Energy Efficiency: A Worldwide Review

Introduction

Since 1992 the World Energy Council (WEC) has been collaborating with ADEME (Agency for Environment and Energy Efficiency, France) on a joint project "Energy Efficiency Policies and Indicators". APERC (Asia Pacific Energy Research Centre) and OLADE (Latin American Energy Organisation) have also participated in the study, which has been monitoring and evaluating energy efficiency policies and their impacts around the world. WEC Member Committees have been providing data and information and ENERDATA (France) has provided technical assistance.

The latest report, published in August 2004, presents and evaluates energy efficiency policies in 63 countries, with a specific focus on five policy measures, for which in-depth case studies were prepared by selected experts:

- Minimum energy efficiency standards for household electrical appliances;
- Innovative energy efficiency funds;
- Voluntary/negotiated agreements on energy efficiency/ CO_2;
- Local energy information centres;
- Packages of measures.

In particular, the report identifies the policy measures, which have proven to be the most effective, and can be recommended to countries which have recently embarked on the development and implementation of energy demand management policies.

During the past ten years, the Kyoto Protocol and, more recently, emerging concerns about security of supply have raised, both the public and the political profile of energy efficiency. Almost all OECD countries and an increasing number of other countries are implementing energy efficiency policies adapted to their national circumstances. In addition to the market instruments (voluntary

agreements, labels, information, etc.), regulatory measures are widely introduced where the market fails to give the right signals (buildings, appliances).

In developing countries, energy efficiency is equally important, even if the drivers are different compared to industrialised countries. Reduction of greenhouse gas emissions and local pollution often have a lower priority for developing countries, where investments in energy supply infrastructure and more efficient use of existing capacities often come first.

Given its broad geographical coverage, the report provides a comprehensive and valuable source of information. Its objective to relate energy efficiency indicators to energy efficiency policy measures represents an original approach to the evaluation of energy efficiency policies.

Overall energy efficiency performance

An overall assessment of energy efficiency performance is based on the primary energy intensity, which relates the total energy consumption of a region or a country to its GDP. The primary intensity measures how much energy is required to produce one unit of GDP.

Higher GDP for less energy resulting in large energy savings at the world level: average annual energy intensity improvement of 1.5%, rising to 1.8% since 1996

Energy intensity is widely used to monitor how efficiently energy is used, and it can provide signals to decision-makers about energy efficiency trends. However, energy intensity is influenced by many factors, among which energy efficiency is only one component. Changes in the structure of a country's national economy (the "economic structure") or in its energy mix can have a strong impact on the energy intensity indicators.

At the world level, there has been a continuous decline in primary energy intensity, by approx. 1.5% p.a. between 1990 and 2002 (1.4% since 1980). This reduction in the energy intensity resulted

in large energy savings: 4.0 Gtoe since 1980 (37% of the total consumption in 2002), and 2.1 Gtoe since 1990 (or 20% of the total consumption).

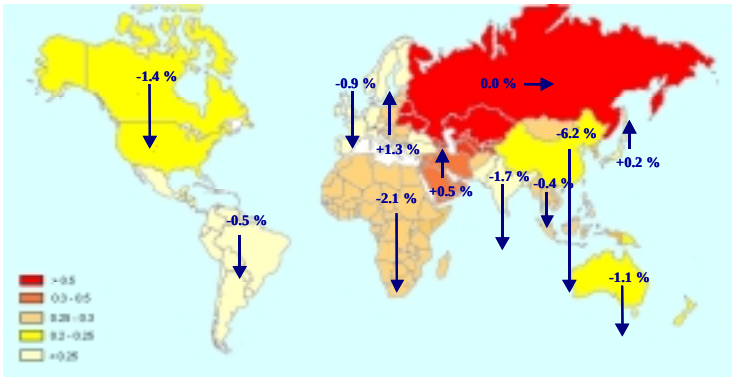
Energy intensity levels and trends are different between the regions

Energy intensity levels in Japan, Western Europe, Latin America and South Asia are about two thirds of the world average. In North America and Oceania (Australia and New Zealand) energy intensity is about 40% higher. In the Middle East and in the former centrally planned economies, energy intensity levels are much higher than the world average, due to low energy efficiency, the dominant role of energy intensive industries, underreporting of the GDP, and generally low price levels.

In most regions the amount of energy used per unit of GDP is decreasing steadily

The primary energy intensity demonstrates a decreasing trend in most regions, as a result of the combined effect of higher energy prices following the second oil shock, energy conservation programmes, and more recently CO_2 abatement policies.

Primary energy intensity by world region



Source: ENERDATA

Note: Energy intensities for 2002 in koe/US$95 at PPP. The arrows show variation between 1990 and 2002.

