



Your guide to energy efficiency in buildings.

How policies need to interact in packages

bigEE recommendations on which measures to combine for effective policy



Save 60 – 90% of energy

New, ultra low energy buildings and appliances can save 60 to 90 % of energy compared to conventional designs prevailing still in many national markets. With policy support for them to become widely available, they can become cost-effective at market-based prices for energy. In renovation and operation of existing buildings, policy can also enable cost-effective energy savings of 50 to 80 % depending on climate.

Market forces alone are unlikely to bring this about. Value chains in the building and appliances sectors are complex. Many different actors – investors, end-users but also building developers, equipment or appliance manufacturers, designers, trade, and builders – have to work together for an optimal outcome. A well-designed package of policies and measures needs, therefore, to assist the various actors in overcoming their specific barriers and strengthening their incentives. Experience from advanced countries and an analysis of market barriers show that several instruments will need to interact and reinforce each other in a comprehensive policy package. Every policy or measure has its own function in the package, its advantages, target groups and specific operational mechanisms. Each is tailored to overcome one or a few certain market barriers and to strengthen the actor-specific incentives, but none can address all of these barriers and incentives. Therefore, the impact of well-combined policies is often larger than the sum of the individual expected impact (IEA, 2005).

Different policies addressing the demand- and supply-side actors of markets should be properly combined according to national circumstances. This does not mean that governments seeking to improve the energy efficiency have to implement all possible policies in order to be successful, but they should combine a selection of instruments tackling the most important market barriers. As successful countries

have demonstrated, a comprehensive and coherent policy package for energy efficiency in buildings and appliances will usually provide a sound balance between clear mandatory measures, incentives, information and capacity building. It also needs a governance framework to enable implementation of these policies.

In addition, a thorough analysis of the market incentives and barriers for energy-efficient new build, renovation/operation, and appliances, and what the different actors need to overcome their barriers and harness energy efficiency has been performed by the bigEE team. It supports the recommended overall policy package presented above. We recommend that policymakers carry out a similar analysis for their country.

The following paragraphs illustrate the bigEE recommended policy packages and demonstrate how the individual instruments with their specific functions interact to make the packages work.

The presentation starts with the overarching governance framework for energy efficiency that is general to all sectors. Afterwards, the three sector-specific parts of the packages with specific policies and measures for energy efficiency in new buildings, in renovation and operation of existing buildings, and in appliances follow suit.



The governance framework for energy efficiency

In the bigEE recommended policy packages, the general governance framework serves to guide and enable implementation of the sector-specific policies, as well as to remove price distortions in energy markets that would make energy efficiency improvements appear less cost-effective than they are.

A Policy Roadmap with a clear timetable and targets will *guide policy-making and signal to the market* a reliable political support for energy efficiency. The targets should, of course, be specific to the three subjects we address in bigEE:

For new buildings lay out the road for mainstreaming ultra low energy buildings (ULEB)

For renovation and operation of existing buildings pave the way for high energy savings in each retrofit and in operation, and for increased rates of energy-efficient retrofit

For appliances prepare markets for mainstreaming highest energy efficiency levels.

The *administrative infrastructure and the funding* for the other policy elements need to be in place. This includes (1) an **energy agency** or similar institution for co-ordinating activities. To ensure (2) **stable funding**, government energy efficiency funds and/or energy companies with the task to achieve energy savings via energy efficiency programmes are also required.

Energy prices should 'tell the economic and ecological truth'. In addition, they must also consider social issues and should encourage energy sufficiency. It is essential that subsidies for energy production or on energy prices be gradually removed - governments are advised to rather use the budget saved to fund energy efficiency schemes for low-income households, so as to keep energy bills affordable instead of keeping energy prices artificially low. In addition to **removing energy subsidies, energy or CO₂ taxes** will finally internalise environmental damage and threats to health into final energy prices.

How the specific policies and measures for energy efficiency in new buildings interact

If we wish to afford heating, cooling and lighting our buildings in 10 or 20 years from now and aim to prevent disastrous climate change, we will need to achieve one operational goal in new construction:



making ultra low energy buildings (ULEB) the mainstream standard.

This can save 60 to 90 % of energy compared to new conventional buildings at costs below market-based energy prices and create enormous job opportunities. In the buildings sector, it will allow us to decouple growth from energy consumption and greenhouse gas emissions.

Figure 1 and the following text present the policy instruments we recommend to combine in a package for achieving this goal. The bigEE buildings guide includes more detail on ULEB.

