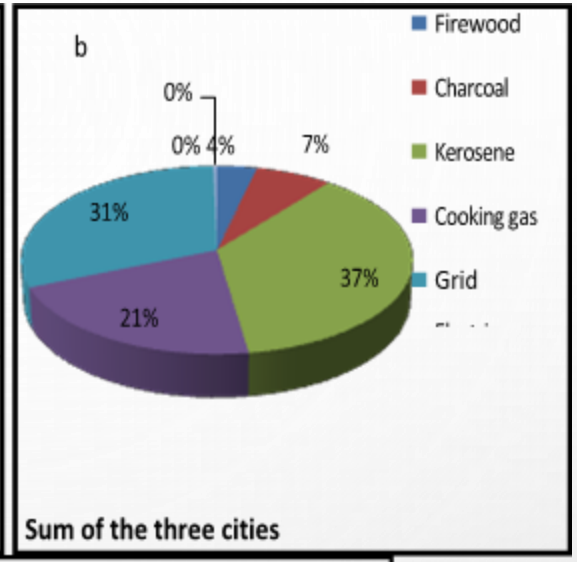
Table 4: Mean daily quantity of hot water consumed per household (typical household 3-5 persons)

Year	Quantity of hot water at 100ºC per household (litres)			
	Minna	Enugu	Abeokuta	Average
Current year	20.50±5.53	17.31±4.80	11.86±2.53	16.56
2008	19.93±6.45	15.07±3.06	11.37±2.25	15.46
2003	19.95±6.39	16.15±4.08	11.30±2.32	15.80

essment of the weekly cost estimate of water consumption for each household indicates that a greater percentage (44%) of the households spends between ₦500 and ₦1000 while 38% spend less than ₦500, 50% and 42% of the households spend less than ₦500 in 2003 and 2008 respectively.

Distribution of the methods used in hot water heating (a) distribution for the current year (b) distribution for the three cities (c) comparison with the last five and ten years





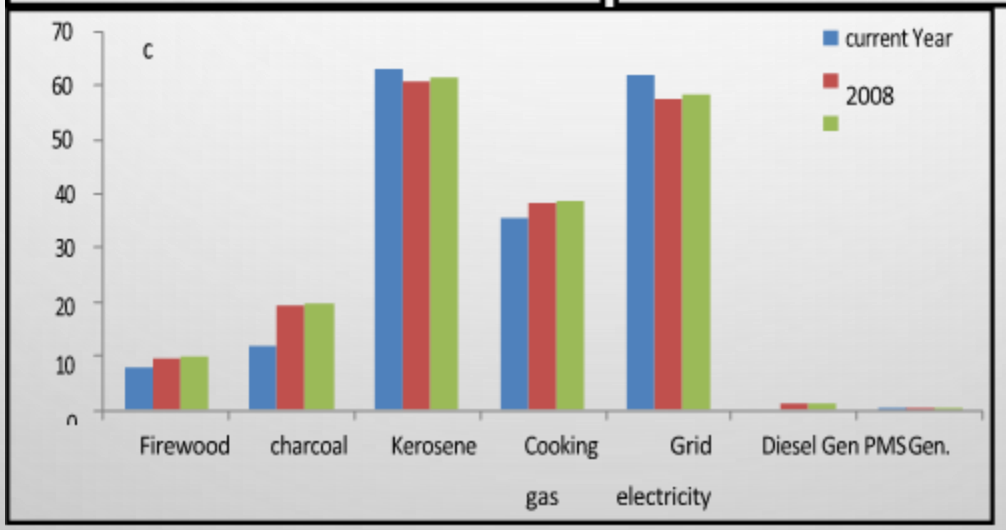


Table 5a: Prices of fuels used

	Electricity tariff (₦/kWh)	Cooking gas (₦/kg)	Kerosene (₦/litre)	Charcoal (₦/kg)	Fuelwood (₦/kg)	PMS (₦/ litre)
Current year	14.82	325	140	37.5	20	97
2008	8.50 [1]	280 [2]	60 [4]	37.5	20	70 [2]
2003	4 [3]	240 [3]	38 [3]	37.5	20	41 [3]

[1] Nigerians to pay higher electricity tariff from April 30 2012, an article published in Punch newspaper February 1, 2012

[2] Petroluem Products Prices Regulatory Authority (PPPRA) (2009) "Transformative Programme for the downstream oil and gas sector" A presentation to the Honorable Minister of Petroleum Resources on 7th august 2009

[19] Nigeria Energy Study Report (2005)

