

Energy Gateway for Renewables

Monitoring, Control & Maintenance

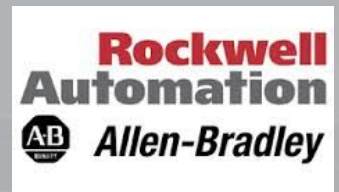
Dušan Ferbas

Solar Monitor s.r.o.
Czech Republic

Solar Monitor – Company History



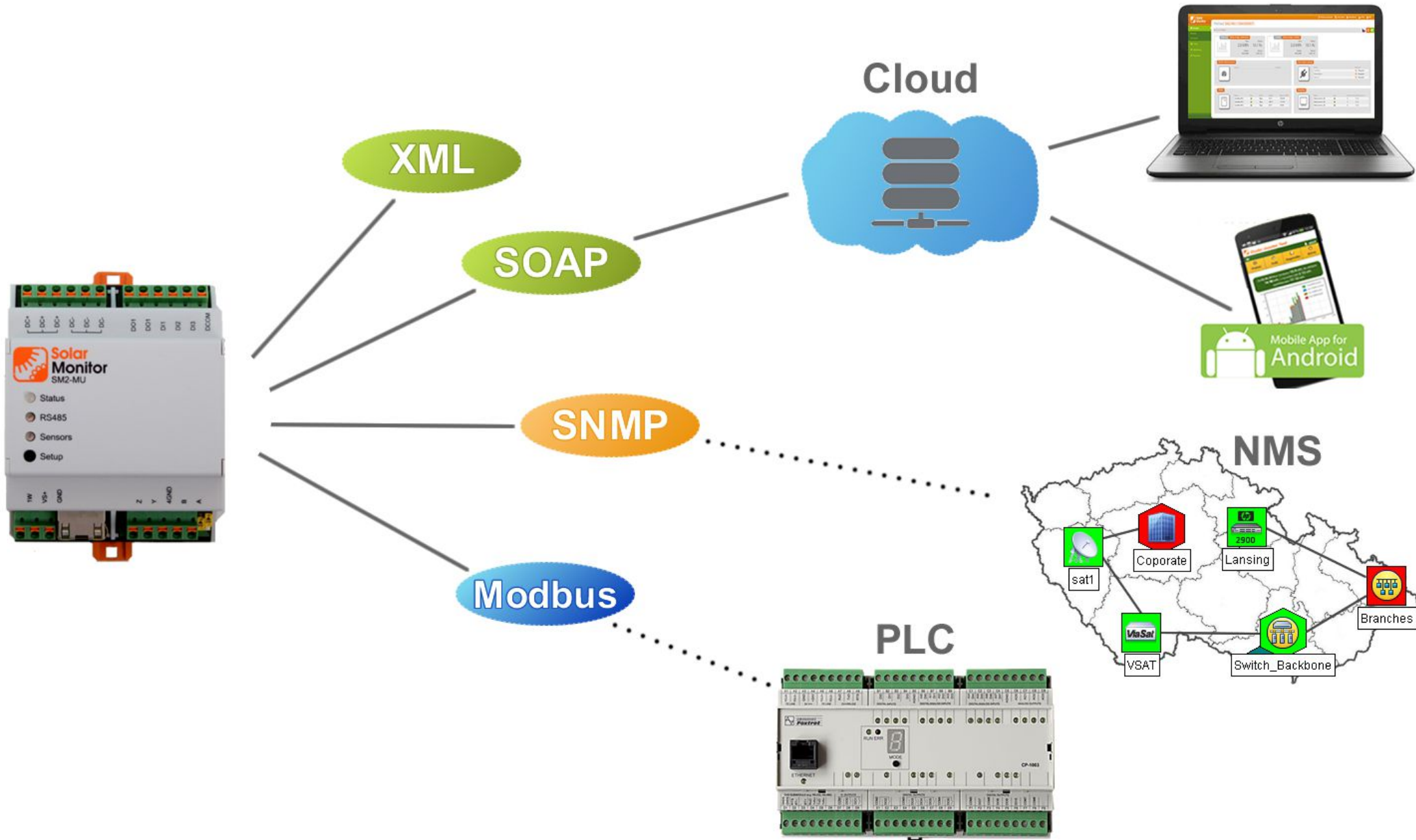
- 1997 – start with embedded systems
- 2004 – Embedded Technologies s.r.o.
- 2009 – Solar Monitor v1
- 2011 – Solar Monitor v2
- 2012 – Solar Monitor s.r.o.
- 2014 – PRE a.s.
- 2016 – ČEZ Solární s.r.o.,
Studer-Innotec SA,
Steca Elektronik GmbH



Solar Monitor – Solution Areas



Software Interface Overview



Solution Examples

- Initial system setup and tuning
- Maintenance & support (mix of inverter types)
- LCD display visualization
- Detailed visualization of energy system
animated icons – Controlweb, Regulus, Reliance
- Energy gateway for PLCs (Modbus)
automation, smart houses
- Gateway for Network Management Systems (SNMP)
(NMS) Telecommunications
- Data source for web service oriented servers

Design Highlights

- Low power consumption (1.2 W)
- No electrolytic capacitors (long lifetime)
- DIN rail format
- Coupling with DIN rail bus requires no wires
- Modular system to suit user applications at minimal cost
- Fast pulse counters
- Own design (other custom modules can be developed)

Software Highlights

- Unused software does not consume any power
- Loadable software modules
- Solution extensibility
- Cloud architecture also for
 - power consumption tracking
 - sensor logging
 - storing of periodic (historical) PLC data
- Back channel for device maintenance w/o fixed IP address
- Own design (implementation of new functionalities)

Product Components

Modular solution

Cost effective sensors

Monitoring of



Inverters



String Boxes



Electricity Meters
(AC, DC)



Sensors (Irradiation,
Temperature, Wind)



Safety Relays



Door Contact
(Theft Protection)



Overvoltage
(Lightning Protection)



