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Photos: Adel Mourtada

Instruments and Financial Mechanisms of energy efficiency measures in building sector

WEC-ADEME Case study

on Energy Efficiency Measures and Policies

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Introduction

Buildings are responsible for at least 40% of energy use in most countries. The absolute figure is rising fast, as construction booms, especially in countries such as China, India and Southern Mediterranean countries. The determinant factors of the energy demand evolution are economic and demographic. For this set of countries, the expected development of the building sector and higher standards of living (directly connected with the consumption of the residential sector) are the main reason for these consumption upsurges. It is essential to act now, because buildings can make a major contribution to tackling climate change and energy use. Progress can begin immediately because knowledge and technology exist today to slash the energy buildings use, while at the same time improving levels of comfort. Behavioral, organizational and financial barriers stand in the way of immediate action. Successful policies and measures have been implemented in several WEC member countries. Evaluation of energy efficiency trends around the world and the interaction between energy efficiency policies and energy efficiency performance of economies can contribute to define approaches that can help overcome these barriers.

However, in the past years there is a positive development of the EE/RE framework conditions in most of WEC member countries. An important aspect has been the increase of the energy prices on the world market. These price increases entailed a heavy additional burden for the national budgets of energy importing countries with high energy subsidies. Meanwhile, several WEC member countries already have or plan to reduce their subsidies on energy prices. A forerunner of this policy, Jordan, exempted also the import of EE/RE equipment from customs duties. The Turkish government declared 2008 to become the Energy Efficiency Year and started a large campaign as the country has the highest fuel prices in Europe and the MEDA-region. Syria started reduction on energy subsidies, Tunisia enacted the new Energy Efficiency Building Code and prepared a program for the thermal rehabilitation of existing buildings, Lebanon started a review to enhance the thermal standard for buildings and launched a program of energy efficiency measures in public buildings, Morocco started the development of its energy efficiency buildings code, Jordan established the Jordan Energy Efficiency Funds, the regional renewable energy center has been established in Egypt and Israel developed its Green buildings code. But also the energy-exporting countries realized that it is better to improve EE and use RE so that more energy may be exported at high world market prices.

Progress must be made now if we are to vastly improve the energy efficiency of both new and existing buildings. Examples exist of where this is being and can be achieved. And there are many ambitious goals; for example, the UK government anticipates dramatic energy reductions to achieve its goal that all new homes in England be carbon-neutral by 2016.

After presentation of principal indicators and trends of buildings sector around the world and a short review of existing energy efficiency measures, this report focuses on successful financial tools for households. The main measures and their impact, from the experience of the main countries that have implemented the measures are presented. This report is completed with case studies of 6 countries representative of world regions and with a good experience in the implementation of the measure.

Energy issues of the building sector in the world

Building stocks

The scale of current residential property stock in selected countries or regions is shown in **Figure 1**. The construction residential market in China is particularly notable and is growing rapidly. China is adding 1.6 billion square meters a year. Southern Mediterranean countries are adding 220 million square meters a year. China is building the equivalent of Southern Mediterranean countries building area every three years.

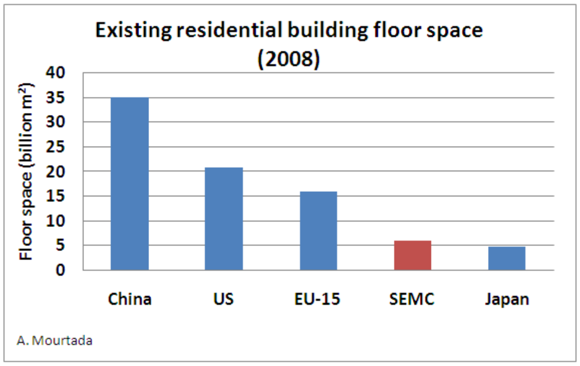


Figure 1 : Existing residential building floor space in selected world's region

Building sector energy consumption

According to IEA data, the final energy consumption of the building sector in the world has risen to 2 794 millions of toe in 2007. The building sector represents around 34% of the world final energy consumption, and hence is the first consumer sector.

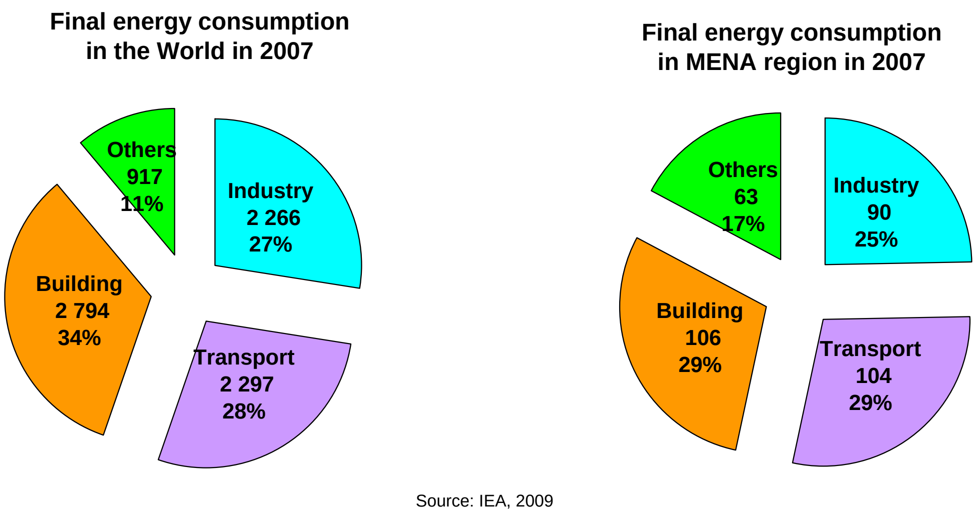


Figure 2 : Final energy consumption in the world in 2007, AIE, 2009.

In the MENA region, buildings sector are also the highest consumer sector with a share in the total final consumption of around 29% (106 Mtoe).

Figure 3 shows the primary energy demand of residential sector in selected countries or regions. **Figure 4** shows Primary energy demand (per m2.year) of existing residential building sector in selected regions and countries (2003). The sources of energy vary greatly with a significant amount of coal and biomass burned on site in China and India, but with a much higher share of electricity being used in other countries. This variation contributes to large differences in primary energy consumption per m^2. Development and urbanization are associated with increased electricity use, which will significantly increase primary energy demand in China, India and SEMC because of the additional energy demands of power generation and distribution.

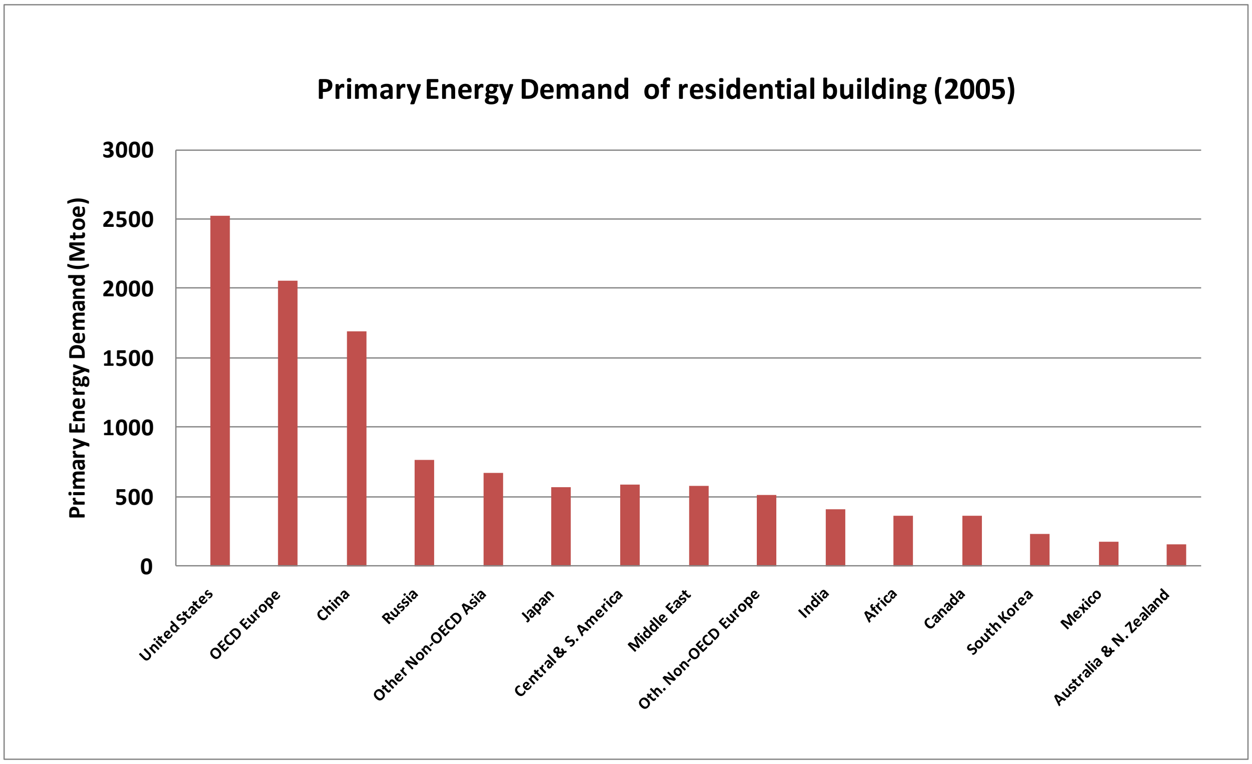
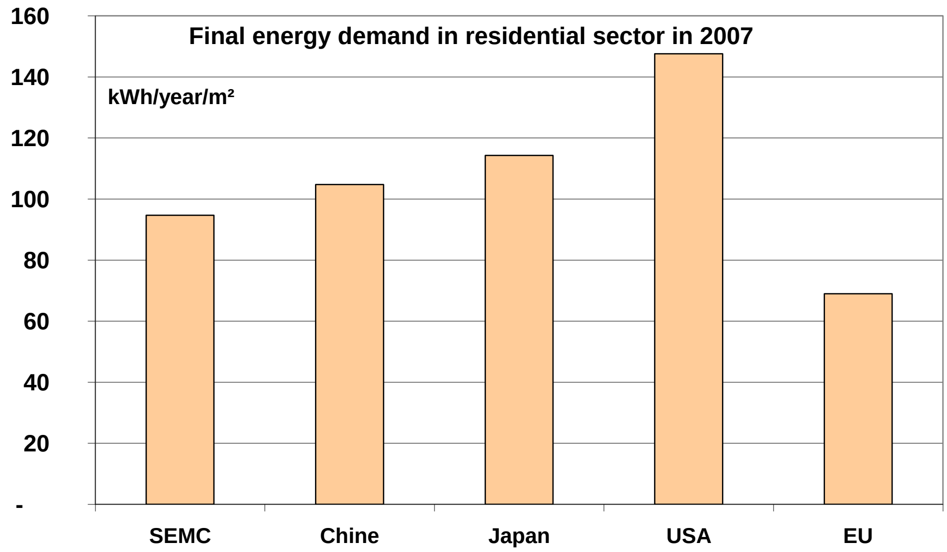


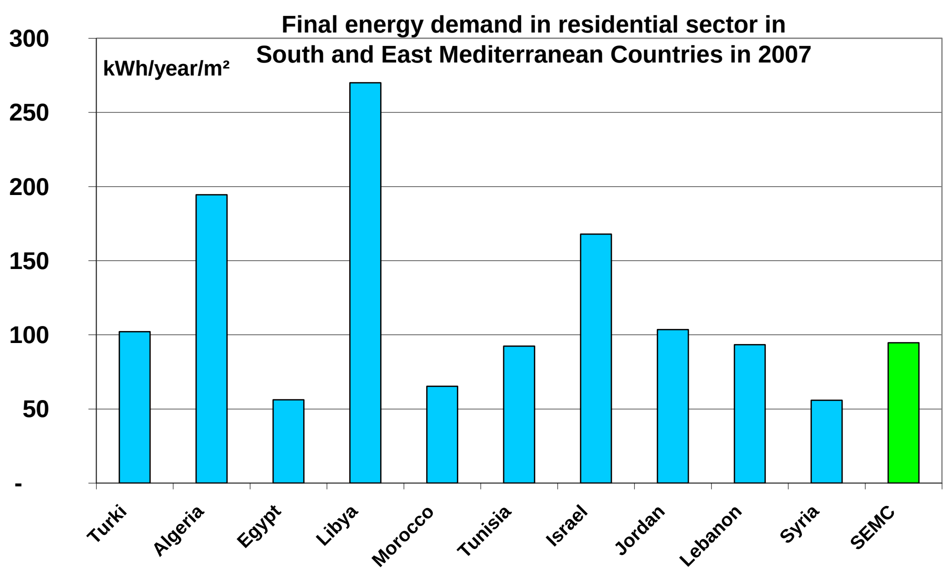
Figure 3 : World Primary energy demand of residential building sector (source :EIA, International Energy Outlook 2008, June 2008, Table A1, p. 83 and Table A14, p. 97.)



Source: Estimation R. Missaoui, from AIE data 2009 and OME scenrios, 2008.

Figure 4 : Final energy demand (per m2.year) of existing residential building sector in selected regions and countries (2007)

For the Southern and Eastern Mediterranean Countries (SEMC), the highest consumption per m² is observed in Libya (275 kWh/y/m²) compared to the lowest one in Egypt (60 kWh/y/m²), as shown by the **figure 5**.



Source: Estimation R. Missaoui, from AIE data 2009 and OME scenarios, 2008.

Figure 5 : Final energy demand (per m2.year) of existing residential building sector in selected SEMC (2007)

The determinant factors of the energy demand evolution in Southern and Eastern Mediterranean Countries are demographic and economic. In 2008, the population of the Mediterranean amounts to 474 Million inhabitants, the population of the Southern and Eastern MEDA countries "SEMCs" amounts to 280 (around 59% of the total population). It should also be noted that concerning SEMCs' population, the bulk of the population will be concentrated in Egypt, Turkey, Algeria and Morocco, which together will represent 81% of the total population in SEMCs.

Trends of energy consumption in building sector

According to the reference scenario of IEA, the building sector will remain the first consumer with in 2030 with consumption share of 32% (3639 Mteo). Its energy demand will grow with an average of around 1.2% per year against 1.4% for the whole final energy consumption.

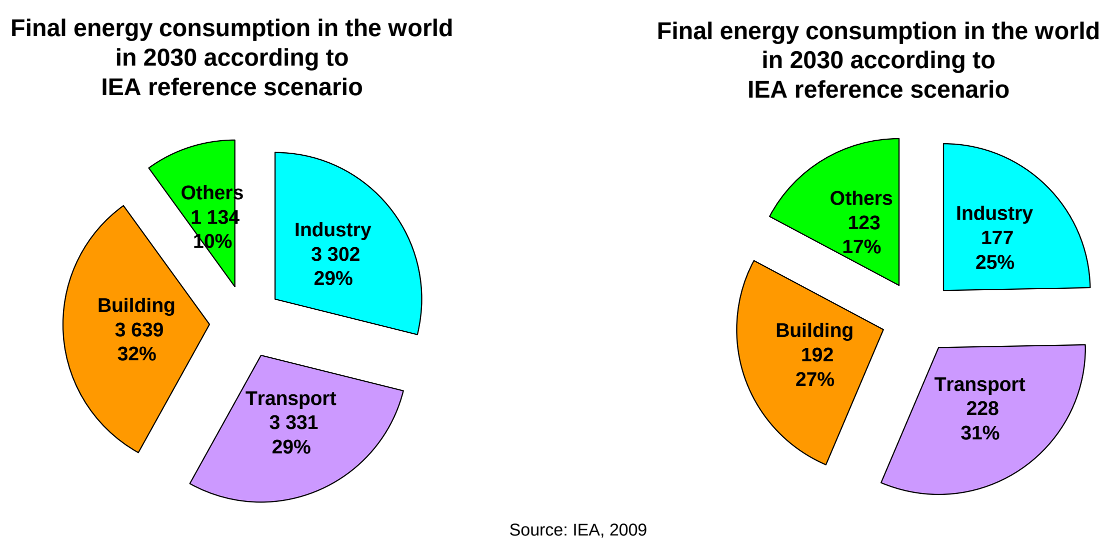


Figure 6 : Final energy consumption prospective in the world in 2030 according to the IEA reference scenario, Energy outlook, IEA, 2009.

