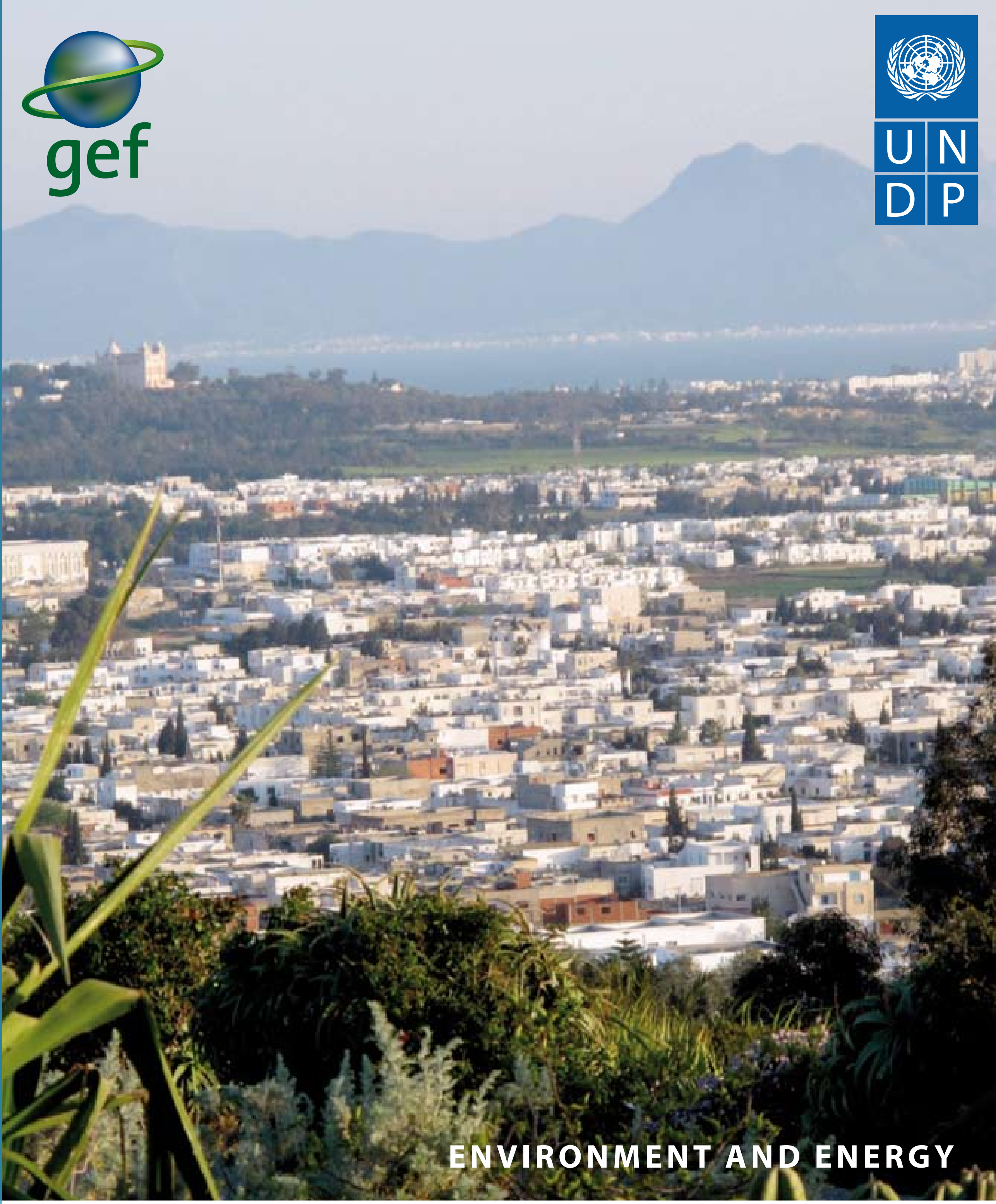

PROMOTING ENERGY EFFICIENCY IN BUILDINGS:

LESSONS LEARNED FROM INTERNATIONAL EXPERIENCE

By the United Nations Development Programme

1 UN Plaza, New York, New York 10017, USA

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PROMOTING **ENERGY EFFICIENCY** IN BUILDINGS:

LESSONS LEARNED FROM INTERNATIONAL EXPERIENCE

This report was prepared by Virgine Schwarz for the United Nations Development Programme, Bureau for Development Policy, Energy and Environment Group under the supervision of Marcel Alers.

March 2009

ACRONYMS & **ABBREVIATIONS**

A/C	Air Conditioning
ACEEE	American Council for an Energy-Efficient Economy
ADEME	*Agence de l'Environnement et de la Maîtrise de l'Energie* (French Agency for Environment and Energy Management)
ANEEL	*Agencia Nacional de Energia Eletrica* (Brazilian Electricity Regulator)
ARC	Adjustable Revenue Cap
CDM	Clean Development Mechanism
CFL	Compact Fluorescent Light
CO_2	Carbon Dioxide
DIY	Do it Yourself Stores
DSM	Demand Side Management
EIE	*Espace Info Energie* (French Energy Information Centres)
ESCO	Energy Service Company
ESP	Energy Service Provider
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse Gases
HVAC	Heating, Ventilation, Air Conditioning
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LRA	Lost Base Revenue Adjustments
NatHERS	Australian Nationwide House Energy Rating Scheme
OECD	Organisation for Economic Co-operation and Development
R&D	Research & Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WEC	World Energy Council
WEO	*World Energy Outlook* (published by the IEA)

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EXECUTIVE **SUMMARY**

The International Energy Agency (IEA) estimates that residential, commercial, and public buildings account for 30 to 40 percent of the world's energy consumption. The sector's contribution to current world CO_2 emissions is estimated by various sources at 25 to 35 percent.

Rapidly growing, especially in developing countries, the building sector offers the largest, most cost-effective opportunities for energy efficiency, with considerable co-benefits. However, to turn these opportunities into reality, multiple barriers must be removed.

PUBLIC POLICIES

To increase the adoption of energy-efficient investments and behaviours in buildings, public policies are necessary to eliminate barriers that discourage stakeholders from pursuing energy efficiency. Beyond removal of barriers, proactive instruments are imperative to give consumers positive reasons to adopt efficient practices.

In this area, a variety of public policies and measures have been implemented, often successfully, in different countries. Although there are few rigourous, quantified evaluations of these policies and their results, there is nevertheless much practical experience that can be analysed for insights into what works and what does not.

The purpose of this report is to help policymakers and their advisors wishing to initiate or develop policies promoting energy efficiency in buildings to assess the most efficient mix of policy measures for a given environment as well as to design new initiatives.

The report focuses on the building itself, its envelope, and major equipment for space conditioning (i.e., heating and cooling) and ventilation. Lighting is not discussed in isolation but considered as one element of an integrated approach to energy efficiency in buildings, taking into account natural inputs (light and heat) as well as internal heat gains (from lights and equipment). Electrical appliances, such as refrigerators and washing machines, which have been the target of numerous well-documented and efficient policies, are not addressed in this report.

Currently, most of the energy consumption attributable to buildings is used during their operational phase, rather than for construction or demolition. Consequently, this document will focus on the energy used in the building during its operational life.

Chapter I presents and discusses international experience with policies and measures to promote energy efficiency in buildings. Chapter II offers some guidelines for future initiatives on prioritising targets, choosing types of policies, and designing mechanisms.

The most widely used and effective policy orientations, when they are pursued in a thorough and adequate way, include implementing mandatory prescriptions such as Energy Building Codes,[1] enrolling proactive structures to 'market' energy efficiency directly to consumers, and working with municipalities. The best results are reached when these instruments are combined with other information or financial activities in policy packages.

However, it should be emphasised that all policy instruments have advantages and disadvantages and that results depend strongly on how appropriate the instrument is to the context, how it is designed, and how it is implemented.

1) When enforcement can be secured, mandatory and regulatory measures are generally the most cost-effective ways of increasing the energy efficiency of the building sector on a long-term basis.

- **For new buildings, this is especially true of Energy Building Codes.** Their success depends mostly on the possibility of enforcing them and on the tools and activities that accompany their implementation. When local circumstances are adequate (see discussion in chapter I), the possibility of setting up Energy Building Codes should be systematically considered.

- When Energy Building Codes cannot be implemented, **standards that establish minimum, mandatory energy-efficiency requirements for building components and equipment** have been used as a first step towards transforming the efficiency of new or existing buildings. Such standards have the advantage of being easier to enforce than building codes in countries with less experience of energy efficiency. They also are easier to use **for renovations of existing buildings** in which upgrades of components and equipment present significant opportunities to improve energy efficiency.

- **Voluntary performance standards (for entire buildings or individual components) are another option that provides an alternative to Energy Building Codes** in encouraging enhanced energy efficiency in buildings. To make it easier to identify buildings that meet voluntary performance standards, labels are often created at the same time. A few of these labels are reaching market shares of 10 to 20 percent. However, **ensuring their adoption requires expensive financial incentives and communication programmes.**

2) A second category of effective policies entails enrolling new or existing structures to become proactive promoters and suppliers of energy efficiency, directly at the consumer level.

- **Electricity and gas utilities are generally in a privileged position to advise their clients on energy efficiency in their homes** through demand side management (DSM)[2] programmes. To use this advantage, various countries have made it mandatory or created incentives for energy utilities to promote energy efficiency to their customers.

- The initial programmes focused mainly on appliances but **more recent schemes, notably in United States and Western Europe, have significantly improved the energy efficiency of buildings through activities on insulation and heating.** One reason for their success is that they provide trustworthy, comprehensive, turn-key solutions to consumers. However, there are still few precedents in developing countries,

- **Energy service companies (ESCOs) offer comprehensive services and financing to reduce energy consumption, with guaranteed results. They are by nature active advocates of energy efficiency.** A few countries, such as Austria, Germany, and the United States, have developed a significant ESCO market, often oriented mostly towards the public sector. However, policies promoting ESCOs have not been successful everywhere. Conditions necessary for ESCOs include the availability of adequate financing, a favourable legal and contractual environment, and support for entities wishing to enter in performance-based contracts. ESCO certification schemes and protocols for evaluation of energy savings can also help increase confidence in the ESCO market.

3) In many countries, municipalities and public buildings have been the principal targets for energy efficiency programmes, both at the national and local levels.

Successful programmes often provide public organisations with technical assistance and support as well as needed adjustments in procurement and accounting rules. Because municipalities generally lack knowledge of and experience

1 An Energy Building Code is a set of rules established by a public authority describing the minimum requirements that apply to buildings in terms of energy efficiency.

2 Demand side management programmes are programmes implemented by utilities or public authorities to influence the quantity or pattern of energy use by consumers (e.g., reduce consumption at peak periods or overall) and provide assistance to consumers in undertaking conservation or efficiency measures, helping to defer the need for additions to the utilities' generating capacity.

with energy efficiency, the hiring and training of municipal energy managers—dedicated, at least in part, to energy efficiency—has proven to be an important component of successful strategies for improving the energy efficiency of municipalities. Establishing networks of municipalities to collaborate on energy efficiency has also been an effective strategy.

4) Other types of policies could be classified more as 'support' policies. They bring some limited savings by themselves but their major benefit lies in the way they can complement other programmes and improve their results, sometimes very significantly. They are necessary but not sufficient. These policies deal mainly with two issues: supply of information and financing.

One of the reasons for the slow spread of energy efficiency, even when it is cost-effective, is the lack of consumer awareness about energy consumption, the benefits of energy efficiency improvements, and how to implement these measures.

- **General awareness campaigns are necessary to help consumers understand the issues related to energy consumption and climate change,** as well as to inform them of possible energy-saving actions and their benefits. Without some level of awareness, there is little chance of reaching a significant take-up level of other, more technical programmes.

- Experience has also shown that once a general level of awareness has been reached, **consumers need more individual technical assistance or 'coaching' to transform good intentions into real investments.** Within a project, they need to know what technical solution to choose, what product, what brand, what technical specifications, where to find a company to do the work, what financial help they can get, and so forth. To meet this need, more and more countries are setting up local information centres to offer impartial information and advice on energy conservation. These centres often have high rates of implementation of their advice, depending on the quality of the advisors and the accessibility of the network.

- Policies promoting **rating, certification, or labeling of buildings** can be very useful to help non-specialists (buyers, financial institutions, public agencies) easily appraise the energy efficiency performance of a building and mobilise them in favour of energy efficiency.

- Policy packages on energy efficiency in buildings should also systematically include training activities on energy efficiency for building professionals. Audit programmes and demonstration programmes can also contribute to the general results.

Financial incentives may also be necessary to complement other policies. Even though it is not the only barrier, the higher upfront cost of energy-efficient equipment, and difficulties in mobilising additional financing to cover these costs, can deter consumers from investing in energy efficiency. Financial incentives can make such investments more attractive. At the same time, they are also a way to attract consumer attention, educate consumers about the benefits of energy efficiency, and demonstrate a government's commitment to improving energy efficiency.

- **Increased energy prices,** through removal of subsidies or via energy/carbon taxes, **can help improve the competitiveness of energy efficiency investments as measured by life-cycle cost analysis.** However, experience shows that policies aimed directly at reducing upfront costs are more effective, as long as beneficiaries and eligible technologies are well defined and the level of the subsidy/tax credit is high enough. Lower import duties on energy-efficient equipment can also have an equivalent impact in developing countries that do not manufacture such equipment.

- Subsidies can be effective but often entail high administrative costs. They are not always sustainable because of the pressure they put on public finances. Tax incentives generally have lower management costs. Because it is difficult for energy efficiency projects to find financing at acceptable terms, **in some cases, it may be more effective to provide low-interest loans for the entire investment cost than a subsidy for a fraction of the cost.** Publicly funded, low-interest loans and guarantee funds have been experimented with in various countries, but generally with limited scope and results.

- Carbon finance is not yet a source of significant financing for energy efficiency in buildings. Until 2008, the lack of approved reference methodologies for calculating the impact of energy efficiency projects on emissions reduction made it difficult for these projects to be financed through the Clean Development Mechanism of the Kyoto Protocol. **Public support for work to address this lack of baseline methodologies and monitoring and verification methods should help increase the number of CDM projects dealing with energy efficiency, especially in buildings.** The possibility of registering CDM projects under a programme of activities could also help to bring forward more projects in the future.

NEW POLICIES

For countries wishing to design and implement strategies to reduce energy consumption in the building sector, some guidelines can be offered on prioritising targets, choosing types of policies, and designing mechanisms.

CHOOSING PRIORITY TARGETS

Before launching major projects on energy efficiency in a country, efforts should be made to gather data on the energy consumption of the various sectors and forecasts on their evolution. This information is necessary to choose priority targets correctly. In many developing countries, a full range of data may not be available.

Opportunities to reduce energy consumption at lower cost should not be missed. In countries with high rates of new construction or short building lifespans, special attention should be given to promoting energy efficiency of new buildings. In countries with older, deteriorated building stocks, existing buildings may prove to be a key priority. Likewise, countries with rising service sectors would do well to consider energy efficiency in commercial buildings, and for countries with growing public sectors, the energy efficiency of public buildings may be a important target.

CHOOSING POLICIES

There is no such thing as the absolute 'best' policy instrument for all circumstances. Once priority targets have been chosen, some policies may be more appropriate than others, depending on local conditions. Amongst the important criteria are the level of enforcement of mandatory requirements, the level of expertise of local building professionals, the importance of the self-build sector, the situation with respect to building ownership, and the performance of the utilities and regulator.

DESIGNING THE MECHANISMS

The design of policies to promote energy efficiency in buildings should take into account a few general principles:

- Policies need to be set for a long period of time.
- Policies should be simple and easy to understand for non-specialists.
- All categories of stakeholders should be involved in policy design and implementation.
- Policies should be regularly evaluated, and updated or adapted if necessary.
- Low-income households should benefit from the programmes.

- Various policy instruments should be combined to complement each other in effective policy package, including awareness and information campaigns.
- More specifically, some guidelines can be identified for the major instruments. They are summarised in the table below.

