RIX DIMENSIJA

Methodology, on the basis of which 15% of the most energy-efficient residential and non-residential buildings in Latvia were determined, based on Taxonomy Regulation no. 2020/852 and the requirements of its implementing legislation (Commission Delegated Regulation (EU) 2021/2139)

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Background

In Latvia, the process of energy certification of buildings started in 2013, when Cabinet of Ministers adopted regulations No. 383 "Rules on energy certification of buildings". However, despite the requirements of the law, the centralized registration of energy certificates was not paid enough attention until 2020.

21 277 certificates were registered in BIS in August 2023 which is less than 5% of the number of buildings registered on 01.01.2023 and which are subject to the requirements of energy certification of buildings.

In 2021, a new building energy certification scale and methodology was introduced. The new methodology envisages the certification of buildings also based on non-renewable primary energy consumption. According to the new methodology, only 3.8% of buildings subject to building energy certification requirements were certified.

Building information systems do not have sufficient building energy efficiency register information to develop a comprehensive methodology for determining the 15% most energy efficient buildings for each building type.

The existing building energy certification scales do not reflect the total primary energy consumption in the certification scales, but are indicated in the annexes of the building energy certificates.

In case the building is connected to centralized heat networks, it is not possible for an independent expert in the field of energy efficiency to unambiguously determine the technology used and the type of fuel. In the following calculations, it is recommended to adopt a factor of 1.0 for the total primary energy, which also includes a correction factor for buildings that are not connected to centralized heat networks.

Thermal energy consumption does not always reflect the full picture of a building's energy efficiency, as it does not take into account other forms of energy such as electricity or other primary energy sources. Therefore, the use of thermal energy consumption data is permissible in cases where the proportion of thermal energy consumption is greater than other forms of energy consumption (lighting, cooling, etc.).

Initial information on the developed methodology

The development of the methodology is based mainly on data on the energy consumption of buildings obtained from three databases. They are:

1. Data from the State Construction Control Office (BVKB) on BIS registered energy certificates and their content [1].
2. ALTUM data on renovated residential buildings [2].
3. AS "Rīgas Siltums" data on the total heat consumption of connected consumers in a given year.

The advantages and disadvantages of the relevant databases are shown in Table 1.

Table 1. Advantages and disadvantages of the used databases

Database	Advantages	Disadvantages
BIS register	Comprehensive information All building types Updated daily	There is no information on whether the energy certificate was issued after or before the renovation There is no information about buildings that have not been rebuilt or renovated Mostly data on newly constructed buildings
ALTUM	Energy consumption before renovation Division by series of buildings	Information only about multi-apartment buildings No data on primary energy consumption
AS "Rīgas Siltums"	Distribution of data by building types	There is no data on the heating area of the building

In addition, data previously collected by the methodology developer on the actual heat consumption of multi-story buildings were used.

Valid certificates were selected from the publicly available database of energy certificates for different types of buildings. Building types were renamed in accordance

[1] https://data.gov.lv/dati/dataset/075498f5-0136-47d7-af86-0066acb0264c/resource/212c0946-a06e-4c2c-8112-833b2969b44b/download/eku-energosertifikati-17.11.2023.csv

[2] https://www.altum.lv/wp-content/uploads/2023/01/publ_dme_progress_uz_31-12-2022.xlsx

with Cabinet of Ministers regulations no. 326 "Rules of classification of buildings" . The buildings were divided into groups according to the year of construction:

- ✓ before 1941
- ✓ from 1941 until 1961
- ✓ from 1962 until 1980
- ✓ after 2003
- ✓ without specified year of construction.

In addition to that, those certificates containing primary energy consumption data were selected from all valid energy certificates. The results are presented in Table 2.