Structural changes in the economy, and especially in industry, following market liberalisation in the former centrally planned economies, and the relocation of industrial activities around the world are among the main drivers. Since 1990, there has been a net slow down in the energy intensity reduction in Western Europe and North America, and even a reverse trend, for example, in Japan and FSU, while energy intensity has grown rapidly in other regions. This can be attributed to the delayed effect of the counter oil shock of 1986, the sharp reduction in energy conservation efforts, and the beginning of the economic slow down.

China accounts for one fourth of the reduction in the world energy intensity

China, which had the world's highest energy intensity level in 1980, experienced the strongest improvement in energy productivity: around 6% p.a. on average, or a reduction about 4 times the world average. With its energy intensity at the level of the world average now, China accounts for about one fourth of the overall energy productivity improvement at the world level since 1990.

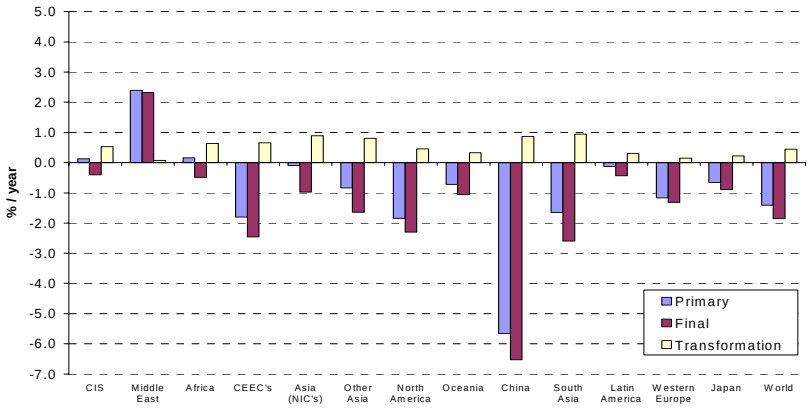
Excluding changes in the structure of the world economy, the energy intensity reduction is only 1.1% per year

Because of the large differences in energy intensities among world regions, any change in the share of each region in the world GDP automatically affects the world average. As the highest economic growth took place in regions with lower energy intensities, this trend accelerated the decrease in the world energy intensity figures. At a constant GDP structure, the energy intensity at the world level would have decreased less: by 1.1% p.a. as compared to 1.5% p.a. since 1990. In other words, one fourth of the reduction was due to differences in the pace of economic development across regions.

About 20% of end-use efficiency improvements are offset by energy conversion

The final energy intensity is decreasing faster or increasing more slowly than the primary energy intensity at the world level (1.9% as compared to 1.5% p.a.). This is true for almost all regions and is a result of the increasing losses in energy conversion, mainly due to two factors: change in the electricity generation mix and increasing use of electricity by final consumers (from 13% in 1980 to 16% today at the world level).

Variations in primary and final energy intensities (1990-2002)



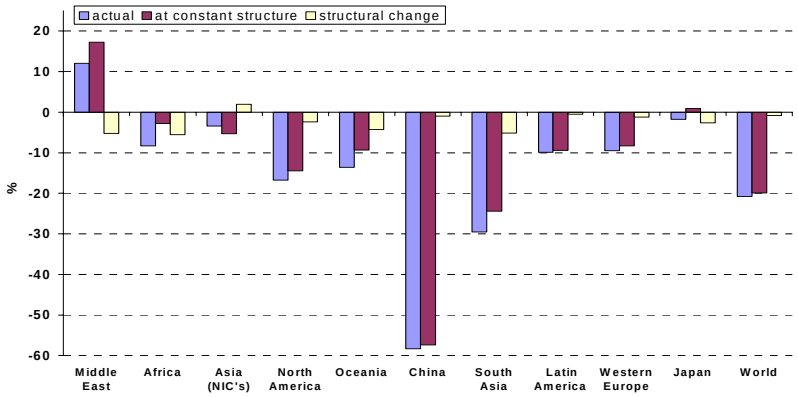
Source: ENERDATA

Changes in the GDP structure amplify variations in overall energy intensities, although this phenomenon is generally not the result of energy efficiency policies. For example, the tertiarisation of the economy does, all other things being equal, decrease total energy intensities. Indeed, industry requires seven times less energy to produce one unit of output than services. The impact of these structural changes is especially important in regions where economic growth is rapid.

Changes in economic structure also influence energy intensities: services require 7 times less energy inputs per unit of value added than industry

In all regions, the final intensity at a constant structure of the economy decreased less than the total final energy intensity, as part of the efficiency improvement was masked by an increasing share of industry in the GDP, the most energy intensive sector. In Africa for instance, structural changes explain about 2/3 of the decrease in the final energy intensity between 1990 and 2002. In the Middle East, tertiarisation has had a significant slowing down impact on the development of energy intensity. In the OECD countries, structural changes had a limited impact over the period, as most of the structural changes took place there in the 1980s.

