A strategy for the efficient renovation of Germany's building stock

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Abstract

Since the enactment of the first Heat Insulation Ordinance in 1977, energy efficiency and the share of renewable energy found in the building sector have increased. However, the German Government has set even more ambitious goals. Up to now, the Government has not made it clear how deep renovation measures can be triggered on a nationwide level, nor how it will be funded or how the costs can be shared justly among all members of the society. This paper makes a contribution to answering these questions by presenting a concept for a new strategy, including five components that complement each other:

1. **Efficiency labels for buildings:** Every building will be assigned an efficiency rating with categories A to H based on a detailed energy classification of both the envelope and the heating system.
2. **A step curve as a dynamic standard for the energy-related quality of every building** presenting the recommended efficiency ratings the individual building has to comply with in order to meet the overall goal of having a carbon-neutral building stock by 2050. Thereby, a long-term perspective for every building is presented by means of which the owner will be able to prepare for the required steps of renovation.
3. **Renovation roadmap as part of an energy consultation programme:** Renovation roadmaps for individual buildings will provide different renovation strategies and document the steps for meeting the requirements of the relevant efficiency rating, if possible. They will be developed, marketed and implemented by certified energy consultants in the framework of a nationwide consultation programme which provides additional financial support for this consultation.
4. **"Climate protection obolus" as a continuous incentive for renovation:** The implementation of the renovation roadmaps requires a continuous funding mechanism that is independent of the governmental budget. Building owners will pay a fine, the so-called climate protection obolus, every year their buildings does not meet the demands of the efficiency rating prescribed by the step curve. The amount to be paid is based on the number of rating categories by which the house fails to fulfil, thus providing part of the necessary financial volume for the support scheme. The burden of proof is shifted. If no roadmap for renovation and/or no energy performance certificate are provided as a proof of adherence to the relevant efficiency requirements, the building will be assigned the lowest rating possible. The climate protection obolus is justified since the heating and/or air-conditioning system in many buildings is not subject to emissions trading and because the tax on gas/fuel oil for CO_2 emissions is significantly lower than the tax on mineral oil for car owners.
5. **Financial support for building renovation:** Building owners who wish to modernise their building beyond the current standard are eligible for promotion. For this purpose, the climate protection obolus paid by "poor renovators" will be assigned to the relevant promotional programmes for "good renovators".

These five components, including the bonus/malus system of No 4 and 5, complement each other forming a coherent strategy for energetic renovation of Germany's building stock in order to reach carbon neutrality. In principle, they can also be used separately in building politics, but only when applied together will they provide a consequent and consistent system of incentives.

Introduction

Since the enactment of the first Heat Insulation Ordinance in 1977, energy efficiency and the share of renewable energy found in the building sector have increased. The two main regulatory instruments in the buildings sector, the German Energy Saving Act (EnEG) with the Energy Conservation Regulations for Buildings (EnEV), and the Renewable Energy Heat Act (EE-WärmeG), have contributed to this development. Furthermore, the German Government set even more ambitious goals. In the buildings sector, the heat requirement shall be reduced by 20 percent by 2020 and the primary energy requirement by 80 percent by 2050 as compared to 2008.

Up to now, these goals have not been sufficiently substantiated with new measures by the Government. One must rather assume that the goals of increasing energy efficiency and promoting renewable energy in the buildings sector cannot be met using today's tools, including the substantial financial support schemes for retrofit activities and energy audits. Further efforts are therefore inevitable.

To reach the targets mentioned above, both the rate of renovated buildings as an indicator for the frequency of renovations and the extent of each renovation need to be increased. Both reasons depend on the size and age of the building. Doubling the rate of completely renovated buildings in residential buildings stock to reach two percent, as the Government aims at, means that more than 70 million square meters would have to be renovated every year (see Prognos 2011). However, the rate of renovated buildings alone says nothing about the reduction achieved in heat requirement or the related reduced energy consumption and CO_2 emissions. Only if more renovation is combined with quality, it will have a predictable effect on the reduction of energy consumption and CO_2 emissions. Consequently, the energy-related quality of renovations must be considerably improved both in partial and complete renovations. With energy-friendly renovation, the annual specific site energy consumption of residential buildings of now 150 kWh/sqm in one- and two-family houses and/or almost 115 kWh/sqm in apartment buildings in 2010 will fall below 30 kWh/sqm in 2025 (see Prognos 2011).

From the perspective of the house owner, increasing the efficiency of renovations will lead to higher marginal CO_2 emission reduction costs per energy unit saved. This means that the demand for investments required for reaching the above-mentioned renovation goals are not always completely covered by the reductions of energy costs. Even if this effect can be mitigated thanks to technological advances and greater leaps in technology in the future, the question for the allocation of costs remains. Consequently, there will be a "funding gap" for the years 2015 and/or 2020 between energy-related extra costs and the cash value of reducing energy costs, which is as high as 5 and/or 9 billion Euros, as long as further benefits such as reduced damages due to climate change mitigation or other co-benefits of retrofits are not included in the calculation. These numbers suggest that refusing a further tightening of building stock ordinances will not help to reach our goals: the financial promotion needed for the required renovation efforts will be too high to be covered by the public budget alone.

