New approach to the assessment of dust emissions from home heating processes

Janina Fudala, Marian Cenowski, Ewa Strzelecka-Jastrzab
Institute for Ecology of Industrial Areas

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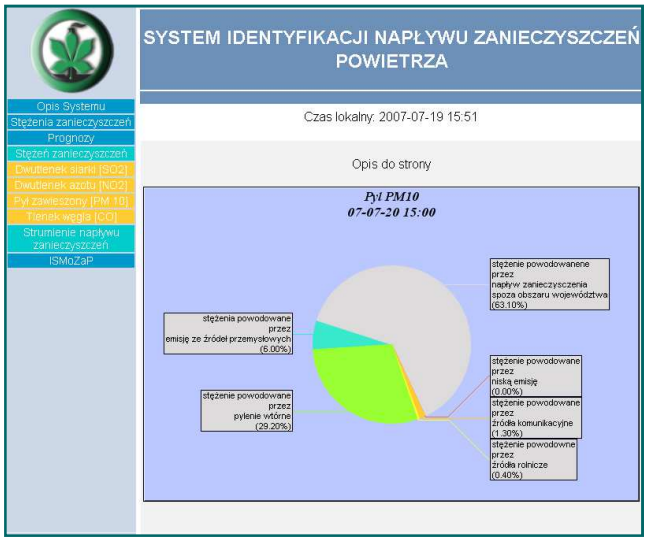
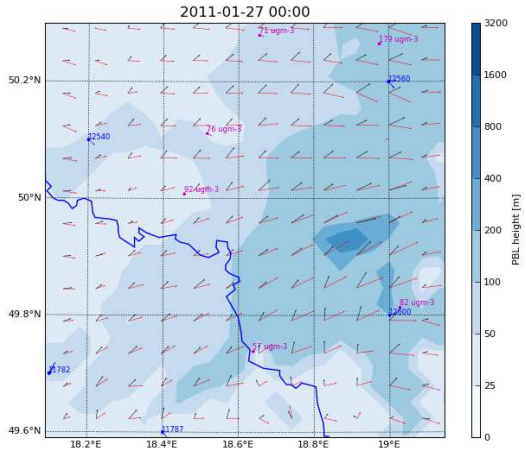
PRZEKRACZAMY GRANICE

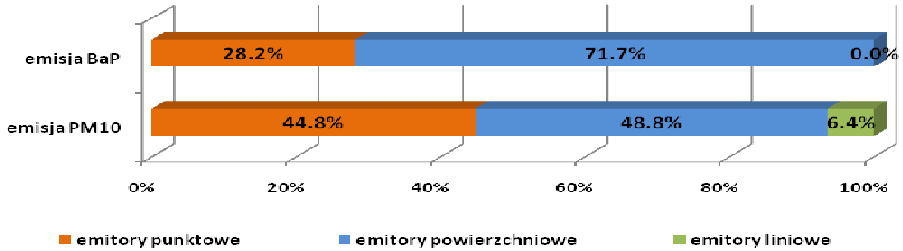


Katowice Monitorig Station – share of emission sources in PM10 concentrations

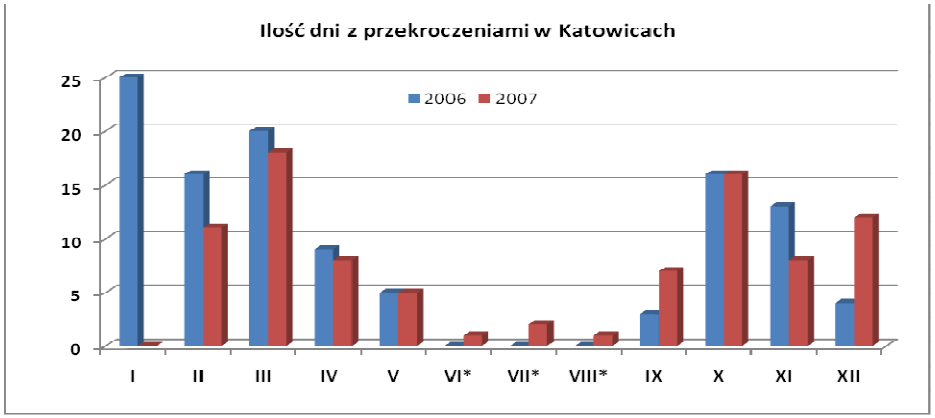


Air quality in Silesia Region is created by:

- meteorological conditions (thin mixing layer)
- long – range transport of pollutants with air masses
- low – level emission sources (municipal emissions)



