Control PV Plant with a PLC
(Energy gateway for renewables)

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Product Components

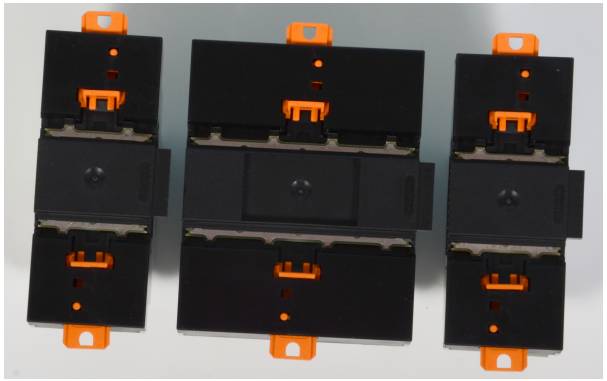
Modular solution

Cost effective sensors

CZECH PRODUCT

Monitoring of

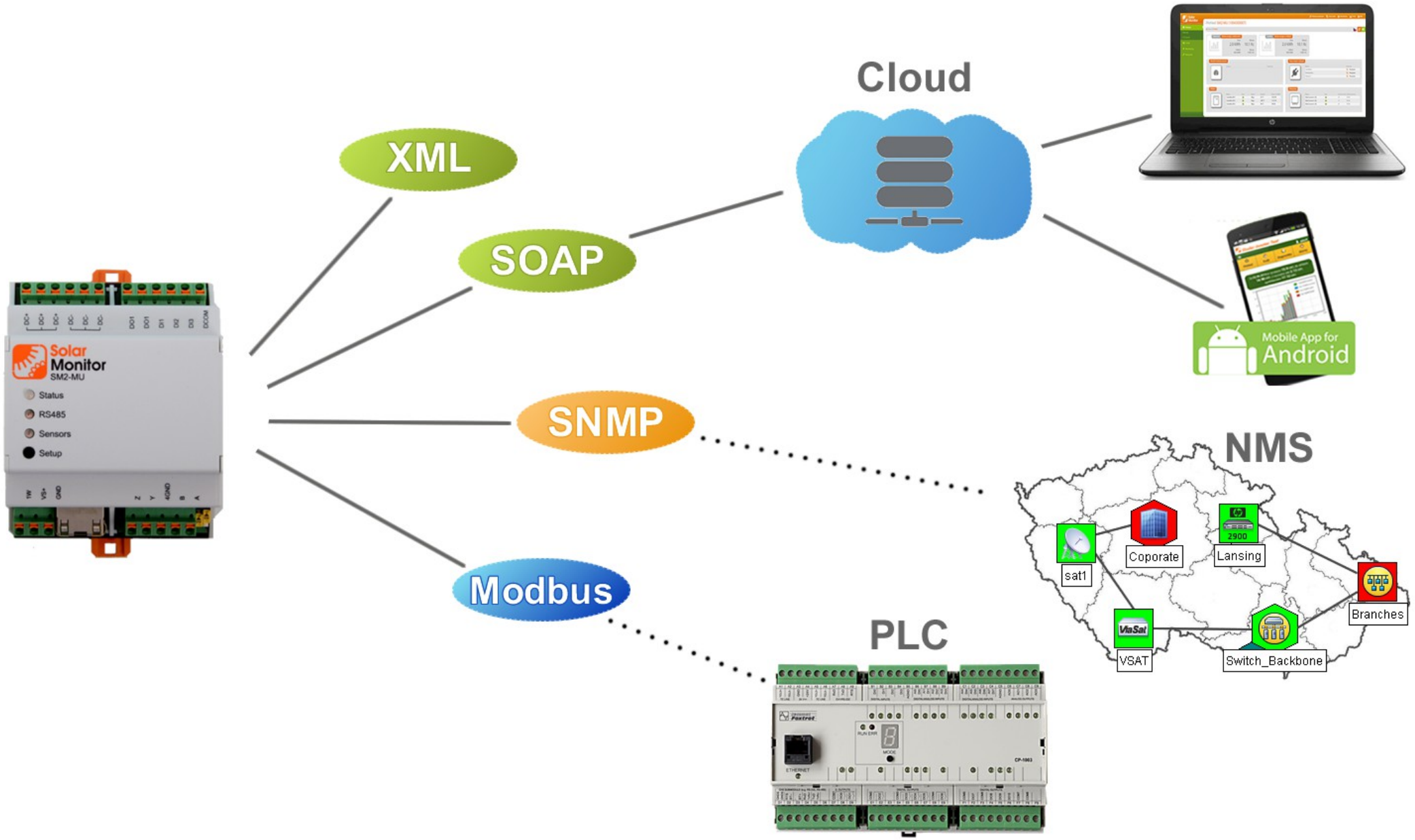
- Inverters
- String Boxes
- Electricity Meters (AC, DC)
- Sensors (Irradiation, Temperature, Wind)
- Safety Relays
- Door Contact (Theft Protection)
- Overvoltage (Lightning Protection)