Supported Devices

Supported
Inverters

AEG

Power Solutions



Conext

Danfoss



DIEHL



KOSTAL



OMRON



POWER-TRAP®



SIEMENS

siliken
innovation experience



Sunville

VACON®

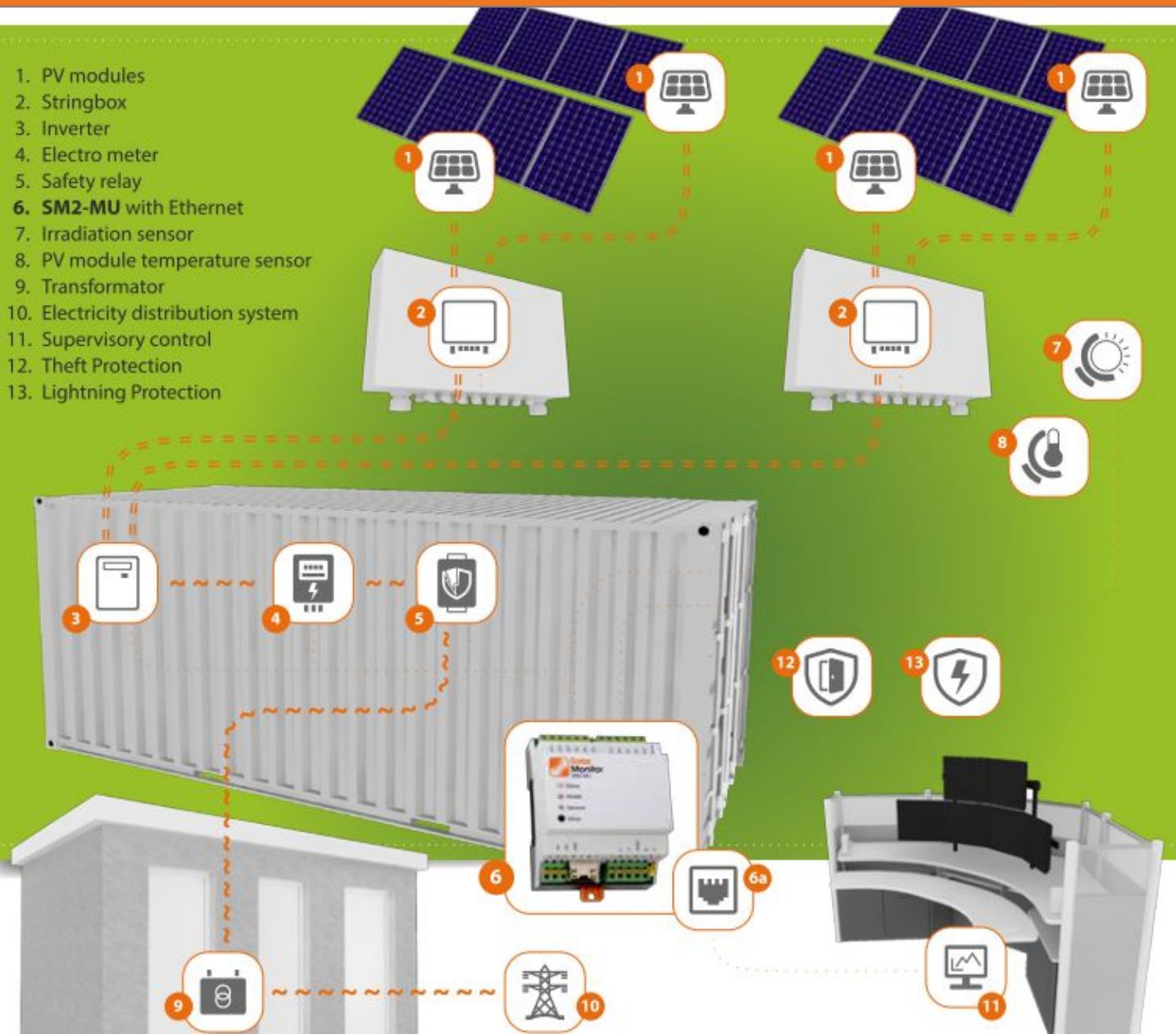
xantrex

Solar Parks

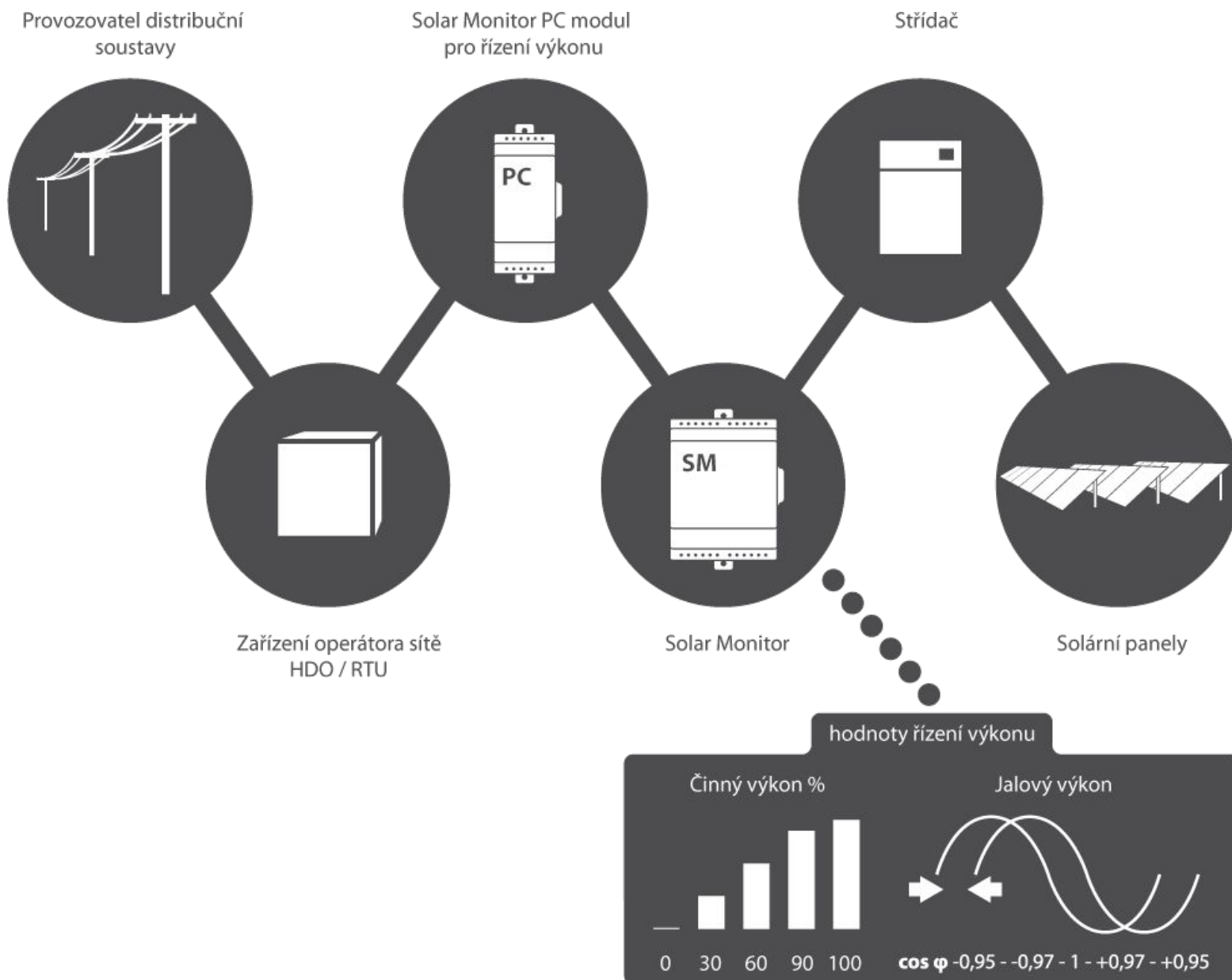
1. PV modules
2. Stringbox
3. Inverter
4. Electro meter
5. Safety relay
6. **SM2-MU** with Ethernet
7. Irradiation sensor
8. PV module temperature sensor
9. Transformer
10. Electricity distribution system
11. Supervisory control
12. Theft Protection
13. Lightning Protection

