Project CARE: Facilitating data-driven retrofits to alleviate energy poverty in Warsaw

Summary and implications for urban policies

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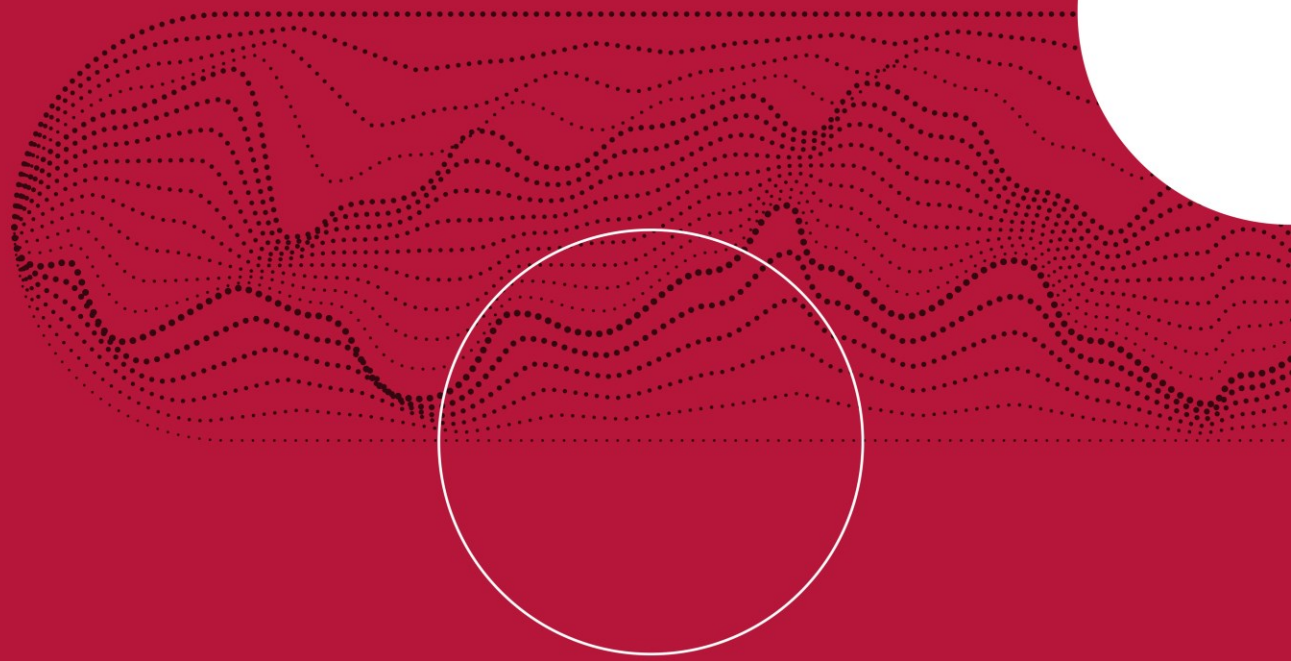
Key findings



Alleviating energy poverty in local government should start from municipal buildings and the support of their residents

Main conclusions from CARE project implementation	Recommendation
Energy renovation of buildings requires cross-sectoral and interdisciplinary cooperation, agreements between various municipal units, and shared, periodical communication channels.	1. Establish a working group to regularly develop an action plan for energy renovation of municipal buildings based on the prepared intervention index.
Current urban monitoring framework does not fully allow for assessing the scale and effectiveness of energy renovations in terms of future investments, including implementing EU directives on reducing emissions in the housing sector.	2. Define energy renovation and introduce measurable criteria for building energy efficiency.
Specific nature of the municipal housing stock and the current stage of urban housing data monitoring system make integrating administrative data challenging.	3. Ensure the interoperability of the urban housing data monitoring system with other registry data and complete missings.
CARE project enabled the development of a tool and a scenario for energy renovation of municipal buildings that balance social and environmental goals rather than direct energy poverty measurement.	4. Further develop the urban housing data monitoring system to consider various dimensions of energy poverty better

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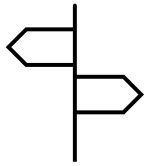
Project CARE: Assumptions and results

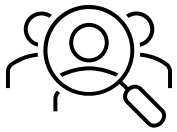
Measuring energy poverty at the local level is a challenge

Poor conceptualisation of energy poverty in local development strategies



Difficulties with assigning specific and accurate indicator to the selected energy poverty dimension (low incomes, high energy expenditures, poor energy efficiency)

Low data availability at the lower level than the regional one



Various analytical units (household, building, apartment, address)

Protection of personal and sensible data

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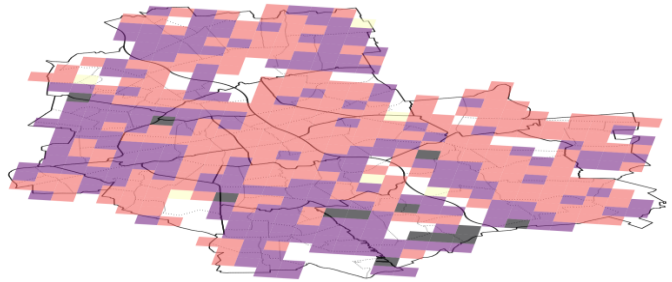
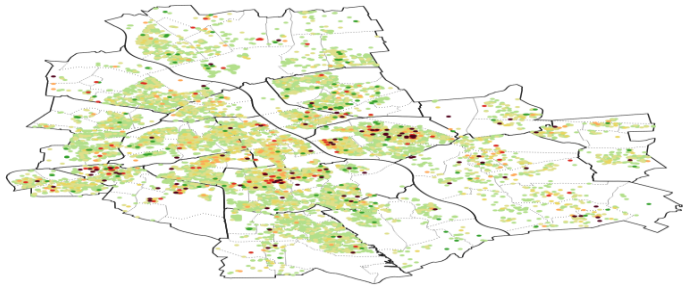
The availability of registry data sources that help identify energy poverty drivers is increasing

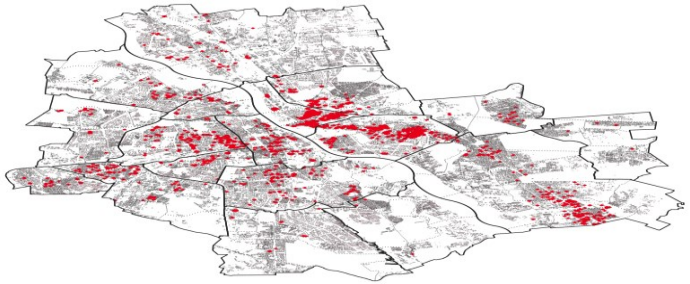
Kind of data	Data	Holder
Administrative (Registry)	Granted social protection allowances, energy and coal benefits, data from social welfare centres, data from city guard inspections	Municipality, social welfare centres
	Basic data about buildings, heating sources, obtained white certificates, number and the structure of people	state institutions (GUGiK, GUNB, URE, COI)
Business	Arrears on bills, consumption (water, gas, heating), tariff (electricity)	Municipal companies
Local vision data	Energy audits, energy performance certificates, other data from local visions (i.e. assessment of the technical condition of the building)	Municipalities, auditors, pollsters
Satellite	Roof area, presence of PVs, technical condition of the building	Google, Bing, other dispatchers
Qualitative	Direct Information from NGO	NGO, local leaders

Źródło: opracowanie własne

Difficulties in obtaining data enforce a pragmatic approach







energy expenditures → Proxy: heating source (heating of the building as a main energy poverty problem in Poland)

income situation → Proxy: value above city median in a selected area; municipal buildings as housing stock with high risk of energy poverty

energy efficiency → Proxy: poor technical condition; in the future, data about energy performance of the buildings

buildings and households → Household proxy: PESEL data and number of apartments

basic layer

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In the CARE project, a building was our analytical unit, which can be covered by the most complex urban intervention to alleviate energy poverty

Main question: How to equitably retrofit municipal buildings? What criteria, indicators and weights to use?

