

Stepwise and structured

Surrounding policy instruments to support the iBRoad approach for building renovation take-off

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Authors

Mandy Werle (ifeu)

Dr. Martin Pehnt (ifeu)

Peter Mellwig (ifeu)

External reviewers

Marianna Papaglastra (Sympraxis Team)

Mariangiola Fabbri (BPIE)

Dragomir Tzanev (EnEffect).

Layout

ifeu / Sympraxis Team

Cover Illustration

mikiel via depositphotos.com / Elena Elisseeva via Shutterstock.com / Sympraxis Team

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I. EXECUTIVE SUMMARY

This report investigates how surrounding policy instruments can be used to increase the dissemination, adoption and impact of the iBRoad Building Renovation Roadmaps developed within the iBRoad project. It also investigates approaches on how to use the iBRoad Building Renovation Roadmap (or its elements) with other instruments to advance highly dynamic and deep retrofits.

At first, the report lists a number of prerequisites for the introduction of iBRoad. They relate to the general viability, administration and basic support of iBRoad. Some prerequisites are mandatory, such as an available EPC software, others strongly support the market ramp-up.

Furthermore, the report shows that key elements of the iBRoad Building Renovation Roadmap and building renovation plans in general, such as the long-term target and the future-oriented renovation strategy, can be integrated into other political instruments to unfold maximum impact. Only when embedded in a supportive policy surrounding, the recommendations of the building roadmap will, with a high probability, be implemented and practically transferred into renovation activity. A supportive policy surrounding refers mainly to three basic fields of action: informational, economic and regulatory instruments. The single instruments are not mandatory but they can complement each other if adjusted to one another. The report gives examples for existing instruments from various countries that address renovation roadmaps either directly or indirectly.

The iBRoad Renovation Roadmap and the Logbook are designed to support building owners on their way to a climate neutral building target. They take the owner's view into consideration as the basis for finding the individually optimised approach to renovation, avoiding mistakes in the long-term perspective. iBRoad tools motivate and help owners to solve their building related problems. However, one cannot expect that iBRoad alone is able to e.g. raise the general awareness for energy problems if the owners do not recognise them. The basic need for a climate neutral building stock has to be communicated by different means. iBRoad can avoid costs and identify renovation strategies that reach the targets at lower investments. However, iBRoad cannot guarantee the economic viability for each renovation. These are exemplary issues that need to be delivered by accompanying instruments. If they are well coordinated, they can make an effective support for iBRoad and vice versa.

II. INTRODUCTION

The building sector accounts for approximately 40 % of total energy consumption and 36 % of CO₂ emissions in the European Union. Currently, almost 75 % of the European building stock is not energy efficient, while the building renovation rate is very low. The Energy Performance of Buildings Directive (EPBD) requires a transformation towards a 'highly efficient and decarbonised building stock by 2050'. Deep building renovation has the potential to lead to significant energy savings and to lower CO₂ emissions and thus, contribute to the energy and climate objectives at national and European level.

During the iBRoad project, funded by the Horizon 2020 European programme, the individual Building Renovation Roadmap for residential buildings was developed, designed and tested in three pilot countries. It was combined with a digital repository of building-related information – the iBRoad Logbook. The iBRoad tools and the concept are being optimised based on the field test results. This refers to the internal functionalities as well as to the external relations to national framings. On the one hand, iBRoad needs to adapt to various specific national circumstances of the Member States. On the other hand, the framing within the Member States can strongly support the implementation of individual Renovation Roadmaps. This report regards the latter issues. It outlines and compares policy instruments that enable and support an introduction of iBRoad in any Member State regardless of its starting point.

III. OBJECTIVES OF THIS REPORT

The iBRoad Building Renovation Roadmap concept unfolds its maximum impact when embedded into concomitant policies. Therefore, the objective of this report is to investigate options to increase the dissemination and impact of iBRoad. A range of instruments could be envisaged and will be investigated in the following chapters, namely informational, economic and regulatory instruments, see Figure 1.



Figure 1: Enabling policy frameworks for iBRoad

In the following, respective measures to increase dissemination and impact of iBRoad will be shown and discussed. Existing measures that address these points or could be adapted in the iBRoad countries Belgium/Flanders, Bulgaria, Germany, Poland, and Portugal as well as in other countries will be illustrated if available.

IV. PREREQUISITES FOR AN INTRODUCTION OF A BUILDING ROADMAP

When introducing building roadmaps as (new) energy audit/consultancy tools, one needs to bear in mind that a supporting context is a prerequisite for making their introduction a success. The experience from the iBRoad field test identified the following requirements among the success factors:

- Software tools to calculate Energy Performance Certificates (EPC). They have to be capable of calculating the energy demand for the present building state as well as for potential future states. Ideally, the tools also provide the renovation costs and the energy bill after a renovation. Both iBRoad tools, Renovation Roadmap and Logbook, are based on the results of EPC calculations. They cannot be used in a targeted way if there is no EPC software available.
- The existence of reliable and trusted energy auditors or EPC issuers. The experts need to be experienced with the national calculation tools, with energy related building requirements and with planning renovation measures for the building envelop and the technical equipment. The experts need to receive comprehensive training before issuing a Renovation Roadmap or Logbook. The basic knowledge and experience about energy in buildings, however, has to be present.
- Energy agencies or similar local authorities to administer the introduction of the iBRoad system, to monitor the quality of the energy assessments and to guide the clients to available auditors.
- Ideally, incentive schemes for EPCs or even energy audits already exist. If they are suited for single-family buildings, they can be used as a starting point. Although the Renovation Roadmap and the Logbook can also be issued without an incentive scheme, effort and costs usually are too high and savings too stretched to form an economically attractive offer for the customers.
- Funding programmes for energy renovation in single-family houses in general can be very helpful as they raise the homeowners' acceptance for renovation measures. In particular, funding schemes that refer to single renovation measures are more helpful for the roll out of iBRoad than programmes relating to complete renovations as iBRoad focusses on stepwise renovation.