Table 1: Key Requirements for Energy Efficiency Policies

POLICY INSTRUMENTS	KEY REQUIREMENTS
Energy Building Codes	- Stakeholder participation in the elaboration of the prescriptions - Extensive testing to demonstrate that the prescriptions are adequate and cost-effective - Acceptable costs - Detailed enforcement plan - Supporting tools - Plans and procedures for revisions - Regional exchanges and benchmarking
Certificates and Labels	- An attractive, clear label that is easily read and understood by non-specialists - Information campaigns - Complementary incentives - Controls to ensure the quality of the label - Rules for revision of certificate ratings and labels
Utility Programmes	- Fair rules that do not distort competition - Appropriate clear and transparent mechanisms for cost recovery and removal of disincentives - Simple, low-cost, well-agreed-upon procedures for measurement and verification - A strong regulator to enforce targets, with incentives for compliance or penalties for non-compliance - Targets that are reasonable, but significantly higher than business as usual
Audits	- Training and certification programmes - Financial incentives to offset at least part of the external audit costs - Further assistance with implementation of audit recommendations
Taxes or Tax Reductions	- An acceptable global taxation level - A long-term commitment by policymakers - A tax level (exemption level) that is significant enough - Eligibility rules that are restricted to new, low-market-share technologies - Information and communication about the tax, both in general and when it is paid
Energy Service Companies (ESCOs)	- Available financing - Adapted legal framework and public procurement procedures as well as technical, legal, and financial assistance - Standard contract provisions and support for contracts - An accreditation system for ESCOs - Standardised savings measurement and verification protocols

Residential Sector Affordable Housing, Sorits. Demonstration projects in Tunisia © Eric Thauvin / AFD

INTRODUCTION

The International Energy Agency (IEA) estimates that residential, commercial and public buildings account for 30 percent to 40 percent of the world's energy consumption. The sector's contribution to current world CO_2 emissions is estimated by various sources at 25 to 35 percent.

Rapidly growing, especially in developing countries, the building sector offers the largest, most cost-effective opportunities for energy efficiency and largest co-benefits. However, to turn these opportunities into reality, multiple barriers must be removed.

To upgrade the efficiency of buildings, a variety of public policies have been implemented, often successfully, in different countries, including continuously updated appliance standards and Building Energy Codes and labeling, utility demand-side management programmes and targets, public-sector energy leadership programmes, energy pricing measures and financial incentives, education and training initiatives, and the promotion of energy service companies (ESCOs).[3] These policies and their results are described in Chapter I.

Because the largest programmes on energy efficiency in buildings have been implemented there, much attention is given to policies in Europe and North America. However, when they exist, policies in developing countries are also analysed. There is unfortunately generally even less data available to evaluate these programmes.

Based on these experiences, Chapter II offers some recommendations for policymakers on choosing types of policies and designing mechanisms.

A RAPIDLY GROWING SECTOR

The share of buildings in national energy consumption is often higher in developed countries (United States: 39 percent: France: 42 percent) and lower in developing countries (Brazil: 20 percent; China: 25 percent), which can sometimes lead to overlooking the importance of the sector in these countries.

However, energy consumption and greenhouse gas (GHG) emissions related to buildings increase quickly as countries develop, become more urban, and comfort increases (higher per capita living area, heating, cooling, number of appliances). The total number of people living in urban areas around the world almost doubled between 1970 and 1995, while the share of population living in urban areas rose from 37 to 45 percent. Urbanisation leads to increased energy use in buildings: commercial fuels, especially electricity, become easier to obtain and the demand for energy services—such as refrigeration, lighting, heating, and cooling—increases.

Also, as countries develop their service sector (for example, in Asia), the number of commercial buildings and corresponding energy consumption increase. Development can also bring larger governments and more public services, and a greater number of buildings from which they operate.

As a result, from 1971 to 2004, more than 60 percent of the increase in CO2 emissions from residential buildings came from developing countries in Asia (42 percent) and the countries of the Middle East/North Africa (19 percent).

A share of the increased energy consumption takes place in newly erected buildings. In China, the floor space of buildings has increased by 50 percent in the last 15 years. With new construction of 1.5 billion to 2 billion square metres every year, China now accounts for 50 percent of

Energy service companies (ESCOs) provide consumers with energy services (heat, cooling, power, light, etc.) rather than fuels. They can help energy consumers go forward with energy efficiency investments by providing them with services and financing, and by guaranteeing results.

total building construction globally. In India and Southeast Asia, new construction is projected to grow by 5 percent annually, compared with 1 to 2 percent in the United States and Western Europe.

The marginal cost of increasing a building's energy efficiency is lowest at construction time. Therefore, new construction represents a real opportunity to integrate efficient materials, new technologies, and best practices from the start. Conversely, retrofitting of existing buildings is more difficult and more expensive. New buildings (that is, buildings that do not currently exist) will represent about 60 percent of the Chinese building stock in 2020, but only around 40 percent of French buildings in 2050.

In rapidly developing countries, the priority for the building sector should be to avoid future emissions related to energy consumption in new buildings, as much as to reduce emissions from existing buildings. Conversely, in many OECD countries, the existing housing stock constitutes a huge challenge. Given the long lifetime of buildings, the penetration of new, more efficient buildings as a proportion of the total building stock is extremely slow. In these countries, in the coming decades, buildings already in existence will still be the major sources of energy consumption and CO2 emissions.

Currently, most of the energy consumption attributable to buildings is used during their operational phase rather than for construction or demolition. Consequently, this document will focus on the energy used in the building during its operational life.

Because of their northern location, heating is the main energy use in most developed countries and countries in transition. Other important energy uses are for water heating, refrigeration, space cooling, and lighting. In developing countries, cooking and water heating often dominate, followed by lighting, small appliances, and refrigerators. However, the demand for space conditioning is steadily increasing, especially for cooling in Southern countries.

↘THE SECTOR WITH THE LARGEST, MOST COST-EFFECTIVE ENERGY EFFICIENCY OPPORTUNITIES

Demonstration programmes and numerous studies have shown that there is enormous potential to reduce (or slow the growth of) energy consumption and CO2 emissions in the building sector, often in a very cost-effective way. Working Group III of the Intergovernmental Panel on Climate Change, in their contribution to the Panel's Fourth Assessment Report, puts it this way:

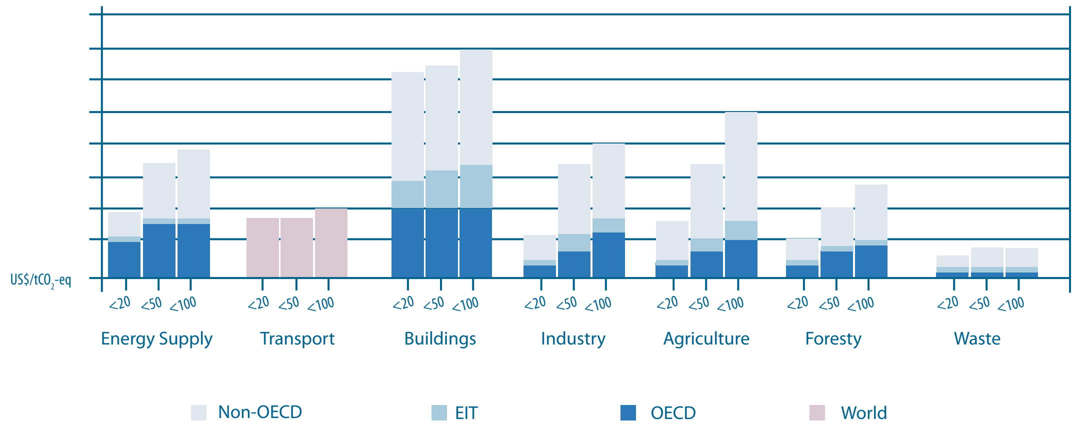
Our survey of the literature (80 studies) indicates that there is a global potential to reduce approximately 29% of the projected baseline emissions by 2020 cost-effectively in the residential and commercial sectors, the highest among all sectors studied in this report…The largest savings in energy use (75% or higher) occur for new buildings, through designing and operating buildings as complete systems…. Over the whole building stock the largest portion of carbon savings by 2030 is in retrofitting existing buildings and replacing energy using equipment due to the slow turnover of the stock.

Similarly, in its 2006 technology assessment, the IEA indicates that, 'In many countries, new buildings could be made 70% more efficient than existing buildings. Some of the technologies that can contribute to this transformation have not yet been commercialised, but most have.'

In Europe today, there are already more than 6,000 passive solar buildings, mainly in Germany and elsewhere in northern Europe. The heating energy needs of these houses are typically 75 percent lower than standard homes, achieved through a combination of good insulation and ventilation heat-exchange. In the United Kingdom, the government announced in December 2006 its ambition that, by 2016, all new homes will be

Figure 1: Estimated Sectoral Economic Potential for Global Mitigation as a Function of Carbon Price in 2030

(Source : Contribution of Working Group III to the IPCC Fourth Assessment Report



zero-energy buildings (i.e., buildings that attain a net energy consumption of zero over the year through good design, efficient appliances, and integration of renewable energy).

In some developing countries, returns on energy efficiency investments can be faster than in OECD countries, because of lower existing average standards and lower labour costs. The *World Energy Outlook 2006* (WEO) analysis shows that an additional US$1 invested on demand-side electricity programmes in the Alternative Policy Scenario avoids US$1.60 in supply costs in OECD countries and more than US$3 in non-OECD countries. In China, the payback on investments required by appliance standards, labeling, and Energy Building Codes has been estimated at 2 years.

A SECTOR WITH LARGE CO-BENEFITS OF ENERGY EFFICIENCY

In addition to being the sector with the largest potential for cost-effective emission reductions, the building sector also has large co-benefits linked to energy efficiency and emission reductions. Economic co-benefits include the creation of jobs and business opportunities and increased energy security. In countries with constraints on electricity generating capacity, especially in Africa, improving energy efficiency for electricity will increase energy security and energy access, by making it possible to supply more consumers with the same electricity production capacity. In countries with high growth of demand for electricity, such as China and many Southeast Asian countries, energy efficiency can slow down electricity demand growth, and reduce the investments necessary in the electricity sector. In both cases, investments in energy efficiency can often be implemented more rapidly than their supply and network alternatives. Energy efficiency also brings social co-benefits such as higher capacity of low-income households to pay their energy bills, increased access to energy services, improved indoor and outdoor air quality, and increased comfort and health. The 2.2 million deaths annually due to indoor air pollution could be substantially reduced by the widespread adoption of modern, efficient cooking devices and lighting. This would also lighten the burden of collecting wood for women and children.

These benefits may be underestimated by policymakers, especially in some developing countries, where other priorities demand attention. In such circumstances, energy shortages can be the driver for renewed interest in energy efficiency, as has happened in Brazil and South Africa in recent years.

MULTIPLE OPTIONS FOR ENERGY EFFICIENCY IN BUILDINGS

The energy consumption of buildings can be reduced in three different ways: reducing the demand for energy services, increasing 'technical' energy efficiency, and integrating renewable sources of energy in the building system to reduce the use of fossil fuels for heating, cooling, ventilation, lighting, or electricity. In this document, by extension, the term 'energy efficiency' will be used to cover all three issues.

Actions can be targeted at improving the building design and construction. The building design, including choice of location, orientation, structure, and layout as well as choice of building materials and equipment largely determines the energy consumption required during the building's operation. Large savings can be achieved by optimising the entire building system rather than improving elements individually. This can only be done at the beginning of the building's life or during major renovations. The rest of the energy consumption is linked to the building use, through the performance of equipment used in the building (e.g., boilers, A/C units, lighting, electrical appliances, etc.) and the behaviour of the people who use it (choice of temperature, turning off unused lights and appliances, etc.).

Electrical appliances such as refrigerators and washing machines have been the target of numerous well-documented and efficient policies, especially minimum efficiency standards and labeling. They are not included in this report, which focuses on the building itself, its envelope, and major equipment for space conditioning (i.e., heating and cooling) and ventilation. Lighting is considered as one element of an integrated approach to energy efficiency in buildings, taking into account natural inputs (light and heat) as well as internal heat gains (from lights and equipment).

MULTIPLE BARRIERS TO ENERGY EFFICIENCY IN BUILDINGS

Multiple barriers make it difficult to transform the potential of energy savings in the building sector into a reality. Some of these barriers are general (that is, they apply to all energy efficiency projects in all sectors), while others are specific to the building sector.

Amongst the general barriers to energy efficiency, including in buildings, are: lack of technology; limited financing; lack of awareness and expertise of financiers; un-adapted or missing regulations; high costs of reliable information; and the greater weight given to upfront costs compared to recurring costs. The lack of lobbies in favour of energy efficiency is also a drawback compared to fossil fuels or even renewable energy, which has active promoters. Similarly, most countries lack governmental agencies with a clear mandate and adequate capacity to design and implement policies in favour of energy efficiency in buildings.

The nature of energy savings is a difficulty in itself. Energy savings represent energy that was not consumed, something that did not happen. Thus, there is no asset on which to base a loan. In societies more oriented towards consumption, the term 'energy savings' is still sometimes understood as a step backward.

Moreover, energy savings cannot be directly measured in the same way that energy use can. Instead, savings are evaluated and quantified using various protocols, which are more or less complex and questionable. It is always difficult to define the baseline case (i.e., what would have happened without the energy efficiency programme), as it is to estimate the number of 'free riders' (i.e., the number of people who would have adopted energy efficiency in the absence of the programme). Another source of uncertainty is the extent of the 'rebound effect', that is, the extent to which consumers will opt to use their increased energy efficiency to improve their comfort level (for instance, by turning up their heating) rather than to decrease their energy consumption.

Beside these general barriers to energy efficiency are additional barriers that are specific to the building sector. One key barrier is the divergence of interests and incentives between the agents making the investment decisions with respect to energy efficiency and those who will ultimately benefit from the energy savings. Developers and builders tend to minimise initial investment and construction costs. They are reluctant to upgrade building design or absorb higher construction costs to enhance energy efficiency, since the benefits of the additional investment (in terms of lower energy bills and operating costs) will accrue to the building's ultimate occupants and not the builder/developer. Moreover, developers and builders are generally sceptical about the prospects for recouping any investment in enhanced energy efficiency through higher rents or sale prices.

Another barrier to energy efficiency is the dispersion of the building sector. Energy efficiency improvements in the sector rely on decisions made by millions of scattered energy consumers, individual homeowners, and business managers. This means they all have to be reached, informed, and convinced of the benefits of energy efficiency before significant changes can occur. Another major handicap for action in the building sector is the fragmentation of the sector among different professions and a variety of often small firms and individuals. In the United States alone, it is estimated that there are more than 100,000 construction companies. Finally, the complexity of buildings as a structure requires a holistic approach to thoroughly optimise the design and operation.

These barriers can be allocated among the following categories:

Tunisia © Eric Thauvin / AFD

Table 2: Most Common Barriers to the Development of Energy-Efficient Buildings

Policy Barriers	The benefits of energy efficiency are not assessed and taken into account for energy policymaking and resource planning.
Institutional, Legal, Regulatory Barriers	Regulations to promote energy efficiency in buildings are un-adapted or missing.
Economic and Financial Barriers	Projects cannot be profitable without fiscal or/and economic incentives that are not in place (exemption from payment of income tax, tax credits, exemption from import duties and taxes, subsidies). Financing is limited; projects are seen as too small and too risky by financiers who lack awareness and expertise on energy efficiency. Fossil energy benefits from favourable conditions and/or subsidies. The agents making the energy efficiency investment decisions are not those paying the energy bills and benefiting from the energy savings (split incentives). Upfront costs are given more attention than recurring costs. Public organisations do not benefit financially from the energy savings they achieve.
Information and Technology Barriers	There is a lack of information on and awareness of energy efficiency and its benefits among policymakers and building officials as well as the general public, including: - Lack of data on energy consumption and building performance - Lack of local expertise for audits - Lack of knowledge about measurement and evaluation protocols - Lack of local capacity to design, build, and maintain energy-efficient buildings (especially among individual or small company builders) - Lack of understanding of energy efficiency solutions and how to implement them - Lack of availability of energy-efficient materials and equipment and limited national expertise to design and manufacture them Energy consumers are scattered and the building sector is fragmented amongst multiple trades and companies.