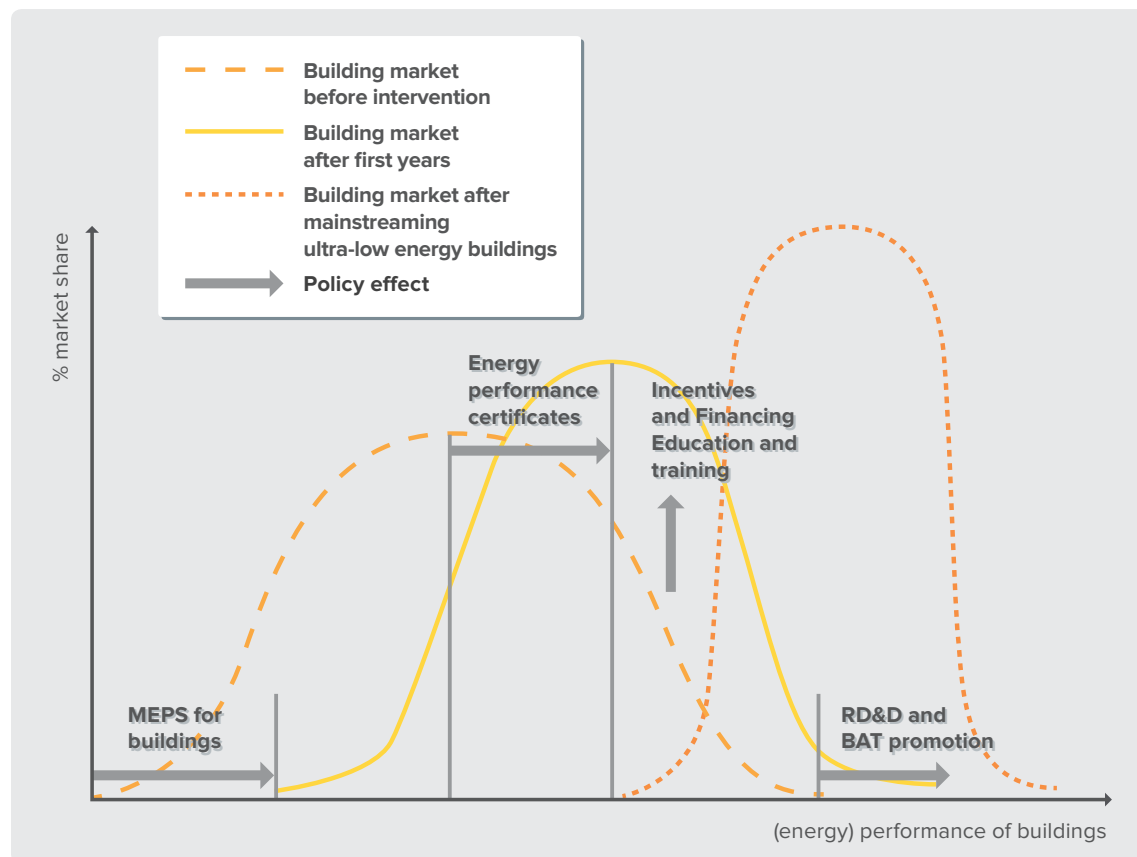


Figure 1: The interactions of policy instruments for energy efficiency in new buildings

Source: Wuppertal Institute (2012), adapted from Klinkenberg Consultants (2006)

