



# **ENERGETSKO UPRAVLJANJE IN CENTRALNI NADZORNI SISTEM**

## **ENERGY MANAGEMENT AND CENTRAL SCADA SYSTEM**

Notranje usposabljanje podjetja EUTRIP, d. o. o

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# ENERGETSKI MONITORING

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## 1 Energetska upravljalna postaja

energetsko knjigovodstvo SEK, sledenje porabe energije EA, baza podatkov

## 2 Vremenska postaja

lokalna zunanja temperatura, vlaga, vetrovnost, osončenje, napoved ...

## 3 Energetski nadzorni sistem

zajemanje in posredovanje realnih trenutnih podatkov, krmiljenje, CNS ...

## 4 E<sup>3</sup> info točke

prikaz informacij, stenska, prostostoječa ali zunanja izvedba, interaktivno posredovanje ...

## 5 Internetna povezava s strežnikom, ethernet, iPad, Android ...

forum, podpora, servis, energetsko daljinsko upravljanje ...

The diagram illustrates the Energy Network (ENERGETSKI NETWORK) architecture. It features a central cloud labeled "INTERNET ENERGETSKI NETWORK".

- Schools (Šole):** Represented by house icons labeled SOLA 1, SOLA 2, and SOLA N. They are connected to the central cloud.
- Energy Monitoring and Control:** A laptop icon labeled "Nadzor energetskega upravljanja v šolah MŠŠ, ŠCV" is connected to the central cloud.
- Energy Monitoring System (ENERGETSKI STREŽNIK):** A server rack icon connected to the central cloud and the "Energetski portal Forum" (a computer monitor icon).
- Energy Data Bases:** Two large cylinder icons representing databases: "Energetska baza mesečnih podatkov" (Monthly energy data base) and "Energetska baza letnih podatkov MŠŠ" (Annual energy data base for MŠŠ). They are connected to the "ENERGETSKI STREŽNIK" and the central cloud.
- Other Systems:** A server rack icon labeled "SIO strežnik, E-šolstvo" is connected to the central cloud and a database icon labeled "E-gradiva: Nadzor energije URE, OVE, Ekologija Okoljevarstvo".

Arrows indicate the flow of data and energy between these components.

## A woman with short brown hair, wearing a black blazer over a pink shirt, is standing and interacting with a public information kiosk. The kiosk is a small, freestanding unit with a screen displaying a website with various icons and text. The background is a plain, light-colored wall.

[illegible]

**Dijalški dom Drava Maribor**

**Monitoring porabe energije**  
Maribor, skrajvano, prihranimo

Dijalški dom: Džodov vrh    Džodov vrh: Džodov vrh    Džodov vrh: Džodov vrh

**SRDPA**  
11. 12. 2013

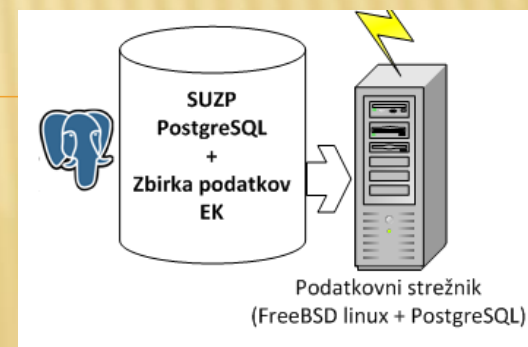
**Džodov vrh: Džodov vrh**    **Džodov vrh: Džodov vrh**  
31,8 °C    31,8 °C

**1288 kWh**

**Pordoba + jaskoljski vrh**

**Pordoba + jaskoljski dol**

**Pordoba + jaskoljski nasos**





## ENERGETSKI UPRAVLJALNI PC:

- spletni energetski portal SEP
- spletno energetska knjigovodstvo SEK
- energetska nadzorni sistem ENS
- energetska analitika EA

## ENERGETSKI MONITORING

1. energetski upravljalni PC
2. info energetska točka
3. krmilno merilni sistem
4. spletna povezava

## ENS/CNS

## EA

## SEK

## SEP

## INFO ENERGETSKA TOČKA/ ENERGETSKA IZKAZNICA

## KRMILNO MERILNI SISTEM

### ENS KRMILNI SISTEM



Temperatura zun.,notr.



