



Montenegro
Ministry of Capital Investments



New EP certification tool - Montenegro -

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ENERGY PERFORMANCE CERTIFICATION OF BUILDINGS



- Energy Performance of Buildings Directive (EPBD) requires a systematic approach in the assessment of the energy performance of buildings - **key requirements is the establishment of a system for the certification of the energy performance of buildings.**
- The calculation of the energy efficiency of buildings and the creation of Energy Performance Certificates (EPC) – **national software for energy performance calculation.**



EPC - STATUS IN MONTENEGRO

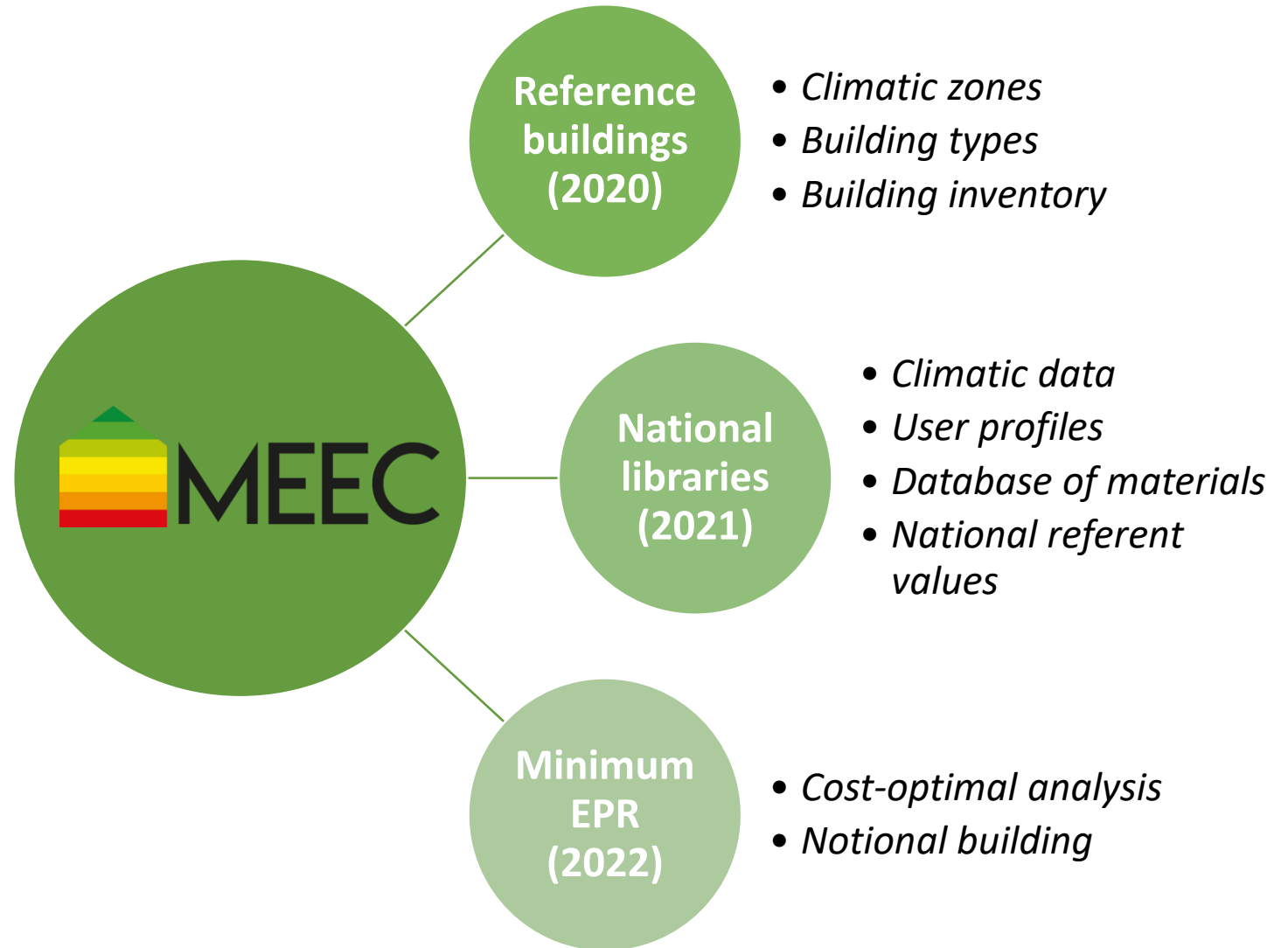


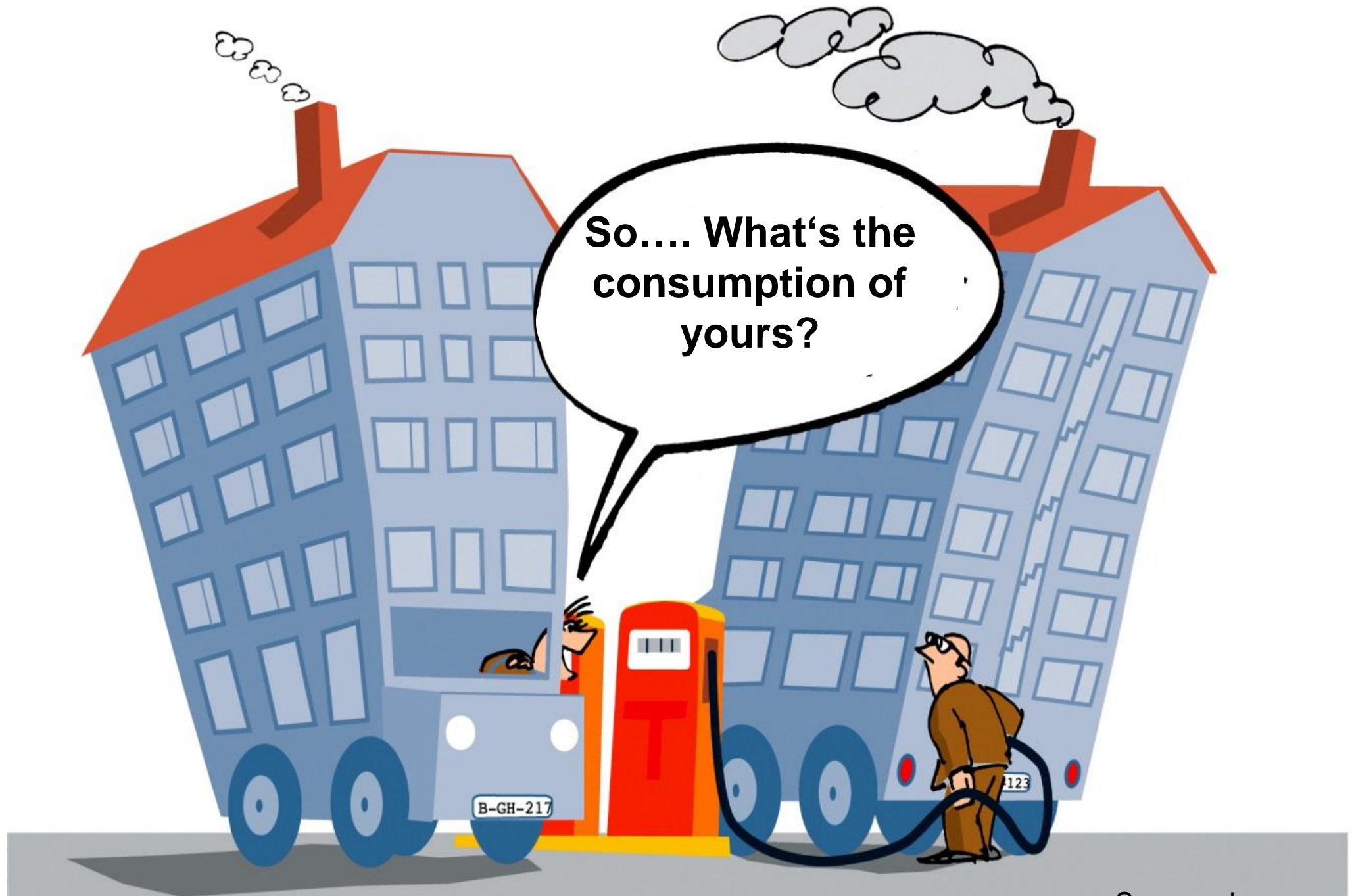
- Ministry of Capital investments is responsible for overall energy efficiency policy including setting up the national framework for energy performance certification in buildings.
- From 2013 Montenegro has set **minimum energy performance requirements** which implementation was **controlled only during design phase** of the building. Evaluation of building energy performance after construction/major renovation was not performed do to the **lack of EPC tool**.
- Support for development of national EPC software was provided by KfW bank within the project „Promotion of energy Efficiency in Public Buildings (PEEPB)“ which recognize importance of the introduction of national EPC scheme.

