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**SELECTED DIRECTIONS
OF INCREASING EFFICIENCY IN SUPPORTING
THERMOMODERNIZATION IN BUILDINGS
FROM PUBLIC FUNDING**

**WYBRANE KIERUNKI
ZWIĘKSZENIA EFEKTYWNOŚCI WSPIERANIA
TERMOMODERNIZACJI W BUDYNKACH
ZE ŚRODKÓW PUBLICZNYCH**

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Summary: The article addresses activities/programs supporting thermomodernization in buildings. Its purpose is to discuss selected directions of their efficiency improvement. The objective was achieved by following a multicriteria descriptive analysis of the identified activities/programs. The set of analysis criteria, presenting also the desirable directions of efficiency improvement, covers accuracy in defining thermomodernization, guarantee for a continuous inflow of funding throughout the entire duration of an activity/program, a proper definition of support activity/program beneficiaries and cost efficiency of distributing financial support means.

Keywords: thermomodernization, efficiency, support activities/programs.

Streszczenie: Przedmiotem artykułu są działania/programy wsparcia termomodernizacji w budynkach. Jego celem jest wskazanie wybranych kierunków poprawy ich efektywności. Cel ten został osiągnięty w drodze wielokryterialnej analizy opisowej zidentyfikowanych działań/programów. Zestawem kryteriów analizy, będących jednocześnie pożądanymi kierunkami poprawy efektywności, objęto: precyzję w definiowaniu termomodernizacji, gwarancję stałego dopływu środków przez cały okres trwania działania/programu, dobrego zdefiniowania beneficjentów działania/wsparcia oraz efektywność kosztową dystrybucji środków wsparcia finansowego.

Słowa kluczowe: termomodernizacja, efektywność, działania/programy wsparcia.

*Energy regime shapes the nature of civilization:
how it is organized, how the fruits of commerce and trade
are distributed, how political power is exercised,
and how social relations are conducted.*

Jeremy Rifkin

1. Introduction

The enforcement of the Act dated 18 December 1998 on supporting thermo-modernization projects (Journal of Laws no. 162, item 1121, as amended [Ustawa z dnia 18 grudnia 1998]) represented a manifestation of awakening awareness that thermomodernization in buildings can become an important factor stimulating integrated development. The Act specified types of thermomodernization projects in buildings and established the Thermomodernization Fund in Bank Gospodarstwa Krajowego (BGK), which aims at supporting these projects within the limits of funding available in the Fund. The EU integration processes, followed by the participation in creating and implementing European developmental strategies in the conditions of new civilization challenges as well as painful experiences resulting from the crisis initiated in 2007–2008 and searching for new developmental potential inspired by the global downturn, not only confirmed the existing awareness, but also facilitated a more extensive activation of the discussed developmental factor. Thermomodernization projects in buildings are currently supported not only by the national funding, but also by the European funds. One out of 11 Thematic Objectives addressed by Europe 2020 strategy is supporting the shift towards a low-carbon economy in all sectors from the Cohesion Fund and the European Regional Development Fund. The interventions carried out within the framework of this Objective are focused on e.g. the Partnership Agreement specific objective – the reduction of economy generated emissions and are executed mainly based on the priority criterion – increasing energy efficiency of public utility buildings and multi-family residential buildings (PI 4iii., PI 4c) [*Programowanie perspektywy finansowej...* 2014].

Support activities/programs aimed at buildings' thermomodernization with or without the European funding constitute the subject matter of this article. Its main purpose is to identify the selected directions for these activities/programs improvement. Achieving the following three detailed goals turned out helpful in carrying out the leading objective: 1) indicating thermomodernization related developmental potential, 2) identifying activities/programs supporting thermomodernization of buildings, 3) conducting a multicriteria descriptive analysis of the identified activities/programs.

In order to achieve the leading objective and the detailed goals, the author reviewed available, even though still quite limited, subject literature, legislation in force, expert reports and applied comparative, descriptive and deduction methods.

