Module 16

# Regulatory and policy options to encourage energy efficiency

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

# CONTENTS

# 1. MODULE OBJECTIVES

## 1.1. Module overview

This module seeks to provide an understanding of the regulatory approaches and policy measures that could encourage higher levels of energy efficiency in the energy system. Some of the suggested approaches and measures would have immediate short-term impacts whereas others would have to be part of a long-term energy efficiency strategy.

## 1.2. Module aims

This module aims:

- To introduce the concept of regulation—or regulatory oversight—in terms of its impacts on energy efficiency.
- To show how regulation and policy measures can be used to encourage increased levels of energy efficiency in the energy system.
- To outline the steps in introducing a more conducive regulatory and institutional environment for energy efficiency interventions and management.

## 1.3. Module learning outcomes

This module attempts to achieve the following learning outcomes:

- To be able to define what is meant by regulation in relation to energy efficiency.
- To understand how regulatory systems operate and how they can be used to encourage higher levels of energy efficiency in the energy system.
- To understand how policy measures can be used to encourage higher levels of energy efficiency.
- To describe an approach to introducing and applying a more progressive regulatory environment for energy efficiency.
- To understand energy regulation and the regulatory and policy mechanisms for encouraging improved levels of energy efficiency.

# 2. INTRODUCTION

This module intends to provide information and understanding of what energy regulation is, how it operates and how it can impact on energy efficiency in the energy system. The module will also cover some of the policy measures that could encourage higher levels of energy efficiency. The module will start with an introduction to the concept of regulation (or regulatory oversight) in terms of its possible impacts on energy efficiency.

## 2.1. Why regulation?

The energy sector requires significant long-term investment to develop the supply and distribution infrastructure required to provide the energy services expected by customers—both large and small. This investment is motivated on the basis of social and economic goals—usually at a national level—and consequently some degree of risk management is required to ensure the long-term security of the investment.

This is particularly the case when public funds are used for investment or for under-writing the investment. Similarly, customers seek assurance that the energy services, which they desire, will be available in an orderly and consistently priced manner. Consequently, it is important that the operation and management of the energy sector is conducted in a stable and predictable manner. Regulatory oversight of the energy sector has evolved over time to protect and manage the interests of all stakeholders in the sector—primarily those of the investors (including governments) and customers.

Energy regulation is also closely linked to energy policy, planning and strategies for implementation. It is also linked to the financial and economic status of the environment in which the energy services are provided.

## 2.2. Who regulates for energy efficiency?

Energy regulation is primarily provided by one (or more) statutory and independent organization(s)—usually called a national energy regulator—which is established by national law and which is accountable to parliament.

It is often the case that there may be multiple regulators, one per sector, such as an Electricity Regulator and, in addition, a Liquid Fuels (and Gas) Regulator. Clearly, this implies a need for good communication and cooperation between these separate regulators to achieve consistency and efficiency in regulation. In addition, energy regulation is also affected by local government by-laws and guidelines. Finally, typical key players are the transmission system operator (TSO) and the distribution system operators (DSO).

Regulatory oversight for energy efficiency often straddles these different domains of regulation and it is often overlooked as a priority by the different regulators (electricity, fuels, and gas). Ideally, energy efficiency should be dealt with through a coordinated approach between the different sectors. In reality this is often hard to achieve.

In different countries, regulation is provided in different forms and with different levels of regulation depending on the state of development (and needs) of the energy sector.

In the early stages of market development, the levels of regulation are generally fairly minimal and loosely administered. The national energy regulator is usually answerable to the parliament or to the Ministry of Energy.

Overall, in Africa the establishment of regulatory oversight is still relatively poorly developed. This is also true in the energy sector. The African Forum for Utility Regulation (AFUR) is an organization aiming to build capacity in African regulators, including energy and electricity regulators, and assists in information dissemination and training amongst other activities.

## 2.3. How is regulation funded?

There are usually three main avenues for funding energy regulation. These are either through a direct budgetary line from the central government to the regulatory agency, through licensing fees from the organizations being regulated (supply, distribution and transmission licences) or through means of a levy charged at the point of consumption. Often, a combination of these approaches is used to fund the regulatory institution.

A fixed annual budget direct from central government has the advantage of a guaranteed level of funding for the regulator but the disadvantage of possible political pressure on the regulator. Licensing fees from the regulated organizations can supplement the government budget. More often than not, the costs of administration and regulation are provided for by means of a levy—or surcharge—which is charged at the point of consumption in the energy service supply chain, i.e. the meter or pump. This cost is finally borne by the customers.

In the case of developing countries, a regulator is often established with financial assistance from a multilateral or bilateral donor. This external financing is used to set up the physical infrastructure of the regulator (offices, equipment) and to hire the core team of staff. Once the regulator has been set up with external assistance, funding for its on-going operation is usually derived from one or a combination of the sources mentioned above. Sometimes international financial assistance is also provided for capacity building and training activities for the regulator staff.

## 2.4. How can regulation and policy affect energy efficiency?

It is generally accepted that there is a huge potential to improve energy efficiency in a cost-effective way. Yet different sectors such as households and industry frequently do not implement these measures. The main reasons for not making the financial and energy savings are a lack of technical capacity, a lack of capital and lack of an appropriate regulatory framework.

As the possible benefits are often not clearly visible on a single household, company or sector level, it is the role and responsibility of regulations and policies to provide the necessary framework and the required incentives to increase energy efficiency in the different economic sectors.

# 3. INSTITUTIONAL CONSIDERATIONS

For regulation and policy to be effective the necessary institutions to implement actions in a country must be in place. Usually this means a regulatory agency or body must be established often assisted at the national level by ancillary organizations such as Energy Advice Centres (as in the United Kingdom) or Energy Efficiency Centres (such as the Energy Foundation in Ghana).

## 3.1. International and regional bodies

As introduced above, regulatory oversight is usually provided by a national institution or a number of different institutions (or regulatory agencies) and will cover all the energy sectors (power, fuel, gas, etc.). These institutions can be assisted at the regional and international level by umbrella organizations or associations that provide other valuable services that can enhance the skills and capabilities of national regulators. The matrix below gives some typical international and regional institutions and their main activities.

Table 1. International and regional institutions related to regulation and energy efficiency

| Level | Examples of institutions | Types of services provided |
|---|---|---|
| International | Centre for Analysis and Dissemination of Demonstrated Energy Technologies (IEA/OECD)<br>www.caddet.org<br><br>International Energy Agency Demand Side Management Programme<br>http://dsm.iea.org | • Exchange of information on new, cost-effective technologies that have been demonstrated in applications such as industry, buildings, transport, utilities and agriculture<br>• Provide case studies<br>• Access information on best practice<br>• Facilitate countries working together to promote energy efficiency measures |
| Regional | African Forum for Utility Regulation (AFUR)[a]<br>www1.worldbank.org/afur/<br><br>Regional Electricity Regulators Association of Southern Africa (RERA)[b]<br>www.rerasadc.com | • Provide advice on regulatory issues<br>• Provide case studies<br>• Access information on best practice<br>• Capacity building services<br>• Organize regional forums<br>• Work towards harmonization of regional standards |

[a]The African Forum for Utility Regulation (AFUR) was established by African Utility Regulators—with support from the World Bank and PPIAF—to promote the development of effective utility regulation within Africa. AFUR seeks to do this by facilitating the exchange of information and lessons of experience between regulators.

[b]The Regional Electricity Regulators Association of Southern Africa (RERA) is a formal association of independent electricity regulators which provides a platform for effective cooperation between independent electricity regulators within the Southern African Development Community region.

## 3.2. Energy Advice Centres

Energy Advice Centres operate usually on a local level and their principal role is to raise awareness and provide advice on energy efficiency towards different sectors and the public. This mainly consists of organizing information campaigns (through media campaigns, street posters, flyers, etc.) and providing independent and personalized advice to the public (via a call centre, a website, an email account, appointment with advisor, etc.).

Energy Advice Centres are often (governmental) energy agencies, or non-profit organizations funded by the government and/or the private sector. Wherever more appropriate, this task can be carried out by the energy regulator or the transmission/distribution company.

For example in Ghana, the Energy Foundation Ghana is a non-profit, public-private partnership institution, devoted to the promotion of energy efficiency and renewable energy, as a key strategy to managing Ghana's growing energy needs in a sustainable manner.[1] The Energy Foundation provides consumers with relevant information on the energy efficiency of common household appliances. In order to increase awareness on energy efficiency and the cost reduction potential, an online tool is offered to calculate the electricity bill both for a residential and a non-residential customer.

In the United Kingdom, Energy Advice Centres raise awareness on energy efficiency and offer a range of services for households and schools, including general energy saving tips, financial advice on how to fund energy efficiency improvements, free posters and energy education packages, and energy audit information.[2] Specifically aimed at low-income households, an "Affordable Warmth Action Plan" was introduced to fight fuel poverty and achieve affordable warmth, helping people to look into which grant aid may be available to upgrade existing systems and reduce their fuel bill.[3] The Housing Energy Efficiency Best Practice programme offers advice, training and publications in best practice technologies and methods in house building and refurbishment to house builders, designers and architects on the range of energy efficiency options in home.

As outlined in the examples above, Energy Advice Centres are able to target different sectors, design according actions as well as address cross-cutting issues. They ideally promote local initiatives and work with key local partners to raise the profile of energy efficiency in their area, having a close relationship with the local authorities.

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[1] www.ghanaef.org, see box 1. for more information

[2] www.energy-advice.co.uk

[3] National Energy Action, www.nea.org.uk

## 3.3. Energy regulators

Most countries in a liberalized or in the process towards liberalized energy markets, introduce a regulatory authority, further called the regulator. The overall mission of the regulator is:

- To guarantee the non-discriminatory, competitive and efficient functioning of the market;
- To bring transparency to the energy market in terms of grid access, tariff setting and the procurement of balancing power;
- To provide appropriate and efficient mechanisms for regulation, control and transparency in order to avoid misuse of a dominant position, which could undermine the proper functioning of the market and harm the interests of the end consumer.

The concrete tasks following from these principles include:

- The assessment of the short, mid- and long-term future infrastructure and network needs for both electricity and gas;
- The calculation of tariffs for transmission and distribution grid operators;
- The elaboration of the conditions and the procedure for submission, examination and approval of supply licences;
- The organization of stakeholder consultations;
- The conducting of surveys to compare the price and quality of offered energy services;
- The formulation of recommendations for national government to adopt new or improve existing policy instruments.

In terms of renewable energy and energy efficiency, the regulator usually operates the support system (management of the green certificate or feed-in database), controls the fulfilment of public service obligations (e.g. for instance a specified energy savings target or the provision of minimal energy services) and collects fines when obligations or targets have not been met.

In order to be able to set up an energy savings target, minimum requirements include:

- The availability of energy consumption data per targeted sector: e.g. households, non-households, consumers connected directly to the transmission grid, consumers connected to the distribution grid, energy-intensive industry and small and medium enterprises. This type of information is required in order to be able to define realistic, possibly differentiated per sector or gradually increasing, energy savings targets.

- A team of experts (per sector) capable of evaluating the proposed actions, calculating the energy savings per action and improving the instrument over time.

As was pointed out in module 2, the electricity sector in most African countries is generally only partly liberalized, if at all, and typical regulatory authority do not generally exist. On the other hand most of the roles as described above could be carried out by other organizations, depending on the existing authorities and expertise in a given country. For instance, the national government could impose an energy savings target on grid operators and authorize one of its ministries (Ministry of Energy, Industry or Environment) to manage the system. Environmental regulators could be handed the authority to control certain actions and non-governmental organizations could be included to carry out stakeholder consultations and surveys.

## 3.4. Main target sectors for energy efficiency policy and regulation

Which appropriate policy or regulatory mechanisms to apply depends significantly on the sector or target groups at which it is aimed. Roughly four sectors could be distinguished, as these are usually the top four energy consumers in any given country:

- Industry
- Households
- Transport
- Offices and buildings

The following section will describe, on a per sector basis, how policies in general are designed, and where this might be relevant or offer opportunities for sub-Saharan countries.

