What makes a good policy? Guidance for assessing and implementing energy efficiency policies

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Abstract

Which factors are crucial to successfully design and implement a 'good practice' policy to increase the energy efficiency of buildings and appliances? This is one of the main challenges for the new web platform bigee.net that provides guidance on good practice policies.

In this paper we examine the question what 'good practice' is by presenting a multi-criteria assessment scheme to analyse different policies worldwide. The assessment scheme contains a set of criteria addressing key factors leading to the success of a policy as well as its outcomes: a good policy addresses all market players and barriers, avoids lost opportunities and lock-in effects, has ambitious and regularly updated energy efficiency levels, and spill-over effects. Other criteria are high energy savings and the calculated cost-effectiveness.

The assessment scheme provides a standardised data collection approach, which paves the way for both qualitative and quantitative evaluation. Furthermore, it can help policy-makers to transfer a successful policy.

The development of the scheme is based on a literature review of worldwide implemented policies and measures that promote energy-efficiency of buildings and appliances. Criteria were operationalized, including a ranking between 0 and 10. The ranking is a decisive factor whether the policy qualifies as good practice. To demonstrate the practicability of this scheme, the paper analyses a good practice example according to the assessment scheme: Energy-Efficient Refurbishment and Energy Efficient Construction programmes of the German public bank KfW.

Introduction

Policy-makers worldwide have increasingly recognised energy efficiency as a key factor to reduce the energy consumption and to realise a sustainable energy future. Significant achievements have already been made in industrialised but also in emerging and developing countries.

In this context, buildings and appliances as a major source of energy use should be a focus to control the energy consumption and to reduce greenhouse gas emissions. Approximately 40 % of global final energy demand and one third of energy related carbon dioxide (CO_2) emissions are related to buildings (IEA 2008a). Thus, early and comprehensive use of energy-efficient design and technology – thermal envelope and supply of heat and cold – can reduce both energy demand and CO_2 emissions by 50 to up to 100 % in some temperate climates such as south-western Europe (Moore et al. 2013). Further energy savings can be made in appliances and equipment used in buildings. The most energy-efficient appliances available today can save between 60 % and 85 % of energy compared to inefficient models that are still on sale in many countries (Wuppertal Institute 2012). The energy efficiency efforts do not only achieve high energy saving potentials. CO_2 emissions can also be reduced cost-effectively from a life-cycle perspective and thus provide economic benefits. Furthermore, several other co-benefits like health and comfort benefits (enhanced daylight exposure, less noise, improved indoor air quality) and increased competitiveness can be realised. By offering innovative products can open up new (niche) markets, which will likely have a positive effect on the economy as a whole (IEA 2012).

The challenge remains to transform the buildings and appliance sector in a way that efficient solutions will no longer be an exception but become the standard choice of market actors. This usually requires well-designed packages of policies (Höfele

& Thomas 2011; Thomas et al., paper 5B-103-13 in these proceedings).

To realise this goal it is essential to inform policy-makers about alternatives among energy efficiency policies and measures and their success factors. Therefore the web-based platform "bigEE.net – Your guide to energy efficiency in buildings" was developed to make structured information easily available and to enable policy-makers to make well-considered decisions. The demonstration of the practicability of different policy approaches and the successful implementation (including energy and cost savings) can be a key motivation for policy makers to transfer a similar policy or to improve existing ones.

The challenge for the project was to find an appropriate way to rate and compare different implemented kinds of policies from all over the world and to define criteria to demonstrate the success of single policies. First, a screening of worldwide implemented policies was conducted based on literature review and second, with regard to this analysis, an own approach was developed. The result is a newly developed multi-criteria assessment scheme. It can be used to evaluate and monitor policies, to collect data, and to compare and rate policies. Furthermore the scheme enables the identification of good practice policies.

In the following, the bigEE project will be described briefly to illustrate the project background and its scope. Afterwards the assessment scheme will be presented with its single criteria and the weighting of each criterion. To illustrate the practicability, an already implemented policy will be presented: the KfW[1] programmes in Germany, which offer comprehensive financial assistance to residential building owners and builders.