2. Development potential related to thermomodernization

The problem of scope and intensity in carrying out thermomodernization projects is of complex nature. Therefore – following the suggestion by G.W. Kołodko – it should be looked upon through the set of appropriate lenses not to lose the sight of what is important [Kołodko 2013, p. 50]. Thus, the significance of the defined problem can be perceived as the abundance of efforts, including modernization specific funding, necessary to solve it, or/and as potential advantages resulting from worked out solutions. Taking a look through the first lens, focused on efforts, can turn out pessimistic. The share of energy in residential buildings in Poland used for domestic hot water, heating and ventilation, in its total consumption, amounts to 87%, in EU-15 82%, whereas in the guidelines issued by The International Energy Agency 62% [Krajowy Plan... 2014, p. 14]. The main reason for low energy efficiency of residential buildings in Poland should be sought in the age structure of the housing stock (see Table 1).

Table 1. Age structure of housing stock in Poland vs. energy consumption

No.	Building/apartment construction period	Structure %		EP	EK
		Buildings	Apartments	kWh/(m ² year)	
1.	Before 1918	7.3	9.1	>350	>300
2.	1918–1944	14.5	11.2	300–350	260–300
3.	1945–1970	24.6	24.0	250–300	220–260
4.	1971–1978	11.9	16.0	210–250	190–220
5.	1979–1988	13.6	16.6	160–210	140–190
6.	1989–2002	12.1	11.7	140–180	125–160
7.	2003–2007	5.8	4.6	100–150	90–120
8.	2008–2011	3.7	3.2	–	–
9.	Under construction	0.5	0.3	–	–
10.	Undefined	6.0	3.3	–	–
Total		100.0	100.0	–	–

EP – the indicator defining annual demand for non-renewable primary energy per unit of temperature-controlled room surface.

EK – the indicator defining annual demand for final energy per unit of temperature-controlled room surface.

Source: *Programowanie perspektywy finansowej...* [2014, p. 24].

In accordance with the legislation in force provided in the regulation by the Minister of Infrastructure dated 12 April 2002 on technical conditions to be met by buildings and their location (Journal of Laws no. 75, item 690, as amended [Rozporządzeniu Ministra Infrastruktury z dnia 12 kwietnia 2002]), a newly erected

multi-family residential building should be characterized by EP indicator equal or lower than 105 kWh/(m² year) and should meet the requirements of the permissible maximum value in terms of heat transfer coefficient for building envelopes and covering technical equipment. Having analyzed the data included in Table 1, one can conclude that about 22% of residential resources present the value three times lower than the reference value of EP indicator and 36% half of the reference value. As far as thermal insulation of building envelopes erected before 1982 is concerned, it is five times lower than the applicable requirements.

In the opinion of experts, 50% of the usable building area should undergo thermomodernization. The level of investments dedicated to this objective, depending on an adopted thermomodernization variant, is estimated in the range from PLN 270 up to PLN 468 billion. As a result, this could allow for saving from 270 to 468 kWh/m² of primary energy per year (mean value for all single and multi-family residential buildings as well as non-residential ones) and from 3.8 up to 6.8 Mtoe final energy per year [Węglarz 2014].

Taking a look through the second lens, focused on the potential advantages obtained from the complex program for thermomodernization projects' implementation, results in a completely different emotional state – a large dose of optimism. Following the analyses conducted by the experts from the Buildings Performance Institute Europe (BPIE), net social benefits from such program implementation, in the time perspective till 2030, can amount to as much as PLN 727 billion, whereas thermal energy savings for consumers – PLN 63 billion [Staniaszek, Zaborowski 2014, p. 21]. They consist of economic, social and environmental benefits, identified with integrated development factors, currently constituting the most desirable development pattern [Słodowa-Helpa 2013, p. 55ff]. Economic advantages result mainly from savings in energy consumption and the development of economic activity, followed by an increasing number of new jobs in thermomodernization specific sectors. According to estimates, annual energy savings can, in 2030, reach between 5 and 26% of 2010 consumption. However, the acceleration of economic growth rate can result in more significant economic advantages, in consequence of higher demand for workforce, materials and additional services, indispensable in thermoregulation projects implementation. The average net number of jobs created annually is estimated at the level of 18,000–119,000, as an ambitious variant. Social advantages can mainly result from reducing such phenomena as energy poverty and social exclusion. According to various estimates, 16–25% of Polish households are threatened by energy poverty (i.e. the situation when the costs of ensuring adequate room temperature, both in winter and in summer, exceed household budget by 10 to 20%). Complex thermomodernization could reduce the costs of room heating/cooling even by half, thus resulting in higher living comfort and also significantly increasing household disposable income. Complex thermomodernization also offers environmental advantages, such as the reduction of greenhouse gas emissions by

