

THE ASSESSMENT OF LABOUR DEMAND GENERATED BY SINGLE-FAMILY BUILDINGS MODERNISATION PROJECTS IMPLEMENTED IN THE VOIVODSHIPS OF MAŁOPOLSKIE AND ŚLĄSKIE

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INTRODUCTION

The adoption of anti-smog resolutions in the voivodships of małopolskie and śląskie implicates the necessity to replace heat sources in the vast majority of single-family houses located in this region. Thermal modernisation interventions may have a positive effect on the labour markets in these voivodships, thus creating additional labour demand, particularly among poorly qualified persons who face greater risk of unemployment than those having a secondary school diploma or a university degree. This study shows what labour demand can be created by thermal modernisation measures taken in single-family houses in the voivodships that were the first in Poland to adopt anti-smog resolutions. With this end in view, we use a labour demand and labour supply model. We consider various

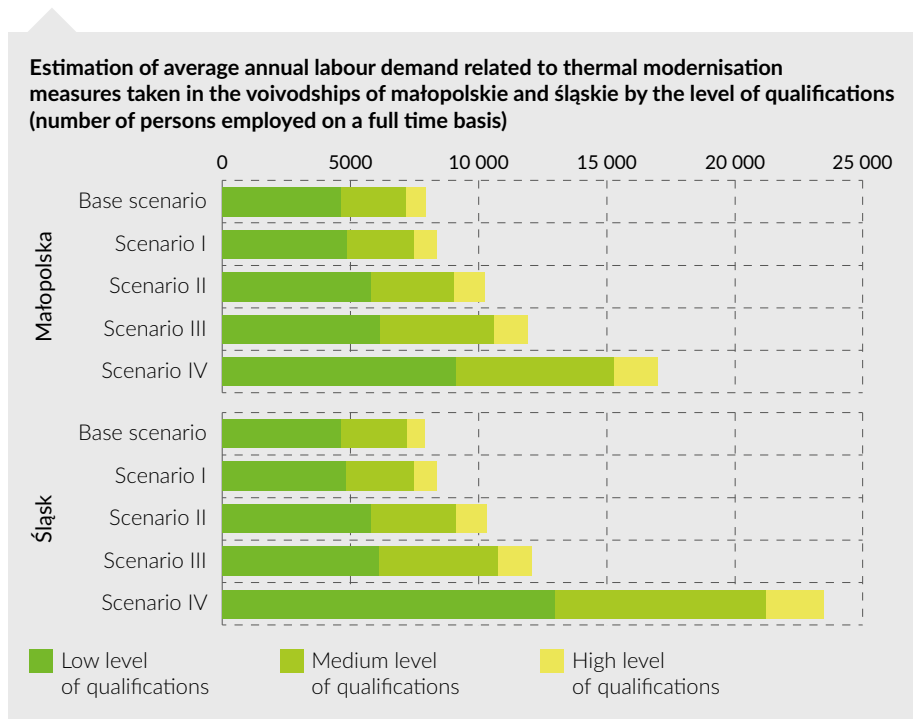
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scenarios of measures taken – from meeting the resolutions' requirements to the comprehensive thermal modernisation including not only the replacement of boilers and the modernisation of systems but also buildings complete insulation and installation of solar collectors. **The simulations that we have carried out indicate that the effect for the labour market may be significant provided that a more comprehensive thermal modernisation of buildings is conducted and not only boilers' replacement.** A simultaneous systems modernisation and installation of solar collectors may bring additional 8 thousand jobs in total in these voivodships, whereas a comprehensive thermal modernisation – four times more.