A web-based knowledge platform to demonstrate good practice policies

"bigEE – bridging the information gap on energy efficiency in buildings" is a project by the Wuppertal Institute, with financial support from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Within the project, the international internet-based knowledge platform "bigEE – your guide to energy efficiency in buildings" was developed (see: www.bigee.net). Three comprehensive guides – for building design and technologies, for appliance energy efficiency and for policy implementation present detailed information about how to increase energy efficiency and how policy can support this development. Apart from information universally applicable for policy makers and investors from all over the world, up to five partner countries will be addressed, starting with China and South Africa and possibly soon Mexico.

A central task for bigEE is collecting and updating information on best available technologies (BAT) on a comparable basis, as well as the gathering of possible energy saving potentials (depending on different scenarios and market developments) and their net economic benefits, and the demonstration of successful implemented good practice policies. To achieve the required quality of information, the bigEE team collaborates with scientific institutes and with existing initiatives (international and in partner countries) including the United Nations Environment Programme (UNEP) and the International Energy Agency (IEA). Furthermore, bigEE engages in the active dissemination of information relevant for policy-makers in the partner countries.

Multi-criteria analysis

The multi-criteria analysis (MCA) is a common approach to reach decisions with complex targets and aspects: When the complexity is too high and multifaceted information can hardly be considered, analysed and rated, the MCA provides a supportive tool to generate a transparent and structured basis for decision-making (Monteiro da Silva & Guedes de Almeida 2010).

The MCA can be regarded as a further development of traditional cost-benefit analyses, which had a limited focus solely on economic criteria. To overcome this limitation and also in order to support "people to make choices according to their values in cases characterised by multiple and conflicting criteria" (Bogetoft & Pruzan 1997) the MCA approach was developed to include further aspects (social, ecological, etc.). The MCA therefore goes beyond traditional schemes and can be used in all areas, where linear analyses generate a strong complexity-reducing effect. The UNFCCC defines a MCA as "a type of decision analysis tool that is particularly applicable in cases where a single-criterion approach (such as cost-benefit analysis) falls short, especially where significant environmental and social impacts cannot be assigned monetary values" (UNFCCC 2010).

The methodological approach, which will be presented in the next chapter, is based on this multi-criteria analysis approach. It was applied and further developed to address the questions and issues of the bigEE project.

The bigEE Multi-Criteria Assessment Scheme

During the work for the bigEE project the question arose, how to rate and identify good practice policies. The term "good practice" or "best practice" is heavily used in policy analysis but there is no common definition and agreement how to select these examples; the term remains rather vague.

Considering different conditions worldwide, it is very difficult to find one best practice example. Thus, bigEE focuses on good practice examples, which are compiled on the basis of a multi-criteria analysis. This approach devises a clear methodology how to rate and select good practices. The aim is to make impacts visible and comparable, and to illustrate the preconditions for a successful policy implementation.

The development of the bigEE Multi-Criteria-Assessment Scheme started with a first step: a screening of more than 200 worldwide implemented policies and measures. The screening was based on a literature review, in this context evaluation and monitoring reports as well as impact assessments were helpful documents. The review covered all kinds of energy efficiency policy instruments, for instance minimum energy performance standards (MEPS), energy labels, financial incentives, or procurement programmes.

Based on this screening a multi-criteria assessment scheme was developed. The criteria range from appropriateness of the policy design, the integration of innovative elements, the availability of ex-post evaluation, to questions of effectiveness (calculated cost-effectiveness and high energy savings). These cri-

1. The KfW Bankengruppe is a government-owned economic development bank from Germany.

teria were operationalized via a ranking between 1 and 10. This procedure results in an overall score, which indicates whether the policy actually is "good practice" or not. According to the assessment scheme, a policy can be considered as a "good practice" if there is a total score of more than five points (Tholen & Thomas 2011). This threshold was chosen as five is the middle of the scale between 1 and 10.