Table 2. Number of buildings for which primary energy consumption data is available

Building types	Distribution	Year of construction					
		Before 1941	1941-1961	1962-1980	1981-2003	After 2003	No information
Administrative buildings/office buildings	Total	118	48	184	148	66	257
	Available data on primary energy	46	22	70	50	37	156
Single-family houses, semi-detached houses	Total	181	128	195	279	1099	7480
	Available data on primary energy	143	114	168	246	901	6422
Multi-apartment buildings	Total	270	327	895	510	84	821
	Available data on primary energy	92	89	261	142	69	576
Shopping centres	Total	9	10	18	38	81	183
	Available data on primary energy	5	4	8	19	52	140
Production buildings/factories	Total	3	3	43	25	33	113
	Available data on primary energy	3	3	43	25	33	113
Educational institutions	Total	140	83	323	115	54	204
	Available data on primary energy	30	27	105	33	26	81
Sports facilities	Total	5	3	27	26	38	39
	Available data on primary energy	1	2	8	13	11	21
Hotels and restaurants	Total	11	8	15	10	21	74
	Available data on primary energy	11	8	15	10	21	74

Justification of the chosen method

Since until now there is not enough extensive information on the specifics of energy consumption of buildings in operation, taking into account the year of building construction, typology, used building materials, etc., it is recommended to introduce a temporary methodology, which has been developed based on ALTUM data. ALTUM data provides information on the energy consumption of multi-storey apartment buildings before renovation. The obtained data have been compared with the information available to the methodology developer on energy consumption before the renovation, and by applying the transition coefficient from heat energy consumption to primary energy consumption, the primary total energy consumption data of buildings have been calculated.

Since the obtained results do not differ significantly between typical projects and the number of buildings belonging to individual series of buildings is not sufficient to objectively determine the energy consumption of the entire series of buildings, the proposed temporary methodology provides for determining a 15% sample from all multi-storey residential buildings, without dividing them by series. It should be noted that the building series is not indicated in the building energy certificates. Therefore, the use of energy certificates for automatic data processing is not possible.

The primary total energy consumption of the remaining 15% and 30% of the most energy-efficient buildings is assumed as a percentage difference between the average consumption of the TOP 15% and 30% of apartment buildings and the consumption of buildings of the corresponding type, using the BIS register data as a basis (Table 3 and 4). A more detailed explanation is given in the section "Methodological model".

Table 3. The average primary total energy consumption of the 15% most energy-efficient buildings and the change in kWh/m2 in relation to the primary total energy of multi-apartment buildings

	Primary total energy	Difference in kWh/m2 relative to the primary total energy of multi-apartment buildings	Difference in % relative to the primary total energy of multi-apartment buildings
Administrative buildings/office buildings	118	40.00	51.28
Single-family houses, semi-detached houses	88	10.00	12.82
Multi-apartment buildings	78	0.00	0.00
Shopping centres	124	46.00	58.97
Production buildings/factories	106	28.00	35.90
Educational institutions	113	35.00	44.87
Sports facilities	118	40.00	51.28
Hotels and restaurants	111	33.00	42.31

Table 4. The average primary total energy consumption of the 15% most energy-efficient buildings and the change in kWh/m2 in relation to the primary total energy of multi-apartment buildings

