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Covenant of Mayors  
for Climate & Energy  
Eastern Partnership

# Covenant of Mayors for Climate & Energy – Eastern Partnership





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## Part 3



### **Energy Management Information System (EMIS) at Municipal Level: concept, tools, establishment and maintenance of EMIS in municipalities and the required local capacities, capabilities and scope of EMSI, benefits**





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# Energy Management Information Systems (EMIS)



- One of the key elements of a comprehensive energy management program.
- It provides opportunity for systematic and timely acquisition of energy data.
- A well-designed energy management information system can save from 5% up to 10% in overall energy consumption based exclusively on improved management capability by facility managers
- Advanced and complex centralized energy management information system based on for e.g. Supervisory Control and Data Acquisition (SCADA) can reduce energy consumption much further





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# Energy Management Information Systems



## MAIN BENEFITS:

- saving time and personnel capacity
- provision of accurate and timely information
- simple process for manipulating allows an easy manipulation of input parameters
- analyzing and storing data for future reference
- a direct decision support tool for decision makers (building owners, operators),
- capability to provide more accurate projections of energy use in the future and under changed circumstances (for e.g. application of an energy renovation measure)
- shows data visualization and visualization of trends





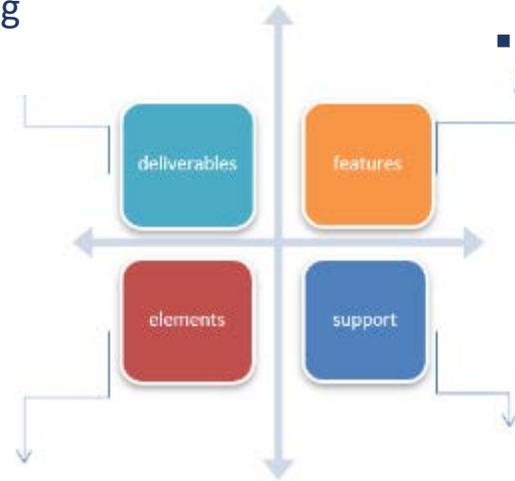
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# Key elements of Energy Management Information Systems



- Early detection of poor performance
- Support for decision making
- Effective energy reporting

- Storage of data in a usable format
- The calculation of energy use targets
- Comparison of actual consumption



- Sensors
- Energy meters
- Hardware and software

- Management commitment
- allocation of responsibility
- Procedures
- Training
- Regular audits





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# Different levels and complexity of Energy Management Information Systems



## Simple (manual) tabular

- Manual reading of energy meters
- Input into basic computer programs such as text or spreadsheet editors
- Manual calculations of EnPIs (Energy Performance Indicators) environmental impacts and cost factors, etc.

Skupaj meseci razdoblje meseci Elektrna Energija, Elektro Toplota energija	Prijemnik mot (kW)	Porazba celovita energija (kWh)					Obratovanje jalova mesec	Obratovanje		
		PE	VT	ET	MT	VT+MT		Q	Skupaj 1	Skupaj 2
Januar	230	1.900	2.514	728	4.097	0	447,94	345,02	861,64 €	
Februar	230	1.900	2.635	821	4.658	0	437,46	324,09	913,86 €	
Mart	230	1.211	2.141	649	4.058	0	415,48	289,69	841,38 €	
April	230	1.012	1.838	512	3.482	0	381,80	241,68	759,91 €	
Maj	230	888	1.625	571	3.258	0	383,18	228,52	731,85 €	
Junj	230	616	1.729	370	2.715	0	382,66	191,17	664,68 €	
Julij	230	1.121	1.666	490	3.456	0	382,64	245,81	765,90 €	
Avgust	230	694	1.419	426	2.588	0	357,66	181,07	648,47 €	
Septembar	230	697	1.668	495	2.890	0	360,88	187,10	657,68 €	
Oktober	230	1.331	1.943	684	3.943	0	410,90	278,36	824,79 €	
Novembar	230	1.010	1.861	603	4.780	0	443,14	333,07	931,46 €	
Decembar	230	1.021	2.163	1.200	4.873	0	443,73	329,15	927,45 €	
Skupaj		13.305	24.055	7.988	45.348	0	4.847,26	3.186,46	9.916,47 €	

## Energy accounting or bookkeeping

- Energy accounting is the collection of information on energy use, the price of energy and the total energy cost.
- Based on this information, we have an overview of the use of energy over a certain period.
- It is the first level of EMIS that applies dedicated software.





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# Different levels and complexity of Energy Management Information Systems



## Digital operational monitoring

- Possibility to **remotely monitor** the consumption of heat and electricity, water and condition of the climatic conditions of the building.
- Key information is dynamic and provides **comparative analyses** (numerical and grain) of use and costs by type and service.
- Provides an overview of the climatic conditions of facilities and deviations from the average values.
- The control over the credibility of the data, the analysis of energy and financial indicators, the inspection and control of installed equipment.

## Central management and control systems

- **Control and managing** individual technological processes within buildings (heating, cooling, lighting, ...) **via remote access** to actuator control (for e.g. through web applications).
- The CNS enables the setting of the facility operation log and the synchronization of the operation of individual elements of the system.
- Determines anomalies and deviations, and enables immediate action and thus optimizes the operating costs of the building.





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# Energy monitoring in Slovenia



## Decree on energy management in public sector

Energy management system has to be set up in buildings and parts of **buildings owned by the Republic of Slovenia or local authorities** or are used by state authorities, local communities, public institutions, public commercial institutions, public funds, public agencies and institutions founded by the Republic of Slovenia or local government, and with an heat area of **more than 250 m<sup>2</sup>**.



Source: Decree on energy management in public sector (Off. Gazette 52/2016 and <http://www.nas-stik.si/1/Novice/novice/tabid/87/ID/4176/Izdana-Uredba-o-upravljanju-z-energijo-v-javnem-sektorju.aspx>)





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# Energy monitoring in Slovenia



**Energy bookkeeping/accounting** is a system of collecting and monitoring of on energy consumption data in a building or a particular/separate part of the building and it is managed as a information database on the basis of the identification number of a building or part of a building.

Information energy bookkeeping database is maintained by the ministry responsible for energy.



