ComActivate

Enabling community action for energy sufficiency

D3.3 EXCEL DATABASES ON ENERGY EFFICIENCY OF ENTIRE RESIDENTIAL HOUSING STOCK IN THREE TARGET DISTRICTS

Preparation of residential sector analyses on energy sufficiency of residential housing stock in target neighbourhoods

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Executive Summary

The ComActivate project focuses on reducing energy poverty for people living in multi-family apartment buildings (MFABs) in four pilot municipalities in Bulgaria, Hungary and Lithuania, among other, through the development of Neighbourhood Energy Sufficiency Roadmaps (NESR).

This report provides analysis of the current state of the building stock in target neighbourhoods in Bulgaria, Lithuania and Hungary and the possibilities for their improvements through implementation of energy efficiency measures to include aspects of energy sufficiency.

Together with other project tasks and reports, this report will help demonstration sites develop approaches to reduce energy poverty in MFABs. The aim of this analysis is to enable relevant authorities to establish efficient and effective policy & finance mechanisms enabling large-scale investments in residential sector of final energy consumption. Each analysis will serve as a reliable planning tool, enabling local authorities to get clear insight in entire residential stock on their territory and scope of pertaining energy-saving and emission-reduction needs and opportunities.

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Introduction

The European Green Deal aims at reducing carbon emissions by at least 55% by 2030 compared to 1990. The building sector plays a crucial role in achieving this goal because it is responsible for 35% of energy-related greenhouse gas emissions[1] and 43% of energy consumption[2] in Europe. This calls for interventions at building and neighbourhood level which will minimise the absolute energy consumption and green the leftover energy used, to reduce related greenhouse gas emissions. In addition, more than 10% of citizens in the EU are categorised as energy poor.[3] Tackling energy poverty can include change of (collective) behaviour patterns of occupants, improvement of energy performance of the building, or increasing local green energy production to reduce energy bill costs.

Interventions can target single buildings and its occupants. This might be a renovation, ideally using low carbon materials (e.g. secondary materials, easily recyclable elements), changes of occupants' energy consumption user patterns, and of course the installation of renewable energy technologies at single building level. Another approach targets many buildings on a *neighbourhood* level (also referred to as district approach). The neighbourhood approach for tackling energy poverty and climate targets for a city goes beyond the named interventions, such as renovations, of just an *array of single buildings*. It considers indicators that concern the whole geographical urban area with its building stock, green infrastructure and people. Benefits of considering the entire neighbourhood include achieving economies of scale and thus cost-efficiency (e.g. prefabricated renovation elements, sourcing building materials from a close geographical area), tackling social cohesion, sharing energy among buildings with diverging user patterns (e.g. schools and residential houses) and thus profiting from cheap electricity rates, and the possibility to profit from systemic solutions such as district heating. Therefore, interventions for absolute energy reduction in buildings at neighbourhood level are more holistic and integrated and allow to harvest synergies of various social and environmental policy goals.

The European Commission identified the benefits of the neighbourhood approach and its potential, specifically to accelerate renovation rates to increase the energy performance of the building stock and at the same time to reduce carbon emissions in the building sector already in the early 2000s. On the EU level it was considered and mentioned in the Leipzig Charta[4] and the Renovation Wave[5] strategy and was also recognised in the 2024 recast of the EPBD[6] under mandatory indicators of the National Building Renovation Plan requirements for member states.

Member States interpret the concept of the neighbourhood renovation approach differently. Whereas in the Western EU countries multiple instruments to roll out the neighbourhood approach were implemented, in EU countries that joined after 2004 the building sector in general was not targeted in the first place.

ComActivate project (2023-2026) is interested in neighbourhood concepts to address the energy poverty in three pilot countries Bulgaria, Hungary and Lithuania with differing climate, legal, administrative and overall cultural circumstances. In four pilot districts in Burgas (BG), Budapest-Józsefváros (HU), Kaišiadorys (LT) and Elektrenai (LT) neighbourhood energy sufficiency roadmaps (NESR) will be developed. Within those, the neighbourhood approach is specifically explored to achieve energy poverty alleviation through renovations.

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[1] European Energy Agency (2023)
[2] Rousselot and Pinto Da Rocha (2021)
[3] Widuto (2023). The ComAct project used the REACH project definition of energy poverty in D1.1.
[4] Bundesministerium des Innern und für Heimat (2020)
[5] European Commission (2020)
[6] European Union (2024, pp. 37–38)

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In this report an analysis of the current state of the building stock in target neighbourhoods in Bulgaria, Lithuania and Hungary is outlined as well as the possibilities for their improvements calculated through implementation of energy efficiency measures to include aspects of energy sufficiency.

