



ASSESSMENT OF POLICY INSTRUMENTS FOR REDUCING GREENHOUSE GAS EMISSIONS FROM BUILDINGS

Summary and Recommendations

UNITED NATIONS ENVIRONMENT PROGRAMME



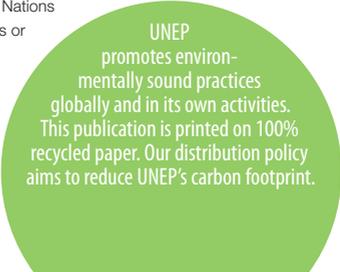
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SUMMARY

Residential and commercial buildings account for approximately one third of all energy related GHG emissions worldwide, which is expected to further increase in the future. Numerous barriers such as market failures, hidden costs and benefits, first-cost barriers, behavioural, informative and structural barriers hinder the realization of the often calculated significant saving potential. These barriers are often overcome by public policies and programmes. Such policies can be divided into the categories of regulatory, economic and fiscal incentives as well as informative/support instruments. However, as there is a large number of policy instruments, the question often

emerges: how to choose the right one? Which are the most effective ones? In order to answer these questions, a comprehensive assessment of these tools is necessary.

The purpose of this report was to provide an appraisal of the instruments available for improving energy efficiency in buildings in order to assist policy-makers in the decision process. Therefore, twenty of the most important instruments were chosen (see table 1) and comparatively evaluated in this study based on concrete case studies.

Over 80 evaluation case studies of implemented policy instruments and review articles were identified and

Table 1: Policy instruments analysed in this study

Control and regulatory instruments		Economic and market-based instruments	Fiscal instruments and incentives	Support, information and voluntary action
Normative: <ul style="list-style-type: none"> – Appliance standards – Building codes – Procurement regulations – Energy efficiency obligations and quotas 	Informative: <ul style="list-style-type: none"> – Mandatory audits – Utility Demand-side management (DSM) programs – Mandatory labelling and certification programs 	<ul style="list-style-type: none"> – Energy performance contracting – Cooperative procurement – Energy efficiency certificate schemes – Kyoto Protocol flexible mechanisms 	<ul style="list-style-type: none"> – Taxes – Tax exemptions / reductions – Public benefit charges – Capital subsidies, grants, subsidized loans 	<ul style="list-style-type: none"> – Voluntary certification and labelling – Voluntary and negotiated agreements – Public leadership programs – Awareness raising, education, information campaigns – Detailed billing and disclosure programs



served as the basis for the analysis. They cover 52 countries¹ from all inhabited continents. Effectiveness of the instruments in reducing GHG emissions, cost-effectiveness for society and success factors were chosen as assessment criteria.

As can be seen on table 2 (next page), many policy instruments evaluated in this study can achieve high savings at low or even negative costs for society². Economic instruments such as energy performance contracting and white

¹ if all EU-member states are counted separately

² if the benefits of saved energy and the associated avoided expenses are taken into account in the cost-effectiveness calculations

certificates achieve diverging results as some of them are still rather new for the buildings sector, but have a high potential. Under the category of fiscal instruments, subsidies, grants and tax exemptions can lead to high saving, but subsidies are less cost-effective to society.

Financial incentives can be helpful to kick-start the market for new energy efficient products as well as for developing countries where funding is not always available. The effectiveness of voluntary instruments such as voluntary labelling and agreements depends on the context as well as on accompanying policy measures. Information instruments such as

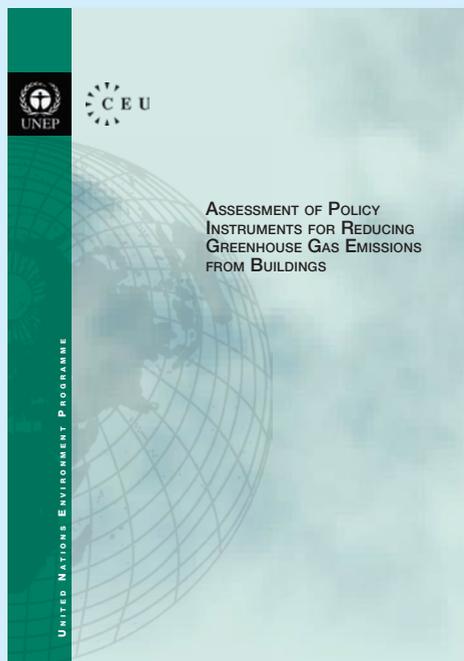


awareness raising programs are moderately effective depending on the design, but can successfully reinforce other instruments.

