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Energy Efficiency: A Recipe for Success – Executive Summary

World Energy Council

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Executive Summary**

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Published 2010 by:

World Energy Council
Regency House 1-4 Warwick Street
London W1B 5LT United Kingdom

ISBN: 978 0 946121 00 7

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Energy efficiency: What is new since 2007? What do the trends show? What energy efficiency measures produce the best results? Which measures are most cost effective?

Introduction

Energy efficiency is “a low hanging fruit” on the “energy tree” which can help address a number of objectives at the same time and at a low or negative cost: security of supply, environmental impacts, competitiveness, balance of trade, investment requirements, social aspects and others. Despite its significant potential for energy savings, energy efficiency is still far from realising this potential. Why? There is no single answer to this question. A meaningful response requires major research and an analytical effort.

WEC works together with ADEME (Agency for Environment and Energy Efficiency, France) and with technical assistance from ENERDATA (France) collecting energy efficiency indicators in countries around the world and conducting surveys of energy efficiency policies and measures. Analysis of the interaction between energy efficiency policies and energy efficiency performance of economies accounts for a significant part of the effort. The databases of energy efficiency indicators and energy efficiency policies and measures on the WEC website¹ provide data and a comparative index of different countries’ performance in a variety of energy efficiency areas.

The 2010 report presents and evaluates energy efficiency policies and trends in about 90 countries 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 are the results?

Evaluation of Energy Efficiency Policies and Measures

This evaluation covers the impact of selected energy efficiency policy measures around the world based on a comprehensive global survey.

The evaluation also draws on six in-depth case studies prepared by international experts. The following measures were selected for in-depth case studies, because they have emerged as new concerns or areas for political action for policy decision-makers²:

1. Innovative communication/information tools for utilities and/or energy agencies.
2. Good practices in the public sector.
3. Successful financial tools for households.

¹

http://www.worldenergy.org/work_programme/technical_programme/technical_committees/energy_efficiency_policies_and_indicators/default.asp

² The following measures have already been evaluated in the previous reports: building codes, energy audits, labelling and standards of electrical appliances, incentives for cars, voluntary/sectoral agreements, local energy information centres, new energy efficiency financing schemes, packages of P&M's., Energy Service Companies (ESCO's), energy efficiency obligation for energy utilities, measures for solar water heaters.

4. Energy efficiency measures for low income households.
5. Obligation of energy savings (white certificates).
6. Regulation and compliance.

Each of the experts prepared a core report with examples of country experiences (“country case studies”)³.

The survey⁴ of energy efficiency policy measures forms another section of the report and covers a total of 88 countries:

- **34 from Europe:** 27 countries from the European Union (EU), and Croatia, Iceland, Norway, Russia, Serbia, Switzerland and Turkey.
- **15 from the Americas:** Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, El Salvador, Mexico, Paraguay, Peru, Uruguay, USA and Venezuela.
- **17 from Asia and the Pacific:** Australia, China, Hong Kong China, India, Indonesia, Japan, Malaysia, Mongolia, Myanmar, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand and Vietnam.
- **15 from Africa:** Algeria, Botswana, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Guinea, Guinea Bissau, Kenya, Mali, Mauritania, Morocco, Nigeria, Senegal, South Africa and Tunisia.

- **7 from the Middle East:** Iran, Israel, Jordan, Kuwait, Lebanon, Syria and Yemen.

The surveyed countries together represent about 90% of the world energy consumption (100% for North America and Western Europe, 95% for Asia, 90% for Latin America, 75% for Africa and 50% for the Middle East).

Almost 70% of the surveyed countries do not belong to OECD. There is still room for improvement in the coverage of Africa but more countries are included this time (15 compared to 12 in 2007). The coverage of Latin America is considerably better than in the previous report (13 compared to 7). Among the 29 OECD countries, 7 countries are outside Europe.

The survey covers institutional aspects, as well as existing regulations and financial measures. It also covers with a greater focus the selected energy efficiency policy measures mentioned above. The measures considered in the survey are organised as follows⁵:

➤ **Institutions and Programmes**

- ❖ Institutions: agencies (national, regional and local), Ministry department; National programmes of energy efficiency with quantitative targets and laws;

➤ **Regulations**

- ❖ Minimum efficiency standards and labels for electrical appliances (refrigerators, washing machines, AC, lamps, water heaters, motors), cars and buildings (new and existing).

³ The full reports are available on the WEC web site

⁴ The survey is based on a questionnaire designed by ADEME and Enerdata and sent in 2009 to all WEC Member Committees and additional contacts from the ADEME network of energy efficiency agencies in the EU 25, North Africa, and some OECD countries. In total 100 countries were contacted, 60 countries answered directly and 25 countries were completed by Enerdata from the previous survey of 2006 and from literature research.

