Low-energy buildings in southern and eastern Mediterranean countries

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Abstract

This paper presents the experiences and conclusions from a regional project, financed by the European Union, that supports the design, construction and monitoring of 10 low-energy demonstration buildings (Pilot Projects) in 10 southern and eastern Mediterranean countries (more information about MED-ENEC under www.med-enec.com):

1. High energy savings can be achieved in buildings with a variety of partly mature and partly innovative technologies. Low- and even zero-energy houses and green buildings are technically feasible in the region.
2. Economic considerations limit the broad application of some of these technologies and thus reduce the technical potential for energy savings in a large-scale dissemination. The most cost-efficient technology mix, according to the type of building, the climate zone, energy prices and the availability of know-how and technologies needs to be identified.
3. High transaction costs such as substantial initial learning and search costs jeopardize the profitability of low-energy buildings in the region and constrain the development of the respective markets.
4. When using a cost-efficient technology mix and if mitigating transaction costs, low-energy buildings become attractive in most of the countries with energy savings of 20-60%, incremental costs of 10-15% and short pay back periods.
5. Donors' and/or government support and incentives are necessary for overcoming the initial high transaction costs and market failures and for boosting energy efficiency in buildings.
6. Subsidies on energy are the most important single constraint for broad dissemination in some of the countries in the region.
7. Government intervention is a profitable investment from a macro-economic point of view. The economic and social gains of energy efficiency quickly outscore the cost of support programs.

Introduction

Low-energy buildings haven't been an issue in most of the southern and eastern Mediterranean countries for long. When energy prices were low, the first priority was keeping down investment costs while constructing swiftly large numbers of buildings for a quickly increasing urban population. But since oil world market prices nearly tripled over roughly one year, individuals suffer from increasing energy costs and most countries in the region are struggling with the heavy burden of energy subsidies on the state budget. Countries like Tunisia, Lebanon and Syria spent billions of dollars on energy subsidies in the last years.

The recent significant reduction of world market energy prices mitigated the pressure on governments and individuals, but energy security issues and the expected long term develop-

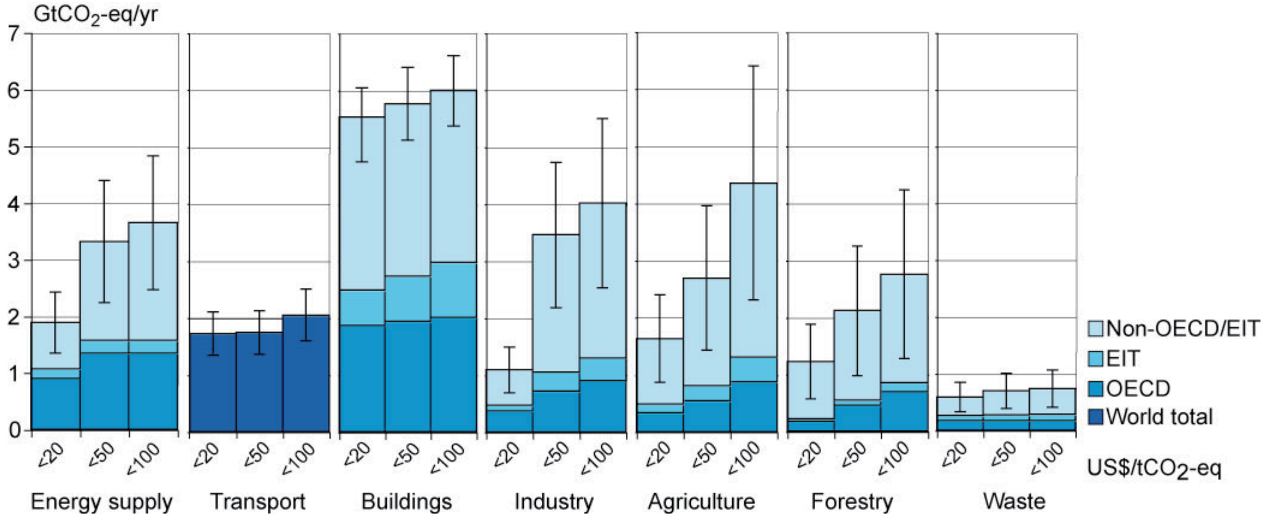

Figure 1: Economic mitigation potential by sector in 2030, 2007 IPCC Report

ment of energy supply and demand have raised attention of governments to tap available potentials for energy efficiency and supply diversification.

Buildings: the silver bullet for energy efficiency?

According to several recent studies, the building sector is the biggest single consumer of final energy world wide, using 35-40% of energy resources (UNEP 2007, WBCSD 2007, and IEA 02/2007) and contributing about a third of all energy-related CO_2 emissions (UNEP 2007).

At the same time, this sector has the highest potential for energy savings and the use of renewable energies. What is even more important: buildings have also the highest saving potential with no-cost and low-cost measures, e.g. by just changing the building design and applying well-known technologies such as insulation, solar-water-heaters, efficient lighting, etc. The 2007 IPCC report estimated the savings potential per sector in different country groups and came to the conclusion that the building sector has the highest saving potential (IPCC 2007, Fig. 4.2) as shows the figure 1.

Also, the McKinsey Global Institute and The Vattenfall Institute of Economic Research developed a similar analysis showing the high business potential for energy efficiency in buildings. The "Global Carbon Abatement Cost Curve" clearly shows the highest profitability for measures in buildings, such as improvement of building insulation and lighting systems (MGI 06/2008). In addition, households in emerging countries are the main driver for energy efficiency improvements in contrast to industrialized countries, where most of the saving potential has been identified in the industry and electricity generation sectors (IEA 2008, p.10 and WEC 2008, p.94).

