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University of Maribor, Faculty of Energy Technology (SI)



Understanding Energy Management in Buildings

Assoc. Prof. Peter Virtič

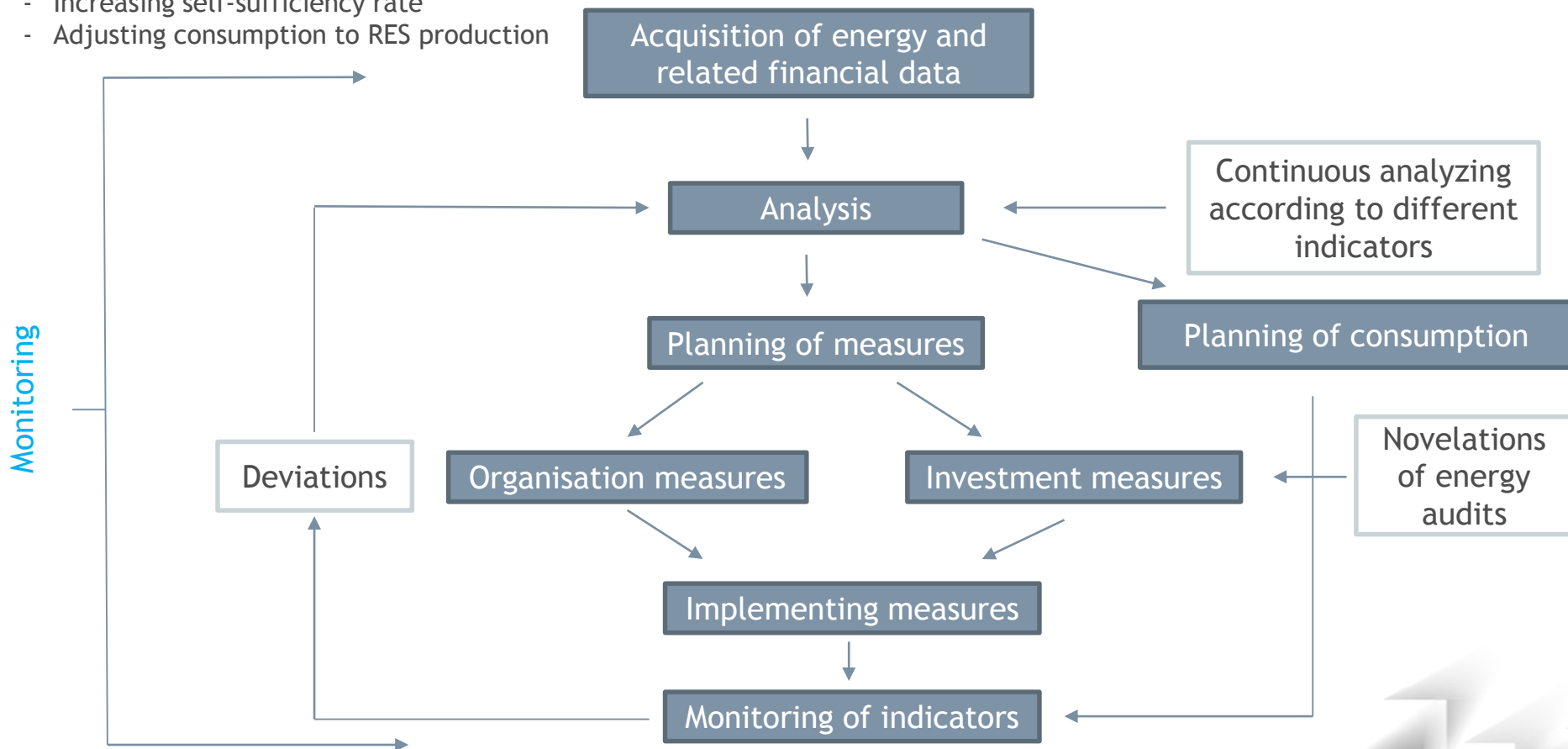