# 4. POLICY OPTIONS FOR INCREASING ENERGY EFFICIENCY IN TARGETED SECTORS

## 4.1. Industry

### Fiscal incentives

Fiscal incentives are an effective means to stimulate companies to realize energy conservation projects in their organization.

In China these fiscal policies included loan payment before tax, three-year product tax and value-added tax exemption for new energy conservation products, import duty reduction and exemption for energy conservation technology and equipment introduction. The state budget made special allocation for an energy conservation infrastructure construction fund and energy conservation technical renovation fund. These special funds enjoyed the preferential policy of reduced interest loans and loan payment before taxation. See case study 3: China's Energy Conservation Policy for more detail.

In Japan the "Energy Conservation Assistance Law" sets out financial incentives for energy conservation in the form of tax exemptions, low-interest financing and industrial improvement bonds to support approved voluntary efforts by business operators and building owners for energy conservation. See case study 1: Japan—Overview of Energy Efficiency Measures for further details.

In Flanders part of the investment to improve energy efficiency in industrial processes is allowed to be deducted from the taxable income of the company (13.5 per cent).

### Energy efficiency targets

Energy efficiency targets can be imposed on or agreed with the energy intensive industry.

For instance in Flanders, the so called benchmarking covenant was agreed between the government and industry, with the aim of benchmarking the energy performance of a given site with the best performing similar site in the world. As such, the companies committed themselves to work towards the best international standard by 2012, taking into account that the best standard will improve in the meantime. The government from its part guaranteed not to impose other measures to these companies, as for instance an energy or $CO_2$ levy.

Experienced consultants perform the benchmark study of a specific site. Therefore it is often necessary to split up the site into its different process installations, being as such different units to be benchmarked separately.

The participant proposes an Energy Plan, which contains all the necessary measures to tend towards, and maintain the best international standard. The terms to realize these measures are defined by the covenant, based on economic efficiency. Once approved and started, the industry will annually draw up a monitoring and progress report. The covenant currently has a working period up to 2012.

In Japan, a similar approach was used for product standards; under the Top-Runner Scheme, the best performing items in their category in the market set the minimum standard for a target year.

The programme originally covered 11 items, and has since been extended to 18 items including cars, refrigerators, air conditioners, televisions, copy machines, etc. If a company cannot achieve the target by a target year, then its name and the product name are made public, and a fine has to be paid. However, compliance is evaluated not based on each product, but on products in the same category.[4]

The Top-Runner Scheme has significantly contributed to energy conservation of machinery and equipment in Japan. It worked especially well for gasoline passenger cars. See case study 1: Japan—Overview of Energy Efficiency Measures for further details.

## EU emissions trading scheme

Following the EU ETS Directive[5] the major energy intensive industries in Europe were obliged to decrease their $CO_2$ emissions. The system is designed as a so-called cap and trade system: the amount of $CO_2$ to be emitted is capped (per sector, plant or installation), and the $CO_2$ emission reductions are tradable, meaning that plant owners can decide to either reduce their $CO_2$ emissions, or buy $CO_2$ emission reductions, whichever is cheaper.

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[4]Current Japanese climate policy from the perspective of using the Kyoto mechanisms, www.iges.or.jp

[5]Directive 2003/87/EC of the European Parliament and of the council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, commonly called EU ETS Directive (ETS = European Trading Scheme), eur-lex.europa.eu

Financial sanctions for non-compliance are imposed (40 €/ton $CO_2$ in 2005-2007/ 100 €/ton $CO_2$ from 2008). The obvious/cheapest way to decrease $CO_2$ emissions is to increase the energy efficiency of the plant/installation.

The EU ETS essentially is a means to internalize the cost of $CO_2$ emissions into the electricity price so as address the failure of economical markets in reaching the social optimum, and could in essence even be called a taxation instrument. The EU ETS system is designed to achieve this reduction in the most cost-effective way, by allowing trade of emission reductions so the reductions are achieved where they are cheapest. As such, this system implies a correction of the market but remains a "market-based" instrument, compatible with the existing market.

Naturally in Africa, the reduction of $CO_2$ emissions does not have the same priority as in Europe. On the other hand, were it not for the $CO_2$, a similar system could still be introduced in order to stimulate or oblige market players to carry out investments they would not carry out in an uncorrected market. It basically comes down to giving the $CO_2$ or the saved energy a price or value (through a fine when the target is not achieved), and then allowing the market players to achieve the target as they wish.[6]

Essentially the same principle of creating a financial value for a thus far unvalued good (e.g. $CO_2$ or energy savings) is applicable in Africa. This might especially be worth considering for energy savings, as a means to stimulate industries in carrying out the investments, which will save them money over time. When considering the adoption of such a scheme, in parallel the issue of upfront costs will need to be addressed, by means of soft loans, additional funds or investment money, as the one without the other would not be effective in an environment short of money in the first place.

### Link with the Clean Development Mechanism

An immediate opportunity of the EU ETS system for developing countries lies in the possibility for industrialized countries to invest (money and technology) in energy efficiency measures in developing countries, claiming the $CO_2$ emission reductions. This system is called the Clean Development Mechanism (CDM) and is one of the flexible mechanisms within the Kyoto Protocol—the EU ETS is linked to CDM through the Linking Directive.[7]

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[6]This is the cap and trade principle, as used in the EU ETS, but also in green certificate quota systems (where it is not a cap but a target) and potentially in policies imposing energy savings targets, although the "trade" aspect is usually not operational (yet), but could be in the future in the form of white certificates.

[7]Directive 2004/101/EC of the European Parliament and of the council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, eur-lex.europa.eu

As is currently shown in Brazil, China and India, CDM can actually facilitate investments in more efficient energy infrastructure by creating an extra value through the selling of $CO_2$ emission reductions to industrialized countries.

When carefully designed, CDM project/programmes could trigger and support other policies in a developing country, e.g. local employment, poverty reduction, gender policies etc. While the actual potential for CDM projects in a given country highly depends on a range of criteria (e.g. type of existing electricity generation infrastructure, economic and political situation), the possibility deserves consideration.

### Small and medium sized companies

Where the described EU ETS scheme includes only the major industry sectors, comparable policy schemes are likely to be adopted in the future for medium and small companies to comply with.

A possible means is a public agreement between given sectors and the government, where the sector commits itself to reduce $CO_2$ emissions (by a certain percentage in an agreed time frame), and where on the other hand the government commits itself to providing favourable investment conditions and/or the promise not to impose other policy obligations (e.g. a $CO_2$ tax) in the future. Examples are the Climate Change Agreement[8] in the United Kingdom and the Benchmark Covenant[9] in Flanders (Belgium).

## 4.2. Households

A number of policies is available to increase energy efficiency on household level, either directly or indirectly.

### Direct policy measures

Energy efficiency technologies generally require higher initial investment costs, while the financial benefit (through lower energy bills) only comes in later. Even when the paid back period is just a few years, the higher initial investment might make people choose the cheaper (less efficient) technology.

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[8]www.defra.gov.uk/environment/ccl/index.htm
[9]www.energiesparen.be

In order to decrease the barrier of higher initial investment, the government can foresee specific tax incentives, investment subsidies or soft loans. A tax incentive includes that (a percentage of) the investment can be deducted from the tax bill. An investment subsidy implies that a certain percentage of the investment cost of the given technology is provided—usually by a direct capital grant for a percentage of the cost. This percentage should equal the extra cost of the more efficient technology compared to the classic technology. The eligible amount to deduct/subsidise can be differentiated according to the technology.

## Indirect policy measures

Actions aiming directly towards households are often complemented by regulations, on a level surmounting the individual household level. This happens when the government defines an energy savings target for the distribution system operator (DSO) to comply with, as part of its public service obligations. For instance if a government sets a target for DSOs to save 1 per cent of their yearly supplied energy, this means a DSO supplying 5000 GWh per year to end-consumers needs to save 50 GWh (1 per cent of 5000 GWh) for the coming year.

It is then up to the DSO to decide which specific actions and regulations towards different target groups are most appropriate to get to the target. Usually the actions are put together in an action plan that is discussed between the DSO and the government. The DSO claims its expenses by an increase of the distribution tariff, to be agreed by the Energy Regulator.

Over the past decades this system has been quite successful in Denmark, keeping Danish energy consumption static since 1980, despite economic growth of around 3 per cent during the last decade. A similar system was introduced in 2003 in Flanders (Belgium) and can be generally evaluated as successful as all network managers reached their target in 2003 and in 2004 (except one grid operator), and the target was reached with less budget than initially planned. As from 2008, the targets will be increased to 2 per cent for households, and 1.5 per cent for non-households. These policies are usually managed by the Energy Agency. In the case of Flanders the roles of the regulator apply to the start of the legal procedure for the collecting of the fines if the targets are not achieved, and to check whether the costs of the Public Service Obligation are incorporated correctly in the electricity tariffs.

These policies are described in detail in the case studies 4 and 5 for Denmark and Flanders respectively.

It is arguable whether this kind of policy should be called a supply or a demand-side measure. The DSO is acting on the supply-side, but as the actions are targeting end-consumers, it also involves demand-side management. The matter is therefore mentioned in the section on supply-side management options, specifically when explaining a market mechanism with which to reach a given target, i.e. white certificates.

Another policy measure is the setting of energy efficiency targets for domestic electric appliances such as refrigerators and air-conditioning systems. The corresponding regulations are usually standards and labels (see also under Regulatory Options: Demand-Side Management—Standards and Labels). An example of standards and labels in a sub-Saharan Africa setting is described in box 1.

Box 1. Industrial energy efficiency standards and labelling regulations in Ghana

In collaboration with the Ghana Standards Board and with financial support from the United Nations Department for Economic and Social Affairs (UNDESA), the Energy Foundation has developed energy efficiency standards and labelling regulations for non-ducted air conditioners or self-ballasted fluorescent lamps, being manufactured in or imported to Ghana. The initiative aims to impose minimum performance requirements, to provide consumers with relevant information on the energy efficiency of common household appliances, and to avoid Ghana becoming a dumping ground for inefficient appliances.

It is stated that only air conditioners that meet a minimum energy efficiency ratio (EER) of 2.8 watts of cooling per watt of electricity input, and compact fluorescent lamps that have a minimum service life of 6,000 hours and minimum efficacy of 33 lumens per watt will be allowed into the country.

This initiative began in 1998 and was formalized by the Minister responsible for energy on 2nd June 2005. The energy efficiency standards and labelling regulations were approved by Parliament in February 2006 and can be downloaded from the website of the Ghana Energy Foundation.

*Source:* Energy Efficiency Standards and Labelling Regulations—the Energy Foundation Ghana, www.ghanaef.org

For most countries in sub-Saharan Africa, cooking is a major use of energy, most often by means of wood (or charcoal where affordable). The use of low-cost appropriate technologies of heat retention cookers (hay baskets/boxes) and fuel-efficient mud stoves can help people use less wood for cooking.[10] Another example is the use of biogas from manure in homemade stoves in Manicaland

[10] Heat retention cookers in Tanzania—Sunseed Tanzania Trust, www.sunseedtanzania.org

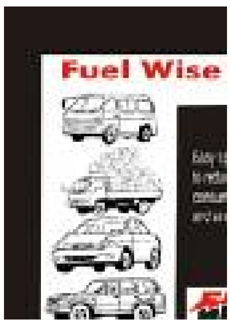
in Zimbabwe. Apart from increased energy efficiency, additional advantages may include a decrease in terms of deforestation and health damage from exposure to smoke.