Monitoring of

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



Power Control



Monitoring PV Plant

One Solution
for all inverter brands
& One Web Portal
for all your plants

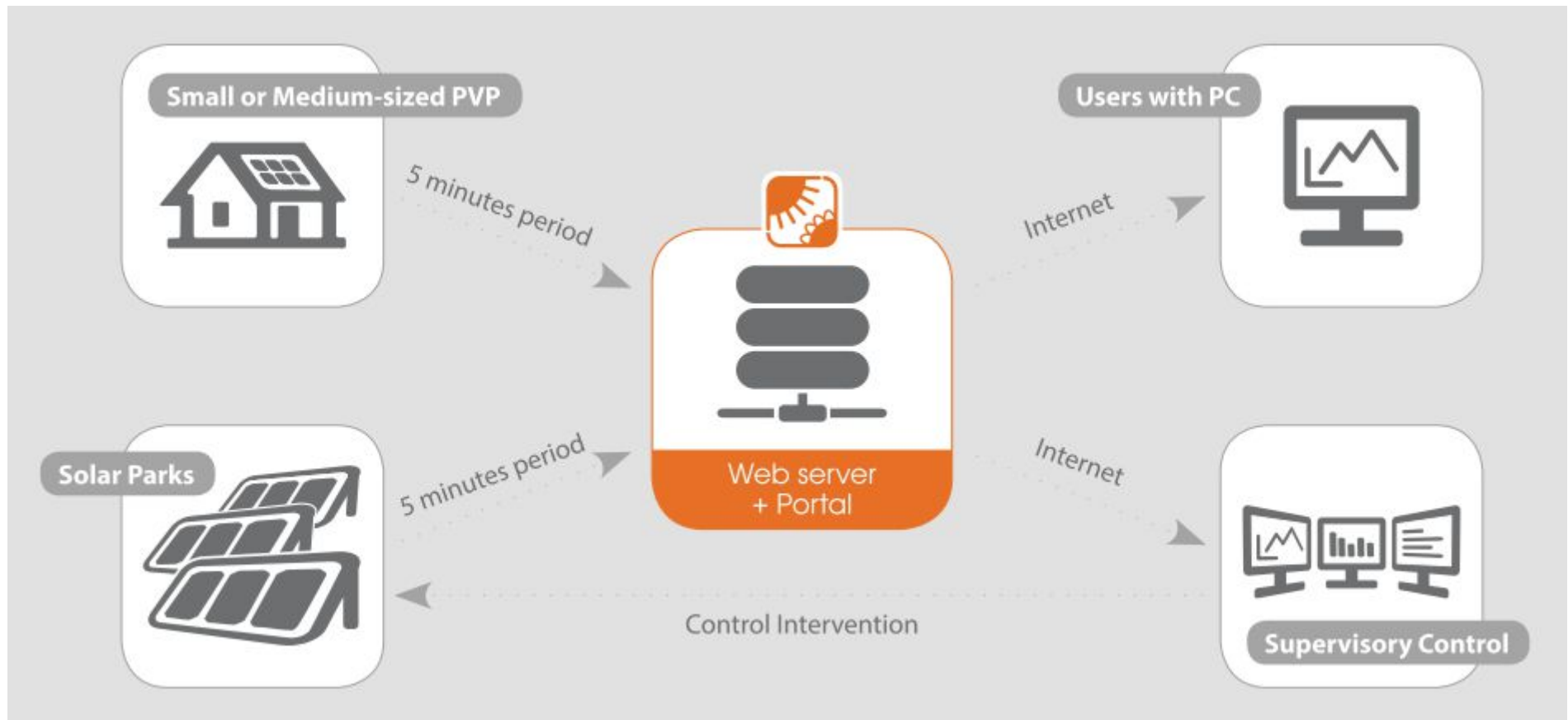
1. PV modules
2. Inverter
3. Electro meter
4. SM2-MU with Ethernet
5. Irradiation sensor
6. PV module temperature sensor
7. Boiler
8. Storage heater
9. Electricity distribution system



Local
network
/ Internet



Remote Monitoring & Web Portal



Smartphone Application

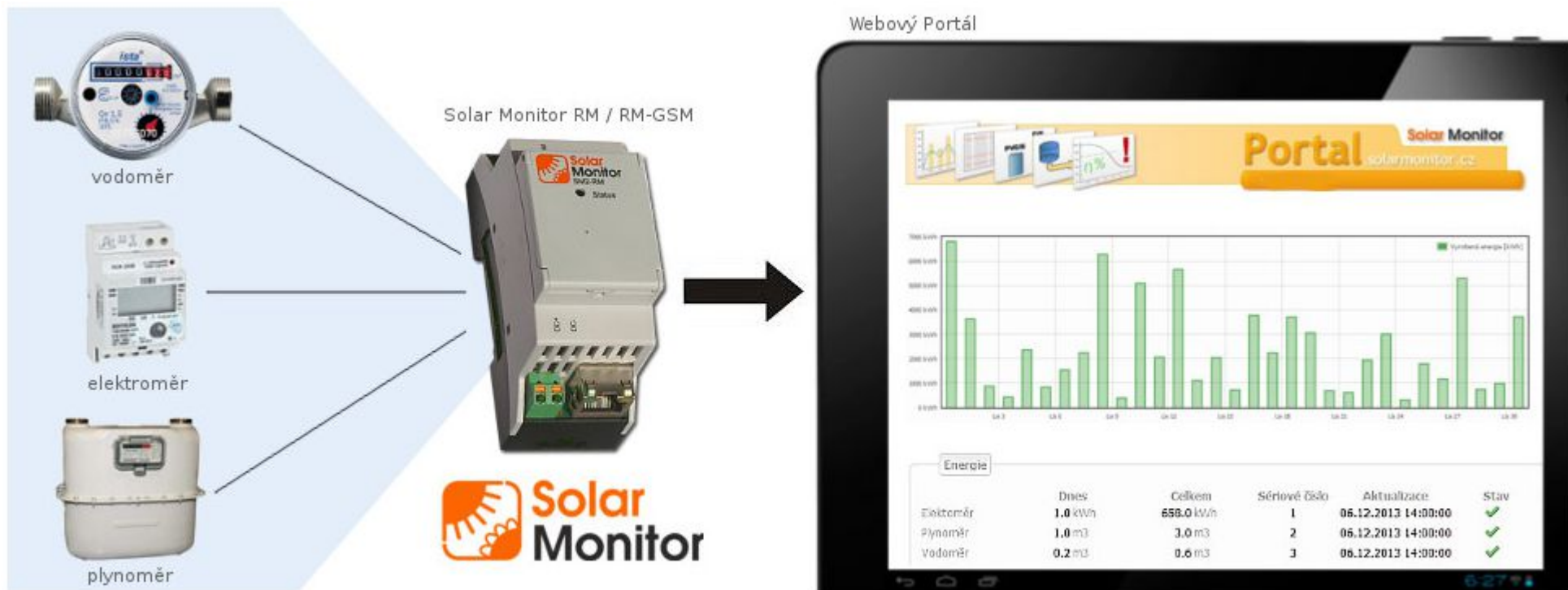
- comfortable remote PV plant monitoring via smartphone or tablet
- monitoring current energy production
- monitoring data from sensors and other connected devices
- notification of alarms (inverter, batteries, trackers, etc.)
- diagnosis with all the available values from the device
- production data in figures and clearly arranged graphs



Online Meter Reading

You can control your PV plant's production, energy consumption, water and gas consumption. The latest Solar Monitor product together with the web portal makes remote monitoring very easy and comprehensible.