ENERGY MANAGEMENT IN BUILDINGS

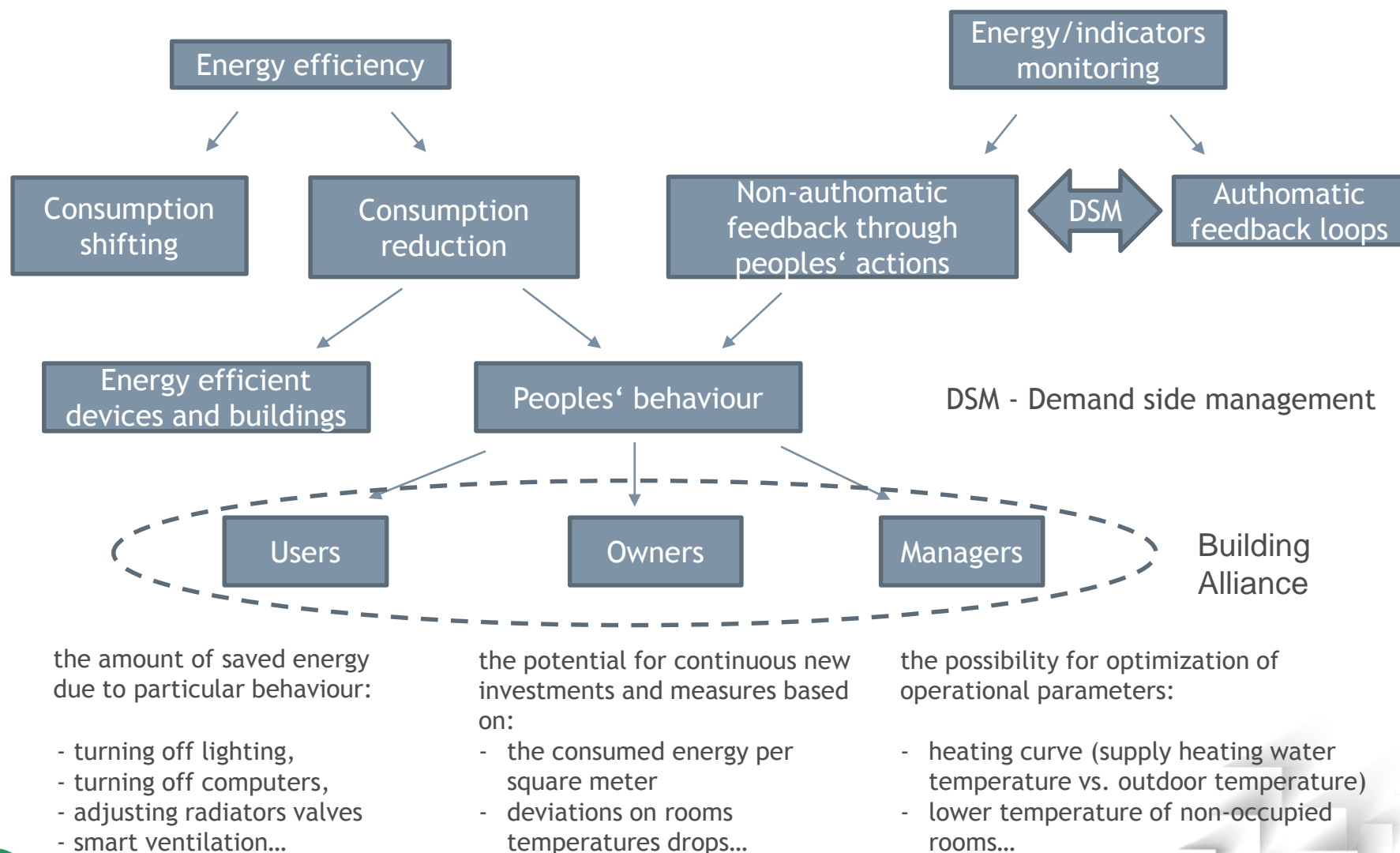
Goals of energy management:

- Reduction of energy consumption
- Increasing the share of RES
- Increasing self-sufficiency rate
- Adjusting consumption to RES production

