Combining theoretical and empirical evidence: Policy packages to make energy savings in appliances happen

Lena Tholen, Dr. Stefan Thomas

Wuppertal Institute for Climate, Environment and Energy

Abstract

What are the best policies and measures to stimulate energy efficiency in residential appliances, heating, ventilation cooling and lighting? The debate on this is at least as diverse as the markets and concepts for energy efficiency in these areas, and is often discussed quite controversially. However, no magic formula seems to have been found so far. It is, therefore, time to bridge the information gap and address the question in a new way - by combining both theoretical evidence on what policy support markets need, and empirical evidence on the combinations or packages of policies which have worked.

In the context of its new four-year project bigEE – "Bridging the Information Gap on Energy Efficiency in Buildings" – the Wuppertal Institute is implementing this new approach. The bigEE project aims to develop an international internet-based knowledge platform for energy efficiency in appliances, buildings, and building-related technologies. Hence, it must provide evidence-based information.

On the theoretical side, the analysis starts with value chains in the appliance sector and the barriers but also market-inherent incentives of the different types of market participants. Empirical evidence will feed the collection of these barriers and incentives. This enables to identify, which policies and measures need to be combined to jointly overcome the barriers and strengthen the incentives.

On the empirical side, model examples of good practices are collected and compared. The search for these policy packages or single instruments is guided by the results of the theoretical analysis. A network of international experts and existing databases and platforms is also giving information for the search. In order to identify what is "good practice" among the examples collected, the project uses a newly developed multi-criteria assessment scheme, which is presented in this paper. The assessment scheme is tested by a successful policy to demonstrate the procedure of the assessment scheme.

Finally, the impacts achieved with the model examples, lessons learned from their implementation, and their transferability shall be used to validate the different factors which are necessary to implement a successful policy and which were identified in the theoretical analysis.

Introduction

Energy efficiency has major potentials for innovation and market opportunities and should therefore be supported by adequate policies and measures. Decision makers already recognised energy efficiency as a key element for progress towards a more sustainable energy future, with high potentials and advantages for their own country. Consequently, the topic has been on the policy and business agenda for years, with significant achievements already made in several countries worldwide.

A main topic for energy efficiency in the residential sector is the electricity consumption of residential appliances like refrigerators, TVs or washing machines. To implement a policy that strives towards energy efficient products and to minimize the use of electricity, decision makers must have good knowledge of the respective sectors concerned, in order to be able to adequately implement a successful policy.

The question remains: What are preconditions for a successful policy and which criteria are crucial to consider? What must a criteria scheme look like to decide about the success of a policy and measure? The new project bigEE – "Bridging the Information Gap on Energy Efficiency in Buildings" – tries to answer these questions and summarises several concepts to fill this information gap and thus attempts to create a new and comprehensive approach. The aim is to detect all relevant factors, which are needed to develop a successful policy and further to make these factors visible to policy makers worldwide. They have the chance to use this knowledge as basic information and thus implement a policy with a well-grounded theoretical and empirical background.

With the presentation of knowledge based on already established experiences and research efforts, the bigEE project aims to increase the energy efficiency level of appliances worldwide and to promote policy options for decision makers to achieve this goal. This paper concentrates on the policy side. A focus is put on the connection between theoretical and empirical evidence and the question how established theoretical options fit together with experiences gained from already implemented policies and measures. Due to the focus of the EEDAL conference, this paper focuses on the identification of policy options for increasing the energy efficiency of residential appliances.

In the following chapters, the bigEE project will be briefly described to illustrate the project background and scope. Afterwards the 'ideal' policy package in the appliance field, which is known in principle with its various policy instruments and the interactions between single policy instruments will be presented. It is now widely accepted that a policy package can achieve the greatest success, given that a large variety of barriers and market failures exist, which hinder a rapid market change towards higher energy efficiency in appliances.

The bigEE project tries to validate this 'ideal' policy package and address the question of how energy efficiency can be supported most effectively – by combining a theoretical, actor-centred analysis with empirical evidence on model examples of good practice policies. By closely analysing the actors in the value chains and their incentive structures and then deducing implementation strategies and ideal policy packages, this paper aims to provide a solid methodological basis for the often-quoted necessity to implement comprehensive policy packages. The methodological approach, which will be presented in the following chapters, is based on and seeking to extend and refine the theory-based policy evaluation approach, which goes back to US experiences with energy efficiency policy evaluation (e.g. [1]) and was applied and developed further more recently within the EU project AID-EE [2]. In the second part, the paper compares the outcome of this actor-centred analysis with empirical evidence on policy instruments that have actually worked and delivered significant energy savings. In this context, a newly developed multi-criteria assessment scheme will be presented to identify good practice policies. One briefly outlined model example illustrates the empirical evidence for a successful policy option that could be part of an 'ideal' policy package.