Role of structural changes in the GDP (1990-2002)



Source: ENERDATA

Industry

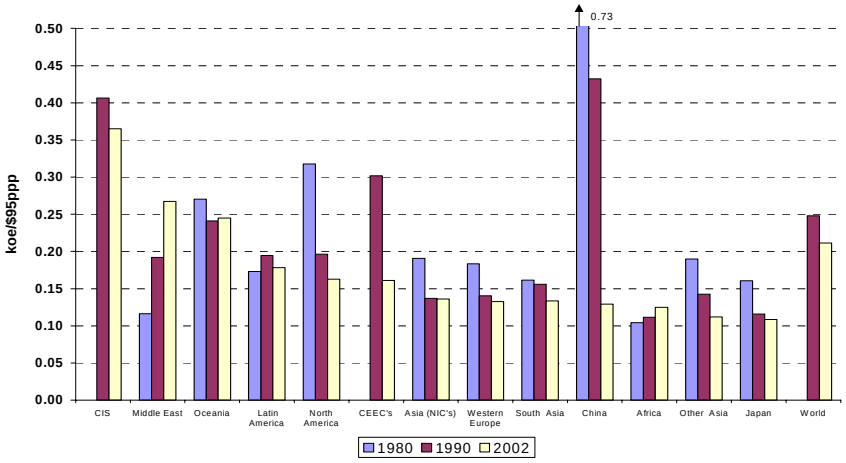
In OECD countries, the general trend indicates a decrease in the energy required per unit of value added. In Western Europe, North America, CIS and Japan, the reduction in industrial energy intensity slowed down in the 1990s and was even reversed in Oceania. Africa and the Middle East experienced an increase in the energy intensity of industry. The energy intensity levels of

North America, Japan, and Western Europe are currently converging.

The energy intensity of industry decreased significantly in OECD countries, China, and other Asian and Central and Eastern European countries, with a slow down since 1990

In energy intensive industries, the general trend is towards a reduction in the energy consumption per tonne of output. This certainly explains the overall energy efficiency improvement outlined above. There is a convergence in most developed countries, whereas in other countries, the situation is more diverse, due to differences in production processes and products. In some countries, negotiated agreements between industry associations and the government on targets of energy efficiency improvements explain part of the results achieved.

Energy intensity of industry



Source: ENERDATA

Convergence in energy intensity performance for energy intensive products

Transport

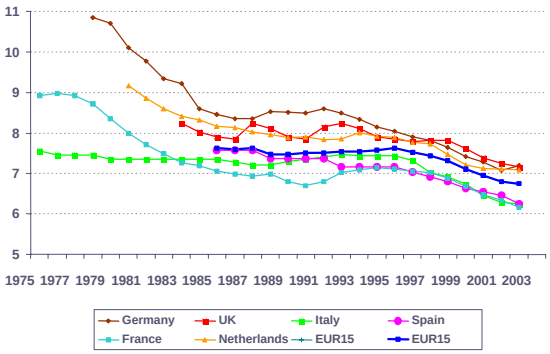
North America and Oceania are among the few regions to have experienced a drastic and continuous improvement in the overall energy efficiency of the transport sector since 1973. In North America, this situation can be mainly explained by the dramatic improvement in the efficiency of cars, following the implementation of the CAFE standards for the fuel economy of new cars.

Energy efficiency improvements in transport are becoming effective in some regions

In Western Europe, only limited energy efficiency programmes were implemented, and despite significant technical improvements in the fuel efficiency of cars (25-30% since 1973), the overall energy efficiency of the transport sector did not improve until 1990. Since then, the energy consumption of transport is increasing at a slower rate than the GDP. This is due to the combined effect of energy efficiency improvements, the continuous increase in motor fuel prices, new priorities given to energy efficiency measures in this sector (especially for urban transport), and, to some extent, saturation in car ownership. In some countries, in recent years, a net slow down in the energy consumption of transport has been observed.

In Latin America, Africa, and South East Asia, energy consumption by transport is increasing more rapidly than economic activity, because of the increasing ownership of cars and motorcycles, and the replacement of rail or water transport of goods by road transport. Poor economic conditions in Latin America have, however, reversed that trend in recent years. In China and South Asia, energy consumption increases more slowly than GDP because of a slower growth in the cars fleet and a continued dominant role of rail for goods transport.