DEVELOPMENT OF EPC TOOL



- Work on development of the national EPC software - MEEC (*Montenegrin Energy Efficiency Certification*) has started back in 2020 in cooperation with Fraunhofer IBP (Stuttgart, Germany).





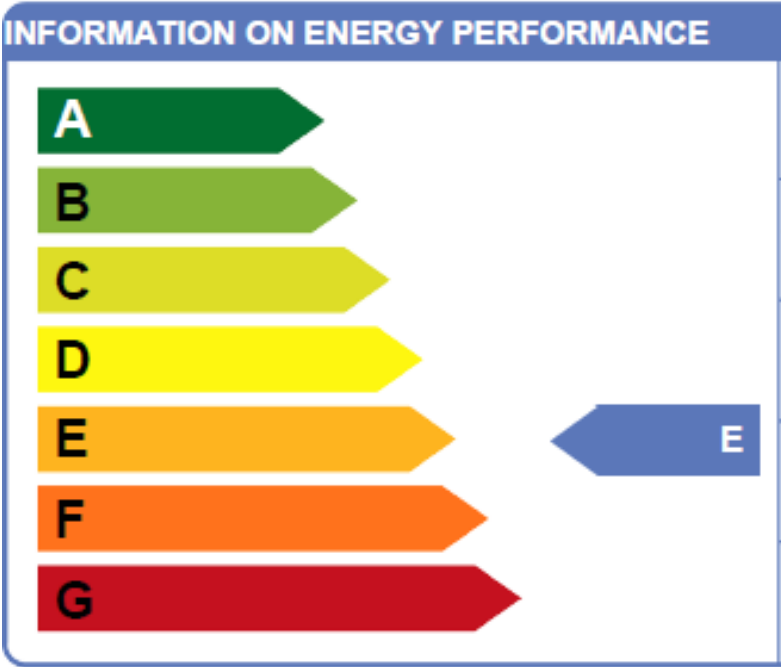
So.... What's the consumption of yours?

Main ideas for the software

- Main goal is to enable energy auditors to calculate energy demand with this software with a flat learning curve
 - Input **similar** to calculations with EN ISO 13790
 - Expert mode included (especially for HVAC part)
- Ensure calculation is in accordance with the rulebook/national regulations without distinct expert knowledge of the rulebook/national regulations for the calculation itself
 - User profiles with all requirements on temperatures, occupancies, lighting levels, air volume flows, etc. included -> **EPBD 2018**
 - HVAC efficiencies are **not an input** to the calculation, but a **result** of the calculation