⁵ Measures to promote renewable energies and fuel substitution were not included. R&D activities, although important in the long term, are also excluded from the survey, as they are less important in developing countries.

CO₂ emissions from energy use were 40% higher in 2008 than in 1990 at world level

- ❖ Other mandatory regulations for designated consumers: energy managers, consumption reporting, saving and maintenance.

- ❖ Obligation of energy savings for energy companies at consumers' premises.

➤ Financial measures

- ❖ Subsidies for audits by sector: industry, commercial, public, households, low income households, transport.

- ❖ Subsidies or soft loans i.e. loans with subsidised interest rates, for energy efficiency investment and equipment by sector.

➤ Fiscal measures:

- ❖ Tax credits

- ❖ Accelerated depreciation

- ❖ Tax reduction for efficiency investment, by type of tax (import, VAT, purchase, annual car registration) and by type of equipment (appliances, cars, lamps, etc.).

➤ Cross-cutting measures:

- ❖ Innovative communication tools.

- ❖ Voluntary agreements.

The results of the survey are summarised in the report using different graphs, which show the degree of implementation of the measures in six world regions: Europe⁶, North America and OECD Asia & Pacific⁷, Latin America, Non OECD Asia, Africa and Middle East⁸. The results of the

survey are also available in an interactive online data base⁹ and can be queried by type of measure, target (i.e. sector, type of appliance) and country.

Although energy pricing is an important component of energy efficiency policies, it was not addressed in the survey, as there are a number of different international data bases that monitor price levels and trends.¹⁰

Many energy importing non-OECD countries are protecting their consumers from increases in the oil price by maintaining subsidised prices for some fuels. This has a negative impact on public finance, which became especially clear in the recent years with the soaring oil price. Subsidies generally act as a significant disincentive for energy efficiency investments and limit the scope and profitability of energy service companies (ESCOs).

Energy producing countries often maintain very low domestic prices, which lead to intensive energy use reflected in their high and rising energy intensities. A reduction in subsidies could save energy which could be sold at a much higher price on the international market and thus bring significant benefits to economies.

Adequate pricing means establishing consumer energy prices that reflect the cost of energy supply, i.e. the long-term marginal cost for electricity and the long-term price of oil products on international markets for fossil fuels. Taxation of energy may further contribute to internalising the externalities (such as social cost, opportunity cost and security of supply cost) in the energy price.

⁶ Including Russia

⁷ USA, Canada, Japan, Australia, South Korea, New Zealand.

⁸ The percentages shown in the different graphs only apply to the countries that have responded to the survey: they are not an exact average of each region, except for Europe where the rate of answers was quite good. The countries are in addition not weighted according to their energy consumption.

⁹ www.wec-policies.enerdata.eu

¹⁰ For instance GTZ monitors motor fuel prices for all countries in the world in its publication: "International Fuel Prices", www.gtz.de/fuelprices; (last update 2009). IEA provide quarterly energy prices for all OECD countries and a selection of non OECD countries.

Although most energy planners agree with such objectives, they often face reluctance and opposition from decision-makers outside the energy sector, who fear public resistance and the impact of energy price corrections on the consumer price index. Moreover, energy is a basic need and its affordability is essential, especially for low-income households. This makes actual price adjustments very slow or non-existent in many developing countries, especially in the household sector.

Energy Efficiency and CO₂ Trends

By reviewing energy efficiency trends and policies at world level, the present report aims to facilitate the exchange of information and share experiences on energy efficiency measures among different countries around the world. It can help government decision-makers and analysts select appropriate and cost-effective measures for each sector, taking into account their national circumstances. Decision tools such as energy efficiency/CO₂ indicators are very useful for monitoring trends in energy use and CO₂ emissions and contribute to a better understanding of the impact of the measures implemented in each sector.

Energy consumption has increased much slower than the GDP since 2004

Energy consumption is growing less rapidly than the economic activity in all world regions, except the Middle East. This decreasing trend for the energy intensity (energy consumption per unit of GDP) accelerated since 2004 because of higher oil prices and the introduction of new policies: 1.9% p.a. between 2004 and 2008 compared to 1.4% p.a. between 1990 and 2008.

In 2009, because of the economic crisis, the trend development was generally slower except in North America and OECD Pacific. More than two thirds of the countries in the world have decreased their energy intensity, and 50% of them by more than 1% p.a. Energy productivity

improved significantly, by more than 3% p.a. in 30 countries.

Energy productivity improvements since 1990 have helped avoid consumption of 3.6 Gtoe of primary energy and CO₂ emissions of 8 Gtoe by 2008

The reduction in the energy intensity between 1990 and 2008 in most world regions resulted in large energy and CO₂ savings, estimated at 3.6 Gtoe in 2008 and 8 Gtoe of CO₂ emissions.

