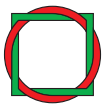
Energy Efficiency Policy in Europe

Developed by:



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To:
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Deutsche Gesellschaft für
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Executive Summary

The report *"Energy efficiency policy in Europe - Policies and measures on European Union and Member States level that aim at increasing energy end-use efficiency and energy savings, and the ideal policy package"* by Wuppertal Institute on behalf of GTZ gives insights into experiences made in Europe with enerygy efficiency policies and measures.

With its focus being limited to **end-use energy efficiency**, the report first gives a comprehensive overview of the **European policy and market developments** in terms of energy efficiency. The main part of the study then analyses the various **types of policy instruments** that are currently being implemented throughout Europe and outlines one good practice example for each of these instruments. In addition, recommendations are presented as to how policies for energy efficiency can be designed effectively and how the different instruments should ideally be coordinated in **policy packages**.

The different policy instruments requisite for supporting energy efficiency improvement should ideally be bundled in comprehensive, well-balanced, effective and efficient, market actor-oriented policy packages. In order to successfully develop such packages the following elements and structures are needed:

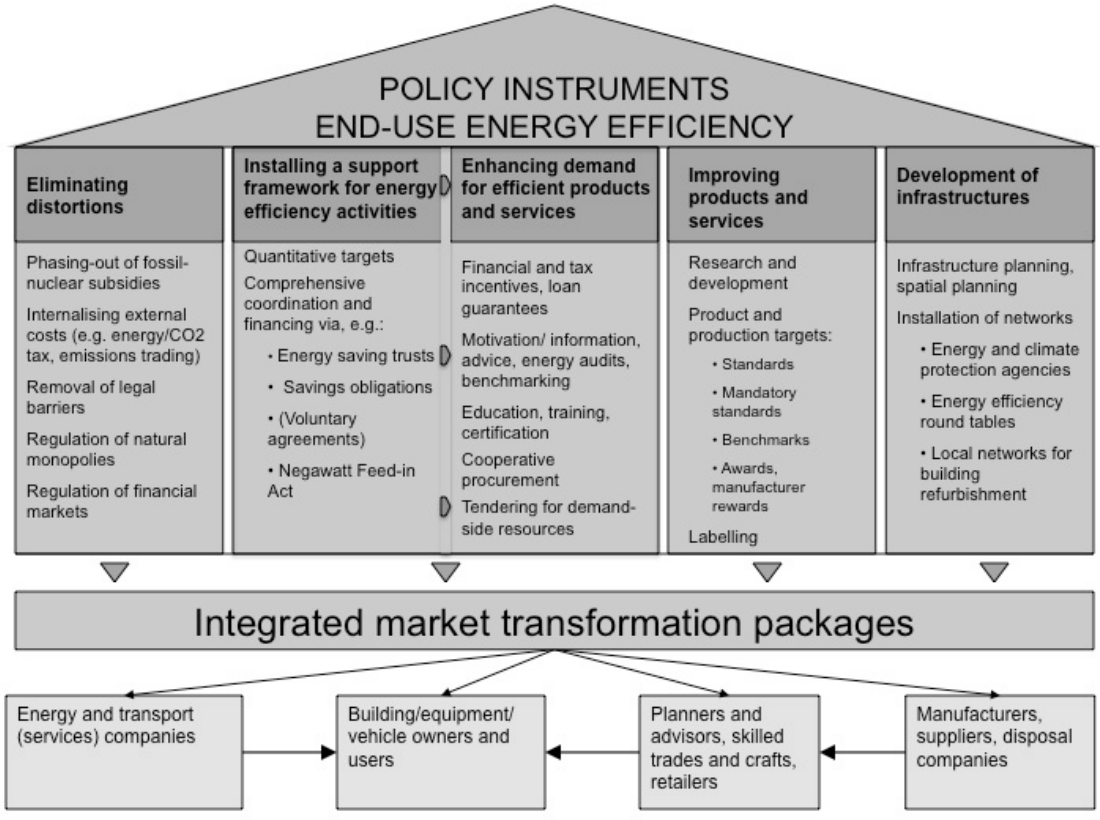
- **Target setting and policy planning:** A coordinated policy planning should include the setting of a clear, binding target along with reporting requirements and well-defined methods for reporting and monitoring of results. As targets are the starting point for effective and efficient policy making, it is recommended to set SMART targets, where **SMART** stands for:
  (i) Specific: be as concrete as possible: what should be achieved with the instrument?
  (ii) Measurable: targets should be quantified; qualitative targets cannot be measured at a later stage; monitoring and evaluation is crucial in order enable policy-makers to assess the impact of policies and measures
  (iii) Ambitious: Does the target go beyond business as usual?
  (iv) Realistic and Acceptable: Is the target achievable in the given timeframe, with the budget available? Is the target accepted by the target group?
  (v) Time framed: Are targets set for a specific year? Are intermediate targets set in order to be able to monitor target progress?
- **Infrastructure for energy efficiency:** Participation of energy agencies and other actors implemeting energy efficiency programmes should be ensured for a continuous, independent, centrally-coordinated implementation of a variety of different energy efficiency activities.
- **Financing:** Sufficient (initial) funding within a supportive framework for the different single energy efficiency activities that enhance demand for energy-efficient buildings, products and services should be provided.

Ultimately, the mix of policies and measures along with the activities by non-governmental actors must **make energy efficiency as easy-to-realise and rewarding**

as possible for the relevant market actors, and thus contribute to a strong market development of energy efficiency technologies and services. It should also be made clear that energy efficiency improvement is desirable from a political and societal perspective.

The following graph shows the interaction between the various instruments in an **ideal market transformation package**. It illustrates that ideally, within a comprehensive promotion framework, targeted and coordinated policy packages should be developed that influence all levels of the market chain. The barriers to energy-efficient behaviour must be overcome for all relevant market actors, and incentives to encourage them to adopt energy-efficient behaviour reinforced. Only then can energy-efficient solutions genuinely establish themselves in the market and become the norm.

Figure: Elements of the policy portfolio for end-use energy efficiency



For the credibility of governmental activities in the field of energy efficiency, the **public sector should lead by example**. Existing market distortions and disincentives to cost-effective, life cycle-oriented solutions should be removed, specific commitment or targets set (e.g. particularly stringent energy performance standards for public buildings), a way of funding the continuous implementation of energy efficiency measures (e.g., a revolving fund) and energy management units established in every public authority.

1 Introduction

In Brazil, the relevant actors in the field of energy efficiency (i.e., policy makers, but also intermediary institutions) are currently going through a period of re-orientation. The report presented here aims to support this process by providing insights into experiences made in Europe with enerygy efficiency policies and measures, thus enabling decision makers to take these into account when re-designing Brazilian energy efficiency policy.

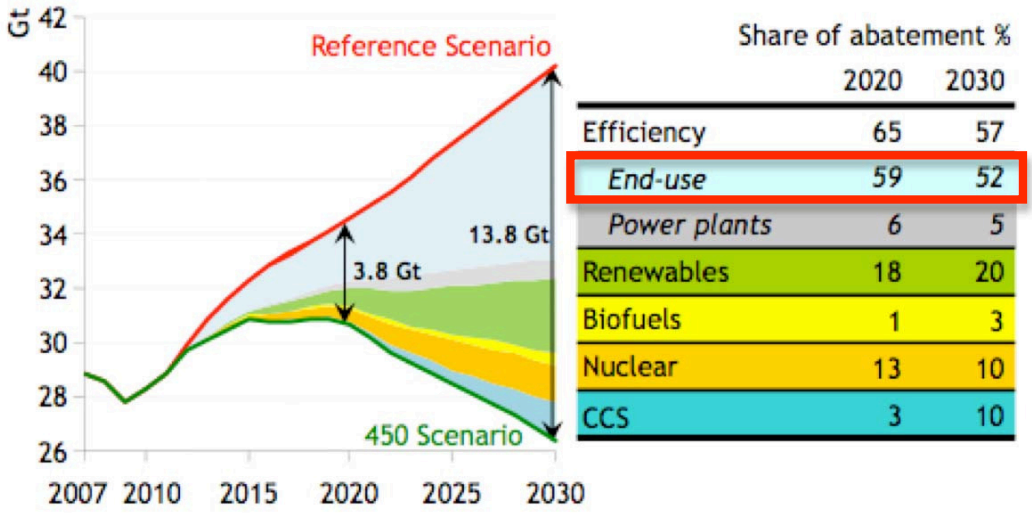
With its focus being limited to end-use energy efficiency, the report first gives a comprehensive overview of the European policy and market developments in terms of energy efficiency. The main part of the study then analyses the various types of policy instruments that are currently being implemented throughout Europe and outlines one good practice example for each of these instruments. In addition, recommendations are presented as to how policies for energy efficiency can be designed effectively and how the different instruments should ideally be bundled and coordinated in policy packages.

2 Overview of Energy Efficiency Policy and Market Developments in Europe

2.1 Multiple benefits of increasing energy efficiency

Among the many arguments in favour of improving energy efficiency, one of the foremost is its key role in **climate change mitigation**. Indeed, improving energy efficiency is now seen as the most important strategy to achieve greenhouse gas (GHG) emission reductions that are necessary to stabilise the global climate system, because improving energy efficiency is particularly **cost-effective and can be achieved rapidly**.

Figure 1: Importance of energy end-use efficiency in achieving climate change mitigation targets: IEA 450 ppm CO2eq scenario to achieve 2° target



Share of abatement %	2020	2030
Efficiency	65	57
End-use	59	52
Power plants	6	5
Renewables	18	20
Biofuels	1	3
Nuclear	13	10
CCS	3	10

Source: IEA World Energy Outlook 2009

Besides the need to mitigate climate change, there are numerous other strong arguments in favour of scaling up energy efficiency, especially the following ones:

- improved **supply security**, e.g. by reducing (national, regional) dependency on energy imports
- improved **competitiveness**, resulting from lower energy costs and technology innovations
- improvement in all key indicators such as GDP, direct climate-related and induced **investments, consumption and employment**
- lower energy costs and in many cases also lower life-cycle costs for **consumers**.

In light of all these arguments, it is clear that increasing energy efficiency can achieve win-win situations for society as a whole. This is also the basis for ambitious policy goals in terms of energy efficiency improvement that have been adopted on European and Member State level in the EU.

2.2 Definition of energy efficiency

While effectiveness marks the degree of achievement of objectives of an activity, efficiency refers to the ratio of benefits to expenses. Energy efficiency, therefore, describes the ratio between the benefit gained and the energy used. From an economic point of view, energy efficiency can thus be described as the marginal productivity of energy input, i.e. it specifies how much energy input is needed to produce a certain level of output (e.g., heat, light, motion, comfort). *Energy efficiency* therefore always refers to individual applications on the process level, whereas on the macroeconomic level the *energy intensity* of an economy is indicated by the amount of primary energy consumption per unit of the gross domestic product (real GDP). Energy intensity can also be measured as a ratio to certain physical parameters. Possible examples are, inter alia, the energy consumption per m2 living space corrected by ambient temperature, the electric power consumption per refrigerator or the fuel consumption per 100 km driving performance. The inverse of energy intensity, *energy productivity*, is usually defined as the value added per unit of primary energy input.

The energy intensity of an economy, however, not only depends on the efficiency of the individual processes, but also on structural factors such as its geographical location (and thus climate) and sectoral structure, as well as on the prevailing consumer preferences. Consequently, energy efficiency improvements do not necessarily lead to a proportional reduction of the overall energy intensity. The existence of rebound effects (meaning that energy-efficient technologies are used more because it is now cheaper to use them) can further lessen the impact of energy efficiency improvements on the desired reduction of energy intensity (cf. Birol / Keppler 2000).

Energy efficiency improvements and energy savings can be achieved at different sections of the energy supply and demand chain:

- in energy generation, e.g., by way of combined heat (cold) and power production, and efficient power plants;
- in energy transmission and distribution, e.g., by using energy-efficient transformers, reducing or - in heat grids - insulating lines, and system optimisation;
- on the energy demand side, through intelligent use of energy without reducing the desired level of comfort (increased energy end-use efficiency), by substituting an energy carrier by one that uses less primary energy (substitution), or by not using certain energy consuming products or services at all („sufficiency“).

As already mentioned, the focus of this report is on energy end-use efficiency.

There are several approaches available for improving energy efficiency on the demand side: By way of technical or organisational measures, through infrastructural changes, but also through changes in the way we use appliances, buildings etc. A few examples of the different types of measures are presented below:

- use of energy-efficient lighting sources (CFLs, LED, etc.) instead of conventional lamps (technical),
- introduction of teleworking (organisational),
- traffic reducing urban development (infrastructural),
- only using washing machines/dishwashers at full load, turning off the lights when leaving the room, etc. (behavioural).

The following definitions and requirements are taken from the European Draft Standard prEN15900 on energy efficiency services, which will come into force in the coming months as commonly accepted European standard EN 15900 (CEN 2009):

> ***Energy efficiency:*** *ratio between an output of performance, service, goods or energy, and an input of energy;*
>
> ***Energy efficiency improvement:*** *increase in energy efficiency as a result of technological, behavioural and/or economic changes;*
>
> *Energy efficiency improvement actions shall include one or more of the following:*
>
> > *a) measures in order to reduce the energy consumption; e.g., installing building insulation, reduction of leakage of compressed air*
> >
> > *b) replacement, modification or addition of equipment; e.g., combined heat and power generation, high efficiency boilers, variable speed motors, energy efficient lighting*
> >
> > *c) more efficient operation; e.g., building automation, logistic and layout optimisation, control parameter adjustment*
> >
> > *d) continuous optimization of operation of technical installations; e.g., maintaining the installed equipment to its best performance*
> >
> > *e) improved maintenance; e.g., maintenance planning, instruction of the operation and maintenance staff*
> >
> > *f) deployment of behavioural change programmes; e.g., training, energy awareness campaigns*
> >
> > *g) implementation of an energy management system. e.g., system compliant with EN 16001.*
>
> ***Energy audit:*** *systematic inspection and analysis of energy use and energy consumption of a system or organisation with the object of identifying energy flows and the potential for energy efficiency improvements;*
>
> ***Energy efficiency service:*** *agreed task or tasks designed to lead to an energy efficiency improvement and other agreed performance criteria;*
>
> *General requirements:*

An energy efficiency service shall be designed to achieve an energy efficiency improvement and meet other agreed performance criteria, such as comfort level, production throughput, safety, etc.

The energy efficiency service shall be based on collected data related to energy consumption.

The energy efficiency service shall include energy audit as well as identification, selection and implementation of actions and verification.

A documented description of the proposed or agreed framework for the actions and the follow-up procedure shall be provided.

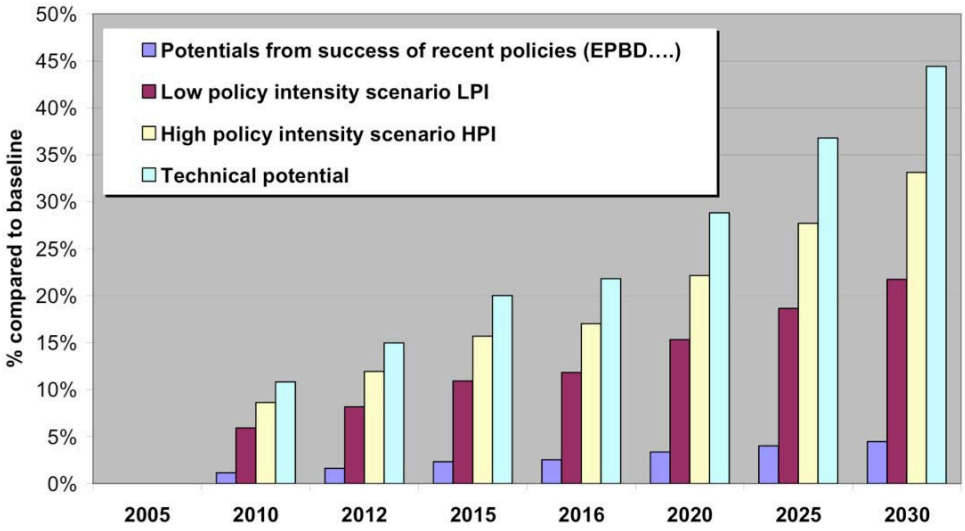
The improvement of energy efficiency shall be measured and verified over a contractually defined period of time through contractually agreed methods.

2.3 Energy efficiency potentials in the European Union

Policy goals are set based on knowledge about existing energy efficiency potentials. Notwithstanding some differences in terms of assumptions made, data basis used and specific insights gained, numerous studies have identified substantial and economically viable potentials to increase end-use energy efficiency: around 30% of energy savings vs. business-as-usual are theoretically achievable over the next 20 years, taking account of the usual reinvestment cycles, with a good 20% achievable within 10 years (cf. FhG-ISI et al. 2009, McKinsey 2007, Prognos 2006, FhG-ISI / FfE 2003, Lechtenböhmer et al. 2005, Lechtenböhmer / Perrels et al. 2006, Wuppertal Institut 2006). These savings can be realised with technologies and organisational approaches which are already available. One would only have to choose the efficient, cost-effective option whenever a building is refurbished or an installation/appliance is replaced anyway.

The following graph shows the results of scenario calculations performed in a recent study commissioned by the European Commission (FhG-ISI et al. 2009). On the one hand, the figure shows that some progress has already been made in Europe. On the other hand, it makes clear that the unexpoited energy end-use efficiency potentials in Europe are still very large.

Figure 2: Energy efficiency potentials in EU-27 in different scenarios (% compared to Autonomous Progress Scenario)



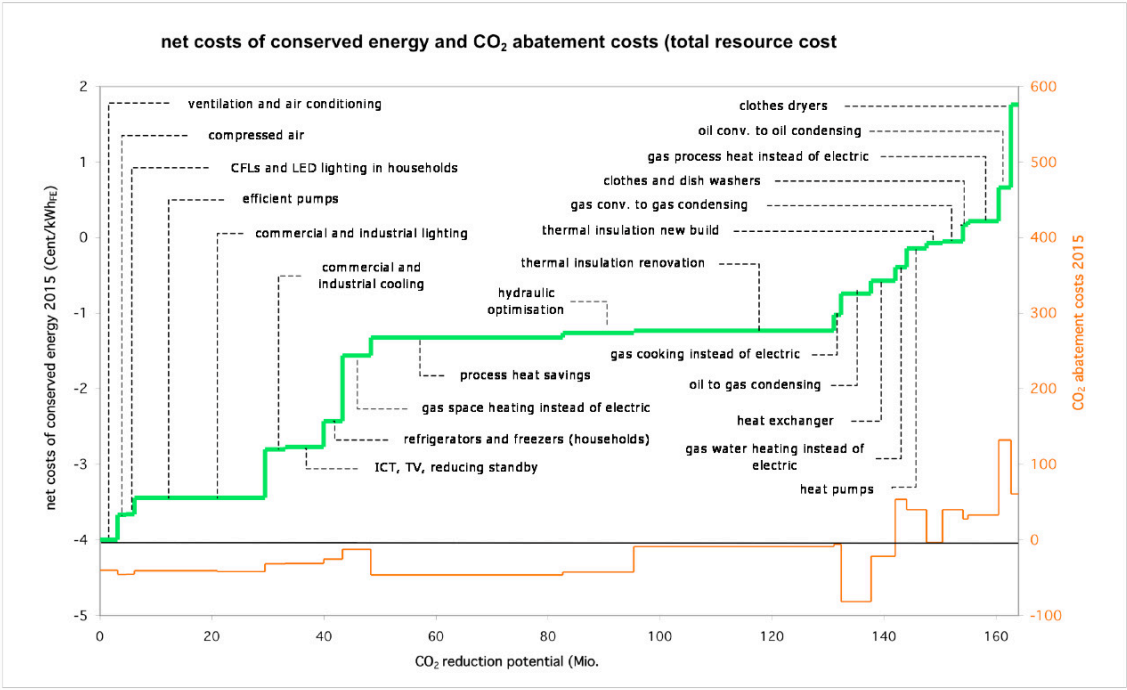
Source: FhG-ISI et al. 2009

On top of these energy end-use efficiency potentials, there are large energy saving potentials to be realised by improving power plant efficiency and especially by using CHP (cf., e.g., Mc Kinsey 2007; Ziesing 2008).

2.4 Cost-potential curves

Cost-potential curves are a very useful presentation of existing energy savings potentials and their cost-effectiveness. Institutions like research institutes and consulting companies like McKinsey make use of this kind of diagramme, which is explained in the following German example of cost-potential curves developed by Wuppertal Institute. Cost-potential curves give an overview in which fields of application / technology there are significant potentials for energy savings and/or CO_2 emission reductions and how cost-effective they are. Together with an analysis of barriers and obstacles that hinder the realisation of these potentials, cost-potential curves can be an important basis for the development of policies and measures and are thus presented here.

Figure 3: The example of a cost-potential curve of end-use energy savings in Germany: Results of an analysis of 70 energy efficiency technologies in Germany



Source: Wuppertal Institute 2006

Wuppertal Institute analysed 70 technologies and measures regarding their potential to reduce CO_2 emissions and to save or substitute end-use energy in Germany. The identified potentials have been evaluated from a micro-economic perspective (interest rate of calculation: 8%) as well as from the macro-economic point of view (interest rate of calculation: 4%). The analyses have been conducted for the years 2005 (year of creation of the study), 2010 and 2015 taking account of the usual reinvestment cycles. The result of the analysis of all individual technologies and system solutions can be presented in various ways.

In order to define ecological efficiency, it is reasonable to identify the particular CO_2 emissions reductions, thereby allowing a comparison between the different measures for electricity and heating fuel savings and fuel switching. The total CO_2 reduction for all reduction technologies and for all sectors is shown in Figure 3 above. Here, measures which aim at the same end-use and which are implemented in the same technology markets have been summarised. The CO_2 reductions of all individual measures were added together; for the costs of conserved energy and the costs of CO_2 abatement, the weighted averages were calculated. It is thus possible to compare the CO_2 reduction potentials and the net costs of saved energy resulting from different end-uses and technology markets. The technology markets are partially overarching different sectors.

In the curves of net costs of conserved energy (bold line) and of net costs of CO_2 reduction (thin line) the measures are represented in an ascending order according to the average net costs of conserved or substituted energy (Euro per kWh of electricity or

heating fuel) from a macroeconomic view. Net costs of conserved energy are the additional costs of the respective technology minus the long-run avoided system costs for the supply of electricity and heating fuels. The additional costs of technical or organisational energy efficiency measures in relation to a saved kWh are calculated from the additional costs of an energy-efficient technology compared to the costs of a baseline technology. The latter are the costs that arise when a 'normal' reinvestment or refurbishment is implemented anyway, using technology that complies with minimum standards or market average. Any investment in highly energy-efficient technology will immediately or later replace an investment in a less energy-efficient, business-as-usual technology – for which we use the term 'baseline technology' here. The costs for this baseline technology will be incurred in any case and may thus not be counted towards the energy efficiency measure. It should be noted that the costs presented here are always average values for additional costs, derived from the analysis of an average case. For the planning of an investment decision, however, the individual case should always be taken as the basis, particularly for more complex measures.

