



DEVELOPING EFFECTIVE OFF-GRID LIGHTING POLICY



GUIDANCE NOTE FOR GOVERNMENTS IN AFRICA





BMZ Indeministeri





gef

03/28

recycled paper, using vegetable -based inks and other eco-friendly practices. mentally sound practices globally and in its own activities. This publication is printed on 100% promotes environ-

Acknowledgements

22

TABLE OF CONTENT

1 The Case for Off-Grid Lighting 05 11 The success of market based solutions 05 1.1 The success of market based solutions 05 1.2 The international policy landscape 06 1.3 Choosing the right policies to increase basic energy access 07 2 Call to Action: Strategies to Create an Enabling Environment 07 2.1 Step 1: Get the fundamentals right – engagement of informed stakeholders and proper monitoring 08 2.1.1 Ensure all relevant stakeholders understand the benefits of the technology 08 2.1.2 Engage all stakeholders, specially the private sector 09
1 The Case for Off-Grid Lighting 05 11 The success of market based solutions 05 12 The international policy landscape 06 13 Choosing the right policies to increase basic energy access 07 2 Call to Action: Strategies to Create an Enabling Environment 07 2.1 Step 1: Get the fundamentals right – engagement of informed stakeholders and proper monitoring 08 2.1.1 Ensure all relevant stakeholders understand the benefits of the technology 08
1 The Case for Off-Grid Lighting 05 1.1 The success of market based solutions 05 1.2 The international policy landscape 06 1.3 Choosing the right policies to increase basic energy access 07 2 Call to Action: Strategies to Create an Enabling Environment 07
1 The Case for Off-Grid Lighting 05 1.1 The success of market based solutions 05 1.2 The international policy landscape 06
1 The Case for Off-Grid Lighting 05

Step 1: Get the fundamentals right – 08 engagement of informed stakeholders understand the benefits of the technology 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Step 2: Kick-start the market – fiscal/financial tools that attract 09 Nonitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Introduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11 Remove subsidies on lighting fuels 11 Rest access to finance across the supply chain 11 Raise awareness for solar lighting benefits among the population 12 accepted minimum standards 12 Raise awareness for solar lighting benefits among the population 15 Leverage public private partnerships to increase market growth 15 Step 4: Sustain the positive impact and keep market as teady growth rates 16 Strengthen enforcement and monitoring of quality assurance programs 17 </th <th>20</th> <th>Conclusion</th> <th>ω</th>	20	Conclusion	ω
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Develop Transparent National Energy Strategies 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Step 3: Scale up the market 12 Ensure product quality through promotion of internationally 12 accepted minimum standards 12 Raise awareness for solar lighting benefits among the population 14 Encourage development of local skills to support market growth 15 Leverage public private partnerships to increase market penetration 15 Step 4: Sustain the positive impact and keep market at steady growth rates 16 Step 4: Sustain the positive impact and monitoring of quality assurance programs 17	17	Provide infrastructure/regulation for proper recycling of spent products	4.2
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Facilitate access to finance across the supply chain 12 Ensure product quality through promotion of internationally 12 Accepted minimum standards 12 Raise awareness for solar lighting benefits among the population 14 Encourage development of local skills to support market growth 15 Leverage public private partnerships to increase market penetration 15 Leverage public private partnerships to increase market as teady growth rates 16 Step 4: Sustain the positive impact and keep market as teady growth rates 16	17	Strengthen enforcement and monitoring of quality assurance programs	4.1
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Step 3: Scale up the market 12 Step 3: Scale up the market 12 Remove subsidies on solar lighting benefits among the population 12 Raise awareness for solar lighting benefits among the population 14 Leverage development of local skills to support market growth 15 Leverage public private partnerships to increase market penetration 15	16	Step 4: Sustain the positive impact and keep market at steady growth rates	2.4
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Develop Transparent National Energy Strategies 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Facilitate access to finance across the supply chain 12 Step 3: Scale up the market 12 Ensure product quality through promotion of internationally 12 accepted minimum standards 12 Raise awareness for solar lighting benefits among the population 14 Encourage development of local skills to support market growth 15	15	Leverage public private partnerships to increase market penetration	3.4
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Develop Transparent National Energy Strategies 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Introduce exemptions on value-added tax and tariffs 11 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Step 3: Scale up the market 12 Ensure product quality through promotion of internationally 12 accepted minimum standards 12 Raise awareness for solar lighting benefits among the population 14	15	Encourage development of local skills to support market growth	ω.
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Introduce exemptions on value-added tax and tariffs 11 Remove subsidies on lighting fuels 11 Step 3: Scale up the market 12 Ensure product quality through promotion of internationally 12 accepted minimum standards 12	14	Raise awareness for solar lighting benefits among the population	3.2
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Develop Transparent National Energy Strategies 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Introduce exemptions on value-added tax and tariffs 11 Remove subsidies on lighting fuels 11 Facilitate access to finance across the supply chain 11 Step 3: Scale up the market 12	12	Ensure product quality through promotion of internationally accepted minimum standards	<u>ω</u>
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10 Introduce exemptions on lighting fuels 11 Facilitate access to finance across the supply chain 11	12	Step 3: Scale up the market	2.3
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10 htroduce exemptions on value-added tax and tariffs 10 Remove subsidies on lighting fuels 11	∃	Facilitate access to finance across the supply chain	2.3
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 09 Step 2: Kicke-start the market – fiscal/financial tools that attract 10 Introduce exemptions on value-added tax and tariffs 10	∃	Remove subsidies on lighting fuels	2.2
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 Monitoring and verification of measures 09 Step 2: Kick-start the market – fiscal/financial tools that attract 09 Step 2: Kick-start the market – fiscal/financial tools that attract 10	10	Introduce exemptions on value-added tax and tariffs	2.1
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09 09 09 <td< td=""><td>10</td><td>Step 2: Kick-start the market — fiscal/financial tools that attract the private sector</td><td>2.2</td></td<>	10	Step 2: Kick-start the market — fiscal/financial tools that attract the private sector	2.2
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09 Develop Transparent National Energy Strategies 09	60	Monitoring and verification of measures	1.4
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08 Engage all stakeholders, specially the private sector 09	60	Develop Transparent National Energy Strategies	
Step 1: Get the fundamentals right – 08 engagement of informed stakeholders and proper monitoring 08 Ensure all relevant stakeholders understand the benefits of the technology 08	60	Engage all stakeholders, specially the private sector	1.2
Step 1: Get the fundamentals right – engagement of informed stakeholders and proper monitoring08	80	Ensure all relevant stakeholders understand the benefits of the technology	11
	80	Step 1: Get the fundamentals right – engagement of informed stakeholders and proper monitoring	2.1

policies

Diagram illustrating the sequence for developing off-grid lighting

-igure 3

80

Energy ladder

Figure 2

06

energy access

Scenarios achieving universal

Figure 1

05

TABLE OF FIGURES

5 Annex I: UNEP integrated policy approach 6 Annex II: Estimated potential benefits from a market transition to efficient off-grid lighting in Africa

25

24 2

profits, even if the enlighten initiative has been advised of exemplary, incidental or punitive damages, including lost the possibility of such damages initiative be liable to you for any indirect, consequential,

Cover photo: Courtesy of NIWA

to any damages or liability and in no event will the en.lighten to the information provided herein. This disclaimer applies In no event will the en.lighten initiative, its related else for any act and conduct in connection with or related corporations, contributors, or the partners, agents or their respective employees have any liability to you or anyone

ISBN: DTI/1911/PA

ACKNOWLEDGEMENTS

to enable the penetration of sustainable off-grid lighting grid lighting concerns. a Regional Efficient Lighting Strategy that addresses off-(ECREEE) for the ongoing collaboration with UNEP to develop Regional Centre for Renewable Energy and Energy Efficiency (ECOWAS) region. Many thanks are extended to the ECOWAS solutions in the Economic Community of West African States to UNEP to facilitate the development of a regional policy operation and Development (BMZ) is providing support (GOGLA). Germany's Federal Ministry for Economic Cocooperation with the Global Off-Grid Lighting Associatior Environment Programme (UNEP)'s en.lighten initiative in This document was prepared for the United Nations

special permission from the copyright holder, provided in any form for educational or non-profit purposes without Copyright © United Nations Environment Programme 2015

This publication may be reproduced in whole or in part and

acknowledgement of the source is made. UNEP would

appreciate receiving a copy of any publication that uses this

publication as a source.

AUTHORS

Johanna Diecker (GOGLA) Essel Ben Hagan (UNEP), Olola Vieyra Mifsud (UNEP) and

REVIEWERS AND CONTRIBUTORS

Mathers, Michael Scholand (UNEP). Laura Fuller, Gustau Mañez Gomis, Elizabeth Mastny, Moira Melnyk (World Bank); Sarah Bendahou, Kathryn Conway Charlie Miller (Solar Aid); Jacob Lewandowski (d.light); Micah Karim Traoré (SNV Netherlands Development Organisation) Itotia Njagi (International Finance Corporation — IFC); Abde Peters (Global Off-Grid Lighting Association – GOGLA) Zusammenarbeit — GIZ); Ibrahim Soumaila (ECREEE); Koer Carsten Hellpap (Deutsche Gesellschaft für Internationale (Lawrence Berkeley National Laboratory); Bohzil Kondey UNEP extends its thanks to the following reviewers for their time and expert insights: Laura Williamson (REN21); Evan Mills

Programme. permission in writing from the United Nations Environment

any other commercial purpose whatsoever without prior No use of this publication may be made for resale or for

DISCLAIMER

commercial processes constitute endorsement. Environment Programme, nor does citing of trade names or the decision or the stated policy of the United Nations or concerning delimitation of its frontiers or boundaries. Environment Programme concerning the legal status of material in this publication do not imply the expression of Moreover, the views expressed do not necessarily represent any country, territory, city or area or of its authorities, any opinion whatsoever on the part of the United Nations The designations employed and the presentation of the

a particular purpose. from the use of this information, and without warranty of completeness, accuracy, timeliness or of the results obtained is provided on an "as-is" basis with no guarantee of obtained from the use of this information. All information to ensure that the information has been obtained from The information contained within this publication is for general guidance on matters of interest only, and may be warranties of performance, merchantability and fitness for any kind, express or implied, including, but not limited to responsible for any errors or omissions, or for the results reliable sources, the UNEP-GEF en.lighten initiative is not subject to change without notice. While we have attempted

lighting products

Integrated policy approach for a transition to efficient off-grid

Figure 5

24

and enforcement

Benefits of monitoring, evaluation,

Figure 4

5

4 References

02/28



The purpose of this report is to provide strategic advice to policymakers within governments and regulatory agencies to accelerate the penetration of efficient off-grid ighting products. It includes an industry perspective on how various policy measures could stimulate growth of how various policy measures could stimulate growth of the efficient of grid lighting market, accelerate access to efficient lighting and reduce the environmental impact of fuel-based lighting.

cantly reduced health and safety impacts, decreased carof working days, education, safety and access to informaels of electricity access, for lighting and other basic elecstrong evidence of the significant benefits of even low levcritical, as a large proportion of households still have no products and thereby secure benefits that include signifiaccelerate the penetration of efficient off-grid lighting as effective, reliable and economically efficient solutions electrification products have already proven themselves using fuel-based lighting products makes a strong case tricity services, on social aspects such as effective length keep pace even with population growth. There is however electrification via expansion of the electricity grid fails to access to electrical services. In many countries, household bon emissions and the creation of green jobs. reduce the dependence on fossil fuels for lighting and to tries have established an integrated policy framework to than traditional grid expansion strategies. Yet few counfor basic level household electrification, at far lower costs for switching to cleaner alternatives. Off-grid lighting and tion. Growing evidence of the negative health impact of The need for off-grid lighting products in Africa remains

> By transitioning to efficient off-grid lighting, countries in Africa could secure large annual savings from reduced use of fuel-based lighting sources, such as kerosene and oits, as well as greatly reduce the greenhouse gas and other emissions associated with fuel-based lighting. The widespread use of modern off-grid lighting technologies can deliver significant socio-economic, health and environmental benefits, such as: new income-generation opportunities for small businesses; longer lighting hours, and better illumination, for studying by schoolchildren and for other productive uses in homes and businesses; and improved health and safety through reductions in indoor air pollution and in the fire hazard associated with flammable fuels.

The scope of this report is based on lessons learned from the integrated policy approach process followed in the Economic Community of West African States (ECOWAS) sub-region and other regions. The publication discusses the context and cross-cutting issues of the transition to efficient off-grid lighting, including potential benefits. It identifies best practices, proven case studies and practical recommendations for establishing a regulatory framework and policy strategies for efficient off-grid lighting promotion, including the four elements of an integrated policy approach to accelerate and ensure a successful transition.