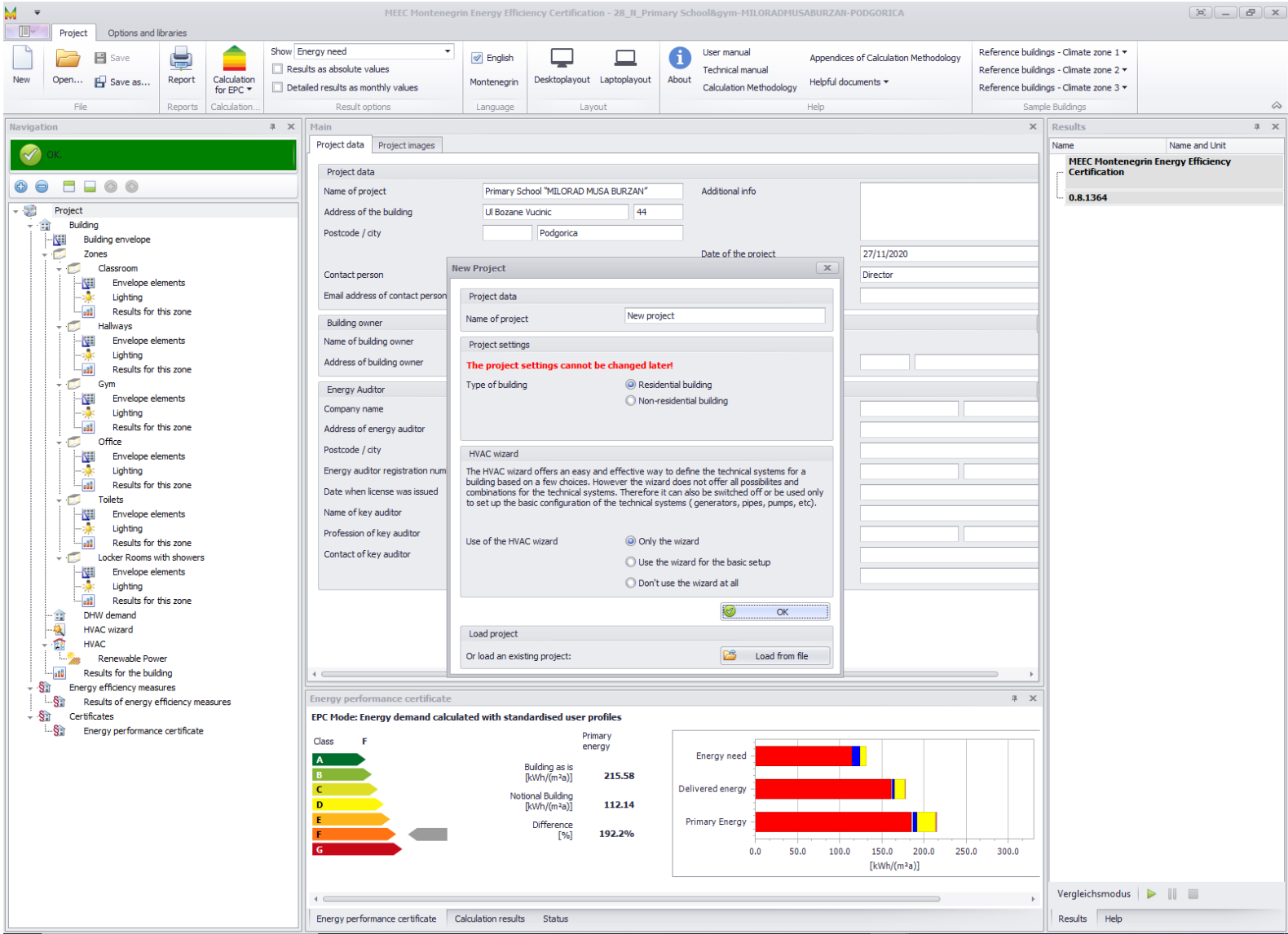
Steps – for assessing a building

Let's assess a building in 9 steps



Including the EPC!

1) Type of project



The screenshot displays the MEEC software interface for a project titled "Primary School 'MILORAD MUSABURZAN'". The interface is divided into several panes:

- Navigation:** A tree view on the left showing the project structure, including Building envelope, Zones, Classroom, Gym, Office, Toilets, Locker Rooms with showers, DHW demand, HVAC wizard, and Renewable Power.
- Main:** The central pane for project data. It includes a "New Project" dialog box with the following fields:
 - Name of project: New project
 - Type of building: Residential building (selected)
 - Use of the HVAC wizard: Only the wizard (selected)
- Project data:** Fields for project information:
 - Name of project: Primary School "MILORAD MUSABURZAN"
 - Address of the building: Ul Bozane Vucinic 44
 - Postcode / city: Podgorica
 - Date of the project: 27/11/2020
 - Contact person: Director
- Results:** A table showing the MEEC certification:

Name	Name and Unit
MEEC Montenegrin Energy Efficiency Certification	
0.8.1364	
- Energy performance certificate:** A section at the bottom showing the EPC mode results:

Class	Primary energy [kWh/(m ² a)]
A	
B	
C	
D	
E	
F	215.58
G	112.14

Additional data: Building as is: 215.58 kWh/(m²a), Notional Building: 112.14 kWh/(m²a), Difference: 192.2%.

2) Define building



The screenshot displays the MEEC software interface for defining a building and viewing its energy performance certificate. The main window is titled "MEEC Montenegrin Energy Efficiency Certification - 28_N_Primary School&gym-MILORADMUSABURZAN-PODGORICA".

Building Definition:

- Building description:** Name of building: Primary School "MILORAD MUSA BURZAN"; Type of building: Non-residential building (multiple zones); Building category: School.
- Building parameters:** Thermal bridges: Not in accordance with recommended solutions; Construction weight: Heavy.
- Infiltration:** Location of building: Moderately open; Condition of building: Windows and façade walls in normal condition.
- Building geometry:** Number of heated/cooled storeys: 3; Total net floor area, net and gross volume are accumulated from the zones.
- Building automation:** Heating: Class C; DHW: Class D=C; Cooling: Class D=C; Sun screen: Class C.

Energy performance certificate:

Class	Primary energy [kWh/(m²a)]
A	
B	
C	
D	
E	
F	215.58
G	112.14

Building as is: 215.58 kWh/(m²a)
Notional Building: 112.14 kWh/(m²a)
Difference: 192.2%

Energy performance certificate chart:

Detailed results for the building:

Name	Name and Unit
Type of building	Non-residential building (...)
Is the building an existing building?	Yes
Calculate as single zone building (simplified approach)?	No
Not in accordance with recommended solutions	0.10 W/(m²K)
Construction weight	100.00 Wh/(m²K)
Location of building	Moderately open
Condition of building	Windows and façade wal...
Infiltration n	0.60 1/h
Air change rate (at delta 50 Pa)	9.00 1/h
Net floor area	3818.72 m²
Heated/cooled net floor area	3818.72 m²
Net volume	15519.69 m³
Gross volume	20831.97 m³
Overall efficiency	66.9%
Efficiency of emission and control	84.4%
Efficiency of distribution	93.7%
Efficiency of storage	100.0%
Efficiency of generation	84.6%
Overall efficiency	99.6%
Efficiency of emission and control	100.0%
Efficiency of distribution	99.6%
Efficiency of storage	100.0%
Efficiency of generation	100.0%

3) Define constructions/windows



The screenshot displays the MEEC software interface for defining constructions and viewing energy performance certificate results. The main window is titled "MEEC Montenegro Energy Efficiency Certification - Practical training_4".

Constructions Tab:

List of constructions used in the project:

Name	U-Value W/(m ² K)	Area m ²
POD1 Ground Floor	0.599	113.06
POD2 Ground Floor	0.593	310.07
KROV1 Flat Roof	0.592	347.90
KROV2 Flat Roof	0.245	86.98
V1 External Door	2.290	6.20

Details of the selected construction (Layers):

Inner R_{si} = 0.10

Name	Density ρ kg/m ³	Thermal conductivity λ W/(mK)	Thickness d cm
1 plywood	300	0.090	2.00
2 Layer with compartment			20.00
Rafter/Rib or Compartment	Density		Width [cm]
Studs or rafters	wood - hard	0.180	10.00
Compartment	mineral wool (MW)	0.035	60.00
3 PE foil, folded	1000	0.190	0.00

Outer R_{se} = 0.04

Energy performance certificate:

EPC Mode: Energy demand calculated with standardised user profiles

Class	Primary energy [kWh/(m ² a)]
A	
B	
C	
D	40.64
E	
F	
G	

Building as is [kWh/(m²a)] 40.64
Notional Building [kWh/(m²a)] 52.41
Difference [%] 77.5%

Energy need, Delivered energy, Primary Energy (Bar chart showing energy demand in kWh/(m²a) for different energy types: H, L, A).