For example in the, in the MENA region, the final energy demand of the building sector will be around 2.6 per year leading to a share of 27%, which is the second place after the transport sector.

Energy saving and GHG reduction potential in building sector

Energy saving potential

To reach the objective of the IEA 450 scenario, the total final energy saving has to reach 1258 Mtoe from which the building sector should represents around 29%. In the MENA region, the biggest part of energy saving will come from the building sector (40%).

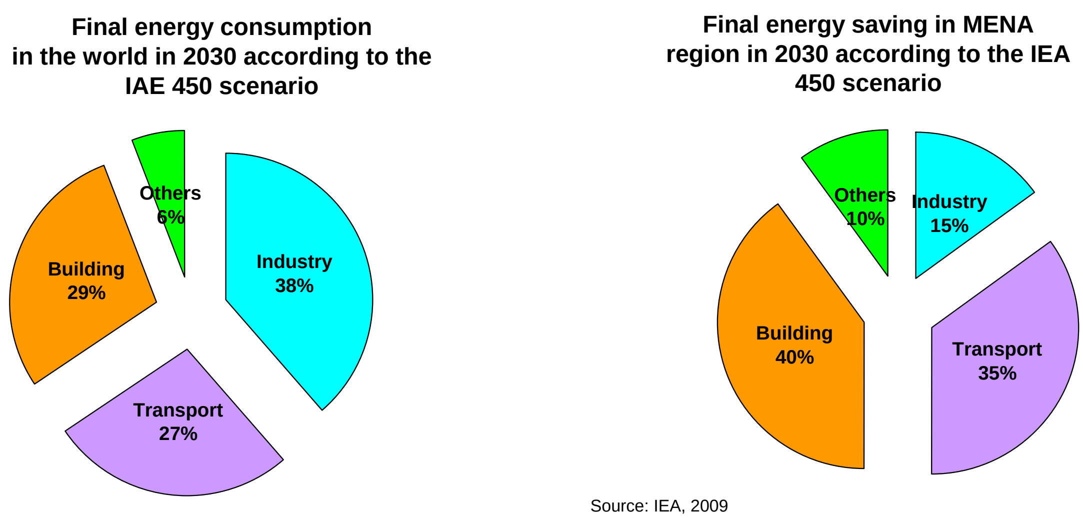


Figure 7 : Final energy saving prospective in the world in 2030 according to the IEA 450 scenario, Energy outlook, IEA, 2009.

Investment cost of energy saving potential mobilization

To reach this objective IEA 450 scenario, the total required additional investment amount is estimated at around 10 500 billions dollars compared to the reference scenario from which 25% has to be invested in building sector (2533 billions $ 2008). The following chart presents the additional investment in the 450 Scenario relative to the Reference Scenario, by region over all the period 2010-2030.

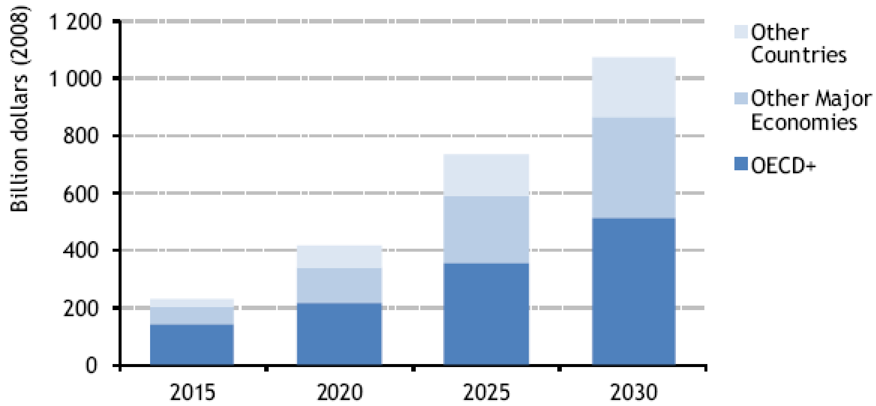


Figure 8 : Additional investment in the 450 Scenario relative to the Reference Scenario, by region (Source: Early excerpt of WEO 2009 for Bangkok UNFCCC meeting)

GHG emission reduction potential

To achieve a goal of cutting emissions by 50%, emissions would have to reach the peak during the next decade and decline to 14 GtCO2 in 2050. What would have to be done in practical terms to achieve this goal? Improving energy efficiency is top of the list. **Figure 9** shows the global cost curve of GHG abatement (IPCC, 2007). Energy efficiency in building sector represents a high potential opportunity to reduce GHG emissions.

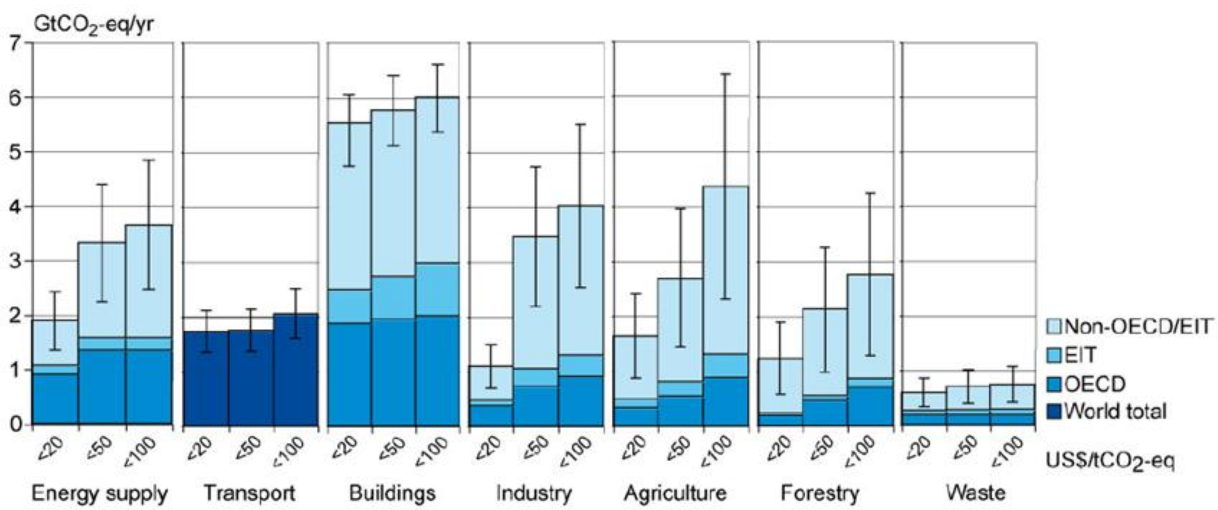


Figure 9 : Global cost curve abatement of GHG opportunities beyond business as usual (source: IPCC, 2007).

Buildings can also deliver large potentials at negative costs. Key areas are (McKinsey, 2007):

- Improved insulation (40%)
- Appliances (30%)
- Lighting (10%)

Energy efficiency in the building sector

Energy use in residential buildings

More than four-fifths of site energy use typically occurs in the operational phase of a building's life, as **Figure 10** shows. The proportion of energy embodied in materials and construction will rise if operational energy efficiency increases and if building life spans shorten. Then it's important to address the materials of construction by energy efficiency measures.

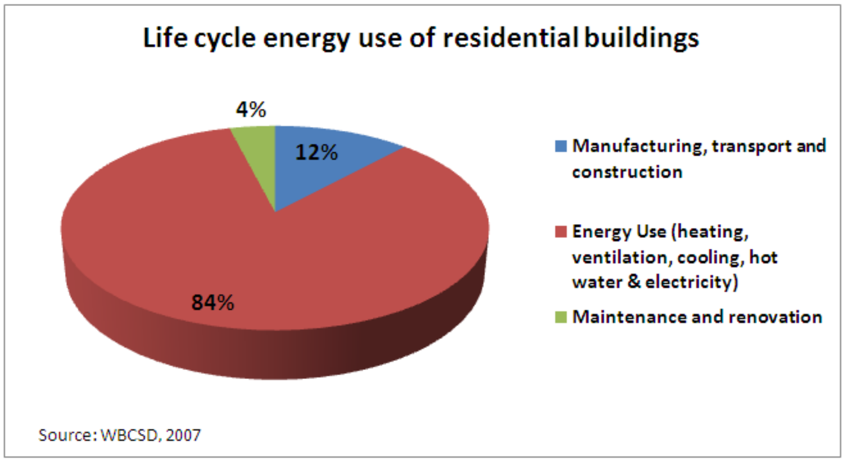


Figure 10 : Life cycle energy use of residential buildings

Energy efficiency of new buildings determines the energy consumption for far longer than in other end-use sectors. Unfortunately, projects and legislation are based on short payback times on a few years. Energy issues buildings should be evaluated over life time of the building or at least over 30 years. Since buildings are typically renovated several times, (residential every 30 – 40 years), renovation offers a special opportunity for improvements of EE. But it has to be done right in the first place! By construction!

Energy efficiency factors in buildings vary according to geography, climate, building type and location. The distinction between developed and developing countries is important, as is the contrast between retrofitting existing buildings and new construction. In all cases there are different standards of building quality. It is vital that energy efficiency permeate all levels and not be restricted to high-end properties. **This complexity means it is impossible to develop a single solution and single financial mechanism for all regions and all cultures.**

Energy use varies among residential buildings by region and climate (climatic conditions can be divided into three zones: cold, moderate and warm), but space and water heating are substantial components in most regions. This is true for the US despite the widespread use of energy for space cooling in warmer states. In developing countries the refrigeration for food conservation and the high penetration of cooling systems should be taken into consideration with the energy consumption for lighting. Household end-uses can be divided broadly into five sections, as illustrated in **figure 11**.

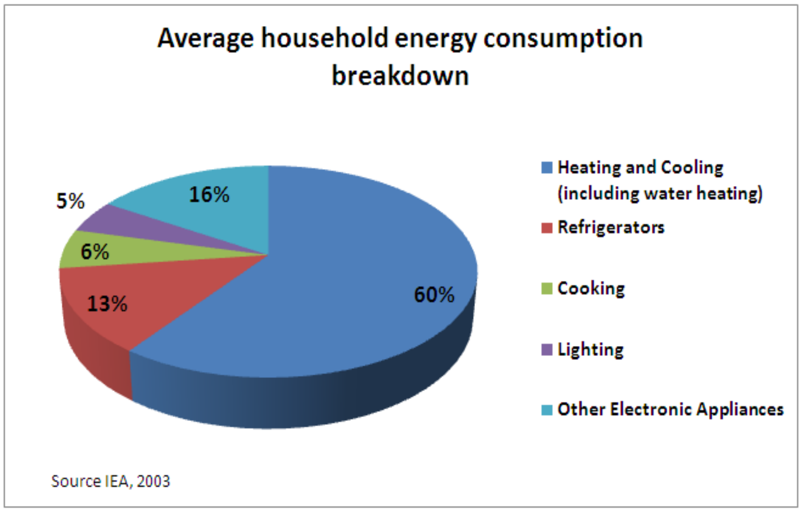


Figure 11 : Average household energy consumption division

Climate change will increase energy demand for cooling as people seek to maintain comfort levels in more extreme conditions.

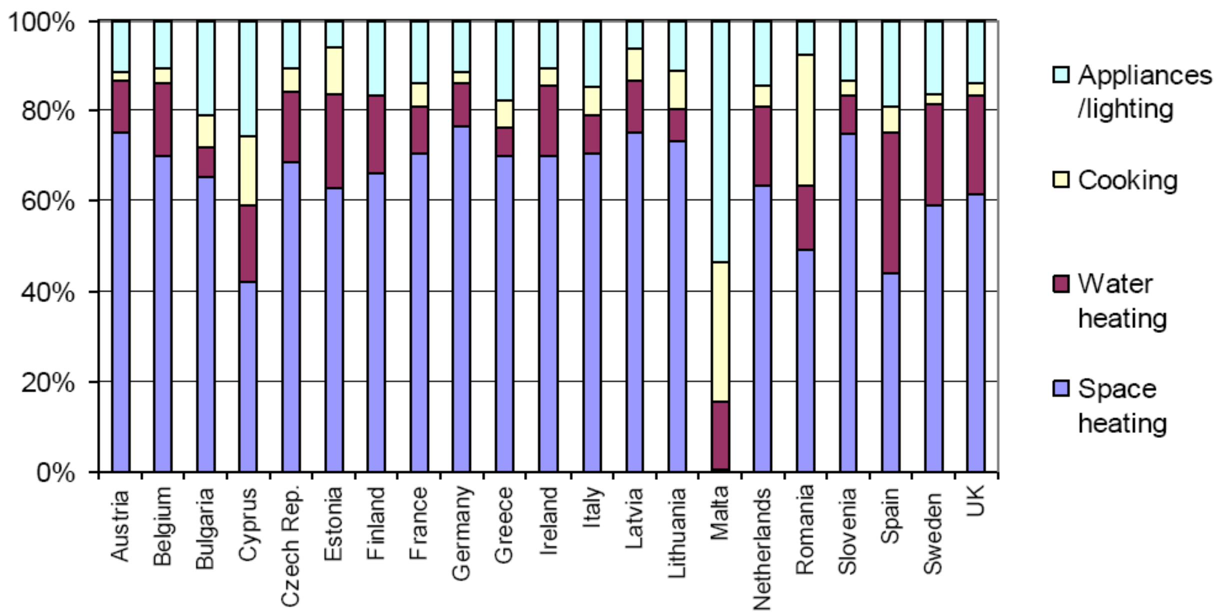


Figure 12 : Break down of household energy use for EU-countries (2005). Source: Energy Efficiency Trends and Policies in the Household & Tertiary sectors in the EU 27, November 2009

Main approaches to improve energy efficiency residential building sector

There are three main approaches to improve energy efficiency in building sector:

- Cut buildings' energy demand: by, for example, using insulation and equipment that is more energy efficient.
- Produce energy locally: from renewable and otherwise wasted energy resources.
- Share energy: create buildings that can generate surplus energy and feed it into an intelligent grid infrastructure.

Energy efficiency design

Building performance depends not only on the performance of individual elements but also on how they perform as integrated systems. The building envelope is particularly important. It is the starting point of energy efficient buildings and the main determinant of the amount of energy required to heat, cool and ventilate. Specifically, it determines how airtight a building is, how much heat is transmitted through "thermal bridges" (that breach insulation and allow heat to flow in or out) and how much natural light and ventilation can be used. Considering equipment and infrastructure is also important, while the design brings together all the influences on energy efficiency.

PassivHaus, which began in Germany in 1991, has developed an approach that can reduce the energy demands of a building to one-twentieth of the norm but still provide comfortable conditions. There are more than 6,000 buildings that meet the PassivHaus standard – offices as well as apartments and houses, and new and renovated buildings.