V. SUPPORTIVE POLICY INSTRUMENTS

i. Informational Instruments

In the following, informational measures to increase dissemination and impact of iBRoad will be identified. Generally, informational measures raise awareness for the instrument, thus making it known to the target groups and increasing its uptake. They also enhance the trust in the tool when it is a known "brand", supported e.g. by governmental information. Ultimately, information events could serve as trigger points for renovation. Where available, existing informational measures that address these points or could be adapted this way in the iBRoad countries Belgium/Flanders, Bulgaria, Germany, Poland, and Portugal as well as in other countries will be illustrated.

iBRoad in awareness and information campaigns

One way to promote the iBRoad concept is to incorporate it into national or regional awareness and information campaigns initiated, for instance, by public authorities, consumer associations or energy agencies.

For instance, Germany embedded its Building Renovation Roadmap ("individueller Sanierungsfahrplan – iSFP") into a broad-based energy efficiency campaign, see Figure 2.

A broad-based campaign can attract attention for and lead to the creation of a number of building renovation roadmaps for individual buildings. However, it should be noted that significant costs are assigned with that and, at the same time, the impact of such a campaign in terms of actual implemented energy improvements with the result of energy savings depends on numerous variables, including the correct messages for the correct target groups, the concreteness of available information, clear contact points, first steps to undertake etc.

In Germany, for instance, a more target-group oriented approach is currently being discussed, addressing different regions (e. g. with high shares of old family houses) and different target groups (e. g. elderly people, owners associations, etc.), with explicit information material.



Example: awareness and information campaign “Deutschland macht’s effizient” [1]

The German Individual Building Renovation Roadmap (“individueller Sanierungsfahrplan – iSFP”) is embedded into a broad-based campaign of the Federal Ministry of Economic Affairs and Energy with the aim to inform people about energy efficiency and to activate people to realise energy efficiency measures. The core of the campaign is the website www.machts-effizient.de. Here people can find general information about energy efficiency and energy saving as well as energy saving tips, and further information, e. g., with regard to funding schemes etc. In addition, there is a hotline that people can call in case of questions. The campaign is present at events and fairs, and there is poster advertising at central locations, e. g., subway stations.



Figure 2: Example Germany – awareness and information campaign "Deutschland macht's effizient"

iBRoad in training for energy auditors

Energy auditors and building experts should be the target of a specific campaign to make them aware of the building roadmap. Energy auditors, being the ones to issue the renovation roadmaps, play a decisive role in the dissemination of iBRoad; they can thus use the roadmap as a commercial service offered to their customers. This requires experts' willingness and motivation to apply the iBRoad tools on the one hand, and particular expertise and knowledge to ensure the correct use and implementation of these tools on the other. Training of energy auditors and building experts should address and cover the following issues:

- training in communication skills, such as conversion guidance and motivation, to guide private homeowners
- the main principles of the renovation roadmap, such as the so-called "best-possible-principle"
- determination and elimination of renovation lock-in effects
- comfort assessment

In Germany, where the Building Renovation Roadmap ("individueller Sanierungsfahrplan – iSFP") was launched in 2017 at federal level, energy auditors were provided with extensive training material and adjusted supporting software, see Figure 3.



Example: handbook, quick reference guide, and checklist for energy auditors

Energy auditors in Germany, who create an Individual Building Renovation Roadmap ("individueller Sanierungsfahrplan – iSFP") can draw on extensive training material: in addition to adjusted supporting software there is, for instance

- a detailed energy auditor's handbook explaining all relevant facts and providing step-by-step guidance,
- a quick reference guide for issuing a building renovation roadmap (seven steps towards a building renovation roadmap), and
- a checklist providing assistance when collecting relevant data.



Figure 3: Example Germany – iSFP training material for energy auditors

ii. Economic instruments

In the following, economic measures to increase dissemination and impact of iBRoad will be identified. Where available, existing economic measures that address these points or could be adapted this way in the iBRoad countries Belgium/Flanders, Bulgaria, Germany, Poland, and Portugal as well as in other countries will be illustrated.

Combining iBRoad with energy consulting

The iBRoad Building Renovation Roadmap could be integrated into existing energy audit incentive programmes. In order to be accepted for an incentivised scheme, the iBRoad Renovation Roadmap has to fulfil the requirements of the energy consulting report (see Figure 4). If the funding programme requires more content than the Renovation Roadmap provides, auditors need to add missing information manually to receive the funding.