4) Specify the building fabric



The screenshot displays the MEEC software interface for energy efficiency certification. The main window is titled "MEEC Montenegro Energy Efficiency Certification - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA". The interface is divided into several panes:

- Navigation:** A tree view on the left shows the project structure, including Building envelope, Zones, Classroom, Gym, Office, Toilets, Locker Rooms with showers, DHW demand, HVAC wizard, Renewable Power, Energy efficiency measures, and Certificates.
- Main:** The central pane shows a table of construction elements and a detailed configuration panel for the selected "External wall Southwest" element.
- Energy performance certificate:** A pane at the bottom shows the EPC Mode results and a bar chart of energy needs.
- Help:** A pane on the right provides guidance on building envelope elements.

Name	Gross area [m ²]	Net area [m ²]	U-value [W/(m ² K)]	Catalogue	Orientation	Incline
External wall Northeast	794.86	563.44	1.110		North East	Incline 90
Windows Northeast		222.11	2.600	old window	North East	Incline 90
Doors Northeast		9.31	4.400	old doors	North East	Incline 90
External wall Northwest	896.96	727.27	1.110		North West	Incline 90
Windows Northwest		157.59	2.600	old window	North West	Incline 90
Doors Northwest		12.10	4.400	old doors	North West	Incline 90
External wall Southeast	641.30	414.97	1.110		South East	Incline 90
Windows Southeast		214.09	2.600	old window	South East	Incline 90
Doors Southeast		12.24	4.400	old doors	South East	Incline 90
External wall Southwest	851.66	619.56	1.110		South West	Incline 90
Windows Southwest		228.12	2.600	old window	South West	Incline 90
Doors Southwest		3.98	4.400	old doors	South West	Incline 90
Pitched roof school	1602.32	1602.32	1.450			

Configuration for External wall Southwest:

- Name of opaque envelope element: External wall Southwest
- Area of envelope element: 851.66 m²
- Type of element: External wall
- Construction: Enter U-value directly
- U-value: 1.11 W/(m²K)
- Orientation: South West
- Incline: Incline 90
- Assigned components: Windows Southwest, Doors Southwest
- Subtracted area from associated building components: 232.10
- Net area for this component: 619.56

Energy performance certificate (EPC Mode):

Class	Primary energy [kWh/(m ² a)]
A	
B	
C	
D	
E	
F	
G	

Building as is: 199.51 kWh/(m²a)
Notional Building: 106.08 kWh/(m²a)
Difference: 188.1%

Energy need bar chart:

Energy Type	Value [kWh/(m ² a)]
Energy need	~100
Delivered energy	~150
Primary Energy	~199.51

Help: Building envelope

Building envelope elements to be defined in this screen are divided in four categories: walls/vertical elements, roofs/upper completion elements, floors/lower completion elements and transparent elements. Each envelope element is entered by selecting one of these categories, whereupon the details of the added element are defined in the section below the listed construction elements.

Walls and vertical elements

External walls, internal walls to unheated areas and doors (opaque) are entered by clicking **Add wall or vertical element** button and selecting one of specified options for this category.

The name of building envelope element is to be entered in the field **Name of opaque envelope element**.

A subcategory of added envelope element, if existing, may be selected from the drop-down list referring to **Type of element**.

U-value for the added construction element can be defined either by selecting the option **Enter U-value directly** and entering an already known U-value, or by selecting from the drop-down menu an already defined construction in **Building/Constructions** screen. The latter is the case when the U-value is not known but must be calculated based on the given layer structure of the building element.

For each element **Orientation** and **Inclination** need to be selected from the corresponding drop-down menu.

5) Define zone(s)



MEEC Montenegro Energy Efficiency Certification - 28_N_Primary School&gym-MILORADMUSABURZAN-PODGORICA *

Project Options and libraries

File Reports Calculation... Result options Language Layout Help

Show Energy need: Results as absolute values, Detailed results as monthly values

English Montenegrin Desktoplayout Laptoplayout About

User manual Technical manual Calculation Methodology Appendices of Calculation Methodology Helpful documents

Reference buildings - Climate zone 1 Reference buildings - Climate zone 2 Reference buildings - Climate zone 3

Sample Buildings

Navigation

Project Building Building envelope Zones Classroom Envelope elements Lighting Results for this zone Hallways Envelope elements Lighting Results for this zone Gym Envelope elements Lighting Results for this zone Office Envelope elements Lighting Results for this zone Toilets Envelope elements Lighting Results for this zone Locker Rooms with showers Envelope elements Lighting Results for this zone DHW demand HVAC wizard Renewable Power Results for the building Energy efficiency measures Results of energy efficiency measures Certificates Energy performance certificate

Main

Zones

List of zones

Add a zone with a non residential use Add residential zone or apartment

Information: The user profile for a residential zone includes indirectly or partially heated areas (staircases, hallways, etc.). These areas must be included in the area of the residential zone and must not be considered in a separate zone. If you have a mixed building with residential and non residential zones, please check the DHW demand and use the correct area for the DHW demand profiles. The DHW demand for the residential zone is already defined in the user profile.

H	C	V	Name	User profile	Net floor area [m ²]
●			Classroom	Classroom in school	1664.67
●			Hallways	Passageways (low-heated)	1154.63
●			Gym	Gymnasium	313.47
●	●		Office	Office area	426.90
●			Toilets	WC and sanitary rooms	200.31
●			Locker Rooms with showers	WC and sanitary rooms	58.74

Help

List of zones

For energy balancing of non-residential buildings, it is necessary to divide the building into several zones.

The zone comprises the (net floor) area of a group of rooms within the building, which are characterized by equal type of usage, same type of conditioning (heating, cooling, ventilation, humidification, lighting and domestic hot water supply), and uniform additional zoning criteria. More information on zoning procedure can be found in the Calculation methodology (Chapter 5).

A zone may have all types of conditioning (heating, cooling, ventilation, humidification, lighting) or just a single one (e.g. lighting). Zones having at least one type of conditioning are so called "conditioned zones". In case a zone is heated and/or cooled, it is called a "thermally conditioned zone". Areas of a building that are not conditioned are grouped together as "unconditioned" zones. A building can have several "unconditioned zones" (e.g. attic floor). In case the zone is only illuminated and/or ventilated but not heated and/or cooled, it is called a "thermally unconditioned zone".

All defined thermally conditioned zones in a building are entered by clicking **Add a zone with a non-residential use** or **Add a residential zone or apartment**.

Although residential buildings are considered as buildings with one zone, this concept of adding both residential and non-residential zones is assumed for mixed buildings (buildings used for residential and non-residential purposes). Only one residential zone can be added, while number of non-residential zones is not limited.

In this window, the building zones are only added, while all data regarding each of them (usage profile, geometric parameters, type of conditioning) are defined separately in the user profile.

