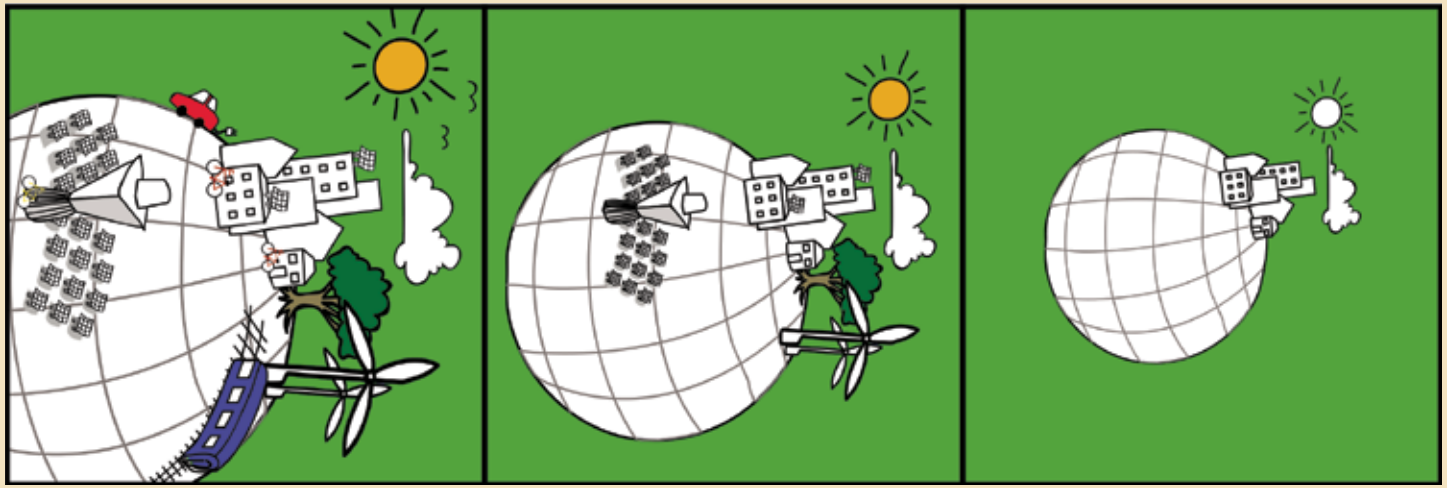
BOA NGUVU:

AN AFRICAN SUSTAINABLE ENERGY COUNTRY – SPECIAL SUMMARY



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AN AFRICAN SUSTAINABLE ENERGY COUNTRY – SPECIAL SUMMARY

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"Boa Nguvu", a country in sub-Saharan Africa, has been created to explore how various successful sustainable energy efforts can be combined in one country to provide energy access for all. It is hoped that this report will serve as a source of inspiration for energy stake-holders in the sub-continent.

Boa Nguvu: An African Sustainable Energy Country

ACRONYMS

AEEP	Africa Energy Partnership
CBO	Community based organisations
CDM	Clean Development Mechanism
COMESA	Common Market for Eastern and Southern Africa
CPV	Concentrated Photovoltaic
CSP	Concentrated Solar Power
DNI	Direct normal irradiance
EAPP	East Africa Power Pool
ECOWAS	Economic Community of West African States
EDF	Energy Development Fund
EIS	Energy Information System
EJ	Exa Joule = 1million TJ (*see* annex energy units)
EU	European Union
FIT	Feed in Tariff
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVEP	Global Village Energy partnership
IEA	International Energy Agency
LPG	Liquefied petroleum gas
LTWP	Lake Turkana Wind Power
MDG	Millennium Development Goal
NAMREP	Namibian Renewable Energy Program
NGO	Non Governmental Organisation
ODA	Official Development Assistance
R&D	Research and Development
RAPP	Regional Africa Power Pool
REDD	Reducing Emissions from Deforestation and Forest Degradation
RES	Renewable Energy Sources
RESP	Renewable Energy Supply Plan
RET	Renewable Energy Technologies
SE4ALL	Sustainable energy for all
SLG	Local Management Structure (Structure Locale de Gestion)
SWH	Solar Water Heater
SSA	sub Saharan Africa Pool
TJ	Tera Joule (see annex energy units)
Toe	Tons oil equivalent
TPES	Total Primary Energy Supply
UN	United Nations
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WWF	World Wide Fund for Nature previously World Wildlife Fund

INTRODUCTION

Sustainable energy is starting to move to the core of energy policy in Africa. There is a growing realisation amongst African policy makers that with deforestation, escalating oil and gas prices, and global measures to mitigate climate change, purely traditional biomass and fossil fuel based development paths are no longer viable. In fact, across Africa a wide range of sustainable energy solutions have already been implemented and, in most instances, are working sustainably and effectively. The opportunity therefore exists for each country to learn from these solutions which exist already somewhere in the continent and bring them all together for implementation at national level, according to the specific energy resource endowments.

The full report "Boa Nguvu – An African Sustainable Energy Country" offers the example of the Republic of Boa Nguvu, which has defined an Energy Strategy 2030, to transition to a sustainable energy based country. In other words, Boa Nguvu has gathered the "Best of Africa" when it comes to sustainable energy practices. The report describes the path chosen by Boa Nguvu in achieving a sustainable energy future, with the expectation that it will inspire other African countries to address their related challenges. It shows how to achieve the transition in a poor country from an energy mix dominated by fossil fuels and traditional biomass to renewable energy including sustainable biomass as the main sources supplying most of the energy needs of all sectors. Although this is a fictional case, it is based on real situations in sub-Saharan Africa.

The three steps to bring about that change are:

1 An **energy diagnosis**, to assess the situation and understand what can be done, as well as who will be involved and at what levels.

2 The **energy planning process or strategy**, using globally recognised tools with which to make the transition from a current situation to a sustainable future.

3 A **plan of action** to address the challenges, practically. The workable action plan is to ensure that, by 2030, there will be universal, affordable, reliable and sustainable energy access in both urban and rural areas of the country, even though currently deprived of the use of modern and efficient use of energy.

This special summary of the full report offers the reader a quick scan of the main steps Boa Nguvu went through, illustrated by the best practical examples.