Example: Financial support of the German Individual Building Renovation Roadmap within the programme “Energieberatung für Wohngebäude” [2]

The programme launched by the German Federal Office for Economic Affairs and Export Control (BAFA) is intended to show building owners and occupants in residential buildings how they can reduce energy consumption by means of the German Individual Building Renovation Roadmap (“individueller Sanierungsfahrplan – iSFP”). It expands on the existing scheme “Energieberatung für Wohngebäude” and introduces the roadmap as additional option.

In general, 60 % of the costs for the iSFP are eligible. The maximum subsidy amounts to 800 EUR for one and two-family houses and 1,100 EUR for buildings with more than three residential units.

Figure 4: Example Germany – iSFP support within the programme “Energieberatung für Wohngebäude”

Evaluation results of the funding scheme mentioned above show the significant impact of the iSFP [3]: the iSFP has led to a shift in investment towards more efficient renovation measures and also numerous renovation measures have been implemented proactively.

It is also possible to reward the implementation of renovation measures proposed in the iBRoad Building Renovation Roadmap. For instance, the city of Tübingen in Germany provides an extra bonus of 500 EUR for homeowners with a Renovation Roadmap when at least one renovation measure suggested by the renovation roadmap is implemented. This approach could be implemented in a very simple manner, e. g., a lump sum support, see Figure 5.



Example: Lump-sum support in case of implementation of a renovation measure recommended by a building renovation roadmap [4]

The city of Tübingen in the federal state of Baden-Württemberg supports home owners with a building renovation roadmap with a lump-sum bonus of 500 EUR if a recommended measure referred to in the roadmap is implemented. The underlying roadmap can be the German Individual Building Renovation Roadmap (“individueller Sanierungsfahrplan – iSFP”), introduced at national level, or the Building Renovation Roadmap Baden-Württemberg (“Sanierungsfahrplan Baden-Württemberg – SFP-BW”), introduced at regional level.

In order to benefit from the bonus, the building renovation roadmap must have been drawn up after 1st of October 2016. At least one of the proposed renovation measures, worth a minimum of 2,500 EUR and a maximum of 25,000 EUR, must be implemented. The application for this funding must be submitted to the Environmental and Climate Protection Office of the City of Tübingen. Together with the application for funding, a copy of the building renovation roadmap as well as a copy of the bill for the renovation measure must be supplied.

Figure 5: Example Germany (city of Tübingen) – lump sum support for implementation of renovation measures on the basis of a building renovation roadmap

Combining iBRoad with funding and tax schemes

Essentially, the idea of combining iBRoad with support programmes or tax schemes is twofold: on the one hand, a building renovation roadmap can justify measures that are financially supported and make sure that a sound concept is the basis for a renovation plan. On the other hand, combining funding and iBRoad can also raise additional interest in the iBRoad Building Renovation Roadmap and the iBRoad Logbook and, thus, make the iBRoad tools more attractive.

The core element of support schemes, such as, for instance, the KfW (German Credit Institute for Reconstruction) loan programme “Energy Efficient Refurbishment”, is to increase the number of deep renovations through funding, while at the same time strengthening the implementation and verification of the quality of the refurbishment. Often, quality criteria in the funding schemes, such as the KfW “Efficiency House Standard” or minimum quality criteria for the components (e. g., U-values, efficiencies or seasonal performance factors), influence the market and deliver an impact even for buildings that were not directly supported because more ambitious standards become common practice.

Option 1: iBRoad Building Renovation Roadmap as prerequisite for funding/tax relief/credits

The iBRoad Building Renovation Roadmap, as a detailed building integrated consulting product, can be made a prerequisite for funding individual measures. The idea of this is based on the principle that path dependencies or lock-in effects need to be avoided (e. g., to avoid thermal bridges and other problems caused by poorly coordinated individual measures).



Example: EFRE funding

In countries where investment in building stock renovation is largely supported by public funds, integration of iBRoad instruments in emerging financing mechanisms can strongly stimulate their market uptake through offering technical consultations tailored to the individual customer's needs. Thus, the iBRoad Building Renovation Roadmap was considered as prerequisite for receiving soft credits for renovation of single-family buildings by the Fund for Urban Development under Operational Programme “Regions in Growth” in Bulgaria. The same approach is suggested for the implementation of the SMARTER Finance for Families project, applying the Green Mortgage scheme in deep energy retrofit scenarios: in this case, it also mitigates the risk for both clients and banks, as it guarantees optimal performance by involving certified auditors and developers.

Figure 6: Example Bulgaria – EFRE funding

However, it should be noted that building renovation funding is expected to stimulate renovation dynamics. Therefore, introducing the additional requirement of a roadmap as prerequisite for funding may be perceived as a barrier; this must be balanced with the benefits of an additional roadmap. The more the investors understand that an iBRoad Roadmap provides them with necessary strategic information to master their long-term renovation projects, the higher the acceptance will be.

Another example is embedding the iBRoad Building Renovation Roadmap into the EuroPACE project [5]. The EuroPACE project (a H2020 project that started in 2018) offers 100 % up-front financing for energy efficiency measures and renewable energy in existing buildings that can be repaid over a long term of up to 25 years. The first EuroPACE pilot will be launched in Olot, Spain, in Autumn 2019 and will focus on residential properties. The project goal is to prove the concept of home-based financing and to develop a legal, operational, administrative, and communication toolkit for further expansion. In the framework of this project, a building renovation roadmap could be useful to identify the renovation plan that will be funded.