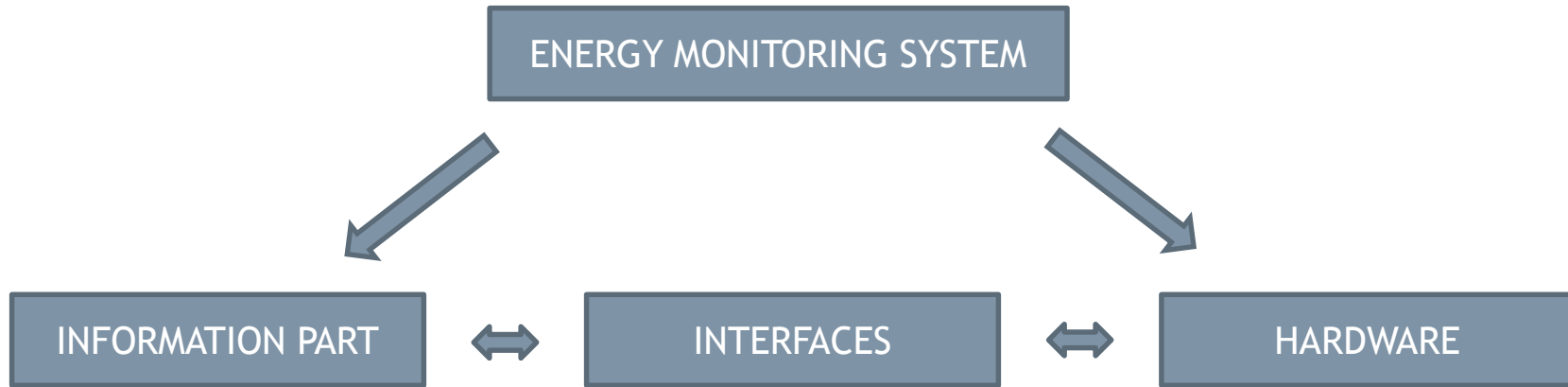
Starting point of energy management is energy audit (if possible with already established monitoring system):



ENERGY MONITORING AND ENERGY EFFICIENCY



ENERGY MONITORING SYSTEMS - TECHNICAL ASPECT



ENERGY MONITORING SYSTEMS - INFORMATION PART AND INTERFACES

- Information part and interfaces:
 1. Monitoring system or integrated with SCADA (supervisory, control and data acquisition on energy consumption and production)
 2. Energy bookkeeping (bills tracking)
 3. Wireless communication between devices in the building (measurement of internal comfort)
 4. Interfaces (APIs)
 5. Energy info point (informing users about energy consumption)

Data flow:

1. Sensors, controllers, SCADA/DAQ
2. Data filtration
3. Data processing/analyzing
4. Data storage (BIG DATA)
5. Displaying monitored data on external devices

Possible configuration of data flow:

1. Sensors (wireless)
2. Main unit (router)
3. Cloud service
4. Data displaying (web access, mobile application)



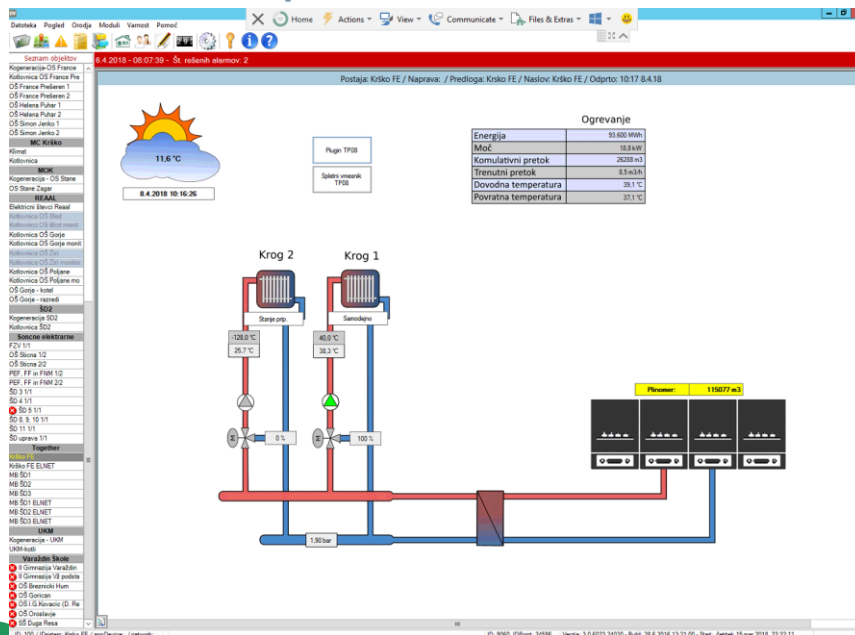
SCADA

Its key advantages are:

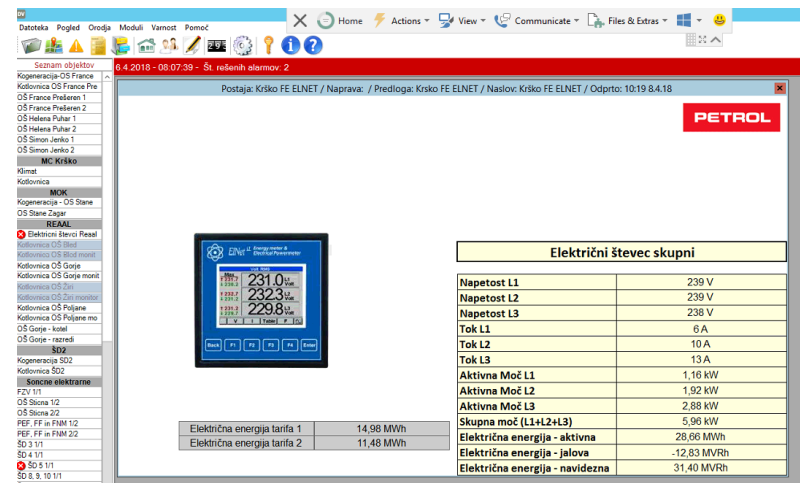
- Data archiving
- On-line implementation
