



Heatmod 7.0
User Guide

Version 1.0



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Introduction

Online calculation tool *Heatmod 7.0* (<http://www.heatmod.lv>) use the same mathematical algorithms as for monthly and annual energy consumption, also for the determination of heating/cooling power, replacing the average temperatures with the minimum (in case of heating) un maximum (in case of cooling) values, thus, simulating regime at highest possible temperature difference. Therefore, a power needed to provide the set indoor temperature in extreme outdoor conditions is calculated.

Calculation tool landing page (**Figure 1**) has a small description, ability to log in for registered users, change languages (currently 2 languages are supported – English and Latvian), create new project, read the terms and conditions and register for the usage.

For **public users** (**Figure 1**), one can use all the features of the tool to make calculation only for one project and its related data within the session. After leaving the web page session and all its data will be lost.

For **registered users** (**Figure 2**), one can save and use unlimited number of projects, constructions, materials and climate data cities, in addition to group and tag all the data for more convenient usage.

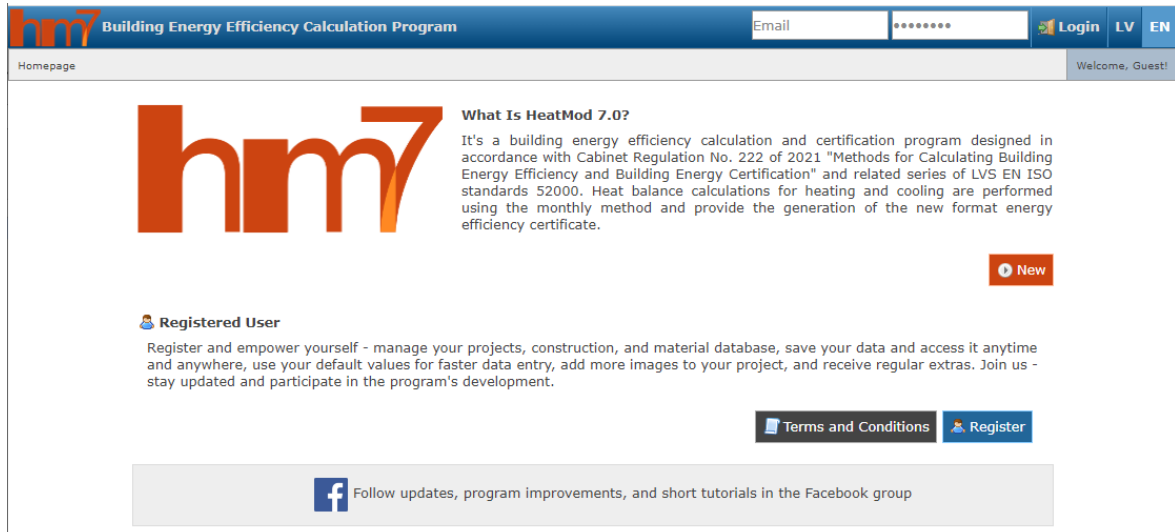


Figure 1 Heatmod 7.0: landing page for public user.

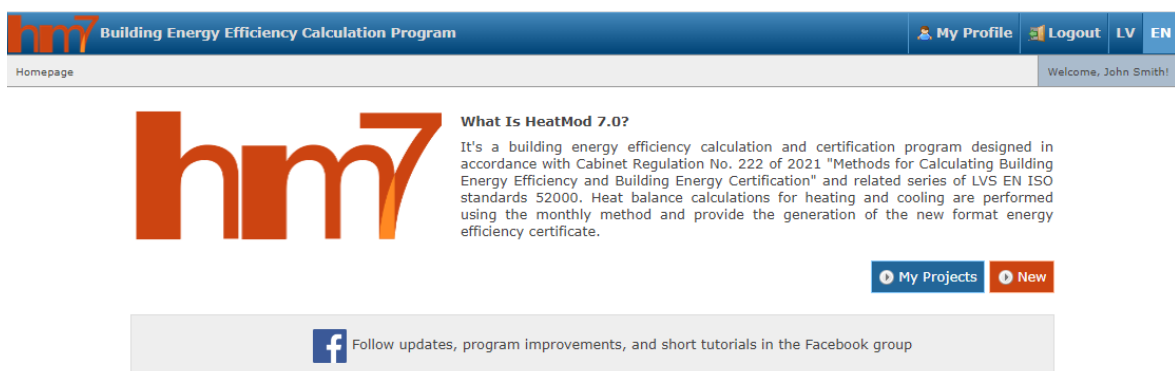


Figure 2 Heatmod 7.0: landing page for registered and logged in user.

Main structure & features

The program structure consists of such main choices:

- **Projects (Figure 3)**, where all user-generated calculations are created, copied or deleted. Typically, one project corresponds to one building with defined set of parameters, every change of them (e.g., replacing the windows or insulation of walls) should be stored as a new project with following grouping feature. One project contains data and results for both - heating and cooling seasons. In addition, user can join multiple projects for comparison reason, also add tags, tag projects to them, archive or export projects.
- **Constructions (Figure 4)** with user-set thermal transmittance values (U -values) and more complex composite building structures, whose U -values are calculated (**Figure 5**) based on material parameters (thickness and thermal conductivity). Constructions may be connected to a specific project, or they may not be related to them - in that case, the created construction can be used for calculation in any project.
- **Materials Database (Figure 6)**, in which the data from the Latvian Building Code LBN 002-19 are collected in a grouped form. The user also has the possibility to create his own materials and group them in a free form by specifying the name and the value of the thermal conductivity.
- **Common Data (Figure 7)** is for different cities in Latvia containing information about monthly average outdoor temperatures, solar irradiation for different orientations. There is also Latvian statistics on average consumption of different type of buildings. In addition, user can add its own custom cities and related climate data for it.
- **My Profile (Figure 8)** is for saving user profile data, change password and manage some default values for projects.

The interface of the calculation tool is divided into some parts (**Figure 9**). At the top there are described main menu with following short path. In the left part there are 3 top-level items – the project level, engineering systems level and the building construction level. The right part displays all the information about selected top-level item, allowing enter and view the content.

Project Name	Count	Archive	Delete
2022. AST (x4)	(4)		
2022. Aalborga konf.	(14)		
2022	(11)		
2021. AST	(4)		
2021	(21)		
2020	(11)		
2019. Kamsenes	(11)		
2019	(5)		
2018.EM. J. 8.Ra	(3)		
2018.EM. J. 7.Vie	(4)		
2018.EM. J. 6.Tī	(4)		
2018.EM. J. 5.Ār	(4)		
2018.EM. J. 4.Iz	(4)		
2018.EM. J. 3.Bī	(4)		
2018.EM. J. 2.DDz	(4)		
2018.EM. J. 1.VDz	(5)		
2018.EM. E. 16.Ra-nE	(6)		
2018.EM. E. 15.Ra-E	(7)		
2018.EM. E. 14.Vie-nE	(5)		
2018.EM. E. 13.Vie-E	(6)		
2018.EM. E. 12.Ti-nE	(6)		
2018.EM. E. 11.Ti-E	(9)		
2018.EM. E. 10.Ār-nE	(11)		
2018.EM. E. 9.Ār-E	(11)		
2018.EM. E. 8.Iz-nE	(11)		
2023.04.LU.Ratnieki.Stallis(viesnīca)	(2)	Archive	Delete
2023.02.RCT.M-1.Esoss	(2)	Archive	Delete
2023.02.RCT.P-5.Esoss	(3)	Archive	Delete
2023.02.RCT.N-7.Esoss	(3)	Archive	Delete
2022.12.Vesetas 7 (Rietumu banka)	(6)	Archive	Delete
AST. Brocēni. 3-Garaža-3v	(3)	Archive	Delete
AST. Brocēni. 2-Garaža-4v	(3)	Archive	Delete
AST. Brocēni. 1-Admin. KOKA VĀRTU NOMAIŅA	(4)	Archive	Delete
AST. Dārzcīema86. Esošs	(4)	Archive	Delete
2022.03. VaiņodesBekons - 4B - Kopija no 'oskars.pulkis@gr		Archive	Delete
2022.03. VaiņodesBekons - 4A - Kopija no 'oskars.pulkis@gr		Archive	Delete
2022.08. Turaidas 34A		Archive	Delete
Aalborga konf. 40(RCP8.5)	(2)	Archive	Delete
Aalborga konf. 40(RCP4.5)		Archive	Delete
Aalborga konf. 40(RCP2.6)		Archive	Delete

Figure 3 Heatmod 7.0: project and group level.

Construction Name	Value	Archive	Delete
AST. Brocēni. 1-Admin - SS	(0)		
2023.02.RCT.M-1.E.(UZL-bēniņi)	(0)		
2023.02.RCT.M-1.Esoss	(0)		
2023.02.RCT.P-5.(UZL-logi)	(0)		
2023.02.RCT.P-5.(UZL-bēniņi)	(0)		
2023.02.RCT.P-5.Esoss	(0)		
2023.02.RCT.N-7.(UZL-logi)	(0)		
2023.02.RCT.N-7.(UZL-bēniņi)	(0)		
2023.02.RCT.N-7.Esoss	(0)		
2022.12.Vesetas 7 (Rietumu banka) - UZLABOJUMI (Apgaismojums)	(0)		
2022.12. Raiņa 19 - UZLABOJUMI - PROJEKTAM	(0)		
2022.12.Vesetas 7 (Rietumu banka)	(0)		
AST. Brocēni. 3-Garaža-3v. SILT. Ārsienas	(1)		
AST. Brocēni. 3-Garaža-3v. SILT. StiklaBlokli->PVC	(0)		
AST. Brocēni. 3-Garaža-3v (2)			
AST. Brocēni. 2-Garaža-4v. SILT - Ārsienas	(1)		
AST. Brocēni. 2-Garaža-4v. SILT - Varti	(0)		
AST. Brocēni. 2-Garaža-4v (3)			
AST. Brocēni. 1-Admin. ĀRSIENI			
2022.09.AST. Br-1. Ārsiena (TO CHI MŪRIS)	0.5136	Archive	Delete
2022.09.AST. Br-1. Ārsiena (40 cm mūris)	1.436	Archive	Delete
2022.09.AST. D86. Ārsiena pret zemi (1m dz.) + S	0.3597	Archive	Delete
2022.09.AST. D86. Ārsiena (18 cm betons + 15 cm	0.1987	Archive	Delete
2022.09.AST. D86. Ārsiena pret zemi (1m dz.)	0.464	Archive	Delete
2022.09.AST. D86. Siltināts jumts	0.1724	Archive	Delete
2022.09.AST. D86. Ārsiena (18 cm betons)	1.322	Archive	Delete
2022.08.T34A.Grīda.	0.641	Archive	Delete
2022.08.T34A.Jumts.20+5	0.1697	Archive	Delete
2022.08.T34A.Ārsiena.GB_tikai(garāža)	0.7042	Archive	Delete
2022.08.T34A.Ārsiena.GB+15	0.1934	Archive	Delete
2022.08.T34A.Ārsiena.Koks+15	0.1845	Archive	Delete
2022.08.T34A.Ārsiena.Koks+10	0.2398	Archive	Delete
2022.08. Rītausmas. Jumts/bēniņi	0.1946	Archive	Delete
2022.08. Rītausmas. Ārsiena	0.2882	Archive	Delete

Figure 4 Heatmod 7.0: construction level.

