Module 6

Formulating regulatory scenarios and national self-assessment

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1. MODULE OBJECTIVES

1.1. Module overview

This module focuses on the design of the regulatory framework, with special emphasis paid to the implementation of institutions to foster sustainable energy in developing countries.[1] It provides tools to evaluate the situation in a country and how to identify gaps and barriers for rural electrification and energy efficiency. It aims to enable decision-makers to prioritize measures and implement institutions and policies that increase the generation of electricity in a sustainable way both financially, politically and environmentally.

1.2. Module aims

This module aims to:

- Provide an overview of the current situation and sustainable energy options for African states.
- Give insight on institutional content and processes with regard to sustainable energy.
- Enable an assessment to be made of levels of sector reform, and the policy and framework in a given country.
- Give design elements and suggest options for the integration of sustainable energy.

1.3. Module learning outcomes

Participants should take from this module:

- An understanding of the link between institutions, policies, regulations and sustainable energy.
- Explicit guidelines to foster sustainable energy.
- Tools to evaluate the situation in their country.
- Inspiration to develop a comprehensive sustainable strategy for a given country.

[1]This module will focus mainly on electricity generation and savings.

2. INTRODUCTION

The different sections of the module briefly recall some of the most important points raised by the previous modules and provide a brief overview of the history of the reforms that have taken place in the electricity sector, emphasizing the role of institutions and specific policies to promote sustainable energy. Specifically the differences between developed countries and developing countries are explained, and some examples from the developing world are presented.

It has to be kept in mind that the process of (de)regulation cannot in itself guarantee that an existing energy system will be the most efficient and sustainable one. It is indeed very likely that it will not be, especially in the African context. Therefore, appropriate policies and frameworks need to be put in place.

The module contents primarily serve as guidance for the self-assessment tools which are referred to throughout the module. These tools will enable participants to evaluate the level of reforms in a country, taking into account its specific context. In this module, readers are asked to evaluate the situation in their home country using a checklist of possible measures. The checklist is meant as a first-step basic evaluation tool only as the institutions and policies for sustainable energy will obviously not be the same for all the countries. The checklist should provide a mechanism with which to evaluate the prevailing national sustainable energy regulation and policy situation in a given country and aid the process of further developing such regulations and policies.

The self-assessment tool consists of four questionnaires, the first of which assesses the current status of the power sector in a given country. The next questionnaire looks into the energy regulatory framework in general, and the final two go into more detail with regard to the renewable energy and energy efficiency measures respectively.

The completion of each questionnaire automatically generates a results page which allows for a quick interpretation of the national situation, and which includes more detailed exercises wherever relevant.

Overall these tools will help to identify the major gaps in the current policy and regulatory framework, providing ideas and suggestions on how to create a bias towards renewable energy and energy efficiency.

3. POWER SECTOR REFORM

Before going into the self-assessment exercise the following section provides introductory information on the experiences in the European context and the possible future for power sectors in Africa.

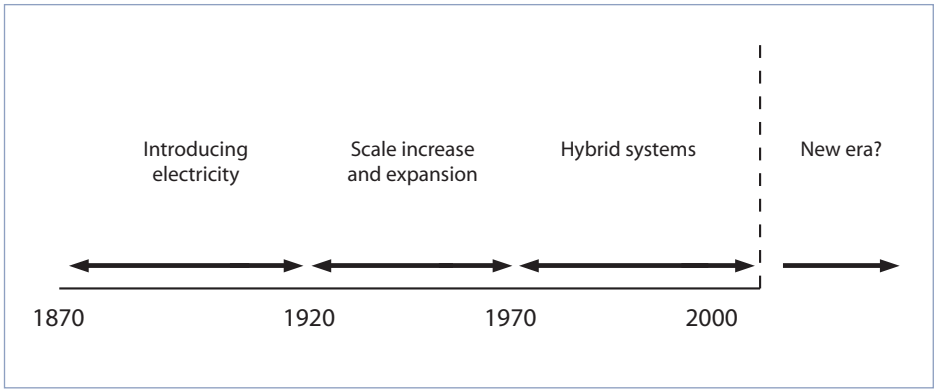
More background information can be found in module 4 "The reform of the power sector in Africa".

3.1. The move from centralized to decentralized energy systems in Europe

There have been four eras in the development of the electricity supply system in Europe (see figure 1). These are:

- An era of decentralized generation (1870-1920)
- An era of centralized generation (1920-1960)
- An era of a hybrid system (1960-2000)
- A new era of decentralized generation (2000-...)

Figure 1. The eras of electricity supply structure in Europe



Source: SUSTELNET, 2002

In terms of scale, European countries have been through a three-staged process from small-scale distributed generation to large-scale centralized generation and are now looking again at the merits of distributed generation.

For African countries with low rates of electrification and low economies of density, there is an opportunity to move directly, in some areas, from the first to the third stage of electrification. To do this they will be required to multiply the use of stand-alone systems for their scattered populations. This would allow for more flexibility than the extension of the grid, as potential systems can be upgraded according to the needs of the users.

Distributed generation in African countries is and will remain quite different from that in European countries. In the latter, connected local systems are complementary to the grid; in African countries stand-alone systems are and probably will remain for a long time to come the only sources of electricity for isolated populations.

The search for economies of scale no longer seems to be the only driving force for the electricity generation market. Economies of scale are not considered as important as they used to be, owing to technological progress.

Centralized electricity generation systems are the product of the socio-technical context of the decades in which electrification took place in Europe and other parts of the developed world in the last century. It does not seem necessary for new systems to be developed in the same manner since the context has changed.

Firstly, electricity generation from big power plants with traditional sources such as coal, oil or gas, require high initial levels of investment. These sources emit CO_2 into the atmosphere and contribute to global warming. Secondly, transmitting electricity over long distances might not be the best solution, since building transmission networks is costly and also transmission losses, which are seldom negligible, have to be taken into account.

In some developing countries, especially in Africa, the connection of households in rural areas to the grid remains largely hypothetical even in the very long-term and this is mainly attributable to demographic dispersion and the lack of financial resources. In fact, on the African continent less than 8 per cent of the population living in rural areas has access to electricity.

Planners are aware that the rate of electrification in Africa is not likely to increase significantly if the same development models are used. In fact, at the rate of electrification during the last decade, it would take more than 80 years to electrify sub-Saharan Africa (IEA, 2002). Renewable sources of electricity could provide affordable and “clean” sources of electricity in the future. More specifically they could make a substantial contribution to meeting the current needs of developing countries for off-grid or mini-grid generation in remote areas.

Rather than fixed investments for large-scale projects, investments for small-scale renewable systems are more flexible and easily adaptable to demand. These systems can be established close to where the demand is, which means that costly transmission networks are not needed.

Today the establishment of enough small-scale renewable electricity generating plants to contribute to a significant proportion of total installed capacity is feasible because of the considerable reduction in costs. Renewable energies like solar photovoltaic systems are fully operational and can often compete with conventional sources of energy in terms of cost in remote areas. The current trend towards establishing centralized electricity generating systems in developing countries is a legacy of the developed world. It has less relevance today owing to changes in the technological context, which allow for the follow-up or even the remote control of renewable energy systems.

Established financial and institutional practices, as well as political interests can nevertheless marginalize renewable sources of electricity. International and national institutions still provide large amounts of funding for conventional sources of electricity generation, as these are often easier to implement and thus can better meet budgeting timetables than small-scale newer renewable technologies. New mechanisms, policy approaches and/ or institutions will therefore often be required to support the large-scale utilization of newer technologies.

3.2. Self assessment of the power sector in your country

Exercises

1. Please read first the sections “3.2.1 Level of competition and unbundling” and “3.2.2 Electricity Law Amendment”, as these will provide guidance on how to interpret the results of the questionnaire as well as inspiration on the way forward.
2. Please complete the questionnaire on Power Sector Reform in annex II of this module (See excel-sheet “Complete Power Sector Reform”).
3. Based on the results (See excel-sheet “Check your results”) think of an appropriate way for the power sector in your country to develop and transform.
4. Write a 1,500 word essay outlining the way forward for your country.

Level of competition and unbundling

The matrix used for this self-evaluation represents potential paths for electricity reforms (Hunt and Shuttleworth, 1996 in Turkson J.K., 2000).

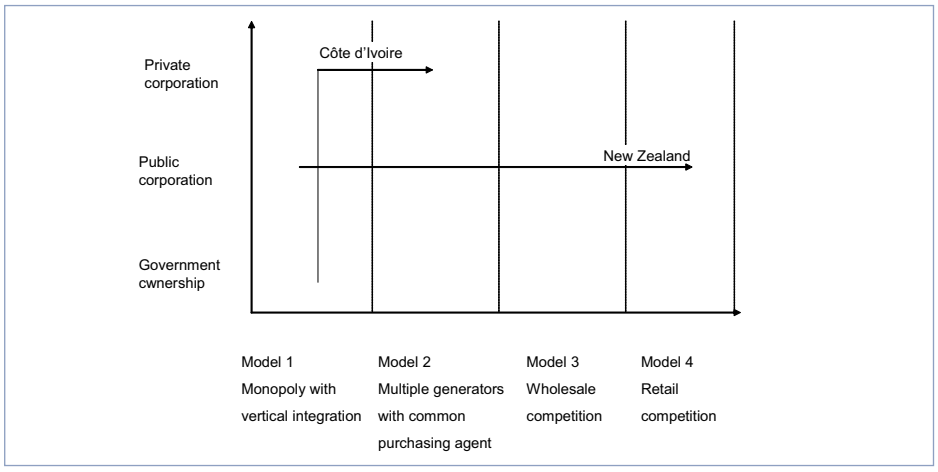
The horizontal axis represents the level of competition on the market:

- Model 1: No competition. Utilities are vertically integrated from generation-transmission-distribution to the end-users.
- Model 2: Competition between generators but with one purchasing agent who has the monopoly over transmission and distribution networks and over sales to the end-users.
- Model 3: Competition between generators. Open access to the transmission network. Several distribution companies are able to buy directly from a producer. Distribution companies keep a monopoly over end-users.
- Model 4: Competition between generators. Open access to the transmission network. Several distribution companies can buy directly from a producer. Distribution is separate from retail activity. End-users are able to choose their supplier.

The vertical axis represents the change of ownership:

- Government ownership (administration following public accountancy rules)
- Public corporation (corporation state owned but a commercial logic and financial autonomy)
- Private enterprises

Figure II. Various paths for electricity reforms



Source: Hunt and Shuttleworth, 1996, in Turkson J.K., 2000

Electricity law amendment

In most African countries the Electricity Law is the principal instrument outlining the legal and regulatory framework, and amendments generally have to pass the National Parliament or Assembly. Typical amendments include:

- Removing the monopoly of the national utility;
- The establishment of a (independent) regulatory body, including its role and responsibilities;
- Create a provision for a rural electrification or renewable energy programme or fund.

4. REGULATORY FRAMEWORK

Before going into the self assessment exercise the following section provides a quick summary of the roles of a regulator and principles for good regulation.

More background information and African examples can be found in module 3 “Introduction to Energy Regulation”.

4.1. Regulatory coverage

The principal roles for the regulator include:

- To ensure free and fair competition within the sector: The regulator must ensure that companies do not abuse their strong position, for example by making it difficult for new companies to enter the market. This role usually includes carrying out the liberalization policy and monitoring the power sector reforms process.
- Protect customers, industry and government interests: One of the key challenges of energy regulators lies in striking a balance between the interests of domestic and non-domestic customers, the industry and the government. Energy regulators must work to protect companies and individuals from the discretionary power of the state and act as referees in case of conflicts.
- Energy planning: what are the future power needs for a country and how can these best be addressed. The socio-economic comparison of the most efficient technology should take into account not only its immediate financial costs, but also its longer term socio-economic potential, and its social and environmental impact. To be able to make these comparisons, most regulators have economic, technical, social and environmental competences.
- Licensing;
- Develop standards/codes of good practice;
- Tariff setting;
- Consumer complaints;
- Manage support system for RE/EE;
- Provide social services, e.g. equal access to minimum energy services for everybody in society.

Splitting regulatory functions between different institutions and government departments tends to compartmentalize the decision-making processes, thereby preventing any long-term integrated planning. It therefore makes sense to make the regulatory body responsible for all main sources of energy. What these “main

sources of energy" are varies at regional level and also sometimes at the country-level. For instance in Europe regulatory bodies usually cover the markets for electricity and gas (as being the main energy sources in use) and increasingly include renewable energy and/or energy efficiency.

The situation of African countries is quite different though, as traditional sources of energy (like wood fuel) are still used and will most probably be used for quite a long period.

The tendency of regulatory bodies in Africa is to focus only on "modern" sources of energy like electricity and gas, but there is a strong case to include other energy sources with an important share in the national fuel mix (e.g. wood fuel). Moreover, whereas the focus of energy systems in most European countries is clearly grid-connected, most African countries face challenges both in urban environments and even more in off grid in rural and remote areas. Accordingly both require differentiated regulatory approaches.

Common agencies and responsibilities to be incorporated in or supervised by the regulatory body include:

- Rural electrification agencies and or rural electrification service companies (RESCOs);
- Renewable energy agencies;
- Energy efficiency agencies and/or energy service companies (ESCOs);
- Entity in charge of grid-extension planning.

Zambia provides a particularly good example of a dedicated energy regulator—the Zambian Energy Regulation Board.[2]

4.2. Principles of good regulation

Key characteristics of a good regulatory framework include:

- Transparency and simplicity: mean that processes and procedures should provide clear information and enable the participation of stakeholders. Access to transcripts, record keeping and the publication of reports and public meetings help improve and maintain credibility of energy regulators. Their language should be simple and understandable;[3]

[2]For a detailed account of the Zambian Energy Regulation Board, the reader should refer to module 5, case study 1.
[3]Extract from a draft guidelines for energy regulation and regulatory practice by the Programme Committee of the World Forum on Energy Regulation. October 2003.

- Stability is often used in the regulatory context to signify certainty or predictability regarding standards. Stability is strongly tied to effective management and that in turn means accountability and communication. Managing with accountability means knowing who is responsible for what, up and down the chain of command, and acting accordingly on that knowledge;[4]
- Coherence of regulatory reforms against the risk of fragmentation completes the principles of transparency, simplicity and stability;
- Sustainability: the aim of regulation is not just to introduce competition to improve financial efficiency, but also to improve the sustainability of energy policies. This means that the regulatory framework takes into account socio-economic and longer-term development goals. The tension between conventional and sustainable sources of energy has to be approached with an open mind: there is no technology that can be considered as absolutely ideal in the perspective of the promotion of sustainable development, and different situations will require different solutions. To avoid bias or prejudice towards given energy sources, the decision-making process should include staff with a broad range of technological knowledge, including on renewable energy technologies and energy efficiency systems.

4.3. Self-assessment of the regulatory framework in your country

Exercises

1. Complete the Questionnaire on the Regulatory Framework in annex III of this module (See annex III - excel-sheet “Complete Regulation”). The score which is calculated (See annex III - excel-sheet “Check result Regulation”) gives a rough indication of the performance of the regulatory body in your country in covering the key relevant areas in the energy sector. Note that this score is indicative only on the "coverage" (yes/no) of these key areas, but not on the "quality" of this coverage, as this would require further performance analysis
2. Carry out the two exercises mentioned in annex III - excel-sheet “Check result Regulation”.

[4]Extract from the speech of the Chairman Nils J. Diaz, NRC Regulatory Information Conference, Washington, D.C, March 8, 2005.

5. INTEGRATING RENEWABLE ENERGY IN THE REGULATORY FRAMEWORK

The following sections will outline the key issues to address with regards to renewable energy and how to integrate these into the reform process and the regulatory framework.

Options and examples are provided as an introduction for the self assessment tool on renewable energy which is in annex III of this module and which aims to assess the legal and regulatory framework in a particular country from a renewable energy perspective. It is therefore recommended to read the following sections 5.1 to 5.5 first, before completing the questionnaire on renewable energy. Once completed additional guidance is provided in section 5.6 to help interpret the results.