Finally it is possible that in the future, small (including household level) low carbon projects will be eligible for so called programmatic CDM, and as such could create an income by selling the $CO_2$ emission reductions. Programmatic CDM is a specific instrument under development within CDM that could address the specific barriers for CDM projects in some African countries and other Least Developed Countries (LDCs). The Meeting of Parties (MOP) to the Kyoto Protocol (COP/MOP2) and the 12th Conference of the Parties to the Climate Change Convention (COP 12) in November 2006 in Nairobi made some progress on agreeing support for capacity-building for African countries and consideration of programmatic CDM, but the definitions and modalities on how programmatic CDM could actually work are not fully clarified at this stage.

## 4.3. Transport

The use of more efficient car and truck engines could substantially lower the fuel cost and the environmental impact of road transport. Once again, policies could address the barrier of the higher initial investment cost by providing tax incentives, investment subsidies or soft loans. Another policy measure that could address transport efficiency issues is the encouragement of public transport and schemes to encourage the development of good public transport infrastructure. Where applicable using (locally produced) bio-fuel, new transport methods potentially could trigger local employment and provide a new market opportunity.

Box 2. Improving fuel efficiency in Ghana




The Energy Foundation in Ghana printed and distributed 100,000 copies of the "Fuel Wise" brochure, which was launched by the Minister of State for Economic Planning in April 2004.

The brochure provides motorists with graphic representations and easy to follow information on the steps they could take to improve fuel efficiency during transportation and save money on their fuel costs. The brochures were distributed free of charge to motorists across the country, through a collaborative effort with the Ghana Oil Company (Goil), a major oil marketing company in Ghana. The entire brochure was published in the national papers for wider coverage.

Box 2. *(continued)*

Radio interviews were also conducted on FM stations on the Fuel Wise brochure in a number of cities including Accra, Kumasi, Sunyani, Takoradi, Konongo, Techiman, Tamale, Goaso and Bolgatanga. The interviews, which were conducted in the various local languages, highlighted the educational information in the Fuel Wise brochure. Questions on energy efficiency, posed by listeners through phone calls were also answered.

The "Fuel Wise" brochure can be downloaded from the website of the Ghana Energy Foundation.

*Source:* Energy Efficiency Standards and Labelling Regulations—The Energy Foundation Ghana, www.ghanaef.org

## 4.4. Offices and buildings

Finally (public) offices and buildings offering a significant energy reduction potential, need to be mentioned as a fourth, cross-cutting category potentially covering all sectors, especially industry and households.

For the construction of new buildings, it is particularly important to consider during the planning phase the use of energy efficient construction methods, lighting and electric appliances.

When considering the renovation of existing buildings, an energy audit is recommended to point out where the main energy reduction potentials are possible and at which costs. Often relighting is worth considering. Changes in lighting systems can often pay back the cost of their installation within a year or less due to savings on the electricity bill.

Building regulations and energy performance standards can be imposed by the government, for instance for any new office with floor surface over 1000 $m^2$. In Europe, the European Union has just introduced the "EU directive on the energy performance of buildings" which aims to improve energy efficiency in the building sector. More details on this are given in box 3.

A common policy is to demonstrate and communicate how energy efficiency in buildings can be improved, followed by imposing building regulations and standards on all new office buildings (over a certain floor surface). Wherever more relevant, renovation projects may be included in the regulation.

### Box 3. The EU directive on the energy performance of buildings

*Introduction*

In 2001 there were about 178 million buildings within the 25 member States of the European Union (EU) accounting for around 41 per cent of all energy consumed within the EU. Of this, around two-thirds was consumed within homes and one-third within commercial buildings.

The biggest single requirement for this energy is for heating (and increasingly cooling) and hot water, representing around 70 per cent of domestic energy consumption and 50 per cent of commercial energy consumption.

There are two main drivers to reduce the level of energy consumed within European buildings:

1. Environmental concerns deriving from energy consumption, particularly climate change.

2. Energy security, in terms of the increasing need to import energy to meet EU demand.

The EU recognizes that energy efficiency is the single most cost-effective and publicly acceptable way of meeting its Kyoto commitments.

The European Climate Change Programme states that the EU Directive on the Energy Performance of Buildings should be able to deliver reductions of 35 to 45 million tonnes of carbon dioxide per year within the EU by 2010. This compares to the requirement under the Kyoto Protocol that the EU reduce its greenhouse gas emissions by eight per cent on 1990 levels, or by 336 million tonnes carbon dioxide per year, by 2010.

In its Green Paper "Towards a European Strategy for Energy Supply", published in June 2002, the European Commission (EC) goes further and states that if its indicative target of reductions in final energy consumption in buildings is realized, then savings of around 100 million tonnes carbon dioxide per year, which equates to a reduction of around 22 per cent can be achieved.

*Aims and objectives*

The objective of the Directive is to "promote the improvement of the energy performance of buildings within the European Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness." This is to be achieved through five main actions:

1. The creation of a general methodology following a framework provided by the Directive that can be used to calculate the energy performance of buildings. This will encompass aspects of building design, construction and services. It

Box 3. *(continued)*

will allow building designers and managers to meet energy reduction standards in a flexible and cost-effective manner, as well as incorporating simple energy indicators.

2. The application of minimum requirements, as measured by the methodology above, to all new residential and tertiary (generally public and commercial) buildings and to the major refurbishment of existing buildings with floor areas greater than 1,000 square metres.
3. The introduction of an energy performance certificate to be available whenever a building is constructed, rented out, or sold. This should include legal standards and benchmarks, as well as recommendations for cost-effective improvement of energy performance. The certificate should be displayed prominently when applied to public buildings or buildings serving large numbers of the public.
4. Regular inspection of boilers with outputs of more than 20 kW and inspection every two years for boilers of more than 100 kW. Where the boiler is more than 15 years old a one-off inspection should be carried out that covers the entire heating system.
5. Regular inspection of air conditioning systems with outputs of more than 12 kW.

*Source:* www.est.org.uk

An example of how energy efficiency policy and regulations can address different sectors is given for India in box 4. Other examples of energy efficiency policies are described in full detail in the case studies for Denmark, Flanders (Belgium), China, Republic of Korea and Japan.

## Review questions

1. Which different sectors can be distinguished for improved energy efficiency?
2. What are different policy measures that can be applied to encourage energy efficiency in these sectors?

Box 4. **Energy efficiency policies in India**

Energy efficiency is an area that did not receive due attention from policy makers in India until fairly recently. Energy Efficiency had traditionally been a subject of the Ministry of Power (MoP) and did cover electrical and industrial energy efficiency promotion. An organization to encourage and promote energy efficiency, namely the Energy Management Centre (EMC) had existed since the late 1980s but its efforts were directed towards information dissemination and awareness creation, rather than policy and regulation.

However, the central government, recognizing the importance of energy efficiency, passed the Energy Conservation Act of 2001, which came into effect from March 2002. The key provisions of the Energy Conservation Act, 2001 are the:

- Establishment of a Bureau of Energy Efficiency (BEE) to provide the policy framework and direction to the national energy conservation activities;
- Conferred power on the central Government to facilitate and enforce the efficient use of energy and its conservation;
- Conferred powers to the state governments to enforce certain provisions for efficient use of energy and conservation;
- Established financing mechanisms such as Central Energy Conservation Fund (CECF) and authorized states to set up State Energy Conservation Funds (SECF) for meeting the provisions of the Act;
- Established procedures for adjudication of non-compliance, penalties and mechanism for appeals under the Act.

The BEE is currently in the process of creating the framework for implementation of the Act and has already been carrying out the following activities:

- Currently developing regulations for a standards and labelling programme for equipment and appliances;
- Designated 14 agencies at the state level to regulate and enforce the provisions of the energy conservation Act;
- Development and implementation of a national energy conservation award scheme for industries;
- Currently developing codes for energy efficiency in buildings and establishments.

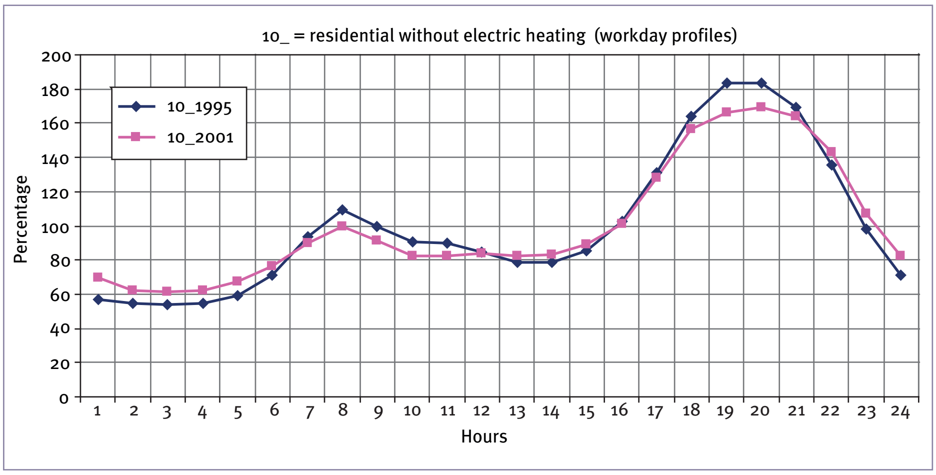
Professional accreditation and certification efforts have been made to organize the first national level examination for energy managers (all designated energy intensive industries are required to appoint an energy manager to comply with the Act).

The policy framework is expected to develop steadily as a result of the continued efforts by BEE as well as the central and state governments under the provisions of the Energy Conservation Act. It is expected that in the short to medium-term, these policies will start to show significant impact on energy efficiency and conservation.

# 5. REGULATORY OPTIONS: DEMAND-SIDE MANAGEMENT

Energy demand fluctuates throughout the day, with morning and evening periods of high usage. The figure below shows the typical load profile of a European household over 24 hours.

**Figure I. Typical load profile of a household over 24 hours**[a]




[a]"The load curves displayed are based on a large number of hourly measurements, taken in 1995 and 2001, of individual residential customers. "10_" is the identifier of the residential customer group without electric heating in Finland. These customers have a normal flat tariff, i.e. constant price. The load curves are relative values so that 100 per cent corresponds to the average hourly consumption of the day: sum of 24 hourly kWh values divided by 24." From communication with the Author on date 2 April 2007.

*Source:* Small customer dynamic pricing pilots in Denmark and Norway (EFFLOCOM-project) vs. demand response of electric heating in Finland, Seppo Kärkkäinen, VTT, DR workshop in Helsinki, April 19, 2005

Demand-side management (DSM) measures aim to increase the efficiency of energy service delivery by using opportunities, which are not being fully taken advantage of in the market. Using DSM measures electricity suppliers try to mobilize cost-effective savings in electricity and peak demand by aiming to influence the time and level of electricity used by customers. DSM essentially aims to decrease the amounts of electricity used during peak times by shifting enough demand from peak morning and evening periods into the mid-day and night-time hours, thus resulting in a constant, efficient use of electricity.

Regulators can encourage electricity suppliers to influence the time and quantity of electricity used by consumers by offering incentives. For example, the regulator can influence the tariffs that can be charged by the supplier at different times of the day, perhaps allowing the supplier to charge higher tariffs during peak hours and lower tariffs during off-peak.

Regulators can also work directly with larger consumers by offering financial assistance on investments to improve consumption patterns and reduce overall consumption through efficiency measures.

A successful DSM strategy will ultimately result in a more efficient electricity system, and therefore in significant cost savings for the provider and the consumer. The household sector is a prime target for DSM measures, as energy consumption in this sector is always rising.

Box 5. DSM in South Africa

In South Africa, the South African national utility (ESKOM), is running a DSM policy where entities improving electricity efficiency are entitled to get financial assistance, following an assessment on whether the implementation criteria are met. An energy services company (ESCO) then assists the DSM implementation.

Both upgrades to existing buildings and the incorporation of efficient systems in new buildings are targeted.