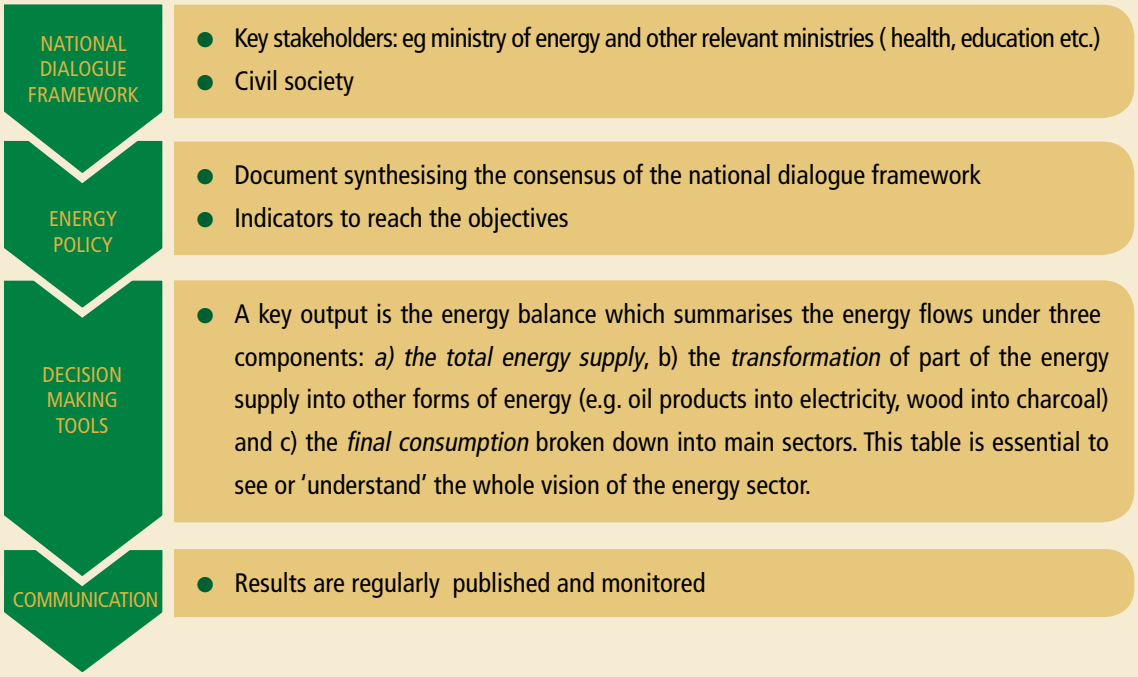
Main steps to achieve a transition to a sustainable energy mix

1 ENERGY SECTOR DIAGNOSIS & RESOURCE ASSESSMENT

An **Energy Diagnosis** involving key stakeholders is a key pre-requisite to ensure that the complexity of energy systems are well understood, that the options for a sustainable energy future are a result of democratic process based on fact and that the needs of particularly poor and vulnerable people are fully taken into consideration. A great tool for such an Energy Diagnosis is the **Energy Information System**.

Energy Information System and energy accountability

The Energy Information System (EIS) is a decision making tool for African Energy Ministries. It has been promoted by the EU Intelligent Energy programme and the "Organisation Internationale de la Francophonie". It provides an in-depth sector analysis and energy indicators, allowing for the design, monitoring, and assessment of energy policy. The EIS also offers a national dialogue framework for energy sector stakeholders, thereby enhancing the transparency of the energy sector. EIS is therefore a communication tool for energy sector stakeholders. The following diagram summarises the steps from the national dialogue framework till the dissemination of the results



The **Survey of Energy Potential** or Resource Assessment (small and large hydro, wind, solar, biomass and waste etc.) accompanied the energy sector diagnosis to design the optimal energy mix by 2030.

For instance, the energy ministry used the recently published Tunisian wind atlas as an example of identifying the best wind potentials. This Atlas required using wind-measuring instruments for a period of a year, at heights of 20 and 40 metres, in 17 different sites in the country, besides the use of the statistics collected by the Institut National de Météorologie. Boa Nguvu wind energy measurements show good potential, particularly along the

coast, average speed of between 6 and 7m/s which is very suitable for wind farms. At least four good sites with a respective potential of 55MW, 100MW, 125MW and 200MW have been identified.

Not all the technical potential for wind, solar, biomass etc. is usable. Socio-economic and environmental aspects should be considered to refine the potential assessment. However, the technical potential assessment enabled Boa Nguvu to start a discussion about the best technologies for its energy mix and where to deploy them. Mapping potentials and comparing them to the needs can also help identify suitable zones for renewable energy development and understand the potential land use impacts of renewable energy, as is highlighted for Madagascar.

Figure 1: Tunisia wind atlas

Madagascar solar atlas

Renewable energy requires land. But just how much?

WWF and First Solar have created a solar atlas that illustrates some answers about solar photovoltaic electricity in seven different regions. One of these regions is Madagascar.

Overall, the solar resource in Madagascar is very strong, with over two-thirds of the island having an annual average global irradiation greater than 6kWh/m2/day. Even on the rainy side of Madagascar, annual global irradiation is greater than 5kWh/m2/day.

Four and a half square kilometres of solar panels would generate enough electricity to meet Madagascar's total current electricity generation. Because population and per capita electricity consumption are expected to rise in the coming decades, 780 square kilometres of land dedicated to solar production would be required to meet 100% of Madagascar's total electricity needs in 2050. Concentrated into one location, this land would represent a square of about 28 kilometres on each side. The solar map shows land needed for 2010 generation (red square) as well as land use needed to meet electricity demand in 2050 (blue square). More info can be found on www.panda.org/solaratlas.

The potential for **geothermal energy** can be mobilised with reasonable costs if the initial capital is secured and financial risks to the private sector of failed drilling mitigated. Boa Nguvu is working with the EU-Africa Infrastructure Trust Fund to further explore the potentials and attract private sector investments.

Geothermal Risk Mitigation Fund, Eastern Africa

The EU-Africa Infrastructure Trust Fund (ITF) is the main financial instrument for financing regional infrastructure projects in Africa. The Trust Fund blends grants from the Commission and member states with long-term financing from European financial institutions and the ADB. The GRMF contains 20m Euro from Germany and 30m Euro mobilised by the EU-Africa Infrastructure Trust Fund. A key feature is reducing barriers for capital investments by helping to offset the high risk of unsuccessful exploratory geothermal drilling, and so help public and private investors for the construction of geothermal power plants.