94

1 THE CASE FOR OFF-GRID LIGHTING

ing and economic productivity. is generally of low quality and expensive, impeding learn candles and battery-powered torches. Fuel-based lighting and dangerous sources of lighting such as kerosene lamps, ulations without access to grid electricity rely on polluting number of people on the African continent living in areas forts of governments fall short of population growth. The in urban areas (IEA 2011). Meanwhile, grid-extension efing around 465 million from rural areas and 121 million able and unstable connections (IEA 2012). Both groups retric grid (IEA 2013). Another one billion only have unreli-To date, 1.3 billion people live without access to the elecabout 700 million by 2030 (Lighting Africa 2013). The popwithout access to the electric grid is expected to rise to people in Africa with no access to grid electricity, includlamps and torches. There are approximately 600 million vert to traditional means of lighting, such as candles, wick

11 THE SUCCESS OF MARKET BASED SOLUTIONS

rently accounts for 90 million tons of CO2 annually (UNEP the burning of fossil fuels for the purposes of lighting curand contribute to climate change. UNEP estimates that tional means of lighting are harmful for the environment preventable deaths a year in Africa alone. Moreover, tradiand lamps can catch fire. Indoor fumes cause 600,000 Kerosene is not just expensive; it is also dangerous: stoves as 10% of their income on fuel for lighting (SolarAid 2014). populations globally USD 23 billion a year, of which around mately 4.5% of the United States' CO2 emissions. about 240 million tonnes of CO2, equivalent to approxiblack carbon are emitted annually from kerosene lamps. 2015b). Additionally it is estimated that 270,000 tonnes of that households at the base of the pyramid spend as much people in rich countries pay. Research by SolarAid found kilowatt-hour, more than a hundred times the amount holds are buying lighting at the equivalent of USD 100 per USD 10 billion is spent in Africa (UNEP 2013b). Poor house-Lighting and cooking with traditional methods costs poor The warming effect of these emissions is equivalent to

Especially connecting the rural population to the grid is logistically challenging as well as resource and maintenance intensive. Based on numbers projected by the International Energy Agency's new policy scenario (IEA 2011) investments needed to achieve universal energy access via grid-extension and mini-grids is equivalent to an average investment of approximately USD 4,000 per electrified household (AT. Kearney and COCLA 2014). However, technological innovation in the field of lighting, solar photovoltaics (PV) and energy storage has led to the emergence of leading edge and very cost-effective technology products that come at prices affordable to the consumers. These new products are well equipped to provide

> basic energy access at moderate costs and to the benefit of consumer households. The initial purchasing costs for efficient off-grid lighting products are often higher than the purchasing costs for kerosene or candles. However, in the long run, solar off-grid lighting products are cheaper - as running costs are zero and the solar light device is a one-time cost. Typically, the investment for a mid-priced solar lantern is paid back in four to five months.



Source: Adapted from A.T. Kearney and GOGLA 2014

The rationale behind offering solar-based lighting is simple. Solar off-grid lighting products are cheaper, brighter, more efficient and healthier than kerosene lamps. Products consist of three parts: a solar panel; a battery; and at least one LED. They come in a broad range, have a battery run time of six hours or more, with a light output of up to 100 lumens. Many products also offer additional important functionality, such as mobile phone charging outlets. 'Solar kits' offer multiple light sources, as well as an external power outlet. Quality entry-level products start from so little as USD 8. The wide product range available allows different consumers to benefit from the technologies and use clean lighting products, small businesses, hospitals, or schools.

What solar lantern owners save on kerosene, they can invest in other important things like food, education for their children, healthcare etc. – in addition to a general improvement to their living standards. Under the assumption of a three-year life cycle for a solar lighting product (Lighting Africa 2012a), a household can save up to 86% of their previous energy expenses for kerosene and mobile charging. Better quality and longer lighting allows school children to study more and better. On average school children study for one additional hour per day (SolarAid 2014a). The longer hours of lighting lengthen the day and give additional productive hours to small businesses or for socialising within families and communities.

The multiple benefits for households are obvious and thus solar lighting products are highly sought after. The offgrid lighting industry is trying to meet this huge demand and market based solutions have borne first fruits. Since

2012, sales figures have tripled and the market is projected to continue to grow at rates of 55% per year (A.T. Kearney and GOGLA 2014). This means that the private sector has provided clean lighting, and in many cases also phone charging systems, to 32 million people in Africa alone (Lighting Africa 2015). The household itself carries the cost for the products and there is thus no need for the government to directly subsidise the product price. Innovative business models such as 'pay as you go' allow consumers to access products by paying small increments over time, thereby overcoming the high initial purchasing costs. For governments, solar off-grid lighting and electricity is the cheapest zero carbon route to energy access. A full transition to clean cources of lighting would also

A full transition to clean sources of lighting would also have several macro-economic benefits. The market-based approach taken so far is proving to be a real job-booster. The industry has the potential to create an additional 500,000 jobs only in the ECOWAS region (Mills 2014c). Additional income generated through the use of additional productive hours also leads to new sources for tax revenues. On the spending side, governments could significantly decrease their spending on kerosene subsidies, and reduced health risks will have a positive impact on the national health budget and social spending.

Lighting is only the first rung on the energy ladder. Companies among GOCLA members report that consumers are always coming back – but never for the same product are Household savings from the first solar lighting product are often re-invested into the next bigger solution. Lighting is the enabler for demand evolution, and as new technologies become available to the bottom of the pyramid, demand for bigger and more expensive systems will rise. Consumers start with an entry-level product and re-invest their savings into a bigger system. The Figure below illustrates the concept of the energy ladder showing demand progression.



gy policies; difficult access to capital; high tax and tariff on the market development. ments of policies and regulations can have huge impacts chance to benefit from market trends. Often slight adjustcreased awareness among policymakers offers the unique adverse effects in the technology landscape of today. Inadopted to support low-income households but have is often due to out-dated policies that were originally able to compete, with traditional means of lighting. This nomically smarter products are struggling to, or are ununeven playing fields in which environmentally and ecoand energy access missing,. companies often encounter incentives for a market-based transition to clean lighting would find it easier to serve the market. Not only are ating an enabling environment in which new business trust. Many of these barriers can be overcome by creburden; and low quality products undermining consume transparency on government plans with respect to eneras: general lack of awareness for the products; missing creasing demand due to a number of market barriers, such demand side. The industry is struggling to meet the in-Today, market growth is limited by the supply and not the

1.2 THE INTERNATIONAL POLICY LANDSCAPE

To increase attention and donor support to tackle energy poverty, the United Nations has declared the decade Z014 2024 as the Decade of Sustainable Energy for All (SE4AII) and aims to reach universal energy access by 2030. Energy access is also part of the Sustainable Development Goals[®] that follow the Millennium Development Goals.

To measure the progress made towards SE4All targets, a global tracking framework has been established. Instead of using binary definitions of electricity access, the framework defines different tiers of energy access. Off-grid lighting products with a minimum lumen output and phone charging capabilities count as basic energy access.³

In this international policy landscape, more and more donor governments focus their development assistance on energy access. For instance, President Obama announced an ambitious Power Africa initiative² that provides tools and resources to accelerate energy access on the continent. Other donors continue, or scale up, their efforts, including multilateral development banks such as the World Bank Group, national governments (Netherlands, Germany, Norway, and the UK) and NGOS (Practical Action, SNV, SolarAid and others). Instead of supporting only grid-extension projects or micro-grids, the new definition

- 2 More information on the Sustainable Development Goals is available here https://sustainabledevelopmentun.org/sdgspraposal
- More an the concept of trend energy access SE4AI/ / Mord Bank (Globa) Tracking Framework: http://www-wds.worldbank.org/external/default/ WDSContentServer/USSPB/2023/0022000112/42_20130528084471/ Rendered/PDF/77889061F0full0-eport.pdf
- More information on Power Africa can be accessed here: http://www.usaid gov/powerafrica

of energy access, as well as proven success in recent years, has prompted these actors to pay attention to small-scale energy access on a household level. Countries such as Tanzania and Kenya have embraced the opportunity of market-based solutions and set incentives for solar products, such as VAT elimination. The markets in Kenya and Tanzania are growing particularly fast, allowing the private sector to deliver basic energy access to thousands of households.

They have realised that by transitioning to efficient offgrid lighting, developing countries could secure large annual savings from reduced use of fuel-based lighting sources, such as kerosene and oil, as well as greatly reduce the greenhouse gas and other emissions associated with fuel-based lighting. Few actions can reduce greenhouse gas emissions as inexpensively and easily as a sustainable transition to efficient off-grid lighting. Vet few countries have established an integrated policy framework5 to reduce the dependence on fuel-based lighting and to accelerate the penetration of efficient off-grid lighting products, thereby concretely reducing health impacts and carbon emissions and creating green jobs.

113 CHOOSING THE RIGHT POLICIES TO INCREASE BASIC ENERGY ACCESS

Governments that seek to reduce or eliminate fuel-based lighting can take steps now to increase access to efficient of-grid lighting products that are affordable, clean and dependable (A.T. Kearney and GOLA 2014). Market based approaches have led to an unprecedented increase in adoption of solar lighting products. Government efforts, in cooperation with the private sector and civil society, will contribute to an increased penetration of off-grid lighting products and thus meeting the universal energy access objective.

The right set of policies at the right time will accelerate market development to the benefit of the entire society. However, policies always need to be well designed and implemented to support market development rather than undermine it. A proper analysis of the existing market is necessary in order to choose the right and most efficient steps: a country in which market activities

takes into account all four key areas. modular structure, the reader should be aware that these in Annex 1). While recommendations are presented in a more information on the integrated policy approach as well as environmentally sound management (see when trying to employ market support mechanisms. Actegrated approach, actions policymakers should consider options to choose. The next chapter will present, in an inthe private sector will inform the decision on which policy try has its own unique characteristics, including strengths completely ineffective in a market that still needs to deare already widely available; it would on the other hand be have a great positive effect in markets where products market development, there is no 'one size fits all' solucertain policy recommendations can be given to boost country where market penetration is well advanced. While are still small will need to start with different policies to a possible, an integrative approach should be taken, that activities are in many cases interdependent. Whenever standards; monitoring, verification and enforcement; mechanisms; the implementation of minimum quality tions recommended will include: supporting policy and weaknesses. Stakeholder consultation and engaging velop basic distribution channels. In addition, each countion. For instance, consumer education campaigns may

2 CALL TO ACTION: STRATEGIES TO CREATE AN ENABLING ENVIRONMENT

Governments and policymakers have a critical role to play to provide universal energy access creating an enabling environment that will allow market forces to fully unfold and deliver solar products to rural households. Policy and regulatory changes should always be calibrated carefully, especially in nascent markets where inappropriate policies can be very distortive to market development. Any policy or regulatory changes, government or public driven programmes or interventions should, by all means, be closely coordinated with the private sector to ensure they support the market and go hand-in-hand with industry efforts, in order to maximise efficacy and impact of the action taken.

The enabling environment can, and should, grow in a natural way in conjunction with the market. There is no blueprint of consecutive steps that have to be taken. Rather, a careful analysis of the current market situation and exchange with the industry, as well as with policymakers that have some experience in the field already, will be necessary to understand which of the recommended policy actions can, and could best, be applied in the local context. Wherever possible, best practices or lessons learnt are shared for each of the policy actions below.