The US Green Building Council has performed numerous studies and concluded that the cost of reaching certification under its Leadership in Energy and Environmental Design (LEED) standards system is between zero and 3%, while the cost of reaching the highest level of LEED (Platinum) comes at a cost premium of less than 10%.

France is implementing ambitious strategy « Factor 4 ». The Building sector is already identified as a key-actor for reaching this goal. The strategy for the building sector is:

- Large possibilities to use conventional and renewable energy sources;
- Possible mixing of different energy sources in the same building;
- Possible conversion of energy sources during the building lifetime;
- User behaviour not subject to radical change;
- Retrofitting possible in different steps over many years;
- Energy efficient buildings more valuable on the market.

New incentives in France:

- 2005: tax reduction, in force until 2009, for efficient technologies (renewable energy, insulation, glazing, energy management systems, heating systems, heat pumps…);
- 2006 : labelling for HEP (High Energy Performance) and VHEP (Very HEP) buildings;

- 2006 : new buying tariff for electricity produced by integrated PV panels: 55 c€/kWh;
- 2006 : financial tools in favour of energy savings and renewable energy sources;
- 2007: implementation through public and private initiatives of an Effinergy label for passive buildings;
- 2007: Energy performance certificate.

Energy Building Codes

One important measure for efficiency in buildings is requirements in Building Codes or in energy efficiency standards for new buildings. Building regulation is used to drive increase efficiency in all new buildings. On longer term: New Buildings don't need to use energy! It is expected to be mandatory by the new energy building codes). But how do we get there?

These energy codes have to be supported by other P&M such as labeling, efficient appliances promotion, incentive measures, etc. For example we can figure out the following actions taken by some governments:

- Brazil: Measures to improve the efficiency of lighting equipment;
- China: Mandatory energy labeling for domestic appliances, broadening and; updating voluntary energy labelling;
- EU: Building "energy passport" required by the Energy Performance in Buildings Directive;
- India: Efficiency standards and new mandatory energy labeling for new appliances and equipment;
- Japan: Top Runner efficiency standards for equipment;
- USA: Energy efficiency programs for utility companies.

Produce energy locally

If we have ultra low energy consumption and we use solar cells and solar panels, we will get zero energy or zero carbon building. European countries start the roadmap path to zero energy. Indeed Several Member States have already set up long-term strategies and targets for achieving low energy standards for new houses. For example, in the Netherlands there is a voluntary agreement with industry to reduce energy consumption compared to the present building codes by 25% in 2011 and 50% in 2015 (which is close to passive house) and to have energy neutral buildings in 2020. In the UK the ambition is to have zero carbon homes by 2016. In France by 2012 all new buildings should comply with "low-consumption" standard, and by 2020 be energy positive, i.e. produce energy.

Green Labels

There is much more than just energy efficiency to be considered:

- Water Conservation
- Indoor Climate
- Waste reduction
- Health Aspects
- Sustainable Products
- Local Resources

– Balance with nature
– Building disposal
– Reuse of elements

New Green Labels are under implementation to take into consideration the requirements of sustainable buildings (ex: BDM, Sustainable Mediterranean Building)

Although the potentials for buildings are large and compelling, only a small potential is realized, because many barriers hamper energy efficiency in buildings.

Sustainable buildings

There is a need for policies and financial mechanisms to ensure efficient buildings. Large experiences exist on technical level. Good sustainable solutions exist at national or local level, but information is not general available. Many networks exist in the field of sustainable buildings, but most have limited scope and are national or regional.

IEA was asked to build up a Sustainable Buildings Network – (Heiligendamm G8 Summit 2007). The G8 wants to:

– Set up a "Sustainable Buildings Network", involving the G8 and open for participation of the major emerging economies. The network will develop practical instruments for assessing and advising on the implementation of energy efficiency in buildings and the use of renewable energies, especially for cooling and heating, taking into consideration the different situations of new and existing buildings, and deployment of low and zero-carbon buildings,
– Invite the IEA to take a central role in creating this network.

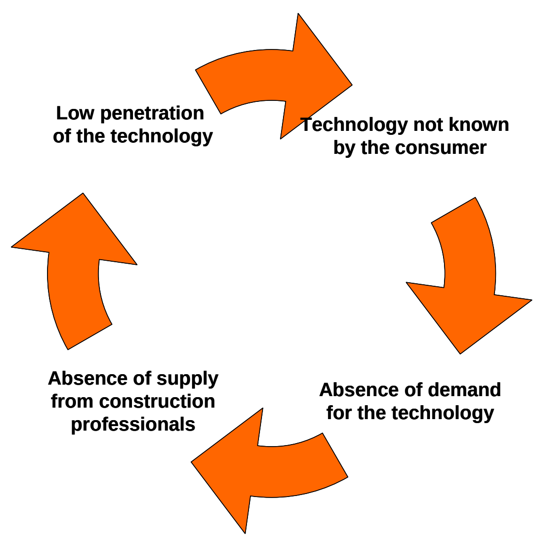
Main barriers large scale development of energy efficiency in building sector

Barriers to energy efficiency in residential building sector in developing countries are of several types:

- Informational
- Economic
- Organizational
- Technical

Informational barriers

In developing countries, few EE and RE measures have currently significant penetration rate in the building sector. It is almost only solar water heaters and efficient lamps in few countries. As a result, most technical solutions available for energy efficiency and especially their economic impact are not well known either by the consumer, or by building professionals or by policy makers. It is hence a classical vicious circle of diffusion of innovation, as indicated by the following scheme:



In these circumstances, the introduction of energy efficiency solutions by an aware professional involves too high transaction costs to convince the final consumer, which becomes an economic constraint for him.

They are several ways to break this vicious circle, but in all cases they involve the active contribution of public policies.

Organizational barriers

In term of organization, the building sector presents some specific characteristics that constitute barriers to dissemination on large scale of energy efficiency measures.

The first barrier is the diffuse and heterogeneous character of the target in building sector (tertiary buildings with several uses and types, residential buildings with several socio-economic and architectural categories, etc.), which increases transaction costs to put in place dissemination mechanism of energy efficiency measures. These difficulties are accentuated by the preponderance, in most developing countries, of self-construction, and even informal buildings. It therefore becomes difficult to gather the stakeholders in these sectors around a single and coherent policy of energy efficiency in this market segment.

The building sector is also characterized by multiple stakeholders: private developers, architects, designers, banks, landlords, tenants, public intuitions managing the sector, etc. These stakeholders have sometimes conflicting interests, motivations and constraints which prevent the dissemination of EE measures.

For example, owner-occupiers are in the best position to make long-term investment decisions about their buildings. They will tend to have a longer term perspective and stand to benefit directly from energy savings. This applies both to owners specifying a new building that they will occupy as well as to existing owner-occupiers considering retrofitting. On the other hand, investors' time horizons are likely to be shorter. Cost saving goes to the occupier even though the developer incurs the investment cost.

The importance of the renting building activities in the major part of the countries weakens the incentive for energy efficiency investments.

Even States, as part of their policies of public social housing often adopt strategies to minimize the sale price and don't care a lot about expenses of operating costs, such as energy consumption expenses.

Generally, when the occupier is different from the building owner, there is a tendency to minimize investment cost without taking into account future costs related to building energy consumption, since the investor not benefit from the energy performance of the building.

Finally, some architects perceive the energy efficiency measures as a constraint that limits their artistic possibility of design.

Technical barriers

These barriers are related to lack of know-how and technical expertise on energy efficiency measures by the professionals of construction sector, at several levels:

- Designers, architects and engineers: They are therefore unable to identify the most appropriate technical solutions to each context and integrate them effectively from the design phase of the building;
- The construction companies: They do not have a skilled labor in this field that is able to implement the technical solutions. For example, the expected performance of thermal insulation in walls can be totally annihilated by the thermal bridges that masons can leave at the time of construction.

Moreover, the unavailability of a reliable local supply of technologies and materials required for EE solutions (SWH, insulation materials, efficient appliances, etc.) can be a major obstacle to the implementation of energy efficiency on large scale base.

Economic barriers

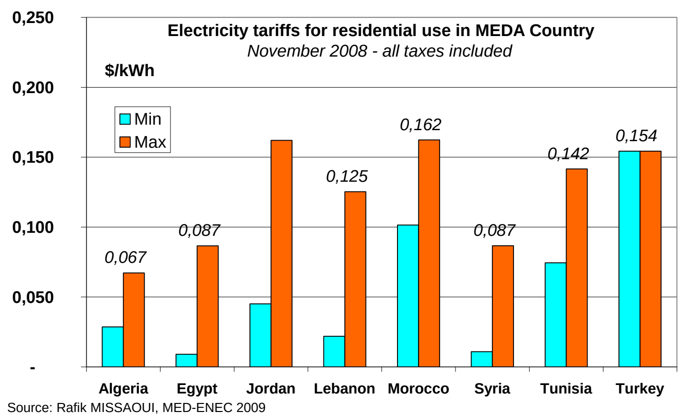
It is often the most important barriers and may be related to two key factors:

- The low profitability measures for the final consumer
- The high costs of initial investment compared to the financing capacity of households

1. The low profitability for the end user

Profitability measures for end user depend on first the cost of the technology and secondly, the final energy prices.

In particular, conventional energy prices are still heavily subsidized in many developing countries. The following charts (**Figure 13**) show the difference in energy tariffs between some countries in the MENA region.



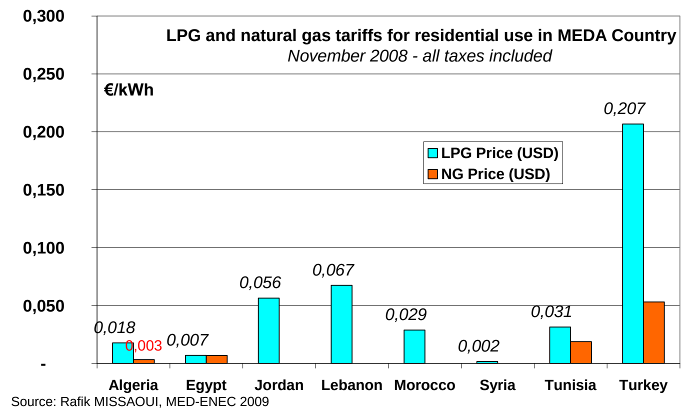


Figure 13 : Electricity and LPG tariffs in MENA region. Source: Rafik Missaoui, MEDENEC, 2008

This disparity in tariffs of energy explains largely the differences of profitability of energy efficiency measures in these countries.

As illustration, the following chart (**Figure 14**) presents the results of profitability analysis for the end user of **solar water heater** (SWH) in the context of some countries in MENA region. The profitability is measured through the pay back period for the end user.

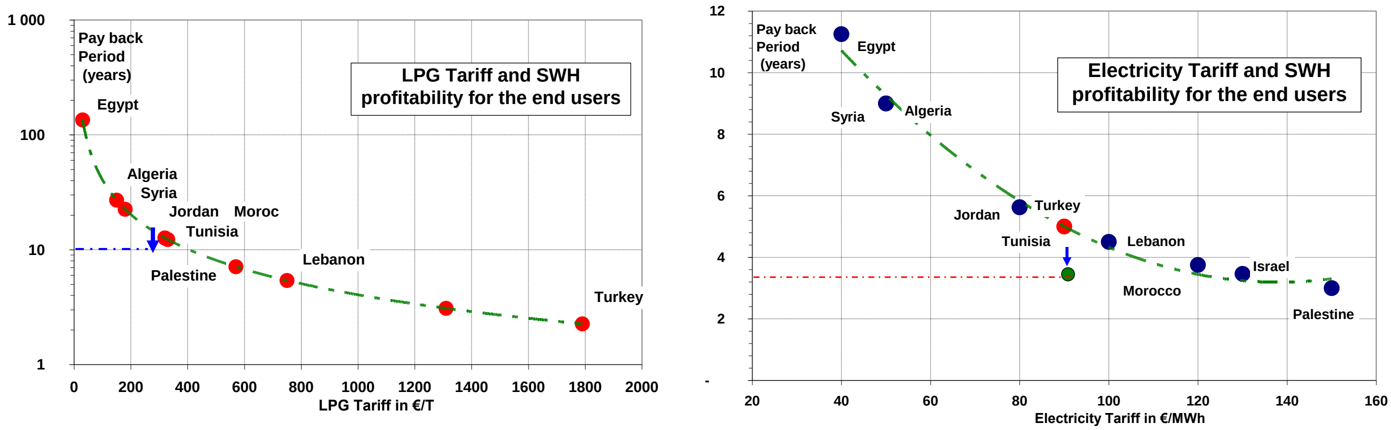


Figure 14 : Profitability of the solar water heater in MENA region countries according to energy tariffs. Source: Rafik Missaoui, MEDENEC, 2008

Thus, given energy prices, the payback period of purchasing a solar water heater compared to LPG water heater in Egypt is more than a hundred years and is about 30 years in Algeria and Syria. The payback period is less than 2 years in Turkey.

Of course, this difference in profitability makes the penetration of solar water heaters very different from one country to another as illustrated below (**Figure 15**):

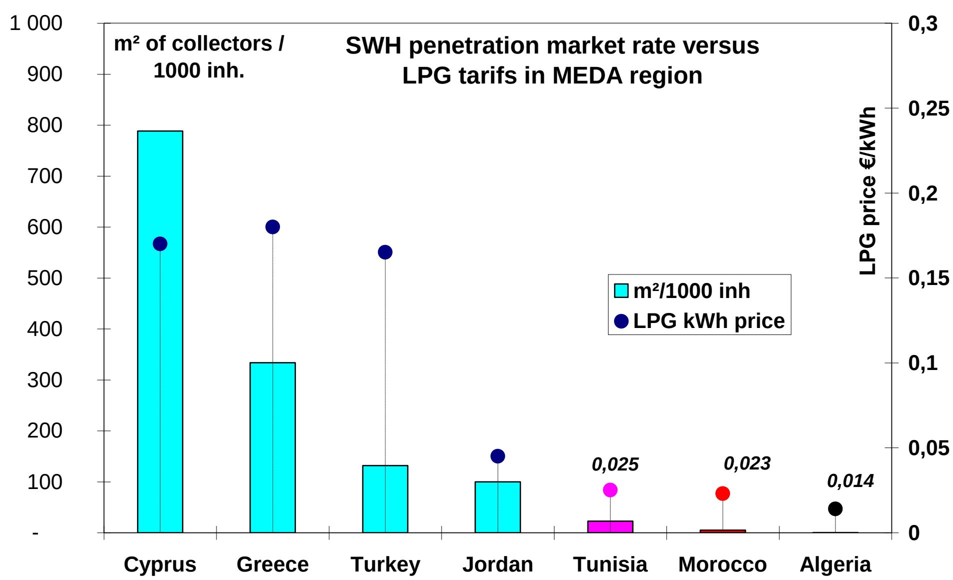


Figure 15 : SWH market penetration versus LPG tariffs in some MENA region countries. Source: Rafik Missaoui, MEDENEC, 2008

Of course, in addition to tariff influences, incentive and regulatory framework can effect widely the market transformation of SWH. For instance, while the LPG tariff is almost the same in Tunisia and Morocco, the SWH market is more developed in Tunisia, as show in **Figure 16**. This can be explained by the effect of incentive program of SWH promotion, PROSOL.