All measures with net costs of saved or substituted energy below zero are cost-effective from the perspective of society. Measures with net costs above zero, in turn, cause additional costs even after the deduction of the avoided energy system costs. Thus, it will be cost-effective from the perspective of society to apply the examined efficiency technologies and measures for saving more than 120 million tons of CO_2 per year within ten years. Especially the insulation of buildings, hydraulic optimisation in all sectors as well as process heat savings and the installation of pumps with variable speed drives in the commercial, public and industrial sector can considerably contribute to cost-effective energy savings and CO_2 reductions.

Additionally, the net costs of CO_2 reduction in Euro per ton for each individual technology are shown from a total resource cost perspective (thin line in Figure 3). When this indicator is applied, most of the analysed potentials are cost-effective, too, i.e. the costs of CO_2 abatement are below the expected certificate price of 10 Euros per ton. When calculating the costs of CO_2 reduction, we did not include the price of a certificate in the avoided energy costs. However, there are mathematical problems especially in the case of resources with a negative value of CO_2 abatement costs, thus not allowing the comparison between measures for saving an end-use energy and fuel switching measures.

2.5 Technology with high energy end-use efficiency potential

Following the results of the cost-potential analysis for Germany presented in Figure 2, technology and areas of application with outstanding and cost-effective energy end-use efficiency potential, from the micro- and macroeconomic perspective and concerning all sectors, are (for more details cf. Wuppertal Institute 2006):

- Fuel savings in process heating in the industry sector
- Heat optimisation / hydraulic adjustment / factor-4-circulation pumps in households

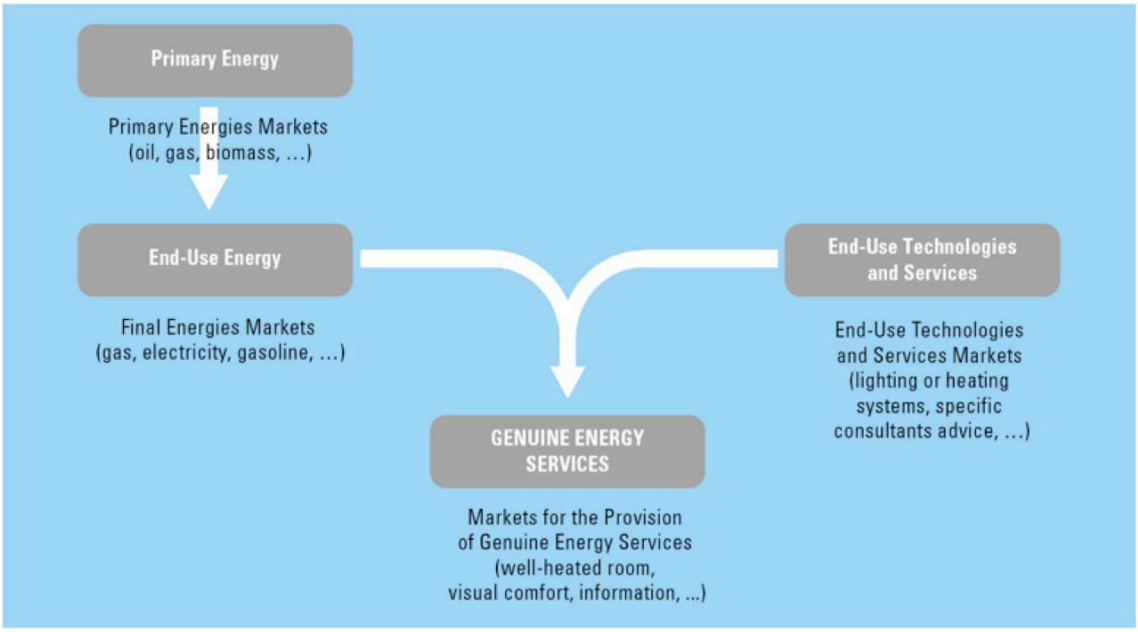
- Thermal insulation according to the low-energy house standard and replacement of heating systems (exchange of gas / oil boilers)
- Efficient pumps in industry, commercial and public sector
- Efficient ventilation and air conditioning in industry, commercial and public sector
- Optimised setting of installations (ventilation, pumps, motors) in industry, commercial and public sector
- Reduced stand-by losses in the residential and tertiary sector (ICT equipment, TVs, etc.)
- Efficient provision of process cooling and compressed air in industry
- Efficient lighting systems in all sectors
- Efficient cooling of groceries through ready-to-use, efficient refrigerators in the commercial sector
- Efficient refrigerators and freezers, hot fill for clothes and dish washers and efficient clothes dryers in households
- Electricity substitution in households, trade, commerce and services (fuel-switching for space and water heating, cooking and cooling)
- Heat recovery in industry and commerce
- Optimisation of air conditioning of mobile phone base stations.

2.6 Why is an active energy efficiency policy needed?

When discussing energy efficiency issues and the necessity of policy intervention, one should always keep in mind that ultimately end-use energy, e.g., gas or electricity, is not the final product, but only an intermediate product. End-users in all sectors do not benefit directly from final energy. What they actually need is **genuine energy services**, i.e. the physical amenity provided by energy-using equipment or buildings, for example cooked or cooled food, illumination, thermal comfort, transportation or product manufacturing. Converting final energy with the help of end-use technology and energy efficiency services produces **genuine energy services**.

Energy-efficient technology and services can help end-users to satisfy their energy-related needs at least cost and with as little harm to the environment as possible. As a consequence, it should be endeavoured to transform the energy market into a market for genuine energy services.

Figure 4: Supply of genuine energy services as the (energy-efficient) final product of interlinked markets



Source: Adapted from Thomas et al. 2002, 21

For this market development, an adequate **policy framework** is needed, which overcomes the existing focus on the energy supply-side and the various existing **barriers and obstacles** the different market actors face. The various existing structural, economic, and social psychological barriers include the following (for a comprehensive information about barriers, cf., for example, Thomas 2007; Sorrell et al. 2004; Enquete 1995; IEA 2000; Nilsson/Wene 2002, 9.268f.):

- **Lack of information and motivation** - There is a lack of information about efficient solutions and the associated opportunities to make savings, not only on the demand side but also on the supply side of energy-efficiency markets (e.g., manufacturers, retailers, installers). Besides, numerous actors must make the 'right', i.e. the most energy-efficient, choice in numerous every-day, planning and purchasing situations. However, energy efficiency is just one of many factors influencing these decisions.
- **Financial restrictions** - Lack of access to capital also constitutes a barrier to investments in energy efficiency, mainly in the residential and public sector. In the industry and commercial sector on the other hand, firms usually prioritise investments in their core business over energy efficiency measures.
- **Split incentives** - In many cases, an investor/user dilemma exists, i.e. the actor who has the opportunity to invest in energy efficiency improvement is not the one benefiting from the resulting energy cost savings and vice-versa.
- **Risk aversion** - The sometimes lengthy payback periods for long-term investments in energy efficiency are a risk many end-users try to avoid. Potential suppliers of efficient solutions also face the risk whether these solutions will be accepted by the

market. Moreover, there is high uncertainty about the transaction costs involved with obtaining information and the costs and benefits of improving energy efficiency. Consequently, risk aversion prevents economic actors from assessing the economic viability of energy efficiency measures over the whole lifetime of the equipment and thus reduces the cost-effective potential dramatically.

Ultimately, all these barriers are the reason why economic potentials exist at all. They therefore justify or rather call for **policy intervention** to make energy efficiency as simple and attractive as possible for all market actors, with a view to realising the large untapped potential for energy saving and CO_2 emission reduction while at the same time creating benefits for end-users and society as a whole.

The following table presents a first guideline which policies and measures could be used to overcome the identified barriers.

Table 1: Existing barriers to energy efficiency improvement and adequate ways to overcome these barriers

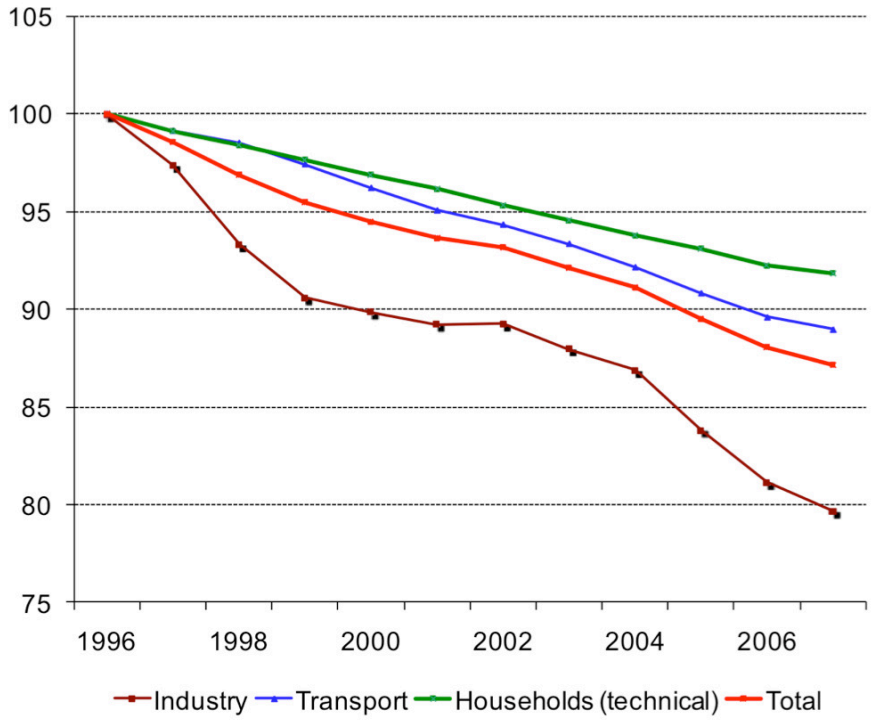
Barrier category	Barrier faced by market actors in different sectors	Policies and measures to tackle the identified barriers
Lack of information and motivation	Lack of information of end-users about existence of saving opportunities, cost-effectiveness of measures	Information campaigns (combined with implementation support); energy advice and audits; labelling schemes
	Lack of information of multipliers (sales staff, installers, planners, etc.) about existence of saving opportunities, cost-effectiveness of measures	Education and training; qualification of multipliers; provision of standardised material, e.g., brochures, tools for calculating/demonstrating cost-effectiveness
	Lack of motivation because savings are too small, other priorities, etc.	Minimum energy efficiency performance standards (MEPS); motivation campaigns; rebate programmes and other incentive programmes signalling that there is a beneficial opportunity
Financial restrictions	Lack of access to capital (residential sector)	Financial support, such as soft loans and guarantees (incl. help on how to find and apply for them); co-operation with banks; support of energy performance contracting (EPC) schemes backed up by credit financing, guarantee schemes, leasing, forfeating, etc.
	Investment priority for core business activities (industry and commerce)	Subsidised audits; information/advice programmes highlighting cost-effectiveness; networks of firms
Split incentives	Landlord-tenant-dilemma (residential and tertiary sector)	Mandatory Energy Performance Certificates; MEPS; Different measures to increase trust in win-win situations; revision of landlord and tenant laws
	Shareholders vs. chief executives (industry and commerce) → long-term vs. short-term profit maximisation	MEPS; sectoral voluntary agreements / target setting; networks of firms; changes in the financial sector
	Users vs. owners of energy-using equipment, e.g. in offices and tourism (tertiary sector)	MEPS; motivation campaigns appealing to the “green conscience”; measures supporting the introduction of automatic control systems (e.g., occupancy sensors for office lighting); voluntary agreements
Risk aversion	Transaction costs of obtaining information	Reduce transactions costs by providing free information (campaigns, brochures, web portals, initial advice)
	Uncertainty about costs and benefits of energy-efficient solutions	Calculation tools for assessing costs and benefits over lifecycle taking risk and uncertainty into account (e.g., sensitivity analysis); different measures to increase trust into market actors; support of EPC with guaranteed savings
	Sometimes high upfront investments and lengthy payback periods	Financial support programmes (incl. help on how to find and apply for them); energy performance contracting schemes; guarantee funds for Energy Efficiency Service Providers

2.7 Energy efficiency trends and market developments in the EU

The EU-funded ODYSSEE-MURE project, which has been monitoring energy efficiency progress in the EU-27 (plus Norway and Croatia) by way of collecting and analysing data on energy efficiency indicators and policy measures in Europe, has yielded the following results (Cf. Lapillonne/ Eichhammer/ Boonekamp 2009):

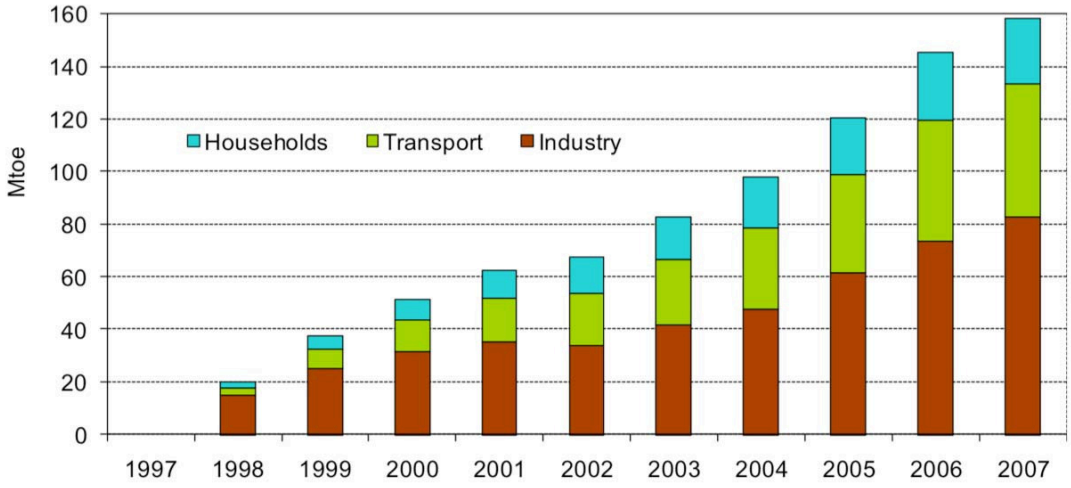
On average, the energy efficiency of final consumers has improved by 13 % in the EU-27 between 1996 and 2007. This resulted in energy savings of about 160 Mtoe, half of which have been achieved in industry.

Figure 5: Energy efficiency progress in EU-27 (1996-2007)



Source: Lapillonne / Eichhammer 2009

Figure 6: Energy savings achieved in the EU-27 per sector

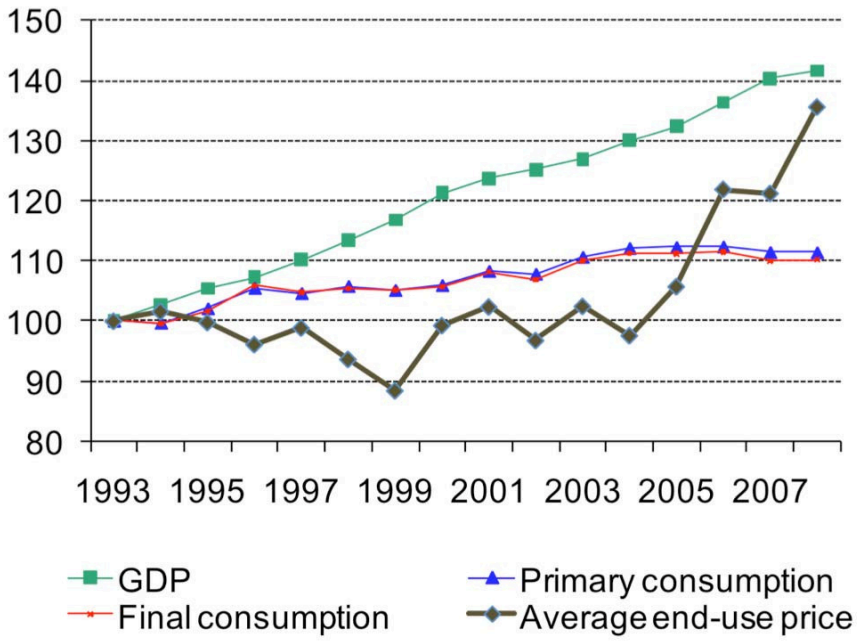


Source: Lapillonne / Eichhammer 2009

In most countries and sectors, energy efficiency improvement has slowed down since the year 2000, which is partly explained by the slower economic growth (business cycle effect). The performances achieved by the different countries range from 2% to 20%.

A clear tendency of decoupling between energy use and economic activity can be observed: Since 1990, energy consumption has been growing at only one third of the rate of the GDP. Between 2004-2007, this rate has further slowed down so that there is almost a full decoupling. Electricity use was still growing with three quarters of the GDP rate since 1990, slowing down to around 60% of GDP growth in 2004-2007.

Figure 7: Energy consumption and GDP in the EU



Source: Lapillonne / Eichhammer 2009

Structural changes in the economy only had a marginal influence on the energy intensity reduction of end-users and account for roughly 10% of this reduction from 1990 to 2007 in the EU as a whole.

In 2007, CO_2 emissions of final consumers were 5% below their 1990 level. Almost 40% of this emission reduction is due to fuel substitution by fuels with lower emission factors, the remainder is due to a reduction in energy intensity.

Major new energy efficiency policies have been introduced in the EU over recent years. However, some of them have been facing major delays and/or strong debate about the exact design, such as the revised Energy Performance of Buildings Directive (EPBD), the Eco-design Directive and its implementing measures, the CO_2 strategy for cars and the Energy Efficiency and Services Directive (cf. chapter 0 for more details on these and other EU policies).

Inspite of the growing number of policies and measures implemented both on EU and Member State level, and also the success already achieved in some areas, such as, e.g., the significantly increased share of A-rated appliances due to the EU energy labelling scheme, there are still substantial energy efficiency potentials remaining to be realised by new or enhanced policies and measures. As for regulatory instruments, better implementation control is also needed and essential for fully harnessing the energy saving opportunities.

2.8 Market actors and policy institutions

2.8.1 Market actors

Political decision-makers must have good knowledge of the respective market actors concerned in order to be able to adequately design and implement energy efficiency policies and measures. The usual statistical differentiation between sectors (industry, commerce / trade / services, residential) is not sufficient for a successful policy design.

Ultimately, the design of policies and measures should always be based on a thorough analysis of their respective scope of impact and the specific incentives and barriers faced by relevant market actors. These actors include on the demand side of energy efficiency technologies and services (cf. Thomas 2007, chapter 2.1.2)

- investors in energy efficiency who are users (of the technology, building, etc.) at the same time,
- investors in energy efficiency who do not use the technology or building themselves (e.g., landlords, project developers, leasing companies, housing corporations), and
- users who are not at the same time investors in energy efficiency (e.g., tenants, buyers of completed / existing buildings).

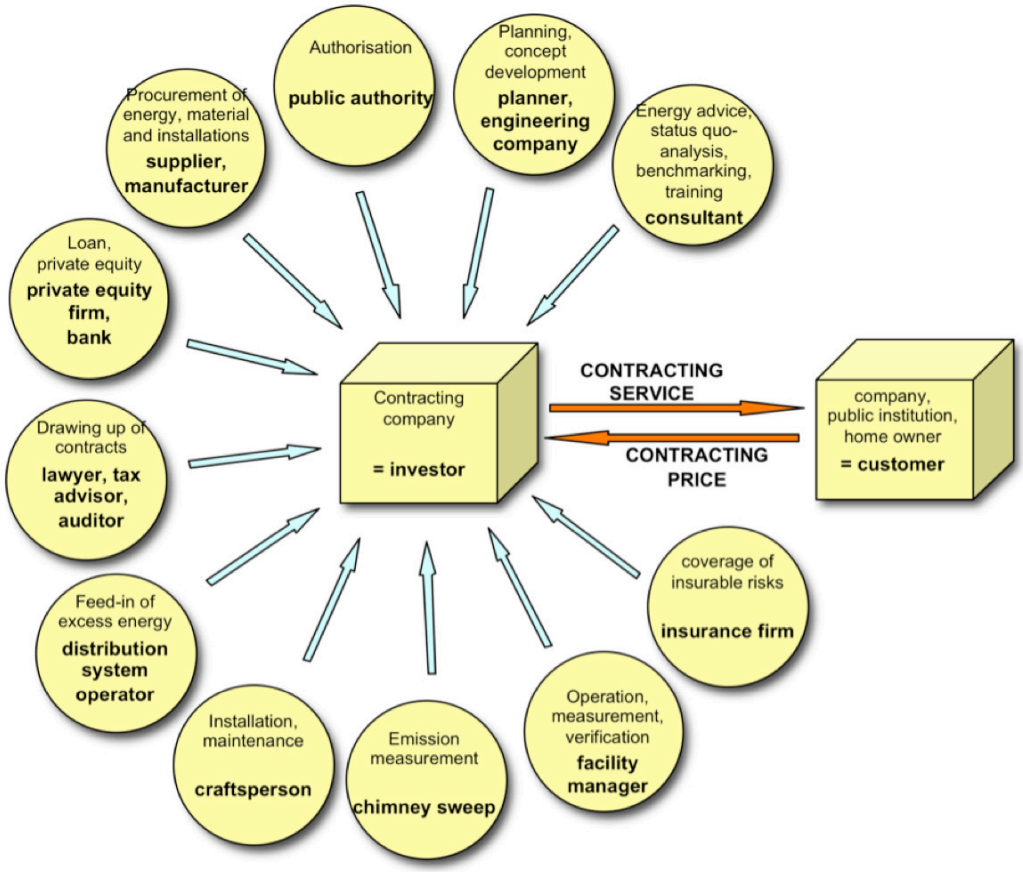
On the supply side of energy efficiency markets the relevant actors are

- manufacturers and importers of products being sold to end-users,
- manufacturers and importers of products being sold to downstream manufacturers or installers,
- planners,
- architects,
- installers,
- wholesalers and retailers (especially sales staff),
- energy consultants,
- ESCOs (Energy Service Companies) or EESCs (Energy Efficiency Service Companies), both meaning energy efficiency service providers,
- insurances and
- public, private-public and private banks.