Quality monitoring and verification, as well as sound market analysis, will allow policymakers to understand which measures worked well and what next steps it would be ap-

⁵ The integrated policy approach was developed by the UNEP-GEF ensighten initiative. It incorporates best practices to achieve a permanent and sustanable transition to efficient on-grid and off-grid lighting. An integrated policy approach ensures that all per timent policy aspects related to energy-efficient (lighting are considered in the development of an efficient lighting, strategy, Fallowing an integrated policy approach will significantly increase the likelihood of a successful transition of efficient lighting, leading to charcial, energy and environmental benefits; it will also streemline the process for those involved in designing and implementing buildies. Each country and regions should determine how the elements of the integrated policy approach firwithin their national or regional context and ensure that all relevant authorities and stakeholders are involved to guarantee a consensus-based process in the development of a national or regional efficient lighting strategy. See Annex I for mare information.

steps to develop off-grid lighting policies supporting maraction taken. The figure below illustrates the sequenced cient manner. It should therefore be an integral part of all lysing the impacts is key to design the next step in an effiket development propriate to take. Monitoring all measures taken and ana-

developing off-grid lighting policies Figure 3 Diagram illustrating the sequence for



off-grid lighting: from a faster transition to clean and sustainable means of in creating an enabling environment and can also benefit Different government organisations play a decisive role

1 Get the fundamentals right

Source: Author's original creation 2015

The 2 Kickstar

the marke

and keep marke

 Local authorities, in particular, often have the most inmation challenges and can provide valuable and practical inforsight into their local situations and implementation

FOREX saving from reduction of fossil fuel imports, and Ministries of Finance can benefit from additional revenue market development. can help to set the right fiscal incentives to accelerate for the government, mobilisation of foreign investment,

STAKEHOLDERS AND PROPER ENGAGEMENT OF INFORMED **FUNDAMENTALS RIGHT** —

MONITORING

2

STEP 1: GET THE

Social and Economic Ministries can benefit from addi partnerships counterpart for the industry in leveraging public private opment of a local industry. They can be an important tional jobs created, local value creation, and the devel-

Ministries of Education can help with distribution to ex population tremely remote communities by leveraging school networks, and thus contributing to better education of the

 Last, but not least, Ministers of Energy will welcome coordinating role. importance to set the right policies overall and take a independence, and the provision of access. They are of the reduction of fossil fuel imports, increased energy

sidies to convey the message within the policy arena. tions on the livelihood, health impacts, and kerosene subout, such as the SolarAid Impact report, UNEP publica-Actors can use supporting evidence from studies carriec

complement one another. the easier it will be to implement integrative policies that broader the coalition of support within the government ing ministers to implement respective regulations. The environment can also come from a parliament request In parliamentary democracies, the push for an enabling

STAKEHOLDERS UNDERSTAND

THE BENEFITS OF THE

TECHNOLOGY

2.1.1 ENSURE ALL RELEVANT

next steps

an integral part of all steps taken by the government to stage and needs. Monitoring and verification should be associations can provide valuable feedback on the market to increase the impact. In particular, renewable energy in the process of developing such a strategy, as well as as the private sector. The engagement of all stakeholders municated to the population and other stakeholders, such develop a joint vision and mission that can be clearly comveloping transparent energy access policies will help to the off-grid lighting and electricity market potential. Desuch as rural electrification agencies, must be aware of development. Governments and other public agencies, an enabling environment, and in turn accelerating market in the field of supporting policies are important to creating At an early stage of market development, four measures

for the planning of concrete steps to be taken, will help

track progress and to inform the planning phase for the

6 See References section for details of these publications

SPECIALLY THE PRIVATE SECTOR 2.1.2 ENGAGE ALL STAKEHOLDERS

market transition ments with these actors can significantly accelerate the sations and social enterprises. The cooperation of governat the initiative of individual firms, not-for-profit organiment – such as through market-based mechanisms and support. Much of the deployment of these new technologroups, and especially the private sector to generate broad ernmental stakeholders, such as utilities and civil society It is also very important to communicate with non-govgies currently takes place without government involve-

should engage these associations and stimulate thei the KEREA example in Box 8). Renewable energy associatogether on joint objectives, such as skilled workforce (see more serve as a platform for the private sector to work consolidated industry feedback on plans. They further ernment on future policies and regulations and provide lighting continue to work. They can consult with the govof market-based avenues to clean and efficient off-grid development and to ensure that the positive impacts industry and can efficiently channel industry feedback. national renewable energy associations as key partners growth by recognising them as valid partners early on. tions typically evolve as the market unfolds. Governments Associations are important to sustain balanced market since they have the mandate to speak on behalf of the Thus governments should recognise stakeholders such as

BOX ENGAGEMENT WITH GOVERNMENT INSTITUTIONS

In 2013, SNV Netherlands Development Organisa-tion (SNV), in collaboration with the United Nations for Achieving an Enabling Environment for a Sustain-able Solar Market. ment institutions in Niger to develop the Roadmap gaged the private sector and academia with govern-Development Programme (UNDP), successfully en-

The engagement also resulted in the following ac-

complishments:

 Niger's law on Renewable Energy was put on the agenda of the Council of Ministers. Tax-exemption was achieved for 1.26 million solar

 APE-Solaire (the National Association of Solar Prowith a press conference. fessionals) organised an official kick-off meeting

Source: SNV Niger 2014.

NATIONAL ENERGY STRATEGIES 2.1.3 DEVELOP TRANSPARENT

approach in providing access. grid solutions to reflect the possibility of using a stepped and plans may also be expanded to include a role for offplanning stability and a consistent policy approach from velopment plans for a country. This ensures long-term al energy strategies can also form part of long-term deoverall better results in terms of energy access. Nationparent energy policies and strategies would thus lead to products would focus its efforts on other regions. Transmini-grids in certain regions, distributors of solar lighting example, planning to extend the national grid or install plement government activities. If the government is, for an informed decision as to where its products best compolicies and strategies will help the private sector to make ment's energy policies and strategies. Official energy to understand in which regions/population segments its carefully analyses the situation in the country in question pany decides to invest into building up new structures, it ing into a new region is a big investment. Before a com-For the private sector, entering a new market or expandsubsequent governments. Rural electrification policies products would be best placed and successful. Critical factors for success are information on the govern-

benefit all stakeholders by: place. A long term policy paper or strategy would however within the government, these policies are often not in Although such policies are also crucial for coordination

- Providing the private sector with planning security;
- Helping to inform fellow ministries about plans and alcive to the national energy policy; and lowing them to implement regulations that are condu-
- Providing the consumer with information on when they area -information, which is key to making the significant purchasing decision of buying a solar light or kit can expect the national grid to be functional in their

stakeholders, especially civil society, to contribute. strategy should be a consultative process that allows all Hence, the development of a national energy policy /

VERIFICATION OF MEASURES 2.1.4 MONITORING AND

of clean and sustainable off-grid lighting technologies. tries of Health) could be leveraged to monitor the impact monitoring systems of relevant public actors (e.g. Minisitoring and verification of progress is essential. Existing inform next steps. In an integrated policy approach, monon it, can help to verify the success of measures and to tive monitoring of the market, and the impact of policies market that is beginning to see a constant growth. Effec-The efficient off-grid lighting sector is a very dynamic

80 /28

ing and professional development programmes (for laboprogrammes for the transfer of expertise and information ments can thereby devote more attention to existing effective means for promoting best practices. Governexchanges between countries and across regions provide ciency programmes. Knowledge sharing and peer-to-peer ities into every aspect of their lighting and energy effiintegrate monitoring, verification and enforcement activ Policymakers and programme implementers can strive to assurance programmes ratory and enforcement staff) is very valuable for quality through the sharing of testing facilities, the results of test-International and regional cooperation for enforcement

enforcement Figure 4 Benefits of monitoring, evaluation, and



Source: UNEP 2012a.

PRIVATE SECTOR MARKET – FISCAL/FINANCIAL 2.2 STEP 2: KICK-START THE **TOOLS THAT ATTRACT THE**

policy mechanisms rican countries. All of these fiscal measures are supporting high-quality and affordable products in the markets in Afeffective strategies to support the introduction of more Three financial incentive measures have been identified as

gible good-quality products. Assuming that these benefits are passed along to the consumer, this makes high-qualcourage private players to invest in the efficient off-grid cient off-grid lighting products. The objective is to ening tax exemptions on imports of high-quality, effilighting market by eliminating the additional surtax on eli-The first measure consists of removing duty and offer

> growing industry. ing the market, as this is one of the main barriers for the transparent and inclusive way for companies enterincrease their value proposition to the consumer. field for energy-efficient lighting technologies and kerosene subsidies in order to create a level playing ity, efficient off-grid lighting devices more affordable. The second measure is a reduction or elimination of The third measure is to facilitate access to finance in a

nance of, products. ucts in the same way that they might invest in other apundermine consumers' willingness to invest in the prodvalue, or that they should be heavily subsidised. This could expectation that efficient off-grid technologies have low free giveaways and reduced product costs may create an relief (e.g. after natural catastrophes). In all other cases, where lighting products form an essential part of disaster should therefore only be considered in extreme situations programmes would only provide short term benefits and However, giveaway programmes, as well as direct retai an appropriate measure to initiate market development term market development. They are often mistaken as lighting products are not a viable tool to support longaways and direct retail subsidies of efficient off-gric Beforehand, it is important to underline that free give culture of dependency and a lack of care for, and mainte pliances that provide valuable services. This could create a subsidies, undermine balanced market development. Such

VALUE-ADDED TAX AND TARIFFS 2.2.1 INTRODUCE EXEMPTIONS ON

supplies and equipment (such as increased taxes on fuels work Sustainable Energy for All Energy Access Practitioner Net set up a searchable tariff database, available through the off-grid products, the United Nations Foundation recently tempts that address import tariffs and barriers to entry for fuel-burning lanterns, wicks or candles). To document atincreasing, deterrents for buying or importing fuel-based on efficient off-grid products, and/or by introducing, or ficient lighting by reducing, or eliminating, import tariffs Some countries have successfully increased access to ef-

In Kenya and Tanzania, two markets where the efficient the purchase of quality products (see Box 2). VAT exemptions can also be used as a tool to incentivise lower prices to consumers. As the Rwanda example shows which eases market entry and allows companies to offer ly strongly, solar products are VAT- and tariff-exemptec off-grid lighting products market is growing particular-

try of Finance is an essential success factor. well-defined strategy to convince and educate the Minis. erated through supportive evidence or data. Therefore, a buy-in from the Ministry of Finance, which can be gen-While this is a key measure, its implementation needs

enforcing the exemptions may be challenging if customs exemptions for high-efficiency off-grid lighting products, toms authorities. Although laws may allow for duty or tax successfully implement new measures via national cus-Furthermore, note that capacity building is required to products that are exempted. ficient resources, to identify, categorise and process the and duties officials are not prepared, or do not have suf-

VAT EXEMPTIONS IN RWANDA

N

of time. on a product that is likely to fail after a short period to buy a superior product instead of spending money low-quality products and incentivises the consumer ity products a competitive pricing advantage Program* are not charged any VAT. This gives qualapproved by the Lighting Global Quality Assurance products that are quality assured. Hence products da has introduced VAT exemptions on solar lighting Since November 2014, the Government of Rwan-ಕ

*See www.lightingglobal.org/activities/qa/

Source: GOGLA 2014

LIGHTING FUELS 2.2.2 REMOVE SUBSIDIES 2

externalities, reached USD 1.9 trillion in 2011 or 2.5% of gas, petroleum fuels, and electricity), including negative (Mills, 2014b). Nevertheless, considerable funds are allighting sources, even when subsidised, is higher than USD 879 billion (IMF 2013). global GDP. Petroleum fuel subsidies alone amounted to subsidies across the entire energy sector (coal, natural located to kerosene subsidies. The annual global cost of those of more efficient and unsubsidised alternatives long-term solutions. The cost to consumers of inefficient ucts that offer safer, more reliable, and more economical ready begun to promote efficient off-grid lighting prodslow the progress of market mechanisms that have al-Current subsidies on lighting fuels, specifically kerosene,

true demand through artificially low prices, which inad (IMF 2013). Additionally, fossil-fuel subsidisation inflates ers. According to the International Monetary Fund (IMF) their intended goals and not reaching the poorest consumsidies (43%) than the poorest 20% of households (7%) countries capture six times more in total fuel product subthe richest 20% of households in low- and middle-income Fuel subsidies are routinely criticised for failing to achieve

> sound environmental and human health policies more efficient and cleaner solutions, and runs contrary to vertently distorts markets, impedes progress towards

tinue to reduce kerosene subsidies. significant savings on money spent on subsidies and conthe demand for kerosene shrinks, governments can make duce the dependency of the population on kerosene. As Clean, and modern, lighting technologies will help to rebe phased out gradually parallel to market development any unintended consequences. Subsidies could therefore thus measures must be taken to proactively minimise subsidy may affect other end-uses, notably cooking, and lighting products. However, any changes in kerosene hance the growth of the market for efficient off-grid Subsidy reforms on kerosene need to be pursued to en-

CHAIN FINANCE ACROSS THE SUPPLY 2.2.3 FACILITATE ACCESS TO

case of non-compliance or corruption. systems for financial transactions and for recourse in the conditions by supporting transparent and equitable legal lighting⁸. Governments can improve finance and market business environment inhibits investment in off-grid non-traditional institutions. Often the lack of a sound to increase the supply of capital from conventional and between financiers and suppliers need to be developed is limited by the supply not the demand side. Partnerships straint for the industry when scaling up. Today the market Access to capital, especially working capital, is a key con-

Kearney and GOGLA 2014). and to explore potential avenues to facilitate access (A.T ments can work with financiers and investors, or private distributors¹⁰ and other financial instruments. Governchange funds); capital equipment loans; microfinance for product imports; a FOREX facility (to access foreign exprivate sector is essential. This could include: credit for components and services where needed, financing for the sector associations, to better understand business needs able and distribute efficient off-grid lighting products To encourage and support supply chains⁹ that make avail-

5

See link to the searchable tariff database on the Sustainable Energy for All website a thttp://www.energoccess.org/resources/tariffs-database. By searching for tariffs by product and then choosing type of praduct and tariff, for example, 'solar insterns' and 'bound', the fariff rate is listed in chart and graphicaphys.