Significant potential for further energy intensity reductions in many world regions

Large differences exist between world regions in their energy intensity levels, even after conversion of GDP to purchasing power parities: the energy intensity in the CIS, for example, is 2.7 times higher than in Europe, the region with the lowest value; and about twice as much in China, The Middle East and Africa. In North America, India and other Asia the intensity is about 50% above the European value. This shows significant potential for reduction in the future. OECD Asia and Pacific and Latin America however are only 10% above Europe.

Apart from Europe, energy productivity gains are greater for final consumers, by 20% at world level

The increasing use of electricity by final consumers has resulted in greater losses in power generation, as most of the electricity is produced from thermal or nuclear power plants. In Europe, there is an opposite trend: the primary energy intensity is decreasing more rapidly than the final energy intensity due to the increasing share of gas turbine combined cycle, wind and cogeneration in power production.

Energy efficiency of thermal power generation is still low in most emerging and developing countries, resulting in a significant potential of energy savings

Energy efficiency of thermal power generation improved only moderately, by 2.6% since 1990 at world level. The world average efficiency is presently 35%, which is far from the EU average (40%). If all world regions had the same performance as the EU average, 450 Mtoe of fuel would have been saved in 2008 alone, avoiding 1.3 Gtoe of CO₂ emissions.

A convergence of performance in industry because of globalisation

The specific energy consumption of energy intensive industries (e.g. steel, cement, paper) is converging and decreasing rapidly in regions with the worst performances because of globalisation of these industries. The best world practices are no longer found in the most developed countries.

The specific consumption of new cars is decreasing consistently thanks to various policy measures

In EU countries and Japan, the specific consumption of new cars has decreased consistently since 1995 (agreement with car manufacturers followed more recently by mandatory labels and a greening of taxes on vehicles for the EU and top-runner programme in Japan) the reduction has been slower in the US.

Increased appliance ownership driven by higher income has partially offset the effect of energy efficiency policies

In the residential sector, the average electricity consumption per household¹¹ did not really slow down, despite implementation of strong policies. Rising household income has led to increased ownership of large appliances (cooling and washing appliances), to a rapid diffusion of new appliances (e.g. air conditioning, ICT

appliances¹²) and devices. The growing use of stand-by mode in an increasing number of applications has offset the impact of the penetration of more efficient appliances.

The growth in electricity consumption per household is much slower in Europe and North America (below 1% p.a.) than in emerging countries, because of stronger policies and saturation in appliance ownership.

Electricity consumption grows faster than activities in services

In the service sector, the electricity consumption is growing much faster than the value added in almost all regions with the growing use of air conditioning and office appliances; there has been a slower development in industrialised countries since 2000.

CO₂ emissions from energy use were 40% higher in 2008 than in 1990 at world level

CO₂ emissions from energy use have increased in all regions since 1990, except in the CIS and Europe: where they were 40% lower in 2008 than in 1990 at world level. The growth is very rapid in non-OECD Asia, in particular in China and India, and in the Middle East where emissions have multiplied by a factor of 2.6 since 1990). In 2008 in Europe, climate change policies have helped to bring CO₂ emissions from energy use down to their 1990 level.

Because of the growing role of emerging countries with lower levels of CO₂ emissions per capita, world CO₂ emissions per capita are only slightly increasing: they stood at 4.2 t CO₂/capita in 2008 compared to 3.9 t in 1990 (+9%).

¹¹ Excluding heating in OECD countries to have comparable consumption.

¹² ICT: Information and Communication Technologies: TV, PC's, modems, etc...

In most countries and at world level, the reduction in CO₂ emissions per unit of GDP was driven primarily by energy productivity improvements (i.e. mostly energy efficiency) and not by fuel substitution.

Developments in Energy Efficiency Policies and Measures¹³

The trends in energy and CO₂ indicators result from various factors, including changes in energy prices and energy efficiency policy measures. The report conducted a comparison of the countries experiences in the implementation of energy efficiency policies. This evaluation helped develop the most effective and innovative policy measures implemented. It also reviewed the experience with specific measures and sectors through several policy case studies: energy savings obligations; role and importance of compliance for regulations; good practices in the public sector; evaluation of smart meters policies; energy efficiency measures for low income households; innovative communication/information tools.

About two-thirds of the countries surveyed have a national energy efficiency agency and programmes with quantitative targets

About two thirds of the countries surveyed (i.e. 60 countries) have a national energy efficiency agency. In recent years there has been an increase in local and regional agencies all over the world (about 1300 local and regional agencies according to the survey, of which there are approximately 900 in Europe).

These agencies at all levels (national, regional or local) are necessary to design, coordinate, implement and evaluate programmes and measures by introducing the requisite technical skill. National agencies can also play leading roles in negotiating sectoral agreements with equipment producers and financial packages for energy efficiency with national banks, international financing institutions or donors.