Due to space constraints, this paper can only present an extract of the full analysis, which will be made available by the time of the EEDAL '11 conference at www.bigee.net.

Bridging the information gap on energy efficiency in buildings

It is widely accepted that energy efficiency is the biggest, fastest, and most cost-effective option for saving energy and mitigating climate change, with at least 40% of the energy efficiency potential in appliances and buildings [4]. Yet, both investors and policy-makers are still far from fully tapping this potential, even if abundant information on good practice technologies and policies is in principle available. However, the information is scattered, too little tailored for specific target groups, and not easy to find for decision-makers. Thus, the information and implementation gap is still large, both in the market and with policy-makers.

This is why bigEE – "Bridging the Gap on Energy Efficiency in Buildings" – the new project by the Wuppertal Institute, with financial support from the German government, aims to develop an international internet-based knowledge platform for energy efficiency in appliances, building-related technologies and buildings overall. The platform will address the needs of decision-makers in businesses and policy; a structured presentation will make it easy to find the information wanted. Primary target groups of the initiative are policy-makers, public and private investors, and actors and consultants in policy and energy service implementation.

Apart from information universally applicable, up to five partner countries will be addressed, starting with China and India. A central task for bigEE is collecting, making comparable and updating information on “best available technologies”, energy saving potential, net economic benefits, and good practice policies. To achieve the required quality of information, the bigEE team collaborates with scientific institutes – international and in partner countries, with existing initiatives – international and in partner countries, with existing initiatives and platforms, and the Sustainable Buildings Network (SBN) under IPEEC. Furthermore, bigEE engages in the active dissemination of information relevant for investors and policy makers in the partner countries, by setting up and cooperating with a network of local partners.

The summarised objectives of the bigEE project are:

- Raise greater awareness and attention for the variety of benefits of increased energy efficiency in new and existing buildings and residential appliances.

- Close the gaps of scattered information and material on energy efficiency by providing latest know-how in a target group oriented, consistent, easily accessible, and transparent way.

- Manage and communicate available knowledge especially for emerging economies.

Figure 1 gives an overview about the bigEE topics. The project aims at two parallel knowledge fields: The technological potentials and the policy options to increase energy efficiency. The column with the title “EE Policies” on the right side of the figure sets the framework for the contents of this paper.

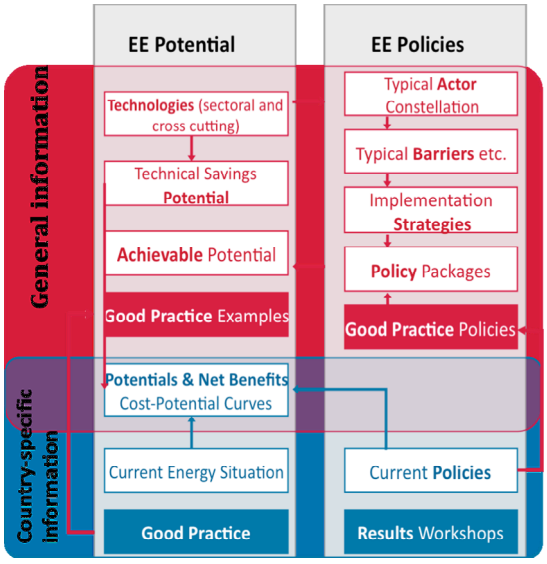

Figure 1: The bigEE project - overview

The ‘ideal’ policy package for appliances

The bigEE project pursues a web-based presentation of energy saving potentials and good practice policies and policy combinations for buildings and appliances worldwide. The objective of this paper is to present how the project attempts to find these ideal packages and good practice policies. According to international research and experience, a package of several types of consistent and technology-specific and actor-specific policy instruments is useful to be most successful. Instead of a single instrument, a package offers the opportunity to achieve synergies between single instruments, and to reach all market actors [6].