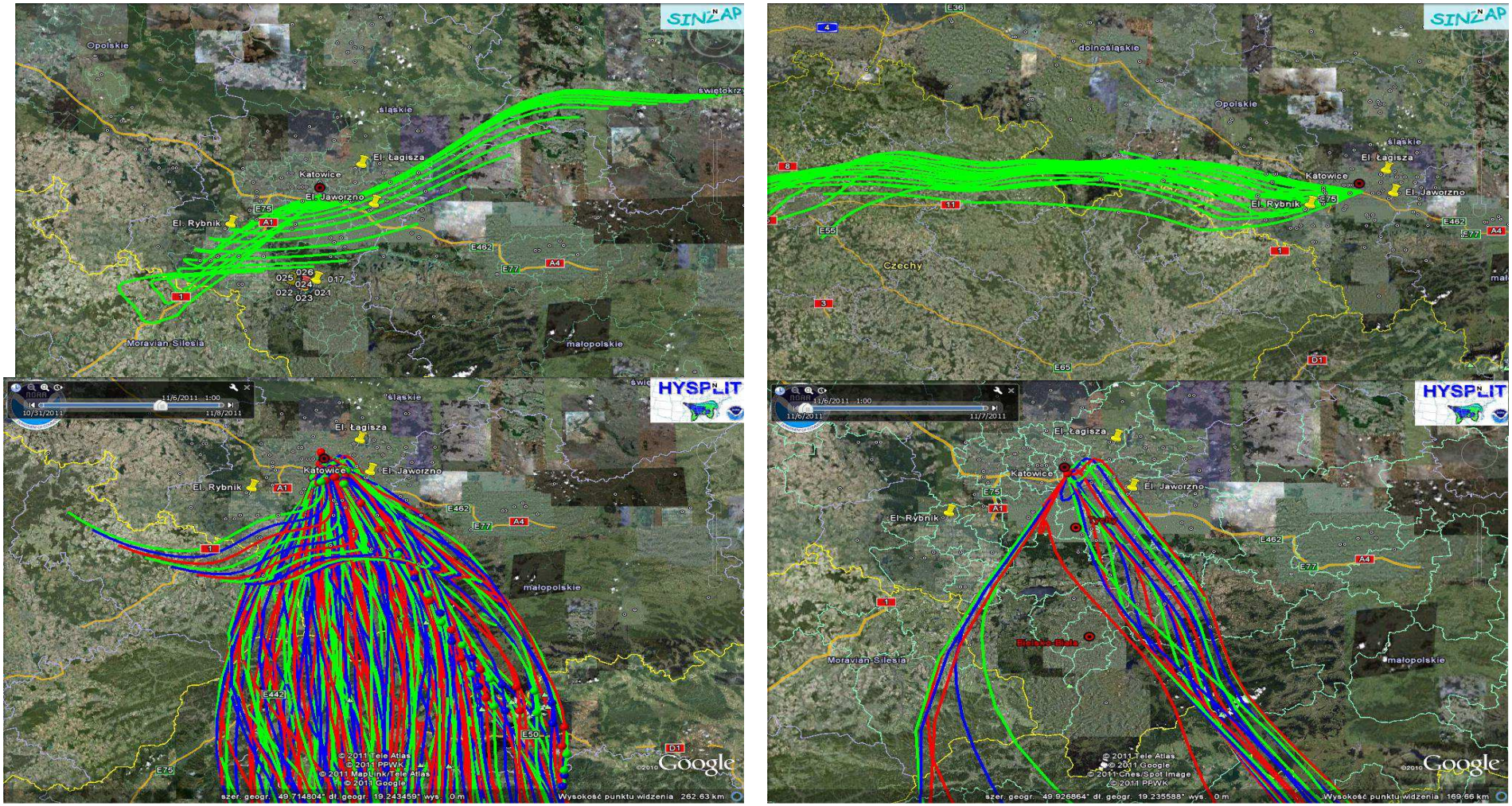
Structure of PM10 emission in Silesia Agglomeration *source: POP, Atmoterm, 2009*



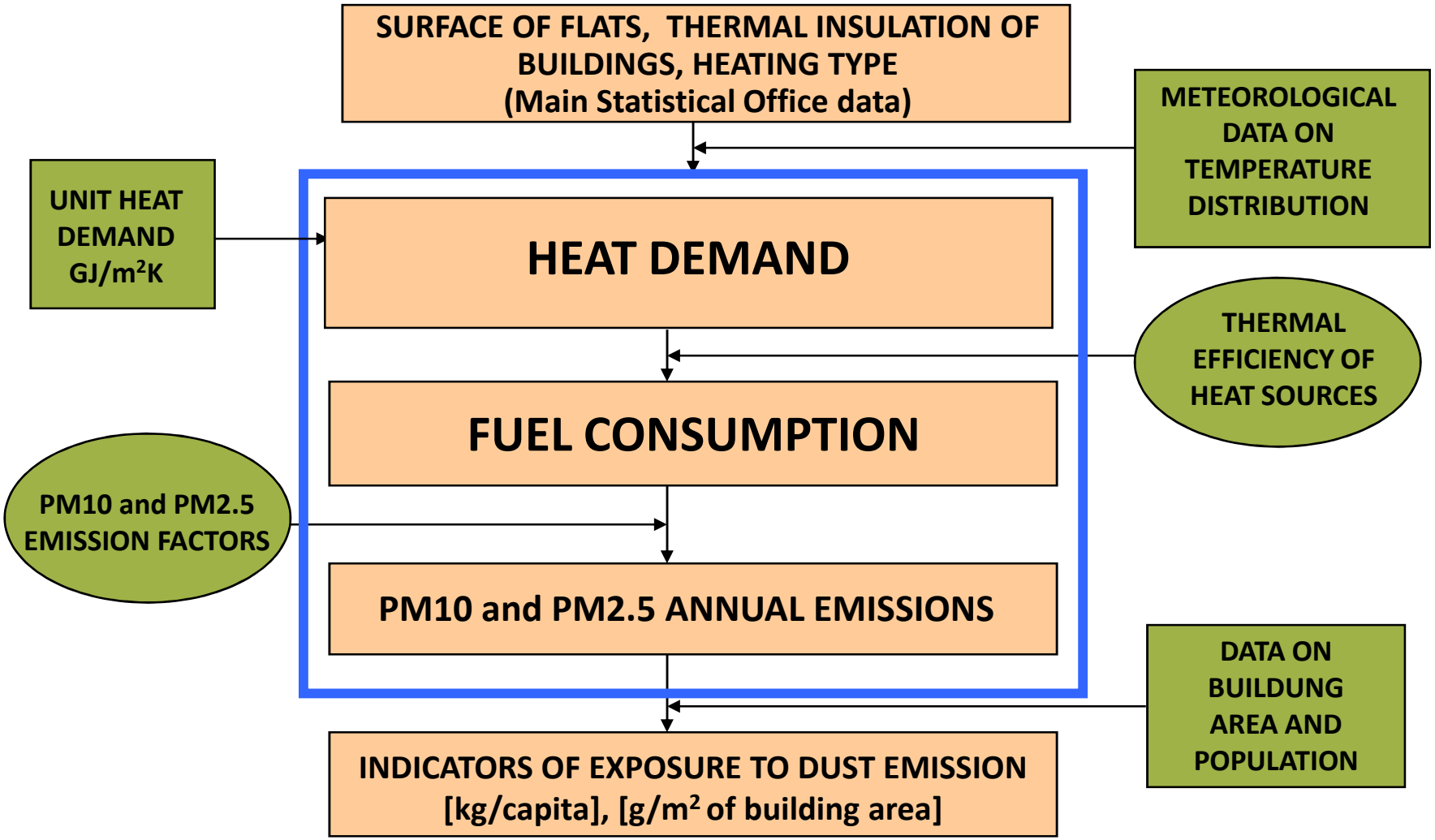
Number of days with exceedance of 24 – hours air quality standards
source : POP, Atmoterm 2009