Vodomer



Kalorimeter



Poraba elek.energije

zajemanje vhodnih podatkov (status trenutne energetske porabe)

## SPLETNA POVEZAVA

- dnevno pošiljanje podatkov
- spletno energetska knjigovodstvo
- forum

## INTERNET ENERGETSKA MREŽA

Ethernet

# E<sup>3</sup> INFO TOČKE (PRIKAZ INFORMACIJ, STENSKA, PROSTOSTOJEČA ALI ZUNANJA IZVEDBA ...)





# PRIKAZ PORABE ENERGIJE NA E-INFOTOČKI



# PRIKAZ PORABE ENERGIJE IN METEOROLOŠKIH PODATKOV NA E-INFOTOČKI

Prvi koraki Zadnje novice Gmail - Prejeto (89) - ...



## ENERGETSKI INŽENIRING



### PORABA ELEKTRIKE

#### Poraba električne energije na ERŠ

Dnevna poraba EL	987 kWh
Mesečna poraba EL	17204 kWh
Stanje EL števca	47898 kWh
Dnevna emisija CO <sub>2</sub>	1537.9
Mesečna emisija CO <sub>2</sub>	28699.3

### PORABA OGREVANJE

#### Ogrevanje ERŠ

Zunanja temperatura sever	4.1 C°
Zunanja temperatura jug	5.4 C°
Toplotna moč števca	55.9 kW
Stanje toplotnega števca	2475.6 kW
Dnevna emisija CO <sub>2</sub>	1537.9
Mesečna emisija CO <sub>2</sub>	28699.3

### PORABA VODE

#### Poraba vode na ERŠ

Pretok vode	0
Dnevna poraba vode	
Mesečna poraba vode	

### VREMENSKA POSTAJA

#### Podatki MIC

Datum	20/01/2014
Ura	22:30:00
Temperatura zraka	5.9 C°
Temperatura rosišča	5.9 C°
Relativna vlažnost	100 %
Sončno sevanje	0 W/m <sup>2</sup>
Zračni pritisk	956.6 hPa
Reduciran zračni tlak	1006.4 hPa
Hitrost vetra	0.5 m/s