In addition, many countries are adopting energy efficiency laws. This should provide a favourable and long lasting context for energy efficiency policies and avoid the negative effect of “stop and start” actions.

Increasingly more countries with quantitative targets for energy efficiency improvement

About two thirds of the surveyed countries have set up official overall or sectoral quantitative targets for energy efficiency improvement. This represents a significant increase compared to the previous survey, especially in Europe where now around 90% of countries have a target compared to 55% in 2007. In addition, many countries have multiple targets. Final consumers are more often targeted in Europe than in the rest of the world, while other regions give a priority to targets on the primary consumption. In most regions, targets are most often expressed in terms of rate of energy efficiency improvements or energy savings; there are fewer objectives on energy intensity reductions, which used to be the dominant way to set up energy efficiency targets. Increasingly these targets are combined with yearly monitoring requirements.

More countries have introduced energy efficiency labels or MEPS¹⁴ and the number of products covered is increasing

Labelling of appliances is the main measure which has been implemented and now in about 60 countries according to the survey. Usually the

¹³ The results of the survey and the policy case studies can be found on the WEC web site at http://www.worldenergy.org/work_programme/technical_programme/technical_committees/energy_efficiency_policies_and_indicators/default.asp.

¹⁴ Minimum Energy Performance Standards

refrigerator is the first appliance to be labelled. Many countries have adopted MEPS for lamps to phase out incandescent lamps. Mandatory use of solar water heaters is now implemented in several countries, for example in Spain.

Building regulations are extended to existing buildings to enlarge their potential impacts. For instance, the EU building directive imposes energy efficiency certificates for existing buildings (equivalent to an energy efficiency label), each time there is a change of occupant or a sale. These certificates enable the buyer to obtain information about the energy consumption of the property they are going to buy or rent. In addition an update of the EU directive introduces mandatory energy standards for existing buildings undergoing renovations.

Economic incentives rely more and more on subsidies than on fiscal incentives

Two thirds of countries have subsidy schemes. Fiscal measures are mainly used in OECD countries where the tax collection system is more developed and revenues from tax higher.

Economic incentives should be targeted to limit the number of consumers that can benefit from them (e.g. low income households, tenants); in addition, they should be also restricted to certain types of investment (from a selected list of equipment), with a long payback time but high efficiency gains (e.g. renewables, co-generation) or to innovative technologies (demonstration or pilot investments). Solar water heaters and CFL are the main appliances to earn financial or fiscal incentives.

Economic incentives are also used to promote the quality of energy efficient equipment and services: in that case, the incentives only apply to products and services that have been certified or accredited by a public authority, generally the energy efficiency agency.

Tax reductions on energy efficient equipment or investments have been introduced in many countries and almost equally in all regions: they are in force in about 30% of the surveyed countries. The compact fluorescent lamp is the most common piece of equipment to which this measure applies outside the OECD. In some European countries, lower VAT level is used on labour costs to reduce the investment costs of buildings renovation. Another innovative way to promote investment in energy efficiency and CO₂ reduction is to offer tax concessions to companies that make concrete commitments on energy efficiency gains/CO₂ reduction, and meet their target.

Green tax on cars

Several countries are now introducing an innovative approach by using green taxes for cars, in which the amount of the tax is function of the CO₂ emissions or energy efficiency of the cars¹⁵. This applies to purchase tax as well as the annual tax. Such taxes have been very effective in shifting demand towards less powerful and more efficient cars.

Energy savings obligations for utilities: a promising market based instrument

Energy savings obligations are used in Europe and South America (e.g. Brazil, Uruguay). There are considerable variations in the way they are applied and on whom the obligations are placed. These obligations have been a success and are expanding in those countries where they have been implemented. The obligations to date have been delivered mainly in the residential sector and have largely operated without significant

¹⁵ France has introduced an innovative package combining a tax and subsidy scheme for new cars (known as “bonus malus”).

trading of their energy savings (White Certificates)¹⁶.

Energy savings obligations are attractive to governments because the cost is not met by them.

Energy savings obligations could be an important policy option for developing countries as they offer a way for governments to tackle energy efficiency at a fairly modest increase of electricity customers' bills (1-2%). Countries just embarking in such obligations will need to establish potential savings for their own local circumstances, although many electrical end-uses are increasingly global (e.g. energy efficient lighting and appliances). These obligations could also be tied in with the Clean Development Mechanism (CDM).

Role and importance of compliance for regulations

There is a trend to multiply the number of appliances, equipment or buildings with efficiency standards. However, to be effective these regulations need to be effectively implemented. This raises the problem of compliance. Poor compliance can have a long-term negative impact on energy efficiency strategies. Compliance comes at a cost but it is significantly lower than the benefits.