Trajectories of air pollutants transport over

Silesia Voivodeship



PM10 and PM2.5 emission calculator calculation scheme

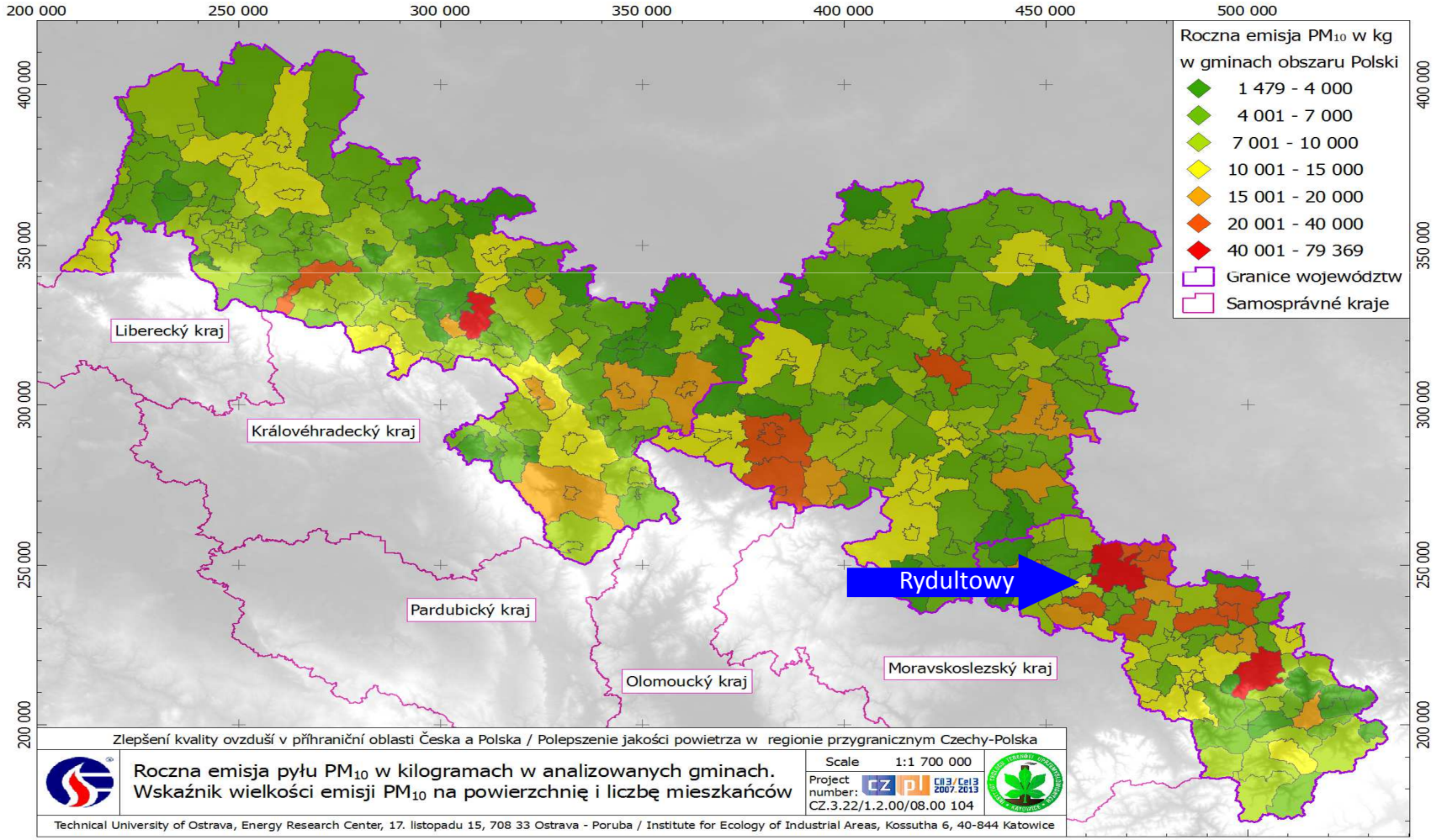


Data on heating types

The following types of heat sources were included in the analyses:

- central heating (network)
- coal stoves (tiled, cast-iron, kitchen, fireplace etc.)
- chamber coal boilers, old type
- chamber coal boilers, new type
- coal boilers with automatic control
- lignite boilers
- heat sources for gaseous fuels (natural gas, LPG)
- heat sources for liquid fuels (fuel oil, kerosene)
- heat sources for biomass
- electric heating

Results of the PM10 emission modelling from residential sources in the vicinity of Czech border