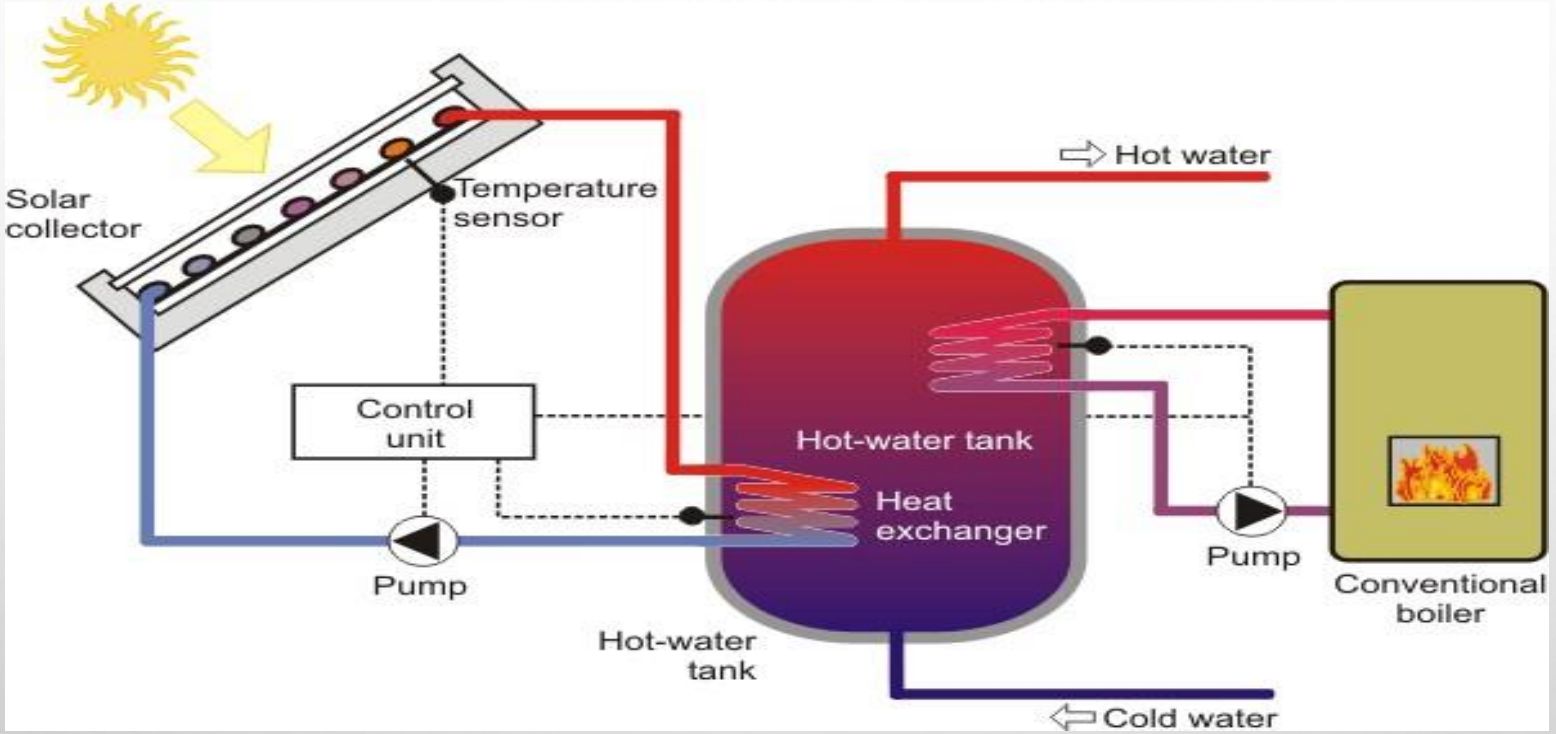
[4] Nwodo O., a dealer in LPG gas in Nsukka (Personal Interview on 23/10/13)

Table 5b: Cost of heating a litre of water from 25°C to 100°C using the various fuels

Year	Cost of heating a litre of water from 25°C to 100°C (₦)				
	Fuelwood	Kerosene	Cooking gas	Charcoal	Grid electricity
Current year	0.78	2.27	2.85	0.72	1.43
2008	0.78	0.97	2.45	0.72	0.82
2003	0.78	0.62	2.10	0.72	0.39