Source: Decree on energy management in public sector (Off. Gazette 52/2016 and <http://www.el-ove.si/>)





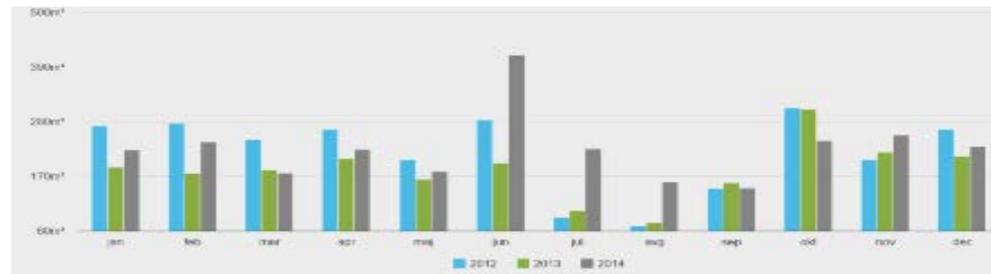
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# Energy monitoring in Slovenia

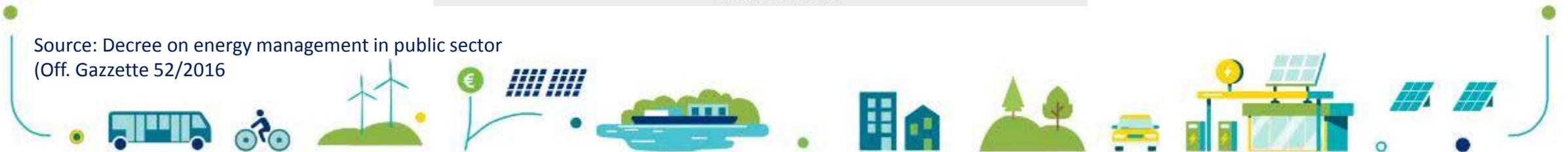


Information database includes the data:

- Annual energy consumption in the building or in particular part of the building – kWh/a;
- The annual cost of energy consumed and energy in the building or in particular part of the building €/a;
- The technical characteristics of the building or a particular part of the building: technical characteristics of the envelope, characteristics of technical systems of the building and on the profile of energy use, including information on the occupancy of the building and the number of users;
- Action plan and list of implemented measures to increase energy efficiency and use of renewable energy sources.



Source: Decree on energy management in public sector  
(Off. Gazzette 52/2016)





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# Energy monitoring in Municipality of Velenje E2 MANAGER



## Information database E2 MANAGER (software):

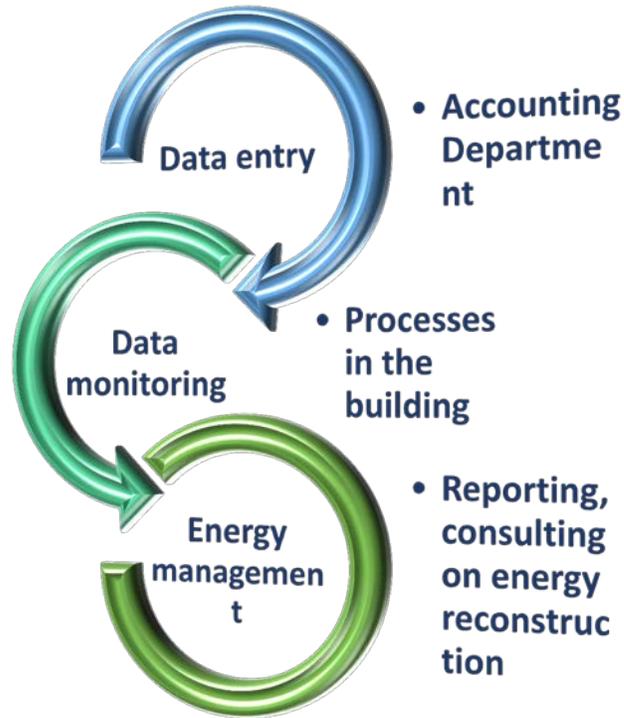
- An overview of the energy consumption data and processes the information about the building, or a large number of buildings;
- Monitor energy costs, consumption, market prices;
- An overview of the numerous energy, economic and environmental indicators;  
printout a number of reports and financial plans;
- It provides assistance in the preparation of energy audits, energy performance certificates; etc





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# How does it work: E2 MANAGER





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# Energy monitoring System

## E2 MANAGER



VNOS	ARHIV	PREGLED ODJEMNIH MEST
<b>Elektrika</b>		
STROŠKOVNO MESTO: EE-01		
↳ <b>Elektro Celje Energija, OM: 136334901006, MM: 2-162240</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		
↳ <b>Elektro Celje, OM: 136334901006, MM: 2-162240</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		
<b>Toplota</b>		
STROŠKOVNO MESTO: TE-01 ↓		
↳ <b>Komunalno podjetje Velenje, OM: 004103-2, MM: OV</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		
STROŠKOVNO MESTO: TE-02 ↓		
↳ <b>Komunalno podjetje Velenje, OM: 000666-4, MM: OP</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		
STROŠKOVNO MESTO: TE-03 ↓		
↳ <b>Komunalno podjetje Velenje, OM: 002378-2, MM: KUHINJA VOD II</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		
<b>Voda</b>		
STROŠKOVNO MESTO: VO-01 ↓		
↳ <b>Komunalno podjetje Velenje, OM: 000666-4, MM: MV</b>		
Zadnji vpis: 20.04.2015   Zadnje obdobje: 31.03.2015   Manjkajočih dni: 0		

Internet Access

Regular and precise data entry

Monthly bills for energy with all attachment

E - invoices





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# Energy monitoring System

## E2 MANAGER



LASTNOSTI NAČINA

Priloga: Dvoletna sezoni - odjava

Številka računa:   v ocnih poročilih

Ustam računa: 11.05.2015

Časovna skrajna: 11.04.2015 do 11.04.2015

SKUPAJ ZMENSKE (ZJAVNOVAN)

Brez DDV: 25,58

Priloga: %

DDV: 0,83

Skupaj: 31,21

OPREDELJEVANJE

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Postavka	Količina	Enota	Cena	Davek	Brez DDV	Znesek
Enerja ST	151	kWh	1.64917	22%	24,3248	25,87601
Enerja ST	100	kWh	0.04000	22%	0	0
Točlana	100	kWh	0.01110	22%	1,08210	1,30000
Priloga za IIRF	100	kWh	0.01100	22%	0,17700	0,21666
<b>Skupaj</b>					<b>25,580</b>	<b>31,214</b>