Even if in 2020 almost 9 billion Euros of the federal budget were to be spent on promoting energy-related building renovation alone, this would by far exceed the amounts currently discussed by politicians – despite any tax incentives, funding by the promotional bank KfW and Renewable Energy Incentive Program (MAP). This means that we must think about new ways to realise the rate of renovation aimed at by the Government and the required efficiency of renovation.

This paper, thus, documents that action is required and proposes a new system of financial incentives for building renovation in order to answer the question of cost allocation while accounting for a diverse and complementary mixture of tools, social justice, financial incentives and regulations.

The paper is based on a publication issued by NABU and authored by IFEU, Ecofys, Borgwardt Architekten, GGSC as well as the NABU (Pehnt et al. 2012).

Five Components of a New System of Incentives

The current tools of the Energy Savings Decree EnEV as well as today's general conditions will neither allow deep nationwide renovation activities to take place nor will they provide sufficient funding for it. The building owner needs information about the actual state of his building (see Component I) as well as about the target state (see Component II) and he needs a description of strategies by which the target state can be reached including individual measures as well as the overall efforts (see Component III), he needs a continuous financial incentive to renovate his building (see Component IV) as well as an accompanying promotional scheme that takes energy and social standards into account (see Component V) and goes hand in hand with the individual components.

For this reason, we suggest a new mix of tools to complement EnEV in its modified version, for creating an incentive for deep and timely renovation. The core of our proposal is a long-term and individual renovation roadmap. It comprises a step curve that sets the path of development for (individual?) buildings from 2020 to 2050 to reach the above-mentioned goal of the Government of nearly carbon-neutral building stock in 2050. The requirements implied by this path will gradually increase over time.

A climate protection obolus will have to be paid for buildings whose energy-related status is not in tune with the relevant development path. On the other hand, renovation measures lowering the energy requirement of the building below the relevant value will be financially promoted. This can be achieved by early and complete renovation but also by individual measures, provided that these are compatible with the future final state of the building.

The goal is to develop a perspective for every building that serves as a reliable basis for renovation decisions today and in the future. This will lead to a system of financial incentives that imply no absolute legal obligation to renovate a building at a given time but serve as a continuously growing financial

incentive. It will be combined with an unambiguous energy label that is clear and comprehensible to everybody (efficiency label).

The strategy we hereby suggest comprises **five core elements** that will be explained in more detail in the following chapters:

1. **Efficiency labels for buildings:** Every building will be assigned an efficiency rating with categories A to H based on a detailed energy classification of both the envelope and the heating system.
2. **A step curve as a dynamic standard for the energy-related quality of every building** presenting the recommended efficiency ratings the individual building has to comply with in order to meet the overall goal of having a carbon-neutral building stock by 2050. Thereby, a long-term perspective for every building is presented by means of which the owner will be able to prepare for the required steps of renovation.
3. **Renovation roadmap as part of an energy consultation programme:** Renovation roadmaps for individual buildings will provide different renovation strategies and document the steps for meeting the requirements of the relevant efficiency rating, if possible. They will be developed, marketed and implemented by certified energy consultants in the framework of a nationwide consultation programme which provides additional financial support for this consultation.
4. **"Climate protection obolus" as a continuous incentive for renovation:** The implementation of the renovation roadmaps requires a continuous funding mechanism that is independent of the governmental budget. Building owners will pay a fine, the so-called climate protection obolus, every year their buildings does not meet the demands of the efficiency rating prescribed by the step curve. The amount to be paid is based on the number of rating categories by which the house fails to fulfil, thus providing part of the necessary financial volume for the support scheme. The burden of proof is shifted. If no roadmap for renovation and/or no energy performance certificate are provided as a proof of adherence to the relevant efficiency requirements, the building will be assigned the lowest rating possible.

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5. **Financial support for building renovation:** Building owners who wish to modernise their building beyond the current standard are eligible for promotion. For this purpose, the climate protection obolus paid by "poor renovators" will be assigned to the relevant promotional programmes for "good renovators".

COMPONENT I: EFFICIENCY LABEL

In order to achieve as much as acceptance by society as possible it is inevitable that the long-term goal of renovation be defined as transparently and reliably as possible for every building. The classification of buildings we propose serves as a central tool. This system comprises several efficiency categories into which the existing building, its (interim) states reached by partial or complete renovation, and its final target state are to be categorised.

These efficiency labels imply an evaluation of both the building envelope and the building's technology (see Figure 1). Such classification had already been proposed in the original definition of the energy performance certificate (see Schüle et al. 2006) but was then replaced by the "ribbon speedometer".

Many European countries have implemented energy labels for buildings, but mainly, these reflect the primary energy performance. But on the one hand, this parameter is not appropriate for climate protection: for example, in Germany the same primary energy factors apply to both fuel oil and natural gas although the CO_2 emissions associated with them do differ considerably. On the other hand, it can also be used to mathematically compensate for inefficient buildings by sources of renewable energy, such as wood.

This is why, in terms of sustainable resource protection, and as opposed to many other European countries, we need a different or additional parameter that will also display the energy efficiency of a building. For this reason, the EnEV defines a parameter that refers to the heat transferring building envelope, the so-called "specific transmission heat loss" H_T' [W/m²K]. Unfortunately, this parameter does neither account for the ventilation heat losses nor for the passive solar heat gains. Though, these considerably influence the thermal heat and cooling requirement in well-insulated buildings.