Interior Exterior

Surface Thermal Loss Resistance (m²K/W) 0.13 0.04

• Layered or Heterogeneous Construction Parameters

Layer Thicknesses, d (mm)				
	Layer 1	Layer 2	Layer 3	Layer 4
	12 Air Gaps Level 0	50 Air Gaps Level 0	150 Air Gaps Level 0	10 Air Gaps Level 0
Section 1 50	Material: ģipškartons λ: 0,25 Air Interlayer: <input type="checkbox"/>	Material: izolācija λ: 0,04 Air Interlayer: <input type="checkbox"/>	Material: ģipškartons λ: 0,25 Air Interlayer: <input type="checkbox"/>	Material: izolācija λ: 0,04 Air Interlayer: <input type="checkbox"/>
Section 2 550	Material: viendabīgs koks λ: 0,1 Air Interlayer: <input type="checkbox"/>	Material: viendabīgs koks λ: 0,1 Air Interlayer: <input type="checkbox"/>	Material: izolācija λ: 0,04 Air Interlayer: <input type="checkbox"/>	Material: viendabīgs koks λ: 0,1 Air Interlayer: <input type="checkbox"/>

▢ Construction Schematic Drawing (with temperature curve)

▢ Thermal Transmittance Coefficient Corrections

• Resulting Construction Parameters

Thickness d (mm)	222
Area A (m ² or %)	600
Thermal Resistance R _T ((m ² K)/W)	3.9
Thermal Transmittance Coefficient U (W/(m ² K))	0.2564

[Save](#)

Figure 5 Heatmod 7.0: U-value calculator at construction level.

Material Database

Welcome, John Smith!

- Metāli (12)
- Koks un materiāli uz tā bāzes (18)
- Ģipsis (3)
- Java (1)
- Betoni (7)
- Akmeņi (5)
- Augsnes (2)
- Ūdens, ledus, sniegs (6)
- Apmetumi (7)
- Stikli (3)
- Gāzes (5)
- Plastmasas, vietas (bez porām) (18)
- Silīkoni (7)
- Gumija (4)
- Stiklojuma distanceri (4)
- Blīvāšanas materiāli (6)

Figure 6 Heatmod 7.0: materials database.

Normative heating days	201
Heating day 1 (°C)	
Heating day 2 (°C)	
Cooling day 1 (°C)	
Cooling day 2 (°C)	
Average of the coldest five days (°C)	-22.1
Heating season (°C)	0.7
Per year (°C)	6.7
January (°C)	-2.6
February (°C)	-3.3
March (°C)	-0.3
April (°C)	5.2
May (°C)	10.5
June (°C)	14.6
July (°C)	17.7
August (°C)	17
September (°C)	12.4

Figure 7 Heatmod 7.0: Climatic data for different locations.

Name Surname: John Smith
Contact Information: t. 987654321
Registration Number: ABC-12345

Save

Send Message (Question, Suggestion, Error Report, etc.)

Figure 8 Heatmod 7.0: User profile data.

Short path: Projects

Main: Common Data

Project's top-level menu: Daudzdzīvokļu ēkas sagatave 2021

Input area: Project Basic Data

Figure 9 Heatmod 7.0: structure.

Working with projects

The project top-level menu **project** (Figure 9) contains all the information (input and output data) about the building that is being calculated:

- **Basic data** of the project, incl. initial data (name, calculation date, calculation type, building condition and life cycle, energy efficiency assessment type), building data (building type/category/usage, address, year of construction volume, number of floors, area and volume etc. (Figure 10), as well as geographic location, which is needed for reading the climatic data from the database (Figure 11). In addition, there can be added building owner, client and expert data.
- **Measured (or projected) consumptions** (Figure 12) are the consolidation of the consumption data entered by the user on **engineering systems** top-level (Figure 9). For data required for the consumption data, see section **Engineering systems**.
- **Calculated consumptions** (Figure 13), displaying calculated values for the cooling and heating by data entered by user on **building construction** top level (Figure 9). For data required for the calculation, see section **Building constructions**. Here it is also possible to visualize the calculated data using different views – by months, energy types (losses, sources), building constructions etc. (Figure 14).
- **Model validation** (Figure 15), showing differences between measured and calculated values. As heat balance model includes only heating and cooling balance, all other consumptions are to be entered manually (ventilation, DHW, lighting and other). Model is valid, if difference between measured and calculated values is less than 10% and not exceeding 10 kWh/m².
- **Printouts** (Figure 16), where it is possible to upload images, certificates and additional data files to be saved within active project. Here is possible also to print out all the project's input data and calculation results as temporary certificate. In addition, there can be planned building improvements and compared to other linked projects data.

The screenshot shows the 'Basic Data' tab in the Heatmod 7.0 software. The interface is divided into several sections:

- Project Name:** Daudzdzīvokļu ēkas sagatave 2021
- Navigation Tabs:** Initial Settings, Building Data, Building Owner, Energoaudit Client, Independent Expert
- Building Type Section:**
 - Object Type: Entire Building
 - Building Category: Residential Building
 - Building Use: Other
 - Building Type: Multi-Apartment Buildings
- Building Data Section:**
 - Cadastral Designation of the Building or Its Part: 123456789
 - Address: Brīvības 10, Kārsava
- Building Characteristics Section:**
 - Year of Initial Acceptance for Use: 1978
 - Last Reconstruction/Refurbishment Year: 2011
 - Number of Above-Ground Floors: 5
 - Number of Underground Floors: 1
 - Mansard: no yes
 - Roof Floor: no yes

Figure 10 Heatmod 7.0: Basic data of the building.

Figure 11 Heatmod 7.0: Geographic location of the building.

Period	Yearly Data	Average Data
2019	(508 352 909 Wh)	
2020	(399 423 923 Wh)	

Figure 12 Heatmod 7.0: Measured values.

Category	Unit	Value
Total Room Volume	m ³	6 750
Total Heated Floor Area	m ²	2 500
Heating Maximum Predicted Power N_{heat}	kW	169.8
Average Calculation Results	per year	
With Distribution H_T	W/K	4 108
With Air Flow H_{ve}	W/m ² K	1.643
For Heating $Q_{heat,dist}$	Wh	385 444 542
For Cooling $Q_{cool,dist}$	kWh/m ²	154.2
For Heating $Q_{heat,vent}$	Wh	134 926 722
For Cooling $Q_{cool,vent}$	kWh/m ²	53.97

Parameter	Value
Average Calculation Results	heating day 1
Set temperature T_1 (°C)	20

Parameter	W	W/m ²
Heat loss flow Φ_{loss}	19 196	7.678
Heat gain flow Φ_{gain}	54 007	21.6
Total heat flow Φ_1	-34 811	-13.92

Figure 13 Heatmod 7.0: Calculated values – for heating and cooling amount (left) or power (right).



Figure 14 Heatmod 7.0: Calculated values – graphs.

The screenshot shows the 'Model Validation' tab. It contains two sections: 'Difference between Projected and Calculation Results' and 'Results by Purpose/Consumption'.

	kWh/m ²	%
Total Energy Consumption	22.53	11.45
For Heating	72.66	59.87
For Cooling	50.39	140.5

	Projection	Calculation
Total Energy Consumption (kWh/m ²)	208	185.5
For Heating (adjusted) (kWh/m ²)	157.7	85.03
For Cooling (and air drying) (kWh/m ²)	10.68	61.07
For ventilation (and air humidification) (kWh/m ²)		
For Hot Water Supply (kWh/m ²)	7.272	7.154
For Lighting (kWh/m ²)	29.78	29.78
Additional (kWh/m ²)	2.56	2.429

Figure 15 Heatmod 7.0: Model validation.

