Programul IPA de Cooperare Transfrontalieră România Serbia

# Monitoring energy and ambient parameters

Vlad Stanciu, Executive Director ROSENC

## Smart And Sustainable Energy Consumption - SASEC Round Tables

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Timișoara

9 Decembrie 2020

**Cooperation beyond borders.**
Interreg-IPA Cross-border Cooperation Romania-Serbia Programme is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.

# Monitoing devices installed in 6 schools: 3 Timisoara, 3 Zrenjanin

| | | | | |
|---|---|---|---|---|
| Liceul Teoretic “Grigore Moisil” | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |
| Colegiul National Banatean | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |
| Colegiul National “C. D. Loga” | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |
| School of Economics “Jovan Trajkovic” | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |
| Technical School Zrenjanin | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |
| Gymnasium Zrenjanin | 25 ambient measuring points | electric energy consumption | thermic energy consumption | communication LoRa+4G |

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# Ambient parameters measuring device




## Specs:

- temperatura ambientala, interval 0°C to 50°C, rezolutie 0.01°C, acuratețe ±0.2°C
- umiditatea relativa, interval 0 - 100 %RH, acuratețe ±2 %RH
- presiunea atmosferica, interval 300 hPa - 1200 hPa, acuratețe ±1 hPa
- CO2, interval 400 ppm – 20000 ppm
- compuși organici volatili, interval 0 ppb – 30000 ppb
- iluminanta, interval 0 lux – 20000 lux, rezolutie 0.1 lux
- Detectarea prezenței la distanța de 2m
- Alimentare prin 2 x AA baterii cu peste 3 luni autonomie
- Intervale de masurare configurabile
- Montabil pe perete
- Transmite date pe banda ISM 868MHz catre Gateway

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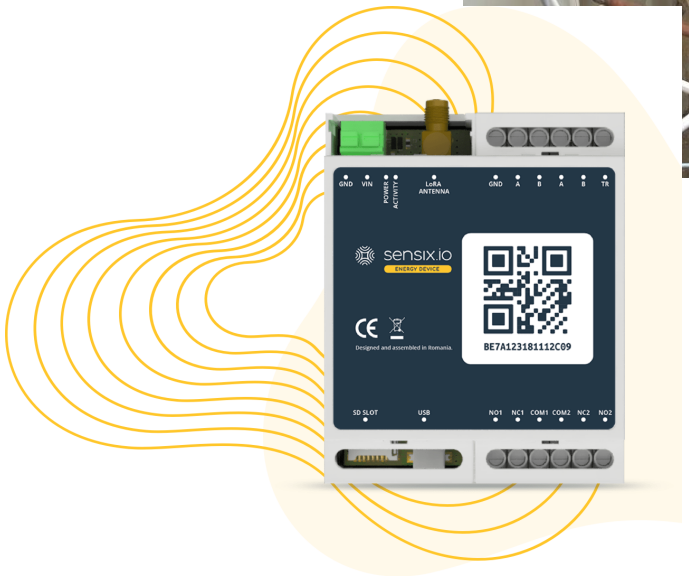
# Device for measuring electric and thermic energy consumption