Consequently, the annual specific **thermal heat and cooling requirement** (q_h' in kWh/sqm per year of living space, i.e. net floor space) seems to be the best parameter for evaluating the energy quality of a building as it shows the total of all heat losses and gains resulting from the quality of the building.

To evaluate the energy quality of the building technology (relevant to climate) we should first of all consider the primary energy efficiency parameter e_p which describes the relation between the heat to be supplied by the system and the required primary energy without accounting for any other dimensions. In combination with the parameter of thermal heat requirement it would account for the decisive qualities of a building.

A drawback of this parameter is that it refers to primary energy, which is less relevant to climate. This is why it makes sense to introduce another parameter besides the thermal heat requirement: the **climate coefficient** "e_{CO2}" that evaluates the CO_2 emissions efficiency instead of the primary energy efficiency of the building technology. This parameter has been proposed in Pehnt and Sieberg (2011) and substantiated in IFEU/Ecofys 2012.

For quantification of efficiency labels for residential buildings, the "nearly zero energy building" standard to apply to newly erected buildings as of 2020 should also define the target for already existing buildings. This will be defined as efficiency category "B", which will also be assigned to passive and efficiency houses 40 (the "efficiency house" definition is used within the financial support scheme of the KfW-Bankengruppe and means, roughly speaking, buildings with standards that are 45 % (for efficiency house 55) and 15 % (efficiency house 85) stricter than the building code standards). Buildings of higher energy-related quality could be assigned class "A" or "A+".

More levels would be set based on the criteria for q_H and $e_{CO2.}$ Depending on the building's technology most "efficiency houses" 55, "efficiency houses 85", new buildings according to EnEV

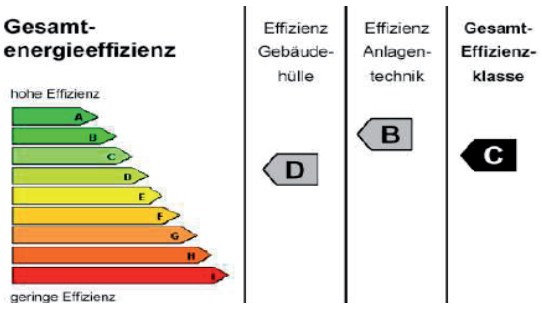

Figure 1. Evaluation of building efficiency by efficiency labels of the building shell and the heating system – Proposal from 2006 (Schüle et al. 2006).

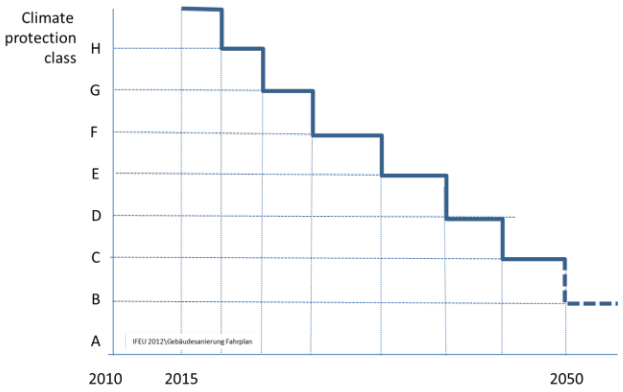

Figure 2. Sample step curve as an orientation for building owners (Pehnt and Mellwig 2012)

2009 and unrenovated buildings would be assigned classes B, C, D, E and H, respectively (Pehnt und Mellwig 2012).

Many existing buildings will not reach rating "B" applying to newly erected buildings – be it for geometric constraints, construction-related conditions (construction-related or geometric thermal bridges) or their basic structure being especially worth retaining for cultural reasons. In the best case, this may mean that e.g. the cellar ceiling can only be insulated to a limited extent, whereas in the worst case it may mean that e.g. besides retrofitting the building with new technology and applying renewable energy, only few building components may be insulated due to the more important demand of preservation.

In order to ensure justice in as many individual cases as possible, the efficiency labels should adequately take into account building components that cannot be changed (for example, building faces listed for heritage reasons, etc.) on the basis of an objective list of criteria.

The procedure for efficiency labels for non-residential buildings is more complex and is documented in Pehnt et. al. (2012).

COMPONENT II: PROVISION OF A STEP CURVE AS AN ORIENTATION FOR EVERY BUILDING

The second core element is a step-curve renovation roadmap serving as an orientation for all building stock in Germany. It is based on the assumption that, according to the goals set by the Government, these buildings generally have to fulfil the requirements of efficiency category B by 2050, while, as far as this is possible, taking into account the objective constraints of the concrete cases. Unless early modernised, each building should rise at least by one category within a given period of time (see Figure 2). Such given period of time has to provide enough time for appropriate renovation strategies but also lead to an adequate promptness of renovation activities.

The building owner can then decide whether he wishes to renovate his building step by step or whether he wants to reach the highest class at once. As the roadmap is a long-term project, the owner is provided with the required security for planning and investment. He is able to decide whether he will renovate his building once completely and thus fulfilling the requirements for the next decades or whether he will renovate it step by step. This means that a long-term renovation roadmap ensures compatibility of life, renovation and investment cycles of building stock and individual building components as every building owner is encouraged to take (economic) action by the long-term goals and the regular tightening of the goals, since the building owner will be looking for the best economic solution. Deep retrofits will therefore gain importance.