Specific fuel consumption of new cars (litres/100 km)



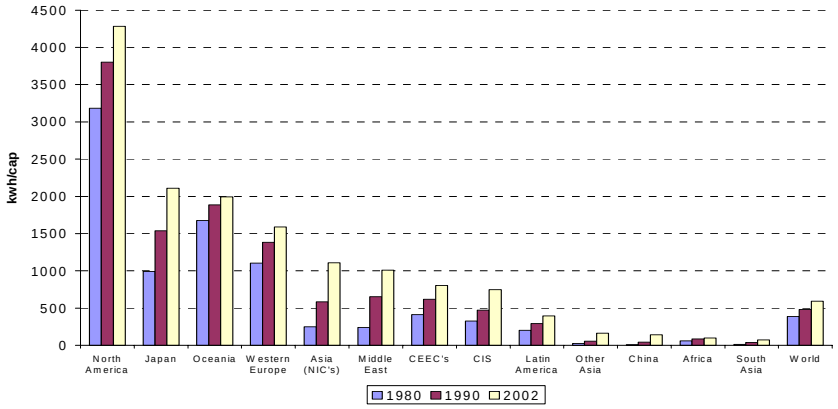
Household and Service Sectors

Electricity consumption per capita in the household sector varies significantly across the most developed regions, depending on the level of ownership of electrical appliances and the importance of space heating by electricity. It varies from around 800 kWh/capita in the Central and Eastern European countries, to around 1500-2000 kWh/capita in Western Europe, Japan, and Oceania, and above 4000 kWh/capita in North America.

Household electricity consumption per capita is rising and becoming increasingly diverse

In all regions, per capita consumption is increasing. The increase is particularly strong in developing countries with high economic growth (e.g. Asian countries) and is accelerating. This general growth has, however, been slowing down since 1990 in all regions, except the CIS and some Asian economies. This development is particularly significant in the OECD countries, which have implemented policies to improve the energy efficiency performance of electrical appliances: labelling, efficiency standards, etc.

Household electricity consumption per capita



Source: ENERDATA

The electricity intensity of the service sector is increasing

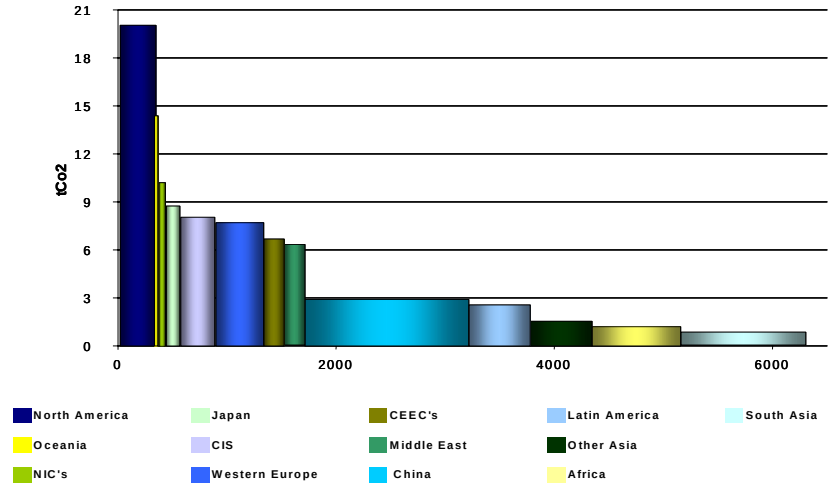
The amount of electricity required to generate one unit of value added is increasing in most regions, especially in less industrialised countries where the service sector is expanding rapidly, and in the countries with growing demand for air conditioning. In North America and Oceania, where energy intensity levels are high, the ratio remains stable.

CO_2 emissions from energy combustion

CO_2 emissions per capita vary significantly across the regions, from under 2t CO_2/cap in less developed regions (Africa, NIC, and Asia) up to about 8-13t CO_2/cap in Western Europe, CIS, Japan, South Asia, and Oceania and nearly 19t CO_2/cap in North America.

CO_2 emissions per capita around the world vary by a factor from 1 to 7

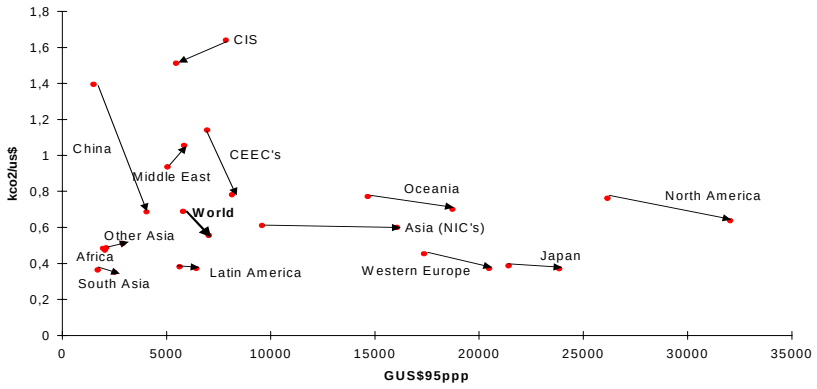
CO_2 emissions per capita (2002)



CO_2 emissions increase more slowly than economic activity

CO_2 emissions from energy use increase more slowly than economic activity in all regions, except the Middle East. At the world level, the CO_2 intensity in relation to GDP decreased by 1.8% p.a. between 1990 and 2002, with most of the reduction due to energy efficiency improvements and only a small part due to changes in the fuel mix (13%).