If the potential is so high at least on the aggregate level of country groups, why then there is still rather few implementation of these available and mature technologies in the North Africa and Near East region? In most of the countries, with some exceptions for urban regions in Israel and Turkey, the thermal building standard and energy efficiency of buildings in general remain very poor. This contradiction seems also to be valid for other regions. For example, authorities in China were aware of the energy efficiency opportunities in buildings already well before the IPCC report. Nevertheless, these energy savings potentials were hardly tapped in the building boom in China during the last years (GTZ 04/2004, p.5). While standards were developed and increasingly enforced and necessary institutional and organisational changes addressed, resistance to change towards higher energy efficiency is still significant. Important stakeholders in the building sector still do not receive clear market signals through economic instruments for incentives and sanctions.

A similar gap between potentials and achievements exists for the dissemination of renewable energies (intensively discussed in OECD/IEA 2008).

This paper intends – on the basis of experiences with model buildings in the Mediterranean region – to show the technical and economic potential for these technologies as well as the bottlenecks and constraints that hinder a broad dissemination. Some conclusions for policy support are also given.

MED-ENEC experiences in 10 southern and eastern Mediterranean countries

Since early 2006, the MED-ENEC project "Energy Efficiency in the Construction Sector in the Mediterranean", financed by the European Union, supports partners in Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, the Palestinian Territories, Syria, Tunisia and Turkey in boosting energy efficiency measures and the use of renewable energies in buildings. In this framework, Pilot Projects in all 10 partner countries have been supported during a period of about three years starting in summer 2006. These model low-energy houses represent a rich variety of building types and include new houses as well as refurbishments. All relevant technologies have been used in order to reduce conventional, i.e. carbon-based energy consumption.

The MED-ENEC Pilot Projects are realized by national partners with the support of international short-term experts. Most buildings are already finalized and inaugurated (Lebanon, Turkey, and Palestine), in the finishing (Algeria, Jordan, Egypt, Syria and Israel) or in the construction phase (Morocco and Tunisia). The table 1 gives an overview about the building

Table 1: Overview of MED-ENEC Pilot Projects (PP) with estimated energy performance data

Type of building	Country / city	Used technologies	Energy performance (per year)		
I) Small residential buildings			**Baseline: kWh/m²**	**PP: kWh/m²**	**CO_2 (t) saving**
1) Rural house (80 m²)	ALG - Souidania, Alger	Bioclimatic design, earth stabilized bricks, night ventilation and fans, solar space heating & hot water	360	159	3.1
2) Urban villa (420 m²)	JOR - Aqaba	Design, orientation, shading, solar cooling, thermal insulation	318	48	23
3) Urban villa/guest house (253 m²)	MRC - Rabat	Bioclimatic design: orientation, thermal insulation, overhang shadowing, thermal mass, night ventilation, solar collector/heat pump system	272	71	10.9
II) Large residential buildings					
4) Flat in apartment building (306 m²)	PAL - Ramallah	Thermal insulation, double-glazed windows, ground coupled heat pump	181	135	3.5
5) Low-income apartment building (2,400 m²)	SYR - Kudsira Suburbs	Thermal insulation, traditional shading, solar chimney, evaporative cooling, solar floor heating & hot water	253	95	72.4
III) Non-residential buildings					
6) Private training & research centre (1,760 m²)	TUR - Gebze	Thermal insulation, natural light, shading, ground heat pumps for cooling & heating	498	328	76.7
7) NGO training & community centre (2,100 m²)	ISR - Sakhnin	Traditional elements: passive cooling towers (Malkafs), natural light openings (Tisanes), shading systems (Mashra-bia). New technologies: CFL bulbs, photovoltaics (PV) and wind turbine	357	89	63.6
8) Public administration office (refurbishment, 576 m²)	EGY - Sharm El Sheikh	Solar cooling, reflective insulation coating for roof, shading, sealing the windows, occupancy sensors	769	408	28.2
9) Private hospital (refurbishment, 6,000 m²)	LEB - Zgharta	Roof insulation, efficient lighting, maintenance of air conditioning, demand-side management system	1416	1215	307.3
10) Tourism complex (3 chalets, 148 m²)	TUN - Beni M'Tir	Wooden construction, bioclimatic design, insulation, shading, thermal mass, night ventilation, geothermal heat, solar air collectors, PV	252	6	5.2

types, the technologies used and the preliminary energy performance data, which are estimated on the basis of simulations and will be monitored after the completion of the buildings. The overall CO_2 savings of the ten Pilot Project buildings sum up to about 600 tons annually.

Lessons learnt

After three years of project lifetime some lessons can be drawn from the realisation of the above shown low-energy buildings in 10 MEDA-countries.

LESSON 1: HIGH ENERGY SAVING POTENTIAL CONFIRMED

High primary energy savings of up to 100% – compared to conventional buildings in the same country – are technically possible and have been realized in the Pilot Projects as shown in Figure 5. These energy savings correspond to 3 to 307 tonnes of avoided CO_2 annually, according to the different size of the buildings and the chosen energy efficiency concept. The average primary energy saving achieved is 57%, compared to a conventional building of the same size and comfort (concerning heating and cooling).