ITF grants are used for:

- Financial support for drilling of exploration wells at the most promising geothermal prospects, to assist developers secure finance for subsequent exploration or appraisal wells.
- Surface studies to determine the optimal location of exploration wells at the most promising geothermal prospects.
- The development of a regional geothermal database of prospects in the region.
- Pre-application training workshops for developers.
- Support to AUC for management of the project.

Source: EU-Africa Infrastructure Trust Fund, 2013

2 CONSULTATION PROCESS

The energy sector diagnosis and resources assessment informed a National Consultation Process, organised in needs assessment workshops, a civil society consultation workshop, and a high-level workshop. The process conformed to models for best practice in multi-stakeholder policy making, and there are various countries that have made some strides towards such consultative energy policy making, Morocco was a good source of inspiration.

Example of Energy Policy Consultation – Morocco

Morocco organised national energy conferences in November 2006, bringing together the sector's main stakeholders (administrators, energy companies and federations, consumers) during thematic workshops (security, sustainable development, competition and investment) and plenary sessions. This event under the patronage of the prime minister provided an opportunity for a wide ranging assessment of the situation, issues and options as regards energy policy. In 2008 and in follow up to this work, the government commissioned a strategy paper and signed an energy cooperation agreement with the EU including, in particular, establishing a twinning system between European and Moroccan administrators covering a wide range of areas addressed by the conferences (statistics and forecasts, security and investment programming).

Source: WWF, 2010

3 OBJECTIVES OF THE 2030 SUSTAINABLE ENERGY STRATEGY

The consultation process outcomes, together with the energy sector diagnosis, served as direct input to the country's energy Strategy 2030 with its Objectives and a Plan of Action.

The **Objectives** of the **2030 Strategy** provided the overarching guidance for the development of the Plan of Action. Realistic objectives have been set to ensure the progress and monitoring of the Action Plan, some of which are summarised below.

- By 2030 there will be universal, affordable, reliable and sustainable energy access in both, urban and rural areas. Access to sustainable energy is a key contributor to human welfare.
- By 2030 the share of imported petroleum products will be halved and almost all electricity will be supplied from renewable energy sources to improve the country's energy security.
- By 2020, a target of 100% of improved kilns and stoves will be achieved.
- By 2030, at least 85% of the total primary energy will be supplied from sustainable biomass and other renewable energy sources and 95% of electricity will be generated from renewable energy
- By 2030, all biomass from energy will be derived from sustainable biomass resources and benefitting rural communities. Hydro power plants will include a thorough environmental impact assessment carried out and monitored by independent institutions.

ACTION PLAN

The Action Plan to realise those objectives is composed of three components: managing **demand for energy**, transforming the **supply of energy** and securing **mechanisms for implementation**.

4 ENERGY DEMAND ACTION PLAN

The government of Boa Nguvu has set ambitious energy demand objectives. The action plan looks at the development of an energy-aware culture; the use of energy efficient equipment, services and buildings; and urban planning and transport. Biomass will remain an important energy source to meet energy household demand by 2030. Therefore, a dedicated **biomass action plan** for Boa Nguvu has been developed encompassing both the demand and the supply side.

ENERGY AWARE CULTURE AND ENERGY EFFICIENT EQUIPMENT

Empowerment, education and behaviour are important factors in the success of any energy demand management policy. Energy efficient technologies need to be available and affordable but the way we use these technologies will play a major role in their impact. Societal change and appropriate technologies are very much at the core of the efficient lighting project in Madagascar and the efficient stove programme in Goma, DRC that influenced the Boa Nguvu action plan.

Efficient electric lighting in Madagascar

In Madagascar, the electrification rate is about 25%. Residential consumption represents 30% of the total electricity generated by JIRAMA (The national power company). Besides, lighting accounts for 10% to 20% of households' electricity bill. 40% of the electricity generated comes from thermal power plants which are fuelled with heavy fuel and diesel; thereby resulting in high production costs and a high selling price. Each year nearly 100 million US dollars of fuel are imported.

The project's goal is to enable the emergence of a good quality and affordable efficient lighting market in Madagascar; thus promoting energy saving. The main objectives are:

- Stimulation of the market by distributing 776,500 compact fluorescent lamps (CFLs) among households in 8 towns in Madagascar.
- Regulation of the lighting market by promoting the adoption of a national framework and regulation that favours good quality and an affordable efficient lighting market in the country.

This would have several benefits for Malagasy society:

Economic

- Reduction of 19MW of the electricity peak power call;
- A yearly saving of 10 million US dollars for the national electricity company on fuel and other inputs;
- More available power: no load shedding, more households having access to electricity;
- Growth of a good quality lighting market.

Environmental

- 776,500 incandescent lamps not used anymore;
- About 72,000T of CO2 emission reduction in seven years.

Social

- Approximately 200,000 households using good quality CFLs;
- At least 7% saving on electricity bills for households.

MOUs have been established between WWF, JIRAMA, the Ministry of Energy and the TELMA Foundation. The CFLs will be purchased by JIRAMA through World Bank funding. JIRAMA ensures the network quality, facilitates the implementation and participates in impacts monitoring. WWF's responsibilities include coordination, fundraising and contracts management. The TELMA Foundation is responsible for the logistics, transport, storage, distribution and collection of the lamps at their shops. The Ministry of Energy facilitates tax issues, and work on the regulation and standardization of the lighting market.

A feasibility study was conducted, followed by a baseline study in the eight targeted cities (Diego, Nosy Be, Mahajanga, Toliara, Antananarivo, Antsirabe, Fianarantsoa and Toamasina) and in the pilot city (Ambositra).

A pilot operation was implemented in the city of Ambositra from 6 October 2011 to the 21 October 2011. Six thousand one hundred CFLs, offered by Philips Corporation, were distributed. The average decrease in household electricity bill was about 10% and JIRAMA savings are estimated at 7 million Ariary for the months of November and December 2011. The population of Ambositra was enthusiastic and receptive to the project. The CFLs were quickly adopted, sparking a craze and bringing awareness to both the economic and ecological impact of lighting behaviour. Media and direct sensitisation have also significantly improved the public understanding of the concept of energy saving.

The distribution of the 776,500 CFLs started in July 2013. It is expected that the project will use Gold Standard VER carbon credit to fund the implementation of the regulation of the lighting market and the recycling of the CFLs.