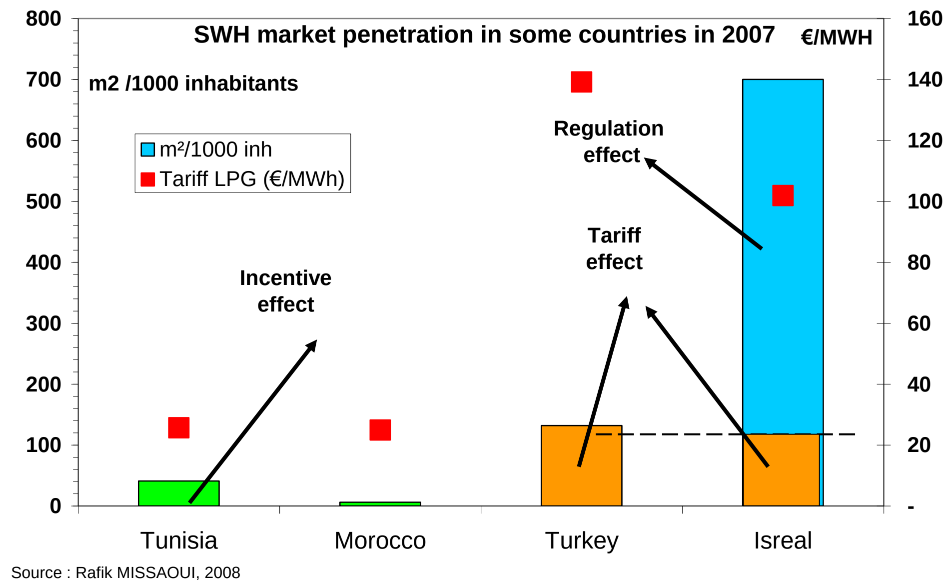


Figure 16 : Regulation and incentive framework effect on SWH market penetration in some Mediterranean counties. Source: Rafik Missaoui, MEDENEC, 2008

In the same way, the high penetration rate in Israel compared to Turkey is due to additional regulatory measures that oblige households to install SWH when the building is less than 27 m height.

The same economic analysis can be made for other energy efficiency measures in buildings, as shown by the **Figure 17** and the following table:

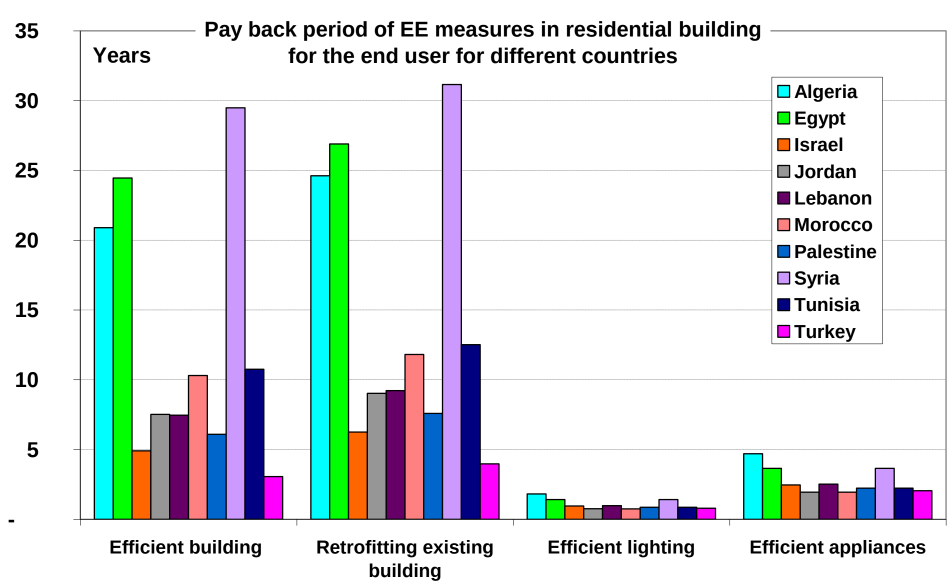


Figure 17 : Payback period of EE measures in residential buildings for the end user in SEMC. Source: Adel Mourtada & Rafik Missaoui, Plan Bleu, 2010.

	Efficient building	Retrofitting existing building	Efficient lighting	Efficient appliances
Algeria	20,9	24,6	1,8	4,7
Egypt	24,5	26,9	1,4	3,6
Israel	4,9	6,3	1,0	2,5
Jordan	7,5	9,0	0,8	1,9
Lebanon	7,5	9,2	1,0	2,5
Morocco	10,3	11,8	0,8	1,9
Palestine	6,1	7,6	0,9	2,2
Syria	29,5	31,2	1,4	3,6
Tunisia	10,8	12,5	0,9	2,2
Turkey	3,1	4,0	0,8	2,0

Source: Adel Mourtada and Rafik MISSAOUI, for Plan Bleu, 2010

The analysis of these cases allows us to draw some lessons regarding key economic conditions for the development of a market for energy efficiency in buildings:

Dissemination of efficient lamps is usually profitable for the end user, with a payback period of usually less than two years.

Dissemination of efficient household appliances is also profitable for the end user and is ranked after efficient lamps. The payback period is usually about 2 years except for three countries where electricity is still heavily subsidized, namely Algeria, Egypt and Syria.

For both measures, there are no real barriers related to economic attractiveness for the end user that block their widespread dissemination. The main barrier lies in the lack of awareness and information of the public and operators of the value of these measures. It can be also related, in less extended way to the barrier of the investment cost that some times exceed the cash capacity for some socio-economic categories of end users.

The thermal retrofitting and new efficient buildings are, however, unprofitable for the end user and are unlikely to develop on the basis of spontaneous market mechanisms in most developing countries. Because of low prices of LPG and natural gas, the payback is often beyond those acceptable for the end user, apart from Turkey and to a lesser extent in Israel, in the above examples.

2. The constraint of the initial investment

In some cases, the high initial investment cost of energy efficiency measures, compared to the financial capacity of the consumer, may constitute a barrier to EE diffusion.

So, even if the payback period of EE measures become attractive to the end user, the change of scale of the market could still be inhibited by the barrier of the initial investment cost that exceeds the capacity of payment of a large class of households. In this case, only a small part of the potential market could be mobilized.

The **Figure 18**, which presents the purchase price of SWH (with power purchase parity) in some countries, illustrates the constraint of the initial investment cost in some cases, such as South Africa, Morocco, Tunisia, and Portugal.

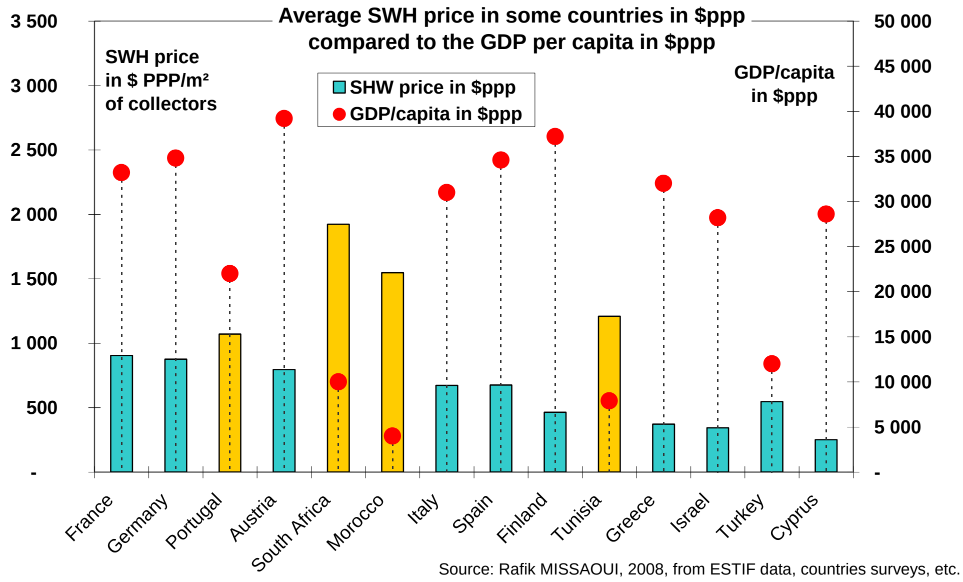


Figure 18 : Average SWH prices in some countries and GDP per capita in $ppp. Source: Rafik Missaoui, from ESTIF data and countries survey, 2009.

In fact, in the countries the purchasing cost of the SWH is rather high compared to the GDP per capita in $ ppp, so to the financing capacity of the households. This can constitute a barrier to the decision of purchasing a solar water heater.

Financial Measures and tools to develop energy efficiency in building sector

The dissemination of EE on a large scale basis requires the implementation of several kinds of tools that should be designed and implemented in a complementary and coherent way. Four types of tools are essential:

- Financial and economic Tools
- Regulatory instruments
- Institutional and organizational instruments
- Tools for capacity building and support to networks

According to the results of the odyssee mure project (October 2009), the prevalent measure types in EU countries are legislative/normative (in particular standards for new dwellings) and financial (addressing mainly existing dwellings), as shown in the **Figure 19**.

Households

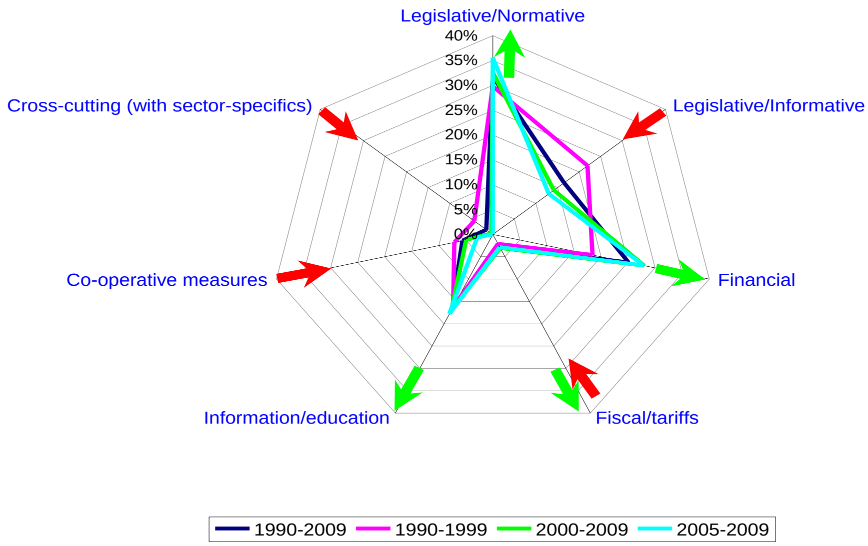


Figure 19 : Patterns of energy efficiency policies by sector (1990-2010). *Source: Odyssee mure program, October 2009.*

These measure types have even strengthened their dominant position. Legislative/informative measures such as labels have decreased in importance. However, this was the consequence of the fact that the very comprehensive labeling policy for electric appliances has stabilised and more or less taken over by the minimum efficiency standards from the Eco-design Directive.

For this work we will focus on financial and economic measures, as the economic barriers are the most important. The incentive tools aim at removing two major economic constraints mentioned above, namely: the low cost-effectiveness for the end consumer barrier and the initial investment cost barrier.

Improve the profitability the EE measures for the end user

The improvement of profitability for the end user implies necessarily lowering investment cost. In theory, three types of measures, all based on public financial effort, can be applied to this end:

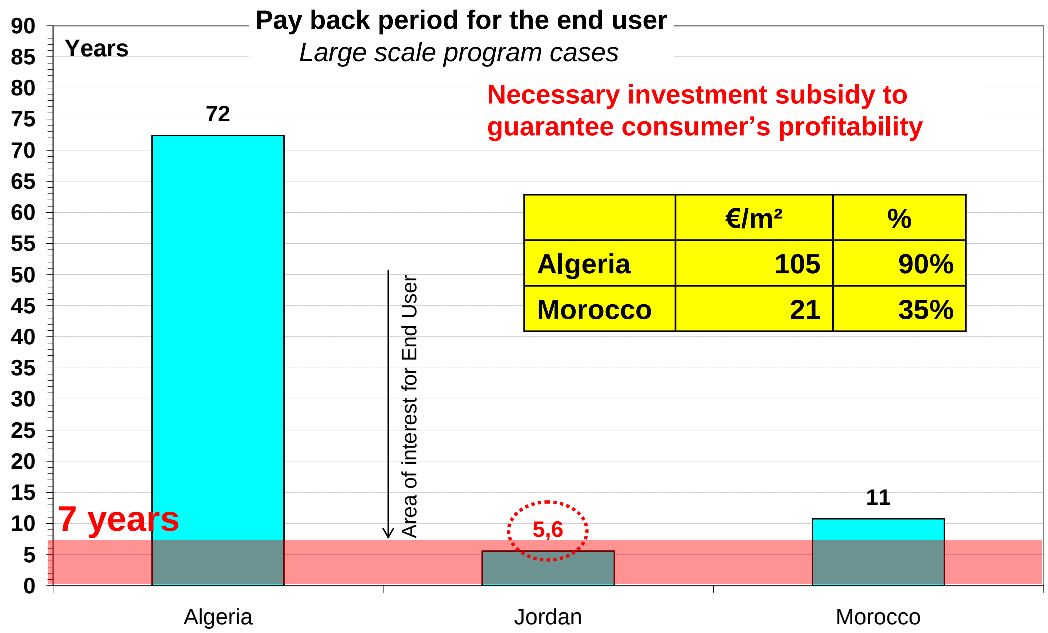
1. Public investment subsidy

The Public investment subsidy for energy efficiency measures is justified by the economic distortion introduced by the public subsidy to conventional energy products, making these solutions unprofitable and unattractive to the consumer.

Often, the implementation of energy efficiency solutions are profitable for the State because of the savings made on avoided subsidies to conventional energy (especially after the rise in international energy prices). But, meanwhile, the profitability of these solutions is very low for the end user, which does not allow the development of a spontaneous market for EE measures.

Thus, the objective of the public subsidy is, among others, to redistribute the positive financial impact of energy efficiency solutions between the State and the end user, in order to establish a win – win situation.

As an illustration, the **Figure 20** shows the pay back period for the end user in case of EE solution in pilot residential buildings in Algeria, Morocco and Jordan (MEDENEC).



	€/m²	%
Algeria	105	90%
Morocco	21	35%

Figure 20 : Payback period for the end user and public subsidy requirement: case of MEDENC pilot projects in Algeria, Morocco and Jordan. Source: Rafik Missaoui, MEDENEC, 2009.

While, in Jordan case, there is no need for public investment subsidy to reach the acceptable payback period for the end user (7 years), a subsidy of 35% is required in the case of Morocco and 90% in the Algerian case.

By saving energy, EE solution will also allow to the governments to avoid subsidies given to conventional energy and which can be estimated by the difference between internal prices and international price of energy. Hence, the profitability of the public subsidies for governments depends of the international prices of energy, as shown by the **Figure 21.**

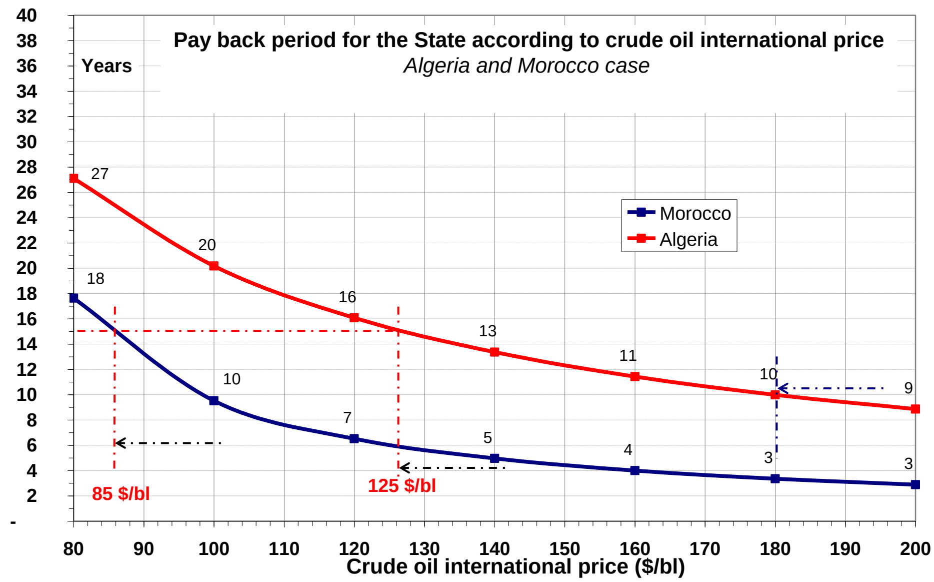


Figure 21 : Payback period for the states according to crude oil international prices: case of MEDENC pilot projects in Algeria and Morocco. Source: Rafik Missaoui, MEDENEC, 2009.