Together with other project tasks and reports, this report will help demonstration sites develop approaches to reduce energy poverty in MFABs. The aim of this analysis is to enable relevant authorities to establish efficient and effective policy & finance mechanisms enabling large-scale investments in residential sector of final energy consumption. Each analysis will serve as a reliable planning tool, enabling local authorities to get clear insight in entire residential stock on their territory and scope of pertaining energy-saving and emission-reduction needs and opportunities.

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Residential sector analyses of target neighbourhoods

Building stock database

ComActivate responds to growing levels of energy poverty across the EU, especially in the CEE region, by addressing the poor energy efficiency of buildings as a major driver of energy poverty, and as a driver of climate change. The project aims to ensure the energy sufficiency of vulnerable people living in multi-family apartment buildings in Central and Eastern Europe by developing best practices for clean energy production, consumption and efficiency measures at the neighbourhood level. Partners will work over the next 3 years with three local municipalities to test the approach and replicate best practices from ComActivate in other regions.

Specific objective of technical development of neighbourhoods' roadmaps is to develop, demonstrate and co-create innovative Neighbourhood Energy Sufficiency Roadmaps (NESRs) for 3 energy-poor MFAB neighbourhoods in three vulnerable districts in Bulgaria, Hungary and Lithuania.

Aim of these analyses is to enable relevant authorities to establish efficient and effective policy & finance mechanisms enabling large-scale investments in residential sector of final energy consumption. Each analysis will serve as a reliable planning tool, enabling local authorities to get clear insight in entire residential stock on their territory and scope of pertaining energy-saving and emission-reduction needs and opportunities. The analyses include:

- current situation,
- possible measures to improve energy efficiency and generate energy savings and investments,
- situation after implementation of the proposed energy efficiency measures,
- environmental, economic and job-creation effects of implementation of the proposed measures.

In the first phase it was necessary to define the scope of neighbourhood in each target area. Upon successful completion of the first phase, site visits with data collection were performed. During this process, where applicable, already available documents have been consulted, such as:

- walkthrough energy audits,
- (district) heating development plans,
- renewable energy possibilities,
- anything related to the current building stock or energy use.

The number of MFABs analysed in target regions is as follows:

- Józsefváros municipality in Budapest, Hungary: 325 buildings,
- The city of Burgas, Bulgaria: 476 buildings,
- Elektrenai and Kaišiadorys municipalities in Lithuania: 308 buildings.

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Scope of this analysis is adapted according to the needs of local communities. Excerpts from excel databases are given here, with the full analyses file attached as an appendix to this report. The information given in the database include the following:

- Location data
  - City
  - Address

- Building geometry
  - Ground area (m^2)
  - Heated area (m^2)
  - Ground circumference (m)
  - Type of floor construction
  - Total number of storeys
  - Height (m)
  - Area of outer walls (m^2)
  - Outer walls insulation
  - Total area of windows and doors (m^2)
  - Total area of PVC windows and doors (m^2)
  - Roof/ceiling area (m^2)
  - Type of roof
  - Roof insulation

- Energy needs and savings
  - Type of heating system
  - Primary energy source
  - Heat required in current state of building (kWh/year)
  - Specific heat required in current condition of building (kWh/m^2/year)
  - Heat required in after insulation of outer walls (kWh/year)
  - Potential saving after insulation of outer walls (kWh/year)
  - Heat required in after insulation of roof/ceiling (kWh/year)
  - Potential saving after insulation of roof/ceiling (kWh/year)
  - Heat required in after replacement of windows and doors (kWh/year)
  - Potential saving after replacement of widows and doors (kWh/year)
  - Heat required in after insulation of floors (kWh/year)
  - Potential saving after insulation of floors (kWh/year)
  - Potential saving after all architectural measures (kWh/year)
  - Heat required after all architectural measures (kWh/year)
  - Specific heat required after all architectural measures (kWh/m^2/year)
  - Total savings by architectural measures (%)

- CO_2 emission
  - Emission in current state of building (t/year)
  - Reduction after insulation of outer walls (t/year)
  - Reduction after insulation of roof/ceiling (t/year)
  - Reduction after replacement of widows and doors (t/year)
  - Reduction after insulation of floors (t/year)
  - Reduction after all measures (t/year)
  - Emission after all measures (t/year)

