Buildings modernisation strategy: Roadmap 2050

Summary

In cooperation with

Instytut Ekonomii Środowiska

KAPE

Narodowa Agencja Poszanowania Energii S.A.

BPIE BUILDINGS PERFORMANCE INSTITUTE EUROPE

pwc

Summary

The construction sector is the most energy consuming in Europe. According to the European Commission, its share of the total final energy consumption in the European Union (EU) is almost 40%, which accounts for 36% of Europe's greenhouse gas emissions*. In most countries on the Old Continent, buildings constructed before the implementation of the first pan-European standards for greenhouse gas emissions are still among the top emitters..

Poland is no exception. While energy efficiency standards for new buildings are becoming more and more stringent, the existing facilities, both public and private, are often inadequately heated and consume lots of energy. This difference in the level of energy consumption is mainly due to the weaknesses of existing energy efficiency schemes, which have usually been fragmentary and supported only selected technologies (e.g. wall insulation or window replacement).

Practical experience proves that this approach has been wrong. Economically and technologically effective thermal modernisation cannot just involve the replacement of individual building components. It requires a holistic approach to the issue of renovation, which focuses on the energy performance of different buildings, as well as the issue of energy generation, with renewable sources taken into account.

The successful implementation of an integrated thermal modernisation scheme covering one geographical region or the whole country, a selected segment of the market or all buildings, is a difficult, time-consuming and costly process. The main challenge faced by the initiators and coordinators of the process is to precisely define the goal, nature and scope of works to be conducted in such a way that the total benefits which arise from increasing the energy efficiency of a building outweigh the benefits derived by individual investors, i.e. in most cases, property owners or users (read more in 'Definition of Deep Thermal Modernisation'). As far as state funded schemes are concerned, an additional challenge is to determine the level of support for different groups of beneficiaries and to adjust the model for the distribution of these resources to the characteristics of their recipients and the applied funds. The aim of this paper is to define the potential scope of a comprehensive scheme to improve the energy efficiency in buildings, indicate the segment in which thermal modernisation could bring the greatest benefit, and also to propose a framework for a system of financial support for such actions.

* "Financial support for energy efficiency in buildings", European Commission, 2013 http://ec.europa.eu/energy/efficiency/buildings/doc/report_financing_ee_buildings_com_2013_225_en.pdf

Comprehensive Thermal modernisation: Three Dimensions of Benefits

The effort associated with the preparation and implementation of a comprehensive thermal modernisation scheme brings tangible benefits. According to estimates from the Building Performance Institute Europe (BPIE), prepared for the purpose of this report, the total net social benefits resulting from the implementation of a comprehensive thermal modernisation scheme by 2045 may amount to around PLN 700 billion. These benefits are diverse and go beyond simple cost savings resulting from reduced energy consumption. These are economic, social and environmental benefits (for more details, see table 'Three scenarios for renovation and thermal modernisation of the building stock in Poland by 2030').

The economic benefits are associated with increased energy efficiency, stimulated economic activity and the creation of new jobs in sectors related to thermal modernisation. According to BPIE estimates, prepared for the purpose of this report, in 2030 the annual savings in energy resulting from thermal modernisation may reach from 5% to 26% of consumption in 2013. This is not all – the total economic benefits may be much greater. As reported by the U.S. Environmental Protection Agency, the total value of economic benefits resulting from the implementation of thermal modernisation projects is 1.5 times as high as the value of the savings in energy consumption. The benefits are derived from the acceleration in economic growth caused by an increase in demand for labour, materials and additional services required for the implementation of construction projects. The analysis of existing studies and thermal modernisation schemes that have already been carried out allows us to predict the potential scale of such benefits. The implementation of a two-year passive house scheme in the Czech Republic cost around EUR 780 million. As a result, 19,000 new jobs were created in the construction sector and every 1 EUR that was invested returned a profit of EUR 2.47 for the state budget. In Germany, support for the thermal modernisation of existing facilities and the construction of passive houses led to the creation of 340,000 new jobs and investment of EUR 1.4 billion returned a profit of around EUR 7.2 billion for the budget. Some idea about the potential benefits resulting from the implementation of a comprehensive thermal modernisation scheme is offered by the report of the Polish Foundation for Energy Efficiency (FEWE), published in 2011. Its authors anticipate that the Polish construction market may grow by 84,000 – 250,000 new work places by 2020 (depending on the degree of intensity of thermal modernisation).