For example, a payback period of 15 years, will be reach for an average crude oil international price of 125 $/barrel in the case of Algeria and 85 $ in the case of Morocco.

The following example (**Figure 22**) illustrates also the conditions for establishing this win - win situation for the dissemination of solar water heaters in different countries.

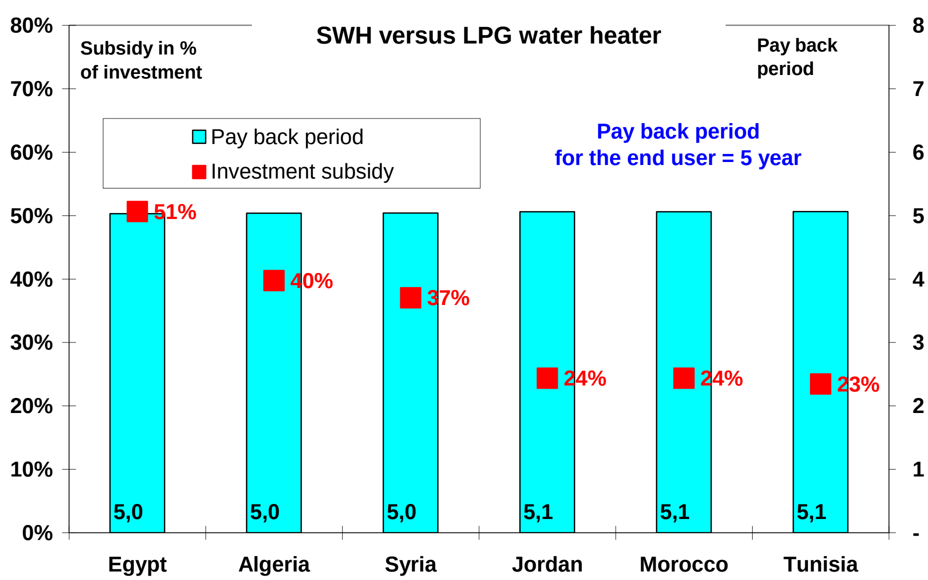


Figure 22 : Payback period of SWH for the end user and public subsidy requirement level in some Mediterranean countries. Source: Rafik Missaoui, MEDENEC, 2008.

Thus, ensuring an acceptable payback period for the end user of SWH compared to a LPG water heater (recovery time = 5 years) will require an average public investment subsidy of about 20% in the context of Tunisia, Morocco or Jordan. In these cases, the pay back period of the subsidy for the State would be roughly equivalent to that of the end user, or about 5 years.

In the case of Algeria, Egypt and Syria where energy is heavily subsidized, Governments should make more effort in subsidizing the SWH, so 40% of the investment cost or more.

Finally, it should be noted that this measure can be effective in the long term, in terms of market transformation, only if upstream resources to be used for public subsidy are sustainable, coming for example from allocated taxes (such as the National Fund for Energy Management Tunisia). Subsidy hold backed by public budgetary resources is dangerous because they may be subject to sector arbitrations and therefore disappear or be reduced at any time.

This was the case of solar water heater development history in Tunisia. In fact, in 2004, the market decrease to around 7000 m² after reaching 18000 m² in 2003, after the depletion of the subsidy to SWH prices given by the GEF project. In 2005, Tunisia has created the National Energy Conservation Fund to provide sustainable financial resources to energy efficiency and renewable energy subsidies.

2. Indirect taxes advantage

These measures consist in reducing or even exempting EE solutions from indirect taxes such as VAT, customs duties, etc.. These measures are simple to implement and often neutral for public finances. Indeed, because of the absence or narrowness of the market for energy efficiency measures, there will be no financial shortfall for the State.

Such tools are already used in several countries in the region that have introduced legislation exempting wholly or partially renewable energy and efficient equipments of VAT and customs duties (Tunisia, Morocco, Jordan, etc.).

In Tunisia for example, SWH, PV systems, efficient lamps and all material used in building insulation are exempt from VAT and customer duties.

3. Reduction of direct taxes

This measure, commonly known under the name of "tax credit" is to allow the reduction of investments made under the energy efficiency measures (thermal renovation, SWH etc.) from revenues tax calculation.

This measure is used in very commonly used in France as an incentive for several EE solutions, as shown by the following table:

Investments qualifying for tax credit	Rate from 1 Jan. 2010
Photovoltaic panels, wind, micro-hydropower	50 %
Heaters using wood and biomass	25 %. 40 % for replacement of existing systems.
Solar system for heating or hot water.	50 %
Heat pumps for heating / air-water	25 %
Heat pumps for heating underground sensors (laying the ground heat exchanger included)	40 %
Thermodynamic heat pumps for hot water production	40 %
Equipment connecting to some networks of heat	25 %

Given the fiscal evasion in most developing countries, this tool is often ineffective in such countries.

In summary, the following table outlines the advantages and disadvantages of the three main types of incentives measures aiming at improving the cost-effectiveness for the end user, presented above:

Measures	Advantages	Disadvantages
Investment public subsidy	**- Clear effect on the cost reduction - Strong signal to the market - Good vector for awareness - Stimulation effect for supply side**	**- Pressure on the public finances - Low sustainability - High management cost**
Indirect taxes advantage	**- Easy implementation - Low pressure on public finances**	**- Low visibility - Low efficiency in case of informal market - Difficulty to apply on services cost**
Reduction of direct taxes	**- Low pressure on public finances**	**- Low efficiency in developing countries - Complexity of implementation in developing countries**

Overcome the initial investment barrier

Easy access to credit with appropriate conditions for financing the initial investment is a fundamental measure to overcome this barrier. However, in the case of buildings and in the context of developing countries, there are several barriers for households to access of credit:

- The low banking rates of households, which is likely to exclude a large proportion of households obtaining a bank loan to finance EE measures in their buildings;
- The high cost of credit distribution because of the diffuse nature of demand and low amount of loans, discouraging banks to target this market;
- The high interest rates often as a result of the high transaction costs;

Various measures are often used to overcome these constraints. They are mainly the following:

- The establishment of specific credit lines to finance energy efficiency in buildings. These lines set up with the help of donor have the advantage of offering concessional conditions and often can also be used as an argument and communication for the dissemination of energy efficiency measures;
- The interest rate subsidy to reduce the high cost of credit;
- The establishment of credit guarantee scheme to encourage banks to be more active in financing such operations by taking more risk. Although theoretically, this measure is attractive, in practice it is often complicated to implement in the context of developing countries.

The following table summarizes the advantages and disadvantages, in the context of the developing countries, of the three main types of measures outlined above:

Measures	Advantages	Disadvantages
Specific credit lines	**- Solve the problem of down stream resources - Involvement of banking sector - Good vector of awareness - Possibility to neutralize the reimbursement of loan by the saving on the energy bill**	**- Implementation slowness - High cost of loan distribution and management - Exclusion of non banked households**
Interest rate subsidy	**- Good vector of awareness - Improve the profitability for the end user**	**- Currency risk coverage - Sustainability of the interest subsidy - Financial market distortion - Pressure on public finance**
Credit guarantee systems	**- easy access to the credit - Incentive for the banking sector**	**- Complexity of implementation in developing countries - Risk of derive**

Carbon revenues

In the case of energy efficiency programs in building sector, carbon revenues from the Clean Development Mechanism can provide additional financial resources that can be used to strengthen the sustainability of these programs: financing of capacity building measures, communication, etc.

However, given the diffuse nature of the target, the CDM methodologies have so far been complex to implement. Currently, the new programmatic approach set up recently by the CDM Executive Board introduces considerable simplification for the registration of these programs and therefore opens new opportunities.

Example of a successful program: PROSOL Tunisia

PROSOL program, launched in 2005, is based on an innovative mechanism designed to address key financial, technical and organizational barriers against the development of the market for solar water heater. This mechanism is based on a coherent set of measures, namely:

- A public subsidy to the consumer of 100 DT / m² (70 $) which was fixed on the basis of a win - win share of impacts between the consumer and the State. This subsidy aims at reducing the payback period for the end user while allowing significant financial gains for the State taking into account the displaced conventional energy for heating water;
- A credit reimbursed via the electricity bill at acceptable conditions for the households, particularly in terms of duration. The objective is to remove the initial barriers to investment;
- A simple and effective mechanism of distribution and collection of loan involving SWH suppliers and the national utility;
- A system of quality control upstream and downstream of the distribution of SWHs.

The organization of the mechanism involved is presented by the following scheme (**Figure 23**):

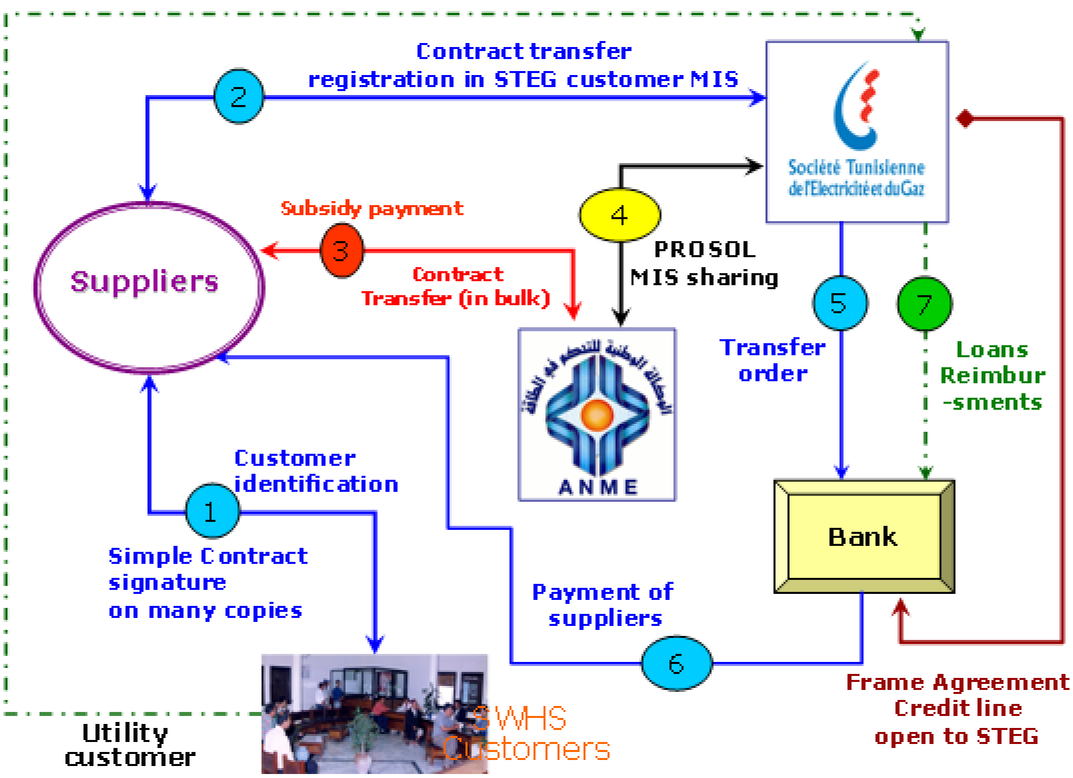
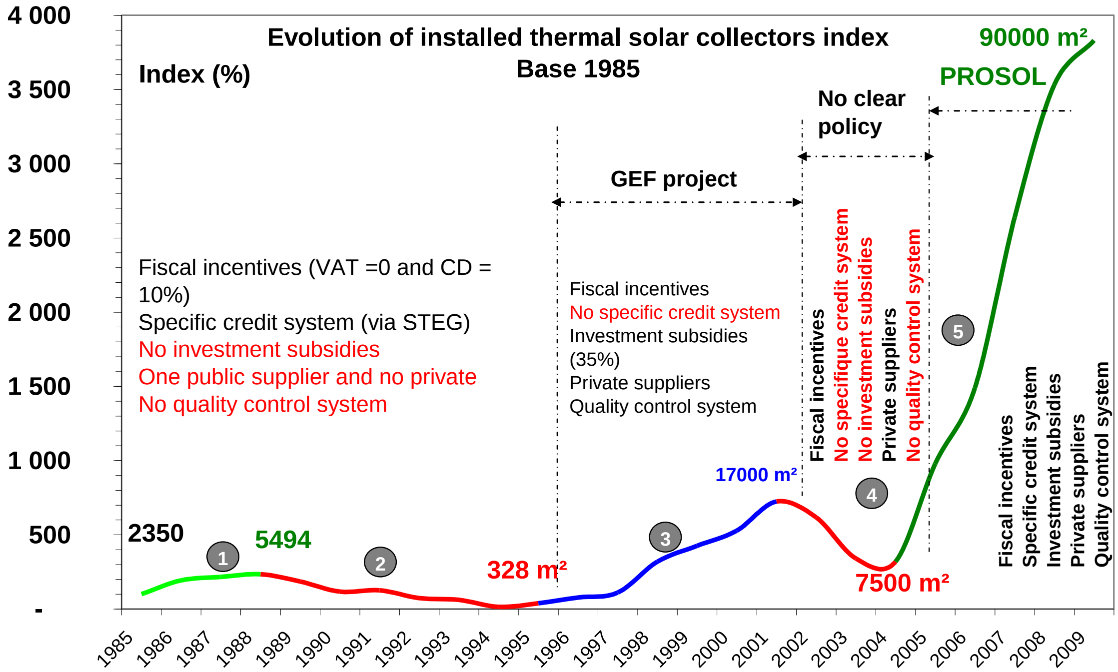


Figure 23 : Prosol Organization procedures, ANME, 2009 .

Thanks to this mechanism, PROSOL has initiated a real market transformation of the SWH in Tunisia, as shown in the chart of market developments:



Evolution of installed thermal solar collectors index
Base 1985
Index (%)
4 000
3 500
3 000
2 500
2 000
1 500
1 000
500
-
2350
5494
328 m²
17000 m²
7500 m²
90000 m²
PROSOL
No clear policy
GEF project
Fiscal incentives (VAT =0 and CD = 10%)
Specific credit system (via STEG)
No investment subsidies
One public supplier and no private
No quality control system
Fiscal incentives
No specific credit system
Investment subsidies (35%)
Private suppliers
Quality control system
Fiscal incentives
No specifique credit system
No investment subsidies
Private suppliers
No quality control system
Fiscal incentives
Specific credit system
Investment subsidies
Private suppliers
Quality control system
1
2
3
4
5
1985
1986
1987
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2006
2007
2008
2009

Conclusion

In summary, the implementation of EE measures on a large scale base in developing countries will require the development of adequate mechanisms combining financial tools and organizational and institutional instruments, with several types of measures:

1. Financial Instruments

On the financial level, the following tools can be combined:

- Win - win public subsidy, to reduce the payback period for the end user, particularly in the current context of tariff subsidy of conventional energy in the many countries. The subsidy has to be sized in a way that the financial impact of the EE measures is shared fairly between the end user and the government.
- Direct taxes reduction, to reduce the investment cost of the EE solutions and improve their profitability for the end user. This tool, commonly used in developed countries (France, Germany, etc.), is less feasible in developing countries because of the high rate of fiscal evasion and the large informal economic activities.
- Indirect taxation reduction is a simple measures and it is often neutral for public finances, particularly in the beginning of the target EE solution market development. Because of the absence or narrowness of the market for energy efficiency measures, there will be no financial shortfall for the State.
- Bank credit. This tool is very important to overcome the barrier of the low financial investment capacity of households. The credit has to be reimbursed over an enough long period so that the amount of the monthly reimbursement will be equivalent to the saving energy bill of the end user. However, this tool can face some barriers in some countries because of the low banking rate of the households, the high interest rates, etc.
- Upstream sufficient sustainable resources for both public subsidy and loan distribution.

