SCCER – FURIES
Shaping the FUtuRe SwIss Electrical InfraStructure

sccer mobility
Swiss Competence Center for Energy Research
Efficient Technologies and Systems for Mobility

Schweizerische Eidgenossenschaft   **Bundesamt für Energie (BFE)**
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Integrating Polysun into a Test Bench for Prosumer Hardware

M.Sc. Steffen Wienands, Dr. Noah Pflugradt, Prof. Dr. Andrea Vezzini

Steffen.wienands@bfh.ch, noah.pflugradt@bfh.ch, andrea.vezzini@bfh.ch

Challenge

- Active participation of private households in the energy market, due to smart control of household devices.
- A Prosumer-Lab test bench for system components of Prosumer-households such as energy management systems (EMS) was set up by BFH as a SFOE-P+D project.
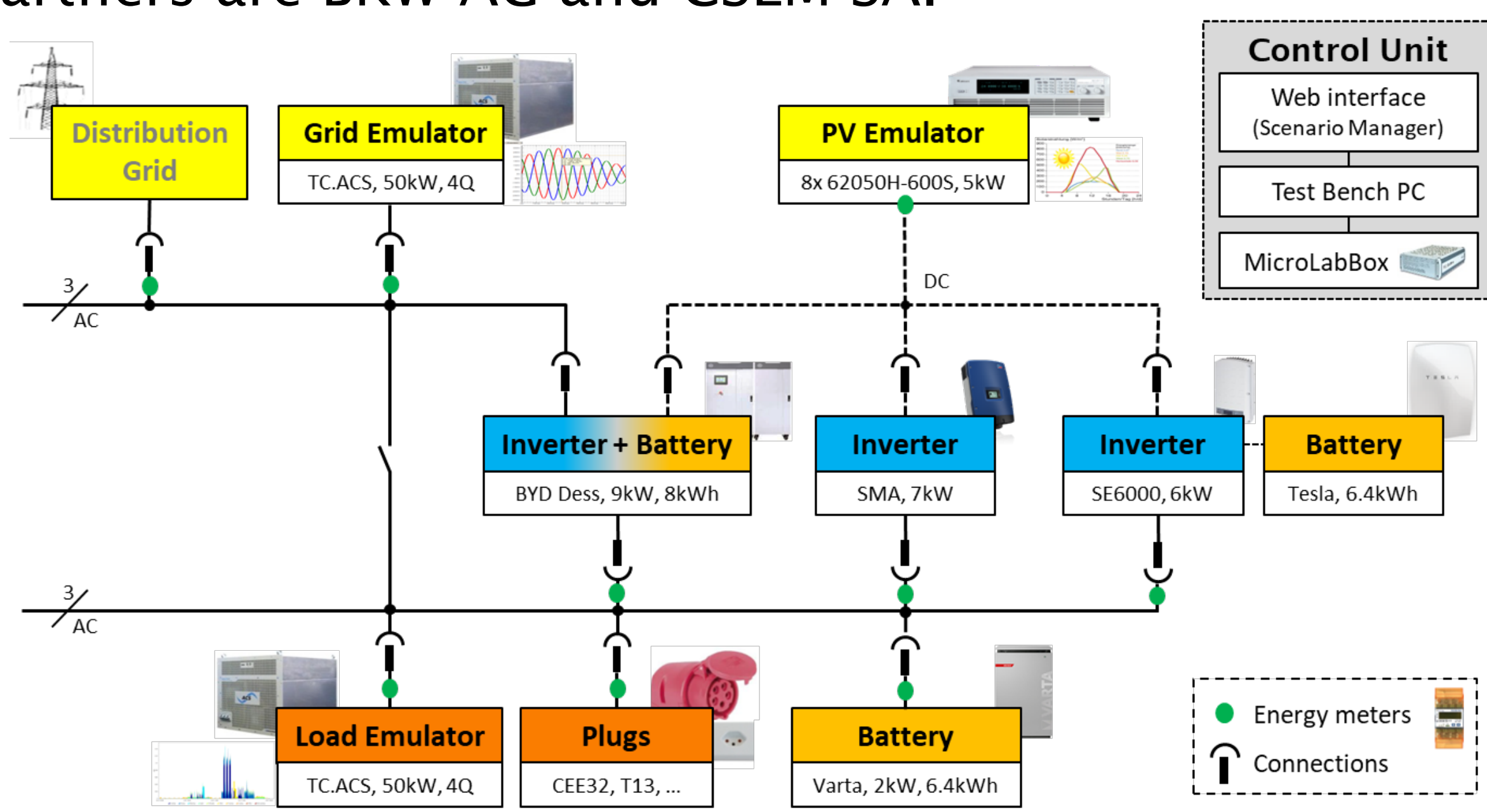- Partners are BKW AG and CSEM SA.

Fig. 1: Modular concept of the Prosumer-Lab test bench.