These barriers are often higher in the developing countries than in the developed world, making it even more difficult to achieve the GHG reduction potential of the building sector.

© Ms. Natalia Olshanska, UNDP project specialist

UNDP-GEF Project, "Removing Barriers to Greenhouse Gas Emissions Mitigation through Energy Efficiency in the District Heating System in Ukraine". Module type individual boiler plant constructed for Humanitarian Gymnasium Complex and Swimming pool in the city of Rivne, Ukraine, in 2008, allowed avoiding significant heat losses at utility's 2km manifolds and secured first comfort winter for schoolchildren and teachers since 1994.

A WIDE RANGE OF PUBLIC POLICIES

To increase the uptake of energy efficiency investments and behaviours in buildings, public policies are necessary to eliminate the barriers that discourage stakeholders from pursuing energy efficiency. Beyond removal of barriers, proactive instruments are imperative to enhance energy users' motivation and incentives to adopt more efficient technologies and practices.

Strong regulations or incentives are needed to overcome remaining obstacles, such as the disruptions linked to refurbishing a home or the absence of incentive for a building owner to invest in equipment which will save energy and money for tenants. Improving energy efficiency generally requires doing something rather than nothing. To draw stakeholders toward making energy efficiency improvements, rationally convincing them of the benefits of energy efficiency is often not enough. This is especially true in the residential sector, where the investment decisions of individual homeowners may be less driven by purely financial considerations, especially when energy is a small part of their budget.

To promote energy efficiency in buildings, a variety of public policies have been implemented, often successfully, in different countries. These policies can benefit from the fact that the building sector is generally subject to a high degree of regulation for health and safety reasons—regulations can be used to disseminate energy efficiency requirements. Another supportive factor is the public sector's role in the building sector. Public buildings often constitute a significant share of a country's total building use. Therefore, by choosing energy-efficient designs and materials for their own buildings, governments can exert a powerful influence on the building sector, as well as setting an example.

Many countries have set up official national energy efficiency laws or programmes with quantified targets for energy savings and specific policies. The existence of such programmes may help give more durability and improve coherence and coordination of public policies in favour of energy efficiency, if the corresponding secondary legislation and practical measures are actually implemented. Buildings are generally included, but the potential for savings and possible cost-effective actions are often underestimated.

For its 2004 study, *Energy Efficiency: A Worldwide Review – Indicators, Policies, Evaluation,* the French Agency for Environment and Energy Management (ADEME) and the World Energy Council (WEC) surveyed the situation in 63 countries in all regions of the world. (For a list of these countries, see Annex 2.) The study found that three-quarters of the countries had explicit national targets and programmes.

Some of these were dedicated solely to energy efficiency, while others were combined with a national programme of greenhouse gas reduction or promotion of renewables. The scope, ambition, and efficiency of these programmes vary widely.

In the European Union, much attention has been given in recent years to energy efficiency in buildings, with three directives: directive of 16 December 2002 on the energy performance of buildings; directive of 6 July 2005 establishing a framework for the setting of eco-design requirements for energy-using products; and directive of 5 April 2006 on energy end-use efficiency and energy services. The country-level implementation of these three directives should induce important changes in energy efficiency in Europe, especially in the building sector.
In United States, the Energy Policy Act of 2005 covers almost every aspect of energy production, distribution, and use. Its provisions concerning energy efficiency in buildings include: energy consumption reduction targets for public buildings; integrating efficient equipment in public procurement; new standards for 14 large appliances; and tax incentives for energy efficiency improvements in homes, commercial buildings, and public buildings. However, environmental organisations have criticised the act for bringing only limited progress on energy efficiency in buildings.

In China, the Medium and Long-Term Special Plan for Energy Conservation, approved in November 2004, sets specific targets to reduce energy intensities for various sectors by 2020. Energy conservation in the building sector is one of the 10 programmes identified. The plan provides that:

- During the Eleventh Five Year Plan period, design standard of 50% energy conservation shall be strictly carried out for new buildings. The few big cities such as Beijing and Tianjin shall take the lead in the implementation of 65% energy saving standard… Energy saving reconstruction for existing residential and public buildings shall be conducted in combination with urban redevelopment, and the completed reconstruction area shall be 25% for big cities, 15% for medium cities and 10% for small cities. ..Area of government agency buildings reconstructed according to building energy conservation standard will be 20% of total area of government agency buildings…energy consumption per unit of building area and energy consumption per capita for the central state organs shall be reduced 10% in 2010 compared with 2002.

In some cities, municipal governments have quickly adopted new regulations and standards. Shanghai, for example, issued new standards for buildings and lighting in 2004 and 2005. To improve local implementation of national targets, the government of China has also announced that local officials' performance evaluations would be based in part on progress achieved on energy efficiency. However, energy efficiency gains do not yet appear to be in line with targets.

In India, the Energy Conservation Law was passed in 2001. Under the law, minimum energy efficiency mandatory standards can be prescribed and enforced. The Prime Minister of India launched an Action Plan on energy efficiency on 23 August 2002. He declared a national commitment to a phased reduction of energy consumption in government organisations by 30 percent over the following 5 years. The private sector was urged to reduce its energy use by 20 percent over the same period.

Under these and other laws, various policies have been implemented around the world to improve the energy efficiency of buildings. The following chapter describes these policies, and the analysis shows that policies exist which, if well implemented, can reduce energy consumption in buildings. These experiences form a base that other countries can use to build their own policies, adapting the details to their specific situation.

I. Public POLICIES

Residential Sector Luxury Housing, Jinenes Ennasr. Demonstration projects in Tunisia © Eric Thauvin / AFD

A variety of public policies and measures on energy efficiency in buildings have been implemented, often successfully, in different countries. Some developed countries have been promoting them for 2 or 3 decades now.

Even though there are few rigourous, quantified evaluations of these policies and their results, there is nevertheless much practical experience that can help countries analyse what works and what does not.

The most widely used and effective policy orientations, when they are pursued in a thorough and adequate way, include implementing mandatory prescriptions such as Energy Building Codes, enrolling proactive structures to 'market' energy efficiency directly to consumers, and working with municipalities. The best results are reached when these proactive instruments are combined with other information or financial activities in policy packages. These supporting instruments, which generally bring only limited benefits on their own, can determine the success of the whole package.

However, it should be emphasised that each policy instrument has advantages and disadvantages, and that results depend strongly on how appropriate the instrument is to the context, how it is designed, and how it is implemented. There is no 'best' policy instrument for all situations, and similar instruments can have very different results in different countries and circumstances.

I.1. Regulations

EXPERIENCE AND EVALUATIONS HAVE DEMONSTRATED THAT MANDATORY AND REGULATORY MEASURES SUCH AS ENERGY BUILDING CODES ARE THE MOST COST-EFFECTIVE WHEN ENFORCEMENT CAN BE SECURED, NOTABLY IN DEVELOPED COUNTRIES.

I.1.1. Energy Building Codes

Examples of Energy Building Codes

In Europe and the United States, buildings have been regulated since the 19th Century for health and safety reasons, such as sanitation, fire protection, and structural integrity. Today, most countries around the world have adopted some national or local rules concerning building design or use. After the oil crises of the 1970s, prescriptions on energy efficiency and insulation were often added.

Energy Building Codes are one of the most cost-effective, commonly used ways of reducing energy consumption in the building sector on a long-term basis. Enforcement is, however, a critical issue.

Scope of the Code: New/Existing Buildings; Residential/Commercial Buildings?

All European countries and most other OECD countries have set up Energy Building Codes, including energy efficiency provisions for new dwellings and new commercial buildings. Some non-OECD countries have also established standards for buildings: Singapore and the Philippines were among the first, followed by Malaysia and South Africa. Singapore has been a pioneer in setting standards for the building envelope and has enforced mandatory standards for both new and existing buildings since 1979.

In Europe and North America, standards generally exist for both dwellings and commercial buildings. In most African and Asian countries, standards only apply to non-residential buildings, which make the largest contribution to energy consumption. There are of course some exceptions: Algeria, China, and Egypt, for example, have also implemented standards for dwellings.

In most countries, building energy standards only apply to construction of new buildings. Of the 51 countries surveyed for a 2001 study by ADEME and the WEC,[4] some 60 percent had mandatory or voluntary standards for new nonresidential buildings (cf. Annex 2).

Amongst the few countries with prescriptions for existing buildings are Singapore and the European Union. The EU directive of 16 December 2002 on the Energy Performance of Buildings mandates, among other measures, that each member state should set minimum energy performance requirements for buildings and that these should apply to new buildings and existing buildings over 1,000 sq m when they undergo a major renovation. Most member states already had minimum performance requirements for new buildings but not for existing buildings. This directive should have been implemented by January 2006; however, many member states were late because of the complexity of setting up a certification process for buildings and an inspection process for boilers (which is related to others items of the directive).

In some US cities, such as San Francisco and Berkeley, California, local Residential Energy Conservation Ordinances have made it mandatory to install certain energy efficiency measures in existing homes built before the standards for new building were enforced, before they can be sold.

One of the arguments in favour of implementing mandatory energy efficiency codes for existing buildings when they are refurbished is the fact that major refurbishments are a rare opportunity to improve building performance substantially, at relatively low cost. Most building owners are reluctant to undergo major renovations because of the disruption it causes for building users. When a renovation does occur, it is very important to do it right and tap as much of the energy efficiency potential as possible. The next renovation might be decades away.

Mandatory or Voluntary?

Strictly speaking, only mandatory prescriptions can be considered as Energy Building Codes.

4 *World* Energy Council, Energy Efficiency Policies and Indicators *(London: World Energy Council, 2001).*

However, in many countries, energy building standards, or revisions, were first introduced as voluntary standards. The voluntary standards are then made mandatory only after their usefulness has been tested and confirmed. Waiting for standards to become more widely used can make them more acceptable when they become mandatory.

In the United Kingdom, a new set of rules, the Code for Sustainable Homes, was established in December 2006. This code is voluntary, except for homes built using public money, and is more stringent than current building regulations (which include mandatory energy efficiency requirements). The new code will be used to test higher standards which could be introduced in future building regulations in 2010, 2013, and 2016.

In India, a new Energy Conservation Building Code was released on 27 May 2007. Initially, implementation of the code will be voluntary, but the government has announced that it will soon be made mandatory for commercial buildings with a connected load of 500 kW or more. The code sets minimum efficiency standards for external walls, roofs, glass structures, lighting, heating, ventilation, and air conditioning of commercial buildings in the country's five climatic zones. State governments will have the flexibility to amend these codes to suit local or regional needs. Implementation of the code is expected to reduce energy consumption by 25 to 40 percent.

Prescriptive or Performance Standards?

Thermal building codes have been changing over time, from simple requirements on building components (prescriptive standards) to more complex standards that consider the whole building system—including the position and orientation of the building, active and passive solar gains, equipment such as heating/cooling, hot water, and lighting, and energy for motors/pumps/ventilators, elevators, etc.—and prescribe standards of consumption but not the way they should be achieved (performance standards).

Performance standards can be more difficult to design as they require a better understanding of the building as a system. They also require more data on the existing building stock and its energy consumption patterns, as well as the characteristics of new buildings being constructed. This is critical in order to have suitable, realistic, effective requirements. It can be a difficult issue in developing countries that do not have extensive, organised data gathering processes.
Monitoring compliance with performance standards can also be more difficult, requiring complete surveys of the building and better trained building inspectors.

However, performance standards are better adapted as requirements strengthen. In order to achieve more ambitious energy efficiency gains, policymakers will find it increasingly necessary to consider all the aspects of the building and their interactions. Performance standards also allow greater flexibility for designers and architects.

In view of these factors, most countries will likely want to start with prescriptive standards, and subsequently move on to performance standards.

Revisions in thermal building codes have become increasingly regular. For instance, over the past 30 years, standards have been reinforced three to four times in most EU countries, including some very recent revisions. At the European level, the new EU building directive has included provisions for a revision of Energy Building Codes every 5 years.

In some countries, the authority over building regulations lies with local governments, which set their own rules. To try and harmonise building rules and practices, national/federal governments generally develop model energy codes, which can be replicated or adapted by local governments. In the United States, for instance, of the 56 states and territories, 4 have no state code for residential dwellings, 8 have voluntary state codes, and 44 have various mandatory codes. All but a handful of these state codes derive from different versions of national model codes. Similarly, the Government of Canada published in 1997 a Model National Energy Code for Houses and a Model National Energy Code for Buildings, whose provisions have been partly adopted in provincial building codes.

Table 3: Examples of Countries with Energy Building Codes

	NEW COMMERCIAL BUILDINGS	NEW DWELLINGS	ALL NEW BUILDINGS	EXISTING COMMERCIAL BUILDINGS	EXISTING DWELLINGS	ALL EXISTING BUILDINGS
Voluntary	Malaysia (1989), Indonesia (1989), Pakistan (1990), Thailand (1989), South Africa	Peru, Turkey	Canada			
Mandatory	Singapore (1982), Philippines (1994), China (hotels), Viet Nam (2003)	Australia, California (+ hotels), some Chinese cities	Russia(1990), Korea (1979), Algeria, EU Australia (2007 for commercial buildings)	Singapore (1979)		EU (for large renovated buildings)

Results:

How Effective Are Energy Building Codes?

Existing studies of the impact of Energy Building Codes indicate that, where the issue of compliance has been seriously addressed, substantial energy savings have been achieved. This remains true even in cases where energy savings were not as great as initially anticipated because of behavioural factors and rebound effects (that is, some consumers choose to use some of the improvement in energy efficiency to increase their comfort with higher heating temperatures, more rooms heated, or longer heating period over the year—rather than reduce their energy consumption). The results also depend directly on the stringency of the code requirements.

In France, regular surveys show that successive thermal regulations led to a reduction in energy consumption per square metre by a factor 2 to 2.5. In Germany, a recent survey found that new dwellings consume 35 percent less energy than dwellings built prior to the first building regulations. (Theoretically, savings from the thermal standards should be 70 percent, however.)

According to a 2004 ADEME/WEC study,[5] in the European Union the cumulative energy saved in new dwellings, compared to dwellings built before the first oil shock, is about 60 percent on average. The additional savings targeted by future revisions in the standards are still high, at 20 to 30 percent.

In California, the California Energy Commission has commissioned some studies on occupant behaviour and energy use in new houses, and concluded that code requirements are generally being met during construction. The building energy efficiency levels in California are significantly higher than in other US states with similar climates but no mandatory energy standards. Building Standards alone were estimated to be responsible for energy savings equal to about 3 percent of total energy consumption in California in 2003.

On the other hand, code compliance has been estimated to be only 20 percent in The Netherlands. A recent survey by the Chinese Ministry of Construction found that, while 60 percent of new buildings in northern Chinese cities complied on paper with the energy code, only 30 percent complied in actual construction.

There is no consensus on whether mandatory or voluntary codes are more efficient. Design of the code as well as implementation, publicity, and enforcement are critical. To be adopted,

5 World Energy Council, Energy Efficiency: A Worldwide Review – Indicators, Policies, Evaluation (London: World Energy Council, 2004).

a voluntary code may require large financial commitment for subsidies, awareness building, and consumer education. As shown in Europe, a mandatory approach is a powerful instrument, but only if well designed and enforced. Conversely, an unenforced mandatory code is useless. The easiest solution, when possible, is to add energy efficiency prescriptions to an existing enforced building code.

Most successful examples of code enforcement link the compliance check with other existing authorisation processes for the building. In California, all plans for new construction must be checked for compliance with the energy code before a building permit is granted. During construction, periodic inspections are also done to verify that construction is consistent with the approved plans.

Independent code enforcement systems were set up, at times, in parts of China, Egypt, Mexico, and Sri Lanka. These have not resulted in strong enforcement or large energy savings.

I.1.2. Building Component and Equipment Standards

When Energy Building Codes cannot be established, standards that specify minimum, mandatory energy-efficiency requirements for building components and equipment (such as boilers, windows, etc.) can be a first step towards transforming new or existing buildings. Such standards are especially useful for increasing the energy efficiency of existing buildings, which in general are not subject to building codes. Building components and equipment generally have shorter lifetimes than buildings, requiring replacement once or more. When such replacements are undertaken, this provides a good opportunity to improve energy efficiency significantly.