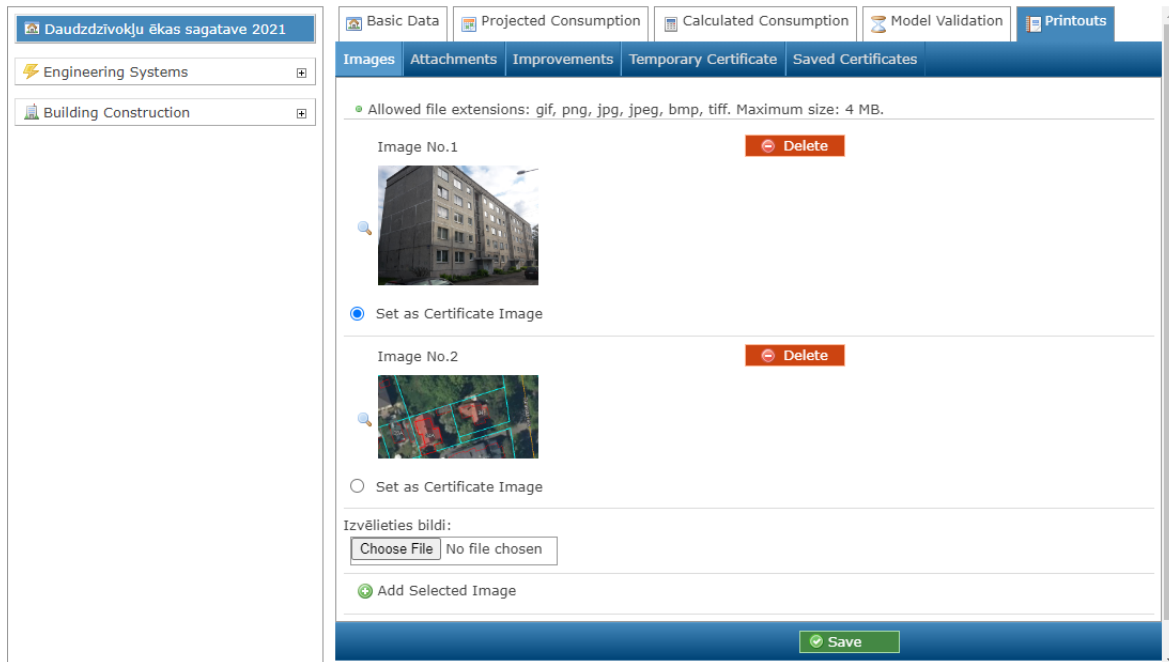


Figure 16 Heatmod 7.0: Data for printout.

After entering the basic project data, the information should be entered in the following two top-menu items: **engineering systems** and **building constructions** (Figure 9):

- **Systems (or engineering systems)** - a list of the main engineering systems used in the building, the measured (or designed) consumptions for them are to be entered here. The results of this section are further summarized in the "Measured values" section of the project (Figure 12).
- **Building (or building constructions)** – a main data of the whole building (or their zones) and the list of the boundary structures with following heat balance modelling and the heating/cooling demand and power. Includes heat losses and sources. The results of this section are further summarized in the "Calculated values" section of the project (Figure 13).

Notes:

- Depending on the project data (condition, like life cycle etc.) its input area (Figure 9) menu is adjusted, by showing only appropriate items.
- Depending on weather user needs to calculate heating and cooling consumption or maximal powers, input area (Figure 9) field are adjusted.

Engineering systems

The project's top-level menu **engineering systems** (Figure 17) is being created from the user entered information about following engineering systems presented is the building: heating, cooling, domestic hot water (DWH), mechanical ventilation and lighting. Additional non-specified energy also can be added to ensure the work of other systems (e.g., circulation pumps for the heating system or DWH).

Each of the engineering systems has the possibility to enter energy into and out of it. For incoming energies, it is possible to indicate the measured data (energy consumption,

length of heating season and indoor/outdoor temperatures) for different years (**Figure 18**), while for outgoing energies the consumption amounts are automatically calculated depending on the efficiency of the engineering system. In case of the heating boiler, the typical efficiency is within the range 85...95%. In case of heat pump, the seasonal coefficient of performance (SCOP) should be used, which is greater than 1 – in this case all the energy difference is assumed to be produced from renewable energy resources (**Figure 19**). Schematic drawing of energy flows is shown near the input form for better understanding of the process (**Figure 20**).

A list of all entered engineering systems is displayed on the left side in a tree structure, each of the items can be collapsed or expanded by clicking on a plus/minus button on the right. The results of this section are summarized in the "Measured values" section of the project (**Figure 12**).

	1. Measured Data	2. Normative Data
Number of heating days $D_{heating}$ (-)		202
Indoor temperature (°C)		20
Outdoor temperature Vidējā ārējais temperatūra (°C)		-0.5
Indoor temperature Grādu dienu skaits GDD (-)	4 141	4 141

Figure 17 Heatmod 7.0: System top-level menu.

	1. Measured Data	2. Normative Data
Number of heating days $D_{heating}$ (-)		202
Indoor temperature (°C)		20
Outdoor temperature Vidējā ārējais temperatūra (°C)		-0.5
Indoor temperature Grādu dienu skaits GDD (-)	4 141	4 141

Figure 18 Heatmod 7.0: Heating data (energy consumption, heating days and temperatures) input for one year.

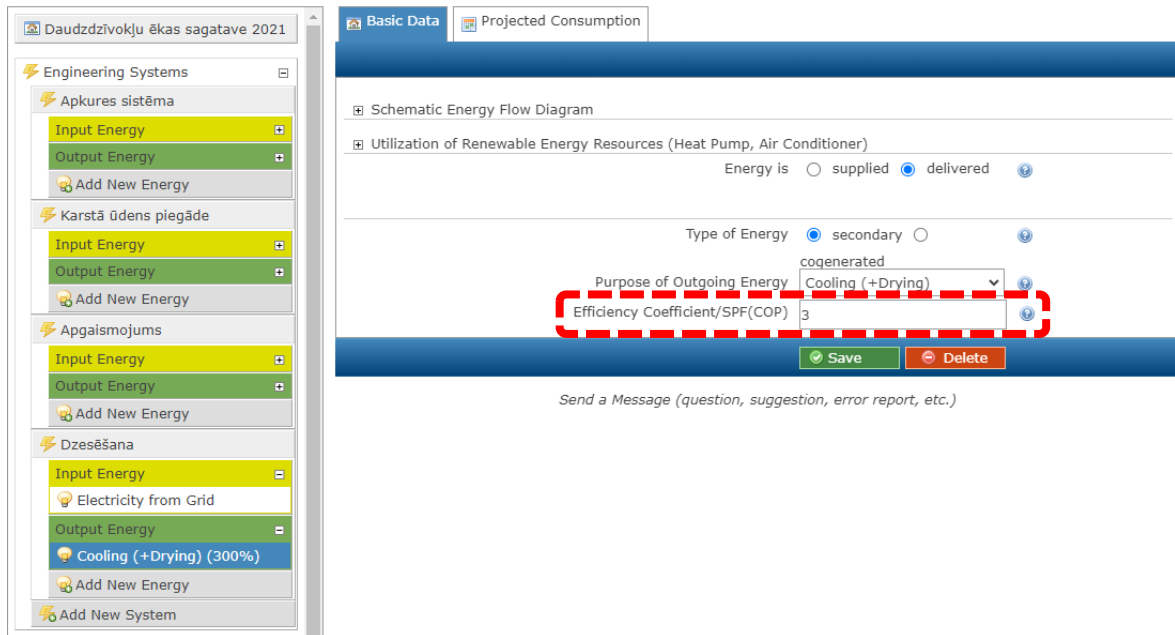


Figure 19 Heatmod 7.0: Definition of the heat pump for cooling with SCOP of 3.

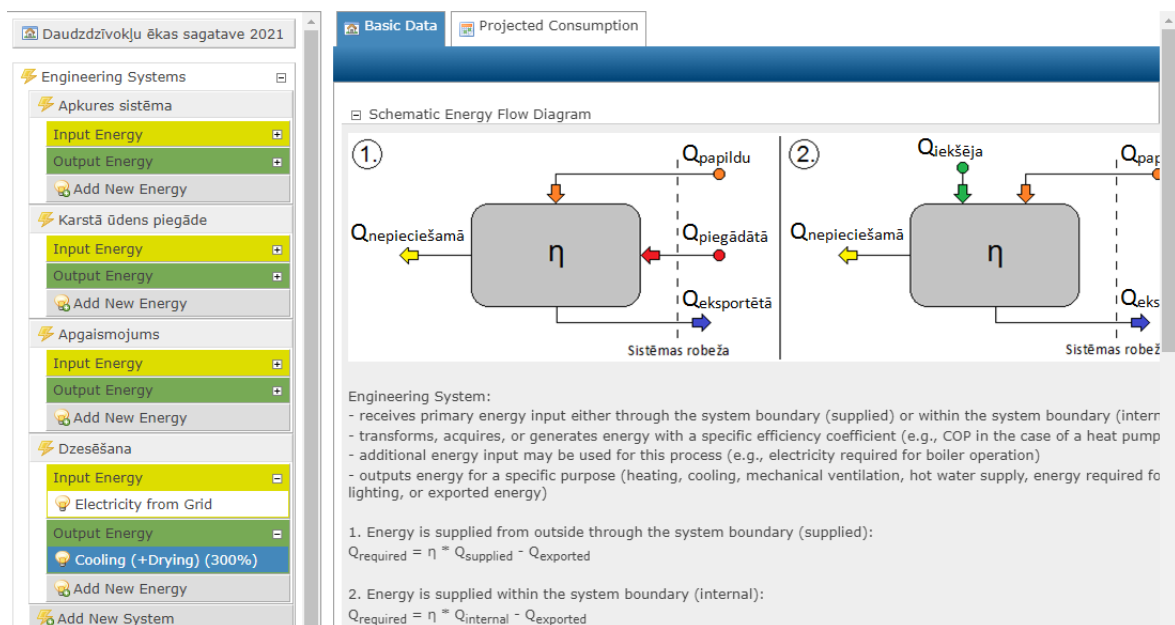


Figure 20 Heatmod 7.0: Schematic drawing of energy flows in one zone.

Building constructions

The project's top-level menu **building constructions** (Figure 21) is the frame for heat balance model of the selected building. It contains at least one building zone (number of zones is unlimited), for which heat losses and gains are defined and needed energy amount and power is calculated according [2]. Each zone consists of set of general parameters (for ventilation and internal heat sources) and boundary structures with their own parameters describing transmittance and solar heat gains (number of structures is unlimited).

A list of all entered zones with corresponding boundary structures is displayed on the left side in a tree structure, each of the items can be collapsed or expanded by clicking on a plus/minus button on the right. The results of this section are summarized in the "Calculated values" section of the project (**Figure 13**, **Figure 14**). Any zone or boundary structure can be copied and deleted. Boundary structures can be copied to another zone as well.