All relevant data from the invoices

E-invoice



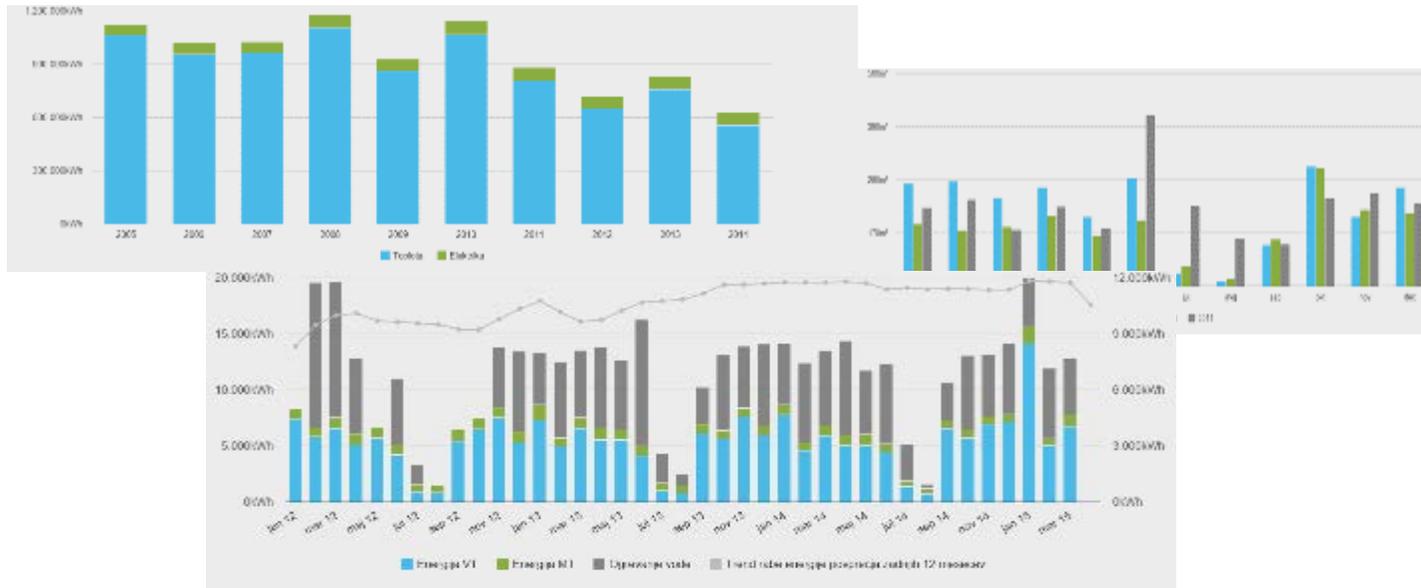


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# Energy monitoring System E2 MANAGER



- Annual consumption– assessment of savings as baseline for the investment
- Monthly comparison– defining the errors + energy consumption monitoring





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# Energy monitoring System

## E2 MANAGER



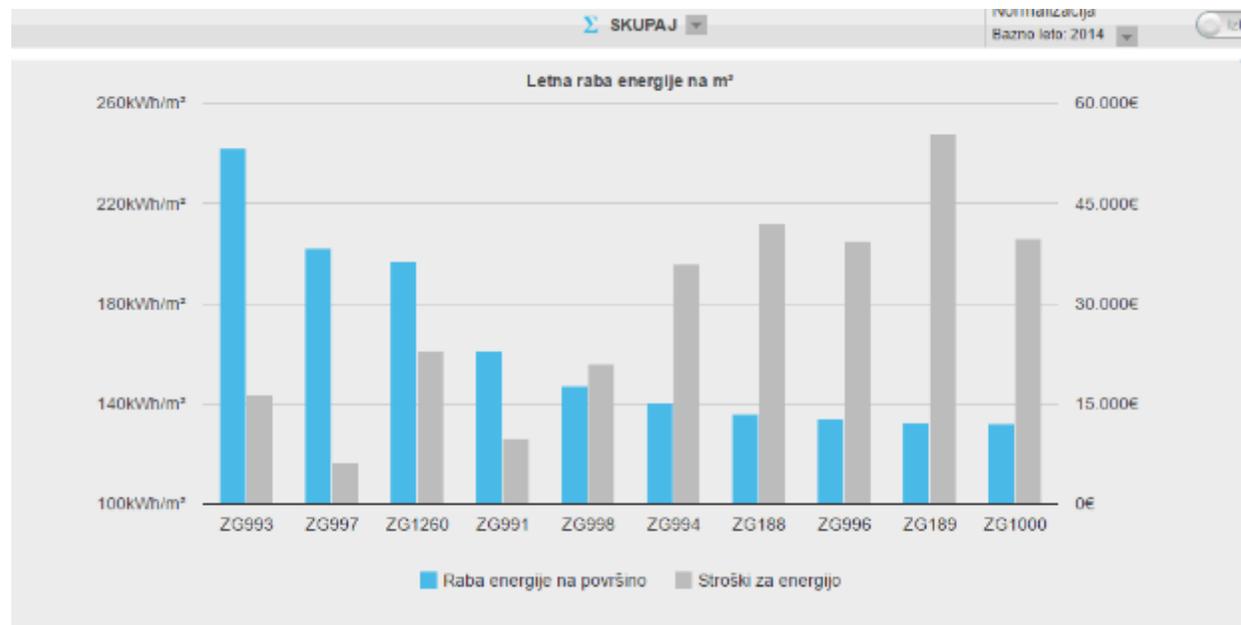
- Annual and Monthly comparison of costs – simply shown
- Prices of energy + taxes, excise duties and others





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# Energy Performance Number - E2 MANAGER



Energy Performance Number in kWh/m<sub>2</sub>/a – Benchmarking of buildings with similar processes