RESULTS

According to our estimates, in each of the voivodships, naturally implemented thermal modernisation measures engage approximately 8 thousand persons, as expressed in annual full-time equivalents. An extended scope of thermal modernisation interventions resulting from the implementation of anti-smog resolutions could increase this number by even 2.5 times. **However, if only obligatory measures, i.e. replacement of heat sources (boilers, scenario I), are taken as a result of the resolutions, the employment in this area will rise insignificantly, only by 6% in each of the voivodships.** The effects will be more noticeable if the replacement of heat sources is accompanied by additional interventions. In the case of a simultaneous modernisation of central heating and domestic hot water systems (scenario II), the number of persons working on thermal modernisation would be 20% higher and would exceed 10 thousand persons (as expressed in annual full-time equivalents) in each of the voivodships. Installation of solar collectors (scenario III) would require two thousand more employees in each of the voivodships. The rate of employment in the area of thermal modernisation would exceed 12 thousand persons in both voivodships, i.e. it would be 50% higher than in the base scenario.

It is, however, insulation of buildings – their external walls, roofs and floors held simultaneously with the replacement of windows (scenario IV) that would have the most significant impact on the labour market. The comprehensive thermal modernisation of single-family houses in the voivodships of śląskie and małopolskie could create jobs even for 32 thousand additional persons. It should be noted that even if the influence of heat sources replacement and systems modernisation scenarios on the rate of employment is similar in both voivodships, the impact of insulation would be more significant in the voivodship of śląskie (15.5 thousand persons) than in the voivodship of małopolskie (9 thousand persons). It results from the fact that the number of single-family houses that will be subject to the heat sources replacement requirement is similar in both voivodships but the number of non-insulated houses is higher in the voivodship of śląskie.



Source: Own analysis

The structure of labour demand created by thermal modernisation measures divided by the level of qualifications is also of major importance for the labour market. Over a half of these jobs require poorly qualified employees, i.e. persons who completed vocational training. Creating such jobs may be particularly useful in the areas where branches that traditionally need such employees fall into decay, especially traditional industries. Furthermore, poorly educated persons face a greater risk of unemployment than better educated people. Therefore, the labour demand created by thermal modernisation measures may contribute to lowering the unemployment rate. According to our estimates, **a drop in the unemployment rate would be noticeable in the case of the labour-consuming scenario IV that encompasses a comprehensive thermal modernisation and would reach 0.3 pp of the unemployment rate in the voivodship of małopolskie and 0.4 pp of the unemployment rate in the voivodship of śląskie. The scenarios that are limited to systems modernisation have an insignificant influence on the unemployment rate (it does not exceed 0.15 pp).**

CONTEXT

The anti-smog resolutions adopted in 2017 in the voivodships of śląskie and małopolskie constitute an important step towards improvement of the quality of air in Poland. The provisions contained in the documents are a significant incentive to increase the pace of replacing heat sources with more environmentally friendly ones, and the necessity to take the measures refers particularly to owners of single-family buildings. In 2016, in the voivodship of małopolskie there were 563.7 thousand single-family buildings, of which 435 thousand were equipped with solid fuel boilers*. 547.2 thousand single-family buildings, of which 470 thousand were equipped with boilers, were located in the voivodship of śląskie**. As it is stipulated in anti-smog resolutions, in the voivodship of małopolskie, coal or wood boilers that meet no emission standards

* Data obtained from the CEM Market and Public Opinion Research Institute.

** Details of an inventory drawn up by the Marshal's Office of the Śląskie Voivodship.

whatsoever should be replaced by the end of 2022, whereas class 3 and 4 boilers – by 2026 (time horizon: 6 and 10 years respectively). In the voivodship of śląskie, boilers that do not meet emission standards can be used for a maximum of 8 years, till the end of 2025. To sum up, in a horizon of approximately 10 years, nearly one million stoves are to be replaced in both voivodships.

However, the resolutions are not a direct incentive to take other thermal modernisation measures, such as systems replacement or houses insulation, by the owners of buildings. Therefore, a question arises whether these regulations will contribute to considerable improvement of energy efficiency in residential buildings. A policy that would accompany these resolutions and that would encourage owners to take thermal modernisation measures on a larger scale could be a facilitator. Currently, single examples of similar profile programmes can be pointed out – e.g. *Jawor* programme handled by the Małopolska Fund for Environmental Protection and Water Management that offers preferential loans to cover the costs of single-family buildings insulation. **Much stronger environmental effects than those obtained only through the replacement of heat sources constitute serious arguments for supporting the comprehensive thermal modernisation.** A significant improvement in buildings energy efficiency also translates into the quality of life of their inhabitants and into savings in household budgets. The financial aspect is of particular importance in the context of new heat sources that require using more expensive, better quality fuels.