Compliance is not a black and white issue. Programmes cannot easily be categorised as in non-compliance and thus the idea of ranking measures as optimal or sub-optimal compliance is more appropriate. All programme evaluations should include an analysis of compliance as a factor in determining overall impact and more analysis is needed as to why compliance is not being favourably implemented.

There should be a healthier sharing of best practice on compliance methods. More capacity building initiatives are needed to improve the

development and implementation of compliance systems.

Good practice in the public sector

Opportunities to harness energy efficiency potential in the public sector are available in every country. As public sector activities reach across various end-use sectors there are always opportunities ranging from small-scale lighting retrofits to larger scale utility upgrades.

Public money is being used to purchase products and services and build facilities: by integrating efficiency considerations into procurement processes public money can be more effective with higher long-term returns.

The potential to learn from the experiences of other countries at different levels of governance is enormous and existing networks of public servants can provide instrumental support in this process. In addition to dissemination of experiences across national borders, learning opportunities are also available from one level of government to another.

Programmes for low income households

Measures for low income households on energy prices (e.g., social tariff, regulation), on household income (e.g., social benefits, direct financial aid) and on energy efficiency programmes should be seen as complementary. Measures related to energy efficiency need more time to reach households and get work done.

The main funding source is usually the public authority in charge of the corresponding policy. But it may also be the utilities or energy suppliers through energy savings obligation schemes. Then the delivery mechanisms are designed to seek out the best compromise between fairness (higher aids to more vulnerable households) and simplicity (minimising administration/transaction costs).

¹⁶ Certificates used for the trading of energy savings are known as "White Certificates".

Coordination between national and local levels appears to be a key success factor. A national framework is essential to develop large-scale activities, especially by raising significant funds. Then local management makes it possible to set up effective partnerships, mobilising all relevant players and skills. The proximity in the delivery of services is crucial. Local implementation schemes also create opportunities to gather various social policies addressing different aspects such as poverty, deprivation or health issues. Other key issues are the quality of services delivered and equipment installed.

Communication campaigns: a highly focused and tailored approach is needed

The full potential of communicative instruments in promoting energy efficiency is still largely untapped, particularly outside the OECD countries. The planning phase is the most important one in carrying out an information campaign. Planners need to have a good understanding of market needs, driving forces and the prevailing circumstances in which campaigns are implemented.

Campaign goals need to be balanced with the resources available. Therefore, campaigns should be based on market segmentation, which allows better focus, use of tailored instruments and more efficient use of resources.

Too often campaigns try to offer “everything to everybody” which leads to inefficient use of resources. Campaign resources can be enhanced by cooperation with partners and other stakeholders.

Generally, multiple communication channels are used in order to reach all chosen target groups and to take into account socio-economic factors, language, access to media etc. The most frequently used instrument is TV, followed by other mass media and also the Internet.

Energy efficiency campaigns, as well as the design of campaigns featuring humour and “energy efficiency ambassadors” create positive reactions from the public. Given the complexity and multitude of energy-use patterns and target groups to be addressed, there is not a simple one-size-fits-all solution in terms of choice of instruments. Instead, a highly focused and tailored approach is needed.

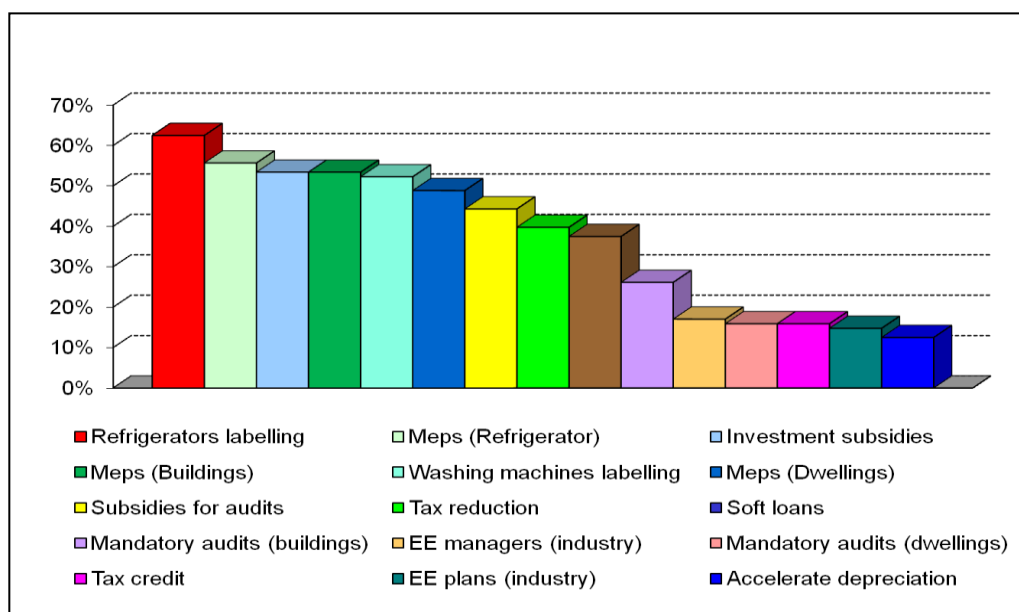
Smart meters: a costly but efficient way to promote energy efficiency if well regulated

Smart meters are measuring devices which send consumption information to the utility. As such they provide more benefits to the utilities than to the end consumers. They however can contribute to reduction of the consumption and contribute to saving fuel for peak power generation.

