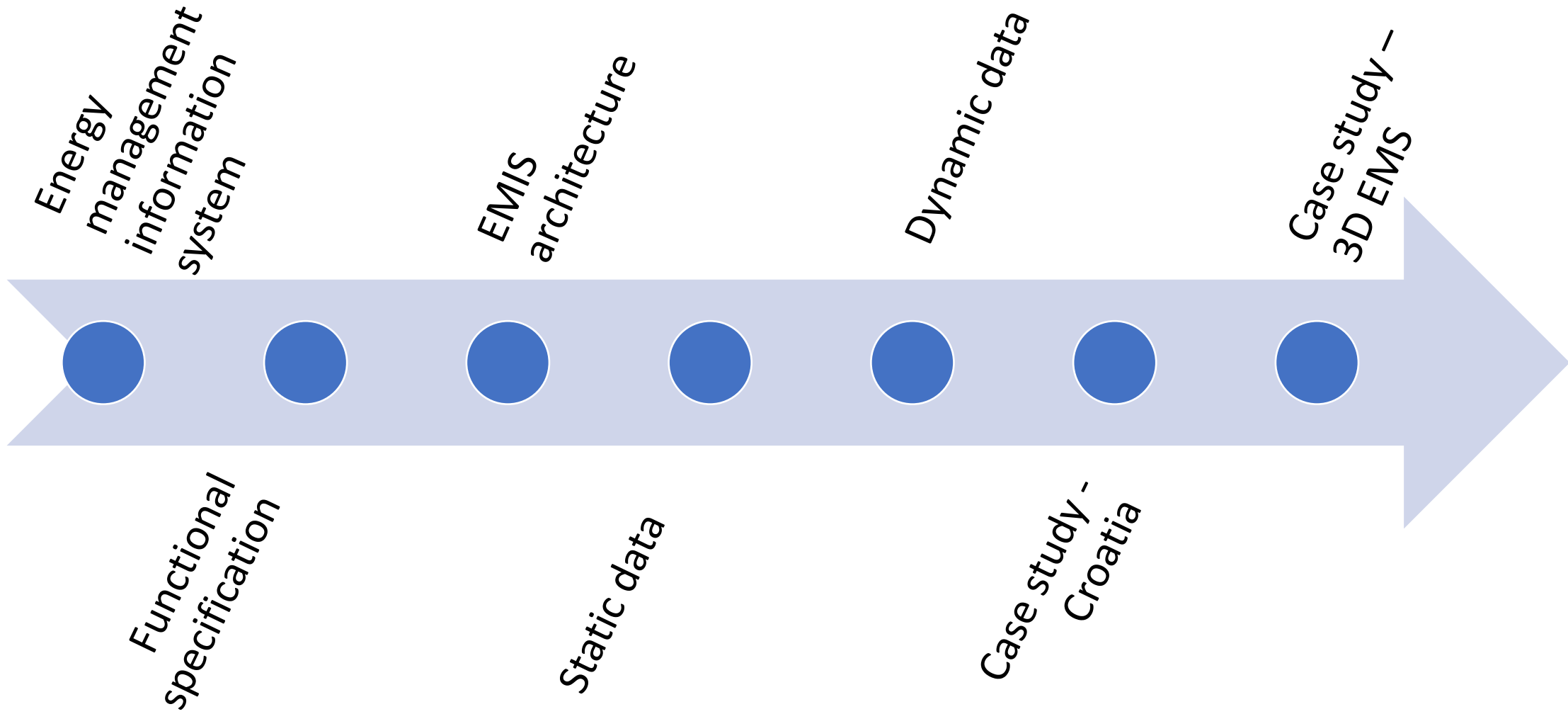


Energy Management
Information System and
examples of energy
management system tools

Table of contents



Energy Management Information System

- Systematic energy management is a body of knowledge and skills based on an organizational structure that links people with assigned responsibilities, efficiency monitoring procedures (monitoring consumption indicators and setting targets for improvement) and continuous measurement and improvement of efficiency
- EMIS software tool that connects processes of entering data on buildings and their energy consumption, monitoring indicators and reporting energy consumption savings
- EMIS is a web application, database-driven application, its data structure composed of tables with data

EMIS enables

- Continuous updating and maintenance of a database of general information on buildings in a municipality/city/county/country
- Continuous entry and monitoring of consumption data for all types of energy and water in buildings
- Calculation of consumption indicators by user-selected independent variables entered in the database data and via preset parameters
- Monitoring and target setting for energy expenses and energy savings for individual buildings and group of buildings
- Report creation according to user preferences or according to preset templates

EMIS functional specification

- Functional specification describes how the final software application should work, through a description of the minimum required functional product features
- It is a guideline for the development team on how to develop software, serves as a basis for determining needed work, and represents an informal agreement between the parties about what exactly should be developed
- It also serves as a point of coordination for the project team

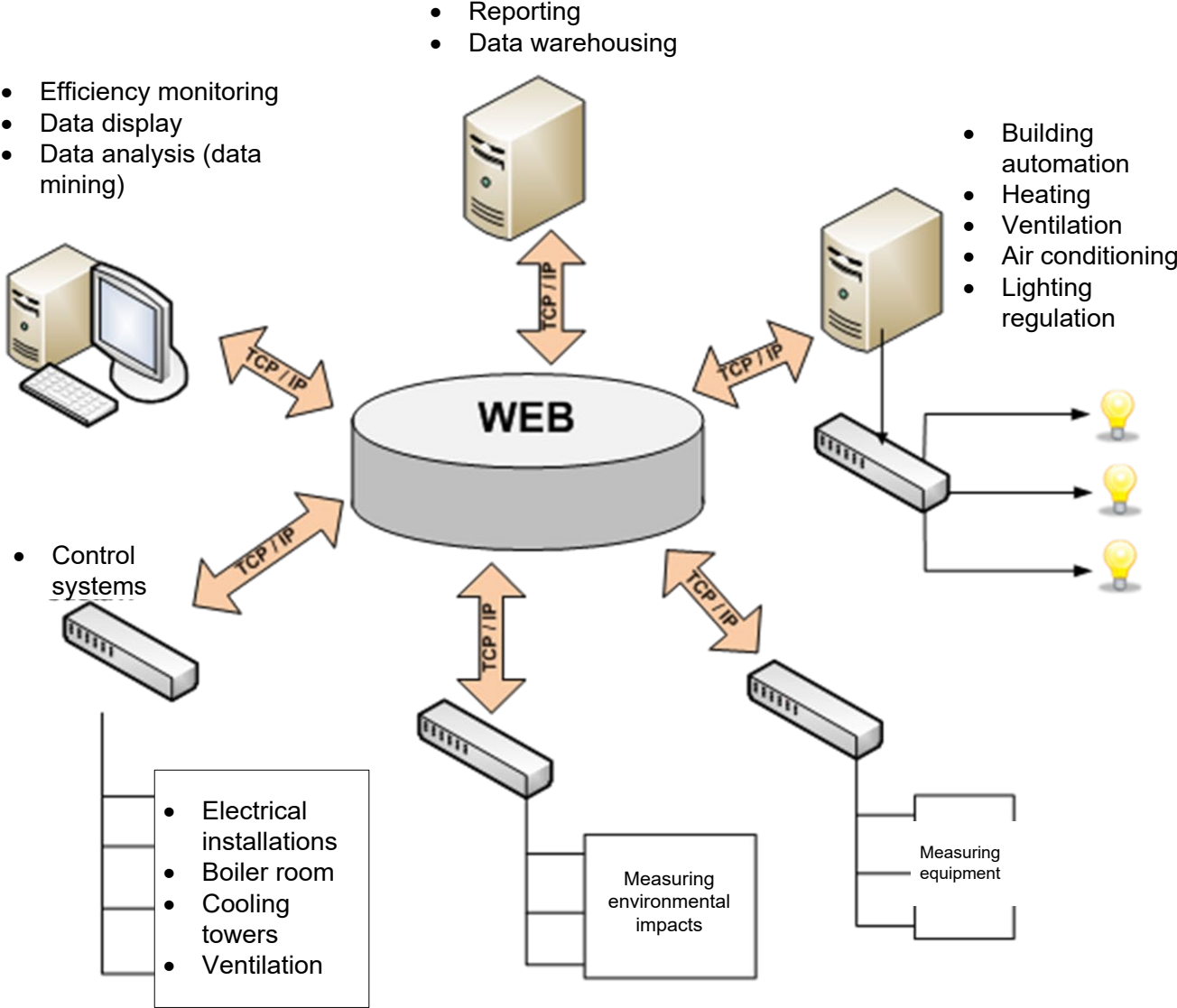
User specification

- The system has the following types of users:
 - Person in charge of technical issues in the buildings – primarily uses EMIS for the registration and control of data
 - Buildings manages (housekeeping manager – primarily uses EMIS for data verification and entry
 - Energy manager – Uses EMIS as one of the basic tools for energy management, responsible for a group of buildings owned by the city/county/ministry
 - Supervisor / controller – primarily uses EMIS to view reports and trends in consumption (access to all data)
 - Guest – review of data marked as available to the public
 - System administrator – person who provides technical support in terms of software maintenance, users and tables in the database management