Banks play a major role in providing funding and linking to energy efficiency programmes. In particular, if commercial banks do not have sufficient knowledge about the costs and benefits and thus the risk associated with energy efficiency investment and are therefore lacking incentives to support such projects, financial incentives provided by governments might not reach the respective target group. Moreover, state-owned banks can provide special energy efficiency financing programmes.

As an example of the oftentimes complex actor constellations in energy efficiency markets, the following figure shows the numerous actors that are involved in the case of energy efficiency service provision.

Figure 8: Actor groups possibly involved in carrying out an energy performance contracting project



Source: Translated from Irrek 2004

2.8.2 Policy institutions and further actors

Some of the market actors mentioned above also play an important part in political decision-making, for example through lobbying organisations, professional associations, etc. Yet, the institutions actually responsible for energy efficiency policy in the European multi-level governance system are:

- the European Parliament, the European Commission, and the Council of the European Union (the Council);
- national parliaments and governments;
- sub-national parliaments and governments (federal states, e.g., the German ‚Laender', local authorities)

- agencies (energy agencies, climate protection agencies, etc., on different levels: global, European, national, regional, local)
- NGOs like environmental organisations or associations of municipalities (e.g., ICLEI, Climate Alliance, Energie cités).

In recent years the topic energy efficiency / energy saving has received growing attention on all these levels. The abovementioned institutions have enacted and implemented numerous additional policies and measures to foster energy efficiency improvement that shall be further described in Chapter 2.9 and Chapter 3.3.

Table 2: Example: Most important market actors and policy institutions in Germany in the field of energy efficiency

Market actors	Several important manufacturers of energy-efficient technology About 500 ESCOs and several hundreds of energy companies offering energy efficiency services; two ESCO associations (ESCO Forum im ZVEI; VfW) About 2,500 energy consultant offices are members of the "Gebäudeenergieberater Ingenieure und Handwerker" and 560 are members of the "Deutsches Energieberaternetzwerk (DEN) e.V." 120,000 architects and thousands of planners: a small part of them offers special energy-efficient solutions 1,000,000 craftsmen, a small part of them offering particular energy-efficient solutions Banks, e. g., state-owned banks (e.g., KfW) or private banks (e.g., GLS) having special programmes for energy-efficient investment Investors (e.g. building owners) and end-users (e.g. tenants)
Agencies and NGOs	German Energy Agency (dena); several energy agencies and climate protection agencies on the level of the Federal States and on local level (e.g., Energy Agency of the State of North Rhine-Westphalia) Several NGOs, e.g. B.A.U.M. e.V. for small and medium enterprises
Ministries with responsibilities in the field of energy efficiency	Federal Ministry of Economy: Main responsibility for energy and energy efficiency Federal Ministry of Transport, Building and Urban Development Federal Ministry of Environment Ministries on the level of the Federal States
Municipalities / Local authorities	Local parliaments / local authorities Associations: Climate Alliance, ICLEI, Energie Cités

On the international level, one of the most relevant actors is the International Energy Agency (IEA). The intergovernmental organisation, which is established in the framework of the OECD, focuses – among other things – on the analysis of energy efficiency potentials and policies and measures. It also organises the exchange of knowledge and dialogue between its members (mainly industrialised states) and other countries. Recently, the IEA also developed high-profile energy efficiency policy recommendations on behalf of the G8 summits (so-called Heiligendamm and Lake Toya processes;

http://www.iea.org/textbase/Papers/2008/cd_energy_efficiency_policy/0_introduction/EffiRecommendations_web.pdf).

Within the UN, it is largely the Environment Programme UNEP that is active in the field of energy efficiency, for example with its Sustainable Buildings Initiative and Cleaner Production Centres, both of which target mainly developing and emerging economies.

Energy efficiency also plays its part in international climate policy albeit still a minor one. The Global Environmental Facility also finances some energy efficiency projects, whereas these are hardly supported via the CDM. The IPCC includes in its reports the scientific insights about energy efficiency potentials, costs and benefits.

In terms of international and bilateral development cooperation, energy efficiency is also of growing relevance. The German Government, for example, has allocated loans amounting to a total of one billion Euros specifically to energy efficiency and renewables projects in developing countries throughout recent years. The German Technical Cooperation implements 4E-programs (with 4E: Engineering, Education, Enforcement, Emergency Response) worldwide for more than 250 Million Euro. Moreover, some non-governmental actors such as energy agencies (some of which are however initiated and/or funded by the government), consumer advice organisations, energy efficiency networks (of market actors), and environmental NGOs are also involved with and important contributors to energy efficiency activities (cf. chapter 2.10.2).

2.9 Multi-level governance: European framework and Member State policies

2.9.1 Interlinkages between governance levels

As already briefly mentioned above, within the European multi-level governance system, energy efficiency policies and measures are being implemented simultaneously or subsequently at three levels: the EU level (EU Directives and other European measures), the Member State level (national policies and measures), and the sub-national or local level (policies and measures implemented by Federal States and/or municipalities). These levels cannot be viewed separately, since there are strong interlinkages between them. It is thus essential to take possible interactions into account already in the design phase of policy instruments and to ensure compatibility – and ideally mutual reinforcement – to the extent possible.

As an example of how the different governance levels interact the case of energy-efficient circulators is presented in the following box.

Good practice example: promoting high-efficiency circulators within a multi-level governance framework

At the *EU level*, in the framework of the Ecodesign Directive, an implementing measure with regard to circulators establishes mandatory energy performance standards (MEPS) for energy end-use efficiency and requirements for other environmental impacts of circulators being sold (imports as well as products manufactured in Europe). In addition, a mandatory energy label will be required.

At *Member State level*, the market penetration of highly energy-efficient circulators is then increased by way of information campaigns and/or grant programmes (implemented by governments, energy agencies or other actors).

At the *municipal level*, this market transformation can be supported by local actors offering, e.g., training for installers, targeted advice to end-users, public procurement guidelines, etc.

In the following subchapters, first energy end-use efficiency policy on EU level is summarised. After that, the report adds some information on Member State policies. In addition, a separate Chapter describes non-governmental activities.

2.9.2 Overview of European framework on energy-efficiency

2.9.2.1 EU green paper and action plan on energy efficiency

Increasing energy efficiency has become a top priority topic of European energy policy over the last 10 years.

In 2000, the EU intensified its activities in the field of energy efficiency with the Action Plan to improve Energy Efficiency in the European Community (COM(2000) 247 final) (EC 2000). The Action Plan estimated a saving potential of 18% by the year 2010 (160 Mtoe or 1 900 TWh) and outlines policies and measures for the realisation of two thirds of this target by 2010 (100 Mtoe or 200 Mt CO_2/year).

The Green Paper on Energy Efficiency, released in June 2005 by the European Commission, aimed at launching the debate on how the EU could cost-effectively reduce its energy consumption by 20% (190 Mtoe) compared to BAU projections for 2020 and, by doing this, limit energy consumption growth to a level of 1520 Mtoe/year in 2020.

In October 2006, the Commission adopted an Energy Efficiency Action Plan that was supposed to help realise the saving targets set in the Green Paper. It proposes a list of measures aiming to put the EU well on the path to achieving the key goal of reducing its global primary energy use by 20% by 2020. If successful, this would mean that by 2020 the EU would use approximately 13% less energy than in 2008, saving €100 billion and around 780 millions tonnes of CO_2 each year. However, this would require significant efforts both in terms of behavioural change and additional investment. Key measures proposed in the Energy Efficiency Action Plan include:

- Accelerating the use of fuel efficient vehicles for transport, making better use of public transport, and ensuring that the true costs of transport are faced by consumers;
- Tougher standards and better labelling on appliances;
- Rapidly improving the energy performance of existing buildings and taking the lead to make very low energy houses the norm for new buildings;
- Coherent use of taxation to achieve more efficient use of energy;
- Improving the efficiency of heat and electricity generation, transmission and distribution;
- A new international agreement on energy efficiency to promote a common effort.

These targets and measures proposed by the European Commission have become part of the Commission's comprehensive energy action plan for an Energy Policy for Europe, published on 10 January 2007. The EU energy ministers adopted the target to improve energy efficiency by 20% at their meeting on 20 February 2007. During its summit on 8/9 March 2007, the European Council adopted a comprehensive Action Plan for the period 2007-2009 based on the Commission's Communication "An Energy Policy for Europe". In particular, it stressed the need to increase energy efficiency in the EU so as to achieve the objective of saving 20% of the EU's energy consumption compared to projections for 2020, as estimated by the Commission in its Green Paper on Energy Efficiency, and to make good use of their National Energy Efficiency Action Plans (cf. next section) for this purpose.

As a consequence of studies showing that the EU will most likely fail to reach the 20% target with only the existing and enacted policies and measures in place, the European Commission has recently started to prepare a new energy efficiency action plan, a very preliminary draft of which was leaked to the public. The publication of this action plan, originally scheduled for November 2009, has been postponed until late 2010 or early 2011.

The most important policies within the action plan are listed in the following. They only represent part of the EU's research and dissemination agenda on energy efficiency.

2.9.2.2 Energy services directive (ESD)

The Directive on Energy End-use Efficiency and Energy Services (2006/32/EC), which became effective in May 2006, sets an indicative target for the EU Member States to achieve overall energy savings of 9% in the ninth year of application of the Directive (2016). Each member state must draw up programmes and measures to improve energy efficiency and report on these in three National Energy Efficiency Action Plans (NEEAPs). The NEEAPs must be submitted by 30 June 2007, 2011 and 2014 respectively. They shall outline strategies to achieve the targets and, from the second NEEAP onwards, include an evaluation of the implementation process to date. Progress with regard to energy end-use savings is to be measured from 1 January 2008.

The ESD lists examples of energy efficiency improvement measures – some compulsory, some optional – which can be deployed to achieve the required energy savings. One approach envisaged by the Directive is that efficiency targets are realised in part by market actors in the energy industry.

2.9.2.3 Ecodesign directive

The so-called Ecodesign Directive (Directive 2009/125/EC) establishes a framework for the setting of ecodesign requirements for individual energy-related products. It covers both products directly consuming energy such as electric appliances or motors, and products such as, e.g., windows or insulation material, that influence energy consumption. The Directive aims to improve the environmental performance of energy-related products throughout their life cycle, not only looking at energy aspects but on different environmental impacts. This objective shall be reached by establishing a framework under which manufacturers of energy-using products will, at the design stage, be obliged to reduce the energy consumption and other negative environmental impacts. The life cycle thinking applied here means that not only a product's energy consumption during operation is to be considered but also the environmental impacts arising during manufacture, distribution and disposal.

In terms of specifying the ecodesign requirements for specific products/product groups, the Directive provides for two alternative courses of action: mandatory implementing measures, and self-regulation by the industry.

So far, implementing measures have been adopted for the following product groups (as at January 2010): Standby and off mode electric power consumption of household and office equipment, lighting products in the domestic and tertiary sectors, electric motors, circulators, external power supplies, simple set-top boxes, household refrigerators and freezers, and televisions.

Also for many other product groups falling under the scope of the Directive (i.e., all energy-related products with annual sales in the EU of more than 200,000 units that have a significant environmental impact and present significant potential for improvement without entailing excessive costs), implementing measures are to be adopted until 2011, and as a first step in this process preparatory studies have been or are currently being drafted.

2.9.2.4 Energy Labelling Directive

Electric appliances are responsible for a significant and increasing share of the EU's electricity consumption. One of the first actions to improve energy efficiency in this field was the so-called Energy Labelling Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances, which made energy labelling mandatory for fridges/freezers, washing machines, dryers, dishwashers, electric ovens, lighting sources, and air-conditioning appliances. The EU-wide implementation of the labelling scheme enables consumer to choose products on the basis of their energy efficiency. However, since

the adoption of the Directive, technological standards have improved significantly for many appliances, which led to the need to (regularly) update the efficiency classes.

On 17 November 2009, political agreement was reached on a revision of the system, with a new “A+++” efficiency class to be introduced for the most energy saving household products. Moreover, the labelling scheme will be extended to cover energy-related products beyond the existing range of domestic electrical appliances, such as taps, shower-heads, windows and building materials.

The new energy labelling classes are expected to be endorsed in early 2010 and shall be implemented into national law one year after publication in the EU's official journal. They will be reviewed in 2014.

2.9.2.5 Energy Performance of Buildings Directive

The Directive on energy performance of buildings (EPBD) (2002/91/EC) is the main legislative instrument at EU level to achieve energy performance in buildings. It acknowledges the fact that the building sector is responsible for about 40% of the EU’s total primary energy consumption. What is more, huge savings can be achieved in a cost-effective way, particularly when regular retrofits are combined with energy-saving measures. The Directive thus requires Member States to apply minimum standards for the energy performance of new and existing buildings, to ensure the issuing of Energy Performance Certificates (EPCs) and to stipulate the regular inspection of boilers and air conditioning systems in buildings.

In 2008 the Commission presented a proposal for a recast of the EPBD with a view to strengthening the energy performance requirements and their actual implementation (including compliance control) at Member State level. A political agreement on the recast Directive was reached on 17 November 2009. The formal adoption by the European Parliament and the Council is scheduled for early 2010.

2.9.2.6 Flexible mechanisms of the Kyoto protocol (ETS, JI, CDM)

In 2002 the EU15 ratified the Kyoto protocol and agreed to an emission reduction target of 8% by 2012, compared to 1990, with separate targets to meet for each Member State. The ten new Member States have also ratified the Kyoto protocol and hence have their own reduction targets (-6% to 8%), except Cyprus and Malta.

The most important so-called “flexible mechanism” of the Kyoto protocol is the Emission Trading Scheme (ETS) implemented in Europe following Directive 2003/87/EC. Each Member State has to set up national allocation plans for each trading period, allocating emission allowances to participating companies.

The ETS is designed as a cap and trade system and focuses on the CO_2 emissions of large installations. It therefore focuses on energy supply-side improvements. However, reduced energy consumption reduces the pressure on the market actors to meet the caps in the short-term, and allows the setting of more ambitious emissions targets in the medium term to long term.

All in all, 15,000 installations (mainly power and heat production, as well as most energy intensive manufacturing industries, with emissions from chemical processes and from non-ferrous metal production as notable exceptions) are covered today by the ETS, which accounts for about 45% of the EU's total CO_2 emissions and 30% of its total GHG emissions. One problem is that emission trading concerns (directly) only about 40% of the required emission reductions by 2010. A further 45% of the emission reductions are to be achieved by other sectors outside ETS, whereas about 15% are left for non-energy related CO_2 and other gases to reduce emissions (Lechtenböhmer/Perrels/et al. 2006).

In addition, with the so-called 'Linking Directive' (2004/101/EC), the project-based mechanisms CDM (Clean Development Mechanism) and JI (Joint Implementation) of the Kyoto Scheme are linked to the EU ETS, which can stimulate, amongst others, projects on energy efficiency improvements on the energy demand-side.

2.9.3 Member State policies

In most EU Member States, energy efficiency policies and measures have developed considerable dynamics with an increasing number of measures being implemented or already in place in all sectors. The patterns of policy measures in different Member States and different sectors vary according to national circumstances, foci of attention, and practices.

The impact of EU energy efficiency policies at the national level is increasing. However, the level of impact is still quite different from sector to sector. Whereas EU policies have to come to represent nearly one third of all measures in the residential sector (in particular due to the impact of the Labelling Directive for household appliances) and of general cross-cutting measures (due to policies such as the CHP Directive, the Ecodesign Directive and renewables policies), the impact of EU regulation is still weaker in transport, industry and the tertiary sectors (cf. Lapillonne/ Eichhammer/ Boonekamp 2009).

The sheer number and diversity of measures in place at Member State level, does not allow going into more detail here. Selected good practice examples are being presented in chapter 3.3. Further and very detailed information on the numerous policies in place in the different Member States and sectors can be found in the MURE database, which can be accessed at http://www.isisrome.com/mure/.

2.10 Non-Governmental Activities

2.10.1 Energy Efficiency Service Market

Besides energy efficiency improvement stimulated by policies and measures on the different levels, there is also some autonomous energy efficiency development in the market. Part of this improvement has been realised with the help of energy efficiency

service (EES) providers like, e. g., energy consultants, auditors and energy service companies (ESCOs) offering, amongst others, energy performance contracting.

The number of EES providers and the value of the EES business have increased in recent years due to a variety of favourable factors: increasing energy prices, improved general framework and specific policies and measures inducing energy efficiency improvement measures, successful agenda-setting on energy efficiency, good practice examples that show the benefits of energy efficiency improvement measures, and increased trust in energy efficiency service providers.

A recent analysis of the EES business in the 18 countries and regions participating in the European "ChangeBest" project (www.changebest.eu) has revealed a significant heterogeneity among the various national EES markets in the European Union. The markedly different national framework conditions and the different history of these markets have led to large differences in terms of EES market development status, EES providers acting on these markets and relationships among these providers, as well as different needs in terms of energy policy instruments or commercial initiatives that may be undertaken to foster EES market development in the various countries.

The country analyses of 18 EU Member States have shown that the EES markets in Germany, Denmark, Flanders (part of Belgium) and France are more or less *well developed,* whereas *moderately developed* EES markets exist in Italy, Sweden, the Netherlands, Czech Republic and Austria. On the other hand the EES market is described as *not well developed (or emerging)* in Portugal, Spain, Latvia, Slovakia, Slovenia and as *at a very preliminary development stage* in Estonia, Poland, Bulgaria and Greece.

As for the existing EES offers, the country analyses indicate that local administrations, industrial companies and hospitals are the customer groups for which a better developed EES market exists in the 18 countries covered, whereas the EES markets in public housing, the retail and the residential sectors are usually ranked at the lowest development stage. The EES market for ESCOs appears in general as more developed than the EES market generated by energy companies in all demand sectors, except for the residential one where the energy company EES market seems to be more mature on average. Particularly in the sectors of health/hospitals, public housing, industry and universities, the ESCO activity level seems to be significantly higher than the one reached by energy companies.

Concerning technologies and fields of application for EES, energy efficiency improvement measures addressing building envelope insulation and heating systems, outdoor and indoor lighting, and renewable energy (e.g. biomass and solar) technologies are the sector cross-cutting technologies mostly indicated in the country reports as typically addressed by the provision of EES.

The very heterogeneous shapes of EES products can be categorised into the consecutive stages of a "value chain" of EES products. Such stages are: awareness raising, information and energy advice, identification of measures, technical planning, financing

and subsidies, implementation (operation, supervision), optimisation of technical operation, saving measurement and verification.

Concerning the positioning of EES providers in the EES product value chain, the identification of measures and their implementation are obviously the EES value chain stages which EES providers mostly focus on, whereas financing and saving measurement and verification are the value chain stages less frequently considered by these providers. The country analyses also confirm that energy companies are typically more involved in awareness raising activities than ESCOs, whereas on average ESCOs are much more focused on all the other value chain stages (notably on energy saving measurement and verification and on optimisation of technical operation).

In general a potential for new and promising EES has been highlighted for all main sectors/customer groups in all the countries considered, notably for EES related to the building sector.

Concerning EES provider financing, the analysis in the 18 countries covered by the "ChangeBest" project revealed that EES provider financing and third party financing is now a common practice in several countries. Nevertheless the various financing opportunities offered are typically guaranteed by the borrower's private assets and the risks for energy efficiency projects are rarely transferred to EES providers or to other financing bodies. Energy Performance Contracts (EPCs) are still rare in several countries. One problem with EPCs concerns the guaranteed performance that should be provided by EES companies. This often requires reliable monitoring of the energy savings achieved, for which comprehensive and therefore costly and time consuming measurement protocols need to be set up. Another typical problem that emerged with EPCs are the risks that EES companies are running associated with accounts receivables. Since the payments to be received from EES customers have the risk of default, a special 'guarantee fund' raised by the government could typically be a way to reduce this risk.

Finally, with regard to the policies and measures that influence EES market development the following categorisation can be made:

- Policies and measures specifically targeting EES companies. A policy is considered to specifically target EES companies or their activities when they are clearly mentioned as the target group in the sources used, or when the policy measures facilitate the provision of EES by these companies. The policy measure can stimulate the supply of EES, the demand for EES, or both. Examples are the accreditation/certification of ESCOs or EES offered, the establishment of platforms for ESCOs with common interest, specific support for ESCOs (e.g. financial support), or legal arrangements, often regarding the removal of barriers for ESCOs.
- Policies and measures creating or supporting general mechanisms for an EES market like white certificate schemes or other mechanisms referred to in Chapter 3.3.1.

- Policies and measures stimulating directly one or more EES activities, such as raising awareness, providing information, advice on saving measures, technical planning and monitoring of results.
- Policies and measures stimulating energy savings and thereby EES activities indirectly or
- Policies and measures restricting the (commercial) market for EES and thus are a barrier towards energy efficiency service market development, like some regulations for public tendering or for the scope of products offered by municipal EES providers, regulation of heat markets in some countries, or tax law.

These policies and measures can be all found in Europe, but not in every Member State.

2.10.2 Intermediaries: Agencies and non-governmental actors

While traditionally energy efficiency used to be a task for governments primarily, the range of private, public-private or public intermediaries active in this field has recently become much more diverse throughout Europe.

Most EU Member States have established independent energy agencies that are however usually funded by and work on behalf of national governments (cf. chapter 3.3.1.1). In addition, numerous non-governmental actors such as environmental (and other) NGOs, consumer organisations, research institutes/universities, large energy companies, local utilities, commercial consultants, public-private partnerships, etc. are also promoting energy efficiency improvement in one way or another.

In doing so, these intermediaries focus on a variety of societal priorities associated with energy efficiency (often with an emphasis on local or regional aspects), which are seemingly not being addressed solely or sufficiently by governmental activities.

The numerous and very diverse services that these intermediaries offer include: provision of information and advice, energy audits, promotion activities, education, training, lobbying, dissemination, project initiation, management and coordination between projects, technology procurement, demonstration activities, network-building, awareness raising and organising campaigns.

This development often goes along with the energy efficiency topic being hosted under a broader agenda such as climate change mitigation, sustainability, or simply “going green”. The widening of the focus has obviously brought numerous new actors into play and has thus also helped to increase awareness and visibility of the energy efficiency issue. In addition, by slightly shifting the perspective, the new, non-governmental intermediaries also appeal to a more diverse range of motives – i.e. instead of simply seeking to use energy more efficiently (which is not necessarily very attractive by itself), end-users are becoming more aware of their contribution to sustainability and envi-

ronmental protection (cf. Heiskanen et al. 2009; further information is available at http://www.energychange.info).

3 Fact Sheets on Selected Policy Instruments

3.1 Overview

This chapter is to give more detailed insights into the variety of policy options that are in general available to policy makers aiming to promote energy efficiency improvement. It further aims to give an overview of and outline the most relevant policies and measures (in terms of scope, success and/or being innovative) that are currently being used throughout Europe.