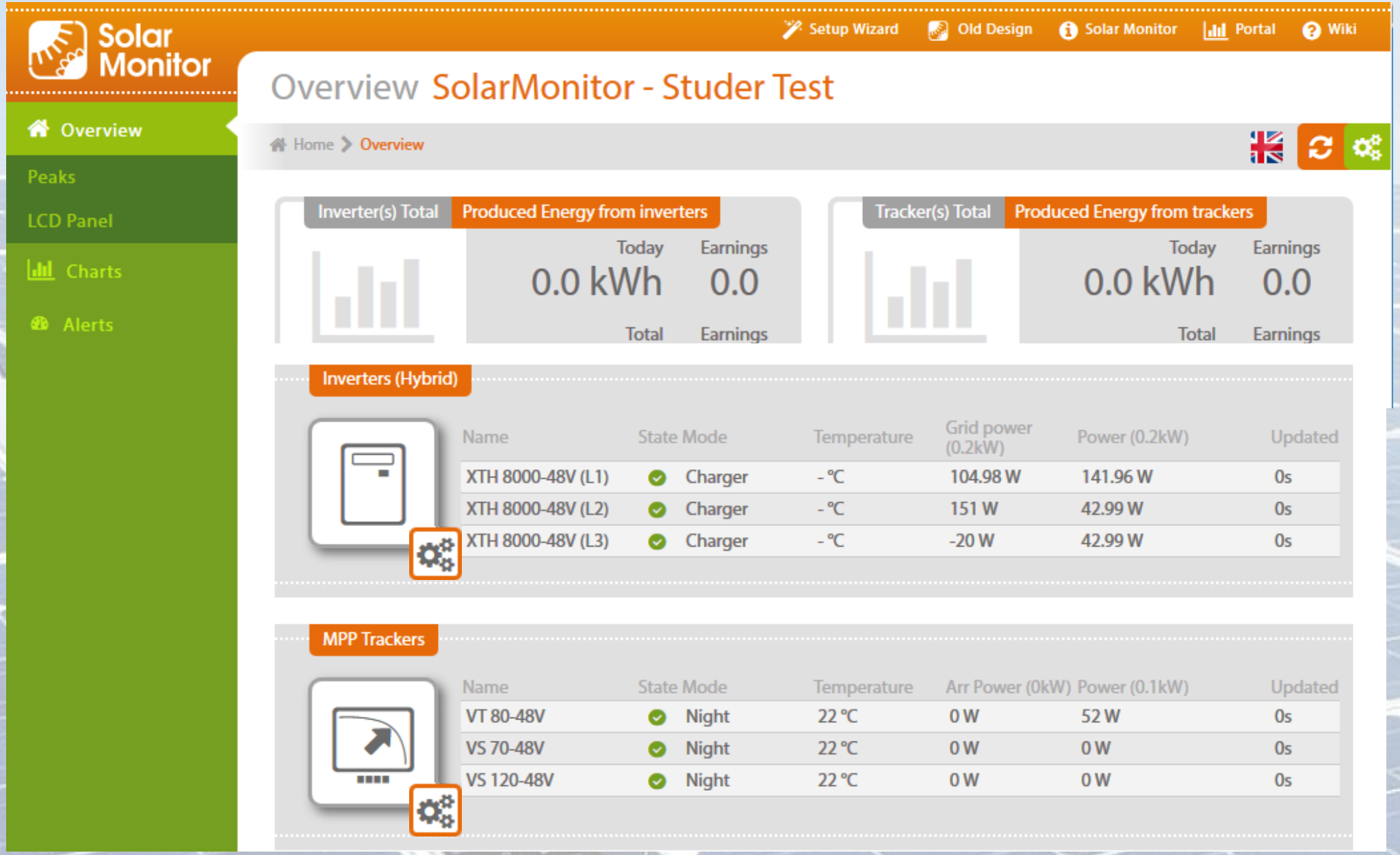
Supported Devices

Solar Monitor – Solution Areas

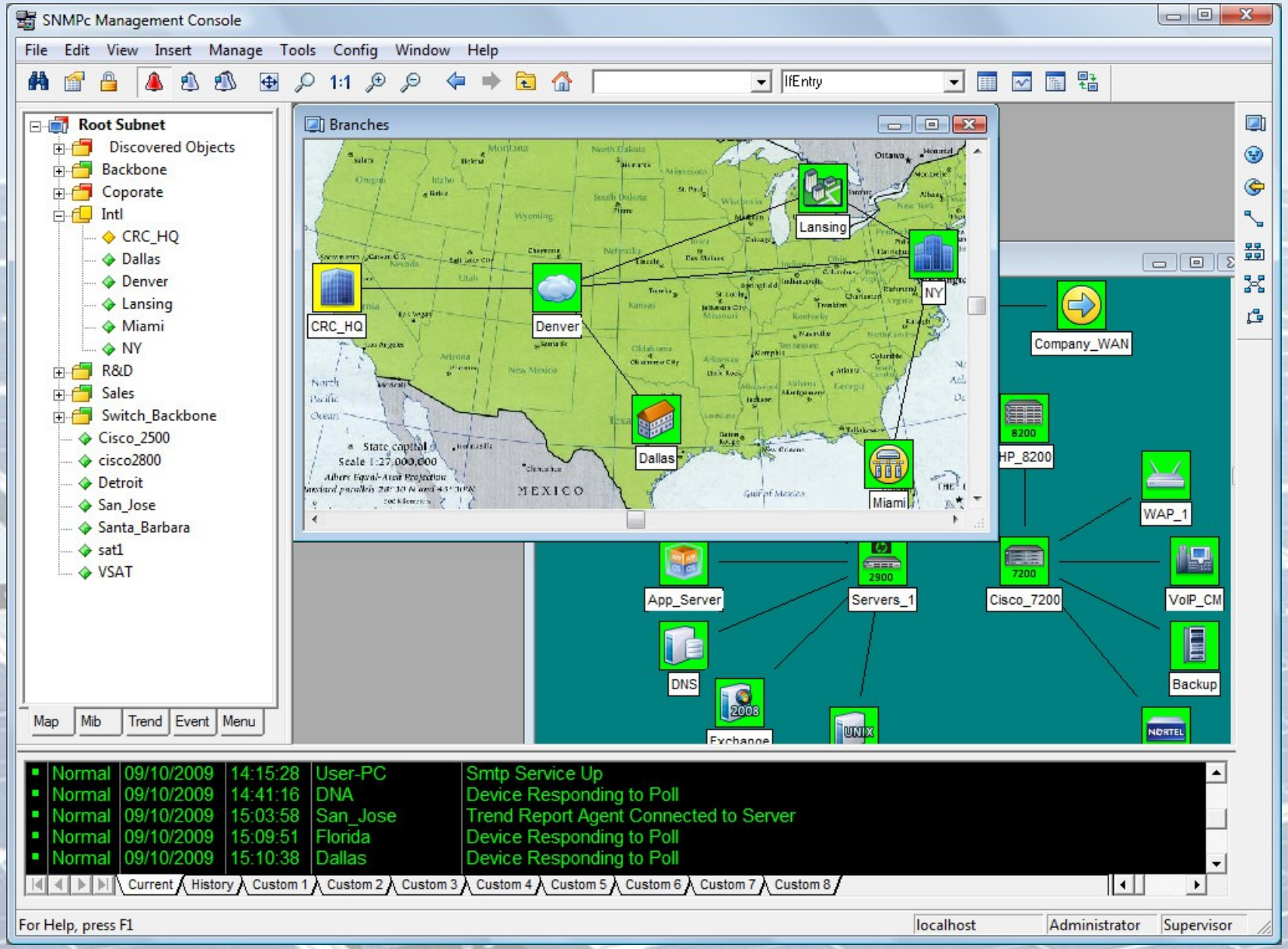
Software Interface Overview



Webserver of the SM2-MU: Responsive Design

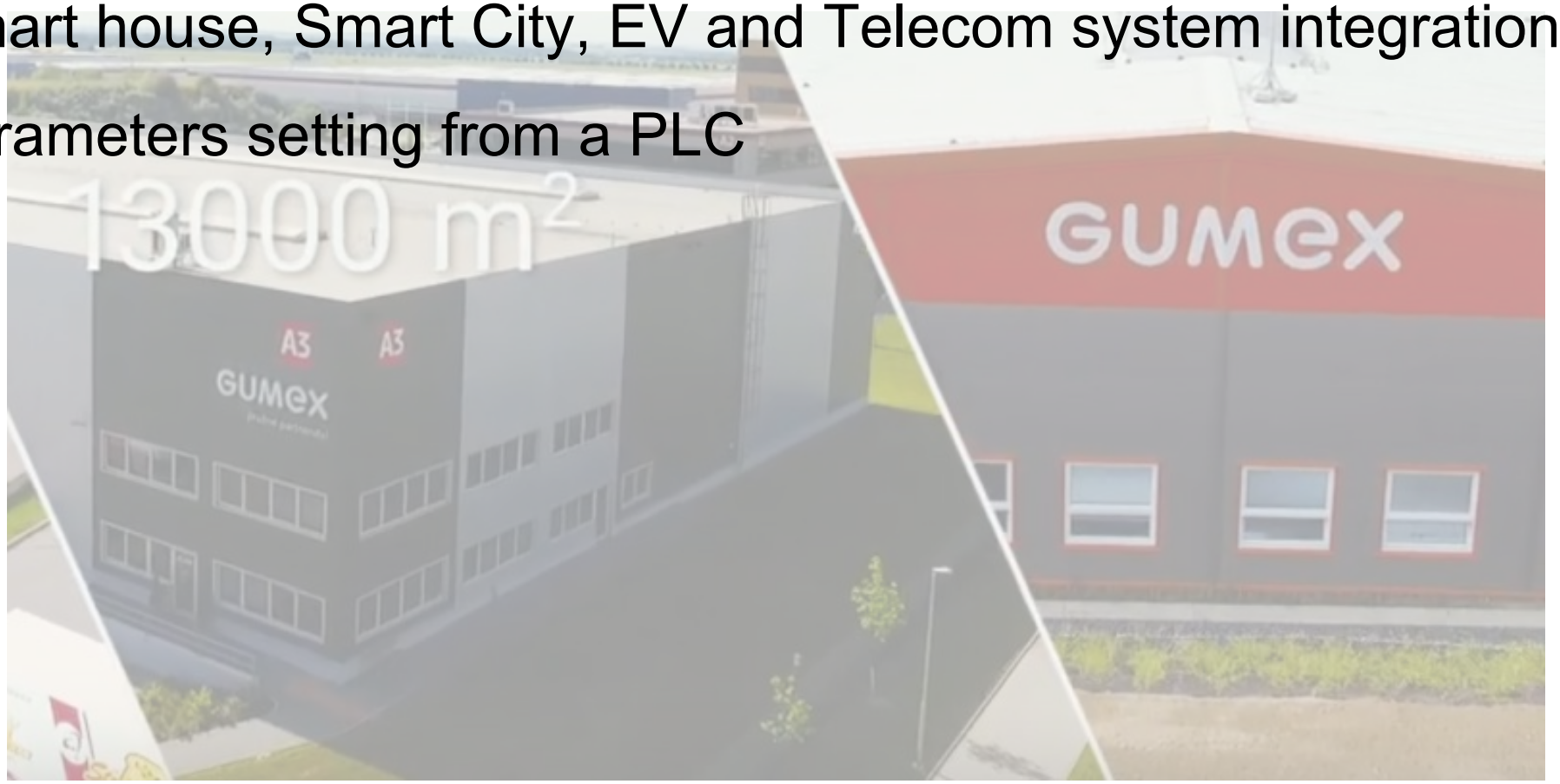


SNMP – Castlerock SNMPc: Geographical Maps



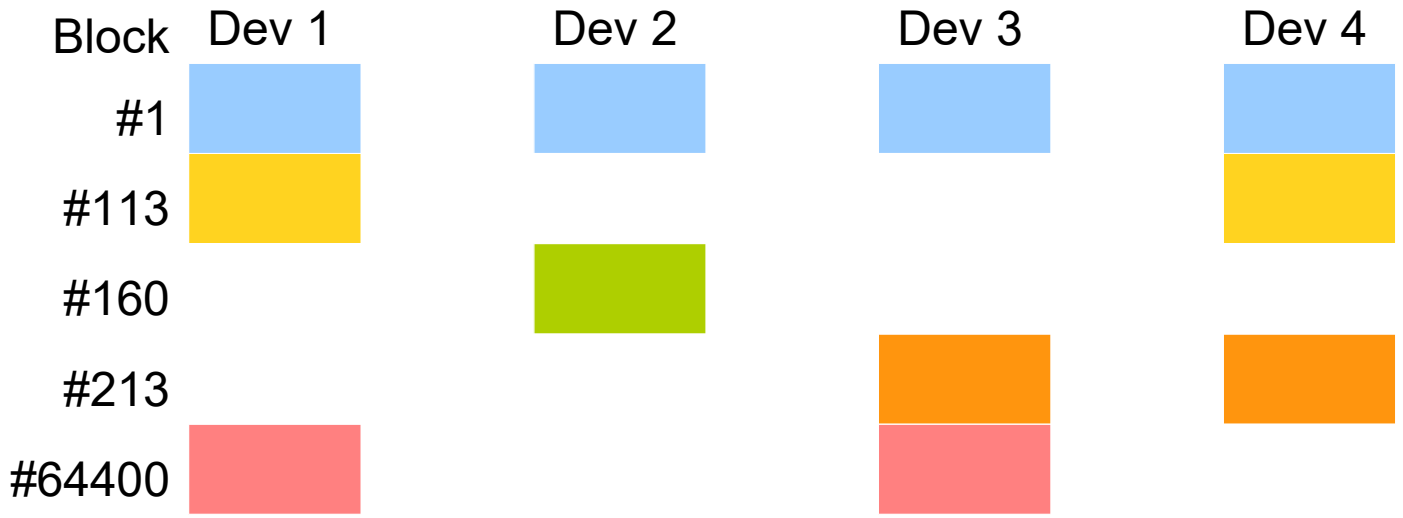
What we automate?

- Power control, fluent regulation
- Obtaining data from devices with proprietary protocols