Smart meters and the communication technology required for energy efficiency programs are expensive – at least €200 per household. They are therefore not necessarily appropriate tools for developing nations, or those where household consumption is low.

Labelling and MEPS of refrigerators are the most popular measures

Labelling and MEPS of refrigerators are the most popular measures followed by investment subsidies and MEPS for buildings. A variety of measure types can be found among the most frequent measures (regulation on labels, regulation on MEPS, financial incentives and fiscal measures) showing that there is no preference for a specific policy instrument and that a mix of different types of measures is generally preferred.



Recommendations

Energy Efficiency: a winning strategy

Energy efficiency is the winning strategy to simultaneously address a variety of policy objectives, including security of supply, climate change, competitiveness, balance of trade, reduced investment need and environmental protection (local pollution, deforestation):

- By reducing the amount of energy imports it is the main strategy for improving the security of supply and reducing the demand for fossil resources, thus extending their availability.
- Energy efficiency could make up half of the reduction needed to drastically reduce greenhouse gas emissions by 2050 in scenarios with strong CO₂ constraints¹⁷.
- Energy efficiency increases competitiveness of industries, especially for energy intensive industries, by reducing their energy costs.
- Energy efficiency limits the macro economic impacts of oil price fluctuations for oil importing countries, in terms of balance of payments, and public finances when prices are subsidised, and it can help economies prepare better for increasing cost of energy in the future.

- It reduces the huge need of investment for expanding energy infrastructure in emerging countries and frees capital for other purposes or helps avoid shortages of capital that limit economic growth; more generally, it enhances economic development by reducing energy shortages and contributes to poverty eradication.
- It contributes to the environmental protection by reducing local pollution and deforestation in particular, in Africa and South Asia where many households still do not have access to modern fuels and have to rely on wood fuel.

To be successful, energy efficiency programmes and projects need to be based on appropriate strategies. The report proposes a set of 10 main recommendations to improve the implementation and effectiveness of energy efficiency policies¹⁸:

¹⁸ These recommendations rely on the discussions and conclusions of various meetings, in particular two regional seminars held by WEC and ADEME in Addis Ababa (28-29 June 2009) and in Tunis (15-16 March 2010), a national WEC seminar in Brazil (5-7 October 2009), and the final ADEME-WEC Workshop on Energy Efficiency Policies held in London (17-18 June 2010). It also relies on the discussions and conclusions of several meetings in which this project was presented, in particular an OLADE seminar on energy efficiency (Cuba, 28-29 October 2009) and an ECOWAS meeting on energy efficiency.

¹⁷ See United Nations report (2007), IEA (2010)

1. Incentive prices are needed to make investments in energy efficiency attractive and cost effective for the consumer.
2. Sustainable institutional support is necessary to give long term signals to market players.
3. Innovative financing schemes are needed to support consumers at a limited cost to the public budget.
4. The quality of energy efficient equipment and services should be promoted.
5. Regulations need to be regularly strengthened, enforced and expanded.
6. Measures should be combined in packages of complementary measures rather than implemented as single measures.
7. The situation in developing countries should be addressed adequately.
8. Consumer behaviour should be addressed as much as technologies.
9. The introduction and impacts of measures should be well monitored.
10. International and regional cooperation should be enhanced.

Incentive prices: a condition for successful energy efficiency policies

Low energy prices or inadequate tariffs may lead to an extended payback time for energy efficient equipment or for investments in energy efficiency and make them not cost effective at all. In addition, low energy price acts as a disincentive for a rational use of end-use equipment.

Adequate pricing is a necessary condition for promoting energy efficiency¹⁹. The first step of any energy efficiency policy should be to give correct price signals to consumers in order to provide them with incentives to change their behaviour or to acquire energy efficient equipment.

Prices should be adjusted to long-term marginal costs in an escalation mode (i.e. in a growing way). These adjustments should take into account the disruptive impact on low-income households and propose compensation mechanisms.

Dynamic pricing through TOU tariffs²⁰ and “smart meters” for large consumers can reduce the need for additional investments in peaking capacity, minimising production in low efficiency fossil fuelled power plants.

Clear price signals alone are not enough to lead to a rationalisation of energy use: policy measures are necessary to reinforce the role of energy prices by removing the usual barriers to energy efficiency and to develop and structure the market for efficient equipment and devices.

