Factsheet N° 2

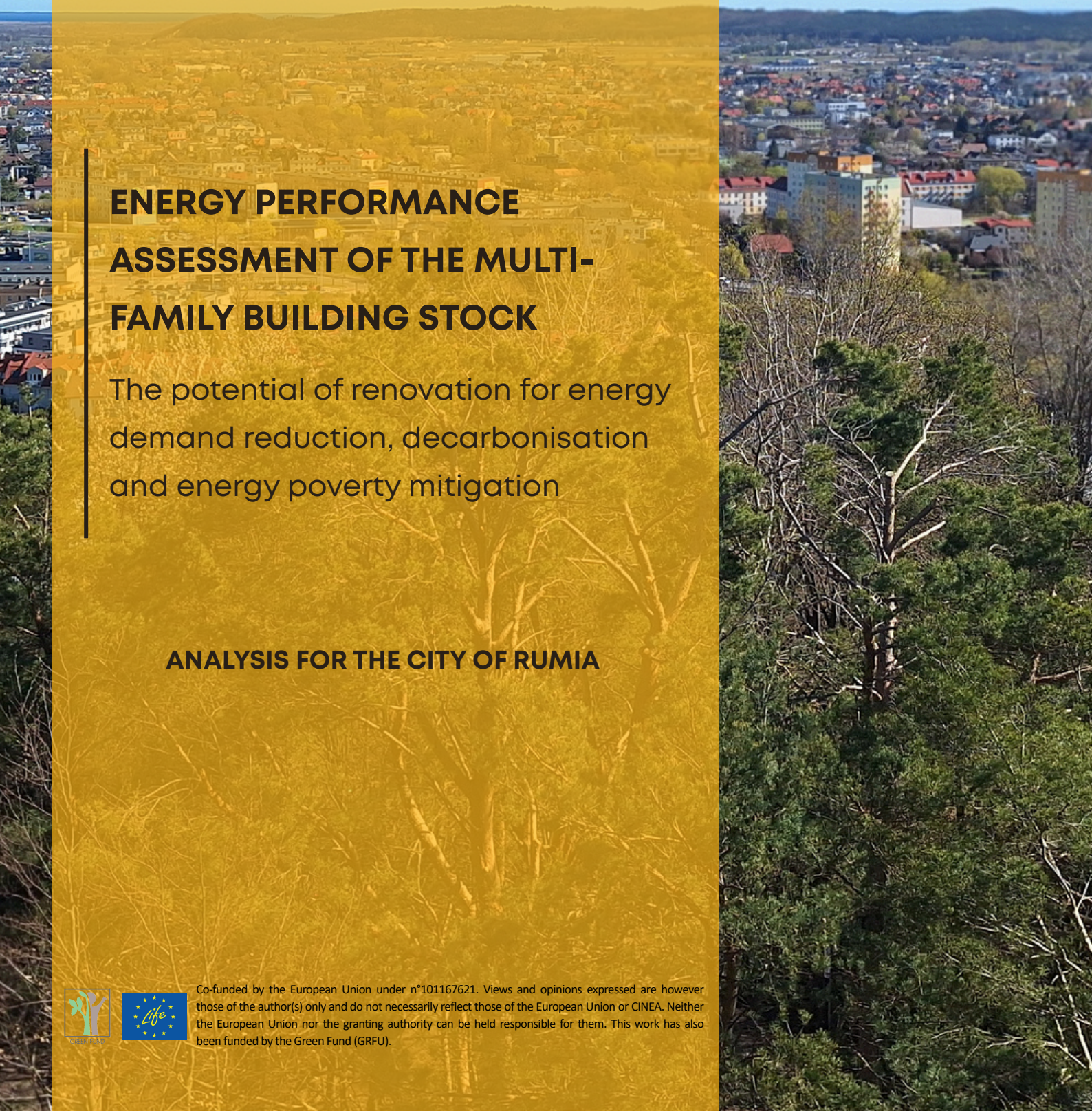
November 2026

LOCATEE

ENERGY PERFORMANCE ASSESSMENT OF THE MULTI-FAMILY BUILDING STOCK

The potential of renovation for energy demand reduction, decarbonisation and energy poverty mitigation

ANALYSIS FOR THE CITY OF RUMIA



Co-funded by the European Union under n°101167621. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them. This work has also been funded by the Green Fund (GRFU).

Energy performance assessment of the multi-family building stock

Why this analysis?