This approach should allow readers to determine where a given country is in terms of regulations and policies designed to promote renewable energy and—in section 6—energy efficiency. It should also allow readers to judge how the situation in the country can develop based on an evaluation of the national situation.

The following paragraphs are meant to provide guidance and inspiration when completing the self-assessment exercise to evaluate the existing situation and fill any gaps identified.

5.1. The legacy of the old institutional systems

To understand the barriers that prevent the wider adoption of renewable sources of electricity generation, one has also to look at the institutional configurations that have resulted from the development of electricity systems elsewhere.

Public policymakers tend to favour large-scale investments, which provide electricity access to urban areas as a priority. Due to population density, it is simpler and cheaper to connect inhabitants of urban areas than rural areas. The lack of financial resources leads to priority being given to connecting urban areas using conventional sources of electricity generation. In fact, evidence shows that the financial system is reluctant to finance projects using technologies that are still perceived (often wrongly) to be unproven or more risky.

The lack of long-term strategies for the promotion of renewable energy and energy efficiency seems to be common in many African countries. The current strategies continue to favour conventional energy systems (often through state subsidies), even when they are more costly and polluting in the long term, making it virtually im possible for renewable energies to compete because all the costs have to be borne by the end-users while conventional energies are heavily subsidized by the state.

Reforms that aim to introduce more competition can foster the development of small-scale generation and open access for small-scale renewable generators (e.g. to distribution networks).

However, reforms can provide companies with incentives to maintain established technologies, instead of investing in new technologies that are perceived to be riskier. To implement decentralized electricity systems requires a new way of thinking, underpinned by specific technical knowledge.

5.2. How can renewable energy be integrated into sector reforms and regulatory frameworks?

Generally energy regulators do not have the authority to take corrective actions (like tax incentives or grants) for social and environmental costs which are not reflected in the market price and consequently, as the principal objective for energy regulators is still to reduce the price of energy for consumers, mainstream regulatory mechanisms do not encourage electricity generation from renewable sources or energy efficiency. Increased amounts of distributed generation may require different forms of price controls and investment incentives designed to create a level playing field between conventional sources of electricity and electricity from renewable sources.

Access to energy is not just a simple matter of kWh, but rather it is an essential service for the local communities. The importance of the social dimension of electricity system reforms cannot be underestimated. This social dimension is widely accepted and is a political goal in itself. Regulators can for instance make their contribution to alter the natural bias in favour of urban areas, which is even more pronounced in Africa than it is elsewhere, by facilitating the entrance of new competitors to off-grid areas.

A regulatory framework that promotes sustainable energy should aim to maximize access to cheap energy alternatives, which can accelerate rural electrification and offer a better quality of service, while minimising negative environmental impacts. To achieve economic efficiency as well as environmental and social justice, there is a need to implement a regulatory framework that promotes sustainable energy and not just competition between conventional energies.

5.3. Integrated energy planning

An appropriate regulatory framework for renewable energy should be first and foremost a framework that ensures that there is a level playing field for renewable energy in rural electrification; i.e. every time a remote village is to be given access to electricity, the comparison should be made between the different sources of off-grid energy and the extension of the network.

This means that when assessing the appropriateness of a given technology, the cost-effectiveness should, apart from economical considerations (including the subsidies for conventional energy sources), take into account social (e.g. market development and income generation) and environmental (e.g. health and climate change) considerations. These three dimensions of an investment analysis are explained in some more detail in annex III of this module.

Apart from the investment analysis the fact can not be neglected that the majority of utilities in Africa face serious financial difficulties; the extension of the grid to areas where the level of consumption per household is low and the households scattered will only increase their financial burden. The key consideration is the delivery of energy services rather than the production of electricity in itself. Since the level of demand for electricity is very low in rural areas, it seems that small-scale projects can make a big difference to the everyday lives of inhabitants. This would be preferable to waiting for a connection to the grid that is unlikely ever to be profitable. The question therefore is how to set up widespread rural electrification projects that are financially and technically viable in the long term.

Rural electrification needs to be boosted with the establishment of a dedicated entity or team to look into planning and implementation with regard to rural electrification. This entity can either be an independent agency, or a dedicated team integrated within the national energy planning authority, the ministry of energy or the energy regulator. In any case it is essential for this entity to cooperate with the institutions in charge of national energy planning (government departments, planning authorities, regulators) to be able to make integrated and realistic assumptions, forecasts and plans.

This entity needs a sufficient budget, which can be provided by a levy on electricity complemented with loans from international and regional banks. The management of the funding needs transparent and clear rules of allocation. This entity can work by giving direct subsidies and tendering long-term concessions. It can also give long-term refundable loans to local companies or provide grants to end-users. This entity can also bundle small-scale projects to mobilize funds from international organizations or via the Clean Development Mechanism.

It is vital for this entity to have good expertise with a stable staff and a clear definition of its goals and the scope of its activities in relation with the role of the regulatory body.[5] Like a utility, it can be placed under the periodic control of the regulator, which can monitor the progress made in rural electrification on behalf of rural households and communicate the results through annual auditing. More and more African countries are setting up an independent rural electrification agency (e.g. Congo, Nigeria, Senegal, Uganda and Zambia).

It has been demonstrated in several developing countries that decentralised energy provision can be financially feasible and sustainable if it is linked to improving economic activity, i.e. the aim should be to activate or increase a local economic potential through the provision of energy services. Such a link is essential for an energy system to survive in the long term and to decrease its dependence from external funding. The inclusion of micro-finance institutions (using funds from the international donor community to overcome the investment barrier) are often part of the success stories.

Grid-connected and off-grid RE systems

A proper connection of small RE plants (e.g. small hydro power plants or wind turbines) to the grid network has to take into account the following aspects:

- The administrative planning authorization process has to be simplified and be straightforward;
- Providing open access to the network means ensuring that there is free and fair competition by removing barriers of entry—whether legal, technical or financial;
- To avoid delays in connection to the transmission network, the substation can be established by the private investor (also see box 6);
- Sales to third parties and open access to the network should be made possible;
- Effective metering of the generation controlled by the utility is required.

When the connection to the network is not possible, this should be clearly notified to all local actors, so that the implementation of stand-alone systems can be considered. Often utilities tend to have totally unrealistic grid extension projects, which raise expectations from clients who, confronted by local politicians, think that they will be soon connected, which tends to freeze implementation of RE (i.e. solar systems) in large areas supposed to be connected to the network

[5]The regulator does not have to operate or supervise this entity but must ensure that the rural electrification entity/agency follows clear rules in giving priority to areas to electrify and that it is not under permanent pressure from local politicians.

in the near future. It is the role of the rural electrification agency to ensure that the plans from utilities are realistic and that private investors who invest in new generation projects can have them easily connected to the grid.

Concession/delegated systems

A rural electrification agency can make sure that the most efficient solution is provided by monitoring a concession system where every time an area is opened to electrification, it is then done with the least costly technology—not in the short term, but in the long term—after comparison of the investments on the longest cycle of generation.[6] Concession also means that the owner has responsibility for the local grid and sometimes—when it applies—for building the substations to the transmission network.

This "stop and go" nature[7] to of the concession system and the fierce competition among competitors has proven to be problematic. This can be smoothened by very long-term concessions and an agreement for periodical revision of the financial conditions by an independent audit. In order to ensure greater development and avoid only the best projects being carried out, the concession approach could also bundle more attractive projects with projects with less attractive potential rates of return—thereby ensuring a greater of access by as many rural communities as possible.

Good planning of the opening of areas to concession contracts could enable the market to grow steadily. It is important to make sure that the final offer is viable in the long term by means of an estimate by the agency of an appropriate rate of return. This should not underestimate the difficulties and the delays in implementing technical systems that accompany the process of social engineering.

Examples are presented in box 1 and box 2.

Box 1. **Mini-grid concessions in Bolivia**

In Bolivia, prior to 2000, all operators of isolated village mini-grids above 300kW of installed generating capacity were required to acquire concessions. This created two problems.

[6]Solar photovoltaic panels for instance are now guaranteed by manufacturers to produce 80% of their initial capacity for 20 years.

[7]"Stop and go" means the support system covers only a limited selection of projects, thus often failing to provide an incentive to utilities and project developers to go out and look for projects, nor does it provide confidence in the support scheme for the investment sector.

First, concessions could legally be granted only to entities that were shareholder companies. This conflicted with the fact that many mini-grids were operated by cooperatives. And second, the reporting requirements and technical standards for concessionaires were impossible (that is, too costly) to satisfy for many of the smaller rural systems.

A partial solution was introduced in 2000. The threshold of regulation was raised to 500 kW peak demand, and cooperatives were allowed to maintain their legal status for an initial period of seven years. Several proposed systems of graduated regulation for rural off-grid systems with different levels of minimal requirement are under discussion.

Source: The World Bank Group, Energy and Mining sector Board Discussion Paper, 2006.

Box 2. **Rural photovoltaic concessions in South Africa: the case of NuRa**

The rural concessions with solar home systems in South Africa represent one of the most ambitious projects of rural electrification using solar energy in Africa. The initial programme, which was launched in 1999 by the government as part of the National Electrification Programme and projected that more than 300,000 solar home systems would be implemented. A call for proposals was issued in February 1999 and seven consortia were identified. Five concessions have reached the implementation stage.

In each concession, the concessionaire gets a monthly fee from the clients, which covers the maintenance costs and the costs of replacement of the batteries. The concessionaire acts like a small local utility that provides a service—electricity—for remuneration. The case of the NuRa concession in Kwazulu-Natal shows that well-managed concession schemes appear to hold promise for the large-scale dissemination of photovoltaic systems in Africa.

The concession attributed to NuRa covers 10,000 km^2. Eight energy stores are disseminated in the concession. They stock parts and sell not only small photovoltaic components but also liquefied petroleum gas—LPG. The sale of LPG allows for an increase in the turnover of the energy stores and thereby facilitates the provision of energy services to rural households (energization approach). To ensure a better quality of service, small local shopkeepers (called "tuck shops") will also soon be able to sell photovoltaic components.

The concession system appears to be one of the ways to deliver a solar energy service and to solve the question of long-term maintenance of solar home systems, which has plagued solar projects for so many years in Africa.

Source: SERN case studies, 2006.

In summary, the following elements are essential with regard to rural electrification:

- A dedicated rural electrification entity (being either a division within the existing electricity institutions or an independent agency) to coordinate all the actors in rural areas and good planning in terms of grid network extension.
- Long-term concessions or delegated systems to attract lasting private investments and a sound financial and taxation environment.
- The existence of standards and codes of practise to ensure the quality of the service provided to end-users.

5.4. Common support mechanisms for renewable electricity

Different support mechanisms to promote electricity from renewable sources are now quite common after having been pioneered in Europe, USA and the developing world. In addition—and mainly thanks to these support mechanisms, costs have been reducing. For example, the prices paid through feed-in tariffs in Denmark for onshore wind fell from 10 euro cents per kWh in the 1980s to 5 euro ents per kWh in 2004.[8] They enable new competitors to enter the market and get access to the network.

But in African countries, in which many remote areas are not connected, the problem is different. Renewable energies are in some cases already competitive, even without the financial support of the state.

This section briefly examines to what extent each of these mechanisms can be adapted to the African context. The mechanisms are:

- The feed-in tariff system;[9]
- The quota obligation system backed by green certificates;
- The tender system;
- In parallel, (investment) subsidies and/or tax incentives are applied.

Feed-in tariff systems, investment subsidies and tax incentives are so called price-based mechanisms (i.e. the mechanism primarily aims to influence the cost/price for RE), whereas quota systems and tender schemes are quantity-based measures (the mechanism primarily aims to achieve a given amount of RE).

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[8]IEA 2006 Energy policies of IEA countries—Country report on Denmark.
[9]More information on feed-in tariff and quota systems can be found in module 9.

These systems are described in more detail in module 9 "Regulatory and Policy Options to encourage the development of Renewable Energy".

Feed-in tariffs[10]

Feed-in tariffs have been adopted in more than 30 countries, including many developing countries such as Brazil, China, Costa Rica, some Indian states, Indonesia, Nicaragua, Sri Lanka, Thailand and Turkey. If the feed-in tariff is set at an appropriate level for a specific period of time, the guaranteed income stream will provide an incentive for investors to invest in renewable electricity generation projects.

Most African countries are facing serious financial constraints. The main disadvantage of feed-in tariffs is that they can be perceived as costly. Scheme design can mitigate this (e.g. by tapering down tariffs over a number of years) and another way of offsetting the cost can be to remove some of the subsidies currently used for conventional energy, which may be encouraging over-consumption, costly imports of energy and pollution.

The reorientation of previous subsidies for conventional energies toward the support of renewable energy can help to set up a local industry instead of financing imports. If a country like India can become a leader in a high technology such as wind power, African countries can realize less complex technologies, in manufacturing terms, such as solar water heaters, can be produced at local level. Even if the solar cells have to be imported, photovoltaic solar panels could be manufactured locally. Biomass is also a sector where potentialities are tremendous for local companies.

Box 3. **Feed-in tariff in Sri Lanka**

Feed-in tariffs offer either a minimum guaranteed price for output or a premium in addition to the market price for output

The Ceylon Electricity Board (CEB), Sri Lanka's state-owned electric utility, purchases electricity generated by renewable energy generators under a Standard Small Power Purchase Agreement (SPPA) between the renewable energy generator and CEB. The SPPA is valid for 15 years. CEB reviews its generation plans, absorptive capacity, the potential of the proposed plant, and other variables, and issues a Letter of Intent to the prospective power producer.

[10]Please refer to annex 1 in module 9 "Regulatory and Policy Options to encourage development of Renewable Energy", for the methodology and examples on how to calculate the level of feed-in tariffs.

The tariff is governed by a Standard Small Power Purchase Tariff and its computation is based on the avoided cost. The avoided cost is calculated every December by the CEB to be used the following year. The tariff is accompanied by a guarantee that the future tariff paid to each renewable energy generator will not fall below 90 per cent of the tariff paid on the first year.

Source: G. Creacen and D. Loy, 2006.

Quota systems

Fewer countries to date have implemented quota systems, compared to feed-in tariffs. Countries that have implemented quota systems include Australia, Belgium, India, Italy, Thailand, United Kingdom and some states in the United States. The results have been variable; the main disadvantage being that the lack of a guaranteed price can limit investor interest, particularly if there is uncertainty about how long the obligation will persist.

For a lot of African countries, it seems very difficult to create a viable liquid green certificates market with only few (if not just one) supply companies. But South Africa is considering setting up a compulsory market in green certificates. This could be the start of a compulsory green certificates market at a regional level.[11]

A quota obligation system can be implemented without certificates (see box 4). An obligation on suppliers to supply a certain percentage of renewable electricity in their electricity mix can be set at a low level and increased progressively, since suppliers will not have the flexibility of exchanging certificates to meet their obligation. Even at a low level, such an obligation could provide a serious incentive for established utilities to start to consider renewable electricity and to integrate it into their technology portfolio.

[11]The voluntary market is quite important in the USA where it represents one third of the total market. It exists in some African countries such as South Africa, but on a small scale. The existence of a middle class sensitive to environmental issues seems to be a pre-condition for the development of such a market. See the annual survey Green Power Marketing in the United States: A Status Report (Ninth Edition), 2006 from the National Renewable Energy Laboratory, Colorado.

Box 4. **The quota system in India**

The quota system is an obligation on electricity suppliers to supply a certain amount of electricity generated from renewable sources. Customers may also be obliged to source a proportion of their power from renewable sources.

As per the Electricity Act of 2003, each state Electricity Regulatory Commission of India shall determine a minimum percentage of renewable energy that must be purchased by state utility.

This percentage varies considerably according to the priority of each regional state. Sometimes, the obligation has been set at a very low level and is already fulfilled. In other cases, the obligation has been at a high level, as some regional states benefit from a very favourable geographical position in terms of wind resources.

Quota systems can be quite complex to design when they include tradable certificates, but this gives some flexibility to suppliers who can exchange certificates to meet their obligation. Reflection on the way to implement such a tradable certificate system is currently going on in India.