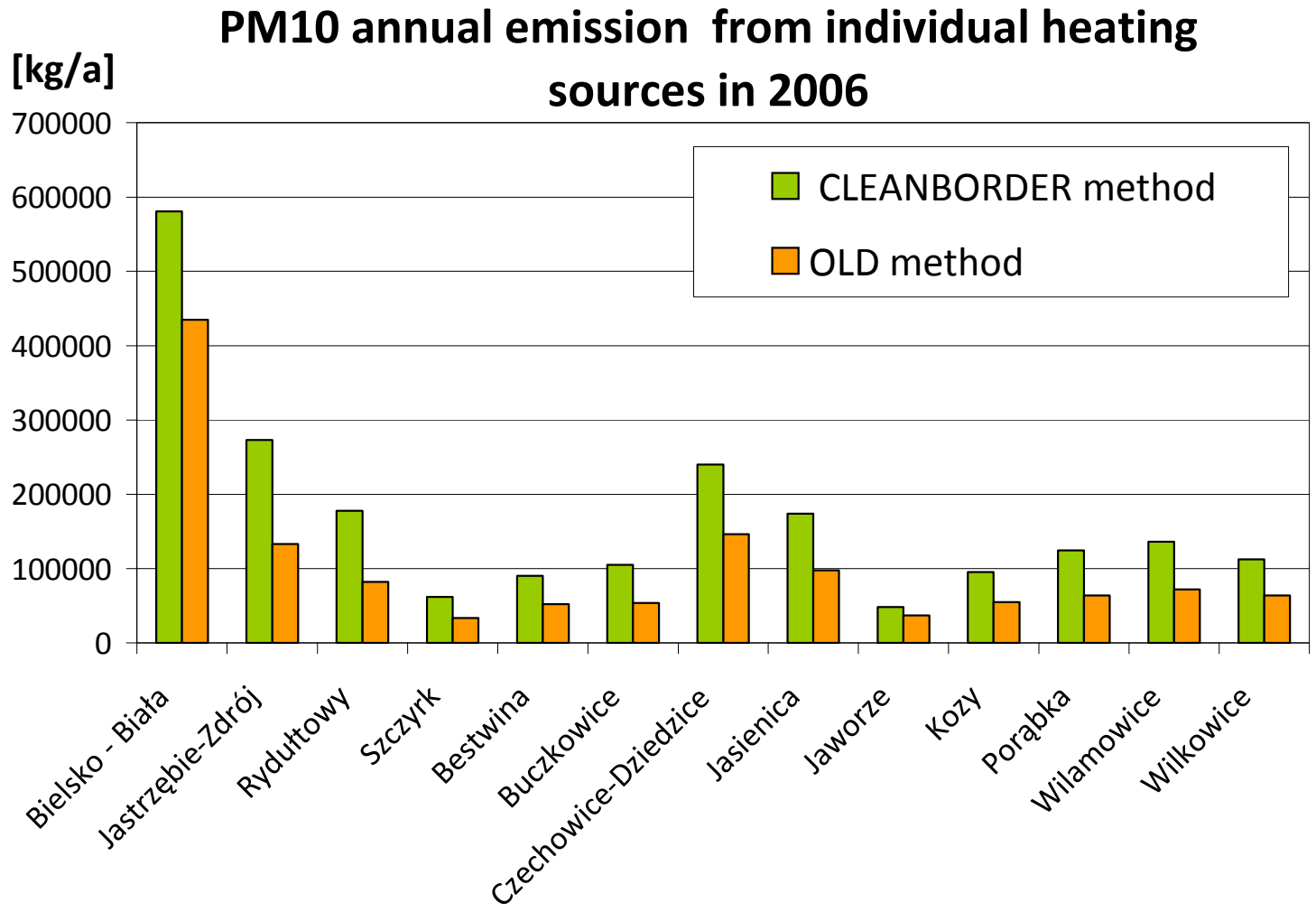


Municipalities of the Silesian Voivodeship with the largest emission of PM10 from small heating sources (2006)

City	Area [km^2]	PM10 emission [Mg/a]	PM10 emission [Mg/ km^2]
1. Rybnik	148.36	906	6.1
2. Bielsko-Biala	125	580	4.6
3. Jastrzebie-Zdroj	88.62	273	3.1
4. Rydultowy	14.95	178	11.9

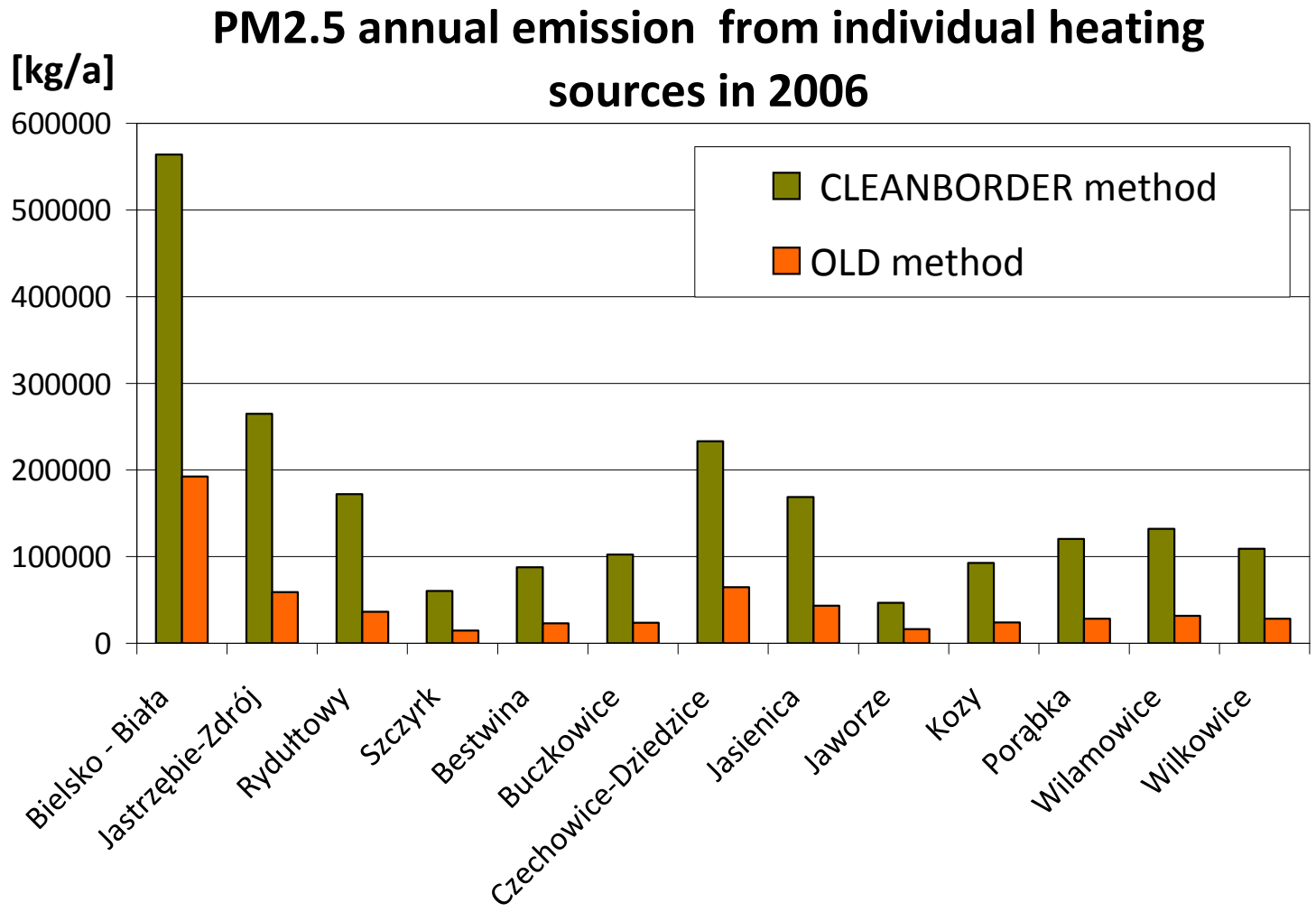
PM10 dust emission in chosen municipalities