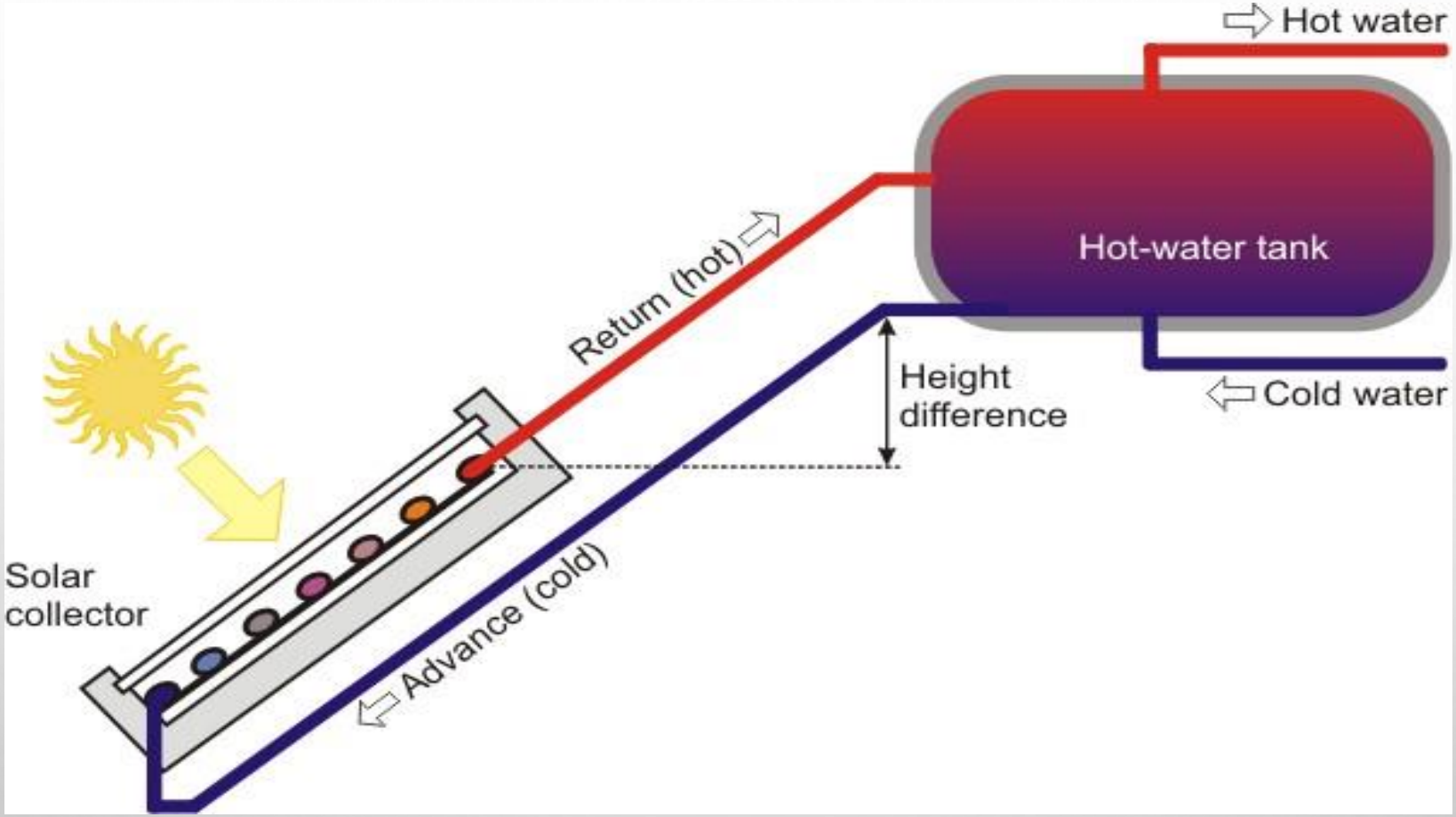
amount of 0,087 kWh is needed to heat 1 litre of water from 25°C to 100°C. Depending on the type of fuel and the efficiency of the hot water preparation method, actual energy consumption is between 0,10 kWh and 0,16 kWh to heat 1 litre of water from 25°C to 100°C.

Figure 12: An active (forced circulation) SWH system



Source ESTIF (2012)

Figure 13: Thermosyphon solar water heater



Source: OME (2012), ESTIF (2012)

Prices of Solar Water Heaters and Associated Services in Nigeria

Globally, there is an inverse relationship between installed SWH collector area and system prices. In Nigeria, the market for SWHs is at its infancy. The bulk of systems already installed in Nigeria are imported from different countries and their prices vary widely.

Currently, there are no specific codes for SWH systems in Nigeria as yet. However, there are indications that the Standards Organization of Nigeria (SON) has plans to develop a national standard for solar water heating systems in the near future.

Prices of some SWH systems available in Nigeria

S/No	Technical Features		Manufacturer	Price (₦)	Price (€)
	Collector	System			
1	4 m^2 Flat plate collector	Thermosyphon system with advanced 40L storage tank (retains water temperature for 72 hours)	Local (Market-ready NCERD prototype)	150,000.00	698.00
2	4 m^2 Flat plate collector	Thermosyphon system with advanced 213L storage tank (retains water temperature for 72 hours)	Local (Market-ready NCERD prototype)	270,000.00	1,256.00
3	3 m^2 Flat plate collector	Hybrid system (solar and electricity) with 275L storage tank	Vendor: Simba Solar Abuja	300,000 incl. installation	1,395.00
4*	4.5 m^2 Flat plate collector	Thermosyphon system with 1000L cold and 500L hot water storage tanks	Local (Market-ready SERC prototype)	380,000	1,767.00
5*	2.25 m^2 Flat plate collector	Thermosyphon system with 500L cold and 250L hot water storage tanks	Local (Market-ready SERC prototype)	150,000	698.00