- Smart house, Smart City, EV and Telecom system integration
- Parameters setting from a PLC



What makes our solution unique?

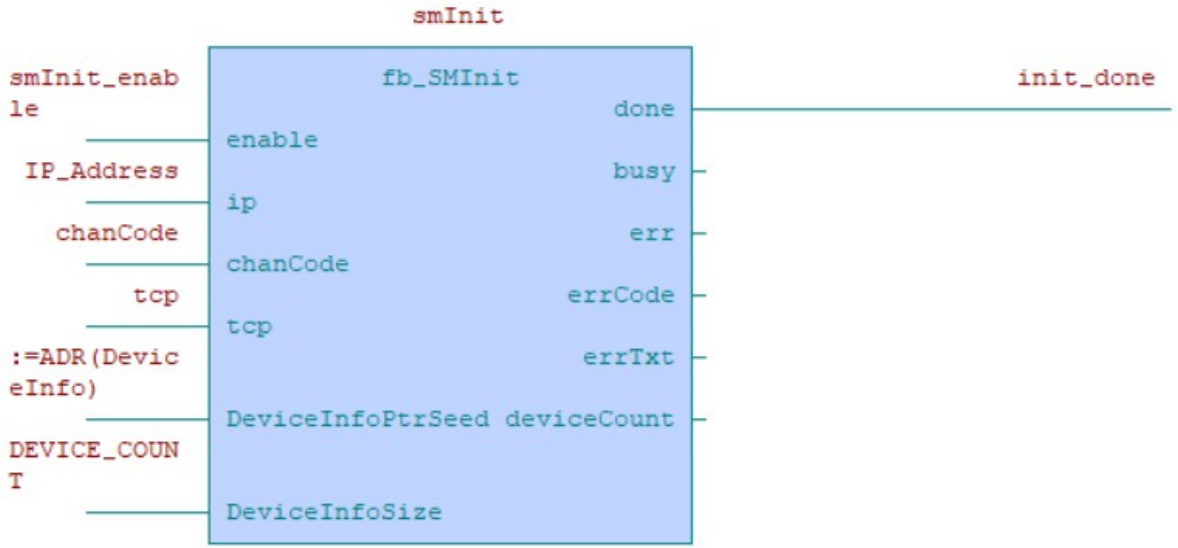
- Universal and custom blocks in the SM2-MU



- Mandatory / optional variables, subblock repetition
- Forward and backward both device and SW compatibility
- Communication with "not yet existing devices"

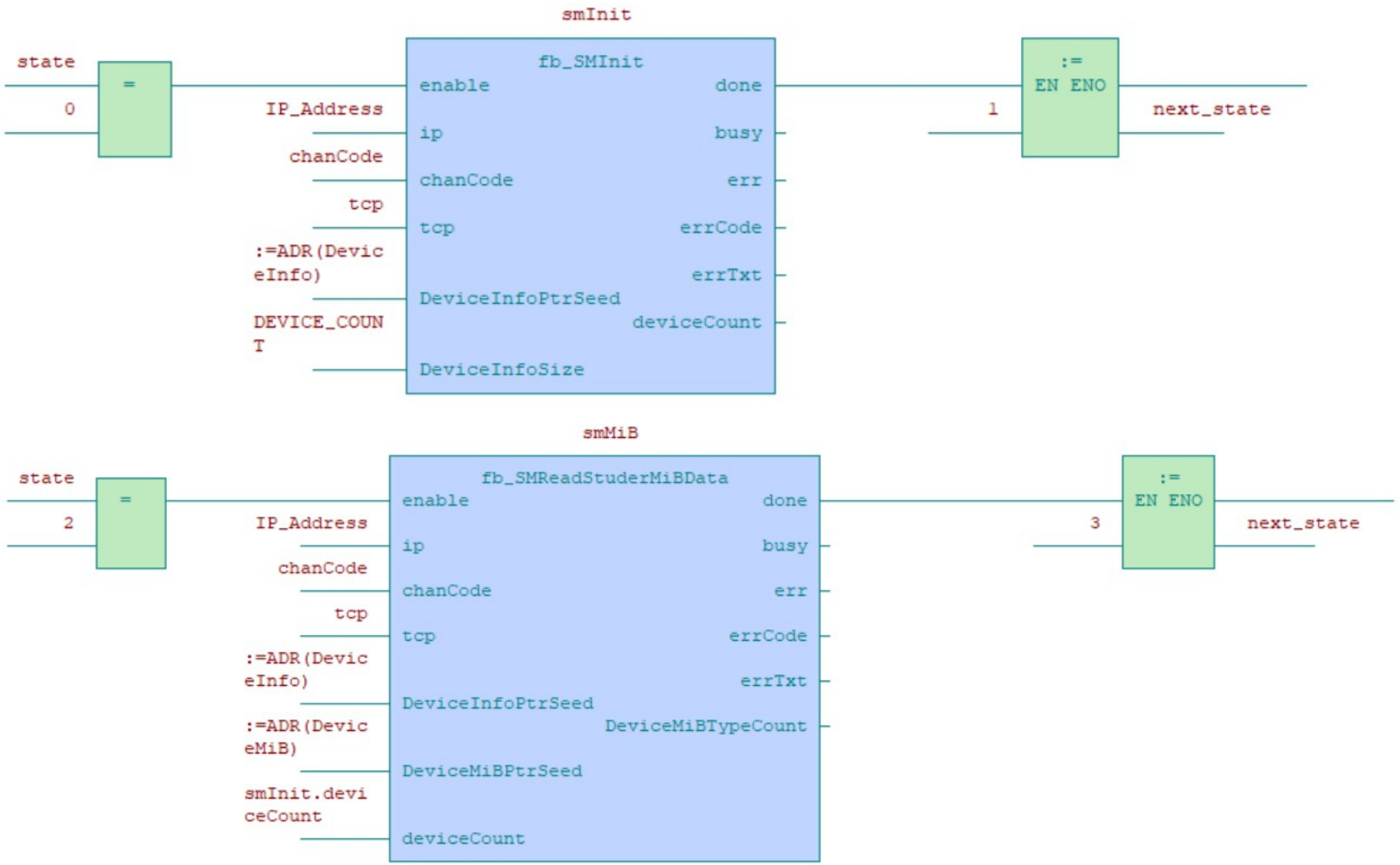
How do we achieve easy and fast implementation?