LOCATEE Deliverable 3.3 quantifies the impacts of selected renovation and renewable energy measures the energy performance of representative multi-family dwellings in Rumia, Torres Vedras and Piraeus. The analysis links technical performance with investment cost and potential household energy bill reductions, informing municipalities to prioritise interventions to local building conditions and energy poverty vulnerability.



- Representative typologies are grounded in local dwelling stock data, including construction period, EPC class and heating systems.
- The DREEM model simulates baseline energy needs under thermal comfort conditions and tests renovation scenarios.
- Results are compared through potential energy consumption reduction, cost-effectiveness and potential energy bill reductions.

Overview

City of Rumia | Poland

5 dwelling typologies

1980 and before / after 1980

How the DREEM assessment works

1

DWELLING CHARACTERISATION

Construction period, EPC class, dwelling area (m^2), envelope and heating/cooling systems

2

BASELINE SIMULATION

Climate, household composition, appliances and thermal comfort setpoints

3

RENOVATION SCENARIOS APPLICATION

Thermal insulation and windows upgrade, heating system upgrade, heat pump installation and 3 kW_p solar PV installation

4

TECHNICAL/ECONOMIC/ ENVIRONMENTAL IMPACTS COMPARISON

Energy consumption reduction, environmental impact (i.e., carbon emissions reduction), technoeconomic assessment and potential energy bill reduction

DREEM model components

Climate & water

Typical Meteorological Year data provide high-resolution irradiance and temperature conditions for each pilot.

Building envelope

Geometry, construction materials, U-values, thermal resistances/capacities and solar potential are utilised to model the thermal behaviour of each typology.

Energy demand

Bottom-up modelling captures heating, cooling, appliances and occupancy/activity profiles.

Thermal comfort

Predicted Mean Vote (PMV) / Predicted Percentage of Dissatisfaction (PPD)-based comfort benchmarks define indoor temperature requirements.

Renovation scenarios

Scenario	What changes	Applicability
Dwelling envelope improvement	External walls insulation with windows upgrade	**All typologies** for testing the effectiveness of envelope interventions in each pilot
Heat pump installation	Electrification of dwelling heating with a high-efficiency heat pump	**All typologies** for testing high-efficiency heating systems
Oil to gas boiler upgrade	Transition from an existing oil boiler to a higher-efficiency condensing gas boiler	**PL_2, PL_5** where the existing heating system is an older lower-efficiency non-condensing gas boiler
Natural gas boiler upgrade	Transition from a lower-efficiency non-condensing gas boiler to a higher-efficiency condensing gas boiler	**PL_2, PL_5** where the existing heating system is a non-condensing gas boiler and district heating system is available (as it is in Rumia)
Renewable energy production	Installation of a 3 kWp residential solar PV system	**All typologies** for testing the effectiveness of renewable technologies in each pilot

INTERPRETATION NOTE

EPC classes are not harmonised across Europe. A class with the same letter may reflect different national thresholds. Cross-pilot typology comparisons should therefore focus on modelled energy outcomes and local context rather than EPC classes alone.

City of Rumia

Through the prism of the existing building stock

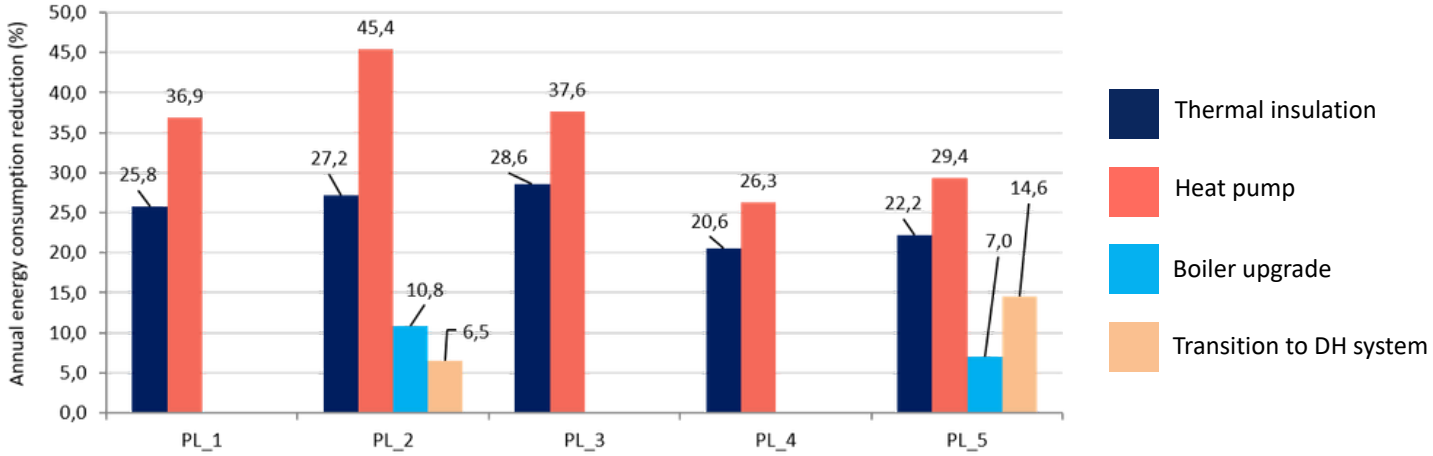
Five representative dwelling typologies capture the city's multi-family dwelling stock across pre-1980 and post-1980 construction periods. The analysis reflects a context where space heating dominates energy use.