Option 2: Increased funding or tax support of individual measures in staged renovations as recommended by the iBRoad Building Renovation Roadmap

The iBRoad Building Renovation Roadmap should, if designed properly, show the way to a deep renovation – whether achieved in one-step or staged. Therefore, the Roadmap defines measures that are sufficiently ambitious and avoid negative lock-in effects due to suboptimal efficiency levels: e. g., insulation of walls with U-values that are also compatible with the long-term climate targets.

In the iBRoad project, this is defined as the “best possible principle”.

Based on this principle, the implementation of the recommended measures of the Roadmap could be rewarded with a special funding, see Figure 7.



Example: Incentives for enhanced renovation qualities in the Austrian “Wohnhaussanierungsrichtlinie” [6]

In the Austrian region of Vorarlberg there is a funding scheme for residential buildings (“Wohnhaussanierungsrichtlinie 2018/2019”) where specific incentives are introduced for enhanced renovation qualities, for instance, incentive bonuses for increased insulation thickness and/or material qualities that go beyond minimum funding requirements. Building owners who thermally improve components such as exterior walls, ceilings and windows or renew the heating system will benefit from the basic subsidy if they comply with minimum energy criteria that are slightly stricter than those prescribed by building law. The basic subsidy will be increased if the refurbishment is particularly energy-efficient and a few minimum ecological requirements must be met when selecting materials. This creates an incentive to realise very high insulating qualities.

Funding level	Roof		Top floor ceiling		Outer walls		Other floors and walls		Windows (glass & frame)	
	U-value	Funding (EUR/m ²)	U-value	Funding (EUR/m ²)	U-value	Funding (EUR/m ²)	U-value	Funding (EUR/m ²)	U-value	Funding (EUR/m ²)
1	≤ 0.16	120 EUR	≤ 0.16	20 EUR	≤ 0.20	80 EUR	≤ 0.30	35 EUR	≤ 1.00	300 – 550 EUR (depending on the material)
2	≤ 0.13	180 EUR	≤ 0.13	35 EUR	≤ 0.15	120 EUR	≤ 0.23	45 EUR	≤ 0,85	450 – 700 EUR (depending on the material)

Figure 7: Example Austria (Vorarlberg) – Incentives for enhanced renovation qualities

Option 3: Increased funding or tax support for packages of measures as recommended by the iBRoad Building Renovation Roadmap

To encourage simultaneous modernisation of several measures and avoid construction problems, funding schemes could provide a higher financial support if bundles of measures are realised simultaneously (e. g., 10 % reimbursement rate for implementing one measure, 15 % for two, 20 % for three). A “measure” would, for instance, be defined as “insulation of outer wall”, “replacement of at least x % of the windows”, “exchange of the boiler”, “installation of PV” or others. The measures should be proposed in the roadmap to avoid lock-ins from uncoordinated combinations of measures. This proposal is inspired by the French Tax Credit Scheme, see Figure 8.



Example: Incentives for implementation of renovation packages in the French “crédit d’impôt pour la transition énergétique – (CITE)” [7]

Under the French “crédit d’impôt pour la transition énergétique – (CITE)” tax credits are available for modernisation of the heating system and energy efficiency saving works. In general, building owners can benefit from a tax credit representing 30 % of the expenses up to a maximum of 8,000 EUR per taxable person. The maximum amount relates to a period of five years. The tax credit is granted on the income tax. The eligible person has to submit the invoices for the investments and deduct other tax benefits and subsidies.

Figure 8: Example France – Incentives for implementation of renovation packages

Bonus-malus system

Another way to increase dissemination and impact of iBRoad is to use an "orientation curve" as the basis of economic incentives, e. g., a so-called bonus-malus system. Bonus-malus systems all have in common that they want to achieve a desired behaviour by means of positive and negative incentives.

In other policy fields (e.g. transportation), bonus-malus systems are already established, for instance:

- Austria has implemented such a system in the automobile liability insurance [8]: There are different levels of tariffs to be paid depending on your driving behaviour. If you register a car you always start with a level that corresponds to 100 % of the tariff. If no accident is caused during an observation period of one year, the tariff to be paid is reduced; vice versa if an accident occurs during the observation period, the tariff to be paid is increased.
- France has introduced a bonus-malus system in 2008 to trigger the purchase of environmentally-friendly cars [9]: you pay a penalty if the car you buy emits high CO₂ emissions and get a bonus if you buy an electric car. For 2019, it starts at 35 EUR and goes up to 10,050 EUR.

A bonus-malus system offers the advantage that it creates direct behavioural incentives: The malus will have to be paid by the building owner, i.e. by the person who makes the decisions for or against an energy-related modernisation of a building. It will encourage the building owner to adhere to the targets in order to avoid payment of the malus. In addition, funds are generated, which could be used as subsidies for inefficient buildings.

However, there are also some drawbacks. For example, the French experience with the bonus-malus system for the purchase of automotive vehicles points to an important problem of the bonus-malus design. France had originally planned a balanced budget between bonuses and penalties. However, due to the tax, the average CO₂ emissions had fallen abruptly, the result being that the goal of a balanced budget was not achieved. Additionally, buildings would have to be classified energetically in a legally safe way. This means substantial transaction costs and the introduction of a simplified but qualitative procedure for classification. When designing other bonus-malus systems, such factors should be considered.