Regulatory and control instruments such as building codes were revealed as the most effective and cost-effective category of instruments in this study if enforcement can be secured. A number of regulatory instruments achieved savings in the triple negative digit range of costs.

The highest GHG emission reductions in the sample were achieved by appliance standards, building codes, demand-side management (DSM) programs, tax exemptions and labelling. Among the most cost-effective instruments were appliance standards, energy efficiency obligations, DSM programs, public benefit charges and labelling. Most of these are regulatory and control instruments. Appliance standards are projected to be especially cost-effective with net societal benefits of -65\$/tCO₂ in 2020 in the United States and -194\$/tCO₂ in 2020 in the EU.

These results can be explained by the special characteristics of the buildings sector which is very fragmented and characterized by many barriers to energy efficiency. Regulatory instruments proved to be the most effective as they can overcome some of the most important barriers, for



example reduce the transaction costs since they eliminate the need to search for information or perform complicated calculations. However, these results - especially the conclusions for cost-effectiveness - require further research as the amount of quantitative data was still limited in 2007, especially for developing countries, and partly difficult to compare due to missing information on baselines and methodologies of calculation. Evaluations are especially rare for developing countries. In addition, many policy measures are implemented as part of policy packages which makes assessment of single policy measures difficult.



Table 2: Instruments analysed in this report

Policy instrument	Emission Reduction Effectiveness	Cost-effectiveness (a)	Special conditions for success, major strengths and limitations, co-benefits
Appliance standards	High	High	Factors for success: periodical update of standards, independent control, information, communication, education
Building codes	High	Medium	No incentive to improve beyond target. Only effective if enforced
Public leadership programs, incl. procurement regulations	Medium/High	High/Medium	Can be effectively used to demonstrate new technologies and practices. Mandatory programs have higher potential than voluntary ones. Factors for success: ambitious energy efficiency labeling and testing.
Energy efficiency obligations and quotas	High	High	Continuous improvements necessary: new energy efficiency measures, short term incentives to transform markets
Mandatory audit requirement	High, but variable	Medium	Most effective if combined with other measures such as financial incentives
Demand-side management programs (DSM)	High	High	Tend to be more cost-effective for the commercial sector than for residences.
Energy performance contracting (EPC)/ESCO support (b)	High	Medium	Strength: no need for public spending or market intervention, co-benefit of improved competitiveness.
Cooperative procurement	High	Medium/High	Combination with standards and labeling, choice of products with technical and market potential
Energy efficiency certificate schemes/white certificates	Medium	High/Medium	No long-term experience. Transaction costs can be high. Institutional structures needed. Profound interactions with existing policies. Benefits for employment.



Kyoto Protocol flexible mechanisms (c)	Low	Low	So far limited number of CDM &JI projects in buildings
Taxation (on CO2 or fuels)	Low	Low	Effect depends on price elasticity. Revenues can be earmarked for further efficiency. More effective when combined with other tools.
Tax exemptions/reductions	High	High	If properly structured, stimulate introduction of highly efficient equipment and new buildings.
Public benefit charges	Medium	High	Success factors: independent administration of funds, regular monitoring & feedback, simple & clear design.
Capital subsidies, grants, subsidized loans	High	Low	Positive for low-income households, risk of free-riders, may induce pioneering investments.
Labelling and certification programs	Medium/High	High	Mandatory programs more effective than voluntary ones. Effectiveness can be boosted by combination with other instrument and regular updates.
Voluntary and negotiated agreements	Medium / High	Medium	Can be effective when regulations are difficult to enforce, combined with financial incentives, and threat of regulation
Education and information programs	Low / Medium	Medium/High	More applicable in residential sector than commercial. Success condition: best applied in combination with other measures.
Detailed billing and disclosure programs	Medium	Medium	Success conditions: combination with other measures and periodic evaluation.

(a) Cost-effectiveness is related to specific societal cost per carbon emissions avoided. (b) Energy service companies (c) Joint Implementation, Clean Development Mechanism, International Emissions Trading (includes the Green Investment Scheme)

Summary of Findings and Recommendations

This study has shown that regulatory instruments and control instruments, such as building codes and appliance standards, were both most effective

and normally also most cost-effective in our sample of 80 case studies. However, the key precondition for their success is the sufficient resources and efforts invested for implementation and enforcement, as well as a