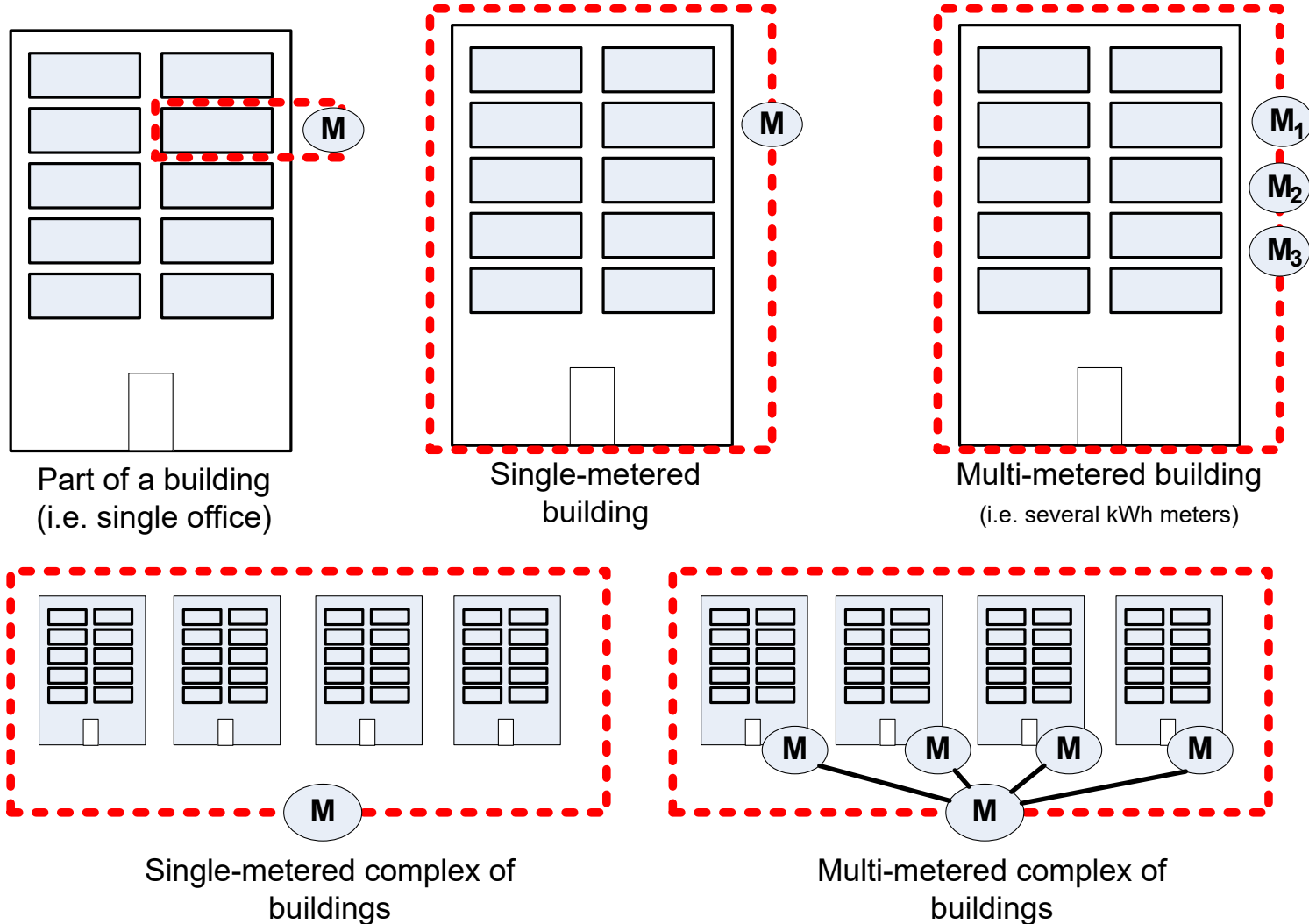
Functionalities

- Application login/logout
- The system of informing and warning users
- Managing tables and table columns
- Grouping buildings by categories
- Managing user rights
- Creating database backups
- Building data entry
- Sorting by building groups

EMIS architecture



Possible architecture of metering devices and buildings



Static data on building

- Enable upload of documents (pdf, doc, xls, jpg) and their storage on the server and Building picture upload
- Identification number
- Name
- Location (address; city/block/municipality/county)
- Purpose
- User
- Ownership
- Share of the use of total building area [%]
- Number of the energy certificate according to the ECZ registry
- Energy class according to the current energy certificate

Static data on building

- Phone
- Fax
- E-mail
- Flat gross floor area of the building [m²]
- Useful area surface of the building, A_k [m²]
- Heated surface area of the building, A [m²]
- Heated volume area of the building, V_e [m³]
- Number of working days per year
- Number of working hours per working day
- General remarks on the use of the building

Static data on building

- Coefficient of heat passing through windows (openings) [$\text{W}/\text{m}^2\text{K}$]
- Coefficient of heat passing through floors [$\text{W}/\text{m}^2\text{K}$]
- Coefficient of heat passing through the ceiling [$\text{W}/\text{m}^2\text{K}$]
- Coefficient of heat passing through walls to unheated spaces [$\text{W}/\text{m}^2\text{K}$]
- Transmission coefficient of heat loss per unit of surface area of heated buildings, HT' [$\text{W}/\text{m}^2\text{K}$]
- Annual thermal energy needed for heating [kWh]

Dynamic data (daily / weekly readings)

Consumption of energy and water meters	N	<ul style="list-style-type: none">• Weekly readings of energy and water.• Monthly inputs of bills received from suppliers.• Update of the possible selection of energy and calorific value is required. Calorific values should be taken from Rules of the energy certification of buildings (NN 113/08).• ...
Outside temperature taken from reference weather stations	N	
Indoor temperature	N	Temperature of the referent room. Possible input from smart meters
Possible input of average number of people during the week	N	If 3. or 4. = 0, application refers to "Building usage". Building users must be able to change or/and enter correct number of people (users) of the building in the observed week.
Possible input of working hours during the week	N	

Energy consumption data entry

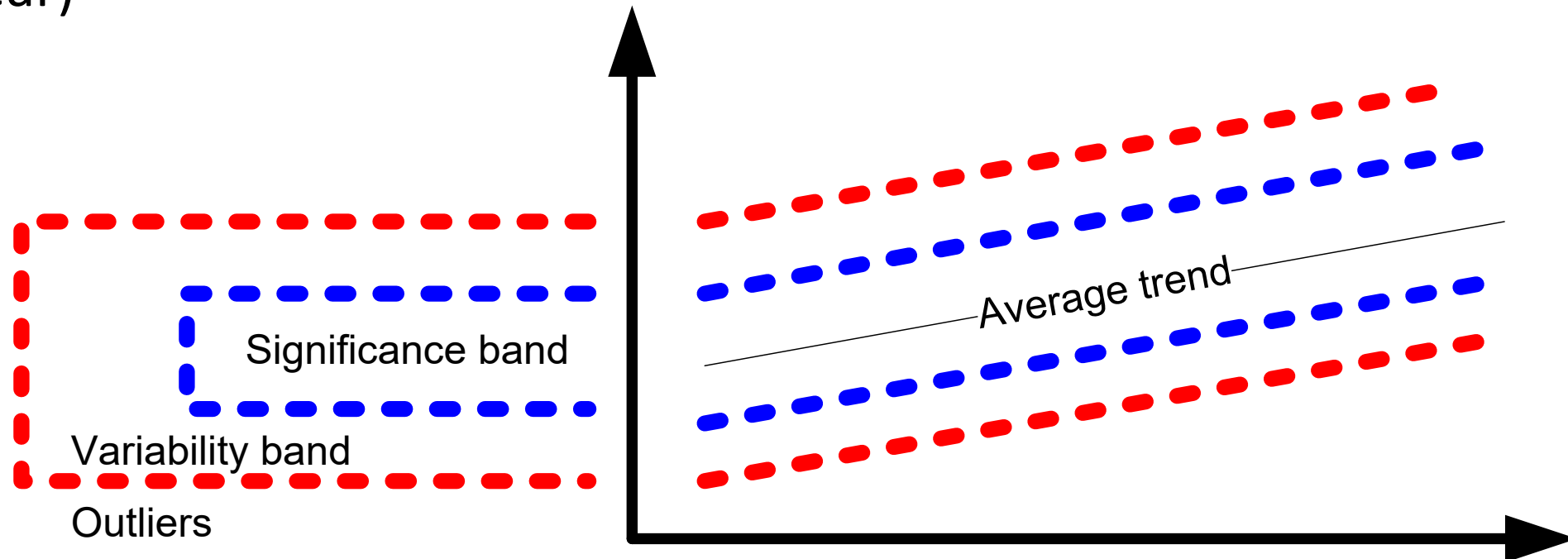
- Based on predefined data for a particular building, user can predefine energy resources used.
- Entry of the thirteenth payment period is enabled - scheduled to enter any correction to the energy consumption of the annual accounts of the calculation
- Monthly bills for energy: natural gas, extra light fuel oil, light fuel oil, firewood, heat (heating), steam, electricity, water and drainage, etc.