- **Mandatory minimum energy performance standards (MEPS)** for all new buildings (and building components where useful) *are the most important policy for energy efficiency in new buildings*. They should be created by law and then strengthened step by step every three to five years, to finally require energy efficiency levels equivalent to ULEB. MEPS reduce transaction costs as well as the landlord-tenant and developer-buyer dilemmas by removing the least energy-efficient building practices and concepts from the market. They should, however, always be at least as stringent as the energy performance level leading to least life-cycle costs. In order to be effective, compliance with MEPS must be controlled at the local level in both the design stage and after construction. In a transition period before a law can make MEPS mandatory, a voluntary standard may help. Especially in developing countries, it may be useful to combine such voluntary or even the introduction of mandatory MEPS with financial incentives or financing for meeting the MEPS requirements, at least for poorer households (Iwaro and Mwasha 2010). Preferably, **other statutory requirements** such as individual metering, energy management for larger buildings and building portfolios, or regular inspections of heating, ventilation, and air conditioning systems would complement the legal framework.
- **Education and training** of building professionals (architects, planners, developers, builders, building and installation contractors, financiers and other relevant market actors) is essential to *prepare introduction and further strengthening of MEPS regulation* up to ULEB. Easy-to-use **tools** for energy-efficient building design and for life-cycle cost calculation are important for the training. **Certification** of successful participation to the training can make it more attractive for both the qualified market actors and their customers.
- The *markets should, furthermore, be prepared for the next step(s) of MEPS regulation* towards ULEB through policies tackling the substantial information deficits and financing barriers. These include building **energy performance certificates** (and energy labels for components where useful), **showcasing** of demonstrated good practice buildings, **advice** and **financing support** for investors, and **financial incentives** – such as grants and tax incentives – for broad market introduction of ULEB. It is mainly for such information and financial programmes that energy efficiency funds or energy companies must contribute. Promotion of energy services for energy savings and voluntary agreements with large developers to build more energy-efficiently than required by MEPS may also support market breakthrough.
- Once a certain market share of (ultra) low energy buildings of a specific energy performance level is reached, the professionals are trained and used to the required practices, and the cost-effectiveness of this energy performance level step is proven, this level can then be mandated by the regulation to become the new MEPS level. This would be *one step of MEPS regulation* towards ULEB in new build.
- *Future steps of MEPS regulation* towards ULEB should be prepared by innovation support through **R&D funding, demonstration** (including in public buildings), **award competitions**, and maybe also already by financial incentives for broad market introduction. The **public sector** should **lead by example** through energy-efficient public procurement and ambitious targets for its own buildings, thereby paving the way for the other sectors to follow.

How the specific policies and measures for energy efficiency in building renovation and operation interact

The existing building stock provides larger potential for cost-effective energy savings than new construction. It is also the bigger challenge to retrofit the walls, roofs, windows, and heating and cooling systems of existing buildings to highest energy performance levels in an integrated way. The operational goal for energy efficiency in existing buildings thus has two dimensions:



- **Achieving very energy-efficient and comprehensive, “deep” retrofits whenever a building is renovated, and**
- **increasing the rate at which buildings undergo such “deep” energetic renovations.**