- Automatic remote monitoring
- Alarming

Users of the system/software are energy managers of each pilots.

Heat consumption control



Electricity consumption monitoring

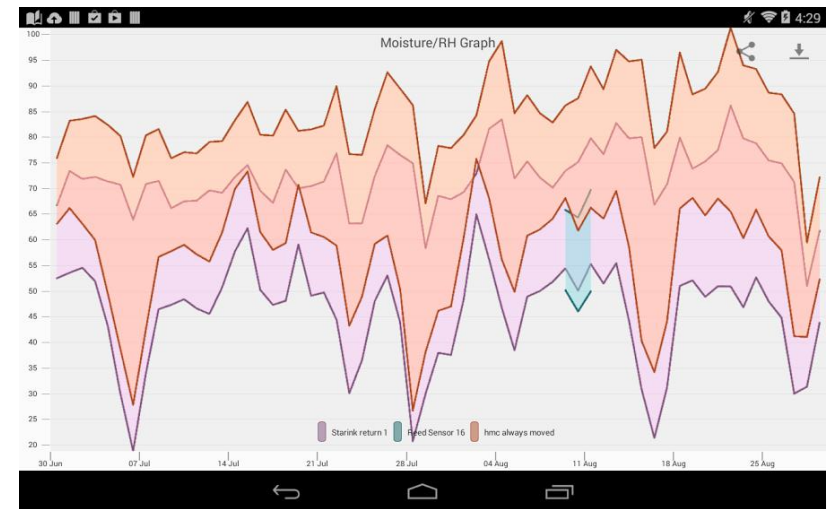
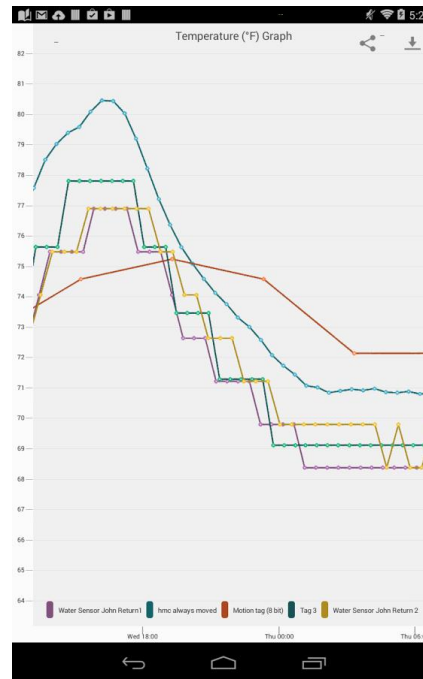
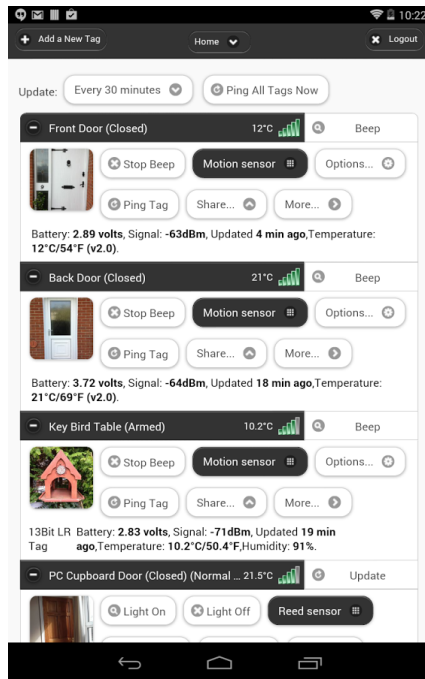


