# HEMS v1.2.x Introduction

Home Energy Management System (HEMS) is a system for:

- monitoring electricity flows at home (consumption, production, and storage)
- control of key consumers
- optimizing consumption in terms of reducing consumption and using cheaper energy to ensure the same comfort with lower costs
- maximize in-house consumption of self generated renewable energy
- minimize cost of electrical energy
- contribute to local micro grid balance as a prosumer
- provide relevant information and help understanding energy flow
- control and manage devices (producers, consumers, prosumers)
- get access to flexibility trade and other digital services
- manage charging of electric vehicles (EV fleet)
- protect main fuse(s) from overcurrent
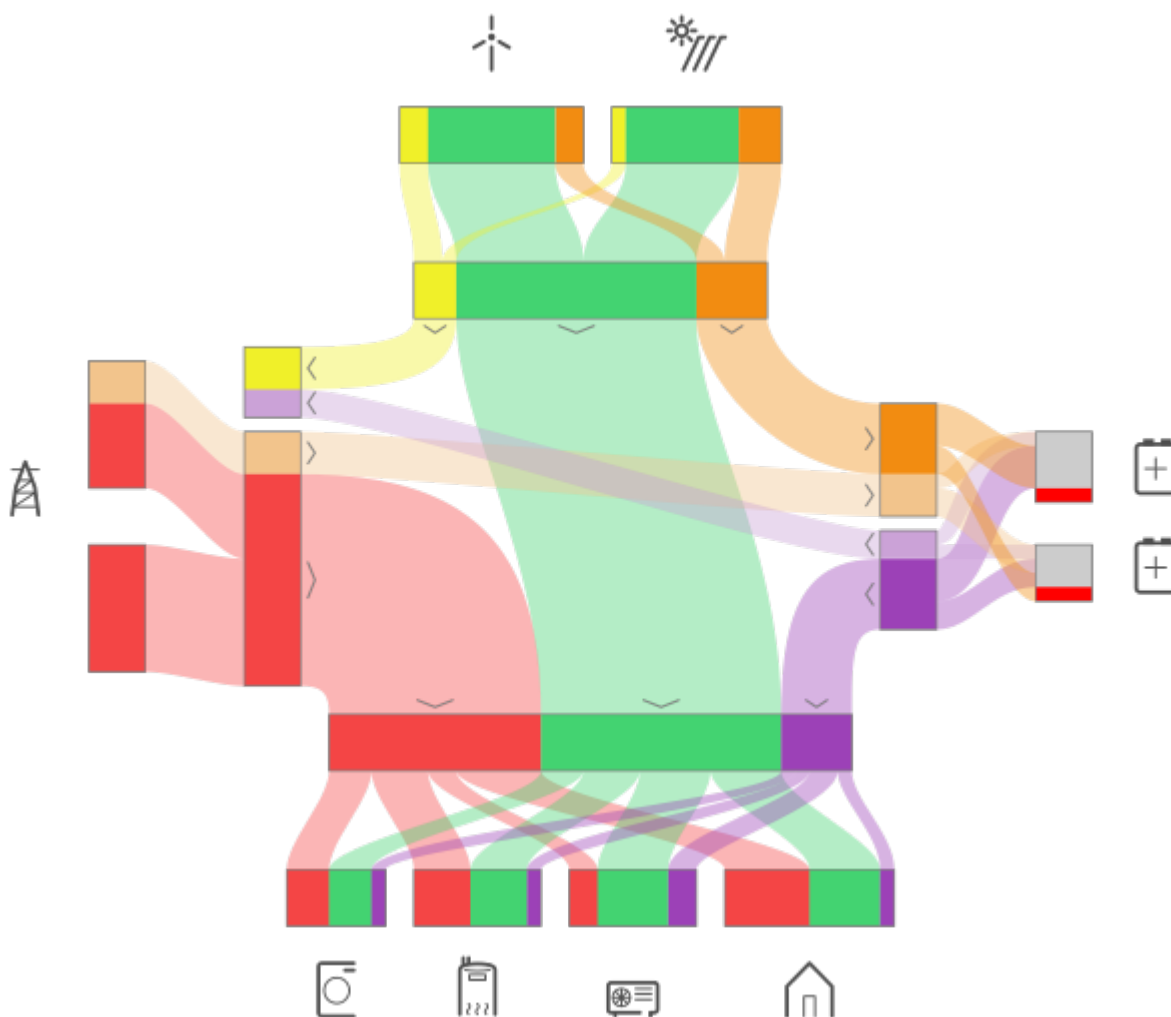
HEMS consists of two parts, one is hardware installed at physical object while second is software to support above listed tasks. Hardware consists of HEMS master controller and units to be connected on it. Units could be divided on input and output:

- from **input**, controller gets measured values e.g. from different sensors (power sensor-PS, temperature) or ON/OFF signals from thermostat, switches, push buttons, while
- on **output**, controller applies result of control algorithm e.g. with power relays switches ON/OFF devices (water heater, washing machine, dryer..) or set charging current for EV on charging station or set charge/discharge current on storage system.