Mass Uptake of Improved Stoves, Goma, Democratic Republic of the Congo

(Ashden Award 2013
www.ashden.org/int_awards)

The *Improved Stoves* project contributes to the overall objective of the World Wide Fund for Nature's 'Environmental Programme around Virunga' (WWF/PEVi) to fight poverty and support local development in order to reduce threats to the Virunga National Park. The *Improved Stoves* project was started in May 2008 together with women associations, who became the producers of efficient stoves. Since then it has been through a number of phases to overcome the barriers to production and widespread usage of improved stoves in Goma.

The acceleration of production and sales since 2010 was driven by several initiatives at the program level:

- A market study, which concentrated efforts on the best model - Only one model of improved stove, the Jiko Nguvu Nyeusi, was produced and promoted
- Large rotating capital was made available to associations so that they could have the quality raw material in sufficient quantity to meet demand.
- An intensive information campaign conducted on the radio for several months succeeded in informing a broad segment of the population of the city about the efficiency of the stoves and the existence of outlets, spread throughout the city.
- Redeployment of outlets of improved stoves to strategic locations in the city which boosted sales to customers who previously did not know where to obtain them.

Since 2009, more and more manufacturers in the city of Goma have abandoned the manufacture of the traditional stove in favour of the improved Jiko Nguvu Nyeusi. It is in this context that the program has also provided training to improve the quality of their production. An impact study showed the following results to date:

Six out of ten households in Goma are currently using an improved stove. In 2008, the proportion was one out of ten. Three quarters of households using an improved stove use the Jiko Nguvu Nyeusi model, using half as much charcoal as the model that was most prevalent in Goma in 2008, reducing consumption of charcoal by over 20%, corresponding to 13,250 tons of charcoal a year. If 80% of the charcoal comes from Virunga National Park, 10,604 tons of charcoal from the park is saved by the use of this improved stove. It can be estimated that nearly 2,544ha of natural forests have been saved in 2012 through the project. This same saving of charcoal enabled half of the population of the city to halve its fuel expenses, which corresponds to over US$6.6 million to be put to other uses in the local economy.

URBAN PLANNING AND TRANSPORT

Africa is experiencing a rapid rate of urbanisation. AUN Habitat and ICLEI report (2009) estimates that by 2050, 62% of the population of the continent will live in urban areas. In Africa, urban areas are responsible for the bulk of energy consumption due to higher income in urban households and the concentration of services (administration, hotels etc.). Urban planning has an important impact on energy consumption and greenhouse gas emissions. Boa Nguvu has devised a city plan based on the recommendations of the UN Habitat Local Governments for Sustainability.

City sustainable energy plan

UN Habitat's planning guide uses a 10-step process as a framework for city planning. This is of course not a linear process (see diagram below for a more dynamic view of the process)

1. Designate a lead office and find a champion
2. Establish partnerships
3. Find the 'hooks' in the vision, goals, and policies of your city
4. Conduct an energy and greenhouse gas (GHG) emissions audit of your city / local authority
5. Analyse your information and develop a draft plan
6. Build public and internal support
7. Finalise the plan
8. Implement and finance the plan
9. Monitor and evaluate the plan
10. Publicise and communicate the benefits.

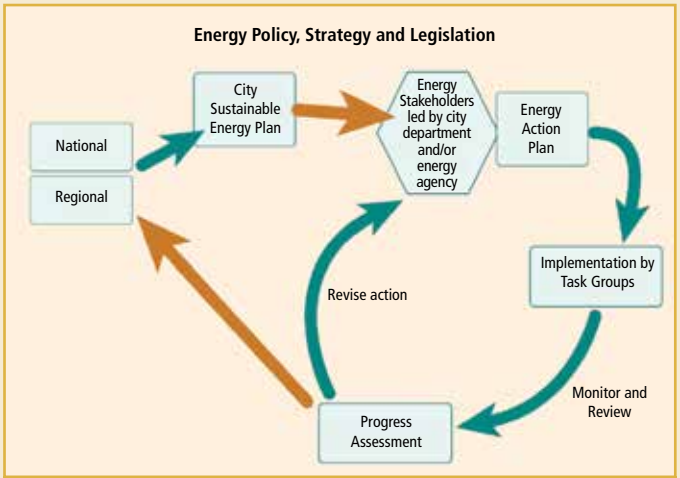


Figure 10: City sustainable energy plan (UN Habitat an ICLEI, 2009)

Source: UNEP, 2009

5 ENERGY SUPPLY ACTION PLAN

RENEWABLE ELECTRICITY

Solar, wind, geothermal and hydropower will be the main sources of renewable electricity in Boa Nguvu. Some renewable energy parks will be large, but smaller, decentralised electricity production will not be forgotten, following examples such as Rwanda on micro hydro and the Lighting Africa initiative.

Micro hydro power in Rwanda

Problem and options

Firewood remains the main source of energy in Rwanda particularly in rural areas. Off-grid renewable solutions are increasingly acknowledged to be the cheapest and most sustainable options for rural areas in much of the developing world," according to REN21, a renewable energy policy network (REN21, 2011).

Strategy

Rwanda has highlighted expanding electricity access and private sector investment in electricity generation as areas of high priority. Unlike traditional power stations that use fossil fuels or large hydro power plants, micro-hydro power has practically no effect on the environment because it does not depend on dams to store and direct water.

As part of the initiative undertaken by the Global Village Energy partnership (GVEP), a micro hydro plant was launched in 2012. Located around 50km from Kigali in the northern region of Rwanda, the Musarara micro hydropower plant was constructed under the expertise of the Global Village Energy partnership (GVEP), to stimulate job for small-scale developers by helping them access finance in the energy sector.