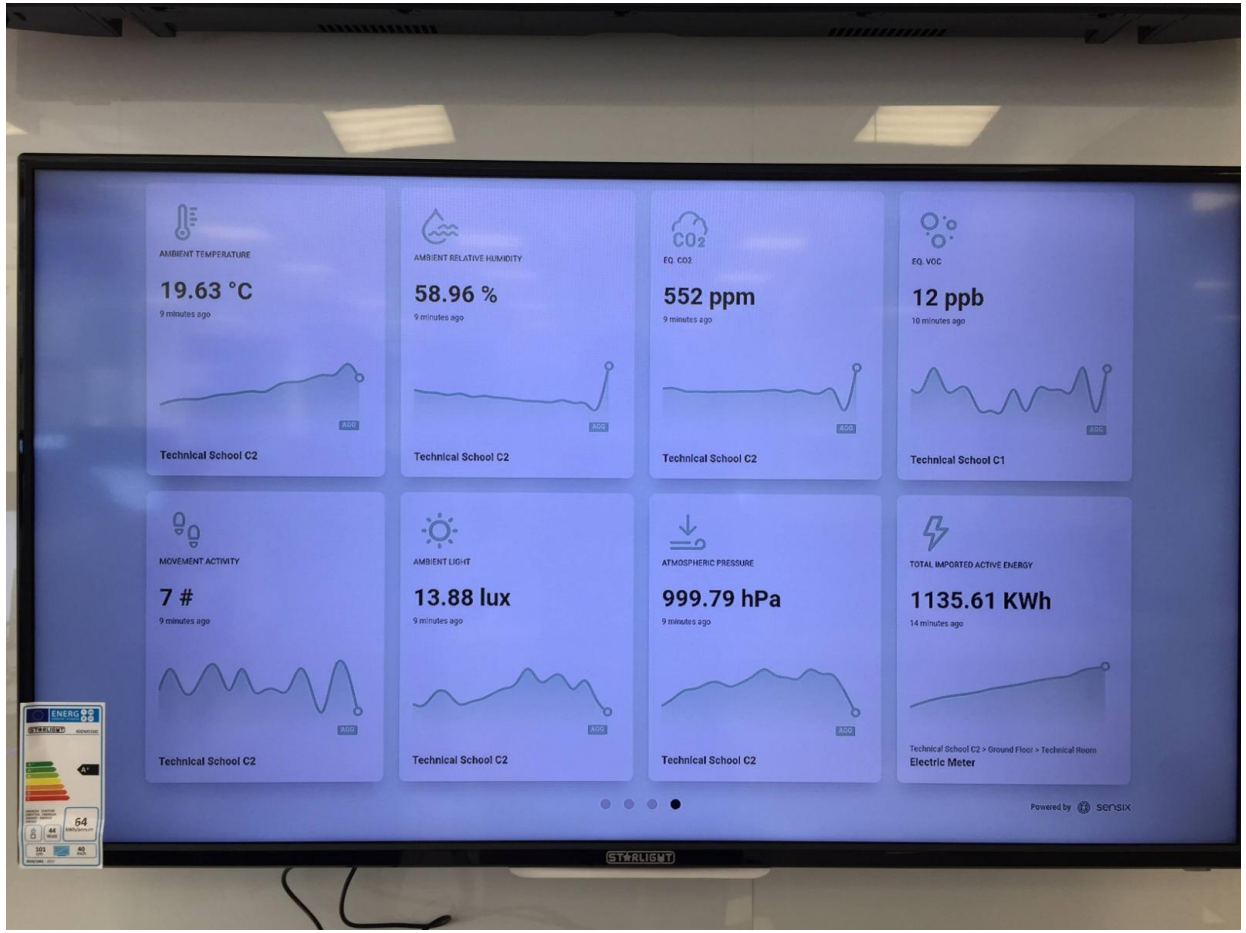



## Specs:

- Suportă conectare la echipamente industriale prin Modbus RTU (RS485)
- 2 canale RS485 cu izolare 2kV
- Curent maxim 10A
- Alimentare 12V
- Colectează datele la interval configurabil
- Se montează pe șină DIN, unde ocupa 4 module
- Suportă conexiunea cu contoarele de energie termica si electrica prin RS485
- Suporta 4 conexiuni RS485 (4 echipamente)
- Compatibil cu cablu antena SMA pana la 5m
- Transmite datele pe banda ISM 868MHz catre Gateway
- Sursa de putere AC/DC 12VDC

# Devices for communication on LoRa (868MHz) and 4G


# Display of key indicators in each school



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# Web interface

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WELCOME, ANDREI.BASARABA@ROSENC.RO.

Site administration

| AUTH TOKEN | | |
|---|---|---|
| Tokens | + Add | Change |

| AUTHENTICATION AND AUTHORIZATION | | |
|---|---|---|
| Groups | + Add | Change |
| Users | + Add | Change |

| BOARDS | | |
|---|---|---|
| Board metrics | + Add | |
| Boards | + Add | |

| CONSTANCE | |
|---|---|
| Config | |

| DEFENDER | | |
|---|---|---|
| Access attempts | + Add | |

Recent actions

My actions

+ 2020-11-16 - 2020-11-23 / Grigore Moisil Liceu
Building csv report

| | | |
|---|---|---|
| Rooms | + Add | Change |

| FILER | | |
|---|---|---|
| Folders | | Change |
| Thumbnail options | + Add | Change |

| LIVE | | |
|---|---|---|
| Equipment | + Add | Change |
| Equipment models | + Add | Change |
| Live metrics | + Add | View |
| Metrics | + Add | View |

| REPORTS | | |
|---|---|---|
| Building csv reports | + Add | Change |
| Device csv reports | + Add | Change |
| Floor csv reports | + Add | Change |
| Room csv reports | + Add | Change |

| THRESHOLDS | | |
|---|---|---|
| Live metric thresholds | + Add | Change |

| | | | | | |
|---|---|---|---|---|---|
| L2 CosPhi | aPh2 | average | | 0 |
| L1 Phase Voltage | MV1 | max | V | 0 |
| L1 Phase Voltage | mV1 | min | V | 0 |
| L1 Phase Voltage | aV1 | average | V | 0 |
| L1 Phase Current | MC1 | max | A | 0 |
| L1 Phase Current | mC1 | min | A | 0 |
| L1 Phase Current | aC1 | average | A | 0 |
| L1 CosPhi | MPh1 | max | | 0 |
| L1 CosPhi | mPh1 | min | | 0 |
| L1 CosPhi | aPh1 | | | |
| Frequency | MFrq | | | |
| Frequency | mFrq | | | |
| Frequency | aFrq | | | |
| Movement activity | pres | | | |
| Eq. VOC | eVOC | | | |
| Eq. CO2 | eCO2 | | | |
| Atmospheric pressure | apre | | | |
| Ambient Temperature | atem | | | |
| Ambient Relative Humidity | arhu | | | |
| Ambient Light | aill | | | |

| NAME | KEY | TYPE | UNITS ABBREV | UNITS ORI |
|---|---|---|---|---|
| QP average time | haQP | average | min | 0 |
| Outlet energy E5 | hoE5 | aggregated | KWh | 3 |
| Inlet energy E4 | hiE4 | aggregated | KWh | 3 |
| Heat Temperature T4 | hT4 | instant | °C | 0 |
| Heat Flow V2 | hQ2 | instant | m³/h | 0 |
| Heat energy E2 | hE2 | aggregated | KWh | 3 |
| Heat COP | hCOP | instant | | 0 |
| Pulse input B | hpiB | instant | # | 0 |
| Pulse input A | hpiA | instant | # | 0 |
| Outlet temperature T2 | hoT2 | instant | °C | 0 |
| Inlet temperature T1 | hiT1 | instant | °C | 0 |
| Heat Volume 2 | hV2 | instant | m³ | 0 |
| Heat Volume 1 | hV1 | instant | m³ | 0 |
| Heat temperature T3 | hT3 | instant | °C | 0 |
| Heat power | hMP | max | KW | 3 |
| Heat power | hiP | instant | KW | 3 |
| Heat Flow | hQ | instant | m³/h | 0 |
| Heat energy | hE | aggregated | KWh | 3 |