Objective

- To develop a sequence of renovation of municipal buildings based on registry data, that will allow the best possible balance of social and environmental goals

Contribution

- Systematise the knowledge about municipal buildings based on registry data
- Propose criteria for equitable modernisation of municipal buildings
- Increase the competence of staff in analytical activities on housing
- Provide analytical support for strategic documents and municipal investments in municipal buildings

The scope of the project covered all fully-owned municipal buildings in Warsaw

Buildings

- 1,886 municipal buildings in Warsaw (with 81 thousand aparments)

People

- Officials working in the field of public housing, as well as implementing complementary urban policies.
- Stakeholders representing tenant communities (neighbourhood/district councillors, local NGOs, tenant movements, residents)

Area

- City of Warsaw, with particular attention to districts with a large number of municipal buildings

Time

- Decade 2020s (according to the most available data)

The tasks of the CARE project included the identification, collection, analysing registry data, and the implementation of the tool in the City Office of Warsaw

Aim	Systematise the knowledge of municipal buildings on the basis of administrative data	Propose criteria for equitable modernization of municipal buildings	Increase staff competence in analytical activities on housing
Task	1.1 Identification of data and discussion regarding its use 1.2 Collecting feedback on the criteria among stakeholders	2.1a Collecting of available socio-economic data 2.1b Collecting energy data on buildings 2.2 Database of buildings	3.1. Recommendations for prioritiy options 3.2. Indication of financing model 4. Presentation of the results
Time	07–10.2023	10.2023–02.2024	03–06.2024

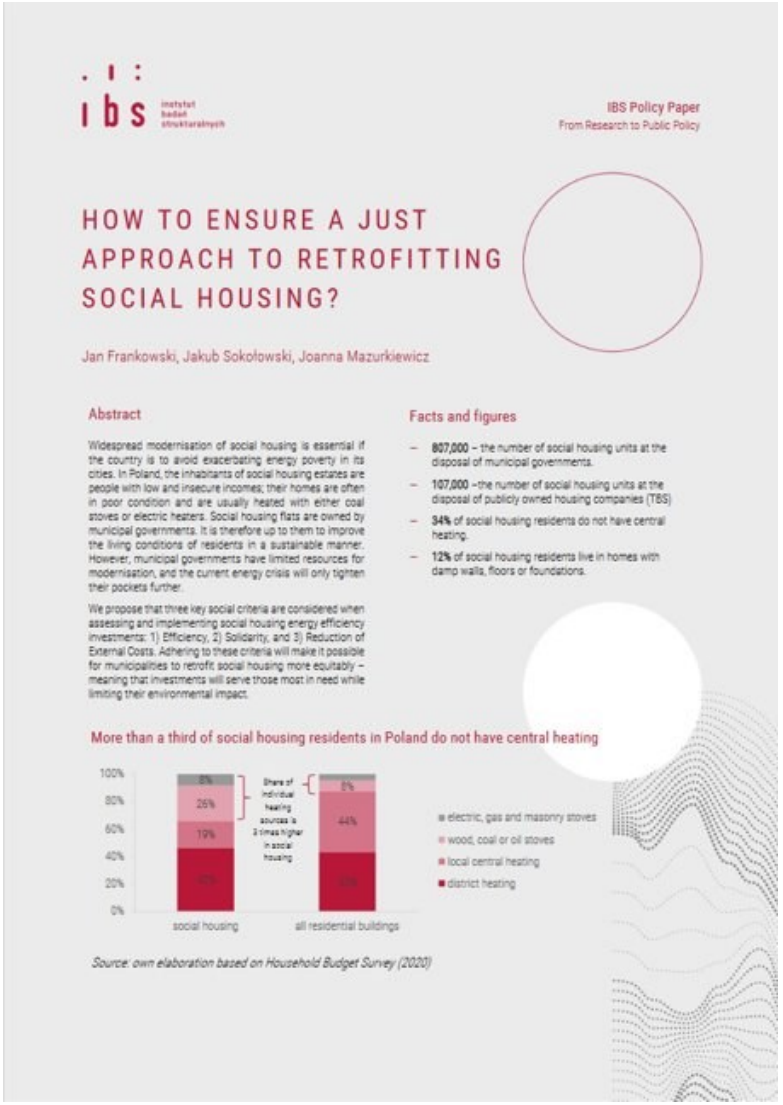
CARE project deliverables included integrated use of municipal building data, a model for generating renovation scenarios, recommendations and training

Analytical products

- Database with a classification of municipal buildings according to social and climate criteria, along with code in R software for generating scenarios
- Instruction on how to use the database and code for the staff of the City of Warsaw
- Policy paper summarising the implementation of the project with a summary of the results
- Non-technical summary for a wider and international audience

Events

- Presentations of the project results during meetings, workshops and conferences
- Training for the staff of the City of Warsaw



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IBS Policy Paper
From Research to Public Policy

HOW TO ENSURE A JUST APPROACH TO RETROFITTING SOCIAL HOUSING?

Jan Frankowski, Jakub Sokołowski, Joanna Mazurkiewicz

Abstract

Widespread modernisation of social housing is essential if the country is to avoid exacerbating energy poverty in its cities. In Poland, the inhabitants of social housing estates are people with low and insecure incomes; their homes are often in poor condition and are usually heated with either coal stoves or electric heaters. Social housing flats are owned by municipal governments. It is therefore up to them to improve the living conditions of residents in a sustainable manner. However, municipal governments have limited resources for modernisation, and the current energy crisis will only tighten their pockets further.

We propose that three key social criteria are considered when assessing and implementing social housing energy efficiency investments: 1) Efficiency, 2) Solidarity, and 3) Reduction of External Costs. Adhering to these criteria will make it possible for municipalities to retrofit social housing more equitably – meaning that investments will serve those most in need while limiting their environmental impact.

Facts and figures

- **807,000** – the number of social housing units at the disposal of municipal governments.
- **107,000** – the number of social housing units at the disposal of publicly owned housing companies (TBS)
- **34%** of social housing residents do not have central heating.
- **12%** of social housing residents live in homes with damp walls, floors or foundations.

More than a third of social housing residents in Poland do not have central heating

Source: own elaboration based on Household Budget Survey (2020)

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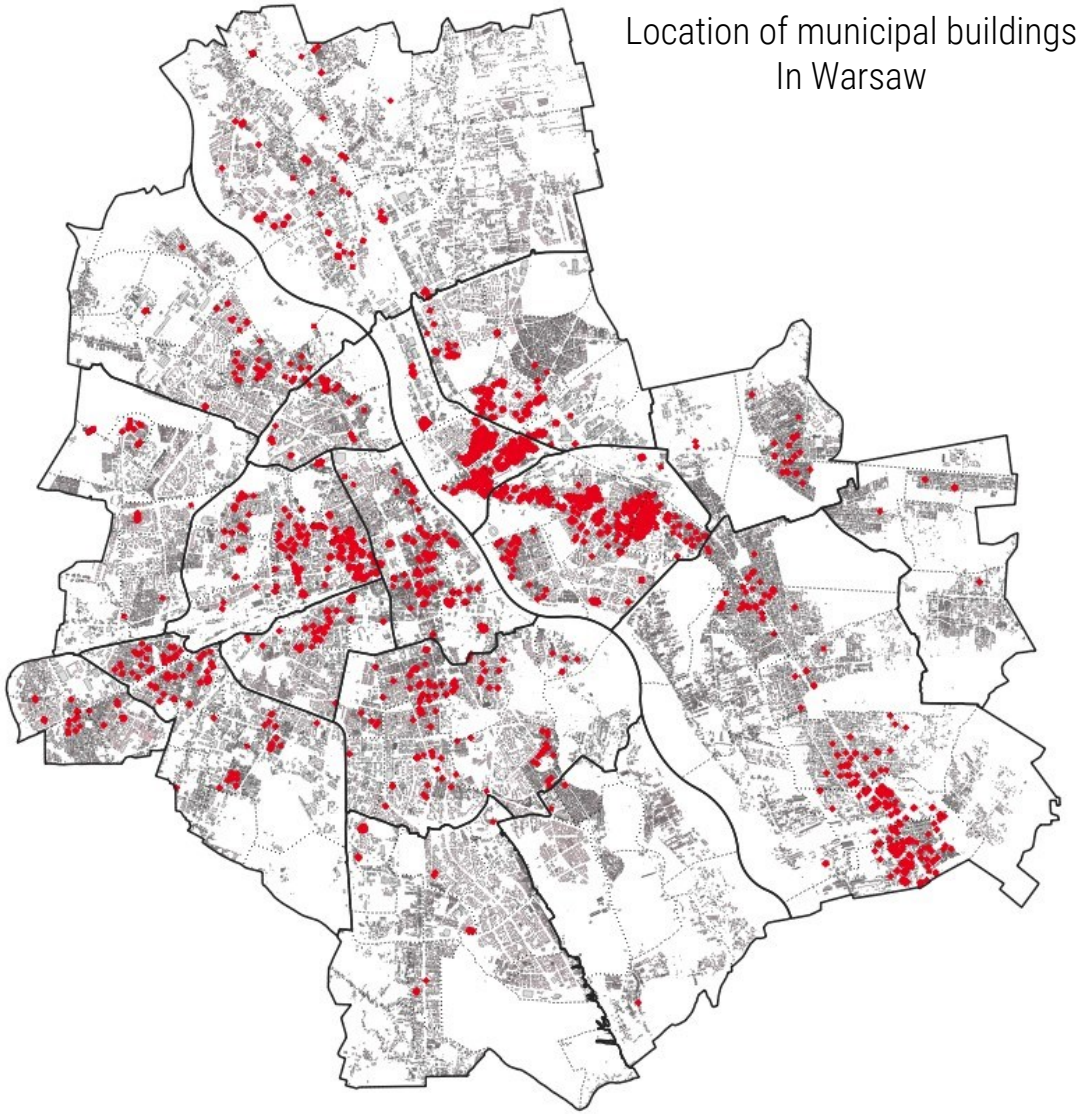
Data analysis and developing intervention criteria