The comparison of the results from two methods for emission estimating (CLEANBORDER and the old one)

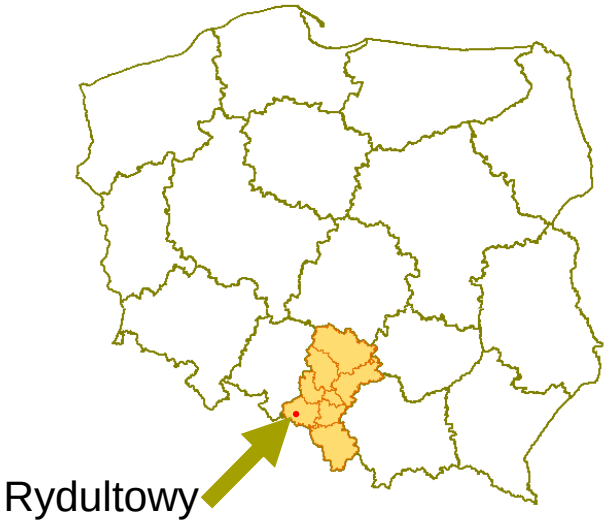


PM2.5 dust emission in chosen municipalities

The comparison of the results from two methods for emission estimating (CLEANBORDER and the old one)

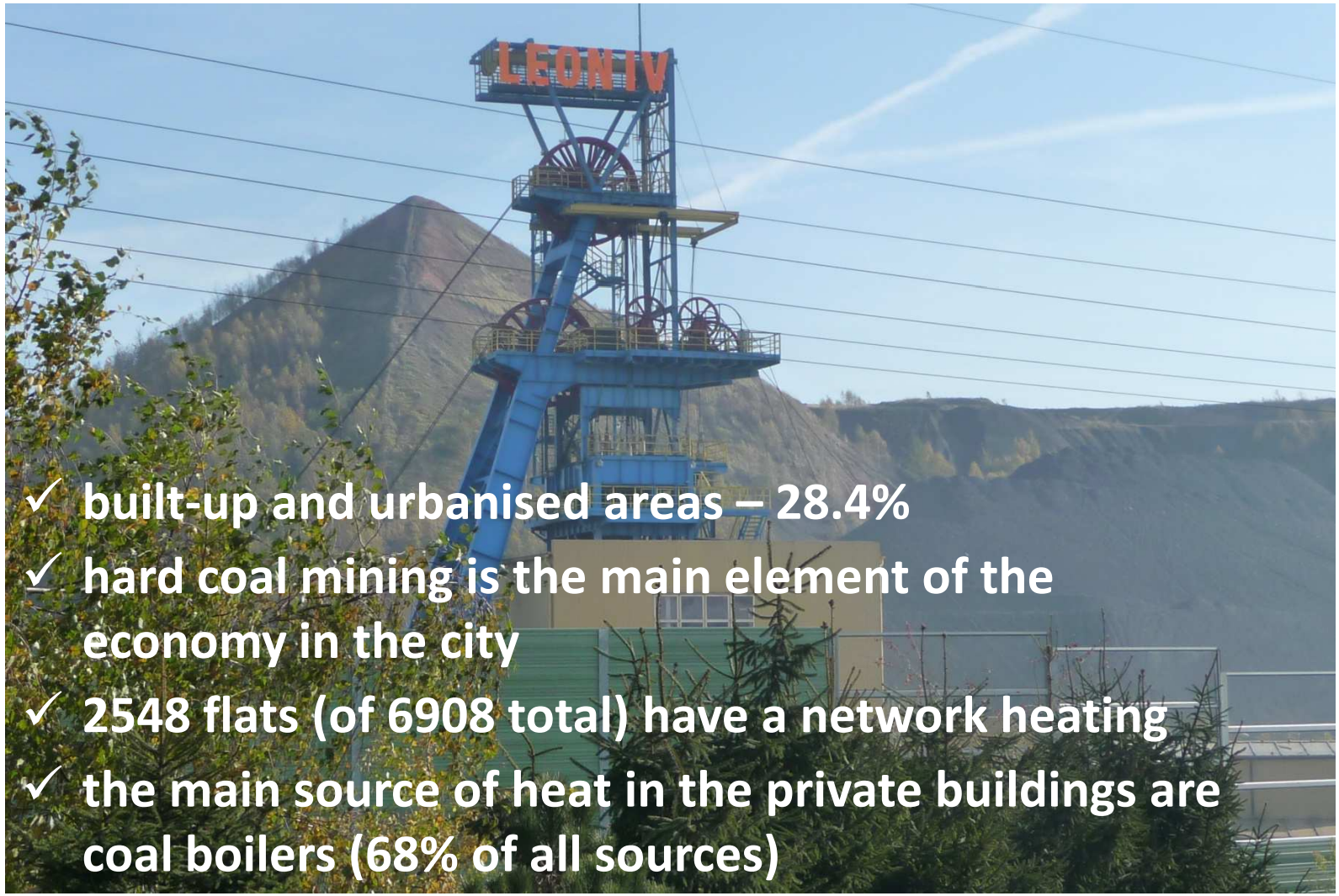


Location of Rydultowy



- ✓ area 15 km²
- ✓ population of 21 850 people

Characteristic of Rydultowy

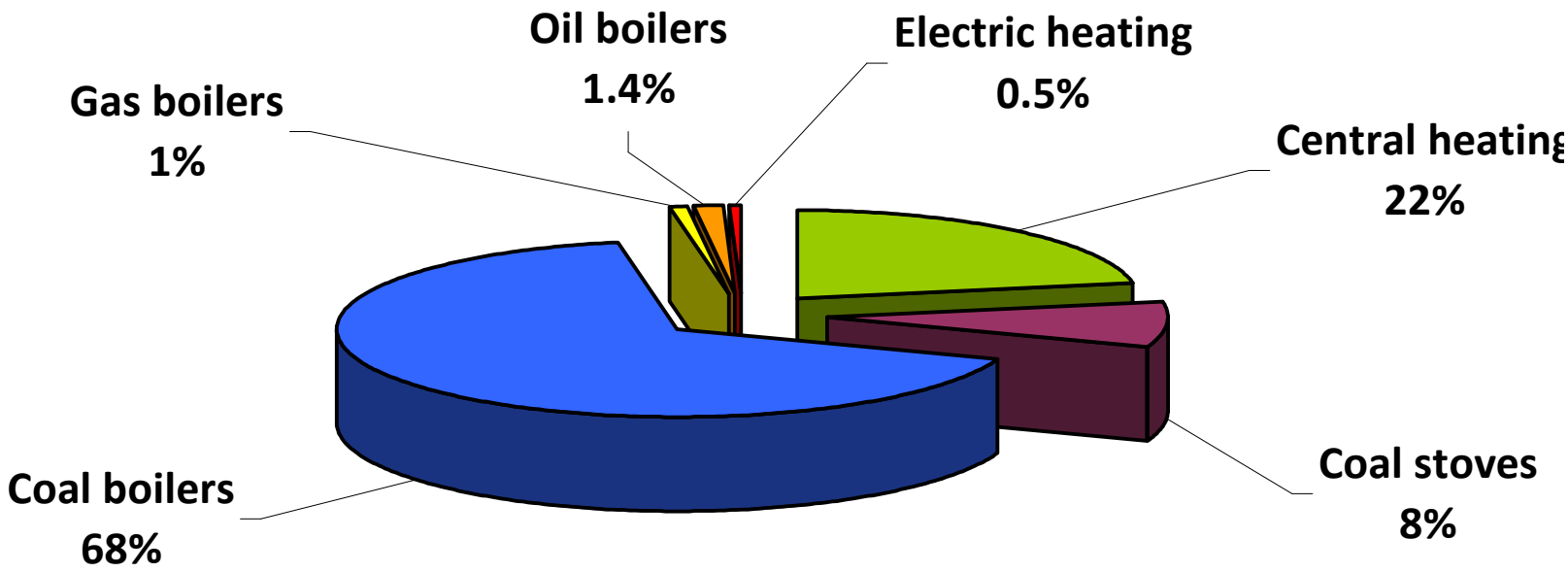