With regard to building renovation plans and the iBRoad Building Renovation Roadmap, a bonus-malus system could be designed as described below [10]:

The basic idea is to implement a long-term renovation goal for buildings, e. g., by defining a certain energy rating as target for the building stock in the year 2050. The bonus/malus can be designed as a function of the energy demand/efficiency rating, e. g., in the shape of a long-term “orientation curve” which describes the desired efficiency rating in each year, with buildings above the curve having to pay a malus and buildings below the curve receiving a reward (either as a yearly re-imbusement or as a one-off support for renovation). The owner can, based on a building renovation plan, decide with which technical measures he or she wants to achieve the objectives.

Setting the ‘malus’ at the right level is essential for the success of such approach: on one hand, the amount of the malus should be high enough to have more than just a symbolic effect to work as an incentive. On the other hand, the malus should not be too high as to avoid imposing financial hardship on building owners.

The efficiency rating could be proven by providing an Energy Performance Certificate (EPC). Randomised checks of the implementation of renovation measures shall be carried out in accordance with the framework on quality controls of EPCs. Here, the financial relevance of the energy labelling, should be noted. Auditors might try to set the parameters of the building calculation in favour of the result to help the building owner to avoid payments. Uncertainty in the classification of the building can have a serious impact. Thus, improved calculation methods are required.

If no EPC is provided for a certain building, it could be automatically assigned to the poorest or lowest proven energy efficiency category. This system shifts the burden of proof to the building owner. As a consequence, this would mean that building owners are not obliged to get an EPC for their building or to implement modernisation measures, but, in this case, they will pay the rising malus. Of course, it should be noted that there can be difficult cases, as for example, buildings owned by older people who do not wish to renovate anymore. These difficult cases should be solved by hardship clauses.

There are various ways in which the above described bonus-malus system could be implemented in building policies, for instance [10]:

- Creation of a new building bonus-malus, e.g., in the shape of a new tax or a tax combined with a funding scheme. The disadvantages lie in the fact that some countries have legal restrictions with respect to the creation of new taxes and that this option may have little social acceptance. Surely, the acceptance depends on the implementation process. It can be expected that a gradual introduction which starts with worst performing buildings would be assessed more positively than a configuration which charges all buildings from the very beginning.
- Integration into already existing taxes, e. g., the property tax, the real estate transfer tax or the inheritance tax. An implementation within the framework of a real estate transfer tax or inheritance tax has the advantage that the bonus-malus becomes effective when there is a high probability for renovation anyway. However, in terms of administrative expenses, the integration into existing taxes is advantageous. Additionally, it should be noted that the above-mentioned taxes are financially limited. The property transfer rate in Germany, for example, is between 3.5 % and 6.5 % of the purchase price. For instance, for a building with a purchase price of 300,000 EUR this equals 10,500 EUR to 19,500 EUR. Thus, an efficiency differentiation, only allows for a difference of a few thousand EUR.



Example: Bonus-malus system within the property transfer tax [10]

In 2007, in the UK, it was suggested to exempt all zero-carbon buildings from Stamp Duty Land Tax (SDLT) by way of a “Zero-Carbon Homes Relief”. The Draft Regulation intended to exempt all qualifying homes under £500,000 from stamp duty land tax; for those costing more than £500,000 the regulation stipulated that their stamp duty land tax bill would be reduced by £15,000.

Figure 9: Example UK – Zero carbon home relief from SDLT

iii. Regulatory Instruments

In the following, regulatory measures to increase dissemination and impact of iBRoad will be identified. Where available, existing regulatory measures that address these points or could be adapted this way in the iBRoad countries Belgium/Flanders, Bulgaria, Germany, Poland, and Portugal as well as in other countries will be illustrated.

iBRoad information embedded in the EPC

In 2003, Energy Performance Certificates (EPCs) entered into force on the basis of the Energy Performance of Buildings Directive (EPBD) (2002/91/EC). The objective was to make the energy performance of individual buildings more transparent. The EPBD recast in 2010 (2010/31/EU) reconfirmed and strengthened the instrument by introducing independent quality control of EPCs, penalties for non-compliance, the obligation to display the energy label in advertisements, a mandatory requirement to hand out a copy of the EPC in sale and rent transactions, and improvement of renovation recommendations.

The iBRoad Building Renovation Roadmap (and building renovation roadmaps in general) could be considered a further development of the EPC as it also supports building owners with personalised suggestions on their options for improvement of the energy efficiency of their building, through renovation. To increase dissemination and impact of the iBRoad Building Renovation Roadmaps (respectively building renovation plans in general) the EPC could incorporate and include information provided by the iBRoad Building Renovation Roadmap.

The Portuguese EPC for residential buildings, for instance, consists of the following components: information on the building’s overall performance, information on the building components and their performance, a proposal of improvement measures to reduce the energy consumption and to improve the comfort, and information on fiscal benefits and access to financing, see Figure 10.

Another example is the Flanders’ EPC+. In 2009, the Flemish EPC was replaced by an “updated version”, the so-called EPC+ that displays

- general building and issuing data, and the buildings' energy label
- a visual overview of the current state of the building embedded into the 2050 long-term target
- renovation recommendations, including an indication of priority, impact, and estimated costs
- in-depth information regarding e. g., technical information and lock-in effects.