2. Institutional and organizational instruments:

The above financial tools can not be efficiently implemented without being associated to adapted institutional and organizational instruments.

- ***Simple and effective management system of public subsidies and loans***. Since in the case of buildings, the target is large and spread, the cost of the subsidy and the credit management (distribution, control, collection of reimbursement, etc.) can be very costly. It can reduce the overall profitability of the program and hence its feasibility. For example, in the case of the SWH program (Prosol) in Tunisia, the public subsidy and the credit are distributed by the suppliers on behalf of the ANME for the subsidy and the bank for the credit. The collection of the credit reimbursement is done via the electricity bill, which reduce the management cost.
- ***Effective operators, accredited to be eligible to the programs***. To insure the energy saving expected from the EE measures and so the profitability of the program for the end user and the State, it is necessary to limit the eligibility to the EE incentives to accredited operators, on the base of performance criteria (technical skill, staff, logistics means, financial situation, etc.). In the case of SWH program in Tunisia (Prosol), the suppliers

and the installers working in the framework of the program have to be accredited by the National Energy conservation Agency on the base of a set of technical and financial criteria.

- ***Effective quality control, but simple and cost-effective***. The main objective of the quality control is to protect the end user from the eventual abuse from free riders operators. Two complementary kinds of control should be combined: 1) downstream control by the accreditation of equipment and materials used for the EE solution 2) upstream control by the visits of randomize sample of installed equipment (10% in the case of PROSOL program in Tunisia)
- ***Accompanying measures to EE programs***. These measures include advertisements and awareness towards end users and decision-makers and also capacity building for all stakeholders involved in the program implementation: suppliers, installers, designers, etc.
- ***Coordinating agency to monitor all the mechanisms***. As the programs require combining a multitude of tools and mechanisms, the quality and the professionalism of the coordination entity of these programs is a key factor to succeed the market transformation.

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Annexes

Annex 1: Example of country case studies file of measures evaluation

United Kingdom

Grants

Context

The UK Government is committed to tackling fuel poverty, and believes that energy efficiency measures remain the most sustainable way of lowering fuel bills and providing affordable warmth to those most in need. Warm Front is the Government's flagship Scheme in tackling fuel poverty.

The Warm Front Programme launched in the UK in 2000 is a typical illustration of a public grant. The programme was designed to provide grants to households with dependent children or the elderly. Warm Front benefited from an envelope of £50 million during first years. Warm Front benefited of additional Government funding (£174m) over the 2008-11 period which enabled the Scheme to meet increased demand and help thousands of additional homes. Two million homes have been helped during the life of the Scheme.

Objective

Grants are generally applied when governments consider that the market will not provide the optimal level of energy efficient investments because of access to capital. The case of the UK Warm Front Programme is a perfect illustration of such principles.

Programme description

Main characteristics

Warm Front makes homes warmer, healthier and more energy-efficient. The Warm Front Scheme provides a package of insulation and heating improvements up to the value of £3,500 (or £6,000 where oil, low carbon or renewable technologies are recommended). It is a Government-funded initiative and the scheme is managed by "eaga'' in coordination with the Department of Energy and Climate Change (DECC). How it works?

Step 1: Qualification	Identifying those most in need through the regionally based Partnership Development Officers (PDOs) is a key part of the work. Benefit Entitlement Check (BEC) team verify the effective qualification of the identified potential beneficiaries.
Step 2: Assessment	One of eaga's Technical Surveyors/Assessors visit home and suggest improvements which should be made under the Scheme.
Step 3: Installation	eaga team of fully-trained installers will make the required improvements to the home.
Step 4: Quality Check	eaga regularly check their installers' work so beneficiary can be confident in the quality of the service

Impact/evaluation

Market transformation

Grants programmes are relevant in overcoming the financial barrier to the extent that they directly fill an immediate financial gap and allow at least a temporary shift in the market. Moreover, by specifically targeting a given gap in the market, and directly responding to it, grants have the advantage of sending a clear message to actors in the market.

Grants programmes will prove particularly efficient in dealing with short term financing needs. However, unless coupled with adequate training and awareness programmes, they will not usually have a lasting impact on the market, nor will they be able to adapt to changing needs of the market

A household in fuel poverty is one where more than 10% of income is needed to heat the home to an adequate standard of warmth. Fuel poverty can come about as the result of a combination of poor energy efficiency in homes, energy prices and low incomes.

According to the report of the National Audit Office (NAO), 2009, :

- Contractor prices are largely competitive and ''eaga'' has provided value for money.
- Customer satisfaction was high, with almost 90% of customers happy with the work provided.
- Warm Front makes a real difference to those households it helps, saving an average of £300 per year off domestic energy bills.

Energy savings

On average in 2008/9, each household receiving Warm Front assistance has the potential to save £362.23 in energy running costs every year. Whilst the average running cost reduction was over £350 per year, many homes save substantially more – some households that have benefited from measures in 2008 have shown illustrative savings of £700 per year and more. This is more than half of the average annual fuel bill. Based on the number of homes receiving Warm Front measures and the average reduction in running costs per property, the potential saving in energy consumption is almost 13 Giga Joules (GJ) per household, each and every year for the next 20 years. A reduction in carbon dioxide emissions in the average household from 6.6 tonnes per year to 5.2 tonnes per year, equalling total annual savings of 1.4 tonnes of CO2 per year for those homes improved, each and every year for the next 20 years.

Perspectives

There are still millions of homes who are in, or at risk of, fuel poverty. Set in the context of a difficult wider economic situation, the importance of the savings and peace of mind provided by Warm Front to households and families across the country is clear.

''eaga'' is increasing its focus on trialling low carbon alternative and renewable heating technologies for those households off the mains gas network and who are in or at risk of fuel poverty. Over the next twelve months, the solar thermal pilot will be added to with a pilot on air source heat pumps.

A number of other changes were also announced, which are intended to further drive value for money, promote greater competition in the supply chain and deliver a more seamless customer service.

Problems / adaptations

Due to high levels of demand, any works carried out under the Scheme are currently taking longer to complete. Insulation work may take up to three months to complete and heating works may take six months to complete.

This said grants also have the limits of their advantages: by offering immediate solutions to specific needs, grants tend not to have a long lasting impact on the market. Although the market will generally pick up during the life of the programme, it will come down as soon as the programme ends. In addition to this potential shortcoming, grants have often been criticised for their lack of flexibility.

Accompanying measures

Only parallel training and awareness campaigns palliate such shortcomings. By adequately training the suppliers and consumers at the same time this will allow a sustainable impact of the governmental grant programme.

Use independent qualified Home Assessors to identify a range of energy efficiency improvements appropriate to the household, including energy advice, it is important for the viability and the impartiality of the programme.

Work in partnership with contractors to enhance standards and drive up quality in the insulation and heating industries

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Annex: Households assisted by the Scheme and Energy Efficiency Measures accomplished

Households assisted

Since start of Scheme (01/06/00 - 31/03/09) **1,950,437**

Scheme year (01/04/08 - 31/03/09) **233,594**

	2008/09 breakdown of measures	Scheme to date
Assisted Households	233,594	1,950,437
Cavity Wall Insulation	27,100	460,572
Draughtproofing	25,991	544,121
Electric Central Heating	8,197	59,945
Foam Insulated Dual Imersion Hot Water Tank (FIDIHWT)	595	7,644
Gas Wall Heaters	303	24,449
New Gas Central Heating	14,698	162,995
Hot Water Tank Jackets	6,145	153,605
Loft Insulation	57,104	660,836
Boiler Replacements	80,458	298,911
Heating Repairs	9,252	82,038
Oil Central Heating	571	1,988

Annexe 2: Example of country case studies file of measures evaluation

FRANCE

Tax Credits for Home Energy Conservation

Context

A recent fiscal scheme implemented in France after the 2000 “Plan Climat”, was designed in a way that factored in initial shortcomings. It defined very clearly (and narrowly) the retrofitting measures which could benefit from fiscal credit. The Plan Climat sets as a national objective to reduce CO2 emissions by a factor of four by the year 2050. The plan identifies energy efficiency as a major means of fulfilling these objectives and as such, the Government has introduced financial incentives to promote energy efficient projects. The ‘Crédit d’Impot’ or tax credit has emerged as the major tool.

Objective

Tax Credits are publicly defined financial incentives which aim at encouraging anyone who occupies a property to implement more EE investments. By providing fiscal cuts or reimbursement, through fiscal credit, governments thus seek to promote energy efficient use. Many countries—France, the Netherlands, or the US—have used this tool with varying degrees of success.

Programme description

Main characteristics

The French tax credit—like other fiscal instruments—is based on the assumption that everyone should be given incentives to invest in energy efficiency. As such, even individuals not paying any tax will be rewarded for implementing energy efficient refurbishment measures (i.e. will receive money in compensation).

The tax credits were formally adopted in law through the 2005 Finance Law. It is only available to anyone who occupies a property in France as their principal home, so second home owners are not eligible.

The eligible works includes most types of home energy conservation, provided the installation meets agreed performance standards.

In most cases, the tax credit is only available for the costs of the materials, and only then provided they are purchased and installed by a registered artisan or company.

There is one important exception to this rule, which is applicable for all work carried out since January 2009. This relates to the installation of roof and wall thermal insulation, for which the tax credit can cover 25% of the labour cost, provided the project is undertaken in its entirety by a registered builder.

All types of residential property are eligible for the tax credit, although in relation to thermal insulation and condensing boilers the property must be at least two years old. The main works for which the tax credit is granted, and the percentage rebate that applies for 2009 are:
- Thermal Insulation (roof, walls, floors, or windows doors) (25%);
- Thermostatic controls and equipment (25%);
- Solar water heating (50%);
- Wind power water heating (50%);

- Heat pump (50%);
- Condensing boiler (25%);
- Wood based heating systems/equipment (40%);
- Rainwater harvesting systems (25%);
- Energy Survey (25%).

From 2010, the installation of double glazing and condensing boilers will only be eligible for a tax credit of 15%, as against 25% if installed in 2009. The enhanced credit of 40% mentioned above is also removed for these works.

With effect from 2010, geothermal space heating pumps are eligible for a tax credit of 40% and thermodynamic hot water pumps at the rate of 25%.

Air-air heat pumps and low condensation boilers have been removed from the list of eligible works for 2009, although beneficiary can still claim a tax credit on these works if he accepted an estimate and made a down payment in 2008, and paid in full for the work in 2009.

There are maximum limits on the level of the tax credit that can be granted, although these are quite generous. Thus, the maximum for one person is €8000, and €16,000 for a couple, which is increased by €400 for each additional person in the household. The allowance can be received over a five year period to 2012. No means testing is carried out.

At the present time, the tax credit is available until 2012.

Impact/evaluation

Market transformation

Fiscal incentives are relevant indirect financial tools in that they specifically target the liquidity barrier. They aim to create demand from the market through financial incentives on energy efficient refurbishments. As such, they offer significant flexibility since the market is responsible for creating the adequate tools to respond to the demand increase. By creating less direct financial incentives rather than grants (i.e. not a direct intervention), fiscal schemes leave more room for market transformation and creativity, thereby increasing sustainability rate.

Energy savings

The scheme is too recent to evaluate effectiveness. Although the implementation of this measure is too recent for an impact and energy savings evaluation.

The cost of this measure for the government was 951 m€ in 2006 and 400 m€ in 2005 (decrease in collected tax). 51.2% of investment went for windows double glazing. The cost of 1 tonne CO2 saved from windows double gazing was 137€. This high cost was the principal drive for the new law aimed to enhance the performance level of measures and equipments eligible for this programme.

Perspectives

The Scheme still fails to address the challenge presented by the least resourceful members of the population, who will still be unable to fill in the extra cash provision. To address this barrier, the French government has launched (March 2009) an enticing package of financial incentives for homeowners to undertake energy conservation works. Those who propose such works can obtain an interest free ‘eco-mortgage’, which can be used in tandem with tax credits.

The new mortgages for energy conservation, called “Interest Free French Mortgages” , “l'éco-prêt à taux zero” (éco PTZ), are available for a sum of up to €30,000, subject to a limit of €300 per m² of the property. They are only available on a property constructed before 1st January 1990, as all properties built since this date should meet the minimum energy performance standards.

Repayment of the mortgage is over a period of 10 years, although in some cases the repayment period can be extended to 15 years. The mortgages are offered without a test of resources, and neither are they subject to maximum income limits. But only those whose net income per year does not exceed €45,000 in the year can be entitled to both the mortgage and the tax credit.

In addition to the “Interest Free French Mortgages” the Eco-Grant, a grant of between 20% and 35% of the cost of works of home energy conservation is available, subject to a test of resources.

Problems / adaptations

Tax Credits often lacks the adequate clarity to be understood by all actors in the market. Even when they do understand the basis of the fiscal benefit, actors will often face a lack of information on the means to implement the scheme. Moreover, fiscal measures need to last a long time to make sure the market has time to adjust and has created adequate, long lasting tools.

Tax Credits can work well if the tax collection rate is sufficiently high: such measures usually perform poorly in an economy in recession or in transition. They are more adapted to well-developed countries: so far, mainly OECD countries have implemented such fiscal measures.

Tax Credits must be carefully designed to account for interactions with other government policies and energy market conditions and may require other supportive policy initiatives to create and sustain a healthy home energy conservation sector.

Accompanying measures

Tax Credits doesn’t work properly alone. This Scheme needs accompanying measures such as grants or loans towards energy saving equipment, notably towards the installation of solar panels.

Information on the means to implement the scheme is a high factor of success. Moreover, fiscal measures need to last a long time to make sure the market has time to adjust and has created adequate, long lasting tools.

Local home energy efficiency offices, called Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME) can give a free advice on the project to ensure that the energy performance standards are achieved and that the building firm choosing to undertake the work is eligible. They also provide the application form you need to complete.

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Annexe 3: Example of country case studies file of measures evaluation

Germany

Preferential Loans

Context	The Kreditanstalt fur Wiederaufbau “KfW” which was created with the funding of the post-WWII rescue package—the Marshall fund—has contributed to the retrofitting of close to a million dwellings from 1996 to 2004, through the provision of preferential rate loans. The KfW mechanism has proven very effective at overcoming financial barriers and creating an energy efficiency market for the implementation of projects.
Objective	Public-Private Partnerships (PPPs) for energy efficiency most commonly appear in the form of preferential rate loans, wherein the government provides a fiscal incentive to the bank so that financial institutions can offer customers reduced rate loans.

