

A torch with a bright flame against a blue sky and snowy mountains.

# A flow battery house

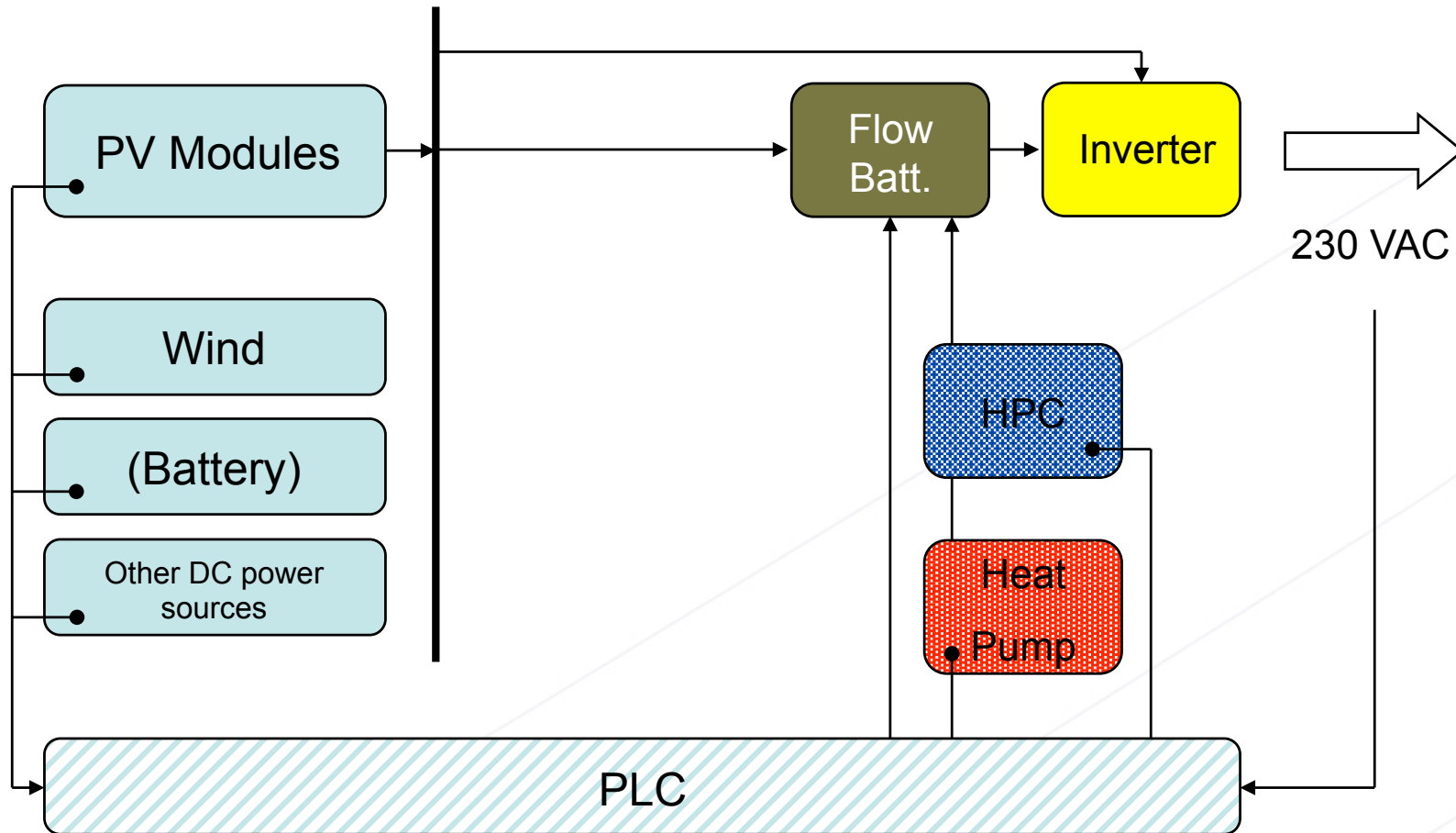
Ron Kok | President

# **An autonomous energy system for domestic use**

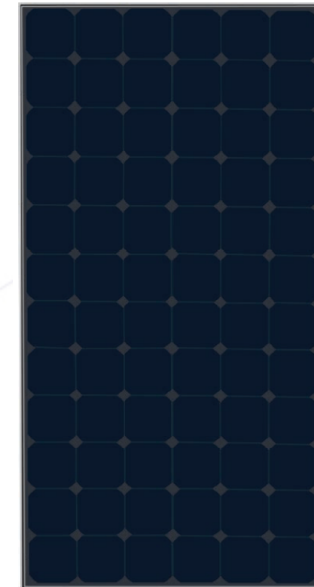
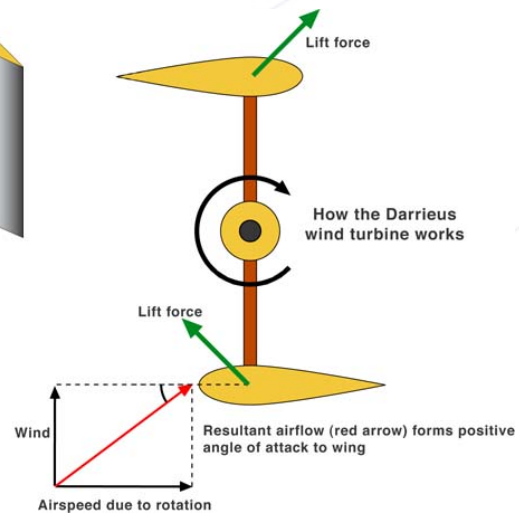
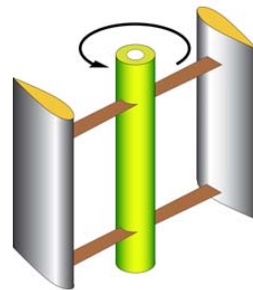
**Based on hydrogen and a flow  
battery fed by renewable energy  
sources**

- Renewable energy source → PV, Wind
- Electricity generator → Flow battery system
- Power electronics → Inverter and Converter
- Control unit → PLC

# Schematical relation between the modules



- Primary use: High performance mono crystalline PV Modules (>20% efficiency)
- Secondary use: Small wind turbine as addition to the delivered energy from PV modules.



High performance PV panel from SunPower Corporation

Example drawing of a Darrieus wind turbine (small, silent, efficient).

- A flow battery is an electrochemical system that is based on storage of electrical energy (DC) in electrolytic fluid.
- Why a flow battery and not a fuel cell?: Easier, more stable system, easier to maintain.
  - Input: Electricity
  - Output: Electricity, Heat

- Depending on the type of flow battery, it also produces heat besides electricity.
- Normally the heat is a rest product of the reaction.
- (In a house, the hot water/steam can easily be used for heating up tap water for domestic use).
- Result: This combination increases the total efficiency of the flow battery system → Heat-Power-Coupling.
- A flow battery has an operating temperature between **20 – 85 degrees** and therefore less interesting for HPC systems compared with other flow battery types.

- As an addition to the Heat-Power-Coupling on the flow battery, a heat pump can be used for the heaters in the house and/or the water for domestic use (bathroom/kitchen).
- The extra heat for these purposes is for example extracted from the earth.