8–59% against 2010 as well as other emissions (particulate matter and benzopyrene) produced as a result of low grade fuel combustion in ineffective domestic stoves.

Thermomodernization projects also bring about measurable advantages for those who invest in them. However, even the most effective economic projects may turn out financially impossible. Therefore, public intervention proved necessary in the area of thermomodernization.

3. The identification of activities/programs supporting thermomodernization

Twenty activities/programs, at the national and the regional level, served/managed by various public sector entities, addressed to diverse beneficiaries and aimed at supporting thermomodernization, were possible to identify. Their list is opened by an activity having the longest history, the legal basis of which is the Act dated 21 November 2008 on supporting thermomodernization and renovation (Journal of Laws from 2004, item 712 [Ustawa z dnia 21 listopada 2008]), amending the Act from 1998 on supporting thermomodernization. Based on the Act provisions, a special fund called Thermomodernization and Renovation Fund, which took over assets and liabilities of the Thermomodernization Fund, was established in Bank Gospodarstwa Krajowego (BGK). In accordance with the Act, public funding covers thermomodernization projects dedicated to:

- improvements resulting in the reduction of energy demand, supplied for the purposes of heating and warming up domestic water as well as central heating;
- improvements resulting in the reduction of primary energy consumption in local heating networks as well as local heat sources supplying them;
- technical connection to the centralized heat source as a result of local heat source elimination;
- total or partial energy source change into a renewable source or the application of high-efficiency cogeneration.

The discussed funding is addressed to owners or managers of residential buildings, multiple occupancy buildings and buildings owned by local authorities, used by them to perform their public tasks, local heating networks and the local heat source. Investors, regardless of their legal status, i.e. legal persons (e.g. housing associations, commercial companies), local authorities and natural persons can become the beneficiaries of funding. Budgetary units and budgetary entities are not entitled to the discussed finding. Achieving a particular economic/environmental effect, confirmed by an energy certificate, constitutes the condition for obtaining support. Thus, as a result of thermomodernization project implementation the following benefits should be achieved:

1) reduction of annual energy demand supplied for the purposes of heating and warming up domestic water as well as central heating by at least 10% in buildings

where only the heating system is modernized, 15% in buildings where after 1984 the heating system was modernized and 25% in other buildings;

- 2) reduction of annual energy losses by at least 25%;
- 3) reduction of annual costs for obtaining heat by at least 20%.

The support takes the form of a thermomodernization bonus. Its level amounts to 20% of the credit amount granted for a given project implementation; however, it may not exceed 16% of the costs incurred in project execution and remain twice higher than anticipated annual savings in energy costs.

The subsequent listed positions represent two thermomodernization support programs offered by the National Fund for Environment Protection and Water Management entitled:

- 1) Energy efficient investments in SME and
- 2) Prosumer – funding line for purchasing and setting up micro-installations for renewable energy sources [*Przewodnik po programach priorytetowych...* 2015, p.18ff].

The first of the above-mentioned programs aims at supporting investments in:

- thermomodernization of building/s and/or the application of renewable energy sources carried out by purchasing materials, equipment, technologies on the List of Eligible Materials and Equipment and if their credit based financing does not exceed EUR 250,000;
- thermomodernization of building/s and/or renewable energy sources as a result of which 30% energy savings is achieved and if their credit based financing does not exceed EUR 1 mn.

