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dena renovation study.
Part 1: Economic viability of upgrading the energy efficiency of the rental housing stock. .

Accompanying research on the dena project "Low-Energy Standards for Existing Buildings". “.

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Given the increasing global energy demand, volatile energy prices and last but not least, the impact of climate change, politics, the economy and science face major challenges. Energy efficiency in the building sector plays a central role in reducing energy consumption. This is because the building sector still offers the largest energy-saving potential: In Germany, 35 percent of the final energy generated is required for heating, hot water and lighting for buildings.

Moreover, a large portion of the approximately 18 million residential buildings in Germany were built before 1978 and therefore before the implementation of the first Heat Insulation Ordinance. At the same time, the proportion of new buildings is less than one percent. In order to achieve the climate change goals, the energy modernisation of existing buildings is crucial.

In no other area do investments lead to so many benefits: Rentability and the operation of real estate are secured in the long term and the value of the building increases. For the user, the increase in energy efficiency leads to a higher living standard, greater independence from energy price increases and, in the long term, an increase of disposable income. In addition, CO2-emissions are reduced.

The energy-saving potential is enormous, especially for existing buildings. Houses that are energetically modernised using standard methods can reduce their energy consumption by up to 85 percent, far better than a standard new building. Nevertheless, there are still concerns regarding energy-efficient construction and renovation. This is due to the high complexity of the projects, a lack of confidence in a quality result, the necessary investment costs and the lack of market transparency. In the future, it will be important to remove market constraints and to utilise the benefits of energy efficient renovations, after all, during the next 20 years nearly half of all homes in Germany are to be renovated. With a stock of 40.2 million[1] housing units, this amounts to about one million renovated homes per year.

Leading by example: the dena model project "Low-Energy Standards for Existing Buildings".

The fact, that the energy-efficient modernisation of existing buildings works at all was demonstrated by dena with their model project "Low-Energy Standards for Existing Buildings", involving around 350 homes, during the past seven years: Houses nationwide were energetically renovated - with innovative and market-tested methods - in a way that will allow for energy savings averaging 85 in the future. The primary energy level of those building is on average 50 percent below that of a new building and comes close to the level of a passive house. During the implementation of the renovation project, various structural and technical measures for improving the energy efficiency were successfully tested and realised.

As best-practice examples, the model projects encourage imitation. They show both the owners and the involved specialists that a highly efficient renovation standard with enormous energy savings can

[1] *German Federal Statistical Office. Buildings and flats. Wiesbaden, 2010*

actually be implemented. And this with methods that have long since moved on to the wider mass market. In order to make the gathered experiences available to the participants and other market actors, dena continuously collect information and exchange these experiences in working groups and conferences. The distribution of the model project "Low-Energy Standards for Existing Buildings" as up the end of the year 2009 is shown in the adjacent diagram.

Differentiated cost analysis

A prerequisite for a reliable calculation is a precise differentiation of the overall costs incurred, whereby it needs to be distinguished between the costs of measures for improving the living quality, the full renovation costs and energy-related additional costs.

Full costs for maintenance and modernisation	**Full costs for the renovation**	**Maintenance** and **repair costs**	Proportionate maintenance effort required to repair damage, to prevent more damage from occurring and to keep the building in a rentable condition	Financed through reserves and future income from the existing net rent
		Energy-related additional costs (energy-based **modernisation costs**)[5]	Proportionate costs for components effective in energy terms and additional expenditure for construction components	Scope for increasing rent as per § 558 or § 559 of the German Civil Code (BGB)
	Modernisation costs		Measures that improve the living quality such as through increasing the living space (e.g. roof extension, additional balcony) or though modernising the interior (e.g. bathroom renovation)	Scope for increasing rent as per § 558 or § 559 of the German Civil Code (BGB)

Table 1: Classification of costs for renovation and modernisation measures

The detailed evaluation of the established costs for the model projects and many enquiries made at dena would indicate that there is considerable uncertainty among the project and market players when it comes to determining the full costs and the energy-related additional costs for energy performance-based renovations.