A number of mature and some innovative technologies are available. A systematic and integrated approach of increasing energy efficiency in buildings is shown in the graph below:

For new buildings, this integrated design process makes sure that all energy saving potentials of the building are tapped. In this process actions are taken to reduce the energy consumption as well through insulation or efficiency as through the design of the buildings and the HVAC systems. Passive use of renewable energy and other natural sources is an integrated part of the design and development process and there is an interactive process between the design of buildings and systems. Examples for this integrated process can be Passive Houses, Zero Energy or Carbon Buildings and Green Buildings (IEA 03/2008, p.26). Integrated design is more complex and difficult to organize, as building users, planners/developers and constructors have to come together in an early planning phase for making sure, that design features and equipment are appropriate and acceptable by the end users.

Figure 2: Pictures from MED-ENEC Pilot Projects in Algeria, Egypt and Israel

Figure 3: Pictures from MED-ENEC Pilot Projects in Morocco, Jordan and Lebanon

Figure 4: Pictures from MED-ENEC Pilot Projects in the Palestinian Territories, Syria, Tunisia and Turkey

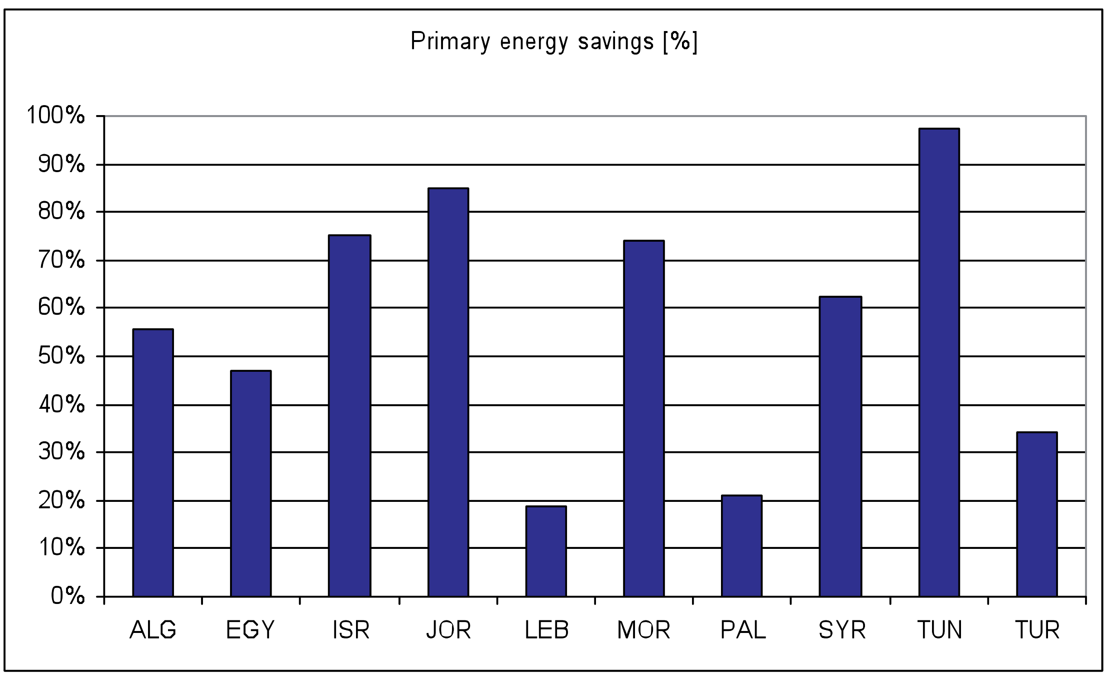

Figure 5: Primary Energy savings of MED-ENEC Pilot Projects

First priority is reducing the energy load through proper design and thermal insulation and only then active measures including the use of renewable energies should be considered. Finally, the behaviour of the inhabitant is crucial for realizing the theoretical saving potential. When shading devices are not used properly, when windows are left open while heating or cooling, all energy-efficient devices and technologies may not have the desired effects. In several MED-ENEC Pilot Projects, for instance in Jordan and Israel, users of the building receive written guidelines and explanations for the handling of the installed equipment and for energy efficient procedures and behaviour.

In addition, a part of the theoretical saving potential may be "lost" in comfort increase, e.g. the rooms are a bit warmer in winter and slightly colder in summer ("rebound effect"). This is particularly important in countries where thermal comfort is rather poor. During the monitoring phase of the MED-ENEC Pilot Projects (for one year after inauguration of the buildings),

Figure 6: Integrated EE-Approach for Buildings (Source: MED-ENEC, Carsten Petersdorff, ecofys)

the real energy savings will be monitored and discrepancies to the estimated values analysed. However, it will be difficult allocating these variances precisely to rebound effects, poor energy-efficient behaviour of the users, climate variations, poor technical performance of equipment and errors in simulation.

It should be noted that significant additional energy saving potentials exist on the urban planning level. District heating and cooling, public transport and green spaces are some examples for energy saving instruments and policies (for some good practices and tools see Cities Alliance 10/2007)

LESSON 2: BEWARE OF THE PAY-BACK!

57% energy saving of the MED-ENEC Pilot Projects seems to be very attractive, but what about the costs? The figure 7 gives an overview about the economic performance indicators of the Pilot Projects.