The starting point for the preparation was an official record of municipal buildings

- Urban data on municipal buildings, technical condition and number of apartments;
- Central Emission Register of Buildings (CEEB) with data about heating sources;
- Land and Property Register (EGiB) about buildings and their profiles;
- National Register of Boundaries (PRG) about verified address points;
- Personal Identity Number (PESEL) about the number and structure of people living under a particular address;
- Statistics Poland (GUS) kilometre grid data about incomes in Warsaw.

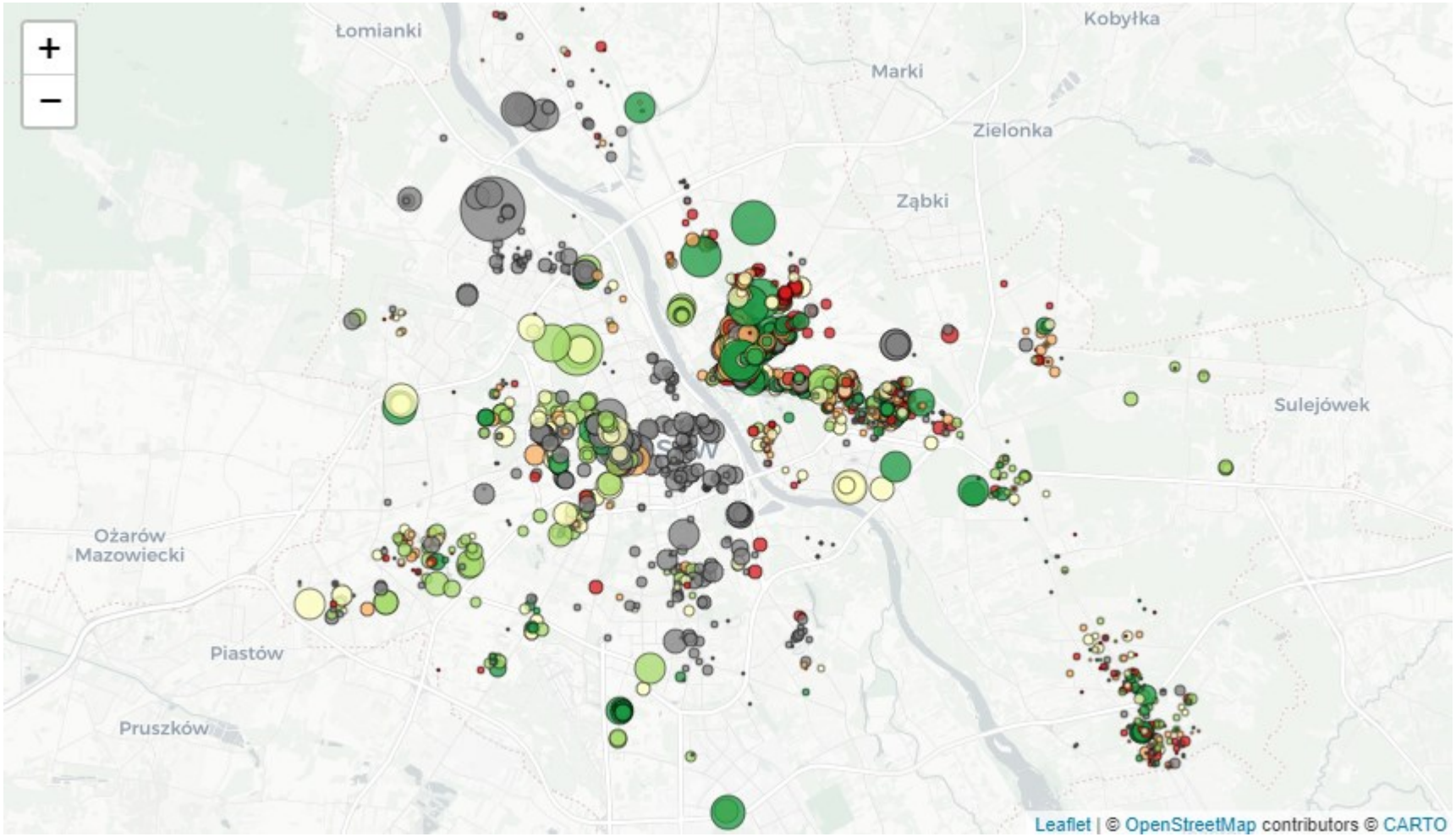


Location of municipal buildings
In Warsaw

During consultations with the city officers, criteria and indicators were developed and further agreed upon to holistically consider various energy renovation criteria

Criteria	Variables	Data missings
Technical (25%)	Technical condition	
	Installations (central heating/electricity/gas/water/sewer)	
Environmental (25%)	Share of dwellings heated with solid fuels (CEEB)	18%
	Thermal modernisation (%)	
Social (25%)	Share of registered persons <19 years old and >65 years old	23%
	Share of electrically heated dwellings	18%
	Location in area with defined income inequality	0,2%
Operational (25%)	Number of dwellings (normalised)	
	Legal status	12%
	Inclusion in the register of historic buildings	0,1%
	Location of the building in the revitalisation area	

The ranking, using indicated criteria and completed datasets, enables to classify 65% of municipal buildings



Intervention index

- Each criteria (technical, environmental, social, operational) in a default scenario weights the same – 25%
- Each indicator contributing to the common criteria in default scenario weights the same;
- Details ⟶ Annex 2