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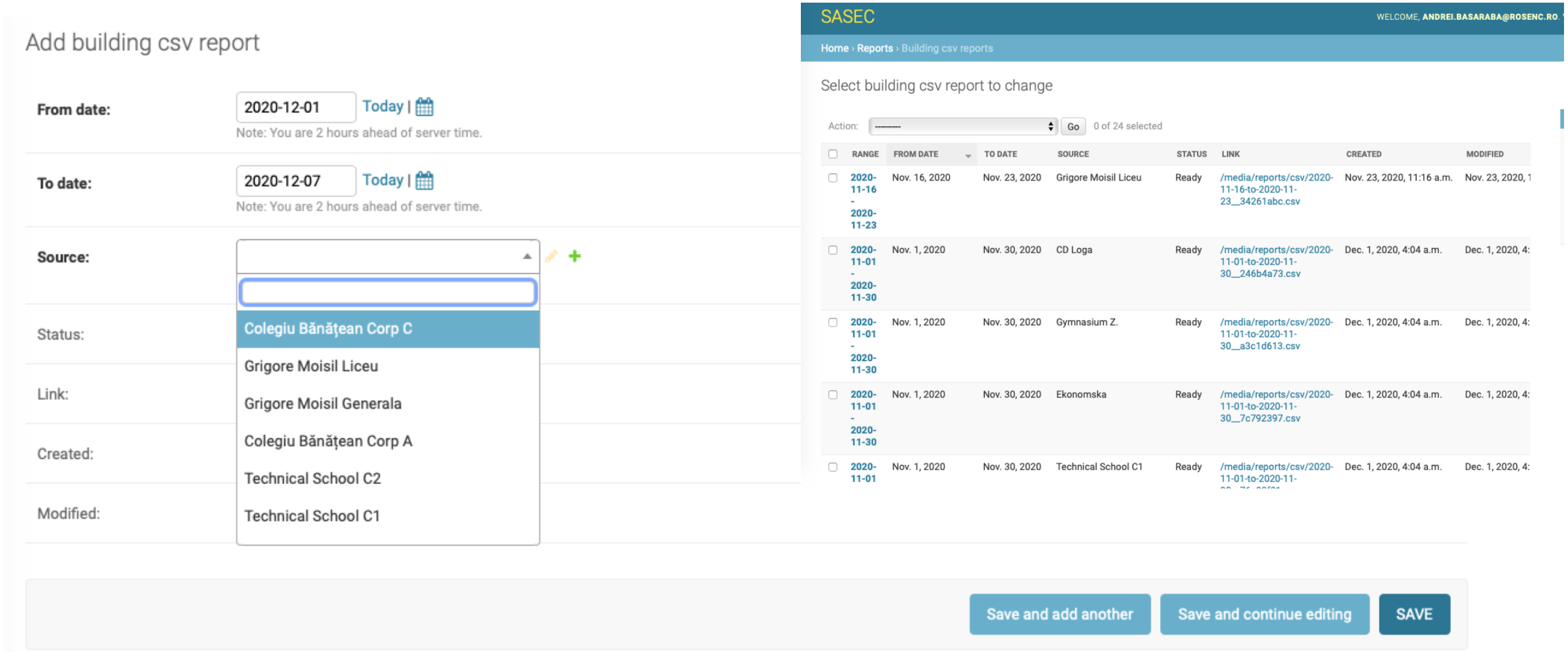
# Preparing and generating reports