For the two refurbishment projects (Egypt and Lebanon), the indicator "incremental cost" is not shown. This information relates the additional costs for energy efficient buildings to the costs of conventional buildings (in %) and makes only sense for new buildings. Only in the case of a refurbishment when maintenance, repair or replacement of existing equipment had been necessary at the same time, e.g. for the lighting system or the roof insulation, it would be interesting to show the incremental costs of the energy efficient refurbishment compared to the "conventional" solution. However, for the two MED-ENEC refurbishing Pilot Projects, there was no major "conventional" refurbishment necessary, so that the baseline costs were assumed to be zero. Although we are aware that a certain cost should have been allocated, as the concerned equipment or building parts such as lamps or roof insulation were not completely new, we did not take this effect into consideration as it would not have changed the indicators significantly.

Anyhow, the pay-back periods are the more important indicators. We use the simple pay-back calculation method by dividing the value of the annual energy costs savings (assuming a 5% annual increase in energy prices) by the incremental costs of the building, compared to a conventional building.

When analysing the economic performance figures, major differences among the Pilot Projects become obvious. On the one hand, the Lebanese Project is the most attractive with a pay-back of roughly one year. The pay-backs for five other projects seem to be moderate with around 10 years. However, four projects are clearly unattractive with pay-backs of 18 to nearly 70 years[1].

1. Most of the performance indicators of the Pilot Projects are still theoretical as a result of simulations. MED-ENEC together with the Pilot Projects is in the phase of monitoring in order to compare these values with the effectively realized results.

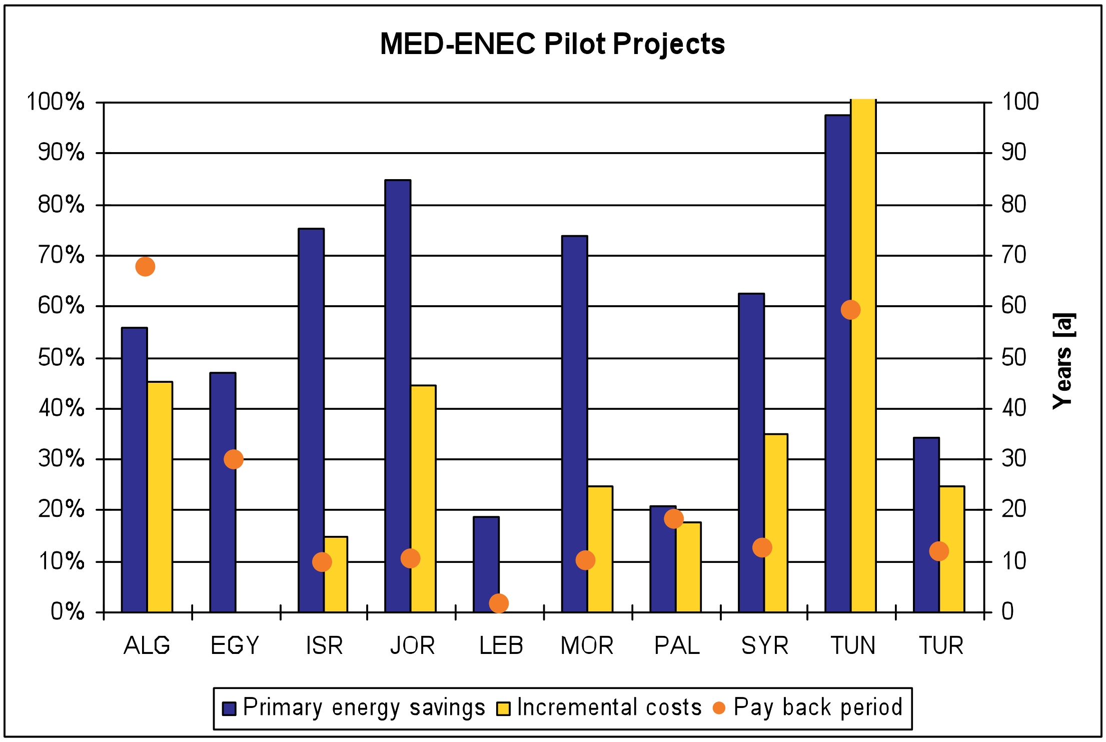

Figure 7: Economic performance indicators of MED-ENEC Pilot Projects

On average, the new buildings (except the Tunisian project, which is a special and rather expensive "show" case), needed incremental investments of about 30%, and show a pay-back period of about 20 years. In the next chapters, we will analyse the three major reasons for poor economic performance: choice of innovative but still expensive technologies for demonstration purposes, high transaction costs and market failures and energy subsidies.

LESSON 3: IDENTIFY YOUR SMART TECHNOLOGY MIX!

In some of the Pilot Projects such as in Tunisia, attracting "green" clients by demonstrating the "state of the art" and maximising the energy saving was a major objective. Therefore, a mix of mature and innovative but rather expensive technologies such as photovoltaic electricity generation or solar cooling was chosen. This approach makes the Pilot Project an interesting place to visit and learn from, but reduces potential for dissemination.

If, however, broad dissemination of low-energy buildings in the region is the first priority, economic considerations, e.g. the relation of energy savings to additional cost, limit the use of available technologies to the most cost-efficient "smart technology mix". The feasible technology mix may be different according to the type of building, the climate zone, national energy prices and the availability of know-how and technologies.

This approach helps reducing incremental costs and improving the pay-back period. Experiences from the MED-ENEC pilot projects lead to the table 2 specific, e.g. project- and country related assessment.

This type of assessment may lead to a ranking of technologies according to their cost-effectiveness. While some technologies, such as photovoltaic are sensible to national framework conditions (e.g. cost-effective in Israel, where a feed-in tariff exists, or in African countries, where grid connection is significantly lower than in the Mediterranean region), some seem to be quite attractive, independent of country and building type. Thus, passive design features, such as orientation of the building, shading, natural ventilation and the use of daylight are free of cost or very cheap in the design phase and therefore always cost-efficient for new buildings. Insulation of roofs and walls as well as efficient lighting (e.g. Compact Fluorescent Lamps or electronic ballast) and solar water heaters proved equally to be in the top ranking.