### VREMENSKA NAPOVED

Velenje 10:30 PM

+4°C

LIVE mo tu we

Elektrika ERŠ | Ogrevanje ERŠ | Celoten Zaslon

Zunanja temperatura jug 5.4 C°

Zunanja temperatura sever 4.1 C°

Stanje toplotnega števca 2475.6 kW

Toplotna moč števca 55.9 kW

Dnevna emisija CO<sub>2</sub> 1537.9

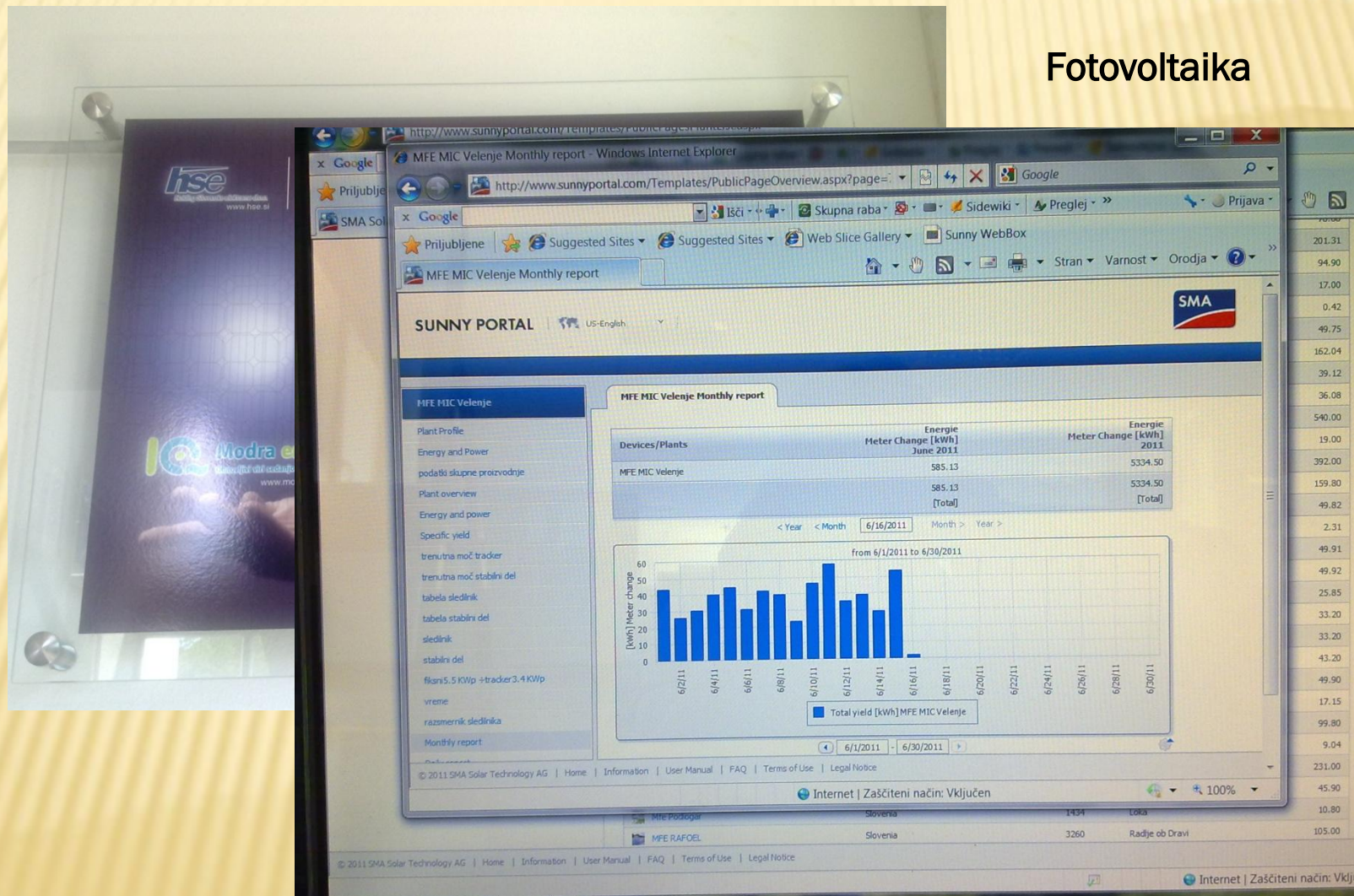
Mesečna emisija CO<sub>2</sub> 28699.3

Inštitut OKO



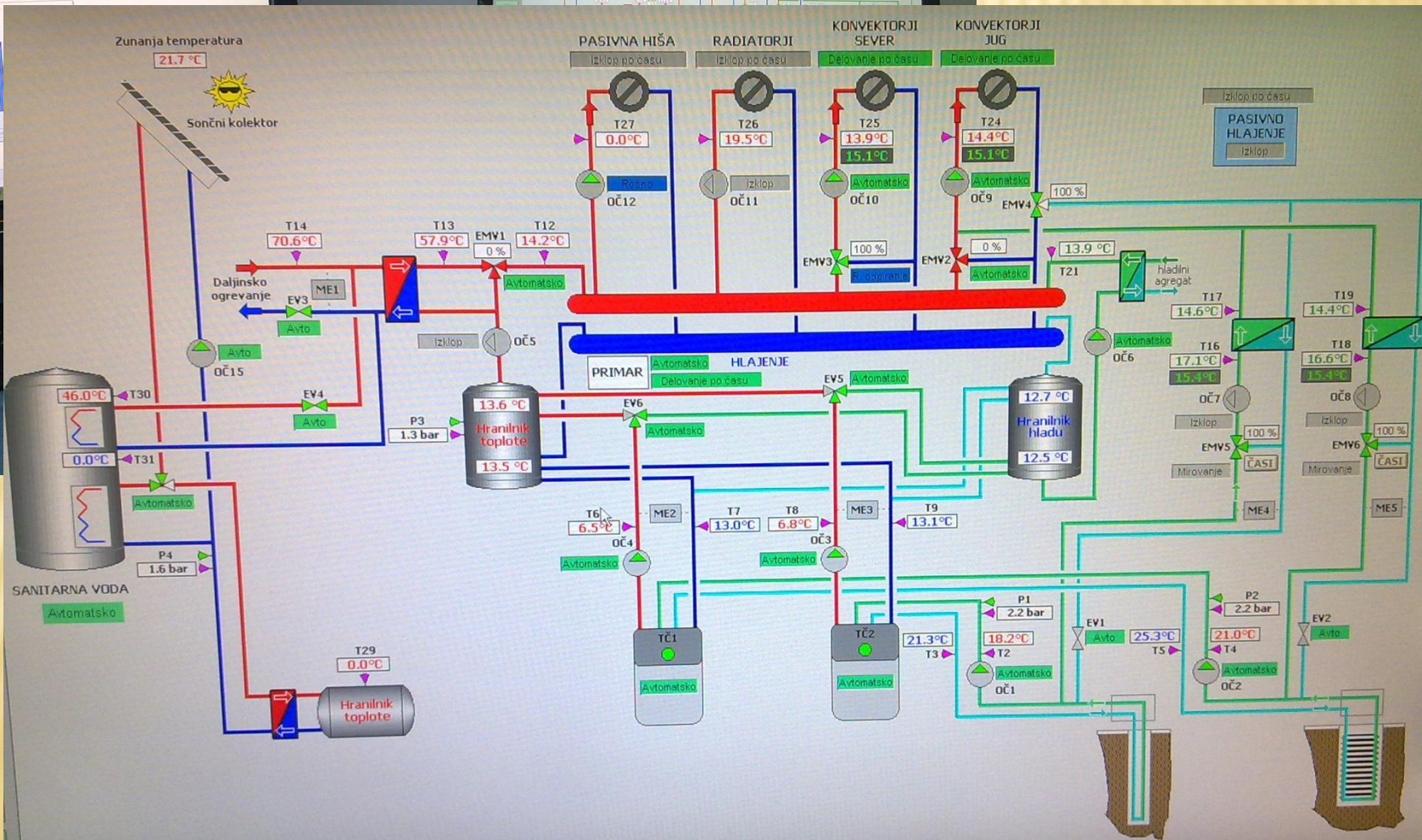
# ENERGETSKI NADZORNI SISTEMI - ZAJEMANJE, POSREDOVANJE PODATKOV, KRMILJENJE...

