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Building renovation, but makes sense. Critical review of economic and environmental aspects.

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Abstract

In this paper, the contradictions between the theoretical savings potential, the requirements of the legislator, the pollutants in and around the existing building and the real waste of resources represented. Here Furthermore, the health risks and the corresponding risks explains what approvingly, whether knowingly or unknowingly, every builder takes into account, as these are standard in almost all buildings available or installed. It has become difficult to environmentally friendly to build or rehabilitate.

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Keywords: poisoned materials; uneconomical renovation; rebound effect; exertion of influence, waste of resources

1. Theoretical problems

The statements made by Prof. Dr. Harald Simons, 2012 and the simplified calculation as: “energy upgrades are generally uneconomical in the sense that the energy cost savings do not cover the costs of the energy-efficient renovation. This already shows a simple thumb calculation: The average energy consumption of not significantly modernized one and two family homes is 167 kWh/(m²a) p.a. With energy costs of € 0.08 / kWh, energy costs amounted to € 13.36 / (m²a) before refurbishment. Assuming that left by an energetic redevelopment in fact 60% of energy can be saved – an ambitious reduction target, which is in reality rarely achieved – so the energy costs by € 8.01/(m²a). Within 15 years, the saved energy costs add up according to 120 € / m² and thus by no means on the clean-up costs, which are already in simple cases between 300 and 500 € / m². Even the integration of the energy-efficient

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renovation in a necessary anyway renovation leads only partly in the economy." (Simons, 2012) Find unfortunately at the present time is not the hearing, which would be necessary to carry out effective and meaningful renovations. One should look at in the context of the ecology and the economy effective and meaningful rehabilitation always. In the just mentioned report, important statements like „There is no general renovation backlog exists – as indeed also shows each visit to a family house area – always means an energetic renovation an early rehabilitation outside the remediation cycle. All feasibility studies, however, show that this is grossly uneconomical." (Simons, 2012) been set. There will always be uneconomic to bring forward such cycles since it always needs an economic payback. A building should not be constantly brought up to date, because there are always techniques and materials, which still have no long-term studies and are equally expensive.

2. Calculation of the rebound effect in facade insulation

This example shows quite clearly that the energy savings at a insulation thickness of this material tilts (Example in the diagram), of 54cm. One must assume that this example applies to all building materials or insulation materials. It is therefore essential to choose a sensible insulation thickness at facade insulation. Practically sees these sensible insulation thickness made so that the required U-value is reached. Basically good but only partly. Unfortunately, the legal requirements are only designed for energy savings in the area of effective use of the building and not to the observation periods prior to installation and the region after the end of the life cycle. It is important also to look at the area in front of the tipping point. Here the economy and ecology is already in danger. Likewise, there is a clear contradiction of optimum insulation thickness for environmental and economic consideration. More problematic is that it is unrealistic to incorporate the appropriate insulation thickness, since it does not make sense for many stakeholders to incorporate an insulation, for example, about 30cm thick. Basically, this also has implications for the utilization of land, boundary distances, land, the general construction law etc. As a result thereof, be put simply, the rooms in the area of small or it falls away spaces. Profitability is therefore in question, if you want to search for investment properties.

Excerpt from the calculation of energy:

$$Q(x) = n \times QT(x) + y(x)$$

n = Considered period in a
x = Required value: Optimal insulation thickness in m
Q_T = required heating energy
Y = Gray energy for the production of the insulating material

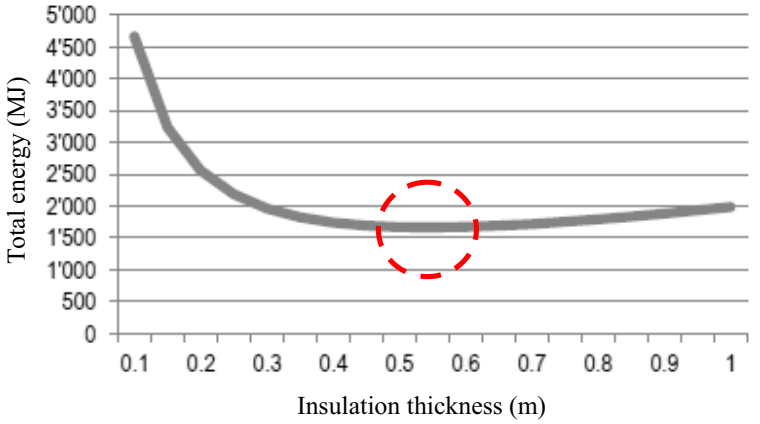

Fig. 1: Graphic total energy

Example calculation for the required heating energy and embodied energy for the production of the insulating material in Dependence on the insulation thickness