Example: Building Renovation Roadmap information in the EPC

The Portuguese Energy Performance Certificate (EPC) is relatively detailed and goes well beyond displaying the building's energy efficiency class. For instance, it contains performance indicators for space heating, cooling, and domestic hot water, and presents a comparison with the reference values of other buildings. It also contains a list of improvement measures with investment cost estimation, expected energy bills saving and impact regarding the energy class.

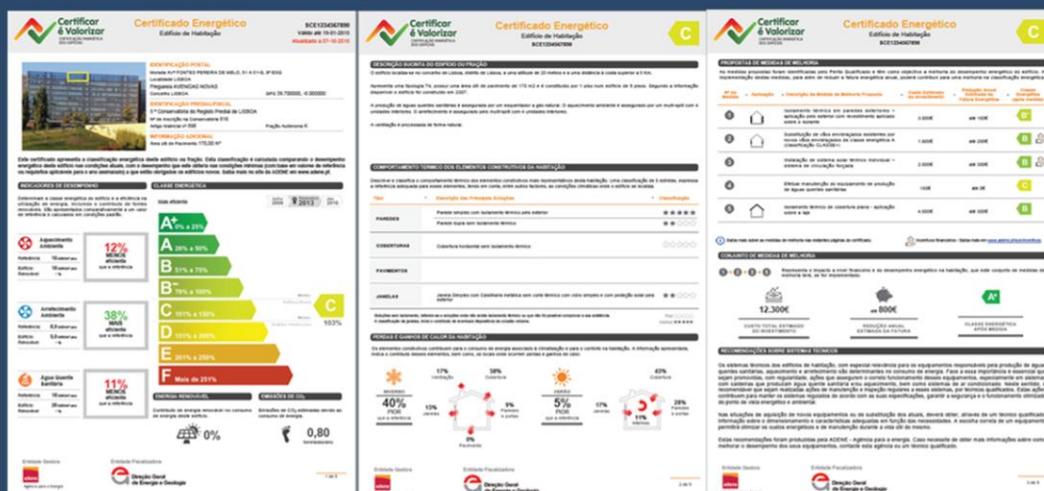


Figure 10: Example Portugal – Building Renovation Roadmap information in the EPC

Making building renovation roadmaps mandatory

The simplest form of integration of the iBRoad Building Renovation Roadmap into regulatory approaches is the creation of a legal requirement to introduce such a renovation roadmap. This policy is weaker than introducing minimum performance levels because only the audit would be required. However, the idea would be that the roadmap convinces a part of the homeowners of the advantages to renovate.

For instance, this may be applied when larger renovation measures are carried out, when predefined energy consumption (or efficiency class) levels are exceeded, when certain building characteristics are present (such as single glazing, no facade insulation, night storage heaters, etc.), or when specific events occur (so-called trigger points such as the change of property ownership, new lease, major changes in the resident structure, etc.).

There are already examples where compulsory energy audits exist and where a building renovation roadmap could be easily incorporated, for instance see Figure 11



Example: Energy Conservation Audit and Disclosure Ordinance [11]

The Energy Conservation Audit and Disclosure Ordinance (ECAD) requires energy audits and disclosures for all buildings which are served by Austin Energy and located within Austin city limits. Specifically, the ECAD requires home owners of smaller residential buildings to acquire an energy audit prior to a sale if the building is ten years or older; such an audit could be based on the renovation roadmap approach. The building owner must disclose the audit results to potential buyers. In the event that you own or manage a property with five or more residential units a specialised energy audit of the property needs to be conducted the year it turns ten years old. Likewise, the energy audit results must be made available to potential and current residents. Regardless of the date of construction of the building, the building owner will receive a notice when an average per-square-foot energy usage exceeds 150 % of the average within the Austin Electric Utility service area. In this case, the building owner shall implement energy efficiency improvements to reduce the average per-square-foot energy usage by 20 % not later than eighteen months after receipt of the notice. All energy audits must be conducted by a person certified as a building performance analyst or equivalent. Non-compliance with ECAD is a Class C misdemeanor with fines from \$ 500 to \$ 2,000.

Figure 11: Example Austin, Texas – Energy Conservation Audit and Disclosure Ordinance

A mandatory and regular energy audit, combined with a building renovation roadmap, has many advantages. However, the relationship of trust between the energy auditor and the homeowner is an important element in the motivation for building renovation; a mandatory renovation roadmap might change this relationship. Basically, the question arises whether it can be useful for homeowners to get energy advice (especially in an ambitious and long-term approach, such as the renovation roadmap) if they are perhaps not even interested in the content. However, if coupled with the EPC, this approach does not necessarily lead to an additional burden. In addition, precautions are necessary to check the compliance with this new obligation.

Combining iBRoad with efficiency or renewable heating obligations

Introducing the iBRoad Building Renovation Roadmap into regulatory measures can also enhance the demand for energy audits and renovation roadmaps. This could be, for instance, that the building renovation roadmap leads to the compliance with certain obligations, e.g., a renewable heating obligation, or that the existence of a building renovation roadmap facilitates the compliance with obligations.