As regards the succession of the steps, we recommend to address the most unfavourable building classes as soon as possible while the other ones should be reached within approx. five years in order for all buildings to reach class B or the highest class possible for each building by 2050.

COMPONENT III: THE RENOVATION ROADMAP AS PART OF A CONSULTATION PROGRAM

To translate the step curve into a strategy for the individual building it should be embedded into the third core element: on-site consultation for every building (if applicable, also for buildings groups and apartments) that integrates the comparison of different renovation options (see Figure 3). This energy consultation should ensure that the ideal technical solution will be chosen for a building. This also implies the extension of capacities for planning (planners, architects, energy consultants) and execution (craftsmen) in order to initiate high-quality renovation practices. As the building owner has the freedom of choice he can also decide how to reach the target rating. Thus, a long-term renovation roadmap is not only open as regards the technology but also offers the most reasonable and economic solution to be chosen for every building of a heterogeneous building stock in order to reach the ecologically necessary goal.

It should be considered that for this purpose the building owner has to have some knowledge about the factors on the utilities side (especially the CO_2 factor in electricity generation). For this purpose, a set of factors based on the governmental goals could be defined.

In addition to complete renovation, other possibilities of modernisation should be considered on the basis of a sensible succession of individual measures in order to ascertain which renovation measures should be taken when. In this framework the renovation roadmap should:

- take the conditions of the building into consideration;

- offer options that account for the current building users and their financial and family situation, their preferences, etc.;
- check the compatibility of technical and structural renovation incl. age-appropriate housing and the like;
- outline the advantages of complete renovation measures concerning heating costs, climate protection, compatibility of measures, while also offering possible alternatives in reasonable steps (customised alternatives that do also lead to fulfilment of the rating requirements in the long term); and
- point to building physical, technology-related or other advantages and disadvantages.

COMPONENT IV: THE CLIMATE PROTECTION OBOLUS

Implementation

The building renovation roadmap proposed in the preceding chapter serves as a basis for a new system of financial incentives – which is the fourth core element. The basic idea is: if a building does not fulfil the requirements for the efficiency rating stipulated for the relevant year, the building owner will have to pay a fine, the so-called "Climate Protection Obolus". The amount of this obolus shall be based on the number of categories by which the building failed to comply with the stipulated class. If a building improves, it will be promoted for the renovation to be implemented.

For example, if rating G will be required in 2021 and a building will only reach rating H, its building owner has to pay the obolus amounting to the rate set for one class. The obolus will rise to a second standard rate with the next class in 2025. For details on the calculation, see below.

In the framework of the described energy consultation program, the building will be examined in detail and an individual, step-by-step renovation programme be developed including the currently feasible modernisation measures. The building owner can now decide whether to completely renovate the building immediately or to renovate it on a step-by-step basis. As long as his building remains in tune with the step curve he will not have to pay the obolus.

The efficiency rating will be proven by providing an energy performance certificate. For more information and to encourage the building users it will also display the energy consumption values measured. For the time being, any existing proofs of consumption could serve as a provisional certificate. Over time, more and more updated energy performance certificates will be furnished, which will take into account the step-by-step implementation of the renovation roadmap measures. Randomised checks of the implementation of these measures shall be carried out in the framework of quality controls of energy performance certificates, which have already been planned based on EU legislation.

If no energy performance certificate is furnished for a certain building, it will automatically be assigned the poorest or the last proven efficiency category. As opposed to former concepts of renovation roadmaps, this system shifts the "burden of proof" for the state of a building. This means that no building owner is obliged to get a certificate for his building or implement