- Modbus variables organized in blocks (Sunspec)
- PLC library



- E.g.: Existing installation with 3 inverters from one manufacturer, 1 device breaks down, replaced with another one, no change in communication, neither in management

PLC Example in IEC 61131-3 FBD: Data Reading



PLC Example in IEC 61131-3 ST: Data Reading

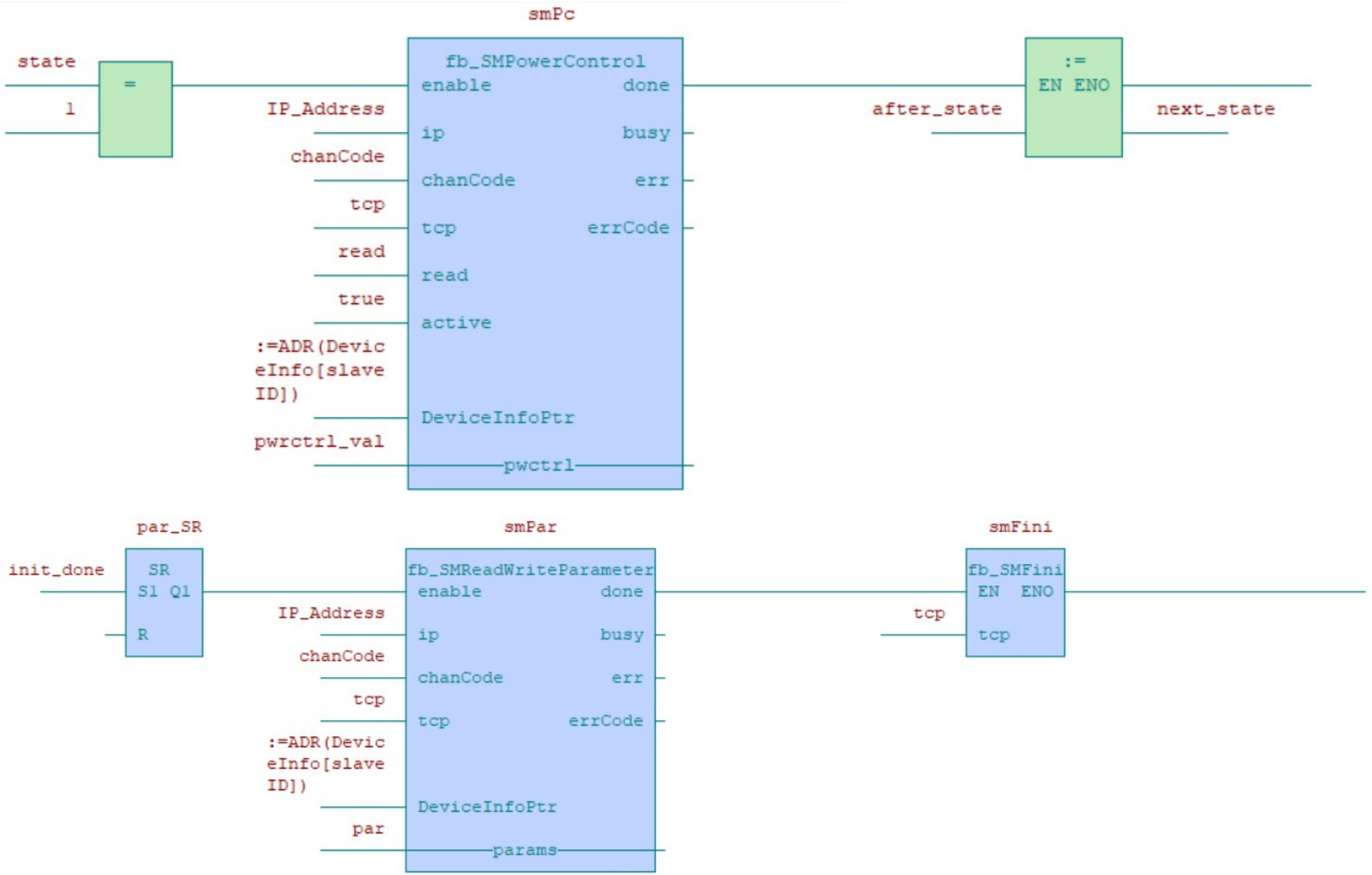
```
PROGRAM prgMain
  VAR_INPUT
  END_VAR
  VAR_OUTPUT
  END_VAR
  VAR
        enable : BOOL := 1;
        ip : STRING := '192.168.1.221:502';
        chanCode : UINT := ETH1_uni0;
        tcp : BOOL := TRUE;
        sm : fb_Solarmonitor10;

  END_VAR
  VAR_TEMP
  END_VAR

    sm(enable := enable, ip := ip, chanCode := chanCode, tcp := tcp);

END_PROGRAM
```

PLC Example in IEC 61131-3 FBD: Power Control



Solar Monitor

PLC Example in IEC 61131-3 ST: Power Control

```
PROGRAM prgMain
  VAR_INPUT
  END_VAR
  VAR_OUTPUT
  END_VAR
  VAR
        enable : BOOL := 1;
        unitID : USINT := 5;
        sm_pc : fb_PowerControl30;
        ip : STRING := '192.168.1.221:502';
        chanCode : UINT := ETH1_uni0;
        tcp : BOOL := TRUE;
        val : UINT := 60;
        active : BOOL := TRUE;

  END_VAR
  VAR_TEMP
  END_VAR

    sm_pc(enable := enable, ip := ip, unitID := unitID, chanCode :=
chanCode, tcp := tcp, pwctrl := val, active := active);

END_PROGRAM
```

Dashboard Example: normal, no consumption during day

Od 04.07.2018 Do 04.07.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 2.94 [kW]
Energy: 23.69 [kWh]