For instance, in Germany it was proposed that some of the renovation obligations, e.g., the obligation to replace very old boilers, could be delayed by a certain time of period if a building renovation roadmap is existent. This would induce additional demand for roadmaps; homeowners could then develop a holistic view of the building and embed the replacement of the boiler into a more structured renovation process.



Example: Renewable-Energies-Heat-Act (Erneuerbare-Wärme-Gesetz (EWärmeG))

Baden-Württemberg, Germany's third largest state, was the first to mandate the installation of renewable heating technologies in 2008. Owners of a heating system need to employ a minimum share of renewable energy (of 10 % until June 2015, "old EWärmeG" and 15 % since July 2015, "new EWärmeG") of the heat demand when the heating system is replaced. Instead of employing a renewable heating system, the building owner can opt for efficiency measures, including insulation of the whole building, the external wall, the roof or the basement ceiling. A part of the obligation (in residential buildings 5 %-points) can be fulfilled by carrying out an energy audit of the building based on an individual building renovation roadmap.

The number of government-funded detailed energy audits per inhabitant in Baden-Württemberg has increased significantly since 2015, when the building renovation roadmap was introduced as fulfilment option. Between 2014 and 2017, this coefficient has doubled, whereas in other German Federal States, the energy consultancy activities have decreased. Likely, the good framework conditions for energy consulting in Baden-Württemberg have contributed to this development (regional energy advice centres play a role here), but the EWärmeG is assumed to provide essential additional impetus.



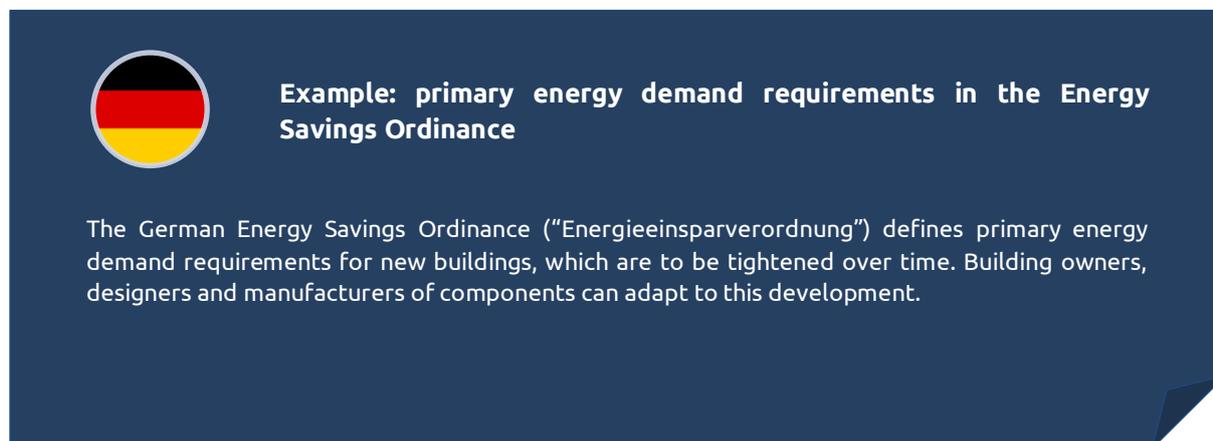
Evolution of the number of funded energy audits per capita in various federal states and in the German as a whole [12]

Figure 12: Example Baden-Württemberg, Germany – Renewable-Energies-Heat-Act (EWärmeG)

Building codes

Long-term targets in building codes

Yet another possibility to integrate long-term renovation strategies by way of a building renovation roadmap into regulatory approaches is to define long-term technical requirements, see Figure 13.



Example: primary energy demand requirements in the Energy Savings Ordinance

The German Energy Savings Ordinance (“Energieeinsparverordnung”) defines primary energy demand requirements for new buildings, which are to be tightened over time. Building owners, designers and manufacturers of components can adapt to this development.

Figure 13: Example Germany – Energy Savings Ordinance

Another option would be to, step by step, tighten the renovation requirements (i.e. U-values) for individual components in the case that renovations must be carried out anyway (e.g., new roof covering).

In the case that individual characteristics do not allow such technical requirements, exceptions need to be made upon confirmation by a building expert (buildings worth preserving, other insulation restrictions, etc.). This is possibly the largest disadvantage of these increasing component requirements. The number of exemptions will increase over time, for example, because wall insulation cannot be carried out to the required thickness. It might also happen that in order to avoid the next stage of requirements, building owners quickly renovate with the lower requirements of the previous stage. This psychological effect causes a short-term increase in renovation activities, at the expense of the long-term goal.

What is essential for the effectiveness of such a regulation is that compliance must be ensured. To this end, an appropriate monitoring and control mechanism is necessary.

Renovation obligations

Among the approaches described, the most invasive policy instrument is the one that defines renovation obligations depending on the energy rating of a building. For example, in a study by Fraunhofer IBP [14], primary energy demand thresholds are defined. The study also suggests above which levels a building must be renovated. For example, the study suggests that old single-family houses were to be renovated when their primary energy demand exceeds 390 kWh/m²year (in 2020), 300 kWh/m²year (in 2030), 185 kWh/m²year (in 2040) or 75 (in 2050) kWh/m²year, respectively. Figure 14 illustrates yet another example.