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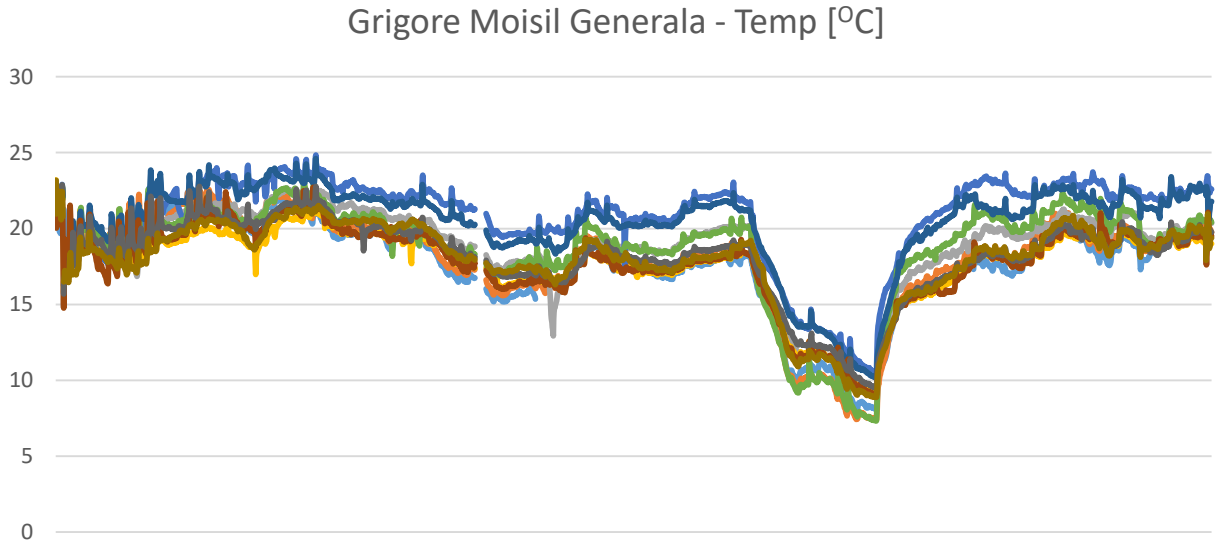
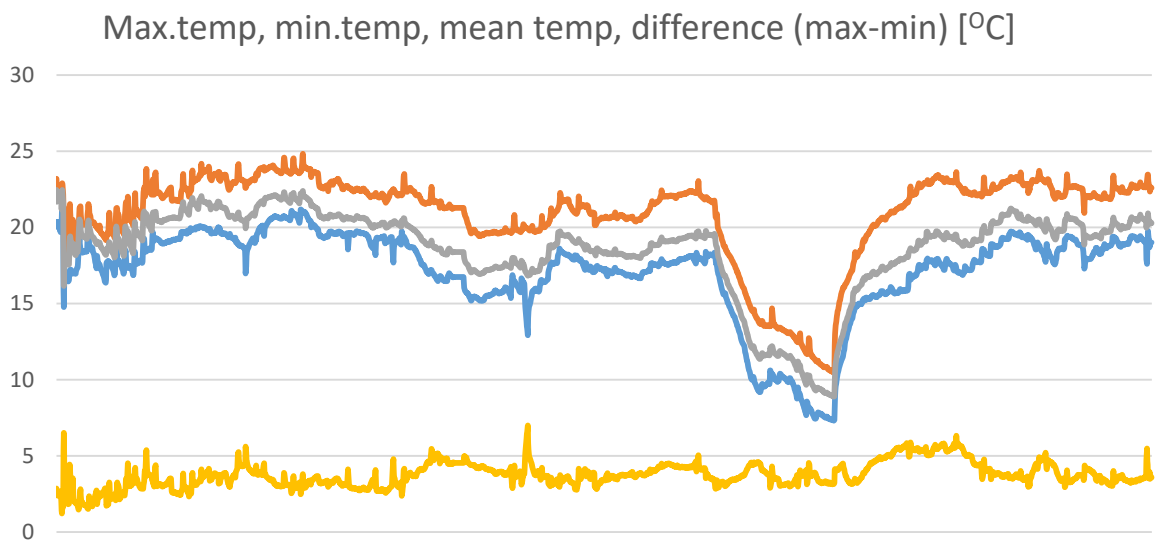
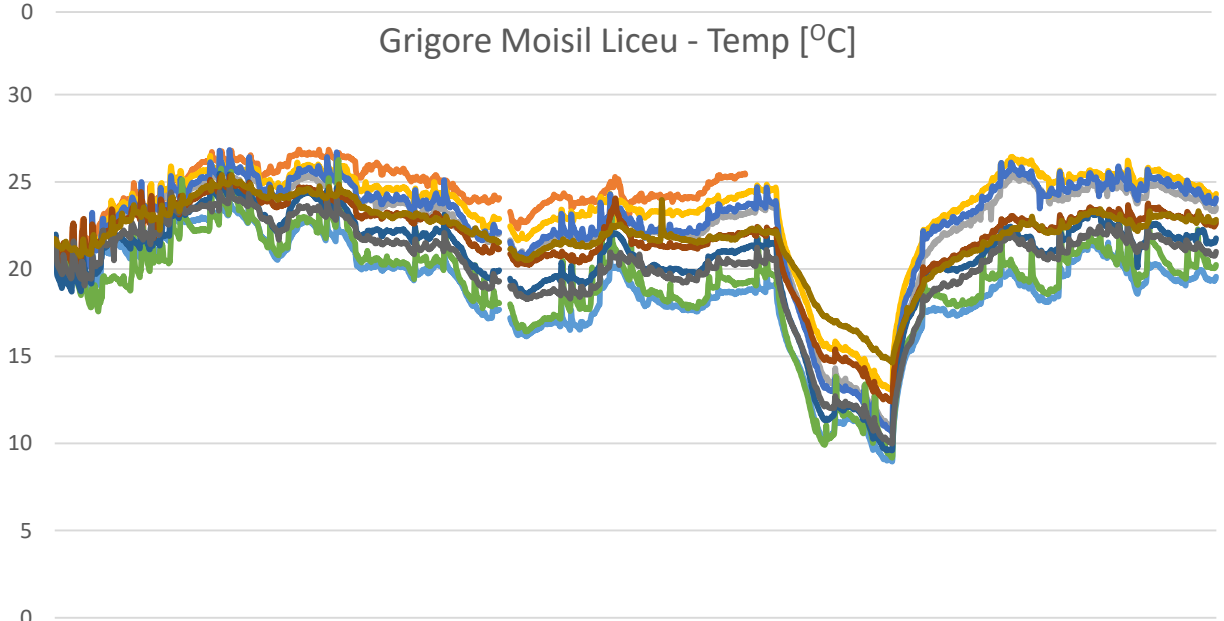
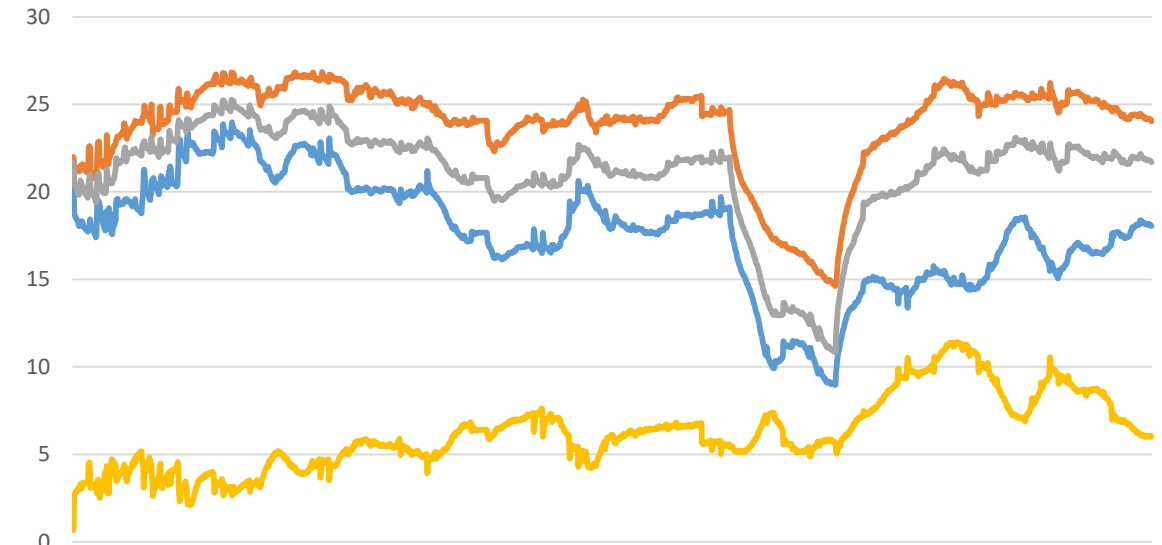
# Example of data
# G. Moisil, sep.2020-feb.2021