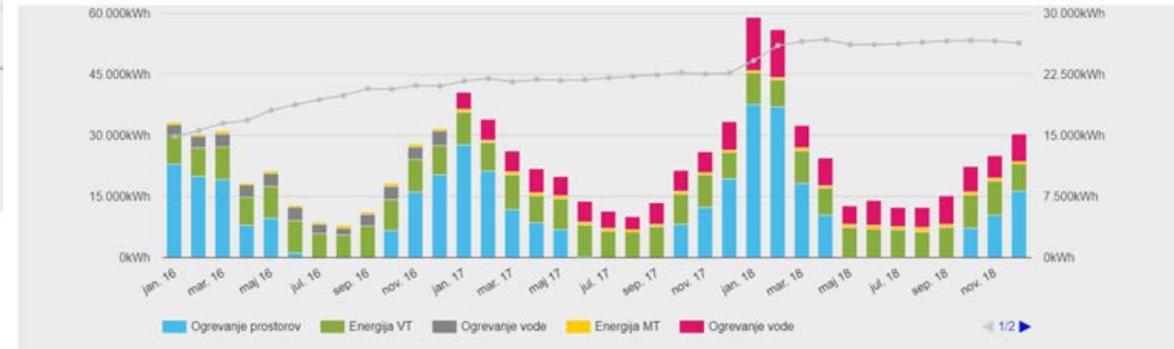
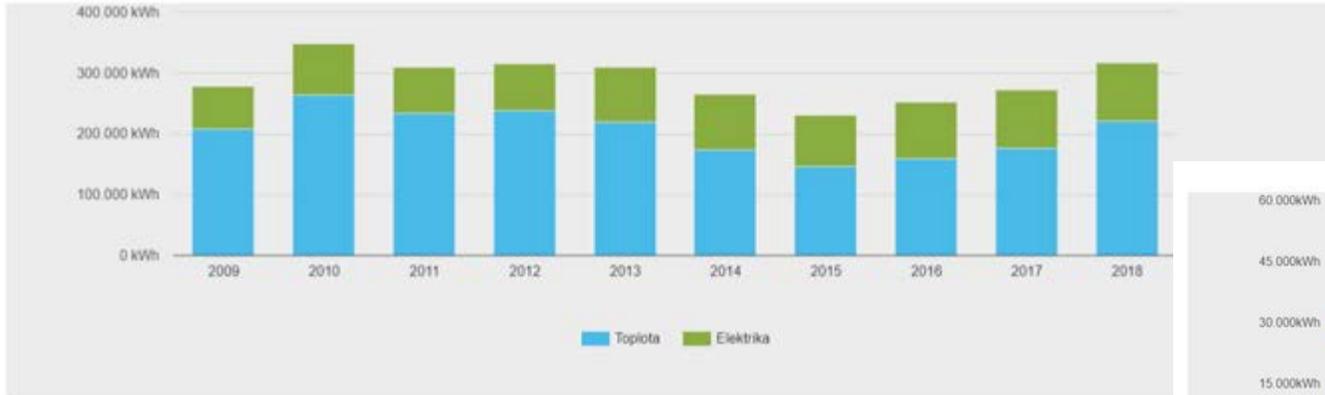


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# EMIS tool – E2 manager example



## Energy analysis – comparison by year and/or month





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# EMIS tool – E2 manager example



Cost analysis





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# Energy monitoring in Kempten, Germany