Attributes of the monthly bills for energy

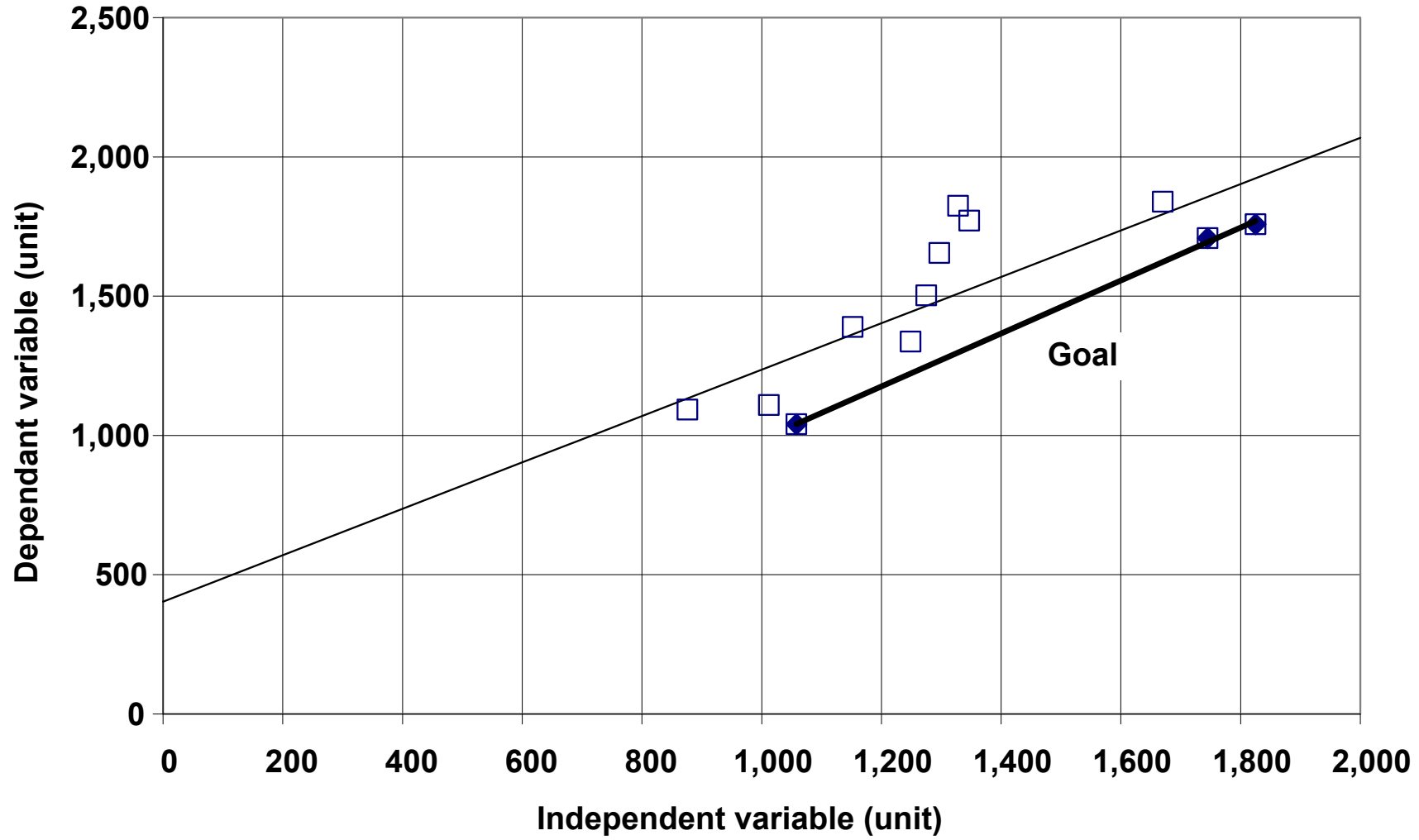
- Natural gas
 - Month
 - Year
 - Bill number
 - Supplier
 - Natural gas – unit price (kn/m³)
 - Natural gas – amount (m³)
 - Infrastructure
 - notes
 - Electricity – transmission and distribution
 - Month
 - Year
 - Bill number
 - Supplier
 - NT-R – unit price (EUR/kWh) // low tariff active
 - NT-R – amount (kWh) // low tariff active
 - VT-R – unit price (EUR/kWh) // high tariff-active
 - VT-R – amount (kWh) // high tariff-active
 - VT-J – unit price (kn/kVArh) // high tariff-reactive
 - VT-J – amount (kVArh) // high tariff-reactive
 - Engaged electric power (kW)
 - Renewable energy fee
 - Etc.
- + supply

Data verification and oversight

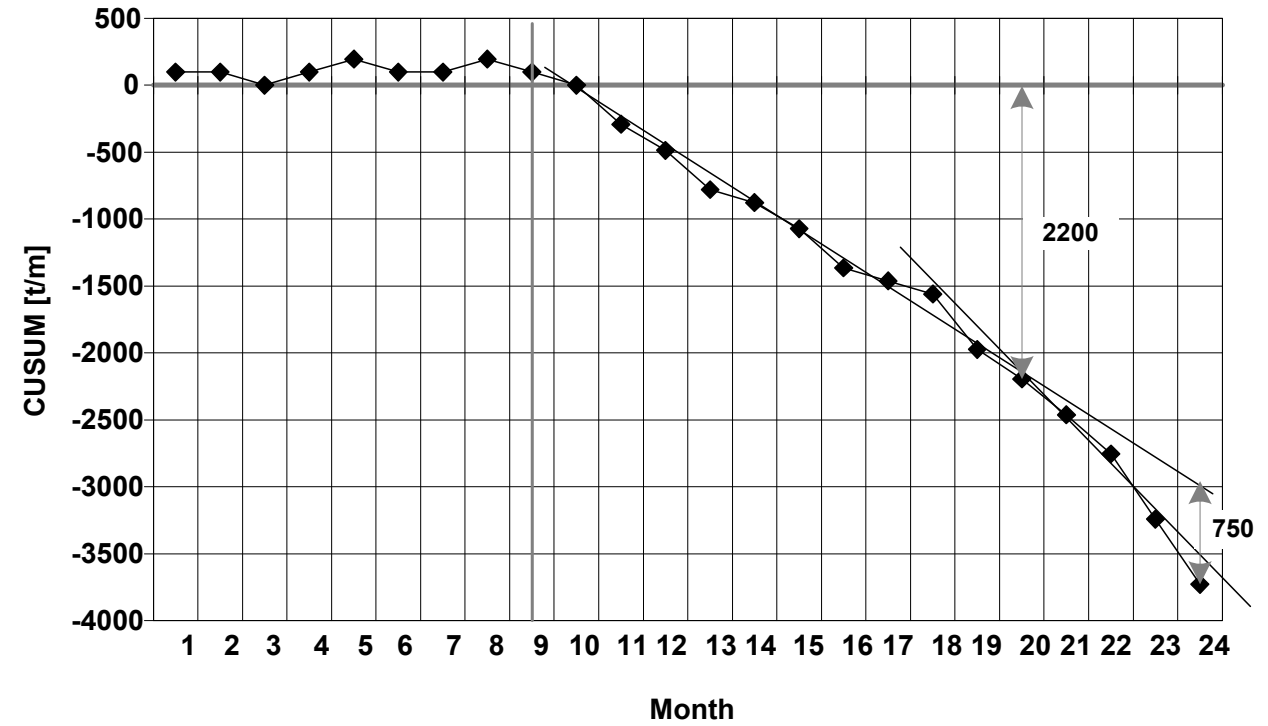
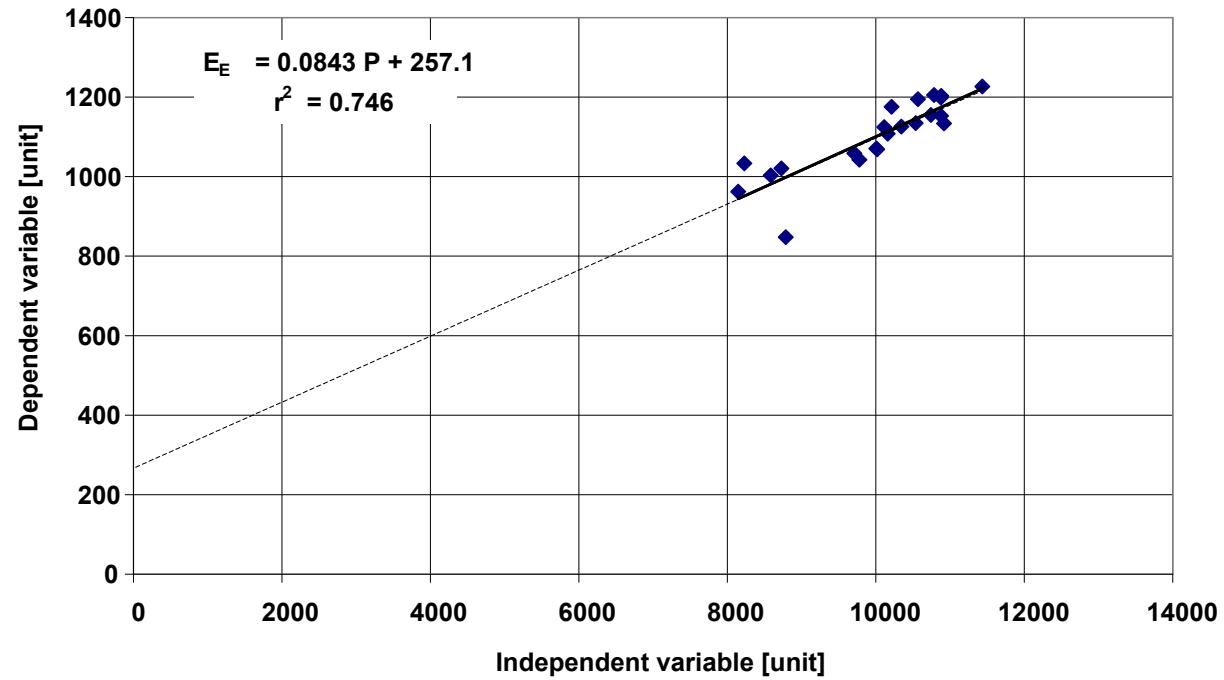
- EMIS must check the time consistency of the data
- Analysis of deviation from the default periodicals (day, week, month)
- Number of entries in a group of data (i.e. number of readings in a year)