CO_2 intensity 1990-2002



Evaluation of energy efficiency policies and measures

The report evaluates the impact of selected energy efficiency policy measures around the world to find answers to the following questions: What is the importance of energy efficiency measures? What are the priorities? What are the trends? What measures are being favoured? What are the innovative measures? What are the results?

The evaluation is based on a comprehensive survey covering 63 countries around the world. It also draws on five in-depth case studies prepared by experts. The following measures were selected as they are widely implemented and are known to be effective:

- Efficiency standards and labelling for household electrical appliances;
- Innovative financing schemes for energy efficiency;
- Voluntary/negotiated agreements with large energy consumers or equipment manufacturers;
- Local energy information centres;
- Packages of measures (e.g. audits + financing schemes).

These measures are also complementary to the set of measures already evaluated in a previous report published in 2001.

Countries covered by the WEC survey on energy efficiency policies

Energy pricing

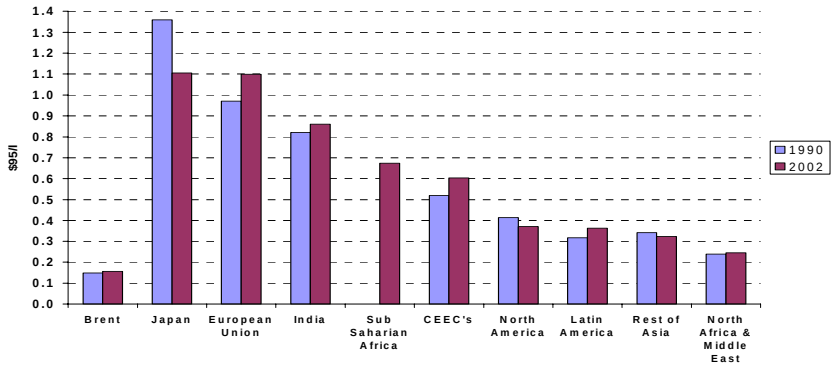
Adequate pricing is a necessary condition for promoting energy efficiency. The first step of any energy efficiency policy should be to adjust energy prices in order to give correct signals to consumers. Although most energy decision makers agree with this objective, they often have to take into account other factors, such as provision of service for low-income households when the price becomes unaffordable, public opposition and limitation of impact on the consumer price index.

Gasoline prices vary enormously due to tax policies

In the EU15 countries and Japan, which are oil importers, the price of motor gasoline has always been high compared to the rest of the world due to heavy taxes. European and Japanese motorists paid about 1.1 US$95/litre in 2002, but in most other countries the prices varied between 0.3 and 0.4 US$/litre.

Trends differ significantly from one region to another, reflecting different tax policies, or a different impact of crude oil price variations. In some countries (EU25, Latin America, and India), the price of gasoline has been increasing in real terms since 1990, often more rapidly than the price of crude oil. In other regions, the price has decreased (North America, Japan, China) or remained roughly stable (North Africa, rest of Asia).

Gasoline prices (tax included)



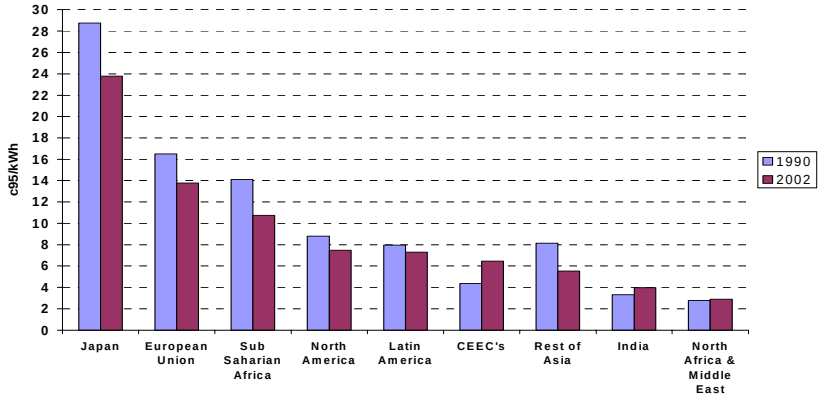
Source: ENERDATA, based on data from IEA, OLADE and World Bank

Electricity prices for households are declining, except in Central and Eastern European countries and parts of Asia

The price of electricity for households varies widely in the OECD countries. Japan has by far the highest price, followed by the EU15 (around 14 US cents/kWh at 1995 prices); North America is at the bottom (around 8 US cents/kWh). Sub-Saharan Africa has a very high price compared to its average income. This can be explained by the region's strong dependence on oil for electricity production and the age of its power plants.