Studies from Asia show similar patterns: improving building insulation quality, lighting, air conditioning and water heating systems are the most cost-effective measures (Civic Exchange 2008, p. 8). In the Mediterranean region, due to the different climate, more emphasis is on cooling while in Europe, the highest efficiency gains are possible for heating (for a comprehensive analysis of the environmental improvement potentials of residential buildings in Europe see JRC 2008).

LESSON 4: INNOVATIVE PIONEERS FACE HIGH TRANSACTION COSTS AND MARKET FAILURES

There have been several major constraints and barriers for the MED-ENEC Pilot Project developers, which resulted in high and often uncompetitive costs. These effects are not specific for the MEDA-region (MGI 05/2007, p.46 and 10/2008, pp.27-29). Other country groups have different framework conditions and additional constraints (for instance in the cases of China and

Table 2: Estimation of cost effectiveness of selected technologies for MED-ENEC Pilot Projects

	ALG	EGY	ISR	JOR	LEB	MRC	PAL	SYR	TUN	TUR
Energy Efficiency										
Design	3		3	3		3		3	3	3
Insulation	2	3	3	3	3	2	3	2	3	3
Shading	2	3	3	3		3	3	3	3	3
Efficient Lighting	3	3	3	3	3	3		3	3	3
Wind towers/ solar chimney			2					2		
Night ventilation, thermal mass	2			3		3	3			
Demand Side Management					3					
Renewable Energy										
Solar DHW	2		2	3		3	3	3	3	
Solar Space heating	2							2		
Solar air collector									1	
Solar cooling		1		1						
Evaporative cooling			3	2						
Geothermal / heat pump						2	3		1	2
Photovoltaic			3	1					1	
Wind turbine			1							
3 =	high cost effectiveness									
2 =	medium cost effectiveness									
1 =	weak cost effectiveness									

Russia, metering according to consumption is not common, which is a strong disincentive for energy efficiency (GDI 2008, p.63), but the below described constraints are quite generally applicable (see also IEA 02/2007, S. 15, Plan Bleu 2008, Part 2, Chapter 6).

Information gaps and asymmetry

Both the general public and most professionals simply are not aware of the available technical solutions for energy efficiency and the scope of renewable energies and, even more important, of the economic saving potential. This is a vicious circle: the customer does not ask for energy-efficient solutions as he does not know about them and the professionals do not offer them as they are not requested.

It takes quite some time, efforts and cost convincing potential house owners to agree to changes in the conventional building technologies and procedures. The perceived risk of innovation is for all participants in the building chain quite high. Informing clients and subcontractors of the advantages of low-energy buildings and thus overcoming resistance to change entailed higher transaction cost for several Pilot Projects. These information and awareness gaps are even harder to bridge when urban low income and/or illiterate persons and households are concerned (see also J. Pett and L. Ramsay 2003 for the elusive audiences of "Hard to Reach and Hard to Help" target groups).

Financing higher up-front costs

Although major savings can be achieved without any cost in the design phase of the building, e.g. through proper orientation of the building, reducing the window surface or by using natural ventilation, low-energy buildings are in most cases more expensive than conventional buildings. The MED-ENEC and other experiences in the region, e.g. for low-energy buildings in Tunisia, show that 5-20% incremental costs are realistic for an energy saving of 30-40%.

However, potential house owners in the region often do not have the financial capacity to bear these additional costs, even if they are convinced of the short pay-back of such investment. Also, most banks are not ready to finance more than the "conventional costs" of a house, as they are not convinced or aware of the saving potential, e.g. the higher available income of the occupants due to reduced energy invoices.

In large public building programs for medium- and low-income inhabitants, a cost ceiling per square meter of the building is fixed by the authorities. Developers are not able to meet these requirements and at the same time introduce energy-efficient technologies. As the Ministries for Construction and Habitat usually have the political task to provide large volumes of cheap and affordable buildings in a minimum of construction time, there is no room for higher energy efficiency.

In few countries such as Tunisia, smart financing programs like the ProSol Programme for solar-water-heaters have been put in place. The incremental investment is financed by a credit that is reimbursed through monthly instalments which correspond to the value of energy saved in the same period. But for whole buildings, such programs are not yet available.

Quality of know-how and availability of products

Professionals in the region have very limited know-how and qualification for identifying the appropriate technologies and no experience in implementing. Consequently, learning and