26.3 - 45.4 % Heat pump energy reduction	**9.3 - 15.1 %** Thermal insulation bill reduction
74.3 - 98.6 % Annual electricity demand coverage by solar PV production	**1.71** Solar PV electricity generated (kWh) per € of investment

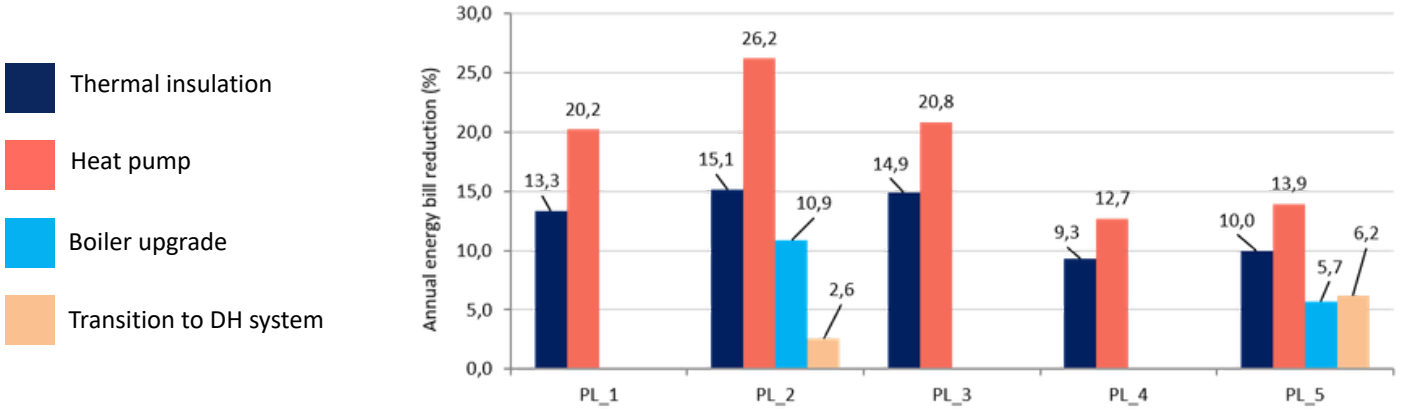
Representative dwelling typologies

Typology no.	Construction Period	EPC Class	Heating System
PL_1	1980 and before	B	District heating
PL_2	1980 and before	C	Non-condensing gas boiler
PL_3	1980 and before	C	District heating
PL_4	After 1980	B	District heating
PL_5	After 1980	B	Non-condensing gas boiler

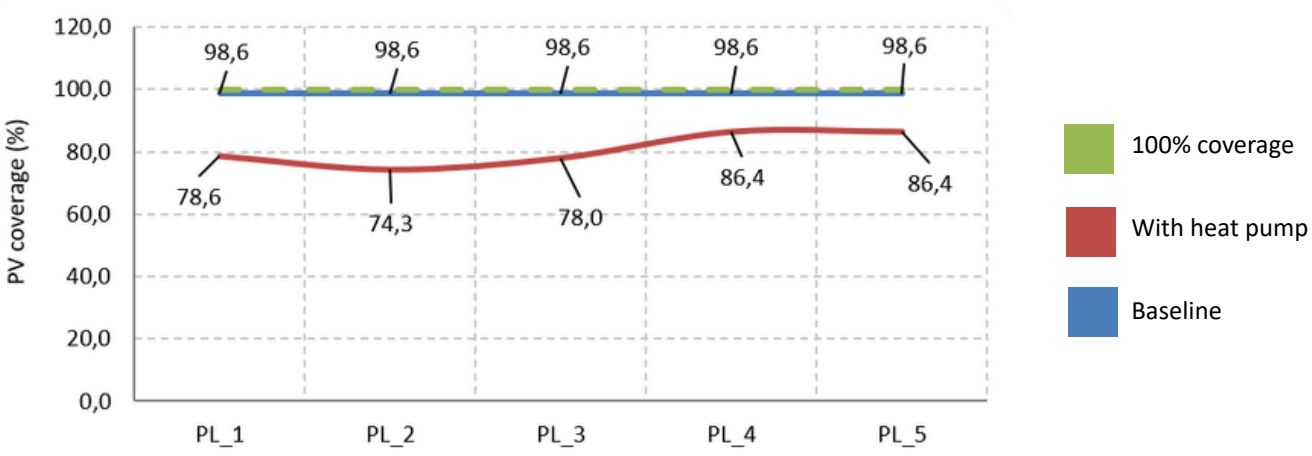
Annual energy consumption reduction (%)