Every policy measure has its own advantages, ideal target groups and specific operational mechanisms. Each is tailored to overcome one or a few certain market barriers, but none can address all barriers. Most instruments achieve higher savings, if they operate in combination with other measures, and often these impacts are synergistic, i.e. the impact of the two is larger than the sum of

the individual expected impact [3]. Therefore, the ideal policy consists of consumer-oriented instruments and instruments for manufacturers (to build a “push and pull strategy” to push consumers and manufacturers away from energy intensive practices and to pull them towards energy efficient ones). Several instruments exist worldwide with the aim to increase the energy efficiency of appliances. For energy efficiency in appliances, these instruments can be packaged as follows:

Legal provisions on minimum energy performance standards (MEPS) reduce search and transaction costs and partly overcome the investor-user dilemma. They are a cost-effective way to at least eliminate the worst energy-performing products from the market. However, they do not harness additional savings potentials due the most energy-efficient products in such cases. Therefore, appliance standards are often combined with labelling and rebates in order to give incentives for investments beyond the level required by the minimum energy efficiency standard. On the other hand, labelling programmes cannot completely transform the market and, for this reason are completed by MEPS in the great majority of countries [7]. To pull the market even more into an energy efficient direction, information programmes, trainings for sales staff and manufacturers, and especially procurement programmes can influence the market to promote energy efficient appliances. Figure 2 illustrates an ideal policy package for appliances and describes the interactions between minimum energy performance standards, energy labels, rebate schemes, market and technology procurement, and information and training programmes.

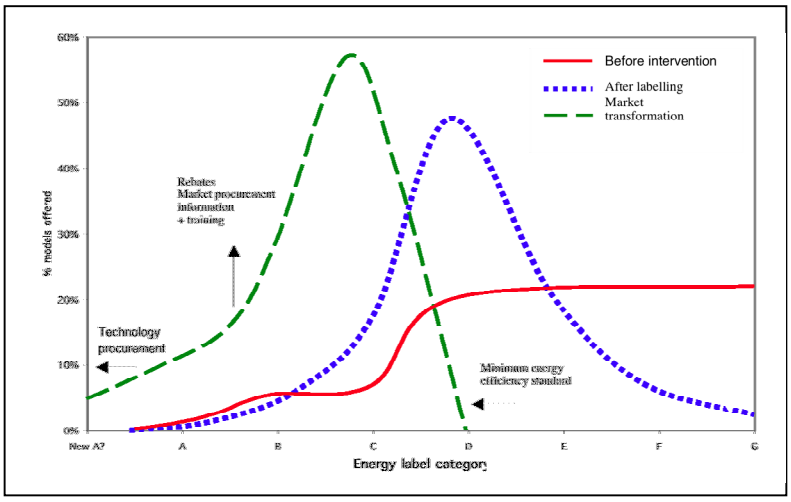

Figure 2: Policy package for domestic appliances

Source: Wuppertal Institute, partly adopted from DECADE (1997)

In order to prove this hypothesis of an ideal policy package that includes push and pull strategies, reaches all relevant market actors, and moves the market towards the most energy efficient appliances, the bigEE project uses a combination of theoretical and empirical evidence. The aim of this paper is to only present the scientific approach with few examples. The approach, and the paper as well, is divided into two parts: The first step is a theoretical, actor-centred analysis which is in a second step combined with an empirical evidence on model examples, i.e. already implemented good practice policies. The full actor-centred analysis can be found at www.bigee.net; the empirical evidence will be added there later.

Theory-based, actor-centred analysis

Different steps are needed to derive an ‘ideal’ policy package, which increases the energy efficiency of appliances. The refined actor-centred approach can be subdivided into several steps. It starts with the identification of all relevant market actors along the value chain of the national market for the type of appliance concerned. In order to be able to adequately design and implement energy efficiency

policies and measures, political decision makers must have good knowledge of the concerned market actors and thoroughly analyse the specific incentives and barriers faced by each of them. As a next step, implementation strategies to overcome the identified barriers and to strengthen the incentives need to be developed. Then, policy instruments to materialise these implementation strategies must be discussed; usually already a package of individual policies and measures needs to work together to implement one strategy. The final step is the combination of these strategies and their respective policies to create market-adapted overall policy packages with the adequate combination of policy instruments.

In a further step, this theoretical approach will be combined with an empirical proof. In the second part of this paper one single instrument will be described and analysed as an example for a part of an effective policy package. This example - a financial incentive programme – was not only successful as a single option but especially as a part of a package consisting of MEPS, labels and soft measures like training and educational programmes.

Market actors and specific barriers and incentives

Before creating a policy to increase the energy efficiency of residential appliances, it is essential to have a closer look at all relevant market players along the value chain and their actor-specific market-inherent barriers and incentives to manufacture, sell, or buy an energy-efficient product. The list below illustrates key actors on the supply side, on the demand side, and further actors [6]. They may be more or less relevant on a national market, but for our analysis to be valid in general, we have included all of them.