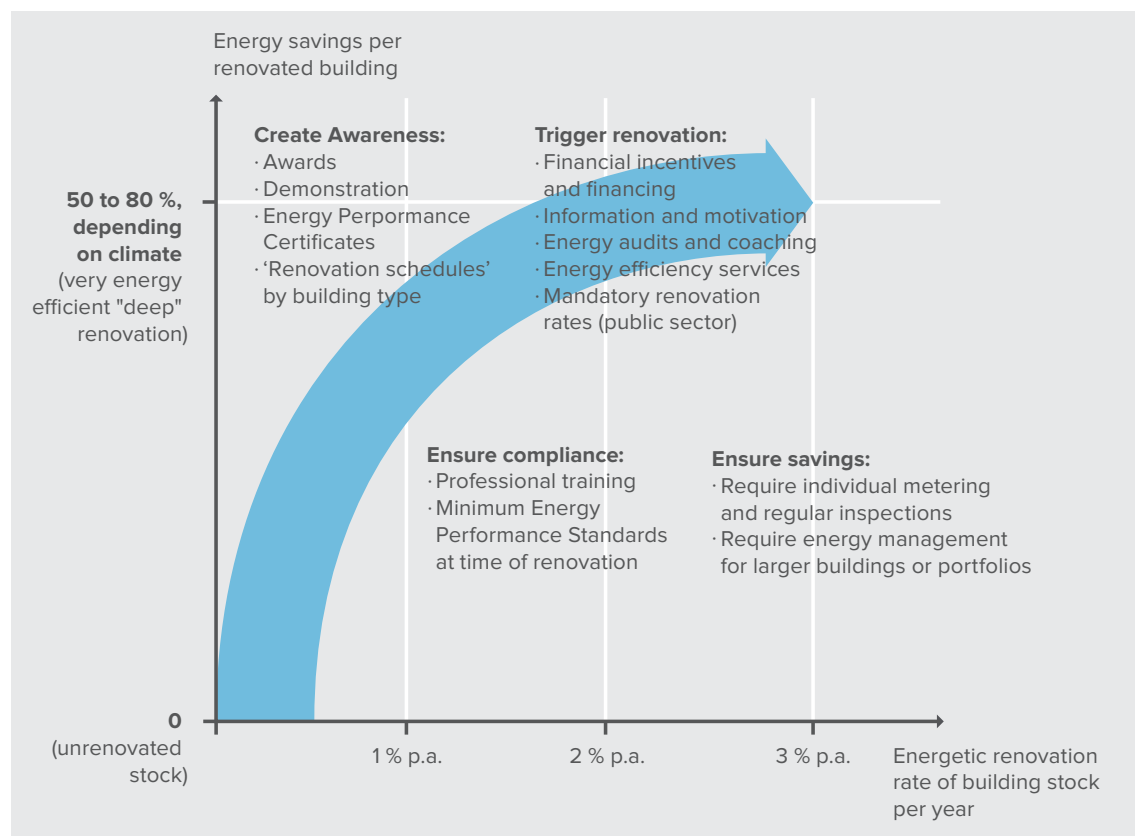


Figure 2: The interactions of policy instruments for energy efficiency in building renovation and operation

Source: Wuppertal Institute (2012)

Figure 2 and the following text present the recommended combination of policy instruments for achieving this two-dimensional goal.

- Every year, many existing buildings undergo renovation for maintenance or beautification anyway. These opportunities should be harnessed to improve energy efficiency by adding thermal insulation or shading and using more energy-efficient windows, heating, and cooling systems, instead of just replacing paint, tiles, or windows as they were before. **Mandatory minimum energy performance standards (MEPS)** for existing buildings undergoing major renovation (e.g., more than 10 or 20 % of the building shell or of the walls, windows, or roofs) as well as for building components and heating and cooling systems *are therefore an important policy for energy efficiency in existing buildings, too*. They should be created by law and then strengthened step by step every three to five years, to finally require energy efficiency levels equivalent or close to ULEB also for existing buildings when the technology is mature and cost-effective enough. MEPS reduce transaction costs as well as the landlord-tenant and seller-buyer dilemmata by removing the least energy-efficient building practices and components from the market. They should, however, always be at least as stringent as the energy performance level leading to least life-cycle costs. In order to be effective, compliance with MEPS must be controlled at the local level in cases of major renovation. In a transition period before a law can make MEPS mandatory, a voluntary standard may help. However, for existing buildings it is much more important to accompany MEPS with individual advice as well as financial incentives or financing for meeting the MEPS requirements, since otherwise building owners may wait with major renovation. A possibility may be to mandate the rate at which the portfolio of large building owners has to undergo energy-efficient renovation each year, as the European Union has recently decided for national government buildings in its Member States.
- The most important policies and measures for energy efficiency in existing buildings are those tackling the substantial information deficits and financing barriers, in order to first move markets towards very energy-efficient retrofit levels („deep renovation“) and then to trigger energy-efficient renovation at all, to increase retrofit rates.*

These instruments include building **energy performance certificates** (and energy labels for components where useful) with mandatory display upon advertisement, rental or sale, **show-casing** of demonstrated good practice building renovations, and **award competitions** for very energy-efficient renovations, combined with **information and motivation programmes** to disseminate the results, *to raise awareness* for energy efficiency opportunities in renovation and to develop more energy-efficient and cost-effective technologies and concepts for building renovation. In addition to these instruments, **individual advice**, such as **energy audits** need to show building owners what they (or their tenants) can save and what is cost-effective, and **coaching** can be essential to assist investors in implementing the retrofits. Still, due to long pay-back times and/or lack of finance, **financing support** for investors, and **financial incentives** – such as grants and tax incentives – for broad market breakthrough of very energy efficient retrofits. It is mainly for such information and financial programmes that energy efficiency funds or energy companies must contribute. Promotion of **energy efficiency services** for guaranteed energy savings and voluntary agreements with large developers to renovate energy-efficiently at an increased rate may also support market breakthrough.

Only all of these instruments together are likely to achieve the double goal of very energy-efficient retrofits at increased rates.
- Preferably, **other statutory requirements** such as individual metering, energy management for larger buildings and building portfolios, or regular inspections of heating, ventilation, and air conditioning systems would complement the legal framework *to ensure energy-efficient operation of buildings*.