## Fotovoltaika





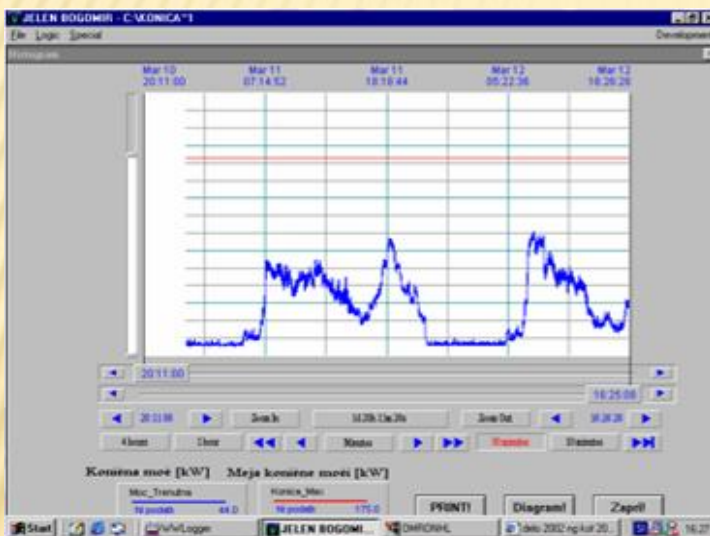
# ENERGETSKI NADZORNI SISTEM - UPRAVLJALNO MESTO





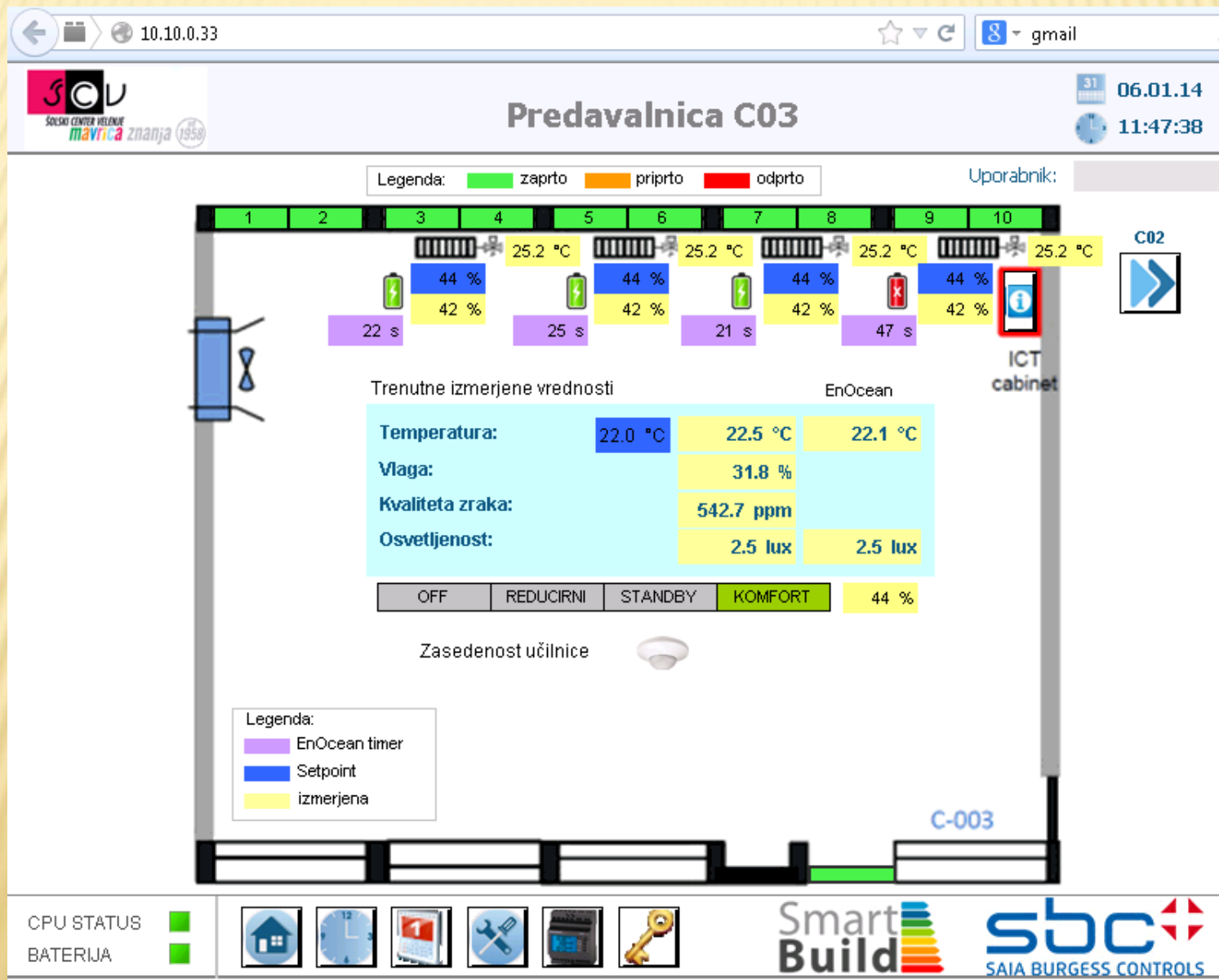
# IZVEDBA AVTOMATIZACIJE ENERGETIKE

- izgradnja krmilno-regulacijskih sistemov v toplotnih postajah in kotlovnica
- izvedba nadzornega sistema porabe električne energije
- vgradnja sodobno krmiljene razsvetljave - DALI

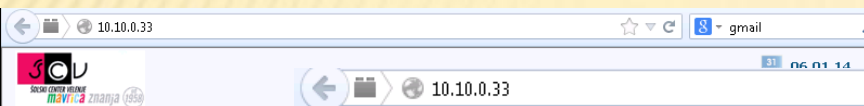




# CENTRALNI NADZORNI SISTEM PROSTORA



# UPRAVLJANJE CNS PROSTORA



Merjenje porabe el. energije

Trenutne izmerjene vrednosti prostor C03

	Napetost	Tok
L1:	223.3 V	1.23 A
L2:	224.0 V	0.27 A
L3:	223.7 V	1.27 A
Frekvenca:	50.0 Hz	
Poraba:	1769 kWh	

Šolski center Velenje

Uporabnik: admin

### Nastavitve parametrov učilnice C03

Režim delovanja: Urniki Izklop Reducirni Standby Komfort

Temperatura prostora: 12.0 °C 18.0 °C 20.0 °C 22.0 °C

CPU STATUS ■

BATERIJA ■

Home Clock Settings Tools

Upošteva praznike in počitnice:

Avt. vklop komfort. režima ob aktiviranju senzorja prisotnosti:

Svetlobni alarm ob prekoračitvi nast. časa odprtja oken:

Za regulacijo upošteva SR04 (EnOcean) izmerjeno vrednost:

### PI regulator

Vrednost deakt.	0.0 %	Reg. vrednost	22.4
Delovna točka	0.0 %	Odstopanje	-0.5
P-vrednost	8.00 °C	Izhodna vrednost	3.9
I-vrednost	1200.0 s	Režim	Auto
Minimum	0.0 %	Y- ročno	3.9
Maximum	10.0 %		
Mrtva cona	0.5 %		