- ✓ built-up and urbanised areas – 28.4%
- ✓ hard coal mining is the main element of the economy in the city
- ✓ 2548 flats (of 6908 total) have a network heating
- ✓ the main source of heat in the private buildings are coal boilers (68% of all sources)

Air quality in Wodzislaw district

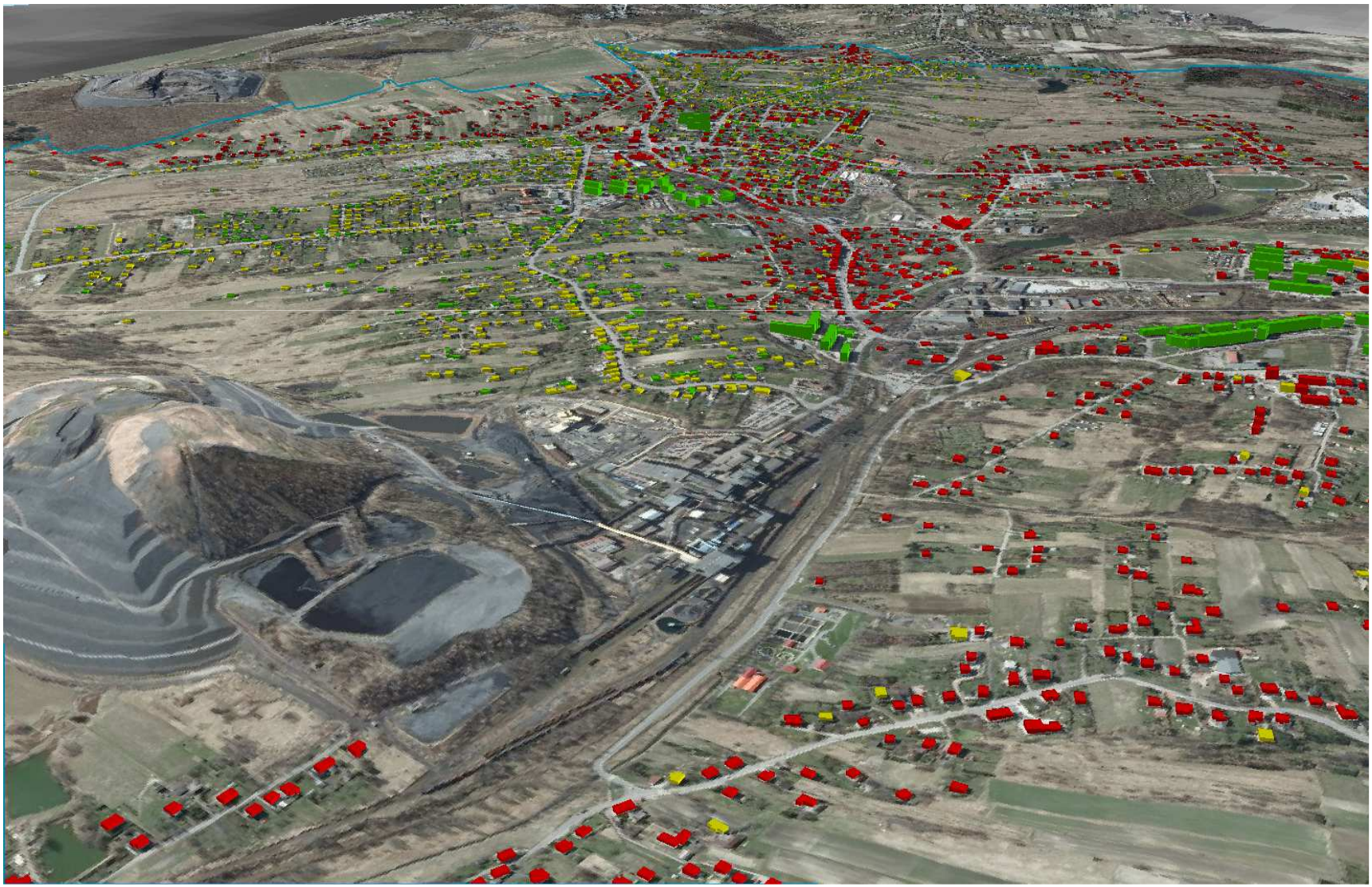
Average annual concentration of PM10 µg/m³			
Permissible level	Measured values		
	2006	2007	2012
40	73	58	65