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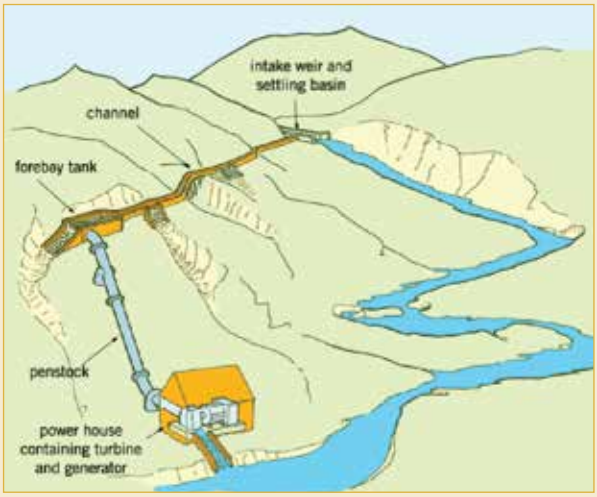
It will generate 438KW of power to around 2000 residents and its neighbouring development infrastructures including hospital and health centres. Within its intervention in Rwanda, GVEP emphasises working hand-in-hand with local entrepreneurs and advising them on how to raise finance as a way of developing long term and trusted business relationships between local people and local businesses (Africa Science Technology and Innovation News, 3 July 2012).

Other projects

Furthermore, under the "Private Sector Participation in Micro-Hydro Development Project in Rwanda", four newly registered Rwandan companies are each constructing a micro-hydro electricity plant (100–500kW) and building a low-voltage distribution grid. These companies financed their plants through their own equity and debt, with support from the PSP Hydro project. This support comprised a subsidy of 30–50% of investment costs, technical and business development assistance, project monitoring and financial controlling. Three key messages: (1) institutional arrangements rather than technical quality determine the success of such projects; (2) truly sustainable rural electrification through micro-hydro development demands a high level of local participation at all levels and throughout all project phases, not just after plant commissioning; and (3) real impact and sustainability can be obtained through close collaboration of local private and financial sector firms requiring only limited external funds. In short, micro-hydro projects can and will be taken up by local investors as a business if the conditions are right.



Source: Pigath and van der Plas, 2009. Illustration: Practical Action, 2013

Solar lanterns as part of the solution for modern lighting

About 600 million people, and more than 10 million micro-enterprises, across Africa have no access to electricity. They use inefficient and costly fuel-based lighting sources such as kerosene lamps, which greatly limit their socio-economic activities.

The Lighting Africa program works with off-grid lighting products or systems that are stand-alone, rechargeable and can be installed, assembled and used easily without requiring assistance from a technician. These products are affordable, typically costing less than US$100, some retailing at US$10 or less.

Modern off-grid lighting products have three key components:

- electricity source, most commonly a small 1-5W solar panel;
- a modern rechargeable battery, increasingly lithium -ion; and
- a modern lantern or lamp, usually with an LED (light emitting diode) bulb.

These lighting products come in many forms. The batteries and solar panel may be built into the lamp, or any one of the components can be separate modules that are easily connected to each other using the 'do-it-yourself' plug-and-play technology.

During the day, the solar panel is placed directly in the sun to generate electricity that recharges the battery. At night, the electricity is available to power the lamp. Other modern off-grid lighting products on the African market are dynamo-powered, with the batteries charged by electricity that is mechanically generated through hand or foot pedalling.

Source: World Bank and International Finance Corporation, 2013

The renewable energy supply strategy is focused on increasing dramatically the share of renewable electricity in the energy mix, including international electricity trade, and the promotion of sustainable modern biomass. Biomass will remain an important energy source to meet energy household demand by 2030. While alternatives to biomass will be researched, tested and disseminated, the country needs to secure its forests and foresee for the needs of its people.

Next to an increase in renewable electricity production, the objective of Boa Nguvu is to strengthen interconnections with neighbouring countries and to become a key stakeholder in the **regional power pool**. Power pools are based on an integrated master plan approach in order to reduce power supply costs. They have several advantages and, generally speaking, they have a good return on investment. They contribute to significantly reducing capital investment and operating costs through improved coordination among power utilities, optimising generation resources with large units and improving power system.

Regional power pool

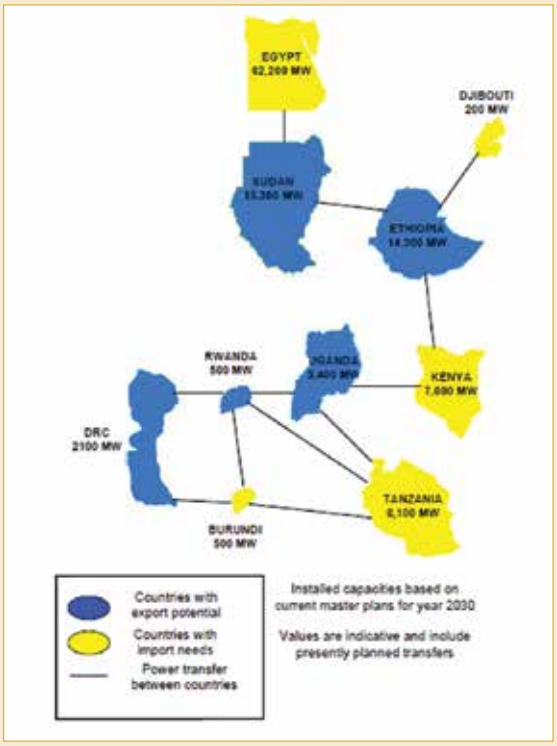
The East Africa Power Pool (EAPP) was set up in 2005 as a specialised institution under COMESA (Common Market for Eastern and Southern Africa).

The main purpose of EAPP is "to provide to the eastern Africa region affordable and reliable electricity, by pooling together all available electrical energy resources in the region in a coordinated manner, in order to increase the access rate to electricity by the population of the region and promote regional integration". There will be mutual assistance among the members in case of failure in their respective power systems.

Under the Inter-governmental Memorandum of Understanding (MOU), signed in February 2005, participating countries have committed amongst others to:

- optimise the usage of energy resources available by working out regional investment schemes in power generation, transmission and distribution, taking into account socio-economic factors
- reduce electricity cost in the region by using power system interconnections and increasing power exchanges between the countries,

A regulatory framework is under preparation. The establishment of a Regional Market Operator and an Independent Regulator is expected. The following table gives an illustration of the potential resources and interconnections within the EAPP by 2030.



Source: SNC Lavalllin, 2010

SUSTAINABLE BIOMASS

Bioenergy is at the heart of the Boa Nguvu 2030 strategy due to its high share in meeting the energy needs particularly for households, its impact on the livelihood of poor people but also due to the threat to the resource itself when it is not managed sustainably.

Sustainable bioenergy supply chains, combined with an efficient use, should enable Boa Nguvu to stabilise biomass consumption and regenerate its forests. Boa Nguvu has taken its inspiration from the examples of natural forest management in the Sahel and wood plantations in Madagascar.

