D4.7_Policy guide with recommendations for incentive strategies for highly efficient retrofits

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

[Improving the energy performance of step-by-step refurbishment and integration of renewable energies]

Contract N°: SI2.645928

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Introduction

Buildings are responsible for 40% of energy demand, therefore, GHG goals can only be met with a dramatic change in building standards, including those of existing buildings.

While hundreds of Passive House components have been developed for new buildings [Comp 2016], they can easily be applied to existing buildings. Retrofit with Passive House components is already well known as the clearly defined and certifiable EnerPHit standard [Bastian 2012], saving 80 to 90 % in heating energy demand. More than 80% of retrofit volume is single measures in a step-by step manner, contrary to a full retrofit. In the EuroPHit project, step by step retrofit was specially addressed, and the concept of the overall retrofit plan has been developed.

Measures for energy efficiency in existing buildings lead to:

- significant reduction in energy consumption costs;
- reduction in resource use;
- significant reductions in GHG emissions.

In addition:

- enhancement of the building envelopes thermal properties;
- improvement in thermal comfort;
- increase in the building's market value; at a more local scale, a stimulus for construction SME’s.

For a quick, high-quality and comprehensive implementation of these measures, incentives are crucial and also incite innovative impulses. This help will be refinanced by the savings that result from the extensive measures initiated.

As we have seen in the guideline 4.1, with correct life cycle cost analysis, today’s energy prices and price scenarios, low interest (discount rates), and the experiences of long component lifetimes (see e.g. [Feist 2016]) we know that measures are mostly economic, so the efficiency related part of the investment is balanced by the savings. Often the return on investment is very attractive, much higher than comparable (risk-free) assets on the capital market. Therefore, business concepts can be developed; on the other hand, for single building owners this is not very realistic, legally complicated, and goes along with a higher financial burden in the first years during and after the implementation of the measure. Lack of information, transparency and capacity is an additional barrier, and sometimes already existing medium energetic quality makes the retrofit less economically viable.

1 Funding and incentives

Funding and incentives help overcome financial barriers. When the investment is not profitable based on life cycle costs (e.g. in markets that are new to energy efficiency), a subsidy can make it economically feasible. This situation can be used to influence the market in an effective way; incentives should aim to support an effective and sustainable reduction of energy demand and carbon emissions, and to guarantee good performance through quality assurance requirements.

If energy efficiency investments are already economically viable, public financial support will still help to provide liquidity, or help in case of split incentives, home owner association, etc. Public funding can increase awareness and pave the way for private capital.

But funding should avoid contributing to retain high prices. Instead, financial aids should focus on:

- Improving liquidity and reducing the financial burden. This can be achieved through direct financial support, but also special credit lines with low interest rates (especially in the first few years)
- supporting collaterals (guarantees) to facilitate access to attractive bank credits and leverage private capital thus significantly boosting effective investments
- binding financial support to quality-assured design (including damage-free construction and long lifetime measures) and guaranteed high performance
- supporting the quality assurance procedure as well as accompanying measures like training, information, transparency and visibility, and development of simplified effective processes, in order to reduce barriers
- also supporting step-by-step plans with special programs. They should aim at effectively reaching the EnerPHit standard in the end, ensuring high quality, cost effectiveness and profitability
- achieving very high energy efficiency with superior quality, because the next renovation will only take place after many years.
- avoiding medium quality which would prevent the necessary reduction of the energy demand and emissions causing a "lock-in" effect.

Moreover, the funding should be related to investment costs without retaining high costs. An ambitious minimum standard of efficiency should be guaranteed to be eligible, but a higher level can get higher incentives to make it more attractive, and for an increased public value (e.g. avoiding more external costs). When the funding is directly related to energy (or CO_2) savings, it is important to link it to a standard initial level in order not to “punish” those who built (or renovated) better earlier. Moreover, the funding should have a focus on the necessary quality, but avoid any additional bureaucracy. A concept was developed in [Jetzt! 2000].

It is not always necessary to invent the wheel again. Many standard, tools, and voluntary quality assurance and certification schemes are already available on the market. One can – and should - make use of them for the benefit of all; but it is important to raise awareness and give the right incentives. One example is the German KfW loan programme for Passive Houses (since 2000). Since 2016, the service of Passive House certification is eligible for funding, too

(additional to the funding of the measures) [1]. In the final EuroPHit Financial workshop[2], it was stressed that the guarantee of quality and performance is a central requirement for financing institutions. In this way, public funding can release private debt capital.