Programme description

Main characteristics

KfW is a public bank owned jointly by the Federal Government and the Leander. In 1996, KfW launched a set of preferential loans to finance energy efficiency projects through a double-edged mechanism:
- Public tax exemption for all money invested in efficiency projects;
- Coupled with direct public subvention;

The maximum amount of money distributed by loan is: EUR 50 000 (new buildings); 80 to EUR/ m2 (refurbishment). Repayment period from 20 to 30
years;

Energy-Efficient Construction

Anyone investing in the construction of new residential buildings is eligible to apply. The construction, production and first acquisition of KfW Efficiency Houses can be financed; the required energy standard must be confirmed by an energy expert.

KfW Efficiency House 55 (EnEV2007) - Energy Conservation Ordinance of the year 2007:
- The annual primary energy consumption Qp and the specific transmission heat loss HT´ must not be more than 55% of the values admissible for a new building in accordance with the EnEV2007 and the annual primary energy consumption must not be more than 40 kWh per m2 of building floor area (AN).

Others characteristics:
- In the form of a long-term, reduced-interest loan with a maturity of up to 30 years including up to 5 repayment-free start-up years
- Fixed interest period of up to 10 years
- Up to 100% of the building costs but not more than EUR 50,000 per housing unit
- Disbursement: 100%
- Repayment terms: After the repayment-free start-up period in quarterly annuity payments

Energy-Efficient Rehabilitation

Anyone investing in the rehabilitation or refurbishment of residential buildings is eligible to apply.

Rehabilitation or refurbishment measures aimed at reducing energy consumption can be financed.
A repayment grant is additionally given if the KfW Efficiency House standard is achieved or the acquisition of newly rehabilitated or refurbished residential buildings.

KfW Efficiency House 100 (EnEV2007) - Energy Conservation Ordinance of the year 2007: The annual primary energy consumption Qp and the specific transmission heat loss HT ´ must not be more than 100% of the values admissible for a new building in accordance with the EnEV2007

Individual measures or free combination of measures in compliance with the minimum technical requirements can be also financed.

Loan variant:

- long-term, reduced-interest loan with a maturity of up to 30 years including up to 5 repayment-free start-up years
- fixed interest period of up to 10 years
- up to 100% of the financeable costs,

KfW Efficiency House – maximum of EUR 75,000 per housing unit

Individual measure - maximum of EUR 50,000 per housing unit

Repayment bonus: 12.5% repayment grant for rehabilitation or refurbishment into a KfW Efficiency House 70, 5% for KfW Efficiency House 100

Grant variant:

- Individual measures: 5% grant to the investment cost, not more than EUR 2,500
- KfW Efficiency House 100 - 10% grant to the investment cost, not more than EUR 7,500
- KfW Efficiency House 70 - 17.5% grant to the investment cost, not more than EUR 13,125

Disbursement: 100%

Commitment fee: No commitment fee for the first 12 months, thereafter 0.25% per month

Impact/evaluation

Market transformation

By calling both on public and private sector concurrently, public-private partnerships combine resources and push the market to adapt while public aid is still ongoing. As such, public-private partnerships tend to be sustainable since they tend to foster a genuine market transformation. Although they do not offer much flexibility in the targets on which they apply, they allow much flexibility in the tools to be applied by the private sector. To the extent that they target specifically the initial cost barrier to more energy efficient homes, preferential loans are very relevant in overcoming weak energy efficient buildings.

Overall KfW loans have been a big success: from 1996 to December 2004, they provided over 330 000 loans spread over 850 000 buildings. Some 95% of those loans were for refurbishment not construction. For the year 2004 alone, these loans amounted to a total of EUR 4.42 billion.

Subsidy programmes for residential buildings cost Dutch society 32–105 US$/t$CO_2$.

Energy savings

There has been limited assessment of the efficiency of these schemes.

Perspectives

Preferential loans is an important tool to ensure a scaling up of energy efficiency now will be a double win by: i- boosting the economy and creating jobs; and ii- setting off the transition to a long awaited low-carbon economy.

Problems / adaptations

The combined efforts of both the public and private sector tend to affect customers' awareness greatly. However, preferential loans schemes have tended to be criticised for being unclear. Currently, the main criticism against public-private partnerships and preferential loans remains that no wide-scale scheme has proven effective on a wide national scale. Moreover, genuine market transformation will only take place when demand is really created, it is questionable to what extent demand does not remain artificial when it is only created by public incentives. Amongst the key findings on preferential loans' evaluation is the benefit of public-private partnerships, and of combining resources and methods.

Accompanying measures

Overall, financial mechanisms that create enabling environments by reassuring investors—through appropriate tools—while simultaneously training their staff, and providing more information to customers, have proven most successful in creating sustainable energy efficiency markets.

Governments should condition their guarantees and cash injections on private institutions' commitment to offer energy efficient loans, require them to train their staff on energy efficient products, and institutionalise collaboration between public-private sector to provide energy efficiency guidance

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Annexe 4: Example of country case studies file of measures evaluation

Tunisia

Solar water heaters programme (PROSOL)

Context

Tunisia has a significant solar potential, with very high irradiation rates. The National Agency for Energy Conservation (ANME) estimates that solar thermal panels could satisfy approximately 70-80% of sanitary hot water needs in the residential sector. So far, SWHs cover only 3% of the market in the domestic sector, the market is dominated by LPG-fired boilers, which constitute 78% of the existing stock (Missaoui and Amous, 2003).
While sun is an abundant source in Tunisia, the country has scant fossil fuel reserves and its net energy balance has been showing negative values since 2001. In particular, LPG is entirely imported and currently subsidized in a measure corresponding to 50% of its real price.
Solar thermal has been repeatedly proposed as a solution to lower the country dependency from imported fossil fuel sources. The first solar thermal energy strategy was developed by the Tunisian government in the 1980s. But only in the period 1997-2001 a real market and technology infrastructure have been developed, thanks to a project financed by the Global Environment Facility (GEF) and the Belgian Cooperation. The support mechanism was based on a 35% capital cost subsidy. At the end of the period, 50,000 m2 of new solar thermal panels were installed, 8 suppliers (among which 3 manufacturers) and over 130 installers were operating in the market, for a total of 260 new jobs created. Despite these important results, as soon as project funds expired, SWH sales dropped again.

Objective

The objective of PROSOL was to revitalize the declining Tunisian SWH market caused by the GEF project ending.

Programme description

Main characteristics

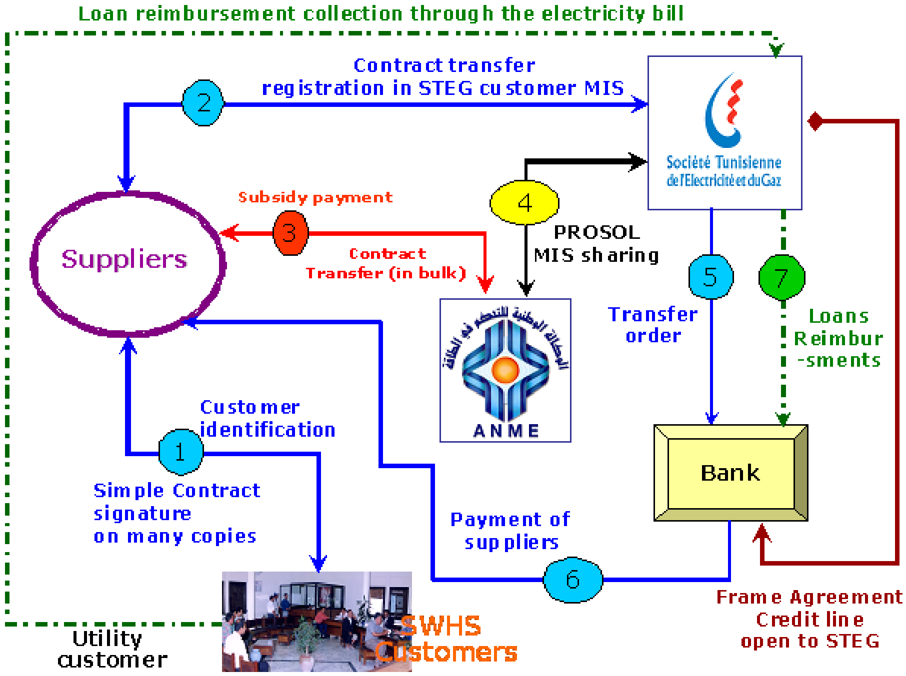
The Prosol project was initiated in 2005 by the Tunisian Minister for Industry, Energy and Small and Medium Enterprises and the National Agency for Energy Conservation (ANME), with the support of the UNEP-MEDREP Finance Initiative.
The innovative component of PROSOL lies in its ability to actively involve all the sector stakeholders and particularly the finance sector which turns it into a key actor for the promotion of clean energy and sustainable development. By identifying new lending opportunities, banks have started building dedicated loan portfolios, thus helping to shift from a cash-based to a credit-based market.
The main features of the PROSOL financing scheme are:

- A loan mechanism for domestic customers to purchase SWHs, paid back through the electricity bill;
- A capital cost subsidy provided by the Tunisian government, up to 100 Dinars (57€) per m2;
- Discounted interest rates on the loans progressively phased out.

A series of accompanying measures have been developed, which include: supply side promotion, control quality system set up, awareness raising campaign, capacity building program and carbon finance.
Besides ANME who manage the overall program, key partners include:

- The State electricity utility STEG (Société Tunisienne d'Electricité et du Gaz)
- A commercial bank that provide the best laon condition under an biding process

(Attijari bank)
- Suppliers including local manufacturers and importers
- Installers of SWHs
- Renewable Energy Syndicate



The most distinctive aspects of the PROSOL financing scheme are:

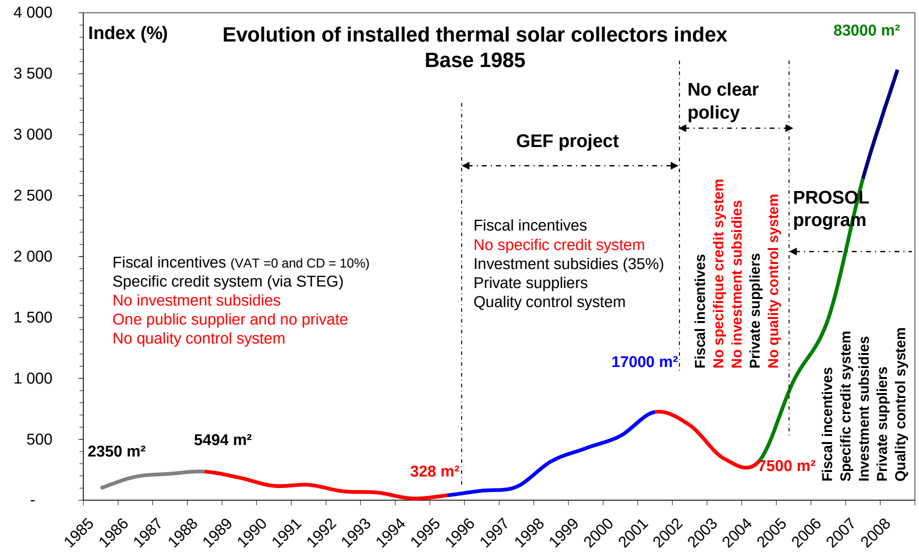
- The engagement of banks: they provide the necessary funds to develop the market;
- The active involvement of the State utility: provided enough guarantee in recovering the loan payments through its electricity bills to banks to extend the loan terms and lower the interest rates.

In PROSOL, loan duration is five years instead of the usual three-year term. As the financial risk is very low for the bank due to STEG guaranty, the interest rate is much lower than the commercial lending rate for similar loan products in Tunisia (around 7% instead of) 14%.
All the mechanism is conducted in transparent manner through a special Management Information System (MIS) used by a dedicated team within the ANME. Moreover, Prosol is regularly evaluated and audited by tierce party (audited by KPMG in 2007).

Impact/evaluation

Market transformation

Launched in April 2005, the PROSOL project has resulted in an immediate success. In less than one year (April-December 2005), sales reached the record figure of 7,400 solar water heating systems, for a total surface installed of 23,000 m2. In 2008, around 30,000 units were installed corresponding to approximately 83,000 m2. The total installed capacity within the prosol is more 200.000 m² of collectors between 2005 and 2008.



These figures show clearly that the Prosol mechanism implied a real market transformation of the solar water heaters in Tunisia.

As regards geographical distribution, the majority of solar heating systems are concentrated in the Northern part of the country and in coastal areas. In terms of equipments, most installations are represented by flat plate solar panels but vacuum tube collectors are slightly gaining market share. As for financial data, the total market for 2005-2008 is estimated at around 80 million \$. The bank sector has granted loans for more than 60 million \$. The number of SWH suppliers eligible within PROSOL has rapidly increased, passing from 5 to 9 in few months and stimulating other applications. Today, the number of companies selling SWH is 30, of which 6 producers. As far as installers are concerned, their number has reached more than 700 units, i.e. 6 times the figure achieved at the end of the GEF project. These remarkable results have led the Tunisian government to set very ambitious targets. In fact the annual avoided subsidies of displaced LPG for the Government could be estimated to around 3 million \$ in 2008.

Energy savings

Around 65 koe/m²/year

Perspectives

In spite of the considerable strengths of the project, the main future issue is the maintenance. In fact, despite that the supplier provides a guaranty of the SWH for 5 years, if no dedicated measures for maintenance are adopted, installed SWH might not be working anymore because of lack of maintenance. New measures are currently in study to develop a hot water service approach by including maintenance contract within Prosol mechanism.

Problems / adaptations

In the initial financial mechanism of PROSOL, solar water heater suppliers were the sole party dealing with banks and were obliged to accept responsibility for the loans they had taken out on behalf of their customers. Ironically, a successful vendor was measured by his level of indebtedness. This limit has been corrected in the new “PROSOL2”, which was launched in 2007. In “PROSOL2”, end users are directly granted the loan from the bank, thus eliminating the burden for suppliers. The new mechanism has been entirely developed by local actors, and no other international institutions are involved. This represents a very positive outcome, since it demonstrates that a self-sustaining market and policy decision making process are being built up.

Accompanying measures

In order to give visibility to the project, inform customers on the advantages of the mechanism and promote the purchase of SWHs, a comprehensive communication plan was developed at national level. The following media were used: TV, radio, posters, brochures. Moreover, a Training Support Facility was established to build capacity amongst financiers and expand their confidence degree in renewable energy technologies, with the ultimate goal to increase the number of sustainable energy loan portfolios. Finally, carbon finance is another important component of PROSOL. Prosol is currently under validation process as CDM Program of Activity (PoA). The CDM revenues will be used to strengthen the program, mainly for awareness and capacity building.

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Annexe 5: Example of country case studies file of measures evaluation

Lebanon

Energy Efficiency in buildings in Lebanon

Context

On April 1, 1997, the French Ministry of Ecology and Sustainable Development (MEDD) has presented to the steering committee of the French Global Environment Facility (FFEM), The energy efficiency in building project in Lebanon which was accepted for an amount of 868 959,40 €.
This project was set up in the context of a quasi entirely dependent economy at the energy level on oil products imports, including electricity generation.
The electricity sector, sharply loss-making and with insufficient production capacities, offered reorganization prospects.
The building sector was rapidly developing, not enough regulated, with housings of below-average thermal quality, generating discomfort or a relatively significant overconsumption of energy.

Objective

The project aims to prove technical and economic feasibility of energy improvements in the collective habitat.
It also aims, by using the results of this demonstration, at launching an energy conservation policy in the habitat sector, by sensitizing the Lebanese decision makers and by reinforcing the local capacities.