Targets – setting goals for individual building



ET curves and CUSUM graphs



Energy Management Information System

- Energy Management Information System (EMIS) – web based application that is used as a main tool for continuous collection, storage, analysis and interpretation of energy consumption data in municipality, city, county, region, at the national level.
- EMIS should be easily accessed through any personal computer connected to the Internet
- Manual or automatic data entry (remote metering system) should be enabled
- EMIS development is an iterative process because there are always new requirements
- In its essence the application should always support the process of energy management in buildings

EMIS development

FIRST ADAPTATION (1.9. - 31.10.2011.)

- new tables managing
- setting goals for object groups
- alarming system upgraded
- new graphs

SECOND ADAPTATION (7.5. - 9.7.2012.)

- verification of monthly energy bills entered
- meter consumption “locking”
- determination of referent year(s)

THIRD ADAPTATION (19.10. - 1.11.2012)

- analysis of automatic readings
- new analysis module
- new system statistics module

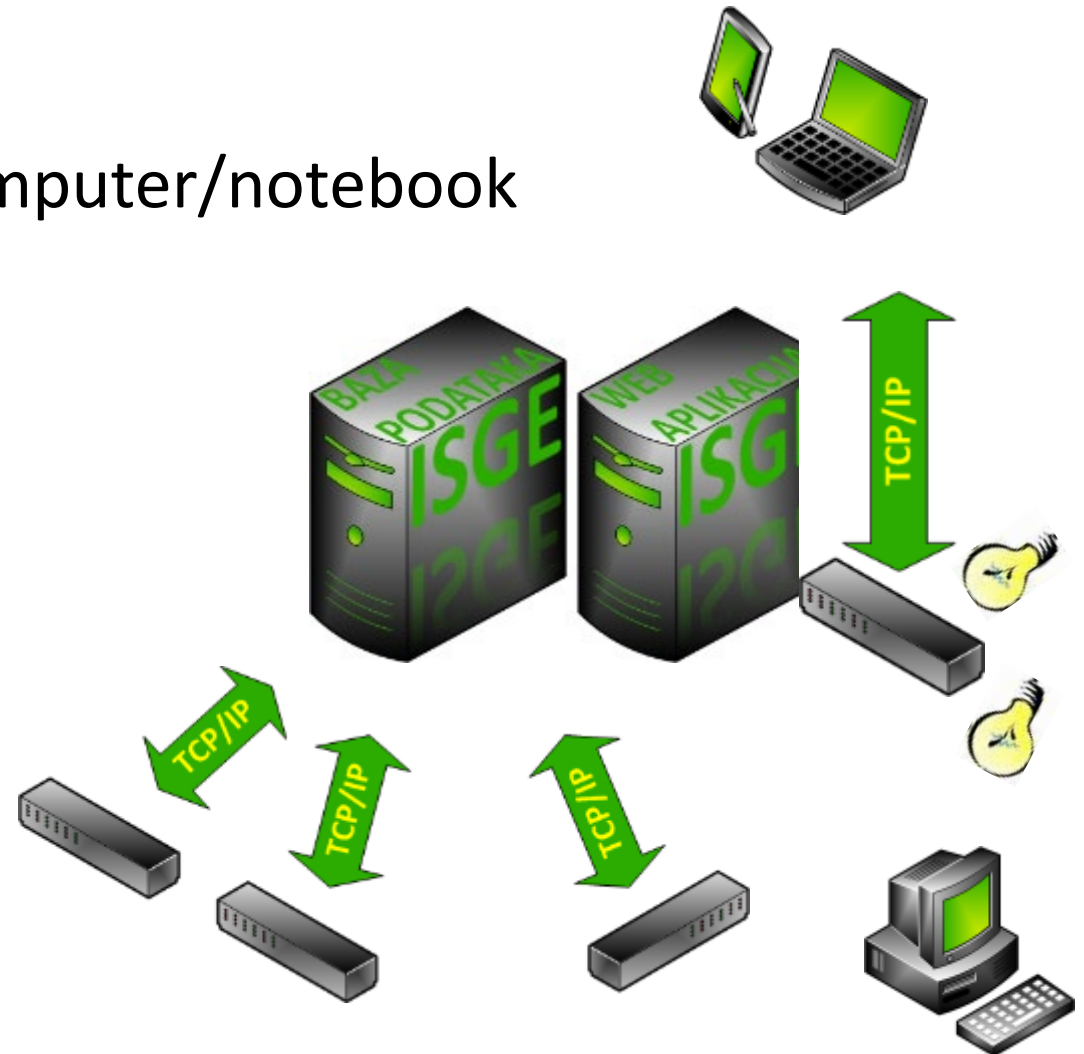
FOURTH ADAPTATION



TWENTIETH ADAPTATION

EMIS structure

- National system
- Web access from local server, desk computer/notebook
- Remote reading systems
- Collecting data from smart systems
- Measuring impact on environment