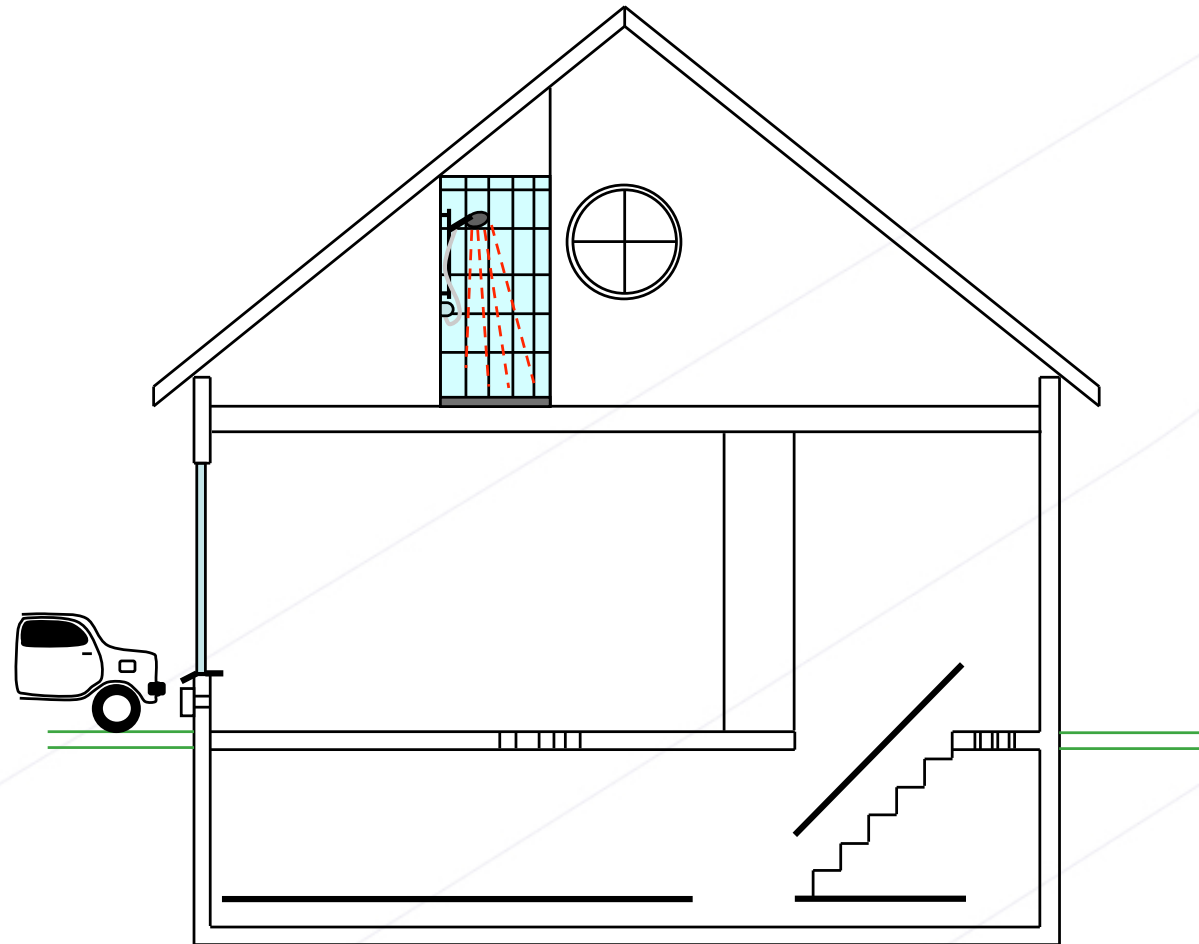


- An inverter is needed to invert the generated electricity from the flow battery (DC) into an useful voltage for domestic use ( $\sim 230$  V).
- The input of the inverter can also handle direct DC current from the initial energy sources like PV modules and wind turbines.

- An control unit (PLC) is necessary to balance the power and gas flows between all the modules in the flow battery system.
  - For example:  
Whenever the light and/or wind energy is not available or enough for the electrical requirements in the house at a certain time the control unit will automatically regulate the flow battery system.