In real terms, the average electricity price for households has been steadily decreasing, except in the countries that have implemented aggressive demand-side management (DSM) programmes (e.g. Denmark or Sweden) or removed subsidies (Eastern European countries). The share of taxes in the electricity price for households is usually low (5 to 15% in most countries), except in a few countries which use the price signals as a strong incentive for energy efficiency improvement and/or CO_2 reduction, such as Denmark or the Netherlands.

Average electricity price for households



Institutions and programmes

An energy efficiency agency is usually focused on the implementation of the national energy efficiency policy. Such agencies have the necessary technical competences and their task is to design, implement, and evaluate programmes and measures, to liaise with other stakeholders, such as companies, local authorities, or NGOs, and, finally, to ensure coordination with international, national, regional, and local administrations.

These agencies are usually public institutions funded by the State budget. In developing countries they are often supported by overseas technical assistance funds. In a few countries, part of the budget is based on a tax on energy (e.g. Norway).

Two thirds of the countries have set up a national energy efficiency agency

In countries with a federal or decentralised structure, energy agencies have been set up by regional administrations. In addition, many countries have set up local or regional agencies. Such agencies provide more targeted measures, as they are closer to consumers and can better appreciate specific regional circumstances (climate, energy resources, etc.).

Three fourths of the countries have formal energy efficiency programmes or a law with concrete energy efficiency/CO_2 targets

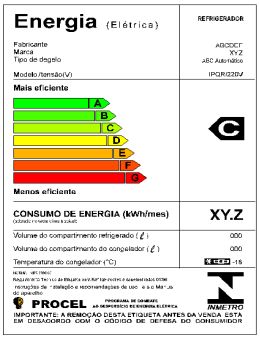
These programmes are either devoted solely to energy efficiency or combined with a national programme of greenhouse gas reduction or of promotion of renewables (especially in most EU countries). In some countries, an energy efficiency law has been adopted recently. Such laws and programmes ensure a certain continuity of public efforts and a better coordination of the various actions and measures.

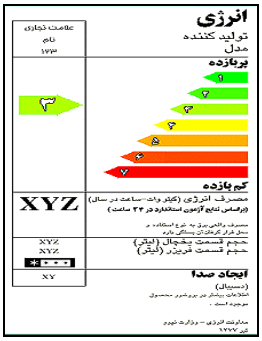
Labelling and efficiency standards for household electrical appliances

To slow down the growth in household electricity consumption and even reverse the trend in industrialised regions, many countries have introduced energy efficiency programmes for household electrical appliances. Labelling programmes and minimum energy performance standards (MEPS) have proved to be very effective. They generally include refrigerators, lamps, washing machines and dryers, water heaters, and room air conditioning units.

In developing countries, labelling is not very common and seldom mandatory, as secondhand appliances account for a large share of the market, and this reduces the scope and potential of measures on new appliances, including labelling.

Examples of energy labels (Thailand, Brazil, Iran)





Labelling programmes and efficiency standards are effective and complementary measures which help transform the market. To remain effective, they must be regularly revised and updated to stimulate technical progress and ensure a steady improvement in energy efficiency. In this respect, one way of establishing dynamic standards is to relate them to the most efficient appliances on the market.

Innovative energy efficiency funds: a mix of public and private funds

The difficulty of obtaining the necessary funding is often a major barrier to energy conservation projects. Many governments have already established energy efficiency funds, mostly as subsidies. More recently, because of the shrinking public budgets, new innovative financial schemes have been designed to entice private funds to finance energy efficiency investments.

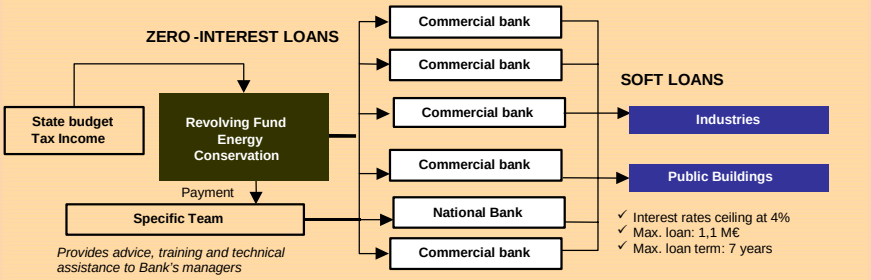
These "innovative funds" use traditional private sector tools (loans, equity participation, venture capital, etc.) and seek partnerships between public institutions and private investors, such as banks or Energy Service Companies (ESCOs). In addition, they have a long-term objective to develop a self-sustaining market for energy efficiency services.

The report highlights several innovative financial schemes:

- Equity participation and indirect investment through ESCOs, in which a fund manager and an investor join together to create a private equity fund;
- Equity participation of a fund in companies developing innovative low carbon technologies, with the objective of creating a market for these technologies;
- Energy Performance Contracting (EPC) between a consumer and an ESCO that uses cost savings from reduced energy consumption to repay the cost of implementing energy conservation measures;
- Guarantee funds based on a mutual guarantee provided by specific institutions to banks granting loans;
- Revolving funds based on the State budget or on incomes from an energy tax to provide banks with a revolving budget, used to offer soft loans to energy consumers undertaking energy efficiency investments.