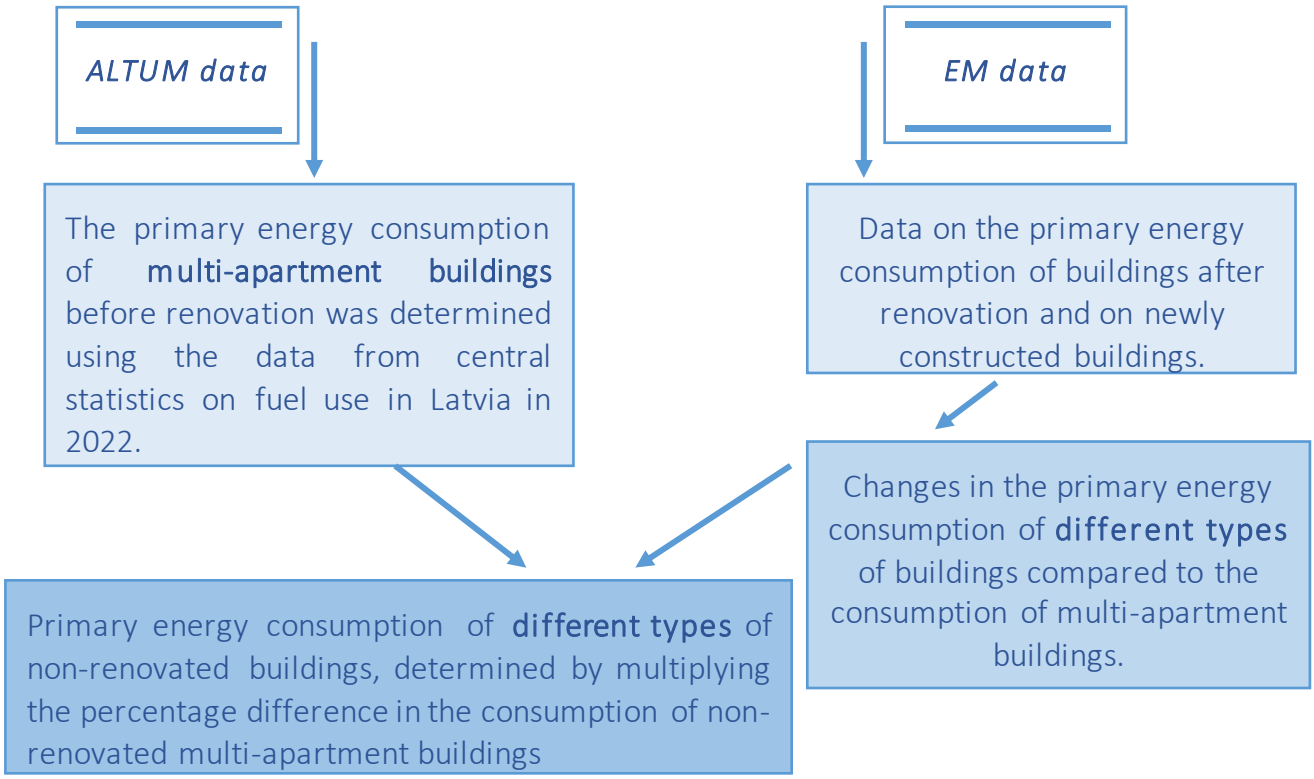
	Primary total energy	Difference in kWh/m2 relative to the primary total energy of multi-apartment buildings	Difference in % relative to the primary total energy of multi-apartment buildings
Administrative buildings/office buildings	141	40.00	39.60
Single-family houses, semi-detached houses	112	11.00	10.89
Multi-apartment buildings	101	0.00	0.00
Shopping centres	158	57.00	56.44
Production buildings/factories	129	28.00	27.72
Educational institutions	144	43.00	42.57
Sports facilities	143	42.00	41.58
Hotels and restaurants	136	35.00	34.65

The development of the new methodology in Latvia will be possible only when compliance with the requirements of the Law on Energy Efficiency of Buildings (Ēku energoefektivitātes likums) is ensured.

Methodology model

The basic calculation of the proposed methodology is based on the information on the average weighted primary energy consumption of multi-apartment buildings provided by the Ministry of Economics and the ALTUM database.

In order to obtain objective data on the primary energy consumption of unrenovated buildings, ALTUM data were used. They provide information only about multi-apartment buildings. This data is well structured, so an objective analysis of this data can be done. The primary energy consumption of the relevant buildings is taken as a reference value, determining the primary energy consumption of all other types of buildings as a percentage difference from the primary energy consumption of multi-apartment buildings, based on the data of the Ministry of Economics.



Next, 15% and 30% have been determined as the weighted average consumption between the data in the EM database and the ALTUM data. The data included in the EM database refer to renovated and new buildings.