Following the brief introduction of possible ways of categorising energy efficiency policies and measures in section 3.2, we will cover in further detail the most relevant types of instruments in section 3.3.

Each of the selected instruments will be briefly described on the basis of the following criteria:

- Type (Category)
- Typical circumstances in which to apply this instrument (e.g., market situation, barriers being faced, actor constellation)
- Characteristics that typically determine the success (target achievement, cost effectiveness)
- Key monitoring information which helps to explain success or failure.

As a complement to this more general analysis, we will also present for each of the selected instruments one explicit, actually implemented good practice example.

3.2 Categorisation of policy instruments

Below, we provide a brief overview of the various types of policy instruments that may be used to improve energy efficiency. Broadly speaking, these can categorised as follows:

- quantitative targets (quantity control, i.e. savings quotas, with or without certificate trading),
- fiscal incentives, i.e. price control via taxation or subsidies (e.g. taxes on energy consumption, financial assistance such as direct subsidies, tax allowances etc. to encourage investments in energy efficiency),
- minimum energy efficiency standards and/or maximum energy consumption standards (regulatory provisions establishing a minimum level of efficiency to be achieved by products, buildings, etc.),
- information, advice and training; in particular,

  - energy consumption labelling (labelling, energy performance certificates)
  - smart metering and other feedback measures

- energy efficiency in public procurement (efficiency criteria and bundling of demand to influence the supply side of technology markets), and
- technology/R&D promotion. Here, it is important to provide financial support for basic research, pilot projects and field tests in the energy-efficiency technology sector. The development of new technologies has positive external effects, which means that without such support, the level of investment will be sub-optimal from a macroeconomic perspective.

Other categorisation approaches are also possible, though. For example, the concept for an ideal policy portfolio presented in chapter 4.2 below aims to effectively bundle measures from the following five overarching categories into comprehensive policy packages:

- eliminating distortions,
- installing a support framework for energy efficiency activities,
- enhancing demand for energy-efficient products and services,
- improving products and services, and
- development of infrastructures.

3.3 Description of policy instruments

3.3.1 Establishing a supportive framework

3.3.1.1 Energy agencies and climate protection agencies

As already described in Chapter 2.10.2, energy agencies and climate protection agencies can play a major role as intermediaries that fulfil diverse co-ordinating and initiating functions. These agencies are often fully or partly financed by the state and usually act as independent organisations.

The numerous and very diverse services that agencies usually offer include: provision of information and initial advice, initial energy audits, promotion activities, education, training, dissemination, co-ordination of projects and programmes, demonstration activities, network-building, awareness raising and organising campaigns.

Table 3: Agencies (e.g. energy agencies, climate protection agencies)

Type of instrument	Information, motivation, co-ordination, networking (partly also financing)
Typical circumstances in which to apply this instrument	When an overall co-ordination is needed When overall campaigns are needed
Success factors (target achievement, cost-effectiveness)	Independency: independent from singulair interests of specific political parties or market actors Sufficient competences and resources Headed by person with persuasive power and good (political) networking
Key monitoring information to explain success or failure	Evaluation of specific programmes / activities rather than evaluation of the organisation as such
Examples	German Energy Agency (see below) Energy Agency of North Rhine-Westphalia (see below) Berlin Energy Agency (strategic partnership with city of Berlin on energy performance contracting projects, etc.); cf. http://www.berliner-e-agentur.de/index.php?idcat=38

Figure 9: Activities and competences of German Energy Agency (dena)

Source: www.dena.de

Figure 10: Target groups, activities and topics of Energy Agency of North Rhine-Westphalia (Germany)

Source: Based on: www.energieagentur.nrw.de

Table 4: Energy Agency of North Rhine - Westphalia

Title (name of policy instrument)	Energy Agency of North Rhine-Westphalia
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	Strategic platform with wide-ranging competence in the energy domain: from the all-through funding of research, technical development, demonstration and market launch to initial energy consultancy and continuous vocational training.
Status	On-going
Period: Starting year, ending year	Since 1990
Region / Country	North Rhine-Westphalia, Germany
Sector / Subsector in focus	Mainly addressing commerce, industry and public authorities / municipalities
Actors responsible for policy implementation	Agency carries out programmes by itself, contributes to programmes on federal or European level, or co-operates with other actors on state level
Target group (i.e., actors responsible for uptake of concrete measures)	Diverse depending on programme
Other actors affected by the policy Who benefits? Who pays?	 Commerce and Industry, Public authorities Taxpayers
Quantified Target	No overall quantified target
Financing	State of North Rhine-Westphalia
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	Different evaluations of single programmes by the agency, and overall reports exist
Technologies and services: implemented measures, innovations induced	Diverse
Target achievement: quantitative impact: energy savings (absolute, relative)	Programmes are often difficult to evaluate. For some programmes, qualitative impact assessments are available.
Cost effectiveness (government cost, other costs, net energy cost savings)	Can hardly be quantified.
Co-benefits	Diverse depending on programme
Replicability	There are several agencies like this one in Europe.
Reference	http://www.energieagentur.nrw.de/

3.3.1.2 General mechanisms supporting energy efficiency programmes

Energy efficiency mechanisms are *„general instruments used by governments or government bodies to create a supportive framework or incentives for market actors to provide and purchase energy services and other energy efficiency improvement measures“* (Art. 3 (f), Energy Services Directive 2006/32/EC). This approach to energy efficiency improvement has become increasingly relevant throughout Europe in recent years.

A few EU Member States already have substantial experience, sometimes built up over decades, in setting up such supportive frameworks. Usually, two approaches for establishing an energy efficiency mechanism are distinguished: the government can establish the requisite framework either via an energy efficiency obligation / mandatory savings target (with or without certificate trading), or via an energy saving trust (including, if appropriate, an obligation for the energy industry to provide funding).

A third option, not yet implemented, is financial remuneration for feeding ‘negawatts’ into the grid. Here, the implementation of energy efficiency programmes is promoted by paying a fixed amount per saved unit of energy instead of setting a quantitative savings obligation similar to feed-in laws for renewable energies.

In these systems (especially the obligation-based solutions), energy companies play a far greater role in supporting energy efficiency improvement than it is usually the case with ‘conventional’ policy instruments.

3.3.1.2.1 Energy efficiency obligations and white certificate schemes

In an increasing number of countries, energy efficiency obligations are being used as a relatively new, innovative policy instrument by which to promote end-use energy efficiency and energy savings. By now, five European countries as well as several US and Australian states have already established such a system. Other EU Member States such as the Netherlands, Poland, Bulgaria and Romania are considering its implementation.

Under such schemes, parts of the energy supply industry (suppliers or distribution system operators) are obligated by statute to achieve a set volume of energy savings by means of demand-side efficiency measures. In order to prevent competitive distortion, these schemes generally only obligate companies from a certain size upwards (in terms of turnover or numbers of customers). The overall savings target is apportioned among the obligated actors in accordance with their respective market shares. These actors must furnish proof to a competent authority that they have achieved a corresponding quantity of energy savings.

In order to meet the targets imposed upon them, the companies concerned must motivate final consumers to carry out concrete energy efficiency measures. In most

schemes this is done primarily by creating financial incentives, but some systems also deploy other kinds of measures (e.g. free or subsidised energy audits).

Systems that, in addition to setting a savings quota, also allow for market trading of certified savings among obligated actors and/or third parties are termed ‘white certificate’ schemes. Similar to the way in which emissions trading functions, the purpose of the trade component is to ensure that, thanks to the market mechanism, a politically desired quantity of energy savings can be generated at least societal cost. Actors able to achieve energy savings at a marginal cost below the certificate price will thus continue to produce certificates beyond their own quota and offer these on the market until their marginal cost is equal to the price. Conversely, companies only able to meet their obligation at a higher marginal cost will buy certificates on the market as long as this is cheaper than performing energy efficiency measures themselves. Thus, in such a system, the marginal compliance costs of all obligated parties converge, and the environmental policy goal is attained at least cost.

Table 5: Energy efficiency obligations / tradable white certificate schemes

Type of instrument	Energy efficiency obligations / tradable white certificate schemes
Typical circumstances in which to apply this instrument	When aiming at energy savings in large end-user groups being difficult to address by energy efficiency services. When knowledge and institutional barriers play a role.
Success factors (target achievement, cost-effectiveness)	Is the target clearly set beyond business-as-usual? Is measurement and verification of savings possible at low cost, e.g. by standardization of energy saving measures? Is the cost-recovery mechanism (energy companies' costs passed to end-users) clear and transparent? Are there penalties in case of non-compliance? Are penalties set at such a level that target achievement is stimulated? Are financial incentives needed to stimulate end-users to implement EE measures? Is the market for tradable certificates transparent and reliable? Is there undesired overlap with other instruments? Are there penalties in case of non-compliance? Are penalties set at such a level that target achievement is stimulated? Are financial incentives needed to stimulate end-users to implement EE measures Is the market for tradable certificates transparent and reliable? Is there undesired overlap with other instruments?
Key monitoring information to explain success or failure	Number and type of end-users approached (for each energy company) Number and type of end-users that have implemented energy saving measures based on activities (energy audits, leaflets, rebates, etc.) by the energy company Number, variety and (additional) costs of energy saving measures implemented Penetration levels of energy saving measures within the target group(s) Number of non-compliant energy companies Number of sanctions Amount of permits traded, price of permits and liquidity of the market
Examples	Carbon Emission Reduction Target - CERT (UK) (see below) White Certificate Systems in France and Italy Utilities Saving Obligation in Denmark (for comparisons of the European White Certificate Schemes cf. Eyre / Pavan / Bodineau 2009; Bertoldi / Rezessy 2009)

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 6: Good practice example of energy efficiency obligation – CERT (UK)

Title (name of policy instrument)	**Carbon Emissions Reduction Target (CERT)**, formerly called Energy Efficiency Commitment (EEC)
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	CERT requires energy suppliers of gas and electricity to raise energy efficiency of private households providing overall lifetime carbon dioxide savings. Energy suppliers can provide various measures to households including e.g. house insulation, boiler replacement and energy saving lamps. The programme imposes energy suppliers to put special focus inter alia on low-income households, since particular barriers exist in connection with energy efficiency measures for these target groups. CERT interacts with several UK and European policies.
Status	**Ongoing**
Period: Starting year, ending year	2002-2005: EEC (first phase) 2005-2008: EEC (second phase) **2008-2011: CERT (current phase)**
Region / Country	**United Kingdom**
Sector / Subsector in focus	**Private households**
Actors responsible for policy implementation	All **domestic energy suppliers** (having a customer base in excess of 50,000 customers)
Target group (i.e., actors responsible for uptake of concrete measures)	**Private households** (with special focus on vulnerable and low-income households, keyword: "priority group obligation")
Other actors affected by the policy Who benefits? Who pays?	**Households and especially low-income** households benefit from CERT since energy-saving measures lead to lower energy bills and help alleviate fuel poverty. It is estimated that on average the annual benefit will amount to approx. £ 35 per year for the lifetime of the measures (due to lower fuel bills and increased comfort and in today's money). Measures are funded by the obligated suppliers, but the costs are passed through to end-users to the extent possible.
Quantified Target	A carbon emissions reduction target of 154 Mt CO_2 has been declared in 2008 for the three-year phase 2008-2011. The carbon emissions reduction target has been further raised by an additional 20 % in 2009. **The revised target for the period 2008-2011 amounts to lifetime savings of 185 Mt CO_2**. This is equate to annual savings of about 5.3 Mt CO_2 by 2011. This target is divided between obligated energy suppliers depending on the amount of domestic costumers they supply electricity or gas to.
Financing	Measures are **funded by the obligated suppliers** but most likely costs will be passed on to consumers to a certain degree via energy prices.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**Ex ante evaluation** is carried out within impact assessments, e.g. in the context of the upgrading of the carbon saving target by 20% in 2009 (Impact Assessment available online: http://www.decc.gov.uk/en/content/cms/consultations/open/cert/cert.aspx). **Ex post evaluation** is done by the Office of the Gas and Electricity Markets (Ofgem).
Technologies and services: implemented measures, innovations induced	Energy suppliers offer **different measures**, such as measures in the field of insulation, heating and lightning as well as innovative measures including solid wall insulation and micro CHP. The monitoring report published in February 2010 by Ofgem shows that **insulation measures make up the largest part** of the total savings since they account for approx. two-thirds of the savings (monitoring reports available online: http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/CU/Pages/CU.aspx).
Target achievement: quantitative impact: energy savings (absolute, relative)	The monitoring report published in February 2010 by Ofgem reveals that **73 % of the CERT target of 185 Mt CO_2 by 2011 has been achieved** by then. It is therefore estimated that the target will be overachieved, as it had always been the case in the previous obligation periods.

Cost effectiveness (government cost, other costs, net energy cost savings)	The impact assessment in the context of upgrading of the carbon saving target by 20 % in 2009 revealed that net resource cost over the programme for all parties is approx. £5.3 billion (suppliers' share: £3.2 billion). The **Net Present Value (NPV) is estimated at PV £14.3 billion** (including external benefits).
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction of green-house gas emissions, CERT leads to **economic benefits** (e.g. long-term savings due to reduction of fuel expenditures) and **social benefits** (e.g. alleviation of fuel poverty).
Replicability	National systems involving energy efficiency obligations have been introduced in various other countries across Europe, e.g., in Italy, France, Denmark, and Belgium (Flanders re-gion).
Reference	http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/cert/cert.aspx http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Pages/EnergyEff.aspx

3.3.1.2.2 „Feed-in tariffs" for certified energy savings

Whereas mandatory target or savings obligation systems set a quantity of savings to be achieved and the resulting price per kWh saved is consequently determined by market activity, there is also the option of fixing the price for certified savings instead (so-called price control mechanism). The successful German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) is based on such an approach, where the desired political goal (a certain share of renewables) is to be reached by price control, i.e. whoever feeds renewable energy into the grid, is guaranteed a certain amount per kWh.

The principles of a fixed remuneration for feed-in and levy funding of the system that are being used for the EEG could in principle be equally applied to energy efficiency. For instance, a fixed price of 1.5 Eurocent/kWh saved would be paid to providers of energy efficiency programmes, manufacturers or importers of energy-efficient technologies. So far, however, such „Negawatt" feed-in tariffs are only being discussed, by scientists mainly, but have not been implemented in practice yet.

In any case, a feed-in tariff would need to be complemented by sector- and technology-specific programmes that target implementation barriers. System optimisation which is necessary to fully realise the existing saving potentials would also have to be addressed separately, because it is not promoted by such a system focussing on single technologies and default measures (Pehnt et al. 2009).

Table 7: „Feed-in tariffs“ for certified energy savings

Type of instrument	„Feed-in tariffs“ for certified energy savings
Typical circumstances in which to apply this instrument	When incentives to invest in energy efficiency are lacking and long-term investment security shall be created for planners, investors, and providers of energy efficiency (especially with respect to energy-efficient cross-cutting technologies)
Success factors (target achievement, cost-effectiveness)	Is the level of remuneration („tariff“) high enough to induce investment, but also low enough to prevent inefficiencies due to excess support? Does the system provide incentives for further technology development / innovation and cost degression, e.g., via the degression of remuneration rates? Are the ways how to prove achieved savings („feed-in“) specified? Will the system be adapted over time according to technological progress and market transformation?
Key monitoring information to explain success or failure	Amount of certified savings achieved Is the political target (i.e., a quantity of energy saved) met or over-/underachieved?
Examples	Not yet implemented, but being discussed, e.g., in Germany and also on EU-level

Source: Wuppertal Institut, based on Ecofys et al. (2006)

3.3.1.2.3 Energy saving trusts

An energy saving trust is another potential mechanism for the organisation and financing of efforts to promote energy efficiency. Here, the government sets up a central body which tenders, provides funding for, and if appropriate, also implements integrated energy efficiency programmes.

The trust thus supports coordinated implementation of mixed schemes for the promotion of energy efficiency, comprising financial support (e.g. bonus programmes, direct installation of energy-efficient technologies, low-interest loans) and information programmes (e.g. motivation, advice, energy audits, cooperation with and training for multipliers, labelling, bundling of demand, etc.). Hard and soft measures targeted at a specific energy application (e.g. domestic appliances) can thus be coordinated within the framework of the trust, thereby creating synergies which would not be achieved if separate organisations implemented these hard/soft measures on their own.

In this context, “hard” measures are those which directly trigger specific and quantifiable savings, e.g. through economic incentives such as bonuses and through regulations (standards); “soft” measures, on the other hand, focus solely on informing/motivating actors. They do not have a price-driven effect on individuals’ calculation of potential benefits, but merely improve the basis for decision-making.

Establishing this type of centralised body with a remit to promote energy efficiency can also help to boost networking among stakeholders (energy companies, manufacturers, suppliers, the skilled trades etc.). The network effects thus produced can help to boost

information flows and more rapid diffusion of innovative approaches, generally reducing the costs of accessing information and harnessing energy efficiency potentials.

In terms of funding, various options are available: the trust may be financed from general tax revenue, from an energy tax, from revenues from emissions trading, or via a new ringfenced levy paid by end-users or the energy companies (for further information about possible funding schemes, cf. Irrek/Thomas 2006, p.83f.). An energy saving trust – unlike an obligation-based solution – does not necessarily involve the energy industry. Nonetheless, an obligation for energy companies to (co)finance a fund is an option which is also mentioned in the Energy Services Directive. Regardless of which type of funding scheme is selected, the energy companies may apply to and access support from the fund, as appropriate, in order to finance energy efficiency schemes.

An energy saving trust can either offer an alternative to, or can complement, an obligation-based solution. Denmark and the United Kingdom are examples of the latter approach. The trust can then offer targeted support programmes for sectors/technologies which are likely not to be covered by an obligation scheme because they are not suitable for the type of standardised programmes usually provided by energy companies. The trust is also the way to finance measures for which accurate monitoring and verification of the savings effect – essential in an obligation-based scheme – are too complicated or the exact savings are impossible to quantify (e.g. information campaigns, energy advice, R&D funding).

Table 8: Energy saving trusts

Type of instrument	Energy saving trust
Typical circumstances in which to apply this instrument	When nationwide support programmes are to be launched (e. g., financial incentives for combinations of energy-efficient technology and technology-specific advice) When co-ordinated packages of measures (e.g., financial incentives along with information campaigns) are to be implemented When measures with hard-to-quantify saving impacts are to be implemented
Success factors (target achievement, cost-effectiveness)	Is the political target (i.e., a quantity of energy saved) met? Are the activities of the trust efficient in terms of costs and benefits (to be assessed by independent evaluator)? Is the trust well-known as *the* relevant national actor for all energy efficiency issues?
Key monitoring information to explain success or failure	Amount of additional energy savings achieved Money spent
Examples	Danish Electricity Saving Trust (see below) Energy Saving Trust and Carbon Trust in the UK (http://www.energysavingtrust.org.uk/ ; http://www.carbontrust.co.uk) Norwegian Energy Fund (managed by the public energy agency Enova) http://www.iea.org/Textbase/pm/?mode=re&id=745&action=detail ; http://www.enova.no

Table 9: Good practice example of an energy saving trust – Elsparefonden (DK)

Title (name of policy instrument)	**The Danish Electricity Saving Trust (Elsparefonden)**, hereinafter "Trust"
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The Trust **aims at increasing electricity savings and more efficient use of electricity** in households as well as in the public sector in accordance with environmental and economic considerations.
Status	**Ongoing**
Period: Starting year, ending year	**1997:** establishment of the Trust
Region / Country	**Denmark**
Sector / Subsector in focus	**Households** and **public sector**
Actors responsible for policy implementation	The **Danish Electricity Saving Trust** is responsible for policy implementation, usually in cooperation with relevant market actors. The Trust is an independent organisation under the auspices of the Danish Ministry of Climate and Energy that appoints a Board consisting of nine directors that are acting as supervisor of the Trust.
Target group (i.e., actors responsible for uptake of concrete measures)	**Households** and **public sector** (and large consumers of electricity)
Other actors affected by the policy Who benefits? Who pays?	End-users in the target sectors pay for the activities of the Trust via the Special Electricity Savings Charge (cf. Financing). However, they are also the ones who can benefit from the Trust's programmes.
Quantified Target	The following target has been declared within the "Electricity Savings Action Plan 2009": new **annual electricity savings of 150 GWh per year in the period 2007 to 2009** shall be generated by activities of the Trust (equal to 1 % of the electricity consumed by households and the public sector). Therefore, total savings in the period 2007 to 2009 amount to 450 GWh. This represents a doubling of the yearly savings target as compared to the first 10 years of operation.
Financing	In order to set up the Trust, there has been a start-up funding from general tax revenue. Since 1998, however, the Trust is funded by a direct tax on electricity – called **Special Electricity Savings Charge –** which amounts to **DKK 0.006/kWh** (0.08 Eurocent/kWh) and is payable by households and the public sector. The total annual earnings amount to approx. DKK 90 million (EUR 12 million). Savings generated by the measures of the Trust are expected to be considerably greater than the costs in terms of the Special Electricity Savings Charge.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**External consultants are charged with the evaluation** of all the Trust's important projects and campaigns. There have been two such evaluations until today, the most recent one took place in 2004.
Technologies and services: implemented measures, innovations induced	**Four fields of activity** have been defined by the Danish Electricity Saving Trust: 1) Public sector and large consumers of electricity 2) Households 3) Electricity heating 4) Product development, Internet activities, recommended products lists and publicising electricity consumption.
Target achievement: quantitative impact: energy savings (absolute, relative)	The evaluation of the Trust by external experts in 2004 revealed that the Trust has achieved major electricity savings. The overall target of the Trust for the years 1998 to 2007 was to achieve annual electricity savings of 750 to 800 GWh in 2007 (i.e., 75 GWh/year). In the evaluation it is stated that targets are most likely to be overfulfilled with estimated **annual electricity savings of approx. 1,000 GWh in 2007**.

Cost effectiveness (government cost, other costs, net energy cost savings)	According to evaluation of the Trust by external experts in 2004, the **proceeds of the Trust have been used efficiently**: Benefits (i.e., electricity savings) are more than ten times higher than the electricity saving charge collected. According to the "Electricity Savings Action Plan 2009", the secretary overhead of the Trust amounts to DKK 9 million. This is equal to a share of approx. 10 % in the total annual proceeds of approx. DKK 90 million.
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction of greenhouse gas emissions, the Trust leads to **economic benefits**, e.g. long-term savings due to reduction of fuel expenditures.
Replicability	Energy saving trusts also exist in the UK, in Norway and in numerous US states (so-called Public Benefit Programmes).
Reference	http://www.savingtrust.dk

3.3.2 Other energy efficiency improvement policies and measures

3.3.2.1 Energy taxation, removal of energy subsidies, and other regulatory framework relevant for the energy (efficiency) sector

The general regulatory framework can be shaped in a way that it is conducive to energy efficiency improvement and energy saving. This includes fiscal instruments such as energy taxes or the removal of counterproductive subsidies of fossil and nuclear fuels. Such measures aim at internalising the external costs of energy use, and thus strengthening the incentives of end-users to use energy more efficiently by way of sending out the correct price signals.