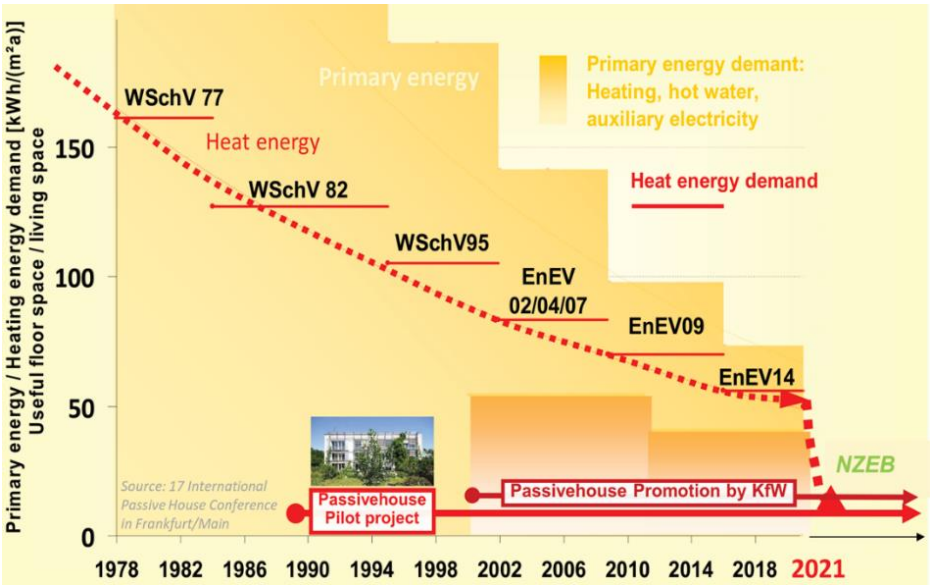


Figure 1: National standards and Passive House: KfW funding since 1999/2000

The low interest loans for energy efficient new (Passive House and “Efficiency House”) and retrofitted buildings are coupled with direct subsidies, which are higher for improved energy efficiency [KfW 2000-2015]. In general, we suggest that in future the focus should be directed towards deep renovation, while standards that lead to future lock-in-effects, should no longer receive funding.

Subsidies are also granted if the measures prove profitable. Even so, they are effective as well as advantageous in terms of the national economy, because even measures that are profitable are not recognised and implemented as such without the relevant incentives. Incentives attract attention, help to overcome the high initial burden, help to reduce the learning costs, and thus create the necessary liquidity for the investor. The prerequisite for ensuring that subsidies support sustainable development is that their steering effect should mainly be used for initiating the right measures: if done at all, then sub-optimal standards should be avoided. This is not always guaranteed by the above-mentioned programme. A good example in this respect are some local and regional programmes such as the funding programme of the state of Hesse referring to the EnerPHit standard.

Figure 2: Local funding for Passive House and EnerPHit standard: Dissemination

[1] Programme 431

[2] In Frankfurt, March 2016

2 Performance indicators

2.1 Sustainable levels and EnerPHit standard

For new builds and retrofits it is very important to reach a sustainable level. A priority of spending public money is to lead in the right direction and avoid lock-in effects. Over the last two decades, the Passive House Standard has gained rapidly in recognition and has proven to be a reliable approach in an ever increasing range of climates. Although Passive House and Passive House components are cost optimal after learning and scaling, this might not be true from the beginning, especially where markets are new to Passive House, components are not locally available and professionals are not yet experienced. Many schemes (e.g. certified Passive House designer, founded within the European IEE programme[3]), tools and databases support the implementation, but public funding is still needed to overcome the information, knowledge and finance barriers, and to ensure the quality and performance