According to the OBIN report, the most problematic factor for business i Africa is "access to financing", closely followed by "corruption" (Stiftung Solarenergie 2014). roblematic factor for business ii

¹⁰ See description of the Lighting Rural Tanzania project, implemented by ARTI with support from the World Bank and the Rural Energy Agency, at http://artb-africa.org/projects/lighting-rural-tanzania/. 9 See, for example, Dalberg 2013.



2.3 STEP 3: SCALE UP THE MARKET

of modest growth, the period of scaling-up is essential in early adopters, but are used on the broader consumer level means that products are not only purchased and used by evolves into a mass market. At the consumer level, this ber of households. It is the period in which a small market delivering efficient lighting products to a maximum numers can contribute to scale up the market. After a perioc a critical mass of capacity to supply products, policymak Once first companies have entered the market and there is

adhere to minimum energy performance standards. have the potential to help ensure that products promotec policy mechanisms. When properly designed, all of them are detailed in the section below and are all supporting partnerships to the benefit of both sides. These measures Finally, the fourth measure is to leverage public private velopment of local skills to support the market growth population. The third measure is to encourage the deawareness for the benefits of solar lighting among the products in the market. The second measure is to create To scale up the market faster, four measures can be taken The first measure is to ensure the dominance of quality

MINIMUM STANDARDS THROUGH PROMOTION OF 2.3.1 ENSURE PRODUCT QUALITY INTERNATIONALLY ACCEPTED

bulk procurement programmes, voluntary or mandatory prospering and sustainable market environment national level risk being more a barrier than a support to a ly accepted standards. Standards that are defined only at and quality standards are harmonised with international-It is important that any minimum energy performance labelling schemes, and for buyers' selection of products specifications based on these standards can be used for quality characteristics of products. Product performance minimum desired performance and methods to test the and quality standards for products are used to establish on the quality of products. Minimum energy performance performance and quality standards -e regulations focused Quality assurance can be achieved via minimum energy in the technology at large, especially in nascent markets growth. Poor quality products undermine consumer trust Ensuring quality in the market is essential to sustair

its Regional Efficient Lighting Initiative. These in turn will cal Specification for Off-Grid Lighting Products as part of World Bank/International Finance Corporation's Lighting based on the International Electrotechnical Commission ing existing national standards. The new standards are be implemented by each of its member countries replac-In West Africa, for example, ECOWAS is adopting a Techni-(IEC) technical specification IEC/TS 62257-9-5^{$^{11}}</sup>$ and the

11 Recommendations for small renewable energy and hybrid systems for rural electrification - Part 9-& Integrated system - Selection of stand-alone lighting kits for rural electrification

12

their products to meet programmatic requirements programme through which manufacturers can qualify Global program, which runs a voluntary quality assurance

get for consumer education. is also costly to implement and requires a substantial budconsumer-facing label would add great value, however it the market (for example, Lighting Global standards). A communications can have positive impacts on quality in uct's light output and performance. Business-to-business end-users or distributors with information about the prodwhereby labels are placed on the packaging to provide datory or voluntary labelling and certification programme, As a stand-alone measure it can be supported by a manquirements to market incentives, such as VAT exemptions. lighting products is best done by connecting quality re-The promotion of quality standards for efficient off-grid



ing requirements (Lighting Global, 2015a): As of January 2015, these standards have the followity, quality, lumen maintenance and warranty terms vate sector entities for truth-in-advertising, durabil-

 Truth-in-advertising: Advertising and marketing materials accurately reflect tested product perfor

 Durability: Product is appropriately protected from being aropped. mance water exposure and physical ingress and survives

System quality: Product passes a visual wiring and

 Lumen maintenance: Product maintains at least assembly inspection.

of operation. 85 per cent of initial light output after 2,000 hours

 Warranty: A one-year (or longer) retail warranty is available

ing labelling of the product. It is a voluntary programme tising, which requires truthful and accurate consumer facefficient off-grid lighting products include truth-in-adver-Global for participating manufacturers and distributors of The minimum quality standards developed by Lighting

> and motivate suppliers to deliver quality products form and empower end-users to make educated choices that allows government to access information on key enbattery capacity and photovoltaic power. These labels inergy performance characteristics such as rated run time

for all quality assurance of off-grid lighting products. bodies consider adopting the Lighting Global framework dards, it is recommended that national standardisation its body of product testing standards. The test method ternational Electrotechnical Commission (IEC) as part of 62257-9-5:2013¹¹ . For the benefit of harmonising stanwas incorporated into its technical specification, IEC TS The Lighting Global test method was adopted by the In-

provide guidance to customers on where to buy a product ate after sales services. Accrediting vendors that are only line with qualified technicians that can provide appropri-Quality assurance can also take place further down the (see case study below). re-selling quality products are another opportunity to

5 |8 **KEREA VENDOR ACCREDITATION**

sist of: framework for solar PV businesses. The process conya, KEREA is implementing a voluntary accreditation increasing consumer confidence in solar PV in Ken-With the objective of reducing market spoilage and

quality of products and having certain verifiable Developing a criterion for accreditation of renewto an agreed upon code of conduct, selling a certain based on conditions such as businesses adhering technical capacity/skills. able product and service providers that would be

Promoting the accreditation system to solar PV what they need to do to meet the accreditation cribusinesses countrywide and providing guidance on

for these businesses. This would include testing of randomly selected products, visits to selected Receiving applications from interested businesses installed systems to check design and installation and implementing the auditing and testing process teria

 Promotion of accredited businesses, engineers or through branding and/or providing their details to standards

paigns and the KEREA website. the public through press, media, awareness camtechnicians to the public and potential markets

cation which would include a teedback/complaints of regular and continuous monitoring and verifi-Developing and implementing sustainable process

credited products will be eligible. business selling / manufacturing Lighting Global ⁻or off-grid lighting products and solar kits, only l ac-

Source: KEREA 2015

ation during peer review process, 2014:

14 "Go example, in Kenya the regulatory authority had rightly identified the lack of qualified technicians as a leading cause for the failure of SNS (solar home system). A law was anotated to creditly this red problem, i.e. SNS companies require qualified technicians to operate. It was a good law, but by the time it came into effect, there were very few trained technicians nationwide and indeed few training institutes to increase the numbers. It was a good law but there was a gop in the strategy to effectively achieve this. "Mana Indumanoh Samander-Manu, IC, personal effectively achieve this." Wana Indumanoh Samander-Manu, IC, personal

network can also deliver reliable after-sales services. The are the foundation of a lasting and scalable distribution entrepreneurs that know how to develop their business

OF LOCAL SKILLS TO SUPPORT MARKET GROWTH

2.3.3 ENCOURAGE DEVELOPMENT

istries of Education to leverage national school networks

population. SunnyMoney successfully partners with Minrepresentatives can also have a very strong effect on the sumers. Endorsement of solar products by government

Local skills are key for building sustainable markets. Savvy

13 For an example of a creative, community-based demonstration that had a strong evaluation approach, see SunnyMoney 2014. ion project

ing and the benefits of efficient off-grid lighting

12 "For example, in Kenya, the regulatory authority had rightly identified the lack of qualified technicians as a leading cause for the failure of SHS [Solar hone systems]. A law was enoced to rectify this real problem, i.e. SVS comparies require qualified technicans to operate. It was a good law, but by the time it came into effect there were very few trained technician and/owide and, indeed. Few raining institutes to increase the numbers. It was a good law but there was a gop in the strategy to effectively achieve this.⁴ Mone Muamodri Asamodri-Manu, life, personal communication during peer review process, 2014.

14/28

early demand for off-grid lighting products and systems. and bulk procurements, thus serving as a way to increase systems installed throughout a community. Demonstrations in a public space (such as a school or clinic) or lighting portable displays for short-term use, larger-scale installaproducts and systems. Demonstrations can be simple. hands-on experience with good-quality off-grid lighting portunity for public-private partnerships to offer users miliar to the target audiences. They are an excellent opoff-grid lighting products can be used in applications fations can be coordinated with government procurements

and increase demand for products among consumers. can show governments the value of the new technologies culate a return on investment. Results of demonstrations maries of initial and operating costs, showing how to calsurement of amount of light and hours of use; and summodern lighting¹². Tools could include: user surveys; meagives all parties additional evidence of the benefits of Pairing demonstrations with various means of evaluation

low-quality product.

market, campaigns should work with companies that are To promote the penetration of quality products in the

Political leaders, who can champion and facilitate abling legislation if they are well informed about

the en-

coordination with industry needs. Training could take of the curricula for technicians and entrepreneurs in close Governments should encourage training and make it part

provide structures to meet new provisions of regulations place in cooperation with the private sector (see Box 8)

National institutions need adequate preparation time to This is a prerequisite for regulations to be efficient¹⁶

products

the energy efficiency and quality of imported lighting toring, verification and enforcement schemes to ensure Customs authorities, which exercise authority in moniucts and components (such as batteries).

on the proper handling of efficient off-grid lighting prod ments and facts on the benefits of efficient lighting, and with consumers and can provide them with valid argu-

electrical technicians should consider including the necesondary schools, but could be facilitated through innova-

tion incubators or similar institutions. Training centres for required skill set is often not part of the curricula of sec-

sary skill set for reliable technical training.

goals and benefits of efficient off-grid lighting.

the population to distinguish a quality product from a distributing quality-verified products and also educate

BOX

KENYA RENEWABLE ENERGY ASSOCIATION (KEREA) TRAINING FOR

00

TECHNICIANS

BOX AWARENESS RAISING CAMPAIGNS –

LIGHTING AFRICA

oped engaging and entertaining educational materi-

training more affordable to technicians, the cost of train technicians properly. To make the two-week training institutions with the necessary materials to

develop trainings for solar technicians and equipped newable Energy Association (KEREA) has helped With support from various donors, the Kenya

Re-5

when they leave any electrical training institution nicians will have the right skill set for solar lighting provisions of the regulation so that all future techtechnicians to ensure their curriculum reflects the seeks to work with training institutions for electrical the training is subsidised. In a second step, KEREA

Source: Interview with KEREA 2015

help to increase the general awareness among the populawill not reach the consumers living in rural areas, but will products. These kind of 'above the line marketing' efforts mation and introduce information about safer off-grid munity health presentations, can also deliver safety infor-

tion for products and help to spread the word.

in a communications and awareness-raising programme Key governmental institutions that can play an active role

on national energy policy and strategies, and whose sup-Ministry or Department of Energy, which has oversight

 Rural electrification agencies, which incorporate efficient port of an efficient off-grid lighting programme is crucial

Ministry of Environment, which has high interest in pro-

products. with sustainable end-of-life treatment of spent lighting grammes that reduce CO2 emissions and also is involved

3

Kenya, Lighting Africa's consumer education

products first-hand.

performances and a chance to test solar lighting

MARKET PENETRATION PARTNERSHIPS TO INCREASE 2.3.4 LEVERAGE PUBLIC PRIVATE

Partnerships between the public and private sector can

feature product demonstrations, fun quizzes, dance during awareness raising campaigns. These shows program carries out in rural villages on market days

These materials compliment the road shows that the

chase reliable solar products locally.

to feature available quality-verified products and to

inform consumers and retailers where they can purand how they transform lives. They can be adapted they work, their use and maintenance, their benefits terials explain what solar lighting products are, how ing products among potential consumers. These mabooks to raise awareness of, and trust in, solar lightals, including radio and TV spots, posters, and comic IFC-World Bank Lighting Africa program has devel As part of their consumer outreach activities, the joint

'edutainment' soap opera, as well as conducting an-nual campaigns to encourage urban residents to gift

into one season of 'Makutano Junction', a popular campaign also imbedded key consumer messages

solar lighting products to their rural relatives.

Source: Lighting Africa 2015

ernment institutions can be of support to reach new contives. By opening up their networks to companies, goveligible product class for economic development incenernments can for example include off-grid lighting as an clean and efficient off-grid lighting. Local or state govin many ways help to increase the market penetration of

lighting on health and safety, and also can support col-lection and recycling schemes for spent lighting proders and the public about the impact of efficient off-grid Ministry of Health, which can inform other policymak-

Ministries of Finance, Trade, Labour and Industry, which and users. ucts to minimise exposure and health risks to workers

can apply fiscal policies to facilitate the market transfor-

in spreading the word about the risks of fuel-based light. support teachers and administrators who can participate dren to be able to study at home in the evening, and can procure efficient off-grid lighting products for their chilAccurate information helps consumers understand the AMONG THE POPULATION mation ucts. reach their full market potential.