Natural forest management for the rural wood energy market

Natural forest management has proved to be a success when institutional and regulatory measures as well as technical measures are devised. In the Sahel, Niger has been pioneering this approach and has introduced major innovations over the past ten years to natural forest management, ranging from forestry co-operative operating systems, to the wood energy rural markets for which particular legislation has been enacted in the 1990s. Since 1989 the Environment Directorate, supported by the Energy II project, has been implementing the Domestic Energy Strategy (DES) with the following objectives:

- improve the commercial value of trees.
- empower the urban and rural populations and meet their needs.
- create revenues.
- sustain management of wood resources.

Key achievements

- Publication of the "Wood Master Plan to Supply Towns" as a planning tool for wood harvesting, based on multi-disciplinary studies incorporating the evaluation of the resource and its generation rate.
- Adoption and implementation of a new tax system for wood energy, in line with the objectives of decentralisation. This encourages the local communities to take on real responsibility through a tax-raising system at source (by the village representatives) and sharing-out this tax between the Treasury, local authorities and rural communities. Niger was the first country in the region to have implemented a policy. Through this tax-raising system and the incentives offered to traders to take supplies to the rural markets and purchase wood cut by local loggers (and no longer their own wage-earning loggers), the financial flows between the towns and the countryside have been drastically changed, making it possible to set an economic development dynamic, springing from the villages themselves and no longer brought about by external financial support.
- Design of new management techniques for Sahelian-type forest formations.

Procedures and Impact

A thorough survey has been conducted by the Inter-governmental Committee to Control Drought in the Sahel (CILSS) on natural forest management and its impact. A key outcome is the creation of sustainable forest exploitation and commercialisation with the creation of rural wood energy markets managed by local communities. This is summarised in the following table.

Continued ➜

Selection of zones to be developed	Prior establishment of development plan to supply urban zones in wood energy. Agreed selection of the priority zones, upon proposal by local populations and after verification of resources and social cohesion
Stages of the implementation of participatory forest development	**6 stages:** 1: Information and sensitisation of rural populations on rural markets, formulation and submission of applications to the Department of Forestry for the creation of a market by villages. 2: Verification of required conditions and validation of the village application. 3: Socio-economic and biophysical diagnosis of the land; socio-economic survey, demarcation of the zone and inventory, elaboration of the development and management plan. 4: Feedback, finalisation and adoption of development plan with the stakeholders: communities, NGO, forest technical services. 5: Support in setting up the local management structure (SLG): training, and elaboration of procedures, preparation of the approval application. 6: Making the rural market official: Handing over by the Department of Forestry of transport vouchers to the SLG and official launching of the market activities. The overall duration of the process is between 1 and 2 years.
Breakdown of income tax and operating revenue	Breakdown according to the origin of the wood. Income shared between: a) State budget, b) local authorities and c) local communities.
Level of development	170 rural markets and 620,000ha as of end 2002.
Regulation framework	1992 Ordinance on the organisation of the exploitation, trade and transportation of wood energy; Rural Code orientation text; New Forestry Code
Poverty control	Significant improvement of incomes in villages: US$0.5 million (2 million CFA / year / village) on average and around US$50,000 (200,000 CFA / year / village) of locally rebated fiscal receipts. Implementation of numerous community investments.

Wood energy plantations in Madagascar

Situation and problem

The South West region of Madagascar has a hot, dry climate with slow forest regeneration and a high vulnerability to over exploitation. The forest production potential has been estimated at 64,000t per year, well below the annual consumption. Only for the local city of Toliara, the annual consumption is excess of 288.000t. Wood energy supply comes from illegal harvesting from natural forests. Poverty has increased and many households resort to charcoal production either as primary or secondary activity, to improve their livelihood, which accelerates forest degradation given the inefficiency of the modes of production.

Strategy

To address the problem, within the framework of the Environmental Program III, a three pronged "Strategy for Sustainable supply of firewood of Toliara" which accounts almost half a million people has been designed.

- Rational exploitation of existing forests for wood energy
- Increase of plantations resources devoted to wood energy
- Forest zoning defining areas for wood energy production

Continued ➜

Achievements, impact and lessons

Three plantation campaigns were carried out between 2008 and 2011. Despite previous failures, there was an increase in planters' participation and in planted areas.

The 3 plantation campaigns between 2008 and 2011 involved 860 planters forming 34 groupings. The approach taken allows the planters to own and exploit agro-forestry areas previously inappropriate for cultivation. Further social cohesion and a feeling of ownership of forest resources have resulted in less bushfires. Based on simplified economics there will be potential benefits from plantations when they reach their maturity.

Lessons learnt

- In the beginning, getting key stakeholder participation was difficult due to low awareness on their part.
- The choice of target groups was not always adequate during the first campaign.
- Insufficient organisation and sensitisation of planters led to mixed results during the first campaign.
- It is therefore important from the outset to design an appropriate social organisation of key stakeholders involved in the plantation.
- At regional level, land tenure security of areas devoted to planters should be addressed.

It is important to ensure the follow-up of plantations by communities and strengthen their capacity. Over the 3 campaigns just 865ha was completed, compared with 30,000ha needed to ensure the sustainable supply in wood energy of Toliara.

Source: WWF, 2011a

6 IMPLEMENTATION MECHANISMS

Implementation mechanisms turn the strategy into concrete achievements, galvanising private and public sector forces. Although financial mechanisms are crucial for the implementation of the action plan, institutional set up, capacity building and the development of local manufacturing facilities and a workforce are also essential to ensure the economic and social development of the Boa Nguvu Economy. The action plan also has to be governed by overarching sustainability mechanisms.

FINANCIAL MECHANISMS

The investment costs for energy efficiency and renewable energy, whether at the small household scale (e.g. efficient stoves, efficient light bulbs) or at the large scale (e.g. refurbishing buildings or developing large wind parks) are still often higher than their polluting alternative and the benefits are often spread over time. They are also less known by the traditional banking system, making access to funds challenging.

In addition, energy tariff distortions and subsidies often don't favour efficiency and renewables.