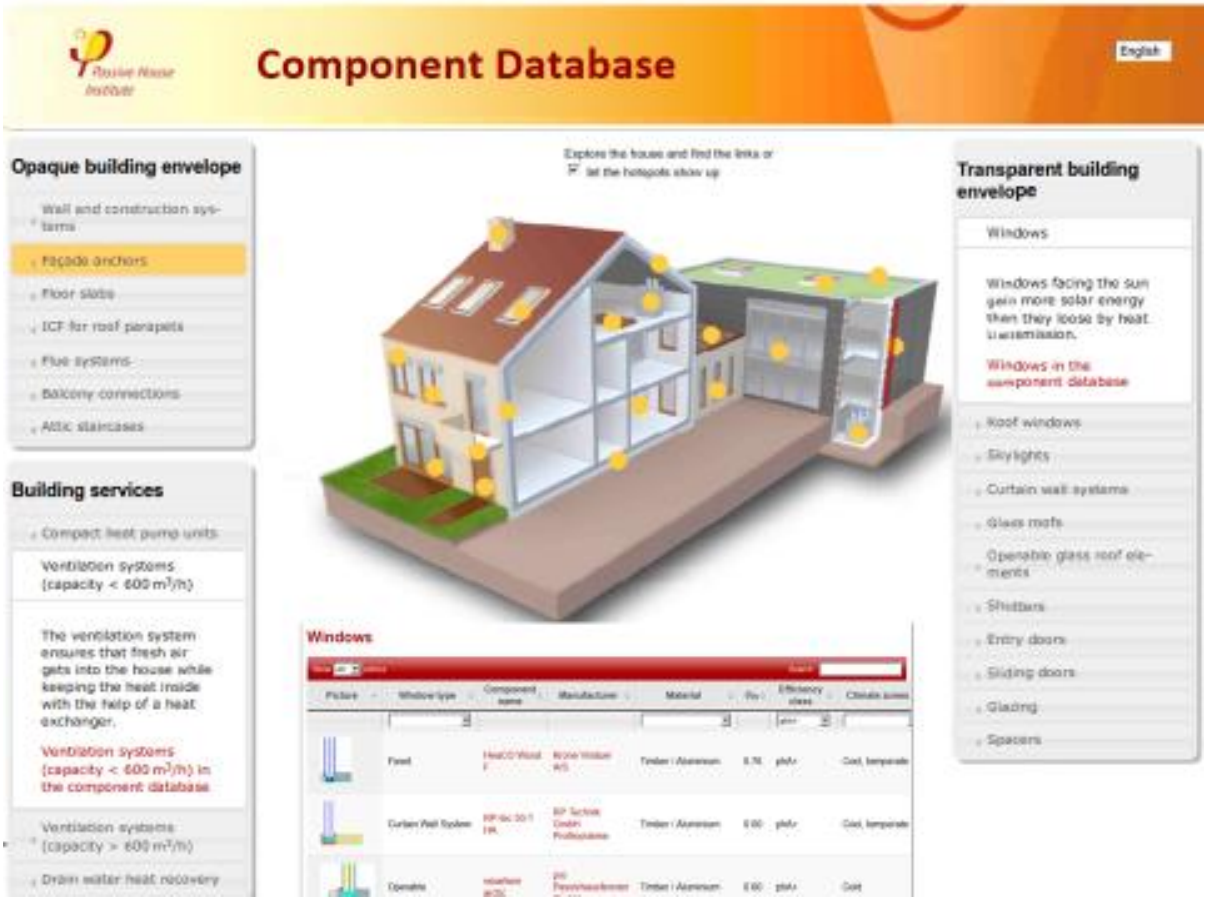


Figure 3: Passive House component database. www.componentdatabase.org

For ***EnerPHit*** retrofit, a similar standard and certification scheme has been developed. Alternatively, Passive House components are eligible. The EnerPHit standard is a good measure for a sustainable level (can be – in general – covered with renewable energy, mostly regionally available)

[3] www.passivehouse-designer.eu, www. passivehouse-trades.org

Climate zone according to PHPP	Energy demand criteria		Opaque envelope[1] against...			Windows	Ventilation
	Heating	Cooling	...ground	...ambient air		Overall[4]	
	Max. heating demand	Max. cooling + dehumidification demand	Insu-lation	Exterior insulation	Interior in-sulation[2]	Max. heat transfer coefficient - vertical ($U_{D/W,installed}$)	Min. heat reco-very rate[7]
	kWh/(m²a)		Max. heat transfer coefficient (U-value) [W/(m²K)]			[W/(m²K)]	%
Arctic	35	equal to Passive House requirement	Deter-mined in PHPP from project specific heating and cooling degree days against ground.	0.09	0.25	0.45	80%
Cold	30			0.12	0.30	0.65	80%
Cool-temperate	25			0.15	0.35	0.85	75%
Warm-temperate	20			0.30	0.50	1.05	75%
Warm	15			0.50	0.75	1.25	-
Hot	-			0.50	0.75	1.25	-

Figure 4: Levels for sustainable retrofits: Target value for public subsidies

As Passive House, the EnerPHit standard offers a system of three classes (EnerPHit Classic, Plus, and Premium) depending on the amount of renewable energy generated as well as the efficiency of the mechanical and electrical systems. Buildings that achieve the classes Plus and Premium could be rewarded with extra financial aids.

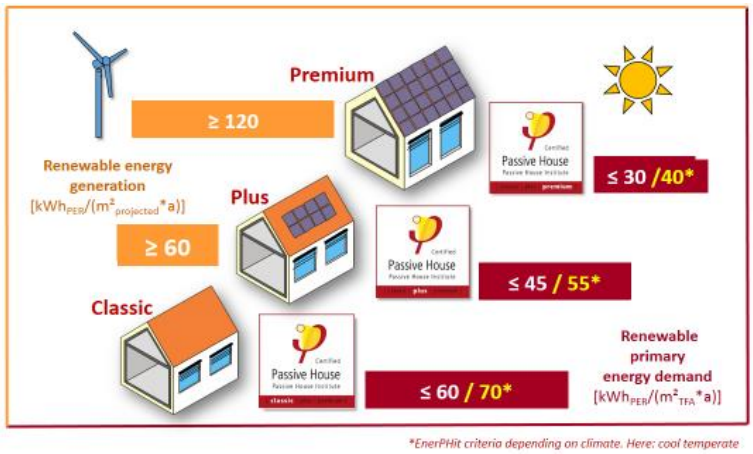


Figure 5: Passive House and EnerPHit classes with renewable energy. The share of supply as represented by the classes can define the amount of funding.

It is not always possible to achieve the Passive House Standard applied to new constructions in the case of refurbishments of existing buildings, even with adequate funds. For this reason, the PHI has developed the “EnerPHit – Quality-Approved Energy Retrofit with Passive House Components” Certificate. Significant energy savings between 75 and 90 % can be achieved even in existing buildings, for which the following measures have proved to be particularly effective:

- improved thermal insulation (based on the principle: if it has to be done, do it right)
- reduced amount of thermal bridges
- considerably improved airtightness

- very good quality windows (there is no reason why Passive-House-suitable windows should not be used whenever the opportunity arises)
- ventilation with highly efficient heat recovery (again, Passive-House-suitable systems are highly recommendable)
- Optimized heat generation
- renewable energy sources

These are exactly the same measures that have proved to be successful in new constructions. A number of examples demonstrating the application of high-efficiency technology in existing buildings have become available in the meantime. The Passive House Institute has advised on the implementation of several projects and carries out measurements in modernised buildings.