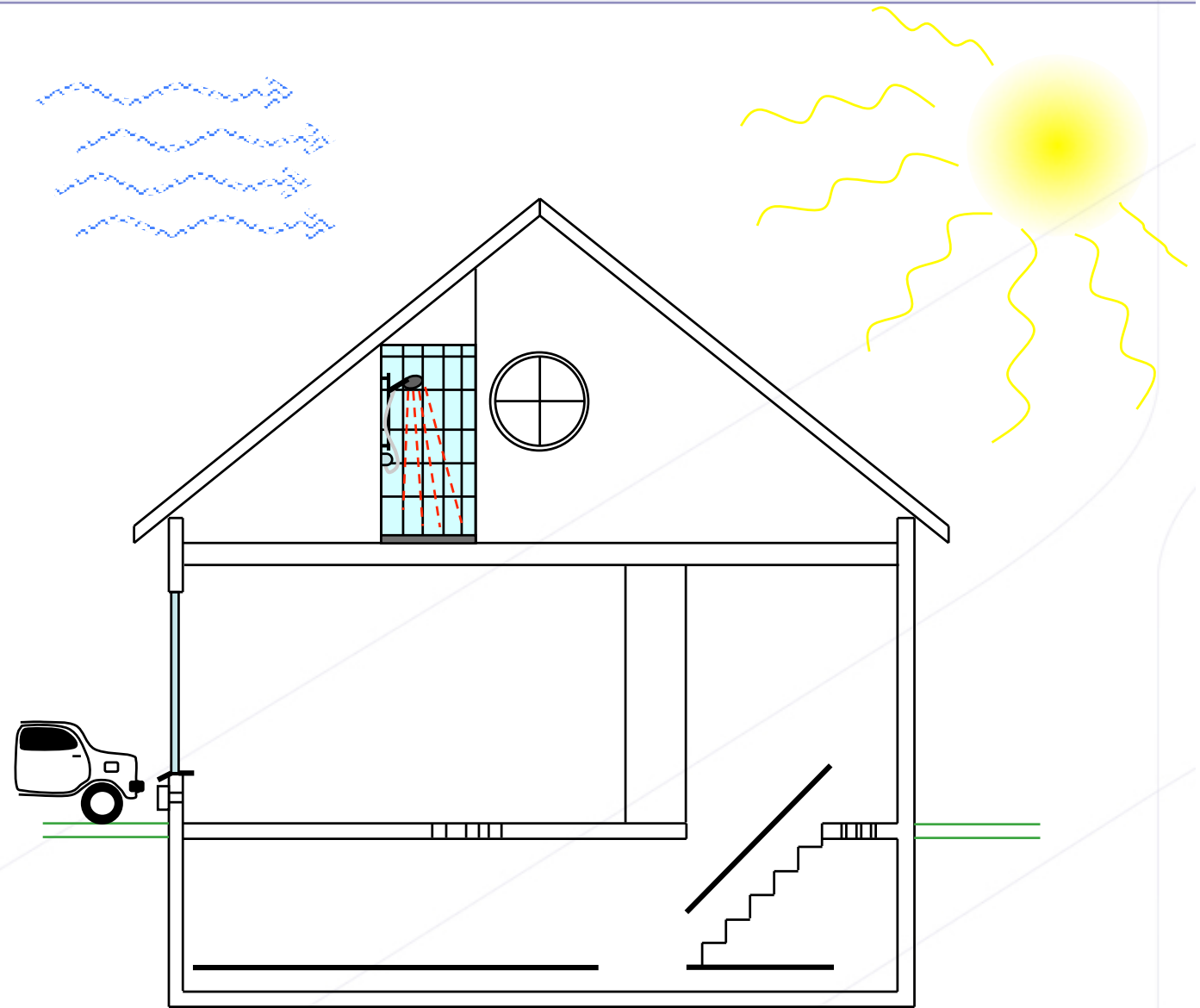
# Build up of a flow battery house (1)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