Consumption

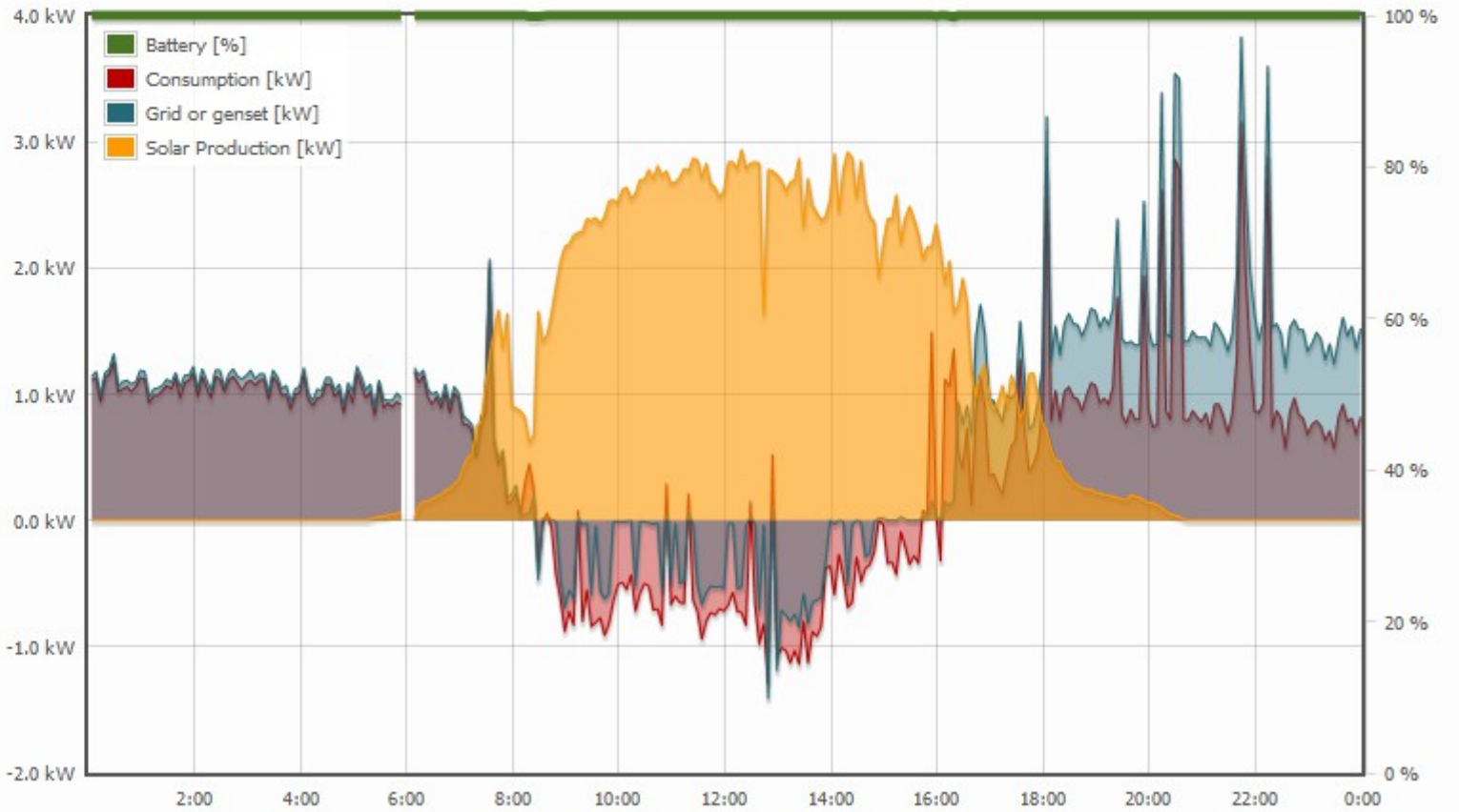
Max: 3.16 [kW]
Energy: 11.33 [kWh]

Grid or genset

Max: 3.83 [kW]
Energy: 18.13 [kWh]

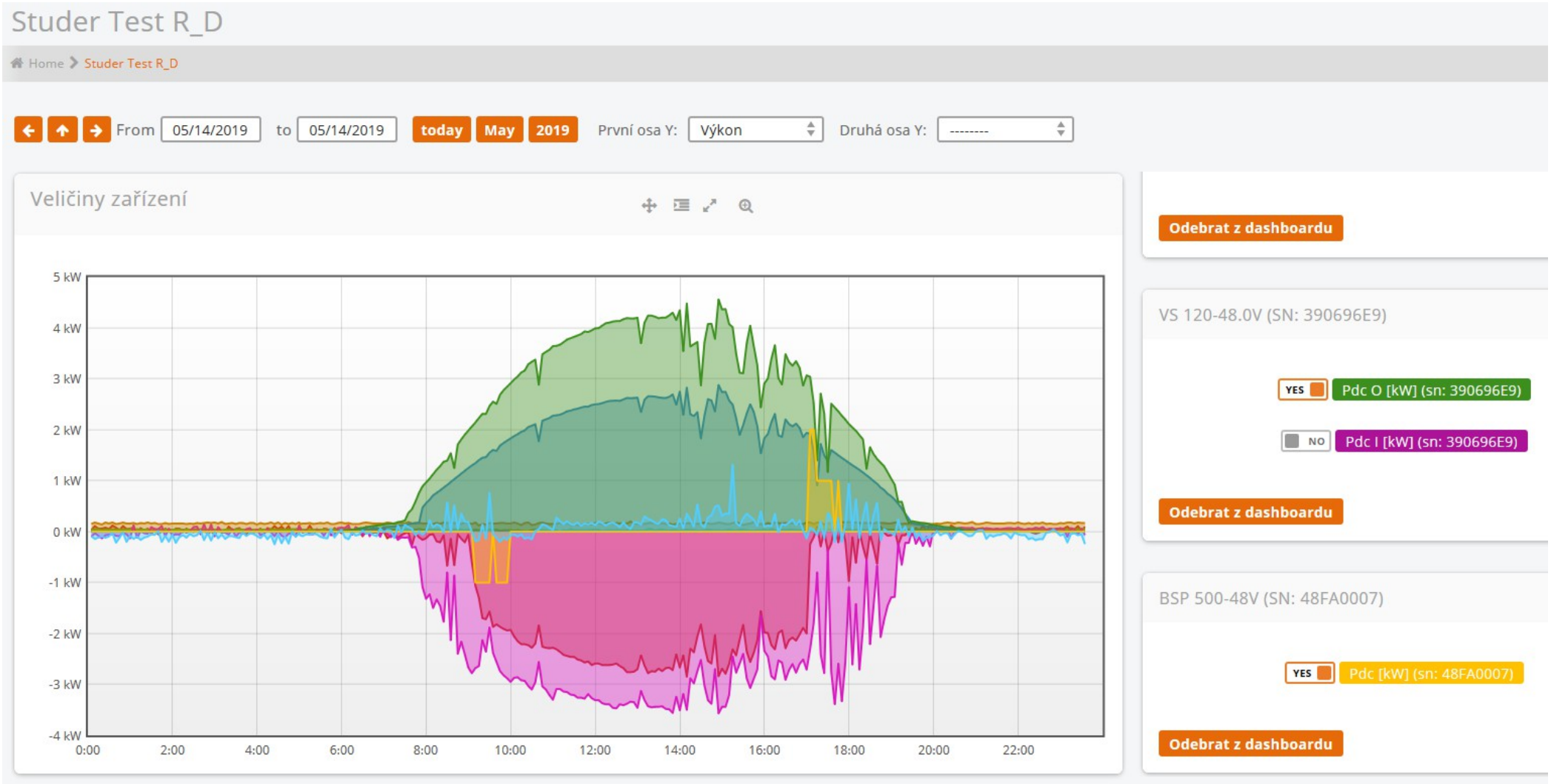
Battery SOC

Max: 100.00 [%]
Min: 99.81 [%]



Custom Graph Example: data from different devices

Custom Graph: inverters, trackers, BSP, meters



Graph Example: normal, consumption during day

Od 30.07.2018 Do 30.07.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 3.00 [kW]
Energy: 25.23 [kWh]

