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The Costs of Obtaining Geothermal Energy in the Municipal Sector in Relation to the Purchasing Power of Money Under Polish Conditions

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ABSTRACT

The work compares the costs of obtaining energy for municipal purposes for geothermal and conventional energy based on the commercial price of energy carriers. Costs of energy were compiled and correlated with the average income of households. The results obtained were compared with those compiled using the same methodology for selected European countries. The obtained results allow comparing the purchasing power of money in the context of the energy needs in the municipal sector. The comparison of the cost of acquisition of geothermal and conventional energy under Polish conditions were also estimated.

1. INTRODUCTION

The paper estimates the total cost for the purchase of thermal energy by a final user. We assumed the purchase of energy from a district heating cooperating with heating plants utilizing conventional energy and geothermal. Conventional primary energy carriers considered were: solid fuel, natural gas and heating oil. The purpose is to compare prices and purchasing force of average salary for domestic purpose. This publication upgrades previous publications on the same subject (Pająk and Bujakowski 2007 and 2011) with the modification of the methodology. A more detailed description of the methodology can be found in the publication by Pająk and Bujakowski (2013).

2. STATEMENT OF BILLING TARIFFS FOR THERMAL ENERGY OBLIGATORY FOR POLISH GEOTHERMAL INSTALLATIONS

Five geothermal installations are operating in Poland for the purpose of exploiting the geothermal water with temperatures above 40°C for heating. Their characteristics are included in the operational data compiled in literature (Bujakowski 2009). These installations meet the needs of municipal thermal energy consumers. The four biggest installations (Podhale, Pyrzyce, Stargard Szczeciński i Mszczonów) sell the thermal energy based on the obligatory billing tariffs - in the same way as for the heating plants using conventional fuels. These tariffs for all geothermal and selected conventional energy sources are summarized in Table 1. Originally prices and costs are given in the Polish currency "zł"(1 $ ≈ 3,06 zł and 1 € ≈ 4,17 zł).

Based on the Table 1 projected net energy purchase price, the valid final user price was determined. This price included both a fee for the energy itself and charges related to the transmission and distribution of energy. Defined total net costs of energy for a final energy user in Figure 1 are shown.

The net purchase price for the thermal energy for the final user was estimated in the year 2013 as follows:

- For installations based on conventional energy carriers: from 10 to 27,8 €/GJ (Figure 1, from 10 to 16.3 €/GJ for coal, 18.5 to 20.5 €/GJ for natural gas and from 21.1 to 27.8 €/GJ for oil),
- For geothermal energy: from 11 to 20 €/GJ.

Energy from geothermal installations has not a higher price than energy from conventional sources. Price of purchase may be comparable to the price of energy from natural gas and the prices of energy from coal in some cases.

3. THE PURCHASING FORCE OF SALARY RELATED TO THERMAL ENERGY PRICE

Average demand for energy consumed for central heating in Polish conditions is about 0.35 GJ/(m^2 year). Households consume extra energy for hot water preparation in an amount of about 4 GJ/(person · year). Assuming a family model consisting of two working parents and two children, average expenses incurred in order to satisfy the above-mentioned energy needs can be assessed.

In 2011, the average floor area per capita in urban areas was in Poland about 25 m^2/person (Central Statistical Office 2013). In 2010, the average gross salary equaled (Central Statistical Office 2013) about 850 €/(person · month) – with net value estimated as 608 €/(person · months).

Based on Figure 1, the gross costs of energy associated with municipal installations are as follows:

- For Polish geothermal installations: from 692 to 1249 €/year,
- For conventional energy sources: from 632 to 1745 €/year.

Average annual expenses incurred in order to meet the energy needs in relation to income can be assumed from 1 up to almost 3 average monthly salaries.