*Source:* Eskom, the major South African electricity supply company, www.eskom.co.za

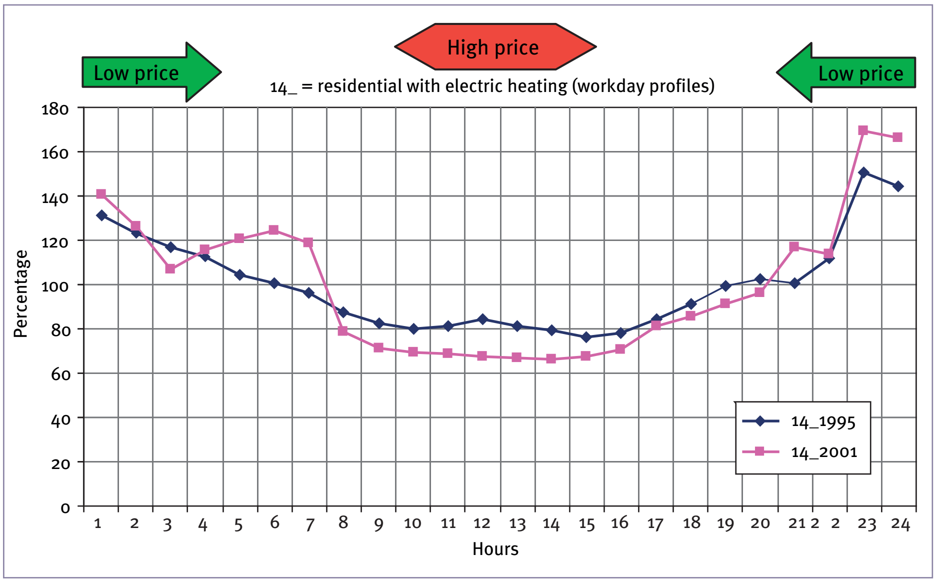
## 5.1. Design of tariffs and prices to encourage lower consumption

### Time of use tariffs

Electricity tariffs varying according to the time of use is an effective means to shift demand from peak times, by setting lower electric rates for off-peak energy use, and higher rates for peak consumption.

Electricity consumers can lower their energy bill and are as such actively encouraged to run certain appliances (e.g. washing and drying machines) off-peak (at night and on weekends) at a lower price per kWh, rather than place those demands on the utility during periods of peak energy consumption. Time of use tariffs can change the load profiles of households from that in figure 1 to that shown in figure 2.

**Figure II. Household load profile over 24 hours influenced by time of use tariffs**[a]




[a]"14_ is the identifier of the residential customer group with electric heating in Finland. These have higher annual consumption, typically 20000 kWh, and have time-of-use tariff The load curves are in relative values as in figure 1." From communication with the author on date 2 April 2007.

*Source:* Small customer dynamic pricing pilots in Denmark and Norway (EFFLOCOM-project) vs. demand response of electric heating in Finland, Seppo Kärkkäinen, VTT, DR workshop in Helsinki, April 19, 2005

China for instance was able to influence energy conservation behaviour by varying the energy price. Under the planed economy, China practised an energy quota system and energy prices were seriously distorted. Under this energy price system, enterprises and individuals lacked the motivation to save energy. From the mid 1980s, the government began to relax the energy price gradually and adopted the dual pricing system. By the mid 1990s, China's energy price had been brought close to international levels. Reform in energy price generated the motivation among enterprises and individuals to save energy and greatly stimulated energy conservation in China.

## Metering

Easy and regular access to reliable energy consumption data is an essential prerequisite for good energy management for every type of consumer. The analysis of existing metering data and consumption profiles can show where the highest and/or easiest to realize energy savings potential lies in order to direct the focus of energy efficiency measures towards certain appliances, certain periods and certain target groups.

Metering provides an effective means to raise awareness on energy efficiency, as metering data offer insight into the increase/decrease of actual energy consumption over the months/years. It is generally recognized that for instance in the household sector, there is the potential to deliver energy savings of 5-10 per cent for many customers through the use of improved feedback on energy consumption.[11]

A possible, although somewhat extreme measure is the use of budget meters, where customers get a card by which they charge their electricity meter (cf. a pay-and-go mobile phone card), according/restricted to their budget. This measure is usually imposed on customers having difficulties to manage their budget and pay their bills. Prepayment meters are offered by private electricity companies and run on the same principle. The disadvantage of these is that the price for the electricity is usually higher.[12]

As the availability of energy consumption data is a major issue for most sub-Saharan African utilities, a first set of data could be collected by distributing a questionnaire to and interviewing a representative sample of a selected target group. As this data will often not be very accurate, rules of thumb could be applied initially in order to estimate energy consumption. The questionnaire and interviews should then be repeated yearly in order to improve the quality of the data (collection) and start building historical data, which in time will enable utilities to discover trends and patterns in energy consumption.

## 5.2. Standards and labels

Policies aiming to increase energy efficient products and encourage product innovation are usually backed by the setting of standards and the establishment of labels. Standards can be applied to products and appliances in household and non-household sectors. The use of voluntary and/or mandatory standards and labels aim to remove the poorest performing appliances from the market.

An example of such a label is the EU Energy Star regulation, a voluntary energy labelling of office equipment.[13] Other appliances to consider setting efficiency requirements for are lighting ballasts, domestic hot water boilers, domestic refrigeration appliances and air conditioning systems. An example of standards setting in Sub-Saharan Africa was given in box 1 “Energy efficiency standards and labelling regulations in Ghana”.

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[11] Energy Efficiency, the UK Government Plan for Action, April 2004, www.defra.gov.uk

[12] www.energywatch.org.uk

[13] http://energyefficiency.jrc.cec.eu.int/energystar/index.htm

# 6. REGULATORY OPTIONS: SUPPLY-SIDE MANAGEMENT

## 6.1. Energy efficiency obligations

As was pointed out in the paragraph on indirect policy measures, the government can impose energy efficiency obligations on the distribution system operator. Denmark and Flanders (Belgium) offer good examples of how electricity distribution companies can play a key role in energy efficiency obligation schemes. These schemes are described in detail in the case studies on Denmark and Flanders.

In principle the same policy is thinkable for transmission system operators (TSO), although in practice this is not very common. The main difference would be the target group, as usually only large companies and organizations with significant electricity consumption are directly connected to the transmission grid.

## 6.2. White certificates

Following the experience gathered with systems using green certificates,[14] the introduction of "white certificates" (or energy saving certificates) is currently being investigated. Some European countries such as Italy and United Kingdom recently adopted a similar system, while France is preparing to do so. New South Wales (Australia) was one of the first regions to introduce a white certificate scheme as part of a Greenhouse Gas Abatement scheme.[15]

A white certificate system is a market-based policy instrument and essentially includes a target (in order to create demand), a clear definition of what the white certificate contains, and a set of certificate trading rules. Whereas demand creation and trading rules can be similar to a green certificate system, the definition of what the white certificate actually stands for needs additional clarification.

A green certificate is commonly defined as an amount (usually 1000 kWh) of electricity produced from renewable energy sources. Defining a white certificate

[14]Tradable green certificates are the means for electricity suppliers or producers to comply with the green electricity quota set by the government. The financial trigger is the fine set when not meeting the target. See module 9: "Regulatory and Policy options to encourage development of renewable energy" for a detailed description of Quota systems.

[15]For more info on the policy scheme in New South Wales, see www.greenhousesgas.nsw.gov.au/default.asp

as an amount of energy saved requires a reference point to compare with (e.g. energy consumption in a given year). The amount of energy saved can be either expressed as primary energy savings (Italy), or as saved kWh (United Kingdom).

The use of white certificates could prove a useful means to trigger more and cost effective energy savings measures in different sectors. Ultimately (cross border) trade of white certificates between grid operators could be possible. As the experience with green certificates has shown though, the establishment of cross border certificate trade faces substantial market and institutional barriers. It is therefore too early at this stage to make assumptions on how successful white certificate systems can be on national and regional level.

# 7. CONCLUSION

Increasing energy efficiency may not be as visible as renewable energy technologies, but it offers a significant energy and cost savings potential in different sectors of society.

As the possible advantages of a successful energy efficiency policy become clear to governments all over the world, a wide range of policies and regulations are currently being operated, and will continue to be updated and improved.

Any policy or regulation needs careful design taking into account the nature of the national electricity sector, the regulatory authorities involved and the targeted sector. The most important sectors to focus on are industry, households, transport and buildings.

# LEARNING RESOURCES

## Key points covered

This module covers the following key points:

- A general outline of the regulatory institutions in the electricity sector.
- The role and possible advantages of energy efficiency policies.
- The main sectors to address when designing policy and regulatory instruments to increase energy efficiency.
- The existing energy efficiency policies—experiences from Europe, Africa and Asia.

### Answers to review questions

Question 1: Which different sectors for improved energy efficiency can be distinguished?

Answer:

Industry, households and transport

Offices and buildings can be mentioned as a fourth sector, as they generally offer a high-energy savings potential.

Question 2: What are different policy measures that can be applied to encourage energy efficiency in these sectors?

Answer: Some examples are:

Industry: Obligation to reduce $CO_2$ emissions by a fixed amount, enforced by financial penalties.

Households: Direct capital grants to enable consumers to buy higher efficiency household appliances.

Transport: Encouraging public transport and improving public transport services such as buses.

Offices and buildings: Setting energy performance standards for newly-built offices over a certain size ($m^2$)

### Presentation/selected discussion

Presentation: ENERGY EFFICIENCY—Module 16 Regulation and policy options to encourage energy efficiency.ppt

Discussion question:

Given the particular situation in your country, analyse which of the mentioned sectors (industry, households, transport, offices and buildings) offers the highest energy savings potential. Apart from the potential itself, consider which sector is most suitable for policy and regulations.

## Relevant case studies

1. Japan: Overview of energy efficiency measures
2. Rational Energy Utilization Act of Korea
3. China's energy conservation policy
4. Denmark: Electricity distribution companies as key actors in energy efficiency policy
5. Flanders' (Belgium) energy savings obligations on electricity grid operators

# REFERENCES

Energy Efficiency Standards and Labelling Regulations in Ghana—The Energy Foundation Ghana, www.ghanaef.org

DSM in South Africa, www.eskom.co.za

Doing more with less, Green Paper on Energy Efficiency, DG TREN, European Commission, ec.europa.eu/dgs/energy_transport/index_en.html

Energy Efficiency Advice Centres in the UK, www.energy-advice.co.uk

National Energy Action, www.nea.org.uk

Energy Efficiency, the UK Government's Plan for Action, April 2004, www.defra.gov.uk

# INTERNET RESOURCES

African Forum for Utility Regulation (AFUR): www1.worldbank.org/afur/about-e.html

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

Independent Pricing and Regulatory Tribunal of New South Wales—Australia: www.ipart.nsw.gov.au

International Energy Agency Demand-Side Management Programme—Strategic Plan 2004-2009: dsm.iea.org

Energy Savings Trust, United Kingdom: www.est.org

Sunseed Tanzania Trust: www.sunseedtanzania.org

Tanzania traditional energy development and environment organization (TaTEDO)—for information on improved cookstoves: www.tatedo.org

# GLOSSARY/DEFINITION OF KEY CONCEPTS

| | |
|---|---|
| *Clean development mechanism* | The clean development mechanism (CDM), being one of the flexible mechanisms within the Kyoto Protocol, is designed to possibly meet the needs of both developing and industrialized countries, by helping to solve non-Annex I countries, needs for capital to finance the technology transfer of clean, energy efficient technologies for economic development and for addressing environmental issues such as loss of biodiversity, while also providing a lower cost, more flexible alternative for annex I countries to meet emissions reduction targets. |
| *Energy savings obligations* | Systems where electricity suppliers or distributors are obliged to undertake energy efficiency measures for final users. |
| *Distribution system operator* | The authority in charge of the operation of the electricity distribution grid within a given region/area. The distribution of electricity is to serve end consumers and normally takes place at lower voltage (under 110 kV). |
| *Energy savings obligations* | Systems where electricity suppliers or distributors are obliged to undertake energy-efficiency measures for final users. |
| *Metering* | The process and methods of utilizing devices to measure the amount (and direction) of electrical energy flow, particularly for end-use. |

| | |
|---|---|
| *MOP* | MOP is the Supreme Body of the UNFCCC's Kyoto Protocol and an acronym for Meeting of Parties. The first Meeting of Parties to the Kyoto Protocol was held during the 11th Conference of Parties (COP) in Montreal in December 2005 since the Protocol's entry into force in February 2005. |
| *Transmission system operator* | The authority in charge of the operation of the electricity transmission grid within a given country/region. The transmission of electricity normally takes place at high voltage (110 kV or above). |
| *White certificates* | Tradable certificates containing a defined amount of energy saved. |