SOLAR LIGHTING BENEFITS 2.3.2 RAISE AWARENESS FOR

participate in efficient off-grid lighting programmes. Informed consumers will be more likely to seek out and

 The mandatory energy performance and quality stan dards may not be readily attainable by the local manpreparation time must be built into the market transforufacturing industry (if it exists); therefore, adequate

such as monitoring, verification and enforcement to other policy options and market surveillance activities

social or individual behaviours, attitudes, values and as well as educate and mobilise the public and influence Public information campaigns designed by government knowledge on the benefits of efficient off-grid lighting. agencies or utilities are effective tools to raise awareness

Other media, such as radio programmes or in-person com-

on efficient off-grid lighting include:

off-grid lighting in their energy access programmes

Ministry of Education, which can encourage parents to mation for efficient off-grid lighting products.

11 Recommendations for small renewable energy and hybrid systems for rural electrification - Part 9-5: Integrated system - Selection of stand-alone lighting kits for rural electrification

responsible choices in their daily behaviour. Participants sumers and to encourage them to make environmentally events are excellent ways to interact directly with conwill spread the message to their peers - family, friends and

neighbours.

health, safety and household expenditure. Community long-term impact of using the improved products on their fore establishing minimum quality standards for efficient ness-raising campaigns show how efficient, high-quality

off-grid lighting

There are some considerations that should be noted be-

Demonstration projects that are coordinated with aware-

Local and regional authorities, which interact directly

the market. Standards should be scheduled allowing sufficient time for compliant products to be made widely available in

 Where possible, harmonisation of standards is an adstandards such as Lighting Africa standards can be an vantage, and thus using existing, widely referenced

advantage.

 The initial costs of compliant products may exceed those the price, such as a VAT exemption on compliant prodconsider combining standards with measures to lower of inefficient products. Governments may, therefore,

Quality assurance programmes should be supported by

to increase awareness for solar lighting and to reach consumers in low-income households and benefits from the involvement of head teachers that are trusted within communities. Schools benefit from the initiative as the better lighting allows students to extend their studying hours after night fall (see Box 10).

BOX DISTRIBUTING EFFICIENT OFF-GRID 9 LIGHTING PRODUCTS VIA SCHOOLS

The international charity SolarAid uses a business-based approach to sell solar lights in Africathrough its social enterprise. SumnyMoney. SumyMoney's field teams visit schools to explain and demonstrate the benefits of off-grid lighting products to head teachers. The head teachers then demonstrate the solar lights to their students and ask them to inform their parents when they go home. The parents subsequently purchase their first solar lights from SumnyMoney's field teams at the schools. By building trust and awareness in solar lights through head teachers at schools, more students and their parents are reached and convinced to procure the solar lights.

In Zambia, SunnyMoney provides access to clean, safe, bright solar lights across the country's Southern, Eastern and Copperbelt provinces. With support from the Ministry of Education, SunnyMoney works closely with district education, SunnyMoney works closely with district education, SunnyMoney together head teacher meetings, bringing groups together to learn about solar lighting so they can offer their students and communities the chance to purchase solar light. Through SunnyMoney Zambia's trade and dealer networks, the teams sell lights through retail outlets, cooperatives and large agri-businesses as well as local shops and agents. SunnyMoney is seed well as local shops and agent sunny Money is seed well as local shops and agent sunny Money is seed well as local shops and agent sunny Money is seed in the reprovide better access and availability to solar light corner to country.



Source: SolarAid, 2014b

Through a successful partnership with the national tea development agency, Barefoot has been enabled to provide thousands of workers on tea plantations with clean energy access (see Box 9).

16

BOX INDUSTRY EXPERIENCE ON **10** PARTNERSHIPS TO ATTRACT PRIVATE SECTOR PARTICIPATION IN KENYA

Barefoot Power^{*} is a business that assists people in developing countries to access affordable renewable energy. One of its biggest successes was to engage with the Kenyan Tea Development Agency (KTDA) and secure a partnership with Unliever. Under the partnership, the housing provided to KTDA workers was outfitted with solar home systems. Barefoot Power also benefited from an enabling framework of reduced duties in Kenya. The partnership increased the volume of products provided from a target number of 10,000 homes to 12,600 homes (a 26% increase in installation).

*<u>http://www.barefootpower.com/index.php/about-us</u> Source: Interview with KEREA 2015

Public-private partnerships could also be co-financed with funds from bilateral donors, development banks, the Global Environment Facility, the Green Climate Fund or other multilateral tools created under the United Nations Framework Convention on Climate Change (UNFC-CC). These tools include Nationally Appropriate Mitigation Actions (NAMAs) or the Clean Development Mechanism

(CDM). The best option for countries considering financing via these tools is to aggregate demand for modern offgrid lighting technology across a larger region.⁶⁵.

2.4 STEP 4: SUSTAIN THE POSI-TIVE IMPACT AND KEEP MARKET AT STEADY GROWTH RATES

Once several companies are in the market and successful in building sustainable distribution chains, sales will continue and an increasing number of people reached. In a sustainable market consumers have the choice between different products and brands. Healthy competition between private sector players stimulates innovation and leads to a constant increase in services provided. To ensure the market keeps on track and to sustain the overall positive impact on society, it is important to strengthen monitoring and enforcement structures for quality assurance. This will ensure quality products continue to dominate the market and prevent copy-cat products from undermining consumer trust. As more consumers are using solar lighting products, the question of collection and

recycling of spent products becomes more important. The private and the public sector should jointly think about appropriate ways to tackle the issue of recycling for spent products and provide infrastructure and regulation for the environmentally sound treatment of products.

2.4.1 STRENGTHEN ENFORCEMENT AND MONITORING OF QUALITY ASSURANCE PROGRAMS

The success of a sustained market transition to efficient off-grid lighting depends on a well-functioning system of monitoring, verification and enforcement that is capable of ensuring full compliance with quality standards:

Monitoring (market surveillance) is a measurement process to check product efficiency. It involves measuring performance claims against a nominated standard in a consistent manner, using accurate instrumentation applied by qualified staff in controlled conditions.

Verification is the measurement process whereby declarations of conformance by lighting suppliers are confirmed.

 Enforcement is the action taken by programme administrators or other responsible parties against suppliers of non-compliant products, as a result of finding fault through either monitoring or verification.

The key factors to consider for a successful monitoring, verification and enforcement scheme for efficient off-grid lighting products are:

 Custom officers should have the capacity to distinguish a quality product (that may be eligible for tax exemptions) from a non-quality product. Counterfeits are increasingly being imported and undermine market development. Low quality products that copy the look and feel of quality products should be dealt with when the products are crossing customs.

 It is critical to have ready access to an experienced, accredited laboratory with sufficient capacity and the ability to turn around test results quickly. For example, Lighting Global has a Test Laboratory Network comprising five accredited laboratories in various locations (including Nairobi, Kenya), which can provide testing services for most African countries without local testing facilities.

Countries or laboratories could establish mutual recognition agreements, to avoid duplication of facilities and expenses, undue delays and unnecessary costs. For example, once a product has been approved by an accredited laboratory, it could be accepted across borders and not be required to re-test.

> Sanctions for non-compliant product suppliers (or in-country parties that may circumvent the system) should be available to allow the enforcement authority to respond quickly and in a cost-effective manner. Sanctions can include: giving notification of non-compliance and identifying a correction period for minor transgressions; de-listing products from a qualified products list or registry; public notice of violations; and legal actions (including suspension and fines).

Where sanctions are necessary, they should be sufficient to outweigh the benefits of non-compliance in order to be an effective deterrent.

The enforcement framework should include a clearly defined appeals process, to allow parties the opportunity to defend the compliance of their products.

24.2 PROVIDE INFRASTRUCTURE/ REGULATION FOR PROPER RECYCLING OF SPENT PRODUCTS

Convention on Mercury. Hazardous Wastes and Their Disposal and the Minamata global international policies that reduce and safely manprinciples of pollution prevention, and be consistent with burning. However, the disposal of spent (no longer uselighting products reduces CO2 emissions from fossil fuel manufacture¹⁶, use and disposal. From a life cycle perspecminimise the environmental impacts that occur during grid lighting products covers the life cycle of products in Environmentally sound management of efficient off vention on the Control of Transboundary Movement of age potentially hazardous waste, such as the Basel Conful) efficient off-grid lighting products should follow the tive, replacing fuel-based lanterns with efficient off-grid benefits of efficient lighting products, it is important to terms of their impact on the environment. To optimise the

and batteries; and assist the private sector to develop and implement national collection systems for spent lamps a comprehensive lighting policy, can prioritise efforts to cilities. National regulators, in their efforts to implement lishment of formal collection channels and recycling fabe carefully drafted and implemented before the estabcoordinated law enforcement. Policy and legislation must Policymakers should consider how to develop a lega establish commercially viable recycling and disposal facilisound disposal of spent lamps and batteries; develop and velop and adopt national regulation for environmentally mentally sound disposal of spent lamps and batteries; demake key stakeholders aware of the benefits of environagement, making this a national priority and ensuring framework for environmentally sound, end-of-life manties for spent lamps and batteries, where possible

¹⁵ For guidance on developing national and regional off-grid efficient lighting strategies and off-grid lighting financing proposals, refer to: Acheving the Global Transition to Energy Efficient Lighting Toolkit (UNEP 2012a)

Guidebook for the Development of a Nationally. A ppropriate Miligotion Action on Efficient Lighting (Conway et al. 2013) CDM methodology: AMS-IILAR: Substituting fossil fuel based lighting with LED/CFL lighting systems— Version 2.0 (WRECC 2012)

¹⁶ For more information, see Alstone et al. 2014

*based on the definition of the WEEE Directive

The members will join forces within GOGLA and with other industries in the area of awareness creation towards end consumers that proper treatment of electronic waste is of value for human health and the environment

The members will align their efforts to approach ministries, non-governmental organizations and all other relevant

d. Avoid the use of hazardous substances and find alternatives for them, if technically possible. If this is not possible

incentives for collection of the parts containing these hazardous substances should be developed

c. Identify synergies in the use of standard resources and materials to facilitate separation during recycling and

Develop products that can be easily maintained and repaired. Spare parts need to be made available;

Strategies to implement proper take-back and recycling should be envisaged in countries of operation,

should be accompanied by the creation of an environmental sound management of the products at the end of their stakeholders to create the awareness, that the use of modern off-grid technology, like all new electronic products,

The members will look for synergies with other industries in identifying possibilities for common collection and recy-

cling activities."

usetul litetime

and in countries outside of the European Union. It procycling of lighting products that already exists in Europe AMBILAMP builds on the experience for collection and reinitiative, with the support of their private sector partners, emerging countries. Initiated by the UNEP-GEF en.lighten systems for spent lighting products in developing and tise for establishing environmentally sound management my for the Recycling of Light was created to provide expertive of 2005. In 2013, the AMBILAMP International Acade Waste Electrical and Electronic Equipment (WEEE) Direc luminaire waste in accordance with the European Union's specifically for the collection and treatment of lamp and behalf of the major lamp manufacturers in Spain in 2005 vides training to policymakers around the world.

salers and retailers).

products on the market (manufacturers, traders, wholeas one of the businesses putting the efficient off-grid of 'extended producer responsibility'. 'Producer' is defined activities of GOGLA members should consider the principle Recycling (see Box 7.3). This statement indicates that all reflected in GOGLA's Industry Opinion on Lifecycle and uct suppliers of efficient off-grid lighting products, are management programmes, from the perspective of prod-

 Developing market surveillance programmes Developing waste treatment standards and facilities. Developing the required regulatory frameworks. A non-profit association, AMBILAMP, was launched on

The key factors for successful environmentally sound

grammes through

in establishing extended producer responsibility proefficient off-grid lighting programmes is to take the lead for a successful environmentally sound management of With respect to governments, their recommended role

operation with industry or consumer associations, in areas and reverse supply chains also could be explored, in co-(SolarAid 2014a). 'Take-back' or 'buy-back' programmes cover computers, televisions, radios and mobile phones be integrated into a broader e-waste effort that could low, then some off-grid products (such as LED lamps) may umes. If the volume of off-grid lighting products remains Successful recycling programmes depend on high vol-

with sufficient volumes of product in use by consumers

(see Boxes 10 and 11).