Synthetic index values

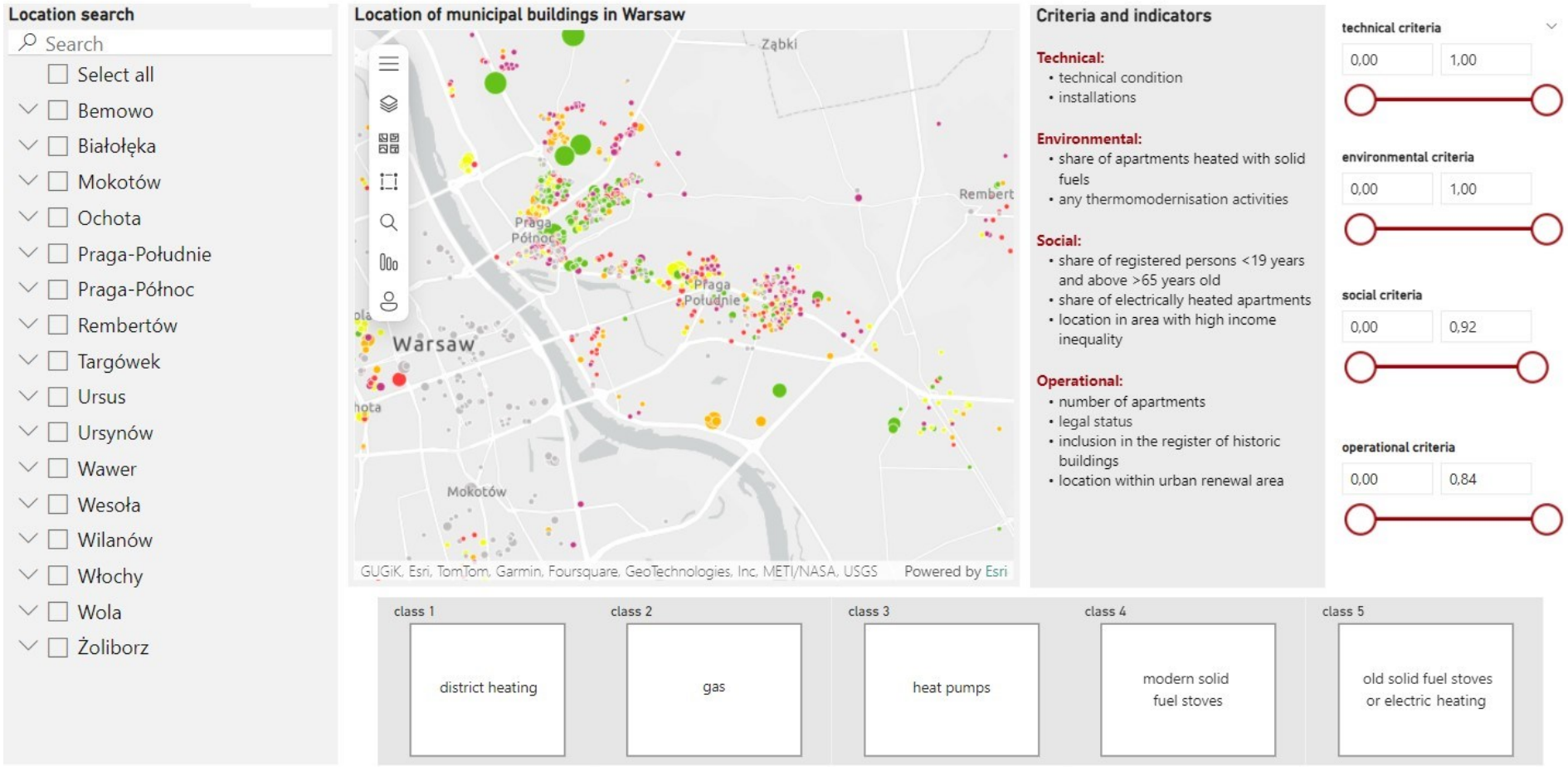
lowest highest

- Each range includes 20% of buildings
- The circle size corresponds to the standardised number of apartments
- Red/orange – most in need of intervention