Source: SERN case studies, 2007

Tenders

Bidding/tender systems have also been used in developed countries to promote renewable electricity. It has been more or less abandoned due to its "stop-go" nature, with delays between each call for tender. This system can be designed to get the best offer for a given technology or to get the cheapest technology.

In the African context, tenders can be used in a different way to introduce effective competition between renewable and conventional electricity. Rather than just having new generation capacity connected to the network (where renewable electricity will probably not be competitive) it could deliver local long term concessions to electrify new areas by the most appropriate technologies.

Given the small size of the market in developing countries, the "stop-go" nature of this bid could be a deterrent. Therefore a correct design with appropriate requirements included in the tender, plus continued regulatory oversight is required to make sure that those who win the tenders do actually invest in maintaining the local network on the basis of the systems they have sold, and agree to provide network access to other companies. Only if the services are delivered should companies be rewarded and allowed to make profits. It is also necessary that the concessions are long-term, with at least 20 years' duration. It would then be possible to compare conventional off-grid energy with low investment costs and high operating costs, with alternative energy that has high investment costs and low operating costs.

This system can provide a way to introduce real competition between renewable electricity and conventional electricity, while also ensuring that it is connected to the network.

Subsidies and tax incentives

A stable regulated support system (i.e. the package of financial incentives, tax breaks, investment grants and other) is one important factor that can help to boost local private investments in rural electrification. Incentives—direct subsidies to tax exemptions—will also stimulate interest in the sector. To remove or lower duties and taxes appears to be a necessary first step.

In general, the design of the system has to be tuned to target potential investors, recognizing the different requirements of small, large, local and foreign investors.

Investment subsidies and tax incentives are usually in place to complement the major support instrument or to focus investment towards specific sectors or technologies.

Box 5. **Wind power in India: A real success story**

India has frequent power cuts, high voltage and frequency fluctuations and a significant demand-supply gap. Tax exemptions and accelerated depreciation of up to 80 per cent of project costs in the first year have proved successful in driving the wind power sector in India. There was more than 5,000 MW of installed wind capacity in 2005. India now has a powerful and influential national wind power industry.

This success has relied on investment by the private sector. Each investor owns specific turbines in a wind farm. Direct sales to third parties are permitted so as to attract investments from industries that need power generation. The latest form of investment is in wind farms run by manufacturers on behalf of investors, a kind of energy service. Open access is nevertheless currently restricted to each Indian regional state. A manufacturer can therefore only get electricity from wind farms implemented in the same state as his plant.

Wind technology manufacturers are in charge of developing and running wind farms, from the wind generator to the substation. They also invest in the construction of the substation so as to avoid delays in connection to the transmission network. They in turn, are reimbursed by the supplier. The meter located at the grid substation are sealed, maintained and calibrated by the state electricity utility, which purchases the generated electricity. Monthly metering is done in the presence of both parties. The level of wheeling charges is fixed by each regional state and can be as low as 2 per cent of the energy.

Source: SERN case studies, 2007

Conclusion on financial support instruments

Briefly summarizing the main features of the described support instruments:

- Feed-in tariffs tend to favour new entrants;
- The quota obligation system puts the obligation on existing companies;
- The tender/concessions system tends to open new areas to electrification.

As the idea in Africa is to generate more power by attracting investors, it could be that a targeted feed-in system is more adapted for the promotion of renewable energy than a general feed-in tariff system (which may appear too costly) or a quota system (more complex to implement with certificates). The concession system is ideal to open areas for rural electrification.

These mechanisms enable renewable energies to compete on a fair basis with conventional energy; the government (in the case of the feed-in tariff system) or the consumers (in case of the obligation system) agree to pay to have green energy. This proves not just to be sound for the environment, but also on a socio-economic perspective as it has generated substantial amounts of jobs and very powerful industries in some countries such as Germany and Spain.

Whatever the system chosen, it needs also to be implemented with a long-term development perspective and a clear evaluation of the potentialities of the targeted renewable sector to be promoted. The design of the mechanisms has to be simple and guarantee long-term activities.

Although obviously essential, the financial mechanism in itself is not sufficient to allow the market to grow. It is also therefore necessary to address non-financial barriers like quality assurance and lack of awareness through communication campaigns. These non-financial measures are described below.

5.5. Standards, labels and codes of practice

Apart from the financial support the regulation of non-financial aspects plays a key role in the success of the support instrument, e.g. by informing consumers through communication campaigns and guaranteeing quality products through official standards, labels and codes of practice. These are essential tools for raising the quality of products and services. Without these, consumers will generally only have access to sub-standard products and services at low prices. As a result, consumers will have no incentive to buy good quality products. After a while the growth of the market will be negatively affected.

Regulated codes of practise for suppliers and installers of goods and services are an essential tool to ensure high standards of service. In the past, poor performance on the part of local or international companies has been a major reason for the failure of numerous renewable energy projects.

The difficulty is to define standards, labels and codes of practise that can be effectively monitored but are not so strict that they damage small businesses, but are strict enough to ensure quality. The strictest standards and codes of practice should be reserved for large industry players, such as large wind power developments.

5.6. Self-assessment exercise on renewable energy

Exercises

1. Complete the questionnaire on renewable energy in annex III of this module (See annex III - excel-sheet “Complete Renewable Energy”), and carry out the exercises where mentioned (See annex III - excel-sheet “Check result Renewable Energy”).
2. Guidance and background information are provided below to help interpret the results.

Renewable energy coverage in the regulatory framework

The score which is calculated (See annex III - excel-sheet “Check result Renewable Energy”) gives a rough indication of the integration of renewably energy in the regulatory framework in your country. Note that this score gives an indication only on whether RE is covered (yes/no) in regulation, but not on the "quality" of this coverage. The quality of the support instruments will be checked in some more detail in the performance analysis in the following section, e.g. by looking into effectiveness and efficiency.

Effectiveness and efficiency

The most common support mechanisms for RE are described in section 5.4 "Common support mechanisms for renewable electricity". The appropriateness of adopting or changing into one or another system will depend on a wide-range of criteria including the historical context of the national power sector and the institutional environment.

Some objective criteria are available though to evaluate the performance of a support system, e.g. the effectiveness and efficiency of the system. A simplified calculation is presented in the Questionnaire (See annex III - excel-sheet "Check your results") and more background is given below.

Effectiveness

Effectiveness in this context means the success of the support measure(s) in increasing the production of renewable electricity over a given period.

In order to assess the effectiveness of a given support mechanism the growth rate in renewable energy is used here as a (simplified) indication of the effectiveness of the (major) support mechanism. The renewable energy production before and after the start of the support mechanism are considered.

For comparison, the global PV market has been growing at an impressive 30 per cent per year over the last 10 years, but growth rates of around 10 per cent are already quite high and suggest the measure is quite effective.

The best figure to use is the amount of new energy produced (MWh) before and after the start of the support mechanism. If these data are not available, the capacity installed (MW) before and after can be used, although this is less secure as the actual energy produced can differ significantly.

A differentiated approach per renewable energy technology (RET) can be applied following the same principles.

Note that high growth rates can be misleading when a new technology is being used in a country. For instance when hardly any PV systems are in use and the next year 200 kW is being installed, the snapshot would show a seemingly extraordinary growth rate of 200 per cent. It is therefore advised to look at growth rates over several years, especially in upcoming markets.

Efficiency

Whereas effectiveness aims to assess the absolute effect of the support mechanism, the result does not necessarily mean the support instrument has also been cost-efficient. Cost-efficiency means how well the financial support reflects the additional cost (for a given RET compared to a reference technology) and aims to assess whether the support is not captured by market actors and intermediaries keeping the costs artificially high.

On the other hand, a so called "levelled playing field" should be agreed when comparing the cost-efficiency of the use of different renewable energy sources against each other and against other energy sources. A support mechanism in favour of RE is usually justified because of the competitive disadvantage that RE suffer due to incomplete internalization of external costs (i.e. environmental, health and socio-economic impacts) in regard to conventional energy sources. Whereas the environmental cost can to some extent be quantified (i.e. by using the price of CO_2), it remains at least partly subjective how to assess the socio-economic impact (i.e. employment, income and development generation, poverty reduction), the impact on health and the impact of other greenhouse gas emission than CO_2. The inclusion of social and environmental aspects in support policies is elaborated in some more detail in annex I "A multi criteria analysis for investments".

A rough indication can be obtained by dividing the budget for the main support instrument (MUSD) by the growth in renewable energy production (MWh) over the same period of time.

This cost can be compared to other (national or international) RE support measures and be benchmarked against them, and/or be compared to the electricity price, and as such be used as an efficiency indicator. This figure also enables one to assess whether this cost can be justified, taking into account development, social and environmental policy goals.

The overall renewable electricity production is used here regardless of the RET. In order to properly evaluate efficiencies, these should be calculated per RET. It should be emphasised once again that the tool as presented is primarily intended to demonstrate the principles of effectiveness and efficiency as performance indicators of support instruments. A detailed analysis of the cost-efficiency of supporting policies in a given country in reality is often not such a straightforward process and requires the availability of good and sufficient data and an in-depth analysis either by the entity in charge of the support scheme(s), or by an external consultancy.

Important note: The principle of calculating the effectiveness and efficiency of a given measure as explained here can be applicable to a small-scale measure, e.g. at village or province level. It should be emphasised that this is merely a first indication of how effective the support instrument actually is. When trying to assess these parameters at a national or regional level the analysis tends to become quite complex, as in reality the effectiveness and efficiency of a support instrument are influenced by other criteria like the interaction with other instruments, the availability of financial resources and human skills, grid barriers, etc.

More detailed analysis of effectiveness use the absolute growth as ratio of the additional potential, but this requires the availability of data both on growth and on additional potential.[12]

[12]OPTRES—Effectiveness and efficiency of present RES-E support policies in EU Member States, www.optres.fhg.de

6. INTEGRATING ENERGY EFFICIENCY IN THE REGULATORY FRAMEWORK

It is known that there is huge untapped potential for energy saving in African countries. By lowering the growth rate of the demand for electricity and reducing the pressure to add new generation capacity, energy efficiency could for instance enable energy companies to reallocate resources to the maintenance and improvement of the existing network.

The experience in developed countries, especially in the United States, is now quite extensive. Lessons can be learned and transferred to developing countries.

The following elements are essential:

- An agency or a private-public foundation to coordinate the efforts of all actors;
- An appropriate and stable investment climate to favour long-term investment.

The subject of energy efficiency regulation including supply-side and demand-side management is elaborated in more detail in modules 13 to 16.

6.1. The creation of an energy savings agency[13]

Most countries committed to energy efficiency have set up a specific agency dedicated to energy savings (sometimes as a department within the energy agency). Such an agency, with a dedicated staff, can ensure the continuity of a policy of energy efficiency and capitalize on past experience.

Commonly, these agencies launch awareness campaigns, conduct energy audits, conceive and promote quality standards and labels. They can also bundle projects to get funds or loans from international or regional banks.

Currently there are very few such dedicated institutions for energy savings in Africa (e.g. Tunisia and Ghana). The case of the Tunisian energy efficiency agency is briefly described in box 6.

[13]Once again, the terminology can vary; the important point is that an autonomous body is created to fill the special function of coordination and funding energy efficiency measures.

Box 6. **National Agency for Energy Efficiency (ANME) in Tunisia**

Since 1985 Tunisia has been at the forefront of energy efficiency policies in the Mediterranean region. This policy was primarily inspired by the forecasted energy deficit, and was built around three pillars:

1. Putting in place an institutional framework, with a dedicated national energy savings agency (ANME) in charge of policy implementation;
2. The elaboration of a complete set of regulatory measures to promote energy efficient practices and techniques;
3. The adoption of financial incentives, including subsidies for energy audits and investments as well as fiscal measures.

An overall savings target of 640 kToe (kiloton oil equivalent) was set by 2010, and a decrease in energy intensity of 2 per cent per year. ANME plays a central role in administering the set of measures and has been able to make energy efficiency an integral part of energy practices throughout different sectors.

In addition a further reinforcement of this policy and a long-term perspective were presented in its energy efficiency policy strategy for 2030, focusing on:

- Energy efficiency in industry
- increased use of CHP
- Increased use of gas
- Certification of electrical appliances
- Increased use of solar thermal

Some more background can be found in module 15 "Impact of Power Sector Reforms on Energy Efficiency in Africa."

Source: Energy Efficiency in Tunisia towards 2030, April 2006, Agence Nationale pour la Maîtrise de l'Énergie (ANME)

6.2. The role of energy service companies (ESCOs)

In some developed countries, Energy Service Companies (ESCOs) have seized the opportunity to design propositions for consumers in which they undertake to invest and install energy efficient systems, using the resulting energy savings to reduce consumers' bills and allow them to take a margin.

ESCOs could operate in the same way in developing countries, so long as there is an appropriate regulatory framework to increase energy efficiency on the side of energy consumers.

6.3. Financial and tax incentives

Financial and tax incentives can accelerate investments in energy efficiency appliances. Utilities can also raise public awareness and conduct energy savings campaigns if they are financially able through an obligation to commit funds for energy savings—reaching a target of electricity saved in the year—and a financial penalty in case of non-compliance. Creation of specific funds for improving load power factor can also be implemented.

6.4. Tariff setting

Tariffs can be set to reduce the peak demand, thus improving the profile of demand to avoid investments in peak generation capacity, the use of extra generators, or the reinforcement of networks. Tariffs can also reduce the overall demand of some sectors by benchmarking the most efficient actors.

6.5. Standards, labels and energy audits

Labels developed for European countries can be adapted for use in African countries. Standards for appliances such as air-conditioning have proved to be very effective in some African countries like Ghana. Energy audits also need to be conducted systematically.

Box 7. **The Energy Foundation and standard regulation in Ghana**

The Energy Foundation was created in November 1997 as a Government-private sector partnership. It is a consumer-focused institution that aims to avoid the bureaucracy that leads to public mistrust. It is registered as a company and governed by an executive council. It has no power to enact or enforce regulations, but plays an advisory role in the formulation of regulations.

The Energy Foundation has since its inception worked on promoting sustainable energy, conducting advocacy and running public awareness campaigns. It also works to put demand-side management at the top of the political agenda. It is well-known for developing standards for energy efficiency and labels for energy appliances with the aid of foreign organizations, such as the Alliance to Save Energy, the Lawrence Berkeley National Laboratory and the International Institute for Energy Conservation (the collaboration of the two latest giving birth to the Collaborative Labelling and Appliance Standard Program—CLASP).

The first appliance standard regulation in sub-Saharan Africa for room air conditioners has been enacted by the Parliament. This standard is to save Ghana the equivalent of 250 MW of generating capacity in 2020 for a negligible cost, which has to be compared with the construction of the 200 MW Bui hydropower plant which cost $US 600 million.

By permanent lobbying, active collaboration with major actors and aggressive marketing targeting each sector of the country, the Energy Foundation has managed to get a central role and ensures that energy efficiency is a major component of the energy policy of Ghana.

6.6. Self-assessment exercise on energy efficiency

Exercises

1. Complete the questionnaire on energy efficiency in annex III of this module (See annex III - excel-sheet “Complete Energy Efficiency”), and carry out the exercises where mentioned (See annex III—excel-sheet “Check result Energy Efficiency”).
2. Guidance and background information are provided below to help interpret the results.

Energy efficiency coverage in the regulatory framework

The score which is calculated (See annex III—excel-sheet “Check result Energy Efficiency”) gives a rough indication of the integration of energy efficiency (EE) in the regulatory framework in your country.

Note that this score gives an indication only on whether EE is covered (yes/no) in regulation, but not on the "quality" of this coverage. The quality of the support instruments will be checked in some more detail in the performance analysis in the following section, e.g. by looking into effectiveness and efficiency.

Effectiveness and efficiency

This provides you with an overview of the financial support schemes for EE in your country.

In addition it introduces the concepts of effectiveness and efficiency with regard to the performance of a support system.

Effectiveness

Effectiveness in this context means the success of the support measure(s) in increasing the energy savings over a given period.