Consumption

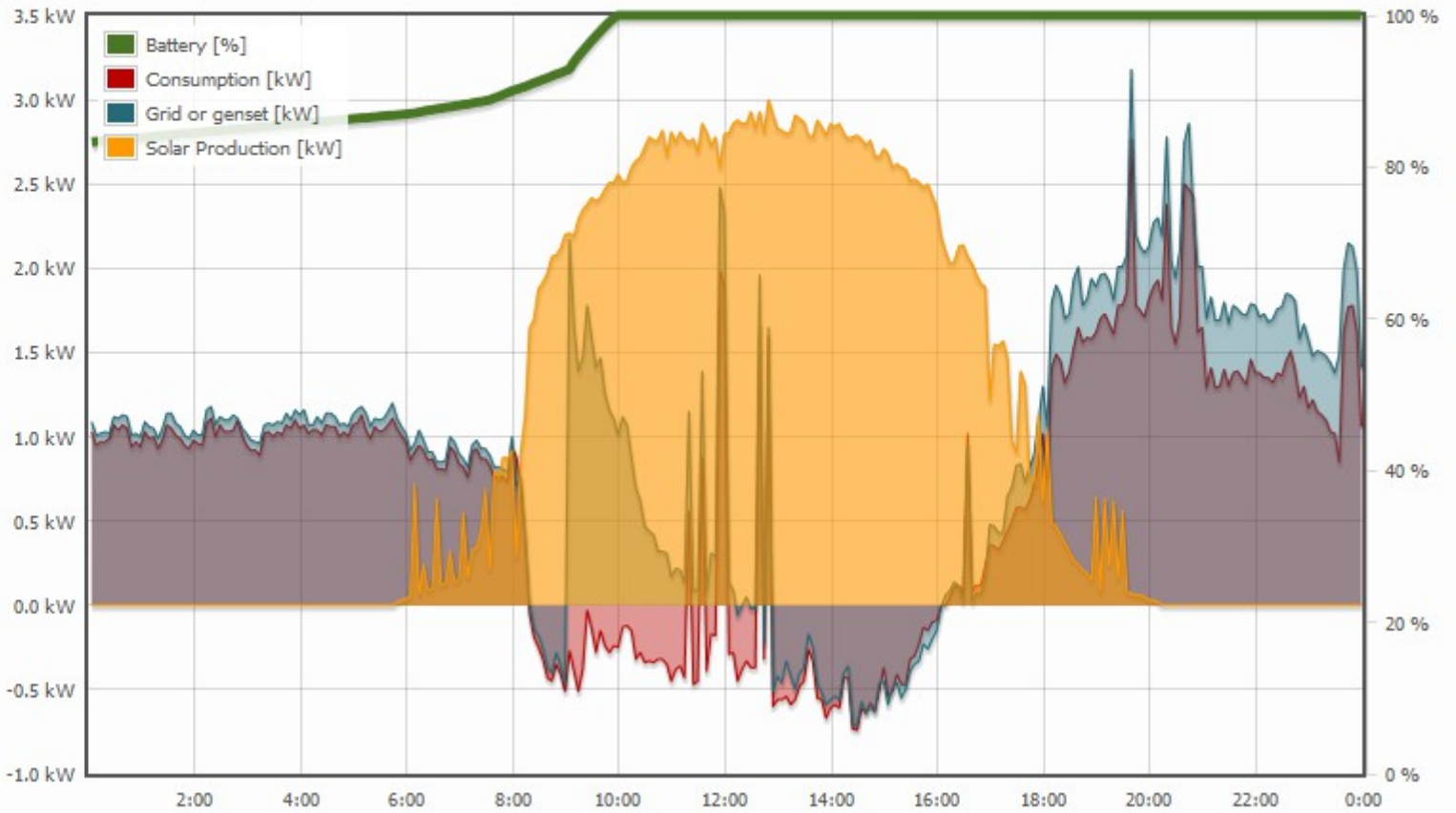
Max: 2.77 [kW]
Energy: 16.04 [kWh]

Grid or genset

Max: 3.18 [kW]
Energy: 22.24 [kWh]

Battery SOC

Max: 100.00 [%]
Min: 83.31 [%]



Graph Example: increasing consumption = ?

Od 27.08.2018 Do 27.08.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 5.86 [kW]
Energy: 33.14 [kWh]

Consumption

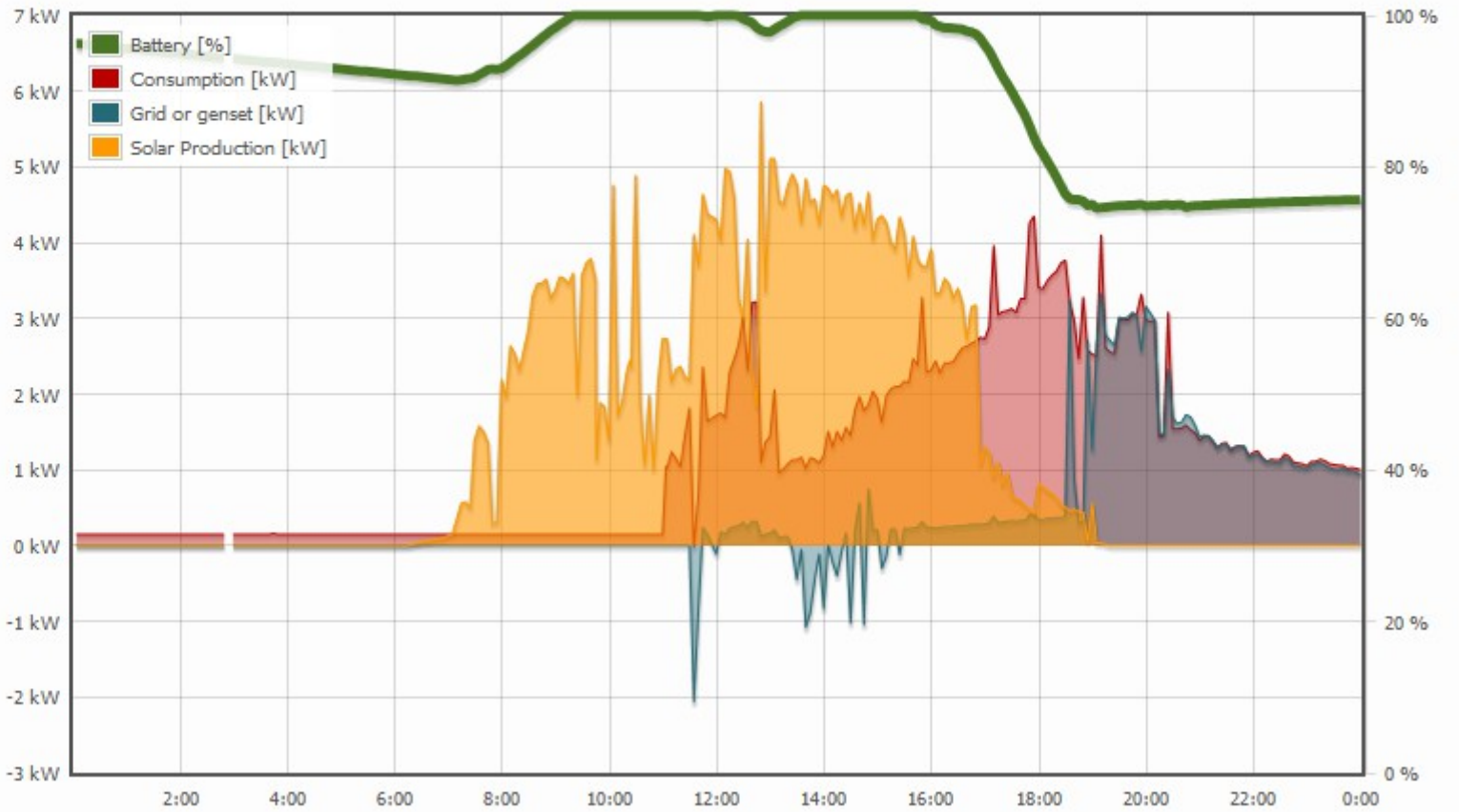
Max: 4.35 [kW]
Energy: 28.23 [kWh]

Grid or genset

Max: 3.33 [kW]
Energy: 9.62 [kWh]

Battery SOC

Max: 100.00 [%]
Min: 74.56 [%]



Graph Example: afternoon consumption discharge battery

Od 28.07.2018 Do 28.07.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 3.34 [kW]
Energy: 13.23 [kWh]