Energy performance certificate

EPC Mode: Energy demand calculated with standardised user profiles

Class	Primary energy [kWh/(m ² ·a)]
A	
B	
C	
D	
E	
F	
G	

Building as is [kWh/(m²·a)] **199.51**

Notional Building [kWh/(m²·a)] **106.08**

Difference [%] **188.1%**

Energy need

Delivered energy

Primary Energy

0.0 50.0 100.0 150.0 200.0 250.0 300.0 [kWh/(m²·a)]

Legend: H, C, V, L, A

Energy performance certificate Calculation results Status

Results Help

6) Define hot water demand



The screenshot displays the MEEC software interface for defining hot water demand. The main window is titled "MEEC - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA". The interface is divided into several panels:

- Navigation:** Shows a tree view of the project structure, including "Zgrada" (Building), "Omotač zgrade" (Building envelope), "Zone" (Zones), "Classroom", "Hallways", "Gym", "Office", "Toilets", "Locker Rooms with showers", "Zahtjev za STV" (STV demand), "Tehnički sistemi" (Technical systems), "Obnovljiva energija" (Renewable energy), and "Energy efficiency measures".
- Glavni prozor (Main window):** Displays the "regled zahtjeva za STV" (STV demand view) for "DHW demand 1". It includes a "Dodaj STV zahtjev" (Add STV demand) button and an "Ukloni izabrano" (Remove selected) button.
- Detalji o zahtjevu za STV (Details of STV demand):** Shows the "Naziv STV zahtjeva" (STV demand name) as "DHW demand 1" and the "Opis" (Description) field. The "Profil zahtjeva za toplom vodom" (Hot water demand profile) is set to "Škola" (School). The "Specifična potrošnja sanitarne tople vode" (Specific sanitary hot water consumption) is set to "Ne" (No). The "Potrošna mjesta za ovaj STV zahtjev su" (Consumption locations for this STV demand) list includes: "Porodična kuća", "Stambena zgrada", "Dječji vrtić", "Poslovna zgrada", "Škola", "Univerzitet", "Bolnica", "Hotel", "Rekreativni objekat", "Komerčajni objekat", "Objekat kulture", "Skladište", "Laka industrija", "Kafe, kafeterija", and "Korisnički definisan profil".
- Rezultati (Results):** Displays a table with the following data:

Naziv	Vrijednost i jedinica
Profil zahtjeva za STV	Škola
Specifična potražnja	34,85 Wh/(m²·d)
Koristi površinu zgrade za podatak o potrebnoj potrošnji STV	Ne
Površina	313,47 m²
Prosječni dnevni zahtjev za STV	188,36 ltr/d

The bottom status bar shows "Sertifikat o energetskim karakteristikama zgrade", "Rezultati proračuna", and "Status". The bottom right corner has "Vergleichsmodus" and "Rezultati Pomoć" buttons.

7) Define technical systems



The screenshot displays the MEEC software interface for defining technical systems. The main window is titled "MEEC Montenegro Energy Efficiency Certification - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA".

Navigation: The left sidebar shows a project tree with categories like Building, Envelope elements, Lighting, Results for this zone, Hallways, Gym, Office, Toilets, Locker Rooms with showers, DHW demand, HVAC wizard, Renewable Power, Energy efficiency measures, Certificates, and Energy performance certificate.

Main Window: The central area is titled "Operation mode of the wizard for the technical systems". It explains that the wizard can be used to define technical systems in three ways: (i) using HVAC wizard, (ii) using HVAC wizard to start with definition of system parameters in more detail, and (iii) detailed description of all systems (no use of HVAC wizard). The wizard is currently set to "Only the wizard is used to define the technical systems. No details are shown."

System selection: The following table shows the selected system parameters:

Parameter	Selected Value
Select the heating generation	Standard boiler
Select the heating emission	Radiators
Select the DHW system	Decentral electrical flow heaters
Select the energy carrier	Oil
Select the solar thermal system	None
Select the cooling system	Split/Multisplit
Select the cooling generation	Split units
Select PV	No PV system
Year of construction for the heating/dhw system	2020
Year of construction for the cooling system	2020

System description: Standard oil boiler. Radiators on the outer wall with 70/55°C flow/return temperature. Electrical flow heaters. No solar thermal support. No zones are mechanically ventilated. Direct system: split/multisplit or VRF system. Split units. No PV system.

Energy performance certificate: The bottom section shows the EPC Mode: Energy demand calculated with standardised user profiles. The building is classified as Class F with a primary energy demand of 199.51 kWh/(m²·a). The notional building has a primary energy demand of 106.08 kWh/(m²·a), resulting in a difference of 188.1%.

Class	Primary energy [kWh/(m²·a)]
A	
B	
C	
D	
E	
F	199.51
G	

Energy need chart: A horizontal bar chart showing Energy need, Delivered energy, and Primary Energy in kWh/(m²·a). The x-axis ranges from 0.0 to 300.0. The bars are color-coded: red for heating, blue for cooling, yellow for lighting, and grey for other.

Help: The right sidebar contains a help section titled "Operation mode of the wizard for the technical systems" and "The wizard for technical systems can set up generators, units, distributions, pipes, pumps, storages etc. for heating, cooling, hot water and/or ventilation." It also includes a warning: "Pushing the apply button will delete all technical systems and create new technical systems according to the selections here." and "In case that certain technical systems are defined in more detail and they are not in accordance with the previously selected options in the HVAC wizard mode, a warning dialog box appears requesting further action regarding HVAC system update. By pressing the Re-apply button all technical systems will be deleted and new technical systems will be created according to the selections here (in HVAC wizard). In case that defined technical systems are to be kept, then this warning message should be ignored and the button The wizard is not used at all should be pressed."

7) Define technical systems



The screenshot displays the MEEC software interface for defining technical systems. The main window is titled "MEEC Montenegro Energy Efficiency Certification - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA". The interface includes a navigation pane on the left, a main workspace, and a help pane on the right.

Navigation Pane: Shows a tree view of the project structure, including Building, Building envelope, Zones, Classroom, Hallways, Gym, Office, Toilets, Locker Rooms with showers, DHW demand, HVAC wizard, Renewable Power, Energy efficiency measures, and Certificates.

Main Workspace: Displays the "Operation mode of the wizard for the technical systems" dialog. It includes three modes: "Only the wizard is used to define the technical systems. No details are shown.", "The wizard is used to start and a refinement is possible or even required", and "The wizard is not used at all". Below this is the "System selection" section with dropdown menus for heating generation (Heat pump (ground collector)), heating emission (Radiators), DHW system (Decentral electrical flow heaters), energy carrier (Electricity), solar thermal system (None), cooling system (Split/Multisplit), cooling generation (Split units), and PV (No PV system). It also includes input fields for the year of construction for heating/dhw and cooling systems, both set to 2020.

Help Pane: Contains text explaining the wizard's operation and a warning: "HVAC system has to be updated". It states: "Pushing the apply button will delete all technical systems and create new technical systems according to the selections here." It also notes that a warning dialog box appears if the current system is not in accordance with the wizard's options.