Remote reading via Solar Monitor system is available for any devices with pulse output S0. In particular electro, water and gas meters.



LCD Visualisation

Visualisation of the PV plant on LCD panel is very popular solution of presenting technologies to schools, offices or municipal authorities. Layout is designed according to customers requirements.

We deliver to you

LCD screen
of required
dimensions



Datalogger

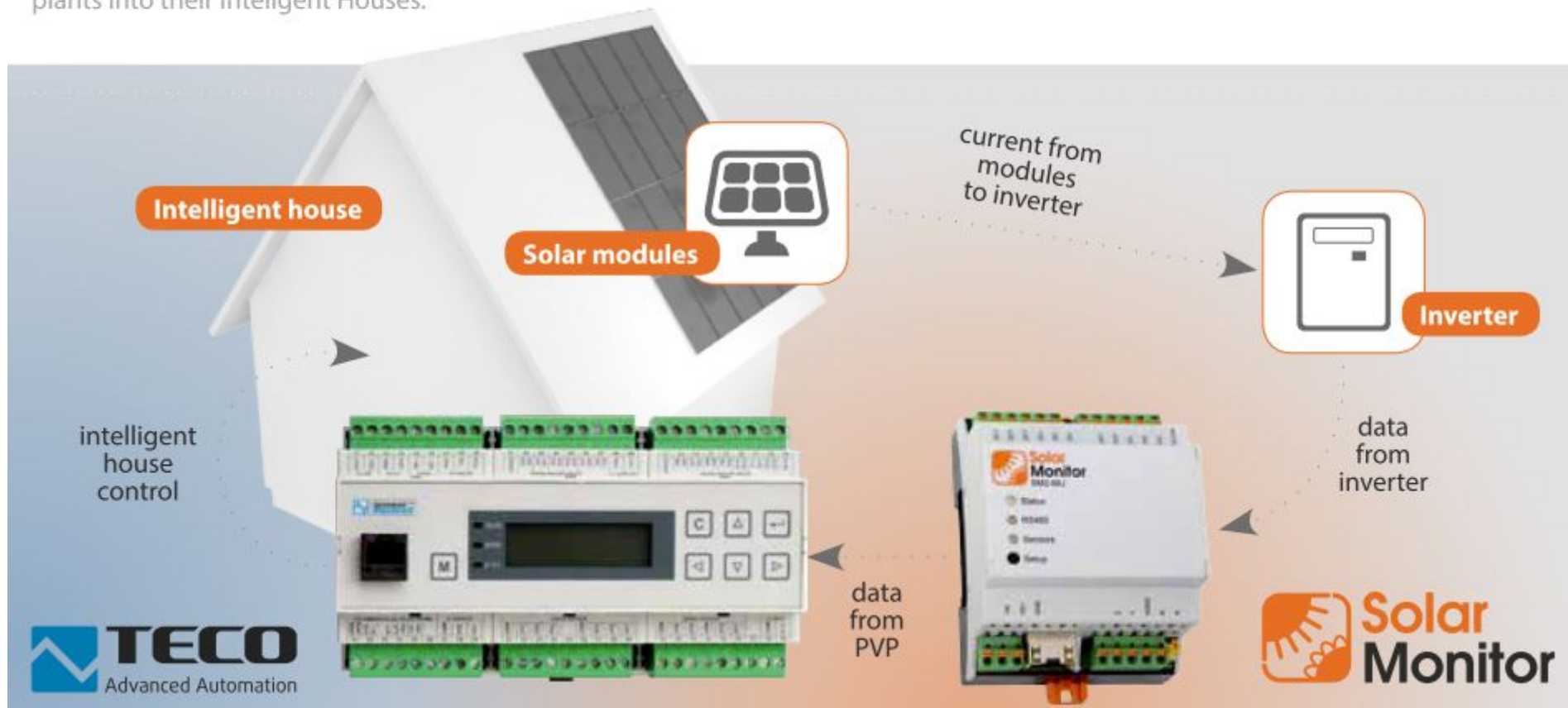


Smart Houses

M2M

Solar Monitor cooperates with several information systems which allows to process data from PV plants. These are e.g. Dispatcher Control Systems but mainly Home Automation Systems that can thus integrate any photovoltaic inverter from established manufacturers into smart house installation.

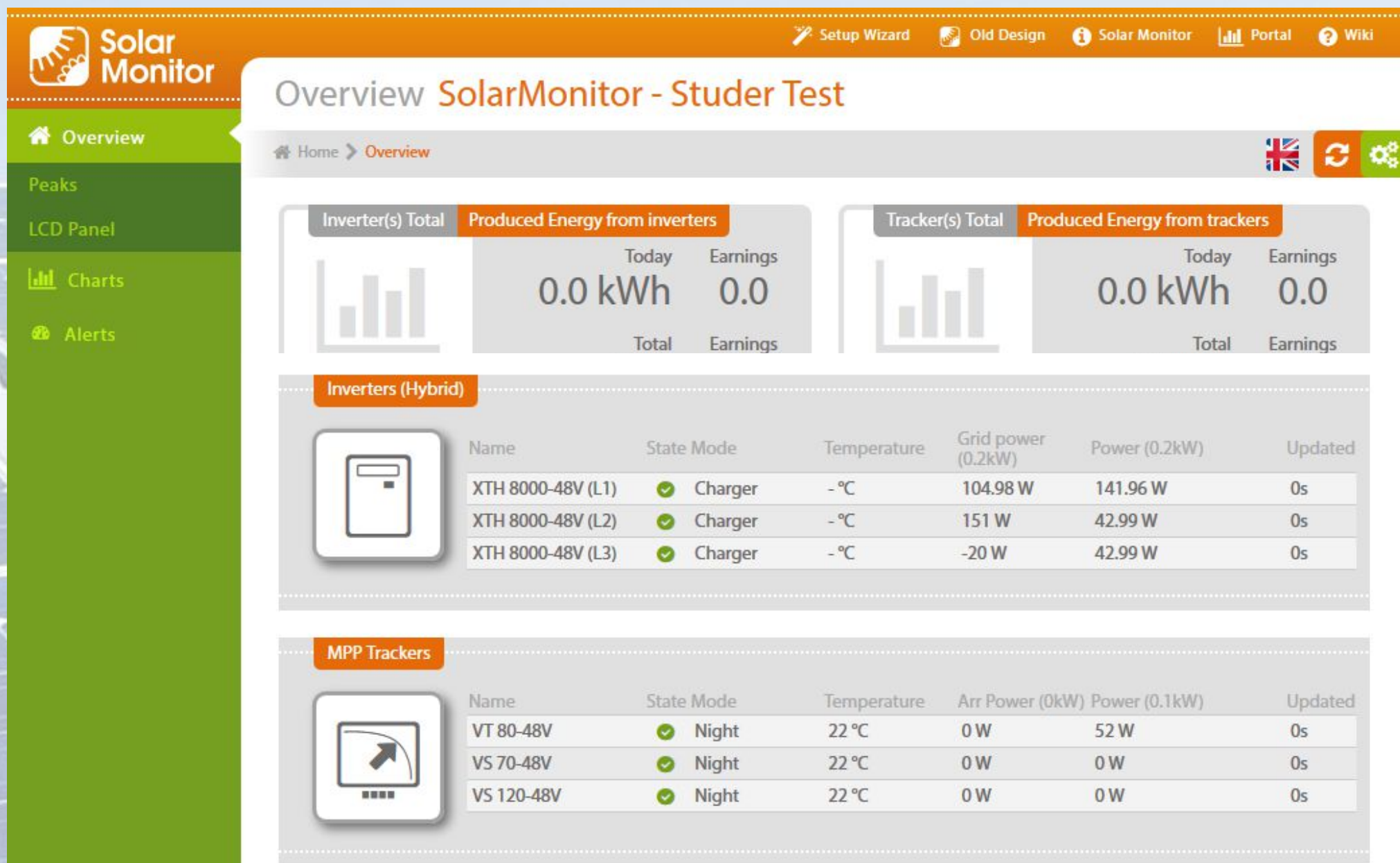
In November 2013 TECO company launched library SolarMonitorLib, that significantly increases Foxtrot PLC's ability to integrate PV plants into their Intelligent Houses.