Taking account of the fact that there may be policies that will not be able to fulfil certain criteria (mostly those addressing quantitative impacts), because they are too recent, the assessment scheme differentiates between so-called proven and innovative policies. Proven policies have already been in place for several years and innovative policies were implemented only recently. Depending on the start year of the policy, the evaluation can focus either on the impact (for proven policies) or on promising design elements (Höfele & Thomas 2011).

Our empirical study of policies has demonstrated the practicability of the bigEE assessment scheme. It provides not only an analysis of good practice policies but also a standardised data collection approach, which paves the way for both qualitative and quantitative evaluation.

EVALUATION CRITERIA

The ten criteria and the motivation for including them in the scheme are listed and explained in Table 1[2]. In addition to the ten selection criteria and their explanation, the operationalization including the rating and the weighting are presented.

Case study: Selected KfW programmes in Germany

In the following, two "KfW" programmes, 'Energy-Efficient Refurbishment' and 'Energy-Efficient Construction' are analysed and rated according to the multi-criteria assessment scheme described above. During the screening of worldwide energy-efficiency policies and their evaluation studies and the consultation of experts, the programmes were chosen as a candidate for a detailed analysis according to the assessment scheme. Subsequently the programmes were examined in further details by the bigEE team to decide whether the programmes were successfully implemented, exceed the minimum score and can hence be named a good practice policy. Full detail can be found online.[3]

In order to increase the energy-efficient refurbishment rate and the construction of new energy-efficient homes in Germany, the government offers a comprehensive financial assistance to residential building owners and builders through programmes of the government-owned economic development bank KfW Bankengruppe. The lack of capital is seen as one of the core challenges for building owners to undertake action (IEA 2008b, pp. 37–38). With the programmes, building owners can apply for grants or soft-loans with a grant element that reduces the loan to be repaid. Either new houses consuming less energy than the energy demand specification in the Energy Conservation Ordinance (Energiesparverordnung/EnEV), i.e., the German Minimum Energy Performance Standard (MEPS) for buildings, or refurbished houses that do not exceed a specific energy requirement defined in relation to that for a comparable new house resp. single retrofit measures can be financed.

RECENT POLICY AND SUCCESSFUL IMPLEMENTATION OF THE POLICY

The KfW Energy Efficient Refurbishment and KfW EnergyEfficient Construction (KfW) programmes were first implemented in 2001 and updated many times; the latest revision took place in 2012. They were very well received by the public and may therefore have a learning effect for other countries.

Rating: Both criteria are met.

APPROPRIATE DESIGN OF P&M

With the two programmes several barriers were addressed and overcome for many investors, most notably lack of funds and motivation; the lack of motivation is addressed trough consultations with an energy advisor as part of the programme. Both programmes have been incorporated in the Energy Concept of the German Federal Government and, thus, are seen as long-term policy commitments. Furthermore, the energy efficiency requirements for grants and loans are aligned to the German MEPS for buildings and strengthened from time to time. They aim to achieve high energy savings and avoid lost opportunities and free riders through a decidedly whole house approach, where other soft loan respectively financial incentive programmes focus only on the improvement of components, and through providing higher grants for higher energy efficiency. However, so far most applications have been for shallower retrofits and low-energy, but not for ultra-low-energy buildings.

Rating: 7 of 10 points.

INNOVATIVE ELEMENTS

The German government has developed a portfolio of measures to incentivise investors to invest in more energy-efficient buildings. As this package of services is funded at various stages (like Consumer Information Centre, On-site Advice, and the KfW Financing and financial incentive programmes as the final stage), investors can access it at low cost. The KfW uses the commercial banks to hand out the loans, thereby minimising administrative costs, but particularly because the commercial banks assume the liability for the credits. Therefore, "the impact on the national budget remained limited as KfW raises funds on the financial market and federal money is only used as a subsidy for reduced interest rates. The loan to the homeowner comes from a normal bank, but is re-financed by KfW on the capital markets, with the German Federal Government providing a subsidy to keep interest rate low" (Schröder et al. 2011, p. 53).