The social benefits primarily result from the limitation of such phenomena as energy poverty and social exclusion. According to various estimates, energy poverty (i.e. a situation where the costs of ensuring the correct temperature in premises, both in winter and in summer, exceed the household budget from 10% to 20%) threatens 16%–25% of households in Poland (data from "Survey on Income and Living Conditions in the EU" 2012). Comprehensive thermal modernisation could lead to a decrease in heating (or cooling) costs of premises by as much as half, and therefore contribute not only to the improvement of comfort of life, but also to an increase in household disposable income. Such actions could limit social exclusion of people with low income.

The environmental benefits result from a decrease in local air pollution (dust, benzo(a)pyrene) and carbon dioxide (CO_2) emissions which lead to climate change. According to analyses by experts from Building Performance Institute Europe (BPIE), the potential decrease in greenhouse gas emissions by 2030 (as compared to 2010), accomplished as a result of thermal modernisation of buildings, may reach from 8% to 59%. Along with the improved energy efficiency of buildings, air pollution resulting from the so-called low-stack emission, i.e. burning solid fuels in inefficient household furnaces, will also drop significantly. Comprehensive thermal modernisation, preferably combined with a replacement of local heat sources and, in certain cases, with a ban on coal burning, may greatly reduce the demand for energy from low efficiency furnaces and, in turn, limit the emission of harmful substances (particulate matter PM_{10} and $PM_{2.5}$ and benzo(a)pyrene).

Comprehensive Thermal modernisation: Cost-Benefit Balance

In line with the estimates of specialists from the Polish Energy Conservation Agency (KAPE) and the National Energy Conservation Agency (NAPE), which were conducted for the purpose of this study, the average cost of the thermal modernisation of 50%* of all single family and multi-family houses, as well as non-residential buildings will, depending on the adopted variant, range from PLN 270 to 470 billion (detailed information is contained in the table "Variant Analysis of Comprehensive Thermal Modernisation in Poland"). Such thermal modernisation activities will result in an average unit saving of primary energy reaching values from 60 to 109 kWh (m2*year), depending on the variant of thermal modernisation. In the case of final energy, depending on the variant of thermal modernisation, savings may range from 3.8 to 6.8 Mtoe/ year (detailed information about this subject is contained in the table "Range of Decrease of Primary and Final Energy Consumption Accomplished Via Comprehensive Thermal Modernisation in Poland").

The total cost of a comprehensive thermal modernisation scheme, as well as the broad range of benefits, not only economic ones, which may be accomplished thanks to the implementation of such a process, determines its shape. Its efficiency depends on two key factors: a proper selection of the entities encompassed by thermal modernisation and an accurate determination of financing principles for the entire process, adjusted to the needs and capacities of the recipients. According to the authors of this study, the problem of comprehensive thermal modernisation should encompass, in the first place, single family houses and its implementation should be financed in a mixed model from public and private funds.

There are several arguments in favour of putting emphasis on single-family buildings (obviously without giving up on the thermal modernisation of other groups of buildings).

First of all, in spite of the fact that single family buildings constitute almost a half of all residential buildings in Poland (46.4%, according to data from the Central Statistical Office of 2012) and almost half of Poles live in such buildings, their thermal modernisation to date has not been supported by the state in any way (e.g. the number of applications submitted by owners of single family houses to the Thermal Modernisation and Renovation Fund was negligible and did not exceed 2% of all applications).

Secondly, the energy efficiency of buildings is often very low. Over half of all single-family buildings were erected in the times of real socialism and almost every fourth before WWII. Many facilities were built by small companies with few employees; some were constructed single-handedly, without professional guidance, on the basis of the simplest construction and architectural premises and with the use of the cheapest materials. The low quality of execution, as well as the absence of access to the heating network have disastrous consequences for air quality in the country. According to studies conducted by the Institute of Environmental Economics (IEE) in 2014 almost 70% of Polish single-family houses are heated with the use of coal boilers and furnaces. Nearly 60% of all single-family houses use very inefficient solid fuel boilers, which emit a significant amount of pollutants.

Thirdly, single family buildings are, to a large degree, inhabited by the people who need the most support, i.e. inhabitants of rural areas and the so-called eastern wall, i.e. provinces where income of households is, on average, 13% lower than the national average and every fourth family is threatened with poverty.

Fourthly, the emphasis on the thermal modernisation of single family buildings is one of the most efficient impulses used to accelerate economic growth, in particular on a local level and in the sector of small and medium-sized enterprises. This also contributes to the development of labour markets in regions where thermal modernisation needs are greatest.

* Assuming the level of thermal modernisation at 50% constitutes an expert estimate on the basis of thermal modernisation projects performed to date. According to the data of the Central Statistical Office, approx. 50% of the surfaces in residential buildings are insulated. Expert evaluations refer to the thermal modernisation of approx. 30% of stock, mainly multi-family buildings. This is also derived from a questionnaire survey conducted by KAPE S.A. in Gdańsk, Sopot and Warsaw. It is assumed that entities that have already performed thermal modernisation will not be willing to make new investments in this respect.