Table 1. Statement considering billing tariffs for the end-user for selected heating companies (June 2013)

Type of the tax / Acronym of tarrifs account	Charge of ordered power [€/MW/yr]	Charge for energy [€/GJ]	The price of energy carriers [€/m^3]	Transfer fee [€/MW/yr]	Variable rate transmission fee [€/GJ]
Geotermia Pyrzyce (A)	32094,07	9,47	5,28	8971,24	3,24
Geotermia Pyrzyce (B)	32094,07	9,47	5,28	6715,25	2,44
Geotermia Pyrzyce (C)	32094,07	9,47	5,28	8168,81	3,38
Geotermia Mazowiecka (M1)	26840,17	10,02	2,56	6429,50	2,58
Geotermia Podhalańska (M1)	17988,12	5,75	4,08	9206,54	2,66
Geotermia Podhalańska (M2)	17988,12	5,75	4,08	10546,97	3,80
Geotermia Podhalańska (M3)	17988,12	5,75	4,08	13394,83	4,92
Geotermia Podhalańska (G)	12748,52	3,93	0,70	0,00	0,00
PEC Stargard (B1 PEC Stargard Szczeciński)	15001,15	6,81	11,57	3558,48	2,12
PEC Stargard (B2/1 PEC Stargard Szczeciński)	15001,15	6,81	11,57	7067,14	3,45
PEC Stargard (B2/2 PEC Stargard Szczeciński)	15001,15	6,81	11,57	5728,30	3,01
PEC Stargard (B3 PEC Stargard Szczeciński)	15001,15	6,81	11,57	7484,15	3,66
Dalkia W-wa S.A. (A22/B1)	31352,37	17,43	0,00	0,00	0,00
MPEC Kraków (KO)	30541,61	22,32	0,00	0,00	0,00
MPEC Kraków (KG)	28298,22	15,16	0,00	0,00	0,00
Dalkia W-wa S.A. (A12/B1/C3)	24003,68	14,06	2,87	4377,84	1,39
Geotermia Mazowiecka (S1)	28167,26	7,76	2,13	7856,64	2,30
Dalkia W-wa S.A. (A15/B1/C1)	16178,01	7,53	1,03	1883,83	0,91
Dalkia W-wa S.A. (A3/B1/C211)	12403,51	4,74	1,37	8493,15	2,83

4. COMPARISON OF ENERGY PRICES AND PURCHASING POWER OF MONEY TO OTHER EUROPEAN COUNTRIES

The average annual net salary for selected countries in the years 2011/2012 is shown in Figure 2. Figure 3 shows the price of final energy (taking into account the efficiency of used equipment). Based on that data the purchasing force of a salary related to the energy carrier were estimated and shown in figure 4.