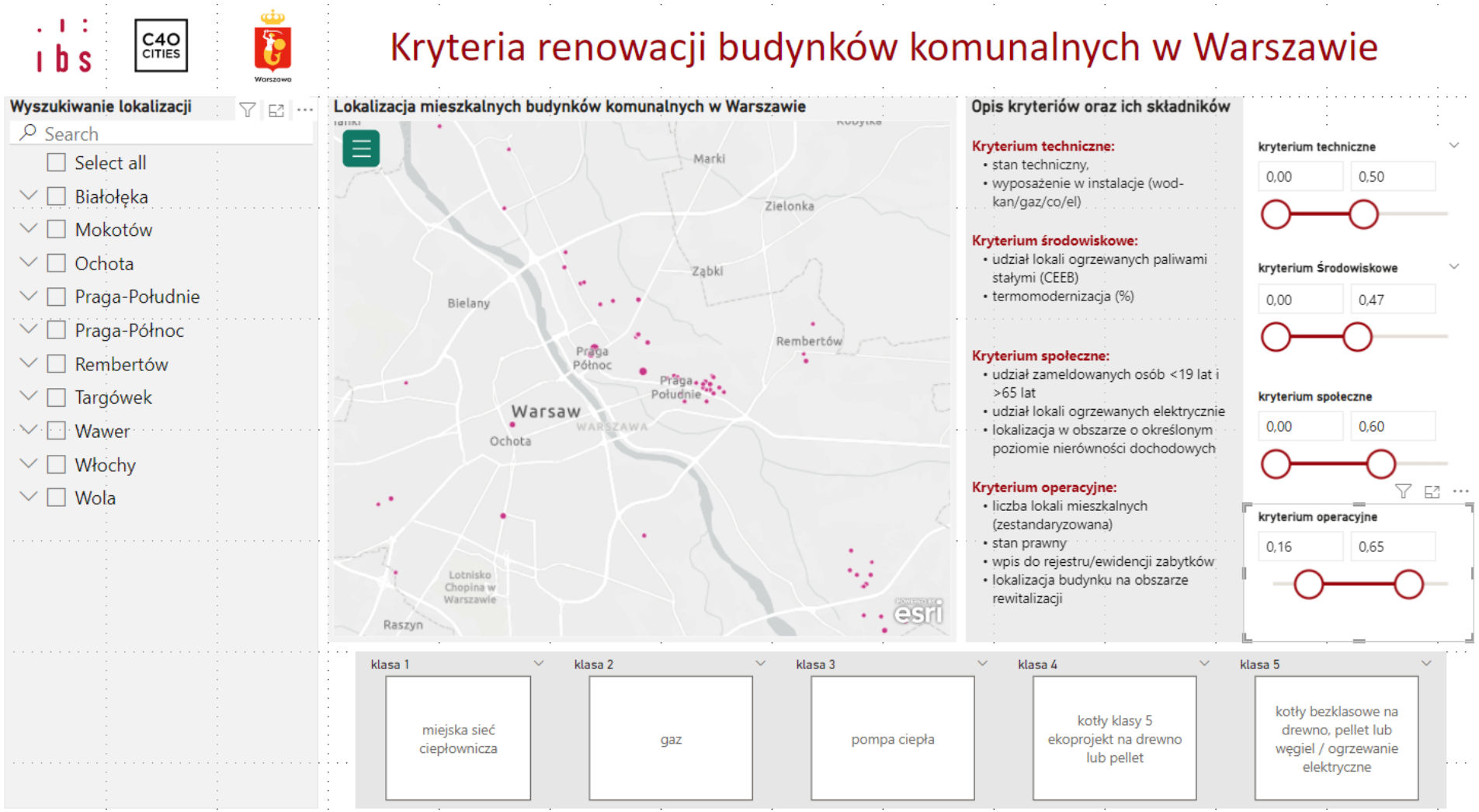
Unclassified buildings due to data gaps

The CARE dashboard enables the simulation of energy renovation scenarios

Renovation criteria for municipal buildings in Warsaw

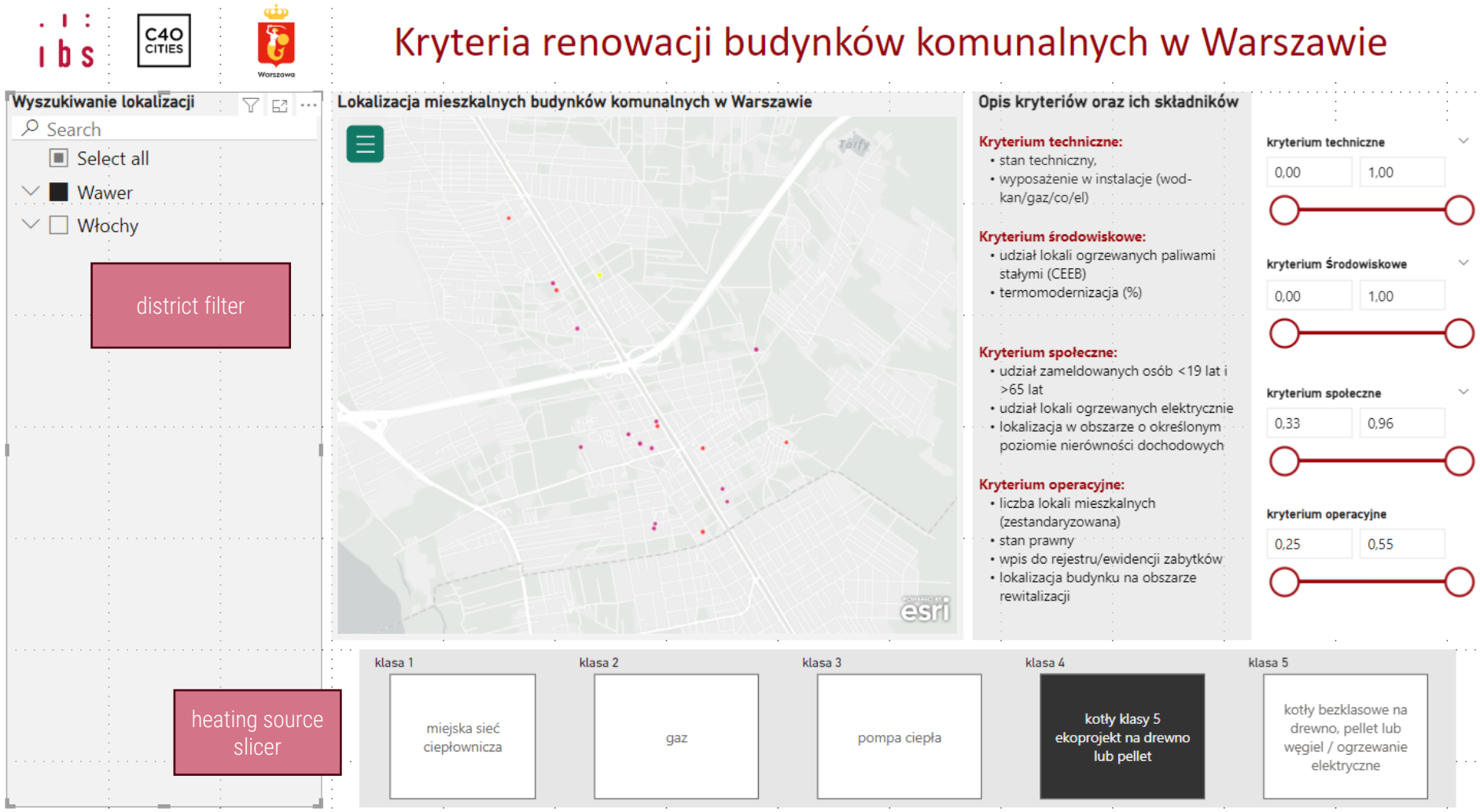


The CARE dashboard allows to modify weights of each of the criteria

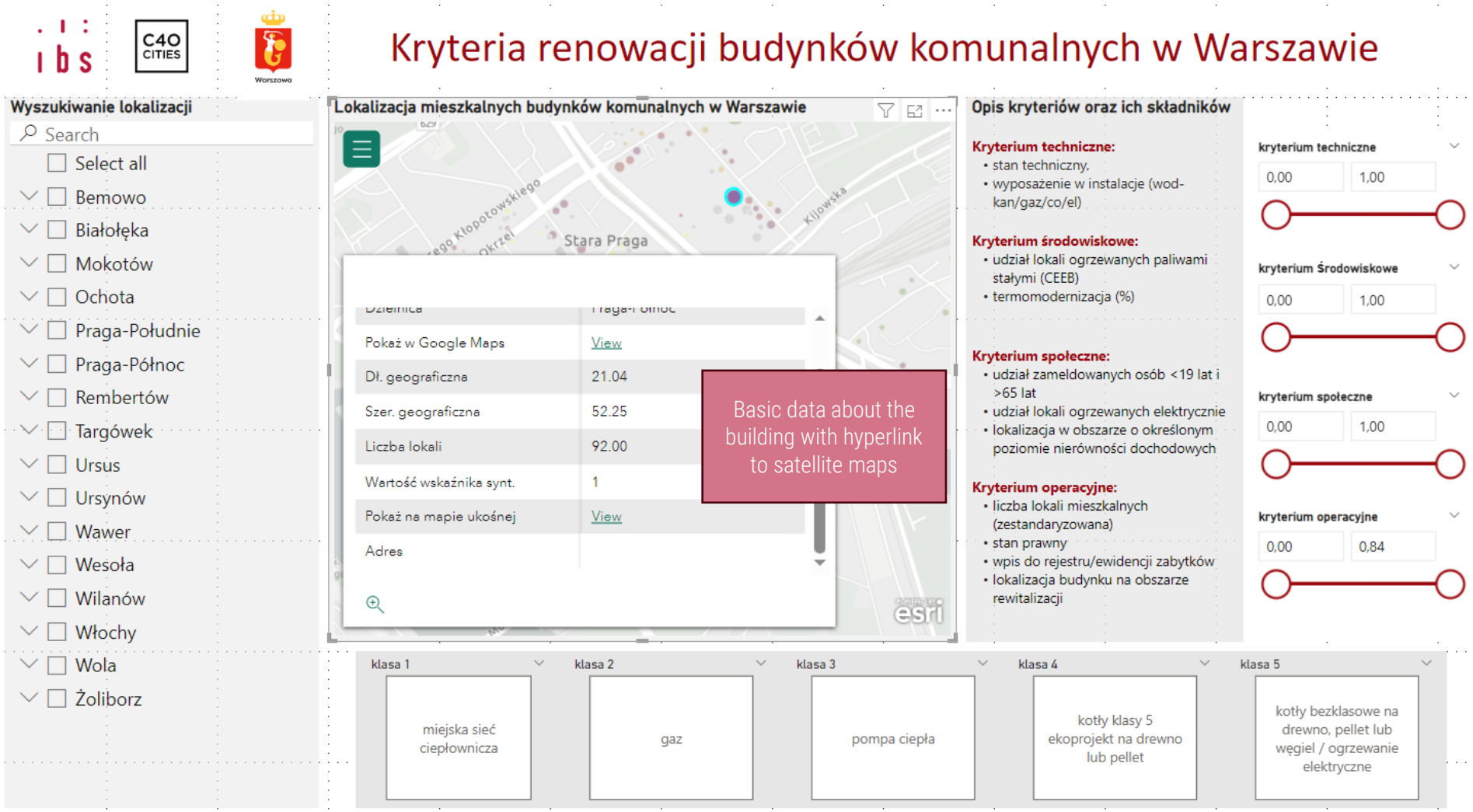


possibility of filtering buildings based on selected threshold

The CARE dashboard allows to filter districts and buildings with specific heat sources



The CARE dashboard allows one to get basic information about particular building and quick preview of the building from open source satellite imagery



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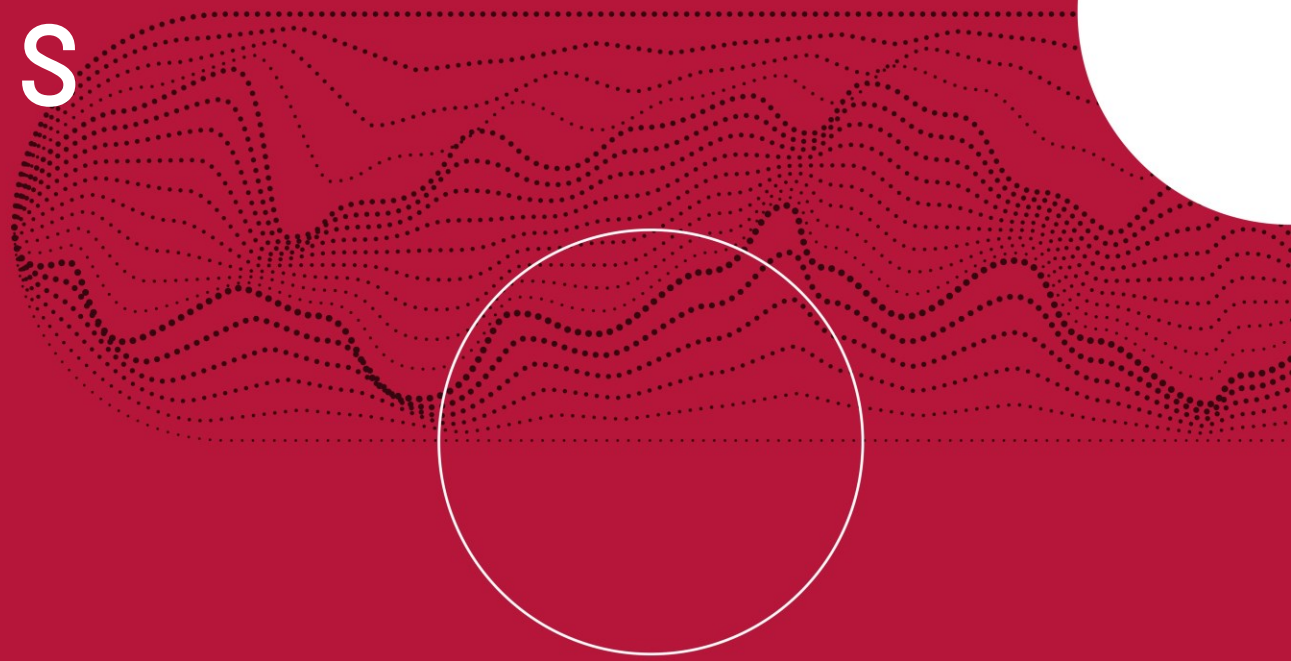
Recommendations



Based on the CARE project, we propose four main recommendations to ensure a just approach to energy renovation of municipal buildings

1. Establish a working group to regularly develop an action plan for energy renovation of municipal buildings based on the prepared intervention index.