Rating: 7 of 10 points.

THE POLICY FOSTERS WORLDWIDE BAT

The demand for highly energy-efficient building design and technology is stimulated. The programmes differentiate between relatively energy-efficient buildings (close to LLCC, e.g. EH 115[4]) and more efficient ones (BAT, e.g. EH 70). As more efficient buildings

2. We relied on the California Standard Practice Definition for the perspectives of cost-effectiveness in Table 1, cf. www.cpuc.ca.gov.

3. URL: http://www.bigee.net/en/policy/guide/new-buildings/recommended/28/example/25/.

4. EH stands for "Effizienzhaus" or "Efficiency House"; the number indicates the building's maximum allowed primary energy demand in comparison to a new building built to meet Germany's minimum energy performance standard (MEPS) for buildings. For example, a refurbished EH 70-certified building demands only 70 % of the primary energy of a comparable new building that just meets the requirements of the German MEPS.

Table 1. bigEE evaluation criteria for good practice of policies and measures (P&M).

	Criteria	Explanation	Rating	Weighting	
				Proven policies	Innovative policies
1	Implementation of the policy/ transferability	The policy or measure is or was in force at least in one country. There are no special preconditions that prevent the transfer to other countries. Policies that are only in the planning phase or whose implementation has failed for some reasons do not qualify as models for others.	none	Precondition; no weighting	Precondition; no weighting
2	Recent P&M	The policy is not older than ten years or a justification is required. The last revision date of the policy or measure counts. The reason for this criterion is that market players and policy-makers are often not so keen on "old stuff" and easier to convince with up-to-date information.	none	Precondition; no weighting	Precondition; no weighting
3	Appropriate design of the P&M	Policies need to be well-designed to be effective and should not fall short of the energy saving potential or promote suboptimal solutions, and should avoid negative side effects. Therefore the policy was designed to address all relevant market actors and the most relevant barriers and incentives. Furthermore the policy aims to foster a dynamic market transformation, for example by promoting innovations to make the best available technology (BAT) even more energy-efficient and/or increasingly removes inefficient technologies from the market. The policy should be designed to address relevant side effects like minimising free-rider effects, snap-back effects and rebound-effects and to maximise spill-over effects.	as a whole on a scale between 0 and 10	30%	40%
4	Innovative elements	In many areas, energy efficiency policies need innovation to become more effective. Therefore the policy or measure includes innovative elements or combines them to an innovative policy package. Example: Different market actors are addressed and included in the policy design and implementation phase or there is an innovative way to combine policies and to overcome barriers (like financial barriers or knowledge barriers).	on a scale between 0 and 10	10%	30%
5	Policy or measure fosters worldwide BAT	Promoting suboptimal solutions will create lost opportunities for savings and lock in inefficient designs and technologies. Therefore the policy should be designed to foster worldwide best available technology (BAT) or country-specific least life-cycle cost (LLCC) solutions. This includes a dynamic life-cycle cost analysis including typical interest rates.	close to BAT/LLCC = 10; substantially different = 0	10%	15%
6	An evaluation exists	An evaluation is crucial for policy assessment and learning. A comprehensive ex-post evaluation exists including an analysis of the status quo and the results in terms of energy savings, emission reductions, cost-effectiveness or other plausible criteria for measuring a P&M impact.	yes =10; no = 0	10%	n/a
7	The policy is cost-effective	Most policy-makers prefer cost-effective policies; these will therefore be more appealing and convincing. The project considered policy cost-effectiveness for energy-efficiency investors, energy end-users or others expected to act due to the policy (usually called 'participants' in the case of an energy efficiency programme), and for the national economy (total resource cost) or better the societal perspective. This includes a benefit-cost analysis including net to gross correction factors and typical lifetimes and interest rates.	Policy must be cost-effective; Benefit-cost ratio from different per-spectives	if no data or not cost-effective justification required	n/a ex-ante data if possible
8	The P&M leads to energy savings per unit	The P&M leads to energy savings per unit (per appliance, per building) compared to a reference case. Expected additional, annual energy savings in %/year and in kWh/year per unit compared to baseline (e.g. business as usual) projections.	only if energy savings/ unit are available	Precondition; no weighting	n/a ex-ante data if possible
9	The overall effectiveness is high	Energy efficiency policies should aim for large overall energy savings and should not fall short of at least the cost-effective potential. This criterion measures what they actually achieved in this respect. 'High' means: have at least 30 % of the energy savings potential available within a specific time frame due to usual investment/refurbishment cycles in the target area (region/country) been implemented. If that is not easy to evaluate, effectiveness could also be measured by the following: the share of energy-efficient technology has at least doubled; or the price premium on energy-efficient technology has decreased at least 30%; or a service has saved on average at least 30% of the customers' energy consumption.	on a scale between 0 and 10	30%	n/a ex-ante data if possible
10	Sustainability aspects	It is not only energy savings that matter. The policy is in line with other sustainability aspects like material efficiency, health or employment aspects.	on a scale between 0 and 10	10%	15%