Comprehensive Thermal Modernisation: Systemic Barriers

The implementation of a comprehensive thermal modernisation scheme in the shape proposed by the authors of this study requires overcoming several barriers. Some of them have a general character and refer to all thermal modernisation schemes, whereas others result from the specific character of a given market segment.

The absence of a comprehensive financing system, aligned to the needs. Every sector in the building market has its own character resulting, *inter alia*, from its adopted financing model, level of transaction costs, average investment value, time horizon in which evaluation of economic benefits is performed and the decision making model.

The unavailability of long-term loan for renovation projects. The absence of long-term, readily available and moderately-priced financing schemes significantly hinders the possibility of conducting comprehensive renovation activities, leading to the rapid accomplishment of substantial energy effects, primarily in the sector of single-family buildings. The absence of easily available, long-term funds for the modernisation of single-family houses makes the owners of facilities of this type postpone the decision about renovation until the very last moment; they decide about it in an ad-hoc manner, without prior conduct of an audit or optimisation of the scope of the project.

High transaction costs. Conducting a comprehensive thermal modernisation scheme requires additional costs related to, *inter alia*: reaching the potential customer with a support offer; time devoted to the examination of the problem, as well as outlays on the preparation of technical and credit documentation. The characteristic feature of activities aimed at the improvement of energy efficiency is their relatively small value. The ratio between transaction costs and the value of investment activities is usually almost the same, which might challenge the profitability of project implementation, even in the case of a subsidised projects.

The low level of contractor knowledge (construction companies, architects, construction site managers) which translates directly into errors in projects, the selection and implementation of technological solutions and, as a result, the parameters of the buildings erected.

A well planned comprehensive thermal modernisation scheme has to overcome these barriers and respond to the needs of investors, who are accustomed to a completely different model of making decisions about renovation. It should offer a convenient source of financing for comprehensive renovation and thermal modernisation schemes rather than reimburse the financing costs of partial investments, which do not significantly improve the energy efficiency of buildings, as well as be conducive to the extension of knowledge on the part of the suppliers of services related to thermal modernisation.

Major Premises of the Concept for National Thermal Modernisation Scheme

An efficient process of comprehensive thermal modernisation requires centralised and coordinated activities integrating the effort of several entities. Therefore, it is justified to establish a national renovation and thermal modernisation scheme for the needs of the entire process, based on uniform programming criteria (determining the principles of support for individual groups of recipients); on consistent principles and procedures of technical aid (a supply of consulting services provided on the basis of a national network of specialists, as well as the promotion of the

entire concept); and on transparent evaluation criteria, as well as supported by an efficient reporting and registration system. For the purpose of implementing joint tasks related to the distribution of information and funds, it is necessary to establish a special organizational unit, selected in a tender or located in one of the already existing financing institutions, e.g. the National Fund for Environmental Protection and Water Management (NFEPWM). Its operation should be controlled by an additional unit responsible for the programming and verification of the efficiency of the efforts undertaken. Additionally, the preparation of such a system may be aided by the establishment of an office of a representative for energy efficiency who would be responsible for the coordination and determination of cooperation principles.

The basic challenge faced by designers and institutions implementing the national programme of renovation and thermal modernisation is efficient process financing. The term "efficient" is understood in the following manner: guaranteeing a constant flow of funds throughout the programme duration; ensuring the proper speed and scope of activities increasing energy efficiency of buildings; encompassing the broadest possible group of well defined beneficiaries and, finally, guaranteeing an efficient distribution of funds with the minimum administrative costs for the entire process.

Assuming multiple sources of financing for thermal modernisation, the distribution system for funds should be governed by the principle that the maximum support received for one objective and one investment cannot exceed a level specified in the system. Obviously, this does not exclude the possibility of combining support – for example combining renovation, energy efficiency, activities related to counteracting poverty and air protection. On the contrary, support should be reasonably combined (which entails the necessity of preparing the relevant procedures and principles) in order to use the social and economic potential of a given project to the maximum.