Actors on the supply side

- Manufacturers and importers of appliances which are sold to end-users or which are sold to downstream manufacturers or installers; component manufacturers
- Wholesalers, retailers and sales staff in retail companies

Actors on the demand side

- Investors in energy efficiency who are users of the energy-efficient appliances at the same
- Investors in equipment who do not use the technology themselves
- Users of appliances who are not, at the same time, investors in energy efficiency

Political institutions and further actors

- National and sub-national or supra-national parliaments, governmental bodies and administrations
- Energy consultants and energy agencies
- (environmental) NGOs, consumer organisations, trade associations

After identifying the relevant actors in the appliances market, it is necessary to put the focus on the actor-specific barriers and incentives. Each actor group has its own characteristics and therefore every policy has to pay attention to these. By knowing the barriers and incentives of every actor the policy package can be adapted to guarantee desired results and achieve the greatest possible success. bigEE has developed extensive tables looking at all relevant actors. The following table presents just an extract.

Table 1: Actor specific barriers and incentives

Target group	Barriers	Incentives
(Component-) Manufacturers	- Prevailing price competition or predominance of other product features over energy efficiency - Risk of technical development: Will	- Increased direct earning of profits for actors on the supply side: The energy-efficient option usually requires higher upfront investment

	there be a market for energy-efficient appliances? - Risk of production and marketing: Will there be a sufficient demand? - Lack of knowledge about the market situation - Lack of knowledge about technical options - Uncertainty about availability of sufficient quantities of reasonably priced components	by the buyer. From a supply perspective, this means higher prices/revenues and possibly higher profits (if customers are willing to pay more due to the expected energy cost savings) - Offering energy-efficient solutions can act as a unique selling proposition and thus lead to competitive advantage of even market leadership - Both end-users and the environment benefit from energy-efficient solutions: Offering such solution thus underpins a company's CSR goals - Offering higher value to the customers
Investors in energy-efficient appliances who are also their users	- Low energy costs/low savings/other economic priorities - Lack of motivation - High search and transaction costs - Reluctance/sceptism towards new products and technologies from new suppliers/companies - Lack of capital - Uncertainty about future energy prices - Lack of knowledge about efficient technology - Insecurity about continuity. What will be in 5, 10, .. years - High profitability requirements - Misleading price signals due to rate design and lack of internalization of external costs - Risk aversion: Does the new technology guarantee the same level of functionality and security? - Other functional priorities - Habits, good experiences	- Save energy costs: The energy-efficient product is often the cost-effective solution - Increase (re-sale) value of the appliance - Contribution to environmental protection - Receive social recognition in return for environmentally-sound behaviour
…	…	…

The identified barriers and incentives create one question: How can these barriers that market actors face be overcome and how can the immanent incentives be strengthened? The described barriers are the major reason why there is a gap between potential and realised energy savings. That is why policy makers have to identify these barriers to overcome them and to strengthen the market inherent incentives for energy efficiency. A number of ways to achieve this are available. The following chapter summarises some of these strategies and describes them briefly. The aim is to make energy efficiency feasible, easy, attractive, and eventually even the default.

Implementation strategies and policy packages

A number of direct ways to reach the relevant actors, tackle their barriers and strengthen their incentives, and thus to maximize the energy savings exist. These ways can be named implementation strategies. An implementation strategy may act on several incentives and barriers. An example for an implementation strategy is: "*Bring down the first costs of energy-efficient appliances via market*

transformation/economics of scale". This example picks up economic aspects and tries to overcome financial barriers and strengthen financial opportunities. The economic barrier is only one example for several other barriers and corresponding implementation strategies. The next table summarizes this example of an implementation strategy with the actor-specific barriers it tackles and incentives it strengthened.

Table 2: An example for an implementation strategy with corresponding barriers tackled and incentives strengthened

Implementation strategy	Barriers tackled	Incentives strengthened
Bring down the first costs of energy-efficient appliances via market transformation/ economics of scale	(Manufacturers) Extra construction costs: risk of loosing customers to the competition (assuming that customers look at first cost only). (Investors, users) Lack of motivation because savings are too small, uncertainty about level of benefits and costs (is it worth it?), other priorities etc. (Investors, users) Present-biased preferences, uncertainty about ability to reap the benefits, excessive expectations in terms of payback. (Investors, users) Lack of capital real or perceived costs, innovations only with short payback period. (Manufacturers, wholesalers, retailers) Prevailing price competition or predominance of other product features over energy efficiency; therefore low priority by manufacturers and low willingness to pay (more) for energy-efficient products. (Investor • users) No direct economic advantage for cost effectiveness.	(Investors) Save energy costs. The energy efficient product is often the cost effective solution (Investor • user, manufacturer) Increase value of the property; from a supply perspective, this means higher revenues and possibly higher profits. Justification for higher prices (Manufactures, users) Contribution to protection of the environment