- In addition, there must also be a sufficient number of skilled providers willing and able to perform the energy-efficient renovation tasks. **Education and training** of building professionals (architects, planners, portfolio managers, builders, building and installation contractors, financiers and other relevant market actors) is essential *to increase renovation rates and ensure high quality and very energy-efficient retrofit*. Easy-to-use **tools** for energy-efficient building design and for life-cycle cost calculation are important for the training. **Certification** of successful participation to the training can make it more attractive for both the qualified market actors and their customers.
- *Future steps of MEPS regulation* towards energy efficiency levels equivalent or close to ULEB should be prepared by innovation support through **R&D funding, demonstration** (including in public buildings), **award competitions**, and maybe also already by financial incentives for broad market introduction. The **public sector** should **lead by example** through very energy-efficient renovations and ambitious energy savings targets for its own buildings, thereby paving the way for the other sectors to follow.
- Once a certain market share of retrofits to a specific energy performance level is reached, the professionals are trained and used to the required practices, and the cost-effectiveness of this energy performance level step is proven, this level can then be mandated by the regulation to become the new MEPS level for major renovations. This would be *one step of MEPS regulation* towards energy efficiency levels equivalent or close to ULEB in existing buildings.

How the specific policies and measures for energy efficiency in appliances interact

Appliances are standardised units that the investor purchases “off the shelf” and just connects to the energy and in a few cases the water network. The energy efficiency optimisation is done by the manufacturer, but the choice between very energy-efficient and inefficient models is influenced by all market participants. The main goal for policy is, therefore,



to move markets to highest energy efficiency levels and ultimately to make very energy-efficient models the standard.

A secondary goal is the promotion of an energy-intelligent use of appliances. Figure 3 shows the relationship between the performance of appliances (the A-G energy efficiency categories are used to dem-

onstrate the energy efficiency level, A is the highest energy efficiency level, G is the lowest level) and the policies applied to increase the energy performance of appliances.

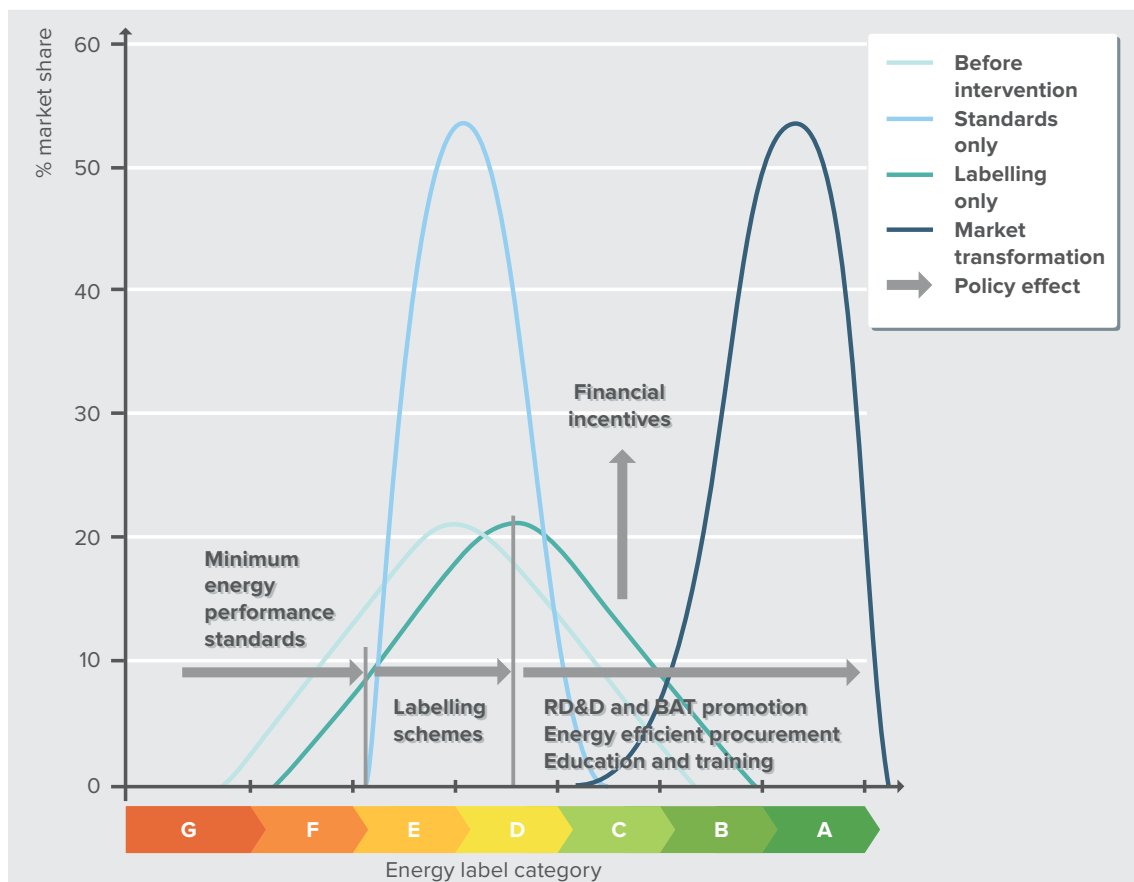


Figure 3: The interactions of policy instruments for energy efficiency in appliances

Source: Wuppertal Institute (2012), adapted from DECADE (1997)

The following bullet points briefly describe the relevant policy instruments to increase the energy efficiency of appliances and illustrate the combinations and interaction of these policies.