Determining the primary energy consumption of Latvia's 15% and 30% of the most energy-efficient multi-apartment buildings

The primary energy consumption of of the most energy-efficient **multi-apartment** buildings in Latvia is determined using a formula (2):

$$Q_{15\%}^{Dz.\bar{e}} = f_{EM}^{Dz.\bar{e}} \cdot f_{EM15\%}^{Dz.\bar{e}} + (1 - f_{EM}^{Dz.\bar{e}}) \cdot q_{15\%}^{AL} \quad (2)$$

Share of new buildings — Share of non renovated

Where:

$Q_{15\%}^{Dz.\bar{e}}$ - the primary energy consumption of Latvia's 15% of most energy-efficient apartment buildings, kWh/m^2;

$f_{EM}^{Dz.\bar{e}}$ - the share of energy certificates of multi-apartment buildings registered in the construction information system;

$f_{EM15\%}^{Dz.\bar{e}}$ - primary total energy consumption of 15% of the most energy-efficient multi-apartment buildings registered in the construction information system, kWh/m^2;

$q_{15\%}^{AL}$ - primary total energy consumption of 15% of the most energy-efficient buildings included in the ALTUM database, kWh/m^2.

30% of the most energy-efficient apartment buildings in Latvia have been determined by the above-mentioned formula, using data on the primary energy consumption of 30% of the most energy-efficient apartment buildings in Latvia.

Based on the values determined as part of this work, the primary energy consumption of 15% and 30% of the most energy-efficient apartment buildings has been calculated:

$$Q_{15\%} = 0.077 \cdot 90.2 + (1 - 0.077) \cdot 158.61 = 153.34 \text{ kWh/m}^2$$

$$Q_{30\%} = 0.077 \cdot 90.2 + (1 - 0.077) \cdot 163.66 = 158.00 \text{ kWh/m}^2$$

Determining the primary energy consumption of the 15% and 30% most energy-efficient buildings of other types.

The primary energy consumption of the 15% most energy-efficient buildings selected from the other types of buildings has been determined according to the formula:

$$Q_{15\%} = f_{EM} \cdot q_{EM15\%} + ((\Delta q_{EM15\%} + Q_{15\%}^{Dz.\bar{e}}) \cdot (1 - f_{EM})) \quad (3)$$

Where:

f_{EM} - the proportion of energy certificates of the respective type of buildings registered in the construction information system;

$q_{EM15\%}$ - the primary total energy consumption of 15% of the most energy-efficient buildings of the relevant type registered in the construction information system, kWh/m^2;

$\Delta q_{EM15\%}$ - the difference between the average consumption of multi-apartment buildings and the consumption of buildings of the relevant type, using BIS register data as a basis, kWh/m^2.

Determining consumption for buildings without registered energy certificates

Table 4 shows the primary energy consumption of the most energy-efficient buildings in Latvia, regardless of the area of the building.

Table 5. Primary energy consumption of Latvia's 15% and 30% of the most energy-efficient buildings,kWh/m^2

	Total primary energy consumption of 15% of the most efficient buildings	Primary energy consumption of 30% of the most efficient buildings by area (excluding buildings with an area of less than 50 m2)
Administrative buildings/office buildings	207	260 (+25%)
Single-family houses, semi-detached houses	173	206 (+19%)
Multi-apartment buildings	153	197 (+ 29%)
Shopping centres	215	245 (+14%)
Production buildings/factories	236	281 (+19%)
Educational institutions	170	245 (+44%)
Sports facilities	249	307 (+23%)
Hotels and restaurants	175	209 (+19%)

It should be noted that Cabinet of Ministers regulations no. 222 determines the minimum permissible level of non-renewable primary energy consumption of the building, depending on the heating area of the building. Table 18 shows the primary energy consumption of 15% of the most energy-efficient buildings in Latvia depending on the heated area. The data of Table 5 on the distribution of primary total energy consumption by heated area are taken as a basis.

Table 6. Primary energy consumption of Latvia's 15% of the most energy-efficient buildings, kWh/m^2

Building type	Heating area of the building, m^2		
	from 50 to 120	from 120 to 250	above 250
Administrative buildings/office buildings	256.2	172.2	210
Single-family houses, semi-detached houses	197.28	157.55	137
Multi-apartment buildings	153	142.29	153
Shopping centres	293.58	265.62	233
Production buildings/factories	98.6	152.25	145
Educational institutions	59.16	154.86	174
Sports facilities	-	199.02	214
Hotels and restaurants	238.62	213.4	194

Table 6. Primary energy consumption of Latvia's 30% of the most energy-efficient buildings, kWh/m^2