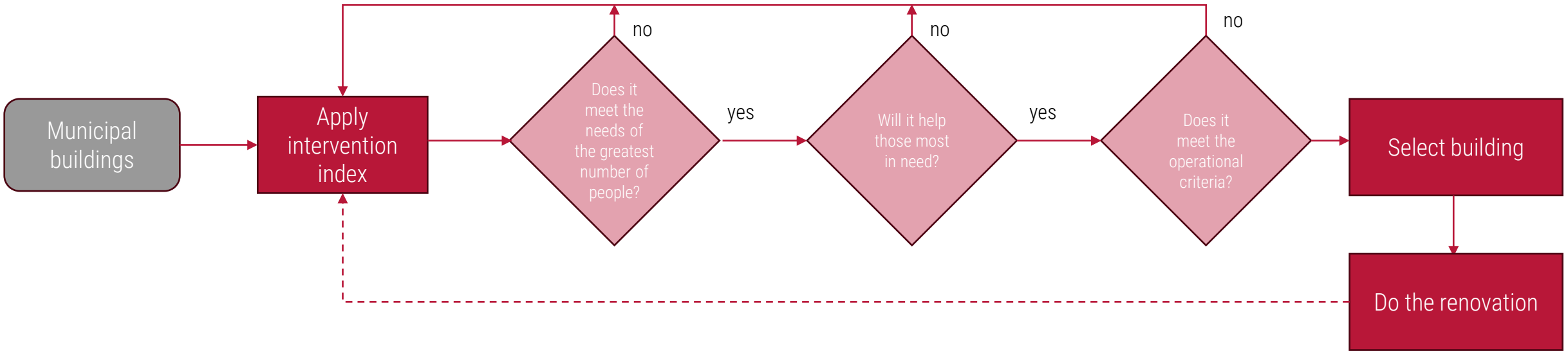
2. Define energy renovation and introduce measurable criteria for building energy efficiency.

3. Ensure the interoperability of the urban housing data monitoring system with other registry data and complete missings.

4. Further develop the urban housing data monitoring system to consider various dimensions of energy poverty better.

On the next slides, we specified these recommendations →

Recommendation 1: Establish a working group to regularly develop an action plan for energy renovation of municipal buildings based on the prepared intervention index



The ways of implementation:

- Establishing a coordination team made of various city departments, neighbourhoods and municipal housing managers meeting periodically and developing urban policies at the intersection of energy, housing, climate and social issues;
- Consider the needs of people waiting for municipal building apartments and those in energy poverty already living in housing stock;
- Define the role of operational criteria for energy renovation (e.g. location in an urban renewal area, legal and heritage status of the building).

Recommendation 2: Define energy renovation and introduce measurable criteria for building energy efficiency

The ways of implementation:

- Implement an official definition of renovation in the urban policy documents and practice, according to the approach undertaken during the consultations with the city units;
- Expand the urban housing data monitoring system on the information about the scope of energy renovation activities undertaken;
- Enable automatic data migration from energy audits and the energy performance certificate database;
- Monitor relevant municipal units at the neighbourhood level to ensure regular updates of information;
- Expand the scope of analyses to include data on energy classes concerning changes required by the EPBD directive;
- Consider integrating data with a tool to estimate the energy renovation costs.

Recommendation 3: Ensure the interoperability of the urban housing data monitoring system with other registry data and complete missings.

The ways of implementation:

- Introduce a unique ID for municipal buildings, consistent with the Land and Property Register;
- Complete the Central Emission Register of Buildings with heat source information for municipal buildings without entries;
- Verify the status and number of residents in the given municipal buildings;
- Complete MSI units for buildings in the urban housing data monitoring system;
- Utilise prepared crosswalks for dataset integration and update them during database updates;

Recommended rule:
Each building should be treated as a separated analytical unit, even though these are few buildings under each address point

Recommendation 4: Further develop the urban housing data monitoring system to consider various dimensions of energy poverty better.

The ways of implementation:

- Attempt to expand the monitoring system to include buildings not owned by the city;
- Support initiatives to make income registry data available for research through consultations with the Ministry of Finance and tax offices;
- Monitor and continue verifying the incomes of residents receiving support;
- Conduct joint consultations between various city office units and energy companies (E.ON, PSGAZ, Veolia) regarding data monitoring on building energy consumption.

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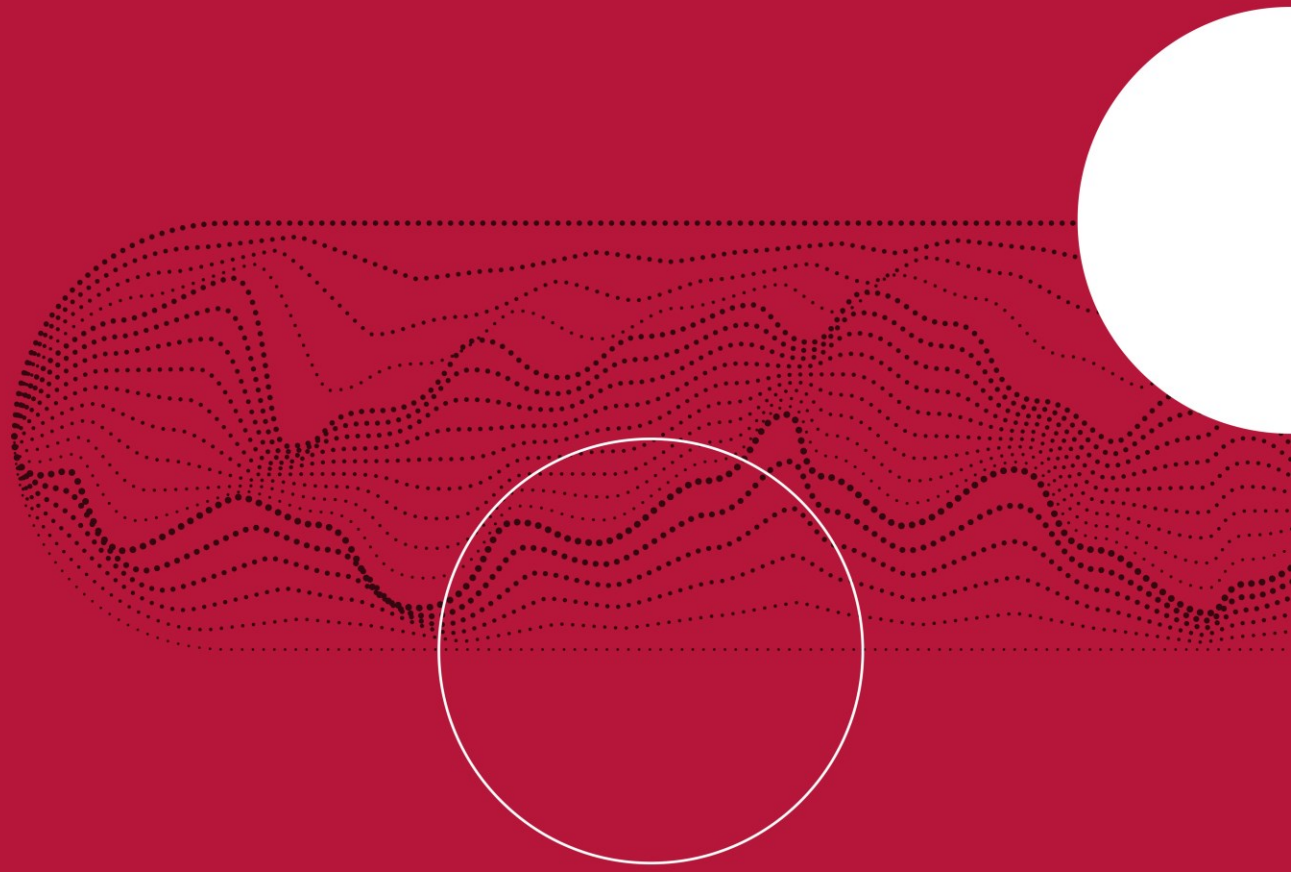