2.2 Step by step retrofit

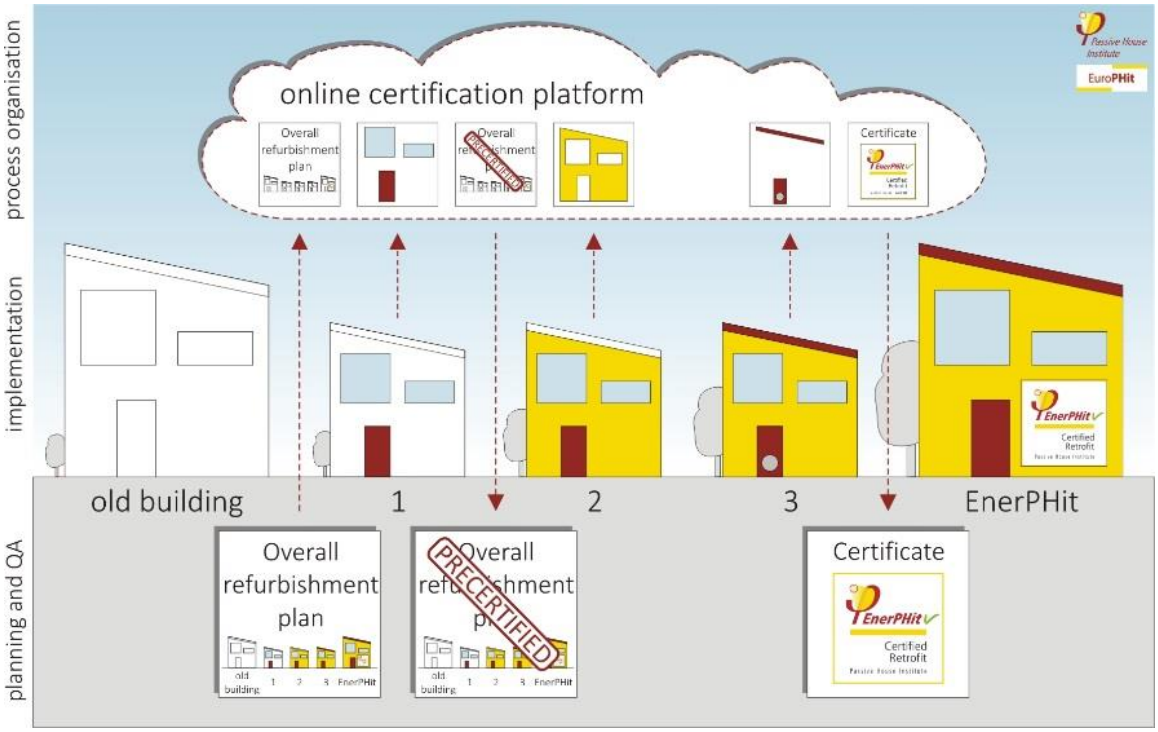


Figure 6: EnerPHit and step-by-step: Quality assurance, plans, tools and certificates

Regarding that most retrofits are not full retrofits, but, instead, are carried out in a step-by-step manner, it is a strategic issue to pay special attention to stepwise retrofits. Public funding helps to trigger investments and private capital to finance them. Controlling the energetic quality of this type of investments has an extremely high influence on future energy demand. For the design of the EnerPHit retrofit plan, tools and a certification scheme have been developed within the EuroPHit project [EuroPHit 2016]. For a guaranteed quality, public funding of a quality-assured retrofit plan is advisable.

3 Financing energy efficiency

3.1 Challenges

As we have seen, sustainable levels of energy efficiency are economically feasible, and are cost-optimal with respect to life cycle costs, after the effects of learning and scale. This means that in most cases, climate change mitigation could be at least cost-neutral. In spite of this, there are a lot of barriers concerning

- implementing energetic retrofit added to standard retrofit
- aiming at efficiency level
- reaching the quality and performance needed for the goals
- receiving the capital needed for the investment.

Therefore, the task is

- implementing an effective incentive program in order to achieve a maximum impact with a limited use of resources;
- defining priorities and assessing effectiveness of measures with respect to sustainability and climate protection
- find targeted solutions and pave the way for private investments
- promoting those measures within such a programme
- evaluating the impact of such a programme on the labour market, tax returns, and the value added in the construction sector.

It can be shown that with only one fourth of the total investment amount required described above, the incentive created could result in more than doubling the implementation of EE measures. This additional investment amounts to annual double- or triple-digit billions. The higher the investment, the higher the increase in value of the market. Thus providing security and employment to the trade and construction industry.

3.2 Principles

Since the retrofit market is huge, public measures have to be as efficient as possible. It is very important to regard the following principles:

- Highly important is that, in the perspective of these EE refurbishment technics to be implemented, all causes are used for an energetic retrofit. It follows that an incentive system promoting the building stock modernization has to integrate a component method.
- For a higher contribution to climate protection, a higher incentive should be given. Basically, this could be done with the EnerPHit classes.
- The basic subvention should be sized to lead to a minimum energy reduction on an ambitious level. Thus encountering free-rider effects and GEG emissions.

- The grant must be attractive, but limited in order not to retain high prices.
- Low transaction costs: the funding application and award should be as little bureaucratic as possible. Therefore, for the grant existing structures should be used as far as possible.

3.3 Goals of a funding concept

- Make investments wanted economically attractive for the investor: capital is directed
- Reduce financial barriers (too high burden even for economic investments)
  - Liquidity, especially in the first years
  - accessibility to capital, provide collaterals (e.g.: to get bank loans)
- Raise awareness
- Stimulate with attractive conditions
- Mobilize positive motivation (instead of formal regulations)
  - but avoid unwanted side effects (high costs, fix technology, lock-ins)
- Performance is decisive to reach goals: guarantee quality (funding allows for better consulting and control)
- Create trust of stakeholders, pave the way for private capital (including equity and bank loans)
- Push innovation, more and more attractive solutions, push cost reduction on the market
  - But reduce transaction costs, make funding accessible
- Macroeconomic perspective: State revenues by taxes, reduction of unemployment, saving expenses for external costs born by the general public; securitiy of supply
  - Especially important: Climate change mitigation. Problems: long term relevance, and costs are uncertain and depend significantly on scenarios or paths.
- The strategy and the results achieved must fit to a sustainable development
  - The assessment should reflect a renewable future supply system
  - Avoid lost opportunities, medium quality, lock-in effects

3.4 Proposal

The proposed subvention consists in a working scheme depending on the national practices. The most common schemes uses by governments are

- Tax reductions. Financial authorities have enough personnel.
- Credit lines extended by public financial institutions.