Table 10: Energy taxation

Type of instrument	Energy tax
Typical circumstances in which to apply this instrument	When a large target group is to be addressed. When external costs are to be internalised. When energy demand is sufficiently price elastic.
Success factors (target achievement, cost-effectiveness)	Is the target group aware of the existence and planned development of the instrument? Is the use of the tax revenue accounted for and well-founded (e.g. for sector- and technology-specific policy instruments aimed at energy efficiency improvement)? Are competitiveness issues being taken into account? Are tax exemptions for certain target groups creating incentives for implementing energy efficiency measures?
Key monitoring information to explain success or failure	Economic impacts to be estimated by adequate economic models on macro (or meso) level Additional questionnaires on behaviour / decision-making of market actors.
Examples	So-called eco-taxes are imposed on energy consumption in many countries all over the world; e.g., in Germany taxes on electricity and fossil fuel are increased stepwise while at the same time the cost of labour is decreased (see below).

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 11: Ecological tax reform in Germany

Title (name of policy instrument)	**Ecological tax reform in Germany**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The ecological tax reform came into effect in Germany in 1999. The general aim of the reform comprises a reduction of Germany's environmental impact by means of an **increase in energy taxes**. More precisely, energy taxes on fossil fuels and electricity have been introduced in stages creating incentives for citizens to save energy. Simultaneously, the revenues incurred by government have been spent for a direct **reduction of non-wage labour costs**, mainly for a reduction of employers' and employees' payments to the pensions fund. Moreover, revenues incurred are, inter alia, used for the support of renewable energies as well as for the improvement of energy performance of buildings. The ecological tax reform interacts with several national as well as European policies.
Status	**On-going**
Period: Starting year, ending year	1999-2003: **introduction of the ecological tax reform in Germany** (five stages) 2003-2004: modifications, predominantly focussing on the reduction of subsidies 2006-2007: restructuring of energy taxation (electricity, fossil fuels and bio fuels) 2007: proposal to reduce energy taxes for those companies installing energy management systems
Region / Country	**Germany**
Sector / Subsector in focus	**Sector-crossing** with sector-specific characteristics (privileges for some sectors, e.g. for the manufacturing industry)
Actors responsible for policy implementation	**Tax offices** are responsible for collecting the additional taxes on energy.
Target group (i.e., actors responsible for uptake of concrete measures)	The target group includes **all consumers of energy in Germany.** However, consumers are more or less affected by ecological tax reform since e.g. lower ecological taxes have been agreed for some industries.
Other actors affected by the policy Who benefits? Who pays?	**Various market actors** are affected by the ecological tax reform. In the industry sector, some companies benefit from the ecological tax reform while others are disadvantaged. For instance, companies producing labour-intensive products benefit from the reform since the reform leads to a reduction of employers' payments to the pension fund.
Quantified Target	**Not quantified** (Qualitative target: Increase in energy taxes and reduction of non-wage labour costs.)
Financing	According to report that has been elaborated by the German Institute for Economic Research in association with Ecologic in 2005 (http://ecologic.eu/node/1155), the revenues due to the introduction of the ecological tax reform amounted to **€ 18.7 billion in 2003**. Approx. 90 % of the money (€ 16.1 billion) was spend for a reduction of employers' and employees' payments to the pensions fund.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**Ex post evaluation** is done within the study by the German Institute for Economic Research and Ecologic: The study points out, that the ecological tax reform **contributes to climate projection, has a positive effect on the labour market and supports market penetration of efficient technologies**. For instance, without the ecological tax reform, payments to the German pension fund would have gone up by at least 1.7 % in 2005 and additional 250,000 jobs would have been lost.
Technologies and services: implemented measures, innovations induced	The **taxes on fossils fuels, gas and heating oil** have been raised and a tax on **electricity** has been introduced. For instance, taxes on petrol and diesel have been raised by a total of € 0.15 per litre between 1998 and 2003. Innovations have been induced, e.g. sales of natural gas cars have increased.
Target achievement: quantitative impact: energy savings	According to the study by German Institute for Economic Research and Ecologic, the ecological tax reform contributes to a restructuring of Germany's tax system in a way that activities leading to environmental pollution are burdened with higher taxes.

(absolute, relative)	These additional taxes on energy create incentives for energy saving and for a reduction of greenhouse gas emissions. It is estimated that the reform leads to an annual CO_2-reduction of the order of approx. **20 Mt CO_2 per year**.
Cost effectiveness (government cost, other costs, net energy cost savings)	There are **government costs** for the introduction of the tax reform. Furthermore, there are additional costs for collecting the ecological taxes. Net cost savings cannot be quantified.
Co-benefits	Besides environmental benefits in terms of a substantial contribution to a reduction of energy consumption and of greenhouse gas emissions, Germany's ecological tax reform leads to **labour market benefits** (labour becomes cheaper due to the reduction of non-wage labour costs).
Replicability	Ecological taxes are imposed on energy consumption in many countries all over the world.
Reference	http://www.bmu.de/english/ecological_industrial_policy/ecological_financial_reform/doc/4328.php http://www.bmu.de/wirtschaft_und_umwelt/oekologische_steuerreform/doc/41248.php http://www.bundesfinanzministerium.de/nn_53848/DE/BMF__Startseite/Service/Glossar/O/001__Oekosteuer-Oekologische_20Steuerreform.html?__nnn=true?__nnn=true

3.3.2.2 Voluntary or negotiated agreements

Voluntary agreements with manufacturers of energy-using appliances and installations can be an alternative to legally binding standards when it comes to implementing maximum energy consumption requirements. For instance, such voluntary agreements of manufacturers are possible within the framework of the Eco-design Directive as an alternative to mandatory implementing measures issued by the European Commission.

All kinds of voluntary or negotiated agreements have in common that they are based on the solidarity of participants, thus leading to new forms of communication and co-operation in the sectors concerned. Their ecological effectiveness depends on the agreement on and the realisation of concrete and ambitious reduction targets, accurate and independent evaluation procedures and effective penalties in case of non-compliance with the targets (Dalkmann et al. 2005).

Table 12: Voluntary agreements

Type of instrument	Voluntary or negotiated agreements to save energy (industry, services sector) or improve energy efficiency (e.g. cars or appliances)
Typical circumstances in which to apply this instrument	When dealing with a small number of actors with which you need to negotiate or a strongly organised sector When there is much relatively cheap saving potential (low hanging fruit).
Success factors (target achievement, cost-effectiveness)	Is the target group motivated to participate in the voluntary agreement? Is the target set beyond business-as-usual? Are there penalties in case of non-compliance (or are there other incentives in place to prevent non-compliance, e.g. a rebate on energy tax, or is there a regulatory threat in case of non-compliance)? Is there a good monitoring system in place?
Key monitoring information to explain success or failure	Number/share of companies in the sector that signed the agreement Share of total sectoral energy consumption accounted for by the participants in the scheme Number of VA compliance plans Number, variety and (additional) costs of energy saving measures implemented Energy savings achieved with implemented projects
Examples	ACEA (European Automobile Manufacturers Association agreement) (cf. Bongardt 2006) LTA (Long Term Agreements) in the Netherlands (http://www.senternovem.nl/LTA/index.asp) Voluntary Agreements in Finland (see below)

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 13: Good practice example of a voluntary agreement scheme – Energy Efficiency Agreements (Finland)

Title (name of policy instrument)	**Voluntary Energy Efficiency Agreement schemes in Finland**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	Voluntary Energy Efficiency Agreement schemes in Finland aim at promoting energy efficiency in various sectors and help Finland to meet its international commitments regarding the reduction of greenhouse gas emissions. The agreements play a decisive role in Finland's national implementation of the Energy Services Directive and in the efforts to reach the national energy savings target. Within the framework of the scheme, companies and municipalities agree to conduct an energy audit, develop an energy saving plan and to carry out cost-effective energy saving measures. In turn, the government susidises the energy audits and in some cases also the implemented measures (when certain criteria are met).
Status	**Ongoing**
Period: Starting year, ending year	Early 1990s: employment of a first voluntary agreement scheme 1997-2007: Energy Conservation Agreements (some agreements are still legally binding) **2008-2016: Energy Efficiency Agreements**
Region / Country	**Finland**
Sector / Subsector in focus	**Various sectors** (e.g. industry and municipal sector)
Actors responsible for policy implementation	**Motiva Oy** – Finland's energy agency – is responsible for reaching Energy Efficiency Agreements. The content of the agreement is elaborated in cooperation with relevant ministries, industry associations, representatives of companies and municipalities as well as Motiva.
Target group (i.e., actors responsible for uptake of concrete measures)	Agreements are made with **various actors**, such as with energy-intensive industries, medium-sized energy users including e.g. food and drink companies, energy services including e.g. district heating companies, cities and municipalities.
Other actors affected by the policy Who benefits? Who pays?	**Energy service companies (ESCOs)** benefit from the agreement scheme since their expertise can be very useful in private and public sector service operations. The companies / municipalities concerned bear the costs for ESCO services. Nevertheless, as the majority of measures is cost-effective, the savings generated by energy efficiency measures generally exceed the costs for ESCO services.
Quantified Target	The energy efficiency target of Finland **for the year 2016 is to achieve annual energy savings of 9 %** of the average annual energy consumption 2001-2005, equivalent to 17.8 TWh. Companies and municipalities define their own individual efficiency targets.
Financing	Measures are **funded by the company or municipality** itself, but government pays **subsidies**, e.g. investment support and subsidies for energy audits.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	An **internet-based monitoring systems** has been installed at the beginning of 2009 which is run by Motiva. Companies or municipalities joining the agreement scheme have to provide data, inter alia on their previous year's energy use. Furthermore, during the subsequent years, energy savings achieved have to be reported annually by the companies / municipalities who signed an agreement.
Technologies and services: implemented measures, innovations induced	Sector-specific **Action Plans** are developed for the Energy Efficiency Agreements. The Action Plans comprise specific measures and obligations to which the companies and municipalities that have signed the agreement are committed. For instance, these measures and obligations include investments in efficient technologies and the arrangement of energy audits. A special focus is put on the support of innovative solutions and on the adoption of new efficient technologies.
Target achievement: quantitative impact: energy savings	The total annual savings achieved of measures under Energy Efficiency Agreements amount to **approx. 9 TWh/a** in 2007 (of which approx. 2 TWh/a electricity savings and approx. 7 TWh/a fuel savings), equivalent to **approx. 2 % of the total energy consumption of Finland** in 2007

(absolute, relative)	(cf. http://www.motiva.fi/files/1348/Finland_Energy_Efficiency_Agreements_2008-2016.pdf).
Cost effectiveness (government cost, other costs, net energy cost savings)	Between 1998 and 2005, subsidies have been granted for energy audits totalling **€ 12.1 million**. In addition, investment subsidies have been granted in the same period totalling **€ 16.5 million**. Furthermore, more than **€ 270 million** have been invested by industry and power plant sector in order to implement the conservation measures. It has been estimated that the annual saving in energy costs achieved between 1998 and 2005 amounts to **approx. € 115 million (**cf. http://www.motiva.fi/files/1446/Energy_Conservation_Agreements_Progress_Review_2005.pdf**)**.
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction of greenhouse gas emissions, the Energy Efficiency Agreements lead to **economic benefits**, e.g. long-term savings due to reduction of fuel expenditures.
Replicability	Voluntary agreements have been introduced in various other countries across Europe, such as in the Netherlands, Denmark, Sweden and United Kingdom.
Reference	http://www.motiva.fi/en/areas_of_operation/energy_efficiency_agreements

3.3.2.3 Energy performance standards for products, processes, buildings

By setting a limit for the allowed energy consumption, energy performance standards can be used to remove the most inefficient products, building technologies, etc. from the market and sometimes also to strive for more ambitious goals. Performance standards can either be made compulsory by law or they can be established on a voluntary basis (cf. previous section). It is a prerequisite for energy performance standards that a valid and accepted methodology for measuring energy consumption and efficiency is either in place or being established.

Table 14: Energy performance standards

Type of instrument	Energy performance standards for products, processes, buildings
Typical circumstances in which to apply this instrument	When dealing with a target group which is unwilling to act (e.g., voluntary agreement not fulfilled) or difficult to address by other policy instruments (e.g., landlord – tenant problem) When aiming at removing the worst products or services from the market When dealing with rather uniform technologies When the achievable energy saving per unit is small, but the total number of units is large
Success factors (target achievement, cost-effectiveness)	Is the standard well-founded, e.g., through life-cycle cost studies? Is the target group well prepared / sufficiently skilled to implement the standard? E.g. through information campaigns, demonstration projects, feasibility studies, training programmes etc. Are there sufficient resources (knowledge, capacity, time, budget, priority) in place to enforce the standard? Are there penalties in place for non-compliance?
Key monitoring information to explain success or failure	Number of checks carried out (permits, buildings) Number of non-compliant permits / buildings Number of sanctions Changes in product range suppliers Number, variety and (additional) costs of energy saving measures Number of buildings constructed according to standard
Examples	Top Runner Programme for appliances, cars (Japan) (cf. http://www.aid-ee.org/documents/018TopRunner-Japan.PDF) Ecodesign Directive (cf. below and chapter 0) Energy Performance of Buildings Directive (cf. chapter 0 and http://www.eceee.org/buildings/) Energy performance standards in many countries worldwide

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 15: Good practice example of an energy performance standard – Ecodesign Directive (EU)

Title (name of policy instrument)	**Ecodesign Directive 2009/125/EC** (recast of the EuP Directive 2005/32/EC)
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The Ecodesign Directive 2009/125/EC establishes a framework for the setting of ecodesign requirements for energy-related products. The Directive is a recast – in terms of an extension to energy related products – of Directive 2005/32/EC that established a framework for the setting of ecodesign requirements of energy-using products. The Ecodesign Directive 2009/125/EC aims at an improvement of environmental performance of certain energy-related products sold on the European market through additional mandatory requirements for CE marking. The Directive interacts with several European as well as various national policies.
Status	**Ongoing**
Period: Starting year, ending year	2005: Directive 2005/32/EC (valid until 2009) 2009: Directive 2009/125/EC (recast) Since 2005: elaboration of implementing measures for selected product groups
Region / Country	**European Union**
Sector / Subsector in focus	**Sector-crossing**
Actors responsible for policy implementation	**Legislative process**: predominantly European Commission (DG Energy, DG Enterprise and Industry) **Manufacturers**: responsible for policy implementation **Market surveillance**: responsible authorities in Member States
Target group (i.e., actors responsible for uptake of concrete measures)	**Manufacturers of products** falling under the Ecodesign Directive, such as heating and water heating equipment, electric motors, lighting in the residential and tertiary sectors, domestic appliances, office equipment in the residential and tertiary sectors, consumer electronics, HVAC (heating, ventilation and air conditioning) systems, etc.
Other actors affected by the policy Who benefits? Who pays?	Ecodesign requirements might require restructuring on manufacturer's side and impacts might also affect other market players along the value chain. Some market players might gain additional market shares while others might not benefit from ecodesign requirements. Market players have to bear the restructuring costs.
Quantified Target	**Not quantified** (Qualitative target: Reduction of environmental impacts of selected products over their life cycle)
Financing	The setting up of the ecodesign requirements (e.g. including the elaboration of Preparatory Studies and the carrying out of the consultation process) is funded by the **European Union**. Cost increases of products due to the implementation of ecodesign requirements are paid by **manufacturers or are passed on to consumers** of the products.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**Ex ante evaluation** is carried out within impact assessments prior to implementing measures. For instance, an impact assessment has been carried out for the product group "refrigerators and freezers (Lot 13)" in 2009, prior to the final implementing measure. **Ex post evaluation** of implementing measures is planned in terms of reviews of the implementing measures.
Technologies and services: implemented measures, innovations induced	Product groups are selected by the European Commission in association with the Member States, stakeholders and other interested parties every three years as part of the "Working Plan". On the basis of the Working Plan, the EU Commission mandates Preparatory Studies for the selected product groups that again serve as basis for ecodesign requirements. The degree of innovations induced by the ecodesign requirements depends inter alia on the quality of the Preparatory Study.
Target achievement: quantitative impact: energy savings (absolute, relative)	At this point in time, **achievements cannot be quantified** since implementing measures for the different product groups have only been adopted very recently or have not been adopted yet.

Cost effectiveness (government cost, other costs, net energy cost savings)	There are **government costs** for the setting of ecodesign requirements, for instance, for the elaboration of the Preparatory Studies. Furthermore, there are **market surveillance costs for Member States** resulting from the establishment of public authorities or from the increase of workforce of existing public authorities in order to guarantee compliance of sold products with passed legislation. Depending on the product group and on the adopted ecodesign requirements, net energy cost savings for consumers can be achieved.
Co-benefits	Besides environmental benefits in terms of a substantial improvement of environmental performance of certain energy-related products, the Ecodesign Directive can lead to **economic benefits for consumers**, e.g. long-term savings due to reduction of fuel expenditures.
Replicability	The establishment of the presented framework for the setting of ecodesign requirements for energy-related products is replicable but requires certain preconditions, such as an existing conformity marking in an economic zone similar to the CE-marking.
Reference	http://ec.europa.eu/enterprise/policies/sustainable-business/sustainable-product-policy/ecodesign/index_en.htm http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm http://www.eup-network.de http://www.ebpg.bam.de/de

3.3.2.4 Energy Labelling

Energy labels aim to inform end-users about the level of energy efficiency of buildings, appliances and installations as compared to products with otherwise identical functionality. They enhance market transparency and can thus help increase the demand for energy-efficient solutions. Energy labels can either be mandatory by law (e.g., the EU energy labelling scheme and its envisaged enhancement under the Ecodesign Directive) or they can be organised on a voluntary basis (e.g., „Blauer Engel“ label in Germany).

The set-up of a labelling scheme can either be based on classes of energy consumption (cp. classes A-G of the EU energy label) or it can only highlight the most energy-efficient products. (cp. GED label for energy-saving consumer electronics).

Table 16: Energy Labelling

Type of instrument	Labelling
Typical circumstances in which to apply this instrument	When there is a knowledge / information barrier When dealing with large consumer or service sector groups When dealing with rather uniform technologies When planning to introduce a performance standard at a later stage
Success factors (target achievement, cost-effectiveness)	Is it foreseen to timely adjust the label to technology progress and market transformation? Is the target group timely and sufficiently informed? E.g. through information campaigns. Is the label clear and transparent? Are there complementary incentives (eco-tax, subsidy, tax exemptions) for stimulating action?
Key monitoring information to explain success or failure	Share of products that carry a label Share of highly efficient products in the sales catalogue Share of consumers who recognize and understand the label Share of consumers who base their buying decision on the label Number of sales of highly efficient products Market share of highly efficient products
Examples	EU Energy Label (see below) Energy Star (cf. http://www.energystar.gov/ ; http://www.eu-energystar.org/)

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 17: Good practice example of an energy labelling scheme – European Energy Labelling (EU)

Title (name of policy instrument)	**European Energy Labelling** (European Council Directive 92/75/EEC)
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The European Energy Labelling Directive aims at an improvement of customer information on the energy consumption (as well as other essential resources) by household appliances, such as, e.g., refrigerators, freezers, washing machines and dishwashers. By means of mandatory labelling and product information, customers are enabled to choose household appliances that are more energy-efficient. Furthermore, the European Energy Labelling Directive helps to harmonise national measures on labelling of energy and other resources across Europe. The labelling is part of Europe's policy instruments for promoting energy efficiency and the European Energy Labelling Directive interacts with several European as well as various national policies.
Status	**Ongoing** Please note: There are plans for a recast of Directive 92/75/EEC and for an extension of its scope. It is planned to stipulate labelling not only for household appliances, but also for all energy-related products in the residential, commercial and industrial sectors as well as some non-energy using products. Moreover, the design and dynamics of the labelling scheme are currently heavily discussed politically. The proposal for the recast of the Energy Labelling Directive is available online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:DKEY=483236:EN:NOT
Period: Starting year, ending year	1992: European Council Directive 92/75/EEC (established framework for labelling) 1994: Directive 94/2/EC (household electric refrigerators, freezers) 1995: Directive 95/12/EC (household washing machines) 1995: Directive 95/13/EC (household electric tumble driers) 1996: Directive 96/60/EC (household combined washer-driers) 1996: Directive 96/89/EC (household washing machines) 1997: Directive 97/17/EC (household dishwashers) 1998: Directive 98/11/EC (household lamps) 1999: Directive 1999/9/EC (amendment: household dishwashers) 2002: Directive 2002/31/EC (household air-conditioners) 2002: Directive 2002/40/EC (amendment: household electric refrigerat., freezers) 2008: Proposal for a recast of Directive 92/75/EEC (extension of the scope)
Region / Country	**European Union**
Sector / Subsector in focus	**Focus on household appliances** (extension of the scope is planned)
Actors responsible for policy implementation	**Legislative process**: predominantly EU Commission (DG Energy) **Manufacturers**: responsible for policy implementation **Market surveillance**: concerned authorities in Member States
Target group (i.e., actors responsible for uptake of concrete measures)	**Manufacturers** of affected products **(**or the authorized representative who places the product on the European market) have to declare energy efficiency according to European Energy Labelling Directive.
Other actors affected by the policy Who benefits? Who pays?	Labelling requirements might require restructuring on manufacturer's side and impacts might also affect other market players along the value chain. Some market players might gain additional market shares while others might not benefit from labelling requirements. Market players have to bear the restructuring costs.
Quantified Target	**Not quantified** (Qualitative target: improvement of customer information on the energy consumption by household appliances and harmonisation of labelling across Europe)
Financing	The setting of labelling requirements is funded by the **European Union**. Costs resulting from implementation of labelling requirements are paid by **manufacturers** (or the authorized representative who places the product on the European market).