In order to assess the effectiveness of a given support mechanism, the growth rate in energy savings is used here as a (simplified) indication of the effectiveness of the (major) support mechanism. The energy savings before and after the start of the support mechanism are considered.

The overall energy efficiency coverage is used here regardless of the EE technology used. A differentiated approach per technology can be applied following the same principles.

Efficiency

Whereas effectiveness aims to assess the absolute effect of the support mechanism, the result does not necessarily mean the support instrument has also been cost-efficient. Cost-efficiency means how well the financial support reflects the additional cost (for investing in the EE system or product).

A rough indication can be obtained by dividing the budget for the main support instrument (MUSD) by the growth in renewable energy production (MWh) over the same period of time.

This cost can be compared to other (national or international) EE support measures and be benchmarked against them, and/or be compared to the electricity price, and as such be used as an efficiency indicator. This figure also enables to assess whether this cost can be justified, taking into account development, social and environmental policy goals. The inclusion of social and environmental aspects in support policies is elaborated in some more detail in annex III “A multi criteria analysis for investments”.

Important note: It should be emphasized once again that the tool as here presented is primarily intended to demonstrate the principles of effectiveness and efficiency as performance indicators of support instruments. A detailed analysis of the cost-efficiency of supporting policies in a given country in reality is often not such a straightforward process and requires the availability of good and sufficient data and an in-depth analysis either by the entity in charge of the support scheme(s), either by an external consultancy.

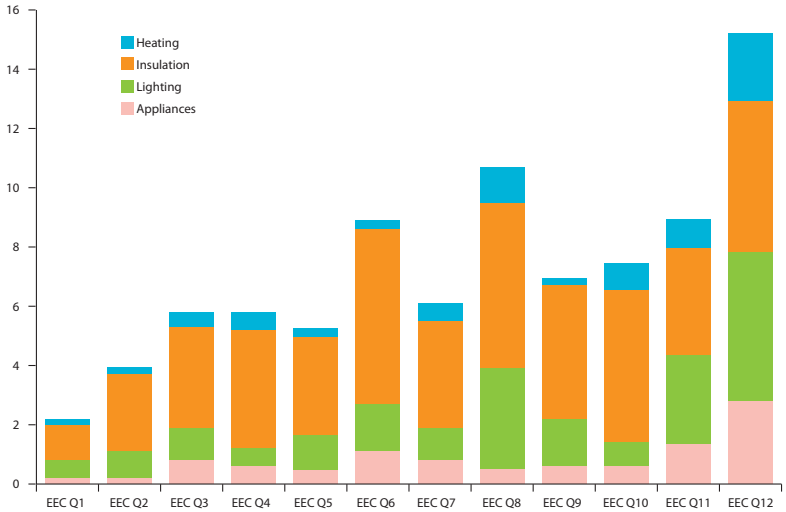
Box 8. **The Energy Efficiency Commitment in the United Kingdom**

The Energy Efficiency Commitment (EEC) in the United Kingdom aims to bring down energy demand in the household sector, with a specific focus on fuel poverty (i.e. 50 per cent of the energy efficiency measures must be achieved in socially vulnerably households). The framework is set out by the government Department for Environment, Food and Rural Affairs (Defra), whilst the implementation and management of the system (e.g. calculations and verifications of saved energy) is administered by the energy regulator, the Office of Gas & Electricity Markets (Ofgem).

The energy reduction target is set by the government and is imposed on electricity and gas suppliers. The first phase between 2002 and 2005 proved very effective with all suppliers achieving their target, and triggering investments worth more than $US 1 billion. With the cost being socialized over all customers, the financial impact on the energy bill could be kept below $US 7 per year (i.e. less than 1 per cent increase).

Insulation, the use of energy-efficient light-bulbs, appliances and heating systems were the most effective and cost-efficient measures, as is illustrated in the chart below (Source: Ofgem).

Chart 1: **Energy savings, by measure type, achieved each quarter during the three years of the ECC**



The cost-efficiency of the EEC is to a large extent due to the energy suppliers "outsourcing" their target to independent third parties, i.e. private companies specialized in the installation of energy efficiency measures, feasibility studies or marketing campaigns. This has stimulated innovation and has led to new business opportunities.

The third phase which runs from 2008 to 2011 is called the Carbon Emission Reduction Target (CERT), and—in addition to energy efficiency measures and reducing energy demand - focus on an increased use of micro generation for electricity and heat. The CERT is defined as a carbon emission reduction obligation on energy suppliers (instead of an energy savings target).

Source: IT Power 2007, Nera 2006, Ofgem 2005.

Box 9. **Energy savings obligation in Denmark**

An energy savings obligation of 1 per cent per year is imposed on distribution grid operators. How the target is met is left to the discretion of the grid operators, stimulating the use of cost-efficient measures. The system is managed by the Danish Energy Authority.

In 2005, the target was met by using energy efficiency measures with an average payback below 3 years. About 155 GWh of energy was saved in the first year, triggering over $US 30 million in investment. The grid operators realised their energy savings target primarily through joint campaigns and consultancy services to the private sector.

In order to increase flexibility and cost efficiency, the introduction of a system of tradable white certificates is currently being evaluated in Denmark.

Further background is available in module 16 the Case Study "Denmark: electricity distribution companies as key factors in energy efficiency policy".

Source: Danish Energy Authority and the Association of Danish Energy Companies.

7. CONCLUSION

The role of policy and regulation in Africa in principle is the same as it is in a developed country. However, the circumstances and many key factors that affect regulation are quite different from those in developed countries.

One of the main differences is that rural electrification in most African countries is still lagging behind. Rural electrification has often not been mentioned in the first electricity sector reforms, and the new regulators have focused on the existing network. Nevertheless, this is changing and rural electrification is now at the top of the political agenda.

Rural electrification agencies will have to play a very important role in this process by ensuring transparency and competition in investments made in rural areas. Unrealistic grid expansion plans will have to be discarded. It is the role of the regulator to make consumers aware of the benefits and limits of each source of electricity.

In any case, the national regulator should contract out some aspects of regulation to this agency and allow them to act on its behalf to avoid duplication of regulation or over regulation of mini-grids and stand-alone systems. Methods of regulation should vary according to the form of electrification and the type of electricity that is providing the electrical service. Apart from the advantages of renewable energy for rural electrification, renewable energy also has a role to play in the urban and industrial environment.

In order to make use of the significant energy savings potential, tailored policies and measures are required for each of the key sectors, i.e. industry, households, tertiary and public sectors. Thus far dedicated agencies and regulators to implement and administer these policies have been rare in Africa.

A key role of the regulators is to ensure that tariff setting encourages utilities to maximize the efficient-use of electricity and the use of energy saving measures. The implementation of energy saving standards and the coordination of energy saving programmes by dedicated agencies should be considered as an absolute priority due to the tremendous benefits they can bring to a country.

LEARNING OUTCOMES

Key points covered

- The institutional organization of the energy sector, and different power sector reform options.
- The place and role of sustainable energy in the reform process within the African electricity sector.
- Distributed generation: the potential for African countries and the institutional resistance to change utilities.
- How institutions and financial incentives can be adapted to promote and support renewable energy and energy efficiency in African countries.

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INTERNET RESOURCES

Afrepren: www.afrepren.org

Collaborative Labelling and Appliance Standards Program - CLASP:
www.clasponline.org/main.php

ENDA: www.enda.sn/energie

Centre for Regulation and Competition:
www.competition-regulation.org.uk/index.shtml

The Kumasi Institute of Technology and Environment - KITE: http://kiteonline.net

Global Regulatory Network: www.globalregulatorynetwork.org

International Energy Regulation Network: http:www.iern.net

Public Research Utility Center: www.purc.ufl.edu

Regulatory Assistance Project: www.raponline.org

Regional Electricity Regulators Association of Southern Africa: www.rerasadc.com

Renewable Energy Case Studies: www.martinot.info/case_studies.htm

Sustainable Energy Regulation Network: www.reeep.org/groups/sern

Sustelnet: www.electricitymarkets.info/sustelnet

UNDP: www.ke.undp.org

GLOSSARY/DEFINITION OF KEY CONCEPTS

Cogeneration — A method of using the heat that is produced as a by-product of electrical generation and that would otherwise be wasted. The heat can be used for space heating of buildings (usually in district or community heating schemes) or for industrial purposes. Utilising the heat in this way means that 70-85 per cent of the energy converted from fuelstuffs can be put to use, rather than the 30-50 per cent that is typical for electrical generation alone. Cogeneration schemes can be relatively small scale, for use at the level of a factory or hospital, or can be major power stations. The term CHP is employed in the UK

	and some other parts of Europe, while the term cogeneration is employed elsewhere in Europe, the US and other countries.
Combined heat and power (CHP)	See Cogeneration.
Demand-side management	The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers only to energy and load-shape modifying activities that are undertaken in response to utility-administered programmes. It does not refer to energy and load-shape changes arising from the normal operation of the marketplace or from government-mandated energy efficiency standards. Demand-side management (DSM) covers the complete range of load-shape objectives, including strategic conservation and load management, as well as strategic load growth.
Deregulation	The process of removing or reducing regulation. It is often employed in connection with the liberalization process for privatized industries. The term is sometimes used erroneously to describe the movement of publicly owned companies and industries in to the private sector. This can generally be more accurately referred to using the terms; privatization, liberalization and re-regulation.
Distributed generation	Distributed generation relies on decentralized technologies where the generator is connected directly to the low voltage distribution electricity network, instead of having to pass through the high voltage transmission electricity grid. It covers various technologies: renewable sources will usually be used as distributed electricity generation.
Distribution	The transport of low voltage electricity. This connects the transmission network with the majority of electricity consumers. The process is overseen by a distribution network operator. Management of distribution is a natural monopoly due to the economies of scale inherent to it.
Economies of density	Generally, economies wherein unit costs are lower in relation to population density. The higher the population density, the lower the likely costs of infrastructure required to provide a service. One example would be the costs associated with providing electricity networks to urban versus rural areas.
Economies of scale	In many cases, the bigger a company gets, the cheaper it is able to produce or distribute each additional unit. Generally, this is because some costs of production do not increase with each unit. These fixed costs are effectively averaged out over the cost of each unit, so that each unit produced reduces the average.
Electricity disclosure	This policy measure which includes mentioning the generation source of electricity on consumers' bills ("disclosing" the electricity

source) is based on the assumption that in a competitive market, consumers may chose to buy their power from less environmentally damaging forms of generation rather than solely allowing their choice to be dictated by the price. Disclosure requirements can include information on the type of generation, the amount of carbon dioxide emitted per kWh or the amount of radioactive waste produced. See module 9 "Regulatory and Policy Options to Encourage Development of Renewable Energy" for some more background on "electricity disclosure" and "green power marketing".

Oligopoly Oligopoly occurs when a number of firms dominate the market for a service or good and effectively act to maintain prices at a higher level than would be likely to occur through competition, effectively mimicking a monopoly. Oligopolies may form as a result of outright collusion, as with the formation of a cartel or may be more informal, as with the adoption of non-price competition, wherein companies in the oligopoly compete on factors other than price in order to avoid margin reducing price wars.

Energy efficiency This can be defined in slightly different ways, and includes using less energy (kWh) to achieve the same benefits (e.g. internal temperature, industrial output etc), or using the same or a lesser amount of energy (kWh) but achieving more benefits (e.g. a warmer home, higher output). The focus tends to be on improving the welfare of the end-user.

Energy services The provision of energy supply and measures concerned with end-use in a single package.

Energy services company (ESCO) Companies concerned with maximizing efficient and cost-effective supply and end-use of energy for their customers. This can encompass a mixture of the following as appropriate; competitive purchasing of various fuels; CHP; end-use efficiency measures; consumption monitoring and management and others. ESCOs should be distinguished from energy supply companies; the main role of which is supplying units of gas, electricity or heat. ESCOs can also be distinguished from energy management companies whose main role is supplying energy efficiency services.

Feed-in tariffs They offer either a minimum guaranteed price for output or a premium in addition to the market price for output. Typical features of feed-in tariffs include:

- Distribution network operators are obliged to allow generators to connect to the grid, and they or retailers have to take all of a project's output at a pre-defined price.
- The scheme can be open-ended, or can be put in place for a specified number of years.
- The tariff schemes can be banded for different technologies,

with less developed technologies receiving higher prices for their output.
- Tariff levels can be set to decline over the years, reflecting the potential for declining technology costs.
- The level of the tariff is often the subject of an explicitly political decision about the level of tariff necessary to stimulate renewable deployment.
- The costs of the tariff can be covered by a levy per kWh on consumers, or on taxpayers, or both.

The level of the tariff tends to be set for several years at a time, often through legislation. This means that there is a high degree of certainty for investors on the returns available, and a high level of confidence about the duration of the scheme. Schemes offering a minimum guaranteed price tend to provide more certainty for investors than those which offer a premium on the market price, because of the higher degree of predictability that this affords.

Generation — The production of electricity from other energy sources. This can include coal, oil, gas, nuclear fission, wind, waste combustion and many others. Generation can be entirely run as a monopoly or be subject to competition.

Green certificates — A certificate that represents a unit of renewable electricity generated that can be used to verify the fulfilment of an obligation to source a certain percentage of renewable generation as required in Renewable Portfolio standard schemes. Trading may be allowed so that companies that under-achieve their obligation can buy certificates from those who have over-achieved.

Level the playing field — To give renewable energies the same advantages and opportunities as conventional energies.

Liberalization — Technically, the removal of restrictions on the movement of capital. It has come to refer to a policy of promoting liberal economics by limiting the role of government in the operation of the market economy. Liberalization can include privatization and deregulation/re-regulation. Typically it refers to the establishment of an industry structure to allow competition, for example, as is possible with electricity generation. The process includes the shifting of publicly owned companies into the private sector, such that provision of services is subject to greater competition or, in the case of natural monopolies to greater oversight with regard to economic efficiency.

Monopoly — The situation wherein one company has the market power to control the price or availability of a good or service. If this is unregulated,

the company is likely to produce fewer goods or to sell goods more expensively than would be the case in a competitive environment. In practise, a monopoly may refer to an industry where one company has power to control the sector regardless of other companies or it may refer to a sector where only one company exists. It should be noted that outside natural monopolies, few monopolies are absolute and that even dominant companies may be subject to pressures on their price setting or limiting of supply. The effects of monopoly, including natural monopoly, on welfare can be limited by appropriate regulation.

Natural monopoly A monopoly where the market can be served most cheaply by a single firm, rather than by a number of competitors. The most notable examples with regard to electricity are transmission and distribution networks, where it would be grossly inefficient in terms of capital investment to have competing networks serve the same customers.

Passive networks The "traditional" electricity supply paradigm, wherein generators are hooked to the transmission network and then supply electricity to order, down to the level of distribution.

Privatization The process of moving a body or institution from ownership in the public sector to ownership in the private sector. This can be carried out using different processes, for example, the sale of shares to the general public or the sale of the whole company to a specific bidder.

Quota mechanism More generally known as a Renewable Portfolio Standard or as an obligation mechanism. The quota system is an obligation on electricity suppliers to supply a certain amount of renewable electricity. Customers may also be obliged to source a proportion of their power from renewable sources.

- The percentage of the obligation can increase over time, so driving increased deployment.
- Suppliers can also choose to pay a penalty rather than buy out of their obligation.
- The operation of the system is supported by tradable green certificates for the output, which certify that the supplier has actually bought renewable electricity. These certificates can be sold with the power, or traded separately. In either case, the value of the certificate adds value to the actual generation.
- Certificates can sometimes be banked for use in future compliance periods.
- There is no requirement on suppliers to allow priority access to networks, as this is the business of distribution network operators in an unbundled system.