# Case study 1.

# JAPAN: OVERVIEW OF ENERGY EFFICIENCY MEASURES

## CONTENTS

# 1. BACKGROUND

Through the energy efficiency efforts of the government and the public, Japan has achieved the highest level of energy efficiency anywhere in the world since the oil crises of the 1970s. However, the weakness of Japan's energy supply structure remains unchanged, and the level of dependency on Middle East crude oil is higher now than at the time of the oil crises. With the tendency of increased of energy consumption in the commercial, residential and transportation sectors in recent years, the promotion of effective and consistent energy efficiency measures in the future remains essential.[1]

# 2. LEGAL FRAMEWORK FOR ENERGY EFFICIENCY

## 2.1. The Energy Conservation Law

Japan's Law Concerning the Rational Use of Energy (Law No. 49), which was enacted 1979, and amended in 1999 and 2005, (also referred to as the "Energy Conservation Law") and the underlying Enforcement Ordinance, Enforcement Regulations, and Evaluation Criteria, establish mechanisms to promote the efficient use of energy in "energy-using" equipment, buildings, factories, and machinery.

Among other things, the Law and related implementing measures establish energy efficiency targets for covered items powered by electricity and combustible fuel. These targets are calculated using a complex formula. This formula essentially measures, for each category of covered items, the average energy consumption efficiency weighted according to the shipped number of the covered items in the category.

In addition, the Law Concerning the Rational Use of Energy specifies energy efficiency labeling for certain manufactured and imported products.

[1]Agency for Natural Resources and Energy, Japan, www.enecho.meti.go.jp

## 2.2. The Energy Conservation Assistance Law

The Law Concerning the Rational Use of Energy and Recycled Resources Utilization, enacted in 1993 and also known as the “Energy Conservation Assistance Law”, sets out financial incentives for energy conservation in the form of:

- Low-interest financing;
- Industrial improvement bonds;
- Tax exemptions

This is to support approved voluntary efforts by business operators and building owners for energy conservation (this law has since been surpassed by the Law Concerning the Rational Use of Energy, mentioned above). These incentives facilitate the realization of the energy efficiency initiatives described under the Law Concerning the Rational Use of Energy.[2]

The latest revision of the Energy Conservation Assistance Law was in 2002. The main measures for each sector are summarized below:

**Factories** (of a given energy consumption—as designated by the government):

- Obligatory energy manager for each factory;
- Medium to long-term plans for rational utilization of energy;
- Regular (annual) reporting to the Government on energy consumption;
- Energy consumption targets;
- Training courses and examinations for energy managers.

**Buildings**

- All owners of new buildings are responsible for energy efficiency measures to reduce heat loss and are to ensure efficient use of air conditioning equipment;
- Energy standards for buildings.

**Machinery and Equipment**

- Call for efforts by manufacturers to improve equipment energy performance;
- Standards for machinery (manufactured and imported);
- Product labelling—energy consumption efficiency.

[2]Energy Efficiency in Japan, www.eiatrack.com

More general measures called for in the law are:

- Budgetary, financial, tax measures to promote the rational use of energy;
- Promotion of science and technology helpful to rational use of energy, supporting research and development;
- Measures for increasing public awareness;
- Penalties for non-conformance with standards or limits on energy consumption.

This law also assigned some responsibilities in the area of energy efficiency and conservation to the New Energy and Industrial Technology Development Organization (NEDO) including development of technology for the rational use of energy to be used in industry in particular, provision of subsidies for the introduction and diffusion of new technologies and provision of guidance on the collection, and distribution of information regarding the rational use of energy.

Box 1. **The Top-Runner Scheme**

The Top-Runner Scheme was introduced in the Amended Law Concerning the Rational Use of Energy, which was passed in the Diet and went into force in April 1999. When the law was amended in 1999, the Top-Runner programme was introduced to replace the existing energy-efficiency standards.

While the energy-efficiency standards were set at a level slightly above the average of the energy efficiency of each product, under the top-runner programme the best performing items in their category in the market set the minimum standard for a target year.

The programme originally covered 11 items, and has since been extended to 18 items including cars, refrigerators, air conditioners, televisions, copy machines, etc. If a company cannot achieve the target by a target year, then its name and the product name are made public, and a fine has to be paid. However, compliance is evaluated not based on each product, but on products in the same category.[a]

The Top-Runner Scheme has significantly contributed to energy conservation of machinery and equipment in Japan. It worked especially well for gasoline passenger cars. The reasons for success include the following:

- A market mechanism is the driver for the scheme;
- Not too harsh penalties made it possible to set very high targets;
- Works best when combined with tax incentives (as in the case of green taxes for passenger cars)

In the future, there is a need to create better awareness among consumers of the scheme and the products contained within it so as to make it more effective.

[a]Current Japanese Climate Policy from the Perspective of Using the Kyoto Mechanisms, www.iges.or.jp

# 3. MAIN POLICIES FOR ENERGY EFFICIENCY

## 3.1. Fundamental policies for rational use of energy (1993)

These fundamental policies were adopted by the cabinet meeting of the Ministry of International Trade and Industry. These policies were aimed at the promotion of the rational use of energy in factories, workshops, buildings and for machines, etc. Apart from specific measures relating to these areas the policies also covered:

- Measures to be adopted by the central and local governments themselves as energy users, etc.;
- Support to capital investment, etc.;
- Support to energy management;
- Support to technical development;
- Support to the introduction and diffusion of optimum energy supply-demand systems in areas;
- Promotion of research and development, etc.;
- Education, public relations, etc. to people.

## 3.2. Establishment of NEDO

The New Energy and Industrial Technology Development Organization (NEDO) was established by the Japanese Government in 1980 to develop new oil-alternative energy technologies. Eight years later, in 1988, NEDO's activities were expanded to include industrial technology research and development, and in 1990, environmental technology research and development. Activities to promote new energy and energy conservation technology were subsequently added in 1993. Following its reorganization as an incorporated administrative agency in October 2003, NEDO is now also responsible for R&D project planning and formation, project management and post-project technology evaluation functions.

# 4. REFERENCES

Agency for Natural Resources and Energy, Japan, www.enecho.meti.go.jp

IEA, Policies and Measures, www.iea.org

Electronic Industries Alliance, Energy Efficiency in Japan, www.eiatrack.com

IGES, Current Japanese Climate Policy from the Perspective of Using the Kyoto Mechanisms (2005), www.iges.or.jp

Impact of Top Runner Scheme on Improvement of Fuel Economy, Shinsuke Ito, Automobile Division, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry, 22 October 2005.

# Case study 2.

# RATIONAL ENERGY UTILIZATION ACT OF KOREA

## CONTENTS

# 1. BACKGROUND

The Republic of Korea has a thriving public sector energy conservation programme that encompasses not only its national government, but also city and state governments and public corporations. Its various initiatives are carried out both by government agencies (e.g. the Ministry of Commerce, Industry, and Energy) as well as by the government-chartered Korean Energy Management Corporation (KEMCO). A big boast to Korea's effort was the 1995 revision of the Rational Energy Utilization Act (originally promulgated in 1979.) While some of Korea's initiatives predate the revision, it both created new programmes and strengthened existing ones.[1]

# 2. RATIONAL ENERGY UTILIZATION ACT OF KOREA

The Rational Energy Utilization Act, passed in 1995, stated the responsibilities of central government, local government, end-users and suppliers, manufacturers and citizens.

## 2.1. Setting out a national energy plan

The Act stated that there would be a five-year basic national energy plan with a period of 10 or more years. The plan would include the following matters:

- Possible transitions and prospects of the domestic and foreign situation on the demand and supply of energy;
- Measures for a stable security and supply of required energy;
- Measures for the utilization of the energy with environmental affinity;
- Measures for the rationalization of energy utilization and carbon dioxide emissions reduction through the rationalization of energy utilization;
- Measures for promoting the development and dissemination of energy related technology;

[1]www.pepsonline.org/index.html—Accessed 29 September 2006.

- Measures for international harmony and cooperation energy and energy related environmental policy;
- Other matters which are deemed necessary by the Minister of Commerce, Industry and Energy for attaining the goal of the national energy policy.

## 2.2. Creation of KEMCO

The Act also created the Korea Energy Management Corporation (KEMCO) with responsibility for carrying out the following projects:

- Driving forward of the projects for rationalization of the energy utilization;
- Development, introduction, guidance and dissemination of energy technology;
- Loan and support funds for the rationalization of the energy utilization, development and dissemination of substitute energy and mass energy supply projects;
- Energy audits and guidance on energy management;
- Promotion of substitute energy development projects;
- Investigation, research, education and public information for energy management;
- Acquisition, installation, operation, lease, and transfer of land, buildings and facilities, etc. for projects focusing on the rationalization of energy utilization;
- Mass energy projects;
- Efficiency management of energy using machinery and materials, and safety control of heat using machinery and materials.

## 2.3. Other measures for energy efficiency

Other measures provided for in this act included:

- Demand-side management investment plan for energy suppliers;
- Management and publication of energy statistics;
- Measurement of energy consumed;
- Public awareness and education;
- Finance, taxation, subsidies to promote the rational use of energy;
- Energy management standards;
- Energy technology development plan;
- Penalty measures.

# 3. ENERGY EFFICIENCY PROGRAMMES

Three programmes that emerged from the 1995 Act are particularly notable. These will be examined below one by one.

## 3.1. Prior Consultation on Energy Utilization Planning Programme

The Prior Consultation on the Energy Utilization Planning Programme, begun in 1993, aims to affect energy-related projects such as the construction of new public buildings or the extension of railway systems. The goal is to influence these projects while they are still in the planning stages. By the end of 2001, the programme had impacted 245 projects, promoting the installation of energy-efficient equipment and systems, as well as larger-scale (e.g., cogeneration) and renewable energy installations. Currently, the six-member staff is trying to broaden the programme's reach through the use of financial incentives and "on-the-spot" assistance to promote highly energy-efficient designs.

## 3.2. Energy Conservation Guideline for Public Institutions

The Energy Conservation Guideline for Public Institutions, started in 1997, directs the creation of annual energy conservation plans, including reduction targets, by public organizations. One element is an efficient public building code requiring the installation of energy-efficient systems and equipment in new public buildings. Transportation energy is addressed by a "Voluntary 10 per cent Reduction Programme," as well as the purchase of higher-efficiency government cars. Also urged is the use of ESCOs to address existing buildings. Among the sites affected were the 2002 World Cup stadiums in Seoul, where energy-efficient motors, transformers, and lighting were installed, and heat was supplied through landfill gas. Another success is the Gwachun Government Complex, where an investment of $US 180,000 in efficient fluorescent lighting is saving $US 100,000 annually.

## 3.3. Energy-Saving Product List

In the purchasing arena, Korea maintains an "Energy-Saving Product List" that includes both products that fall under Korea's national energy information labeling programme, like clothes washers and cars, as well as energy-using products that hold the Korean endorsement label for being more efficient than others of the same type. In all, 55 product types are covered. Public sector purchasers are required to buy models with the endorsement label, which covers 43 classes of products.