Minimum energy performance standards for building components and equipment also have the advantage of being easier to monitor for compliance than codes. Compliance checks can be done at the level of equipment producers and distributors, rather than having to be done in individual buildings.

Australia, Canada, China, and the European Union have all announced phase-outs of incandescent lamps that will become effective between 2010 and 2017, and several other countries are considering doing the same.. This will bring significant reductions in energy consumption for lighting, because the alternate technologies—compact fluorescent lights (CFLs) and light-emitting diodes (LEDs)—are much more energy-efficient.

I.1.3. Mandatory Energy Saving Targets/Utility DSM Plans

Electricity and gas utilities are generally in a privileged position to advise their clients on energy efficiency in their homes through demand side management (DSM) programmes. They have regular individual contacts with their customers through bills and metering; access to information on their clients' energy use patterns; recognised technical expertise on energy use; long-standing and generally good relationships with their customers and with the communities they serve; and large field organisations that can deliver advice and support to customers.

To take advantage of utilities' unique attributes and capabilities, various countries have made it mandatory or created incentives for energy utilities to actively promote energy efficiency to their customers. Such utility programmes also have the benefit of not counting as government expenditure as well as being very flexible (to target specific social groups, for example).

Although utilities have sometimes resisted marketing energy efficiency to their customers, once energy markets were opened to competition, some suppliers begin to view such programmes as a means to differentiate themselves from their competitors by offering new services (energy management services, that is) to their customers.

The initial programmes focused mainly on appliances. More recent schemes, notably in the United States and Western Europe, have brought significant results in improving the energy efficiency of buildings. However, there are still few precedents in developing countries.

Utility Programmes in the United States

Programmes

Utility DSM programmes have been a major aspect of US energy efficiency policy since the mid-1970s. However, there have been huge differences between states.

Following the 1973 energy crisis, both state and federal regulators in the United States started to encourage or mandate regulated utilities to implement a wide range of energy conservation programmes towards their captive customers. In 1978, the National Energy Conservation Policy Act (NECPA) required utilities to offer energy audits to residential customers. This led utilities to create, staff, train, and maintain internal organisations devoted to helping customers manage electricity use. In the 1980s, many states passed 'least cost planning' regulations, which made it necessary for utilities to look at all options for reconciling supply and demand, before they could get approval for new generation investments.

After 1994, spending for utility energy efficiency DSM programmes started to shrink, as restructuring of the electricity sector created uncertainty about the financing and management of future programmes. According to the Energy Information Administration, spending on these programmes (load management excluded) dropped from about $2 billion in 1994 to $1 billion in 1998, before starting to increase slightly again. By 2005, spending was $1.3 billion.

To improve the performance of utility energy efficiency programmes, regulators found that they needed to ensure full cooperation from utilities by removing existing disincentives and creating new, positive incentives for cooperation. Traditional rate schemes entail multiple disincentives for utility DSM programmes, including:

- Programme expenses (i.e., the cost of implementing the programme, such as marketing, subsidies, administrative costs, etc.)
- Lost revenues and profits from sales not made (improvements in energy efficiency mean lower energy consumption for the same level of comfort, and thus lower sales and profits)
- Lost investment opportunities (programme expenses and lost sales and profits represent funds that could have been invested in profit-earning activities)

Many states managed to remove the disincentives through methods known as Lost Base Revenue Adjustments (LRAs)[6] and Adjustable Revenue Caps (ARCs, also known as decoupling or conservation tariffs).[7] Some states went even further by creating separate financial incentives for the delivery of efficient DSM programmes. The success of these new regulatory approaches has often been cited as a key factor in changing utilities' perception of their role, from providing energy *as an commodity* to one of providing *energy services.*

6 LRAs compensate utilities for the revenues lost from sales that did not happen as a result of the utility's DSM programmes. The compensation is based on an estimate of what sales would have been without DSM, that is, the amount of energy saved through the programme. Thus, the level of energy savings attributed to the DSM programme directly impacts utility revenues. Because energy savings cannot be measured directly, but only estimated, this approach to compensation carries with it a higher risk of controversy, manipulation, or fraud.

7 ARCs 'decouple' revenue from sales. They are based on setting revenue targets that are independent of sales and then comparing actual revenues with the targets. If there is a discrepancy, the difference is compensated by a surcharge or a rebate. This approach has several advantages. Not only does it remove the disincentive for utilities to promote energy efficiency, it also removes incentives that encourage utilities to boost sales to customers not covered by the energy efficiency programme. This is because, in the short run, revenues are independent of actual sales volumes. The approach also helps reduce utility opposition to other energy efficiency policy or regulatory changes that might adversely affect utility sales, since such changes can be made revenue-neutral to the utilities.

Another regulatory innovation has involved a shift from defining utility obligations in terms of money spent on DSM programmes to more recent state regulations mandating that utilities achieve energy savings equivalent to a percentage of consumption or of forecasted load growth. Such mandates are often called Energy Efficiency Portfolio Standards, or are sometimes integrated in Renewable Portfolio Standards. In Texas, for example, utilities have to offset 10 percent of their demand growth through end-use energy efficiency programmes.

Programmes implemented range from general information and audits to subsidies or direct installation of more modern equipment. Some utilities also implemented market transformation programmes with equipment manufacturers, wholesalers, or dealers. Programmes initially focused on appliances increasingly address building structure and space conditioning.

In California, for example, the two utility companies (Pacific Gas & Electric and Southern California Edison) both have incentive programmes that reward architects, builders, and building owners for constructing buildings that exceed Energy Building Code requirements by 10 to 20 percent. The utility pays for the additional cost of improving the building design and/or gives a monetary reward to the building owner if measured energy usage is actually as low as expected.

Results

According to a national scorecard prepared by the American Council for an Energy-Efficient Economy (a non-governmental organisation), DSM programmes in 2003 generated energy savings equivalent to 1.9 percent of annual retail sales. The US Energy Information Administration estimates that between 1994 and 2005, annual savings rose from 50 GWh to 59 GWh.

Earlier results from the DSM programmes of the 1980s and early 1990s were uneven, with some programmes producing cost-effective results and others achieved at relatively high costs. A 1996 study by the Lawrence Berkeley National Laboratory[8] found that, on average, DSM programmes were highly cost-effective, saving energy at a cost of US$ 0.032 /kWh. However, utility performance was not uniform. Some utilities, notably those with large DSM programmes, had saved energy at cost of less than US$ 0.02 / kWh, while others had saved energy at a cost in excess of US$ 0.10 /kWh.

European Experiences

In the United Kingdom, under the Energy Efficiency Commitment (EEC), electricity and gas suppliers are required to achieve targets for improvements in domestic energy efficiency. Over the 3-year period from mid-2002 to mid-2005, cumulative energy savings reached 91 TWh, far outpacing the government's target of 62 TWh. This programme was very cost-effective. The net present value of the benefits to households, after deducting their direct contributions and the energy suppliers' total costs, was estimated at about $5.2 billion.[9] For every $1 spent by the energy suppliers, householders benefited by an estimated $9. The total cost of electricity and gas savings was $0.022 /kWh and $0.009 /kWh, respectively, much lower than the consumer prices of these fuels ($0.113 /kWh and $0.031 / kWh, respectively, in 2004).

The majority of the savings was achieved by a relatively small number of measures, including wall and loft insulation, installation of higher-efficiency freezers and washing machines, and replacement of incandescent lights by compact fluorescent lamps. Some 65 percent of the energy savings came from insulation and heating measures.

The programme was followed up by a second commitment period running from 2005 through 2008. The overall target for this phase was 130 TWh. The UK government has announced that it is considering doubling the target for the 2008–2011 period and has committed itself to

8 J. Eto, 'The Past, Present, and Future of U.S. Utility Demand-Side Management Programs', Lawrence Berkeley National Laboratory Paper No. LBNL-39931 (December 1996).

9 Eoin Lees Energy, Evaluation of the Energy Efficiency Commitment 2002-05 *(February 2006).*

maintaining some form of obligation on household energy suppliers until at least 2020.

France initiated a similar system in 2006. The government compels energy suppliers (of electricity, gas, liquefied petroleum gas (LPG), and oil for heating and cooling systems) to generate a set volume of energy savings, most of which will come from the building sector. For the first 3-year period (July 2006–June 2009), a target of 54 TWh has been set. Suppliers are free to decide what type of action to implement in pursuit of this objective. They can set up their own programmes to promote energy efficiency to their customers. They will then receive a certificate ('white certificate') documenting the volume of demonstrated energy savings resulting from their action over the lifetime of the investment. Suppliers can also buy certificates from other organisations if these organisations can provide energy savings more cost-effectively. Suppliers will be compensated for their costs by an increase in energy rates but fined by the treasury if they fail to meet their targets.

For the first year, over 90 percent of the savings were related to insulation improvements or more efficient heating.

In both the British and the French programmes, the ability of utilities to provide customers with comprehensive standardised turn-key solutions and technical assistance in implementing them is one of the major reasons for their success.

Denmark, Italy, and the Flanders Region in Belgium also have energy saving obligations for distributors. In Denmark, they are expected to provide more than 20 percent of the savings in the new Danish Action Plan for Energy Efficiency. In Italy, the results of the first year exceeded targets, but problems related to the design of the instrument seem to be appearing.

In Ireland, a DSM programme implemented by the Irish Electricity Supply Board was estimated[10] to have led to a 7 percent decrease of electricity demand. For private households, the information programmes included information leaflets in electricity bills, advertising in DIY journals, special programmes for school teachers, and distribution by mail of devices such as energy-saving bulbs.

The cost of verification and monitoring of these measures can be an issue. Schemes in the United Kingdom and France have managed to keep costs of running the system low by promoting standardised actions and using deemed savings[11] to evaluate the benefits of the actions instead of individual audits. To be sufficiently accurate, calculations of deemed savings requires extensive data on building stocks, equipment performance, and markets for energy-related products. In some countries, the availability of such data could be an issue.

At the European level, the directive of 5 April 2006 on energy end-use efficiency and energy services also takes up the idea of giving energy utilities a part to play in the promotion of energy efficiency.

Experiences in Developing Countries

There are few similar experiences in developing countries.

In 1998 ANEEL (the Brazilian electricity regulator) established a regulation requiring that the privatised utilities invest a total of 1 percent of their net annual operational revenues in energy efficiency (end-use and supply-side) and research and development programmes. The utility programmes had to be submitted to ANEEL for approval before their implementation. However, utilities were allowed to spend up to 65 percent of the budget on supply-side efficiency. Many of the investments were concentrated on programmes such as reducing utilities' commercial losses by improving metering or upgrading distribution lines to reduce electricity losses in

10 U. Dulleck and S. Kaufmann, 'On the Effectiveness of DSM Information Programs on Household Electricity Demand', University of Vienna Working Paper No. 1 (February 2000).

11 Deemed savings are an estimate of energy savings per unit of an installed energy efficiency measure, often used for programme planning purposes. They can also be used to evaluate programme results in lieu of programme-specific evaluations. In other words, the unit savings estimate is 'deemed' to be acceptable for a given programme.

Energy Efficiency Buildings in Mongolia: Wall erection for a timber-frame house © Ts.Battur

Energy Efficiency Buildings in Mongolia: Timber-frame house construction (inner view) © Ts.Battu grid systems. Stricter rules were implemented in 2000, but the mandatory spending amount was reduced to 0.5 percent of revenues.

Since 1996, the Republic of Korea has made it mandatory for all utilities to establish and implement a DSM investment plan on an annual basis. National utility DSM plans were also implemented in the 1990s in Indonesia, Jamaica, Malaysia, the Philippines, Sri Lanka, Thailand, and Viet Nam, often on a voluntary basis with international support. Most programmes were targeted at promotion of compact fluorescent lamps (CFLs). Many were considered to be successful, but there has been little experience with improvements in the energy efficiency of buildings themselves.

Instead of having utilities operate custom-built DSM programmes, some countries have used utilities only as financial facilitators. In these schemes, equipment such as CFLs are sold to energy users, which pay for them through their energy bills. The cost of the equipment is spread over time and partly or completely offset by the resulting energy savings. This can be an easier option to start with for utilities with limited expertise in energy efficiency.

I.2. INFORMATION

ONE OF THE REASONS FOR THE SLOW SPREAD OF ENERGY EFFICIENCY, EVEN WHEN IT IS COST-EFFECTIVE, IS THE LACK OF CONSUMER AWARENESS CONCERNING ENERGY CONSUMPTION, THE BENEFITS OF ENERGY EFFICIENCY IMPROVEMENTS, AND HOW TO IMPLEMENT THESE MEASURES. SURVEYS REGULARLY DEMONSTRATE THAT ENERGY USERS UNDERESTIMATE THE BENEFITS OF ENERGY-SAVING TECHNOLOGIES AND OVERESTIMATE THEIR COSTS.

Reducing this 'information gap' has been the objective of many policies all around the world, with actions ranging from general awareness campaigns to individual audits, advice by information centres, and demonstrations. These activities are typically aimed at the general public, building-sector professionals, or both.

Limited results are available from evaluation of such measures. However, the results that are available seem to indicate information programmes can produce some energy savings, but in and of themselves are less effective than regulatory instruments.

The most effective application of information programmes is to complement other energy efficiency programmes and improve their results. This is illustrated by the findings of a 2006 study[12] showing that the energy efficiency results achieved by various electricity and gas suppliers under the UK Energy Efficiency Commitment (EEC) programme and its government-mandated energy saving targets were attributable as much or more to the information and marketing skills of the suppliers than to the level of subsidies offered by the programme. The study also suggested that an effective awareness campaign could increase by 50 percent the savings delivered by the EEC programme, without any increase in the level of subsidies.

I.2.1. General Awareness and Information Campaigns

General awareness campaigns are necessary to help consumers understand the issues related to energy consumption and climate change, as well as inform them on the possible energy-saving actions and their benefits. Without some level of awareness, there is little chance of reaching a significant take-up level of other, more technical programmes. Awareness and information campaigns increase the effectiveness of other policy instruments and should be part of the first step of any energy-efficiency policy package.

Such campaigns can help promote both more efficient investment choices and behaviour changes. They are one of the only ways to influence behaviour, which has been found to be responsible for variations in energy consumption of 40 to 100 percent in similar homes.

One difficulty, however, is that awareness campaigns need to be maintained over time to have a sustained effect. Results generally start declining after the campaigns stop.

Many countries have organised information campaigns focusing on simple energy efficiency gestures, such as turning off lights or turning down the heat in unused rooms. The overall result of such behaviours in terms of savings is not insignificant and this is an effective tool to begin to get consumers more involved with energy efficiency in a hands-on manner. However, once again, the message needs to be constantly repeated over time.

I.2.2. Audits and Energy Use Reports

In some countries, regulations mandate large energy consumers, including commercial buildings, to have regular audits. In other countries, incentive programmes attempt to encourage large consumers to audit their buildings on a voluntary basis. In both cases, the expectation is that the potential energy savings shown by the audits will convince building owners/users to invest in energy efficiency programmes.

The 2004 ADEME/WEC study[13] showed that audits for residential and commercial buildings are mandatory in about half of the European countries, mainly for large buildings. In the other regions, only five countries report mandatory audits (Costa Rica, Israel, Taiwan, Thailand, and Tunisia), mainly for non-residential buildings.

Mandatory energy audits are usually paid for in part or in full by public agencies or utilities. In Europe, subsidies for building audits are generally only partial. In half of the other countries covered by the ADEME/WEC study, energy audits for buildings are provided free of charge in order to encourage participation.

The Finnish government, for example, set a goal of having 80 percent of industrial and tertiary buildings audited between 1992 and 2010, with public financing covering 40 to 50 percent of audit costs. For those buildings that have been audited, about two-thirds of the recommended measures had been installed within 2 years of audit completion. However, the number of finished audits is far behind targets and no real market transformation has been observed in the audit market.