CPU STATUS ■

BATERIJA ■

Home Clock Settings Tools

Šolski center Velenje

Uporabnik: admin

Počitnice

Skupina-1

On 00:00 Off

Novo leto

Praznik dela

Praznik

Praznik

Praznik

Praznik

Praznik

Praznik

Praznik

Praznik

Praznik

CPU STATUS ■

BATERIJA ■

Home Clock Settings Tools

Šolski center Velenje

Uporabnik: admin

### Urniki učilnice C03

Kanal	Ura	Dan	Režim	
	On	Off	Po To Sr Če Pe So Ne Pr	1 2 3
1 <input checked="" type="checkbox"/>	06:00	19:00	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
2 <input type="checkbox"/>	19:00	06:00	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3 <input checked="" type="checkbox"/>	06:00	14:00	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4 <input type="checkbox"/>	00:00	00:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5 <input type="checkbox"/>	14:30	22:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6 <input type="checkbox"/>	00:00	00:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7 <input type="checkbox"/>	00:00	00:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8 <input type="checkbox"/>	00:00	00:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
9 <input type="checkbox"/>	00:00	00:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
10 <input type="checkbox"/>	06:00	22:00	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Standby

Komfortni

Rezerva

CPU STATUS ■

BATERIJA ■

Home Clock Settings Tools



# SENZORSKA, MERILNA IN KRMILNA OPREMA PROSTORA



# ICT1 CONNECTION & COMMUNICATION

Verification and testing data of eWon for A

Firefox eWON Session (Adm) 10.10.0.20/Ast/MainAst.shtm

Google

eWON

View I/O Alarm Summary Diagnostic Configuration  
Alarm History Files Transfer Log off

Show Graph For Selection Historical Logging Table Page: Default Update 20/09/2013 08:14:15

Tag Name	Value	New Value	Update	Description
QGN_A013_Frequenza	50	50	Update	Frequenza
QGN_A013_I1	0.072	0.072	Update	Corrente fase L1
QGN_A013_I2	3.912	3.912	Update	Corrente fase L2
QGN_A013_I3	0.06	0.06	Update	Corrente fase L3
QGN_A013_In	3.984	3.984	Update	Corrente neutro
QGN_A013_V1	221.99	221.99	Update	Tensione semplice fase L1
QGN_A013_V2	224.47	224.47	Update	Tensione semplice fase L2
QGN_A013_V3	224.62	224.62	Update	Tensione semplice fase L3
QGN_A014_Frequenza	50	50	Update	Frequenza
QGN_A014_I1	0.48	0.48	Update	Corrente fase L1
QGN_A014_I2	0.036	0.036	Update	Corrente fase L2
QGN_A014_I3	0.048	0.048	Update	Corrente fase L3
QGN_A014_In	0	0	Update	Corrente neutro
QGN_A014_V1	224.82	224.82	Update	Tensione semplice fase L1
QGN_A014_V2	224.07	224.07	Update	Tensione semplice fase L2
QGN_A014_V3	222.18	222.18	Update	Tensione semplice fase L3
slaLcr013F0Pco2	1995.7			
slaLcr013F0Pd	1			
slaLcr013F0Plux	231.061			
slaLcr013F0Po	1			
slaLcr013F0Prh	56.4523			
slaLcr013F0Pt	22.4216			
slaLcr013F0Pw1	1			
slaLcr013F0Pw2	1			
slaLcr013F0Pw3	1			
slaLcr013F0Pw4	0			
slaLcr013F0Sp_aPec	-0.01	-0.01	Update	Potenza attiva Fase L1 (kW)
slaLcr013F0Sp_11Pec	0.71	0.71	Update	Potenza attiva Fase L2 (kW)
slaLcr013F0Sp_12Pec	0	0	Update	Potenza attiva Fase L3 (kW)
slaLcr014F0Pco2	2000			
slaLcr014F0Pd	1			
slaLcr014F0Plux	484.817			
slaLcr014F0Po	0			
slaLcr014F0Prh	50.6722			
slaLcr014F0Pt	23.1838			

SL 9:14 20.9.2013



# ICT1 CONNECTION & COMMUNICATION

## Verification and testing data of MOXA for A

Firefox 10.10.0.21

MOXA ioLogik Remote I/O Server

Password :