Operations within zone includes:

- **Basic data (Figure 22)**: name, description, type (residential, office, etc.), main construction material and classification, heated floor area, average height and total volume, as well as monthly indoor temperature for heating and cooling in of annual calculation method or one temperature for power calculations (**Figure 23**).
- **Transmission** – contains a summary of heat transmission losses in the selected zone, which is calculated from data on building elements of the zone (**Figure 24**). It includes area of all defined boundary structures (m^2), heat transfer coefficient H_T (W/K), power and energy as absolute (W, Wh) or normalized (W/m^2 , kWh/m^2) value.
- **Ventilation** – provides an opportunity to define the ventilation parameters in the selected zone (**Figure 25**) for both – natural and mechanical ventilation cases. For the natural ventilation it is possible to define an air exchange rate (h^{-1}) or an air flow (m^3/h), in case of mechanical ventilation – also heat recovery coefficient (%), which affects the inlet air temperature (**Figure 26**). Calculation of the related heat transfer coefficient H_T (W/K), power and energy as absolute (W, Wh) or normalized (W/m^2 , kWh/m^2) value are shown as the results on this page (**Figure 27**). In addition, there is a possibility to add multiple windows and night ventilation calculations for further use in ventilation (**Figure 28**).
- **Internal sources (heat gains)** – provides an opportunity to define all internal heat gains (**Figure 29**) inside the zone. The minimum needed input data consists of parameters characterizing residents, appliances and lighting. Additionally, the data about domestic hot water system incl. heat release from the circulation may be defined. Another specific internal heat gains from processes and objects may be defined here too.
- **Solar heat gains** – contains a summary of solar heat gains through transparent and opaque building elements according to EN ISO 52016-1 standard [2] as power distribution over the cardinal directions, and total energy as absolute (W, Wh) or normalized (W/m^2 , kWh/m^2) values for selected zone (**Figure 30**).
- **Calculation** – summarizes all the results of heat balance calculations for one zone according to EN ISO 52016-1 standard [2] both – heating and cooling seasons. The main data includes set indoor temperature, transmittance and ventilation power and energy, indoor and solar heat gains, as well the overall results – heating and cooling energy demand for the whole year in kWh and kWh/m^2 (**Figure 31**). In case of only one room modelling, the power for pre-set 4 days are displayed (**Figure 32**).
- **Heating interruptions (or breaks)** – provides a way to define interruptions and "holidays" in the zone, thereby correcting the total required energy for heating and/or cooling (**Figure 33**).

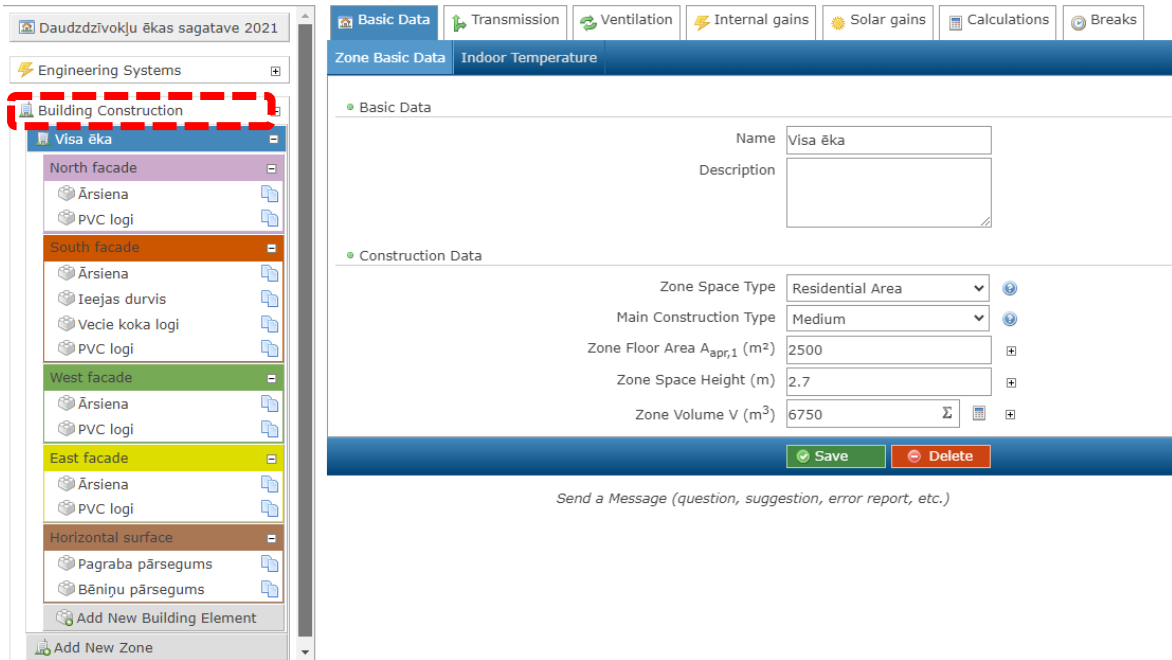


Figure 21 Heatmod 7.0: Building top-level menu.

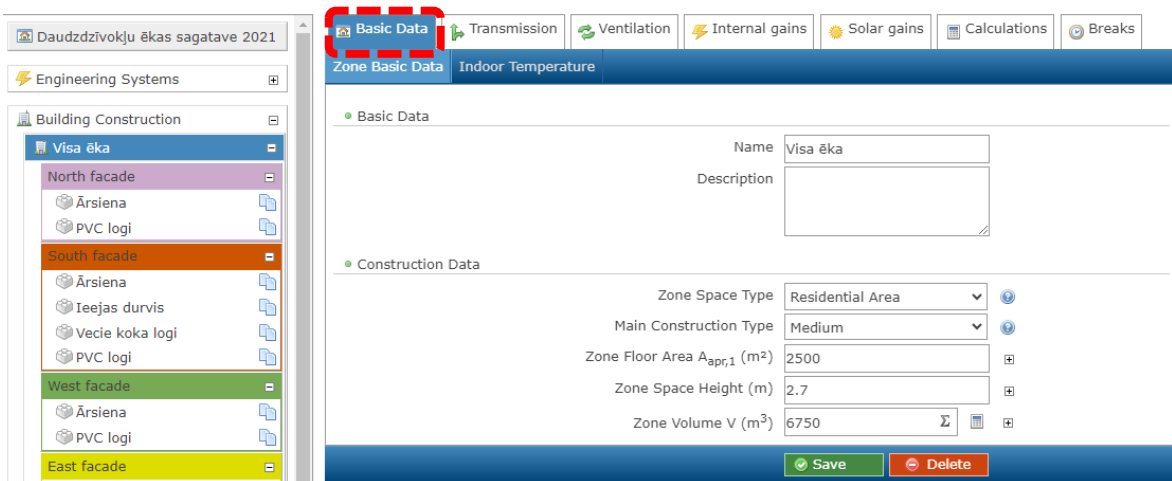


Figure 22 Heatmod 7.0: Basic data for the zone.

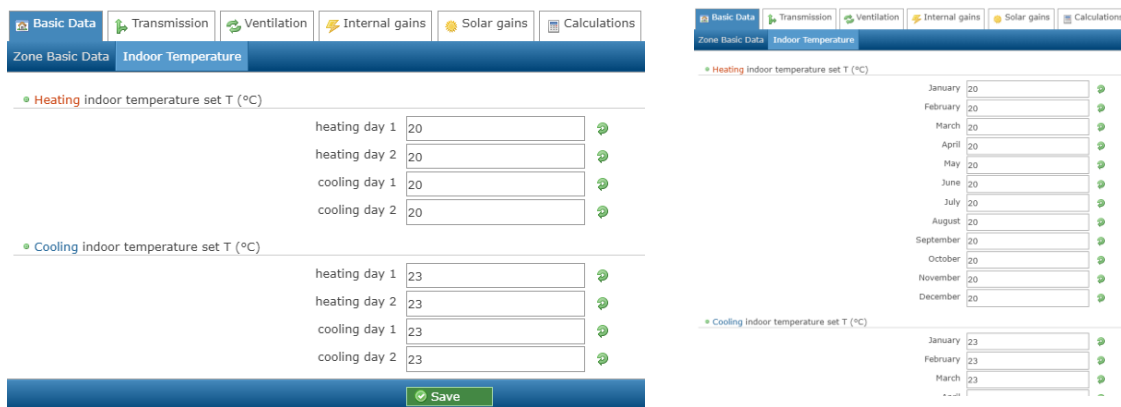


Figure 23 Heatmod 7.0: Input of temperatures for power (left) and monthly (right) calculations.

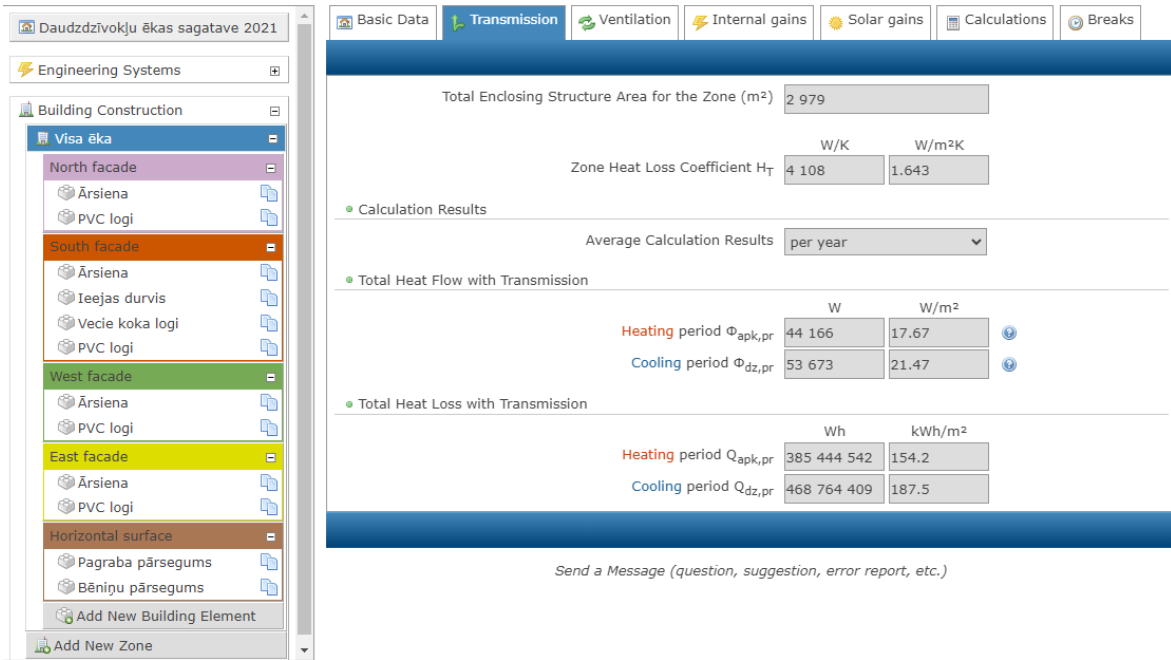


Figure 24 Heatmod 7.0: Summary of transmission heat losses for one zone.