After evaluating the data, the energy-related additional costs for a renovation amount to between 30 and 55 percent of the full costs. That means that around half to two thirds of the full costs for a renovation comprise maintenance or repair costs.

The study does not take into consideration other measures that improve the living quality or necessary repairs to building damage that are anyway conducted as part of extensive renovation and modernisation work, since these measures arise from the minimum requirements of the residential market with the aim of ensuring long term rentability. These costs cannot be treated causally in relation to energy savings. They have to be assessed in regards to the strategic development of the building stock and taking into consideration the requirements of the residential market (layout and furnishing of housing units, demographic developments as well as urban and regional development). Nevertheless, these overall costs that stem from modernisation and renovation work and their ability to be levied in the market represent an important decision-making factor for investors when

examining the portfolio for a building or building stock. In order to draw clear conclusions, the various costs must be examined and assessed in terms of their respective ability to be levied.

Summary and Conclusion.

The energy efficient renovation of apartment buildings is worthwhile - for landlords and tenants. Until the energy efficiency class 70 is implemented, apartment buildings in need of renovation can be renovated in a heating cost neutral way. This means: The landlord can profitably apportion the investment costs to the base rent. At the same time, the tenant can benefit from lower heating costs, so that the monthly rent - which is what the tenant pays in the end - does not increase. This requires coupling the energetic measures with the upcoming modernisation and maintenance work as well as good planning, execution and strategic evaluation of the building.

The statements made in this conclusion are valid for those apartment buildings in the rental housing stock that have not been energetically modernised since being built and those in dire need of repair. In addition, these buildings are below the average local rent level with potential rent increases as per § 558 of the German Civil Code. These preconditions are true for the funded buildings in the dena model project "Low-Energy Standards for Existing Buildings".

Either way, these buildings are in need of extensive improvements and other housing quality improvements of the structures and their surroundings and these measures can be comfortably combined with an energetic modernisation.

- The rent increase necessary to refinance the costs of the energy-saving measures for these buildings is often lower than the tenant's energy cost savings. Thus a rent-neutral cost increase is easy to communicate to tenants and landlords alike.
- While the energy standards as per EnEV 2009 and the house-efficiency class 70 have already proven to be cost-effective, the house-efficiency class 55 is on the threshold of profitability. From the perspective of an investor, however, precisely this higher house-efficiency class can be advantageous if one considers the financial support from the state or the Federal States bridging the refinancing gap.[2]
- If a comprehensive structural modernisation of the building and its systems is urgently required due to a significant maintenance backlog, dena believe that especially the high efficiency standards are sustainable for ecological and economic reasons:
  - It seems likely that sustainably higher rent profits can be made along with reducing vacancy rates - both as a consequence of the high-quality energy efficiency upgrades in accordance with the regulatory minimum requirements of the EnEV (Appendix 1, Table 3) over the period under consideration. Therefore, an investment in these high-quality standards appears less risky.
  - The high efficiency standards lead to further reductions in CO_2 emissions and therefore make a lasting contribution to climate protection.
  - The components required for high energetic standards are real-world solutions that are available on the mass market.