A sustainable institutional support to give long terms signals to market actors

Energy efficiency policies and programmes should give long-term signals to market players. They should rely on a sustainable regulatory framework that can provide a long lasting context for energy efficiency policies and avoid the negative effect of stop and go actions.

Such goals can be reached by the adoption of energy efficiency laws and official quantitative targets for energy efficiency improvement by Government.

¹⁹ Beyond energy efficiency considerations, subsidised energy prices represent a burden on the public budget of energy importing countries when domestic prices are much lower than international prices. For energy producing countries price below international prices represent a loss of revenue

²⁰ TOU : Time Of Use

In addition, policy makers should signal in advance to both consumers and manufacturers/constructors on future regulations so that they can adapt, especially with respect to mandatory efficiency standards

Energy efficiency policies should organise and stimulate the market of energy efficiency equipment and services by establishing energy efficiency agencies at national, regional and local levels: such agencies are necessary to design, coordinate, implement and evaluate programmes and measures. National agencies can have a leading role in developing appropriate finance mechanisms with national and international financing institutions.

The public sector, at national, regional and local levels should play a leading and exemplary role in the development of the ESCOs market as well in public procurement of energy efficient equipment.

Innovative financing to support consumers at a limited cost for the public budget

The large-scale diffusion of energy efficiency investments and equipment requires massive and sustainable funding to support customers by decreasing the payback time of these investments and by removing the barrier of initial cost.

Revolving energy efficiency funds should be set up with guarantee mechanisms to attract the participation of financing institutions. In less developed countries, projects should be grouped to be attractive for multilateral funding.

To reduce the burden on the public budget, new sources of funding should be considered, such as:

- Earmarked taxes²¹.

- Public private partnership between public institutions and private investors, such as banks or private companies (ESCO's);
- Energy savings obligations for utilities, where utilities must have an active role in the promotion of energy efficiency, including provision of financial supports for consumers;
- Combined tax and subsidy schemes (e.g “bonus malus”) that are neutral for the public budget²²;
- Use of CO₂ revenues from carbon auctions and carbon finance (CDM projects).

The financial support to consumers should be attractive, by lowering the payback time and enabling acceptable monthly loan repayments. This requires the introduction or maintenance of investment subsidies or tax credits provided the energy efficient equipment or investments have extended payback times and low interest or even zero interest loans.

Channeling of these funds to the consumers can also be improved by appropriate mechanisms, such as monthly loan repayments via energy bills²³.

A quality of energy efficient equipment and services

To inspire confidence in consumers and avoid negative feedback from low quality energy efficient equipment and services, quality labels and technical norms of equipment should be developed. This quality control of equipment should address both locally produced and imported products.

The introduction of norms and certification of equipment implies the existence of independent certification and testing facilities.

²¹ Earmarked taxes correspond to taxes the revenue of which has to be used for energy efficiency support.

²² In this scheme, the income from the tax is used to fund the subsidies.

²³ This is the case for the solar programme in Tunisia.

This may be a constraint in many developing countries (especially for small countries) and regional centres could provide a solution. The existence of a national or regional testing centre is a key element to ensure that imported products are in compliance with national standards. There is also a need for development of international recognised norms through ISO or regional bodies such as CEN and CENELEC²⁴ in Europe.

The performance of some efficient appliances (e.g. solar heaters) and buildings is also related to the quality of the installation or construction. In this respect, skilled installers and builders and their certification can guarantee the quality of the services offered. In the same way, audit schemes assume a certain quality of auditor as well as the staff responsible for energy management in the companies (energy managers). The certification of auditors and training of energy managers can assure this.

To ensure the success of certification schemes, independent control of the effective quality of these certifications should be implemented.

Only equipment complying with energy efficiency norms should benefit from economic support measures, such as subsidies or public purchasing.

Regulations need to be regularly strengthened, enforced and expanded

To be effective, labelling programmes and energy performance standards must be regularly updated. Indeed, there is no incentive for manufacturers to go beyond what is required if no stricter standards have been planned for the future or when most of the models on the market are in the best efficiency classes.

It is therefore essential to review and reinforce standards at regular intervals as a way to stimulate technical progress and to ensure a

steady improvement in energy efficiency. Revisions of standards for buildings and equipment should be embedded in regulations to ensure an effective strengthening of regulation over time.

Regulations on buildings or equipment are effective as long as they are really enforced. The multiplication and tightening of regulations increase the risk of non-compliance and limit their effect. This issue is often insufficiently addressed by policies, because of budget limitations. Enforcing existing regulations may be in some case as efficient as strengthening further these regulations. Compliance should be integrated in regulations and include random controls. Evaluation of the reasons for non-compliance should be studied to provide the necessary corrections to improve compliance.