The program is dedicated to private enterprises meeting the definition of microenterprises and SME included in the European Commission recommendation dated 6 May 2003 regarding the definition of microenterprises and SME (Official Gazette EC L 124 of 20 May 2003 [*Zalecenie Komisji z dnia 6 maja 2003 r.*]).

The support is transferred in the form of subsidies for the repayment of part of a credit granted by banks cooperating with the National Fund within the framework of the discussed program. The subsidy amounts to 10% of the credit capital used for covering costs of qualified projects and can be increased up to 15% when a project is preceded by obtaining an energy certificate.

The prosumer program consists of three modules representing specific National Fund cooperation platforms with local authorities, banks and regional funds for environment protection and water management. Within the framework of the program support is allocated to thermomodernization projects aimed at purchasing and setting up small or micro-installations for renewable energy sources to produce heat as well as heat and electricity in residential buildings, such as:

- biomass-fired heat sources with installed thermal capacity up to 300 kWt;
- heat pumps with installed thermal capacity up to 300 kWt;
- micro-cogeneration with installed electric power up to 40 kWe.

Natural persons, entitled to use a single-family residential building or housing associations and housing cooperatives managing multifamily residential buildings, remain the ultimate beneficiaries of the support under analysis.

A loan with a subsidy is a form of support in modules 1 and 3, whereas in module 2 it is a credit with a subsidy. A loan/credit is granted following preferential terms (1% annual interest rate, grace period for repayment of up to 6 months). The level of subsidy reaches 15% of loan/credit capital used to cover qualified costs of the project and even 40% in 2015 in 2015.

The list of identified programs, dedicated to thermomodernization stimulation at the national level, covers also the Green Investment Scheme: Energy management in public utility buildings operated by the National Fund for Environment Protection and Water Management. Since this program is going to be finalized this year (no funds allocation is expected in 2015), it will not be covered more extensively in the present study. It should, however, be observed that owing to funding from this particular program (loan with a subsidy), it was possible to reduce thermal energy consumption in buildings used by local authorities, volunteer fire fighters and church legal persons.

The list of identified programs for stimulating thermomodernization in buildings is completed by 16 Regional Operational Programs. In accordance with the provisions of Partnership Agreement the activities focused on energy consumption modernization in buildings are supposed to promote its complex dimension (so-called deep thermomodernization). The funding should cover both, residential buildings and public utility ones. The construction of financial instruments, within the framework of these programs, was left to the discretion of regional authorities.

4. The analysis of thermomodernization support activities/ programs efficiency

The efficiency analysis of the discussed activities/programs, aimed at thermomodernization stimulation, has been subject to brief analysis based on the following criteria:

- 1) clear definition of thermomodernization in buildings to which activities/programs are dedicated;
- 2) guarantee for a continuous inflow of financial means throughout an entire period of a given activity/program functioning;
- 3) proper definition of activity/program beneficiaries;
- 4) cost-effective distribution of financial support means.

The efficiency of activities/programs dedicated to financing buildings requires its clear definition, since it is of great significance while specifying the type and level of support granted, both in an individual dimension (of a particular activity/program) and in more general terms (desire to spend public means in the most effective way). In the latter case, the origins of support means (domestic, European) and their program

operator/manager (national bank, state legal person, regional authorities) does not matter from the substantive point of view. However, it does matter “what” was achieved as a result of spending the aforementioned means. The question of “what” makes sense when a clear definition of thermomodernization is available (not just a list of generic thermomodernization activities) and – in the case of multiplicity of activities/programs supporting thermomodernization projects – it is almost binding. The review of financing activities/programs, aimed at thermomodernization of buildings, proves that such a definition does not exist. The analysis of Partnership Agreement content confirms that in the current financial perspective, the EU does focus on the so-called deep thermomodernization. In accordance with the guidelines provided in the EU directives, “deep thermomodernization” should be defined considering local determinants. The authors of the Strategy for buildings’ modernization: 2050 road map adopted the following definition: “Deep thermomodernization stands for a group of renovation and modernization activities aimed at the reduction of energy consumption in buildings. The scope of activities performed within the framework of deep thermomodernization is specified at an optimal level from an economic perspective. Optimal cost method is applied in order to define the optimal set of modernization activities” [Zaborowski 2014, p. 31].