Programme description

Main characteristics

This project consisted, by way of demonstration, in developing and applying energy design improvements for the envelope and the equipment of certain new buildings, in taking measurements and then on this basis, developing an accompanying program at the national level , aiming at the diffusion of better practices for the energy efficiency in buildings.
Two types of improvement are introduced in the program:
- An adapted thermal design of buildings (roof and walls insulation, solar protection, reinforcement of the walls and windows tightness, double-glazing, controlled mechanical ventilation...);
- Efficient equipment in the energy plan (collective solar water heaters, compact fluorescent lamps).

The project includes a program of physical achievements in two phases, with measurement campaigns.

The project has comprised five programs carried out in various climatic areas, with four operators of private, co-operative and social sectors. It concerned in a first phase (1999-2001) a building site of a private property developer in Zouk Mosbeh, in the north of Beirut and in the second phase (2002-2004) two orphanages of Dar Al Aytam foundation one in the southern suburbs of Beirut (Ouzaï) and the other in the plain of Bekaa (Khirbet-Rouha) as well as a family building in a residential area (Aïn Aalak). The total area of the demonstration sites was around 20 000 m².

To promote the emergence of property programs saving energy, the project has provided:
- A 10 % capital cost for the collective water-heater on each site;
- A 30 % subsidy for the improvements on the building of which the effects are more difficult to evaluate and which have a deferred profitability.

Impact/evaluation

Market transformation

The project has allowed a reinforcement of tools and competences for the collective housings design, with the establishment of climatic areas in Lebanon and recommendations regarding insulation presented to the professionals in partnership with the engineers and architects associations. After been approached for the supply of pilot sites, a firm has initiated on the spot manufacture of profiles and frames for double-glazing with rupture of thermal bridge.
Innovations were introduced in the field of collective solar heated water. The Zouk Mosbeh installation was first of its kind in Lebanon, as well as the solar results guarantee contracts) and service contracts established within the framework of this project. Lessons drawn from this installation led to improvements on a second site (Maghdoucheh) and to put in place an individual counting of consumed heated water.

The manufacturers of solar water heaters have formed an association to stimulate the thermal solar market. A second association of designer and industrials was also put in place around the pilot programs stakeholders.
The project financed by the FFEM is developed at the Lebanese and regional levels. Complementarities have been found in Lebanon with two projects of the Global Environment Facility (FEM – thermal standards in buildings and Lebanese Center for Energy Conservation Project). Additionally, another project of energy efficiency in the building sector in the Mediterranean region (MED ENEC) of 4 millions of euros is just starting. Its approach is connected with this project.

Energy savings

Electricity saving relating to the project represent at least 1 500 kWh/year per typical housing of 150 m² for an investment overcosts of about 5 %.
For the built 20 000 m², it represents a saving of 235 MWh/year.

Perspectives

The project revealed a need for prefinancing energy equipment that the beneficiaries cannot always bear. This issue, complex from legal, institutional and financial point of view, should be studied with the assistance of a credit institution. Several options are possible for the nature of the borrower: specific customers but with weak unit amounts and difficult guarantees to implement or a company selling solar energy with a guarantee of solar results.
Because of the starting situation, it was certainly premature to address this issue at the project level.
The prefinancing energy equipment is a point that must be examined as soon as the market reach a sufficient size deemed interesting for a credit institution.
This question ties up with the needs incentives, which must be assessed on the basis of economic balance of energy efficiency projects and parallel to regulatory and standardization measures.

Problems /

The project was initially designed with Byblos Construction Company (BCCO), An important private builder established very well in the area of Jbeil (old town of Byblos to 30

adaptations	km in the north of Beirut). A study of the possible improvements was conducted for a 2 phases- program of around 23 000m², in Byblos Blatt, on a pitched plot. The plots permit was not obtained for reasons of density excess on the constructible party of the plot. It was thus necessary to find an alternative to BCCO. Ultimately, the project was implemented on five sites with four different operators from the private, co-operative and associative sectors
Accompanying measures	The project has comprised accompanying measures at the national level : • Identification of the principal energy saving field of the sector; • Development of tools for the Lebanese construction operators (methods of thermal building design and sizing of the hot solar water installations); • Promotion of more efficient household equipments and the initialization of a program of electricity demand control within the decision makers; • Development of a minimum thermal regulation for Lebanon.
References	Efficacité énergétique dans la construction au Liban, Expost n° 06, November 2007

Annexe 6: Example of country case studies file of measures evaluation

THAILAND

Energy Efficiency Revolving Fund

Context

The Energy Conservation Promotion Act (ENCON Act), passed in 1992, is the primary legislation guiding Thailand's energy conservation and renewable energy policy.
In the early years after the implementation of the ENCON Act, much of the energy efficiency work carried out in Designated Facilities was geared toward energy auditing and reporting. Implementation of actual energy efficiency projects was hindered by lack of awareness of energy efficiency opportunities, the low priority given to energy costs in management decision-making, and limited access to capital due to the 1997 economic crisis in Thailand. To overcome these barriers to increased energy efficiency, The Department of Alternative Energy Development and Efficiency (DEDE, the primary government agency responsible for implementing energy efficiency under the ENCON Act) introduced two new programs in late 2002 and early 2003, using funds sourced from the ENCON Fund:

- the Energy Efficiency Revolving Fund which stimulates investment in energy efficiency by involving the Thai finance sector in providing low interest loans for energy efficiency projects; and
- the 30% Subsidy Program

Objective

To stimulate investment in energy efficiency by involving the Thai finance sector in providing low interest loans for energy efficiency projects.

Programme description

Main characteristics

<u>Design of the fund</u>

- The initial amount allocated from the ENCON Fund to the Energy Efficiency Revolving Fund is THB 2 billion (USD 50 million).
- The maximum loan available from the Energy Efficiency Revolving Fund is THB 50 million (USD 1.25 million) per project.
- Funds for loans under the Energy Efficiency Revolving Fund are provided from the ENCON Fund to the banks at a zero interest rate.
- The banks lend this money to proponents of energy efficiency projects (customers) at a fixed interest rate of no more than 4% per annum.

<u>Projects Eligible for Funding</u>

Projects which implement "energy conservation" as defined in Sections 7 and 17 of the ENCON Act are eligible for a loan from the Energy Efficiency Revolving Fund :

<u>Projects in Factories</u>

Under Section 7 of the ENCON Act, energy conservation in factories means one of the following measures:

- improvement in combustion efficiency of fuels;
- prevention of energy loss;
- recycling of energy wastes;
- substitution of one type of energy by another type;

- more efficient use of electricity through improvements in power factors, reduction of maximum power demand during the period of the electricity system's peak demand, use of appropriate equipments, and other approaches;
- the use of energy-efficient machinery or equipment as well as the use of operation control systems and materials that contribute to energy conservation;
- other means of energy conservation as stipulated in the Ministerial Regulations.

Projects in Buildings
Under Section 17 of the ENCON Act, energy conservation in *buildings* means one of the following measures:

- reduction of heat from the sunlight that enters the building;
- efficient air-conditioning, including maintaining room temperature at an appropriate level;
- use of energy-efficient construction materials and demonstration of qualities of such materials;
- efficient use of light in the building;
- use and installation of machinery, equipment, and materials that contribute to energy conservation in the building;
- use of operation control systems for machinery and equipment;
- other measures for energy conservation as prescribed in the Ministerial Regulations.

Repayments

The initial allocation from the ENCON Fund to the Energy Efficiency Revolving Fund is for 10 years, meaning that DEDE must repay the total THB 2 billion to the ENCON Fund within 10 years from the commencing date of the Energy Efficiency Revolving Fund.
Funds used by a participating bank to make a loan to a customer are repayable by DEDE to the ENCON Fund within seven years after the first drawdown of the loan.
Each loan agreement between a participating bank and a project proponent includes a schedule of regular repayments of loan principal and interest by the project proponent to the bank. All repayments by the project proponent must be completed within seven years from the first drawdown. However, project proponents can request a grace period with no repayments during the first year if their project requires some time to be completely implemented.
The bank must repay the principal to DEDE within seven days of receiving a repayment from the project proponent.

Administration

The banks are responsible for most aspects of the lending process for the Energy Efficiency Revolving Fund, including marketing, economic (and sometimes technical) assessment, credit approval, and, importantly, loan repayment in case of default by a customer. The banks are required to submit regular reports on the status of individual projects so that DEDE can track the use of funds, the level of investment in energy efficiency projects and equipment, and the actual energy and demand savings.

Lending Process for the Fund

The lending process for the Energy Efficiency Revolving Fund comprises six stages.
The **first stage** involves the identification of an energy efficiency project which may be eligible for a loan from the Fund. The project may be identified directly by the owner of a facility or through an energy audit of the facility carried out by an energy management company or an ESCO.
Once an energy efficiency project has been identified, a detailed feasibility study is carried out by the facility owner, usually assisted by a technical adviser who may be either a staff member or an outside consultant. This study focuses on:
- assessing whether the proposed energy efficiency measures are technically feasible;
- estimating the likely energy savings from the project; and
- determining whether the likely repayment commitments under a loan from the Fund can be met.

If the results of the feasibility study are acceptable, the facility owner makes an application through a participating bank for a loan from the Fund.
Following the extension of the eligibility criterion in May 2004, third parties, such as energy

service companies (ESCOs), who do not own the facility in which an energy efficiency project is to be implemented, are also eligible to apply for a loan on their own account. Where applications are made by third parties, there must be an agreement in place between the facility owner and the third party which governs the conditions under which the energy efficiency project will be implemented in the facility.

In the **second stage**, the bank performs a financial analysis of the project. Some banks which have technical staff (eg engineers) may also carry out a technical analysis of the proposed energy efficiency measures. If the analytical results are acceptable, the bank passes on the application to DEDE.

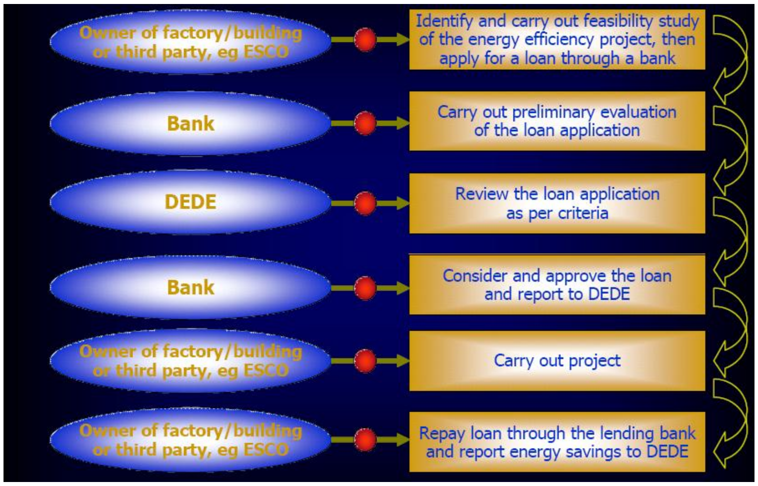
In the **third stage**, DEDE assesses the project and decides whether to approve it according to specified criteria and conditions. The purpose of this assessment is to determine whether the project is eligible for a loan from the Fund and whether the proposed energy saving measures are technically feasible. DEDE then informs the bank whether or not the project has been approved.

In the **fourth stage**, if the project has been approved by DEDE, the bank considers and approves a loan and submits a disbursement and repayment plan to DEDE so that DEDE can organize the disbursement of funds from the ENCON Fund to the bank.

In the **fifth stage**, the borrower uses the loan funds to invest in, and implement, the energy efficiency project.

In the **sixth stage**, the borrower makes repayments of loan principal and interest to the bank and also submits reports to DEDE on the energy savings from the project. Within seven days of receiving a repayment, the bank repays the principal amount to DEDE. DEDE then returns the funds to the ENCON Fund.

The lending process is summarised in the following figure.



Impact/evaluation

Market transformation

Since its start in late 2002 ,the Energy Efficiency Revolving Fund has realized **until June 2005** interesting performance and results, as illustrated in the figure below :

BUILDINGS	
Hotels	6
Hospitals	4
Total	10
FACTORIES	
Food and drink	20
Chemical	16
Textile	9
Others	6
Non-metallic	4
Paper	1
Total	56
Grand Total	66

The total funded projects amounts to 66: about 85 % of the projects are implemented in factories whereas 15% in office buildings.

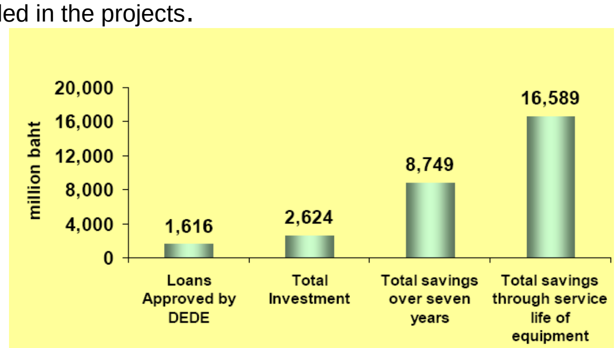
The total investment of the implemented energy efficiency measures in funded projects is 2,622.13 investment million baht with a 1,267.37 million baht total yearly savings.

	Measures	Investment (million baht)	Total savings per annum (million baht)	Average Payback (years)
1	Energy management and control	66.14	24.39	2.71
2	Insulation	6.92	7.84	0.88
3	Process improvement	168.35	66.48	2.53
4	High efficiency equipment	400.06	392.40	1.02
5	Renewable energy	751.80	424.84	1.77
6	Improvement of machinery	35.69	19.90	1.79
7	Air conditioning	92.29	33.19	2.78
8	Electrical system	4.01	1.00	4.01
9	Lighting	2.30	0.91	2.53
10	Cogeneration	1,055.77	265.42	3.98
11	Boiler	38.80	31.00	1.25
	Total	2,622.13	1,267.37	2.07

According to more recent data, the total investment is around 500 million USD from which 150 million USD were allocated from the revolving fund for 252 projects (as of Jan 2010)

Energy savings

The energy savings of the energy efficiency projects leveraged by loans from the Fund are measured here as total financial savings which will be achieved over the life of the equipment installed in the projects.



As shown in the figure above, each dollar of lending results in more than 10 dollars in lifetime energy cost savings. Additionally, every dollar lent from the Fund leverages approximately 60 cents in commercial bank lending.

Perspectives

Problems / adaptations

When the Energy Efficiency Revolving Fund commenced in January 2003, only owners of Designated Facilities under the ENCON Act were eligible to apply for funding for energy efficiency projects.

In May 2004, this eligibility criterion was extended to enable owners of any commercial or industrial facility, whether or not it is a Designated Facility, to be eligible to apply for loans from the Fund. In addition, third parties, such as energy service companies (ESCOs), who do not own the facility in which an energy efficiency project is to be implemented, are also eligible to apply for loans. However, most banks are reluctant to make loans to third parties because they usually do not own substantial land, buildings or equipment which can be offered as collateral.

During the first eighteen months operation of the Fund, the take up of loans was relatively slow. The eligibility criterion was extended principally to broaden the target area for the Fund, and particularly to make loan funds available to small and medium enterprises. Following the extension, the take up of loans has increased. In June 2005, 12 loans have been made to non-designated factories, one to a non-designated building, and one to an ESCO.

Accompanying measures

- DEDE technical assistance to the banks and their potential clients;
- Monitoring by the DEDE of the performance of the banks to ensure that they meet their targets in terms of number of energy efficiency projects, lending, and repayments;
- Evaluation by the DEDE of the performance of the funded projects, so as to measure total energy savings.

References

Thailand’s Energy Efficiency Revolving Fund: A case study, July 2005

Note

The currency exchange rate used in this Case Study is 40 Thai baht (THB) = 1 US dollar (USD).