## 4. REFERENCES

Promoting an energy-efficient Public Sector (PePS) is a collaborative effort funded by multiple sources to promote and assist energy conservation programs in governments around the world. www.pepsonline.org/index.html

# Case study 3.

# CHINA'S ENERGY CONSERVATION POLICY

## CONTENTS

# 1. BACKGROUND

## 1.1. Strategic importance of energy conservation in China

Population control, efficient utilization of limited resources and environmental protection have been taken as fundamental policies by the Chinese government to safeguard sustainable social economic development. From 1980 to 1998, the annual GDP growth rate in China reached 9.9 per cent, while consumption of primary energy only grew by 4.9 per cent annually.

The strategic importance of energy conservation in China can be summarized as follows:

### Effectively relieve future energy demand and supply pressure

Stimulated by population growth and rapid economic development, future energy demand in China is expected to increase greatly leading to increasing energy supply pressure. Without effective energy efficiency measures, energy shortages will become a severe constraint for future economic development. If by 2020 China's energy efficiency level can be raised to the present advanced international level, energy demand could be reduced by 8-9 per cent by 2020 and 13-15 per cent by 2050. This will significantly reduce future energy supply pressure and facilitate sustainable economic growth.

### Relieve regional and global environmental pressure

In 1995, China's $CO_2$ emissions were 800 million tons ranking second in the world. Under business as usual, $CO_2$ emissions will surpass the United States in the next 20 years, with China becoming the largest emitter in the world. China will, thus, inevitably become a focal point for world $CO_2$ emission reductions.

On the other hand, China also faces serious environmental pressure from within. Environmental degradation from $SO_2$ resulting in acid rain, soil acidification and forest destruction has become a serious concern. Currently, one third of China's land area has been affected by acid rain to various degrees. Without effective $SO_2$ emission control measures, $SO_2$ emissions will increase from the present 17 Mt to 60 Mt by 2020. This will lead to even more severe acid rain and soil acidification problems further increasing agricultural and forest destruction. Research proves that energy efficiency improvement is the most practical and cost effective means to reduce $CO_2$ and $SO_2$ emissions. It is, therefore, concluded that energy efficiency strengthening and improvement can effectively reduce future energy demand, directly reduce $SO_2$ and $CO_2$ emissions and relieve domestic and international environmental pressures as well as promote future economic growth in an environmental sustainable manner.

## Increase economic competitiveness

It has been calculated that overall energy efficiency level in China was 32 per cent in 1997 being 10 percentage points lower compared to advanced international levels. In 1997, the share of  total energy cost to GDP was 12 per cent being 5 and 9 percentage points higher than the US and Japan respectively. Energy consumption in China is dominated by industry accounting for more than 70 per cent of the total. Of the total industrial energy consumption, energy intensive subsectors such as mining, power generation and heating supply, iron and steel, non-ferrous metals, building materials, chemicals, oil refinery and coke making account for more than 70 per cent of the total. Currently, energy cost accounted for >25 per cent, 40-50 per cent, 70-75 per cent, and 40 per cent of the total production cost for the iron and steel, building materials, fertilizer, and petrochemicals industries respectively.

For the short-term, energy conservation and cost reduction will facilitate the smooth reform of large state-owned enterprises. From a long-term point of view, energy conservation can also increase overall national economic efficiency and competitiveness in China in the context of increasing globalization.

## Reducing dependence on international energy market

For a considerably long period of time, China has been relying on domestic energy resources in order to maintain energy security. Globalization provides China with the opportunity to utilize both domestic and international markets as well as resources. However, in seeking additional energy resources from the international market, China has to face the uncertainties of the international energy market. Experts estimated that by 2020, oil imports in China could reach 140 Mt and as much as 400 Mt by 2050. Energy efficiency improvement can reduce energy demand and lead to lower dependency on the international energy market.

# 2. ENERGY CONSERVATION EXPERIENCES AND EVOLUTION OF ENERGY CONSERVATION POLICY REGULATION

## 2.1. Evolution of energy conservation policies

China began to pay great attention to energy conservation in the late 1970s in the context of domestic energy shortages and international oil crises. Under a centrally planned economy at that time, the government mainly adopted a top-down approach through administrative measures to promote energy conservation. The main characteristics of energy conservation management by the government were through a fixed energy supply and energy quota management system.

In 1981, the then State Economic Commission, State Planning Commission and the State Energy Commission jointly promulgated the Regulations on Energy Conservation for Enterprises and Cities which laid the foundation for energy conservation during this period. The regulation for the first time standardized energy conservation work making requirements for the establishment and strengthening of energy conservation management institutions. Specific requirements were also made for enterprises to install energy-measuring instruments, conduct thermal balance measurements and to conduct energy conservation propaganda and training. The regulation also stipulated an energy bonus system and put forward energy efficiency targets for industrial boilers, kilns and other general electric appliances and in particular made higher requirements for reducing direct oil burning.

An important milestone was the promulgation and implementation of the Provisional Regulations for Energy Conservation Management by the State Council in 1986. The Regulation made specific provisions on energy conservation management systems, energy supply and utilization, energy conservation technological advance, energy consumption and penalties and award measures. Under the centrally planed economic system, the regulation was implemented fully by various sectoral and regional authorities. These authorities also formulated detailed rules following the promulgation of the Provisional Regulation. The regulation played significant roles in energy conservation in the following decade and beyond.

In order to improve energy conservation management standards, energy utilization efficiency and reduce product energy consumption in enterprises, energy conservation management upgrade (grading) activities were conducted in enterprises. The state authority in charge of energy conservation formulated the Regulation for Enterprises Energy Conservation Management Upgrading (Grading). Many sectors also formulated their respective Enterprise Energy Conservation Management Upgrading (Grading) Methods putting forward specific energy consumption targets for enterprises of different grades. These upgrading (grading) activities were conducted in almost all enterprises. Enterprise upgrading activities had a significant impact in enterprise energy conservation work.

From 1986 to the early 1990s, enterprises in China generally practised the energy conservation bonus system. Enterprises could allocate certain amount of funds in proportion to an energy conservation volume and award energy conservation operating and management staff. This practice greatly motivated the initiatives of the enterprises and employees increasing their awareness and strengthening energy conservation management.

In the 1990s, deepening economic reform, and the transformation of the function and operation of government within enterprises, resulted in enterprises becoming the main business operating entities. It is no longer practical to carry out energy conservation administration using the previous practices. In view of the new changes in the national economy, the Government began to adopt market mechanisms, implement market-based energy conservation projects, explore market-based incentive policies for energy conservation as well as strengthening energy conservation information dissemination and international cooperation.

In November 1997, the Chinese government promulgated the Energy Conservation Law and it into effectiveness on the 1 January 1998. The Energy Conservation Law made provisions for energy conservation administration, the rational use of energy and the promotion of energy conservation technology advances. Currently, the central government and the local and sector authorities are formulating supporting regulations for the implementation of the Energy Conservation Law. In November 1998, the China Energy Saving Product Certification Administration Committee and the China Energy Saving Product Certification Administration Centre were established and formulated the China Energy Saving Product Certification Administration Method. In March 1999, the government issued the Administration Method for Key Energy Consuming Units. This resulted in the List of Key Energy Consuming Units, which was published in August of the same year. To date, Shanghai, Zhejiang, Shandong, Beijing and Shanxi have formulated their respective Energy Conservation Regulation and Implementation Methods.

In addition, in order to standardize the management system and energy consumption behaviour, the State has promulgated a range of policies and regulations. Other laws and regulations relevant to energy conservation include the Electricity Law, Coal Law, Law of Mineral Resources and the Law on Atmosphere Pollution Prevention etc.

By the end of 1998, at the central government level alone, a total of 25 energy conservation regulations and provisions, 27 energy conservation design codes, nearly 100 national standards on energy conservation had been issued. Over the years, the government has also made announcements to popularize 18 batches with a total of 1068 energy saving products as well as to eliminate 17 batches with a total of 610 energy inefficient products.

In view of the new changes in the national economy emerged in recent years, government intervention in the national economic activities is gradually shifting from past control and command to relying on market-based measures. More attention is being focused on strengthening macro control, structural adjustment and upgrading and improving economic operating quality and benefits. The objective of formulating energy conservation plans has also shifted away from meeting short-term energy supply shortages. Instead, formulation of the energy conservation plan is to meet the requirement of medium to long-term socio-economic development for energy through energy structure optimization, control of energy efficiency for newly increased production capacity and the technical renovation of existing facilities.

## 2.2. Energy management systems

In the 1980s, China established one of the most extensive energy conservation management systems. At the central government level, the State Council established the working meeting system to study and decide on key national energy conservation issues. Energy conservation management organizations were also established by the SETC, SPC, local and sectoral authorities to organize and implement various energy conservation management work. Key energy consuming enterprises also established energy conservation units and allocated specific personnel to monitor and manage energy use within the enterprises. In addition, more than 200 energy conservation technical service centers were also established nationally to provide technical services, energy auditing and information services to enterprises.

## 2.3. Formulating preferential economic policy and providing special fund for energy conservation

In the 1980s, the State practised various preferential economic policies to promote energy conservation. These policies included low interest rate loans, loan payment before tax, three-year product tax and value-added tax exemption for new energy conservation products, import duty reduction and exemption for energy conservation technology and equipment introduction. The state budget made special allocation for an energy conservation infrastructure construction fund and an energy conservation technical renovation fund. These special funds enjoyed the preferential policy of reduced interest loans and loan payments before taxation.

1. The Energy Conservation Infrastructure Construction Fund: The fund was allocated from the state budget and the state established the national-level Energy Conservation Investment Corporation to manage the energy conservation infrastructure fund. The fund was undertaken by the China Construction Bank, the Commercial and Industry Bank of China and China Agricultural Bank. In the 1980s, the fund was provided through preferential interest rate and a differential interest rate in 1991-1993 before being cancelled in 1994.

2. The Energy Conservation Technical Renovation Fund: This fund was raised by the government through a 30 per cent depreciation collected from enterprises. Before 1988, the fund was provided to enterprises in the form of grants and was subsequently changed to low-interest rate loans afterwards. The energy conservation technical renovation fund was undertaken by the Industrial and Commercial Bank of China and was administrated by the State Economic and Trade Commission. In 1998, the fund was merged into the general technical renovation fund.

3. In addition, local authorities also established similar funds to support important energy conservation infrastructure construction and technical renovation projects in their respective regions.

Overall, from 1981-1998, total energy conservation investment reached 136.3 billion Yuan ($US 17.6 billion), of which 27 per cent was from the central Government.

Table 1. Energy conservation investment from 1981-1998

| | Total investment ($10^8$ Yuan/$10^8$ USD) | Of state grant and loans | Local and enterprise fund | EC Capacity formed ($10^4$tce*) |
|---|---|---|---|---|
| State ECIC* Fund | 615/79 | 265/34.21 | 350/45.19 | 4580 |
| State ECTR* Fund | 194.75/25.14 | 106.39/13.73 | 88.36/11.41 | 4462 |
| Societal ECTR* investment | (748.01/96.57) | | (64.62/82.83) | |
| Total | 809.75/104.54<br>(163.01/175.96) | 371.39/47.95 | 438.36/56.59<br>(991.62/128.02) | 9042 |

*Note:* EC stands for Energy Conservation, ECIC for Energy Conservation Infrastructure Construction, ECTR for Energy Conservation Technical Renovation. Estimated in US Dollar is based on the exchange rate dd. 26 February 2007, Chinese yuan to US Dollar = 0.1291.

*1 ton coal equivalent (tce)

## 2.4. Using energy price to influence energy conservation

Under the planned economy, China practised an energy quota system and the energy price was seriously distorted. Under this energy price system, enterprises and individuals lacked the motivation to save energy. From the mid 1980s, the Government began to relax the energy price gradually and adopted the dual pricing system. By the mid 1990s, China's energy price had been brought close to international levels. Reform in energy prices generated the motivation among enterprises and individuals to save energy and greatly stimulated energy conservation in China.