receive better loan and/ or grant conditions, this gradually moves the market to higher energy performance levels, although currently the demand for less deep retrofit measures is higher, likely due to the greater complexity of carrying out deep retrofits (Neuhoff et al. 2012). Adaptation of MEPS to higher energy performance levels is facilitated. Overall, the market and the policy framework are made dynamic towards higher energy efficiency.

Rating: 10 of 10 points.

AN EVALUATION EXISTS

For each calendar year, the programmes' impacts are estimated through an independent evaluation, e.g. BEI & IWU (2010) and IWU & BEI (2011; 2012) for the years 2009, 2010 and 2011. The reports use a sample of buildings to estimate the overall impact on energy savings, energy cost savings by consumers, greenhouse gas emission reductions, employment, and value added tax (VAT) income to the government budget.

Rating: 10 of 10 points.

THE POLICY IS COST-EFFECTIVE

Both programmes are cost-effective to consumers[5] and even for the government budget. According to IWU & BEI (2012) calculations, the new build and refurbishment programmes together result in about €6.3 billion of tax revenues, as compared to €0.9 billion of budget allocation to the programmes. However, this is based on the full cost of construction, not just the incremental costs of energy efficiency improvements. Furthermore, cost-effectiveness from the national economy (total resource cost) perspective was not evaluated. The programmes are likely to meet this criterion too.

Rating: Criterion fulfilled.

THE P&M LEADS TO ENERGY SAVINGS PER UNIT

Energy Efficient Refurbishment programme: On average, KfW investors annually saved 82.2 KWh/m^2/yr and 7,148 KWh/yr per building unit through the Energy Efficient Refurbishment Programme in 2010. The energy demand before the refurbishment was about 7,876 GWh/yr and after about 5,427 GWh/yr; this is about 31 % of energy savings compared to the situation before. For new construction, the savings were ca. 40 % relative to the MEPS for new buildings (IWU & BEI 2011).

Rating: Criterion fulfilled.

THE OVERALL EFFECTIVENESS IS HIGH

Energy Efficient Construction programme: Between 2006 and 2010, the programme (and its predecessor "Building Environmentally-friendly") saved 1,341 GWh/yr on the national level as compared to the reference case. This means that new buildings only fulfilling the minimum criteria for new constructions instead of favouring more ambitious action (EH 40, 55, 70) would have used 3,310 GWh per year.

Energy Efficient Refurbishment programme: Considering that the cost-effective potential for energy savings in refurbishment in German dwellings is around two thirds (Enseling & Hinz 2008) and the programme achieved energy savings of around 31 % (IWU & BEI 2011)[6], the effectiveness of the programme in tapping the potential in each case may be estimated at ca. 50 %. At first glance, this does not appear very effective, however, the percentage reached is better than results of many other financial incentive programmes on building energy efficiency refurbishment. For new buildings, with savings of 40 % and Ultra-Low-Energy buildings saving up to 70 % vs. current legal requirements (Moore et al. 2013), the effectiveness is somewhat higher than 50 %. In addition, the rate of energy-efficient refurbishment can be increased further.