Advantages, Highlights (LAN)

- Support for Studer-Innotec products
- Ease of use, setup wizard
- Responsive web design (tablets, mobiles)
- Sensors (1-Wire, industrial 0-20 mA / 0-10 V)
- Various technologies (inverters, meters, heat pumps)
- Alarms (failures, event handling, ESS, inputs - surge protectors)
- Switching outputs due to triggers (power, temperature)
- Energy gateway to other systems (M2M – NMS, PLC)
- Active and reactive power control
- Different transport to cloud (ethernet, GPRS)

Webserver of the SM2-MU: Responsive Design



Webserver of the SM2-MU: Setup Wizard

The screenshot shows the 'SolarMonitor - Studer Test Devices' setup wizard, step 2. The interface includes a sidebar with navigation links: Overview, Charts, Alerts, and Settings. The main content area is titled 'Interface Settings' and shows the 'RS485 Interface (A,B)' configuration. A dropdown menu for 'Protocol Type' is open, listing various manufacturers including Studer Innotec (which is highlighted), MorningStar, Omron, Refusol, Riello UPS, Santerno, ServeMaster, Schneider (SunEzy), Siemens, Siliken, SMA (SMA-Net), SMA (Sunny-Net), SolarMax, Solutronic, Sungrow, Sungrow (Modbus), Sunville, Sunways, Vacon, and Xantrex. The 'Baud Rate' is set to 115200 Bd. On the right, a vertical sidebar lists the steps of the wizard: 1 General Settings, 2 Devices Device Detection (current step), 3 Sensors Sensor Detection, 4 Counters Counter Settings, 5 E-mails & SMS Recipient Settings, 6 Portal Send to portal, 7 Date & Time Time from internet, and 8 Summary Summary of all settings. Navigation buttons for BACK and NEXT are at the top right. The footer of the interface reads 'onitor s.r.o. | All rights reserved'.

Solar Monitor

Setup Wizard Old Design Solar Monitor Portal Wiki

SolarMonitor - Studer Test Devices 2 SETUP WIZARD

Interface Settings

RS485 Interface (A,B)