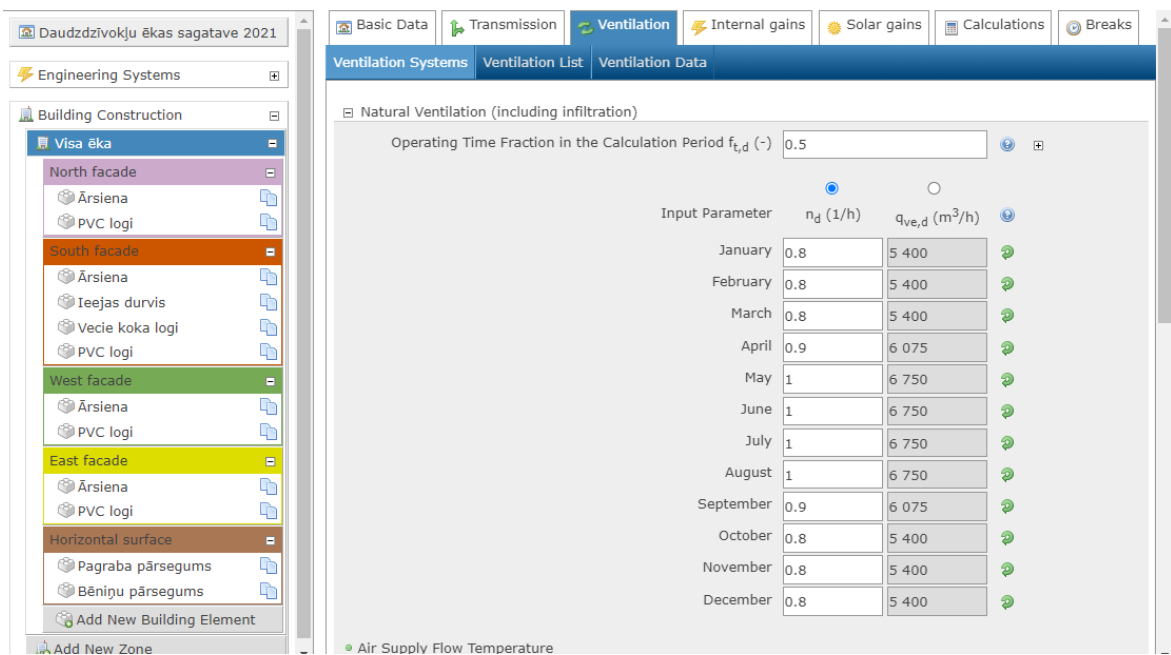


Figure 25 Heatmod 7.0: Defining the air exchange rate for ventilation calculations.

Operating Time Fraction in the Calculation Period $f_{t,m}$ (-) 0,5

Input Parameter n_m (1/h) $q_{ve,m}$ (m³/h)

Month	n_m (1/h)	$q_{ve,m}$ (m ³ /h)
January	1	6 750
February	1	6 750
March	1	6 750
April	1	6 750
May	1	6 750
June	1	6 750
July	1	6 750
August	1	6 750
September	1	6 750
October	1	6 750
November	1	6 750
December	1	6 750

Matches Outdoor Air Temperature? yes no

Efficiency of Ventilation Equipment with Heat Recovery (%) 85

Figure 26 Heatmod 7.0: Defining the heat recovery for mechanical ventilation calculations.

Average Calculation Results per year

Operating Time Fraction in the Calculation Period f_t (-) 1

Air Exchange Coefficient n (1/h) 0,9417

Set Temperature

Heating $T_{1,heat,m}$ (°C) 20

Cooling $T_{1,cool,m}$ (°C) 23

Heat Loss Coefficient with Air Flow H_{ve}

	W/K	W/m ² K
Heating	2 161	0.8645

Total Heat Flow with Ventilation

	W	W/m ²
Heating period $\Phi_{heat,ve}$	15 468	6.187
Cooling period $\Phi_{cool,ve}$	19 026	7.61

Total Heat Losses with Ventilation

	Wh	kWh/m ²
Heating period $Q_{heat,ve}$	134 926 722	53.97
Cooling period $Q_{cool,ve}$	166 103 654	66.44

Figure 27 Heatmod 7.0: Ventilation heat losses for one zone.

The screenshot displays the 'Ventilation' tab in the software. On the left, under 'Ventilation Systems', there is a 'Ventilation List' showing a scenario named '25 atvėrtie logi' with a total ventilation rate $\Sigma n_{d,total}: 0.02231$. A 'Delete' button is next to it. Below the list is a field to 'Add a new ventilation scenario with a name:'. On the right, the 'Ventilation Data' form is shown for the selected scenario. It includes fields for 'Ventilation Name' (25 atvėrtie logi), 'Descriptive Parameters' (Average ventilation duration in hours per day (h/d) = 2, Reduction Factor (-) = 1), 'Climate Conditions' (Temperature Difference between Indoor and Outdoor (K) = 10, Wind Speed (m/s) = 1), and 'First Window Group' (Number of Windows = 25, Window Width (openable part) (m) = 1, Window Height (openable part) (m) = 1, Is the window tilted downward? = yes, Width of the tilted window opening (m) = 0.05). A 'Second Window Group (cross-ventilation)' section is also present but empty.

Figure 28 Heatmod 7.0: Window and night ventilation calculations – list (left) and data form (right).

The screenshot shows the 'Internal gains' tab. On the left, a tree view under 'Building Construction' shows 'Visa ēka' expanded to 'South facade', which includes 'Ārsiena', 'Ieejas durvis', 'Vecie koka logi', and 'PVC logi'. The main area contains the 'Internal gains' form. It is divided into three sections: 'Heat Flows from Inhabitants and Devices', 'Heat Flows from Hot Water Systems', and 'Lighting'. The 'Inhabitants' section includes $\Phi_{int,occ} (W)$ (15 000), $f_{occ} (-)$ (1), and $q_{occ} (W/m^2)$ (6). The 'Devices' section includes $\Phi_{int,dev} (W)$ (15 000), $f_{dev} (-)$ (2), and $q_{dev} (W/m^2)$ (3). The 'Lighting' section includes $\Phi_{int,light} (W)$ (5 063), 'Installed Lighting Power (W)' (27 000), 'Heat Energy Coefficient (-)' (0.9), and 'Operating Hours during the Day (h)' (5). The 'Hot Water Systems' section includes $\Phi_{int,hot,other} (W)$ (7 544), 'Hot Water Liters Used during the Day (l)' (4 500), and 'Hot Water Temperature (°C)' (55).

Figure 29 Heatmod 7.0: Defining of internal heat gains for one zone.

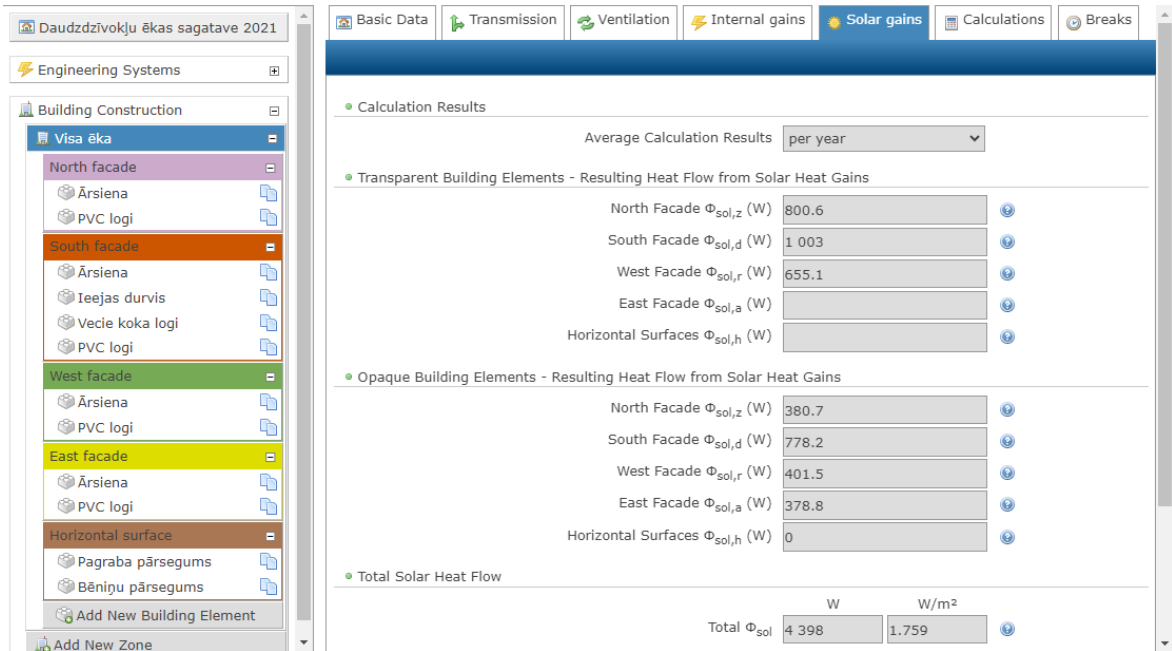


Figure 30 Heatmod 7.0: Summary of solar heat gains for one zone.