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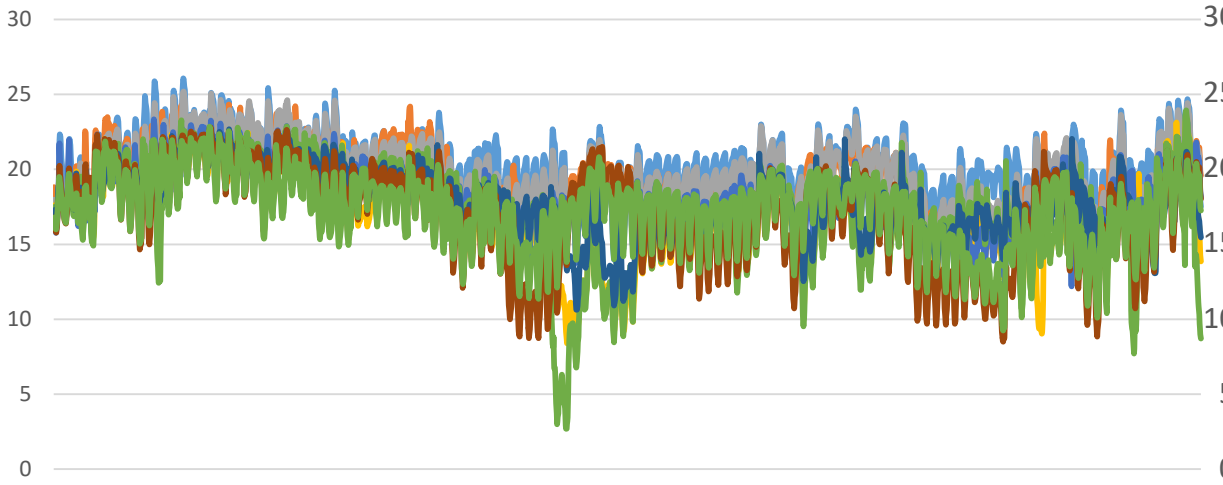
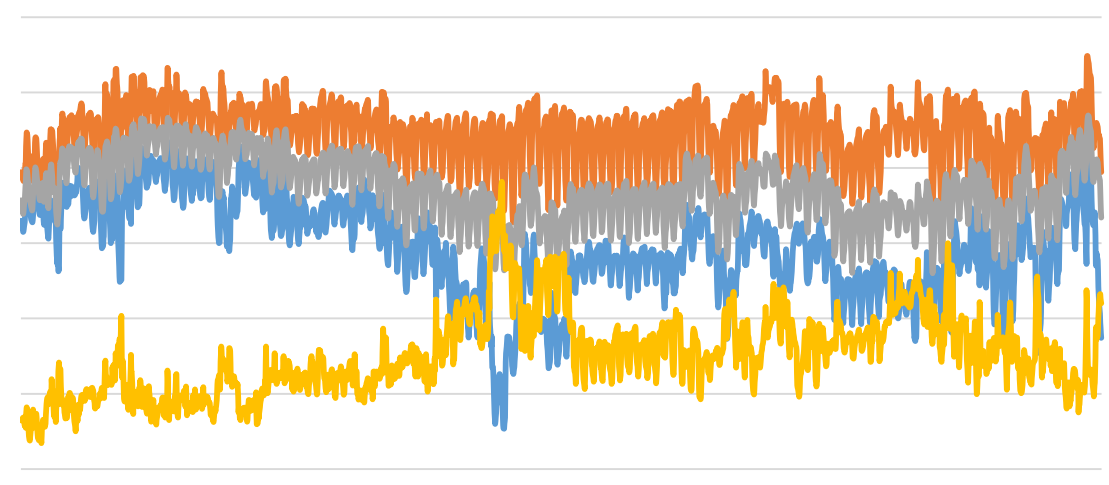
# Example of data
# Technical School, sep.2020-feb.2021

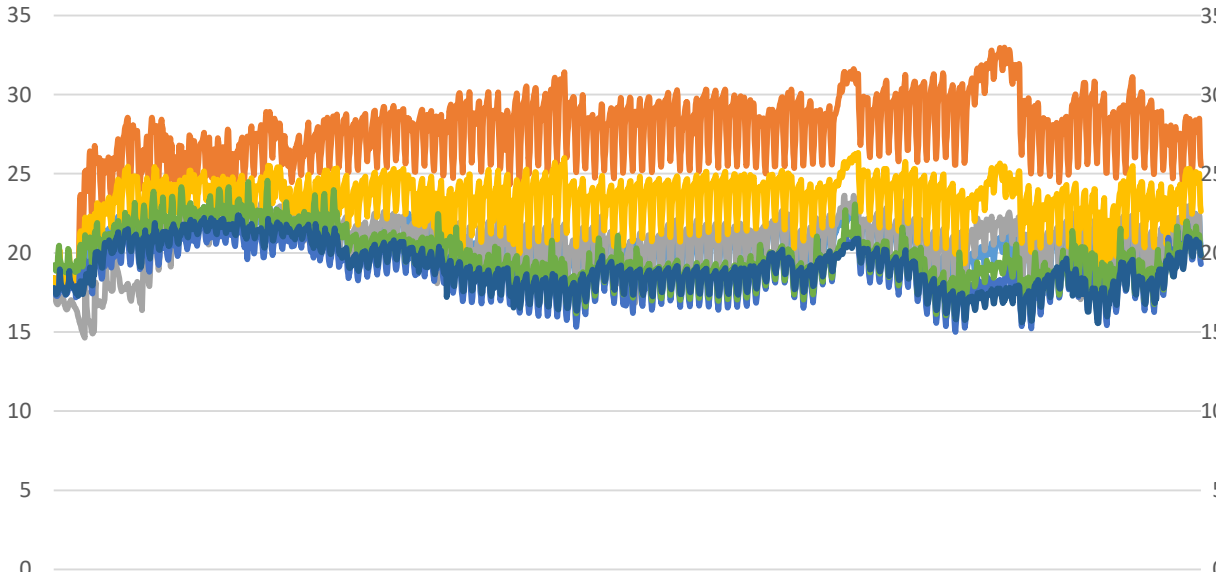
Technical School C1 - Temp [$^{O}$C]