Protocol Type: Studer Innotec

Baud Rate: 115200 Bd

RS4 RS2 Ne

1 General Settings

2 Devices Device Detection

3 Sensors Sensor Detection

4 Counters Counter Settings

5 E-mails & SMS Recipient Settings

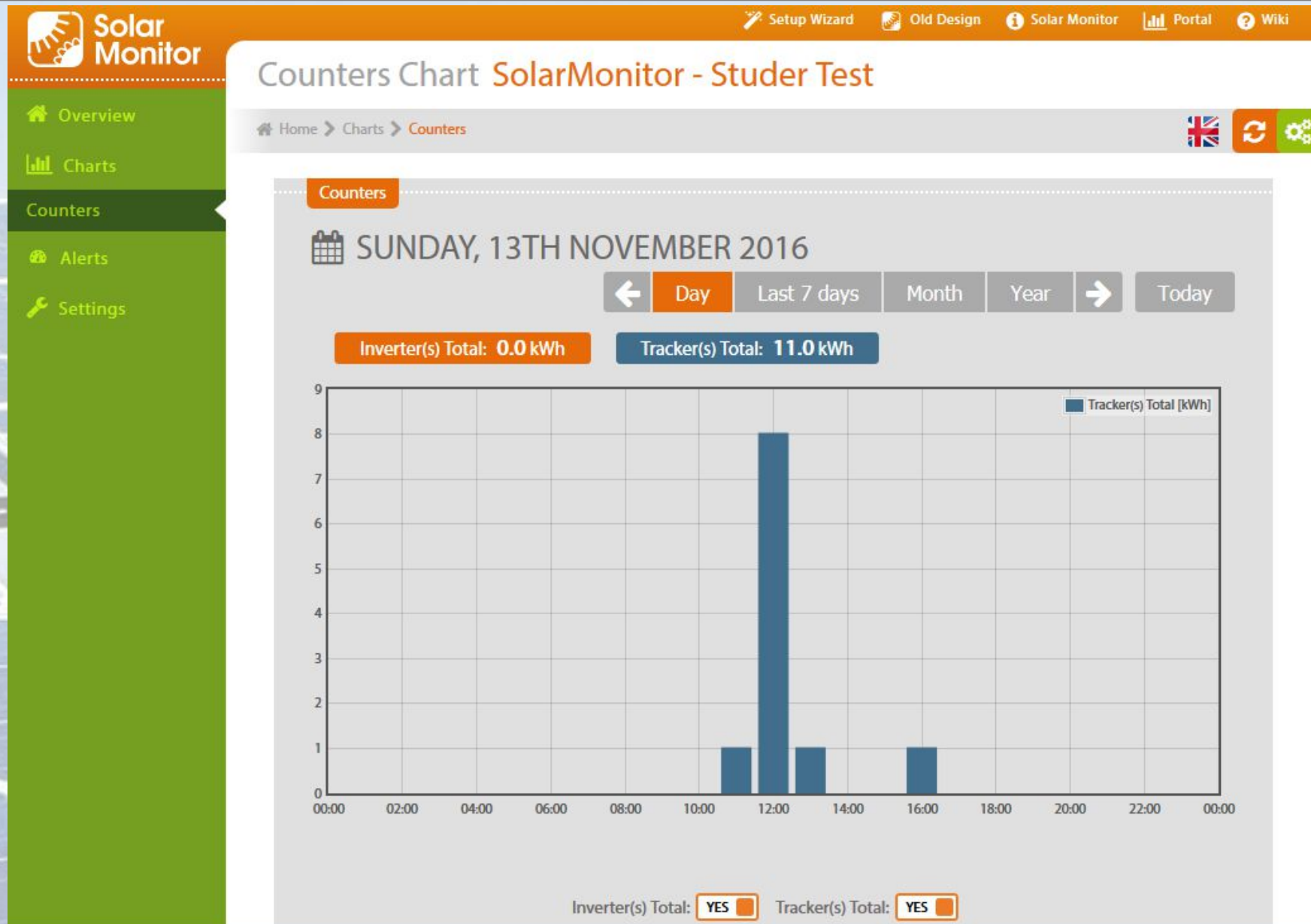
6 Portal Send to portal

7 Date & Time Time from internet

8 Summary Summary of all settings

onitor s.r.o. | All rights reserved

Webserver of the SM2-MU: Energy Charts




Advantages, Highlights (WAN)

- Cloud DB + web app
- Mobile app
- Windows gadget
- No need for public IP address
- All energies overview
- Online data, effortless graphs
- Management of different manufacturer products
- Maintenance, support (back channel – config, firmware)
- User privileges (delegating access)
- Customized design, separate databases

Name

Password


































Login

 EN

?

Show 25 entries

Search

	Device	Last Update	Produced [MWh]	Peak Power [kWp]	Current power [kW]		
	SVP Solar - Říčany	05.02.2015 12:06:07	11.675	5	1.757	35%	
	Praha 4 - Podolí	27.09.2014 12:35:39	49.944	3.2	0	0%	
	Solar Lhota	26.09.2014 21:44:02	---	---	---	0%	
	FVE Tesla - Praha-východ	05.02.2015 12:08:50	28.54	5.7	4.072	71%	
	FVE Slavkov	05.02.2015 12:01:44	1207.968	258.7	0	0%	
	FVE_Poštorná	05.02.2015 12:05:01	7993.439	1656	0	0%	
	FVE TREBOVA	05.02.2015 12:04:59	---	---	---	45%	
	X	05.02.2015 12:08:04	4.331	4.5	3.87	86%	
	FVE Strojírny Olšovec	05.02.2015 12:05:00	---	---	---	11%	
	FVE_Sudomerice II	18.10.2014 05:50:09	0	500	0	0%	
	Nettl	05.02.2015 12:06:00	16.512	5	0	0%	
	FVE Osadní	05.02.2015 12:09:03	---	---	---	58%	
	FVE Lodherov	05.02.2015 12:05:02	---	---	---	19%	
	FVE Choustníkovo Hradiště II	05.02.2015 12:05:06	---	---	---	45%	
	RD-Bzenec	05.02.2015 12:05:13	39.667	6.4	4.808	75%	
	Přelouč	05.02.2015 12:05:00	8.643	4.8	0	0%	
	FVE Licno	05.02.2015 12:05:12	---	---	---	64%	
	FVE Choustníkovo Hradiště I	05.02.2015 12:05:11	---	---	---	35%	

Actual state



State	 Online
Last Update	02.02.2015 09:46:10
Peak Power	5.0 kWp
Current power	0.352 kW
Today's Energy Production	0.2 kWh
Today's light exposure	43.3 Wh/m2




Grid Operator Reports

[Start Service](#)
[More information](#)


Energy

	Today	Total	Serial Number	Last Update	State
Electrometer	0.2 kWh	11658.4 kWh	1	02.02.2015 09:46:10	

Sensors

	Value	Daily Average	Serial Number	Last Update	State
Module Temperature	0.4 °C	-1.4 °C	16194	02.02.2015 09:46:10	
Ambient Temperature	3.1 °C	2.2 °C	14797	02.02.2015 09:46:10	
Irradiation	4.4 W/m2	4.4 W/m2	54920	02.02.2015 09:46:10	



Back



Overview



Graphs



Diagnostics



Alarms



Export



From 01/01/2014

to 12/31/2014

today

February

2015

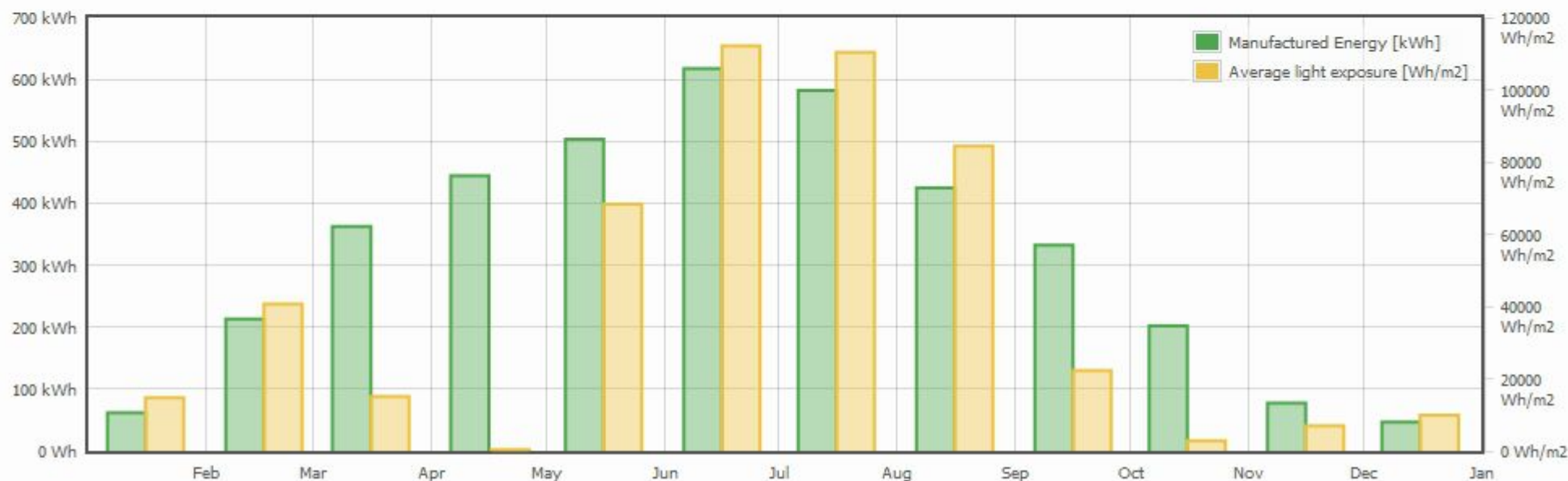
Power production/consumption

Type of production: Electrometer (SN: 1)

Irradiance Sensor: Osvit (SN: 54920)