In general, the ADEME/WEC study reported highly varied results in terms of implementation rate of the measures recommended by the audits: from 80 percent in New Zealand to 10 percent in Egypt. Success is often explained by the availability of funds and support for the energy efficiency improvements recommended by the audits. This is for example the case in Tunisia, where the rate of implementation has reached 60 to 70 percent.

The results of auditing schemes in terms of actual energy savings are also naturally linked to the quality of the audits. To enhance quality, many programmes have included training and certification activities for auditors and made certification a condition of the subsidisation of the audit, as in The Netherlands.

Even if individual audits can lead to significant improvements in the energy efficiency of a sin-

12 Oxera Consulting Ltd, Policies for Energy Efficiency in the UK Household Sector (Oxford, UK: Oxera Consulting, 2006).

13 World Energy Council, Energy Efficiency: A Worldwide Review – Indicators, Policies, Evaluation (London: World Energy Council, 2004).

gle building when the recommended measures are implemented, there are as of yet no examples of an audit programme by itself delivering substantial transformations at the level of the entire building sector.

I.2.3. Building Certificates and Labels

Many rating programmes have been developed to help non-specialists easily appraise the energy efficiency performance of a building and mobilise them in favor of energy efficiency. These ratings can be used by several different types of actor:

- **Potential buyers, renters, or occupants,** who can thus access more information on a given building's energy efficiency performance. The idea is to induce them to choose more efficient buildings or upgrade the buildings they already live, or work, in by showing them how much they can save on utility bills
- **Financial institutions,** which typically do not have internal expertise to evaluate energy efficiency projects and wish to limit transaction costs
- **Governmental agencies,** which can target their support policies on only the most efficient buildings, without high administrative costs

These policies are directly inspired by the labeling policies for appliances, which have proved to be widely successful.

↘Different types of schemes exist:

- **Voluntary rating/certification of buildings.** Interested parties can get a rating of any building's performance. Different types of information can be used, including level of energy consumption, CO2 emissions, technical performance of building components, etc. Performance can be shown in absolute terms or by group classification and/or benchmarking. A 'categorical' rating scheme (that is, one which indicates energy efficiency performance in terms of a number of stars or an A-B-C rating, similar to the system used for appliances) has some advantages. Such a system is often easier for consumers to understand; many consumers now are used to this system for appliances and can transfer this experience to buildings. Also, such schemes do not require any technical understanding of energy units.
- **Voluntary labeling.** Instead of giving the level of performance of any building, these labels are restricted to the most energy-efficient ones. There is generally some marketing of the label to make consumers more familiar with it and help them understand its implications. Building labels are similar to voluntary Energy Building Codes in many ways, because they set efficiency requirements for buildings to meet. However, codes often target minimal requirements to be applied to a large proportion of buildings, whereas labels generally aim to promote only excellence. Also, there can be several building labels in one country or state but there is generally only one code. Finally, voluntary labels are not always developed and promoted by governments, or at least not by governments alone.
- **Mandatory disclosure of information** in forms of consumption values, group ratings, and so forth. Disclosure is generally mandated either at time of sale or on energy bills.

All these schemes can exist in addition to mandatory Energy Building Codes to promote more stringent requirements in a more limited number of homes, or as substitutes when mandatory Energy Building Codes do not exist. The labels and ratings can provide a useful reference for public or private programmes promoting energy-efficient buildings, such as tax incentives, rebates, or 'green' public procurement. In the United States, for example, many federal or local programmes are based on the Energy Star label (see below).

The move towards performance-based standards and the tools that go with them have made it easier to introduce building certificates that rate energy performance building-wide.

Examples of Ratings and Labels

In OECD countries, voluntary and mandatory rating and labeling schemes have existed for several years. They generally rely on third-party certification to guarantee compliance with the requirements. Australia, for example, has a ten-star rating system called Nationwide House Energy Rating Scheme (NatHERS), which is mandatory in six of its eight states/territories.

In Russia, the Energy Passport of the building is a mandatory document that provides potential buyers and residents with information on what they can expect regarding the building's energy performance. It also assists in minimising non-compliance with the code requirements by compelling the seller of the building to disclose how compliance was reached, and what the cost consequences of non-compliance are. The calculations in the Energy Passport document can demonstrate the extent of additional energy savings that would have to be achieved in order for the owner/resident to gain access to economic incentives for energy efficiency.

In the United States, to earn the Energy Star label, homes must meet guidelines for energy efficiency set by the US Environmental Protection Agency. Energy Star qualified homes are at least 15 percent more energy-efficient than homes built according to the average building code requirements. Energy Star achieved an average national market presence in the new homes sector of more than 12 percent in 2006. This success seems linked to the numerous financial programmes offered by states, municipalities, and utilities to reduce the cost of Energy Star homes for homeowners, as well as to the extensive efforts put into promotion of the label itself. In 2005, 60 percent of US households recognised the Energy Star label and 70 percent of them then correctly interpreted its meaning.

In Switzerland, the Minergie® label applies to existing and new residential and commercial buildings with a high level of comfort and energy efficiency. The Minergie® system is a complete package that offers referenced professionals, technical guides, and pre-approved technical modules for doors, windows, or walls. There are also specific public subsidies and low-interest loans for Minergie® buildings. The existence of a complete package makes it easier for the consumer to build a Minergie® home. To get the label, investment costs must not be more than 10 percent higher than the average Swiss house. In practice, on average, the difference in construction costs is only 6 percent, while the difference in energy usage is large, with about half the energy usage costs of an average home. As of March 2009, more than 12,000 Minergie® buildings have been built or renovated in Switzerland. The national market share of Minergie® for new homes is about 10 percent and is up to 20 percent in some areas. Since 2006, Minergie® has been extended to France.

More and more, voluntary rating and labeling methods are not restricted to energy efficiency assessment, but look at other environmental issues, such as waste, water, and air quality. Such labels include the building environmental assessment method, HK-BEAM in Hong Kong, the Green Star for commercial buildings in Australia, and the Code for Sustainable Homes in the United Kingdom. In France, the HQE (High Environmental Quality) label is becoming increasingly popular.

Following the directive on the energy performance of buildings, the energy labeling of buildings in the European Union has been required since June 2007. All buildings, both new and existing, must be labeled when they are sold. For public buildings, the label must be displayed in view of the public.

The implementation of such a system requires good understanding of the existing building stock in order to develop modeling tools that can help evaluate a building within a reasonable timeframe and at a reasonable cost. Large numbers of auditors must also be trained and certification and/or quality control processes implemented. In France alone, an estimated 5,000 auditors will be needed to implement the directive.

In the United States, the state of Kansas requires mandatory disclosure of energy efficiency levels to prospective buyers of new residential buildings. However, the information is not a global rating of the dwelling but rather data on performance ratings of components such as doors, walls, water heaters, and air conditioners, combined with statements of compliance with applicable codes and standards.

As an alternative to building rating, various countries have initiated voluntary or mandatory programmes of disclosure on metered energy consumption, generally with benchmarking either to previous bills or to average consumers. Australia, for example, has a requirement for energy retailers to provide benchmark data on household energy bills. This type of information has the advantage of giving building-specific data instead of theoretical building energy consumption. However, it is more difficult to analyse because it mixes structural factors, such as building insulation, with behaviour of the homeowners.

I.2.4. Labeling of Construction Products and Equipment

The labeling of construction products and equipment—such as doors, windows, insulation, boilers, A/C units, etc.—aims to give homeowners easily understandable information on what they can expect from the products they are buying and how to choose efficient products when renovating (or building) their homes. The principle is similar to that of the labeling of electric appliances or houses.

Professionals in the building sector are expected to master the technical specifications of the products they use and not need such simplified labels. In practice, however, these labels can also help influence professionals, especially individual builders or small building companies, to use more energy-efficient products. This is especially relevant in countries with high rates of self-building and DIY or poor qualification of the building sector.

Often, energy-efficient technologies are first introduced in new buildings through voluntary programmes, and later made mandatory for all buildings through Energy Building Codes or standards. As the market share of efficient products increases, costs decrease and the older generation of products can be phased out, in existing as well as new buildings. In this way, the market transformation brought about by voluntary programmes can advance technologies to the point where mandatory requirements are no longer controversial.

One example of this comes from the United Kingdom, where condensing boilers (energy-efficient water-heating devices that recover heat that is usually lost through the flue) were made mandatory after they had been intensively promoted by utilities in existing homes through the Energy Efficiency Commitments programme. The growth of condensing boiler sales (which reached 30 percent of the overall market) and associated installation experience gave the government confidence to ban less efficient boilers.

In most of Europe, double-glazed windows have replaced single glazing ones for new and existing buildings, with only limited regulations. Double glazing was at first voluntary, then mandatory for new buildings; after a few years, prices went down and producers saw no reason to continue manufacturing the old windows, which were no longer significantly cheaper. Almost all preassembled windows (frame+glass) are now sold with double glazing, and single-glazed windows can only be obtained by special order.

Experience has shown that in order to be successful, market transformation policies based on labeling must also include promotion activities (advertising and educational material), training of salespersons and installers, and financial incentives, at least in the initial stages.

The best known examples of equipment labeling schemes are Minergie® and Energy Star. The Efficient Lighting Initiative (ELI) financed by GEF also promotes quality certification of efficient lighting products.

I.2.5. Local Energy Efficiency Information Centres: Providing Practical Individualised Information and Technical Assistance

Experience has shown that general information activities, including media campaigns and technical brochures, can fail to reach the majority of relevant consumers, especially once the campaign ends. Also, by definition, general information campaigns fail to address consumers' specific questions and concerns. Once a general level of awareness has been reached, consumers need more individual 'coaching' to transform good intentions (or even mandatory requirements) into real investments. Within a project, they need to know what technical solution to choose, what product, what brand, what technical specifications, where to find a company to do the work, what financial help they can get, and so forth.

To meet this consumer need, more and more countries are setting up local Energy Efficiency Information Centres. These centres are local focal points that offer impartial information on energy conservation (and, often, renewable energy) to the general public, including technical advice on projects and on useful contacts (installers, manufacturers, relevant authorities, funding sources, etc.). They often have high rates of implementation of their advice, depending on the quality of the advisors and the accessibility of the network. In some countries, these centres also implement demonstration projects and act as policy advisors to the government on energy efficiency matters.

The 2004 ADEME/WEC study[14] showed that 14 countries in Europe (of which 9 in the EU 15) had implemented such local information centres, as had 4 countries in Asia (Australia, China, the Philippines, and Viet Nam), 3 in Africa (Kenya, Mali, and Morocco) and 1 in the Middle East (Iran). Europe, the most active region in that field, counts 750 centres with about 1,600 advisers at national, regional, local, or European level.

In France, a network of local information centres (EIE – *Espace Info Energie)* was created in 2001 to provide free, impartial practical advice to individuals on energy efficiency (and renewable energy). As of January 2007, it had 187 local information centres with 340 advisors. In 2006, the centres reached 770,000 people, of which 400,000 received detailed personal advice. An evaluation in 2006 showed that some 56 percent of the recommended investments were actually implemented. In 2006, consumers invested some 3.3 million euros in projects after advice from an EIE. Some 85 percent of those who contacted the network were households, and the centres achieved an 80 percent satisfaction rate.

In the United Kingdom, the Energy Saving Trust has a similar network of 49 local advice centres, with a staff of over 500. Since 1996, they have advised 5.8 million customers. In Sweden, it is mandatory for municipalities to employ at least one local energy advisor to give objective advice to households and small businesses.

In countries where the cost of individual counseling appears prohibitive, minimal practical information (such as lists of retailers, installers, average costs, technical guides, etc.) can be supplied through centralised web sites.

14 World Energy Council, Energy Efficiency: A Worldwide Review – Indicators, Policies, Evaluation (London: World Energy Council, 2004).

Energy Efficiency Buildings in Mongolia: Roofing of timber-frame house © Ts.Battur

I.2.6. Training

Designing, building, and renovating more energy-efficient building requires changing the work practices of professionals in the building sector, including architects, designers, builders, contractors, installers, and so forth. Buildings need to be designed differently and new technologies need to be used. Professionals need to be trained appropriately, which takes a long time, whatever the country.

For example, energy-efficient condensing boilers are widely available in the European market, but to achieve the expected savings relative to less efficient units, they have to be chosen and integrated adequately in the building's heating system. The results of building energy audits in Europe show that this is still not always the case. In France, there are still few contractors capable of installing external insulation despite its higher energy efficiency.

In many countries, upgrading the skills of the building industry is made even more difficult by the low level of education of manual labourers in the construction sector.

Various countries have implemented training activities for working professionals as well as changes in the standard curriculum. The programmes can be national or local, led by governments or by private initiatives.

In the United States, for example, the Northwest Energy Efficiency Alliance, in the context of its utility members' DSM programmes, has created workshops for professionals called 'Better Bricks for Businesses'.

Certification programmes are also under development to help building owners/users identify trained professionals. In the United States, for example, publicly funded programmes have been developed to train and certify residential architects and remodeling contractors as Certified Energy Efficiency Professionals. By signing a memorandum of understanding with the

US Environmental Protection Agency (EPA), they can also become Energy Star Partners. A similar programme exists for building operators.

A survey of UK householders[15] showed that accreditation of insulation installers was highly influential in their decision to adopt insulation. Its effect was found to be similar to a subsidy of over 75 percent.

Because the construction sector is not a concentrated one, it is both a critical and difficult issue to reach all the different people and companies that are part of the construction process.

I.2.7. Demonstration Programmes

Demonstration programmes are useful to provide data on technical and economic feasibility, which can be used in general information campaigns as well as to set the requirements of labels. They are also an important part of the 'marketing' of energy efficiency. They demonstrate that energy efficiency gains are possible without compromising the quality of services delivered and at a reasonable cost.

To ensure more progress is constantly being made, new demonstration programmes become necessary as new energy-efficient technologies become available and more efficient design methodologies are promoted.
All countries actively promoting energy efficiency in buildings have used demonstration/pilot projects at one stage or another.

However, these demonstration programmes only completely fulfill their purpose if their results are made available to a large number of stakeholders who can use them in their own decision process. Too often, the job is considered finished once the demonstration programme itself is completed and results are only known by those directly connected to the project.

More than the number of demonstration programmes, the key to success lies in the way results are consolidated and disseminated.

The replicability of demonstration programmes is also a critical issue. If circumstances are too different from what a 'normal' building would encounter (very high subsidy rates, exemption from normal planning rules, etc.), such programmes will not be useful as a reference for other investors.

15 Oxera Consulting Ltd, Policies for Energy Efficiency in the UK Household Sector (Oxford, UK: Oxera Consulting, 2006).

I.2.8. Research and Development

In the last years, new materials resulting from Research and Development programmes, such as triple glazing, external insulation and condensing boilers, have brought significant efficiency improvements. Today the priority is more on lowering the costs of these technologies and making them easier to use, especially for renovations.

Residential Sector Luxury Housing, Perle Du Lac. Demonstration projects in Tunisia © Eric Thauvin / AFD

I.3. FINANCIAL INCENTIVES

EVEN THOUGH IT IS NOT THE ONLY BARRIER, THE HIGHER UPFRONT COST OF EFFICIENT EQUIPMENT, DIFFICULTY IN MOBILISING FINANCING, AND, IN SOME CASES, THE LOW RETURN CAN DETER CONSUMERS FROM INVESTING IN ENERGY EFFICIENCY. FINANCIAL INCENTIVES CAN MAKE THESE INVESTMENTS MORE ATTRACTIVE. AT THE SAME TIME, THEY ARE ALSO A WAY TO ATTRACT CONSUMER ATTENTION, RAISE AWARENESS OF BENEFITS, AND DEMONSTRATE A GOVERNMENT'S COMMITMENT TO IMPROVING ENERGY EFFICIENCY.

Especially in developing countries, where the cost differential between conventional and high-efficiency equipment may represent a higher proportion of consumer's disposable income, financial incentives aimed at reducing the upfront cost will generally bring more benefits than incentives spread out over the lifetime of the investment.

To operate properly, financing mechanisms to encourage energy efficiency investment must include efficient and cost-effective arrangements for assessing the technical aspects of projects. Experience has shown that this is often critical to the success of the scheme. Project proponents will be scared away by excessively burdensome procedures but public and private investors demand a high level of confidence in the projects' reliability.