	In contrast to tariff systems, here the Government sets the desired level of output. A quota system avoids the Government selecting which technologies will receive the benefits, instead leaving the technical choices to the market. However, a quota system can be banded so that outputs from different technologies are rewarded differently. The level of incentive for the suppliers to comply with the obligation depends on the level of the buy-out price, which can be paid by companies as an alternative to securing new capacity and certificates. The Government sets the buy-out price, which in turn sets the certificate price. The value of renewable electricity will be further enhanced by redistributing the proceeds of the buy-out fund to companies who have met their obligation through presenting certificates.
Regulatory failure	This occurs where the costs of introducing regulation outweigh the benefits.
Regulatory risk	A risk to businesses that changes in regulation will have a negative impact on their operation. Where governments and regulators raise regulatory risk, they are likely to come under pressure to allot some form of compensation to companies who suffer as a result of regulation in order to ensure that future investment is not discouraged.
Renewable energy	The use of energy from a source that does not result in the depletion of the earth's resources whether this is from a central or local source.
Renewable Portfolio Standard (RPS)	A market-based mechanism devised by Nancy Rader and Richard Norgaard for the American Wind Energy Association in 1996. It obliges supply companies or consumers to purchase a specific amount of electricity from renewable energy sources. The key goal of such a mechanism is to minimise the costs of increasing renewable energy capacity through the stimulation of competition to fulfil obligations. The RPS mechanism is also known as a quota or obligation mechanism. Examples of the RPS include the Renewables Obligation in the UK or the Mandatory Renewable Energy Target in Australia). The market may be operated through the creation and trading of certificates (Renewable Energy Certificates).
Supply	The sale of electricity to final users. Many electricity industries do not separate the supply function from the distribution function and allow the monopoly control of both functions. Other countries or territories separate the functions to allow the use of competition within the supply function whilst separately regulating the natural monopoly of the distribution function.

Sustainable development	Development "... which meets all the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations Brundtland Commission).
Sustainable energy	Effectively, the provision of energy such that it meets the needs of the future without compromising the ability of future generations to meet their own needs (see Sustainable Development). Sustainable Energy has two key components; renewable energy and energy efficiency.
System operator	The operator of the transmission grid. Its responsibilities often include proving access to the grid for generators, managing congestion and controlling despatch.
Tariff mechanism	A mechanism to encourage the growth of renewable energy generating capacity. Notable examples are Denmark and Germany. A tariff mechanism generally provides a particular rate per kWh of electricity generated and guarantees that payments will continue for a fixed or minimum period. The tariff can be fixed beforehand, can be fixed to reduce in specific gradations over time or can be linked to the Average Electricity Tariff. Also known as a price mechanism.
Transmission	The transport of high voltage electricity. This is achieved with a transmission network (or grid). Generally the network will connect large generators to lower voltage distribution networks where it will be transported to the majority of electricity consumers. Alternatively, large-scale electricity users may connect directly to the transmission network. Management of transmission is a natural monopoly due to the economies of scale inherent to it.
Wheeling charges	Transmission charges for wheeling the power and energy generated by an independent power producer to third party consumers.

ANNEX I. A MULTI CRITERIA ANALYSIS FOR INVESTMENTS

The decision-making process of an investment should allow for a true socio-economic comparison of the most efficient technology to be made, taking into account not only its immediate financial costs, but also its environmental and social impact.

The responsibility of the long-term integrated planning of a country's energy infrastructure is best handed to an independent regulatory body, which must be able to collect data from utilities (and other relevant institutions and stakeholders) and monitor systematically their investments, before benchmarking them according to best practices and a multidimensional criteria analysis.

The principle for a sustainable framework leading to sustainable energy system (or at least a less unsustainable one)[1] basically means that apart from short-term financial, also social and environmental considerations are taken into account. These three dimensions are described below.

I. Financial and economic considerations

The idea that conventional energies are necessarily unsustainable while renewable energies would be sustainable cannot be simply assumed. The quality of the decision-process that leads to the investment in one or the other is in fact crucial, especially to avoid the over-sizing of the generation capacity and to guarantee an efficient use of the electricity generated. Conventional fuels used in small-scale projects like gas fired combined cycle plants or small-hydro installations may be considered as more sustainable sources of electricity than large plants. Being located near their end-users they can avoid grid losses.

Many renewable sources are indeed used on a small-scale and in an efficient way owing to high investment costs (e.g. solar home systems linked with energy-efficient appliances). Some renewable technologies however may be used on a larger and more remote scale (e.g. wind farms). They are also sustainable in the sense that they use the power of the sun (passive and active solar energy), wind, water or biomass, but the cost of maintenance has to be taken into account.

[1]While it is difficult to define what "sustainable electricity" means, it is easier to describe what "unsustainable electricity" looks like: it looks like most of the world's present-day electricity systems. See W. Patterson, 1999. The total annual amount of fossil fuel consumption subsidies in the world has been estimated by the World Bank in 1992 at around $US 230 billion.

A sustainable regulatory framework is one that prescribes a comparison between all sources of energy in a given location, considering not just the short term but also the long-term aspects. Because investments in renewable sources are generally more costly than those in conventional ones, this means that an appropriate regulatory framework is the one that takes a life-cycle perspective in appraising and comparing projects.

II. Social considerations

In some countries, energy companies have been privatized and as profit-making companies they are supposed to make efficient decisions on how to best allocate their resources. However, the electricity sector has a high social impact. Issues such as access to supply for the poorest households in rural areas will not necessarily be addressed by private companies. On the contrary, they might be inclined to concentrate their services on higher income households or on industrial and commercial customers.

One of the roles of regulators and policymakers is therefore to ensure that all consumers have access to minimum energy services at a reasonable cost and within a reasonable timescale. In African countries, where the majority of rural areas are not connected to the grid, private energy companies need appropriate incentives to expand services into rural areas. A sustainable regulatory framework is therefore one that ensures that energy companies are encouraged to provide the poorest households and the most remote locations with access to energy services.

III. Environmental considerations

A sustainable regulatory framework requires that all external costs linked to the use of various technologies be internalized. This is not an exact science, but estimates can be made on the basis of expert assumptions. There is a need for standards even for so-called environment-friendly renewable energies (e.g. standards requiring recycling of the batteries from solar systems).

Renewable sources of electricity generation have an important role in a sustainable energy policy as they have a limited impact on the environment locally (in terms of health) and globally (in terms of climate change). This is unlike conventional sources such as oil, coal and gas, which have a negative impact on the environment, particularly in terms of CO_2 emissions. The treatment of nuclear waste remains uncertain. Large-scale hydro plants can also have severe negative environmental impacts.

ANNEX II. SELF-ASSESSMENT ON POWER SECTOR REFORM

This self-assessment exercise aims to assess the status of the current power in a given country and provide input and ideas to serve as inspiration for the way forward.

See section 3 of this module for experiences in sub-Saharan Africa and additional background to interpret the results.

In order to offer some guidance, the case of Zambia is mentioned as an example.

Exercises

1. Complete the questionnaire in sheet "Power Sector Reform".
2. Check the results in sheet "Check your result".
3. Based on the results, write a 1,500 words essay on an appropriate way for the power sector in your country to develop and transform.

UNIDO Module 6 Self-Assessment Spreadsheet on Power Sector Reform—Questionnaire

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Zambia Mark Draeck IT Power Ltd. Consultancy UK Jan-08		
LEVEL OF COMPETITION AND UNBUNDLING					
P1	Are any of the functions "Generation", "Transmission", "Distribution" or "Supply to end-consumers" of electricity open for competition in your country?	Yes/No	Yes		
	If No go to P5				
P2	If Yes, are all three functions "Generation", "Distribution" and "Supply to end-consumers" open for competition?	Yes/No	No		
	If Yes, go to P5				
P3	If No, is only "Generation" of electricity open for competition?	Yes/No	Yes		
	If Yes, go to P5	Yes/No			
P4	If No, this means at least one other function apart from "Generation" is open for (some form of) competition. Please indicate which function(s). Specify if necessary.	"Transmission", "Distribution","Supply to end-consumers"			

OWNERSHIP AND CORPORATIZATION					
P5	Is the state-owned utility fully owned by the government and following public accountancy rules?	Yes/No	Yes		
	If Yes, go to P8				
P6	If No, is the utility still state-owned but has it been transformed into a corporate body with financial autonomy and applying commercial principles?	Yes/No			
	If Yes, go to P8				
P7	If No, has the state-owned utility been transformed into (one or more) fully private enterprise(s)?	Yes/No			
	If Yes, go to P8				
	If No please specify.				
ELECTRICITY LAW AMENDMENT					
P8	Is an amendment of the Electricity Law/Act passed (or proposed) in your country?	Passed/ Proposed/No	Yes		

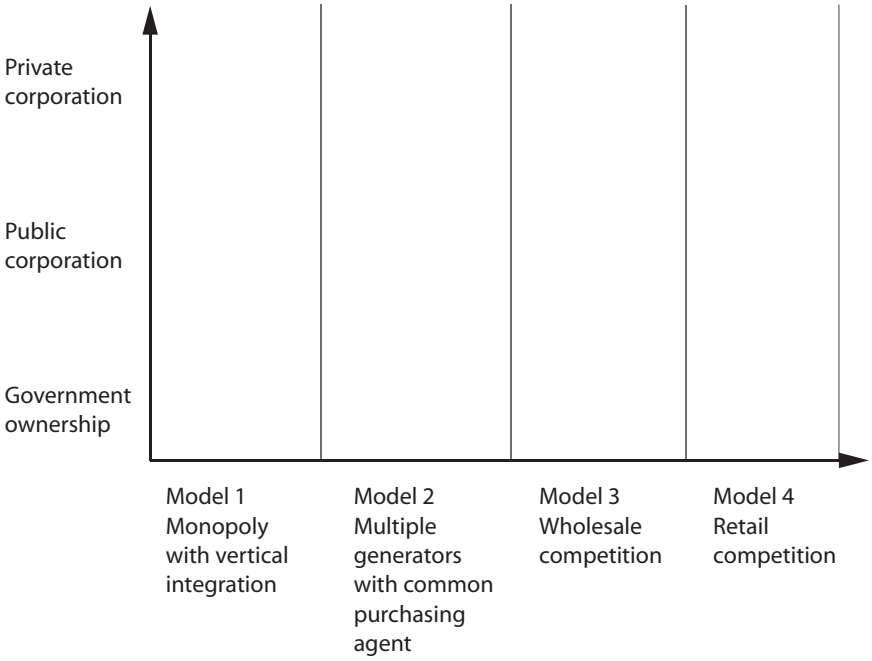
UNIDO Module 6 Self-Assessment Spreadsheet on Power Sector Reform: Results

	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Your answer	Your result	What does it mean?
POWER SECTOR REFORMS					***What should I do next?***
LEVEL OF COMPETITION AND UNBUNDLING					
P1	Are any of the functions "Generation", "Transmission", "Distribution" or "Supply to end-consumers" of electricity open for competition in your country?	Yes/No		If you answered "No"on P1 this means your national power sector is most likely in Model 1 on the horizontal axis of the graph "The path of electricity reform"	Model 1 means: There is no competition. Utilities are vertically integrated from generation-transmission-distribution to the end-users.
	If No go to P5				
P2	If Yes, are all three functions "Generation", "Distribution" and "Supply to end-consumers" open for competition?	Yes/No		If you answered "Yes" on P2 this means your national power sector is most likely in Model 4 on the horizontal axis of the graph "The path of electricity reform"	Model 4 means: There is competition between generators. Open access to the transmission network Several distribution companies are able to buy directly from a producer. Distribution is separate from retail activity. End-users are able to choose their supplier.
	If Yes, go to P5				
P3	If No, is only "Generation" of electricity open for competition?	Yes/No		If you answered "Yes" on P3 this means your national power sector is most likely in Model 2 on the horizontal axis of the graph "The path of electricity reform"	Model 2 means: There is competition between generators but with one purchasing agent who has the monopoly over transmission and distribution networks and over sales to the end-users.
	If Yes, go to P5	Yes/No			
P4	If No, this means at least one other function apart from "Generation" is open for (some form of) competition. Please indicate which function(s). Specify if necessary.	"Transmission", "Distribution", "Supply to end-consumers"		If you answered "No" on P4 this means your national power sector is most likely in Model 3 on the horizontal axis of the graph "The path of electricity reform". If additional specifications were mentioned, ask the trainer.	Model 3 means: There is competition between generators. There is open access to the transmission network. Several distribution companies are able to buy directly from a producer. Distribution companies keep a monopoly over end-users.

					Background: Check Module 6 Section 3 "Power Sector Reform" to provide you with background information and some African examples.
					Exercise: Develop a view on how to proceed from the situation in your country and draw the path of electricity reform for your country in the graph.
OWNERSHIP AND CORPORATIZATION					
P5	Is the state-owned utility fully owned by the government and following public accountancy rules?	Yes/No		If you answered "Yes" on P5 this means your national power sector is most likely positioned in the lower section of the vertical axis of the graph "The path of electricity reform"	The lower part on the vertical axis means the utility is government owned and is administered following public accountancy rules.
	If Yes, go to P8				
P6	If No, is the utility still state-owned but has it been transformed into a corporate body with financial autonomy and applying commercial principles?	Yes/No		If you answered "Yes" on P6 this means your national power sector is most likely positioned in the middle section of the vertical axis of the graph "The path of electricity reform"	The middle part on the vertical axis means the utility is still government owned but is managed as a corporate entity following a commercial logic based on financial autonomy. This is the first step in the "corporatization" process.
	If Yes, go to P8				
P7	If No, has the state-owned utility been transformed into (one or more) fully private enterprise(s)?	Yes/No		If you answered "Yes" on P7 this means your national power sector is most likely positioned in the upper section of the vertical axis of the graph "The path of electricity reform"	The upper part on the vertical axis means the utility is turned into a fully commercial entity with no (or very little) government ownership or involvement in the entity's operational and financial management.
	If Yes, go to P8				
	If No please specify.			If you answered "No" on P7 this means your national power sector is probably positioned somewhere in between the mentioned situations.	Ask the trainer for help in interpretation if necessary.

			Your answer	Your result	What does it mean?
ELECTRICITY LAW AMENDMENT					
P8	Is an amendment of the Electricity Law/Act passed (or proposed) in your country?	Passed/Proposed/No		If you answered "Passed" on P8 this means a reform process is underway in your national power sector, and the Electricity Law has most likely been amended with regard to one or more of the following aspects: removing the monopoly of the national utility; the establishment of an independent regulatory body; the provision for a programme or fund on rural electrification and/or renewable energy; other	*Check what the experiences with regard to (at least one of) the amended aspects have been thus far. Based on this information develop recommendations for improvement and think about how they could be included in the path for sector reform.*
				If you answered "Proposed" on P8 this means there is an intention and a suggested way forward to reform your national power sector. The policymaking process has yet to start or is underway, and no final decisions have been taken with regard to the following aspects: removing the monopoly of the national utility; the establishment of an independent regulatory body; the provision for a programme or fund on rural electrification and/or renewable energy; other	*Check what the proposed way forward is with regard to (at least one of) the amended aspects. Identify those issues which are causing (or likely to cause) controversy and opposition, analyse why that is and think of a balanced way to proceed.*
				If you answered "No" on P8 this means most likely no reform process is underway in your country and the Electricity Law thus far has not been amended with regard to one or more of the following aspects: removing the monopoly of the national utility; the establishment of an independent regulatory body; the provision for a programme or fund on rural electrification and/or renewable energy; other	*Based on the difficulties the power sector faces in your country, prioritize the amendments you think are most urgent. Develop recommendations for (at least one of) the amended aspects and think about how they could be included in the path for sector reform.*

The path of electricity reform in your country



ANNEX III. SELF-ASSESSMENT ON REGULATION, RENEWABLE ENERGY AND ENERGY EFFICIENCY

These self-assessment exercises on regulation, renewable energy and energy efficiency are intended to allow the participant to begin to form a comprehensive picture of where their country lies in terms of sustainable energy regulation and policy development. The process of designing and implementing appropriate and effective regulations and policies is a difficult task, which requires considerable resources and time and hence the self-assessment exercise contained in this module is only meant as an initial rough measure. However, the results of this exercise could be used to begin the process of advancing the state of sustainable energy regulation and policies in the reader's country.

The (three) questionnaires are set up as partly automated excel tools which can also be used in a printed format.