SYSTEM FOR MEASURING INDOOR COMFORT IN THE REFERENCE ROOMS

- Application available for Android & iOS:

<https://play.google.com/store/apps/details?id=com.wirelesstag.android3>

- DSM tool to influence the users' behaviour



MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY

Real time input data (indoor comfort and outdoor temperature)

Smart multipurpose sensor (temperature, humidity, illumination, presence)



External temperature sensor



MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY - BOILER ROOM



MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY - BOILER ROOM



MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY - HEAT ENERGY

Heat meter



Controller



Communication with data system via internet



Gas meter

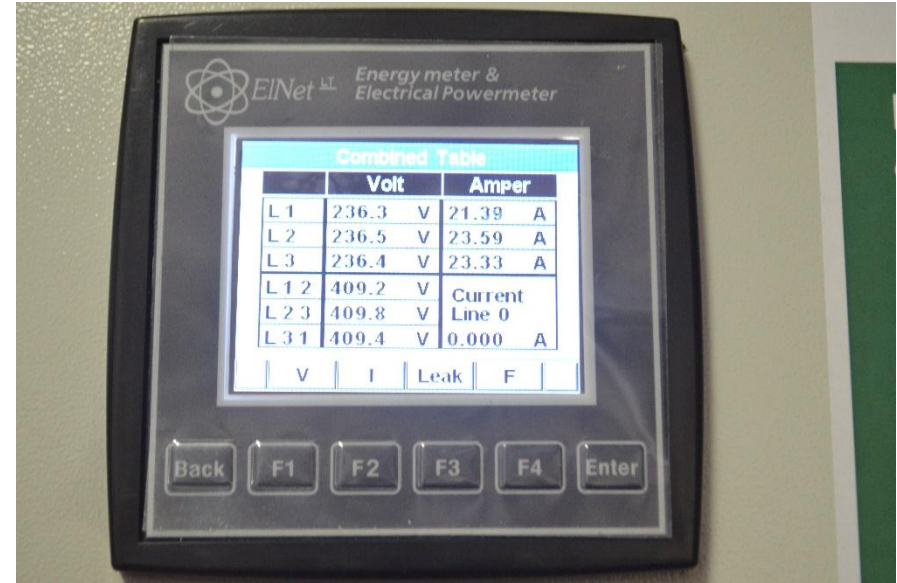


MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY - ELECTRICITY

Electric cabinet with current measurement transformers



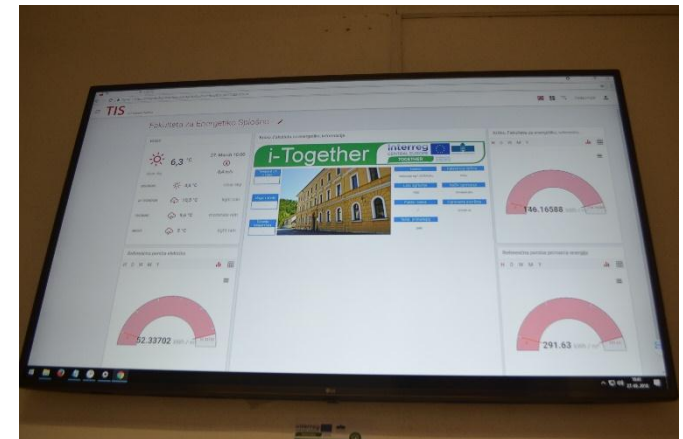
Electricity meter



MONITORING SYSTEM HARDWARE - FACULTY OF ENERGY TECHNOLOGY

Screen for raising awareness through:

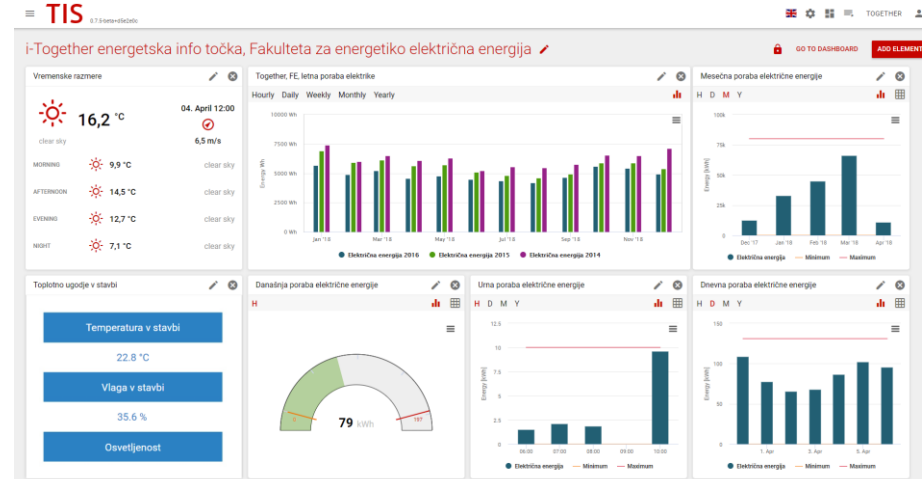
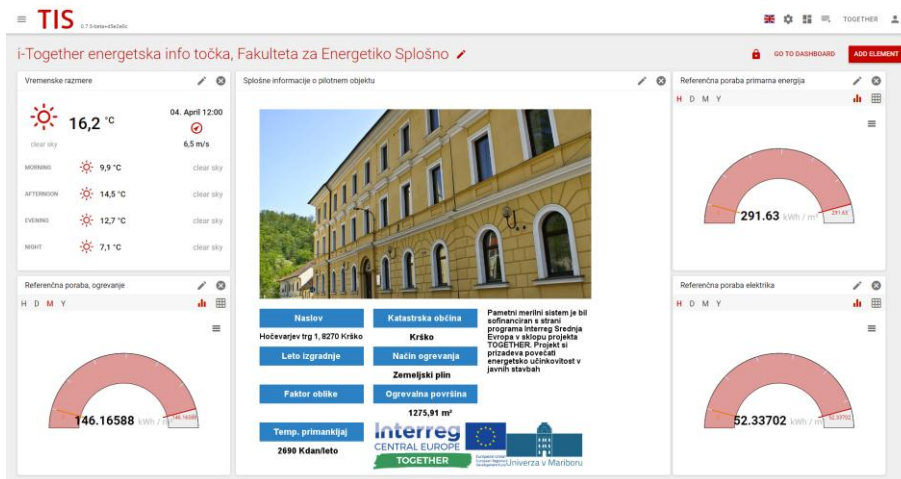
- real time energy measurements and
- historical data analytics.