Revolving Fund for Energy Conservation in Thailand

The fund was created under the umbrella of a larger fund, the Energy Conservation Promotion Fund (ENCON), financed by a tax on oil income in cooperation with six national banks. 43 M€ has been allocated to the Department of Alternative Energy Development and Energy Efficiency which is in charge of funds allocation between six banks. This fund provides banks with direct money to finance the loan.



Guarantee funds and revolving funds can be developed in any part of the world that has a basic financial sector. Other funds involving ESCOs require a certain number of energy service companies to increase the effectiveness of the tendering process, as well as the number of projects covered.

Some funds seek to use the emissions reductions resulting from the financed project to obtain carbon credits: this can increase a project's profitability and mitigate risks.

Voluntary agreements: good political acceptance with unclear results

Voluntary/negotiated agreements (VAs/NAs) were developed in the 1990s to address the prevailing view that environmental regulation, in particular in respect to climate change, had reached its limits, and at the same time economic instruments seemed too costly (subsidies) or too unpopular (energy/CO_2 taxes). At present, several countries are introducing new VAs schemes

using previous experience (e.g. France) or implementing VAs for the first time (e.g. Austria and Ireland). The most advanced country in this field, the Netherlands, has left the traditional VAs concept and moved on to another type of agreement based on benchmark values.

There are three main types of VAs/NAs in the field of energy efficiency/climate change: unilateral commitments made by industrial companies; negotiated agreements (NA) between industrial companies and public authorities - most of the existing agreements; and voluntary programmes developed by public authorities in which companies are invited to participate.

The case studies in the report illustrate a variety of VAs/NAs: the Greenhouse Challenge in Australia; the voluntary agreement of German industry on the reduction of CO_2 emissions and specific energy consumption; the long-term agreements with the industrial sector and the "benchmarking covenants" in the Netherlands; the voluntary labelling of electric motors in the EU (CEMEP/EU Agreement); the conservation agreements for industry, municipalities, and residential sector in Finland; and, finally, the Keidanren Voluntary Action Plan on the Environment in Japan.

Independent post evaluations or verification of VAs/NAs are rarely carried out. Results of existing evaluation studies conclude that the effectiveness of this instrument is in many cases uncertain. Even for the Dutch voluntary agreements, an independent evaluation concluded that they accounted for about 25-50% of the observed decrease in the industrial energy intensity. This, in itself a good result, was achieved by a combination of a large public and private effort. Most other agreements probably achieved considerably less impact.

VAs may be more appropriate as complementary instruments for other measures, rather than the prime policy measures to address energy efficiency and climate change. OECD countries mainly use VAs, whereas other countries have so far rarely made use of this instrument. It is therefore difficult to recommend the use of VAs for these countries.

Local energy information centres

One of the main barriers to energy efficiency is the lack of consumer information. To address this issue, a wide range of information activities has been designed, including media campaigns, technical publications, training, education, and energy efficiency awards. However, these activities often fail to create enough consumer awareness and concern to remain effective beyond the time of the campaigns. A relatively new approach is local energy information centres set up close to consumers. These centres offer impartial information on energy conservation and, usually, renewable energy services to the general public and specific target groups (e.g. housing associations, citizen groups, local institutions, small business, farmers, politicians, schools, etc), including advice on useful contacts (project developers, equipment manufacturers, relevant authorities, funding agencies, etc.).

Evaluation of local energy information centres in France

155 local info centres were established by ADEME between 2001 and 2003, employing 275 advisers. A recent evaluation shows the following results:

- 80 000 contacts, of which 84% from households;
- 90% rate of satisfaction;
- 25% of recommended investments were actually implemented (including large investments);
- the average investment by an adviser was 730 000 €.

Packaging energy efficiency policy measures

The acceptance of energy efficiency policy measures differs widely according to the type of measure and the targeted consumers. Policy makers can be tempted, either to avoid "difficult" measures, even if they might be very effective, if they consider the "political transaction costs" to be too high, or to enter slowly into a long and costly process for their practical application.

It is possible to package **alternative measures** directed at the same energy efficiency target, and allow consumers to choose measures according to their own priorities. One example is the "Green Tax Package" for industry in Denmark.

Packaging of alternative measures: the Green Tax Package in industry in Denmark

The components of this package are a set of fiscal measures (energy, CO_2 and SO_2 taxes). The alternative package combines audits and voluntary agreement. The proposed "deal" offers industrial consumers benefits from significant tax reductions if they submit to the Danish Energy Authority an implementation plan, comprising an audit, an energy efficiency action plan, and precise energy efficiency targets. If the targets are not fulfilled, the consumer will have to reimburse the tax rebate. The first results are rather promising: in 2001, 300 enterprises, accounting for more than 60% of the total industry energy consumption, have signed agreements.