→  
monthly Meter Readings

←  
Analysis  
Monthly Report

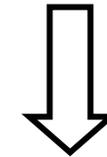


←  
Building Inspections  
Optimization of  
technical infrastructure



←  
Information  
and  
Motivation

Modus operandi by



Annual report

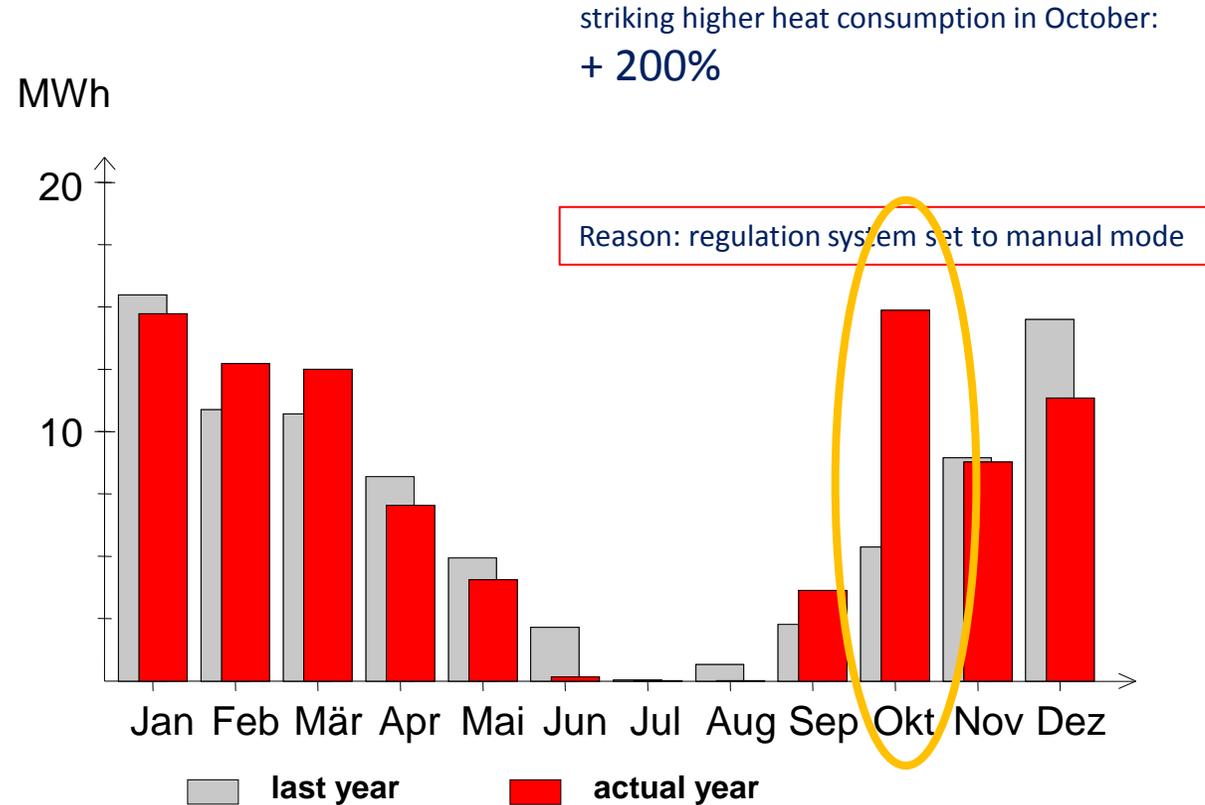
Source: Felix Geyer, EZA



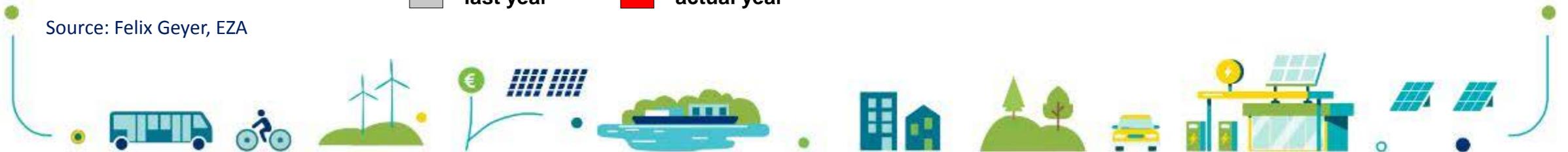


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# Monitoring: Heat consumption (with climate correction)



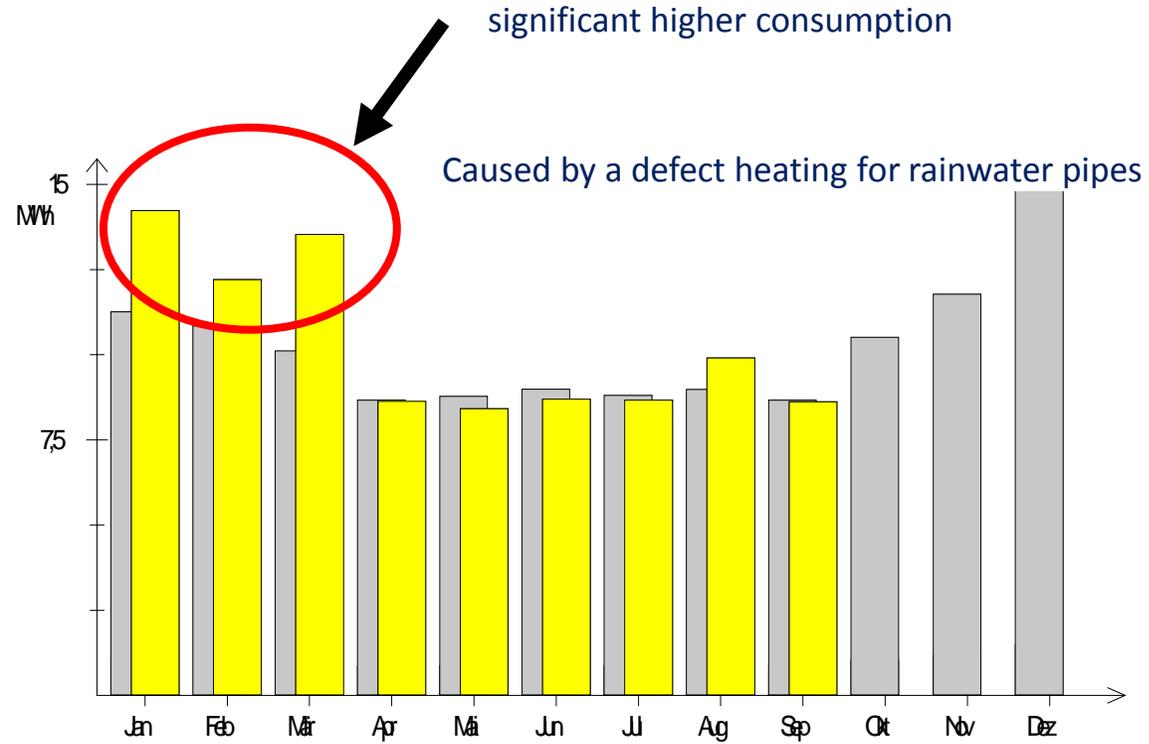
Source: Felix Geyer, EZA





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# Monitoring: Electric Energy



Source: Felix Geyer, EZA



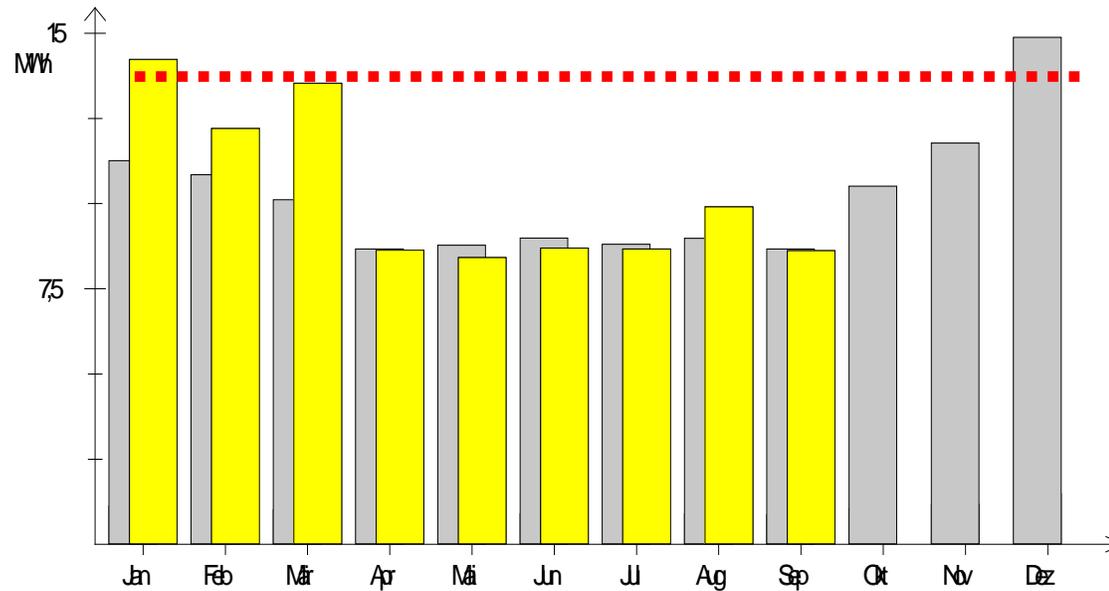


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# Monitoring: Electric Energy