In both cases, deductions of tax or of interest/amortization over a longer period would be appropriate regarding the longevity of the measures, e.g. 10 years or more. The latter may

depend on common practice; in some countries amortization periods of 50 years are common with respect to taxation. During that time a public "compensation" of energy savings achieved could be e.g. 2-3 €cents per kilowatt hour[7]. In principle, the amount can be derived from the savings of final energy, primary energy[8], or greenhouse gas emissions. Final (purchased) energy is most transparent.

Single measures on existing buildings can be funded in accordance with a positive catalogue. The measures have to guarantee significant energy savings according to the state of the art; the catalogue is based on the given national standard for existing buildings for reference. The target values are derived from the EnerPHit criteria. Renewable energies receive extra funding. The saved energy is calculated

- As final energy

  or

- As primary energy renewable10 thus reflecting a sustainable, renewable future, where the building finally has to fit in [Grove-Smith et al, 2016].

Constraints are:

- Total (cumulative) finding should be capped at a maximum 40-50% of the total amount of the tradesmen´s bills
- An upper value of subsidies per household should be set, eg. at 600 – 1000 €/a for a 10 years period.

When the savings are the basis for the subsidy, a reference case is to be established. This approach allows to set measure for each of the works that can be implemented without having to calculate the complete energy balance of a building. To guarantee this method, accredited craftsmen´s bills are to be used as proof sheets to fulfill a control document. Moreover, all through the building process, each details changes made to the building retrofit should be listed in a document signed by both accredited craftsmen and investor, or its legal representative.

Each of the primary energy unit saved (in kWh) is to be weighted up with a coefficient valorizing the total amount of energy saved in a grant expressed in Euro/a, C_{klima}:

$$C_{klima} = \sum_{i=1}^{i=n} r_i A_i \left(U_{R_{ef,i}} - U_i\right) * HDD * c_i$$

r_i is the weight allocated to each element of the building:

Outer walls and windows, $r_i = 1$

Slabs and basement ceilings, $r_i = 0{,}5$;

A_i Surface of the building element in m², $i \in \{1,2,3\}$;

$U_{R_{ef,i}}$ Reference U value and U_i building U value in *W/(m².K)*;

[7] Proposed values should be ultimately determined by the legislature. We chose these values so that in a fully funded investment, the present value of the total funding amounts 32% of the investment.

[8] While primary energy as a benchmark has a long tradition, and is also targeted in the EPBD, the shift of supply structures to renewables change the view. The PHI has suggested an assessment on the basis of primary energy renewable, see https://passipedia.org/certification/passive_house_categories/per

[10] The PER assessment is available in PHPP9.

HDD Heating degree days in kKh/a;

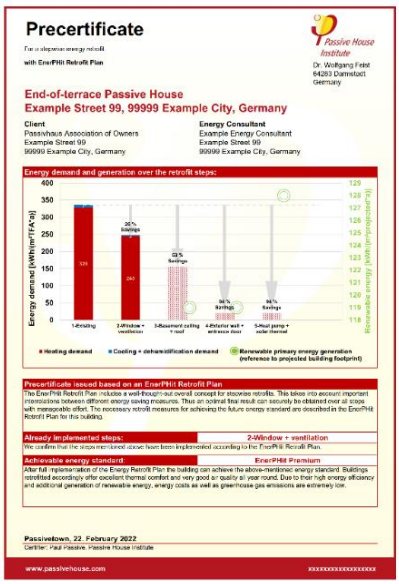
c_i in *€/kWh* the economical weight coefficient.

We propose that $c_i$corresponds to 2 - 3 €ct/kWh final energy or PER – so every saved kWh primary energy gets a maximum funding of 2 -3 €ct, dependent on the quality assurance. For a 10 years amortization period and central European climate, regarding the (marginal) efficiency of the heating system, $HDD * c_i$ is typically 2 – 3 *[€K/(Wa)]*.

Using existing institutions and structures, a simple and transparent funding system can be implemented quickly and unbureaucratically. For simple single measures, it is enough to proof the energetic standard and the craftsman's invoice.

But it is advisable to attribute a higher amount of funding when the implementation is accompanied by a quality assured design and implementation. A flat (ca. 500 €/apartment) can be awarded for the quality assurance, too. Supplementing measures are training for building professionals as well as for bankers, creating expertise on different levels which is necessary to provide and to assess energetic design and quality assurance.

3.5 EnerPHit Retrofit plan


Precertificate

End-of-terrace Passive House
Example Street 99, 99999 Example City, Germany

Client
Passivhaus Association of Owners
Example Street 99
99999 Example City, Germany

Energy Consultant
Example Energy Consultant
Example Street 99
99999 Example City, Germany

Energy demand and generation over the retrofit steps:

Precertificate issued based on an EnerPHit Retrofit Plan

Already implemented steps: 2-Window + ventilation

Achievable energy standard: EnerPHit Premium

Passivehown, 22. February 2022

www.passivehouse.com

Figure 7: Pre-certificate for step-by step energetic retrofit. The EnerPHit retrofit plan must be delivered with the first retrofit step

Special attention has to be paid to the quality of single measures or partial retrofits in a step-by-step procedure, regarding the whole building. In EuroPHit, the quality procedure of the "EnerPHit retrofit plan" was developed. Since this ends up to a guaranteed performance, a certification is possible of a single measure package together with this plan for the future. Such a plan and (pre) certification is extra cost paying back only many years later without a clear measure for the amount of the later return. Therefore, such a plan and quality assurance (e.g. certification) has to be done by qualified experts. Since:

- quality is crucial for the success

- implementation of such a plan with and future performance is of public interest
- guaranteed quality leverages investment capital (equity and debt)
- the need of such a scheme is not obvious for the owners

the retrofit plan deserves extra funding. The amount of funding should be limited to 500 – 1000 €/ apartment.