Table 1. Examples calculating optimum thickness of insulation

Insulation Materials	Considered period (in years)	λ in W/mK	Concentration in kg/m3	δ- Grey energy of the insulating material in Joul/kg*10^3	Location Zurich, Heating Degree Days 3260	fixed value 24	fixed value 3600	Result†
Rockwool "Flumroc Compact"	40	0.040	100	15.35	3260	24	3600	**0.54**
Softboard, Switzerland	40	0.038	140	10.09	3260	24	3600	**0.55**
Extruded polystyrene (XPS)	40	0.031	18	105.13	3260	24	3600	**0.43**
Polyurethane (PUR / PIR)	40	0.022	30	100.02	3260	24	3600	**0.29**
Cork plate	40	0.050	500	24.84	3260	24	3600	**0.21**
Glass wool	40	0.035	30	45.53	3260	24	3600	**0.54**
Wood-wool board, Cement bound	40	0.065	450	3.61	3260	24	3600	**0.67**

Table 2. Further table calculating optimum thickness of insulation

	Result‡	∅ real insulation thicknesses in m	Falling below the theoretical possibilities in%	Weighting	Ecology and exploitation Evaluation
Rockwool "Flumroc Compact"	0.54	0.15	72.317	0.1423	4.
Softboard, Switzerland	0.55	0.06	89.101	0.1753	5.
Extruded polystyrene (XPS)	0.43	0.20	53.446	0.1052	2.
Polyurethane (PUR / PIR)	0.29	0.20	30.413	0.0598	1.
Cork plate	0.21	0.01	95.305	0.1875	6.
Glass wool	0.54	0.15	72.083	0.1418	3.
Wood-wool board, Cement bound	0.67	0.03	95.532	0.1880	7.
			508.197	1.000	

†,3 Result: Optimum insulation thickness in meters: for the required heating energy and embodied energy for the production of the insulating material in Dependence on the insulation thickness

3. Pollutants in and around the building

Pollutants that can occur without problems in the interior of buildings and may lead to severe health problems and damage as part are summarized in the following table. The list does not claim to be complete: „Asbestos, chlorinated paraffins, chlorothalonil, dichlofluanid, endosulfan, fiber cement, fire retardants, formaldehyde, Furmecyclorox, lindane, solvents, pentachlorophenol (PCP), permethrin, piperonyl butoxide, polychlorinated biphenyls (PCBs), Polychloror-2-aminodiphenylether (PDA), polycyclic aromatic hydrocarbons, propoxur, pyrethroids.“ (Tübingen, GER company: Pollutant consultation (Tübingen, Fa. Schadstoffberatung), 2015)

This can occur in electrical cabinets, insulation, electrical installations, roofing, exterior cladding, special protective clothing, putty, floor coverings, wall coverings, plasters, wall paints, gaskets, road surfaces, in window construction and so on. It can result in contact with damage to eyes, mucous membranes or to the skin. Headache, drowsiness may be further consequences in contact with these agents. Cancer in various forms is also not uncommon.§

4. Exertions of influence

Unfortunately, it is now so that the legislator pretends building physics thermal values which must be complied with. These are regulated in Germany in the ENEV, which simultaneously defines an efficiency of 25 years. The policy creates here for homeowners putative incentives such as tax breaks or government subsidies. A study by O. Tschimke 2012 (Tschimpke, et al., 2012) shows that it is technically possible without any problems holistically to reduce energy consumption in existing buildings with appropriate measures by at least 50%. Unfortunately, this is a big minus for the economy, in the implementation of the owner assigned. Ecologically top, economically disastrous. Logical economic and ecological dependencies and their consequences are not considered great. It can also certainly be possible to certain economic interest groups have a corresponding influence in advising the respective institutions. This opinion is also represented by Prof. Dr. H. Simons in his publication of 2012 Design. „So the price of a condensing boiler since 2000 has increased by 40%, although the solar cells a decrease would be analogous been quite expectable due to the increasing market reach, through economies of scale or by cheap imports from the Far East. Overall, prices for energy-related materials have risen considerably more than prices for all construction materials together or the price index of cost of living. Obvious way, there is a specific price drivers for energy-related materials, whose strength and cause should be further investigated.“ (Simons, 2012). Unfortunately, the legislator leads here by any objective consideration of all necessary measures and thus leaves a very wide latitude in maintaining the building, in terms of ecology. We are talking about a substantive climate policy that is missing. Furthermore, considered only theoretical values of the specifications. It is not the users and their behavior are taken into account here that is to say, for example, a very different perception of warmth of the users, etc. It is here uneaten image, for the rehabilitation of buildings, produced and it is irrelevant whether there is a thermal insulation or a technical rehabilitation is. This is among others in the research report “Introducing the prebound effect: the gap between performance and actual energy consumption” (Sunikka-Blank & Galvin, 2012) been exposed. In this study, approximately 3400 residential buildings have been investigated in order to clarify the following questions.

- How are the distribution characteristics of the actual energy consumption of space heating and water heating in the flats, compared to the calculated values in the buildings (EPR)?
- What are the political implications for the achievement of major savings in heating energy and CO2 emissions from thermal retrofits?

To this, to find an adequate response not only to clarify the technical issues, but also to consider the sociological aspects. As already mentioned, everyone has a different perception of temperature, air quality, air flows, etc. In the above-mentioned study of Minna Sunikka-Blank and Ray Galvin (University of Cambridge) (Sunikka-Blank &

§ The complementary identification criteria shelter with detailed explanations free of charge at the possession: http://www.dguv.de/ifa/de, Webcode: 494044

Galvin, 2012) for this purpose are made interesting researches. This resulted in contrast to the “rebound effect”, here a “prebound effect”, which turned out to be in older buildings with users. Basic here is the theoretical calculation of the consumption of heat and hot water use.