If defect remains undetected : excess consumption of 36.000 kWh / year  
Additional costs of > 7.000 € / year



Source: Felix Geyer, EZA



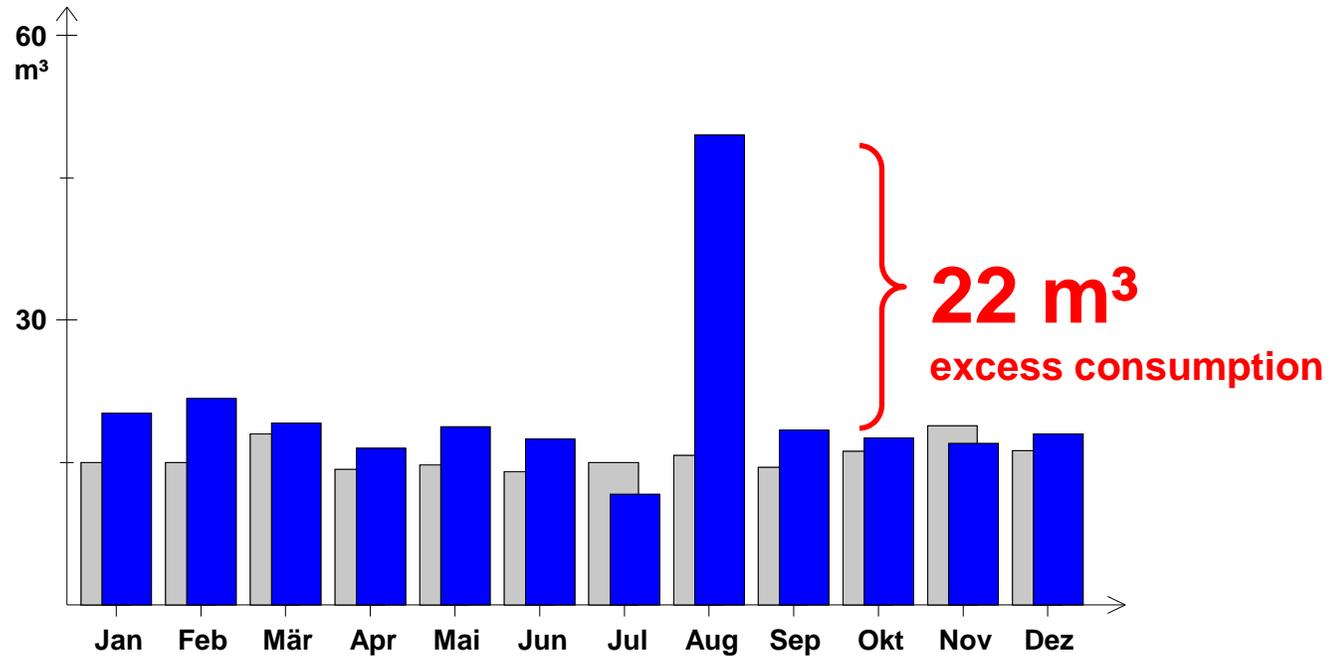


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# Monitoring: Water



## Water consumption Kindergarten



Source: Felix Geyer, EZA





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# Monitoring: Water



0,5 Liter per minute  
= 720 Liter per day  
= 22.000 Liter per month  
= 264.000 Liter per year  
= 1.000 € additional  
costs in one single year

Source: Felix Geyer, EZA





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# Ljubljana Central Monitoring System



Supports your business intelligence with real time validated data



Centralised key performance indicators aggregated and integrated from IoT devices, data sources, protocols and software systems



Control, monitoring and analysis in one transparent and reliable solution



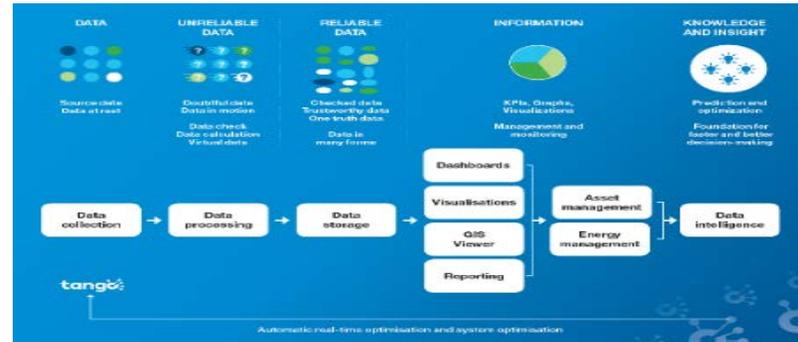


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# Ljubljana Central Monitoring System



- TANGO is a platform and a system that is technologically ready for tomorrow,
- TANGO successfully passed a security check of the entire system executed by international certification institution, including vulnerability to external attacks,
- TANGO is a solution independent of operating systems,
- It has a responsive design - the content itself adjusts to the device that uses TANGO (computer, tablet PC, phone),
- Works without plug-ins,
- The latest guidelines for the development and display of content are used - Google material.