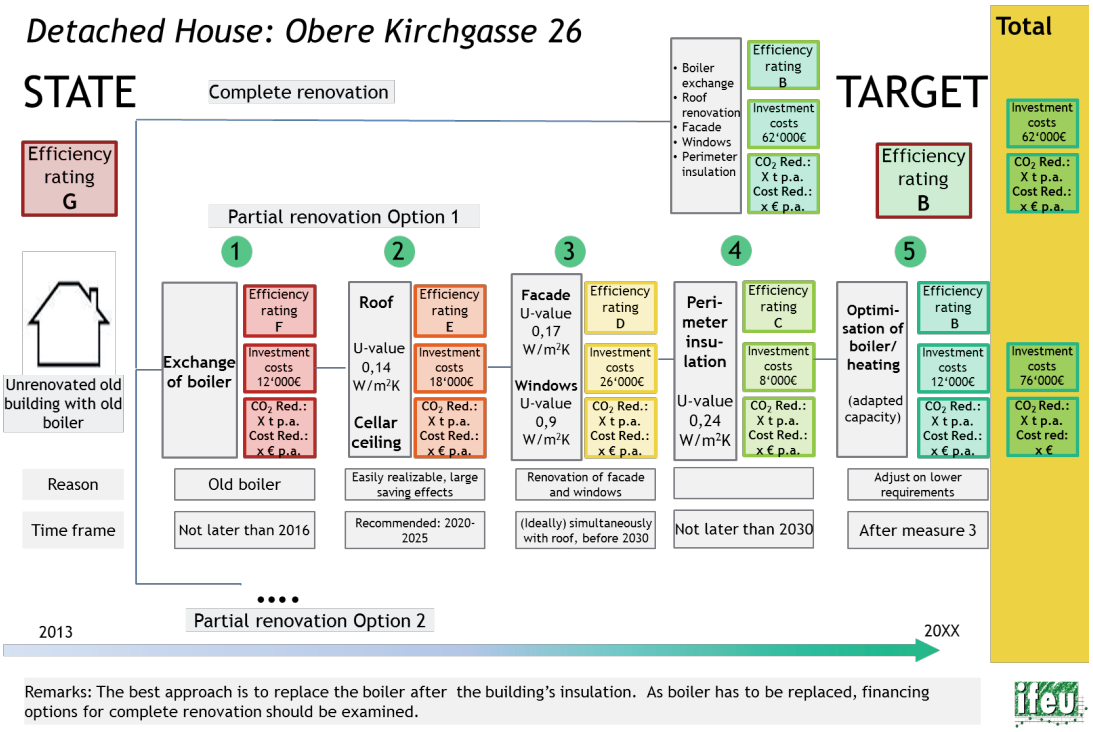

Figure 3. Example: elements of a renovation roadmap (Pehnt and Bürger 2012). The roadmap describes several options (full renovation, several step by step renovation options with reasonable sequences of renovation steps) and compares cost estimates and achievable efficiency levels.

modernisation measures because he still can pay the (rising) obolus for the protection of the climate. Postponing modernisation can, for example, be a reasonable decision if a building is planned to be modified or fundamentally reconstructed a few years later.

To make the roadmap more **flexible** it would also be possible that, in the early phase, an individual renovation roadmap based on an extensive energy consultation leads to a postponement of the obolus.

The proposed obolus differs in several ways from an allocation on fossil fuels, i.e. an energy tax increase on fossil fuels and heating current. The proposal of a fuel tax is referenced time and again, be it in Irrek and Thomas (2006), IFEU/ WI (2009) or lately by the Green Budget Germany (Küchler and Nestle 2012).

The obolus will be borne by the building owner, i.e. by the person who takes the decisions for or against energy-related modernisation of a building. This means that it will not only raise funds but also encourage the building owner to adhere to the step curve in order to avoid payment of the obolus. The annual obolus notice will raise the question if it would not be better to renovate the building (psychological "pester power" of the annual and rising obolus). Furthermore, the classification of buildings and the related amount of the obolus would serve as an objective means of differentiation for energy standards on the real estate market.

In contrast, funding via an increase of energy tax/fuels tax would burden all building users regardless of whether they own or rent the apartment or building. That means that the rent including service charges will be increased. As opposed to owner-occupants who are able to decrease the burden arising from the obolus by modernisation measures, tenants are hardly able to actively influence their own consumption and, thus, the burden arising from the obolus. Furthermore, it should be considered that mainly socially disadvantaged persons do often live in buildings with a poor energy performance.

However, the obolus for the protection of the climate does have some drawbacks as compared to a fuel tax:

The process of raising the obolus will require much more effort than raising a fuel tax (which will be "automatically" imposed on the fuel) due to its referring to individual buildings. Any building that a building owner wants to certify for that it belongs to a better category would have to be appraised. For this purpose, the quality of the preparation of energy performance certificate must be ensured. Another requirement is the set-up of a building register, which can be prepared by using the real estate tax database.

There can be cases of hardship, for example with buildings in value-impaired locations for which no renovation decision will be taken, or with buildings owned by older people who do not wish to renovate it. These cases of hardship should be solved by adequate regulations (see below).

When defining the long-term incentive system it should be verified whether it will really lead to sustainable renovation. This is an important issue, especially in the light of uncertain technological developments and the long-term tools to be applied. For instance, the question is whether to dispense with the differentiation between envelope and technology, e.g. because wind energy is so cheap that using electrical wind energy heating will be cheaper than insulation measures. Several reasons will still speak in favour of long-term differentiation between envelope and technology in the definition of the efficiency label and its categories and, thus, in the incentive system. First, most renewable energy sources have a limited potential, be it due to the growth rate (biomass) or the regeneration rate (geothermal energy), due to the development potential (hydro energy) or the available spaces and other ecological considerations (wind power). Second, renovation will also contribute to the efficiency of using renewable energy source, not only because the temperature required in the heating circuit will be lowered. And finally, it is rather improbable that the costs of electricity and/ or fuels mainly obtained from renewable energy sources will decrease that much that the annual heating costs will be lower than the energy savings achieved by heat insulation, at least not without any great technology leaps.

But even if these assumptions had to be corrected in the light of actual developments, the incentive system as such will withstand these changes. The efficiency categories can be adjusted without leading to disadvantages for then already renovated buildings.

Regulations for Cases of Hardship

These must be divided into regulations for cases of hardship triggered by the obolus for the protection of climate for building owners on the one hand and for tenants in rented building stock on the other hand.

Hardship regulations for building owners. As a case of social hardship, any building owner can be exempt from paying the obolus due to special circumstances, if both the implementation of renovation measures and payment of the obolus are unacceptable or if they would translate into extra-ordinary hardship.

One reason may be objective inability to finance renovation, while the amount of the obolus exceeds the owner´s financial means. Since the regulation of hardship means individual exemption from obligations, it would need a transparent, objective and legally confirmed list of criteria to be developed for it to minimise transaction costs.

