

Energy Management in the Housing Sector in Poland

Example from Warsaw

The example is a demonstration project concerning additional insulation of the building envelope done in connection to renovation of the outer walls. The demonstration buildings are located in the suburb "Na Skraju" located south east of the centre of Warsaw and not far from airport.

Two buildings were chosen; one renovated building "the Experimental building" at Przybylskiego 7 and a reference building at Przybylskiego 12.

Description of the buildings



The demonstration project at Przybylskiego 7 includes external insulation of the building envelope. The technical installations are renovated with new heat exchangers for Domestic Hot Water and for the space heating with a radiator system. The supply temperature for the radiator system is controlled automatically according to the ambient temperature. The temperature of the Domestic Hot Water is controlled by an electronic controller according to a desired temperature.

The key figures for Przybylskiego 7 are:

Volume:	m ³	5601,40
Height:	m ²	12,80
Flat Area:	m ²	1173
Gross area:	m ²	1750
Number of floors:		4
Number of inhabitants:	of	57
Building type:		Multi family
Construction type:		prefabricated panels
External walls:		insulation 10 cm, mineral wool
Roof:		insulation 20 cm, Ekofiber

At the reference building at Przybylskiego 12, no renovation has taken place.

The key figures for this building are:

Volume:	m ³	5601,40
Height:	m	12,80
Flat Area:	m ²	1173
Gross area:	m ²	1750
Number of floors:		4
Number of inhabitants:	of	63
Building type:		multi-family
Construction type:		panel building
External walls:		no insulation
Roof:		no insulation

In both buildings heat meters are installed for measurements of heat supply for Domestic Hot Water and for space heating and both buildings are supplied with heat from the district-heating network.



The heat exchanger at Przybylskiego 7 for Domestic Hot Water.

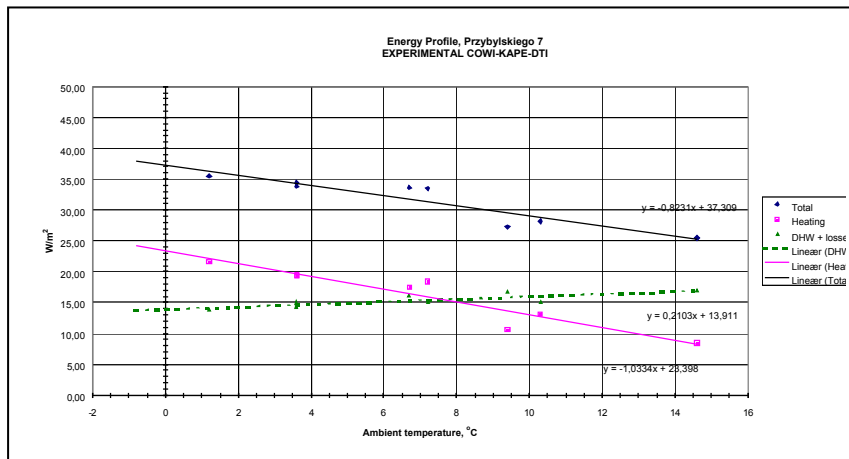
Example of measurements and making an energy profile

The heat consumption in both buildings has been recorded on weekly basis from February 1999 to April 1999 and for the same periods in year 2000. The ambient temperature was recorded with a data-logger on the location on hourly basis in the same periods.

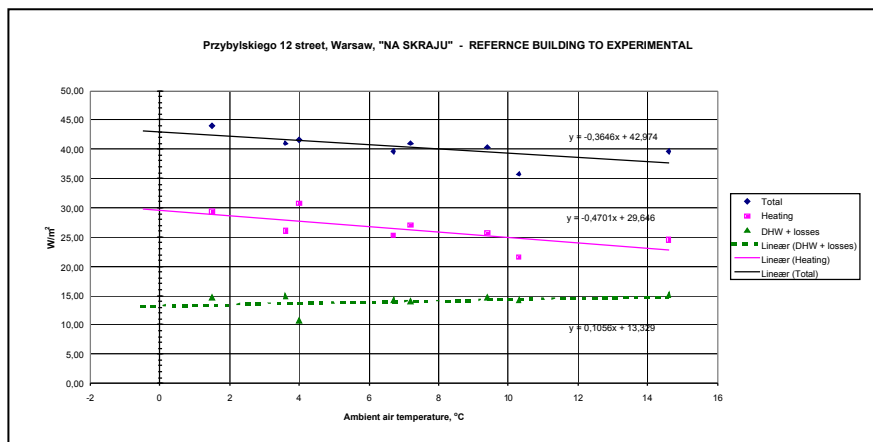
It is possible to measure the heat consumption for Domestic Hot Water separately in both buildings. The consumption is very much alike and represents an average effect of approximately 15 W/m².