## 2.5. Promoting industrial technological structure advance

These measures included:

- Closing down outdated factories and eliminating highly energy consuming techniques;
- Technical renovation of existing factories;
- Developing, introducing and disseminating advanced production and energy saving technologies;
- Energy conservation propaganda and training;
- Phasing out outdated mechanical and electrical products and disseminating advanced products;
- Fostering the development of an energy conservation technical and service market;
- Organizing and promoting important energy conservation system engineering projects.

Some of the important energy conservation projects are:

### China Green Lights Programme

In 1996, the Chinese government initiated the China Green Lights Programme with the aims of promoting efficient lighting products, reducing lighting electricity consumption, facilitating the development of a Chinese lighting equipment manufacturing industry, increasing enterprise competitiveness and protecting the environment.

## China Energy Conservation Project

China Energy Conservation Project is a cooperative project between the World Bank/GEF and the Chinese government to support China adopting, demonstrating and disseminating market-based performance contracting mechanisms for energy conservation. The China Energy Conservation Project includes the following three major components:

- Energy management company (EMC) demonstration;
- Energy conservation information dissemination;
- Project management.

In order to further disseminate the performance contracting mechanism in China, the Chinese government and the World Bank are discussing to initiate the second phase for the project. In the second phase, the performance contracting is to be disseminated widely in China and more new EMCs will be established. In addition, the project will also seek the participation of the domestic financing sector to provide financing for the EMCs to implement energy conservation projects.

## Developing combined heat and power (CHP)

In order to promote the development of combined power and heat, the State Planning Commission issued the directive "Notice to Prepare Urban Combined Heat and Power Plan" in 1997 requesting local authorities to develop CHP plans. In 1998, the State Planning Commission, State Economic and Trade Commission, the Ministry of Electric Power and the Ministry of Construction jointly issued Regulations to Promote Combined Heat and Power Development. The regulation stipulates technical guidelines for newly built and expanding CHP. All newly built and expanding CHP facilities meeting the technical requirement enjoy the preferential policy of free grid connection.

In addition, China is also actively implementing DSM[1] and IRP[2] demonstration projects and has made experimented in the power grid of Shenzhen, Shanghai, Beijing, Liaoning, Fujian and Shengli Oilfield. A DSM Centre has also been established by the State Power Corporation.

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[1]Demand-side management (DSM) measures aim to increase the efficiency of energy service delivery by using opportunities which are not being fully taken advantage of in the market; using DSM measures requires special programs that try to mobilize cost-effective savings in energy usage and peak electricity demand.

[2]Integrated resource planning (IRP) is a planning process for electric utilities that evaluates many different options for meeting future electricity demands and selects the optimal mix of resources that minimizes the cost of electricity supply while meeting reliability needs and other objectives.

# 3. ENERGY CONSERVATION ACHIEVEMENTS

From 1981 to 1998, a total of 2300 energy conservation infrastructure construction projects were implemented forming a combined annual energy saving capacity of 45.8 Mtce (371 GWh).[3] These projects include:

- Important energy conservation projects;
- Energy conservation demonstration projects;
- Energy efficient fans and pumps leasing;
- Comprehensive utilization and environmental protection projects;
- Energy conservation industry development projects;

Examples include: the reconstruction of the national economic structure (i.e. industry, sector and product adjustments) and the enhancement of energy management, the construction of new large-scale power generation units, cogeneration for district heating and the retrofitting of power grids in urban and rural areas.[4]

The state invested 19.5 billion yuan ($US 2.52 billion) in the energy conservation technical renovation special fund between 1981 and 1998 and formed a combined annual energy saving capacity of 44.6 Mtce (361 GWh). These include:

## Technical renovation projects

Key projects in this category mainly included waste heat utilization and power generation, industrial boiler and heat supply system renovation, kiln renovation, renovation and transformation of old and low efficiency equipment, clean combustion technology, green lighting etc.

## Material conservation

This has formed a conservation capacity of 400,000 tons of steel and 20,000 tons of non-ferrous metal per year, with a total investment of 1.14 billion yuan equivalent to an energy saving capacity of 1.40 Mtce/year (11 GWh).

[3] One ton of coal equivalent (tce) = $0.7 \times 10^{7}$ kcal = approximately 8100 kWh (1 kWh = 3.6 MJ = 859.8 kcal)
[4] Economic Development and Energy Issues in China, Wei Zhihong, March 2004

## Comprehensive utilization

This mainly includes the utilization of power station fly ash, coal gangue, waste plastics and glass etc. Total investment for these projects amounted to 2.245 billion yuan ($US 0.29 billion) resulting in an annual energy saving capacity of 4.30 Mtce or 33.8 GWh.

The achievements of energy conservation in China can be summarized as follows:

## Safeguarding rapid economic growth

China's GDP grew at an annual rate of 9.87 per cent between 1980 and 1998 whereas increase in primary energy consumption only increased by 4.87 per cent per year. Energy elasticity for the same period was only 0.48 indicating that nearly half of the energy required to support economic development was from energy conservation.

## Greatly increased energy productivity

From 1981-1998, per GDP energy consumption decreased from 7.98 tce/104 yuan to 3.24 tce/104 yuan[5] decreasing by 59 per cent. In the same period, unit energy productivity increase by 144 per cent from 750 yuan/tce to 1828 yuan/tce.

## Reducing the unit product energy consumption gap between China and International level

From 1980-1997, the gap in specific energy consumption for thermal power supply decreased from +32.5 per cent to +25.8 per cent and for steel production it reduced from +70 per cent to +49 per cent.

## Achieving great economic benefit

From 1980 to 1998, China achieved a cumulative energy saving volume of 834 million tce. Based on the 1997 end-use energy price of 945 yuan/tce, energy saving

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[5]For a better understanding, these figures were converted in Wh/USD, using estimates. The sentence then reads: "From 1981-1998, per GDP energy consumption decreased from 0.07Wh/USD to 0.03Wh/USD, decreasing by 59 per cent." The following conversions were used: 1 ton of coal equivalent (tce) = 0.7×107kcal = approximately 8100 kWh (1 kWh = 3.6 MJ = 859.8 kcal). Estimate in US Dollar (USD) is based on the exchange rate dd. 26 February 2007, Chinese yuan to USD = 0.1291. 13.43 USD.

generated an economic benefit of 788.4 billion yuan. Average annual energy conservation volume in China reached 46.3 Mtce from 1981-1998. In 1997, investment required for new supply capacity was 5702 yuan/tce. Based on this, reduction in energy supply investment amounted to 264.2 billion yuan ($US 34 billion).

### Environmental benefit

Based on the cumulative energy saving volume and the emissions factors for 1995, energy efficiency improvement and energy conservation led to reductions of 526 Mt of $CO_2$ emissions and 15.1 Mt of $SO_2$ emissions.

## 4. FUTURE DEVELOPMENT TREND

Overall, in order to meet the requirements of the future, the Chinese energy conservation policy will have the following characteristics:

- Reliance on market mechanisms and strengthen the macro control and adjustment of the government;
- In terms of the overall socio-economic development plan, the policy is to guide the establishment of rational end-use demand structures to enable the development of industrial structures in a energy efficient and environment friendly direction;
- Creation a level playing field between energy development and energy conservation and provide energy conservation incentive policies to overcome market barriers for energy efficiency investments—in order to fully implement the policy of energy conservation, this being the priority;
- Formulation guiding and compulsory regulations and rules which can be easily implemented and monitored to internalize energy conservation benefits;
- Formulation and implementation energy conservation and environmental protection through comprehensive technical, informational and energy efficient engineering projects to promote technical advance and optimal resource allocation;
- Promotion of the development of an energy conservation investment market.

# 5. REFERENCES

*Status Report on Energy Efficiency Policy and Programs in China*, Energy Analysis Department, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory (December 1999)

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# Case study 4.

# DENMARK: ELECTRICITY DISTRIBUTION COMPANIES AS KEY FACTORS IN ENERGY EFFICIENCY POLICY

## CONTENTS

# 1. BACKGROUND

Denmark has a long history when it comes to proactive government energy policies. The leading role Denmark has played in renewable energy, especially during the eighties and the nineties, has been an example for the rest of the world and was extensively documented. Besides its pioneering role in renewable energy, Denmark has been running an ambitious policy on energy efficiency.

Policies on energy efficiency include stringent building codes, the public sector setting an efficiency example, an extensive combined heat and power and district heating network, high taxes on energy and negotiated agreements with industry.

The following will focus on the current government-induced energy efficiency programme through the electricity distribution companies.

# 2. KEY ROLE FOR ELECTRICITY DISTRIBUTION COMPANIES

The Danish Government recently introduced legislation by which electricity distribution companies are to play a key role in reaching the energy efficiency target.

Since 1994 legislation has been in place that sets Danish electricity distribution companies (EDC), to be the companies responsible for maintaining the low voltage distribution grid, and to promote energy efficiency as part of their public service obligation. So far this initiative has brought measurable savings in consumption of 0.5 per cent per year, keeping Danish energy consumption static since 1980, despite economic growth of around 3 per cent over the last decade.

In June 2005 the Danish Government agreed to increase the goal for energy savings to 1 per cent per year from energy efficiency activities, representing a saving target of 7.5 Peta Joules (PJ) per year during the period 2006-2013.

The programme allocates a certain amount of demand reduction to each EDC, whereby the way to achieve the actual reduction is up to the EDC to decide. As the money provided to the EDC remains the same as before, but the target increases, there is a strong incentive to reduce costs and achieve the goals in the most cost effective way.

## 3. WHITE CERTIFICATES

The use of tradable energy efficiency certificates (white certificates) might offer an additional way to increase cost efficiency. Similar to green certificate systems, the government puts in place a quota and a fine in order to create a demand for certificates, but leaves it upto the market players to choose where (location and target group) and how (type of technologies and appliances) to develop projects, assuming the most cost effective projects will be realized. As the white certificates would be tradable, an EDC could decide to realize its own projects, or to buy white certificates on the market, depending on which option is expected to be cheaper.

## 4. ANALYSIS

The major possible obstacle to an energy target imposed on EDCs is the possible complexity of the system and the methodology and standards to be determined to measure the savings (as well as the associated monitoring and evaluation aspects) of each proposed action. A calculation methodology, which is as clear and simple as possible, will be a prerequisite for a well-functioning system.

Moreover, when considering the cross border trade of white certificates, methodologies will need to be mutually recognized by both importing and exporting countries. As well as other aspects of White Certificates, the Euro WhiteCert project is looking into this issue.

The expected evolution for Denmark in the near future is a sort of exchange facility for energy savings to emerge in some form. In the short-term, it is rather unlikely a white certificate system as described would be implemented.

## 5. CONCLUSIONS

Energy savings policies are generally cheaper than renewable energy policies when it comes to reducing $CO_2$ emissions. On the other hand, energy savings projects are usually small-scale (household or building level) projects, and therefore ECDs can play a key role as an intermediary between different target groups.

As savings calculations and evaluation methodologies tend to become complex, it will be crucial for governments to keep these as clear and simple as possible. Finally the introduction of white certificates might offer an effective means to further develop energy reduction potential through the most cost-effective measures.

# 6. REFERENCES

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IEA, *Energy Efficiency the Danish Way, Newsletter of the International Energy Agency Demand-Side management programme,* (July 2006), dsm.iea.org

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# Case study 5.

# FLANDERS' (BELGIUM) ENERGY SAVINGS OBLIGATIONS ON ELECTRICITY GRID OPERATORS

## CONTENTS

# 1. BACKGROUND: LEGAL FRAMEWORK

The Flemish Parliament Act of 17 July 2000 and the Decree of 29 March 2002 imposes Rational Use of Energy (RUE) public service obligations on the electricity grid operators. A primary energy saving target for end users every year was defined as follows:

- Low voltage clients (< = 1000V)
  - 1 per cent of the electricity supplied for the year 2003
  - 2 per cent and 2.1 per cent for the years 2004 and 2005
  - 2.2 per cent for the calendars years 2006 and 2007
- High voltage clients (> 1000V)
  - Target of 1 per cent each year

# 2. THE RUE ACTION PLAN

Each grid operator needs to put together and submit a plan with RUE actions for the next year each year before 1 June. These actions must contain the following information:

- The proposed financial support (e.g. premium);
- Proposal for the calculation of energy savings;
- How awareness-raising and information campaigns are included.