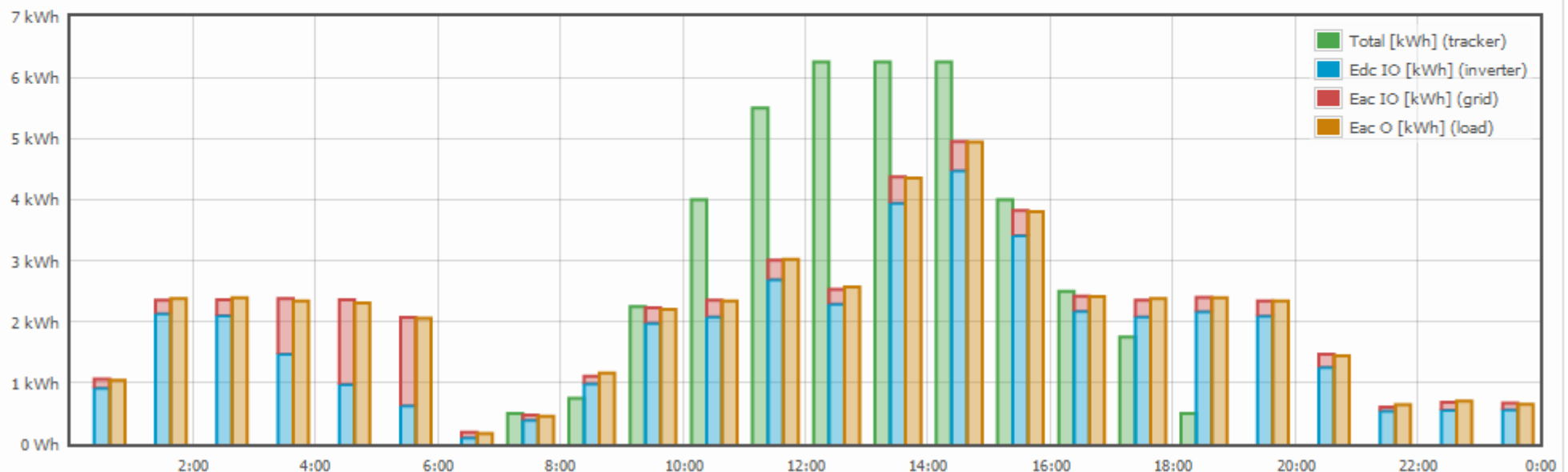


From **01.01.2014** to **31.12.2014** was manufactured **3867.7** kWh.



Overview of energy

For **03.04.2014** was manufactured **40.5 kWh**, do střídače **41.92 kWh**, z rozvodné sítě **8.62 kWh**, consumed **50.47 kWh**.



Complex information about hybrid system behavior, which are normally hidden to customer.

Web Portal: Custom Solutions







Portal.isolar.cz

Jméno Heslo

 CZ 

Zobrazit záznamů na stránku

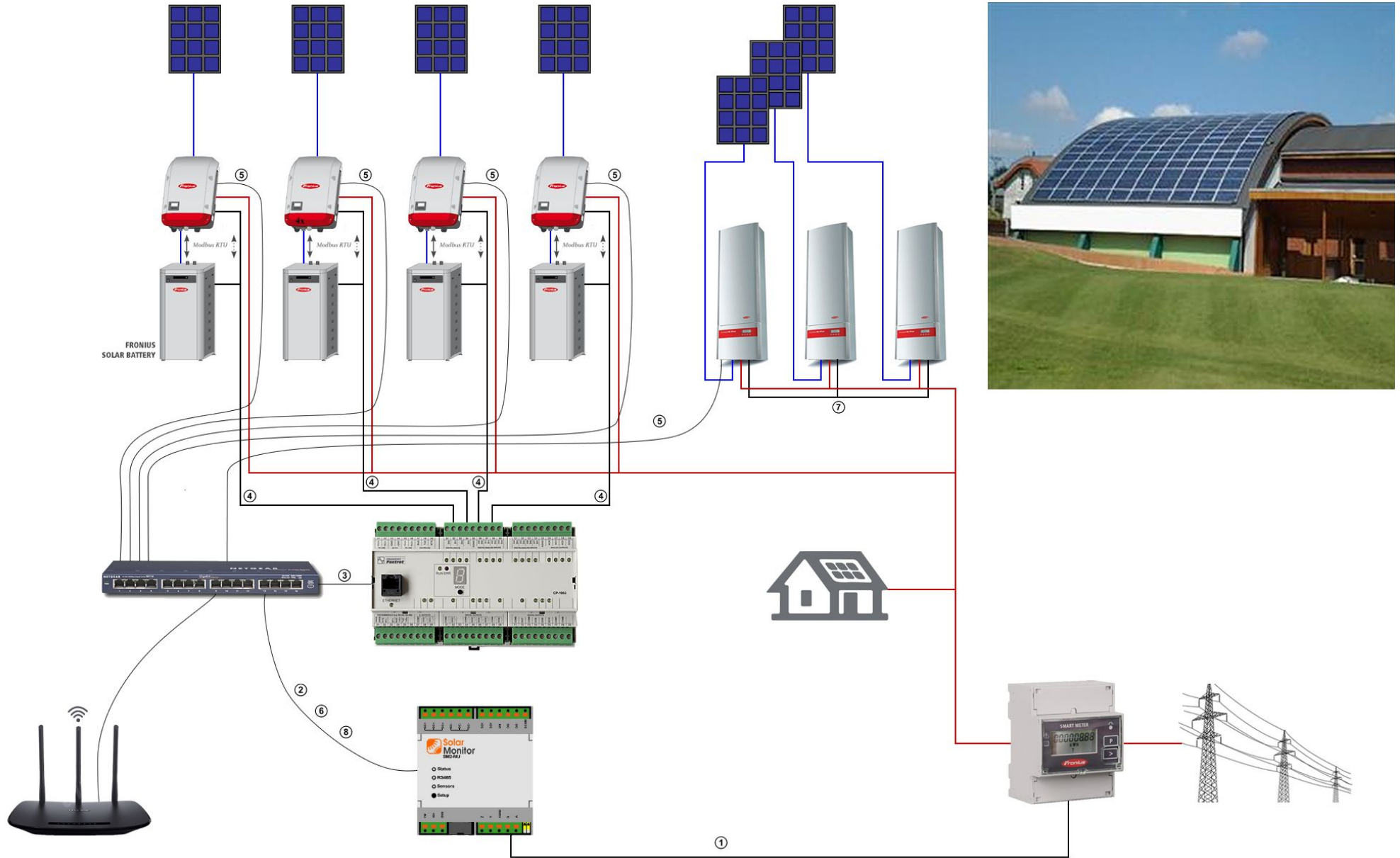
Hledat

	Zařízení	Aktualizace	Vyrobeno [MWh]	Inst. výkon [kWp]	Akt. výkon [kW]		
	FVE p.Ružička	05.02.2015 12:20:26	11.793	4.7	0.823	18%	
	FVE p.Brandejs	05.02.2015 12:21:17	17.581	7.3	4.681	64%	
	FVE p.Plašil st.	05.02.2015 12:20:26	12.587	5.1	4.508	88%	
	FVE Budík	05.02.2015 12:20:33	9.845	4.7	1.019	22%	
	FVE p.Bednář	05.02.2015 12:21:02	63.002	29.6	20.942	71%	
	FVE p.Plašil ml.	05.02.2015 12:21:07	11.606	5	3.334	67%	
	FVE p.Lorenc	04.02.2015 18:30:29	30.968	14.7	0	0%	
	FVE p.Brandejs	05.02.2015 12:20:21	48.969	23.7	15.443	65%	
	FVE p.Forejtek	05.02.2015 12:21:21	26.038	11.7	9.348	80%	
	FVE Fejfarovi	05.02.2015 12:21:44	10.602	5.5	1.182	21%	
	FVE EKO Plyn	05.02.2015 12:21:39	40.778	20.7	5.69	27%	
	FVE p.Löwy	05.02.2015 12:21:10	18.697	9.7	1.982	20%	
	FVE p.Horáček	05.02.2015 12:21:49	10.145	4.6	1.131	25%	