*Excluding installation costs. €1=₦215

Comparison between life-cycle costs of SWH and an electrical water heater

S/No	Item	Electrical Heater	Solar Water Heater
1	Specification	1.2 kW suitable for 2-4 persons	2.0 m^2 Flat-plate, thermosyphon; suitable for 2-4 persons
2	Initial Cost (₦)	20,000.00	150,000.00
3	Installation Cost (₦)	10% = 2,000.00	20% = 30,000.00
4	Maintenance Cost (₦)	Minimal	Minimal
5	Running Cost for Residential Use (₦)	1-2 hrs/day @ ₦14.8/kWhr = 76,723 – 153,446	None
6	Running Cost for Hotel Use (₦)	2-4 hrs/day @ ₦21.8/kWhr = 226,022 – 452,044	None
7	Expected Life Span	8-12 years	15-20 years
8	Life Cycle Cost Residential (₦)	98,723 – 175,446	180,000
9	Life Cycle Cost Hotel (₦)	248,022-474,044	180,000

*Running costs were calculated using R2 and C2 electricity tariffs, as per MYTO (FGN 2012)

Various types of barriers and solutions how to overcome them

Type of barrier	Barriers from the client's perspective	Solutions how to overcome barriers	Barriers from the companies' perspective
Information	Not having heard about SWH and the advantages	Awareness creation addressing customers	Not knowing that SWH could be a business activity for the company
Social and cultural	Doubts whether SWH really work	Demonstration projects in various sectors	Doubts whether SWH really work
Financial	SWH are too expensive, not affordable	Provide financial support to customers until market develops	SWH are too expensive, no viable business
Political	Where to find a reliable company who can do the design, the import, the installation and maintenance of the SWH	Training and certification of (future) SWH companies Development of information and training material	Not having the knowledge and the skills to design, import, install and maintain SWH
Legal	What to do if the SWH does not work properly	Development of model contracts (e.g. ESCO-based)	Not knowing how to conclude a service contact
Political		Quality assurance and random sample testing to ensure compliance with standards	Not knowing whether the quality of SWH is as stated (which is the precondition for a service contract)
Political		Integration of SWH as a requirement into the energy building code	No legal obligation for SWH which will create enough business to justify the investment in training and acquiring new skills
Social		Integration of SWH as a requirement into the voluntary Green Building Assessment Scheme (GBCN)	Big clients such as hotel owners do not demand for it because there is no publicity for SWH in large buildings

Survey Outcome

The survey has shown that most of the people have not even heard about nor seen a solar water heater. A pilot/demonstration project will be vital for the popularization of this technology. In addition, a closer cooperation with the relevant government agencies should be sought especially in the area of developing necessary policy that will drive the technology.

- Housing: Very few household and Estate have Solar water system installed
- Educational institutions: During the baseline study good contact has been established with several secondary schools and other institutions, and the installation in existing buildings is an option.
- Hospitals: SWH is not profitable at all in hospitals; however, fully funded demonstration projects could still be installed due to the benefit of promoting SWH and make them known to the patients.
- Hotels: Most existing buildings use decentralised hot water supply. Therefor the activity might mainly address new buildings with a central hot water supply or selected parts of existing buildings (e.g. laundry) .

The Nigerian Energy Support Programme (NESP) in collaboration with the Federal Ministry of Power, Works and Housing (Housing) developed the Building Energy Efficiency Code (BEEC) that supports the regulation of energy consumption of buildings and also promotes the used of the Solar Water System.

The NESP also built a demonstration project on order to promote the use of Solar Water Systems.

68 units of solar water heaters were provided as a grant to a boarding secondary school in Plateau State. The installed heaters provide access to hot water to over 1000 students and staff who previously did not have access to hot water.

This project helped in showcasing the viability of solar water heating technology in Nigeria and improving the living conditions of students and staff of GSS, Kuru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Public partners:	Federal Ministry of Power, Works and Housing Plateau State Government
Host Community:	Government Science School, Kuru, Jos-South LGA
Capacity of systems:	Sixty eight (68) Units of Solar Water Heaters with a total collector area of 212m^2 and annual solar production of 171,373 kWh
Persons with access to hot water:	Approximately 1000 students and Staff
Major occupation In community area:	Students, Academics
Potential users:	Students, Staff
Trainings and Capacity Building For Plateau State:	We have organised trainings and provided technical assistance to the maintenance team of GSS Kuru. They received training in installation as well as maintenance of the solar water heaters
Funding:	Grant Funded


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THANK YOU