Energy performance certificate: Shows the "EPC Mode: Energy demand calculated with standardised user profiles". It includes a bar chart comparing the building's performance to a notional building. The building's primary energy is 94.61 kWh/(m²a), while the notional building's is 106.08 kWh/(m²a), resulting in a difference of 89.2%.

Class	D	Primary energy [kWh/(m²a)]
A		
B		
C		
D		
E		
F		
G		

Building as is [kWh/(m²a)]: 94.61
Notional Building [kWh/(m²a)]: 106.08
Difference [%]: 89.2%

Energy need, Delivered energy, Primary Energy [kWh/(m²a)]

7) Define technical systems



The screenshot displays the MEEC software interface for defining technical systems. The main window is titled "MEEC Montenegro Energy Efficiency Certification - 28_IL Primary School&gym-MILORADHUSABURZAN-PODGORICA". The interface includes a navigation pane on the left, a main workspace, and a help pane on the right.

Navigation Pane: Shows a tree view of the project structure, including Building envelope, Zones, Classroom, Hallways, Gym, Office, Toilets, Locker Rooms with showers, DHW demand, HVAC wizard, and Renewable Power.

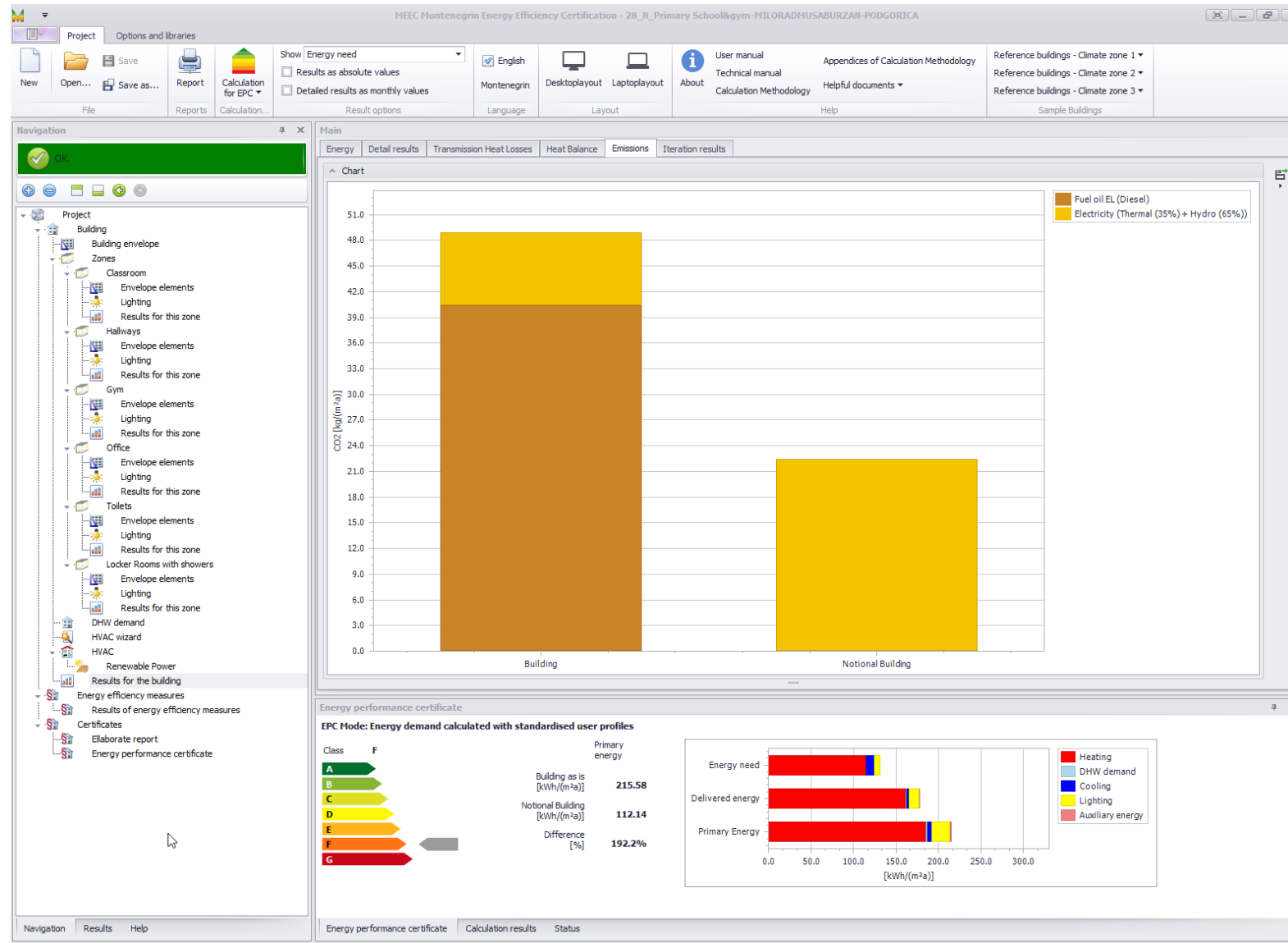
Main Workspace: Displays the "Operation mode of the wizard for the technical systems" dialog. It includes three modes: "Only the wizard is used to define the technical systems. No details are shown.", "The wizard is used to start and a refinement is possible or even required", and "The wizard is not used at all". Below this is the "System selection" section, which includes a list of heating generation options (Biomass boiler, Individual stoves, Standard boiler, Low temperature boiler, Condensing boiler, Biomass boiler, Electric boiler, Split heating unit, Multisplit heating unit, VRF heating unit, District heating) and a "System description" text area.

Help Pane: Contains the text: "Operation mode of the wizard for the technical systems", "The wizard for technical systems can set up generators, units, distributions, pipes, pumps, storages etc. for heating, cooling, hot water and/or ventilation.", "The wizard for technical systems can set up generators, units, distributions, pipes, pumps, storages etc. for heating, cooling, hot water and/or ventilation.", "Technical systems in building can be defined in three ways: (i) using HVAC wizard, (ii) using HVAC wizard to start with definition of system parameters in more detail, and (iii) detailed description of all systems (no use of HVAC wizard). These options are offered when starting the programme, but the choice made at the start can be changed when coming up to this screen.", "HVAC system has to be updated", "Pushing the apply button will delete all technical systems and create new technical systems according to the selections here.", "In case that certain technical systems are defined in more detail and they are not in accordance with the previously selected options in the HVAC wizard mode, a warning dialog box appears requesting further action regarding HVAC system update. By pressing the Re-apply button all technical systems will be deleted and new technical systems will be created according to the selections here (in HVAC wizard). In case that defined technical systems are to be kept, then this warning message should be ignored and the button The wizard is not used at all should be pressed.", "System selection", "Using HVAC wizard is a simplified approach since the systems are automatically configured according to a small number of selected options referring to some basic information about systems and parts of the systems, such as heat generator, energy carrier, type of emissions, etc. Modelling of technical systems is carried out completely in the".