	Costs might be **passed on to consumers** of the products.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**Ex ante evaluation** is carried out within impact assessments in the course of legislation. **Ex post evaluation** of European Labelling Directive has been planned in terms of an assessment of its implementation and the results obtained.
Technologies and services: implemented measures, innovations induced	At this point in time, European Energy Labelling is focussed on household appliances, such as refrigerators, freezers, washing machines and dishwashers. The degree of innovations induced by the labelling requirements depends inter alia on the degree of ambitiousness of the labelling.
Target achievement: quantitative impact: energy savings (absolute, relative)	The achievements of the labelling scheme become obvious taking into account **market shares of efficient products** with energy class A (A+/++ in the case of refrigerators and freezers) that **have increased substantially**.
Cost effectiveness (government cost, other costs, net energy cost savings)	There are **government costs** for the setting of labelling requirements, for instance, for the elaboration of directives. Furthermore, there are **market surveillance costs for Member States** resulting from the establishment of public authorities or increase of workforce of existing public authorities in order to guarantee compliance of sold products with passed legislation. Depending on the appliances and on the adopted labelling requirements, net energy cost savings for consumers can be achieved.
Co-benefits	Besides environmental benefits due to an increase of market shares of efficient appliances, the European Energy Labelling can lead to **economic benefits for consumers**, e.g. long-term savings due to reduction of energy costs.
Replicability	The establishment of the presented framework for the setting of labelling requirements is replicable. Various energy labelling schemes exist in other countries, such as, e.g., the U.S. Energy Star Programme.
Reference	http://ec.europa.eu/energy/efficiency/labelling/labelling_en.htm

3.3.2.5 Financial incentives

Financial incentives which can be created by means of fiscal policies and measures or through promotion programmes – e.g., within in the framework of an energy saving trust – are classical instruments for fostering energy efficiency. They are typically used with a view to accelerating the market penetration of certain energy efficiency technologies or services and can thus make an important contribution to increasing the share of best available technologies (BAT) in the stock of buildings, appliances, etc.

Instead of providing direct subsidies, governments can also promote energy efficiency by way of tax breaks (tax exemptions, tax deductions, or tax credits). Then again, one can also increase the tax imposed on goods with above-average energy consumption, an instrument sometimes referred to as „feebates“.

Table 18: Financial incentives

Type of instrument	Financial / fiscal instruments such as soft loans, subsidy schemes, investment deduction schemes, rebates
Typical circumstances in which to apply this instrument	When there is a financial barrier in place When an informative instrument (e.g. energy audit) needs financial incentives to attract the target group When measure implementation is to be triggered by the signalling effect of financial incentives
Success factors (target achievement, cost-effectiveness)	Is the target group aware of the existence of the instrument? Is the financial support sufficient to attract new investments or to carry out energy audits? Is the annual budget for the instrument well-linked to the target? Is the procedure for getting financial support sufficiently known by the target group and simple enough? Do commercial banks have sufficient knowledge and incentive to inform about financing instrument?
Key monitoring information to explain success or failure	Number/share of eligible actors that are familiar with the scheme Number of eligible actors that apply for the scheme Number and variety of rejected projects Number, variety and (additional costs) of granted projects Market share of eligible measures / changes in product range of suppliers (to determine free riders and spill-over) Changes in energy tax / other financial incentives / energy prices
Examples	CO_2-Building-Refurbishment Programme of the German KfW (see below) Subsidies for CHP in Germany (http://www.isisrome.com/mure/output2_ind.asp?Cod=GER3) Tax credits for Energy Star buildings and products (USA) (http://www.energystar.gov/index.cfm?c=tax_credits.tx_index)

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 19: Financial support programmes offered by KfW Bankengruppe, Germany

Title (name of policy instrument)	**Financial support programmes offered by KfW Bankengruppe**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The German KfW Bankengruppe is owned by the Federal Republic of Germany and its federal states. The promotional bank offers financial incentives to various market actors, such as small and medium-sized enterprises or building owners. The bank committed to a policy of sustainable development and programmes offered by the bank, inter alia, support activities in the field of environmental protection and energy-efficiency.
Status	**On-going**
Period: Starting year, ending year	**No general statement possible** (There is broad variety of different KfW-programmes and starting year as well as ending year depend on the programme that the focus is on.)
Region / Country	**Germany**
Sector / Subsector in focus	**Sector-crossing**
Actors responsible for policy implementation	**KfW Bankengruppe** is owned by the Federal Republic of Germany (80 %) and its federal states (20 %) and employs more than 4,000 people.
Target group (i.e., actors responsible for uptake of concrete measures)	**Target group varies** depending on the programme that the focus is on (target groups include e.g. owner-occupiers, tenants, landlords, housing associations, small and medium-sized enterprises, large enterprises, and energy suppliers)
Other actors affected by the policy Who benefits? Who pays?	**Various market actors** are affected by the KfW-programmes. In the industry sector, some companies benefit from the KfW-programmes due to increases in demand, such as those producing construction materials for energetic building refurbishment. Building companies, planners, installers etc. also benefit from enhanced business opportunities.
Quantified Target	**Not quantified** (Qualitative target: Values are stated by which the bank measures its action including e.g. sustainability, responsibility, market economy, and humanity)
Financing	According to the bank's annual report 2008 (http://www.kfw.de/DE_Home/Service/Download_Center/Finanzpublikationen/PDF_Dokumente_Berichte_etc./1_Geschaeftsberichte/GB08_FINAL_DE_InternetPdf_Barrierefrei.pdf) the total financing volume of the bank amounted to **€ 70.6 billion in 2008**. This total volume of financial incentives can be subdivided based on the bank's business divisions: KfW Förderbank € 33.8 billion, KfW Mittelstandsbank € 14.3 billion, KfW IPEX-Bank € 17.6 billion, KfW Entwicklungsbank € 3.7 billion, DEG € 1.2 billion. KfW Bankengruppe covers more than 90 % of its capital needs on the national and international capital market.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	**Ex post evaluation** is done by the independent Evaluation Department (FZ E). This institution evaluates every individual project of KfW Bankengruppe. The tenth evaluation report presented by the bank on the effectiveness of financial cooperation – entitled "Evaluating development, Developing evaluation" – reveals that **approx. 80 % of the projects are successful** (Report available online: http://www.kfw.de/DE_Home/Presse/Aktuelles_aus_der_KfW/PDF-Dateien/FZ-Evaluierungsbericht_DRUCKVERSION.pdf).
Technologies and services: implemented measures, innovations induced	There are several KfW-programmes that support energy efficiency activities, such as the Energy-Efficient Rehabilitation programme. Within this programme, (repayment) grants to the investment costs are awarded for measures aimed at reducing energy consumption of buildings.
Target achievement: quantitative impact: energy savings (absolute, relative)	**Not quantified**

Cost effectiveness (government cost, other costs, net energy cost savings)	According to the annual report 2008, approx. 6 % of the total financial volume of € 70.6 billion is tax money. Therefore, public funds that have been provided to the bank amount to approx. **€ 4.2 billion**. Net energy costs savings cannot be quantified.
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction energy consumption and of greenhouse gas emissions, the KfW-programmes lead to **economical benefits** (e.g. long-term savings due to reduction of fuel expenditures). An exact quantification of the impact by KfW programmes is difficult since several policy instruments and market developments influence investment behaviour into energy efficiency at the same time, and a single cause-impact relationship cannot be stipulated.
Replicability	The concept of KfW-programmes is replicable.
Reference	http://www.kfw.de http://www.isisrome.com/mure/output2.asp?Cod=GER33

3.3.2.6 Energy advice, energy audits

Energy advice, energy audits and related services such as on-site measurement of energy consumption, individual energy saving advice via personalised internet tools, informative billing, etc. help energy end-users to identify energy saving opportunities and to take adequate action.

Table 20: Energy advice, energy audits

Type of instrument	Energy audits (different audit types range from simple screening audits to comprehensive audits) Energy advice
Typical circumstances in which to apply this instrument	When there is a knowledge barrier for buildings and production facilities
Success factors (target achievement, cost-effectiveness)	Is the target group well-informed about existence of instrument? Is the target group well-informed about benefits and costs of instrument and of energy-saving measures identified (e.g., through demonstration projects)? Is the energy audit targeting all relevant energy end uses? Does the audit lead to a well-founded estimate of energy (cost) savings and requisite investment?
Key monitoring information to explain success or failure	Number and quality of assigned auditors Quality of auditing tools Number of audits carried out Number of advised measures with acceptable payback times Number of recipients that implement recommended improvements Number, variety and costs of energy savings measures implemented
Examples	Energy audits performed under the Danish energy saving obligations scheme (see below) Energy Audit Programme (EAP) of the Finnish energy agency MOTIVA (http://www.isisrome.com/mure/output2_ind.asp?Cod=FIN3 ; http://www.motiva.fi/en/finland_energy_facts/key_policies/energy_audits) International examples, e.g. from Indonesia, India, China

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 21: Good practice example of energy audits - Denmark

Title (name of policy instrument)	**Energy saving advice / energy audits for industry and tertiary sector provided by distribution system operators (Denmark)**	
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	Distribution system operators are **obliged to offer general information as well as targeted energy advice and audits primarily to industrial and tertiary sector end-users** as part of their mandatory energy efficiency activities (energy efficiency obligation scheme, cf. chapter 3.3.1.2.1). The policy thus aims to realise the large untapped savings potential in these sectors by way of overcoming existing information barriers.	
Status	**Ongoing**	
Period: Starting year, ending year	**since 1995:** Danish utilities (at first only electricity, from 2001 all energy sources) are obliged to plan and implement energy saving measures for all end-users; after liberalisation and unbundling, the regulated distribution system operators take over the obligation; the level of activity is determined by the utilities association ELFOR **since 2006:** concrete annual savings target are established to be met by the obliged companies	
Region / Country	**Denmark**	
Sector / Subsector in focus	**All sectors except transport** are **covered by the obligation scheme,** but the **energy audits mainly address** the **industry and tertiary sector**	
Actors responsible for policy implementation	The **distribution system operators** are responsible for policy implementation. However, they **usually involve other actors**, such as commercial daughter companies, engineering companies, professional energy advisors, installers, etc. The Danish Energy Agency (DEA) is in charge of basic administration.	
Target group (i.e., actors responsible for uptake of concrete measures)	**Private industrial and tertiary sector companies**	
Other actors affected by the policy Who benefits? Who pays?	The other actors involved, such as **commercial daughter companies, engineering companies, professional energy advisors, installers, etc. benefit from enhanced business opportunities**. The **companies receiving the advice/audits** can **benefit** from significantly reduced energy costs. Ultimately, the **end-users pay** for the measures, since the system is financed by a **public benefit charge** which is included in the grid charges.	
Quantified Target	The target for the Danish energy savings obligation was **2.95 PJ/a in the period 2006-2009**, representing 0.7% of the energy consumption in the included sectors. **From 2010** onwards, the target has **increased to 5.4 PJ/a**, which equals 1.2% of the respective consumption.	
Financing	The system is financed by a **public benefit charge** which is included in the grid charges.	
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	To allow for better impact evaluation, the distribution system operators are **obliged to collect in databases all relevant data** such as energy consumption, energy saving technology used, programmes and audits implemented, and subsidies paid. An **independent audit and quality control is required** for the documentation of activities.	
Technologies and services: implemented measures, innovations induced	**Types of technologies addressed:** Boilers, ventilation, heating (59%) Industrial processes (25%) Appliances (4%) Lighting (3%)	**Examples (projects with highest savings):** Six step evaporator Use of by-product hydrogen to produce steam

	Buildings (insulation, windows) (3%) Pressurised air (2%) Other (4%)	Conversion of new type of town gas Campaign for using clothesline instead of tumble dryers Partnership with chemical company New natural gas steam boilers Converting oil and electricity for heating to natural gas Retrofitting boiler with flue gas Retrofitting kiln to optimise air flow New motors and frequency control on ventilation Natural cooling for refrigerating New curtains in greenhouse Savings in relation to pressurised air New condensing boiler
Target achievement: quantitative impact: energy savings (absolute, relative)	The target for the period 2006-2009 was **overachieved by 11%** by mid 2009 already.	
Cost effectiveness (government cost, other costs, net energy cost savings)	According to an evaluation performed by EA Energy Analysis, the obligation scheme is **highly cost-effective.** In 2006-2009, the average cost per kWh saved was 4.5 Eurocents for first year savings, which corresponds to **0.45 Eurocents/kWh saved** if an average lifetime of measures of ten years is assumed. The **administration costs** at the DEA are **very low**, since the verification of savings is done by the obliged companies themselves.	
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction of greenhouse gas emissions, the audits lead to **economic benefits** (i.e., reduced energy costs) for the participating companies. The scheme also provides incentives for **technology development.**	
Replicability	National systems involving energy efficiency obligations have been introduced in various other countries across Europe, such as in Italy and France. Energy audit programmes exist in many EU Member States, such as, e.g., Finland, Germany, Czech Republic, Sweden, Austria, France, Ireland.	
Reference	Togeby et al. 2009, Togeby 2008	

Table 22: Good practice example of an innovative energy advice programme – Electricity saving in low-income households (Germany)

Title (name of policy instrument)	**Improving efficiency of electricity use in low-income households (Germany, pilot project)**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The pilot programme, which was financed by the German Environment Ministry, represents a **combination of energy audits, advice, concrete implementation of energy efficiency measures, financial incentives and micro-credits**. Low-income households receive a free energy audit, advice on behavioural measures, an "instant help package" with some energy saving equipment, and – in case significant energy savings can be achieved – support (by subsidy and loan) for replacing their fridge/freezer.
Status	**Completed** (pilot project) Based on the positive results of the pilot project, a **similar programme is currently being implemented nationwide** (by the Caritas Association and the Association of German Enery Agencies)
Period: Starting year, ending year	**2008**
Region / Country	**Germany (Berlin and Freiburg)**
Sector / Subsector in focus	**Residential**
Actors responsible for policy implementation	**Local energy agencies**
Target group (i.e., actors responsible for uptake of concrete measures)	**Low-income households**
Other actors affected by the policy Who benefits? Who pays?	- Low-income households benefit; Government bears the cost.
Quantified Target	No target quantified.
Financing	The audits, help packages, and subsidies are funded by the Government. The loans are provided by the Government, too, but are later repaid by households using the achieved energy cost savings.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	The pilot project included an evaluation of the direct saving results of the 108 energy audits performed. Basic data was collected and end-users were questioned about their energy consumption habits before the audit. The audits also included direct measurement of the energy consumption of fridges and freezers
Technologies and services: implemented measures, innovations induced	CFLs, water saving equipment (low-flow shower heads, aerators for taps, toilet flush retrofit devices), power strips preventing stand-by losses, timers
Target achievement: quantitative impact: energy savings (absolute, relative)	18 % electricity consumption were saved on average.
Cost effectiveness (government cost, other costs, net energy cost savings)	The **costs per kWh saved were 3.7 Eurocents** on average (1.2 Ct for CFL installation, 7 Ct for fridge/freezer replacement). The **average advantage per household was 820 Euros** over the lifetime of the technologies used. The programme was also cost-effective from a macro-economic point of view: with a **cost-benefit ratio of 0.64**, the benefits (i.e., the avoided electricity generation and distribution costs) clearly outweighed the costs of implementing the programme.

Co-benefits	Besides the environmental benefits due to reduced CO_2 emissions, participants benefit from **low energy costs**. The instrument thus contributes to **alleviating fuel poverty and possibly also to raising the standard of living**. It also helps to **raise awareness on energy-efficient behaviour**.
Replicability	The larger-scale implementation following the pilot project shows that the programme **is replicable.**
Reference	Seifried / Richter / Schüle 2009

3.3.2.7 Information and communication, motivation campaigns

Information and motivation and campaigns, which can be organised by public authorities but also by energy agencies, NGOs, energy companies or by several of these actors cooperating, can play an important part in raising awareness about the potentials and opportunities available for improving energy efficiency. Decision makers should however bear in mind that campaigns and other forms of information provision are not necessarily very effective as such, but will achieve the highest impact when they are implemented as part of a coordinated policy package targeting a specific end-use, technology and/or group of actors.

When such campaigns are launched, it should thus be ensured that real opportunities to act are being provided at the same time, e.g., by means of cooperating with market partners such as retailers or installers, and by providing easy-to-use information in data bases or product lists. Otherwise there is a risk that such campaigns could leave target groups at loss and frustrated. Moreover, it is essential to perform a thorough ex-post evaluation of information campaigns in order to be able to assess the actual impact that such measures have in terms of awareness raising and removal of knowledge barriers.

Table 23: Information and communication, motivation campaigns

Type of instrument	Information, motivation
Typical circumstances in which to apply this instrument	When there is a knowledge barrier When dealing with large target groups When the end-users' motivation for energy saving is to be enhanced.
Success factors (target achievement, cost-effectiveness)	Is the information well-linked to the customer type within the target group? Is the information clearly linked to other instruments (regulation, financial/fiscal, voluntary agreement, etc.)?
Key monitoring information to explain success or failure	Number of end-users aware of the information activity Number of end-users taking action as a result of the information activity
Examples	Information campaigns and energy advice offered by energy agencies, consumer advice centres, other actors offering energy efficiency programmes (e.g., www.co2online.de) and NGOs Information activities conducted by federal states, municipalities, manufacturers, retailers, craftsmen, energy companies, etc.

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 24: Good practice example of information campaigns / online energy advice – co2online (Germany)

Title (name of policy instrument)	**co2online – provision of information and advice, campaigns (Germany)**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	co2online is a **not-for-profit consulting company** that has been actively promoting climate change mitigation and rational energy use since 2003. Its **primary objective** is to **reduce the electricity and heating fuel consumption and the associated CO2 emissions of residential end-users**. With a view to achieving this goal, they have launched several **campaigns** and offer various types of guidance (**online consultation tools**) on how to save energy via their website www.co2online.de. In addition, they have established a **partner network of energy efficiency practicioners** with a view to transforming the information input that end-users receive into actual implementation of tangible energy efficiency measures.
Status	**Ongoing**
Period: Starting year, ending year	**2003 (foundation of co2online)** **2004 (start of the campaign "Klima sucht Schutz" – climate seeks protection)**
Region / Country	**Germany**
Sector / Subsector in focus	**Residential**
Actors responsible for policy implementation	**co2online** along with its partner network (cf. other actors affected)
Target group (i.e., actors responsible for uptake of concrete measures)	**Households**
Other actors affected by the policy Who benefits? Who pays?	Co2online has managed to establish an **extensive network of partners comprising all relevant actors** in terms of energy efficient refurbishment and other energy saving activities: the **media, politics and associations** serve as multipliers and contribute to a wider dissemination of the projects, services and campaigns; **craftspeople and energy advisors** are competent local contact persons; **manufacturers of energy saving equipment and energy efficient refurbishment materials** accompany the refurbishment process; **banks** provide support in financing the measures.
Quantified Target	No target quantified.
Financing	The co2online campaigns and projects are funded by the German Ministry for the Environment, Nature Conservation and Nuclear Safety
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	The number of completed online consultations is constantly being **monitored by way of web statistics tools**. **Independent evaluations of the impact** of the different guides are commissioned at irregular intervals.
Technologies and services: implemented measures, innovations induced	Online consultations and checks for the following topics: energy consumption for heating, energy efficient refurbishment, Energy Performance Certificates, efficient circulators, efficient lighting, efficient cooling, efficient appliances, information about available grants and application support, 'energy saving account' (self-monitoring tool for visualising one's energy consumption and savings)
Target achievement: quantitative impact: energy savings (absolute, relative)	Between July 2004 and March 2010, more than **3,000,000 online consultations** were performed. The following impacts were assessed: **4.269 Mt CO2 emission reduction**, **1.414 billion € turnover** for industry and the skilled trades, **20,200 person years employment** and **256,553 residential units refurbished**
Cost effectiveness (government cost, other costs, net energy cost savings)	-
Co-benefits	Besides the environmental impacts, significant **investment was induced, jobs were created, standard of living was improved**, etc. (cf. facts mentioned under

	Target achievement)
Replicability	The concept is **replicable**. National circumstances (such as climate conditions, support framework and national practices) have to be taken into account, however. The **website has already been internationalised**, with adapted versions for the UK, France, Poland, Switzerland, Italy, Austria, Luxembourg.
Reference	www.co2online.de

3.3.2.8 Public procurement / Co-operative procurement

This policy instrument concerns public administrations and other public institutions such as schools or hospitals on the one hand, but then it is also relevant for large private sector companies. Apart from the resulting energy and cost savings for the respective institution, the instrument can also be used (especially by public actors) with a view to influencing the supply-side of energy efficiency markets. I.e., large and thus powerful buyers increase the demand for energy-efficient products or services significantly which in turn will lead to an increase in supply. That way the prices of these goods and services will fall due to economies of scale and the market transformation will thus be substantially accelerated (cf. Borg et al. 2003, X).

Such so-called „demand pull" (as opposed to the classical „supply push" via financial support of R&D and demonstration activities) can also be created when the demand of several companies or administrations is bundled. This approach, which usually requires coordination by an independent mediator, was successfully tested in Sweden and also on the European level (cp. the EU-supported project *Energy+*).

Table 25: Public procurement / Co-operative procurement

Type of instrument	Co-operative or public procurement, „Technology Procurement"
Typical circumstances in which to apply this instrument	When there are sufficient possibilities to bundle large buyers of energy efficiency technologies When there is a limited number of market actors supplying energy efficiency technologies When potentials for further development and market transformation of new technologies are large enough.
Success factors (target achievement, cost-effectiveness)	Is the programme management qualified and engaged? Can the buyers and suppliers group be motivated in principle? Is the buyers group involved in the programme set up? Is the buyers group sufficiently sized?
Key monitoring information to explain success or failure	Number of participants (buyers, suppliers) Sales numbers of new product/technology
Examples	Energy+ (see below and Energy+ (2005))

Source: Wuppertal Institut, based on Ecofys et al. (2006)

Table 26: Good practice example of a co-operative procurement programme – Energy+ (EU)

Title (name of policy instrument)	**Energy+** (procurement and information programme)
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	Energy+ is a co-operative procurement program of energy agencies and research institutes. It aims at stimulating the market for high energy efficient appliances. This target is achieved through methods of technology procurement supporting the rapid break-through of high efficient appliances in the short run and transforming the market in a way that these technologies become standard in the long run. Energy+ interacts with the European Energy Labelling programme.
Status	**Ongoing**
Period: Starting year, ending year	**1999-2004**: procurement and information programme on high efficient refrigerators and freezers **since 2006**: procurement and information programme on high efficient circulating pumps
Region / Country	**European Union**
Sector / Subsector in focus	**Household**
Actors responsible for policy implementation	**Associations and industry**
Target group (i.e., actors responsible for uptake of concrete measures)	**Retailers and manufacturers**
Other actors affected by the policy Who benefits? Who pays?	Energy+ provides **advantages for consumers** since the programme aims at supporting a rapid break-trough of efficient appliances in the short-term. Furthermore, it initiates a market transformation in the long-term including that new technologies become standard, at prices similar to those of today's standard appliances.
Quantified Target	**Not quantified** (Qualitative target: Energy+ aims at supporting the rapid break-through of high efficient appliances in the in the short run and transforming the market in a way that these technologies become standard in the long run.)
Financing	The programme is **funded by the EU-programme** "Intelligent Energy Europe". Furthermore, it is funded by several ministries of Member States.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	-
Technologies and services: implemented measures, innovations induced	Programmes have been initiated for two different appliances, namely refrigeration and freezers as well as circulating pumps. The degree of innovation induced is very high.
Target achievement: quantitative impact: energy savings (absolute, relative)	The net impact (final energy) due to the programme on high efficient refrigerators and freezers amounted to 0.36 PJ.
Cost effectiveness (government cost, other costs, net energy cost savings)	Government costs for the duration of the programme on high efficient refrigerators and freezers were below € 2 million.
Co-benefits	Besides environmental benefits due to an increase of market shares of efficient appliances, Energy+ can lead to **economic benefits for consumers**, e.g. long-term savings due to reduction of energy costs.
Replicability	The Energy+ programme on high efficiency pumps is the successor of the Energy+ programme on high efficiency refrigerators and freezers. The programme **is replicable** since the approach of programme is transferable to various other appliances.