The aim of these exercises is to get a comprehensive view of the situation in a specific country regarding sustainable energy:

- What has been done?
- And after identifying the gaps, what could be done?

Some questions/items remain necessarily ambivalent (e.g. how the independence of a regulator can be defined) and open to discussion among the readers. Definitions and background are given to guide the self-assessment process, although this guidance remains indicative. See sections 4, 5 and 6 of this module for experiences in sub-Saharan Africa and additional background to interpret the results.

In order to offer some guidance, the case of Zambia is mentioned as an example.

Exercises

1. Complete the questionnaire in sheet "Complete Regulation".
2. Check the results in sheet "Check Results Energy Regulation" and carry out the exercises where mentioned.
3. Complete the questionnaire in sheet "Complete Renewable Energy".
4. Check the results in sheet "Check Results Renewable Energy" and carry out the exercises where mentioned.
5. Complete the questionnaire in sheet "Complete Energy Efficiency".
6. Check the results in sheet "Check Results Energy Efficiency" and carry out the exercises where mentioned.

Glossary

CHP	Combined heat and power
DNO	Distribution network operator
DSM	Demand-side management
EE	Energy efficiency
ESCO	Energy service company
IPP	Independent power producers
PPA	Power purchase agreement
RE	Renewable energy
RET	Renewable energy technology
TSO	Transmission system operator
USD	United States dollar

UNIDO Module 6 Self-Assessment Spreadsheet on Regulation—Questionnaire

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Zambia Mark Draeck IT Power Ltd. Consultancy UK Feb 08		
REGULATORY COVERAGE					
R1	What are the core responsibilities of the regulatory body in your country: Monitor liberalization policy	Yes/No	Yes		
	Licensing	Yes/No	Yes		
	Manage support system for RE/EE	Yes/No	No		
	Develop standards/codes of good practice	Yes/No	Yes		
	Tariff setting	Yes/No	Yes		
	Consumer complaints	Yes/No	Yes		
	Other (If yes, please specify)	Yes/No	0		
R2a	Is the regulatory body in charge of energy planning for: Urban areas	Yes/No	No		
	Grid extension to rural and remote areas	Yes/No	No		
	Off grid options for rural and remote areas	Yes/No	No		

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
R2b	***If one of the answers in R2a is No:***				
	Is the regulatory body involved in energy planning for: Urban areas	Yes/No	Yes		
	Grid extension to rural and remote areas	Yes/No	Yes		
	Off grid options for rural and remote areas	Yes/No	Yes		
R3	Are any of the following agencies under supervision of the regulatory body? Rural electrification agencies	Yes/No	No		
	Renewable energy agencies	Yes/No	n/a		
	Energy efficiency agencies	Yes/No	n/a		
	ESCOs	Yes/No	No		
	Other (please specify)	Yes/No	no		
R4	Does the regulatory body cover only electricity and/or gas?	Yes/No	No		
	If no, what are the other types of energy covered? Traditional fuels (e.g. wood fuel)	Yes/No	Yes		
	Transport fuels	Yes/No	No		
	Other (please specify)	Yes/No	Petroleum, coal, new and renewable energy sources		
R5	Does regulation cover: Generation	Yes/No	Yes		
	Transmission	Yes/No	Yes		
	Distribution	Yes/No	Yes		
	Supply	Yes/No	Yes		

PRINCIPLES OF GOOD REGULATION					
R6	Are the regulatory processes and procedures generally simple and transparent?	Yes/No/Other (Please specify)	Yes		
R7	Has the regulatory framework been stable over the last 3-5 years, i.e. state “yes” if there were no abrupt or completely unexpected changes in terms of regulation.	Yes/No/Other (Please specify)	Yes		
R8	Has the regulatory framework been sustainable, i.e have socio-economic and long-term development been taken into account when designing new regulation.	Yes/No/Other (Please specify)	Partly. There is currently no overall framework for RE and EE		
R9	How many members are on the board of directors?		7		
R10	For how many years are they appointed?		3		
R11	Are the criteria for their appointment clear and transparent?	Yes/No/Other (Please specify)	Yes		
R12	Are the criteria for their appointment objective?	Yes/No/Other (Please specify)	Yes		
R13	How many executive members work for the regulatory body?		55		
R14	How many on RE?		4		
R15	How many on EE?		4		

UNIDO Module 6 Self-Assessment Spreadsheet on Renewable Energy (RE)—Questionnaire

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Zambia Mark Draeck IT Power Ltd. Consultancy UK Feb 08		
COVERAGE OF RE IN REGULATORY FRAMEWORK					
RE1	Has national legislation been passed (or proposed) regarding the stimulation of RE?	Passed/Proposed/ No/Other (Please specify)	Government's intentions were set out in National Energy policy (Feb 07). No legal approval yet		
RE2	Has the potential of RE technologies been assessed? (if Yes please specify the RETs)?	Yes/No	Yes		
RE3	Has a roadmap for RE deployment been developed?	Yes/No	Yes		
RE4	Is there an entity in charge of RE in your country?	Yes/No	Yes		
	If no go to RE5				
	If yes, is this entity: the regulatory authority/the rural electrification agency/the RE agency/other	The regulatory authority/ the rural electrification agency/the RE agency/ other (please specify)	Regulatory authority and rural electrification agency		
	Please specify which entity(-ies) covers RE in: Urban areas (on grid)	The regulatory authority/ the rural electrification agency/the RE agency/ other (please specify)	Regulatory authority		
	Rural and remote areas (on & off grid)	The regulatory authority/ the rural electrification agency/the RE agency/ other (please specify)	Regulatory authority and rural electrification agency		

RE5	With regard to rural electrification, is there an electrification plan being implemented or developed with regard to rural and remote areas?	Being implemented/ Being developed/No/ Other (please specify)	Being developed (Rural Electrification Master Plan)		
	Does this plan consider the use of RE on grid & off grid?	On grid/Off grid/Both/ No/Other (Please specify)	On grid/off grid		
RE6	With regard to rural electrification, which of the following measures are in place:				
	Decentralized off-grid programme	Yes/No	Yes		
	Concession system	Yes/No	Yes		
	Open access/third party	Yes/No	No		
	Integrated electricity planning	Yes/No	Yes		
	Transparent PPA/IPP	Yes/No	Yes		
	Realistic grid plan extension	Yes/No	Yes		
	Existence of ESCOs	Yes/No	Yes		
	Net-metering Law	Yes/No	No		
	Participatory approaches	Yes/No	Yes		
ENERGY SUBSIDIES					
RE7	What is the base tariff for domestic electricity in your country? (in USD cents per kWh)	USD cents/kWh	3.1		
	What is the base tariff for electricity for industry in your country? (in USD cents per kWh)	USD cents/kWh	3.4		
	What is the base tariff for commercial electricity in your country? (in USD cents per kWh)	USD cents/kWh	4.8		
	Are these tariffs cost-reflective?	Yes/No	No		
RE8	What was the yearly budget for subsidies for (during last year or the most recent figure available - please mention the year):				
	Conventional energy	Million USD	Not disclosed		
	Renewable energy	Million USD	Not disclosed		

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
RE9	Are there stimulating measures in use to support the use of RE in your country (on grid and/or off grid)?	Yes/No	No		
	If yes, what are these measures? Fiscal measures (e.g. tax breaks)	Yes/No	No		
	Investment subsidies	Yes/No	Yes		
	Feed-in tariff	Yes/No	Yes		
	Tenders	Yes/No	Yes		
	Obligations and targets	Yes/No	No		
	Tradable green certificates	Yes/No	No		
	Other tradable certificates (e.g. CHP certificates,...) Please specify	Yes/No	No		
	Electricity disclosure	Yes/No	No		
	Other (If yes, please specify)	Yes/No	No		
EFFECTIVENESS AND EFFICIENCY					
RE10a	What is/are the major measure/s supporting renewable energy in your country?		Tariff setting		
	For how many years has/ve this/ese measure/s been running?	# years	1		
RE11a	In what year did this measure start?		2008		
	How much renewable electricity was produced per year (in energy production—MWh) before this measure came into force?	xx MWh/year	72000		
	How much renewable electricity (in energy production—MWh) was produced per year since this measure was introduced?	xx MWh	77000		
RE12a	What was the budget per year for this measure (MUSD)?		0.4		
	Repeat the exercise for as many measures you deem relevant:				

RE10b	Measure: For how many years has this measure been running?	# years			
RE11b	In what year did this measure start?				
	How much renewable electricity was produced per year (in energy production—MWh) before this measure came into force?	xx MWh/year			
	How much renewable electricity (in energy production—MWh) was produced per year since this measure was introduced?	xx MWh			
RE12b	What was the budget per year for this measure (MUSD)?				
RE10c	Measure: For how many years has this measure been running?	# years			
RE11c	How much renewable electricity was produced per year (in energy production—MWh) before this measure came into force?	xx MWh/year			
	How much renewable electricity (in energy production—MWh) was produced per year since this measure was introduced?	xx MWh			
RE12c	What was the budget per year for this measure (MUSD)?				
NON-FINANCIAL MEASURES					
RE13	Which of the following regulations and/or measures are in place for the following RETs: ***PV***				
	Licensing	Yes/No	Yes		
	Codes of practice	Yes/No	Being developed		
	Standards	Yes/No	Being developed		
	Consumer awareness campaign	Yes/No	Being developed		

	Answer using one of these options only	Example	Use this column for your country	Comments (optional)
Solar water heaters				
Licensing	Yes/No	Yes		
Codes of practice	Yes/No	Being developed		
Standards	Yes/No	Being developed		
Consumer awareness campaign	Yes/No	Being developed		
Small hydro				
Licensing	Yes/No	Yes		
Codes of practice	Yes/No	Being developed		
Standards	Yes/No	Being developed		
Consumer awareness campaign	Yes/No	Being developed		
Wind energy				
Licensing	Yes/No	No		
Codes of practice	Yes/No	No		
Standards	Yes/No	No		
Consumer awareness campaign	Yes/No	No		
Biomass				
Licensing	Yes/No	Yes		
Codes of practice	Yes/No	Being developed		
Standards	Yes/No	Being developed		
Consumer awareness campaign	Yes/No	Being developed		
Other RET				
Licensing	Yes/No			
Codes of practice	Yes/No			
Standards	Yes/No			
Consumer awareness campaign	Yes/No			

UNIDO Module 6 Self-Assessment Spreadsheet on Energy Efficiency (EE)—Questionnaire

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Zambia Mark Draeck IT Power Ltd. Consultancy UK Feb 08		
COVERAGE OF EE IN REGULATORY FRAMEWORK					
EE1	Has national legislation been passed (or proposed) regarding the stimulation of EE?	Passed/Proposed/No/ Other (Please specify)	Government's intentions were set out in National Energy policy (Feb 07). No legal approval yet		
EE2	Has the EE potential been assessed in the key sectors industry-households-tertiary-public?	Yes/No	Yes		
EE3	Has a national EE plan been developed to use the potential?	Yes/No	Yes		
EE4	Is there an entity in charge of EE in your country?	Yes/No	Yes		
	If no go to EE5				
	If yes, is this entity: the regulatory authority/the EE agency/transmission system operator (TSO)/distribution system operator (DNO)/other	The regulatory authority/ the EE agency/TSO/DNO/ Other (please specify)	The regulatory authority		

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
	Does this entity(-ies) cover EE in: Industry	Yes/No	Yes		
	Households in urban areas	Yes/No	Yes		
	Households in rural areas	Yes/No	Yes		
	Tertiary sector (e.g. hotels, hospitals,...)	Yes/No	Yes		
	Public sector	Yes/No	Yes		
EE REGULATION					
EE5	Is any of the following regulations with regard to *demand-side management (DSM)* in place: Integrated electricity planning	Yes/No	Yes		
	Bid competition: supply versus demand	Yes/No	Yes		
	Existence of ESCOs	Yes/No	No		
	Energy savings in public administrations	Yes/No	No		
	Other (If Yes please specify)	Yes/No			
EE6	Is any of the following types of *tariff regulation* in place? Decoupling profits/sales level for utilities	Yes/No	No		
	Utilities being rewarded for energy savings	Yes/No	No		
	Tariff for cogeneration	Yes/No	No		
	Other (If Yes please specify)	Yes/No			
EE7	Are any of the following types of *load management* in place? Tariff for reduction of peak demand (e.g. time-of-the-day differentiation)	Yes/No	No		
	Tariff for type of clients (e.g. industry,...)	Yes/No	Yes		
	Load factor improvement		No		
	Other (If Yes please specify)	Yes/No			

EE8	What was the yearly budget for subsidies for (during last year or the most recent figure available—please mention the year): Conventional energy (in MUSD)		Not disclosed		
	Energy efficiency (in MSUD)		Not disclosed		
EE9	Are there stimulating measures in use to stimulate EE in your country (on grid and/or off grid)?	Yes/No	No		
	If yes, what are these measures?				
	Fiscal measures (e.g. tax breaks)	Yes/No	Yes		
	Investment subsidies	Yes/No	Yes		
	Obligations and targets	Yes/No	No		
	Tradable white certificates	Yes/No	No		
	Other tradable certificates (e.g. CHP certificates,...) Please specify	Yes/No	No		
	Other (If Yes please specify)	Yes/No			
EFFECTIVENESS AND EFFICIENCY					
EE10a	What is the major measure supporting energy efficiency in your country?		Tariff setting		
	For how many years has this measure been running?		1		
EE11a	In what year did this measure start?		2007		
	How much energy was saved per year (in MWh) before this measure came into force?		50		
	How much energy (in MWh) was saved per year since this measure was introduced?		200		
EE12a	What was the budget per year for this measure (MUSD)?		0.01		
	Repeat the exercise for as many measures you deem relevant:				
EE10b	Measure:				
	For how many years has this measure been running?				