EMIS data, analysis, implementation

- DATA AQUISITION

- daily, weekly, monthly
- data entry via Internet

- ANALYSIS

- regular inputs in database
- detecting deviations
- early fault detection

- IMPLEMENTATION

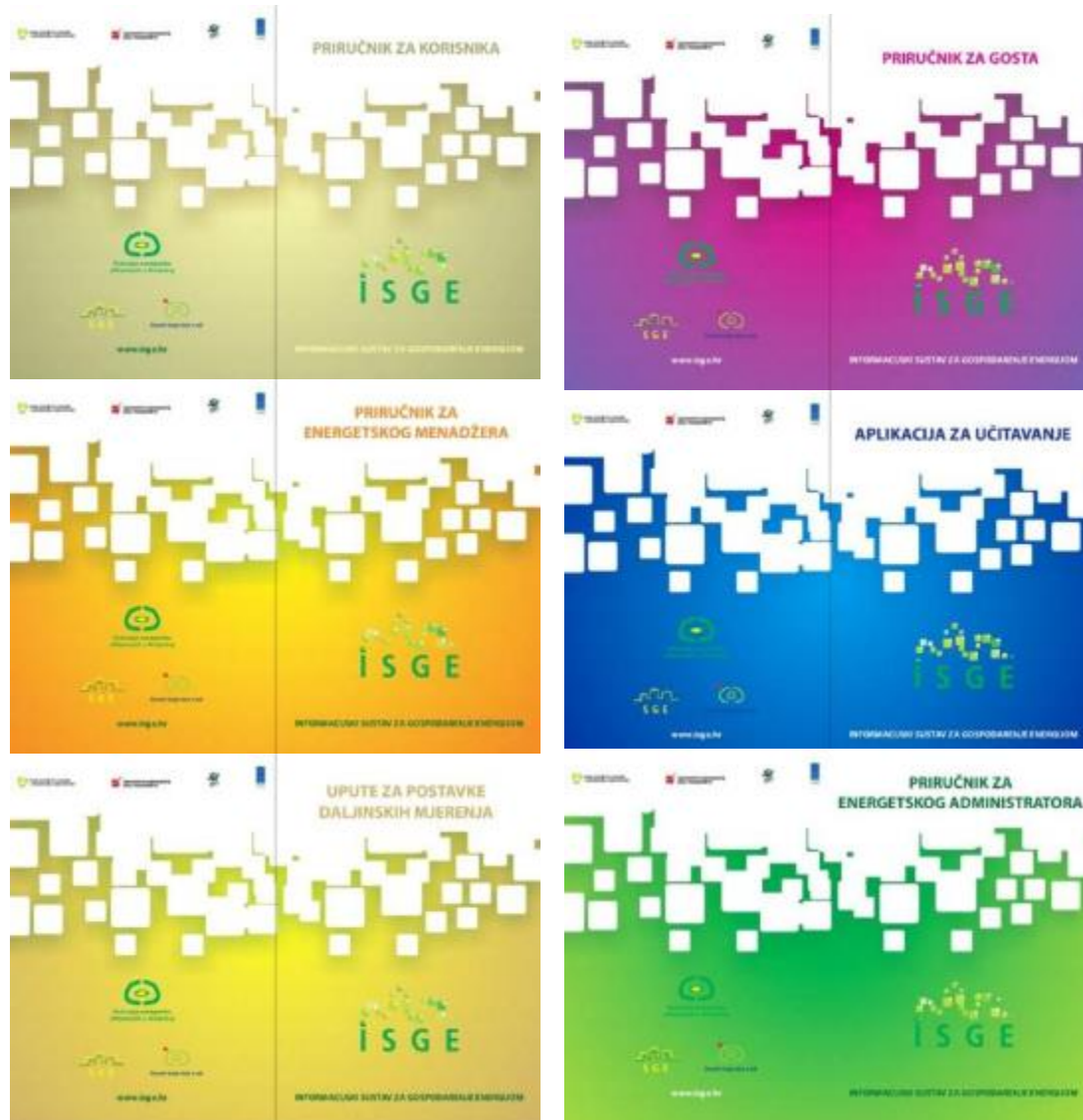
- where, when and what we consume every day
- insight into possible savings
- currently responding to system irregularities



EMIS functionalities

- Different user interfaces for each user role
- Advance database filtering
- Excel, pdf data export
- Assortment of different building types
- Custom definition of energy bills
- Automatic readings
- Indicators of consumption
- ET curves, QUSUM graphs
- Locking verified places of consumption
- Nelson rules
- Communication and alarming system
- ...

EMIS user manuals



Dobro došli u INFORMACIJSKI SUSTAV ZA GOSPODARENJE ENERGIJOM

Novo! [Upute za slanje godišnjih izvještaja - Energetski administrator](#)

Novo! [Upute za slanje godišnjih izvještaja - Korisnik](#)

Korisničko ime :

Zaporka :

Login

[Zaboravili ste zaporku?](#)



Broj odbijenih zaključanih godina / mjernih mjesta: 32. Datum zadnjeg odbijanja: 31.05.2021. [Pregled](#)

[STATISTIKA](#)
[STATISTIKA MOJIH OBJEKATA](#)

Ukupni statistički podaci ISGE baze podataka (11.10.2021.)						
Vrsta ETC-a	Broj objekata	Broj mjernih mjesta	Broj automatskih mjernih mjesta	Broj računa	Broj očitavanja	Broj automatskih očitavanja
Kompleks	1.019	3.351	436	506.132	16.880.583	16.373.236
Zgrada u kompleksu	4.110	3.809	507	548.403	15.046.015	14.481.914
Slobodnostojeća zgrada	10.626	26.676	849	4.178.272	24.471.254	22.527.650
Dio zgrade	3.720	7.078	73	975.589	1.973.067	1.745.504
Suma - Zgradarstvo	19.475 (14.736)	40.914	1.865	6.208.396	58.370.919	55.128.304
Javna rasvjeta	24.139	23.238	3	4.127.942	1.163	0
Suma	43.614	64.152	1.868	10.336.338	58.372.082	55.128.304

Aktivni ISGE korisnici	
Uloga	Broj
Gost	1
Korisnik	1054
Energetski menadžer	11
Energetski administrator	180
Administrator sustava	10
Ukupno	1256

Grafovi računa

[Grafovi računa](#)
[Grupe energenata](#)
[Projektna referentna potrošnja](#)
[Trenutni grafovi / zaključavanje](#)

2000 - 2021 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Energent

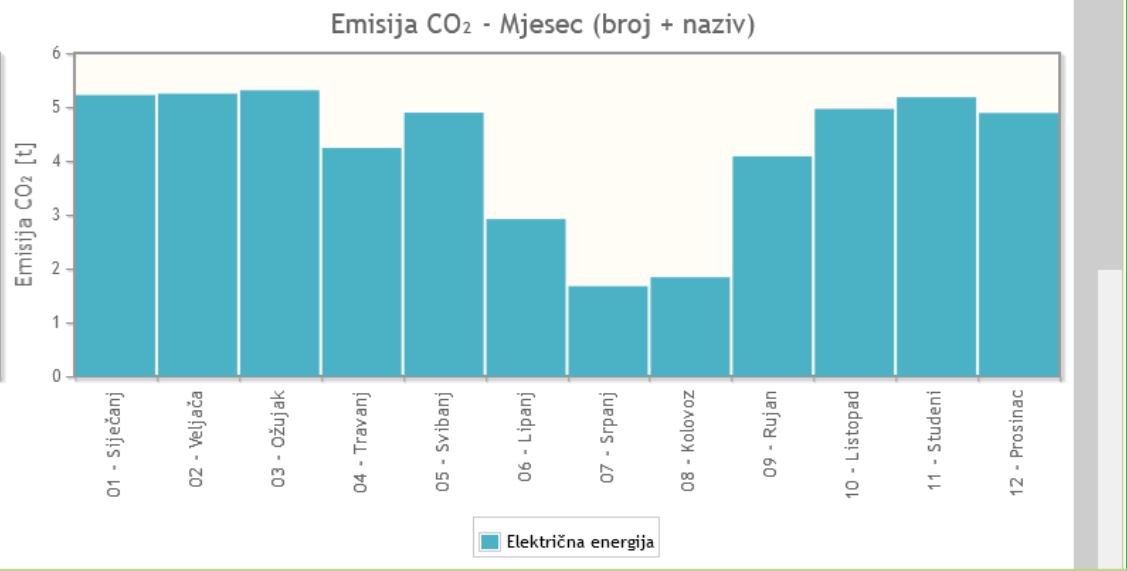
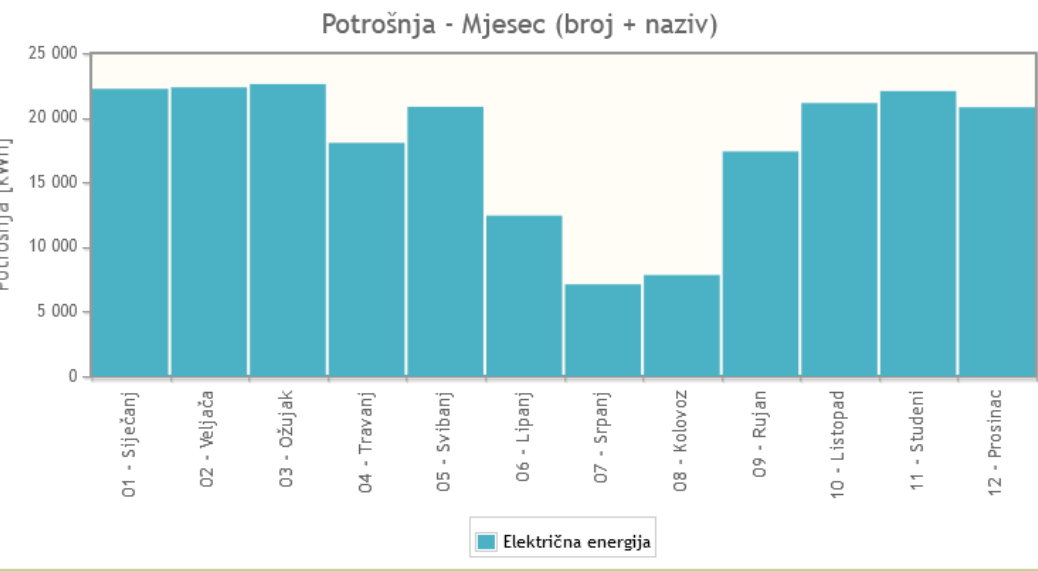
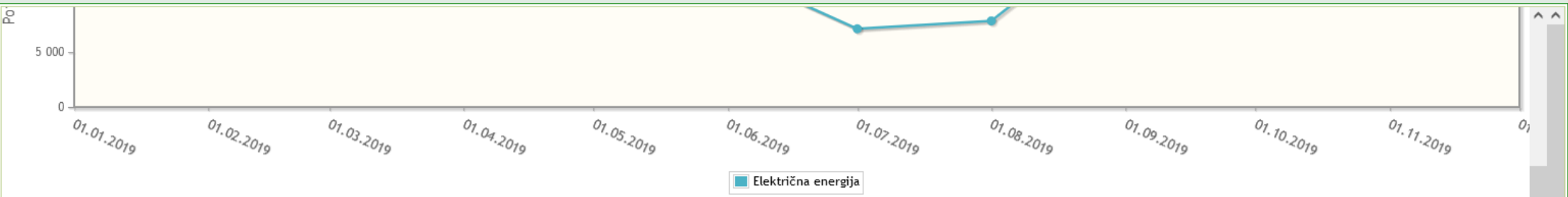
- Svi energenti
- Električna energija**
- Prirodni plin
- Plin u boci
- Loživo ulje ekstra lako
- Voda