Based on these records the average effect for each interval of meter readings was calculated and plotted against the average ambient temperature for the same period of time.

The result for Przybylskiego 7 was as follows:



And the result for Przybylskiego 12 was as follows:



The heat consumption for Domestic Hot Water is very much alike in the two buildings; around 15 W/m². This is approximately the double as for the demonstration buildings in Gdańsk (following example). The reason for this is assumable a higher temperature level in the hot water system and therefore much higher heat losses from the circulation system.

When comparing the energy consumption for space heating, the experimental building has consumption, which is approximately 40% less than the reference building.

Looking at this in isolation it is impressive, but the potential for energy savings, even at the demonstration building is still large.

Conclusion and calculation of energy saving potential

Looking at the energy profile for Przybylskiego 7, the experimental building, the energy saving potential compared to the energy profile at figure 1 is very large. The total consumption at an ambient temperature of 16 °C (no space heating) should not exceed 10 W/m² (normal Domestic Hot Water consumption). The total consumption is, however, 25 W/m². The saving potential during the transition period (spring and autumn) is thus some 15 W/m²

The total consumption at the ambient temperature of zero, the consumption should not be more than 25 W/m² and it is measured to 37 W/m² - this indicates an energy saving potential of 12 W/m². In average during the whole year it would be around 13 W/m².

This 13 W/m² represents, however, 114 kWh/m² per year, and in total for the 1750 m² this amount to approximately 200,000 kWh/year or equivalent to 20,000 litres of oil. In this case no investments are needed – only the man-hours to identify the reason for the additional consumption. Most likely – based on experience – the control system for the supply temperature should be checked and adjusted and the same for the Domestic Hot Water system (the energy consumption for DHW is the double compared to Gdańsk and to similar measurements in Denmark).

The figures from the Energy Profile indicate that the saving potential is equal for the DHW supply and for the space heating supply. The energy saving could easy finance such a check and adjustment.

Looking at the energy profile for Przybylskiego 12 the energy saving potential is in average approximately 22 W/m² compared to the same reference as Przybylskiego 7 (-3 W/m² because of no thermorenovation of the envelope). The total energy saving potential is therefor approximately 1.7 times higher or approximately 340,000 kWh per year. This is equivalent to 34,000 litres of oil. In this case investments are needed. As an estimate the establishment of a unit for controlling the supply temperature to the radiator system could most likely be installed for an amount equivalent to a ½ year energy savings.

Example from Gdańsk

The example is a demonstration project concerning additional insulation of the building envelope done in connection to renovation of the outer walls. The demonstration buildings are located in Gdańsk-Oliwa.

Description of the buildings

Also the example from Gdańsk is a demonstration project partly finances by the Danish Government.

In 12 of April 99 a monitoring of heating consumption commenced in two blocks of flats. Both of them are after thermomodernisation, but the level of it is different for each house.

In first house located at Piastowska 159 modernisation of heating installation was done (i.e. new heat exchangers, pumps, valves with thermostatic heads on radiators, automatic control and heat measuring). Thermal insulation of external walls was added.

In second house located at Piastowska 163, additionally to used in first house steps of thermorenovation, balancing valves on riser pipes, tightened all windows and changed outer doors were added.

The buildings consist of five storey apartment blocks. Both of them are supplied with heat for space heating and for Domestic Hot Water from a district heating plant and equipped with energy meters.

At the renovated building the connection to the district heating system has been changed to indirect connection via heat exchangers for space heating and Domestic Hot Water. The supply temperature for the radiator system is regulated according to the ambient temperature.

All changes are made in the basement of the building and the construction consists of a prefabricated unit. However, in the flats, heat allocation meters are installed at the radiators.



From the Demonstration project in Gdańsk. The buildings at the front have been thermorenovated and the building in the back as it looked before thermorenovation.