		Answer using one of these options only	Example	Use this column for your country	Comments (optional)
EE11b	In what year did this measure start?				
	How much energy was saved per year (in MWh) before this measure came into force?				
	How much energy (in MWh) was saved per year since this measure was introduced?				
EE12b	What was the budget per year for this measure (MUSD)?				
EE10c	Measure: For how many years has this measure been running?				
EE11c	In what year did this measure start?				
	How much energy was saved per year (in MWh) before this measure came into force?				
	How much energy (in MWh) was saved per year since this measure was introduced?				
EE12c	What was the budget per year for this measure (MUSD)?				
NON-FINANCIAL MEASURES					
EE13	Which of the following regulations and/or measures are in place for the following EE products/systems:		Standards and codes are mentioned in the National Energy Policy for energy efficient equipment (not specified) in different sectors		
	Air conditioning systems				
	Labels	Yes/No	No		
	Codes of practice	Yes/No	No		
	Standards	Yes/No	No		
	Consumer awareness campaign	Yes/No	No		
	Solar water heaters				
	Labels	Yes/No	No		
	Codes of practice	Yes/No	No		
	Standards	Yes/No	No		
	Consumer awareness campaign	Yes/No	No		

	Buildings				
	Labels	Yes/No	No		
	Codes of practice	Yes/No	No		
	Standards	Yes/No	No		
	Consumer awareness campaign	Yes/No	No		
	Fridges-freezers				
	Labels	Yes/No	No		
	Codes of practice	Yes/No	No		
	Standards	Yes/No	No		
	Consumer awareness campaign	Yes/No	No		
	Compact fluorescent lamps				
	Labels	Yes/No	No		
	Codes of practice	Yes/No	No		
	Standards	Yes/No	No		
	Consumer awareness campaign	Yes/No	No		
	Other EE product/system (please specify):				
	Labels	Yes/No			
	Codes of practice	Yes/No			
	Standards	Yes/No			
	Consumer awareness campaign	Yes/No			
	Other EE product/system (please specify):				
	Labels	Yes/No			
	Codes of practice	Yes/No			
	Standards	Yes/No			
	Consumer awareness campaign	Yes/No			
EE14	Are energy audits being carried out and/or subsidized in: Industry	Yes/No	No		
	Households	Yes/No	No		
	Tertiary sector (hotels, hospitals,...)	Yes/No	No		
	Public sector	Yes/No	No		

UNIDO Module 6 Self-Assessment Spreadsheet on Regulatory Frameworks: Results

	Country: Author: Name of company/organization/institution: Type of company/organization/institution: Country: Date:			*Check out your score* ↓	
			Your answer	Score calculator	Your score
REGULATORY FRAMEWORK					
REGULATORY COVERAGE					
R1	What are the core responsibilities of the regulatory body in your country: Monitor liberalization policy	Yes/No			
	Licensing	Yes/No			
	Manage support system for RE/EE	Yes/No			
	Develop dtandards/codes of good practice	Yes/No			
	Tariff setting	Yes/No			
	Consumer complaints	Yes/No			
	Other (Please specify)	Yes/No			
				If 4 or more of the mentioned 6 responsibilities are covered = 5 points; If 2 or 3 = 3 points; If only one = 1 point; If none = 0 points; If "Other" are specified ask the trainer	Score:

R2	Is the regulatory body in charge of/ involved in energy planning for: Urban areas	Yes/No			Score:
	Grid extension to rural and remote areas	Yes/No			
	Off grid options for rural and remote areas	Yes/No			
				If 3 out of 3 areas are covered = 3 points; If 2 out of 3 areas are covered = 2 points; if 1 = 1 point; if none = 0 points	
R3	Are other agencies under supervision of the regulatory body? Rural electrification agencies	Yes/No			
	Renewable energy agencies	Yes/No			
	Energy efficiency agencies	Yes/No			
	ESCOs	Yes/No			
	Other (please specify)	Yes/No			
				If 2 or more agencies are integrated in or under supervision of the regulatory body = 2 points; If 1 agency = 1 point; If none = 0 points	Score:
R4	Does the regulatory body cover only electricity and/or gas?	Yes/No			
	If no, what are the other types of energy covered?				
	Traditional fuels (e.g. wood fuel)	Yes/No			
	Transport fuels	Yes/No			
	Other (please specify)	Yes/No			

			Your answer	Score calculator	Your score
				If only electricity and/or gas is covered = 1 point; If Traditional fuels and/or Transport Fuels are covered too = 2 points; If "Other" ask the trainer	Score:
R5	Does regulation cover: Generation	Yes/No			
	Transmission	Yes/No			
	Distribution	Yes/No			
	Supply	Yes/No			
				If all four - G-T-D-S - are covered = 4 points; If three are covered = 3 points; If two are covered = 2 points; etc.	Score:
				Score on Regulatory coverage:	
PRINCIPLES OF GOOD REGULATION					
R6	Are the regulatory processes and procedures generally simple and transparent?	Yes/No/Other (Please specify)		If "Yes" = 1 point; If "Other" ask the trainer	
R7	Has the regulatory framework been stable over the last 3-5 years, i.e. there were no abrupt or completely unexpected changes in terms of regulation.	Yes/No/Other (Please specify)		If "Yes" = 1 point; If "Other" ask the trainer	

R8	Has the regulatory framework been sustainable, i.e have socio-economic and long-term developments been taken into account when designing new regulation.	Yes/No/Other (Please specify)		If "Yes" = 1 point; If "Other" ask the trainer	
R9	How many members are in the board of directors?				
R10	For how many years are they appointed?			If "years" is between 3 and 6 = 1 point	
R11	Are the criteria for their appointment clear and transparent?	Yes/No/Other (Please specify)		If "Yes" = 1 point; If "Other" ask the trainer	
R12	Are the criteria for their appointment objective?	Yes/No/Other (Please specify)		If "Yes" = 1 point; If "Other" ask the trainer	
R13	How many executive members work for the regulatory body?				
R14	How many on RE?			If R14/R13 > 15% = 1 point	
R15	How many on EE?			If R15/R13 > 15% = 1 point	
				Score on Principles of good Regulation:	Score:

UNIDO Module 6 Self-Assessment Spreadsheet on Renewable Energy: Results

	Country: Author: Name of company/ organization/institution: Type of company/ organization/institution: Country: Date:		Your answer	What does it mean?
RENEWABLE ENERGY				*What should I do next?*
COVERAGE OF RE IN REGULATORY FRAMEWORK				
RE1	Has national legislation been passed (or proposed) regarding the stimulation of RE?	Passed/Proposed/No/Other (Please specify)	Government's intentions were set out in national energy policy (Feb 07). No legal approval yet	
RE2	Has the RE potential been assessed (especially for the most important RETs)?	Yes/No	0	
RE3	Has a roadmap for RE deployment been developed?	Yes/No	Yes	
RE4	Is there an entity in charge of RE in your country?	Yes/No	Yes	
	If no go to RE5			
	If yes, is this entity: the regulatory authority/ the rural electrification agency/the RE agency/ other	The regulatory authority/the rural electrification agency/the RE agency/other (please specify)	Regulatory authority and rural electrification agency	
	Please specify which entity(-ies) covers RE in: Urban areas (on grid)	 The regulatory authority/the rural electrification agency/the RE agency/other (please specify)	 Regulatory authority	
	Rural and remote areas (on & off grid)	The regulatory authority/the rural electrification agency/the RE agency/other (please specify)	Regulatory authority and rural electrification agency	

RE5	With regard to rural electrification, is there an electrification plan being implemented or developed with regard to rural and remote areas?	Being implemented/Being developed/No/Other (please specify)	Being developed (rural electrification master plan)	
	Does this plan consider the use of RE on grid & off grid?	On grid/Off grid/Both/No/ Other (Please specify)	On grid/off grid	
RE6	With regard to rural electrification, which of the following measures are in place: Decentralized off-grid programme	 Yes/No	 Yes	
	Concession system	Yes/No	Yes	
	Open access/third party	Yes/No	No	
	Integrated electricity planning	Yes/No	Yes	
	Transparent PPA/IPP	Yes/No	Yes	
	Realistic grid plan extension	Yes/No	Yes	
	Existence of ESCOs	Yes/No	Yes	
	Net-metering Law	Yes/No	No	
	Participatory approaches	Yes/No	Yes	
			Score	This score gives a rough indication of the integration of renewable energy in the regulatory framework in your country. If your score is 9 or 10; excellent; If your score is 7 or 8; good; If 5 or 6; fair; If lower than 5; poor. Note that this score gives an indication only on whether RE is covered (yes/no) in regulation, but not on the "quality" of this coverage. The quality of the support instruments will be checked in some more detail in the performance analysis in the following section, e.g. by looking into effectiveness and efficiency.
				Exercise: *Choose one of the areas (e.g. legislation, regulatory entity, RE in urban or rural areas,...) and write half a page on what you think is the most urgent issue to address and what solutions could like look like.*

			Your answer	What does it mean? *What should I do next?*
				Background: *Check Module 6 Section 5 "Integrating RE in the regulatory framework" to provide you with background information and some African examples. Section 5.3 in particular focuses on rural electrification.*
ENERGY SUBSIDIES				
RE7	What is the base tariff for domestic electricity in your country? (in cUSD per kWh)		o	
	Is this tariff cost-reflective?	Yes/No	o	
RE8	What was the yearly budget for subsidies for (during last year or the most recent figure available—please mention the year): Conventional energy		o	
	Renewable energy		o	
RE9	Are there stimulating measures in use to support the use of RE in your country (on grid and/or off grid)?	Yes/No	o	
	If yes, what are these measures? Fiscal measures (e.g. tax breaks)	Yes/No	o	
	Investment subsidies	Yes/No	o	
	Feed-in tariff	Yes/No	o	
	Tenders	Yes/No	o	
	Obligations and targets	Yes/No	o	
	Tradable green certificates	Yes/No	o	
	Other tradable certificates (e.g. CHP certificates,...) Please specify	Yes/No	o	
	Electricity disclosure	Yes/No	o	
	Other (If yes, please specify)	Yes/No	o	
				Exercise: *List the pros and cons for the main support instrument for RE in your country. Section 5.4 "Common support mechanisms for renewable electricity" provides you with background information and examples.*

EFFECTIVENESS AND EFFICIENCY				
RE10a	What is/are the major measure/s supporting renewable energy in your country?		o	
	For how many years has/have this/these measure/s been running?		o	
RE11a	How much renewable electricity was produced per year (in energy production—MWh) before this measure came into force?		o	
	How much renewable electricity (in energy production—MWh) was produced per year since this measure was introduced?		o	[(production(year n) - production(year n -1)/ (production (year n-1)]/(number of years since the measure started); The relative growth rate in RE production (%)—before and after the start of the support mechanism—shows how fast the RE production has grown (over the number of years since the measure was introduced) and gives an indication of the effectiveness of the mechanism.
RE12a	What was the budget per year for this measure (MUSD)?			The budget for the major RE measure divided by the increase in RE production over the same period of time gives an indication of the cost of the measure (in USD/kWh). This cost can be compared to other RE measures and be benchmarked against them, and/or be compared to the electricity price, and as such be used as a (rough) efficiency indicator.
				Background: *Check Module 6 Section 5.7.2 "Effectiveness and Efficiency" to interpret your result.*
				Exercise: *If effectiveness is low (< 5%) then list the major reasons and barriers why that is, and write half a page on how you think this can/should be improved. If effectiveness is higher then calculate effectiveness for the best performing RET in your country and explain the key reasons for its success.*

			Your answer	What does it mean? *What should I do next?*
NON-FINANCIAL MEASURES				
RE13	Which of the following regulations and/or measures are in place for the following RETs: ***PV***			
	Licensing	Yes/No	o	
	Codes of practice	Yes/No	o	
	Standards	Yes/No	o	
	Consumer awareness campaign	Yes/No	o	
	Solar water heaters			
	Licensing	Yes/No	o	
	Codes of practice	Yes/No	o	
	Standards	Yes/No	o	
	Consumer awareness campaign	Yes/No	o	
	Small hydro			
	Licensing	Yes/No	o	
	Codes of practice	Yes/No	o	
	Standards	Yes/No	o	
	Consumer awareness campaign	Yes/No	o	
	Wind energy			
	Licensing	Yes/No	o	
	Codes of practice	Yes/No	o	
	Standards	Yes/No	o	
	Consumer awareness campaign	Yes/No	o	
	Other RET			
	Licensing	Yes/No	o	
	Codes of practice	Yes/No	o	

Standards	Yes/No	o	
Consumer awareness campaign	Yes/No	o	
			This gives an idea of how well the non-financial barriers for each RET are adressed in your country.
			Background: *Check Module 6 Section 5.5 "Standards, labels and codes of practice" for additional information.*
			Exercise: *Pick the RET which is most relevant for your country and describe on half a page how it is covered in terms of non-financial barriers.*

UNIDO Module 6 Self Assessment Spreadsheet on Energy Efficiency: Results

	Country: Author: Name of company/organization/institution: Type of company/organization/institution: Country: Date:					
			Your answer	Score calculator	Your score	What does it mean? *What should I do next?*
ENERGY EFFICIENCY						
COVERAGE OF EE IN REGULATORY FRAMEWORK						
EE1	Has national legislation been passed (or proposed) regarding the stimulation of EE?	Passed/Proposed/ No/Other (Please specify)		Passed = 2 points; Proposed = 1 point; No = 0 points; Other = ask the trainer		
EE2	Has the EE potential been assessed in the key sectors industry-households-tertiary-public?	Yes/No		If yes = 1 point; If No = 0 points		
EE3	Has a national EE plan been developed to use the potential?	Yes/No		If yes = 1 point; If No = 0 points		
EE4	Is there an entity in charge of EE in your country?	Yes/No				
	If no go to EE5					
	If yes, is this entity: the regulatory authority/ the EE agency/transmission system operator (TSO)/distribution system operator (DNO)/ Other	The regulatory authority/the EE agency/TSO/DNO/ Other (please specify)				
	Does this entity(-ies) cover EE in: Industry	 Yes/No				
	Households in urban areas	Yes/No				
	Households in rural areas	Yes/No				
	Tertiary sector (e.g. hotels, hospitals,...)	Yes/No				
	Public sector	Yes/No				

				If at least 4 are covered = 3 points; If 2 or 3 are covered = 2 points; If 1 is covered = 1 point; If none is covered = 0 points		
				Score on Coverage of EE:		This score gives a rough indication of the integration of energy efficiency in the regulatory framework in your country. If your score is 7 or 8; excellent; If your score is 5 or 6; fair; If your score is 4 or below; poor. Note that this score gives an indication only on whether EE is covered (yes/no) in regulation, but not on the "quality" of this coverage. The quality of the support instruments will be checked in some more detail in the following sections.
						Exercise: *Choose one of the sectors (e.g. industry, tertiary,...) and write half a page on what you think is the most urgent issue to address and what solutions could like look like.*
						Background: Check Module 6 Section 6 "Integrating EE in the regulatory framework" to provide you with background information and some African examples. Also see Module 15 "Impact of different Power Sector Reforms Options on Energy Efficiency in Africa" for further reading on this subject.
EE REGULATION						
EE5	Is any of the following regulations with regard to *demand-side management (DSM)* in place:					
	Integrated electricity planning	Yes/No	o			
	Bid competition: supply versus demand	Yes/No	o			
	Existence of ESCOs	Yes/No	o			
	Energy savings in public administrations	Yes/No	o			
	Other (Please specify)	Yes/No	o			

			Your answer	Score calculator	Your score	What does it mean? *What should I do next?*
EE6	Are any of the following types of *tariff regulation* in place?					
	Decoupling profits/sales level for utilities	Yes/No	o			
	Utilities being rewarded for energy savings	Yes/No	o			
	Tariff for cogeneration	Yes/No	o			
	Other (If Yes please specify)	Yes/No	o			
EE7	Is any of the following types of *load management* in place?					
	Tariff for reduction of peak demand (e.g. time-of-the-day differentiation)	Yes/No	o			
	Tariff for type of clients (e.g. industry,...)	Yes/No	o			
	Load factor improvement	Yes/No	o			
	Other (If Yes please specify)	Yes/No	o			
EE8	What was the yearly budget for subsidies for (during last year or the most recent figure available—please mention the year):					
	Conventional energy (in MUSD)		o			
	Energy efficiency (in MUSD)		o			
EE9	Are there stimulating measures in use to stimulate EE in your country (on grid and/or off grid)?	Yes/No	o			
	If yes, what are these measures?					
	Fiscal measures (e.g. tax breaks)	Yes/No	o			
	Investment subsidies	Yes/No	o			
	Obligations and targets	Yes/No	o			
	Tradable white certificates	Yes/No	o			
	Other tradable certificates (e.g. CHP certificates,...) Please specify	Yes/No	o			
	Other (If Yes please specify)	Yes/No	o			

						This provides you with an overview of the financial support schemes for EE in your country.
						Exercise: *Write half a page on how DSM and tariff setting could (further) stimulate EE in your country.*
EFFECTIVENESS AND EFFICIENCY						
EE10a	What is the major measure supporting energy efficiency in your country?					
	For how many years has this measure been running?					
EE11a	In what year did this measure start?					
	How much energy was saved per year (in MWh) before this measure came into force?					
	How much energy (in MWh) was saved per year since this measure was introduced?					[(energy savings(year n) – energy savings (year n-1)/(energy savings (year n-1)]/(number of years since the measure started); The relative growth rate (%) in EE savings (before and after the start of the support mechanism) shows how fast energy savings have grown (over the number of years since the measure was introduced) and gives an indication of the effectiveness of the mechanism.
EE12a	What was the budget per year for this measure (MUSD)?					The budget for the major EE measure divided by the increase in energy savings over the same period of time gives an indication of the cost of the measure (in USD/kWh). This cost can be compared to other EE measures and be benchmarked against them, and/or be compared to the electricity price, and as such be used as a (rough) efficiency indicator.
	Repeat the exercise for as many measures you deem relevant:					
EE10b	Measure:					
	For how many years has this measure been running?					