The definition of thermomodernization (may be supported by a more extensive glossary of the related terms) could turn out useful in the delimitation of support segments for thermomodernization projects and to construct benchmarks for the needs of these segments’ efficiency assessment and the specific support standards.

The second criterion covered in the course of conducted analysis is a guarantee for a continuous inflow of financial means through an entire period of an activity/program duration. Such guarantees are not present in relation to the Thermomodernization and Renovation Fund and, to a lesser extent, with regard to the programs managed by the National Fund for Environment Protection and Water Management, supporting which is not covered by the so-called long-term commitments provided for in Art. 401c of the Act dated 27 April 2001 on Environment Protection Law (Journal of Laws from 2013, item 1232, as amended [Ustawa z dnia 27 kwietnia 2001]). The Thermomodernization and Renovation Fund represents the so-called flow fund operated by Bank Gospodarstwa Krajowego (BGK) [Brzozowska 2010, p. 25]. It is mainly supported by the funds transferred from the budget in the amount specified in the Budget Act. Thermomodernization remains one of the three directions in spending means originating from this budget. The means obtained from the budget are annually defined, whereas their occurrence and level depends on the current budgetary policy which determines their instability. This is confirmed by the statistics – in 2011 such support was absent [*Report on BGK operations...* 2013, p. 62]. Relatively stable funding, on the other hand, is provided for projects within the framework of regional operational programs, since they are carried out in a seven-year financial perspective.

A proper definition of activity/program beneficiaries remains yet another criterion in the conducted analysis. Thermomodernization of buildings represents a challenge faced by all economy sectors, the public finance sector and natural persons. Therefore, the entities from the above-mentioned sectors are potential support beneficiaries based on undertaken thermomodernization projects. Making them actual beneficiaries of specific activities/programs should be preceded by *ex ante* multi-level, complex analysis (considering technical, regulatory, economic, social and environmental factors) as well as coordinated, in the cross-section of support segments, at the national level and related to other pro-development activities/programs. The postulate for conducting an *ex ante* analysis, along with programs' coordination, is met, to the greatest extent, by those responsible for Regional Operation Funds management and to the smallest extent by the Thermomodernization and Development Fund operator.

Finally, activities/programs should be characterized by cost effectiveness in the distribution of financial support means (i.e. administrative costs should be minimized) on the part of an ultimate beneficiary, but also that of program operator/manager. The evaluation the extent to which cost effectiveness criterion of activities/programs stimulating thermomodernization is met remains impossible because of the existing information gap. Due to a weaker position of support beneficiaries, one can assume that it is them who cover the highest distribution costs. It should be emphasized that the proportion between transaction costs and the value of thermomodernization projects is similar, which can undermine the profitability of specific projects' implementation, even the ones supported by subsidies. The problem does exist and should be considered in the course of constructing support instruments and their scope within the framework of particular activities/programs.

5. Conclusions

Following the worldwide experience [Szyja 2013, p. 164], thermomodernization of buildings represents an important potential factor enhancing integrated development. The effects of implemented activities/programs are of diverse nature and go beyond simple savings resulting from energy consumption reduction. It is possible to achieve them; however, it requires their continuous improvement – removing the existing pro-efficiency barriers. Some of them are of general nature and cover all identified thermomodernization activities/programs. Among them the following should be listed:

- no clear definition of thermomodernization;
- no long-term guarantees for funds supporting the majority of programs at an adequate level;
- no binding recommendations for performing analyses prior to undertaking actions/setting up programs and public debates about their scope and results in reporting periods;

- no coordination of activities/programs in the cross-section of support segments and also in national scale;
- no apparent concern for support transaction costs and their fair division between programs' operators/managers and their beneficiaries.

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