3.6 Impacts of public funding

Increasing quality. The funding concept proposed here leads first to a significant improvement of the energy performance of construction and building technical services. In comparison to standard measure, these means significant primary energy savings and therefore contributions made to climate protection.

Implementation rates. Overall, the current implementation rates of energy efficiency measures on existing buildings are be multiplied. Raising awareness to these measures and creating trust by successful examples, will further increase implementation rates. At the same time the execution quality will be considerably improved and guarantee reliable performance and energy savings.

Climate protection. By high implementation rates and performance the building sector contributes effectively to the 1.5 – 2° goals.

Additional benefits. The quality improvement has not only impacts in terms of energy saving, but is as well better preserving the building structure and maintaining a higher comfort standard in the apartments. These aspects plus heating cost savings result in a significant contribution to paying themselves.

Boost investment. Funding paves the way for private capital and is multiplied.

Added value the craftsmanship The additional Investment affects mainly tradespersons and building professionals. All measures on existing buildings, more accurately described above, require professional implementation by well-trained, qualified construction craft workers. That is the reason why the funding program can create and secure a significant number of jobs. Release in health insurance system will result in getting a return on public finance. Unlike traditional "job creation measures" the most part of the money financing the benefit from the program will be paid back by saved energy costs.

Added value of buildings, higher comfort, permanently improved security of supply, innovation.

Triggered by the program additional measures not only provide direct economic benefits of energy cost savings but lead to a host of other benefits:

- There are basis measures to modernize existing buildings, they lead to an increase in value. In contrast to the alternatively persisting fuel consumption, the bettering of the building value after the measure is permanently available.
- A higher comfort arises in all thermal protection measures, because the significantly higher surface temperatures result in winter comfort. The comfort is also increased by the building technical measures.

- When energy consumption is sustainably reduced, the security of supply is also improved.

Particularly in the case of small and medium-sized construction industry, the programme outlined here boosts innovation. Triggered by Passive House requirements, the top glazings, windows, construction and ventilations systems have been developed and are demanded on the international market – and this is a permanent innovation process.

3.7 Macroeconomic benefits of public funding

Along with quality-assurance measures for achieving the objectives, it has been shown that public financial support for energy efficiency measures also has net positive effects for the state and the community, because the direct and indirect taxes and the savings in unemployment payments are higher than the incentive grants [Feist 2013], [Huse 2013].

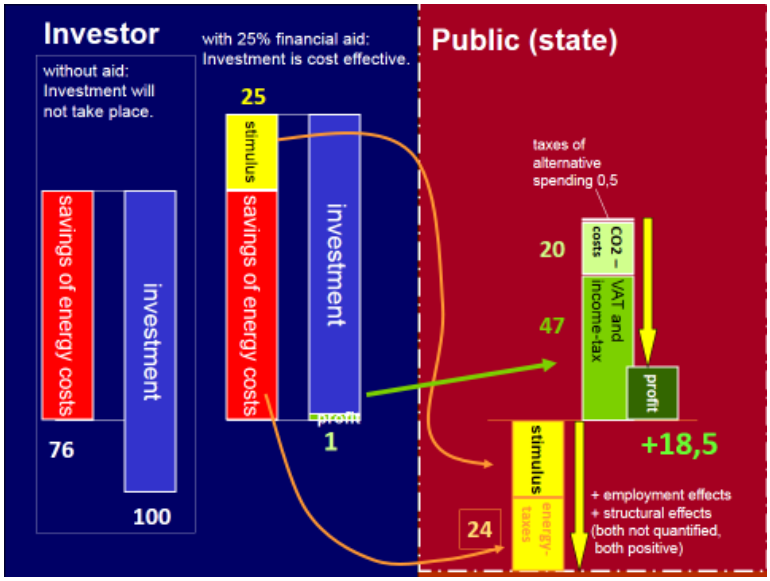


Figure 8: State balance of energy efficiency funding [AkkP 42].

Evaluations performed especially by the KfW subsidy programmes "Energy Efficient Construction" and "Energy Efficient Retrofitting" and "Energy Efficiency Programme of the KfW" also reached the conclusion that

- funding for building energy efficiency is multiplied: depending on the programme design, investments were 10 times or more higher compared with the funding (which were mostly allocated to subsided loans) [STE 2015]
- significant numbers of jobs, mainly in the regional medium-sized construction industry, were created or retained
- the gross domestic product increased (0.4 % according to [Prognos 2013]) due to multiplier effects
- Tax recovery (VAT and wage/income tax) from the generated investments was higher than the cost of the programme [KfW 2014]. Adding social security contributions and

saved expenditure for unemployment, since 2010 between 3 and 10 fold the program costs are obtained as public revenues.

Many German regions provide extra subsidies for the promotion of energy efficiency. The federal state of Hesse provides significant support for deep renovation to the EnerPHit level [Hesse 2014]. For the Hanover region for example, it could be proved that every Euro granted by the proKlima-Fonds

- generated a total investment of € 16 while the extra investment for additional efficiency was only € 2 (but was double the value of the incentive)
- created added value of € 7
- generated local labour equivalent to € 3 [Huse 2013].