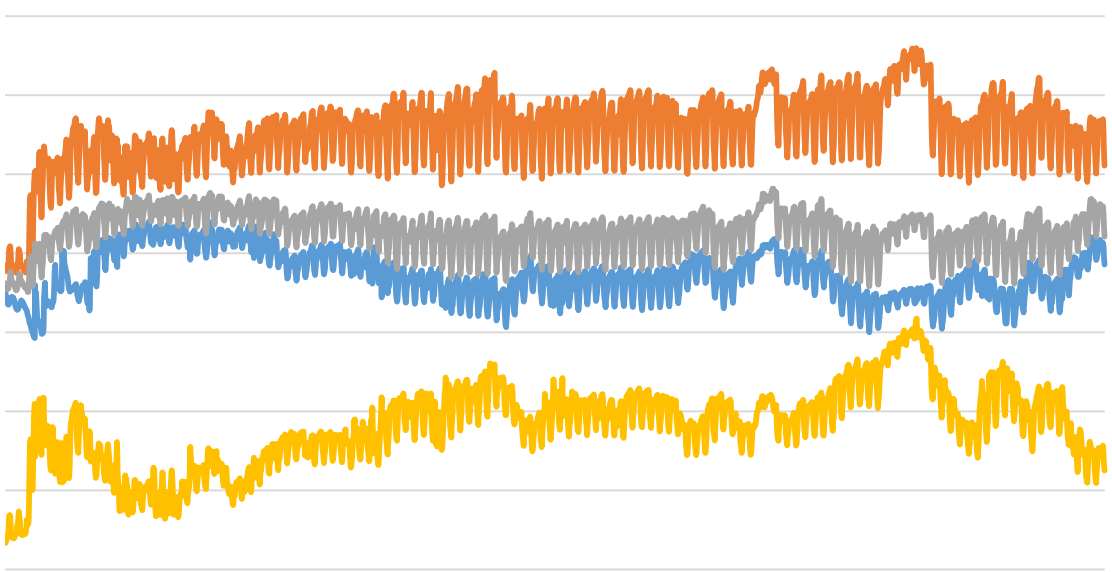



Max.temp, min.temp, mean temp, difference (max-min) [$^{O}$C]




Technical School C2 - Temp [$^{O}$C]



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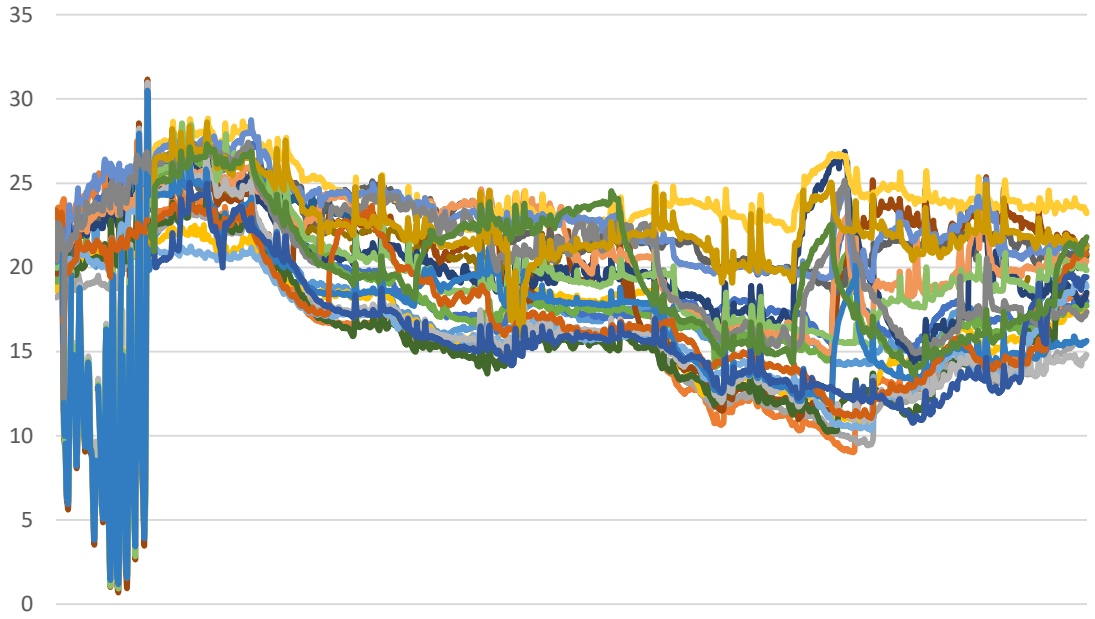
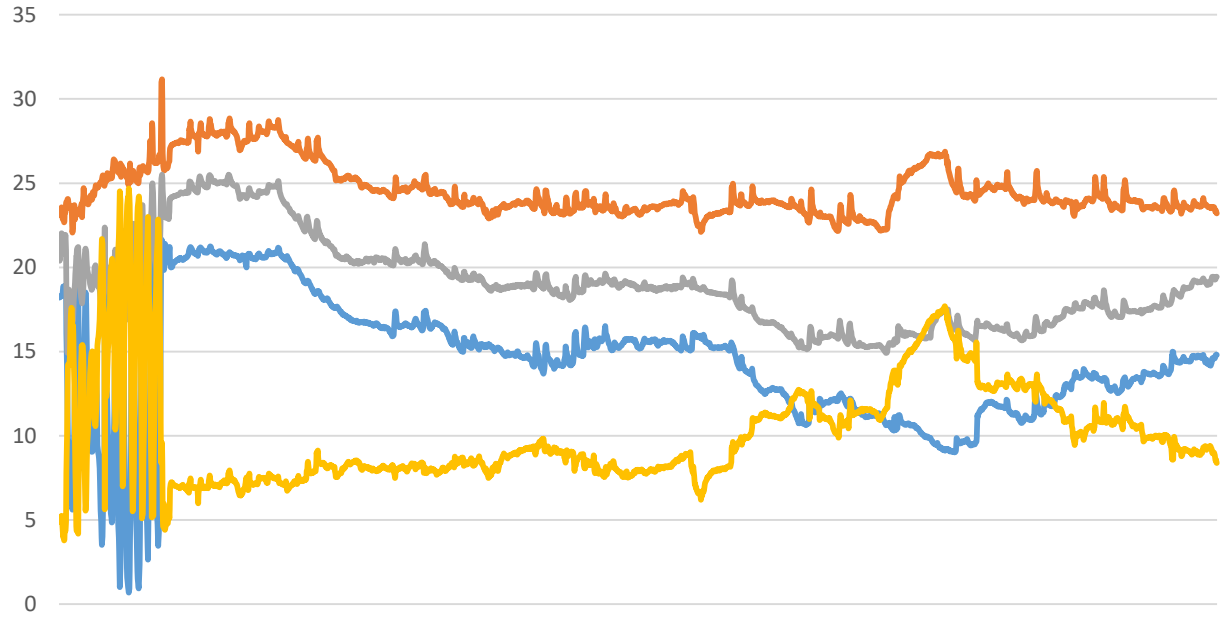
# Example of data
# C.D. Loga, oct.2020-feb.2021