I.3.1. Energy Prices

The price of energy is a key factor determining the profitability and feasibility of energy-saving measures. When subsidies keep energy prices very low, energy-saving measures are unlikely be profitable, and consumers will have little financial incentive to change their behaviour or to buy energy-efficient equipment.

However, economists differ on the precise role of energy costs in consumer decision-making on energy efficiency. Some economists consider it critical, while other analysts insist that energy consumers, especially households, do not base their investments and life choices on purely rational economic calculations and are generally more influenced by the level of upfront costs than by long-term savings. The UK study[16] referred to above even found that future energy savings did not appear to be an important factor in household decisions whether to invest in insulation. Other US studies have confirmed this for small firms. This is consistent with energy economists' observations that consumers have a very high implicit discount rate where energy efficiency investments are concerned. That said, the lack of profitability can nonetheless be a foil to any energy efficiency investment.

Therefore, adapting energy prices to reduce subsidies to the lowest possible level and give consumers the correct signals should be encouraged. The signal given to consumers can be both economic and political, showing the importance given to energy efficiency in a government's agenda. In countries that have started to implement energy efficiency programmes without first adjusting energy prices, results have been disappointing.

Overall, consumption subsidies have been falling since the 1980s. According to the World Bank, global consumption subsidies dropped by more than half in the 5 years to 1996. The biggest reduction has occurred in the transition economies and in China, where coal subsidies have been largely reduced.

16 Oxera Consulting Ltd, Policies for Energy Efficiency in the UK Household Sector (Oxford, UK: Oxera Consulting, 2006).

However, the IEA's *World Energy Outlook 1999* estimated that, in eight of the largest non-OECD countries,[17] accounting for almost 60 percent of total non-OECD energy demand, energy subsidies still amounted to some $95 billion in 1998. The bulk of these subsidies went to electricity and coal. End-use prices were found to be about one-fifth below market levels in those countries. The IEA estimated that removing these consumption subsidies would reduce primary energy use by 13 percent and raise GDP by almost 1 percent in those countries.

Considering the possible social implications of energy prices, adapting them is naturally a difficult issue and should be accompanied by communication on the benefits of subsidy reform and implementation of adequate alternative compensating mechanisms for low-income groups.

Liberalisation generally leads to lower subsidies on energy prices. However, new non-vertically integrated utilities may have less interest in promoting energy efficiency to their clients than they did previously. They are no longer concerned by the benefits in terms of displaced generation or transmission investments and often have more urgent, commercial priorities. All in all, consequences differ from one country to another.

I.3.2. Rebates, Subsidies, Grants

Many countries have developed various subsidy schemes to overcome the barrier of high upfront costs of energy efficiency investments. These measures often focus on retrofitting existing buildings or dwellings that are not covered by Energy Building Codes. In some countries, grants were also used as a tool to promote compliance with voluntary Energy Building Codes for new buildings.

As with subsidies in other fields, energy efficiency grant programmes have drawn criticism for the number of 'free riders' they attract (that is, consumers who would have carried out the investments even without the incentive), on the low level of public knowledge of these programmes, and on the administrative burden and transaction costs they create. The most successful programmes have been characterised by restrictive definitions of possible beneficiaries and eligible technologies, as well as simplified processes that were easy to understand and operate.

In the US, in January 2007, the Database of State Incentives for Renewables and Efficiency (DSIRE) counted 609 federal, state, or utility rebate programmes and 53 grant programmes.

At the federal level, evaluations of residential subsidised retrofit programmes carried out in the 1970s and 1980s generally found that actual energy savings were much less than ex ante engineering estimates. This discrepancy was attributed to poor installation of efficiency measures, human behaviour effects, and inaccurate engineering estimates of savings potential. Subsequent programmes were more efficient.[18]

In other developed countries, the success of subsidy programmes has been mixed. Whereas the scheme in The Netherlands was estimated by various studies to have high costs, the Danish programme was much more cost-effective.

Grants are often essential in developing countries, where the first-cost barrier can be higher. However, such grants are not always compatible with other public spending priorities.

17 China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa, and Venezuela.

18 The national weatherisation programme for low-income households, for example, lowered energy consumption for space heating in participating households by an average of about 30 percent between 1993 and 2002. This figure is based on evaluation of actual results, not ex ante estimates. This level of energy savings is much greater than that realised under the same programme during the 1970s and 1980s.

I.3.3. Tax Incentives/Energy Taxes

Historically, many countries have preferred to use tax incentives rather than subsidies to limit public expenditure. In the building sector, these incentives include tax credits and deductions for households, accelerated depreciation for commercial buildings, reduced sales taxes or import duties, and higher taxes on energy consumption.

Using the existing taxation system to reach very large numbers of beneficiaries limits administrative costs relative to a dedicated system for allocation of individual subsidies.

Tax credits

In France, tax credits for energy efficiency (and renewables) have been set up and regularly increased since 2002 with good results. High-efficiency insulation, adjustment devices, and condensing boilers in existing homes are eligible for a tax credit. A 25 percent tax credit has applied for all existing buildings (over 2 years old) since 2005. In 2006, the tax credit was raised to 40 percent for homes built before the first Energy Building Code in 1977. After the rate for condensing boilers was increased from 15 to 25 percent, their market share rose from 4 percent in 2004 to 10 percent in 2005.

The US federal government provided tax credits for households and businesses for energy efficiency measures in the late 1970s and early 1980s. The credit amounted to 15 percent of the cost for households and 10 percent of the cost for businesses. These programmes were generally found not to have been very effective because of the small size of the credits and low technical performance requirements.

Tax credits can only be effective if the level is high enough and they apply to products with low market shares to limit free riders.

Lower Sales and Import Taxes on Efficient Products

Energy-efficient products and materials can also be promoted by reducing sales tax. In the European Union, low VAT rates apply to many energy-efficient products as well as labour costs for building renovations in some countries but not all. In the United States, 12 states charge taxes on energy-saving devices but not on residential fuels and electricity.

In developing countries, where energy-efficient products for buildings are typically imported, reducing duty taxes can bring significant results.

One drawback of tax incentives is that they are almost always linked only to the purchase of an asset, not to the way it is used in practice. Because of variation in behaviour patterns, the real impact of a given investment can differ substantially. Estimates of the amounts of energy saved can only be expected to be meaningful in aggregate, and not in specific cases, which can diverge significantly.

Another risk of these tax credit instruments is their volatility, real or imagined. Their effectiveness depends on the level of confidence among building owners and managers that the tax credit in effect at the start of project design and/or construction will still be in effect when the time comes to make the actual investment.

Energy and Carbon Taxes

Instead of tax credits for efficient materials and equipment, some countries have set up energy and carbon taxes to internalise the negative externalities of energy consumption in the final prices of goods and services. Consumers are encouraged to reduce their energy consumption but left free to choose the means to do so.

Countries in Europe taxing energy products according to their carbon or energy content include Austria, Denmark, Finland, Germany, Italy, The Netherlands, Norway, and Sweden.

In Denmark, the benefits of resulting savings were estimated to be more than 10 times the charge collected. However, the Norwegian energy tax was evaluated as not cost-effective and quantitative data are lacking for many other countries.

In some cases, to make a new energy or carbon tax more acceptable to the general public, it has been created as revenue-neutral, with a corresponding decrease in taxes on wages. Another alternative is to reinvest the revenues from the tax in energy efficiency projects, thus maximising its effect.

In Switzerland, the industry, regrouped in a 'Climate Cent Foundation', has created a voluntary fund financed by a levy on car fuel imports to invest in energy efficiency and emission reduction projects in Switzerland and in developing countries.

In the United States, many states have established Public Benefit Funds (PBF) where a small charge is added to electric (and sometimes natural gas) bills to fund energy efficiency programmes and other public interest programmes (such as assistance to low-income households). Some 18 states have such funds, which in some cases are used to fund utility DSM programmes. In 2002, total annual spending was just over $900 million. Annual savings were estimated to range from 0.1 to 0.8 percent of total electricity sales, but only limited data were available.[19] For nine of the most active states, the benefit/cost ratio was evaluated to be between 1 and 4.3, depending on the state, and the cost of saved energy between $0.023 /kWh and $0.044 /kWh.

South Korea also has established a levy on imports of petroleum, petroleum products, and liquid natural gas as well as on electricity consumption. The money raised is invested in energy efficiency and renewables.

I.3.4. Low-Interest Loans and Guarantee Funds

Obtaining financing can be a major hurdle to the adoption of energy-efficient measures and practices. Investments in building energy efficiency are typically small, non-asset-based, and have long-term returns, making them unattractive to financial institutions. Banks are also deterred by the issues of monitoring and measurement. What is more, many developing countries have little or no experience with project financing.

It is therefore difficult for projects to find financing at acceptable conditions, and it may prove more effective to provide low-interest loans for the entire investment cost than a subsidy for a fraction of the cost. In response, some countries have set up publicly financed, low-interest loans to help building owners invest in energy efficiency. Loans are either directly offered by public entities or, as increasingly is the case, managed by private commercial financial institutions in public-private partnerships.

In Europe, such loans exist in Germany, Hungary, Latvia, and Spain.

In the United States, in 2007, there were 209 federal, state, or utility loan programmes.[20] In Canada, the Green Municipal Investment Fund of the Federation of Canadian Municipalities offers low-interest loans designed specifically for municipalities, as well as subsidies for audits and feasibility studies.

In Japan, the Government Housing Loan Corporation offers long-term, flat-rate loans, with conditions depending on the energy efficiency of the project. In Korea, since 1980, companies have benefited from long-term,

19 M. Kushler, D. York, and P. Witte, Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies *(Washington, DC: ACEEE, 2004).*

20 Cf. Database of State Incentives for Renewables and Efficiency (DSIRE).

low-interest loans from The Fund for Rational Use of Energy. In Thailand, the Energy Efficiency Revolving Fund provides funds to commercial banks at zero interest, allowing the banks to offer low-rate loans for energy efficiency projects.

Public support to financial institutions offering low-interest loans for energy efficiency can also be implemented through guarantee funds that reduce the risk for lenders. However, as of early 2009, there have been few examples of successful large-scale guarantee funds for energy efficiency.

Apart from these government-funded programmes, only a few banks have adjusted their loan policies to take into account the drawbacks but also the advantages of energy efficiency investments, and factor in the increased credit capacity resulting from lower energy bills. In the United States, since 1995, a programme called Energy Efficient Mortgages (EEM) has been developed through a partnership between the national mortgage industry, energy raters, and the National Association of State Energy Officials. It offers more favourable terms to homebuyers and homeowners who invest in home energy improvements. The expected savings on energy running costs and higher value of energy-efficient homes are taken into account for qualification purposes. Homebuyers can have access to a mortgage more easily or can get a higher mortgage (the lender is allowed to increase the borrower's income by a dollar amount equal to the estimated energy savings.). An analysis by the Environmental Protection Agency found that an average of 6.8 percent more families would be able to qualify for a mortgage through an energy-efficient mortgage.

To improve the availability of financing for energy efficiency projects, another issue is the availability of independent assessment capacity. Financiers, who are not familiar with energy efficiency, can be reassured by the possibility of obtaining an outside assessment of the technical strengths and weaknesses of the project. This can be done through private energy service companies or, in some cases, through public agencies or publicly funded energy centres.

I.3.5. ESCOs

Energy service companies (ESCOs) can help energy consumers go forward with energy efficiency investments by providing them with services and financing, and by guaranteeing results. An ESCO generally offers a complete range of services: audit, identification of possible savings and recommended measures, arranging financing, designing and installing (or overseeing installation) of measures, procurement of equipment/energy, training of staff, operation and maintenance, monitoring, evaluation, and guarantee of savings. They are by nature active advocates of energy efficiency.

Relations with ESCOs usually rely on Energy Performance Contracts (EPC), through which the ESCO guarantees a level of savings that can be used to pay for the initial investment. The remuneration of the ESCO is directly tied to project performance.

ESCOs can help overcome the difficulties inherent in the small size of many energy efficiency projects in buildings by bundling several similar projects and making them more attractive for investors. ESCOs also bring technical knowledge, technical assistance, and turn-key projects to companies or institutions with small projects that do not justify developing in-house expertise on energy efficiency.

In many countries, the public/institutional building sector has been the first market for ESCOs because of its aging facilities and equipment in need of upgrades, its limited capital budgets for improvements, and, more and more often, its 'green' public policies requiring energy conservation. However, this market can only develop if the necessary laws are in place. Often, public bodies are restricted in their possibilities of taking on multi-year financial obligations. Energy

Tertiary Sector Office Buildings, Head Offices of the EPPM Company © Eric Thauvin / ADF

Tertiary Sector Office Buildings, Ennasr Private Clinic © Eric Thauvin / ADF efficiency projects can then only be implemented if budgetary funds are available to pay for the investment up front. This limits the number and size of projects that can be undertaken and often also limits the possibility of working with ESCOs, unless specific provisions are passed.

Financing is a major difficulty in all ESCO markets. ESCOs are not always capable of bearing the financial needs of projects on their own, at least when volumes begin to increase. Smaller ESCOs tend to lack sufficient equity capacity to endure the risks and uncertainty of energy efficiency projects, and larger ones are quickly overcome by the debt of their previous projects. For example, in Korea, ESCOs have an average debt load of 378 percent, compared with 160 percent for manufacturing companies. When they try to arrange third-party financing, ESCOs are often rejected by financiers unfamiliar with energy savings performance contracts and the performance risk and length of term they entail. This can be even worse in developing countries with a shortage of investment capital.

Over time, various types of contracts were introduced in the US ESCO market (see Annex 4). They allowed different allocations of risk and responsibility and opened up opportunities for new actors, including electricity and gas utilities.

A study by the Lawrence Berkeley Laboratory[21] has shown that average energy savings from public-sector ESCO projects amounted to some 15 to 20 percent of baseline utility costs. When public funds were available, the savings from projects implemented through ESCOs were not higher than those of projects authorised and funded through budgetary funds. However, such availability of funds was estimated to be rare which made ESCO financing attractive.

Since a number of companies are eager to call themselves ESCOs, without having proper qualifications, it is important to ensure that ESCOs provide a qualified and reliable service. In the United States, an ESCO accreditation system has been set up by the National Association of Energy Service Companies (NAESCO).

ESCOs in the United States

The United States was the first country to develop a market for ESCOs. Since 1992, various legislation has encouraged public agencies to develop projects with ESCOs. In 2000, an estimated $2 billion was invested in projects through ESCOs.

Despite some successful private-sector projects, public and institutional-sector customers (government facilities, schools, universities, and hospitals) have consistently provided the greatest market for ESCOs in the United States. Public building managers are compelled to act by public-sector energy saving targets and cuts in operational budgets. Moreover, various federal and state laws and programmes have made ESCOs an easy and attractive option by offering legal and technical support and standardised contractual mechanisms. Some 48 states have enacted enabling legislation for schools, universities, or state/local governments, though the scope and quality of legislation varies. These tools and support have been critical for the development of the ESCO market.

ESCOs in Europe

According to a 2005 status report on ESCOs in Europe,[22] the market for energy services in Western Europe was €150 million in 2000. Industry and the public sector are the two major sectors for ESCOs. Situations are quite different from one country to another. Austria and Germany and Austria are reckoned to be the most important ESCO markets, while some countries, such as Belgium, Ireland, and The Netherlands have almost no ESCO activity.

In Europe, most ESCOs have been founded either by large companies or as subsidiaries of large companies (equipment manufacturers or retailers, utilities, etc.) and they have provided financing themselves. Most contracts have been based on the shared savings model. Third-party financing has seldom been used, except in the

21 N. Hopper et al., 'Public and Institutional Markets for ESCO Services: Comparing Programs, Practices and Performance', Lawrence Berkeley National Laboratory Paper No. LBNL-55002 (March 2005).

22 P. Bertoldi and S. Rezessy, Energy Service Companies in Europe: Status Report 2005 *(Luxembourg: European Communities: 2005).*

United Kingdom, where companies have been able to benefit from the country's tradition of project financing. 'Chauffage' (supply of energy) contracts are also commonly used.