The influence of thermal modernisation measures' intensification on the labour market may also be vital for the public policy. Although the rate of unemployment* in 2016 was low both in Poland (6.3%) and in the analysed voivodships (śląskie – 5.5%, małopolskie – 5.3%), it was considerably higher among poorly qualified employees and amounted to 9.2% in Poland, 9.2% in the voivodship of śląskie and 7.2% in the voivodship of małopolskie. As we prove in this paper, poorly qualified unemployed persons will be able to find jobs related to buildings modernisation.

* The rate of unemployment for the population aged 15-64. Own calculations based on the Central Statistical Office's Research on Population Economic Activity (2016).

ESTIMATION OF LABOUR INTENSITY OF ENERGY RETROFIT

In order to estimate labour demand and its influence on the level of unemployment, single-family buildings were divided into two categories taking into account their age – into those built before 1970 and newer ones. Then, a model building with average or most typical features was assigned to each category. Buildings erected before 1970 are represented by a one-storey house of 76 m² of usable floor area, with a non-habitable attic, gable roof and non-insulated external walls made of solid brick. For buildings erected after 1970, the model building is a two-storey house of 137 m² of usable area, with a full basement, flat roof and non-insulated external walls made of brick*.

* Detailed characteristics of the model buildings can be found in the methodological report on the website www.ibs.org.pl.

In the next step, thermal modernisation works were matched to both model buildings according to their specificity. We took into account not only building envelope insulation and replacement of window frames but also heating system modernisation. For particular interventions conducted in a given building, we determined the necessary labour inputs divided into work of persons having low, medium and high level of qualifications. The labour inputs were expressed in man-hours and calculated on the basis of the Construction Pricing Guide (KNR – Katalog Nakładów Rzeczowych) that are used to make a cost estimate of construction works and constitute the only comprehensive source of knowledge about labour consumption of construction works. Labour inputs of highly qualified persons – auditors and energy advisors, managers in construction companies and employees responsible for design documentation were estimated separately with the use of expertise**. The results of this estimation were presented in the table below. The most labour-consuming intervention for both types of buildings is insulation of external walls, then insulation of floor/ceiling above the basement in buildings erected before 1970 and replacement of windows in buildings erected after 1970. **All the works except for the installation of solar collectors require particularly labour input of poorly qualified persons.**

** Currently, thermal modernisation of single-family buildings requires work of highly qualified persons to a lesser extent. It was however assumed that introduction of public support programmes would impose at least partial professionalization of the method of thermal modernisation interventions.

Labour inputs necessary to conduct thermal modernisation works, divided by type of single-family buildings and qualifications of employees [man-hours]	Building 1 (erected before 1970)			Building 2 (erected after 1970)		
	Low level of qualifications	Medium level of qualifications	High level of qualifications	Low level of qualifications	Medium level of qualifications	High level of qualifications
Insulation of external walls	388	230	20	789	379	33
Insulation of flat roof / attic	50	0	20	59	46	32
Replacement of windows	41	38	20	87	80	32
Ground level floor/ ceiling above basement	109	0	20	18	14	32
Central heating system	58	27	7.5	38	28	8.5
Domestic hot water system	3	6	7.5	3	7	8.5
Boiler	12	4	7.5	12	4	8.5
Solar collectors	12	64	7.5	18	70	8.5
IN TOTAL	673	369	110	1024	628	163

Source: Own study for IBS prepared by Adrian Chmielewski, Faculty of Civil Engineering, Warsaw University of Technology

SINGLE-FAMILY HOUSES THERMAL MODERNISATION SCENARIOS

The scope of thermal modernisation measures influences a change in characteristics of single-family buildings and the necessary labour demand alike. As it is impossible to determine in advance the scope of measures taken as a result of anti-smog resolutions entered into force in the voivodships of małopolskie and śląskie, four different scenarios are taken into account.