- The test bench requires realistic and reproducible electrical and thermal testing conditions.
- Setup of a real complete thermal system within the test bench would be very complex and cost-expensive.

Method

- The scenario manager (Java) as the top-level control integrates various smaller applications. They communicate with a REST-interface.
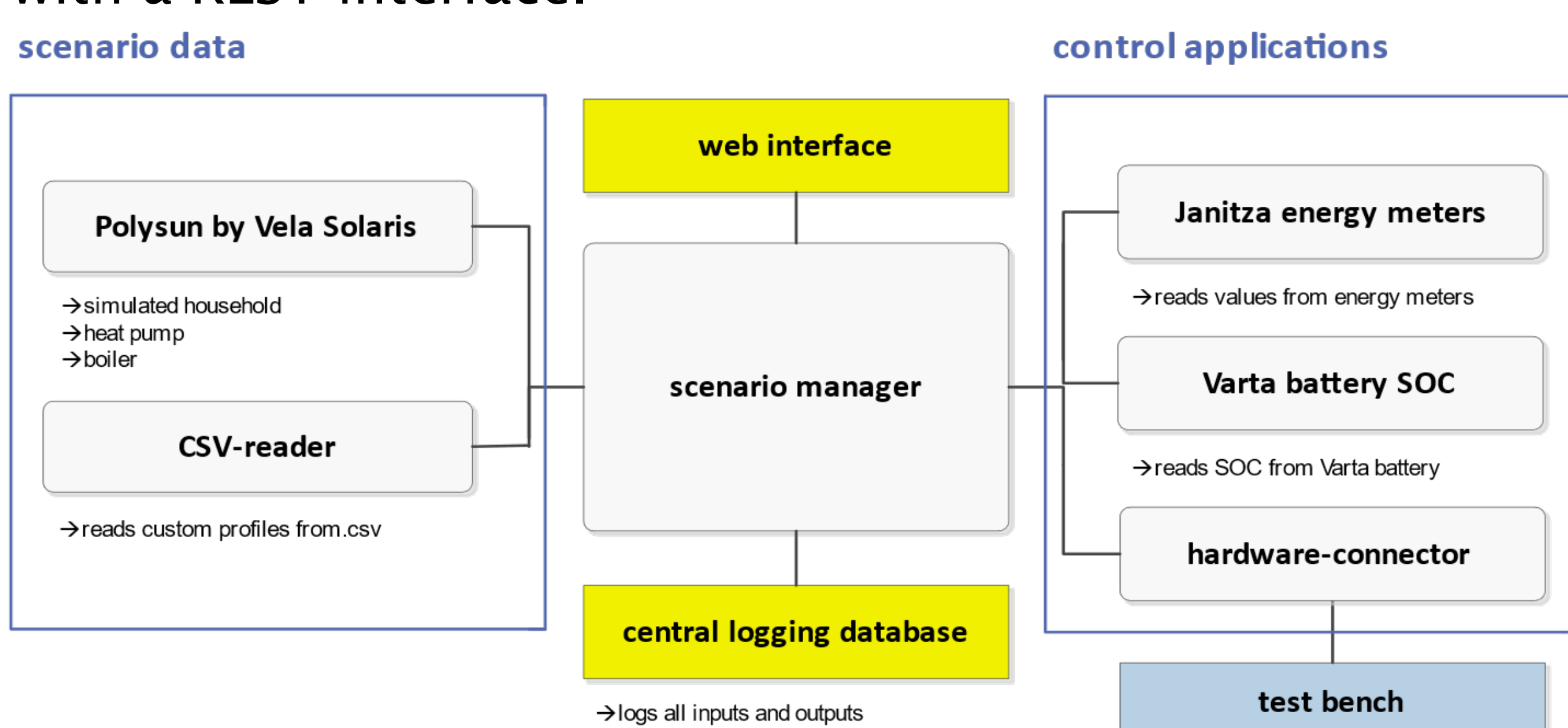

Fig. 1: The scenario manager integrates various applications into the test bench.

- The built-in heat pump controller of Polysun is replaced by a custom controller to integrate Polysun into the test bench for thermal simulations.
- The scenario manager connects to the test bench hardware through the real-time system dSPACE MicroLabBox.

Testing scenarios

- Electrical profiles for the emulation devices are based on measurements and behavior simulation.
- During testing, the custom controller of Polysun acquires e.g. current state of the EMS signal to control target temperature for two simulated DHW cylinders, subsequently switching on/off the simulated heat pump.
- The power consumption of the simulated heat pump influences the target values for the load-emulator, leading to real current flows.

Table 1: General description for the scenarios used for testing EMS heat pump control.