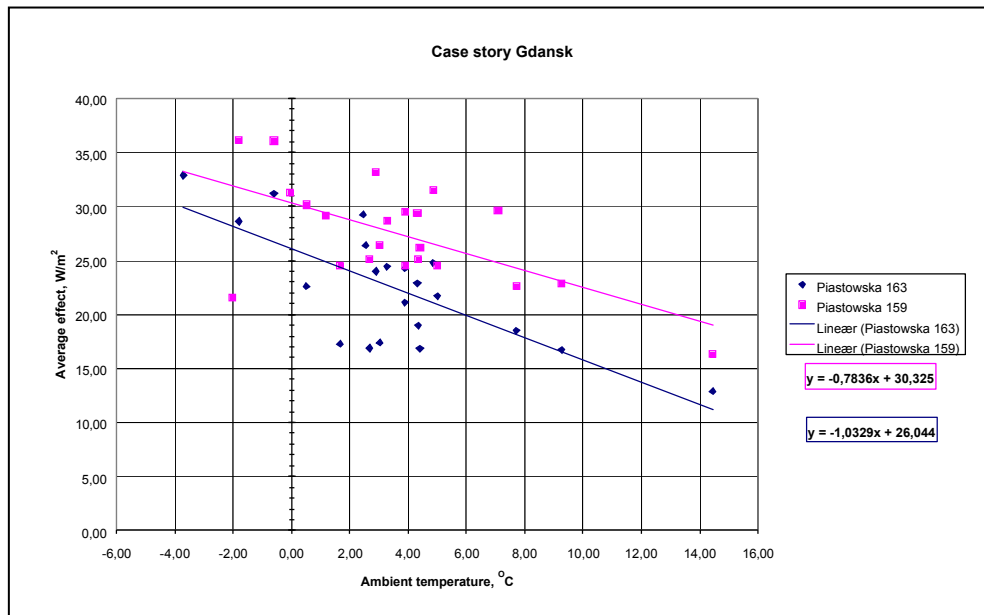
The demonstration building is located at Piastowska 163 and is inhabited with 185 people. The reference building is located at Piastowska 159 and is inhabited by 220 people. Both buildings have a total floor area of 4820 m².

Example of measurements and making an energy profile

The heat consumption in both buildings has been recorded on a weekly basis from November 1999 to April 2000 and the ambient temperature was recorded with a data-logger on the location on an hourly basis in the same period.

It is possible to calculate / measure the heat consumption for Domestic Hot Water in both buildings. The consumption is very much alike and represents an average effect of approximately 7 W/m².

Based on these records the average effect for each interval of meter readings was calculated and plotted against the average ambient temperature for the same period of time.



Energy Profiles from the case buildings in Gdańsk

Conclusion and calculation of energy saving potential

Looking at the energy profile for Piastowska 163, the case building the energy saving potential compared to the energy profile is very modest. However, the consumption at an ambient temperature of 16 °C (no space heating) should not exceed 7 W/m² (the measured Domestic Hot Water consumption. The total consumption at the ambient temperature of zero, the consumption should not be more than 25 W/m² - it indicates an energy saving potential of only 1 W/m² in average during the whole year.

This 1 W/m² represents, however, 8,76 kWh/m², and in total for the 4820 m² this amount to approximately 42,000 kWh/year or equivalent to 4200 litres of oil. In this case no investments are needed – only the man-hours to identify the reason for the additional consumption. Most likely – based on experience – the control system for the supply temperature should be checked and adjusted. The energy saving could easy finance such a check and adjustment.

Looking at the energy profile for Piastowska 159 the energy saving potential is in average approximately 7 W/m² compared to the same reference as Piastowska 163. The total energy saving potential is therefor approximately seven times higher or approximately 300,000 kWh per year. This is equivalent to 30,000 litres of oil. In this case investments are needed. As an estimate the establishment of a unit for controlling the supply temperature to the radiator system could most likely be installed for an amount equivalent to a ½ year energy savings.

The conclusion from this case is that it is feasible to start up an Energy Management system – the expected energy saving is much higher than the cost for the consultant fee. This is also the case when having a newly renovated building. In the long run, having a regular check of the energy consumption can be financed by ensuring that the energy consumption does not increase by only ½ W/m².

Organisational aspects

The conclusions from both cases are that there is huge energy saving potentials involving no costs or relatively low investment costs.

From an organisational point of view there are some aspects to overcome:

First to establish a scheme where the energy consumption is mapped systematically and analysed in such a way that excessive use of energy is exposed. Hereafter, to organise systematically dissemination of the results for including more buildings in the scheme.

In general it will not include extra cost for the building owners, as the reduction in energy consumption will cause saving at the energy bill that is much larger than the fee for the consultant.

After having experience with running such a "pilot " scheme it might be mandatory for building owners to join the scheme. In Denmark similar schemes are mandatory for buildings of more than 1500 m² total heated area. The initiative to the schemes was taken of a governmental body - The Danish Energy Agency.

The scheme in Denmark is administrated by a secretariat. All energy consumption data and energy saving measures (costs and savings) are reported to the secretariat. In this way a very large material is collected to be used in future national energy planning and energy action plans.

Secondly, during the current project, it was exposed that the district heating companies (who apparently owns the equipment) limited the necessary access to the technical installation in the buildings (control equipment etc.). This organisational obstacle for further progress in the energy reduction activities should have high priority to be settled for the benefit of the customer's economy and the environment.