Grupa energenata

- EE
- Grijanje
- Voda

Mjerno mjesto (Električna energija)

- 0172530015
- 0172533071



Apsolutne vrijednosti

- Apsolutne vrijednosti
- Apsolutne vrijednosti
- Usporedba s očitanim

Indikatori

- Potrošnja [kWh]
- Energija [kWh]
- Emisija CO₂ [t]
- Primarna energija [kWh]
- Trošak [kWh]

ET

- Temperatura [°C]
- Stupanj daždivosti [mm]

Kumulativna

- Potrošnja [kWh]
- Energija [kWh]
- Emisija CO₂ [t]

Case study - Ukraine

- Eight types of software are used for energy monitoring and management: AIS Energyservice, ASEM, Energobalance, UMUNI, ISE, Energyplan, EManagement24 and Kyivshchyna Energoefektivna
- Data collected: year of construction, heating area and volume, heat load, energy consumption

"Київщина енергоефективна"
01001, м.Київ, вул. Мельникова, 40

Контакти
044-206-74-47

Інформація про будівлю

Категорія Будинок або споруда навчального закладу	Опалення Вимкнено	Поверхів 2
Рік —	Опалювана площа 3000.0 м²	Висота —
Кількість людей (робочий час) 257	Опалюваний об'єм 9600.0 м³	Площа 3000.0 м²
Кількість людей (ввечерній час) —	Теплове навантаження на опалювання —	Об'єм 9600.0 м³

Статус опалення будівлі: **Вимкнено**

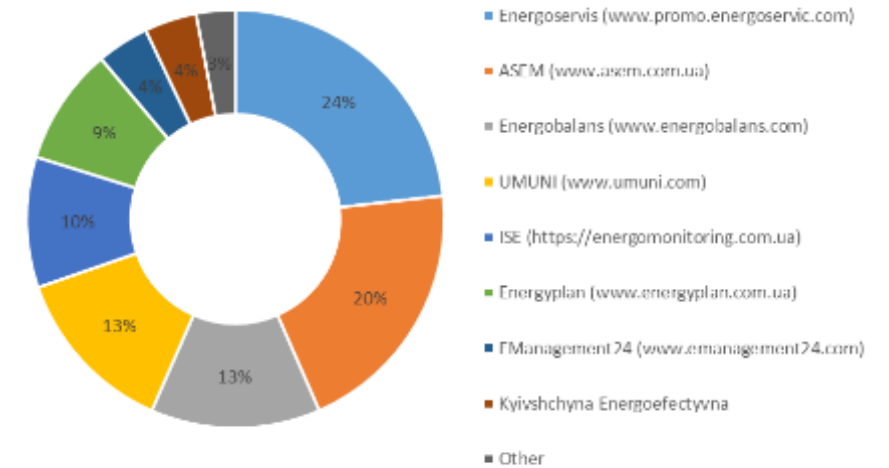
017-ЗОШ № 9 (основне приміщення) (Код: N004000)
Київ, вул. Діброва № 102

Температурна зона	1	Висота	8.0 м
Точка збору фактичної температури	Україна Центр	Площа	1392.7 м²
Категорія	Будинок або споруда навчального закладу	Об'єм	6821.0 м³
Рік	1937	Опалювана площа	1392.7 м²
Поверхів	2	Опалюваний об'єм	6821.0 м³
Кількість людей (робочий час)	504	Максимально допустиме значення теплової потужності	28 кВт/чол/ м²
Кількість людей (ввечерній час)	2	Теплове навантаження на опалювання	Головний
Опалення	Центральне опалення		

Case study - Ukraine

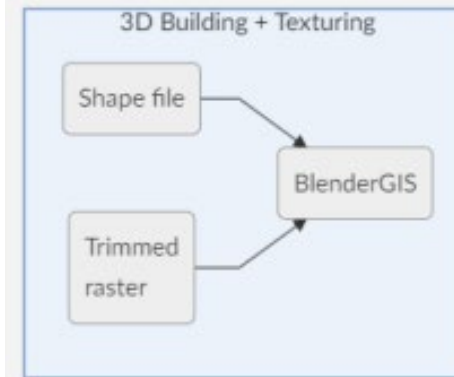
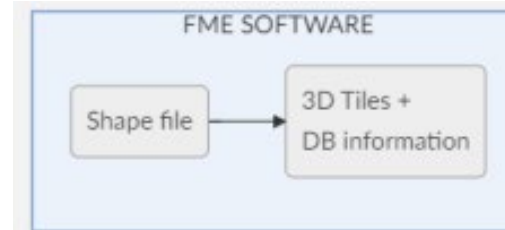
- Possibility of data comparison (not at the national level)
- Difficult and time consuming to transfer from one EMS to another (risk of losing data)
- Need to have a national EMS (open database accessible to all municipalities)
- Benchmarking is missing as well as national statistics needed for programming of future national building energy retrofit action plans

Energy management systems used in Ukraine

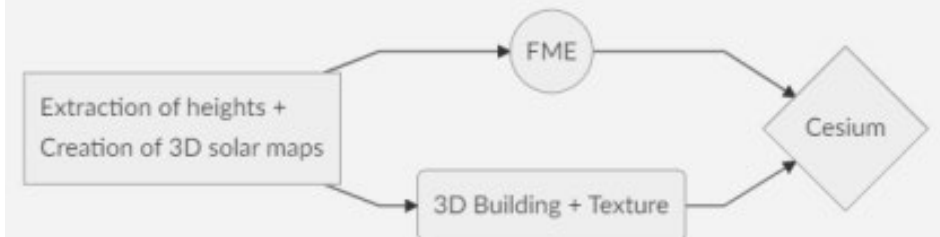


OnePlace platform – 3D EMS

The screenshot shows the OnePlace website homepage. At the top left, there is a logo for 'Interreg CENTRAL EUROPE BOOSTEE-CE'. The main heading is 'OnePlace The Online Energy Platform'. Below this is a navigation bar with links: HOME, LIVING ENERGY MARKETPLACE, ENERGY EFFICIENT CITIES, FINANCING ENERGY EFFICIENCY, and 3D ENERGY MANAGEMENT SYSTEM. The central part of the page features the 'OnePlace' logo with a lightbulb icon and the text 'The Online Energy Platform'. A paragraph below states: 'This is an open platform where you can find interesting guidebooks, presentations, online tools and case studies, that will help you improve the energy efficiency of your building(s) and involve public authorities and users in energy saving activities.' At the bottom, it says 'The OnePlace platform has 4 main modules:' and lists four modules with corresponding icons: 'Living Energy Marketplace', 'Energy Efficient Cities', 'Financing Energy Efficiency', and '3D Energy Management System'.