Example: SmartREGs system [15]

In 2011, the city of Boulder, Colorado enacted its “SmartRegs” ordinance that requires all single-family and multi-family rental properties to meet a minimum energy efficiency standard by 2019. This introduced an eight-year compliance period that would allow rental owners sufficient time to budget for energy improvements. In addition, the city’s Energy Smart programme offered financial incentives and technical assistance.

There were two paths for compliance, both requiring an energy audit: a detailed energy modelling (with measurements of all building dimensions and individual components, air leakage and duct leakage testing) or a simplified point system. The first path resulted in a Home Energy Rating System (HERS) Index. If the rental unit achieved a HERS Index of 120 or less, it was considered to be in compliance with the ordinance. The other path involved a checklist and a slightly less comprehensive audit: fewer measurements were required, duct leakage testing was not required and energy modelling was not necessary. Points were awarded for energy efficient features, with minimum compliance score of 100 points, which was roughly the equivalent of a HERS rating of 120.

Figure 14: Example USA (Colorado, City of Boulder) – SmartREGs system

Whereas from a legal standpoint, in general, renovation obligations are possible, there are certain constraints, among which a low degree of acceptance among owners, but also among policy makers, even if flexible elements are included. Here again, compliance and verification are important issues to be considered and integrated in the programme since the design.

VI. CONCLUSIONS AND RECOMMENDATIONS

Overall, key elements of the iBRoad Building Renovation Roadmap and building renovation plans in general can be implemented in current policy tools to a varying degree. This applies namely to the long-term perspective, the definition and implementation of a target, and a sound, comprehensive and systematic renovation approach. The following table summarises the relevant information.

Instrument	Potential impacts Qualitative ranking: 0 no impact. 3 high positive impact				
	on dissemination of building roadmap	on quality of roadmaps	on implementation of proposed measures	on renovation rate	on renovation depth
Informational instruments					
Awareness/ information campaigns	3 Makes roadmap known to homeowners and triggers demand	0	0	1 Indirectly through promotion of roadmap	1 Indirectly through promotion of roadmap
Training for auditors	2 Makes roadmap known to auditors and triggers supply	3 Principles, tools and experience improves quality of roadmaps	1 indirectly through promotion by energy auditors	1 Indirectly through promotion of roadmap	1 Indirectly through promotion of roadmap
Economic instruments					
Financial support for audits	3 Through promotion of the support scheme and higher demand for audits	2 Incentives require well trained auditors	1 Audits usually consider next steps	2 Through higher demand for audits and risen awareness	3 More audits lead to deeper insight to required renovation depth
Combination with tax and funding schemes: roadmap as prerequisite	3 Roadmap as prerequisite implies a strong commitment and trust	2 well trained auditors required, thread of issuing as an alibi	3 Funding depends on implementation, funding can refer to long-term perspective	3 Stepwise renovations become more targeted	3 Enabling staged deep renovations
Combination with tax and funding schemes: increased funding with	3	3	3 Better	3	3

Instrument	Potential impacts Qualitative ranking: 0 no impact. 3 high positive impact				
	on dissemination of building roadmap	on quality of roadmaps	on implementation of proposed measures	on renovation rate	on renovation depth
roadmap for deeper renovations	Through promotion of the scheme	Roadmaps need to be very concrete	funding depends directly on implementation	Stepwise renovations become more targeted	Deep renovations become economic worthier
Combination with tax and funding schemes: increased funding for packages	3 Through promotion of the scheme	2 Roadmaps need to foresee packages	2 Restrictions through diminished flexibility	2 Through higher demand for audits and risen awareness	2 More audits lead to deeper insight to required renovation depth
Combination with a bonus-malus instrument: Roadmap as consulting	2 main streaming long-term perspective	3 concrete planning required to avoid malus	3 strong incentive through bonuses for renovation and maluses for omission	3 direct steering of the renovation rate through bonus/malus instrument	3 direct steering of the renovation depth through requirements in bonus/malus instrument
Regulatory instruments					
Embed in EPC	3 very high impact, however less targeted	1 Roadmap not demanded by EPC issuers and customers, quick and easy information required	2 through raising awareness for long-term thinking	2 through better information	2 through better information
Mandatory roadmaps	3 very high impact, however less targeted	1 Roadmap not demanded by EPC issuers and customers,	1 trigger of the obligation should	2 through better information	2 through better information

Instrument	Potential impacts Qualitative ranking: 0 no impact. 3 high positive impact				
	on dissemination of building roadmap	on quality of roadmaps	on implementation of proposed measures	on renovation rate	on renovation depth
		quick and easy information required	relate to given renovation occasions		
Combining iBRoad with efficiency or renewable heating obligations	3 very high impact, however less targeted	1 negative perception of obligation can affect the Roadmap, Roadmap not as easy escape from obligations	1 depending on the occasions that trigger the obligations and if they are suited for renovations	2 through better information	2 through better information
Long-term targets in building codes	2 main streaming long-term perspective	3 concrete planning required to achieve pending code	2 depending on bonuses for renovation and/or maluses for omission	2 depending on bonuses for renovation and/or maluses for omission	2 depending on bonuses for renovation and/or maluses for omission
Renovation obligations	2 main streaming long-term perspective	3 concrete planning required to avoid obligation	2 depending on execution and sentencing for the obligation	2 at first targeted to worst performing buildings	2 depending on execution and sentencing for the obligation

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