M2M + PLC: Symo Hybrid Charging Optimization

- 4x Fronius Symo Hybrid + Sony battery
- 3x Fronius IG120-Plus
- Fronius Smartmeter
- SM2-MU-300
- PLC Teco Foxtrot
- Originally unsuitable battery charging / discharging
- Energy flow monitoring in the system
- Charging parameters control due to system state

M2M + PLC Example: Golf Club 50 kWp PV Plant



What SNMP stands for?

- Network Management Systems
 - telecommunication industry
 - already installed software, trained staff
- Simple Network Management System (SNMP)
- Management Information Database (MIB)
 - tree structure, enterprise, IANA
 - leafs, tables, indexes
 - how Studer fits into it?
- Services
 - versions (v1, v2c, v2, v3)
- Security (v3, AES / DES encryption)

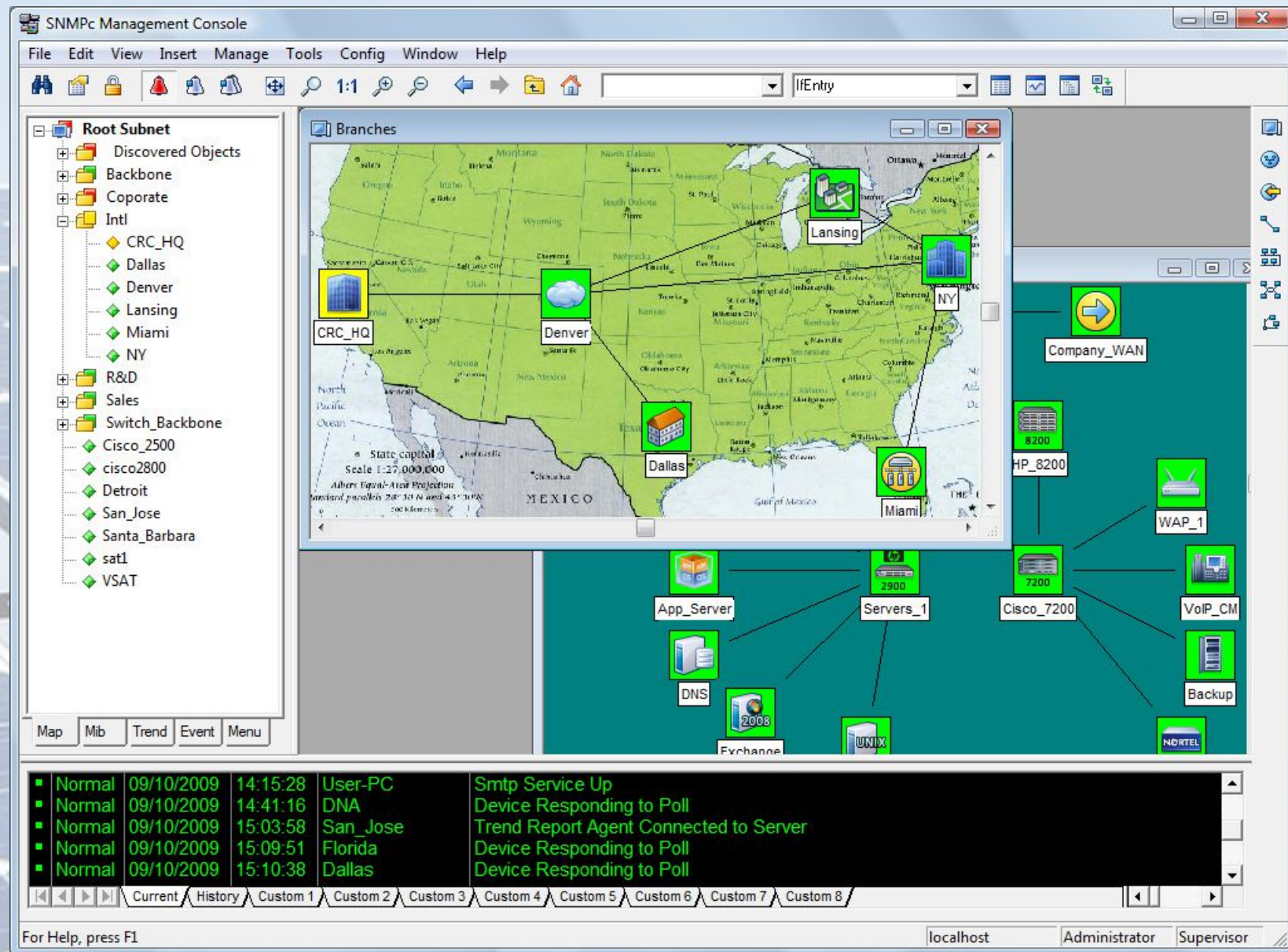
SNMP – iReasoning Browser: Studer MIB

SNMP MIBs

- POSEIDON-MIB.iso.org.dod.internet
- PNETMOD-MIB.iso.org.dod.internet
- STUDER-INNOTEK-SA-MIB.iso.org.dod.internet.private.enterprises.studer.st
- studerMonitoringObjects
 - studerSystem
 - sysBatteryVoltage
 - sysBatteryTemp
 - sysBatteryCurrent
 - sysStateOfCharge
 - sysChargedToday
 - sysDischargedToday
 - sysPVPower
 - sysPVChargingCurrent
 - sysPVEnergyToday
 - sysTable
 - studerXtender
 - xtTable
 - xtEntry
 - xtIndex
 - xtModel
 - xtFID
 - xtSwVersion
 - xtIdBatteryVoltage
 - xtDefinedPhase
 - xtState
 - xtBatteryVoltage
 - xtBatteryChargeCurrent
 - xtBatteryCyclePhase
 - xtInVoltage
 - xtInVoltageMin
 - xtInVoltageMax
 - xtInCurrent
 - xtInCurrentMin

Name	xtBatteryVoltage
OID	.1.3.6.1.4.1.47183.1.1.2.1.1.8
Syntax	NumericTenth
Access	read-only

SNMP – Castlerock SNMPc: Geographical Maps



Any questions are welcome!

Dušan Ferbas
Solar Monitor s.r.o.