ENERGY INFO POINT - DASHBOARD

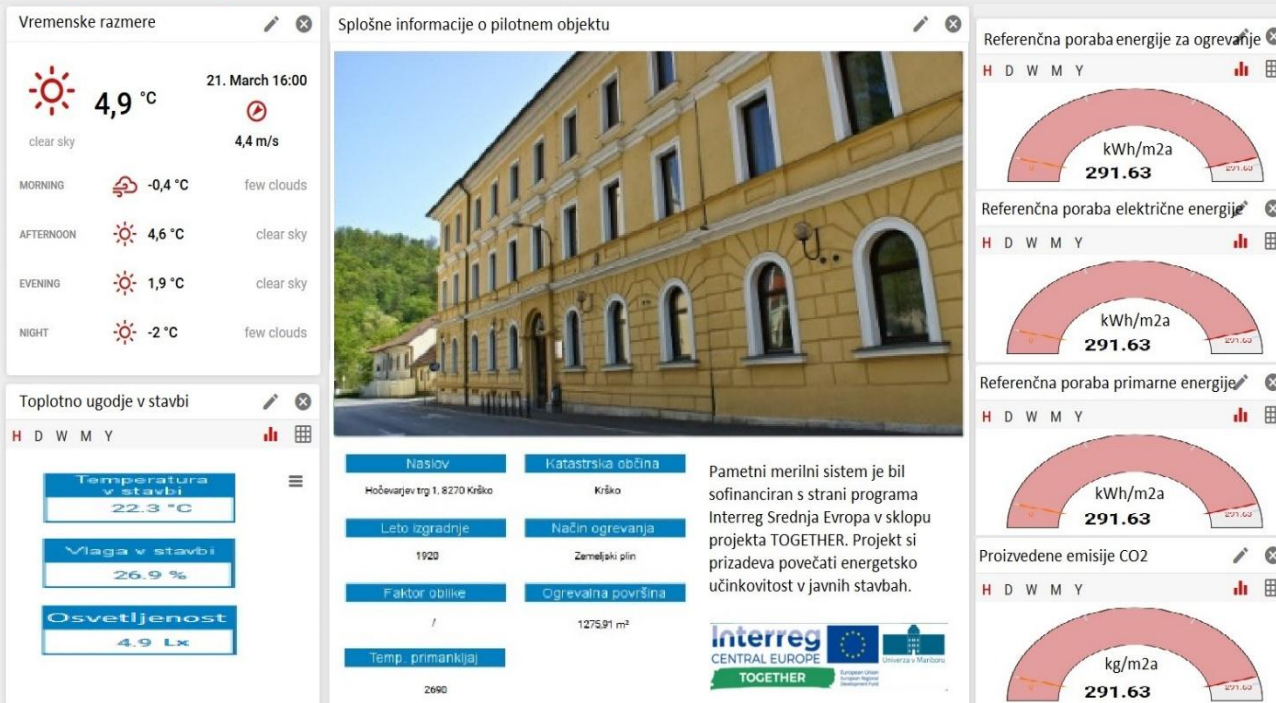
- Building has a monitor/screen located in the most visible / visited place in the building, which displays data on the energy consumption in the building

Printscreens (case of Faculty of Energy Technology):



Together Energy Info Point - general data

i-Together energetska info točka



Info point - general data:

- Real time weather conditions
- Thermal comfort in the building (temperature in the building - reference room, illumination)
- General data of the building (year of construction, energy source, heating surface, temperature deficit)
- Average/reference energy consumption for heating per square meter
- Average/reference electricity consumption for heating per square meter
- Average/reference primary energy consumption per square meter
- Produced emissions per square meter