Login

- Main Menu - E1242

Overview

- Network Settings

- User-defined Modbus Addressing

- AOPC Server Settings

- I/O Settings

- Peer-to-Peer Settings

- System Management

Change Password

Load Factory Default

Save/Restart

Remote Ethernet I/O Server

Model Name

Serial Number

Firmware Version

Ethernet IP Address

Ethernet MAC Address

Peer to Peer

E1242

08781

V1.6 Build11031010

10.10.0.21

00-90-e8-2b-0f-f3

Disable

I/O Status

DI Channel

BA\_A013\_Oc-00

BA\_A013\_Door-01

DI-02

DI-03

Mode

DI

DI

DI

DI

Status

ON

ON

OFF

OFF

Filter

100.0 ms

100.0 ms

100.0 ms

100.0 ms

DO Channel

DO-00

DO-01

DO-02

DO-03

Mode

DO

DO

DO

DO

Status

OFF

OFF

OFF

OFF

Low Width

--

--

--

--

AI Channel

BA\_A013\_Rh-00

BA\_A013\_T-01

BA\_A013\_CO2-02

BA\_A013\_Lux-03

Range

0.000 - 100.000%

0.000 - 50.000C

0.000 - 2000.000ppm

10.000 - 16400.000Lux

Value

57.006%

22.470C

1995.758ppm

231.061Lux

Min

0.000%

20.235C

440.527ppm

39.490Lux

# ICT1 CONNECTION & COMMUNICATION

Verification and testing data of MOXA for A / scaling of luminosity in Lux - Theben

Firefox Remote Ethernet I/O Server

10.10.0.21/home.htm?Password=debc77501c639b67384b228eed1c2d74&Submit=Submit

**MOXA®** ioLogik Remote Ethernet

Model - E1242 Ethernet I/O Server IP  
Name - Multisensor (CO2, Temp, Rh) + Presence and Luminosity Serial No.  
Location - Room A013 System Elaps

- Main Menu - E1242  
Overview  
- Network Settings  
- User-defined Modbus Addressing  
- AOPC Server Settings  
- I/O Settings  
DI Channels  
DO Channels  
AI Channels  
- Peer-to-Peer Settings  
- System Management  
Change Password  
Load Factory Default  
Save/Restart

**AI Channel Settings**

Refresh page Clear Max. and Min.

AI Channel	Range
BA_A013_Rh-00	0.000 - 100.000
BA_A013_T-01	0.000 - 50.000
BA_A013_CO2-02	0.000 - 2000.000
BA_A013_Lux-03	10.000 - 16400.000

**AI Channel 3 Settings**

☒ Enable AI Channel

**AI Input Range**

0-10V

**Auto Scaling Settings**

☐ Disable Scaling  
☒ Enable Point-Slope formula

	Actual (x.xxx)		Scaled (x.xxx)
Min (n1)	0.026	Min (n2)	10.000
Max (m1)	10.000	Max (m2)	16400.000
Unit	V	Unit	Lux