Energy performance certificate: Shows the EPC Mode: Energy demand calculated with standardised user profiles. The Class is B. The Building as is energy demand is 44.42 kWh/(m²a), and the Notional Building energy demand is 106.08 kWh/(m²a). The Difference is 41.9%.

Energy need chart: A bar chart showing Energy need, Delivered energy, and Primary Energy. The x-axis is labeled [kWh/(m²a)] and ranges from 0.0 to 300.0. The y-axis categories are Energy need, Delivered energy, and Primary Energy. The chart shows that the Building as is energy demand is significantly lower than the Notional Building energy demand.

8) Results



9) Energy efficiency measures



MEEC Montenegro Energy Efficiency Certification - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA *

Project Options and libraries

File Reports Calculation... Show Energy need Results as absolute values Detailed results as monthly values English Montenegrin Desktoplayout Laptoplayout About User manual Technical manual Calculation Methodology Appendices of Calculation Methodology Reference buildings - Climate zone 1 Reference buildings - Climate zone 2 Reference buildings - Climate zone 3 Sample Buildings

Navigation

Project Building Building envelope Zones Classroom Envelope elements Lighting Results for this zone Hallways Envelope elements Lighting Results for this zone Gym Envelope elements Lighting Results for this zone Office Envelope elements Lighting Results for this zone Toilets Envelope elements Lighting Results for this zone Locker Rooms with showers Envelope elements Lighting Results for this zone DHW demand HVAC wizard Renewable Power Results for the building Energy efficiency measures Results of energy efficiency measures Certificates Energy performance certificate

Main Energy efficiency measures Options Energy consumption costs

List of measure packages

Package of measures 1

Details of measure package

Name of measure package: Package of measures 1

Description:

Also apply measures from another linked package

Linked package:

List of measures for this package

Measures defined in this package

Name	
Add a layer of thermal insulation to external envelope elements	✗
Add a layer of thermal insulation to roof/upper elements	✗
Add a layer of thermal insulation to roof/upper elements	✗
Replacement of windows	✗
Replacement of doors	✗
Installation of different luminaires	✗
Installation of different luminaires	✗
Installation of a new central heating and DHW system	✗

Measures defined in linked package

Details of measure

Name of measure: Add a layer of thermal insulation to external envelope elements

Description: Add a layer of thermal insulation to external envelope elements

Material of additional insulation and thickness: 8.00 cm

expanded polystyrene (EPS) (15 kg/m³)

Investment for this measure related to element area: 0.00 €/m

Fixed investment for this measure: 153313.70 €

Price increase for this measure: 0.00 %

Annual savings in operating costs: 0.00 €/a

Lifespan for this measure: 25.00 a

Measure is applied to:

- External wall Northeast
- External wall Northwest
- External wall Southeast
- External wall Southwest

Energy performance certificate

EPC Mode: Energy demand calculated with standardised user profiles

Class	Primary energy [kWh/(m ² a)]
A	
B	
C	
D	
E	
F	199.51
G	106.08
Difference [%]	188.1%

Building as is [kWh/(m²a)]: 199.51

Notional Building [kWh/(m²a)]: 106.08

Difference [%]: 188.1%

Energy need

Delivered energy

Primary Energy

Energy need [kWh/(m²a)]: 164.54

Delivered energy [kWh/(m²a)]: 101.27

Primary Energy [kWh/(m²a)]: 199.51

Results

Name	Name and Unit
Baseline	
Delivered energy	164.54 kWh/(m ² a)
Package of measures 1	
Add a layer of thermal insulation to external envelope elements	Investm... costs 153314 €
Add a layer of thermal insulation to roof/upper elements	Investm... costs 66577 €
Add a layer of thermal insulation to roof/upper elements	Investm... costs 30095 €
Replacement of windows	Investm... costs 46751 €
Replacement of doors	Investm... costs 0 €
Installation of different luminaires	Investm... costs 49074 €
Installation of different luminaires	Investm... costs 0 €
Installation of a new central heating and DHW system	Investm... costs 60380 €
Results	
Delivered energy	101.27 kWh/(m ² a)
Reduction in energy costs	-43884 €

Vergleichsmodus

Results Help

Et voilà



MEEC Montenegrin Energy Efficiency Certification - 28_N_Primary School&gym-MILORADHUSABURZAN-PODGORICA *

Project Options and libraries

File Reports Calculation... Result options Language Layout Help

Show Energy need
 Results as absolute values
 Detailed results as monthly values

English Montenegrin Desktoplayout Laptoplayout About

User manual Technical manual Appendices of Calculation Methodology Reference buildings - Climate zone 1
 Calculation Methodology Helpful documents
 Reference buildings - Climate zone 2
 Reference buildings - Climate zone 3
 Sample Buildings

Navigation

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 - Lighting
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 - Hallways
 - Envelope elements
 - Lighting
 - Results for this zone
 - Gym
 - Envelope elements
 - Lighting
 - Results for this zone
 - Office
 - Envelope elements
 - Lighting
 - Results for this zone
 - Toilets
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 - Lighting
 - Results for this zone
 - Locker Rooms with showers
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Main


Energy performance certificate

Create final EPC and upload it to registrar Create final EPC

BUILDING ENERGY PERFORMANCE CERTIFICATE

Reference number of certificate: Expiration date: 28.10.31 1

GENERAL INFORMATION ABOUT THE BUILDING

		Cadaster parcel:	
Location / Address:		UI Bozane Vucinic 44	
Owner:		Ministry of Education	
Year of construction:		1948	
Type / Purpose of the building:		School	
Building part / Zone:		School and Gym	
Climate zone:		Zone I	
Building <input type="checkbox"/> New <input checked="" type="checkbox"/> Existing <input type="checkbox"/> Reconstructed			
Gross floor area [m ²]:	4492.61	Gross building volume [m ³]:	20831.97
Useful floor area thermally conditioned [m ²]:	3818.72	Net building volume [m ³]:	15519.69
		Building shape factor [m ⁻¹]:	0.32

INFORMATION ON ENERGY PERFORMANCE

A	Energy class of the building:	F		
B		Primary energy per useful floor area thermally conditioned [kWh/m ² ·a]:	199.51	Notional Building: 106.08
C		Delivered energy per useful floor area thermally conditioned [kWh/m ² ·a]:	164.54	Notional Building: 60.62
D		Annual emission CO ₂ [kg CO ₂ /m ² ·a]:	38.03	Notional Building: 29.70
E		Share of renewable energy sources:	4.96%	
F				
G				

ENERGY DEMAND OF THE BUILDING [kWh/m²]