Consumption

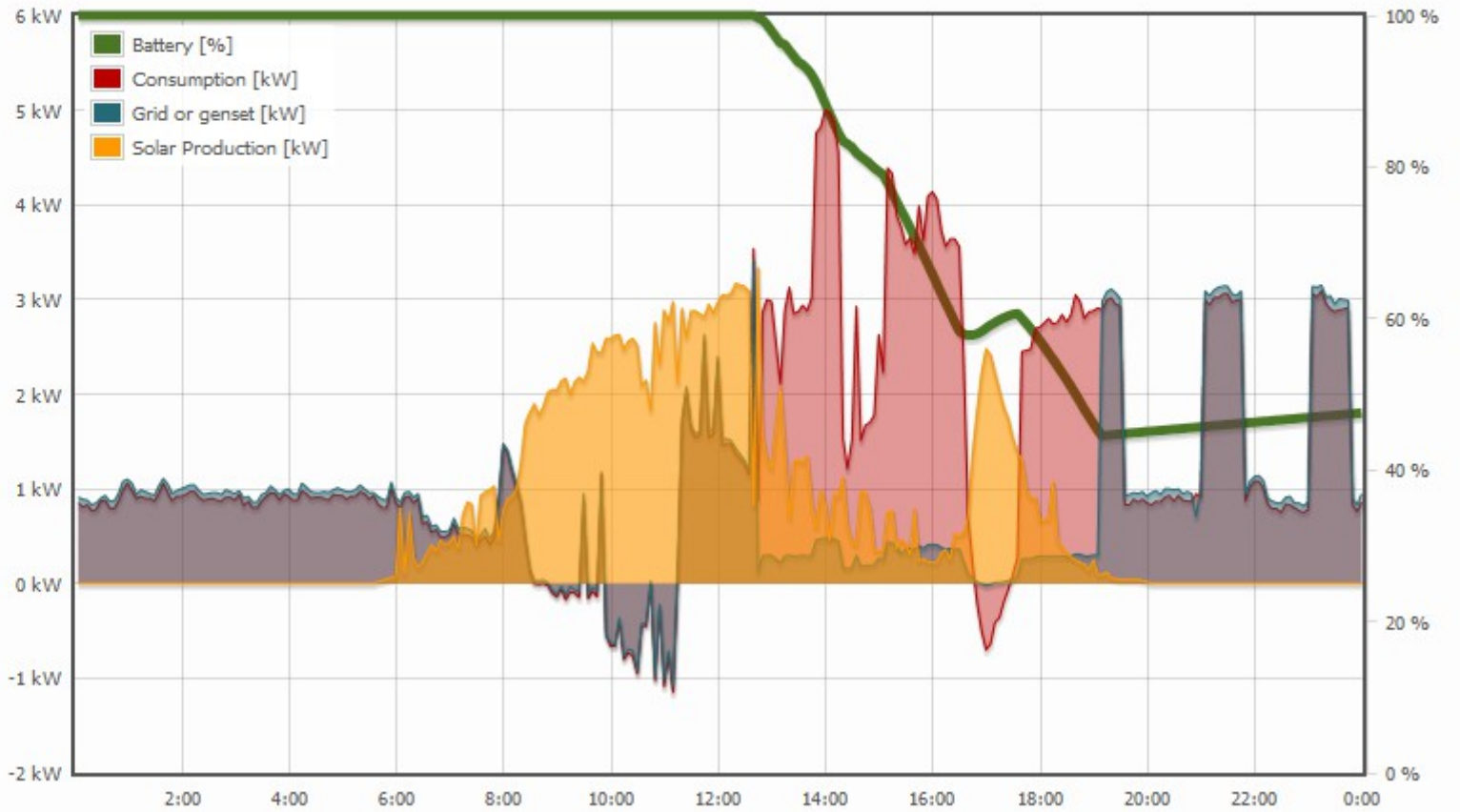
Max: 5.00 [kW]
Energy: 25.97 [kWh]

Grid or genset

Max: 3.42 [kW]
Energy: 11.88 [kWh]

Battery SOC

Max: 100.00 [%]
Min: 44.50 [%]



Graph Example: evening consumption, night peaks

Od 30.08.2018 Do 30.08.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 4.40 [kW]
Energy: 25.54 [kWh]

Consumption

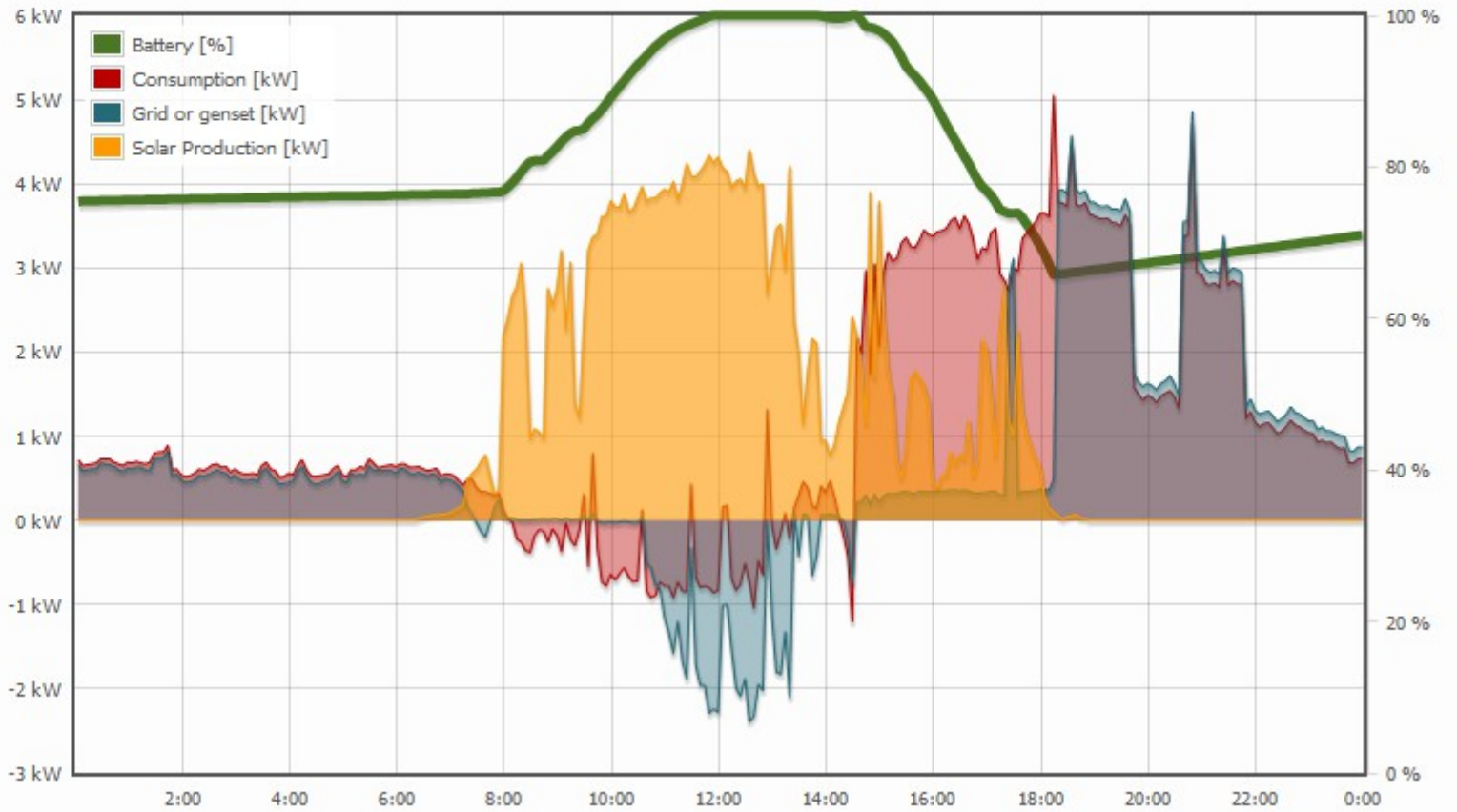
Max: 5.05 [kW]
Energy: 27.15 [kWh]

Grid or genset

Max: 4.86 [kW]
Energy: 14.68 [kWh]

Battery SOC

Max: 100.00 [%]
Min: 65.75 [%]



Graph Example: same situation + next day (charging)

Od 30.08.2018 Do 31.08.2018 dnes listopad 2018

Dashboard

Solar Production

Max: 4.40 [kW]
Energy: 45.60 [kWh]