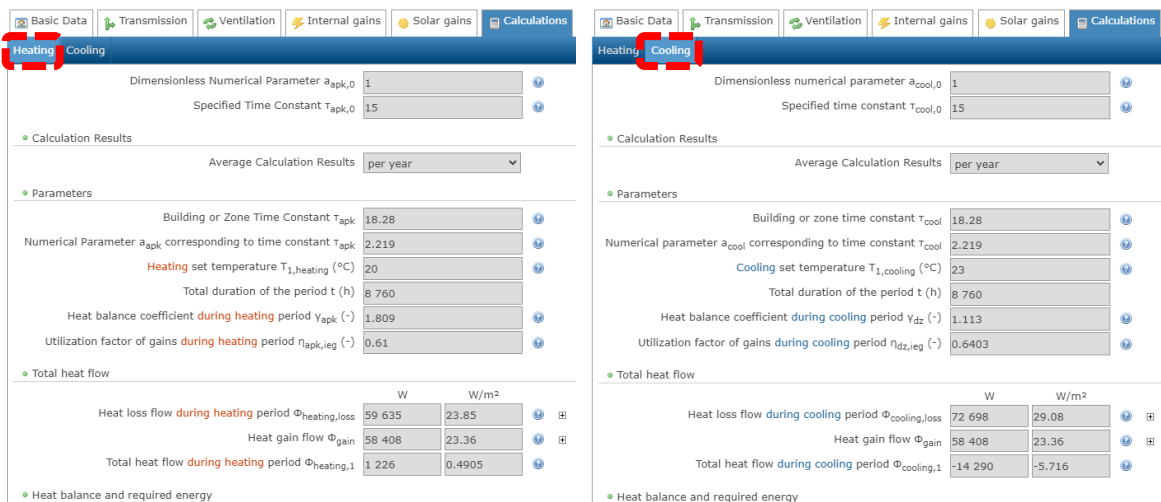


Figure 31 Heatmod 7.0: Calculation results for monthly calculations (heating – left, cooling - right).

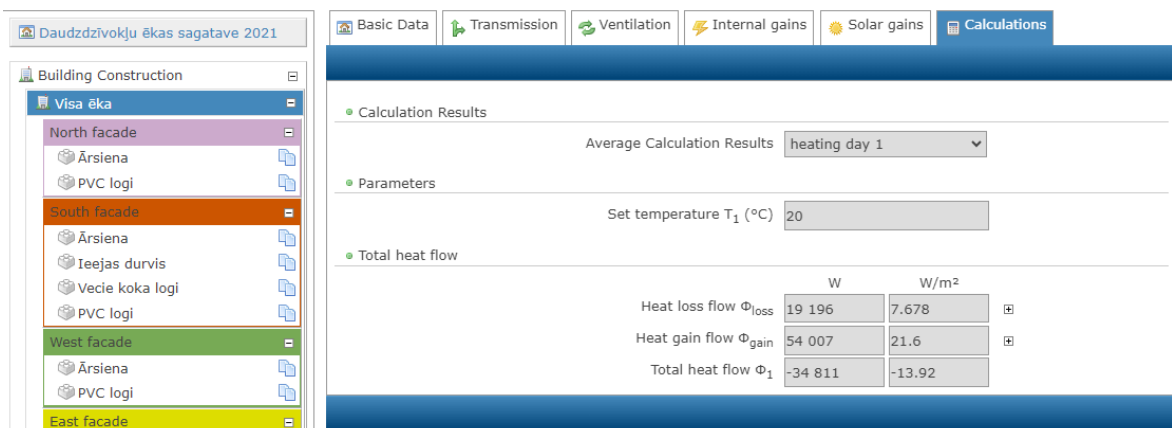


Figure 32 Heatmod 7.0: Calculation results in case of one room calculations.

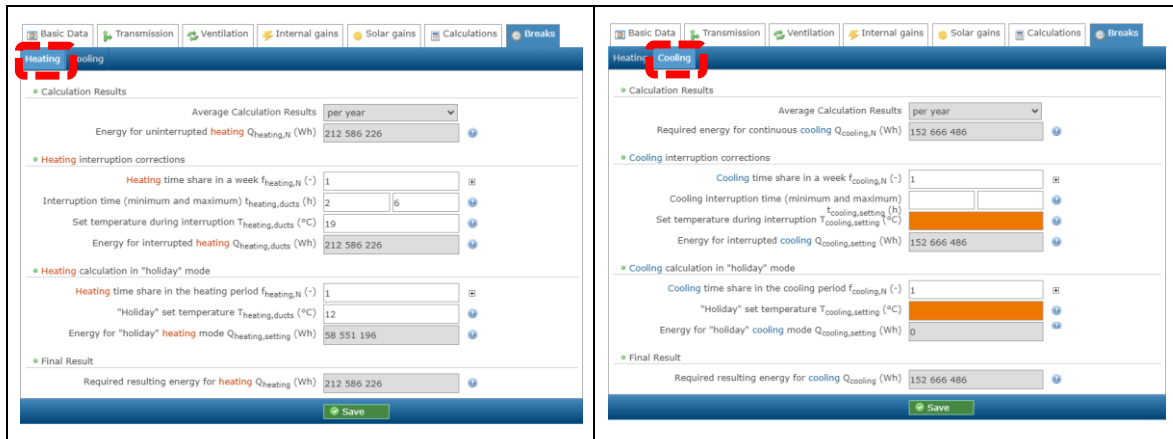


Figure 33 Heatmod 7.0: Heating or cooling breaks (or interruptions) and “holidays” – heating (left) and cooling (right).

Without parameters describing one zone as one object (ventilation and internal heat gains), there are parameters characterizing different boundary structures individually – transmittance heat losses and solar heat gains. Generally, they depend on the construction’s area and spatial orientation, therefore, should be defined separately. Operations for each building element (boundary structure) includes:

- **Basic data (Figure 34)** – type (wall, ceiling, floor, window, door), orientation (north, south, east, west or horizontal), name, optional description.
- **Transmission heat losses (Figure 35)** with
 - **main data** – area (m²) with build-it calculator option, U -value (W/m²/K), optional thermal bridges, and resulting heat transfer coefficient H_T (W/K);
 - **calculations of U -value** for adjoining rooms (Figure 36) and floor (Figure 37) or ceiling (Figure 38) constructions;
 - possibility to set different **temperature outside** (e.g., to other rooms - Figure 39).
- **Solar heat gains (Figure 40)** with
 - **main data** – proportion of the frame and type of glazing for g -value selection;
 - adding multiple shading to element (Figure 41), for each making calculations of different types of shadings (Figure 42);
 - summary of solar heat gains for one building element for heating and cooling seasons (Figure 43).

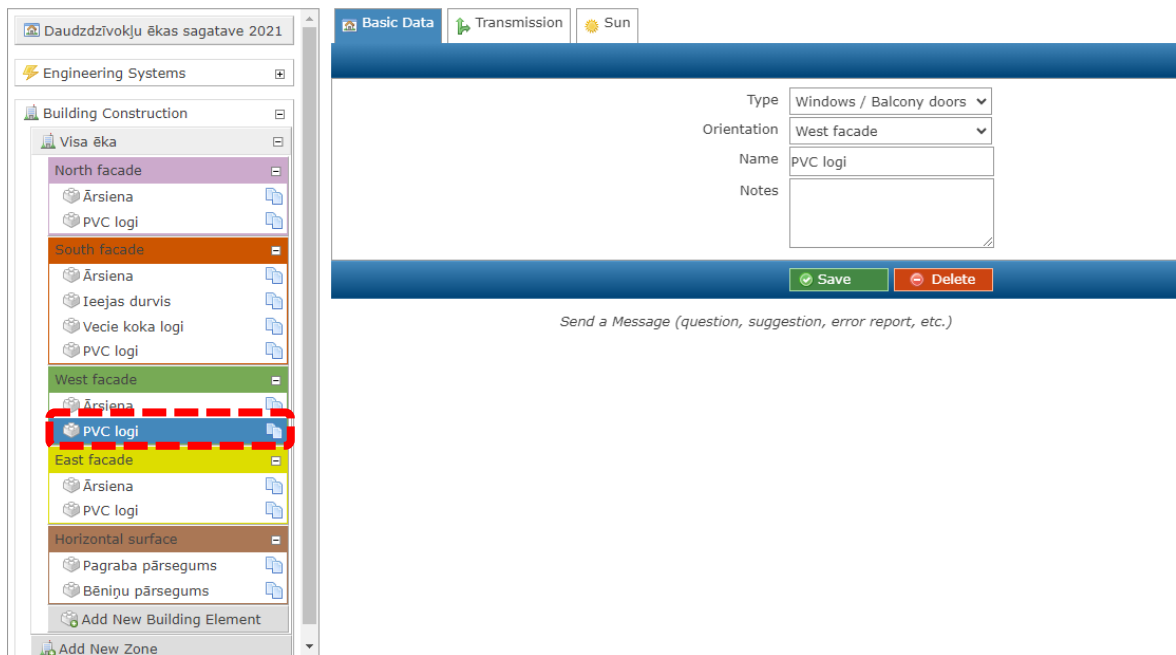


Figure 34 Heatmod 7.0: data entry for one building element.