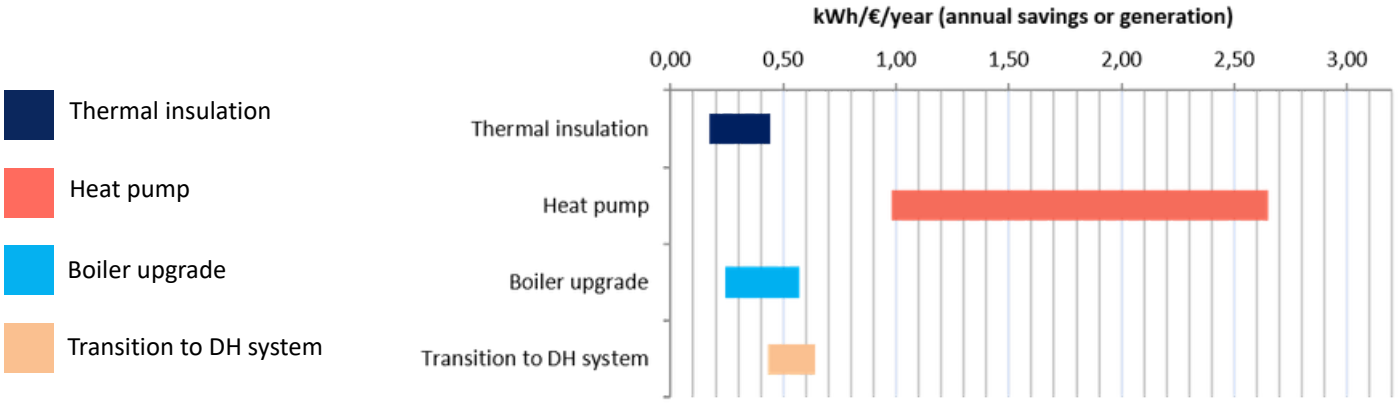
Annual energy bill reduction (%)



PV coverage (%)



Technoeconomic assessment



HIGHLIGHTS

- Heat pumps provide the strongest overall energy savings: 26.3 - 45.4 % lower annual consumption and 12.7 - 26.2 % potential bill reductions.
- Thermal insulation has consistent performance in Rumia, cutting energy demand by 20.6 - 28.6 % and energy bills by 9.3 - 15.1 %, with stronger value in older dwellings.
- Conventional boiler upgrades deliver more limited energy savings (7.0 - 10.8 %).
- Connecting gas-heated typologies to current district heating reduces final energy use by 6.5 - 14.6 % but can increase CO_2 emissions under the present Polish heat supply mix.
- The emissions advantage of heat pumps is currently constrained by the carbon intensity of electricity; this improves as the power system decarbonises.

SOLAR PV CONTRIBUTION

A 3 kW_p PV system produces about 4,017 kWh/year. The share of household demand electricity that can be covered by solar PV ranges from 74.3% to 98.6% across the examined typologies and scenarios. Heat pump installation paired with solar PV has lower coverage because of the electrification of the heating system. PV remains an important complementary measure for increasing household electricity self-sufficiency. Solar PV generation cost-effectiveness: 1.71 kWh/€/year.

INDICATIVE TARGETING LOGIC:

- Prioritise older, higher-demand dwelling typologies for envelope upgrades.
- Coordinate any district heating transition with planned low-carbon district heating investments.

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Scan here to access Deliverable 3.3

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https://ibs.org.pl/en/research/locatee-local-authorities-tackling-energy-poverty-in-private-multi-apartment-buildings/

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