Rydultowy - shares of different residential heating systems



Base on data of Main Statistical Office, Population and Housing Census 2002

Classification of residential buildings due to the type of heating



Classification of residential buildings due to the heat losses

Estimation of dust concentrations in the city and the choice of areas requiring emission reduction

The city was divided on 11 emission sub-areas. One receptor point was located in every sub-area.

For every receptor point:

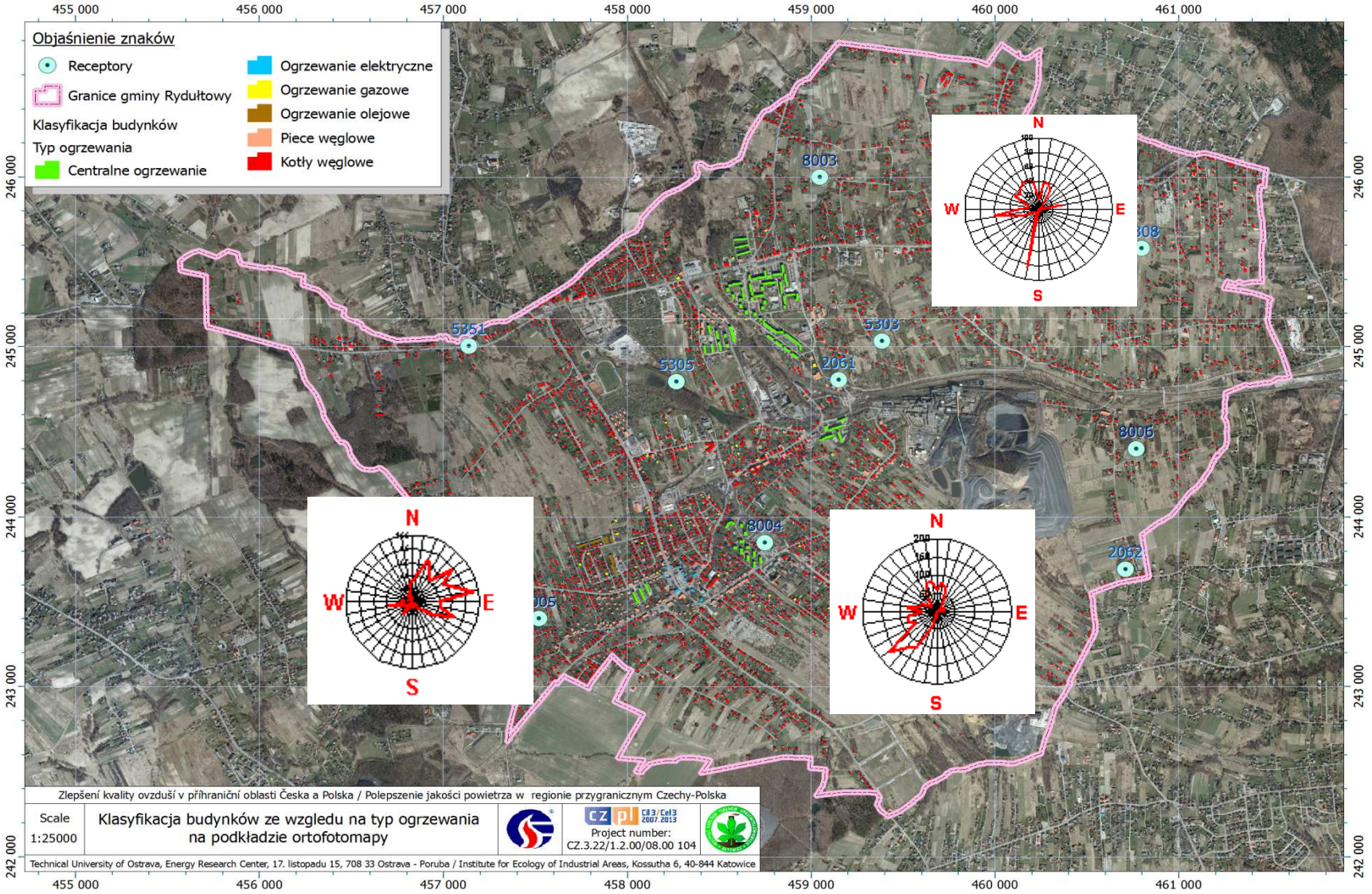
✓values of 24-hour concentration of PM10 caused by emission from residential sources for all analysed period of 2006 – 2007 were calculated,

✓analysis of the directions of dust inflow (in the case of concentrations > 25 ug/m^3) were performed,