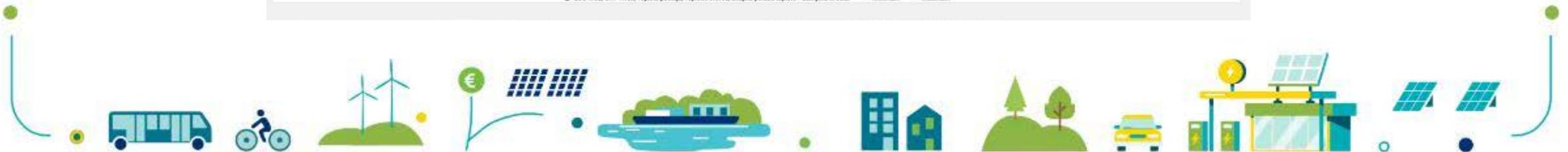
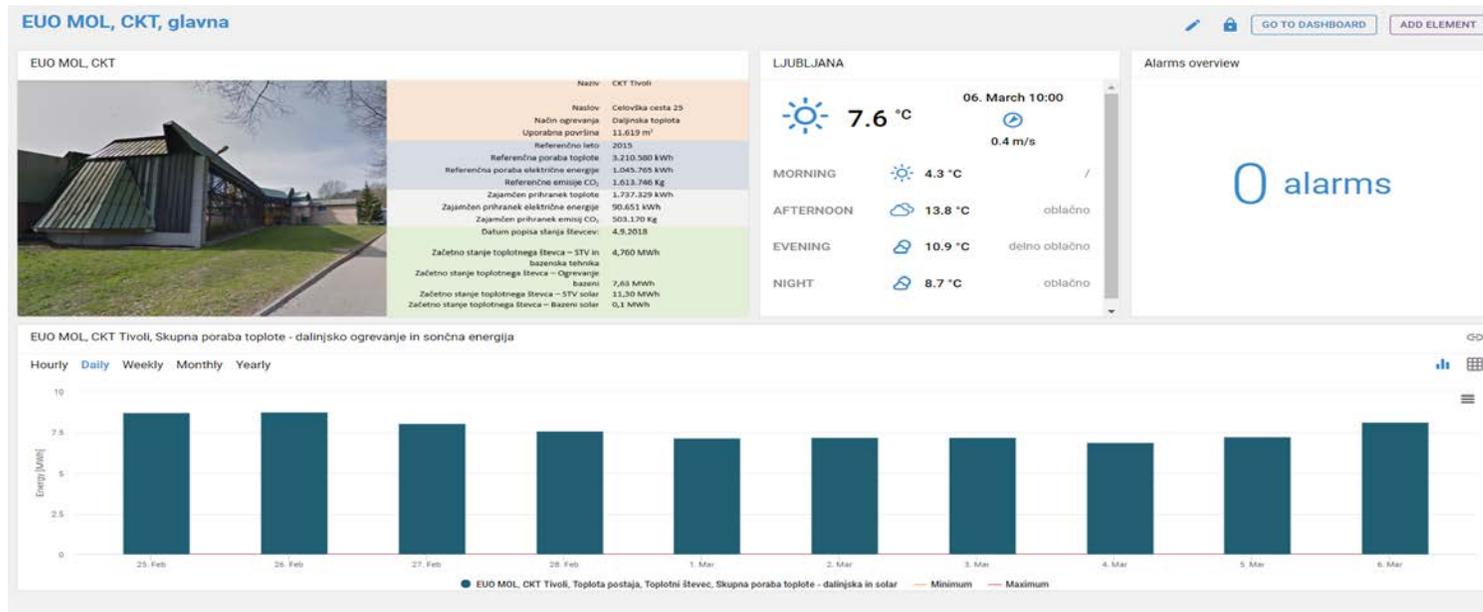


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# Ljubljana Central Monitoring System



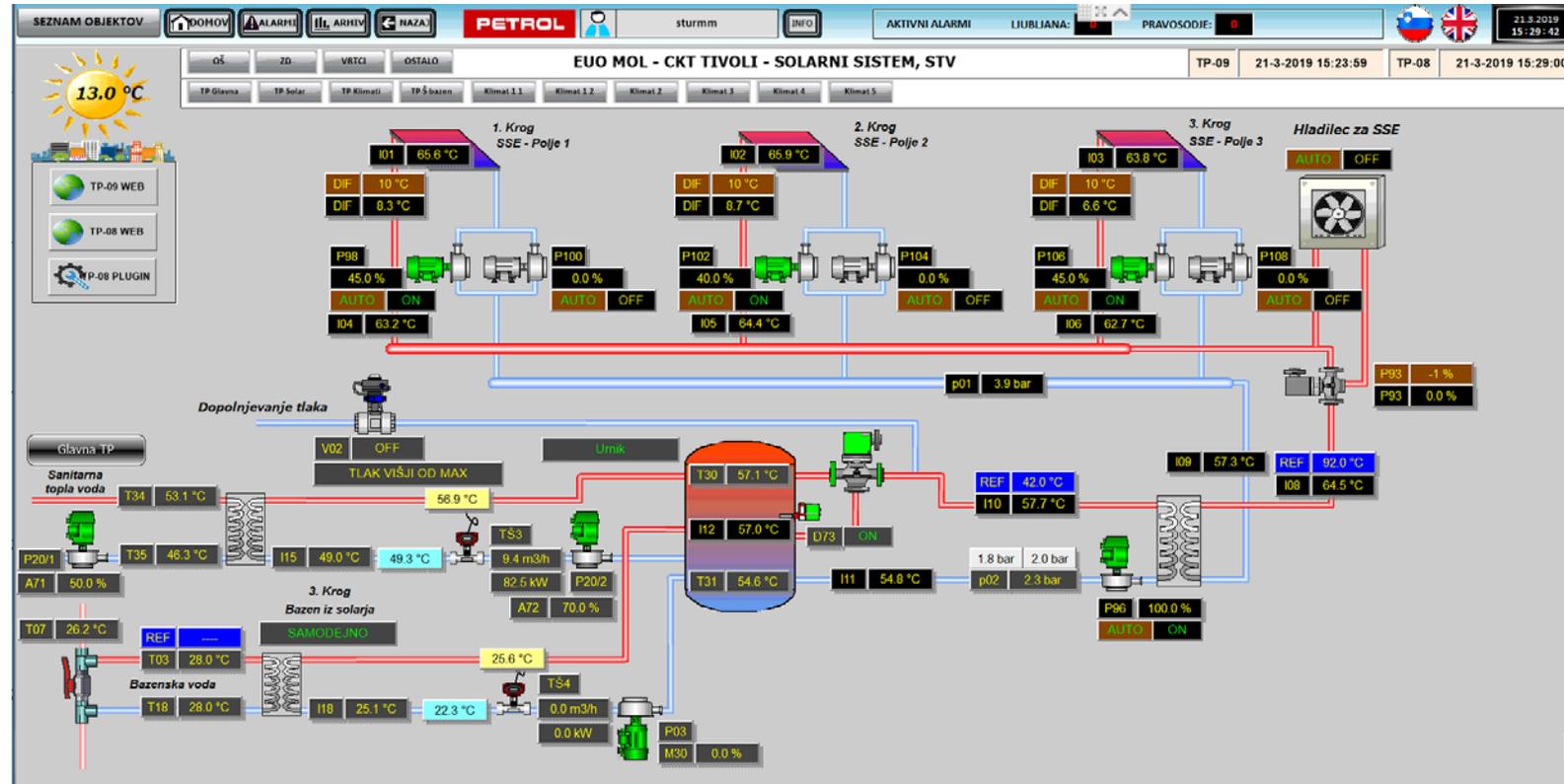
- TANGO portal enables many user friendly functionalities on the visualization level,
- All visualizations are adapted to different users,
- Different views can be adapted and allowed for types of different users or authorisations.