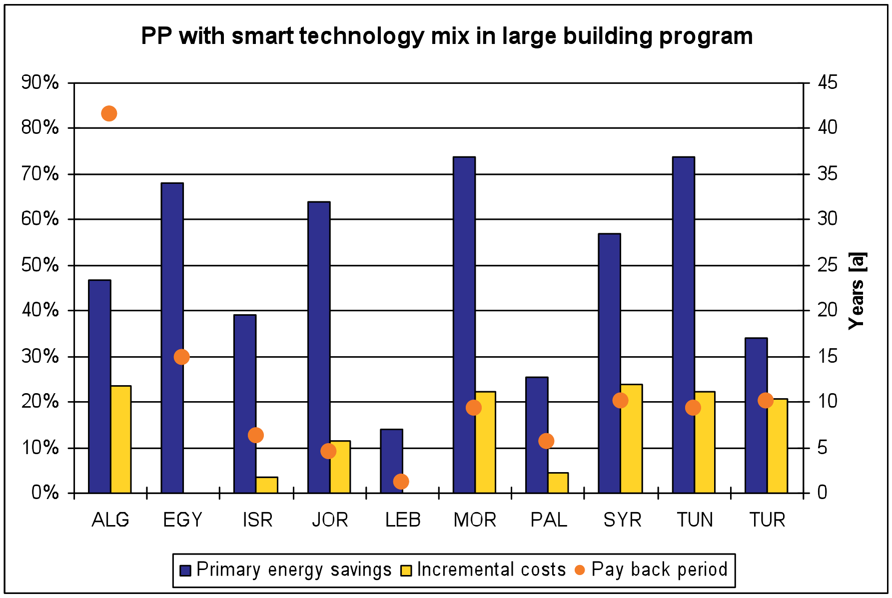

Figure 8: Economic performance indicators for PP with smart technology mix in large building programs

search costs of the Pilot Projects were quite substantial. In the case of Palestine, a comprehensive training of project staff in geothermal application was necessary in order to avoid costly mistakes during implementation. Another example is the project in Jordan, where the monitoring of the workers was much more extensive and time-consuming than on a conventional building site. In Syria, insulation material had to be imported as no production facilities exist in the country due to inexistent demand.

Diversity of actors and split incentives

The value chain of the construction sector is particularly diversified. Investors, developers, architects, construction companies, subcontractors, banks, owners and inhabitants all have interests and motivations that may be in conflict. Thus, the investor in new buildings is often interested in the cheapest solution, e.g. selling price, not taking into consideration the life-cycle costs. However, according to MED-ENEC estimates, around 80% of life cycle costs of buildings occur during operation, one major element of the operation costs being energy consumption.

In countries where an important share of buildings is occupied by tenants and not by the owners, there is a systematic bias for low-cost construction as the investor does not benefit from the higher energy-efficiency of the building. In some European countries, developers address this market barrier by publishing rent rates of houses including the average energy costs.

But in most MEDA countries, both supply and demand side actors clearly prefer the short-term perspective of minimizing construction costs and avoiding uncertainty about the effective savings of new technologies. Investing in low-energy buildings in this framework thus entails substantial risks for the private investor.

Rationale for government intervention

Public policies and government intervention are justified if substantial energy efficiency potentials are hardly or too slowly tapped due to these market failures and high transaction costs (Golove/Eto 1996). Donors' support may trigger individual initiatives and support capacity building and technology transfer such as through the MED-ENEC Pilot Projects. But framework conditions need to be conducive and a strong policy package for support is necessary for broad market development.

LESSON 5: PUBLIC-PRIVATE PARTNERSHIP IS CRUCIAL FOR MARKET DEVELOPMENT

With the support of MED-ENEC, most of the Pilot Projects were able to finance at least part of the higher transaction costs and to convince partners and clients of the advantages of their low-energy buildings. Thus, for the Project in Ramallah, the perceived risk of an engagement in these innovations was just bearable with the MED-ENEC technical and financial support. Otherwise, the company would not have dared making this experience.

All Pilot Projects did need at least initial support for developing their capacities and for creating a market for future dissemination. But public support and adequate framework conditions are still necessary, for developing the market for these technologies.

MED-ENEC made a simulation to find out, how a smart and cost-efficient technology mix and reduced transaction costs through implementation of this technology mix in large public or private building programmes would change the economic performance indicators. As a result, nearly all Pilot Projects become attractive with primary energy savings of 20-60%, incremental costs of 10-15% and reasonable pay back periods of less than 10 years.

These findings are confirmed for other regions and climate zones. For instance, a Malaysian low-energy office building achieved 64% energy savings with upfront extra cost of 10%, respecting the minimum standards set in the Malaysian codes of practice. The pay pack period is ten years (UNEP 2007,

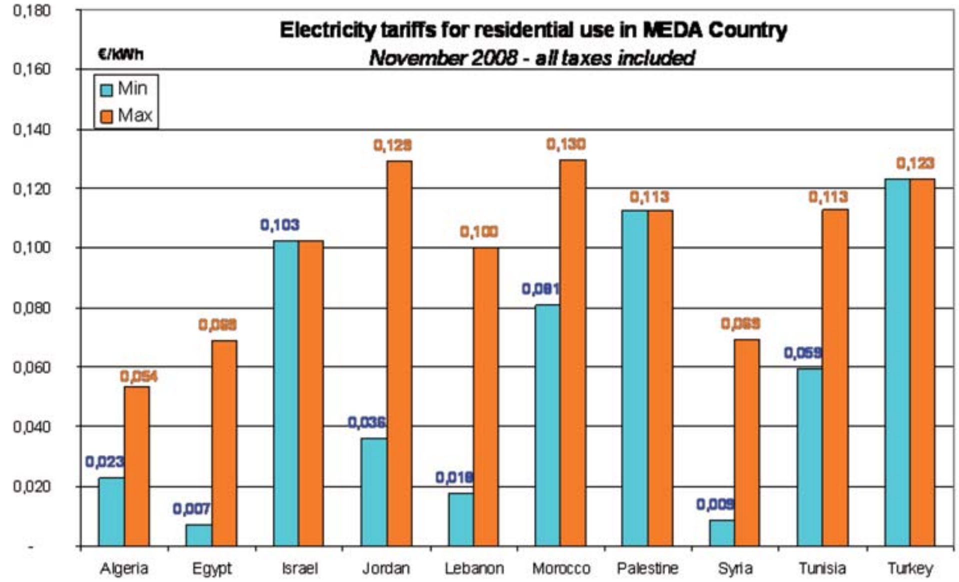

Figure 9: Electricity tariffs for residential use in MEDA countries (Source: MED-ENEC survey on the basis of information received from Energy Agencies and Ministries, 11/2008)