INDUSTRY EXPERIENCE WITH HANDLING OF SPENT PRODUCTS

encourages companies to design products for reuse, recyburden of the disposal of the waste/products/material; it ernment of the financial, and in some cases, operational schemes offer various benefits. It relieves the local gov-As one possibility, extended producer responsibility

tion in recycling technology. However, extended producer clability and materials reduction; and it promotes innova-

esponsibility schemes are difficult to implement and am-

cycling/recovery operations for spent lighting products

couraged to manage the collection systems and the republic. For example, private sector firms should be enSupporting participation by relevant parties and the

product recyclers.

Certifying and maintaining a list of qualified lighting

longevity and toxicity.

 Establishing lighting performance standards for product Collecting data on programme performance.

has identified the following points for consideration: industry experience with handling spent products

bitious

Governments need to consider implementation of

handling of products and disposal of batteries). policies on hazardous waste (hazardous material,

EXAMPLE OF AN INDUSTRY ASSOCIATION STATEMENT

Manufacturers have a responsibility to design pro-grammes for collection and recycling of off-grid lighting products.

 The recycling value of off-grid products may be financially viable, but economies of scale should be

Risk Newsletter)

sought to reduce recycling costs per unit

 Within the appropriate international legal convenlighting products within a region could be considtions, transboundary shipments of spent off-grid

of facilities. ered, to increase volumes and to make efficient use

 A commercial recycling facility, East African Complithe region, including Ethiopia. It may possibly roll out to Nigeria, too. The company works with lolighting wastes. Its facility also handles a variety of cal communities and the informal sector to collect ant Recycling, operates in Nairobi, Kenya, to serve

 \sim

Therefore the members are committed to:

ket)* should accompany all activities of GOGLA members

<u>o</u>

reuse

1. The principle of the extended producer responsibility (the producer is the entity putting the product on the local mar-

the members of GOGLA are committed to the following values all driven by the intention to preserve the environment pects are considered over the full product lifecycle. While bringing light and energy to non-electrified areas of the world, considerably reducing the problem of electronic waste. The benefits of off-grid technology will be maximised if all as-

and avoid or minimize any hazardous waste contamination:

"Management of end-of-life electrical and electronic equipment (WEEE) is recognized as a huge challenge not just for business, but also for governments, environmental and human rights groups throughout the world." (Compliance and

"Solar-based off-grid lighting technologies already substitute the use of non-rechargeable batteries for lighting, thereby

GOGLA Industry Opinion on Lifecycle and Recycling (April 5, 2014, Cologne, Germany)

e-waste products. Source: Interview with Lighting Africa 2014.

INDUSTRY EXPERIENCE WITH COLLECTION AND RECYCLING

cycling programme, the following practices can be spent products. In countries that do not have a red.light) are considering plans to collect and recycle Some off-grid lighting manufacturers (including followed

 Import products that do not contain hazardous materials or ones that can be treated along with other

electronic appliances at end of use.

Avoid or reduce the use of hazardous materials in upstream production. For example, d.light uses lithium-polymer batteries instead of lithium acid or

lithium-ion batteries.

 Communicate to manufacturers the need for prod must treated as hazardous waste (such as batteries) ucts that are designed so that any components that

can be easily separated at end of use.

 Encourage manufacturers and distributors to coning process as possible the energy embodied in the manufactursider life cycle cost analyses and to reduce as much

Source: Interview with KEREA 2015

of the spent products for the production of useful items. of product users and the community and allows recycling on Mercury. In addition it ensures the health and safety Wastes and Their Disposal and the Minamata Convention on the Control of Transboundary Movement of Hazardous manage hazardous waste, such as the Basel Convention form to global international policies that reduce and safely service life. It also ensures a national obligation to coners and other stakeholders to ensure maximum possible tages. Among other benefits, it incentivises manufacturefficient off-grid lighting products has significant advan-On one side, the environmentally sound management of

scheme ly sound management programmes for efficient off-grid On the other side, major constraints of environmentalmentation and enforcement of a comprehensive collection implementation, adequate enabling legislation and implelighting products are the need for sustainable funding for



3 CONCLUSION

This report has given an overview of the benefits of off-grid lighting and ways for the government to seize market opportunities by creating an enabling environment. If government and the private sector work together, the market can grow at a higher speed and thus provide more households with basic energy access and clean lighting facilities faster. In partnership with the private sector (manufacturers, distributors and industry association) and civil society organisations, policymakers could design sound policies and benefit from the current trend in the off-grid lighting market to create new opportunities for job creation and economic growth and reduce the negative impact on the environment.

To this end, the report has identified best practices, case studies and practical recommendations for the establishment of regulatory framework and policy strategies for efficient off-grid lighting. The key steps are to: get the fundamentals right; kick-start the market; scale up the market; and sustain the positive impact. Based on a careful analysis of the state of the market in the country, governments can plan, take action and establish a sound off-grid lighting policy framework to accelerate market arrowth

While the structure of the publication follows these sequenced steps, there is no blue print for the creation of an enabling environment. Policies have to be designed in response to local context and not follow a 'one-size-fits-all' logic. Through an integrated approach, policymakers can chose different activities to implement related to the respective situation in-country. Policymakers can develop tailored supporting policies and mechanisms in their countries, but should follow an integrated approach in which policies complement one another.

As mentioned in earlier sections, the success of a rapid market development for efficient off-grid lighting depends, in part, on the selection and **combination of complementary policies to meet the needs of a country**. The mechanisms and measures presented in this report range from fiscal mechanisms, such as VAT and tariff exemptions or the phase out of kerosene subsidies, to the promotion of minimum quality standards and the environmentally sound management of spent products. An energy policy can help to set the framework for these mechanisms to complement each other.

In a second edition of this report, tartical advice and concrete next steps could be given. The tartical toolbox could provide policymakers with further ideas and guidelines for the implementation of respective policies. This would however neouries additional research and thus resources.

4 REFERENCES

A.T. Kearney and GOGLA (2014). Investment and Finance Study for Off-Grid Lighting: An A.T. Kearney report in Collaboration with GOGLA. Utrecht. Available from <u>http:// global-off-grid-lighting-association.org/wp-content/uploads/2013/09/A-T-Kearney-GOGLA.pdf.</u>

Alstone, Peter et al. (2014). High life cycle efficacy explains fast energy payback for improved off-grid lighting systems. Journal of Industrial Ecology, vol. 8, No. 5 (October), pp. 722–33.

Arc Finance and USAID (U.S. Agency for International Development (2014). Financing small-scale clean energy using remittances. Renewable Energy Microfinance and Microenterprise Program Briefing Note. Available from <u>http://www.arcfinance.org/pdfs/pubs/REMMP_Briefing_</u> <u>Note_Remittance.pdf</u>.

Conway, Kathryn M. et al. (2013). Guidebook for the Development of a Nationally Appropriate Mitigation Action on Efficient Lighting. UNEP/GEF en.lighten initiative. Paris. Available from <u>http://www.enlighten-initiative.org/</u> portals/0/documents/Resources/publications/UNEP%20 <u>Efficient%20Lighting%20NAMA%20Guidebook%20Decem-</u> <u>ber%202013.pdf</u>.

ECREEE (ECOWAS Regional Centre for Renewable Energy and Energy Efficiency) (2012a). The ECOWAS Energy Efficiency Policy (EEP). Praia, Cape Verde, September. Available from <u>http://www.ecreee.org/sites/defuilt/files/docu-</u> <u>ments/basic_page/081012-ecowas-ee-policy-final-en.pdf.</u>

ECREEE (2012b). Project Proposal Initiative on Energy Efficient Lighting in ECOWAS. Praia, Cape Verde.

ECREEE (2014a). ECOWAS Regional Strategy on Energy Efficient Lighting. Praia, Cape Verde, May. Available from http://www.enlighten-initiative.org/Portals/0/documents/ http://www.enlighten-initiative.org/Portals/0/documents/ country-activities/Regional%20Efficient%20Lighting%20 country-activities/Regional%20Efficient%20Lighting%20 Strategy_EN_final%20draft_ECREEE-190614.pdf.

ECREEE (2014b). ECOWAS Regional Status Report on Efficient Lighting. Praia, Cape Verde, January. Available from <u>http://www.enlighten-initiative.org/portals/0/Documents/</u> <u>inaction/Regional%20status%20report_final_17.01.2014.pdf.</u>

GIZ, IFC and Global LEAP (2013). Workshop summary report: Last Mile Distribution of Off-grid Solar Products: Support Needs, Concerns, and Opportunities. Available from http://www.foreneegomonicitestrift.org/Por-

Available from http://www.cleanenergyministerial.org/Portals/2/pdfs/GlobalLEAP-last_mile_distro_offgrid_solar.pdf

GOGLA (2014). Adoption of industry opinion on lifecyde and recycling. Cologne, 5 April. Available from <u>http:// global-off-grid-lighting-association.org/wp-content/ uploads/2014/06/606LA-Industry-Opinion-on-Life-Cyde-and-Recycling.pdf.</u>

> Harper, Meg (2012). Lighting Global 2012 Outstanding Product Awards. Schatz Energy Research Center, Humboldt State University. Arcata, California, 21 December. Available from <u>http://www.schatzlab.org/news/2012/12/</u> *lighting-global-2012-outstanding-product-awards/*.

IEA (2011). World Energy Outlook 2011. Available from http://www.worldenergyoutlook.org/publications/weo-2011/

IEA (2012). World Energy Outlook 2012. Available from http://www.worldenergyoutlook.org/publications/weo-2012/

IEA (2013). World Energy Outlook 2013. Available from http://www.worldenergyoutlook.org/publications/weo-2013/

IEC (International Electrotechnical Commission) (2013). IEC Technical Specification 62257-9-5, Edition 2.0. Available from <u>http://webstore.iec.ch/preview/Info_iec62257-9-5%7Bed2.0%7Den.pdf.</u>

IMF (2013). Energy Subsidy Reform: Lessons and Implications. Available from <u>http://www.imf.org/external/np/pp/</u> eng/2013/012813.pdf

Jacobson, Arne (2014). Quality Assurance for Off-Grid Lighting: The Role of the TERI University Solar Lighting Laboratory in an Emerging International Framework. Available from <u>http://regisindla.com/wp-content/uplogds/2014/02/TERI-SLLub.pdf.</u>

Lighting Africa (2012a). Lighting Africa Progress Report, 1 July 2010 - 30 June 2011. Available from <u>https://www.light-</u> Ingafrica.org/resources/all-resources/.

Lighting Africa (2012b). Policy Report Note: Ghana. August. Available from <u>http://www.lightingafrica.org/resourc-</u> <u>es/policy-reports/</u>.

Lighting Africa (2012c). Policy Report Note: Senegal. August. Available from <u>http://www.lightingafrica.org/resourc-</u> <u>es/policy-reports/</u>.

Lighting Africa (2013). Lighting Africa Market Trends Report 2012. Available from <u>https://www.lightingafri-</u> ca.org/wp-content/uploads/bsk-pdf-manager/5_Mar-<u>ket-Brief-Report-ElectronicREV-1.pdf</u>.