Table 3: Barriers to energy efficiency and policies as possible remedies

Barrier category	Instrument category recommended	Recommended policy instruments as remedies
Economic barriers	Regulatory- normative/ regulatory-informative Economic instruments Fiscal instruments	Appliance standards, building codes, energy efficiency obligations, mandatory labelling, procurement regulations, DSM programs EPC/ESCOs, cooperative procurement, energy efficiency certificates Taxation, public benefit charges, tax exemptions, subsidies/rebates/grants
Hidden costs/ benefits	Regulatory-normative Economic instruments Support action	Appliance standards, building codes EPC/ ESCOs Public leadership programs
Market failures	Regulatory-normative/ regulatory/informative Economic instruments Fiscal instruments Support, information, voluntary action	Appliance standards, building codes, energy efficiency obligations, mandatory labelling, procurement regulations, DSM programs EPC/ESCOs, cooperative procurement, energy efficiency certificates, Kyoto Flexibility mechanisms Taxation, public benefit charges, tax exemptions, subsidies/rebates/grants Voluntary labelling, voluntary agreement, public leadership programs, awareness raising, detailed billing
Cultural/ behavioral barriers	Support, information, voluntary action	Voluntary labelling, voluntary agreement, public leadership programs, awareness raising, detailed billing
Information barriers	Support, information, voluntary action Regulatory/informative	Voluntary labelling, voluntary agreement, public leadership programs, awareness raising, detailed billing mandatory labelling, procurement regulations, DSM programs, mandatory audits
Structural/ political		Public leadership programs



regular updating of the specifications. Mandatory and possibly subsidized audits are recommended methods for already existing buildings.

By using energy efficient technologies and procurement rules, the public sector can not only reduce its own energy costs but also act as a role model, create a demand for energy efficient products in the country, and give incentives to the private sector. Furthermore, if energy prices reflect real costs a much broader set of efficiency investments become profitable than with subsidized prices; therefore a phase-out or partial lifting of subsidies is often an important precondition to the success of other energy efficiency policies. In return, the introduction of new energy efficient, but more expensive technologies can be supported through grants or rebates if the first-cost barrier is very important such as in developing countries.

Limitation in time is a main success factor for fiscal measures such as grants and rebates as well as combination with informative measures in order to prevent or at least limit an increase in consumption following the improved efficiency. National or international financial support and capacity-building are especially important for developing countries.

Country-specific solutions which analyse in detail the local market structure, culture, climate, traditions

and construction styles are more likely to be successful. In the past, many buildings, for example in Africa and in Scandinavia, were traditionally constructed in an energy efficient way, but this ancient know-how is increasingly lost or neglected when modern architecture is used or as a result of the uniform solutions offered by the globalised construction industry. It is therefore important that the traditional construction know-how is conserved and its applicable elements are integrated into the training of architects and other construction professionals.

Since different countries face different barriers to energy efficiency, adapting the policy instruments to these barriers (see table 3) increases the effectiveness of the overall policy. However, it is also





important to recognize that the same instruments can significantly vary in their success in different settings which is due to differences in design and other success factors.

Success factors vary from instrument to instrument, but correct enforcement and appropriate combination with other instruments as well as involvement of stakeholders and simple procedures and mechanisms are important for all of them. Regular evaluation and monitoring from the beginning help to recognize and correct possible mistakes in the program design and implementation. Long-term commitment of stakeholders and funding agencies, also during the implementation phase,

is a success condition, for example for building codes and other regulatory measures which also require regular updates. Adaptation to the local situation and the local barriers is crucial as well.

One of the most important success factors for most policy instruments is a transformation of the product or building market which implies a long-lasting and sustainable shift to more energy efficient products or buildings.

Since all instruments have advantages and disadvantages, appropriate combination with other policy instruments can maximize the overall effectiveness. The following policy