C.D. Loga - Temp [$^{O}$C]




C.D. Loga - Temp Avg [$^{O}$C]

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# Example of data

| Building | Average indoor temp difference (max-min) | Maximum indoor temperature difference |
|---|---|---|
| **Timisoara** | | |
| Grigore Moisil Generala | 3,75 $^{O}$C | 6,99 $^{O}$C |
| Grigore Moisil Liceu | 6,16 $^{O}$C | 11,43 $^{O}$C |
| C.D. Loga | 10,13 $^{O}$C | 24,68 $^{O}$C |
| Colegiul Banatean Corp A | 4,98 $^{O}$C | 11,31 $^{O}$C |
| Colegiul Banatean Corp C | 3,83 $^{O}$C | 7,31 $^{O}$C |
| **Zrenjanin** | | |
| Technical School C1 | 7,55 $^{O}$C | 19,07 $^{O}$C |
| Technical School C2 | 9,04 $^{O}$C | 15,86 $^{O}$C |
| Ekonomska | 5,92 $^{O}$C | 12,55 $^{O}$C |
| Gymnasium | 8,08 $^{O}$C | 15,80 $^{O}$C |

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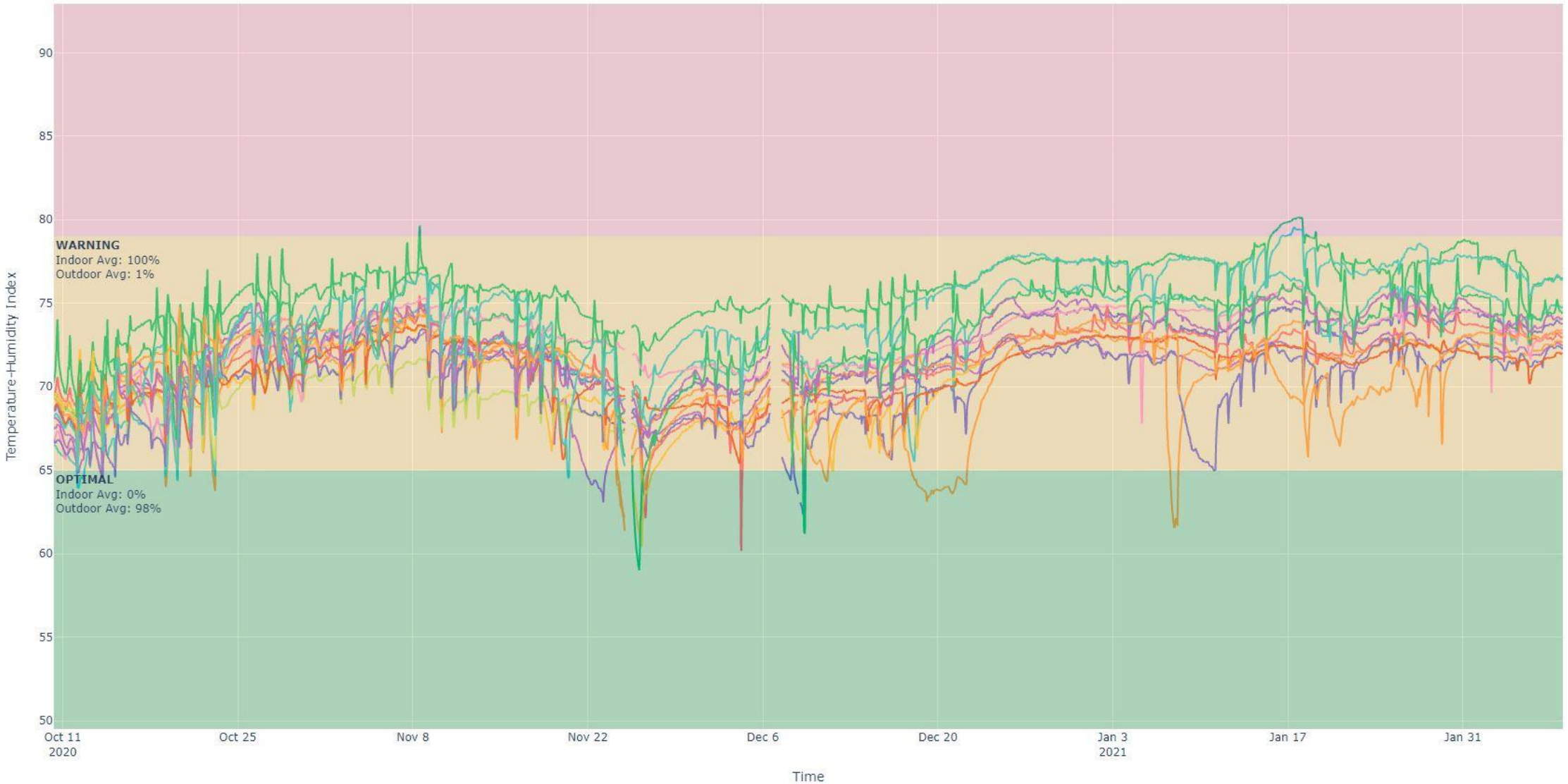
**THI oct-feb**