At the European level, various initiatives have been undertaken to promote ESCOs since 1992, such as standard ESCO-type model contracts for energy efficiency improvements in buildings and an online database of ESCOs.

In Austria, as in Germany and Spain, the regional and the national energy agencies have played a critical role in the development of ESCOs. They have implemented significant information and marketing activities and brought practical advice on how to use Energy Performance Contracts. The development of quality criteria and certification has also been estimated to play an important part in building consumer trust in ESCOs. Generally, actions were first implemented in public buildings and the results then drew the attention of businesses to the possible savings from end-use energy efficiency. In Austria, close to half of all public buildings have already been renovated through Energy Performance Contracts leading to annual energy cost savings between €50 million and €60 million. In Germany, Berlin alone has 1,500 buildings served by an ESCO; the buildings are grouped in a number of pools to minimise transaction costs. The total guaranteed savings in Berlin are more than 25 percent of the baseline energy consumption.

ESCOs in Asia

In Korea, in 2006, there were 150 ESCOs. This development was brought by a support programme from the Korean government and international organisations. The programme included: changing laws to make it possible to finance long-term projects from utility savings; training and certifying energy auditors; developing funding opportunities for ESCOs; offering tax credits for ESCOs and their customers; and giving free assistance and grants for regional and municipal government energy efficiency projects. The first projects were in the building sector. The major barriers identified for ESCO development were excessively low energy prices, inconsistent ESCO quality, and financing difficulties for ESCOs.

Thailand also implemented a programme to support ESCO development, notably through interest-free loans.

I.3.6. Carbon Finance

In some areas of climate change mitigation, carbon finance has become a significant source of financing. This is not yet the case for energy efficiency in buildings.

All end-use energy efficiency projects are difficult to include in the European Trading Scheme, which is based on a physical upstream approach and not an allocation by end uses.

Under the Clean Development Mechanism (CDM), very few projects on energy efficiency in buildings have been approved. In November 2007, only three projects (biomass excluded) had been registered (two for services, one for households) and six were pending (four in India, one in Brazil, and one in the Philippines dealing with cook stoves). Only one methodology had been approved for large-scale projects (CFLs) and two for small-scale projects.

The small size of the projects in the building sector is a drawback for project-based instruments like the CDM, but lack of available methodologies for calculations is also an issue. Public support for work on design of baseline methodologies and monitoring and verification methods should help increase the number of CDM projects dealing with energy efficiency, especially in buildings. The possibility of registering CDM project activities under a programme of activities could also help to bring forward more projects in the future.

I.4. PUBLIC AUTHORITIES AND PUBLIC BUILDINGS: SHOWING THE WAY

FOR VARIOUS REASONS, PUBLIC AUTHORITIES, AND ESPECIALLY MUNICIPALITIES, CAN PLAY AN IMPORTANT PART IN REDUCING THE ENERGY CONSUMPTION OF BUILDINGS.

- **Public buildings** (schools, hospitals, government offices, etc.) and public lighting account for a significant share of the building sector's national energy consumption. In many countries, municipalities and other local authorities also play a significant role in the management of social housing. Dissemination of good practices can be made easier because a single decision-maker can be responsible for large building stocks and buildings are often quite standardised locally by category, with similar characteristics for all schools, all hospitals, or all social housing.
- **As policymakers,** municipalities can have an important role to play in promoting energy efficiency in all buildings and implementing action plans locally. They may also be more responsive to environmental concerns. Working on their own assets can help them build the skills they need to become engaged in larger issues concerning the building sector (public and private).
- **Public buildings** can set examples for other building owners to follow. Conversely, not working on reducing energy consumption in its own buildings could seriously undermine the credibility of any public authority's commitment to improve energy efficiency in the building sector.
- **Public authorities** can, through their purchases and investments, help build markets for efficient products and practices by increasing sales volume and market share, thus lowering unit costs.

However, municipalities generally lack knowledge and experience on energy efficiency and need specific support to become active players in favour of more energy-efficient buildings.

Amongst the measures that have been promoted are:

- Hiring and training municipal energy managers
- Organising data collection and monitoring of energy consumption
- Participating in networks of municipalities that disseminate best practices, tools, and experiences between municipalities
- Adapting procurement rules (which often make it mandatory for municipalities to purchase solutions with the lowest upfront costs rather than lower overall costs) and budgetary rules (which prevent municipalities from financially benefiting from the energy savings they generate or limit the possibility of signing long-term contracts like Energy Performance Contracts)

In the United States, the federal government is the largest single consumer of energy. The Energy Policy Act of 2005 and subsequent amendments have set up specific goals and measures for reducing energy consumption, including reducing energy consumption in public buildings by 30 percent between 2003 and 2015. Public agencies that achieve these savings will be able to keep the money saved on energy bills for future energy efficiency investments. Funds are also provided to help states build energy-efficient buildings, but federal funding is limited.

The Federal Energy Management Program (FEMP) provides guidance, technical assistance, and tools for public facilities managers. However, a 2005 government evaluation of this programme showed that energy savings were below targets and rated the programme as moderately effective. One failure was estimated to be a too high dependency on outside contractors and laboratories for planning and strategy development.

At the local level, many states have set mandatory efficiency requirements for new or renovated buildings.

In China, targets have been set for reconstruction of 20 percent of existing government agency buildings and reduction of energy consumption per capita for the central state organs by 10 percent in 2010 compared with 2002.

In India, the Government (including public-sector undertakings, the railways, airports, ports, and defense establishments) is the single largest consumer of energy in the country. In 2002, the Prime Minister called for all government organisations to reduce their energy consumption by 30 percent in the following 5 years. Performance contracts and ESCOs were planned to bring an important contribution to this objective.

In Thailand, since 1992, a special fund from taxes on petroleum products has financed audits and retrofits of government office buildings. However, excessively complex procedures limited the impact of the system.

In Bamako, Mali, a programme implemented by IEPF *(Institut de l'Energie et de l'Environnement de la Francophonie)* with the municipality in 2003 reduced the energy consumption in public buildings by at least 43 percent. The programme included training municipal and utility staff in energy efficiency and designing and implementing an action plan.

Municipalities and public organisations, when they want to improve the energy efficiency of their buildings, are often deterred by procurement rules mandating that they purchase solutions with the lowest upfront costs rather than lower overall costs and ignoring environmental and social benefits. Changing these rules is often a pre-requisite before any large-scale changes can take place.

Budgetary rules that prevent municipalities or public bodies from benefiting financially from the energy savings they generate can also be a strong disincentive and need to be amended. Changes will also need to be made to regulations limiting the possibility of signing long-term contracts, such as Energy Performance Contracts.

Because municipalities generally lack knowledge and experience on energy efficiency, the hiring and training of municipal energy managers and networks of municipalities dedicated, at least in part, to energy efficiency are two of the strategies that have proved to be most successful to improve energy efficiency of municipalities.

In Europe, several national or international networks—such as MUNEE (Municipal Network for Energy Efficiency – Central and Eastern Europe), *Energie Cités* (24 European countries), and EcoEnergy (Bulgaria)—disseminate best practices, tools, and experiences between municipalities. Smaller networks of similar buildings (hospitals, schools, etc.) at the level of the city or the region can also be very effective in bringing practical improvements in the daily operation of buildings. These networks generally organise monitoring schemes, provide benchmarks, and share technical and human resources amongst members as well as pooling procurement to lower costs.

Energy Efficiency Buildings in Mongolia: Concrete board roofing for a brick house © Ts.Battur

II. NEW POLICIES - **CHOOSING AND DESIGNING THE BEST MECHANISM FOR EACH COUNTRY**

Residential Sector Welfare Housing, Snit. Demonstration projects in Tunisia © Eric Thauvin / AFD

Buildings are one of the most important targets for energy efficiency policies worldwide, with a large potential for cost-effective savings. This is especially true in countries with large energy consumption per building, either due to poor technical efficiency, or strong demand for space conditioning (heating or cooling) because of extreme temperatures.

II.1 CHOOSING PRIORITY TARGETS

BEFORE LAUNCHING MAJOR POLICIES ON ENERGY EFFICIENCY IN A COUNTRY, ALL POSSIBLE EFFORTS SHOULD BE MADE TO GATHER DATA ON THE ENERGY CONSUMPTION OF THE VARIOUS SECTORS AND FORECASTS ON THEIR EVOLUTION. THIS INFORMATION IS NECESSARY TO CHOOSE PRIORITY TARGETS CORRECTLY. IN MANY COUNTRIES, A FULL RANGE OF DATA MAY NOT BE AVAILABLE. HOWEVER, GENERAL ORIENTATIONS CAN BE INFERRED FROM INFORMATION SUCH AS GROWTH RATES OF MAJOR ECONOMIC SECTORS, POPULATION GROWTH, LIFESTYLE CHANGES, ETC. IN RAPIDLY CHANGING COUNTRIES, GROWTH RATES ARE EVEN MORE IMPORTANT THAN CURRENT CONSUMPTION PATTERNS.

Opportunities to reduce energy consumption at lower costs should not be missed. To identify priority targets for strategies to reduce energy consumption in buildings, special attention should be given to high rates of new construction, short building lifespans, old deteriorated building stocks, rising service sectors, or developing public sectors.

Table 4: Opportunities to Increase Energy Efficiency in Buildings.

FINDINGS	PRIORITY TARGET	RATIONALE	EXAMPLES	INSTRUMENTS
High rate of construction	New Buildings	→ The consumption of the building sector will probably increase with the number of buildings → New buildings provide a good opportunity to 'do things right from the start', which is easier and cheaper than refurbishing	Parts of Asia: China, India, ..	Energy Building Codes, Labeling of Buildings, Training of Designers and Builders
Short building lifespan	New Buildings	→ The average lifespan of buildings can differ strongly from country to country. In Europe, buildings are often refurbished and used for more than a century. Conversely, in Japan, 50 percent of the houses do not last more than 30 years. In countries with short building lifespans, the priority should be to implement policies focused on new buildings.	Parts of Asia	Energy Building Codes, Labeling of Buildings, Training of Designers and Builders
Old deteriorated building stock	Existing Dwellings	→ There are many opportunities for cost-effective refurbishments that will be well accepted by the tenants → Apartments are often located in large groups of identical buildings, which creates possibilities of standardised actions with lower costs.	Eastern Europe	Audits, Energy Information Centres, Utility Programmes, Standards for Equipment, Soft Loans, Tax Credits
Rising service sector	Service Sector, Hotels	→ Service-sector energy consumption will increase with activity → Service companies are sensitive to their image and can use their energy efficiency as a marketing argument → Hotels need to renovate their amenities regularly. Energy efficiency can be increased at low cost and minimal disturbance during one of these planned upgrades	South Asia	Audits, Demonstration Programmes, Tax Credits
Developing public sector: hospitals, schools, etc.	Public Sector	→ It can be easier for governments to work on public buildings.	Parts of North Africa	ESCOs, Training, Networks

II.2 CHOOSING THE BEST POLICIES FOR EACH COUNTRY

THERE IS NO SUCH THING AS THE ABSOLUTE 'BEST' POLICY INSTRUMENT. HOWEVER, ONCE PRIORITY TARGETS HAVE BEEN CHOSEN, SOME POLICIES CAN BE MORE APPROPRIATE THAN OTHERS, DEPENDING ON LOCAL CIRCUMSTANCES.

- **Level of enforcement of mandatory requirements:**
  Mandatory prescriptions can be very efficient, but only if they are strongly enforced. In countries without a strong record of enforcement, especially in the building sector, it may be better to choose voluntary-based policies.

- **Level of expertise of the local building professionals:**
  Performance Energy Building Codes and building labels rely on the assumption that local professionals (architects, designers, builders, auditors) will have a good understanding of the building as a system and of solutions to improve its efficiency. In countries with little experience of energy efficiency and a limited level of technical expertise in the building sector, policies dealing with equipment and materials, such as prescriptive Energy Building Codes or mandatory minimum performance standards, may be easier to implement and will still bring significant improvement compared to a situation with no specific energy efficiency policies.

- **Importance of the self-build sector:**
  Similarly, in countries where a high percentage of houses are self-built or built informally, policies should be kept as simple as possible to be applicable even by non-professional builders. Much emphasis should also be put on developing support tools and resources, possibly through local energy centres.

- **Ownership situation:**
  If most of the buildings (at least in the residential sector) are owner-occupied, policies can rely more on awareness raising, demonstration programmes, and providing information and support to energy users. If the private rented sector is more significant, stronger policies, such as Energy Building Codes or high levels of subsidies, may be necessary to overcome the lack of direct incentive for the owner to invest in energy efficiency.

- **Performance of the utilities and regulator:**
  Utility DSM programmes can be a very effective way of reaching scattered energy consumers. However, they can only be implemented by well-run utilities that are not overwhelmed by other issues. The financial situation must be profitable enough and the rate recovery must be high enough to allow for the additional costs related to energy efficiency programmes.

To really motivate the utilities, the regulator must have the technical skill and legal ability to remove disincentives for the utility to invest in energy efficiency. Better still is the ability of the regulator to create new, positive incentives for utility DSM.

II.3 DESIGNING THE MECHANISMS

POLICIES TO PROMOTE ENERGY EFFICIENCY IN BUILDINGS SHOULD BE DESIGNED TAKING INTO ACCOUNT A FEW GENERAL PRINCIPLES:

- Policies need to be set for a long period of time, so that producers, builders, and consumers find it worthwhile to change their practices and behaviour. Policymakers need to convince them that the government's commitment to improve energy efficiency will not wither in the long term.
- Policies should be simple and easy to understand for non-specialist, scattered energy consumers.
- The variety of building-sector trades related to the design, construction, and operation of buildings should be involved with programme design and implementation, as should utilities, local authorities, and consumers.
- Policies should be regularly evaluated and updated or adapted if necessary. This requires that measurement and verification programmes be designed and implemented at the same time as the policy itself, and that funding be available.
- To allow low-income households to benefit from the programmes, additional targeted support to cope with the possible additional upfront costs may be necessary.
- Various policy instruments should be combined to complement each other in effective policy packages. In particular, all programmes should be preceded, or at least accompanied, by awareness and information campaigns to help consumers and other target groups put into perspective the general objectives and benefits of energy efficiency, as well as increase their knowledge of the programme itself.

More specifically, some guidelines can be identified for the major instruments.

Energy Building Codes

The key elements of a successful building code are:

- Stakeholder participation for the elaboration of the prescriptions: all building trades (architects, builders, developers, contractors, etc…) should be associated. This will concur to making the prescriptions more practical and well adapted to local practices and technologies as well as increase stakeholder appropriation of the prescriptions. The process must, however, be driven by government staff to promote a high level of improvement over business-as-usual performances.
- Extensive testing to check and demonstrate that the prescriptions are adequate and can be met cost-effectively.
- Acceptable costs resulting from thorough cost-analysis studies and supported by demonstration programmes.
- Detailed enforcement plan, including compliance procedures, staffed and trained building code officials, and tools to help check compliance. The most efficient solution is generally to include compliance checks of the energy efficiency building code in existing building application procedures. In some countries with a low record of compliance with rules and standards, additional incentives might be necessary.
- Supporting tools: training of construction professionals, compliance manuals, forms and software.
- Plans and procedures for revisions in accordance with technology and market changes.
- Regional exchanges and benchmarking. Regional similarities can help save time and money on code development by adapting codes, as long as local building characteristics and climatic conditions are well taken into account.

Residential Sector Welfare Housing, Snit © Eric Thauvin/ADF

Performance or prescriptive codes:
A performance code is both more difficult to design (if not well developed, there can be loopholes) and more difficult to understand. It has the advantage of providing designers with more flexibility but requires more experienced professionals. It is generally best adapted for commercial Energy Building Codes and countries with some experience with energy efficiency in buildings.

Because it is easier to follow, a prescriptive code is better adapted for situations where there is low qualification and skills of the building sector or high self-construction rate and in countries with limited overall experience with energy efficiency. It can be the best option for the first energy efficiency building code in a country, especially for residential buildings.