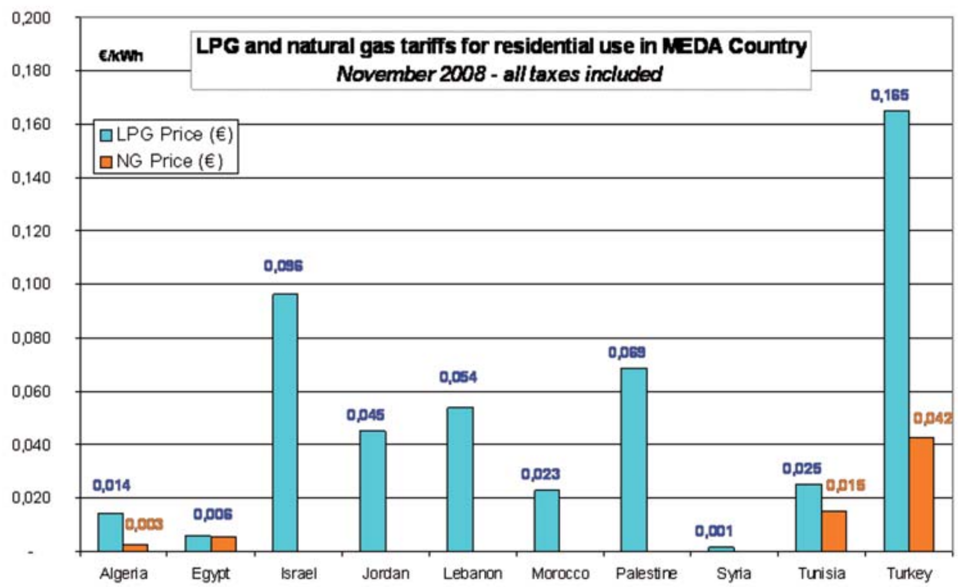

Figure 10: Gas tariffs for residential use in MEDA countries (Source: MED-ENEC survey on the basis of information received from Energy Agencies and Ministries, 11/2008)

The only exceptions are the Pilot Projects in Algeria and Egypt (the reasons will be discussed in the next chapter) and Tunisia, which is a special case of a "green" tourist resort that intends assuring profitability through attracting higher income clients.

LESSON 6: ENERGY SUBSIDIES ARE THE KEY CONSTRAINT IN SEVERAL COUNTRIES

The poor economic performance indicators of the Pilot Projects in Algeria, Egypt - and to certain extend also in Syria – are mainly the result of highly subsidized energy tariffs in those countries. Thus, the inhabitant of the rural low-energy house in Algeria would only save around 70 Euro per year (!) on energy costs as gas is extremely cheap.

The share of energy costs in the total household expenditures plays an important role in the perception of the saving potential and the motivation to engage in energy efficiency measures. In Hong Kong residential properties, the typical combined cost of electricity and gas supplies represents only about 3% of general household expenditures (Civic Exchange 2008, p.27). If energy tariffs are highly subsidized such as in Algeria, the potential for significant savings are rather limited and the incentive for action is low. On the other hand, low-income households suffer

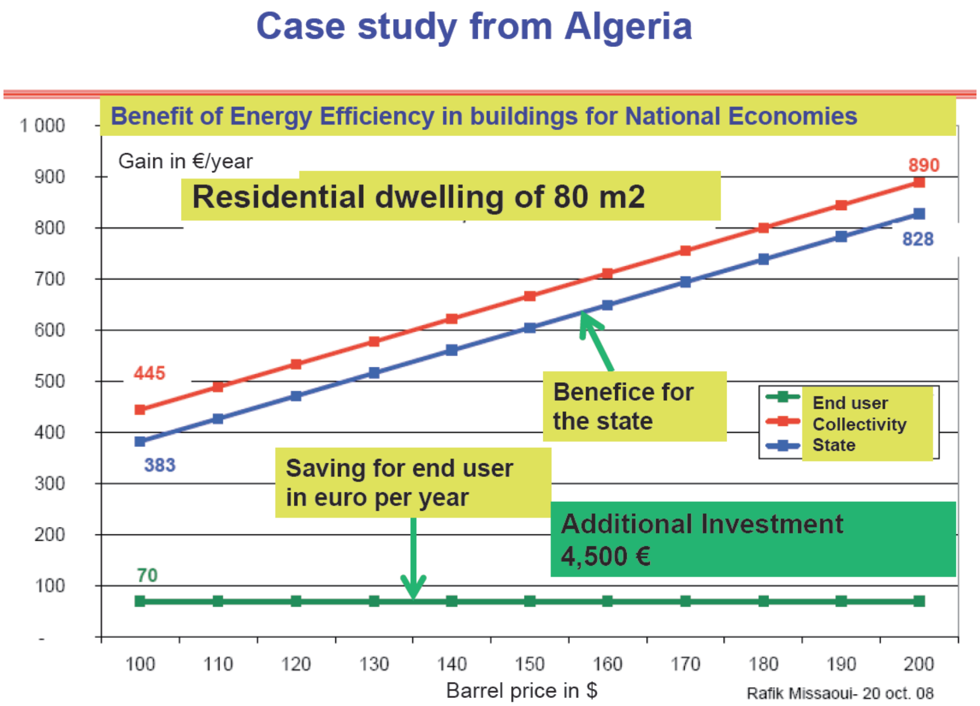

Figure 11: Benefit from EE in Buildings, Algerian Case Study (Source: Rafik Missaou, Tunisia, for MED-ENEC)

most from increasing energy prices as the share of energy in the total spending is higher than in rich households.