The next step is to find an adequate policy package to realise the implementation strategies and to guarantee lasting effects. It is essential to have a look at the technology and the product-specific potentials and to demonstrate the best way how to increase energy efficiency with a package of different but coordinated instruments.

To come back to the financial oriented implementation strategy presented in table 2 and addressing certain actor-specific barriers and incentives, the following policy instruments are options to bring down the first costs of energy-efficient appliances: economic incentives like grants, subsidies, rebates, soft loans, and innovative financing schemes such as on-bill financing, functional services or 'pay as you save' schemes for very efficient new products. In addition, a support on how to find and apply these financial options is essential to be successful. Other measures to reduce the first costs are tax rebates and public or technology procurement programmes. The target group for these measures are (directly and indirectly) manufacturers, end-users and investors in energy efficient appliances.

Some instruments are alternative to each other, but usually several instruments should be coordinated in an adequate policy package to establish synergy effects and realise the implementation strategy. The implementation strategy mentioned for tackling economic barriers and incentives is only one example of several other implementation strategies and their respective policies and measures. The ideal package to realise all the needed implementation strategies will be illustrated on the project related website www.bigee.net. In general, we conclude that our actor-centred analysis has confirmed the 'ideal' policy package presented above but lack the space to demonstrate the final steps in this paper.

The empirical proof: policies and measures used by successful countries

To create successful policy packages and to guarantee lasting results single policies and measures must be successfully implemented and coordinated with other policies which were already implemented. An effective policy package consists of several innovative and successful P&Ms.

Numerous programmes to promote the energy efficiency of appliances exist. For example, minimum energy performance standards and voluntary or mandatory labelling schemes were already implemented in many countries worldwide (overview: see inter alia www.clasponline.org or www.iea.org). Furthermore, financial incentive programmes and awareness-building measures were implemented in many countries in addition to regulatory instruments to lead consumers to buy the most energy-efficient products. Nevertheless, full analytical assessments which of these strategies and instruments were most successful are not available until now. The first part of this paper dealt with the actor-centred theoretical analysis and the development of implementation strategies and policy packages to increase energy efficiency.

For the verification of the described theoretical approach and the resulting 'ideal' policy package, policies already implemented in different countries will be analysed in the bigEE project to find out, which preconditions are necessary to name a policy a "good practice example", and to create the basis for a successful policy package that consists of several well implemented policies. Consequently, a method how to find good practice policies is necessary. A new multi-criteria assessment scheme was developed to rate policies and measures and to judge whether a policy was successfully implemented and can be named a good practice policy or not.

Criteria to rate the policy instruments

To evaluate, compare and decide which policy or policy combinations have worked best and can be called 'good practice', the Wuppertal Institute developed a new multi-criteria assessment scheme. The function of the assessment scheme is to compare policies and to highlight worldwide good practice policies. A comprehensive system to rate policies and measures has the chance to demonstrate success factors and potentials (energy savings, cost-effectiveness etc.). The aim is to present good practice examples to policy makers and to provide incentives to transfer these policies (especially to emerging countries).

The scheme is based on ten criteria. Main criteria are the already mentioned integration of all relevant market actors and the analysis of existing barriers and incentives. The ideal policy addresses all market players and barriers, avoids lost opportunities and lock-in effects, has dynamic efficiency levels, lasting results and spillover effects. Other aspects are the innovative structure of the policy or the policy package and the promotion of high energy efficiency standards (according to the best available technology or the least life cycle costs). The policy must have been evaluated to be a model example. The calculated cost-effectiveness and the achieved high energy savings (per unit and overall) demonstrate the successful implementation. Finally, the measures should not have significant negative side-effects like rebound effects, snap-back effects and free-rider effects to be ranked as good practice policy.

Table 2 shows this multi-criteria assessment scheme for good practice policies. Next to the ten selection criteria, the operationalisation is described and the weight for the selection is presented. The assessment scheme differentiates between proven policies, which are already in place for several years, and innovative policies, which were implemented short time ago. Some of the selection criteria require a ranking between 0 and 10. This ranking will play a role in the overall assessment of the policy and during the decision whether the policy can be named good practice policy. The comments on the right side give some explanatory remarks.