			Your answer	Score calculator	Your score	What does it mean? *What should I do next?*
EE11b	In what year did this measure start?					
	How much energy was saved per year (in MWh) before this measure came into force?					
	How much energy (in MWh) was saved per year since this measure was introduced?					
EE12b	What was the budget per year for this measure (MUSD)?					
EE10c	Measure: For how many years has this measure been running?					
EE11c	In what year did this measure start?					
	How much energy was saved per year (in MWh) before this measure came into force?					
	How much energy (in MWh) was saved per year since this measure was introduced?					
EE12c	What was the budget per year for this measure (MUSD)?					
						Background: *Check Module 6 Section 6.6.2 "Energy Efficiency Regulation—Effectiveness and Efficiency " to help interpret your result.*
						Exercise: *If effectiveness is low (< 5%) then list the major reasons and barriers why that is, and write half a page on how you think this can/should be improved. If effectiveness is higher then calculate effectiveness for the best performing EE system or product in your country and explain the key reasons for its success.*
NON-FINANCIAL MEASURES						
EE13	Which of the following regulations and/or measures are in place for the following EE products/systems: ***Air conditioning systems***					
	Labels	Yes/No				

Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Solar water heaters						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Buildings						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Fridges-freezers						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Compact fluorescent lamps						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Other EE product/system (please specify):						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					
Other EE product/system (please specify):						
Labels	Yes/No					
Codes of practice	Yes/No					
Standards	Yes/No					
Consumer awareness campaign	Yes/No					

			Your answer	Score calculator	Your score	What does it mean? *What should I do next?*
EE14	Are energy audits being carried out and/or subsidized in: Industry	Yes/No				
	Households	Yes/No				
	Tertiary sector (hotels, hospitals, ...)	Yes/No				
	Public sector	Yes/No				
						This gives an idea of how well the non-financial barriers for EE in each sector are adressed in your country.
						Background: *Check Module 6 Section 6.5 "Standards, labels and codes of practice" for additional information.*
						Exercise: *Pick the EE system or product which is most relevant for your country and describe on half a page how it is covered in terms of non-financial barriers.*

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Energy Regulation

Module 6:
FORMULATING REGULATORY SCENARIOS AND NATIONAL SELF-ASSESSMENT

Module 6

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Module overview

- Rationale of reforms in the electricity sector and sustainable energy
- Implementation of a regulatory framework for sustainable energy in African countries
- Self-evaluation exercises

Module 6

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Module aims

- Provide an overview of sustainable energy regulatory options for African countries
- Give insight on institutional content and process with regard to sustainable energy
- Give design elements and suggest options for the integration of sustainable energy
- Explain the role of regulators in addressing key issues related to RE and EE market development
- Enable an assessment to be made of levels of sector reform, and the policy and framework in a given country

Module 6

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Module learning outcomes

- Gain appreciation of the link between institutions, policies, regulation and sustainable energy
- Explicit guidelines on how to foster sustainable energy through policies and regulation
- Be informed of tools aimed to assess and evaluate policies and regulatory frameworks in place in a country
- Inspiration to develop a comprehensive sustainable strategy for a given country

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SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

The Rationale of Reforms in the Electricity Sector and Sustainable Energy

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SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Electricity Reforms

- Widely adopted around the world
  - Privatization + Unbundling ➔ market
  - Regulation of this market
  - Competition = efficiency
- What impact on sustainable energy?

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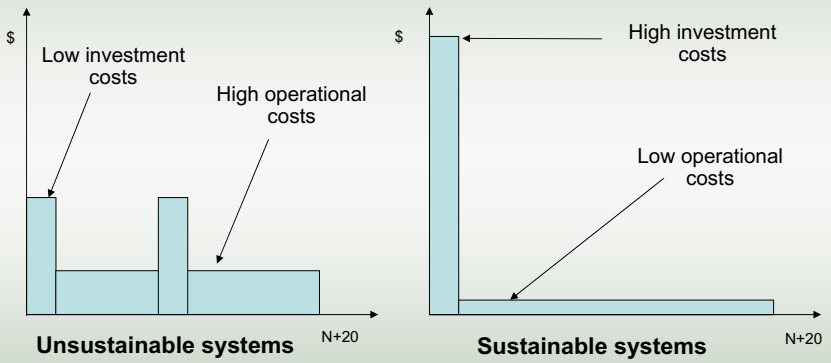
Structure of Costs



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Competition and Sustainable Energy

- Up front cost of sustainable energy >> up-front costs of unsustainable energy
  - Costs of renewable energies > conventional energies
  - Cost of efficient appliances > inefficient appliances
  - Short-term competition ➔ Unsustainable systems are chosen
- Policies and regulatory framework:
  - Incentives for sustainable energies / up-front costs
  - Long-term integrated socio-economic comparisons
    - Lifetime: 20 years (wind power, PV, solar water heaters,…)
    - Rising operational costs of conventional energies
  - Standards and codes of practices

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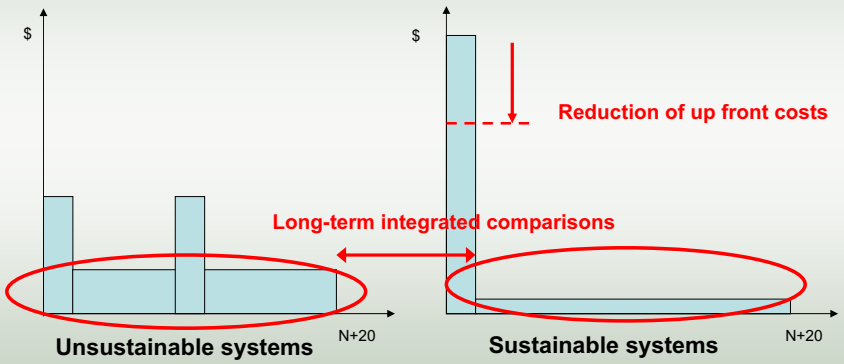
Fair Competition and Up-Front Cost



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Cost of Renewable Energies

- Costs of renewable energies are decreasing very quickly
  - Cost of PV modules decreased from $US 20/Wp in 1970s to $US 5/Wp today (source IEA, 2002)
  - This trend will continue (economies of scale + technology developments)
- Break even point reached making them competitive in rural areas
  - Grid extension $US 2-10 /kWh compared to photovoltaic $US 1-3 /kWh (IEA 2002)
  - Other renewable energies can be even less expensive
- BUT up front costs of renewable energy will always remain high

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The History of Electrification

Four eras:

- Era of decentralized generation (1870-1920)
- Era of centralized generation (1920-1960)
- Era of hybrid system (1960-2000)
- A new era of decentralized generation (2000-…)

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The Four Eras of Electricity Supply in Europe

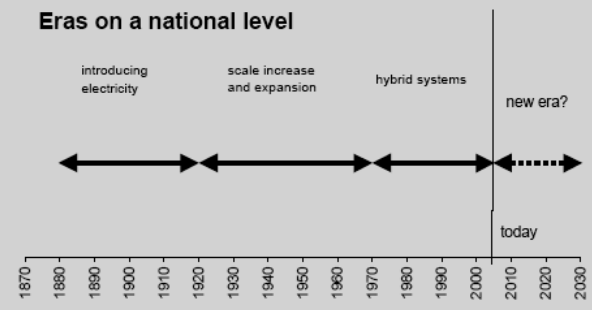

Figure 2.1 *Three eras in the development of electricity supply systems*

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Decentralized Generation in Africa

- Network still in its infancy! Will take more than 80 years to extend the grid!!! Quality of the network is also an issue!
- Stand alone systems + small grid
  - Small PV systems (50 Wc) for SHS + Health + Education
  - Small Hydro / Geothermal / Wind power
  - Hybrid systems (diesel + PV, biomass + PV,…)
- Biomass
  - Efficient use at a local level
  - Bio-fuel / cogeneration

➔ Decentralized generation in Africa implies specific policies and institutions

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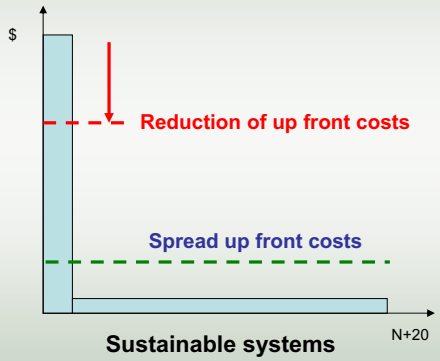
How to Solve the Issue of Up-Front Costs

- Support mechanisms (i.e. feed-in) to reduce the up-front costs plus creation of funding agencies
- Creation of organizations to spread the up-front costs (i.e. ESCOs, ..)



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Implementation of a Regulatory Framework for Sustainable Energy in Africa

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Regulatory Frameworks for Africa

- Mechanisms to support renewable energies
  - What are the most successful mechanisms?
  - How to adapt these mechanisms to the African context?
- What institutions and measures to support renewable energies and energy efficiency ?

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Feed-in Tariffs

- Minimum (specified) guaranteed price for output or a premium on market prices for electricity
- Paid by electricity utilities to the producer
- Level of the tariff often set for a number of years
- More than 30 countries in the world have a feed-in tariff
  - Germany, Denmark, …
  - India, China, Indonesia, Brazil, Nicaragua, Costa Rica, Sri Lanka, Thailand, Turkey. South Africa considering it

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Quota Systems

- Obligation for a certain percentage of renewable production or consumption
- Projects selected by utilities rather than government
- Penalties for non-compliance
- Supported by tradable green certificates
- More than 10 countries have a quota system
  - Australia, Belgium, Italy, Japan, Sweden, Switzerland, UK, USA
  - Poland, Thailand, India

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Regulatory Mechanisms for Africa

- How to transfer and adapt regulatory mechanisms used in developed countries to small developing countries?
  - Feed-in tariff
    - Financial cost? Not so high if targeted feed-in tariff
  - Quota mechanisms + green/white certificates
    - Complexity? Clear that certificates ➔ large market
- Other measures?
  - Tender systems, tax incentives,…
    - Transparency, clear definition of objectives, simplicity

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Bias against RE Rural Electrification

- Most sub-Saharan African and South Asian countries are faced with serious constraints in terms of financial resources
- Meeting the electricity needs of the urban poor costs much less, per capita, than meeting those of the rural poor plus the up front costs of sustainable energy
- Subsidies to conventional energy are in the order of $US 250 billion per year while sales of “new” renewable energies are in the order of $US 20 billion per year

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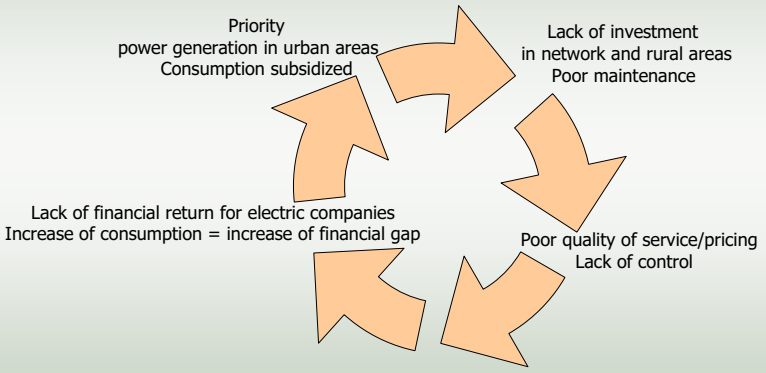
The Vicious Cycle of an Unregulated Environment



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How to foster RE Rural Electrification?

- What kind of rural electrification in African countries
  - Extension of the grid network proposed by utilities? Not always the best solution in remote areas!
  - Off-grid systems!
    - Stand-alone systems with solar photovoltaic, biomass,
    - Mini-grid with solar or small hydro-electricity

    ➔What kind of management and how to finance?
- **<u>Rural electrification agency</u>**
  - Autonomous body
  - Staff + budget
  - Transparency/accountability
  - Organize/prioritize electrification of rural areas
  - Support creation / provide loans to ESCOs
  - Bundle projects / international funding agencies

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How to foster Energy Efficiency?

- Huge untapped potential
  - Often underestimated and constantly evolving
  - DSM cheaper than increase of supply
    - Awareness of decision-makers
    - Regulation to disconnect increase of supply / profit for utilities and give opportunities for the creation of ESCOs
- **Energy efficiency agency**
  - Autonomous body
  - Dedicated staff + budget
  - Least cost planning
  - Energy audits/public awareness campaign
  - Flexibility and visibility
  - Bundle projects/international funding organizations

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Financing Organizations / Up-front Cost

- **Energy Saving Companies (ESCOs):**
  - For rural electrifications with RE
    - Maintain the system
    - Collect monthly fees
  - For energy savings
    - Audit and invest on efficient systems
    - Remunerate themselves with clients' energy savings
- Other alternatives
  - Credit (revolving credit, micro–credit,…)
  - Link with financial institutions (bank guarantees, loans to small companies)
  - Management/ownership of the systems (state, companies, individuals)

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SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Regulatory Framework for RE and EE ?

- Currently rarely taken into account
  - Regulation mainly of conventional energies
  - Multi-energies regulators (and not just electricity)
  - Clear policy (energy + industrial policy)
- What can independent regulators do?
  - 1. Tariff settings which avoid cross-subsidies
  - 2. To have socio-economic comparisons/competition between each sources of energy every time an area is open to electrification or between supply-side and demand-side investments (least cost planning)
  - 3. Promote codes of practices, standards and labels
  - 4. Consumer awareness

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Tariff Settings

- Fair competition
  - Progressively removes subsidies to conventional energies
  - Or at least have the same level of subsidies to renewable energies and conventional energies
  - Taxes, custom duties at the same level
- Financial impact can be mitigated by energy efficiency measures + subsidizing efficient energy systems in rural areas
- Metering systems/willingness to pay
  - Electricity is not free!

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Socio-Economic Comparisons for Integrated Planning

- Regulators need to get basic comparisons done
  - Lifetime of the project (20 years)
  - Investment costs + operational costs can be estimated
  - Least cost planning - demand versus supply
- Other benefits of RE/EE can be a factor of choice
  - Reliability of RE
  - Security of RE/EE compared to risk linked to conventional energies
  - Local creation of jobs
  - Externalities - i.e. environmental impact

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Code of Practices, Standards and Labels

- Regulators can refer to already existing materials:
  - Labels (e.g. in Europe for fridges/freezers)
  - Standards (e.g. for air conditioning in Ghana)
  - Codes of practices (e.g. for photovoltaic or solar heater installations)
- Regulation of the market has a tremendous impact for limited cost
  - Avoid sub-standards products or installation
  - Guarantee consumer satisfaction
- Important to monitor/regulate effectively the market
  - Periodic control
  - Staff specialized on renewable energies and energy efficiency

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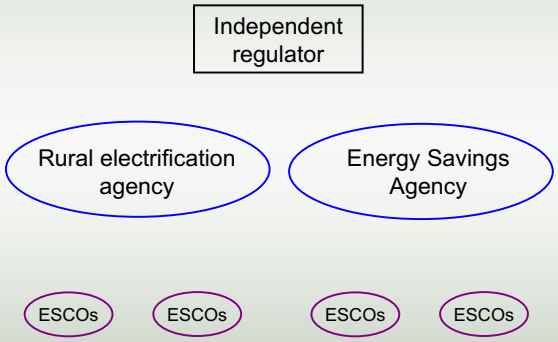
A Possible Robust Institutional Framework

- Defines rules for competition (tariff for RE/EE); integrated planning; standards
- Operational measures (energy surveys) and funding/ bundling (loans, grants)
- Collect fees and guarantee functioning of sustainable energy systems



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CONCLUSIONS

- New institutions / new way of thinking
  - that do marketing
  - that deliver energy services and not just kWh
  - Private/public partnership
- … with regulation for new actors
  - Adapted to small companies = introduce new actors
  - Limit the power market of existing utilities and force them to commit to sustainable energies (incentives/penalties)
- … framed by a real energy strategy/policy
  - Long-term commitment of the government
  - Energy + industrial policy (nurse a market and create jobs)

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SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

Self-Evaluation Exercises

- **Power sector reform**
  - Assess current power sector in country x
  - Inspire the way forward
- **Regulation, renewable energy and energy efficiency**
  - What has been done?
  - What could be done?

Module 6