Rating: 5 of 10 points.

SUSTAINABILITY ASPECTS

Both programmes massively contribute to lowering the environmental impact of Germany's carbon footprint: CO_2 emission reductions of the Energy Efficient Refurbishment Programme since 2005 account for 4.2 million tonnes of CO_2 each year (IWU & BEI 2012). With the Energy Efficient Construction programme, since 2005, accumulated emissions reductions are just under 500,000 tonnes of CO_2/yr (IWU & BEI 2012, p. 5). Furthermore, employment effects are considerable IWU and BEI calculate that the Energy Efficient Refurbishment programme, resulted in employment effects of 52,000 person years of which 38,000 are direct effects (IWU & BEI 2012). Effects calculated for 2010 were 92,500 person years.

Aspects such as material efficiency or health are not explicitly addressed by the programmes.

Rating: 5 of 10 points.

RESULT

The overall rating of the KfW programmes is 6,8 out of 10 points (the weighting criteria can be found in the table above for proven policies). Therefore the policy is a good practice policy according to this multi-criteria assessment scheme. The policy still has some weaknesses in the effectiveness and sustainability aspects but all in all the policy has a rating of more than 5 points and can therefore be described as a good practice example.

Discussion and conclusions

To reduce the high consumption of energy it is essential to convince policy-makers to design and implement appropriate policies and measures to increase the energy efficiency of buildings and appliances. The aim of the bigEE project is to provide a knowledge platform and to inform policy-makers about 1) different types of policies and measures and their interaction in policy packages and specific design options and 2) how proactive countries already implemented these policies successfully. For that reason the presentation of already implemented successful policies and measures is a central task of the project.

5. For an operating life of 30 years of the energy-efficient refurbishment actions funded, heating cost savings from the 2011 programme year alone reached €3.3 billion (present value) or €4.2 billion (nominal value) (IWU & BEI 2012, p. 40 et seg.). Energy cost savings (present value) therefore seem lower than the overall investments of €3.85 billion. However, this includes at least 30 to 80 % of costs (depending on energy efficiency action) that investors would have incurred anyway for scheduled refurbishment of walls, windows, roofs, or heating systems without improving energy efficiency. Comparing the energy costs savings only with the incremental investment for energy efficiency improvements will therefore demonstrate a net benefit. A similar calculation applies to the new build programme.

6. On average, KfW investors annually saved 82.2 kWh/m2/yr and 7,148 kWh/yr per building unit through the Energy Efficient Refurbishment Programme in 2010. This is about 31 % of energy savings (IWU & BEI 2011).

However, the identification of good practice policies was a challenge for the project and a generally valid method to identify good practice policies is still missing. Therefore a multi-criteria assessment scheme was developed to rate and compare policies, to highlight success factors and to demonstrate the transferability of single policies. 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 interaction with other policies. The assessment scheme illustrates the design and implementation factors of different policies and measures and thus aims to convince policy-makers worldwide to transfer these successful policies in order to achieve similar results.

The practicability of the assessment scheme was examined here exemplarily with one policy: the KfW Energy Efficient Refurbishment and KfW EnergyEfficient Construction programmes in Germany. The programmes were tested according to the assessment scheme and rated as good practice example[7].

A crucial requirement to use the multi-criteria assessment scheme is the availability of data: expert knowledge and comprehensive evaluations are pivotal to fill in the table. Therefore, the availability of data is the largest barrier of the assessment scheme. There might be very successfully implemented policies available which do not have the chance to be rated as good practice policy simply because detailed data is not available. To overcome these barriers, bigEE continues to co-operate with local institutions, organisations and experts.

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7. Further good practice examples can be accessed at www.bigee.net/en/policy/guide.