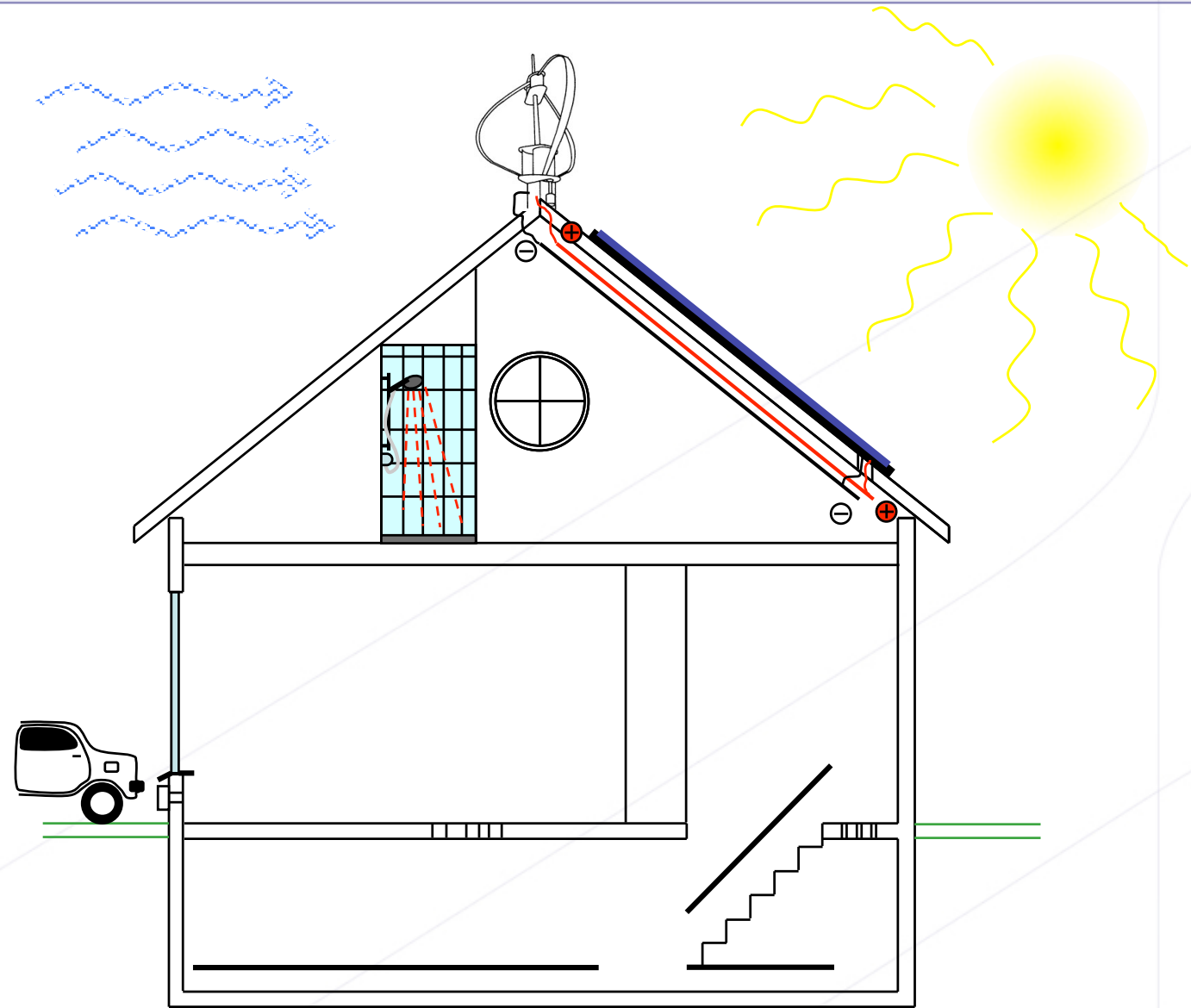
# Build up of a flow battery house (2)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