Tailored financial mechanisms such as feed-in tariffs (FIT), renewable energy calls for tenders, and social tariffs are important for the deployment of renewable energy on a large scale for grid connected consumers and for the rural population. For instance, the Lake Turkana Wind Project is taking advantage of the feed-in tariff in Kenya. Smart combinations of grants, bank loans, cooperation with the electricity utility help people to participate in the shift towards renewables and energy efficiency, such as in Tunisia and Namibia.

Lake Turkana wind project

Location and justification: The Lake Turkana Wind Power Project is located in north-western Kenya, near Lake Turkana, a relatively desolate spot without any transmission line networks. The winds sweeping the area moves consistently at 11 metres per second making this an ideal area for wind turbines.

The Kenyan government is seeking to reduce its reliance on imported energy and fossil fuel, while ensuring a reliable supply of electricity based on clean low-cost energy. According to the government's projections through 2029, Kenya will need additional installed electric energy capacity of 2,396MW by 2020 and 7,539MW by 2029. To meet these needs, the country will have to import nearly half the energy for 2020 and more than one-quarter for 2029.

The government included the Lake Turkana Wind Power Project into its power development plan, issued an independent power producer license and negotiated the costs of the electricity that it generates. In addition to reliable, inexpensive electricity in rural areas, the project will also provide access to carbon credits under the Gold Standard scheme, making it possible to use ICT, to light schools and electrify health centres, and ultimately create new jobs.

The project

The project includes building 365 wind turbines, reinforcing 200km of roads and bridges and adding an estimated 426km of transmission lines to connect and supply power to the national electric grid at an optimal point. The reliable, continuous clean power will add an additional 30% to Kenya's current total installed power. The project is forecast to reduce carbon emissions by 16 million tons during its 20-year lifespan.

The wind park will be generating 300MW when it is fully commissioned. Projected costs are approximately €459 million. According to Lake Turkana Wind Power,

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the wind park will deliver electricity at a rate ~60% cheaper than thermal power plants. The African Development Bank, the lead broker, will facilitate the entire debt tranche through the African Financing Partnership facility. In April 2013 a €115 million AfDB loan tranche was released after the Spanish government agreed to provide concessional funding for the 428km transmission line to connect the power to the national grid.

Although the Spanish investment will mitigate this, the project requires financial risk guarantees, which the World Bank is reluctant to provide, given the uncertainly that all the electricity will be consumed. An alternative suggested by the WB is that the project should be brought on line, in phases, over ten years to keep up with the expected increase in demand.

Source: AfDB (2012); Wind Power Monthly (2012); Renewable Energy Focus.com (30 April 2013); Lake Turkana Wind Power (2013)

The Ministry of Energy of Boa Nguvu will be following a model (PROSOL) similar to that developed in Tunisia to promote solar water heaters (SWH). The main features of this financing scheme are:

- A bank loan mechanism for domestic consumers to purchase SWHs, paid back through the electricity bill.
- A capital cost subsidy provided by the Tunisian government, up to 100 Dinars (57€) per m^2.
- A series of accompanying measures have been developed, which include supply-sidecontrol quality system set up, awareness raising campaign and capacity building.

Figure 16: PROSOL. Source: UNEP, no date.

Renewable Revolving energy fund

The Namibian Renewable Energy Program (NAMREP) developed a loan financing scheme "Solar Revolving Fund" (SRF) as a financing model and assisted in its implementation. The fund was tasked to finance 100 systems in each financial year by careful selection of applications, so that the scheme benefits citizens throughout the 13 regions in Namibia. It is evidenced that, at the end-of the-project, this was achieved.

The project contracted two commercial financing institutions, Bank Windhoek and First National Bank (FNB) to provide financing for the renewable energy products for the duration of NAMREP programme through a regulation driven mechanism of the Ministry of Mines and Energy (MME)`s SRF. The major commercial financial institutions in the country involved with the financing of commercial and domestic property loan schemes are targeting previously disadvantaged groups and farmers living in remote areas that have no access to grid-connectivity.

Source: Namibia, Ministry of Mines and Energy, 2006

OPTIMISED INSTITUTIONAL FRAMEWORK

The new Ministry of Energy structure reflects stakeholders' recommendations to implement the 2030 strategy with a new department dealing with sustainable energy (access to energy, renewable energy and energy efficiency). The energy information system is institutionalised and strengthened to provide comprehensive and detailed information to carry out analysis of the current situation, and modelling for the scenario strategies at the 2030 horizon.

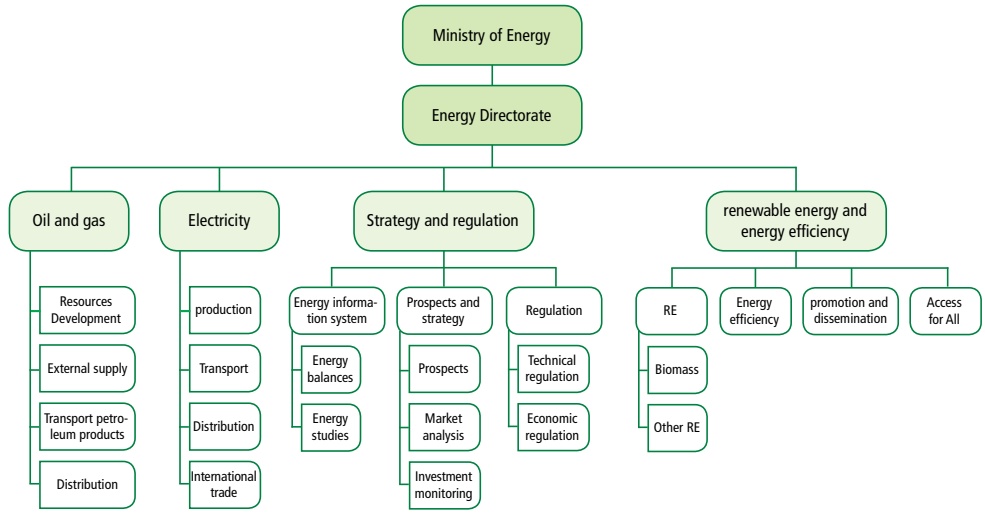

Figure 15: New structure of the ministry of energy

CAPACITY BUILDING

Not having a skilled labour force is a major hindrance to design and implement renewable energy projects.

Boa Nguvu needs the human resources to achieve its objectives.