Table 4: Recommendations for designing an effective energy efficiency program

Program Design and/or Development	Program Adoption and/or Implementation	Program Monitoring and Evaluation
<ol style="list-style-type: none"> 1. Obtain commitment from legislature, utility commission, or other body 2. Evaluate existing building energy code and other laws and options for implementation and enforcement 3. Involve key stakeholders and assess their support early 4. Use sound economic and environmental quantitative analysis – determine cost-effective achievable potential for energy efficiency 5. Start with low-cost well established programs, lighting for instance 6. Set annual and cumulative targets using analysis and stakeholder input, e.g. % of base-year energy sales 7. Establish a long-term frame to overcome market and funding cycles 8. Ensure that workable funding methods are available to meet EEPS target 9. Take care to select the most appropriate entities responsible for program implementation and/or meeting the target and the procurement rules they must follow 10. Assess training needs and other forms of technical support for code officials, builder associations, building supply organizations, auditors. 11. Contact material and equipment suppliers to ascertain availability of code compliant products 	<ol style="list-style-type: none"> 1. Use clear basis for assessing compliance. 2. Update goals regularly 3. Ensure additionality over and above existing program commitments 4. Coordinate with PBF programs 5. Ensure that supply-side resource filings reflect the energy savings goals 6. Approve long-term funding cycles (5-10 years) 7. Design programs to meet customers needs in the relevant market 8. Keep program design simple 9. Educate and train key participants regularly such as builders, building officials, supply companies 10. Provide right resources, code requirements overview, laminated cards, simple software packages, how to conduct plan and site inspections, who to contact for more information. 11. Implementing and enforcing codes requires high level of engineering expertise that many code officials do not have. Contact universities, and architect engineering firms for detailed analysis of codes. 12. Provide budget and staff for the program, and train staff 	<ol style="list-style-type: none"> 1. Use methods proven over time 2. Include key tracking and reporting practices in program design 3. Provide qualitative evaluation in addition to a quantitative one 4. Evaluate programs regularly against stated objectives 5. Utilize a third party verifier 6. Provide for adequate funding for evaluation 7. Provide feedback to oversight agencies and adjust future savings goals as needed 8. Provide for consistent and transparent evaluations 9. Maintain a functional database that records customer participation over time on geographical location and customer class <p>Source: Sathaye et al. 2006. Note: EEPS- Energy Efficiency Portfolio Standards, PBF- Public Benefit Fund</p>



instruments, for example, can be effectively combined:

- standards, labelling and financial incentives
- regulatory instruments and information programs
- public leadership programs and energy performance contracting (EPC), i.e. EPC in the public sector
- financial incentives and labelling.

Policy packages are particularly beneficial for the success of policy measures in developing countries due to the special barriers there, such as lack of funding, lack of awareness, lack of experts as well as technology (depending on the country) and

problems with enforcement of laws.

An integrated policy framework combining regulatory instruments, such as standards or mandatory audits in certain buildings, capacity building, training and information campaigns as well as demonstration projects coupled with (fiscal or other) incentives is most likely to effectively reduce GHG emissions in developing countries.

Regulatory measures are important, but only effective if special efforts are made to implement and enforce them. While in developed countries combinations of instruments may moderate the rebound effect that constrain the effectiveness of regulatory instruments, in developing countries energy-efficiency policies





rarely result in a reduction of energy consumption, but most often in the increase of the affordable energy services with the available resources.

In order to ensure continuous commitment, capacity-building and assistance, the creation of special institutions dedicated to energy (efficiency) is useful, such as ministries, commissions and/or energy agencies. As developing countries vary considerably in their level of development, traditions or climatic zone country-specific and even regionally adapted solutions are especially important. Policy-makers, but also residential consumers and industries can be convinced of the necessity of energy efficiency measures through high (unsubsidized) energy prices which reflect the real, but also by highlighting the numerous co-benefits of improved energy efficiency such as reduced air pollution or employment creation.

In addition, developing countries especially need capacity-building and technical assistance. Information campaigns and demonstration projects are very important to increase knowledge about and trust in energy efficiency programs. Funding represents a major challenge and can be secured in more developed countries such as economies in transition through internal mechanisms, for instance public benefit charges or



taxes. In other developing countries, this can be achieved through international financial support.

Further recommendations for designing policy measures effectively especially in developing countries are included in table 4 (page 9).

However, significant research gaps still exist: the situation of developing countries clearly requires further implementation of policy measures as well as further research: many of them have not yet introduced or are just about to introduce policy instruments for reducing GHG emissions from buildings. Only very few evaluation studies are currently available and even less include quantitative data on



effectiveness and cost-effectiveness. Baseline data on details of energy consumption is often missing in developing countries.

Monitoring of energy consumption is currently just being introduced in many places. However, systematic monitoring of energy consumption as well as evaluation of projects based on a common methodology would be necessary to continuously improve programs. Calculating and including quantitative data in evaluation studies, especially on effectiveness and cost-effectiveness, enables and simplifies comparisons between different policy measures. These data can also be used to convince policy-makers and funding agencies of the benefits of the policy measures. In addition, collecting lessons learned from different places enhances learning and makes improvement of project designs possible.

Furthermore, since policy packages have been identified as most effective, some typical combinations of instruments need further research. Finally, the relatively new instruments such as Energy Efficiency Certificate schemes, which have only been applied for a few years in selected countries, require further attention as well as some of those instruments which could not be included in this study, such as pricing schemes or green building rating systems.

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Buildings contribute on average to 30% of energy use in society causing similar levels of associated greenhouse gas emissions. There are many proven ways to reduce the energy use in new and existing buildings but experience shows that this will not happen without intervention from policy makers. This study presents the qualitative and quantitative experiences from different kinds of policy tools applied in countries all around the world.