HEMS supports:

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✔ 1 grid power sensor
✔ up to 3 sensors for local power plants (PV, Wind, Cogeneration, Generator,
etc) - as SOURCES
✔ up to 2 local storage systems (home battery) - as CONSUMER OR SOURCE
✔ up to 8 devices (electrical heating, EV charging station, electrical
domestic water heater, washing machine, tumble dryer, …) as CONSUMERS.
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In terms of HEMS terminology there are devices producing energy (PV) named as **sources** and devices consuming energy named **consumers**. For both types, measured electrical characteristic are provided by power meter sensor connected to this device. Consumers could be defined as:

1. Power sensor connected to measured device without capability of control (just measuring),
2. Power sensor connected to measured device with capability of control (HEMS is in charge of controlling a device),
3. Managed device connected to controller without power sensor but with the default set nominal power for device,
4. Managed device connected to controller without power sensor and without set default nominal power.

For connection on cloud HEMS is using IOT linker device.

Below is illustrated HEMS scheme. Connection between controller and units could be **wired** (directly on port, modbus RTU/TCP) or **wireless** (using EnOcean protocol or wireless modbus to modbus bridge):
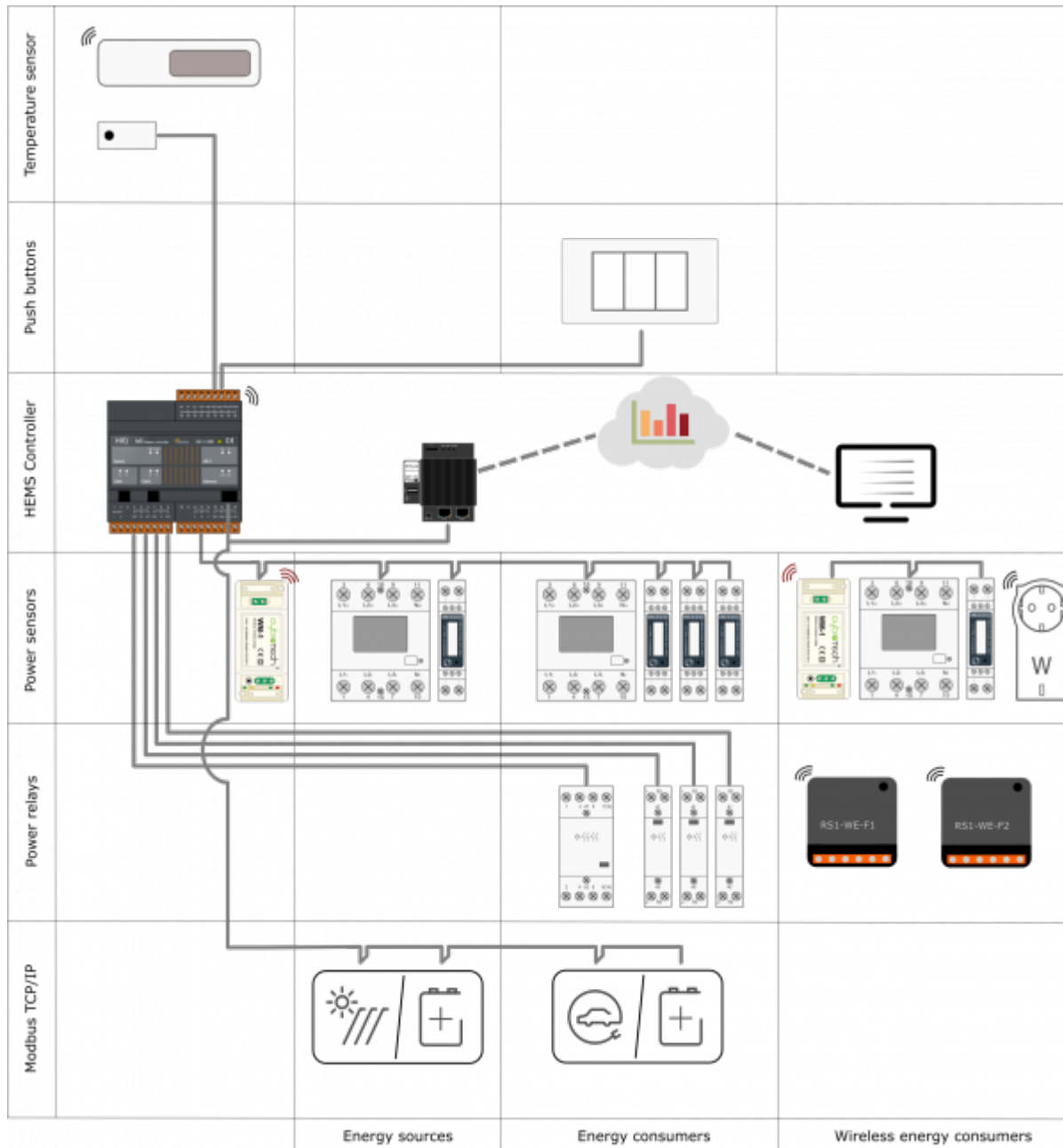
where:

- temperature sensor is directly wired (Digital temperature sensor) or paired (Wireless temperature sensor and Wireless temperature and humidity sensor) to the HEMS master controller MC-230. **Note**: only one temperature sensor can be added,
- measurement of electrical power and energy is provided by single-phase (PM1-E-D) or three-phase (PM3-I-D and PM3-E-D) power sensors which are connected directly to HEMS master controller MC-230 or they could be connected wirelessly using WM-1 wireless modbus unit.
- there are also wireless modules Metering smart plug and Micro smart plug with integrated power sensor to measure consumption and power of consumer,
- power relays are used for control of managed consumers. They are toggling power supply or enabling signals for the operation of the device. Supported connection is as wired as wireless (wireless relay switch),
- push button are used for manual control of managed devices, and are directly wired or paired (Soft remote) to HEMS master controller.

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