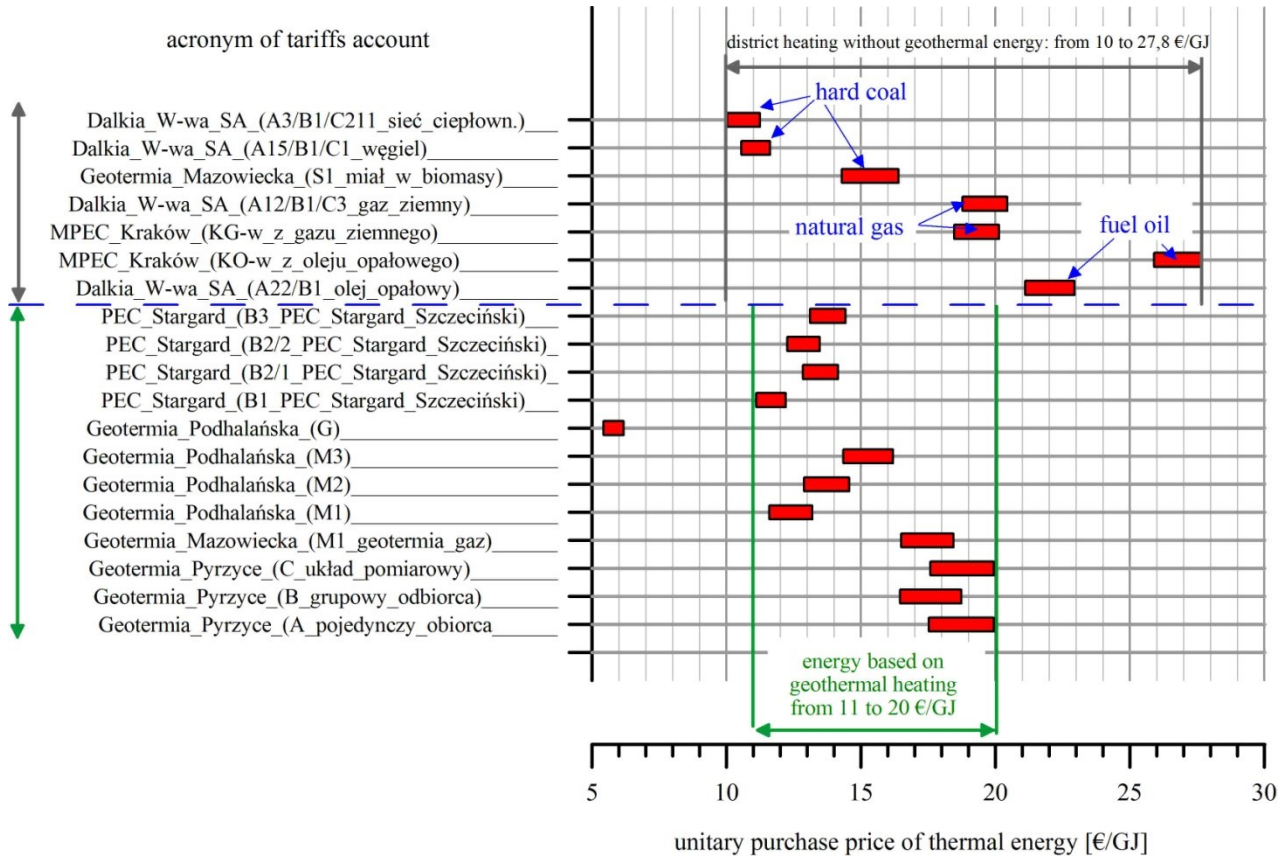

Figure 1. Graphical comparison of the projected unit price of thermal energy for the final user for the analyzed thermal energy suppliers – (June 2013; based on Table 1)