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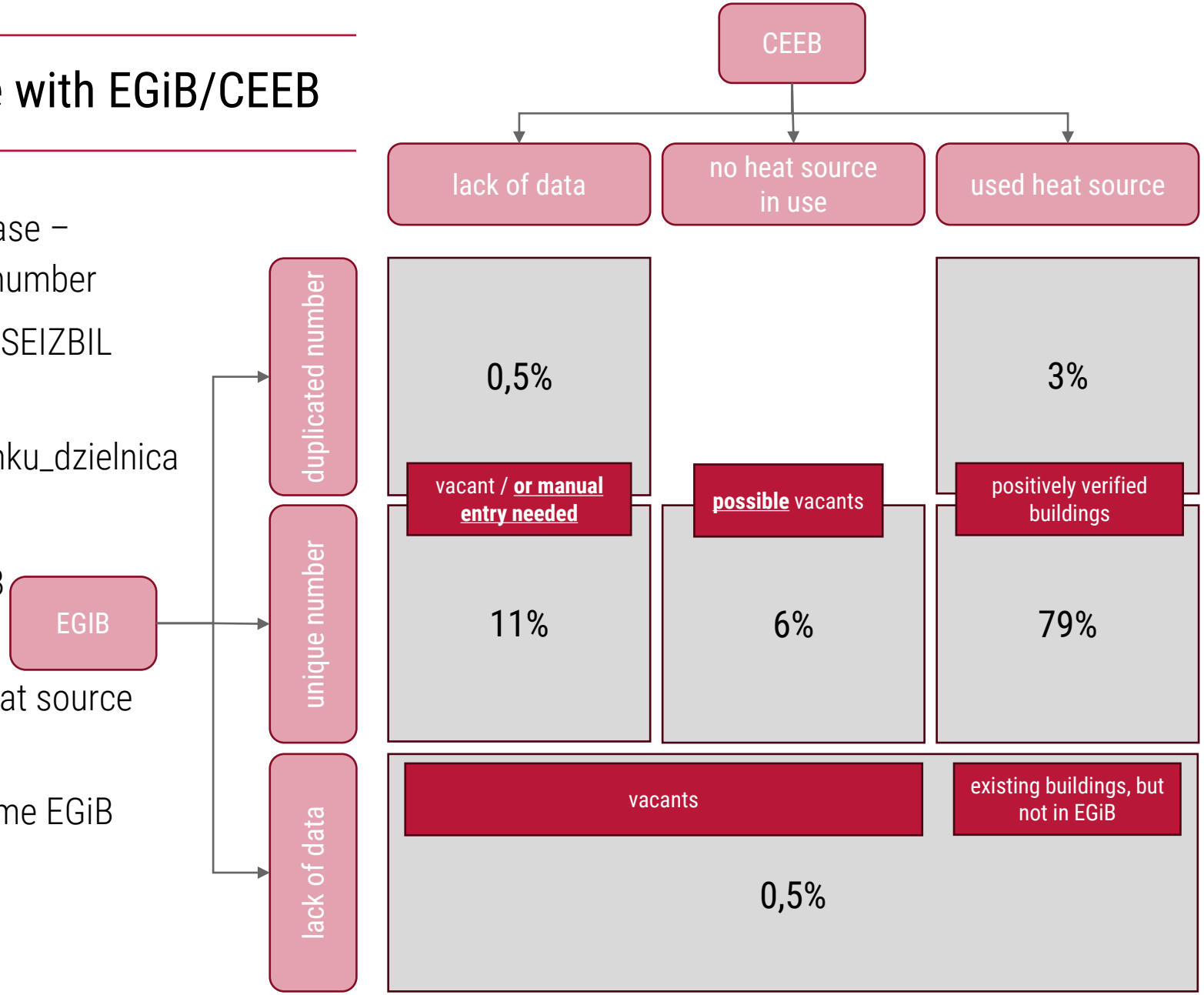
Annex 1: Analytical challenges of database interoperability

82% of SEIZBIL data was in line with EGiB/CEEB

- SEIZBIL lacks a unique ID in the database – therefore, we propose using the EGiB number
- Missing EGiB numbers for buildings in SEIZBIL have been manually supplemented*
- Crosswalks from CEEB: ulica_nr_budynku_dzielnica

- 11% of buildings have no entry in CEEB (mostly vacant properties).
- 6% of buildings have no operational heat source (possibly vacant properties).
- 3% of buildings in SEIZBIL have the same EGiB number duplicated.



* The highest number of missings was identified for districts: Śródmieście, Mokotów, Praga Północ.

The SEIZBIL and EGiB databases should be unified

Example:
two empty buildings in urban database outside EGiB, not classified as residential buildings

The highest incoherences are for complex multi-family buildings in Praga district

- Some buildings in SEIZBIL have the same number in EGiB (record: even four times!)
- The same applies to address points (PRG): under one address, there can be three buildings...
- ... but there have been instances where the situation is reversed: two or more address points for one building or no address in PRG (Osiedle Jazdów, so-called summer houses).
- Next, we matched buildings from SEIZBIL/EGiB CEEB databases to the PESEL registry.
- Since PESEL operates on address points (PRG database), we removed duplicated values, assigning values for the front building in case of missing data

We carefully estimate that 76%–87% of municipal buildings is inhabited

- The absolute data on the number of residents in SEIZBIL and PESEL may differ from the actual state, and caution should be exercised in their interpretation*
  - We proposed a variable [building status] and three categories: uninhabited / inhabited** / to be checked
  - In cases of missing data or inconsistencies in the number of people, the building status was assigned based on the analysis of Google StreetView images (ultimately, we arbitrarily classified a building as "inhabited" based on curtains/blinds/plant pots in windows, cars on the property, waste containers, new letterboxes, hanging laundry, etc. – verification is especially needed for images before 2020 and where Google StreetView was not available).
  - We were unable to verify the status of tenements with 'wells' – usually, inside buildings do not have a separate address (and thus a separate entry in PESEL), and they are rarely visible in satellite images (especially Praga district)

* Data regarding the estimated number of individuals in a given building in SEIZBIL were provided by two districts: Praga-Południe and Wola. These data, as well as the data in the PESEL registry, may differ from the actual state (presumably due to their timeliness) – for example, both registries reported several to several dozen individuals in the evacuated Dudziarska Estate.
** t should be noted that in many municipal buildings, a portion of the apartments also remains vacant.