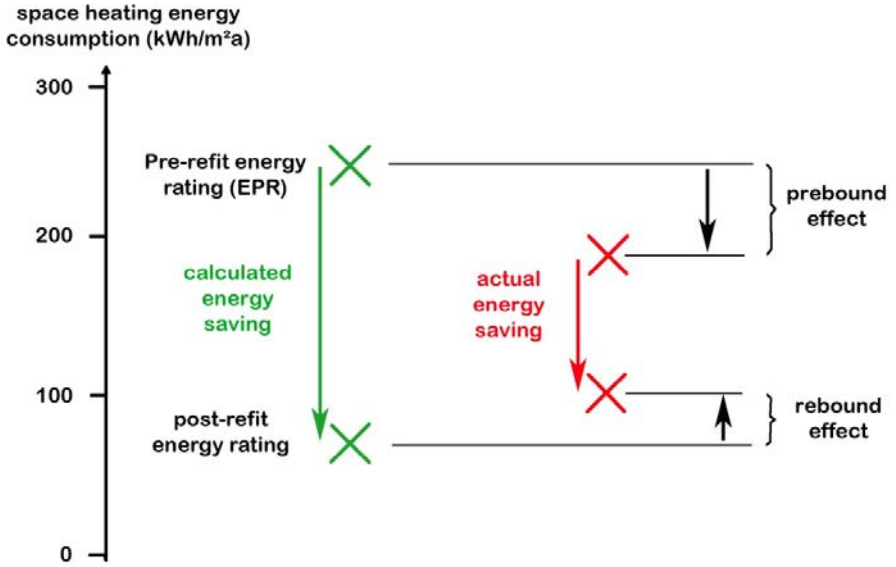

Fig. 2. Schematic showing how the prebound and rebound effects may limit energy saving to be reduced from its theoretical amount

Would be exciting this intensive sociological investigation, in which the users of the old building, would move directly into a new building with a high energy saving potential would be it specifically pointed without. Tighelaar and Menkveld had partly started this investigation 2011th Reasons to choose a restoration can be varied. Stieß (Stieß, van der Land, Birzle-Harder, & Deffner, 2010) have over 1000 owners of one and two family homes, which have carried out a major energy investment in the years 2005 to 2008 interviewed (not only energy-efficient renovation) of their homes by the events and locations of restoration. Very clearly this outweigh private reasons. The reason to make a contribution to climate protection, has answered this by 12% of respondents with “is exactly”, but because the respondents could give several answers, climate change is also at these 12% only one of several reasons of rehabilitation. According to a survey by GfK on behalf of the LBS building societies is only 3% of the homeowner's contribution to environmental protection the most important reason for remediation. (Federal business place of the land building societies into German savings banks and giro association & (Bundesgeschäftstelle der Landesbausparkassen im Deutschen Sparkassen und Giroverband, 2012) Most reasons for rehabilitation are more likely to be seen in that personal well-being or that of the other users is in the foreground. For this purpose, among other things bright, cheerful, light-flooded rooms, general well-being by comfortable fresh air and comfortable heat supply, operation of installations and the general increase in development standards mentioned.

5. Questions and objectives

The methodological research and questioning are specifically targeted among other things on the following simplified questionnaire:

- How ecologically can really carry out a refurbishment / renovation?
- Become known pollutants by new, partly as yet unknown, replaced?
- What impact has the economic side during the renovation?

- Who can influence the ecological and economic aspect the most?
- Why cannot take into account all aspects of today's technologies?
- Can the future user behavior are influenced by the rehabilitation with?
- How is the understanding of the ecology for the exporting entrepreneurs anchored?
- What remediation form is to achieve the most appropriate and most effective given a standard?
- How appropriate are photovoltaic systems and solar panels?

The aim should be to create frameworks which form the renovation is really useful. The creation of a possible basic form as a guide for the true energy refurbishment, renovation, conversion or attachment. The consideration, from the outset, should be in focus, even when considering the called “rebound effect”. There are also to be achieved forms of modernization for Minergie-House, Minergie-P-House and the Minergie-A-House form, are considered critical. The same should also be checked, etc. with the energy payback time of thermal insulation. An expedient statement should and also needs to be taken to say that an economical and ecological renovation of a building or part of the building will no longer be possible. Problems may be at this point, imposed by the authorities (the conservation of monuments and historic buildings etc.) a personal bond of the owner to the building, building regulations use of the land.

6. Outlook

In this paper is to show that a simple restoration is not possible. It is in advance at a plurality of points to be clarified. The problem is also that the legislator fairly simple calls for greater austerity measures in the renovation of buildings, but does not stand in the context of the overall consideration of the building and the renovation. There are further studies on the optimal reorganization form to overall to form an image of the ecological and economic rehabilitation here.

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