Reference	http://www.energypluspumps.eu http://www.isisrome.com/mure/output2.asp?Cod=EU21 http://www.aid-ee.org/documents/SummaryreportFinal.PDF

3.3.2.9 Planning instruments

With a view to improving energy efficiency, possible measures in the framework of public planning are

- planning and constructing buildings and infrastructure in such a way that the distances to be covered by users of this infrastructure will be reduced (transport prevention),
- taking energy efficient refurbishment into account when developing urban districts,
- developing long-term heat plans along with guidelines for the future heat supply of municipalities and districts, so that activities related to building refurbisment, construction of new buildings and heat supply can be coordinated and energy saving measures will thus become more effective and efficient, and
- determining priority areas for local/district heating.

Table 27: Planning instruments

Type of instrument	Planning instruments on different levels
Typical circumstances in which to apply this instrument	When a system approach following clear planning guidelines or regulations leads to better results with regard to sustainability objectives than the sum of individual acts. When a long-term perspective should be followed, which cannot be achieved by rather short-term oriented market activities.
Success factors (target achievement, cost-effectiveness)	Is the planning guideline or regulation well-founded? Is the target group well prepared / sufficiently skilled to follow the planning rules? E.g. through information campaigns, demonstration projects, feasibility studies, training programmes etc. Are there sufficient resources (knowledge, capacity, time, budget, priority) in place to enforce the planning? Are there penalties in place for non-compliance?
Key monitoring information to explain success or failure	Changes in energy supply and/or use over time Energy savings achieved over time compared to a non-planning scenario.
Examples	Country-wide shift to CHP in municipalities in Denmark (http://www.isisrome.com/mure/output2_tert.asp?Cod=DK7) Local public planning in some German cities (cf. example provided below)

Table 28: Good practice example of sustainable public planning – Kronsberg district (Germany)

Title (name of policy instrument)	**Sustainable urban district development: demonstration project Hannover Kronsberg**
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The Kronsberg district was developed as an exhibit of an **examplary sustainable settlement** for the EXPO 2000. It was planned and built applying state-of-the-art expertise on ecological construction and habitation, **in the spirit of Agenda 21**. This included water and waste management systems, a transportation plan and an **energy concept**. The latter was based on three main elements: construction of **low energy dwellings** including quality assurance and a skilling & qualification programme for architects/developers, **district heating supply through local cogeneration units**, and an **electricity saving programme** (residents receive grants for purchasing high efficiency appliances). In addition, **renewable energy sources** are used in order to further avoid CO_2 emissions.
Status	**Completed**
Period: Starting year, ending year	1990: City council resolution 1994: adoption of amendment to land-use plan 1997: start of construction 2000: nearly 3,000 dwellings finished
Region / Country	**Germany, City of Hannover**
Sector / Subsector in focus	**Residential**
Actors responsible for policy implementation	The **City of Hannover** led the development of the new district. The actual implementation was done in cooperation with developers, architects, construction companies, and to some extent also with the residents. The **Kronsberg Environmental Liaison Agency** (Kronsberg-Kommunikations-Agentur GmbH / **KUKA**) was created in 1997 and was charged with coordinating and supporting the various Kronsberg projects as well as offering a range of information, communication and training services for all involved or interested in Kronsberg.
Target group (i.e., actors responsible for uptake of concrete measures)	**Architects, developers, construction companies, district residents**
Other actors affected by the policy Who benefits? Who pays?	-
Quantified Target	The goal specified by the City of Hannover was that the Kronsberg district should **save 45% of the heating energy consumption and 60% (80% including electricity generation by wind power) of CO_2 emissions resulting from total residential energy consumption** (heating, hot water, electricity) as compared to conventional new-built districts (1995 standard).
Financing	The development of the Kronsberg district and the establishment of the KUKA Agency were **supported by** the **federal, regional** (State of Lower Saxony) **and local** (City of Hannover) **governments** along with developers, energy utilities, engineering offices and others connected to Kronsberg. KUKA has also been funded by the Deutsche Bundesstiftung Umwelt (German federal environmental foundation). Public and private sector investments for the first construction phase 1997-2000 amounted to more than 500 million EUR.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	The implemented quality assurance scheme ensured continuous monitoring of the measures implemented during the planning and construction phases. An independent ex-post evaluation was performed by IFEU in 2003.

Technologies and services: implemented measures, innovations induced	District heating by law, low energy houses, passive houses, give-aways of CFLs and water-saving taps, grants for efficient appliances, advice on energy saving habits, installation of hot water connections for washing machines/dishwashers, photovoltaic, solar-thermal and wind power installations; In general, the approach fostered the use of the most innovative technologies/building materials at hand.
Target achievement: quantitative impact: energy savings (absolute, relative)	The CO_2 impact evaluation by IFEU assessed that, including the impact of the three wind turbines installed in Kronsberg, **CO_2 emissions per resident were reduced by 74% as compared to conventional new-built districts**. The 80% reduction target was thus almost met. The electricity saving programme was not as successful, though: by 2001, only one fifth of the envisaged electricity savings of 750 kWh/a per houshold had been achieved.
Cost effectiveness (government cost, other costs, net energy cost savings)	-
Co-benefits	Besides the environmental benefits due to reduced CO_2 emissions, residents benefit from **low energy costs**, **short distances to cover** (as a result of the transportation plan), and in general from the **high standard of living** provided by the Kronsberg district (e.g., due to good air quality, green areas, etc.). The **professionals associated with the development, construction and installing works** and their future customers also **benefit from the extensive skilling activities.**
Replicability	Replicability of this example depends on availability of resources. However, in general planning of urban development could be directed towards sustainability issues in every country / region /city.
Reference	http://connectedcities.eu/downloads/showcases/kronsberg_hannover_handbook.pdf Eckert et al. 2000: Modell Kronsberg

3.3.2.10 Participation, cooperation und networking

Communication within networks, cooperation and participation are good starting points for getting actors to take an interest in energy efficiency / energy saving activities. Three essential parameters are to be taken into account when such networking processes are to be established (Böde / Gruber 2000):

- the way the actors communicate and interact,
- which agreements have been taken for the process (explicitly and implicitly), and
- which internal and external resources can be used.

In order to ensure long-term success of such participation approaches, it is crucial to support the establishing of networks through adequate institutions.

Table 29: Participation, co-operation and networking

Type of instrument	Different models of participation, co-operation and networking
Typical circumstances in which to apply this instrument	Participation: To make use of ideas and knowledge of different actors; to avoid conflicts already at an early stage Co-operation: To avoid conflict and to make use of capacities and competences of other actors. Networking: a) as self-supporting group of actors with similar interest; b) as possibility to address a large number of actors at the same time
Success factors (target achievement, cost-effectiveness)	Are objectives clearly defined? Is procedure transparent? Is benefit clearly visible that actors can expect from participating, co-operating, becoming network member?
Key monitoring information to explain success or failure	Activities and activity results of network members / co-operating actors.
Examples	Network of small and medium enterprises in Germany (Modell Hohenlohe, see below)

Table 30: Networking example „EnergieModell Hohenlohe“, Germany

Title (name of policy instrument)	**Pilot project “EnergieModell Hohenlohe”**: Local network of small and medium enterprises (SME) for energy efficiency.
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	“EnergieModell Hohenlohe” is a pilot project on behalf of the Ministry for Environment and Transport of Baden-Württemberg. At the beginning, the project aimed at the establishment of a corporate local network for energy efficiency in a region within the federal state of Baden-Württemberg, and used the positive experiences gained from a local learning network for energy efficiency in small and medium-sized enterprises in Switzerland for that. By means of the local network and exchange of experience, the project aimed at the improvement of energy efficiency in participating enterprises.
Status	**On-going**
Period: Starting year, ending year	**2002-2004**: project on behalf of the Ministry for Environment and Transport of Baden-Württemberg
Region / Country	**Germany**
Sector / Subsector in focus	**Industry sector**
Actors responsible for policy implementation	The project was initiated on behalf of the **Ministry for Environment and Transport of Baden-Württemberg**. A consulting engineer was employed who coordinated the project in a large part.
Target group (i.e., actors responsible for uptake of concrete measures)	**Small and medium-sized enterprises** (At the beginning, 17 enterprises belonging to different sectors participated in the project. Depending on the enterprise, the number of workforce varied between 5 and 1,750 employees and the energy consumption varied between 210 MWh/a and almost 47,400 MWh/a.)
Other actors affected by the policy Who benefits? Who pays?	**Other local energy efficiency networks** benefit from the experiences gained by the pilot project “EnergieModell Hohenlohe”.
Quantified Target	The non-mandatory target was to **improve energy efficiency by 7 %** and **reduce CO_2 emissions by 8 %** within four years between 2001 and 2005.
Financing	The pilot project has been **co-financed by the federal state of Baden-Württemberg**.
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	The performance and success of the pilot project “EnergieModell Hohenlohe” were evaluated scientifically. The (interim) results were published as part of a report in 2004, entitled “Modellvorhaben Energieeffizienz-Initiative Region Hohenlohe zur Reduzierung der CO_2-Emissionen” (Report available online: http://www.uvm.baden-wuerttemberg.de/servlet/is/6296/Energietisch%20-%20Endbericht%202004.pdf?command=downloadContent&filename=Energietisch%20-%20Endbericht%202004.pdf).
Technologies and services: implemented measures, innovations induced	Implemented measures included, e.g., changes in lighting systems, insulation of pipes, waste heat recovery and efficient electric motors.
Target achievement: quantitative impact: energy savings (absolute, relative)	According to the evaluation report, energy efficiency in the participating enterprises increased **by 1.4 % per year between 2001 and 2003** due to technical improvements. Energy efficiency gains in the participating enterprises were thus twice as high as the average energy efficiency gains in industry due to technical improvements in the period 1994-2004. By 2007, the participating enterprises had realised energy savings of

	approx. 20% (base year: 2001).
Cost effectiveness (government cost, other costs, net energy cost savings)	Usually, the implemented energy efficiency measures were **cost-effective**.
Co-benefits	Besides environmental benefits in terms of substantial contribution to reduction energy consumption and of greenhouse gas emissions, the pilot project led to **economical benefits** (e.g. long-term savings due to reduction of fuel expenditures, improvements of noise protection, enhancements in product quality).
Replicability	An essential precondition for replicability of the project is the existence of **enterprises that actively participate in the project** (e.g. entrust an employee with the task, implement measures within a narrow time frame). Furthermore, the success of a network depends on the **presence of a dedicated person** that is deeply committed to the network and actively promotes energy efficiency.
Reference	http://www.modell-hohenlohe.de http://www.leen-system.de http://www.uvm.baden-wuerttemberg.de/servlet/is/6296/Energietisch%20-%20Endbericht%202004.pdf?command=downloadContent&filename=Energietisch%20-%20Endbericht%202004.pdf

3.3.2.11 Education, training, qualification and certificates

In terms of wider dissemination of knowledge and expertise about topics relating to efficient energy use, it is important to integrate these matters into school and university curricula and make them a vital part of vocational education and training especially for professionals like craftspeople, architects and engineers. Qualification can also include the issuing of certificates to individuals or organisations who have reached a certain qualification level. Such certificates can increase trust in the market, e. g., certificates for ESCOs / ESCO business.

Table 31: Education, training, qualification and certificates

Type of instrument	Different models of education, training, qualification and certificates
Typical circumstances in which to apply this instrument	When knowledge and practical competences are not well-developed yet. When trust by end-users has to be increased.
Success factors (target achievement, cost-effectiveness)	Are the didactics applied appropriate and well-developed? Are the contents to be learnt state-of-the-art and useful for the target group? Are the certificates transparent to the market? And is substantial effort needed to gain a certificate?
Key monitoring information to explain success or failure	Number of courses and participants Feedback by participants Number of certificates
Examples	Special courses and certificates for energy auditors / advisors in Germany (see below). Certification of ESCOs or energy efficiency services in some countries.

Table 32: Seal of quality for contracting by ESCO Forum of ZVEI, Germany

Title (name of policy instrument)	**Seal of quality** for contracting
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	The members of the ESCO association "ESCO Forum im ZVEI" in Germany have voluntarily agreed to classify the energy efficiency services offered by them into four service levels.
Status	On-going
Period: Starting year, ending year	Proposed in April 2007
Region / Country	Germany
Sector / Subsector in focus	
Actors responsible for policy implementation	ESCO Forum im ZVEI (association of ESCOs) in Germany
Target group (i.e., actors responsible for uptake of concrete measures)	ESCOs
Other actors affected by the policy Who benefits? Who pays?	 Customers benefit: increased trust in the market ESCOs themselves
Quantified Target	./.
Financing	
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	./.
Technologies and services: implemented measures, innovations induced	./.
Target achievement: quantitative impact: energy savings (absolute, relative)	./.
Cost effectiveness (government cost, other costs, net energy cost savings)	Low costs; probably very cost-effective from societal point of view.
Co-benefits	Increased customers satisfaction Increase workers satisfaction.
Replicability	Can be applied by any ESCO association in principle.
Reference	ESCO Forum im ZVEI: www.zvei.org

3.3.2.12 Research and development

The financial support to research and development (R&D), demonstration and dissemination activities aims at the following:

- (further) development of innovative energy efficiency technologies and services;
- research in terms of implementing conditions and processes;
- interlinking development research with research on implementation and implementation support.

Table 33: Research and development

Type of instrument	Financial support to R&D, demonstration and dissemination activities
Typical circumstances in which to apply this instrument	When further research and development of innovative sustainable solutions (products, services, planning, policies and measures, etc.) and cause-impact relationships is needed. When the link between innovations and their application (implementation) is missing.
Success factors (target achievement, cost-effectiveness)	Well-defined and sufficiently detailed call for tenders
Key monitoring information to explain success or failure	Number of technical innovations / patents in the field of energy efficiency. Number of social / organisational innovations in the field of enery efficiency. Number of demonstration and dissemination projects. Dissemination objectives depending on what should be disseminated.
Examples	EU 7th Framework Programme EU Programme “Intelligent Energy Europe”

Table 34: EU Programme „Intelligent Energy Europe“

Title (name of policy instrument)	Intelligent Energy Europe, Call 2010
Short description / General aim of the policy / Function with respect to overcoming existing barriers / Role in policy package	Providing for dissemination and promotion action to foster energy efficiency and the rational use of energy resources, to promote new and renewable energy sources and to support energy diversification, and to promote energy efficiency and the use of new and renewable energy sources in transport. Tackling non-technological barriers to the spread of efficient use of energy and greater use of new and renewable energy sources.
Status	Call published in March 2010; projects will start in 2011
Period: Starting year, ending year	2010 - 2013
Region / Country	EU-27
Sector / Subsector in focus	All
Actors responsible for policy implementation	Executive agency eaci on behalf of European Commission
Target group (i.e., actors responsible for uptake of concrete measures)	Market actors, scientific organisations
Other actors affected by the policy Who benefits? Who pays?	 End-users in different sectors European Commission (taxpayer’s money)
Quantified Target	Contributing to EU’s 20-20-20 target.
Financing	104 Mio. Euro for Call 2010
Impact evaluation (data availability; availability of evaluation ex ante / ex post)	Commission Staff Working Paper, Annex to the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Mid-term Evaluation of the Multiannual Programme for Action in the Field of Energy “Intelligent Energy – Europe, 2003-2006”, Summary of the Evaluators’ Report, March 2006 (COM(2006) 357).
Technologies and services: implemented measures, innovations induced	Various
Target achievement: quantitative impact: energy savings (absolute, relative)	Mid-term evaluation only mentions qualitative performance; quantitative performance difficult to assess.
Cost effectiveness (government cost, other costs, net energy cost savings)	Cannot be quantified
Co-benefits	Diverse co-benefits depending on project financed.
Replicability	In principle, such programmes make sense in markets where dissemination and implementation of already existing technology could be increased.
Reference	http://ec.europa.eu/energy/intelligent/

4 Effective policy packages

The following chapter deals with the question how the policy instruments described above should be ideally bundled into effective policy packages.

4.1 Guidelines and governance structures

4.1.1 Main elements of effective policy packages

The different policy instruments requisite for supporting energy efficiency improvement should ideally be bundled in comprehensive, well-balanced, effective and efficient, market actor-oriented policy packages. In order to successfully develop such packages the following elements and structures are needed:

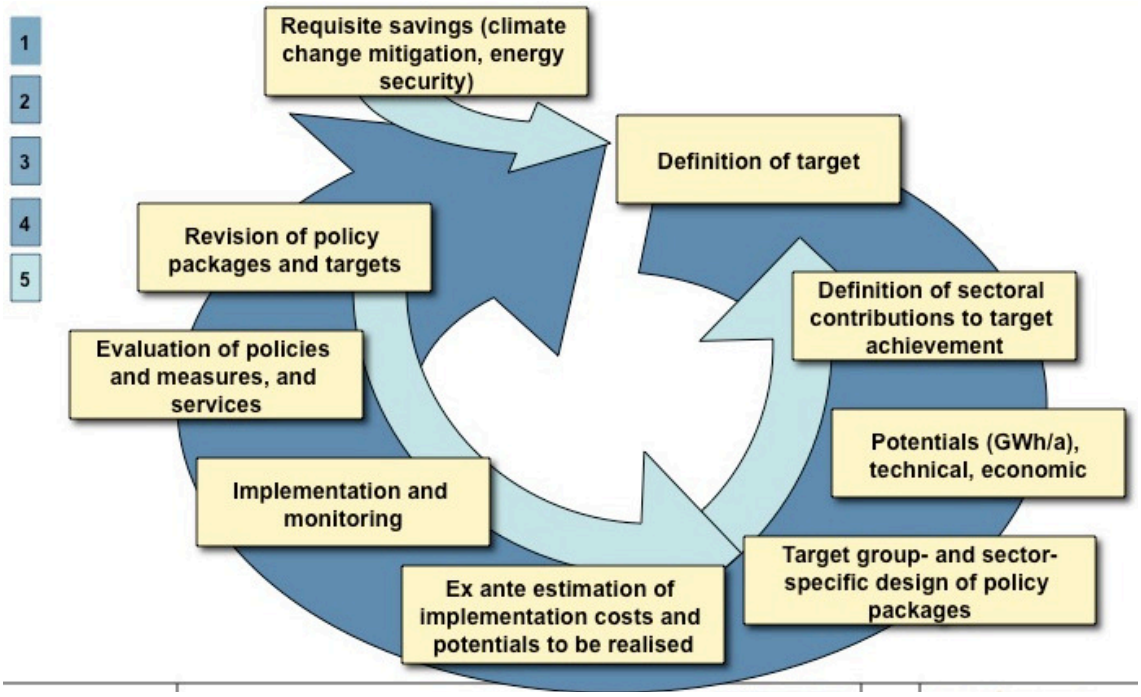
- **Target setting and policy planning:** A coordinated policy planning should include the setting of a clear, binding target along with reporting requirements and well-defined methods for reporting and monitoring of results;
- **Infrastructure for energy efficiency:** Participation of energy agencies and other actors implemeting energy efficiency programmes in order to ensure continuous, independent, centrally-coordinated implementation of a variety of different energy efficiency activities;
- **Financing: Financing:** Sufficient (initial) funding within a supportive framework for the different single energy efficiency activities that enhance demand for energy-efficient buildings, products and services.

Ultimately, the mix of policies and measures along with the activities by non-governmental actors must make energy efficiency as easy-to-realise and rewarding as possible for the relevant market actors, and thus contribute to a strong market development of energy efficiency technologies and services. It should also be made clear that energy efficiency improvement is desirable from a political and societal perspective.

4.1.2 Target setting and policy design

At the outset of any policy design there should be a target. This target has to be measurable or verifyable and thus requires success factors. Furthermore it must be achievable, therefore information about energy saving potentials must be available. After that policy packages must be developed in such manner that they are suitable for addressing specific target groups. The impact of the policy has to be assessed ex-ante and measured ex-post. Some of these steps may have to be repeated. Then policy instruments have to be implemented and they also should be revised once in a while. The following figure illustrates how all these steps should work together in an ideal policy planning process.

Figure 11: Mutual learning process of target setting, analyses, policy design, implementation, monitoring and evaluation



Source: Wuppertal Institut / Ecofys 2009

In general, the following approach is recommended when it comes to developing new policies and measures or revising existing ones (cf. the guidelines for policy theory based evaluation and policy design developed in the AID-EE project: Ecofys et al. 2006):

- Analyse the market chain in the market segment concerned: which actors (manufacturers, planners, craftspeople, retailers, sales staff, building owners, end-users) have to take what kind of action in order to improve energy efficiency?
- Identify the market forces that have to be strengthened, i.e., the disincentives (barriers) but also incentives for all actors in the market chain to implement the desired energy efficiency measure.
- Develop an adequate, realistic idea of the cause-impact relationship of the policy instrument (based on, e.g., evaluations of previous policies or similar instruments in other countries).
- Organise workshops to discuss the policy instrument and its impacts with involved stakeholders and market actors.
- Identify the important barriers that need to be overcome for a successful implementation of the policy instrument.
- Identify the need for packaging of instruments. Normally a policy instrument will need to be part of a package of instruments in order to increase the combined efficiency and effectiveness and overcome all market barriers to the various market participants. In the planning phase of such policy packages, it is crucial to analyse

the interlinkages between single policies and measures within a package, within the entire policy mix for energy efficiency and also possible interactions with instruments from other policy areas (e.g., renewables, climate policy).