Table 3: Multi-criteria assessment scheme for good practice policies or policy packages

No	Selection Criteria Good Practice P&M		Operationalisation	Weight for selection		Comments
				P&M with proven effective-ness	Innovative P&M	
1	The policy has been **successfully** and durably **implemented** into the market		Implemented	Eligibility	Eligibility	P&M is or was in force at least in one country and provides preconditions which are in principle transferable to other countries
			At least 2 years in place before date of website publication	Eligibility	n/a	P&M is or was in force at least in one country
2	**Recent** P&M		Not older than 10 years before date of website publication	If not, justification required	If not, justification required	Last revision date of the P&M counts
3	**Appropriate design of P&M**	Addresses **all relevant market actors** and **most relevant barriers and incentives**	Ranking as a whole on a scale between 0 and 10	30%	40%	Often better achieved when policy is part of a package
		Is designed to **avoid lost opportunities**				For example, addresses the energy-efficient solutions in the right manner and moment, e.g., by taking into account the investment cycle of the target group
		Aims at **dynamic** market transformation				For example, promotes innovations to make BAT even more energy-efficient, and/or, increasingly removes inefficient technology/practices from market
		Achieves **lasting** results				For example, no snap-back effect
		Positive **spillover** effects should be an objective				Large multiplier effects
4	Includes **innovative P&M elements** or combines them to an innovative P&M package		Ranking on a scale between 0 and 10	10%	30%	Outstanding compared to other countries, e.g.: market actor addressed who is not included in other existing P&M; an innovative way to overcome barriers; innovative package of P&M

5	Does the P&M foster **worldwide BAT** or country-specific **LLCC solutions**? (whatever is appro-priate in the country)	Close to BAT/LLCC = 10; Substantially different from BAT/LLCC = 0	10%	15%	Dynamic life-cycle cost analysis including typical interest rates??
6	A satisfying **ex-post evaluation** exists	Yes = 10; no = 0	10%	n/a ex-ante data if possible	Ex-post evaluation usually gives more reliable data than ex-ante evaluation
7	The energy savings are **cost-effective** (for consumers and the economy)	Benefit-cost ratios from different perspectives	If no data or not cost-effective, justificatio n required	n/a ex-ante data if possible	Dynamic life-cycle cost analysis including correction factors and typical interest rates
8	**Effectiveness I**: The P&M leads to **energy savings per unit** (per appliance) compared to reference case	Is data on energy savings per unit available? Please give absolute and relative numbers.	Not eligible, if no data	n/a ex-ante data if possible	Expected additional, yearly energy savings in %/year and in kWh/year per unit (per appliance) compared to baseline projections
	Effectiveness II: The **effectiveness** is high: How many % of the energy savings potential available within a specific time frame due to normal investment/refurbish ment cycles in the target area (**region / country**) have been implemented?	Please give absolute and relative numbers (BAT or LLCC vs. reference; including correction factors), and then rank on a scale between 0 and 10.	30%	n/a ex-ante data if possible	For example, at least 30% of the potential has been implemented; or the share of energy-efficient technology has increased considerably; or the price premium on energy-efficient technology has decreased; or a service has saved on average at least 30% of the customers' energy consumption
9	The policy is in line with other **sustainability** criteria	Ranking on a scale between 0 and 10	10%	15%	Other aspects like material efficiency, health or employment aspects taken into account.
10	**Mix of countries / continents**	Final selection of portfolio	Global perspective, mix of countries		

P&M = Policies and Measures; BAT = Best Available Technology; LLCC = Least Life-Cycle Cost; correction factors = factors correcting the gross savings for rebound, free-rider and spill-over effects, as well as to eliminate double-counting between P&M

A model example of a good practice policy

To analyse the feasibility of the multi-criteria assessment scheme, the EnergiePremieRegeling (EPR, energy premium scheme), which was developed in the Netherlands in 2000 is used as an example. The Dutch programme was implemented from 2000 to 2003, aiming at, inter alia the purchase of appliances at the top levels of efficiency and performances by creating favourable conditions for consumers. The programme offered cash rebates for the purchase of higher energy efficiency household appliances, like refrigerators (e.g. in 2002, customers received 50€ for each appliance with energy label A and 100€ for super-efficient A+ appliances; in 2003, only A+ and A++ models were eligible for rebates). Therefore, the target group were buyers and users of residential appliances. The rebates, funded by an energy tax (Regulating Energy Tax; Regulerende Energie Belasting REB) were channelled back to the consumer through the utilities. This so called "ecotax" on electricity and gas was in principle paid by the consumer to the state; but the energy companies collected it. The customers had the possibility to get a rebate paid out by the energy company for specific energy

efficiency measures. This ended up, as an example, in 94.4% of the market of washing machines being Class A and higher, i.e. the highest penetration in Europe at that time. The energy companies subtracted these energy rebate payments from their ecotax debt [6].