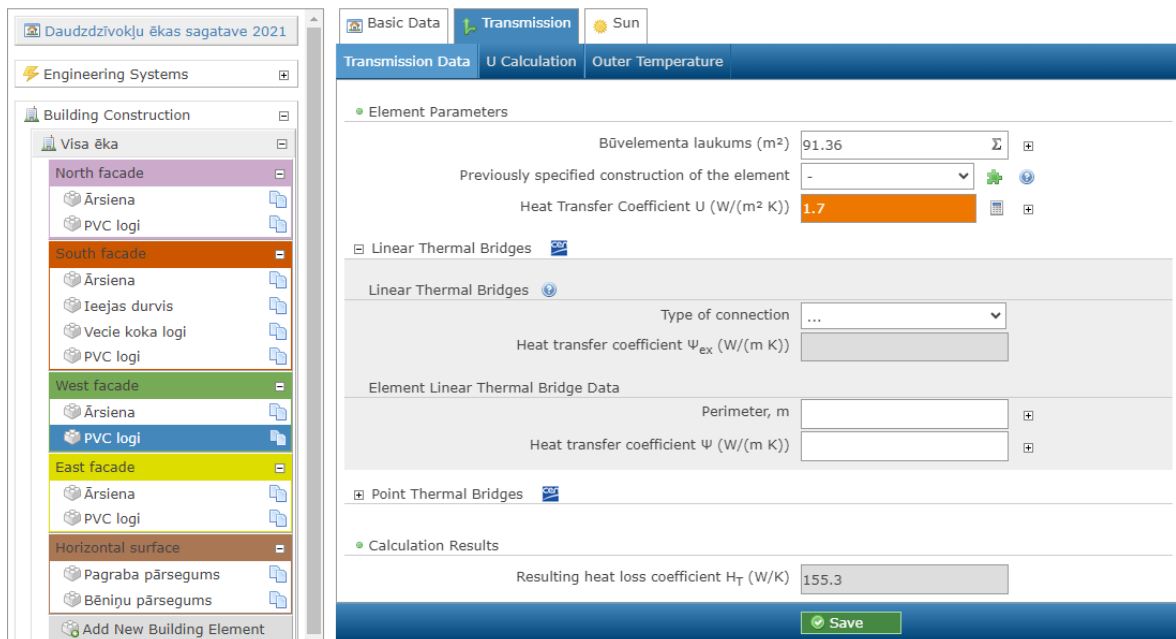


Figure 35 Heatmod 7.0: Transmission heat losses thought one building element.

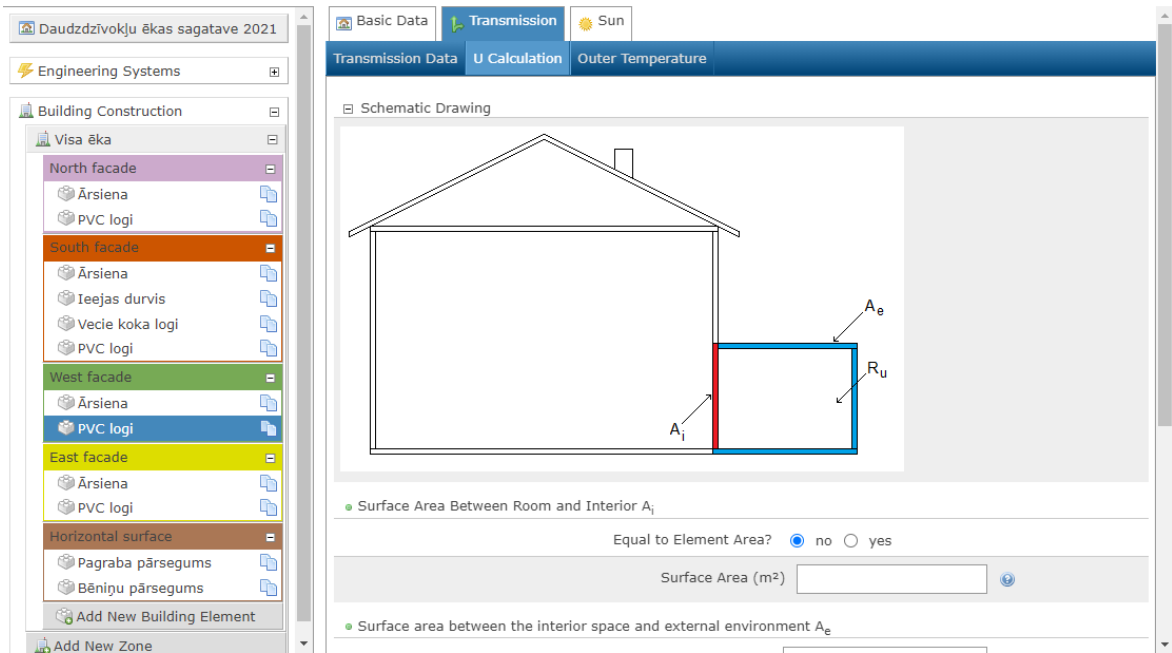


Figure 36 Heatmod 7.0: Calculation of U value for adjoining rooms.

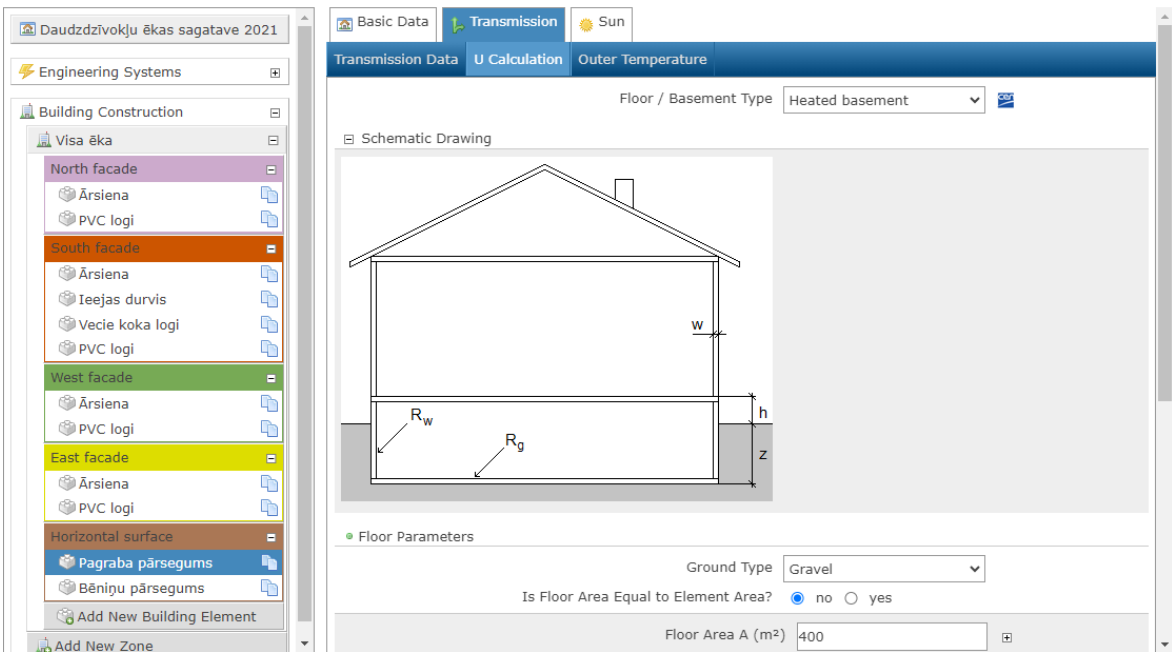


Figure 37 Heatmod 7.0: Calculation of U value for floor.

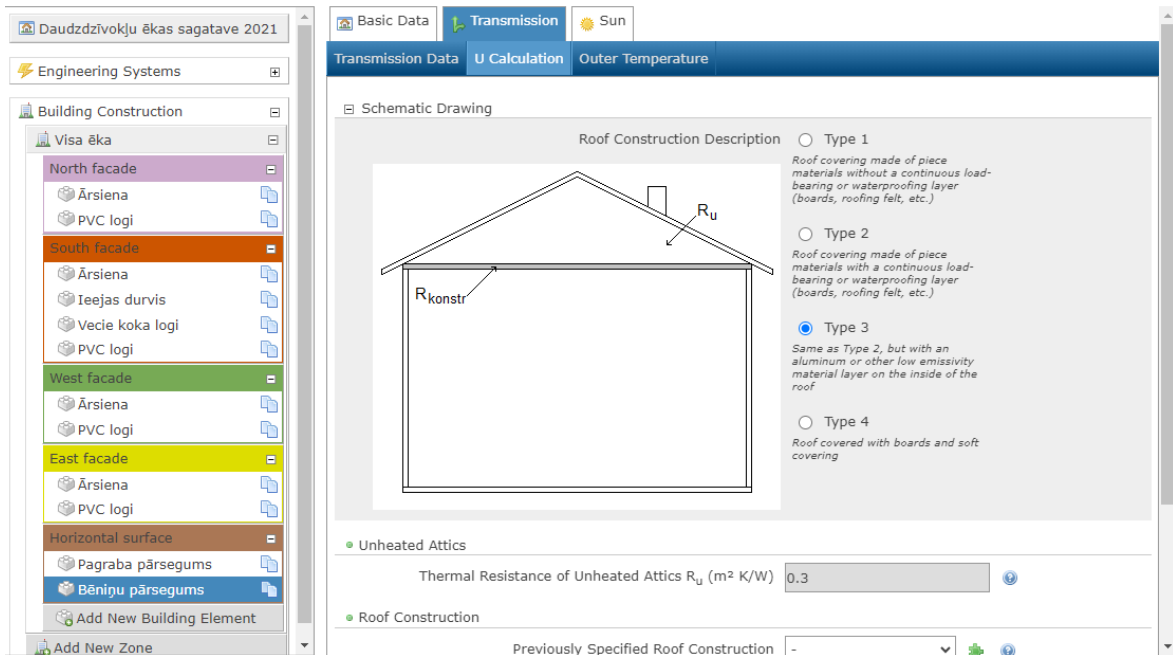


Figure 38 Heatmod 7.0: Calculation of U value for ceiling.