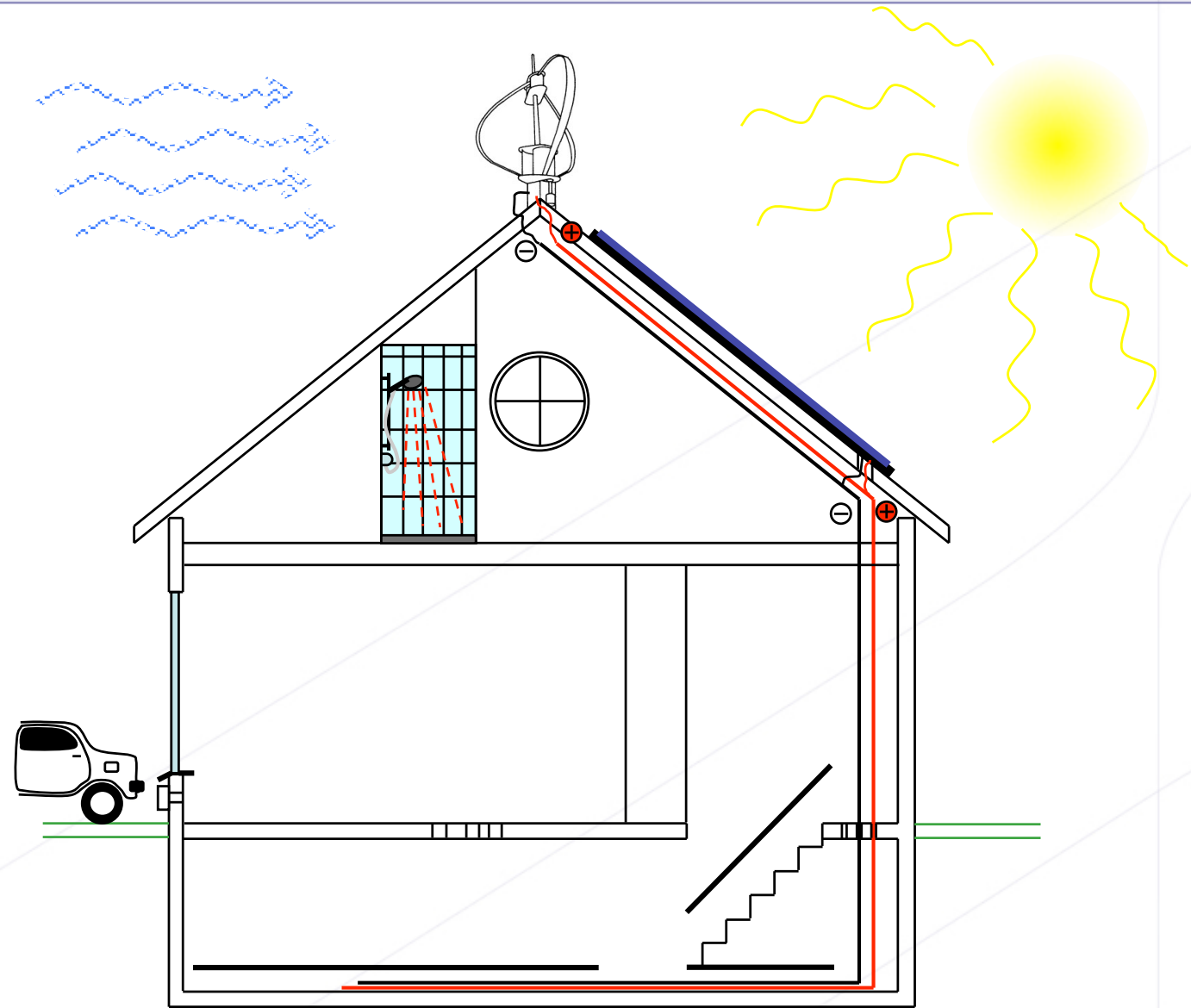
# Build up of a flow battery house (3)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