Together Energy Info Point - electricity

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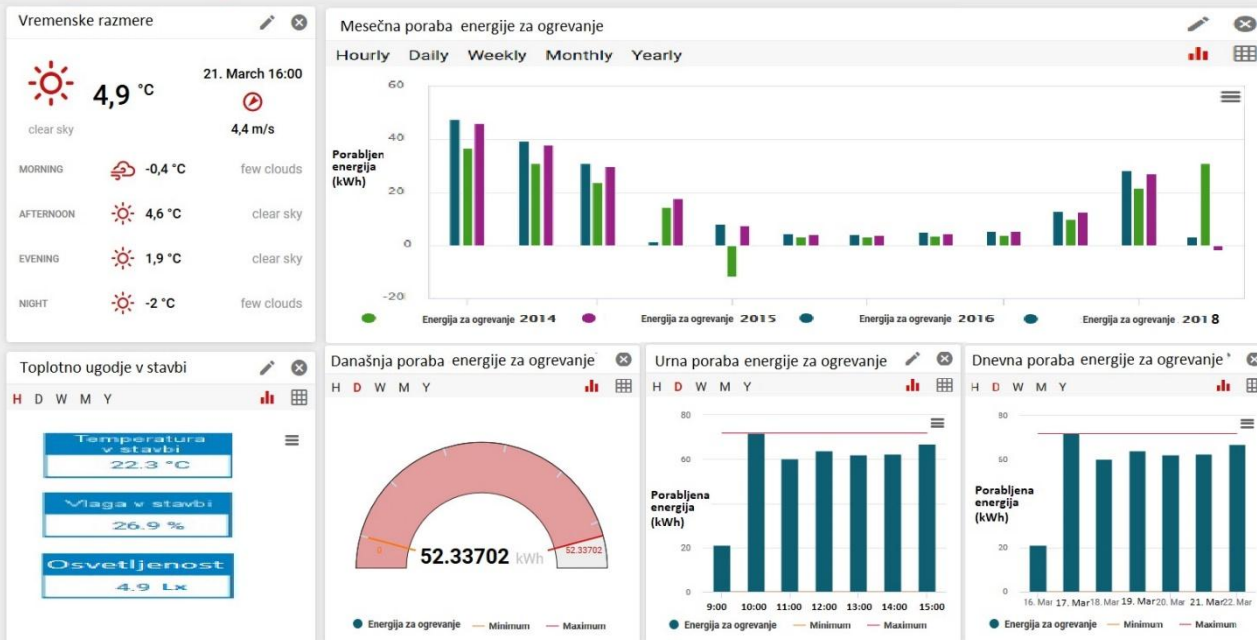
Info point - electricity:

- Real time weather conditions
- Thermal comfort in the building (temperature in the building - reference room, illumination)
- Monthly electricity consumption for last three years
- Total daily real time electricity consumption
- Hourly electricity consumption compared to the past 6 hours
- Daily electricity consumption compared to the last 6 days



Together Energy Info Point - heating

i-Together energetska info točka



Info point - heating:

- Real time weather conditions
- Thermal comfort in the building (temperature in the building - reference room, illumination)
- Monthly heat consumption for last three years
- Total daily real time heat consumption
- Hourly heat consumption compared to the past 6 hours
- Daily heat consumption compared to the last 6 days

Negative-reconciliation bill-before monitoring



MONITORING SYSTEM - FACULTY OF ENERGY TECHNOLOGY



MONITORING SYSTEM - STUDENT DORMITORIES



TRAININGS ON MONITORING SYSTEMS AND INFLUENCE ON ENERGY EFFICIENCY

Financial training



Trainings on monitoring systems increase users/owners/managers awareness about:

- the amount of saved energy from particular behaviour (turning on/off lighting, computers...) - users
- the potential for new investments and measures based on the consumed energy per square meter - owners
- the possibility for optimization of operational parameters (e.g. heating curve: supply temperature vs. outdoor temperature) – managers

Trainings form and strengthen Building Alliance of buildings managers, owners and users.

DSM training



Technical training



Contact details



Contact: Peter Vrtič



Website: <https://www.fe.um.si/>



Email: peter.vrtic@um.si



Telephone +386 41569740



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