Even when using only the most cost-efficient technology mix and reducing transaction costs in a large building programme, the pay-back for the Algerian Pilot Project would be over 40 years. The tables on figure 9 and figure 10 give an idea of the huge differences in energy tariffs in the region that have direct effects on the pay-back periods and thus on the potential for dissemination:

LESSON 7: SUPPORT FOR ENERGY EFFICIENCY IS "GOOD GOVERNANCE"

Subsidies on energy are usually poorly targeted and hardly achieve their objectives. In Egypt, for example, electricity subsidies mostly benefit the residential sector. The structure of tariffs reflects considerations of social welfare, with increasing block tariffs to make electricity affordable for the poor. However, a 2004 analysis found that individuals in the highest-income quintile received more than 2.5 times the subsidies received by the poor (CAPMAS 2004). The wealthiest 20% of the population received 93% of gasoline subsidies, because they own most of the vehicles. Similarly, they received 65% of the natural gas subsidies, because the gas network reaches only the wealthiest urban neighbourhoods. The kerosene subsidy is an important exception to this pattern; it is the fuel of poor households.

In countries where energy tariffs are extremely low, direct subsidies by the government are the only way for developing the market for low-energy buildings. But also when energy tariffs are high, such as in Turkey or in the Palestinian Territories, the government has an important role to play for counterbalancing high initial transaction costs and market barriers and failures.

But it seems that, on a macro-economic level, these direct and targeted subsidies may be a profitable investment for the State.

If significant energy savings are achieved in new buildings, the country may:

- save direct subsidies on energy,
- increase energy exports at far higher world market prices and/or
- reduce investments for construction of new power plants.

In the case of Algeria, MED-ENEC estimated the benefits of the Pilot Project on the micro-economic level (end user) and on the macro-economic level (government and community):

The inhabitant of the 80 m^2 demonstration building saves only 70 Euro per year, independent of the barrel price. However, the State saves between 383 and 828 Euro per year, depending on the world market prices. Even with a barrel price of US$50 there is still some substantial saving. The community even saves more, when the indirect effects and other external benefits are taken into consideration. The economic and social gains may consist of:

- protecting vulnerable parts of the population (social protection through targeted subsidies),
- avoiding health and environmental costs of energy production, e.g. through air pollution,
- developing technological competence and know-how and by
- creating new jobs in cutting-edge business sectors.

It is quite difficult identifying exact figures about the scope and volume of energy subsidies and savings or for the macro-economic and external benefits. However, the underlying effects are real, and in the simulation above, the pay-back for the state of a 100% subsidy for the incremental costs of the Pilot Project (4.500 Euro) would be less than 12 years, when assuming an average barrel price of US$100 for the next decade. The pay-back for the community would be even less, e.g. around 10 years. Although the barrel price may stay for some time at a lower level of US$50-75, these macro-economic considerations should be integrated into government policy[2].

Conclusions

"Government must lead" (Civic Exchange 2008, p.5) – this is true not only for the Mediterranean region but for all regions and country groups. Setting regulations and standards and enforcing them is a necessary but not sufficient condition for success. As the value chain in the building sector is long and much diversified, with plenty of stakeholders acting on individual perceptions of risks and benefits, it is of highest importance that economic signals such as energy tariffs, incentives and sanctions orientate the actors in the market. Manufacturers, architects and engineers, developers and investors, construction companies, retailers and installers, property managers, occupiers and tenants do react to these signals.

However, resistance to change, initial market failures and high transaction costs usually slow down or even impede this reaction and development of the market for energy efficient products and services. An integrated package of regulation and standards (including control and enforcement), financial support and incentives, information, awareness, training, education as well as research and development activities has to come along with improved economic framework conditions. There has been some research to identify the most (cost-) effective policy mix. But there is no such thing as a "best" policy instrument. Each country needs to work out a comprehensive analysis of individual framework conditions and barriers and has to design an adapted policy package[3]. In this process, stakeholder participation, definition and monitoring of quantitative objectives and the synergetic combination of instruments are major general success factors (IEA 03/2008, UNEP 09/2007, ECOFYS 03/2007, WEC 2008, GTZ/Wuppertal Institute/UNEP 2007).

The lessons learned of the MED-ENEC project seem to be valid for most emerging and developing countries, independent of climate and cultural differences. Evidently, an appropriate policy mix according to different framework conditions is necessary. Countries with very low energy prices need strong political will through enforced regulations and standards as well as significant subsidies for energy efficient products and services while reducing non-targeted energy subsidies and at the same time protecting the vulnerable part of the population. Countries, where framework conditions are rather favourable and where the private sector is strong will rather focus on policy packages with information, training, quality control, technology transfer and credit program components.

2. UNEP 2008, pp.12-26, Worldbank 2007, chapter 4 and UNFCCC 2007 elaborate about effects of energy subsidies and best practices for policies reducing these price distortions while protecting vulnerable parts of the population.

3. For Asian framework conditions see ABC 2007, pp.68-95 for an analysis of market inefficiencies and policy tools for market transformation.

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