Web application based in Cesium:

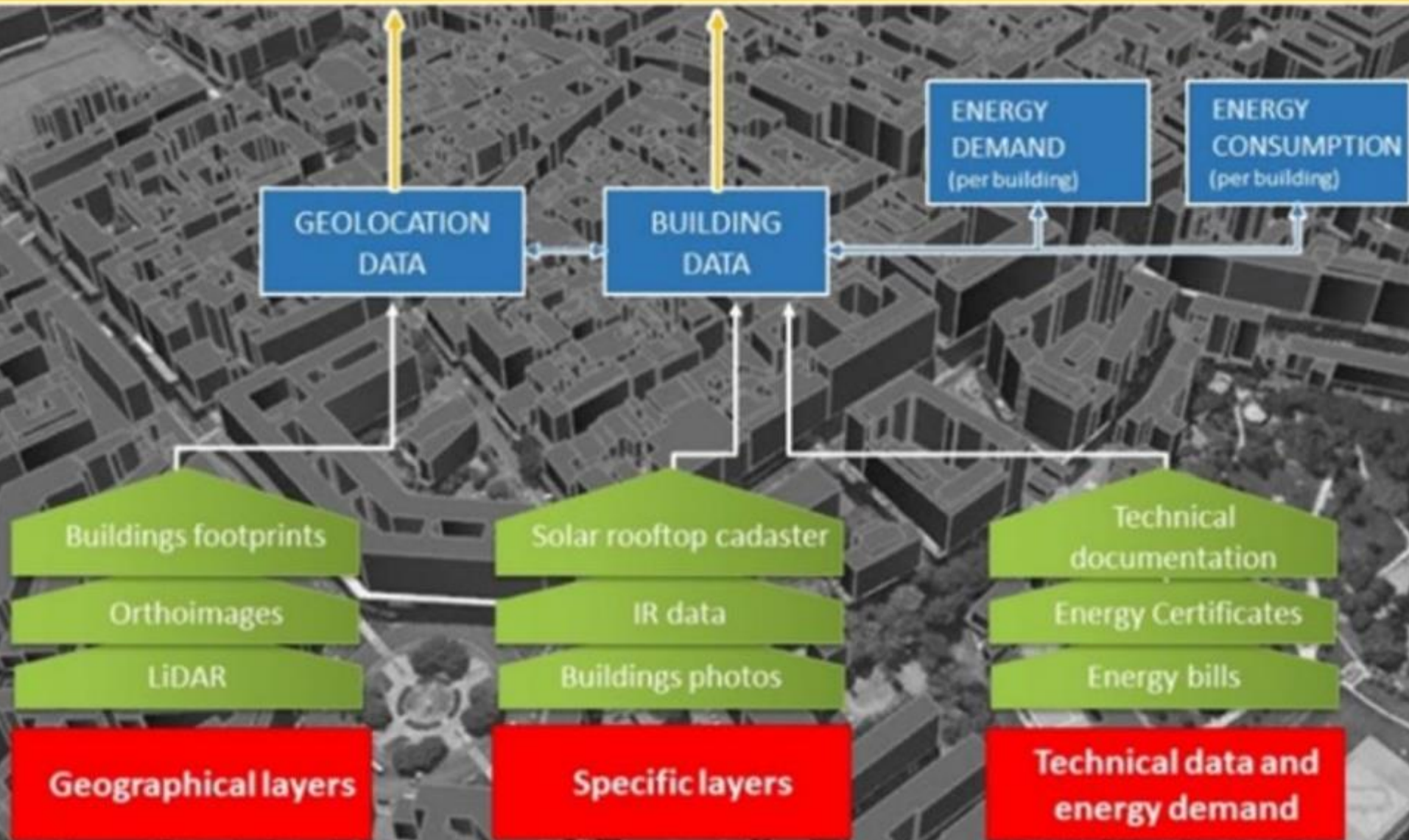


OnePlace platform

- <https://oneplace.max.si/3d>
- 4 modules
 - Living Energy Marketplace – LEM
 - Energy Efficiency Cities – EEC
 - Financing Energy Efficiency – FEE
 - 3D Energy Management System – 3DEMS
- The viewer is a webGIS that allows users to interactively navigate a map or 3D building models of a pilot location, select a building of interest and retrieve energy and other cadastral/building information, including non-spatial data



Energy Geodatabase for public buildings



3D ENERGY MANAGEMENT SYSTEM

Cities

Velenje, Slovenia

Color by attribute

- Default
- By height
- By area
- By perimeter

Filter

By height:

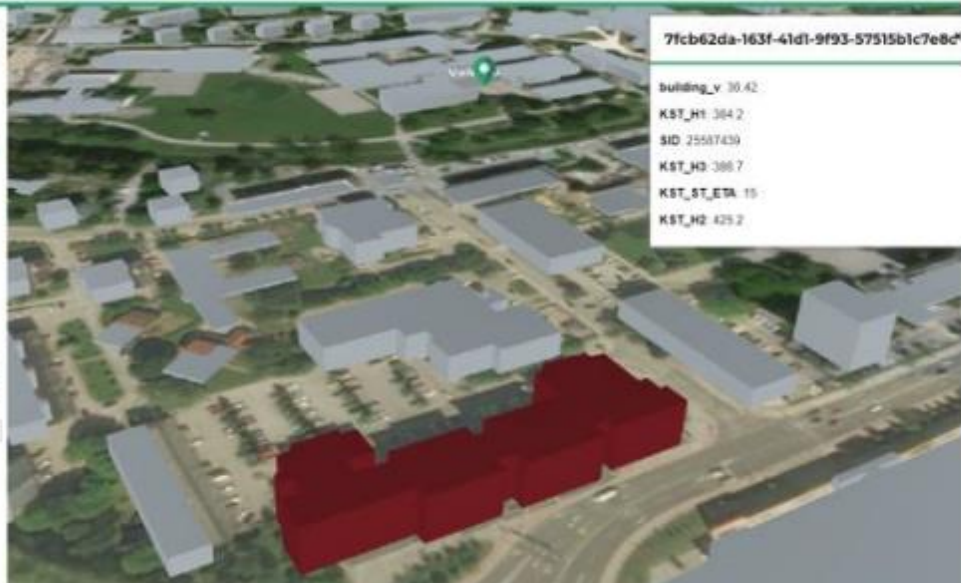
Larger than:

Value for filter:

Filter

Display options

- Shadows



7fcb62da-163f-41d1-9f93-57515b1c7e8c

building_v: 30.42
 KST_H1: 304.2
 SID: 25587439
 KST_H2: 306.7
 KST_ST_ETD: 15
 KST_H2: 425.2

3D ENERGY MANAGEMENT SYSTEM

Cities

Koprivnica, Croatia

Color by attribute

- Default
- By height
- By area
- By perimeter

Filter

By height:

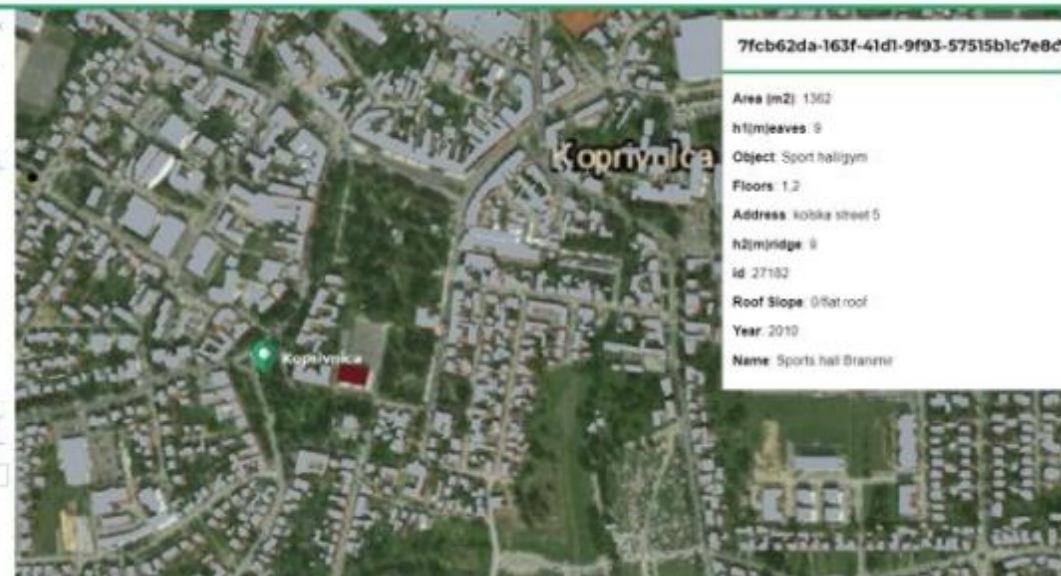
Larger than:

Value for filter:

Filter

Display options

- Shadows



7fcb62da-163f-41d1-9f93-57515b1c7e8c

Area (m2): 1362
 h1(m)leaves: 9
 Object: Sport haligym
 Floors: 1.2
 Address: kolbka street 5
 h2(m)ridge: 8
 id: 27182
 Roof Slope: 0/flat roof
 Year: 2010
 Name: Sports hal Branmr

3D ENERGY MANAGEMENT SYSTEM

Cities

Judenburg, Austria

Color by attribute

- Default
- By height
- By area
- By perimeter

Filter

By height:

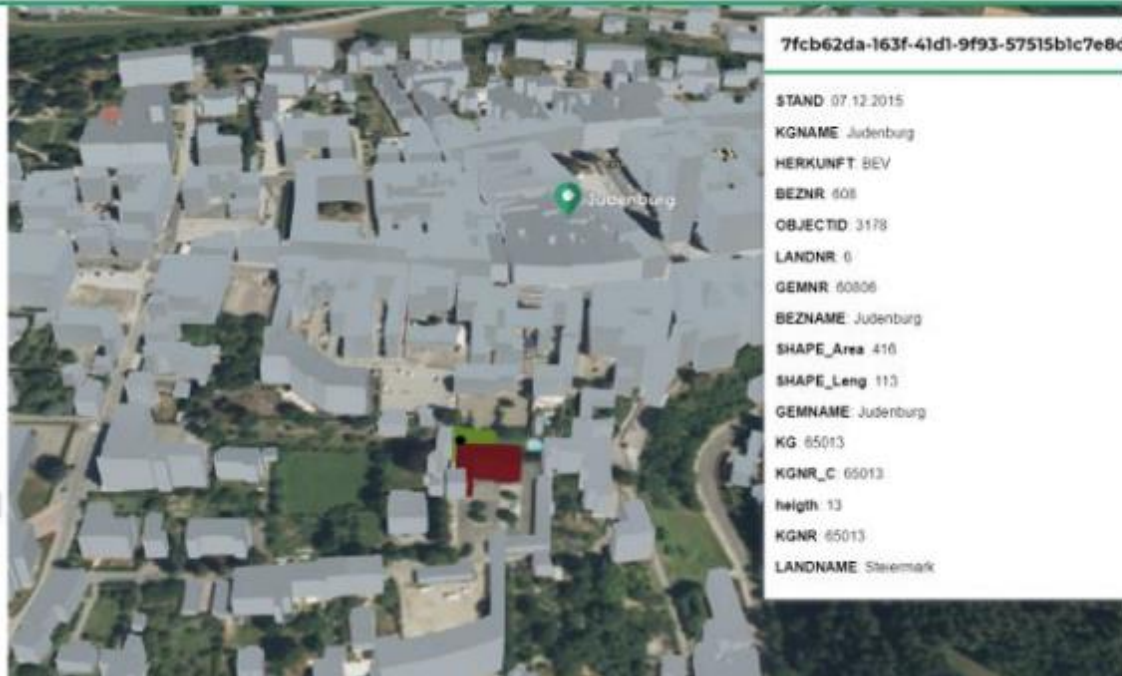
Larger than:

Value for filter:

Filter

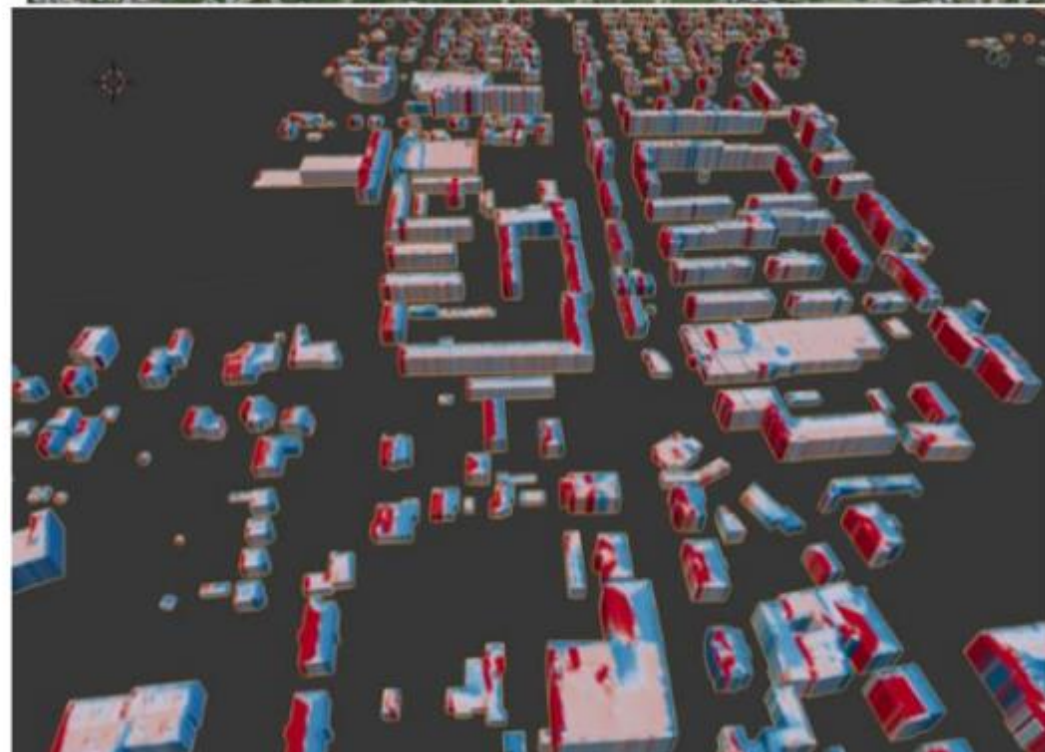
Display options

- Shadows



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STAND: 07.12.2015
 KGNAME: Judenburg
 HERKUNFT: BEV
 BEZNR: 608
 OBJECTID: 3178
 LANDNR: 0
 GEMNR: 60806
 BEZNAME: Judenburg
 SHAPE_Area: 416
 SHAPE_Leng: 113
 GEMNAME: Judenburg
 KG: 85013
 KGNR_C: 65013
 heigth: 13
 KGNR: 65013
 LANDNAME: Steiermark



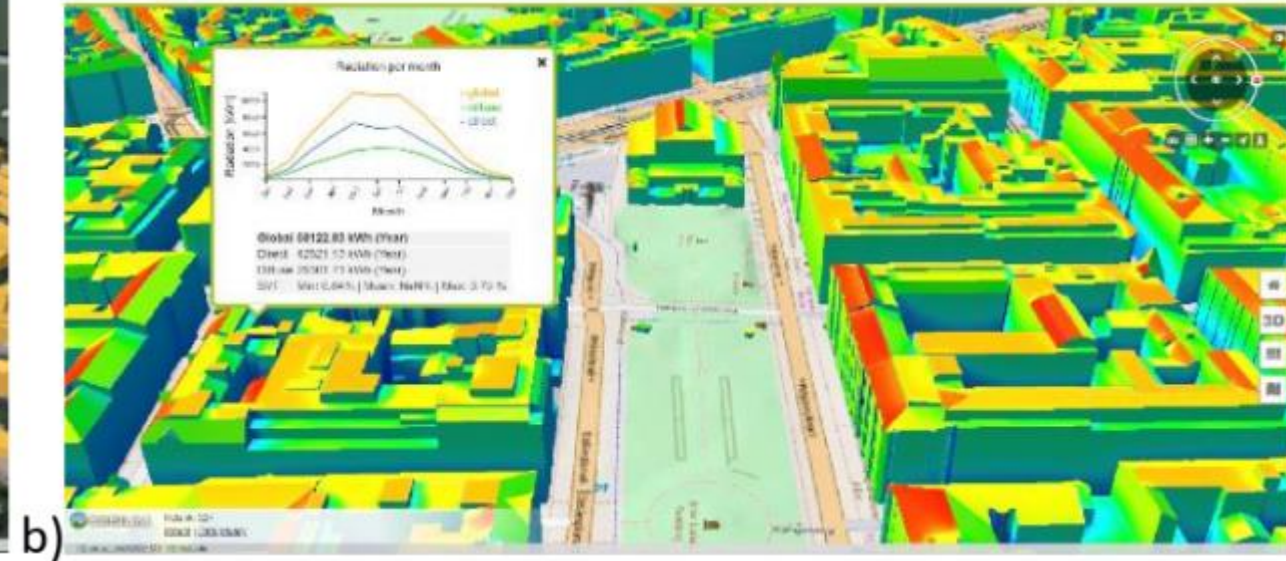
The Energy Atlas – Berlin, Germany

- The Energy Atlas of Berlin presents an integrated approach for strategic energy planning and use of renewable sources in urban areas
- Visualizing the effects of planned measures
- Based on CityGML semantic 3D city model of Berlin (information such as building address, height, volumes, purpose, etc.)
- Solar potential estimated for ca. 500,000 Berlin's roof from the Solar Atlas Berlin (roof pitch, solar irradiation, average efficiency and price of solar cells)
- Data and modelling approach for various utility network (i.t. gas, water, electricity, etc.) developed in the SIMKAS-3D project
- Methodology to perform assessment of the energy retrofit of buildings and heating energy consumption

The Energy and Climate Atlas – Helsinki, Finland

- The Helsinki Climate and Energy Atlas is using 3D city model. The energy atlas of the city is part of the mySMARTLife project
- The atlas has compiled energy-related data on its buildings stock and made it freely available for public use
- Information such as: energy efficiency retrofit potential, performance classification, energy source used for heating
- Sophisticated analyses and simulations are also available
- Three thematic categories:
 - Basic building information: use, height, number of floors, building materials, year of construction, etc.
 - Building energy and retrofit information (heating system, energy source, energy certificates, etc.)
 - Building consumption data

The Energy and Climate Atlas – Helsinki, Finland



Q&As

Thank you for your attention!

Matija Vajdić