	Parameters
PV installed	PV-emulators, 5.4 kWp, orientation: south, 45˚ elevation
PV inverter	SMA Sunny Tripower 7000
Heat pump	Polysun: air-fluid HP (10 kW, COP at A2/W35: 3.1)
Boiler	Polysun: 3.5 kW
Thermal loads	Polysun: indoor temperature development with given min/max-values
	Polysun: 200 liters/day warm water at 50˚C
Household	Bern; single-family house; family, 4 persons
Irradiance data	MeteoSwiss, Koppingen, Switzerland, 2015
Outside temp. data	MeteoSwiss, Koppingen, Switzerland, 2015

Results

- First EMS test results indicate similar switching behavior of the heat pump to increase own consumption.
- Therefore, a systematic investigation of the EMS is necessary to understanding functionalities.
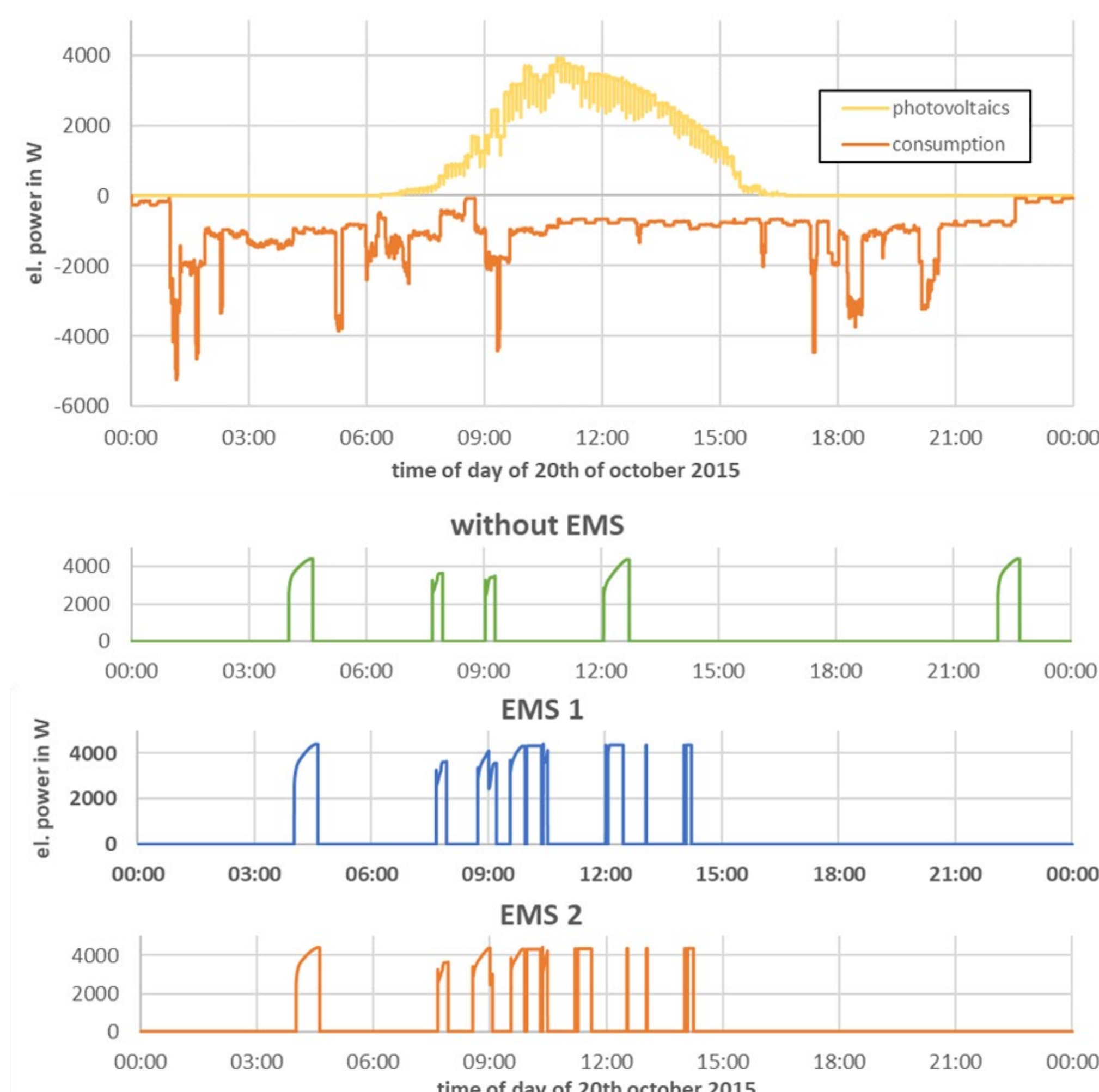

Fig. 2: Comparison of power consumption of the heat pump during operation without and when controlled by two different EMS. PV-production and consumption based on a representative 4-person household in switzerland on 20 October 2015.

Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

CSEM
BKW

BFH Energy Storage Research Centre
Institute for Energy and Mobility Research

Aarbergstrasse 5 | 2560 Nidau
bfh.ch/energy