Type of energy demand	Energy need	Delivered energy	Primary energy
Heating	103.95	147.39	169.50
Cooling	8.71	2.78	8.71
Domestic hot water	0.72	0.72	1.26
Lighting	7.66	12.63	22.10

Results

Name and Unit

MEEC Montenegrin Energy Efficiency Certification

0.8.1364

Vergleichsmodus

Results Help

Et voilà



BUILDING ENERGY PERFORMANCE CERTIFICATE

Reference number of certificate:

Expiration date: 28.10.31

1

GENERAL INFORMATION ABOUT THE BUILDING



Cadaster parcel:	
Location / Address:	Ul Bozane Vucinic 44
Owner:	Ministry of Education
Year of construction:	1948
Type / Purpose of the building:	School
Building part / Zone:	School and Gym
Climate zone:	Zone I

Building	<input type="checkbox"/> New	<input checked="" type="checkbox"/> Existing	<input type="checkbox"/> Reconstructed
Gross floor area [m ²]:	4492.61	Gross building volume [m ³]:	20831.97
Useful floor area thermally conditioned [m ²]:	3818.72	Net building volume [m ³]:	15519.69
		Building shape factor [m ⁻¹]:	0.36

INFORMATION ON ENERGY PERFORMANCE

A	Energy class of the building:	F	Notional Building:
B			
C			
D			
E			
F	Primary energy per useful floor area thermally conditioned [kWh/m ² ·a]:	215.58	112.14
G	Delivered energy per useful floor area thermally conditioned [kWh/m ² ·a]:	178.43	64.08
	Annual emission CO ₂ [kg CO ₂ /m ² ·a]:	51.34	31.40
	Share of renewable energy sources	4.67%	

BUILDING ENERGY PERFORMANCE CERTIFICATE

Reference number of certificate:

Expiration date: 28.10.31

1

GENERAL INFORMATION ABOUT THE BUILDING



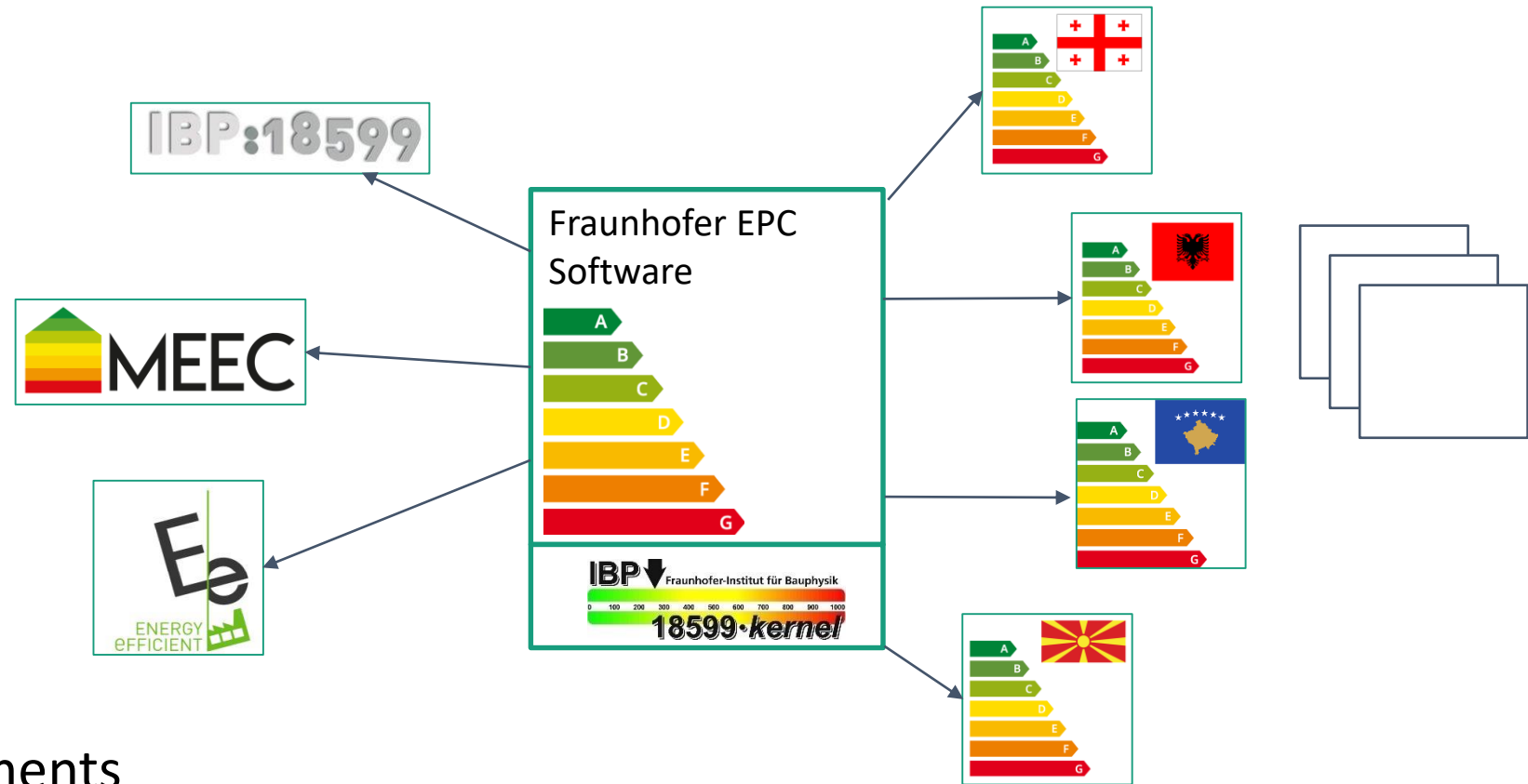
Cadaster parcel:	
Location / Address:	Ul Bozane Vucinic 44
Owner:	Ministry of Education
Year of construction:	1948
Type / Purpose of the building:	School
Building part / Zone:	School and Gym
Climate zone:	Zone I

Building	<input type="checkbox"/> New	<input type="checkbox"/> Existing	<input checked="" type="checkbox"/> Reconstructed
Gross floor area [m ²]:	4492.61	Gross building volume [m ³]:	20831.97
Useful floor area thermally conditioned [m ²]:	3818.72	Net building volume [m ³]:	15519.69
		Building shape factor [m ⁻¹]:	0.36

INFORMATION ON ENERGY PERFORMANCE

A	Energy class of the building:	E	Notional Building:
B			
C			
D			
E			
F	Primary energy per useful floor area thermally conditioned [kWh/m ² ·a]:	129.82	112.29
G	Delivered energy per useful floor area thermally conditioned [kWh/m ² ·a]:	105.76	64.17
	Annual emission CO ₂ [kg CO ₂ /m ² ·a]:	31.19	31.44
	Share of renewable energy sources	6.13%	

Thank you!



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Ministry of Capital Investments

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