Lighting Africa (2014). Energy and carbon benefits of pico-powered lighting. Eco Design Notes, No. 4 (August). Available from <u>http://www.lightingglobal.org/wp-content/</u> <u>upbads/2014/08/Issue_4_Energy_and_Carbon_Benefits-final2.pdf.</u>

Lighting Africa (2015). Impacts. Available from <u>https://</u> www.lightingafrica.org/results/

Lighting Global (2014). Lighting Global Quality Assurance Framework: Past, Present, and Future Support for the Off-Grid Energy Market. February. Available from <u>http://www. lightingglobal.org/wp-content/uploads/2013/12/Lighting-Global-QualityAssurance-Readmop_Feb2014-v4.pdf.</u>

SNV Niger (2014). Vers un Marché Durable pour l'Energie 2015. ergy access. Available from http://www.se4all.org/our-vi-Grid Lighting Market. UNEP/GEF en.lighten initiative. SolarAid (2013). Impact Report. London, Summer. Availment for a Sustainable Solar Market) Available from http:// nouvelables (Roadmap for Achieving an Enabling Environ-Solaire: Feuille de Route pour la Promotion des Energies Re-SE4ALL (2015c). Energy efficiency. Available from http:// SE4ALL (2015b). Renewable energy. Available from http:// SE4ALL (Sustainable Energy for All) (2015a). Universal enficiency (August). Available from http://link.springer.com/ Mills, Evan et al. (2014). Low-cost LED flashlights and maring to Electrical Alternatives. UNEP/GEF en.lighten initiafor Employment in the Transition from Fuel-based Light-Mills, Evan (2014c). Light and Livelihood: A Bright Outlook trom ducing the Health and Safety Impacts of Fuel-Based Mills, Evan (2014a). Light for Life: Identifying and Re-Version 4.4. January. Available from https://www.lightable from http://www.solar-aid.org/assets/Uploads/Publi- cyv. Accessed 3 March 2015. gy/. Accessed 3 March 2015. article/10.1007%2Fs12053-014-9294-2 ket spoiling in Kenya's off-grid lighting market. Energy Eftive. Paris. Available from http://www.en Paris. Available from http://www.eni Light: Assessing the Effect of Fuel Subsidies in the Off-Mills, Evan (2014b). Lifting the Darkness on the Price of Lighting. UNEP/GEF en.lighten initiative. Paris. Available from <u>http://www.lighting</u> Lighting Global (2015c). Test laboratory network. Available March 2015. Lighting Global (2015a). Lighting Global Quality Standards. route_pour_la_promotion_des_er.pdf. Accessed 8 May 2015. for%20Employment.pdf. and%20Livelihood%20-%20A%20Bright%20Outlook%20 the %20Darkness%20-%20Effects%20of%20Fuel%20Subsiel-Based%20Lighting.pdf. -%20Health%20and%20Safety%20Impacts%20of%20Furatory-network/. Accessed 3 March 2015. Lighting Global (2015b). Quality assurance. Available from www.snvworid.org/en/dow lies.pdf. 00rtals/0/documents/Resources/publications/Lifting%20 iments/Resources/publications/Light%20for%20Life%20 Jan2014_V4_4.pdf. ngglobal.org/wp-content/uploads/2015/01/MQStandards -objectives/universal-energy/. Accessed 3 March http://www.enlig htingglobal.org/activities/qa/. Accessed 3 ents/Resources/publications/Light %20 vision/our-objectives/energy-efficiennten-initiative.org/portals/0/docr-objectives/renewable-enerighten-initiative.org/ ies/qa/test-labonten-Initiative.

> SolarAid (2014b). Zambia Country Report 2014. Lonwww.solar-aid.org/impact/. Accessed 3 March 2015. SolarAid (2014a). Impact Report. Available from http://

cations/Impact-report-web-updated.pdf.

Stiftung Solarenergie – Solar Energy Foundation (2014) don. Available from <u>http://solar-aid.org/assets/Uploads</u>, pact-pages/Zambia-report-2014.pdf.

sen, Germany. Available from http://stiftung-solarenergie OBIN Off-Grid Business Indicator 2014 – Africa. Merzhaude/fileadmin/Dateien/OBIN_World_2014_FINAL.pdf.

SunnyMoney (2014). A Guide to the Light Library Mod Senegal. SolarAid. London, August. Available from https:/ el: Lessons, Results & Recommendations from the Field Library-guide-FINAL-KH-09.09.14.pdf. htingafrica.org/wp-co ntent/uploads/2014/10/Light-

initiative. Paris. Available from <u>http://learning.enlighten-ini-</u> Achieving the Global Transition to Energy Efficient Lighting UNEP (United Nations Environment Programme) (2012a) Toolkit. UNEP/Global Environment Facility (GEF) en.lighten tiative.org/ebook/en_lighten_english_complete.pdf.

en_Sub-Saharan%20Report.pdf. initiative. Paris. Available from http://www.enligh Sub-Saharan African Countries. UNEP/GEF en.lighten UNEP (2012b). Regional Report on Efficient Lighting in tiative.org/portals/0/documents/country-support/en.light-

from Strategy. UNEP/GEF en.lighten initiative. Paris. Available UNEP (2013a). Developing a National Efficient Lighting ing%20Strategy_%20Annotated%20outline%20-%20ENG.pdf <u>ments/country-support/National%20Efficient%20Light-</u> nttp: www.enliah e.ora/Portals/0/docu-

able from: <u>http://www.unep.org/Documents.Multilingual.</u> Deliver Major Development and Climate Benefits. Avail-UNEP (2013b). Sustainable Off-Grid Lighting Solutions Can t.asp?DocumentID=2704&ArticleID=9407&I=en

aspx. Accessed 3 March 2015. http://www.unep.org/climatechange/mitigation/Default UNEP (2015a). Climate change mitigation. Available from

http://map.enlighten-initiative.org/. UNEP/GEF en.lighten initiative. Paris. Available from UNEP (2015b). Off-Grid Country Lighting Assessments

3 March 2014. change. Available from http://www. UNEP ROA (Regional Office for Africa) (2015). Climate <u>es/ClimateChange/tabid/7173/Default.aspx.</u> Accessed ep.org/roa/Pro-

mate Change) (2012). AMS-III.AR.: Substituting fossil fuel 2.0. Available from https://cdm.u based lighting with LED/CFL lighting systems - Version UNFCCC (United Nations Framework Convention on Cli-DB/1ERD0JQX620D2BH65G74XM28Z2CL53. "ccc.int/methodologies/

able from http://www.worldbank.org/pr World Bank (2014). Lighting Lives in Liberia project. Availlighting-lives-liberia?lang=en. Accessed 3 March 2015. cts/P124014/

e de

22/28

5 ANNEX I: UNEP INTEGRATED POLICY APPROACH The growth of regional and local markets for efficient off Designing and implementing monitoring, verification Setting minimum energy performance and quality stan-Designing and establishing supporting policies, includand consultative stakeholder process standards should be developed through a transparent gy benefits of their products); reduced taxes on off-grid efficient products to inform consumers about the enerconsumers to change their behaviour. These include: struments and communication strategies to persuade ing economic and market-based instruments, fiscal inen initiative. In detail below are the actions need to be ly sound management. The integrated policy approach grid lighting in Africa can be sustained via an integrated version to use of fuel-based lighting; and the increased confidence in modern lighting products and possible reslower progress towards achieving environmental and tored, verified and enforced, the consequences include: If the quality of off-grid lighting products is not moniof low quality, low-cost products entering the market established minimum energy performance standards systems and to ensure that products comply with the ing programme, to allow for product quality surveillance and enforcement measures in every aspect of the lightshould be phased out. Minimum energy performance lighting products, and help to identify any products that many energy-saving and other benefits of good-quality entry of low-quality products that would not deliver the before they can be sold. This can help prevent the market mand and use that off-grid lighting products must meet and other key characteristics that affect the energy dedards that specify the energy efficiency requirements proaches) introduce and evaluate efficient off-grid lighting aplighting products; and demonstration programmes (to tification and labelling (to encourage manufacturers of public support and change societal and cultural attitudes awareness raising, promotion and education (to mobilise taken in the field: veloping countries globally, through the UNEP en.lightinternational experts and applied by more than 27 defor efficient lighting has been developed with input from verification and enforcement, as well as environmentalenergy performance and quality standards, monitoring, policy mechanisms, the implementation of minimum policy approach that includes four elements: supporting cient off-grid lighting industry; end-consumers' lack of poverty-alleviation goals; reputational risks to the effi-This can help to avoid the challenge of a large proportion and behaviours regarding energy-efficient lighting); cer-

> Engaging in environmentally sound management of efficient off-grid lighting products to reduce their impact on the environment. From a life-cycle perspective, replacing fuel-based lanterns with off-grid lighting products reduces cabon dioxide (CO2) emissions from fossil fuel burning. However, sustainable end-of-life schemes for spent products (especially batteries and the mercury in compact fluorescent lamps) are needed, and should follow the principles of pollution prevention and environmentally sound management, including extended producer responsibility.

Figure 5 Integrated policy approach for a transition to efficient off-grid lighting products



Source: UNEP 2015

6 ANNEX II: ESTIMATED POTENTIAL BENEFITS FROM A MARKET TRANSITION TO EFFICIENT OFF-GRID LIGHTING IN AFRICA

COUNTRY	Number of Off-Grid Households 17	Annual Savings - Low Scenario (USS)	Annual Savings - High Scenario (USS)	Annual CO2 Savings (tonnes)	Kerosene Savings (litres)	Candle Savings (tonnes)	Annual Household Savings, Low to High (USS)
Afghanistan	5,662,000	408,261,000	554,074,000	749,000	288,167,000	17,000	61 to 83
Algeria	133,000	9,674,000	13,388,000	23,000	8,665,000	I	60 to 83
Angola	3,062,000	217,501,000	270,955,000	756,000	290,608,000	16,000	61 to 76
Argentina	415,000	20,167,000	27,226,000	80,000	30,692,000	1,000	42 to 57
Bangladesh	14,488,000	800,537,000	1,095,519,000	2,248,000	864,529,000	14,000	46 to 63
Belize	7,000	679,000	946,000	2,000	623,000	1	80 to 112
Benin	1,350,000	211,044,000	286,413,000	352,000	135,438,000	8,000	133 to 180
Bhutan	55,000	5,697,000	7,937,000	14,000	5,223,000	1	90 to 125
Bolivia	295,000	25,544,000	25,978,000	6,000	2,394,000	6,000	74 to 76
Botswana	167,000	14,561,000	16,666,000	14,000	5,323,000	3,000	74 to 85
Brazil	467,000	37,065,000	51,656,000	88,000	34,036,000	1,000	69 to 97
Burkina Faso	2,589,000	227,588,000	306,693,000	458,000	176,241,000	10,000	74 to 99
Burundi	1,830,000	248,803,000	307,238,000	174,000	64,906,000	31,000	114 to 141
Cambodia	2,165,000	177,062,000	248,037,000	321,000	123,648,000	2,000	68 to 96
Cameroon	2,000,000	217,160,000	285,472,000	512,000	196,988,000	11,000	92 to 121
Cape Verde	5,000	784,000	1,066,000	1,000	489,000	1	125 to 170
Central African Republic	855,000	90,292,000	123,564,000	148,000	56,885,000	3,000	88 to 120
Chad	2,369,000	222,213,000	240,629,000	79,000	30,441,000	44,000	84 to 90
Chile	80,000	7,618,000	10,739,000	14,000	5,322,000	1	84 to 119
China	931,000	69,868,000	98,007,000	145,000	55,612,000	1,000	66 to 93
Colombia	366,000	29,484,000	41,091,000	70,000	27,074,000	1	70 to 98
Comoros	84,000	6,628,000	9,152,000	19,000	7,220,000	1	68 to 95
Congo, Dem. Rep.	12,006,000	1,084,578,000	1,169,838,000	390,000	150,073,000	216,000	81 to 87
Congo, Rep.	840,000	56,625,000	74,896,000	139,000	53,502,000	3,000	57 to 75
Costa Rica	9,000	826,000	1,157,000	2,000	677,000	1	81 to 114
Cote d'Ivoire	1,963,000	234,469,000	278,791,000	198,000	73,620,000	35,000	99 to 118
Cuba	64,000	5,171,000	7,206,000	12,000	4,748,000	1	70 to 98
Djibouti	91,000	11,390,000	15,273,000	22,000	8,458,000	1	107 to 143
Dominican Republic	121,000	12,384,000	17,436,000	23,000	8,930,000	I	90 to 127
Ecuador	240,000	18,744,000	26,085,000	46,000	17,732,000	1	68 to 95
Egypt, Arab Rep.	435,000	10,812,000	13,377,000	74,000	28,390,000	1	20 to 25
El Salvador	125,000	10,089,000	14,060,000	24,000	9,264,000	1	70 to 98
Equatorial Guinea	33,000	3,265,000	4,116,000	11,000	4,062,000	1	81 to 102
Eritrea	882,000	46,950,000	64,148,000	135,000	51,925,000	1,000	44 to 60
Ethiopia	17,179,000	956,547,000	1,319,407,000	2,370,000	911,372,000	15,000	46 to 64
Fiji	20,000	1,848,000	2,329,000	3,000	1,100,000	1	76 to 96
Gabon	137,000	11,817,000	13,059,000	13,000	4,860,000	2,000	72 to 80
Gambia, The	321,000	31,188,000	33,745,000	11,000	4,288,000	6,000	87 to 94
Georgia	2,000	45,000	54,000	1	169,000	1	16 to 19
Ghana	1,665,000	307,013,000	422,243,000	422,000	162,137,000	9,000	157 to 216