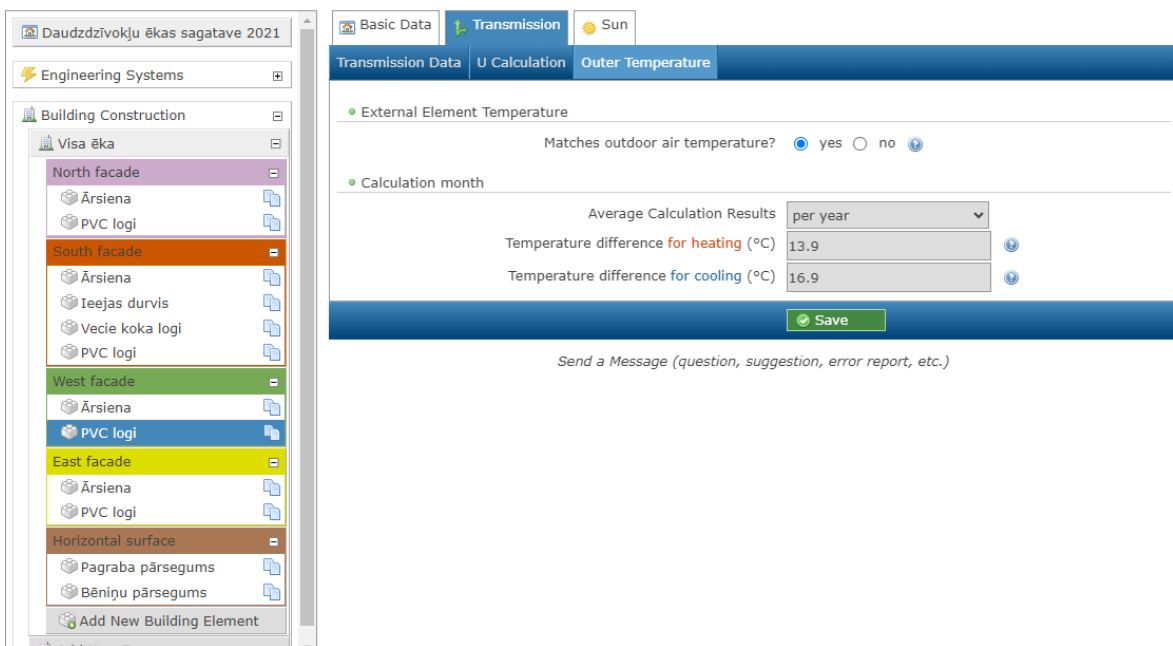


Figure 39 Heatmod 7.0: Setting different outside temperature for element.

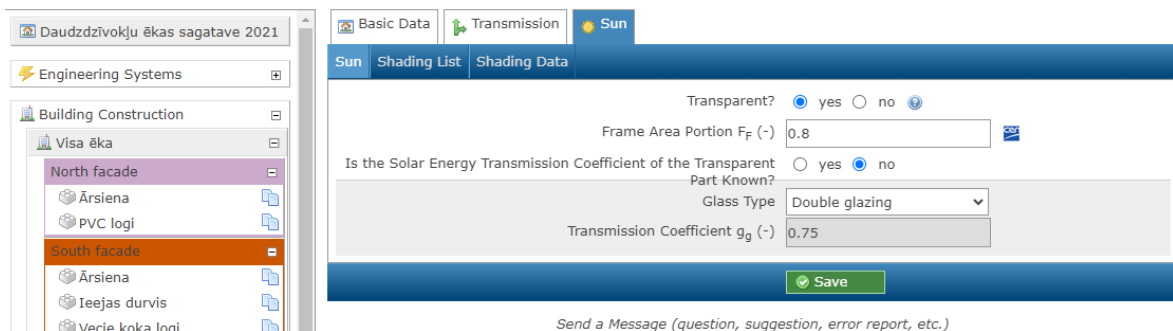


Figure 40 Heatmod 7.0: Parameters for solar heat gains through one building element.

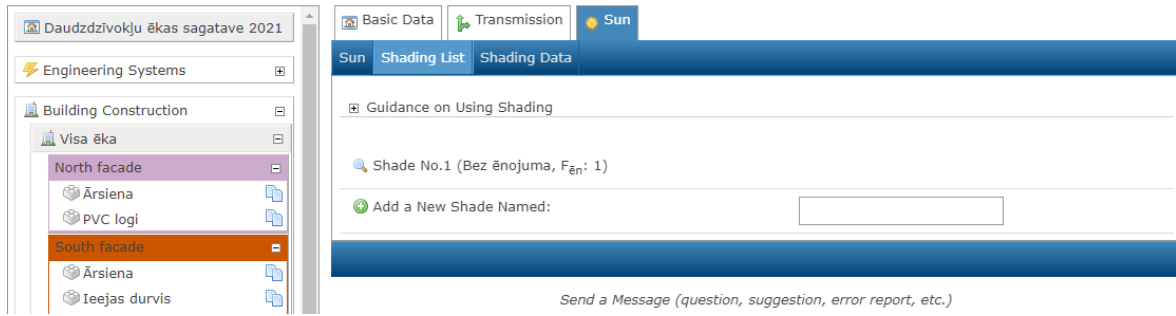


Figure 41 Heatmod 7.0: Elements solar shading list.

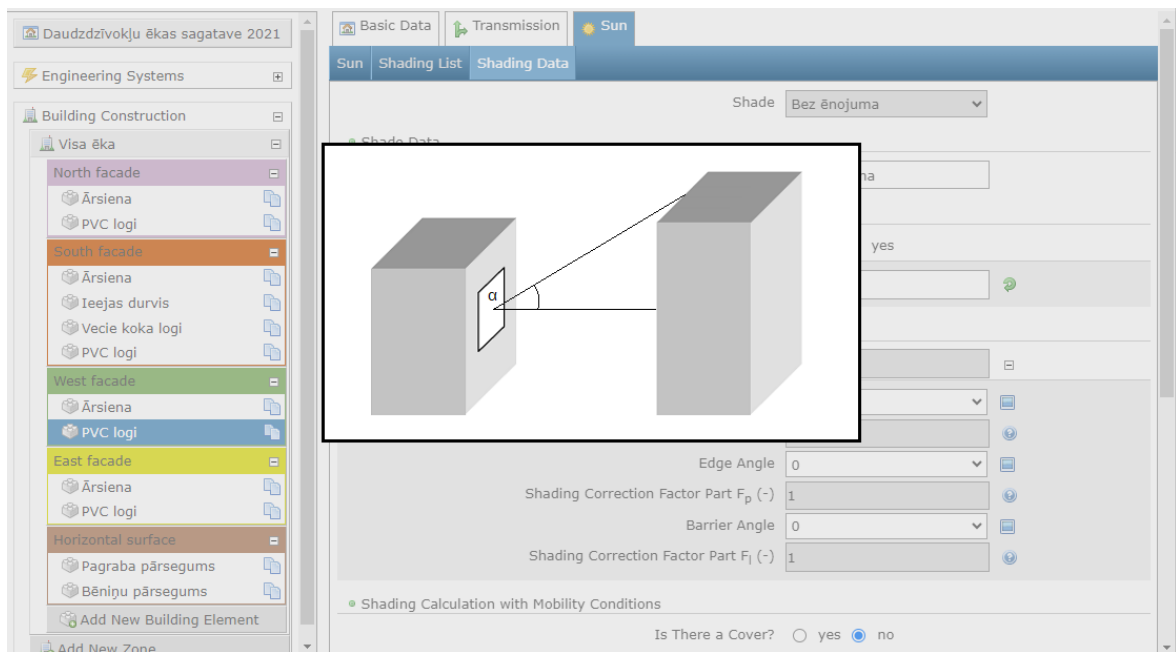


Figure 42 Heatmod 7.0: Solar shading options for solar heat gain calculations.

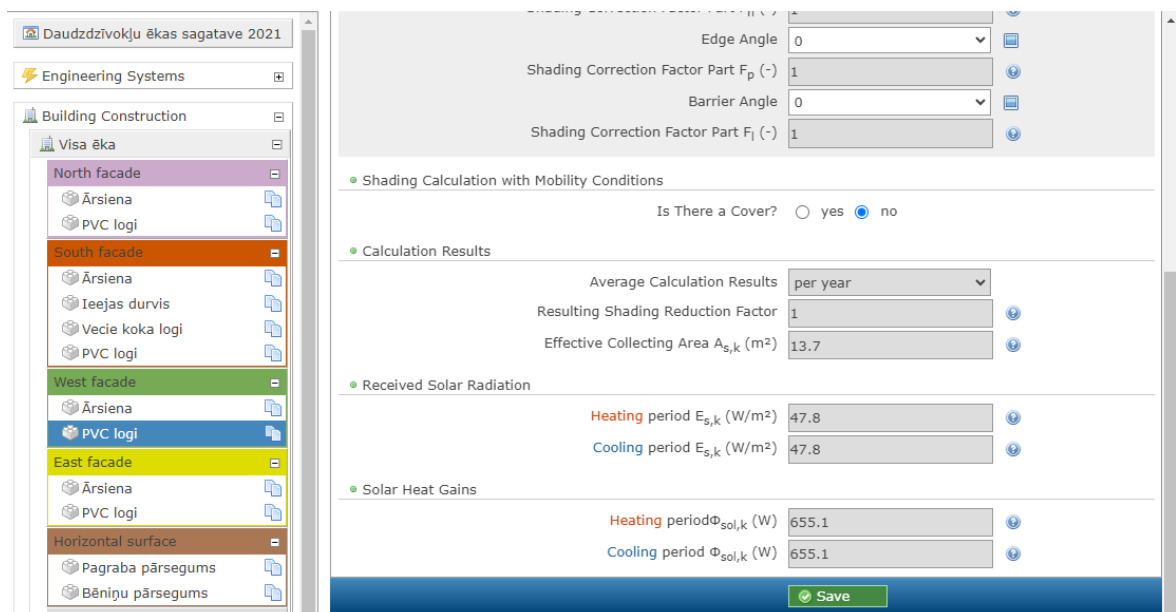




Figure 43 Heatmod 7.0: Summary of solar heat gains for one building element.

Literature

[1] EN ISO 52000-1, Energy performance of buildings — Overarching EPB assessment – Part 1: General framework and procedures (2017).

[2] EN ISO 52016-1, EPB – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads – Part 1: Calculation procedures (2017).

[3] *Heatmod 7.0* – a web-based application for calculating of the building's energy performance in accordance with LVS EN ISO 52000 series standards. [Online]. [Accessed 13.05.2022]. Available: <http://www.heatmod.lv>.

[4] Latvian Building Code LBN 003-19 “Construction Climatology”, Cabinet of Ministers of Latvia, 2019. [in Latvian]. [Online]. [Accessed 19.05.2022]. Available: <https://likumi.lv/ta/id/309453-noteikumi-par-latvijas-buvnormativu-lbn-003-19-buvklimatologija>