Building type	Building area, m^2		
	from 50 to 120	from 120 to 250	above 250
Administrative buildings/office buildings	320.25	215.25	262.5
Single-family houses, semi-detached houses	234.76	187.48	163.03
Multi-apartment buildings	197.37	183.5541	197.37
Shopping centres	334.6812	302.8068	265.62
Production buildings/factories	117.334	181.1775	172.55
Educational institutions	85.1904	222.9984	250.56
Sports facilities	-	244.7946	263.22
Hotels and restaurants	283.9578	253.946	230.86

Conclusions and proposals on the developed methodology

Methodology description

The basic calculation of the proposed methodology is based on the information on the average weighted primary energy consumption of multi-apartment buildings provided by the Ministry of Economics and the ALTUM database. In order to obtain objective data on the primary energy consumption of unrenovated multi-apartment buildings, ALTUM data were used. The primary energy consumption of the relevant buildings is taken as a reference value, determining the primary energy consumption of all other types of buildings as a percentage difference from the primary energy consumption of multi-apartment buildings, based on the data of the Ministry of Economics. Next, 15% and 30% have been determined as the weighted average consumption between the data in the EM database and the ALTUM data.

The developed methodology has the following shortcomings:

Limited data availability. The method is based on information on the average weighted primary energy consumption of multi-apartment buildings obtained from the EM and ALTUM database. However, limitations of data sources could affect accuracy and coverage, as the data does not cover all building types.

Incomplete coverage. ALTUM data only provides information on apartment buildings, so the methodology may be insufficient or inappropriate for the assessment of other types of buildings, such as single-family homes, offices or industrial buildings.

Incomplete comparability. When using the energy consumption of multi-apartment buildings as a reference, it should be taken into account that the characteristics and energy efficiency potential of other types of buildings may be different. Thus, the results of the analysis may also be incomplete or inaccurate.

Despite these shortcomings, future proposals for improving the methodology are considered:

Obtaining additional data. Using updated information on available certificates, as well as data on primary energy consumption in buildings (the BIS register is updated daily; AS "Rīgas Siltums" data is updated monthly), which refer to different types of buildings

and aspects of energy efficiency, it would be possible to expand the database, improve the accuracy of the analysis and perform a recalculation.

Methodology improvement. By conducting research and developing new approaches, based on examples of good practice from other EU countries, it would be possible to improve the methodology so that it reflects more accurately the characteristics and energy efficiency potential of different types of buildings.

Adjustment of the model. Using additional information and improving the model, it would be possible to assess more accurately and compare the energy efficiency of different types of buildings and achieve more objective results.

These measures would help to improve the developed methodology and make it even more efficient and accurate.

Methodology update

This methodology will be reviewed regularly to ensure it is consistent with current data and best practices in the construction and real estate industries. It will be revised at least once a year or as necessary if significant changes in the regulatory environment, available data sources or methodological approach are identified. This will ensure that users are informed of any new data, changes or improvements that affect the methodology and the results of its use. Such a regular review will help maintain the methodology's compliance with current standards and requirements, thus ensuring its reliability and applicability in sustainability reports and other issues in the construction and real estate industries.

The need for methodology update is justified by the following criteria:

Data collection. The initial information – data – is updated daily/weekly/monthly/yearly, data on the energy efficiency of various buildings, including both primary energy consumption and other relevant metrics, is collected. This data is obtained from available sources of the construction and real estate industries.

Selection of criteria. According to the principles of the taxonomy, the criteria characterizing the energy efficiency of buildings are selected.

Data analysis and classification. The collected data is analyzed and a score is assigned to each building type, taking into account the selected criteria. Buildings are classified according to their level of energy efficiency and arranged in ascending order according to these ratings.

Determining the 15% sampling threshold. After building classification, a sampling threshold of 15% of the most energy-efficient buildings that meet the specified criteria is determined.

Inspection and adjustment. The methodology will be tested and adapted as necessary to ensure its compliance with current taxonomy and best practice in the construction and real estate industries.

Such a methodology, which takes into account taxonomy criteria, provides a systematic and objective approach to identifying the most energy-efficient buildings and determining the relevant thresholds in accordance with the goals and requirements of sustainable development.