Certificates and Labels

The key elements of a successful certification/labeling policy are:

- An attractive and clear label that is easily read and understood by non-specialists. In general, there should be only one comprehensive set of rules on energy efficiency rating and certification in each country: certificates for appliances, homes, cars, etc. should all follow the same design so that they can reinforce each other.
- Information campaigns to make the target groups (home buyers, tenants, realtors, builders, developers, etc.) aware of the existence and meaning of the certification/label.
- Complementary incentives to stimulate uptake of the most efficient choices as demonstrated by the certificates/labels, at least at the beginning.
- Controls to ensure the quality of the label.
- Rules for revisions of certificate ratings and labels. For group ratings with stars or A,B, C ratings, expected progress in energy efficiency should be included in the design of the categories from the start, so that categories do not have to be modified too often.

Utility DSM

The key elements of a successful utility DSM programme are:

- Fair rules which do not distort competition between utilities in their other fields of activity. Targets and procedures should, however, be adapted to the size and competence of the utility. In some cases, it is more cost-effective to simply exclude the smallest companies.

- Appropriate, clear, and transparent mechanisms for cost recovery (from end users) and removal of disincentives for utilities to help improve energy efficiency.
- Simple and low-cost, well-agreed upon, procedures for measurement and verification.
- A strong regulator to enforce targets with incentives for compliance or penalties for non- compliance.
- Targets that are reasonable but significantly higher than existing, business-as-usual household practices. Otherwise, utilities will be getting credit for actions that would have taken place anyway.

Audits

The key elements of a successful audit programme are:

- Training programmes to increase the quality of audits. Ideally, a certification programme for auditors should be set up as a part of any large-scale auditing program.
- Financial incentives to offset at least part of the external audit costs. This will significantly improve the uptake of audits. Since audits in themselves do not save money, consumers are reluctant to invest money in them.
- Further assistance (technical and financial) for the implementation of the audit recommendations.

Taxes or Tax Reductions

The key elements of a successful taxation (or tax reduction) programme are:

- An acceptable global taxation level. To make them more acceptable, in several countries, carbon taxes were introduced as revenue-neutral, that is, other existing taxes were lowered at the time the new tax was implemented. Returns from energy taxes can also be used for energy efficiency improvements.
- Enough commitment by the Government and Parliament to convince investors that the tax (or tax exemption) will exist for a long period.
- A tax level (exemption level) that is significant enough to make it worthwhile to act in favour of energy efficiency.
- Eligibility rules which are restricted to new, low-market-share technologies until their penetration rate has increased.
- Clear information on the tax, both in general and when it is paid, to show consumers the benefits of changing their consumption patterns

ESCOs

The key elements of a successful ESCO promotion programme are:

- Available financing, either directly of the ESCO itself, allowing it then to provide a full service to its customers, or of the projects.
- Adapted legal framework and public procurement procedures to allow easy use of Energy Performance Contracts by public entities, as well as technical, legal, and financial assistance for public bodies willing to enter into this type of contract.
- Standard contract provisions and support for contracts.
- An accreditation system for ESCOs, to guarantee good quality of services.
- Standardised savings measurement and verification protocols to reduce disputes and improve trust in ESCOs, as well as reduce measurement costs for ESCOs and risks related to mistakes in estimates or measurements of savings

ANNEXES

Tertiary Sector Hotel Buildings, Russelior Hotel. Demonstration projects in Tunisia © Eric Thauvin / ADF

Annex 1 - REFERENCES

Reports

Australian Building Codes Board, Office of. 2000. *International Survey of Building Energy Codes*. Report prepared for the Australian Greenhouse Office.

Bertoldi, P., and S. Rezessy. 2005. *Energy Service Companies in Europe: Status Report 2005*. Report prepared for the European Commission, Directorate-General Joint Research Center, Institute for Environment and Sustainability. Report No. EUR 21646 ENG. Luxembourg: European Communities.

California Energy Commission. 2005. *Options for Energy Efficiency in Existing Buildings: Commission Report*. Report No. CEC-400-2005-039-CMF.

Carter, S. 2001. 'Breaking the Consumption Habit: Ratemaking for Efficient Resource Decisions'. *Electricity Journal* 14(10):66–74.

Chandler, W., J. Parker, I. Bashmakov, Z. Genchev, J. Marouskek, S. Pasierb, M. Raptsun, and Z. Dadi. 1999. *Energy Efficiency Centers in Six Countries: A Review*. Report No. PNNL-13073. Washington, DC: Pacific Northwest National Laboratory, Advanced International Studies Unit,.

de T'Serclaes, P. 2007. 'Financing Energy Efficient Homes: Existing Policy Responses to Financial Barriers'. IEA Information Paper. Paris: OECD/IEA.

Dulleck, U., and S. Kaufmann. 2000. 'On the effectiveness of DSM information programs on household electricity demand'. University of Vienna Working Papers No. 0001.

ECOFYS et al. 2007. *From Theory Based Policy Evaluation to SMART Policy Design: Summary Report of the AID-EE Project*. Report prepared within the framework of the EU Intelligent Energy for Europe project 'Active Implementation of the European Directive on Energy Efficiency'.

Eoin Lees Energy. 2006. *Evaluation of the Energy Efficiency Commitment 2002-05*. Report to the UK Department of Environment, Food, and Rural Affairs (Defra).

Eto, J. 1996. 'The Past, Present, and Future of U.S. Utility Demand-Side Management Programs'. Lawrence Berkeley National Laboratory Paper No. LBNL-39931.

FaberMaunsell Consulting. 2005. *A Study into International Directions for the Mandatory Disclosure of the Energy Performance of Buildings*. Report commissioned by the Australian Greenhouse Office.

Gillingham, K., R. Newell, and K. Palmer. 2004. 'Retrospective Examination of Demand-Side Energy Efficiency Policies'. Discussion paper No. RFF DP 04-19. Washington, DC: Resources for the Future.

Hopper, N., C. Goldman, J. McWilliams, D. Birr, and K.S. McMordie. 2005. 'Public and Institutional Markets for ESCO Services: Comparing Programs, Practices and Performance'. Lawrence Berkeley National Laboratory Paper No. LBNL-55002.

International Energy Agency. 2007. 'IEA Energy Efficiency Policy Recommendations to the G8 2007 Summit, Heiligendamm'.

International Energy Agency. 2006a. *Energy Technology Perspectives 2006: Scenarios & Strategies to 2050*. Paris: OECD/IEA.

International Energy Agency. 2006b. *World Energy Outlook 2006*. Paris: OECD/IEA.

International Energy Agency. 2004. *Oil Crises & Climate Challenges: 30 Years of Energy Use in IEA Countries*. Paris: OECD/IEA.

Kushler, M., and D. York. 2005. *ACEEE's 3rd National Scorecard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity*. ACEEE Report No. U054. Washington, DC: American Council for an Energy-Efficient Economy.

Kushler, M., D. York, and P. Witte. 2004. *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies*. Report U041. Washington, DC: American Council for an Energy-Efficient Economy.

Levine, M., D. Ürge-Vorsatz, K. Blok, L.Geng, D. Harvey, S. Lang, G. Levermore, A. Mongameli Mehlwana, S. Mirasgedis, A. Novikova, J. Rilling, and H. Yoshino. 2007. 'Residential and Commercial Buildings'. In *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. B. Metz, O. Davidson, P. Bosch, R. Dave, and L. Meyer, eds. Cambridge, UK and New York: Cambridge University Press.

Levine, M., E. Hirst, J. Koomey, J. McMahon, and A. Sanstad. 1994. 'Energy Efficiency, Market Failures, and Government Policy'. Lawrence Berkeley National Laboratory Paper No. LBL-35376 and Oak Ridge National Laboratory Paper No. ORNL 383.

Matrosov, Y., M. Chao, D. Goldstein, and C. Majersik. 2004. 'Recent Advances in Energy Codes in Russia and Kazakhstan: Innovation, Energy Savings, Market Transformation'.

Nadel, S. 2006. *Energy Efficiency Resource Standards: Experience and Recommendations*. ACEEE Report No. E063. Washington, DC: American Council for an Energy-Efficient Economy.

Nadel, S., J. Thorne, H. Sachs, B. Prindle, and N. Elliott. 2003. *Market Transformation: Substantial Progress from a Decade of Work*. ACEEE Report A036. Washington, DC: American Council for an Energy-Efficient Economy.

Oxera Consulting Limited. 2006. *Policies for Energy Efficiency in the UK Household Sector*. Report prepared for the UK Department of Environment, Food and Rural Affairs (Defra). Oxford, UK: Oxera Consulting.

Regulatory Assistance Project. 2005. 'Regulatory Reform: Removing the Disincentives to Utility Investment in Energy Efficiency'. Regulatory Assistance Project *Issuesletter* (September).

Sanchez, M., C. Webber, R. Brown, and G. Homan. 2007. '2007 Status Report: Savings Estimates for the Energy Star® Voluntary Labeling Program'. Lawrence Berkeley National Laboratory Paper No. LBNL-56380.

Stern, N. 2006. *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press.

United Nations Economic and Social Commission for Asia and the Pacific. 1999. *Compendium of Energy Conservation Legislation in Countries of the Asia and Pacific Region*. Bangkok: United Nations.

United Nations Environment Programme. 2007a. *Assessment of Policy Instruments for Reducing Greenhouse Gas Emissions from Buildings*. Nairobi: UNEP.

United Nations Environment Programme. 2007b. *Buildings and Climate Change: Status, Challenges and Opportunities*. Nairobi: UNEP.

United Nations Environment Programme. 2002. *Reforming Energy Subsidies: Opportunities to Contribute to the Climate Change Agenda*. Nairobi: UNEP.

US Department of Energy. 2002. *Energy Efficiency and Renewable Energy Strategic Program Review*. Washington, DC: US Department of Energy.

US Environmental Protection Agency. 2007. *Evaluation Report: ENERGY STAR Program Can Strengthen Controls Protecting the Integrity of the Label*. EPA Office of Inspector General, Report No. 2007-P-00028.

Western Governors' Association. 2006. *Clean Energy, a Strong Economy and a Healthy Environment: Report of the Clean and Diversified Energy Advisory Committee to the Western Governors*. Denver: Western Governors' Association.

World Energy Council. 2007. *Energy and Climate Change*. London: World Energy Council.

World Energy Council. 2004. *Energy Efficiency: A Worldwide Review – Indicators, Policies, Evaluation.* London: World Energy Council.

World Energy Council. 2001. *Energy Efficiency Policies and Indicators*. London: World Energy Council.

↘Web sites

Alliance to Save Energy: www.ase.org

ANEEL (Brazilian Electricity Regulatory Agency): www.aneel.gov.br

American Council for an Energy-Efficient Economy: www.aceee.org

Australian National Framework for Energy Efficiency: www.nfee.gov.au

Australian National House Energy Rating Scheme: www.nathers.gov.au

Bureau of Energy Efficiency (India): www.bee-india.nic.in

Canadian Commission on Building and Fire Codes: www.nationalcodes.ca

Center for Renewable Energy & Sustainable Technology (CREST): www.crest.org

Database of State Incentives for Renewables & Efficiency: www.dsireusa.org

Energy Information Administration (United States): www.eia.doe.gov

Energy Saving Trust: www.energysavingtrust.org.uk

Federal Energy Management Program: www1.eere.energy.gov/femp

IEA, Global Renewable Energy Policies and Measures Database: www.iea.org

Institut de l'Energie et de l'Environnement de la Francophonie: www.iepf.org

Korea Energy Management Corporation: www.kemco.or.kr

Minergie®: www.minergie.ch

Senter Novem: www.senternovem.nl

US Department of Energy, Energy Efficiency and Renewable Energy, Building Energy Codes Program: www.energycodes.gov

Annex 2 - COUNTRIES SURVEYED FOR THE 2001 AND 2004 ADEME/WEC REPORTS ON ENERGY EFFICIENCY POLICIES AND INDICATORS

For the 2001 report, the policies of 51 countries were surveyed, including:

- 17 from Western Europe (EU countries (excluding Luxembourg), Norway, Switzerland, and Turkey)
- 11 from Central and Eastern Europe (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovenia, and Slovakia)
- 6 from the Americas (Canada, Chile, Colombia, Peru, Mexico, and the United States)
- 9 from Asia (India, Hong Kong, China, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Taiwan, China, and Viet Nam)
- 3 from the Pacific (Australia, New Zealand, and Papua New Guinea)
- 5 from Africa (Algeria, Cameroon, Egypt, Nigeria, and South Africa)

For the 2004 report, the policies of 63 countries were surveyed, including:

- 27 countries from Europe (EU15 countries (minus Luxembourg), Czech Republic, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia, Romania, Bulgaria, Russia, Norway, Switzerland, and Turkey)
- 8 from the Americas (Brazil, Canada, Chile, Colombia, Costa Rica, Peru, Mexico, and the United States)
- 11 from Asia and the Pacific (Australia, China, Hong Kong China, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Taiwan, China, and Viet Nam)
- 12 from Africa (Algeria, Botswana, Cote d'Ivoire, Egypt, Ghana, Kenya, Mali, Mauritania, Morocco, South Africa, Tanzania, and Tunisia)
- 5 countries from the Middle East (Iran, Israel, Jordan, Lebanon, and Syria)

The 63 surveyed countries account for 83 percent of world energy consumption (100 percent for North America and Western Europe, 88 percent for all Europe including CIS countries, 68 percent of Latin America, 77 percent of Asia, 54 percent of Africa, and 44 percent of the Middle East).

Annex 3 - TYPES OF ENERGY PERFORMANCE CONTRACTS IN THE UNITED STATES

In the institutional non-federal sector (MUSH, including municipal agencies, universities, schools, and hospitals), ESCOs in the US have mainly used two types of contracts: Guaranteed Savings and Shared Savings. In a shared savings contract, the cost savings are split for a pre-determined length of time in accordance with a pre-arranged percentage. Financing is generally brought by, or through, the ESCO, which is responsible for repaying the loan. In a guaranteed savings contract, the ESCO guarantees a certain level of energy savings and the financing is set up directly by the energy user, who assumes the credit risk, while the ESCO assumes the risk for the savings.

The shared savings contract was the initial model. It later gave way to the guaranteed savings model in response to customers' desires. Some customers felt they could have access to cheaper financing directly (through tax-free financing for some public projects, for instance), while others were ready to accept more risk in exchange for lower interest, as they grew more familiar with energy efficiency. The guaranteed savings contract opened the market for smaller ESCOs, which did not have capital to finance projects themselves or access to competitive loans. The shared savings model can be a good introductory model for developing countries in which energy users find it difficult to directly access financing for their energy efficiency projects.

In the US federal market, the dominant ESCO contract is the Energy Savings Performance Contract (ESPC), which is similar to an ESCO-financed guaranteed savings contract. ESCOs assume the financing risk, but there is no sharing of savings.

The Utility Energy Savings Contract (UESC) is the alternative type of contract used by federal organisations to improve the energy efficiency of their buildings. It provides them with some of the services of an ESCO contract but is contracted with an energy utility. The agency contracts with the utility and pays for the energy services from its utility budget. The utility typically arranges financing to cover the capital costs of the project. The utility is then repaid over the contract term from the cost savings generated by the energy efficiency measures.

More than 45 electric and gas utilities have provided project financing for energy and water efficiency upgrades at federal facilities since 1995.

Table 4: Characteristics of the Different Types of Energy Performance Contracts in the US Market.

TYPE OF CONTRACT	SECTOR	CONTRACTOR	FINANCING	ALLOCATION OF SAVINGS
Shared Savings	MUSH	ESCO	By the ESCO	Shared savings according to pre-agreed proportions
Guaranteed Savings	MUSH	ESCO	By the energy consumer	Level of guaranteed savings. Additional savings go to the energy consumer.
Energy Savings Performance Contract (ESPC)	Federal	ESCO	By the ESCO	Level of guaranteed savings. Additional savings go to the energy consumer
Utility Energy Savings Contract (UESC)	Federal	Utility	By the utility	Level of guaranteed savings. Additional savings go to the energy consumer

United Nations Development Programme
Bureau for Development Policy
Environment and Energy Group
304 east 45th Street
New York, NY 10017. USA

For more information: www.undp.org / www.thegef.org/gef/