Hardship regulations for tenants. The strategy will not legally oblige anybody to take direct energy modernisation measures. With being imposed the obolus, the building owner will merely be encouraged to renovate his building, even if he has rented it out. If he refuses to renovate the building and fails to furnish proof of adherence to the currently stipulated efficiency categories, the building owner will not be allowed to pass on the costs incurred by payment of the obolus to his tenants as service charges as he is not legally justified to do so. This means that this strategy as such will not directly increase rents, which could lead to cases of hardship among tenants. Measures proposed under this strategy should not be evaluated as "unacceptable measures" either, for which tenants would be obliged to pay a higher rent according to Art. 242 of the German Civil Code (BGB), regardless of the hardship reasons.

Therefore, the only question is whether the obolus for the protection of the climate and the step curve will trigger wide and deep energy-related renovation which would lead to an unacceptable burden of increased living costs. If this overall strategy is successful, one has to assume that based on tenancy law regulations living costs will be increased and as a result more cases of hardship will occur. However, this problem cannot be

solved in the framework of this proposal but by tenancy law as well as social law in general. Due to more public funding, rising rents will be compensated again to a limited extent since the funding must be deducted from the increased rents. Nevertheless, tenancy law regulations will have to be adapted just as the regulations for securing living for persons with transfer income.

Amount of the Obolus

Although the amount to be paid as a climate protection obolus eventually is a matter to be solved in a political decision-making process, politicians must take various aspects into account:

- The amount of the obolus for the protection of the climate should be high enough to have a more than just symbolic effect (i.e. to work as an incentive).
- On the other hand, the obolus must not be too high as to cause a high number of cases of hardship.
- To do so, the obolus may be based on either (1) the saved CO_2 emissions and their "market value" (10 to > 30 Euros/ton) or on the costs caused by their damage (up to 270 Euros/ton, depending on the study); or (2) on the required costs for funding over a certain period of time.

If based on the CO_2 emission savings per difference of category and assuming 70 Euros/ton of costs arising from climate damage (a guidance value e. g. used by the German Federal Ministry for the Environment), this calculation results into a cost of climate damage saved ranging between 0.2 (difference between efficiency categories B and C) and 4 Euros/sqm/year (difference between efficiency categories G and H). When applying a possibly long-term certificate price of 30 Euros/ton of CO_2, these values range between 0.075 and 1.7 Euros/sqm/year.

If the obolus was set to amount to 0.5 Euros/sqm/year for the first renovation level not adhered to and make it increase gradually to up to 5 Euros/sqm^2/year by 2050 for six failed levels, it would, roughly estimated, generate a cumulative volume of approx. 50 billion Euros for the German residential building stock. When assuming that an increasing demand for promotion ranges between 50 (improvement by one category) and 175 Euro/sqm (improvement by six categories) and a renovation rate of 1.0 to 2.5 percent/year by 2024, this would result into a demand for promotion costs of about 70 billion Euros (cumulative) until 2050.

These calculations show that a rate of 0.5 to 1 Euro/sqm/year indeed is a reasonable value. However, this is still a simple model calculation that has to be differentiated yet.

Legal assessment

The obolus for the protection of the climate has been evaluated for its compatibility with the constitutional rules governing public finances (see Gaßner and Neusüß 2012), and this evaluation was legally reviewed again (see Klinski 2012). They examined whether the obolus for the protection of the climate could be imposed as a non-tax levy in the meaning of a special levy, regulatory and equalisation levy, or as an absorption levy.

As a result, the obolus is, in fact, compatible with the constitutional rules governing public finances. It is no (real estate) tax because the funds arising from the obolus will be exclusively used (on a legitimate basis) for promoting early renovation measures.

COMPONENT V: THE FINANCIAL SUPPORT PROGRAMME

The climate protection obolus serves the purpose of financing a comprehensive support programme. Building owners are thereby enabled to act and make use of financial incentives even before the step curve will urge them to do so. Voluntary and early actions will thus be rewarded. The higher the achieved renovation efficiency is, the more they will be promoted. Furthermore, minimum requirements to renovation efficiency ensure that the funds will be used economically and that the individual measures will be targeted as best as possible on the long-term climate protection goals. Although the owners willing to renovate their buildings must be rewarded, owners whose social and/or economic situation does not allow for energy-related renovation must be supported.

The programme shall provide strong incentives for building owners to carry out energy-related modernisation measures which are compatible with the efficiency rating to be reached by every building (differentiated by building types) by 2050. The compatibility of the goal should be ensured even if only individual building parts, such as the external walls, the roof or the windows, were modernised. However, especially the last, very ambitious renovation steps incur over-proportionally high modernisation costs. Currently, the required measures are so expensive that they normally fail to reach an economic optimum as seen from the building owner's point of view. This ambitious level therefore requires us to reduce the financial burden of the building owners concerned by financially promoting them. The promotional programme to be launched to complement the new system of incentives will consist of two main elements: the granting of funds and the generation of funds.

However, in the first years, the obolus alone will not suffice to completely cover the costs required by the promotional programme (see Figure 5). More sources of funding will be necessary in addition to the obolus for the protection of the climate in order to generate sufficient funds that remain constant over the years and to offer reliable promotion conditions to the building owners concerned and thus a high security for investment. Further financial sources could include funding from the budget or from funds; funding from a tax relief for energy-related renovation measures in residential buildings; funding from raising the energy tax rate.