Another approach is to coordinate measures to **"push"** consumers away from energy intensive practices and to **"pull"** them towards energy efficient ones (e.g. buildings in Finland).

Package of push/pull measures for energy efficient buildings in Finland

Finland has adopted a package of "push-pull" measures for commercial buildings based on the following components: a subsidy scheme for energy audits since 1994, with subsidies up to 50%; subsidies for investments (between 10% and 25%); and voluntary agreements to save heat and electricity.

It is also possible to reduce the "rebound effect" by packaging together **complementary measures** aimed at different sectors, for instance technology and economy. For example, a combination of insulation standards and an energy tax can be considered for space heating or cooling. Insulation standards result in the construction of new buildings which consume less energy per m^2 for the same indoor temperature; the energy tax is

intended to prevent people from taking advantage of the reduction in heating/cooling costs to upgrade their comfort.

The final idea is to package **conditional measures**: to implement first the less costly measures, and then consider their reinforcement or more costly measures depending on whether the first measures succeed in achieving the target. An example of this would be voluntary agreement at first, then regulation or taxation if the voluntary agreement does not work. In the case of existing buildings, an example of packaged conditional measures is the combination of energy labels for buildings transactions, a tax linked to the average yearly consumption, and mandatory thermal retrofitting.

The implementation and evaluation of individual energy efficiency policy measures face two types of challenges:

- ex-ante: scope of a measure and assessment of its cost effectiveness require a sound evaluation of its likely impact on future energy consumption, which to a large extent depends on other measures taken at the same time;
- assessing ex-post if the actual impact of a specific measure in regard to its implementation cost is almost impossible if other measures have been taken simultaneously, because of the interactions among measures and the great chance of double counting the impacts.

The interaction between the measures can been split into four categories:

- interactions in terms of social and economic acceptability and related transaction and implementation costs;
- synergies versus antagonisms among measures that either reinforce each other or create a conflict (overlapping between subsidies and tax reduction for example);
- interactions affecting the overall costs to consumer;
- interactions affecting the achievement of the efficiency target.

Depending on the mix of measures taken at the same time, the overall impact on energy efficiency might be well below the

overall target, even if, in theory, the addition of all the individual measures taken separately would have been sufficient to reach it.

Packaging the measures is the right approach to ensure that the mix of implemented measures comes close to the set efficiency target. The package must consider the four types of interaction outlined above to ensure a proper balance between minimising the overall cost of implementation of all the measures on the one hand, and maximising the potential for achieving the overall target, on the other hand.

Conclusions and recommendations

Energy efficiency policies in the new decade

The main reason for the introduction of energy efficiency policies related to long-term issues is global warming, but also, to some extent, the looming depletion of oil and gas resources around 2030-2050. In non-OECD countries, energy efficiency is also a way to alleviate the investment constraints on the supply side. Since 2000, with the sharp increase in the price of oil, many countries, especially the less developed ones, are again facing macroeconomic constraints.

The liberalisation of the energy sector and the globalisation of economies make the intervention of governments much more difficult as unilateral measures (such as energy taxes) could weaken domestic industries facing international competition. However, the climate change issue will impose a constraint on energy consumption, even if flexibility mechanisms were able to alleviate this for a while. The CO_2 emissions tradable permits may allow the Annex 1 countries to avoid strong constraints on their industries in the short term, but in the long term, the prices of permits should increase, making energy more and more costly.

Coordination of certain policies and measures at the international level would help to overcome the obstacles to the implementation of both standards and price signals.

At the domestic level, governments should incorporate energy efficiency into all main public sector policies (land planning, transport infrastructure, social housing policy, urban planning). The infrastructure investment decisions should incorporate the possibility of growing energy prices and constraints on CO_2 emissions. The mitigation of the transport sector's CO_2 emissions is highly relevant. This could be done through a value of carbon being included in public decisions to direct consumer choices toward energy efficient solutions (a low initial value but growing regularly).

The WEC's Energy Efficiency project aims to facilitate the exchange of information and share experiences on energy efficiency measures among different countries around the world. This forum can help governments select appropriate and cost effective sets of measures among each sector, taking into account their national circumstances. The energy efficiency indicators are a unique tool allowing the global impact of a mix of measures implemented in each sector to be quantified.

Development of an energy efficient economy is a tough challenge for all countries. The climate change issue, the lack of public resources for investment in energy supply, and the prospective depletion of fossil energy resources in the long term provide strong incentives for the exchange of experience on policies for improving energy efficiency, and the World Energy Council is a unique forum for this task.

The full version of the report is available on the World Energy Council website at www.worldenergy.org or in hard copy. Please quote ISBN 2 86817 775 1 (ADEME) or ISBN 0 946121 17 6 (WEC).