Two types of skills are required:

- Skills to operate and maintain large energy equipment (energy generation systems, high and medium voltage transmission lines, transformation centres, etc).
- Skills to operate and maintain small scale energy systems around the country (rural electrification schemes, cooking stoves, and other energy generation devices). Here, the Barefoot College approach provides a great example to follow.

CAPACITY BUILDING – THE BAREFOOT COLLEGE MODEL

The Barefoot College's mission is to provide basic services and solutions to problems in rural communities, with the objective of making them self-sufficient and sustainable. Barefoot College has significant experience in India at delivering rural development and renewable energy solutions at scale. One of the Barefoot College's most successful programmes is the "Barefoot Solar engineers". The Barefoot College offers an original and highly effective model to equip the villages with sustainable solar photovoltaic power. Local women are selected to become solar engineers ("Master Trainers") and are sent to Tilonia in Rajasthan, India for a six months training. Upon return, they are equipped with solar systems and are able to effectively electrify their villages and maintain the systems over time. Knowledge is transferred to the community and the costs of solar electrification are kept low. Equipment may be sponsored or paid back by the

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community, depending on the communities' ability to pay back. The Barefoot College methodology is described in detail at: www.barefootcollege.org/solution/solar-electrification/solar-lighting/.

The concept has been so successful that women from around Africa have attended the training. African governments have become interested in the approach, which places the rural poor at the centre of a sustainable energy revolution. Five governments have agreed to support the creation of a Barefoot College in their country, with financial support from the Government of India and technical support from the Barefoot College in Tilonia. These countries are Tanzania, Senegal, Burkina Faso, Ethiopia and Benin.

Postscript: The WWF – **Barefoot College partnership** is an initiative that creates a concrete link between poor communities and national or international policy. It can provide great examples of sustainable rural energy with special environmental, social and cultural considerations. It can feed national and international policy discussions about access to energy and the role of empowerment to the marginalised and poor.

WWF's goal is to promote the Barefoot College model and to actively use it in its climate, energy and conservation activities. The ultimate objective is to have independent "Barefoot College" institutes promoted by governments in every country where poor people gain from access to training and education. A first common project has been initiated in Madagascar.

INDUSTRIAL DEVELOPMENT

Local manufacturing of renewable energy and efficient appliances is a major opportunity for job creation and is key to the deployment of renewable energy and energy efficiency equipment. Large and medium scale equipment and systems will continue using equipment manufactured abroad. However, by 2020, Boa Nguvu will have the national capacity to assemble, operate and maintain the following equipment:

- hydropower systems up to one MW,
  - wind systems up to 10kW, wind pumps for livestock and drinking water and wind generators,
  - solar water heating, solar dryers, solar cookers,
  - installation and maintenance of decentralised solar PV systems
  - household size bio-digesters.

ENVIRONMENTAL & SOCIAL SUSTAINABILITY MECHANISMS

Environmental Impact Assessments and their effective enforcement, together with the sustainability assessments of policies, are the governments' first tools to improve projects' sustainability.

Next to these instruments, there are several other tools that can be included in policies or adhered to by the

private sector. WWF has been an active participant in the development of most of these tools.

The Roundtable on Sustainable Biofuels (RSB) has developed sustainability criteria and a certification scheme for biofuels. The International Hydropower Association has developed the Hydropower Sustainability Assessment Protocol. Sustainability guidelines for wind parks have been proposed by many institutions, including the European Commission.

WWF and First Solar have published a solar atlas (www.panda.org/solaratlas), showing that, at the country scale, solar PV does not use a lot of land, even if disseminated at a huge scale. At the local level, the report provides guidelines for solar PV parks.

WWF is leading the development of sustainability criteria for geothermal energy in the Philippines. While there are not yet sustainability criteria for all renewable energy projects, the Gold Standard for carbon projects (www.cdmgoldstandard.org) provides a useful sustainability matrix to assess all kinds of renewable energy projects.

DEVELOPMENT COOPERATION MODALITIES

The systemic challenges to delivering universal energy access in the context of global climate and energy security challenges can only be resolved starting with political will and subsequent concerted action from international partners. This will help distribute energy resources more equitably. International energy and climate policies in the large economies of Europe, the Americas and Asia have far-reaching consequences for poor people.

Decentralised technologies such as improved cooking stoves, stand-alone power devices and mini-grids driven by wind, solar, hydro and bioenergy technologies are often the least costly options to reach the un-served when the density of demand is low.

Investor interest is, however, concentrated more on large centralised schemes, such as hydro power plants. Smaller rural projects are seen as risky and often bear high transaction costs. A re-balancing of effort is required with strategies to deliver decentralised solutions going hand in hand with expanded and reformed utility services.

Bilateral and Multilateral donors will therefore need to allocate significant proportions of their energy sector budgets for Africa towards improved cooking stoves programmes and decentralised electricity systems as well as large power plants fed from renewable energy sources. Other development institutions with large energy sector budgets should take a similar approach to financing energy access for the poor.

There are various initiatives currently underway to support sustainable energy strategies in Sub-Saharan Africa. A government like Boa Nguvu will need flexibility in order to adapt to different modalities in order to maximise the in-flow of relevant financial and technical partnerships. Relevant examples are grant finance, commercialisation and payment by results.

An example of EU cooperation at work is the **ECOWAS Renewable Energy Policy**, developed under the Regional Renewable Energy Policy in West Africa Project. The policy is developed with technical assistance from the EUEI-PDF, employing consultants for Innovation, Energy and Development. It is co-funded by the Renewable Energy Cooperation Programme. The project aims at the elaboration of the ECOWAS Renewable Energy Policy and its implementation through targeted national follow up activities. The regional policy is a first step towards aligning the regional and national government's energy policies, legislative and regulatory procedures in a systematic approach.

Source: ECOWAS, 2012

CONCLUSIONS

In the last five years, Boa Nguvu has been hit by a dual crisis of rising prices of imported and domestic energy. The global oil price has been rising steadily and, domestically, the charcoal market has spiked due to reduced production and higher transportation costs. The country reacted with the development of a bold strategy and action plan. Fundamental to the Sustainable Energy Strategy 2030 is the political will to make challenging choices and prioritise public policy and investment in the energy sector.

The great examples of existing initiatives in Africa show that a transition to sustainable energy is possible. With the combination of political will, participatory planning and concerted action including international partners, Boa Nguvu is well on its way towards a sustainable energy sector. It is hoped that the Boa Nguvu story will inspire Africa.

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