- SO_2 emission
  - Emission in current state of building (t/year)
  - Reduction after insulation of outer walls (t/year)

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  - Reduction after insulation of roof/ceiling (t/year)
  - Reduction after replacement of widows and doors (t/year)
  - Reduction after insulation of floors (t/year)
  - Reduction after all measures (t/year)
  - Emission after all measures (t/year)

- NO_x emission
  - Emission in current state of building (t/year)
  - Reduction after insulation of outer walls (t/year)
  - Reduction after insulation of roof/ceiling (t/year)
  - Reduction after replacement of widows and doors (t/year)
  - Reduction after insulation of floors (t/year)
  - Reduction after all measures (t/year)
  - Emission after all measures (t/year)

- Investments
  - Wall insulation (EUR)
  - Roof/ceiling insulation (EUR)
  - Windows replacement (EUR)
  - Floor insulation (EUR)
  - Total investment (EUR)

- Heat transfer coefficient U, current condition
  - U-wall (W/m^2K)
  - U-windows (W/m^2K)
  - U-floor (W/m^2K)
  - U-roof (W/m^2K)

- Heat transfer coefficient U, after insulation
  - U-wall (W/m^2K)
  - U-windows (W/m^2K)
  - U-floor (W/m^2K)
  - U-roof (W/m^2K)

Some general notes about these excel files are as follows. All Excels have a DATA tab, where specific values can be changed in accordance with local regulations, actual or current values, or according to standards/laws. Buildings were separated by entrances where it made sense. As a general rule, separation was made by addresses, except where one building has two, three or four addresses. Construction characteristics (envelope characteristics) were taken into account based on what was visible from pictures and maps. A significant problem here were the inner courtyards and parts of the buildings not visible from the street. This applies to Budapest and Burgas, whereas the buildings in Lithuania do not have such a complex geometry. The same calculation methodology was used for all locations, except where we had data based on sources provided by pilots, which is a very small number of buildings. Savings ranges (%) are reasonable and well within of what is typically obtainable on buildings of comparable age, type, size and shape factor. All needs and savings are calculated based on an approximate budget, using estimated geometry. Energy sources used in individual entrances are taken based on the appearance of the building, information from pilots or data available on the Internet. Electricity consumption for air conditioners in transitional periods is neglected. Electricity consumption for lighting has not been considered, nor can it be taken into account based on these input data.

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Number	LOCATION DATA		BUILDING GEOMETRY									
	City	Address	Ground area	Heated area	Ground circumference	Type of floor construction	Total number of storeys	Height	Area of outer walls	Outer walls insulation	Total area of windows and doors	Total area of **PVC** windows and doorsa
			m^2	m^2	m			m	m^2		m^2	m^2
1	Budapest	Apáthy István utca 10; Szigony utca 34	546.70	1,749.44	194.60	Ground	4	14.50	2,312.40	N	509.30	140.50
2	Budapest	Apáthy István utca 12	248.00	396.80	63.00	Basement	2	8.50	430.50	N	105.00	0.00
3	Budapest	Apáthy István utca 14	135.00	540.00	68.00	Ground	5	17.50	975.80	N	214.20	0.00
4	Budapest	Balassa utca 1; Tömő utca 23C	300.30	1,201.20	97.60	Ground	5	17.50	1,395.90	N	312.10	103.90
5	Budapest	Baross utca 91	340.00	1,632.00	74.00	Basement	6	17.50	1,022.50	N	272.50	0.00
6	Budapest	Baross utca 93	340.00	1,632.00	74.00	Basement	6	17.50	1,016.70	N	278.30	0.00
7	Budapest	Baross utca 101	212.50	2,040.00	59.00	Ground	12	34.50	1,631.70	Y	403.80	403.80
8	Budapest	Baross utca 101A	212.50	2,040.00	59.00	Ground	12	34.50	1,628.00	Y	407.50	407.50
9	Budapest	Baross utca 103	340.00	3,264.00	74.00	Ground	12	34.50	2,012.20	Y	540.80	540.80
10	Budapest	Baross utca 103A, 103B	300.00	2,880.00	70.00	Ground	12	34.50	1,811.20	Y	603.80	603.80
11	Budapest	Baross utca 105	330.80	1,058.56	52.00	Ground	4	14.50	633.36	N	120.64	0.00
12	Budapest	Baross utca 107	266.50	426.40	66.00	Ground	2	8.50	460.10	N	100.90	0.00
13	Budapest	Baross utca 109	184.90	739.60	60.20	Ground	5	17.50	832.30	N	221.20	0.00
14	Budapest	Baross utca 111	159.80	1,534.08	50.60	Ground	12	34.50	1,344.20	Y	401.50	60.15