The step curve will ensure that the funds arising from the obolus will be low in the first years after its ratification. Although the efficiency label that the amount of obolus is based on requires relatively "poor" renovation measures, i.e. even completely unrenovated buildings will fail by only one class, many of the buildings that have at least partially been renovated over the last years will reach the second "poorest" class even if only minor heat insulation measures have been carried out (e. g. new windows with insulated glass).

Sample calculation

Figure 5 illustrates this effect. It uses a simplified model calculation assuming that a progressive obolus amounting to 0.5 and 5 Euros/sqm/year must be paid, depending on the difference between the efficiency category stipulated and the class actually reached.

For an unrenovated one-family house with a floor space of 150 sqm, the resulting amount of obolus will be almost

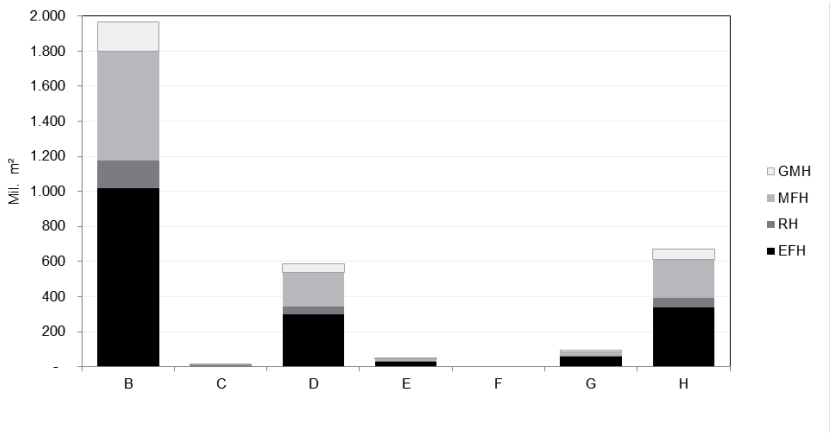

Figure 4. Floor space of the residential building stock in 2050 by efficiency label. EFH: single-family house, RH: semi-detached house; MFH: multi-family building; GMH: large multi-family building. Source: Bettgenhäuser in Pehnt et al. (2012).

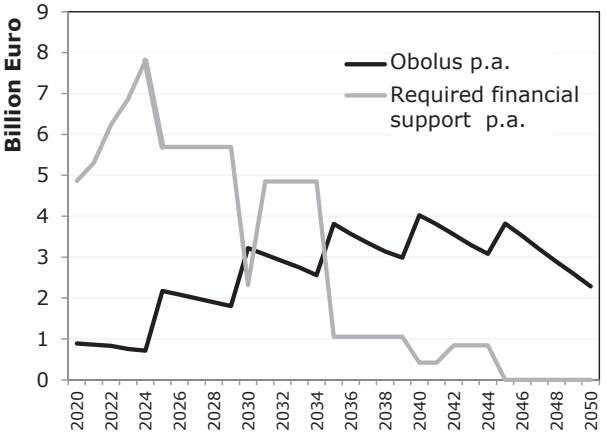

Figure 5. Development of the obolus for the protection of the climate and the volume of funds granted in Euro (assumptions: obolus 0.5–5 Euros/sqm, funds 50–175 Euros/sqm). Source: Bettgenhäuser in Pehnt et al. (2012).

7,000 Euros. As an alternative, the building owner would be eligible for a one-time promotion payment of 15,000 Euros in case of adequate renovation and improvement by three categories.

The promotion amount in case of renovation is based on the number of skipped categories. Taking the additional energy-related renovation costs into account, it will range between 50 Euros and 175 Euros/sqm per case of renovation. Furthermore, it assumes that the CO_2 factor of electricity provision will reduce by 90 percent between 2012 and 2050. It will thus fall from 0.6 kg/kWh to 0.06 kg/kWh for air/water heat pump systems and from 0.25 kg/kWh to 0.03 kg/kWh for district heating systems. A worst-case assessment now assumes that the buildings will be top renovated at a rate climbing from 1.0 to 2.5 percent per year.

If the efficiency label requirements for building stock will be tightened every five years as of 2020 (starting at the category G in 2020), floor space of residential building stock will be distributed in 2050 as shown in Figure 4. It is plain to see that the majority of one-family houses will have reached the most ambitious category for already existing buildings by 2050. The remaining buildings will reach the moderate category D.

The annual demand of promotion as shown in Figure 5 depends on the relevant renovation states and will initially range between eight and later on one billion $Euros_{2012}$. The levy will first rise from one billion to approx. four billion Euros and will then fall again. All in all, the obolus will be able to cover about 70 % of the cost for promotion, but not at the same time since the levy will increase over time until 2040.

Furthermore, the total volume generated by the obolus, i.e. the sum of all payments independent of how the building owners concerned will respond to the new tool. There could be fluctuations over the years: The more building owners (partially) renovate their buildings in order to avoid the obolus, the lower will be the financial means generated for the promotional funds. On the other hand, the demand of promotion will, of course, increase even more if many building owners decide to carry out energy-related modernisation.

Prospects and Need for Action until 2020

The required development of the renovation rate needs to be initiated gradually. It should be defined when to apply which tools and which effect they shall have when combined with other tools. This way, the owners will be provided with long-term clarity about public stipulations and promotional offers (planning and investment security) and there will be sufficient flexibility when choosing the technical means (extensive freedom of decision-making and being open to new technologies). At the same time, every overall strategy has to include a matching promotional programme and the provision of information and consultation must be strengthened.