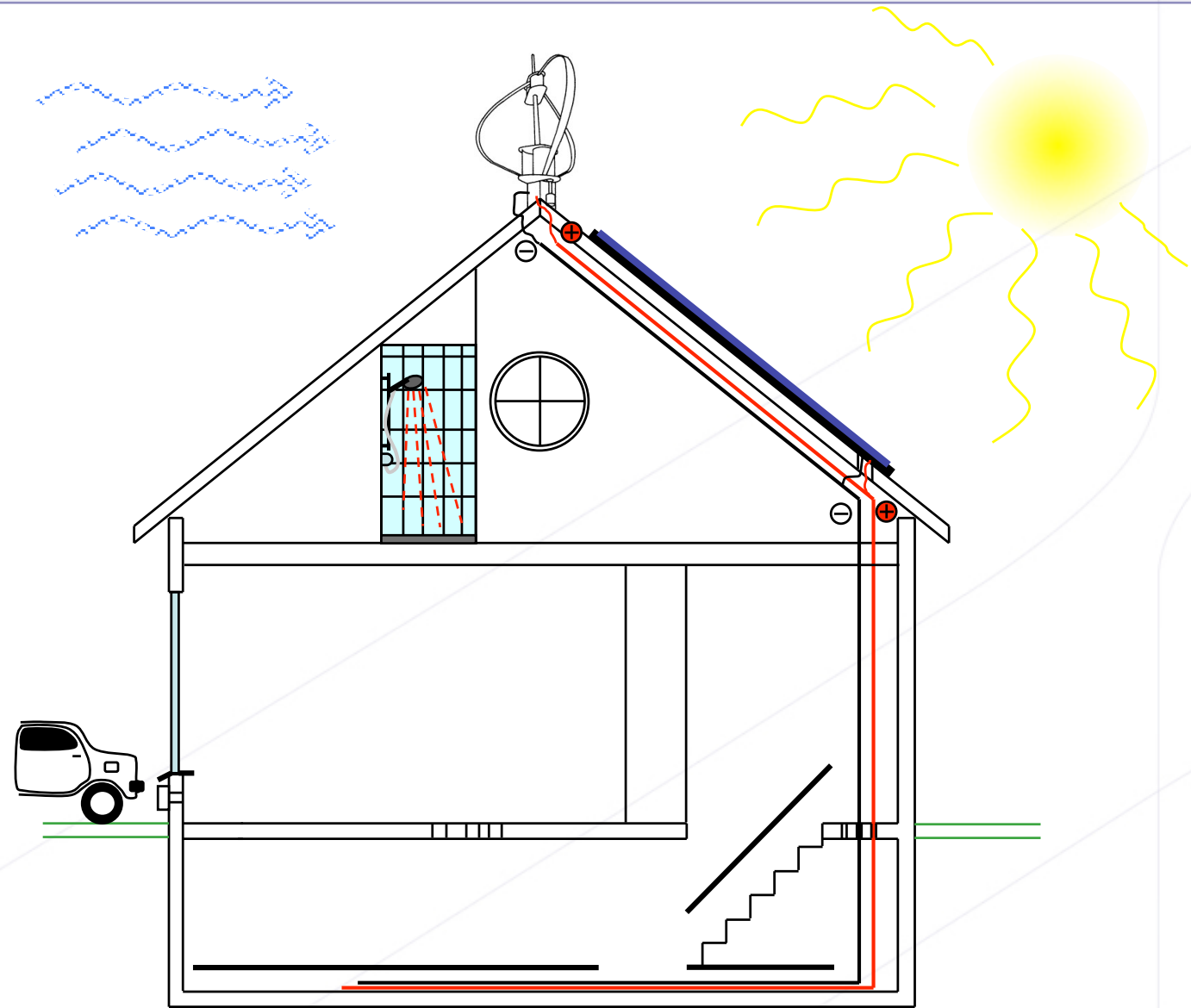
# Build up of a flow battery house (4)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