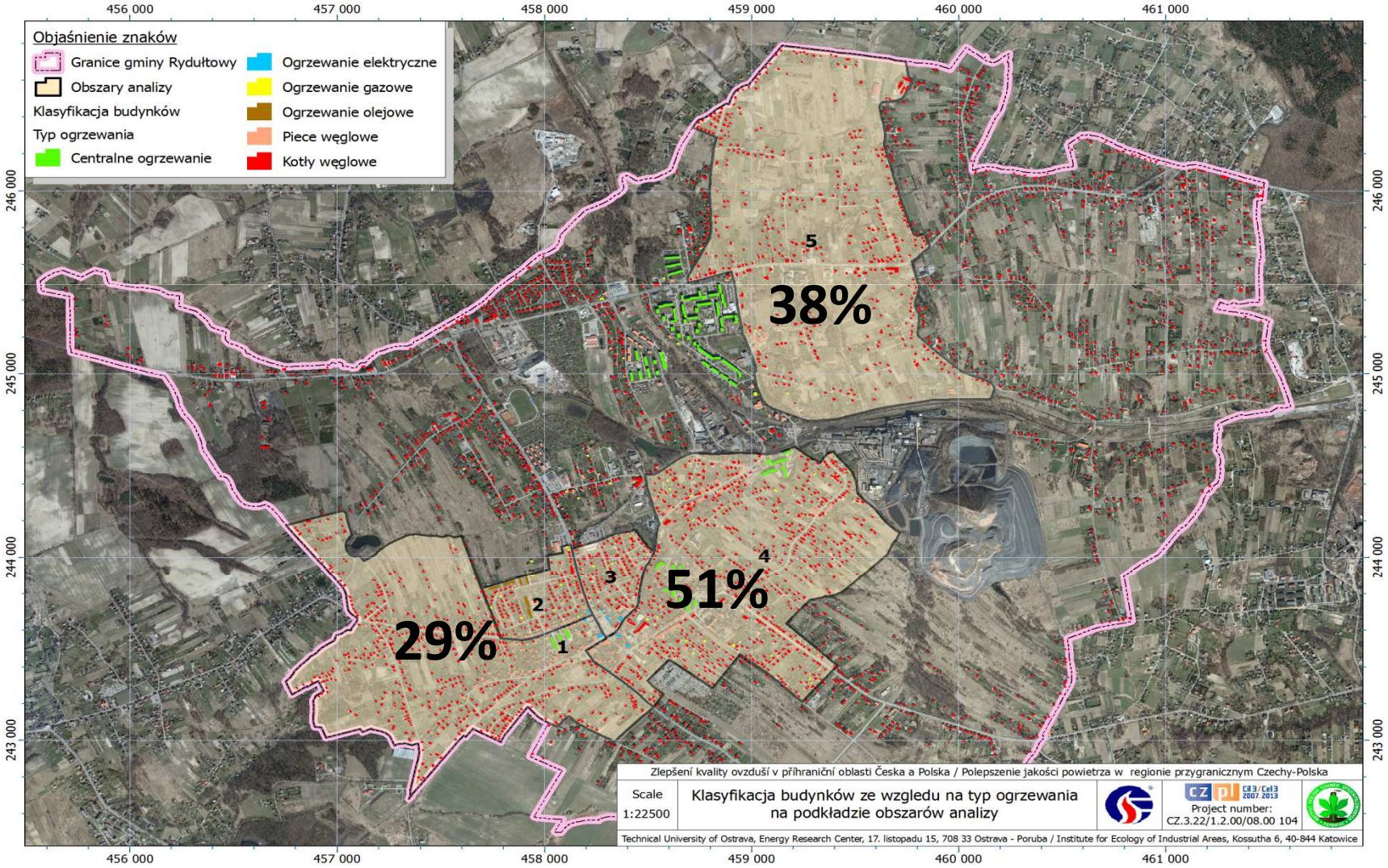
✓ the 36th value of maximum 24-hour concentration of PM10 caused by emission from residential sources was determined for the year 2006 and 2007, and this value was compared with 50% of permissible level of 24-hour concentration = 50 ug/m^3.

It was stated that for 3 emission sub-areas (among 11) the condition for 36th of 24-hour PM10 concentration caused by emission from residential sources < 25 ug/m^3 has not been met.

Directions of the dust inflow on the receptor points



Choice of areas requiring emission reduction



Possible measures for dust emission reduction

✓Modernisation of residential buildings (insulating of buildings, the replacement of windows),
✓Connecting to the municipal heat distribution network,
✓Replacement of the old coal boilers to the boilers of new type (automatic, chamber),
✓Replacement of the coal boiler to the gas or oil ones,
✓Applying the electric heating in the place of coal stove,
✓Using alternative energy sources (e.g. solar panels, heat pumps, geothermal energy),
✓Combination of the actions mentioned above.

Factors influencing the choice of method:
✓availability of heating media: heat from network, gas, electric energy,
✓investment and operating costs,
✓administrative measures (organizational and financial assistance of municipality).

Rydultowy – characteristic of emission sub-area no 3

Rydułtowy – variants of dust emission reduction proposed for sub-area 3

(the required effect of PM10 emission reduction is about 51%)

Variant 1 – the replacement of 40% of old coal boilers to the new automatic ones and the replacement of 40% old coal boilers to new chamber boilers (investment costs - about 1.6 mln €)

Variant 2 - the replacement of 40% of old coal boilers to the new automatic ones and the replacement of 30% old coal boilers to new chamber boilers, and connecting the 10% of flats heated by old coal boilers to the central heat network (investment costs - about 1.6 mln €)

Variant 3 - insulation of 20% of flats with large heat losses to a standard of small heat losses and insulation of 40% of flats with large heat losses to a standard of medium heat losses, and insulation of 20% of flats with medium heat losses to a standard of small heat losses, and the replacement of 40% of old coal boilers to the new automatic ones, and the replacement of 25% old coal boilers to the new chamber boilers (investment costs - about 2.6 mln €)

The advantages and applicability of emission calculator in Polish conditions

✓In Poland, due to the complex market of fuels, especially coal market, there is no statistical data on coal consumption in residential houses, especially on the level of small administrative units, for example the municipality or province level. Even if such data exist, they are incomplete.

✓This is the reason because of which the estimates of emissions from the residential sector could not be done on the basis of statistical data on fuel consumption.

✓The developed calculator allows to determine the emissions of PM10 and PM2.5 based only on the characteristics of housing and on local weather conditions.

✓Calculator allows on the assessment of the environmental impact of the various policy options at the municipal level.

✓The use of calculator is possible through the CLEANBORDER project website (www.cleanborder.eu), which allows each municipality to optimise activities taken on its area in order to improve air quality.

Thank you for the attention

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