The presented components can be used individually in buildings politics and contribute decisively to the above-mentioned goals. But only when used together they will lead to a consequent and effective system of incentives, which is needed for actually raising the potentials in the buildings sector and for reaching the climate protection goals formulated by the German Government. Nevertheless, transition periods should be set for individual components in order to provide the building owners with possibilities for preparing for the future require-

ments. The same applies to the consultation capacities and the implementing companies of the construction materials industry and crafts enterprises: the relevant capacities must be developed to reach high quantity and quality.

References

Bürger, V. et al. (2012). Darstellung des aktuellen Rechts- und Förderrahmens und dessen Wirkungen; Ausarbeitung im Rahmen des Projektes "Erarbeitung einer Integrierten Wärme- und Kältestrategie". Im Auftrag des Bundesumweltministeriums.

IFEU and Ecofys (2012). "Kennziffern für Gebäude". Working paper within the project "100 % Erneuerbare im Gebäudebestand". Supported by the Federal Ministry of the Environment. ifeu – Institut für Energie- und Umweltforschung Heidelberg, Ecofys, Bergische Universität Wuppertal, Technische Universität Darmstadt.

Ifeu and WI (2009). "Energiebalance – Optimale Systemlösungen für Erneuerbare Energien und Energieeffizienz. Endbericht". ifeu – Institut für Energie- und Umweltforschung Heidelberg, Wuppertal Institut Klima Umwelt Energie. On behalf of the Federal Ministry of the Environment. Download www.ifeu.de/energiebalance.

Gaßner, H. and P. Neusüß (2011). Sanierungsvorgaben für bestehende Gebäude. Vereinbarkeit mit Eigentumsschutz und anderen Grundrechten. Berlin, Gaßner, Groth, Siederer & Coll.

Gaßner, H. and P. Neusüß (2012). Vereinbarkeit eines Klimaschutz-Obolus mit der Finanzverfassung. Berlin, GGSC – Gaßner, Groth, Siederer & Coll.

Irrek, W. and S. Thomas (2005). Der EnergieSparFonds für Deutschland. Wuppertal, edition der Hans Böckler Stiftung.

Klinski, S. (2012): Stellungnahme zum GGSC-Gutachten "Vereinbarkeit eines Klimaschutz-Obolus mit der Finanzverfassung". Berlin, Hochschule für Wirtschaft und Recht.

Küchler, S. and U. Nestle (2012). Strategien zur Modernisierung I. Neue Finanzierungsmodelle für einen klimaneutralen Gebäudebestand. Heidelberg, Heinrich Böll-Stiftung Schriften zur Ökologie.

Pehnt, M. and P. Mellwig (2012). Klimaschutzklassen im Gebäudebestand. Working paper within the project "100 % Erneuerbare im Gebäudebestand". Supported by the Federal Ministry of the Environment. ifeu – Institut für Energie- und Umweltforschung Heidelberg, Ecofys, Bergische Universität Wuppertal, Technische Universität Darmstadt.

Pehnt, M. and U. Sieberg (2011). Ein Stufenmodell als langfristiger Sanierungsfahrplan – Vorschlag eines neuen Instruments für die energetische Gebäudesanierung, in: ECEEE – European Council for an energy efficiency economy (Hrsg.): Summer Study Paper.

Pehnt, M. and V. Bürger (2012). Der gebäudeindividuelle Sanierungsfahrplan im Rahmen der baden-württembergischen Landespolitik. Kurzgutachten und Diskussionspapier im Auftrag des Umweltministeriums Baden-Württemberg. Heidelberg, Freiburg, ifeu – Institut für Energie- und Umweltforschung Heidelberg, Öko-Institut e. V.

Pehnt M., P. Mellwig, K. Bettgenhäuser, A. Hermelink, R. Borgwardt, P. Neusüß, U. Sieberg (2012). Diskussionsschrift Strategie für eine wirkungsvolle Sanierung des deutschen Gebäudebestandes. Fünf Bausteine für ein System wirtschaftlicher Anreize. Report on behalf of the Naturschutzbund Deutschland. Heidelberg, Berlin, 2012

Prognos: Seefeldt, F. and N. Thamling (2011). Sanierungsfahrplan 2012–2050. Mittel und Wege zu einem klimaneutralen Gebäudebestand. Berlin, Prognos AG, in: Anforderungen an einen Sanierungsfahrplan – Auf dem Weg zu einem klimaneutralen Gebäudebestand bis 2050. On behalf of the Naturschutzbund NABU. Download http://www.nabu.de/imperia/md/content/nabude/energie/nabu-sanierungsfahrplan_endg.pdf.

Schüle, R., H. Hertle et al. (2004). "Energiepass Sachsen" – Evaluation und Begleitung der Einführung. Final report. Download https://www.ifeu.de/energie/pdf/WPSachs_end.pdf. ifeu – Institut für Energie- und Umweltforschung Heidelberg.

Sieberg, U. and E. Große-Ruse (2012). Mit EnEV, EEWärmeG & Co. in der Sanierungsfalle? – Kluge Vorgaben für den Gebäudesektor, in J. Pöschk (ed.): Jahrbuch Energieeffizienz in Gebäuden. Berlin, VME-Verlag.