Number	LOCATION DATA		ENERGY NEEDS AND SAVINGS							
	City	Address	Heat required in current state of building	Specific heat required in current condition of building	Heat required in after insulation of outer walls	Potential saving after insulation of outer walls	Heat required in after insulation of roof/ceiling	Potential saving after insulation of roof/ceiling	Heat required in after replacement of windows and doors	Potential saving after replacement of widows and doors
			kWh/year	kWh/m^2year	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year
1	Budapest	Apáthy István utca 10; Szigony utca 34	301,457.36	172.32	177,701.75	123,755.61	251,598.47	49,858.88	274,124.21	27,333.14
2	Budapest	Apáthy István utca 12	80,190.12	202.09	57,150.51	23,039.61	57,567.28	22,622.84	72,408.18	7,781.94
3	Budapest	Apáthy István utca 14	115,323.70	213.56	63,100.58	52,223.11	102,971.89	12,351.81	99,448.54	15,875.16
4	Budapest	Balassa utca 1; Tömő utca 23C	180,336.07	150.13	105,629.94	74,706.13	152,946.59	27,389.49	164,905.60	15,430.48
5	Budapest	Baross utca 91	170,119.76	104.24	115,397.34	54,722.41	139,111.86	31,007.90	149,923.77	20,195.99
6	Budapest	Baross utca 93	170,456.28	104.45	116,044.27	54,412.01	139,448.38	31,007.90	149,830.43	20,625.85
7	Budapest	Baross utca 101	80,683.74	39.55	80,683.74	0.00	79,774.86	908.88	80,683.74	0.00
8	Budapest	Baross utca 101A	80,816.93	39.62	80,816.93	0.00	79,908.05	908.88	80,816.93	0.00
9	Budapest	Baross utca 103	117,852.50	36.11	117,852.50	0.00	116,398.29	1,454.21	117,852.50	0.00
10	Budapest	Baross utca 103A, 103B	110,620.39	38.41	110,620.39	0.00	109,166.18	1,454.21	110,620.39	0.00
11	Budapest	Baross utca 105	118,071.29	111.54	84,174.97	33,896.32	87,902.43	30,168.86	109,130.21	8,941.08
12	Budapest	Baross utca 107	83,032.88	194.73	58,409.14	24,623.75	58,728.16	24,304.72	75,554.81	7,478.07
13	Budapest	Baross utca 109	117,576.68	158.97	73,033.44	44,543.24	100,713.86	16,862.83	101,182.73	16,393.96
14	Budapest	Baross utca 111	91,771.43	59.82	91,771.43	0.00	91,087.95	683.48	66,472.71	25,298.72

Number	LOCATION DATA		CO_2 EMISSION					SO_2 EMISSION			
	City	Address	Reduction after insulation of roof/ceiling	Reduction after replacement of widows and doors	Reduction after insulation of floors	Reduction after all measures	Emission after all measures	Emission in current state of building	Reduction after insulation of outer walls	Reduction after insulation of roof/ceiling	Reduction after replacement of widows and doors
			t/year	t/year	t/year	t/year	t/year	t/year	t/year	t/year	t/year
211	Budapest	Magdolna utca 29	2.07	0.36	0.00	4.00	1.31	0.36	0.11	0.14	0.02
212	Budapest	Magdolna utca 31	2.21	0.44	0.00	4.46	1.66	0.41	0.12	0.15	0.03
213	Budapest	Magdolna utca 33	0.34	0.00	0.00	0.34	15.91	1.10	0.00	0.02	0.00
214	Budapest	Magdolna utca 35	0.13	0.00	0.00	8.32	7.07	1.04	0.55	0.01	0.00
215	Budapest	Magdolna utca 41	1.51	0.48	0.00	3.31	1.26	0.31	0.09	0.10	0.03
216	Budapest	Magdolna utca 43; Lujza utca 13	5.19	1.91	0.00	19.90	9.51	1.99	0.86	0.35	0.13
217	Budapest	Magdolna utca 45; Lujza utca 18	0.11	0.23	0.24	0.58	5.61	0.42	0.00	0.01	0.02
218	Budapest	Magdolna utca 47	14.21	0.41	1.44	25.24	12.69	2.56	0.62	0.96	0.03
219	Budapest	Magdolna utca 49	2.59	0.37	0.26	5.15	1.76	0.47	0.13	0.17	0.02
220	Budapest	Magdolna utca 51	1.63	0.33	0.00	3.58	1.28	0.33	0.11	0.11	0.02
221	Budapest	Magdolna utca 53; Dobozi utca 23	0.21	1.51	0.45	2.17	9.22	0.77	0.00	0.01	0.10
222	Budapest	Molnár Ferenc tér 2	5.14	1.93	0.00	18.63	11.46	2.03	0.78	0.35	0.13
223	Budapest	Molnár Ferenc tér 3	16.66	3.47	0.00	40.86	31.09	4.86	1.40	1.13	0.23
224	Budapest	Orczy tér 4/ A	15.07	0.00	0.00	46.51	31.55	2.66	1.07	0.51	0.00