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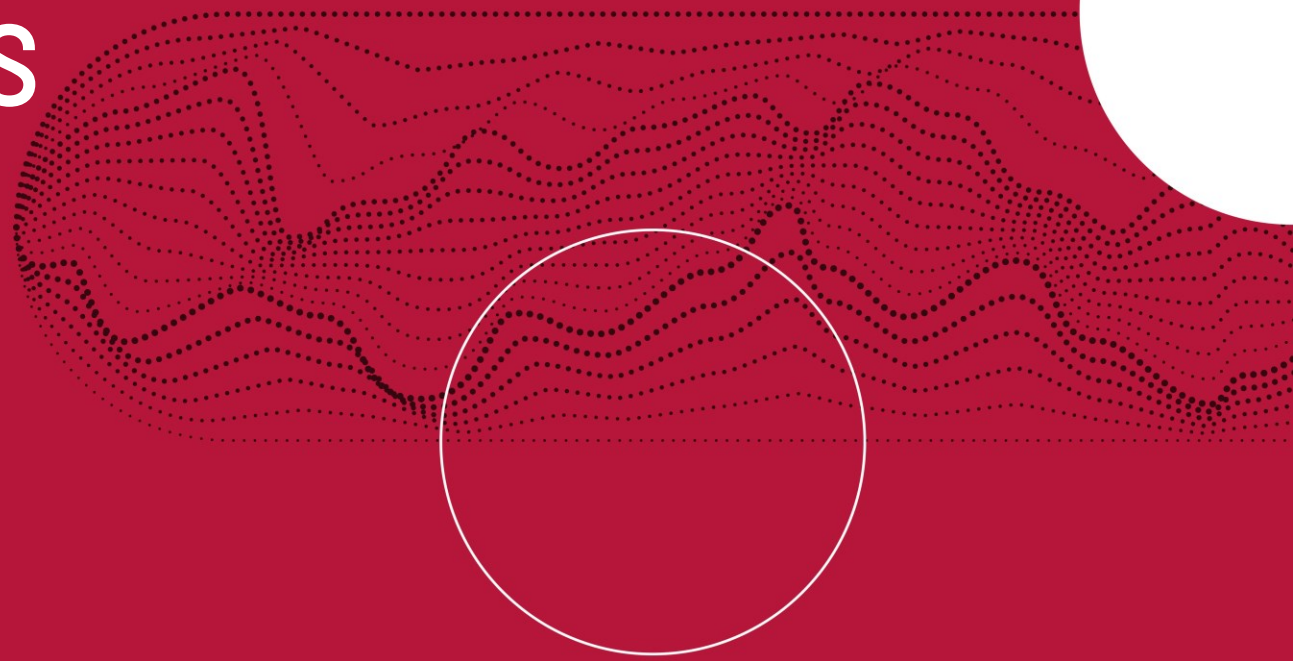
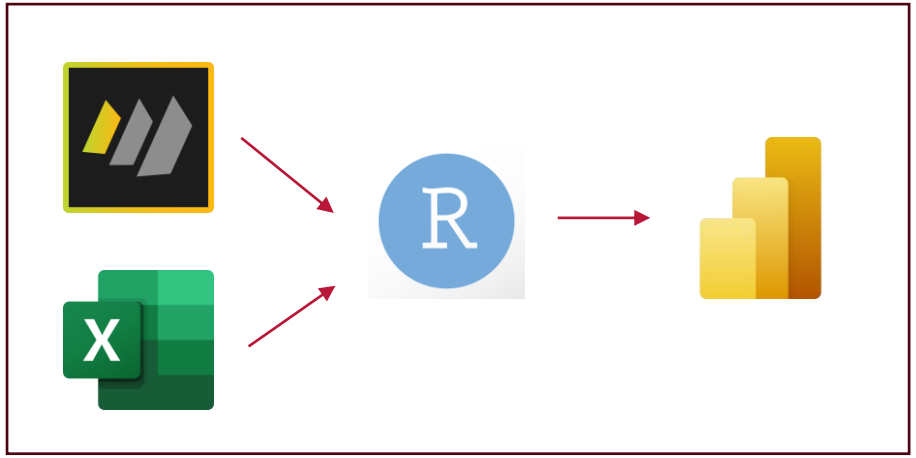
Annex 2: Analysis



Import, cleaning, analysing and visualising data were main activities of the CARE project

- data import (CSV)
- data processing
- renaming and selection of variables
- order and categorisation of variables
- construction and selection of indicators, tackling:
  - technical criteria
  - environmental criteria
  - social criteria
  - operational criteria
- checking data distributions and missings
- transforming destimulants to stimulants and normalisation
- calculating synthetic index
- export data to PowerBI dashboard



The variables were chosen to avoid very high correlation coefficients

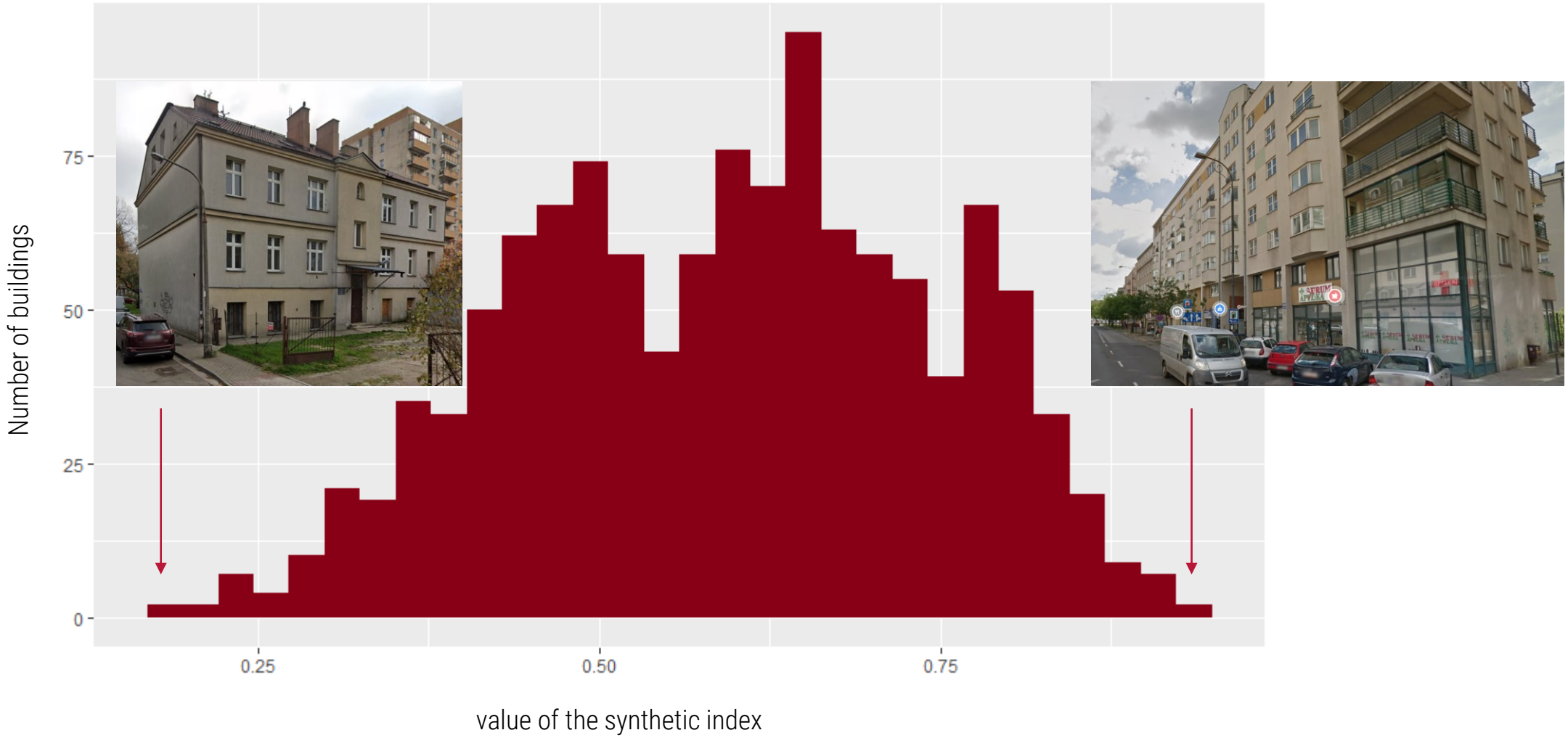
Control: The degree of equipment in installations is positively correlated with the technical condition of the building

tech2	0.32	-0.03	0.15	0.35	0.34	-0.01	0.11	0.18	0.17	-0.09
0.32	inst2	-0.04	0.46	0.26	0.55	0.11	0.19	0.2	-0.08	-0.06
-0.03	-0.04	los2	0.01	0	-0.04	-0.05	0.07	0	-0.05	0.07
0.15	0.46	0.01	ogps2	0.16	0.27	0.1	0.19	0.01	-0.16	0.1
0.35	0.26	0	0.16	termo2	0.25	0.14	0.16	0.22	-0.11	0.03
0.34	0.55	-0.04	0.27	0.25	ogel2	0.05	0.13	0.33	0.08	-0.13
-0.01	0.11	-0.05	0.1	0.14	0.05	gini2	-0.01	-0.02	-0.21	-0.18
0.11	0.19	0.07	0.19	0.16	0.13	-0.01	lokalem2	0.03	-0.1	0.12
0.18	0.2	0	0.01	0.22	0.33	-0.02	0.03	stan_prawny 2	0.07	-0.15
0.17	-0.08	-0.05	-0.16	-0.11	0.08	-0.21	-0.1	0.07	zaby tek2	-0.3
-0.09	-0.06	0.07	0.1	0.03	-0.13	-0.18	0.12	-0.15	-0.3	rew2

Control: the incidence of electric heating is positively correlated with unregulated legal status

Control: entry in the Register of Historic Buildings is negatively correlated with location in the regeneration area (as the entry is destimulant)

The distribution of the synthetic index is close to normal



Source of photos: Google StreetView