Colegiu Bănățean Corp A - Temperature-Humidity Index, from 16 devices



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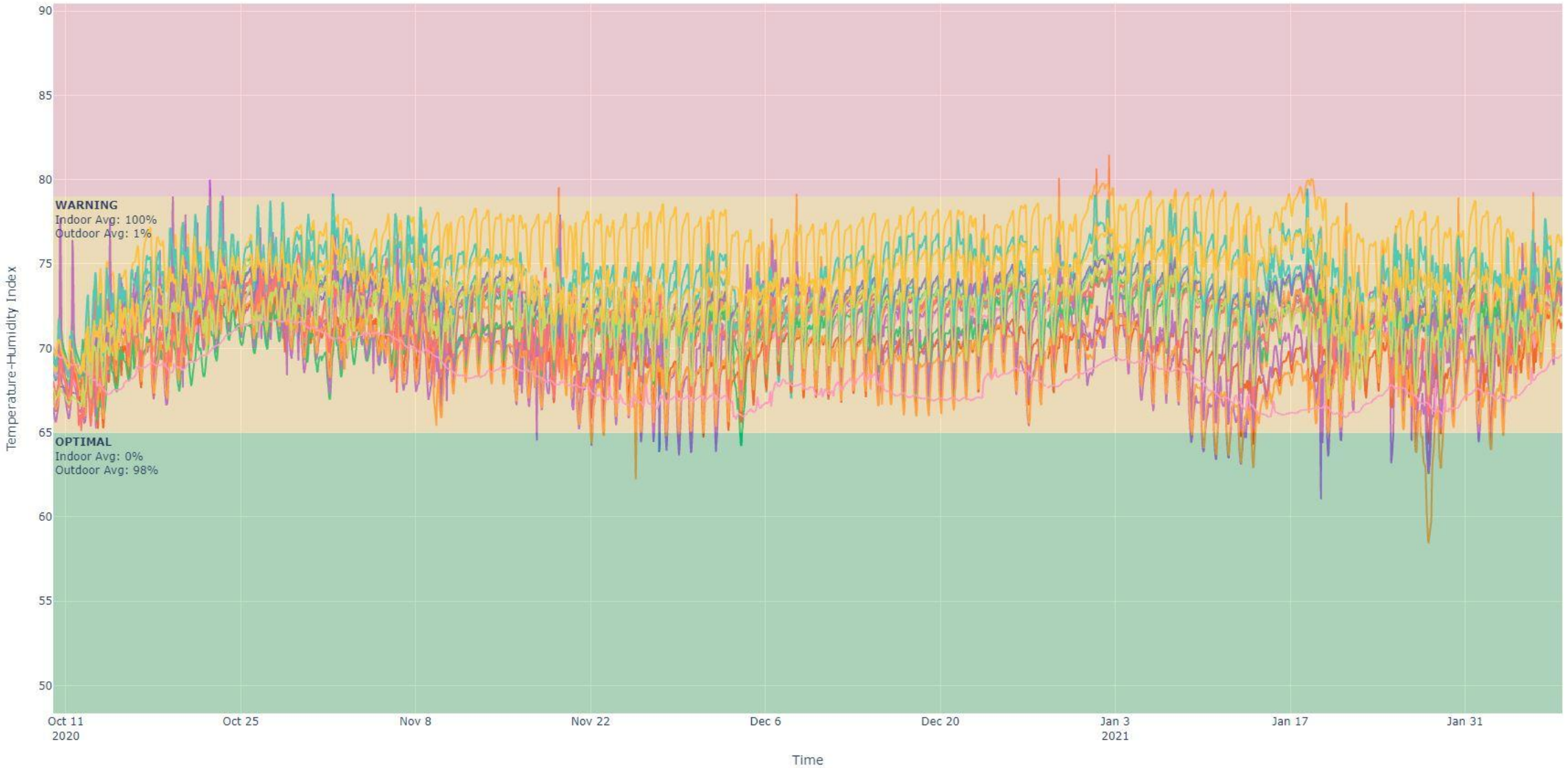
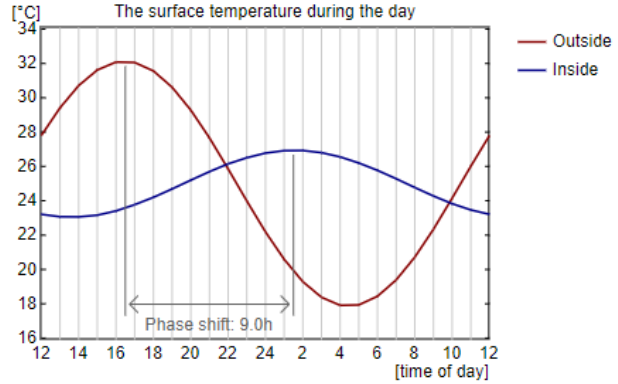
**THI oct-feb**

Ekonomska - Temperature-Humidity Index, from 20 devices



# Other indicators in progress




- *Kwh/sqrm*year, Kwh/cm*year*
- *Building phase shift – thermic inertia*
- *Specific building energy consumption /1$^{O}$C diff (indoor-outdoor)*
- *Exceeding thresholds for energy consumption parameters*
- *Risk of harmful microorganisms*

- *Conclusions will be presented in the Report for Energy Efficiency and will include:*
  - ***Non-cost measures for energy efficiency** (changing behavior)*
  - ***Investment measures for energy efficiency** (proposed for future projects)*
- *Building administrators will be able to justify future investment, based on measured data and expert analysis*

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# Thank You!

*Vlad Stanciu*

*Executive Director*

*Romanian Sustainable Energy Cluster - ROSENC*

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