- **Mandatory minimum energy performance standards (MEPS)** are the most important policy for energy efficiency in appliances. They should be created by law and then strengthened step by step every three to five years, to finally require energy efficiency levels equivalent to very energy-efficient appliances. MEPS reduce transaction costs as well as the landlord-tenant and buyer-user dilemma by removing the least energy-efficient models from the market. They should, however, always be at least as stringent as the energy performance level leading to least life-cycle costs. In a transition period before a law can make MEPS mandatory, a voluntary standard may help. Preferably, **other statutory requirements**, such as individual metering, would complement the legal framework.
- **Energy Labelling** works together perfectly with energy performance standards. MEPS usually eliminate the worst products from the market but do not harness additional energy-saving potentials. Energy labels present the best products on the market and are primarily made for buyers and end-users. They are, thus, one element of the package to “reach the energy efficiency top”, like the others that follow here. Mandatory energy labelling schemes mostly compare the products on a classification scale to show the best but also the worst products on the market. Such classification labels are, however, useful only if there is a large enough spread of energy efficiency levels between the models of a type of appliance offered in a market. Where that is not the case, an endorsement label for the most energy-efficient models only may be an alternative. Furthermore, an information campaign is needed in order to promote the label and to raise the consumers’ awareness towards energy efficiency.
- The market should, furthermore, be prepared for the next step(s) of MEPS regulation towards very efficient appliances through policies tackling the substantial information deficits and financing barriers. This includes the already mentioned energy labels, but also **advice**, easy-to-use product choice and life-cycle cost calculation **tools** and **financial incentives** - such as rebates, grants and tax incentives – for broad market introduction of energy-efficient appliances. The latter are more costly than other instruments, so they will be particularly useful if there is a very large spread of energy efficiencies in the market and, hence, large energy cost savings are possible. In addition, they can often be limited to a certain time period (e.g., two or three years) until the market offer and demand has switched to the energy-efficient models. For low-income households, **financing support** may be needed to purchase very energy-efficient appliances that have a higher upfront price but pay back over their lifetime through lower energy bills. It is mainly for such information and financial programmes that energy efficiency funds or energy companies must contribute.
- **Education and training** of professionals (manufacturers, sales staff, and other relevant market actors) should *prepare introduction and further strengthening of MEPS regulation*. Certification of successful participation to the training can make it more attractive for both the qualified market actors and their customers.
- Once a certain market share of (highly) energy-efficient appliances is reached, the professionals are trained and used to selling the energy-efficient models, and the cost-effectiveness of the next step is proven, then this level can then be mandated by the regulation to become the new MEPS level.
- *Future steps of MEPS regulation* towards very energy-efficient appliances should be prepared by innovation support through **R&D funding**, award **competitions**, and maybe also already by financial incentives for broad market introduction. The **public sector** should **lead by example** through energy-efficient public procurement, thereby paving the way for the other sectors to follow. To push the market further towards energy-efficient appliances and create first markets for them, **co-operative procurement** programmes can make an important contribution towards very efficient products due to the high purchasing power. Voluntary agreements with large buyers to purchase more energy efficiently than required by MEPS may also support market introduction.

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bigee.net

bigEE is an international initiative of research institutes for technical and policy advice and public agencies in the field of energy and climate, co-ordinated by the Wuppertal Institute (Germany). Its aim is to develop the international web-based knowledge platform bigee.net for energy efficiency in buildings, building-related technologies, and appliances in the world's main climatic zones.

The bigee.net platform informs users about energy efficiency options and savings potentials, net benefits and how policy can support achieving those savings. Targeted information is paired with recommendations and examples of good practice.

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Dr. Stefan Thomas • bigee@wupperinst.org

Wuppertal Institute for Climate, Environment and Energy • Doeppersberg 19 • 42103 Wuppertal • Germany • Phone: +49 (0)202 2492-129