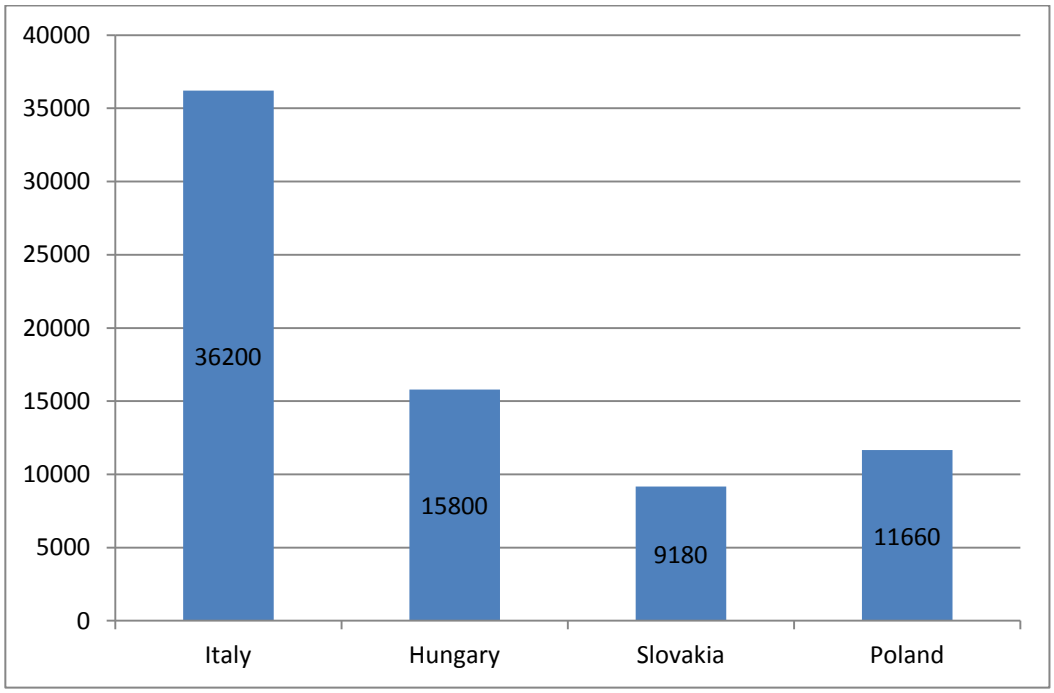

Figure 2. The average annual net salary [€/year] for selected countries in the years 2011/2012, according to data from http://www.averagesalarysurvey.com/article/average-salary-in-eu/26025059.aspx

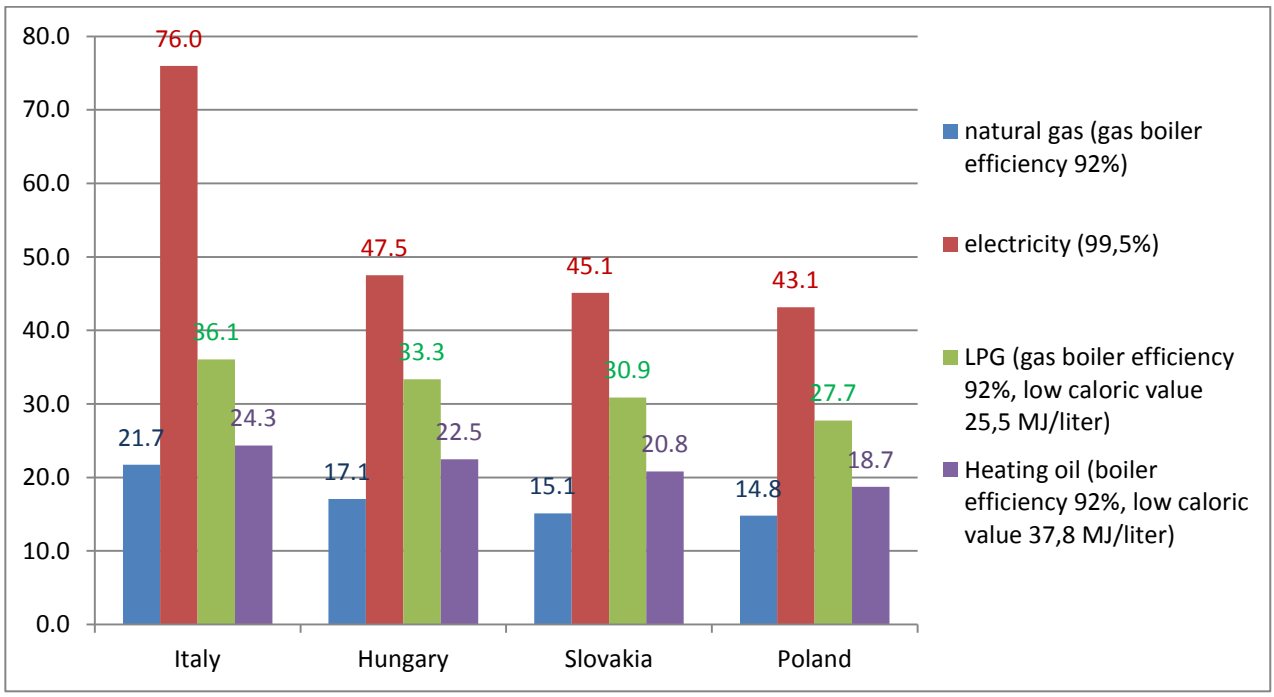

Figure 3. Price of final heat contained in a carrier including efficiency of equipment (boilers, heater) [€/GJ] based on: http://www.energy.eu/