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# Ljubljana Central Monitoring System





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# Energy Monitoring System – General Hospital Celje



Measures:

- new air conditional system
- Thermal isolation of buildings
- modernization of boilers
- three-generation of heat, power and cold
- SCADA monitoring system



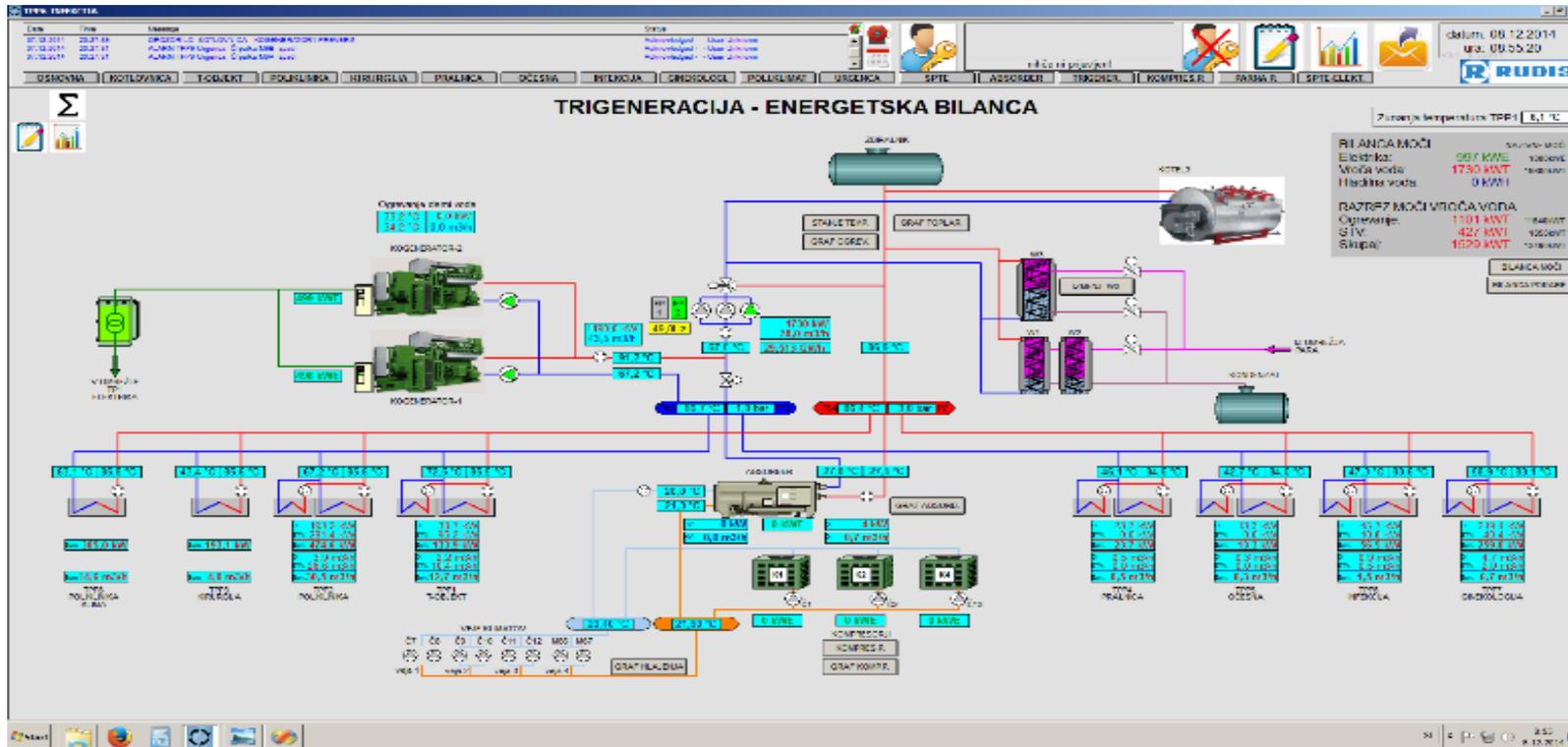


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# Energy Monitoring System – General Hospital Celje



SCADA monitoring system





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# Digital Twin of the Distribution Network



The goal of the project is the development of a digital twin of a low-voltage distribution network to accelerate the energy and green transition. This will enable the collection of mega data about the distribution network, analytics of this data, and simulation of the network through the development of the digital twin. These advancements aim to improve current processes in network planning and development, investment planning and expansion, and provide a **leverage point for integrating dispersed renewable energy sources (RES) into the network**.

The latter will be addressed through the development of a module for calculating the feasibility of connecting RES and new loads at a micro-location. The use of the DigiGRID solution will have a significant impact on the faster adoption of RES through the automation of connection processes and application handling, greater control over the network, and consequently, a contribution to the transition to actively managed distribution networks.

 Total project value: EUR 571,614.48

 Program: Recovery and Resilience Plan: NextGen (only for Slovenia: 5,7 billion EUR, 2,1 billion in grants!!)





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# Pilot-demonstration project MODEL+



Pilot-demonstration project MODEL+, Demonstration of smart modular construction, connectivity, and control of next-generation electrical and thermal sources

- The main purpose of the project is the development and demonstration of smart modular construction, connectivity technologies, and solutions for generating, storing, and managing electric-thermal sources using a digital twin for energy-efficient and self-sufficient modular structures of the new generation

## The project objectives are:

- Annual savings of 21.2 tons of CO<sub>2</sub>.
- Establishment of an energy-efficient and energy self-sufficient modular structure with 8 hours of operational autonomy
- Program: Call for proposals for recovery and resilience with pilot demonstration projects (JR DEMO PILOTS RRF)





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# Results of quality EMIS



- Energy, CO<sub>2</sub> and money savings
- Organized systems of investments – best value for money by meanings of savings
- Better energy consumption prediction
- Easier implementation of legislation and other obligations (planning scenarios)
- Streamlined reporting
- Good data to search for new financial sources (Public Private Partnership, EU Investment Bank, Energy Contracting,...)
- People cooperate when they understand





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# Thank you!

Boštjan KRAJNC

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