The first scenario assumes that house owners and administrators will fulfil only their minimum obligation imposed by the resolutions, i.e. they will replace class 3 and 4 boilers as well as boilers that meet no emission standards whatsoever. The second scenario assumes that while replacing

a boiler, central heating and domestic hot water system will also be modernised. The third scenario assumes that apart from the replacement of a boiler and modernisation of central heating and domestic hot water system, solar collectors will also be installed. Finally, **the most challenging scenario (IV) assumes that the above-mentioned modernisations connected with heat supply will be accompanied by building comprehensive insulation: insulation of external walls, roof, ground level floor or ceiling above the basement and replacement of windows. In terms of energy efficiency and low-stack emission reduction, it is the most desirable scenario.** Anti-smog resolutions indicate various time horizons for different class boilers but accessible data do not enable us to estimate the share of particular classes in the current stock of boilers. Therefore, in order to facilitate comparisons between the scenarios, it is assumed for each of them that selected interventions included in a given scenario will be implemented within 10 years on the entire stock of single-family houses – in the case of interventions concerning heat sources, on the entire stock of houses equipped with stoves and in the case of walls insulation, in all uninsulated buildings. It is simultaneously assumed that interventions not included in a given scenario will be conducted in the current pace.

Housing stock subject to modernisation

Voivodship	Buildings erected before 1970		Buildings erected after 1970	
	Uninsulated buildings in total	Buildings equipped with solid-fuel stoves (insulated and uninsulated)	Uninsulated buildings in total	Buildings equipped with solid-fuel stoves (insulated and uninsulated)
Małopolskie	83 458	190 573	107 042	244 427
Śląskie	146 331	234 569	146 869	235 431

Source: Data obtained from the CEM Market and Public Opinion Research Institute and from the Marshal's Office of the Śląskie Voivodship, divided into the buildings erected before and after 1970 in accordance with the National Census 2011.

The scenarios are analysed with reference to the base scenario, i.e. the annual pace of thermal modernisation measures that would be taken regardless of the adopted anti-smog resolutions. **On the basis of data obtained from the Central**

Statistical Office*, the annual pace of conducting insulation works was estimated at 2.7%** in the case of buildings erected before 1970 and at 1.7% in the case of buildings erected after 1970. As the decision on building insulation is not always accompanied by modernisation of heat sources, it is assumed that the natural pace of replacing boilers, modernisation of central heating and domestic hot water system as well as installation of solar collectors is 50% slower than the pace of insulation works, i.e. 1.3% per year for buildings erected before 1970 and 0.8% per year for buildings erected after 1970 (accessible data do not enable a more accurate estimation).

* Research on household budgets and survey on consumption of fuels and energy in households, 2012 and 2015.

** With reference to the entire stock of a given type of buildings, insulated and uninsulated ones.

Thermal modernisation scenarios in single-family houses located in the voivodships of małopolskie and śląskie	Intervention pace			
	Boiler replacement	Modernisation of central heating and domestic hot water systems	Installation of solar collectors	Insulation of external walls, roof, ground level floor or ceiling above the basement and replacement of windows
Base scenario	natural	natural	natural	natural
Scenario I – basic	accelerated – the entire stock modernised within 10 years	natural	natural	natural
Scenario II – intermediate	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years	natural	natural
Scenario III – intermediate with RES elements	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years	natural
Scenario IV – advanced	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years	accelerated – the entire stock modernised within 10 years

Source: Own analysis

LABOUR MARKET MODEL

We have used a labour market model that provides projections of employment and labour supply in Poland and in particular voivodships, altogether and by employees' qualifications. The projection is based on the Central Statistical Office population forecast and encompasses the period until 2030. This model description can be found in the methodological report available on the IBS website.