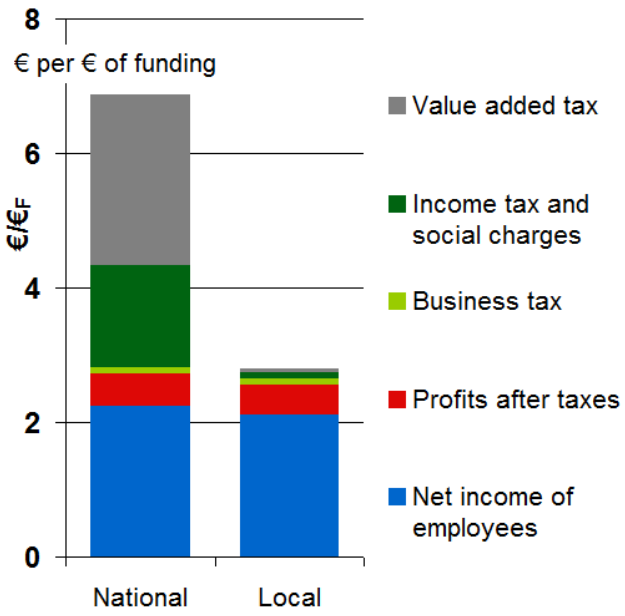


Figure 9: Added value created by local funding of energy efficiency [Huse 2013]

Therefore, funding is not only beneficial for the investor and the building owner, but also for the community. In addition, there are a lot more advantages for the public. According to IPCC, only the monetizable co-benefits associated with energy efficiency in buildings are at least twice operating cost savings [IPCC 2014]. Not yet included are the (external) costs of climate change.

4 The investor-user dilemma

The disparity between cost burdens and benefits is often seen as one of the greatest problems ("split incentives"). Revenues go to users while expenses are borne by the investors. Under these circumstances there is naturally a lack of interest on the part of the latter, and investment does not occur. In actual fact, this is no real dilemma. There is no inextricable conflict or contradiction in the situation presented here; rather, the cost for utilisation has not been adequately negotiated. The investment has not only created a benefit the market value of which will first have to be proved, but also a direct cost benefit. If investment in energy efficiency generates a profit, then both parties can participate in this and the profit can be divided between them. If this fails to happen and one party benefits at the expense of the other, the market does not function as it should. There may be many reasons for this, including legal, social, and political reasons; this is primarily still a problem of lack of transparency.

Table 1: Investor and user: who profits?

Object
Comparison of investment alternatives Total investment costs, annual operating costs, residual values or differential investment that generates revenues. Positive net present value = profit; margin for distribution of the profit Further benefits: longer lifetime
Investor
Perspectives: financing, market Investment decision with reference to total property Advantages: improvement of the building substance Market attractiveness Higher revenues with same burden for the tenant, better standard (comfort), lower vacancy rates, lower fluctuation rate, less effort for marketing, better tenant mix, low risk, increased attractiveness of the district
User
Lower energy costs or higher quality with the same costs (rent including heating), thermal comfort, air quality lower risk: with reference to energy costs and guaranteed comfort living quality and attractive location © PHI
When the effects of energetic renovation are transparent, the benefits can be distributed between the investor and user. The advantages of these measures can then be monetised

The legal provisions are usually not unfavourable for the investor. For example, in Germany, in accordance with Paragraph 559 of the German Civil Code, 11% per year of the costs of renovation can be transferred to the tenant. This is far above the annual capital costs for interest and repayment, and would adversely affect the tenant. If it is not possible to achieve a share of costs to this amount in the market then a sufficient margin for a win-win situation still remains with a more moderate share of costs. Note that this is true as long as high energy costs can be saved: Once the first step is done to a minor level of quality, for the second step aiming at a sustainable level the financial scope for a win-win situation for all parties becomes

much tighter. Again this stresses the importance of reaching the final efficiency level for each component in one investment step.

4.1 The market value of energy efficiency

Making the benefits visible is most important – only then will it be possible to assess them. This is equally important for the rental market as for the property market: owners will be more likely to invest in energy efficiency when they achieve higher rents, and/or an adequate sale price. In principle, energy passes are a suitable instrument for achieving this; the economic value must also be shown at least approximately in all cases, and quality assurance must be ensured. Although restrictions obviously apply here and it must therefore be expected that the energy pass is only effective to a limited extent, evaluations carried out retroactively show that the market rewards a better level of energy efficiency that is documented with an energy pass. According to a EU Commission study of the property market in 11 European regions (countries included: Austria, Belgium, France, Ireland, and the UK), energy-relevant refurbishment increases the market value of a property upon sale by 3 - 4% on average for each class of the seven-class energy passes used in the 6 countries that were studied [DG Energy 2013]. The intervals of the energy classes were in the order of 25 – 50 kWh/(m²a). [Cajias 2012] comes to a similar conclusion in a study of the German property market. Although the results are quite similar in the separate regions, they show that with the appropriate transparency and awareness (which generally could not be taken for granted at the time of the study) as well as reliability that builds trust, not only is energy efficiency rewarded by the market, but in part it even exceeds the expected costs for saved energy. This is also understandable because quality assured energy efficient buildings also generate additional benefits, especially for users. Even so, the response of the rental market which was examined in the same study was significantly lower. A lack of transparency certainly still exists here.