More appliances and equipment need to be addressed to cover a larger part of the electricity and fuel consumption. This implies to expand regulations to a larger set of appliances (e.g. standby, ICTs) and equipment (e.g. light duty vehicles, tyres).

Measures should be combined in packages of complementary measures

Investment in energy efficiency entails a complex process due to many barriers and decision-makers. To achieve a greater impact the implementation of several complementary measures that will help address all steps towards efficient deployment. These packages of measures should combine information and communication actions, regulations, subsidies, soft loans, training and certification and should be implemented simultaneously and not one after another.

Examples of packages of measures can be information campaigns complemented with direct subsidies plus financing methods, or with economic incentives plus quality labels, or else with regulations plus subsidies or financing mechanisms and quality labels, and so on.

²⁴ CEN, European Committee for Standardization and CENELEC, European Committee for Electrotechnical Standardization.

There is no systematic miracle optimal mix: the package needs to be tuned to each target or actions according to national specifics.

The situation in developing countries should be addressed more adequately

Most measures that have been implemented in developing countries are transferred and adapted from industrialised countries. Therefore, the specific situation and needs of these countries regarding energy efficiency remain insufficiently addressed, for instance:

- Used second-hand electric appliances and cars represent the bulk of appliances/car purchase;
- Lighting is the main use of electricity in rural areas and for low urban income households;
- Cooking with biomass makes up a significant share of the household energy consumption, which is very costly if biomass is purchased or time consuming if it is collected, due to the low efficiency of traditional cooking stoves.

Therefore specific measures should be designed and implemented in developing countries, such as:

- Regulations on second-hand appliances and cars (including ban);
- Adapted incentives for efficient biomass stoves and CFL;
- R&D in improved biomass stoves and solar cookers;
- Capacity building.

Behaviour should be addressed as much as technologies

Real energy savings are always far from what is expected from technologies because of consumers' behaviour (e.g. purchase of larger efficient refrigerators, higher indoor temperature, rebound effects). It is therefore recommended to conduct more studies on the impact of behaviour and to develop and promote technologies that

can limit the impact of inefficient behaviour (e.g. speed limiters, thermal regulation of room temperature, automatic switch off of lights in unoccupied rooms, light sensors, programme automatically set to saving modes for washing appliances).

It is also recommended to provide tools to the consumers to enable them to manage their energy consumption better, such as informative billing or in-house display devices. One form of informative billing is to provide comparative information that enables each consumer to understand the bill or specialised support comparing the consumption level by similar consumers (for households) or similar companies (in industry and services).

As it is difficult to reach the multitude of consumers, it is recommended to improve communication tools linked to energy efficiency campaigns.

In the transport and household sector, improving the efficiency of new equipment, vehicles and buildings is important. But it is equally important to maintain the equipment and vehicles to avoid a progressive loss of efficiency. Policy measures also need to focus on maintenance.

The impacts of measures should be monitored

Monitoring the effectiveness of the measures implemented is important to evaluate the impact on energy use, to understand how efficient and successful the measures are, to evaluate the use of public funds, to monitor targets and also to follow legal requirements in terms of reporting.

To monitor the impacts of measures it is recommended to implement the following actions:

- Develop detailed data collection system on energy uses by sub-sector or end-uses, i.e. beyond the usual energy balance data;

- Develop energy efficiency indicators to monitor progress achieved on a yearly basis²⁵;
- Evaluate the measures that work and do not work to better tune them;
- Evaluate the drawbacks of some measures (e.g. rebound effects²⁶).

International and regional cooperation should be enhanced

International and regional cooperation is important to save time and money in the implementation of measures by benefiting from economies of scale. Firstly this can be achieved through regional testing facilities, regional certification and through exchange of experience on regulations (e.g. labels, MEPS) and other measures.

It is also important to develop harmonised regional regulations and standards to avoid distortion of competition and to create a larger market for energy efficiency products.

International and regional cooperation enables a broader dissemination of information on best practices through regional benchmarking and common and harmonised data collection at regional levels.

Regional cooperation can help to speed up energy efficiency improvements through the introduction of common measures and policies in all countries within the same economic region. (e.g. EU), ensuring that all countries move at the

same pace.²⁷ Therefore, it also contributes to political integration.

To be effective, cooperation and twinning programmes should accompany international cooperation between energy efficiency agencies, including technical assistance, transfer of experience and know-how.

The World Energy Council provides a unique opportunity for effective international cooperation between the energy decision-makers and energy consumers.

²⁵ In this area, norms are being developed to calculate energy savings, such as for instance in Europe at the level of CEN/ CENELEC (draft norm presently under public inquiry).

²⁶ The rebound effect corresponds to a change in energy using behaviour that leads to an increased level of service following the purchase of an energy efficiency equipment.

²⁷ e.g. EU with mandatory targets of energy savings, mandatory regulation for member countries.

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ISBN: 978 0 946121 00 7