\*Result =  $n2 + ((input - n1) \times [(m2-n2)/(m1-n1)])$

☐ Enable Slope-intercept

M=   
D=   
Unit

\*Result =  $M \times Input + D$

☐ Apply to All Channels

**Alias Name Settings**

Alias Name of Channel BA\_A013\_Lux

Submit Close

**WARNING: Be sure to Save/Restart your settings**

www.moxa.com

2b-0f-f3  
11031010

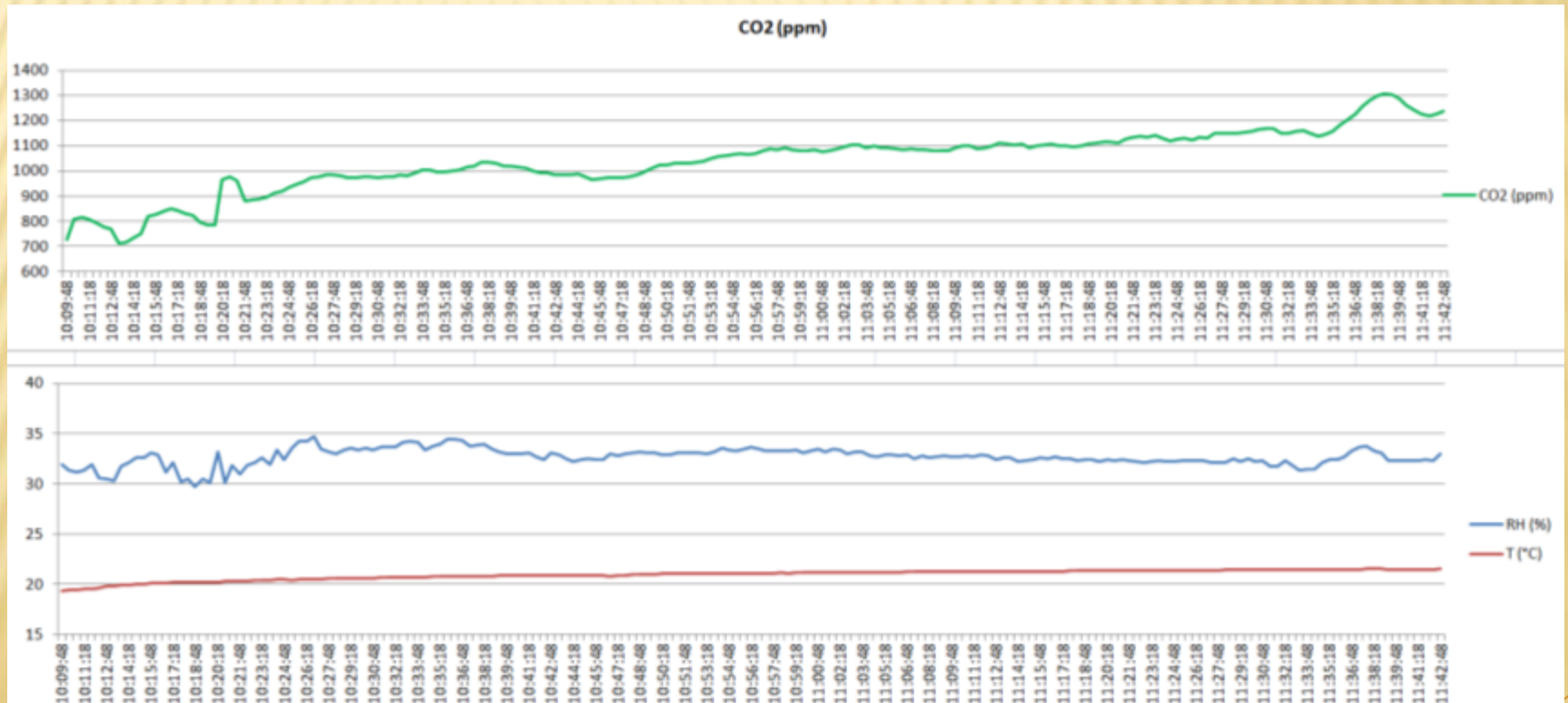
Max
70.626%
25.100C
1997.283ppm
1885.742Lux



## Reference values of the living comfort parameters

### Other reference values of the living comfort parameters

- The relative humidity RH: from 35% to 85%
- Noise in the room: up to 35 dB / 40 dB contingent in shorter time interval
- Minimum average luminosity general classrooms Emin = 300 lux, table Emin = 500 lux
- The recommended concentration of CO2 in the room: up to 1000 ppm / conditional to 1500 ppm with occasional short-term ventilation



# Example

**Example 1:** Daily/Weekly/Monthly measurement of microclimate in the classroom A13/A14, .... /Date: \_\_\_\_\_

- **Outdoor** hour 8.00:  $T_z = 17,0\text{ }^{\circ}\text{C}$ ; hour 12.30:  $T_z = 27,7\text{ }^{\circ}\text{C}$  /  $RH_z = 47,8\%$
- **Indor**
  - Event 1** Ura 8.00:  $T_n = 38,7\text{ }^{\circ}\text{C}$ ;  $RH_n = 25,6\%$ ;  $CO_2n = 1237\text{ ppm}$  / coming in classroom
  - Event 2** Ura 8.20:  $T_n = 41\text{ }^{\circ}\text{C}$ ;  $RH_n = 23,4\%$ ;  $CO_2n = 1405\text{ ppm}$  / start of lesson
  - Event 3** Ura 10.00:  $T_n = 32,1\text{ }^{\circ}\text{C}$ ;  $RH_n = 50,8\%$ ;  $CO_2n = 4364\text{ ppm}$  / airing 20 minut
  - Event 4** Ura 11.15:  $T_n = 31,7\text{ }^{\circ}\text{C}$ ;  $RH_n = 51,5\%$ ;  $CO_2n = 2686\text{ ppm}$  / non-aerated empty classroom
  - Avg:  $T_n = 31,8\text{ }^{\circ}\text{C}$ ;  $RH_n = 44,3\%$ ;  $CO_2n = 1944\text{ ppm}$
  - Min:  $T_n = 25,7\text{ }^{\circ}\text{C}$ ;  $RH_n = 22,5\%$ ;  $CO_2n = 619\text{ ppm}$
  - Max:  $T_n = 42,5\text{ }^{\circ}\text{C}$ ;  $RH_n = 56,9\%$ ;  $CO_2n = 4555\text{ ppm}$
  - Num. of occup.: 20 students + teacher

A13

A14