[2] *A detailed consideration can be found in chapter 7c.*

- The buildings in the dena model project, on average, represent the state of energetically insufficient buildings. Energy consumption averaged at 225 kilowatt hours per square metre of living area per year.[3] The results of the evaluation and categorisation can be transferred to non-refurbished buildings of the same age classes.
- The investigated buildings with a high energy consumption represent about 15 percent[4] of the total rental building stock in Germany. Exploiting the opportunities of the required renovation can, with an appropriate focus, lead to a significant increase of the energetic modernisation rate[5].
- Buildings are different from other goods in that they have a very long economic life-span. It includes several renewal cycles of individual systems and components. Many buildings from the middle of the last century will require their exterior elements (facades, roofs and windows) to be renovated in the coming years. In a further differentiated development, a renovation roadmap can pick up these technical renovation cycles and focus first on buildings with the highest consumption and the largest renovation backlog. Thus energetic renovation is promoted in those buildings, in which the economic optimum of renovation results as a consequence of the coupling principle, while at the same time achieving the highest savings. For buildings with a low or medium heating requirement not yet in demand of a full renovation, it makes sense to exchange individual components with high-quality energy-efficient components. With appropriate funding, a broad impact can be achieved and then coupled with sensible measures.
- If the renovations are used to establish a link between the energy efficiency requirement levels and urban development and demographic trends, a sustainable building stock can be established.

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[3] *225 kWh/(m² living area·a) for heating and hot water as calculated in accordance with § 19 (2) EnEV based on 187.5 kWh/(m² AN·a) of usable area.*

[4] *Own evaluations made in the context of extrapolations of the German building stock from approx. 7,000 energy performance certificates in the dena database*

[5] *Regarding the renovation rate, a distinction has to be made between "energetic renovation rate" and "total renovation rate". The energetic renovation rate only represents a portion of the total renovations made out of structural and technical necessity in the context of normal renovation cycles. The Federal Government's Energy Concept aims to double the energetic renovation rate to two percent. This means that significantly more purely structural and technical renovations have to be used for an energetic renovation.*