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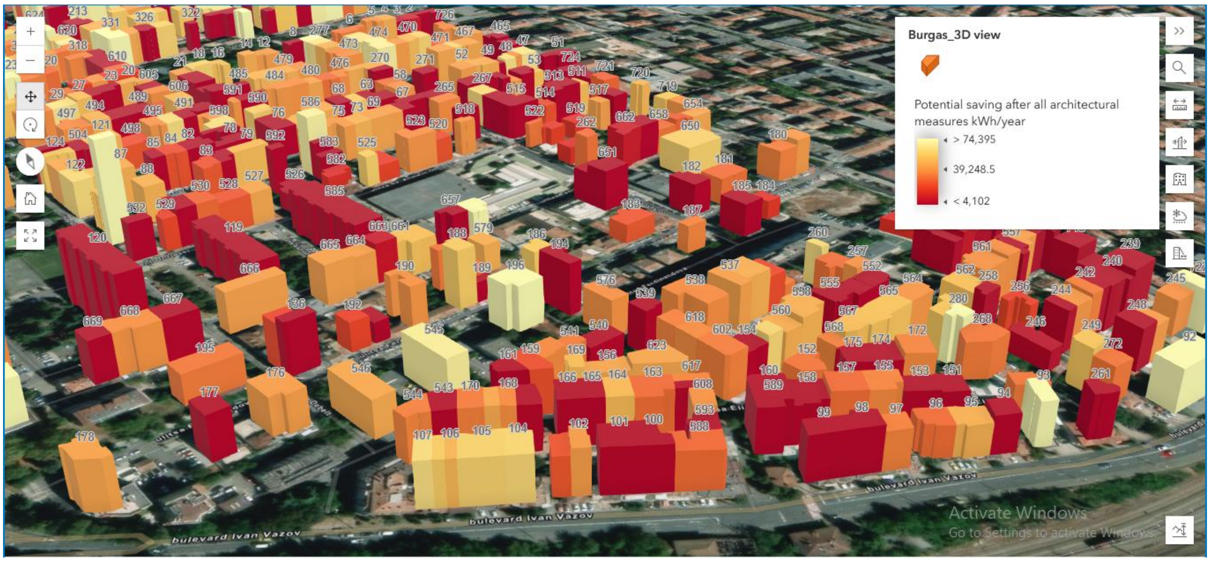
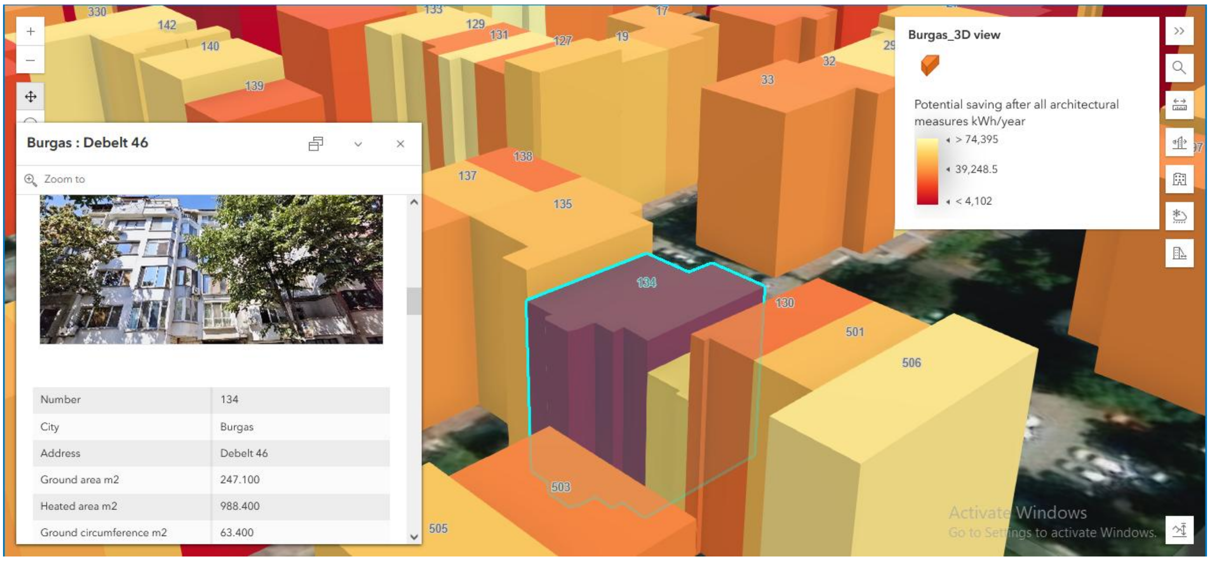
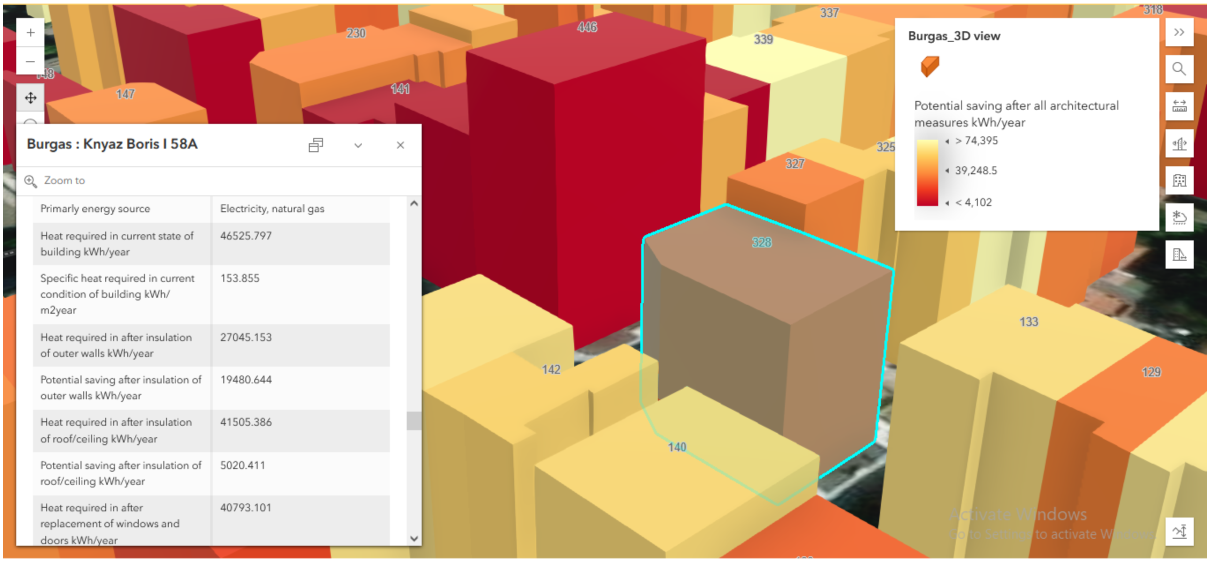
3D models of target neighbourhoods

In addition, [3D GIS model](#) of energy use and energy saving assessments for MFAB clusters in selected neighbourhoods is created based on the data obtained through building stock analyses. The model allows "walking" through the neighbourhood, clicking on any particular building and getting all relevant data about that building, such as outer dimensions, surface area, heated surface, energy needs, energy sources used for heating, investments needed for implementation of energy efficiency measures, possible savings, etc. Examples of 3D models for MFAB in target neighbourhoods are added to this report.







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Appendix 1 – Building stock of Józsefváros

Appendix 2 – Building stock of Burgas

Appendix 3 – Building stock of Kaišiadorys

Appendix 4 – Building stock of Elektrenai

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