These first impressions of the programme promise success for the identification of a good practice policy according to the newly created multi-criteria assessment scheme. The next chapter analyses the criteria in detail to decide whether the policy was successfully implemented and can be named a good practice policy.

EnergiePremieRegeling – a good practice policy?

The ten criteria of the assessment scheme will be taken up by the policy example to identify a good practice policy. Firstly the policy was successfully and durably implemented in the Netherlands from 2000 – 2003 and the end of the programme is not longer ago than 10 years. Therefore the EnergiePremieRegeling was successfully implemented and is a recent P&M. The next aspect of the assessment scheme deals with the appropriate design of the policy. The programme aims to avoid lost opportunities by providing financial benefits to buy an energy efficient product. Consumers and investors were successfully addressed to overcome existing barriers and to strengthen incentives. Barriers are for example the lack of capital, low energy savings compared to the costs and the lack of knowledge. Furthermore the rebound effect could be minimised because the programme went along with information campaigns and social marketing mechanisms. However, the free-rider effect was high in the early years, because apart from saving energy [6], the main goal of the EPR was to channel back the energy tax to the tax payer (households). Regarding snap-back effects, the programme was effective for only a few years. After this period no supports were offered anymore but the increase in sales has also produced a decrease in the prices of A-labelled white goods. Their market shares remained at a significantly higher level than before.

Furthermore, the policy included innovative elements by using an intelligent policy package including a wide scale of information campaign, like national campaigns on television, national newspapers, advertisement in shops, actions targeting installers, and websites. Moreover the programme is in accordance with the EU energy labelling scheme and the Energy+ campaign that prepared the label sub-classes A+ and A++ for cold appliances. If a customer decides to buy an energy-efficient appliance, the energy label provides information, whether a funding is possible or not. The same mechanism was offered by the Energy+ campaign. The subsidies funded by an energy tax which was channelled back to the consumers through the utility is also an innovative element.

The EU energy label demonstrates the best available products on the market. The Energy+ campaign allowed to distinguish even higher energy efficiency within class A of the label. The energy premium scheme offered cash rebates for the purchase of these very energy-efficient household appliances. That is why the policy was close to a best available solution and fostered worldwide BAT.

To come back to the assessment scheme, a satisfying evaluation exists and the cost-effectiveness was calculated. In total, about 15% of the ecotax is used for the energy credit scheme. The amount of funds available to the citizens for 2000 and 2001 were 158 million €, of which 97% was actually spent. Another important measurable side effect were increases in VAT and taxes on profit and the avoided unemployment benefits. They were calculated for the case of washing machines: extra company profit tax: 1.9 million €/year and extra VAT: 6.6 million €/year [8].

Regarding cost-effectiveness, the energy savings were also high. In November 2001, almost two years after the start of the programme, one third of Dutch households had applied for the rebates. Around two thirds of these rebates concerned domestic appliances. The introduction of the premium scheme has led to an enormous growth of the supply of A-labelled and later A+ and A++-labelled appliances. The market share of A-labelled washing machines grew from 40 to 88% over the 1999-2001 period. This means the proportion of A-labelled appliances doubled and prices decreased (up to 25%). This increase is most likely due to the energy premium scheme and led to a situation where retailers very often advice their customers to buy an A-labelled appliance as the best on offer. An analysis of the Wuppertal Institute calculated that energy savings for household appliances of 300 GWh/year, plus 500 GWh/year in heating energy for buildings and 0.3 million tons of CO_2 were realised with the energy premium scheme programme until 2002 alone (including the market transformation effect and other side effects) [6].

According to this analysis and the positive results, the programme addressed selected market players and overcame existing barriers. It avoided lost opportunities and fostered lasting results. The policy had an innovative structure and promoted high and rapidly increasing energy efficiency standards, particularly for refrigerators and freezers (only A+ and A++ received rebates in 2003). The calculated cost-effectiveness and the achieved high energy savings confirm the successful implementation. Therefore the energy premium scheme can be named a good practice policy.