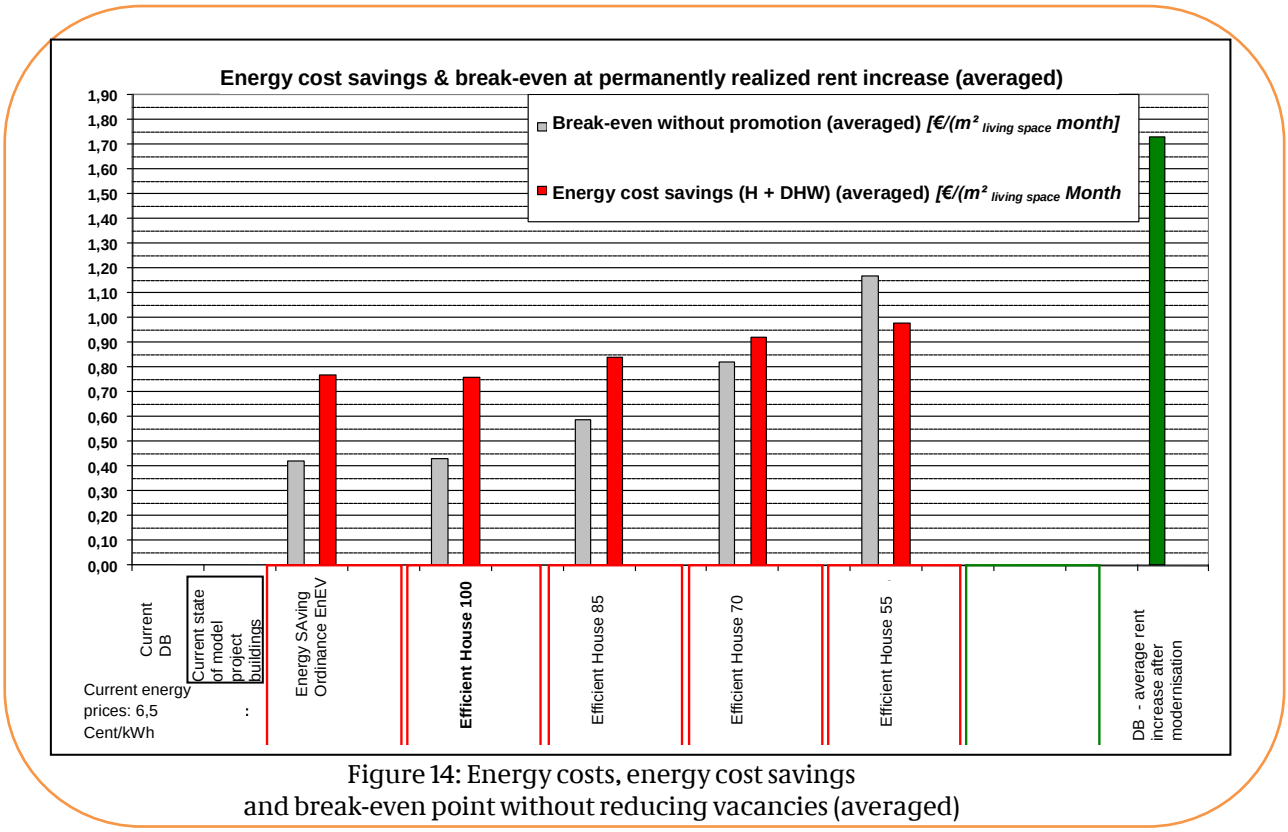

Figure 14: Energy costs, energy cost savings
and break-even point without reducing vacancies (averaged)

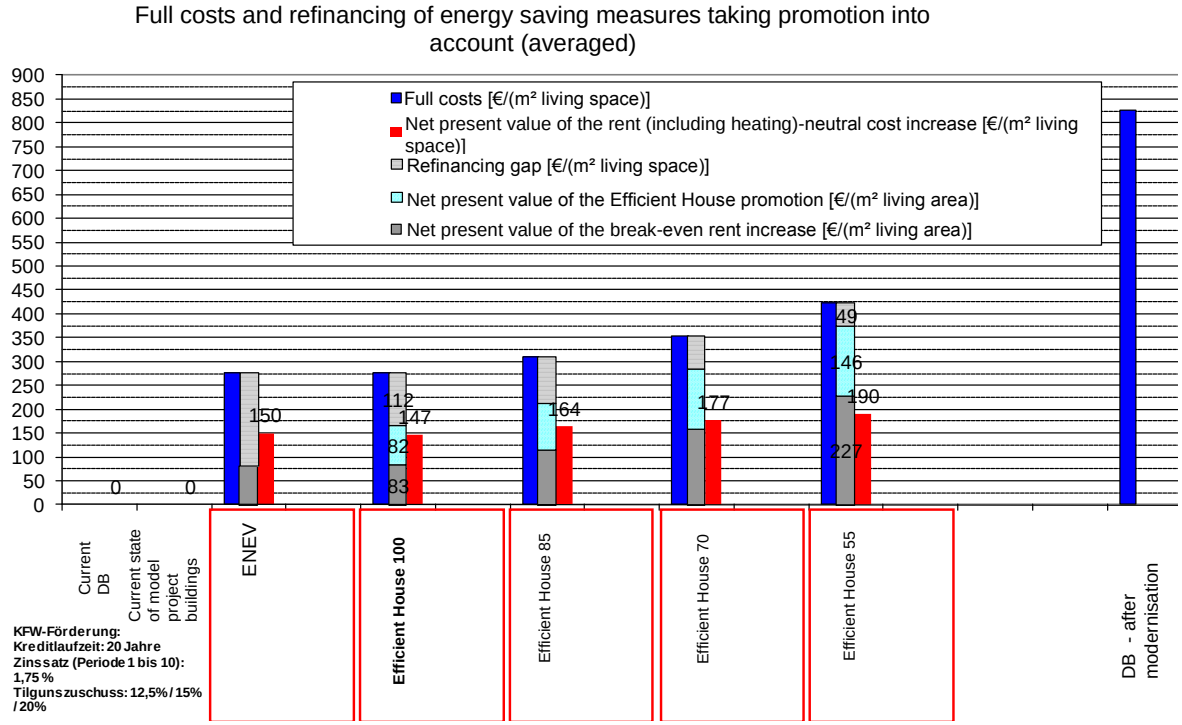

Figure 15: Full costs with promotion and energy-related additional costs (averaged)

Excursus: Energetic portfolio management.