- Set preliminary objectives and boundaries for the instrument and make a (rough) ex-ante assessment of its expected impacts and its efficiency.
- As targets are the starting point for effective and efficient policy making, it is recommended to set SMART targets, where SMART stands for: (i) Specific: be as concrete as possible: what should be achieved with the instrument? (ii) Measurable: targets should be quantified; qualitative targets cannot be measured at a later stage. (iii) Ambitious: Does the target go beyond business as usual? (iv) Realistic and Acceptable: Is the target achievable in the given timeframe, with the budget available? Is the target accepted by the target group? (v) Time framed: Are targets set for a specific year? Are intermediate targets set in order to be able to monitor target progress?
- Identify the needs for monitoring and evaluation. Careful planning of monitoring activities already in the design phase of a policy instrument greatly facilitates the later evaluation.
- Make good use of experiences gained from the implementation of similar policy instruments, both national and in other countries.

4.1.3 Infrastructure for energy efficiency

Independent energy agencies and similar actors (e.g., an energy saving trust) can play a key part in the policy mix for energy efficiency, provided that they have sufficient funds. They can offer important organisational support when it comes to implementing energy efficiency measures, e.g., through information and advice on adequate saving measures, suppliers of efficient technologies, drawing up of contracts, verification of savings, etc. An important feature of such actors is that they can establish the crucial links between advice on measures and actual measure implementation. Apart from that, they can also tender and coordinate financial support programmes. Thirdly, they are also important actors for the implementation of informative measures (information and motivation campaigns, energy audits, labelling, education and training). It is vital that their level of activity is steady and continuously high, thus providing the infrastructure and preparing the ground for further development of energy efficiency activities.

What is the potential role of energy companies in this context? Energy companies can establish energy agencies or contribute to their creation and funding. Such cases can be found, e.g., in Germany at the municipal level (Bremen, Hannover). Furthermore, energy companies can also offer energy efficiency programmes and services themselves, particularly as they are increasingly required – this is especially the case for utilities on the local level – to participate actively in energy efficiency and climate change mitigation activities. Experiences from other countries show that such activity

by energy companies needs an adequate support framework that allows for compensation of the negative economic incentives.

4.1.4 Financing

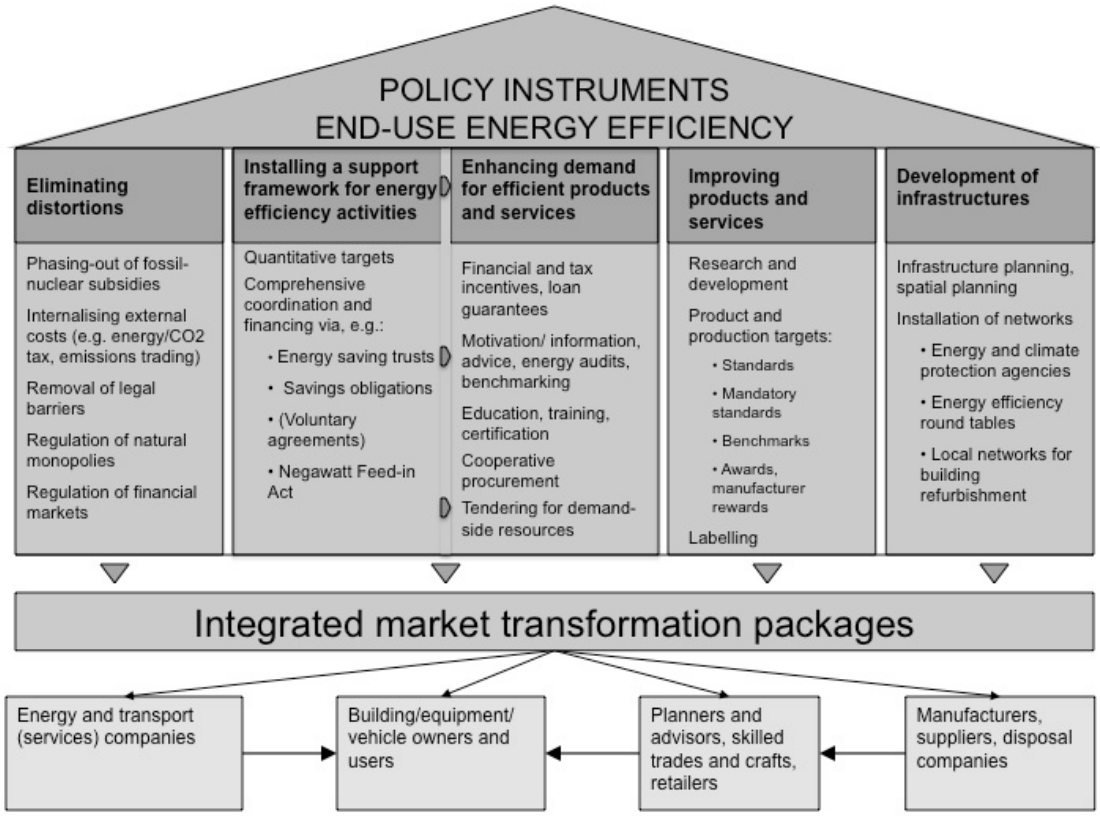
In order to efficiently foster the market for energy efficiency technologies and services and to support energy saving by way of integrated policy packages, an adequate financing framework is requisite. Different sources can be tapped for the required funding, such as general tax revenue, specific tax revenue (e.g., from energy taxation), revenue from the auctioning of emission allowances, levies on energy prices (e.g., via grid charges).

4.2 The ideal policy package

Experience has shown that ultimately, a mix of several or even all types of policy instruments is likely to be most successful. For example, price incentives, e.g. via energy taxes or emissions trading, are an important element but are certainly not enough to harness the full potential. Legal provisions on minimum efficiency standards, in turn, only harness part of the savings potential; this is because standards only cover the technical aspects of energy efficiency in standardised products or components and do not harness the savings potential afforded by system optimisation. The buildings sector is one exception, but even here, regulations only apply to new-builds and buildings undergoing extensive renovation – assuming, that is, that compliance with the regulations is monitored at all. Furthermore, standards generally only exclude the most inefficient technologies and practices from the market, but do not promote the most efficient (best available technology – BAT). So it is essential to promote market penetration of BAT to ensure that standards have a dynamic impact.

The following graph shows the interaction between the various instruments. It illustrates that ideally, within a comprehensive promotion framework, targeted and coordinated policy packages should be developed that influence all levels of the market chain. The barriers to energy-efficient behaviour must be overcome for all relevant market actors, and incentives to encourage them to adopt energy-efficient behaviour reinforced. Only then can energy-efficient solutions genuinely establish themselves in the market and become the norm.

Figure 12: Elements of the policy portfolio for end-use energy efficiency



4.3 Monitoring and evaluation

4.3.1 Monitoring and evaluation of policies and measures

Monitoring and evaluation is crucial in order enable policymakers to assess the impact of policies and measures: Have targets been met? Do instruments need improvement? How should they be adjusted, i.e. which components require refinement? There is a general distinction between two types of evaluations:

- **impact evaluation** assesses the effectiveness, efficiency, distribution aspects and public acceptance, side effects as well as interactions of policies and measures, whereas
- **process evaluation** analyses the processes of target setting, instrument selection, implementation and adaptation to changing situations during implementation.

On the European level, the potential effects of legislation are being evaluated ex-ante by means of „Impact Assessment“ (cf. the respective guidelines and information at: http://ec.europa.eu/governance/impact/index_en.htm). There is also a long tradition and thus valuable expertise in terms of monitoring and evaluation in Anglo-Saxon

countries. On the contrary, in most of the other EU Member States such as, e.g., Germany, policy evaluation is not (yet) being done as throroughly and systematically as in the abovementioned regions.

When it comes to evaluating single policy instruments, one always has to take into account the interactions that occur between different policies and also between governance levels. In practice, this aspect is often not sufficiently considered. Another risk is that evaluations may not be completely neutral, i.e. the outcomes may depend on who commissioned them.

The best way to ensure that an independent and comprehensive evaluation will actually be done is by any means to clearly specify the monitoring and evaluation requirements in the respective laws and decrees, as it has been done for example in the EU Directive on energy end-use efficiency and energy services.

The next section deals with the question how energy savings can actually be measured. After that we briefly describe possible ways to evaluate the costs and benefits of policies and measures.

4.3.2 Measuring energy savings

Unlike energy consumption, energy savings cannot be directly measured. Besides that, a change in energy consumption does not instantly shed light on its (possibly various) cause(s). For expample, one can think of many different reasons for a decrease in gas use in a houshold:

- Children have moved out, which leaves their former rooms almost unheated;
- The family decided that a room temperature of 20°C instead of 22°C is sufficient, so they wear sweaters in wintertime now;
- The winter was extremely mild;
- The gas stove was replaced by an electric stove;
- The pipes of the heating system were insulated and the radiators were replaced by more efficient ones;
- The existing low-temperature boiler was replaced by a condensing boiler;
- The building was insulated.

Consequently, apart from the impact of energy efficiency improvement measures, changes in energy consumption can also be caused by climatic, structural and substitution effects. While only the absolute change in energy consumption is relevant in terms of climate change mitigation and security of energy supply, it is necessary to separate the different influencing factors when it comes to assessing policy effectiveness. In order to properly identify the energy savings impact of energy efficiency policies and measures, one has to find out how the energy consumption would have evolved without these measures, i.e. solely due to changes in climate conditions, sectoral structure of the economy and technological progress.

There are two main calculation methodologies for measuring end-use energy savings: *top down* and *bottom-up* (for more details cf. Thomas et al. 2009).

Bottom-up evaluation starts from data at the level of a single energy efficiency improvement measure, mechanism, programme, or energy service (e.g. monitoring energy savings per participant and number of participants), and then aggregates results from all measures reported to assess the total energy savings in a specific field.
The required data can be obtained by either direct measurement, analysis of energy bills, or expert calculations or estimates (ex ante or ex post; with or without on-site inspection).
Bottom-up calculation needs specific monitoring but can provide information on the effectiveness and cost-effectiveness of measures, on potential improvements, and on greenhouse gas emission reductions additional to baseline projections. However, bottom-up calculation can be costly.
Bottom-up methods are used for a very accurate description of the effects of a single policy (package) in terms of achieved energy savings. They are particularly useful for evaluating energy savings in buildings, the industry and tertiary sectors with their larger final consumers that are easier to monitor, and for modal shifts and eco-driving in transport.
In these areas, structural effects can often not be corrected for in top-down indicators, or it will need costly bottom-up modelling and gathering the necessary data for that modelling to do the required corrections.

Top-down evaluation means starting from global data like national statistics for energy consumption or sales of equipment, and then going down to more disaggregated data when necessary and correlating the realised energy savings with energy efficiency improvement measures by way of regression analysis.
Top-down calculation of energy savings can be easier to apply, particularly in areas, for which many and overlapping energy efficiency improvement measures exist. However, it is often difficult to define the reference trend.
Top-down methods can be used for electric appliances and vehicles, for which there is a well-defined statistical indicator of the average specific annual energy consumption per unit of appliance or per vehicle. However, bottom-up calculations are possible for these fields of application, too. Top-down is also the way to calculate the effects of energy taxation.

4.3.3 Evaluating the economic efficiency of policies and measures for energy efficiency improvement

Cost-benefit analyses of the impacts of policies and measures for energy efficiency improvement and energy saving can be conducted from different perspectives:

- perspective of society or economy, with or without consideration of external costs
- perspective of the state (government)

- perspective of the actors implementing energy efficiency activities (e.g. energy companies, energy agencies)
- perspective of the end-users, differentiated between beneficiaries of the measures and end-users who do not make use of the measures.

Such evaluation can be done, for example, via cost-benefit-tests that calculate the ratio of benefit and costs. Depending on the perspective, different benefit and cost components have to be considered and different interest rates have to be applied for discounting future costs and revenues.

As for the costs, the following types of costs have to be taken into account depending on the perspective chosen: expenses for designing policies and measures, marketing, advice, administration, efficiency technology, installation, maintenance, bonus payments, monitoring and evaluation. The benefits comprise the (long-run) avoided costs for energy production or procurement, transmission and distribution as well as supply. Besides, the avoided external costs for energy supply, which are difficult to quantify, have to be added. Furthermore, improved comfort for end-users and synergy effects for the actors implementing energy efficiency activities (e.g., customer retention effects for energy companies) may be viewed as additional benefits.

5 Sectoral recommendations

5.1 Caveats

This section aims to identify the most relevant policies and measures from a European perspective for four sectors: Buildings, private households, industry and commerce, and public authorities.

The tables presented in the following give recommendations as to which elements should be included in comprehensive policy packages for each sector with a view to effectively tackling the specific barriers and making the whole sector more energy-efficient. The selection of policy instruments and categorisation of their relevance presented in the tables should be viewed as an intersubjective expert opinion based on long-term experience with analysis, design and evaluation of energy end-use efficiency policies and measures in Germany and Europe.

The categorisation of relevance does not imply that some of the instruments can be abandoned; if feasible, it is always recommended to implement the complete package. For example, several policy instruments and measures can have synergy effects that even increase their effectiveness. The categories of relevant in the following tables are rather meant to work as guidelines for policy makers in terms of prioritisation, i.e. which policies should be implemented first, for instance when budgets are tight.

For a possible transfer of these recommended policy packages to a specific country like Brazil it should be noted that this overview cannot replace a thorough analysis of the market, market actors and policy institutions, energy consumption and energy efficiency potentials, barriers and obstacles for the different market actors as well as expected cause-impact relationships (cf. Chapter 4 regarding the process of designing policy packages, guidelines and crucial elements of such packages).

5.2 Buildings

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Essential	Removing market distortions, e.g. replacing existing subsidies of prices for conventional energy (fossil fuels, nuclear energy) by direct transfers to indigent consumers	Lack of economic incentive
	Spatial planning and urban district planning	Inconsistency of individual solutions; lack of system approaches (integrating aspects of buildings, building technology, transport and urban development)
	Stringent energy performance standards for new and existing buildings, including effective market surveillance and requirements regarding inspection of building technology	Lack of motivation and lack of knowledge; performance standards for the building as a whole also target the saving potential achievable through system optimisation
	Eco-design requirements and labelling of HVAC equipment and energy-related building components or materials (e.g., windows, insulation material, etc.)	Lack of motivation because savings are too small, split incentives, other priorities, etc.
	Education and training for architects, planners, installers, craftspeople, facility managers	Lack of information of multipliers (installers, planners, etc.) about existence of saving opportunities, cost-effectiveness of measures, best-available technologies (BAT)
	Promotion of energy audits (subsidised or mandatory ones) and establishing local networks for building refurbishment that link these promoted audits to implementation by qualified market actors and to any existing financial support	Lack of information of building owners about existence of saving opportunities and their cost-effectiveness, about existing financial support and trustful market actors; lack of trust in market actors

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Important	Financial incentives for energy-efficient refurbishment and new buildings (via soft loans, tax breaks, etc.)	Lack of access to capital (residential sector and SMEs); investment priority for core business activities (industry and commerce); risk aversion: high investments and long pay-back periods especially for building measures
	Establishment of energy management systems in non-residential buildings (either mandatory or via voluntary agreements)	Lack of knowledge about drivers of energy consumption and saving options
	Promotion of energy performance contracting and (public) internal performance commitments / contracting (e.g., removal of barriers, model contracts, financial guarantees, certificates for providers, etc.)	Risk aversion: professional contractors assess risks differently as compared to building owners
	Mandatory Energy Performance Certificates	Landlord-tenant dilemma: higher rent / sales price can be justified through the certificate
	Certification of energy consultants, ESCOs, etc.	Risk aversion: transaction costs of finding a trustworthy consultant/ESCO are reduced
Additional	Competitions and awards for „Green Buildings“	Lack of information on innovative solutions and good practice, e.g. solutions not using energy like natural cooling
	Public or cooperative procurement with regard to energy-efficient building technologies	Lack of demand for particularly energy-efficient technology; high prices for innovative technology
	Support to research and development	Lack of innovative technical, organisational, economic or social solutions

5.3 Private Households

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Essential	Removing market distortions, e.g. replacing existing subsidies of prices for conventional energy (fossil fuels, nuclear energy) by direct transfers to indigent consumers	Lack of economic incentive
	Eco-design requirements/ minimum energy efficiency standards for buildings, appliances, lighting, etc.	Lack of motivation because savings are too small, other priorities, lack of know-ledge, etc.
	Mandatory energy labelling of buildings, ap-pliances, lighting, etc.	Lack of information; transaction costs of finding efficient equipment
	Information and motivation campaigns on energy labelling, energy saving possibilities (e.g. web-based quick calculation tools, which give intial energy advice), good practice, etc.	Lack of motivation and information; uncertainty about costs and benefits of energy-efficient solutions
Important	Financial support (e.g., rebate programmes for highly energy-efficient appliances, free give-aways of low-cost equipment to low-income households, soft loans for refurbish-ment/ replacement measures)	Lack of access to capital; risk aversion: high upfront investment costs and long pay-back periods, e.g., for large appliances
	Qualification and training for multipliers who have direct contact with residential end-users (sales staff, craftspeople)	Lack of information of multipliers (sales staff, retailers etc.) about existence of saving opportunities, cost-effectiveness of measures
	Local advice centres	Lack of information; transaction costs of finding efficient equipment; uncertainty about costs and benefits of energy-efficient solutions
	Eco-tax on electricity and heating fuels or CO_2	Incorrect price signals (external effects of energy consumption not included in prices) → tax corrects this

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Additional	On-site advice (home audits)	Lack of information; transaction costs of finding efficient equipment; uncertainty about costs and benefits of energy-efficient solutions
	Competitions and awards for households (e.g., between households, buildings, building blocks, districtc, etc.); networking	Lack of information on possibilities to save energy in practice; lack of motivation to start acting
	Support to research and development	Lack of innovative technical, organisational, economic or social solutions

5.4 Industry and commerce

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Essential	Removing market distortions, e.g. replacing existing subsidies of prices for conventional energy (fossil fuels, nuclear energy) by direct transfers to indigent consumers	Lack of economic incentive
	Eco-tax on electricity and heating fuels or CO_2, compatible with (international) competition	Incorrect price signals (external effects of energy consumption not included in prices) → tax corrects this
	Eco-design requirements/ minimum energy efficiency standards for cross-cutting energy-using technology	Lack of motivation because savings are too small, other priorities, lack of knowledge, etc.
	Long-term negotiated and monitored agreements with (large) industry (maybe combined with tax incentives, i.e. companies can avoid the full tax if they agree to implement energy saving measures)	Asymmetric information between industry and state; lack of commitment by industry
	Promotion of energy audits and establishing local networks for small and medium enterprises that link these promoted audits to implementation by qualified market actors and to any existing financial support	Lack of information of managers about existence of saving opportunities, cost-effectiveness of measures, BAT
	Mandatory establishment of energy management systems	Lack of knowledge about drivers of energy consumption and saving options; institutionalisation of energy saving activities can yield large benefits
Important	Qualification and training for energy managers and facility managers and energy consultants	Lack of knowledge
	Promotion of energy performance contracting and (public) internal performance commitments / contracting (e.g., removal of barriers, model contracts, financial guarantees, certificates for providers, etc.)	Priority for core business activities -> outsourcing of energy efficiency activities
	Competitions and awards for „Green Companies“	Co-benefits in terms of reputation and customer retention increase the motivation/ willingness to implement energy efficiency measures; lack of good practice

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Additional	Cooperative procurement	Lack of demand for particularly energy-efficient technology; high prices for innovative technology
	Mandatory energy labelling of cross-cutting energy-using technology used by small and medium enterprises	Lack of information; transaction costs of finding efficient equipment
	Providing tool kits, e.g., for life-cycle cost calculations	Lack of knowledge in identifying cost-effective potentials
	Information and motivation campaigns on energy labelling, energy saving possibilities (e.g. web-based quick calculation tools, which give intial energy advice), good practice, etc.	Lack of motivation and information; uncertainty about costs and benefits of energy-efficient solutions
	Support to research and development	Lack of innovative technical, organisational, economic or social solutions

5.5 Public authorities

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Essential	Removing market distortions, e.g. replacing existing subsidies of prices for conventional energy (fossil fuels, nuclear energy) by direct transfers to indigent consumers	Lack of economic incentive
	Removing disincentives and correcting regulations hindering energy-efficient and (over their lifecycle) cost-effective solutions like e.g. accounting principles, decision structures, etc.	Lack of economic incentive; organisational barriers
	Specific commitment or target by the different levels of government to give a good example in the public sector, describing the level of future energy efficiency investments and energy savings	Lack of commitment
	Particularly stringent energy performance standards for new and existing buildings, including effective market surveillance and requirements regarding inspection of building technology, so that government can lead by good example	Lack of motivation and lack of knowledge; performance standards for the building as a whole also target the saving potential achievable through system optimisation
	A way of funding the continuous implementation of energy efficiency measures: e.g., budget act which introduces a specific energy efficiency budget line, revolving fund kick-started with the provision of seed money for energy efficiency investments in the first years and continuously fed by the energy cost savings that follow	Lack of finance
	Establishment of energy management units capable of implementing financing schemes, fulfilling targets and co-ordinating projects	Lack of priority, lack of knowledge, lack of organisation

Relevance	Policies and measures	Sector-specific barriers addressed by the policy instrument
Important	Mandatory Energy Performance Certificates	Lack of information on cost-effective energy efficiency potentials
	Mandatory energy-efficient public procurement with guidelines for buyers in public authorities and based on life-cycle costing; co-operative public procurement; central green procurement desks	Lack of demand for particularly energy-efficient technology; lack of co-ordination of procurement activities; prevailance of short-term perspective on initial price instead of looking at least life-cycle costs; high prices for innovative technology
	Qualification and training for buyers and facility managers	Lack of knowledge
	Promotion of energy performance contracting and public internal performance commitments / contracting (e.g., removal of barriers, model tenders and model contracts, certificates for providers, etc.)	Lack of capacity in implementing measures, lack of knowledge, lack of finance, existing barriers in the energy efficiency service market
Additional	Competitions and awards for „green municipalities“ and „green regions“	Co-benefits in terms of reputation and showing responsibility to the citizens increase the motivation/ willingness to implement energy efficiency measures; lack of good practice
	Providing tool kits, e.g., for life-cycle cost calculations	Lack of knowledge in identifying cost-effective potentials
	Information and motivation campaigns on energy labelling, energy saving possibilities (e.g. web-based quick calculation tools, which give intial energy advice), good practice, etc.	Lack of motivation and information; uncertainty about costs and benefits of energy-efficient solutions
	Support to research and development	Lack of innovative technical, organisational, economic or social solutions

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