24/28

difficulty and cost of engaging in outreach to consumers

in order to overcome mistrust and other barriers

26 /28		

Panama	Delen	Pakistan	Nigeria	Niger	Nicaragua	Nepal	Namibia	Myanmar	Mozambique	Morocco	Montenegro	Mongolia	Micronesia, Fed. Sts.	Mexico	Mauritania	Marshall Islands	Mali	Maldives	Malaysia	Malawi	Madagascar	Macedonia, FYR	Liberia	Lesotho	Lebanon	Lao PDR	Korea, Dem. Rep.	Kiribati	Kenya	Kazakhstan	Jamaica	Iraq	Iran, Islamic Rep.	Indonesia	India	Honduras	Haiti	Guyana	Guinea-Bissau	Guinea	Guatemala	COUNTRY
104,000	' .	9,897,000	21,149,000	2,759,000	432,000	1,257,000	336,000	7,985,000	3,505,000	70,000	78,000	98,000	10,000	1,522,000	563,000	3,000	2,030,000	1	192,000	3,367,000	3,890,000	30,000	770,000	315,000	425,000	665,000	6,162,000	12,000	7,590,000	151,000	46,000	1,037,000	255,000	13,125,000	60,655,000	296,000	1,899,000	43,000	253,000	1,949,000	571,000	Number of Off-Grid Households 17
8,790,000	A 000 -	885,231,000	1,432,962,000	222,413,000	37,421,000	102,018,000	32,569,000	508,884,000	279,182,000	4,268,000	8,230,000	6,365,000	810,000	113,215,000	56,170,000	250,000	191,658,000	13,000	12,574,000	269,113,000	376,453,000	2,264,000	74,169,000	32,778,000	24,385,000	42,357,000	347,297,000	000,696	761,181,000	3,529,000	5,250,000	27,473,000	4,564,000	488,445,000	2,600,177,000	25,023,000	152,910,000	3,641,000	24,545,000	193,837,000	49,832,000	Annual Savings - Low Scenario (US\$)
12.249.000		1,226,912,000	1,751,965,000	309,464,000	39,221,000	141,931,000	37,542,000	704,348,000	297,286,000	5,844,000	11,621,000	8,872,000	1,019,000	156,251,000	61,304,000	314,000	205,169,000	13,000	17,186,000	364,901,000	398,211,000	3,155,000	79,978,000	38,446,000	33,859,000	58,627,000	486,405,000	1,219,000	1,064,594,000	4,426,000	7,394,000	32,640,000	5,375,000	633,014,000	3,374,612,000	25,981,000	155,545,000	5,089,000	26,535,000	211,316,000	52,406,000	Annual Savings - High Scenario (US\$)
21,000	' .	2,002,000	5,517,000	468,000	8,000	215,000	31,000	1,185,000	104,000	12,000	14,000	15,000	1,000	324,000	20,000	1	71,000	1	42,000	500,000	141,000	5,000	27,000	29,000	54,000	99,000	635,000	2,000	1,674,000	26,000	10,000	228,000	40,000	2,871,000	15,016,000	6,000	37,000	8,000	9,000	68,000	11,000	Annual CO2 Savings (tonnes)
8,069,000	A 000 -	770,059,000	2,121,924,000	179,870,000	3,260,000	82,691,000	11,599,000	455,940,000	39,931,000	4,568,000	5,463,000	5,848,000	487,000	124,742,000	7,530,000	150,000	27,150,000	2,000	16,148,000	192,409,000	54,044,000	2,079,000	10,295,000	10,904,000	20,612,000	37,951,000	244,329,000	583,000	643,771,000	10,079,000	3,740,000	87,608,000	15,201,000	1,104,053,000	5,775,489,000	2,232,000	14,321,000	3,146,000	3,382,000	26,071,000	4,304,000	Kerosene Savings (litres)
1		13,000	118,000	3,000	8,000	1,000	5,000	8,000	58,000	1	1	1	1	2,000	11,000	1	39,000	1	1	11,000	83,000	1	15,000	5,000	1	1,000	4,000	1	12,000	1		1,000	1	20,000	105,000	6,000	37,000	-1	5,000	37,000	11,000	Candle Savings (tonnes)
74 to 103	20 +~ 111	73 to 101	58 to 70	67 to 93	75 to 78	67 to 94	82 to 94	53 to 73	72 to 76	50 to 69	92 to 131	57 to 80	66 to 83	64 to 89	89 to 97	66 to 83	85 to 90	88 to 92	56 to 78	67 to 91	83 to 88	66 to 93	86 to 93	87 to 102	48 to 67	53 to 73	47 to 67	66 to 83	87 to 122	20 to 25	100 to 142	21 to 25	15 to 17	31 to 41	36 to 47	73 to 76	69 to 71	75 to 105	87 to 93	89 to 96	75 to 79	Annual Household Savings, Low to High (USS)

Number of Off-Grid	Annual Savings	Annual Savings -	Annual CO2	Kerosene	Candle	Annual Household
Households 17	US\$)	(US\$)	(tonnes)	(litres)	(tonnes)	Savings, Low to High (USS)
866,000	98,935,000	139,158,000	189,000	72,867,000	1,000	100 to 141
17,000	1,617,000	2,254,000	4,000	1,484,000	I	80 to 112
696,000	54,854,000	76,373,000	134,000	51,407,000	1,000	69 to 96
5,424,000	632,296,000	885,975,000	1,325,000	509,590,000	9,000	101 to 142
2,000	78,000	107,000	I	80,000	1	40 to 55
735,000	44,973,000	62,692,000	107,000	41,331,000	1,000	54 to 75
2,034,000	184,533,000	251,239,000	325,000	125,013,000	7,000	76 to 103
2,000	186,000	234,000	I	112,000	1	66 to 83
16,000	1,544,000	2,014,000	4,000	1,500,000	I	83 to 109
75,000	1,097,000	1,292,000	10,000	3,657,000	I	12 to 14
1,300,000	242,680,000	333,407,000	339,000	130,410,000	7,000	158 to 217
1,069,000	100,259,000	107,048,000	37,000	14,304,000	21,000	84 to 89
77,000	10,272,000	13,512,000	12,000	4,415,000	I	110 to 145
1,847,000	121,374,000	167,993,000	283,000	108,743,000	2,000	55 to 76
1,654,000	161,913,000	187,073,000	154,000	57,151,000	27,000	82 to 95
1,850,000	201,451,000	280,597,000	480,000	184,616,000	3,000	93 to 131
618,000	36,007,000	49,314,000	117,000	45,069,000	1,000	51 to 70
1,000	68,000	81,000	1	56,000	1	43 to 51
4,168,000	644,495,000	910,492,000	1,082,000	416,011,000	8,000	134 to 189
7,000	568,000	791,000	1,000	521,000	1	70 to 98
191,000	20,061,000	23,595,000	18,000	6,598,000	3,000	88 to 104
574,000	29,042,000	40,046,000	72,000	27,846,000	I	42 to 58
179,000	15,536,000	21,632,000	32,000	12,364,000	T	72 to 100
7,557,000	832,791,000	1,145,998,000	1,250,000	480,732,000	29,000	92 to 127
235,000	23,224,000	32,671,000	44,000	17,114,000	I	87 to 122
199,000	16,324,000	22,869,000	30,000	11,383,000	1	68 to 96
924,000	85,295,000	115,395,000	164,000	62,925,000	4,000	77 to 104
5,000	470,000	606,000	1,000	242,000	1	77 to 99
6,517,000	682,813,000	867,440,000	827,000	318,125,000	29,000	90 to 114
772,000	52,991,000	73,862,000	127,000	48,683,000	1,000	60 to 84
9,000	902,000	1,274,000	2,000	603,000	1	86 to 121
197,000	20,619,000	28,791,000	47,000	18,017,000	1	90 to 127
39,000	4,704,000	6,249,000	5,000	1,840,000	1	101 to 134
94,000	8,438,000	11,758,000	20,000	7,744,000	1	78 to 109
836,000	80,573,000	112,487,000	184,000	70,946,000	1,000	84 to 117
2,130,000	68,575,000	86,189,000	426,000	163,733,000	3,000	26 to 33
0 100 000	190,443,000	204,657,000	69,000	26,626,000	38,000	80 to 86
2,100,000	153,780,000	164,574,000	56,000	21,729,000	31,000	77 to 82
1,800,000					1301000	
	Number of Hoff-Grid 17,000 866,000 17,000 696,000 5,424,000 2,000 2,000 2,000 2,000 2,000 2,000 2,000 1,1300,000 2,000 1,6000 1,6000 1,300,000 1,47,000 1,480,000 1,900 1,900 1,900 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 1,950,000 5,000 1,90,000 1,90,000 1,90,000 1,90,000 1,90,000 1,90,000 9,000 9,000 1,90,000 1,90,000 1,90,000 1,90,000	Number of the ferial (USS) Annual Savings (USS) 866,000 98,935,000 17,000 98,935,000 866,000 98,935,000 1617,000 632,296,000 54,854,000 632,296,000 2,000 78,000 2,000 14,973,000 2,000 186,000 1,600 186,000 1,000 1,44,93,000 1,000 1,54,4,000 1,000 10,272,000 1,47,000 12,43,74,000 1,47,000 12,44,000 1,480,000 10,259,000 1,480,000 12,1374,000 1,480,000 20,4451,000 1,480,000 20,061,000 1,480,000 20,061,000 14,90,000 15,536,000 179,000 23,224,000 199,000 15,536,000 172,000 16,324,000 199,000 16,324,000 199,000 16,324,000 199,000 16,324,000 199,000 16,324,000	Number of bdf-6rd bdf-6rd 1000 Annual Saving -Losy Scenario Annual Saving USS B66,000 98,935,000 139,158,000 17,000 1617,000 2,224,000 696,000 54,854,000 76,373,000 54,24,000 78,000 885,975,000 2,000 78,000 885,975,000 2,000 78,000 885,975,000 2,000 184,933,000 2,224,000 2,000 184,933,000 23,4,000 2,000 184,933,000 23,4,000 2,000 1,544,000 2,04,000 7,000 10,259,000 107,048,000 1,930,000 12,73,400 187,973,000 1,947,000 12,73,4000 187,973,000 1,947,000 12,73,4000 187,973,000 1,947,000 12,73,4000 187,973,000 1,947,000 12,73,4000 19,93,000 1,950,000 19,93,000 19,93,000 1,960,000 23,947,000 23,950,000 19,000 10,942,000 21,932,000	Number of the fer al body senario Annual Savings the Senario Annual Savings the Senario Annual Savings Savings Savings 866,000 19,935,000 139,158,000 189,000 17,000 2,254,000 139,158,000 130,000 69,000 54,854,000 78,373,000 130,000 54,24,000 632,296,000 88,975,000 1,325,000 2,000 632,296,000 88,975,000 1,325,000 2,000 144,973,000 82,975,000 1,225,000 2,000 144,533,000 224,000 232,000 2,000 144,533,000 231,230,000 325,000 16,000 1,972,000 1,972,000 1,970,000 339,000 16,000 10,723,000 12,900,00 12,900,00 12,900,00 1,960,000 10,723,000 143,900,00 140,900,00 140,000 1,960,000 143,93,000 140,900,00 140,000 10,92,000 1,960,000 190,492,000 10,92,000 12,90,000 12,93,000 12,90,000 1,960,000	Withober Investiols Annual Savings Annual Savings Annual Coz Savings Kersen Savings 866,000 19,350,000 139,158,000 189,000 72,87,000 17,000 1617,000 2,224,000 189,000 72,87,000 669,000 63,2296,000 88,975,000 132,50,00 144,000 2,000 63,2296,000 88,975,000 1225,000 107,000 2,000 64,84,000 224,000 1225,000 125,010 2,000 184,53,000 224,000 125,010 125,010 1,000 1,97,000 224,000 120,000 125,010,00 1,000 1,97,000 129,000 120,000 130,410,000 1,000 1,97,000 139,40,000 14,30,000 14,30,000 1,98,000 12,714,000 139,410,000 14,940,000 14,940,000 1,98,000 12,714,000 139,40,000 12,940,000 14,940,000 1,98,000 12,714,000 139,40,000 14,940,000 14,940,000 1,98,000	Manual Saving Type Annual Saving Type Annual Guz Kersen Konsen Condi- Savings B66,000 98,950,000 139,159,000 189,000 72,87,000 129,000 B66,000 1,817,000 2,254,000 1325,000 1325,000 142,80,000 54,854,000 54,854,000 75,373,000 1325,000 142,80,000 1000 5,000 12,254,000 1325,000 120,000 1000 1000 5,000 12,250,000 125,013,000 1000 1000 1000 2,000 124,80,000 214,000 1000 120,000 1000 2,000 124,80,000 214,000 1000 120,000 1000 2,000 124,80,000 12,000 1000 1000 1000 1,000 12,42,80,000 12,130,000 12,000 1000 1000 1,000 12,130,000 12,140,000 12,000 1000 1000 1000 1,000 12,145,000 12,140,000 1000,00 14,140,000

www.unep.org United Nations Environment Programm PO. Box 30552 Nairobi, Kenya Tel.: ++254-(0)20-762 1234 Fax: ++254-(0)20-762 3927 E-mail: uneppub@unep.org