The model buildings looked at in this study are mainly owned by housing associations and private landlords. For housing companies with large stocks, portfolio management is an essential tool for strategic planning. The objective of portfolio management for housing associations is to support strategic business decisions and avoid bad investments such as in stocks with no future prospects and to examine stocks, recognise and utilise their potential and avoid premature disinvestments. In essence, "conventional" portfolio management consists of eight modules[6]:

1. The establishment of the company's strategic framework, that is, the determination of the underlying mission, of the organisation profile, corporate vision and medium term objectives with regard to the portfolio, return, and environmental and social aspects
2. The measurement of the current performance of the housing portfolio, for example the technical quality of the existing buildings and the resident structure
3. The analysis of the regional market and its sub-markets in terms of potential, bottlenecks, etc.
4. The segmentation of the existing buildings by means of appropriate criteria (e.g. asset quality and site quality, often by means of a so-called portfolio matrix)
5. Testing and evaluating resources in terms of their strategic classification regarding levy, investment and disinvestment
6. The derivation of a medium term investment plan and annual planning
7. Examining the chosen strategies with a risk analysis
8. The preparation and implementation of object-related measures

In particular, the introduction of energy performance certificates for residential buildings provides housing companies large amounts of data on the energy efficiency of their housing stock. The companies are faced with the challenge of integrating the newly obtained data as well as other energy-related information into their management process, in particular portfolio management. The question "What is to be done with which buildings in the future?" is particularly significant due to the long renovation cycles of buildings and the limited financial resources of housing companies. Details about the energetic quality of buildings can be systematically incorporated into the portfolio management system of housing associations in different ways:

- This information may only be used to evaluate the building stock in terms of energy quality and identify potential savings ("energy register"). This opportunity is also available to smaller companies without an existing portfolio management system.
- They can be taken into account at all the levels of portfolio management ("full integration") mentioned above. A prerequisite for this is that a portfolio management system already exists or will be implemented soon.
- The information about the energetic state of the buildings can only be taken into account in selected stages of portfolio management ("partial integration"). This option suggests itself when an existing portfolio management system is not to be significantly changed.

All three of these possibilities can be described as "Energetic Portfolio Management". The choice for one of these approaches must be specific to the company and it depends on the individual framework conditions, data requirements and conditions within the company itself.

As part of such an energetic portfolio management system, the transition from an object-specific to a portfolio-specific profitability analysis has to take place. The practice of determining the profitability

[6] *Based on the portfolio management „PM 10“ (13) conceived as part of the EU project "Sustainable Refurbishment Europe (SUREURO)".*

of energy-saving investments is often based on the modernisation levy (11 percent apportionment) as per § 559 of the German Civil Code. This object-oriented approach does not go far enough because, in the light of energy price developments, other factors increasingly influence profitability (e.g. avoided vacancy in the future due to low heating bills and increased living comfort, increased potential for increasing net yields, value enhancement).

A systematic consideration of these factors is only possible in the context of an overall profit and loss account (for example a complete financial plan) with supporting scenario analyses. This also facilitates a detailed presentation of the financial situation, liquidity and tax effects. The non-energetic modernisation measures often carried out during the course of energetic renovations can also be considered. Consequently, a housing company can consciously choose to make an initially unprofitable object-specific investment within the framework of such a portfolio consideration allowing to sustain a strategically important segment of the housing stock, for example by means of adding facilities for the elderly or disabled or by means of an energetic modernisation.

Outlook.

Based on this report, dena is currently compiling specialist articles on representative experience gained with different building types. In order to make it as practice-related as possible, experts (architects, engineers and energy consultants) will be involved in producing the articles. In addition to a general description of the building types, the publication will describe typical means of construction and weak points as well as recommendations for action and possible solutions.

In the next few years, the implementation of the model projects and the accompanying research will be continued in the same manner with a study on participating single-family homes and municipal non-residential buildings.