Rent indices represent an interesting instrument as these treat the value-determining features as factors that influence the rental price. They have a double effect: on the one hand, stating a feature draws attention to it, and due to this the market value becomes empirically measureable on the other hand. Trivially enough, it is not possible to assign a value to characteristics which are not mentioned as quality features – it is simply not charged. As a rule, this is exactly the case with energy efficiency which is unquestionably a value creating feature of accommodation, but is usually not considered as such at all.

However, there are some rent indices which state the energy-relevant performance as a quality feature of the accommodation. This makes it possible to allocate a value to this characteristic. For instance, in the rent index for Darmstadt (Germany), an additional monthly rent of up to € 0.50/m² can be demanded for low energy consumption [Darmstadt 2010].

With a (real) calculatory interest rate of 2.0% p.a. and a life cycle of 50 years, this amounts to a capitalised (market) value of €189 /m². As a rule, extra costs for saving energy are therefore very easily affordable for the investor. With a (future) fuel price of 9 cents/kWh (future average price), the tenant is also financially better off with a rent index premium if he also saves at least 67 kWh/(m²a). The attention attracted by the rent index has a reciprocal effect on the market and increases differentiation according to this feature of energy efficiency. In the new edition of the rent index 2014, several standards have been listed with surcharges between 3% and

7% on the basic rental price. This is significantly more than the above-mentioned studies established in the regions in which such an instrument presumably did not exist.

4.2 Public funding

The above example shows that landlords as well as tenants can be satisfied if the relevant transparency is ensured; the "investor-user dilemma" is solvable. The reason why this does not often seem to succeed is usually due to the well-known reasons for the way in which the gains from a profitable investment are simply removed from the equation, mostly through the wrong boundary conditions:

- expectation of short payback periods – on both sides
- unrealistically high discount rate (high returns are expected)
- assumption of low energy prices
- ignoring the coupling principle: instead of the extra costs, the total costs are adopted as value-increasing energy efficiency investment, and recovery is expected via the rent – however, the costs incurred in any case are the costs of refurbishment which must be financed from the regular rental income through reserves and debt servicing for loans
- lack of information
- uncertainty about quality and performance.

Obviously, incentives can help here to attract owners and investors. Funding makes it easier for both parties to profit. With a subsidy, conflicts with tenants are less probable. Funding can support business models, e.g.

- third parties like Escos can supply capital for investment
- collaterals make it easier for a bank to provide a loan.

Public subsidies are especially important in this case for their steering potential. With the proper conditions described above,

- sub-optimal standards will be avoid (which would restrict the future scope of action of investors)
- Quality assurance measures should be obligatory, can also be funded, and they guarantee the performance of the buildings and the necessary contribution to the climate goals.

5 Home owner associations

Specific issues arise with blocks of flats with individual owners, whereby owners' associations need to be involved in line with the specific legislation and practices. In this case, privately-owned property of a particular flat is connected to share in the common property. Occupants bear financial responsibility for their own special property. Each property owner must pay a share of the costs incurred to manage the common property. In the 'new EU Member States' this kind of property is proportionally very high due to the former state-owned housing situation.

5.1 Main barriers to Step-by-step retrofit in case of joint home ownership are known

- Energy efficient retrofit of single units in an apartment block needs to include investments in common property like the heating system and the outside building shell.
- Most energetic relevant parts of the building are common property (roof, façade, heat generation and distribution). Statutory regulation of associations do not permit an individual owner to do substantial retrofit of his flat (except e.g. internal insulation). Instead, any substantial retrofit decision requires the majority of all associates.
- Ambiguities in the legal standing of joint home ownerships.
- Associates have various interests in their property and financial conditions. Lengthy and cumbersome decision-making due to a large number of decision makers. One critical aspect is that owners benefit in different degrees from the retrofit (e.g. self-users and tenants)
- Decisions depend on the socio-demographic situation of the owner community, the knowledge of the costs and benefits of energetic retrofits and the interests and motivation of the home owners.
- In the case of properties which are managed by housing management companies, steps for renovation are only undertaken with great reluctance, especially if the proportion of rented units is very high.

5.2 Step-by-step approach is a viable strategy of building retrofit

- The most common strategy of building retrofit is a step by step approach of applying the best technologies every time when refurbishment activities are implemented (EnerPHit approach). For each building this requires a lifecycle concept and a long term strategy.
- In a first step encourage flat owners to concentrate on works inside the dwelling – change boilers and windows – do the 'easy' bits first. Internal works are mostly possible. Motivate action within the dwelling alongside other refurbishment (eg kitchen refits).

5.2.1 Easing the decision making process on energy retrofits

- Conduct a detailed review of the energy saving and mortgage laws regarding the minimum requirements of energetic retrofits
- Use of dispute resolution procedures. Introduce mediating structures. Retrofit decisions have to be voted by the majority of owners.

5.2.2 Provide information and motivate the owners on the financial viability of energy efficiency measures

- Promote awareness of benefits of energy efficiency measures. Promote guidance on cost-benefit of energy efficiency measures during retrofits. Better energy efficiency substantially increase the value of the property and it has been the main factor in convincing owners.
- Energy audits can help to provide this information. Enable landlords/owners to carry out retrofit measures and to recover the costs of energetic retrofits.

5.2.3 Provide information and motivate the owners on the financial viability of energy efficiency measures

- Specific loan programmes are helpful. In some East European countries, where many apartment blocks are privatized public buildings in poor physical condition, retrofit might only be possible with substantial financial and technical support by the government.
- Provide non-monetary support (eg legal and practical advice; advice on dealing with mortgage providers) to block owners and tenants who do want to proceed with works but may be put off by the legal barriers.

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