Summarising, the assessment scheme was successfully tested for a policy example– a financial incentive programme, which can be an essential element of the 'ideal' policy package –with the result that it is possible to identify good practice policies. The main barrier for the application of the bigEE assessment scheme is the availability of relevant data. For many policies, there is a lack of data due to the lack of attention to and funds for evaluation. Adequate information is often not available and national experts may be essential with appropriate background knowledge.

Good practice in policy packages to prove the results of the actor-centred analysis

In the previous chapter, the EnergiePremieRegeling was tested as a successful single instrument. Furthermore, the programme was also part of an effective policy package, which is a proof of our actor-centered analysis. The rebate scheme was developed in accordance with minimum energy performance standards, the European energy label, voluntary labelling schemes and information programmes. Particularly, the EU Energy label and the procurement programme Energy+ formed the basis for the EPR. They provided information, whether a consumer was entitled to a rebate when buying a specific model or not. The dynamic tightening of the requirements for award of a rebate (from A to only the equivalent of what became A+ and A++ later on), in turn, prepared the revision of the EU cold appliance label to include A+ and A++ subclasses, by enabling manufacturers to start mass production to meet the demand created by the EPR scheme. The package thus comes close to the 'ideal policy package' presented in figure 2.

Other examples for successful and coordinated policy packages for energy-efficient domestic appliances can be found, e.g., in Japan, Brazil and California. They, too, include innovative elements and demonstrate the successful interaction of different policies, like MEPS, labels, financial mechanisms, replacement programmes, procurement measures and information campaigns.

Conclusion

Energy efficiency is one of the most important issues in order to protect the climate and to stop the growing consumption of energy. For that reason, policy makers face the challenge to develop and implement appropriate instruments to increase energy efficiency of residential appliances. Such programmes are already in place in many countries. Especially minimum energy performance standards and labelling schemes were already implemented in industrialised but also developing countries. Different databases list these instruments and describe them briefly (see inter alia databases developed by CLASP and the International Energy Agency). It is also known that the interaction of several instruments guarantees the greatest success with push- and pull factors to influence all relevant actors and to tap all the available potential.

The refined approach, which was presented in this paper, illustrates how an actor-centred analysis enables developing an 'ideal' policy package, looking at the relevant market actors, their specific barriers and incentives, and concluding on implementation strategies which are derived from the earlier analysis. Based on this analysis, packages of policy instruments were identified, which are consistent with these implementation strategies. Since they address all relevant barriers, the package can be expected to transform the market towards high levels of energy efficiency.

This theoretical result was proofed by an empirical analysis, illustrated by a concrete example. To identify which policies and measures were successfully implemented and which factors were crucial to develop this policy, a multi-criteria assessment scheme was created and presented. The new scheme is justified by the fact that although several implemented policies are already in force, the effects of energy efficiency programmes are often poorly documented. Advantages and disadvantages are often unknown. That is why policy makers often rejected policy proposals because it seems too

difficult to implement adequate measures. The empirical analysis tries to close this information gap by assessing the success and effectiveness of existing policies.

The newly created multi-criteria assessment scheme takes the analysis a step forward to rate policies and to define success factors. Criteria of the assessment scheme are primarily the energy savings and the cost-effectiveness of the policy but also the avoidance of negative side effects and the promotion of best available technologies. The new method rates policies and measures in more detail compared to already known schemes, which mainly focus on the effectiveness, the efficiency, the political feasibility and the innovation potential (see e.g. [5]). It goes beyond these approaches and considers the realised energy savings compared to the existing potentials, the cost-effectiveness and the design of the policy. The assessment scheme illustrates benefits of different policies and measures and thus aims to convince policy makers worldwide to transfer the policy from other countries in order to achieve similar results.

In the empirical part of this paper, the assessment scheme was exemplarily illustrated with the Energy Premium Scheme, which was implemented in the Netherlands in 2000. The review demonstrated the feasibility of the new method. According to the assessment scheme, the programme can be named a good practice policy and has therefore been successfully implemented. It is also a part of a policy package that comes close to the 'ideal package' and significantly accelerated energy efficiency in the market for cold appliances.

A precondition to use the assessment scheme is the availability of data. A comprehensive evaluation is essential to fill in the list of criteria. This is a precondition and therefore the biggest barrier of the scheme. Experts are necessary with a high level of knowledge about the policy-specific data and the design of the policy. A comparison of different measures is, therefore, still only feasible with considerable effort. However, the resulting comprehensive assessment and identification of what is really good practice will be worth the effort.

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