The support system for thermal modernisation should consist of two independent and separate instruments, i.e. a support system for renovation based on attractive loan facilities and a support system for energy efficiency based on subsidies, addressed to investors who cannot obtain credit. It is necessary to establish a scheme which would offer long-term credit facilities (even up to 20 years – this is the average period between general renovations of buildings along with the replacement of heating installation) by such institutions as Bank Gospodarstwa Krajowego (BGK) or the NFEPWM. The facilities would have security in the form of a mortgage and would be available upon attractive conditions (e.g. on the level of the reference interest rate for credit facilities on the WIBOR market), guaranteed by the state. On account of the specific character of recipients, the credit facility should be integrated with support mechanisms for energy-saving activities (consulting, subsidies), as well as the registration and estimation of the energy-efficiency of investments, additionally supplemented by technical support (for comprehensive modernisation investments in the form of a free-of-charge investment plan, containing a financing plan and, potentially, if necessary, an energy audit). Within the scope of financed renovation and modernisation activities, measures which bring building elements (building envelope, heating system) in line with currently binding standards should receive support in the first place. In relation to this, obtaining a favourable credit facility for renovation should be conditional on the approval, by a qualified advisor, of a thermal modernisation or renovation plan. This would allow for the prevention of situations in which, due to reasons related to savings, an investor implements a project based on inefficient technological solutions.

Financing a Domestic Renovation and Thermal Modernisation Scheme

Due to the convergence of the postulated programme with strategic EU objectives, as well as due to changes in expenditure principles adopted by the European Commission (EC), the most natural sources of financing for the domestic programme of renovation and thermal modernisation seem to be European funds, available within the scope of the new financial perspective 2014–2020.

In line with the guidelines of the European Commission, the spending of structural EU funds between 2014 and 2020 should be directed at the implementation of the objectives of the strategy "Europe 2020. A Strategy for an Intelligent, Sustainable and Inclusive Growth" (Europe 2020 Strategy), along with the assumptions of one of its key elements, i.e. the 20/20/20 energy package. Its implementation should, in the case of Poland, bring about a drop in emissions of greenhouse gases, an increase in the share of energy from RES in total energy consumption to 15%, improved energy efficiency, i.e. accomplishment, by 2016, of savings in final energy by not less than 9% of the domestic average consumption of such energy throughout a year (the average value refers to the years 2001–2005). At the same time, the implementation of strategic objectives, supported by structural funds, should comply with at least one out of 11 Thematic Objectives, four of which directly refer to energy issues and a decrease in emission intensity for the economy (support for the transfer to a low-carbon economy in all sectors; promotion of climate change adaptation, risk prevention and risk management; protection of the natural environment and support for efficiency in the use of resources; the promotion of sustainable transport and the removal of deficiencies in capacity in operation of the most important network infrastructures).

In the case of activities financed from EU funds assigned for 2014–2020, all projects have to comply with several additional conditions. First of all, they have to lead to so-called deep thermal modernisation (defined separately by every member state) and be based on a reliable evaluation of effects that are possible to accomplish. In the case of larger, comprehensive investments, this entails the necessity of conducting energy audits, and in the case of smaller investments, the purchase of solutions may be performed on the basis of a set of guidelines regarding eligible equipment from the LEME list*.

Secondly, projects have to not only support the fulfilment of the requirements of the energy and climate package, but also maximise effects with respect to the creation of new, durable workplaces and promote the application of varied intervention tools.

Thirdly, activities for the benefit of increasing efficiency should serve as the basis for a multi-level system of education and expert support for all entities involved in the process, as well as ensure the structuring of proper technical assistance funds for this purpose.

Fourthly, the support system for thermal modernisation should enable the improvement of market imperfections (externalities) which appear in the course of its functioning. Additionally, the EC also expects that investments financed from structural funds will be supported by private financing. In practice, this also entails the promotion of returnable financial instruments in all places where possible, as well as support for the entire operating programme by a series of in-depth analyses, conducted before, during and after the public financial intervention.

General requirements on the level of the national Operational Programme should be supported by regulations determined on the level of Regional Operational Programmes based on domestic guidelines, as well as a complex pool of evaluations (performed before, during and after project completion).

Adoption of a mixed (hybrid) model of financial support imposes several additional obligations on the institutions managing the programme. It forces the unification of the principles of conducting interventions from public funds, so that the funds for the same objectives directed to the same beneficiaries are distributed according to the same principles. It also imposes, on the managing entity, the obligation of a prior examination of investment needs. All of this is necessary to avoid a situation in which an excess of funds assigned for a specific purpose results in the discontinuation of activities in another sector (which happens, in the case of the co-existence of several uncoordinated support programmes implemented by various public institutions). As a result, this entails the necessity of justifying more preferential support by a reliable analysis of the market situation (e.g. avoiding the establishment of parallel programmes of returnable and non-returnable support for the same objective in a given territory).

* A list of eligible materials and equipment holding high energy characteristics for installations within the scope of thermal modernisation activities – PolSEFF programme of the European Bank for Reconstruction and Development.

Głęboka Termomodernizacja

www.renowacja2050.pl