Consumption

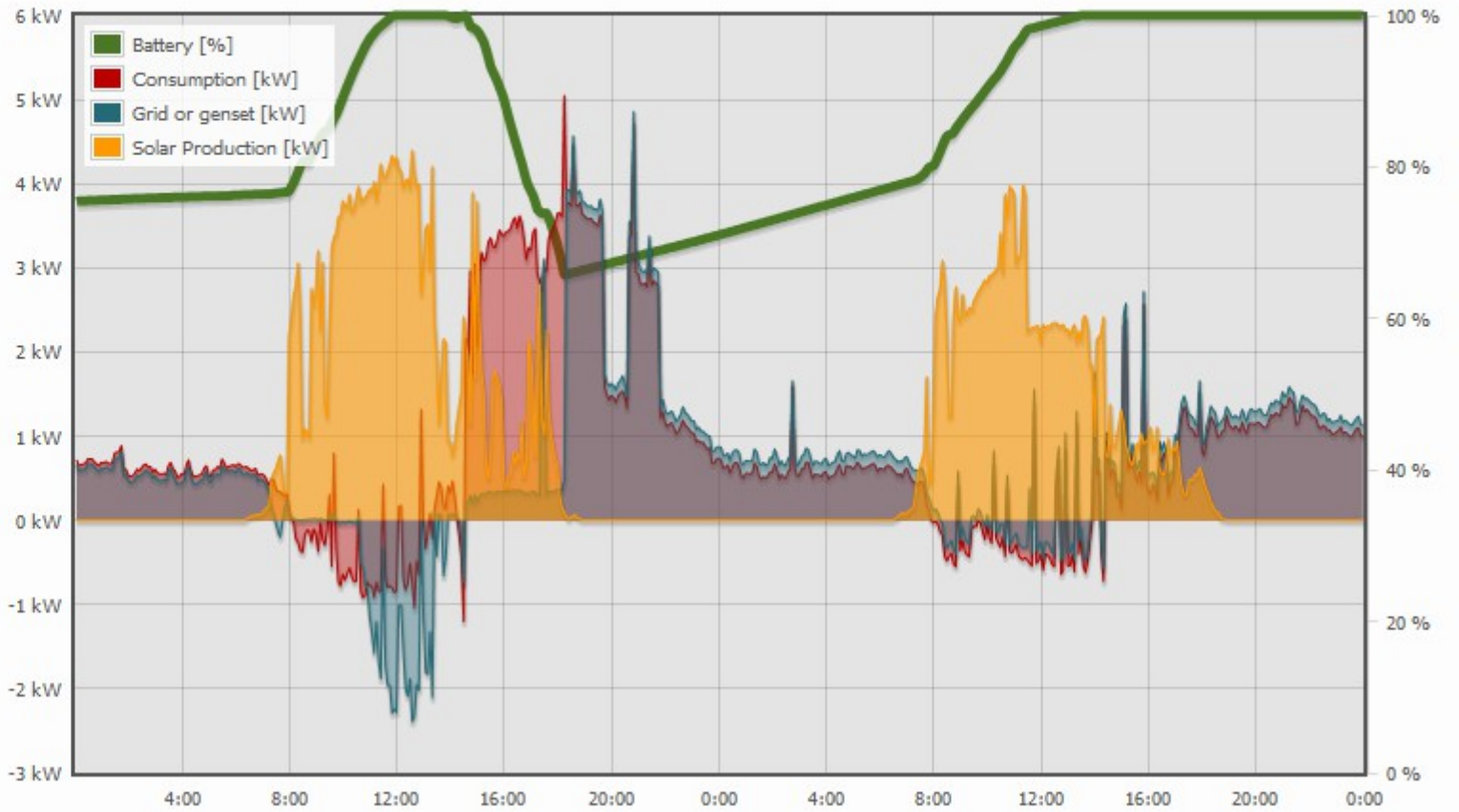
Max: 5.05 [kW]
Energy: 40.26 [kWh]

Grid or genset

Max: 4.86 [kW]
Energy: 31.26 [kWh]

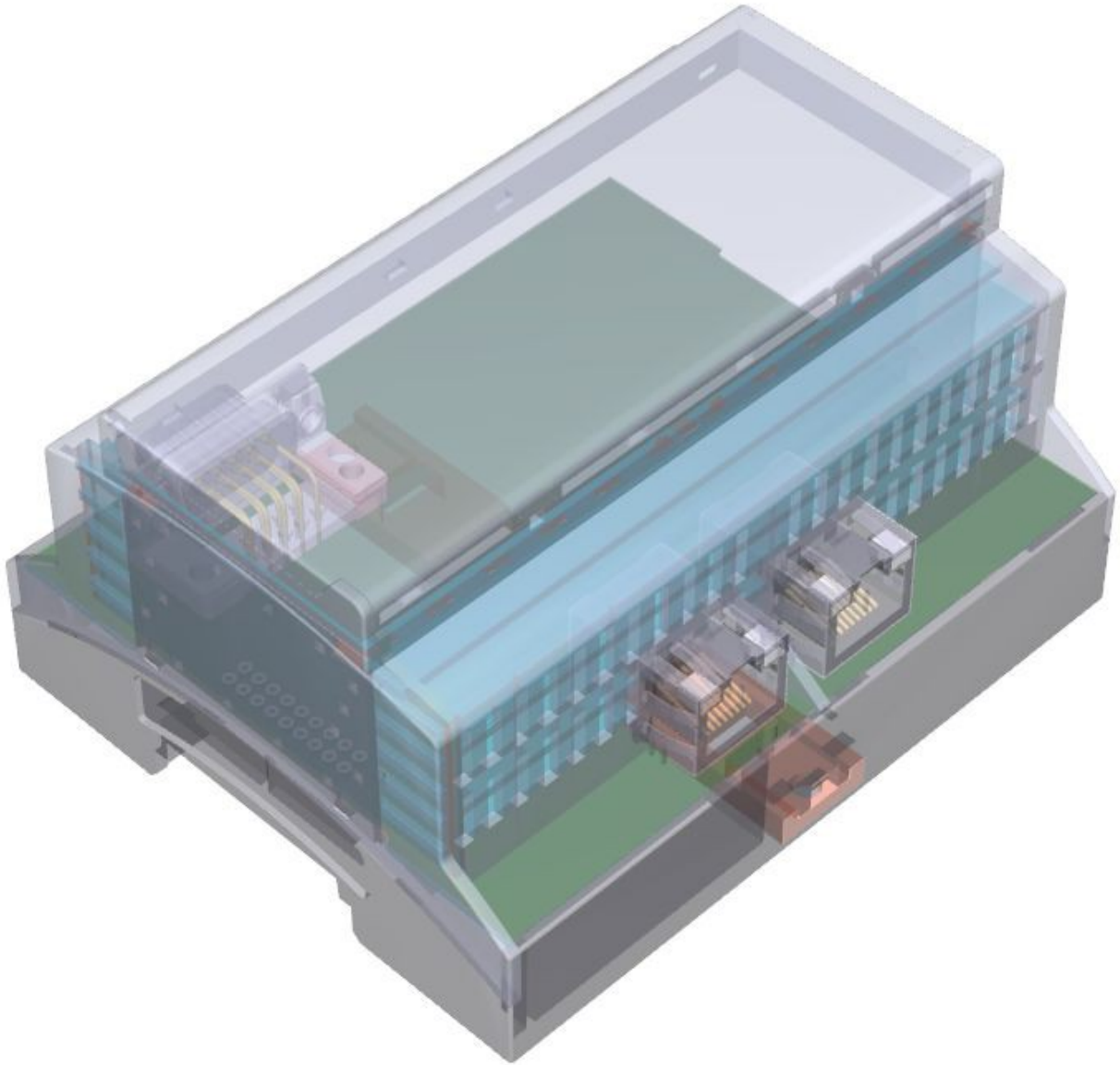
Battery SOC

Max: 100.00 [%]
Min: 65.75 [%]



Planned … „miniCloud“ for DIN Rail

- For strict „in-house“ solutions
- Suitable for apartment house energy billing, banks
- 1x Gb ethernet
- 2x ARM Cortex A7, 1 GHz
- 1-2 GB RAM DDR3L 1.600 MT / s
- SATA SSD



Any questions are welcome!

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