The Flemish Energy Agency then evaluates and (dis)approves the method for the calculation of the energy savings. Not only actions for electricity savings, but for all kind of fuels are considered. The primary energy saving is equaled as the electricity saving multiplied by 2.5 (being the average conversion factor for primary energy into electricity).

## 2.1 Examples

| Action | Premium | Saving/year |
|---|---|---|
| Energy saving bulb | free | 168 kWh |
| Energy saving shower | free | 1311 kWh |
| Condensing boiler | 125 Euro | 7800 kWh |
| Solar boiler | 625 Euro | 2410 kWh |
| Roof insulation | 1,25 Euro/m$^2$ | 158 kWh/m$^2$ |

## 2.2. Control and evaluation

The grid operator must draw up an evaluation report every year before 1 May on the execution of the actions during the previous year. The Flemish Energy Agency then presents a report to the Flemish regulator (VREG).

When grid operators do not meet their target, a fine is imposed (10 euro cents for every kWh of primary energy that is not saved). The cost of the fine cannot be calculated in the (electricity distribution) tariff, whereas the costs for the energy savings action plans can be, as part of the public service obligation. The VREG then starts the legal procedure for the collection of fines if targets are not achieved

It is clear that this mechanism provides a strong incentive for the grid operator to comply with the target.

## 2.3. Some figures for 2003

### Domestic clients

| Premiums | 13.629 |
|---|---|
| Amount | 2,86 million Euro |
| Primary energy | |
| Savings | 76,72 GWhp* |
| Cost effectiveness | av. 3,7 €cent/kWhp<br>(between 0,5 and 113 €cent/kWhp) |

*The "p" stands for "primary", as the target for grid operators is formulated as a primary energy savings target. This means that fuel savings are calculated directly whereas electricity savings are multiplied with a factor 2.5.

### Best domestic actions

| TOP +6 premiums | TOP +6 energy saving | TOP +6 cost effectiveness |
|---|---|---|
| Energy saving light bulbs | Energy saving showerhead | Energy saving showerhead |
| Energy saving showerhead | Energy saving light bulbs | Tube insulation |
| Condensing boilers | Condensing boilers | Radiator foil |
| High efficient boilers | High efficient boilers | Roof insulation |
| Super insulating glazing | Roof insulation | Energy saving light bulbs |
| Roof insulation | Super insulating glazing | High efficient boilers |

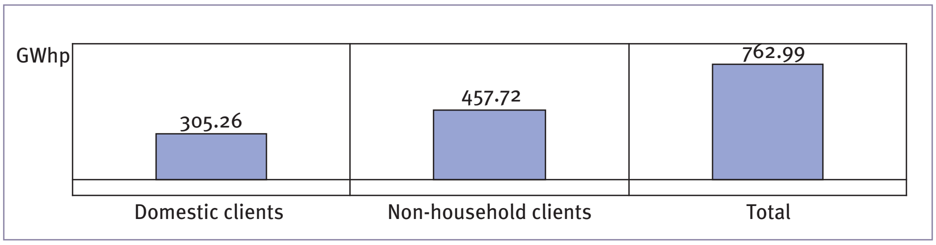
## Non-household clients

| PremiumsPremiums | 2.828 |
|---|---|
| Amount | 4,73 million Euro |
| Primary energy Savings | 457,718 GWhp |
| Cost effectiveness | av. 1,03 €cent/kWhp (between 0,25 en 152 €cent/kWhp) |

## Best non-household actions

| TOP +5 premiums | TOP +5 energy saving | TOP +5 cost effectiveness |
|---|---|---|
| Frequency converters | Frequency converters | Thorough audit |
| Energy bookkeeping | Thorough audit | Quick scan |
| Condensing technology | Relighting | Frequency converters |
| Heat pumps | Condensing technology | Roof insulation |
| Relighting | Roof insulation | High efficiency motors |
| Roof insulation | Super insulating glazing | |

**Figure I. Energy consumption per sector for 2003**



# 3. EVALUATION AND CONCLUSIONS

The main advantages of the system are:

- A clear and quantitative energy saving target;
- The incentive for grid operators to take cost-effective actions
- The financing of these actions is clear and transparent;
- Thorough control and evaluation of actions is possible.

The main disadvantages of the system are:

- The actions are not uniform throughout Flanders (as grid operators define their own actions);
- The conditions to get the premium for the same measure can therefore differ between one town and another;
- There is an overlap with other energy efficiency instruments such as the benchmarking covenant and tax deduction.

The policy instrument can be generally evaluated as successful as all network managers reached their targets in 2003 and in 2004 (except one grid operator), and the target was reached with a lower budget than initially planned.

As of 2008, the targets will be increased to 2 per cent for households, and 1.5 per cent for non-households. Moreover the Energy Agency will have to approve not only the savings calculations but also the level and conditions of the premiums. This will allow the Energy Agency to impose uniformity on the currently different premium schemes run by the grid operators.

# 4. REFERENCES

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Relevant legislation on the website of the Flemish Regulator for Electricity and Gas (VREG), www.vreg.be

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Energy Efficiency

## Module 16:
## REGULATION AND POLICY OPTIONS TO ENCOURAGE ENERGY EFFICIENCY

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Module overview

- Introduction
- Institutional considerations
- Energy efficiency policy: main target sectors
- Energy efficiency regulation
- Conclusions

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Module aims

- To introduce the concept of regulation—or regulatory oversight—in terms of its impacts on energy efficiency.
- To show how regulation and policy measures can be used to encourage increased levels of energy efficiency in the energy system.
- To outline the steps in introducing a more conducive regulatory and institutional environment for energy efficiency interventions and management.

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Module learning outcomes

- To be able to define what is meant by regulation in relation to energy efficiency.
- To understand how regulatory systems and policy measures can be used to encourage higher levels of energy efficiency in the energy system.
- To be able to describe an approach to introducing and applying a more progressive regulatory environment for energy efficiency.
- To understand existing regulatory and policy mechanisms for encouraging improved levels of energy efficiency.

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Why Regulation?

- Energy supply and distribution infrastructure are long-term investments
  - Often including public funds
  - Strategic and of essential importance
- Regulation to ensure operation and management of the energy sector is conducted in a stable and predictable manner.

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Who Regulates for Energy Efficiency?

- Primarily a statutory and independent organization (national energy regulator)
- Often multiple regulators:
  - Electricity regulator
  - Liquid fuels (and gas) regulator
- Role of:
  - Distribution system operator
  - Transmission system operator

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Role of Regulation?

- Hugh potential for cost effective energy savings!
- Not carried out due to lack of:
  - Awareness of top industry and political level
  - Capital
  - Appropriate regulatory framework

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Institutional Considerations

- International
  - IEA/OECD www.caddet.org
  - DSM http://dsm.iea.org
- Regional
  - AFUR www.1.worldbank.org/afur
  - RERA www.rerasadc.com
- National/local
  - Energy Advice Centres
  - Cf. Ghana, UK

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Main EE Policy Target Sectors

- Industry
- Households
- Transport
- Offices and buildings

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Industry

Fiscal incentives

- To stimulate energy conservation investments

Energy efficiency targets

- Imposed on / voluntary agreement with energy intensive sectors
- Examples in Flanders and Japan

$CO_2$ emission trading in industrialized countries—primarily EU ETS

- Possible opportunity for developing countries through the Clean Development Mechanism (CDM) of the Kyoto Protocol

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Households

- EE: higher investment cost
- Direct policy:
  - Investment subsidies
  - Tax incentives
  - Soft loans

  Cf. South Korea
- Indirect policy:
  - Standards and labelling cf. Ghana and Japan
  - Obligation on grid operator cf. Denmark and Flanders (BE)

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Transport

More energy efficient car and truck engines:

- Higher investment cost
- Policy cf. households
- Biofuels

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## Offices and Buildings

- Significant energy reduction potential
- Designing new buildings:
  - Construction methods
  - Lighting
  - Electrical appliances
- Renovating:
  - Relighting
  - Air-conditioning systems
- Energy performance standards cf. India, Netherlands

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## EE Regulation: Demand Side

- Demand-side management (DSM):
  - Aims to decrease peak time electricity consumption by shifting enough demand from peak morning and evening periods into the mid-day and nighttime hours
  - By charging higher tariffs during peak hours and lower tariffs during off-peak
  - Cf. South Africa
- Design of tariffs and prices:
  - Time of use tariffs cf. China
  - Metering
- Standards and labels Cf. Ghana

Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## EE Regulation: Supply Side

- Energy efficiency obligations:
  - Target imposed on the distribution system operator (DSO)
  - DSO to decide on preferred /most cost effective actions to reach the target
  - Successful examples include Denmark and Flanders
- White certificates:
  - Instrument to make the energy savings units tradable cf. EU ETS
  - First experiences in South Wales, Italy, France UK

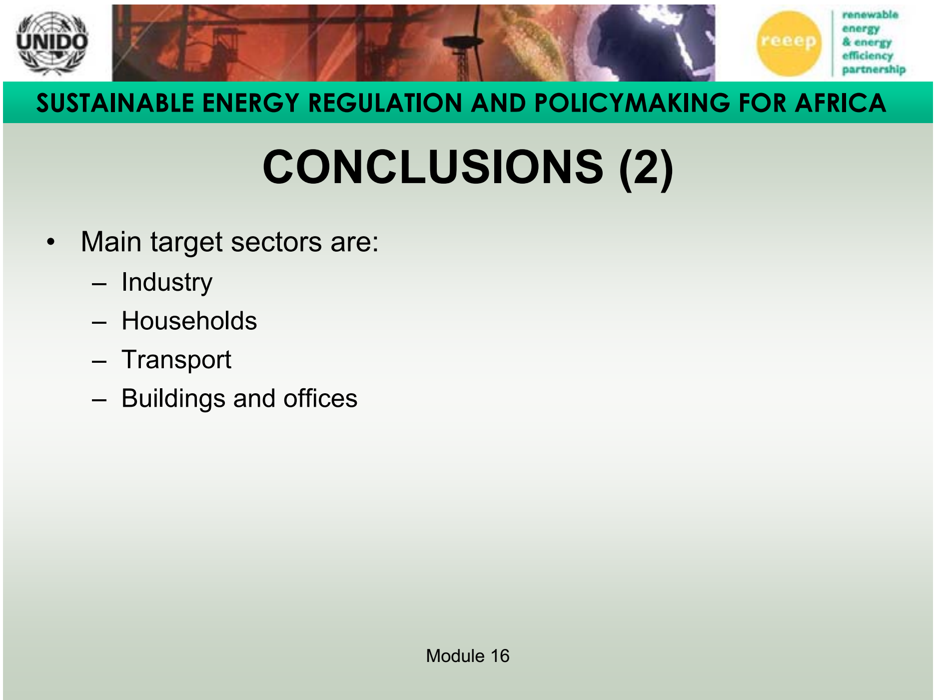
Module 16

SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA

## CONCLUSIONS

- High energy savings potential in different sectors
- Need for instruments and incentives to activate this potential
- Policymakers and regulators play key role, as do DSO and TSO
- Design of policy/regulatory instruments to be tailored according to:
  - National energy system
  - Existing regulatory authorities
  - Targeted sector

Module 16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SUSTAINABLE ENERGY REGULATION AND POLICYMAKING FOR AFRICA
CONCLUSIONS (2)
• Main target sectors are:
– Industry
– Households
– Transport
– Buildings and offices
Module 16