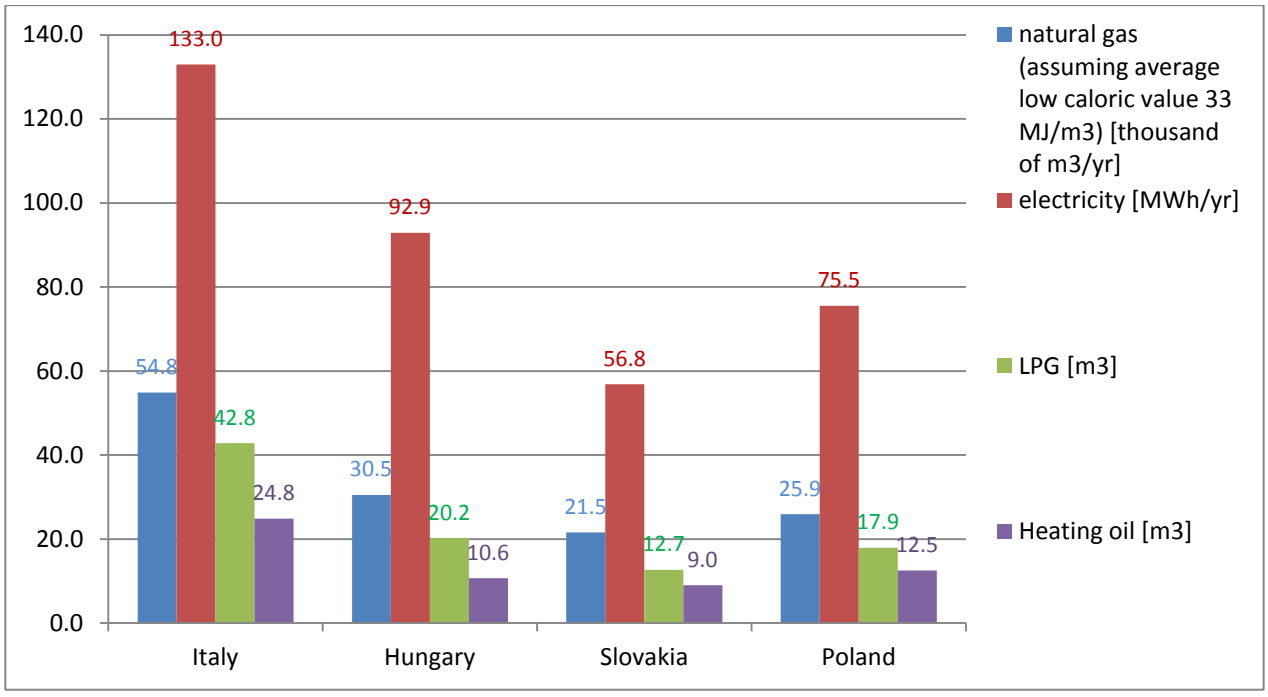

Figure 4. Purchasing force of a salary, how many energy carriers might be bought by a yearly salary (based data included on figures 2 and 3)

SUMMARY

Prices of thermal energy supplied by the Polish geothermal heating plants do not exceed the price of energy derived from conventional carriers. These prices can be comparable with the prices of energy from natural gas (Figure 1). The average household (described in the article) assigns annually from 1 to 3 average monthly salaries to buying the thermal energy. In case of geothermal energy this range is closer to one or two monthly salaries yearly. The costs of obtaining thermal energy in Poland is not high compared to some other European countries (Figure 3). Due to the high purchasing power in the case of the more developed countries - such as in Italy (Figure 2), the purchasing power of the average wage is much lower (Figure 4).

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