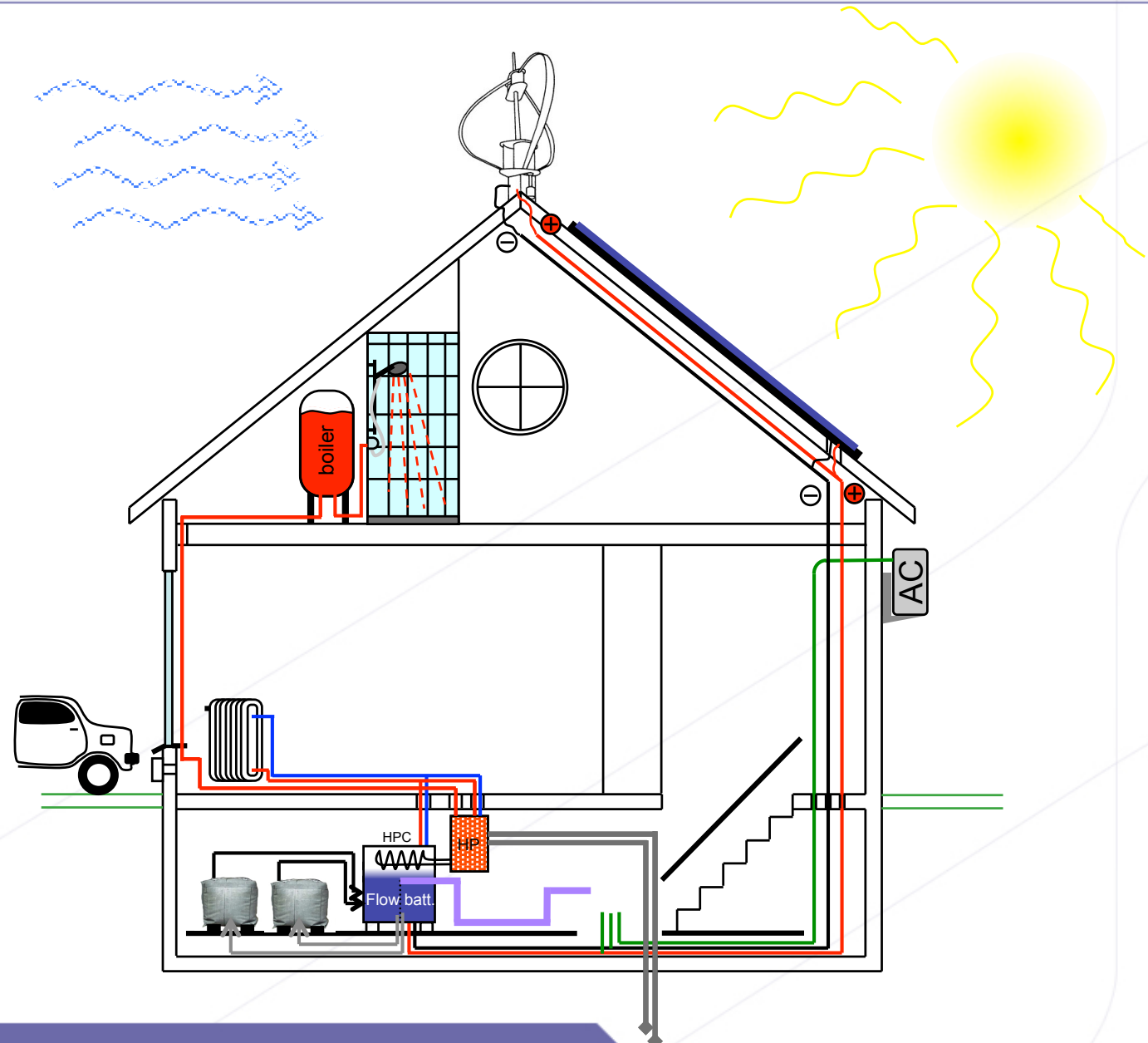
# Build up of a flow battery house (5)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



# Build up of a flow battery house (6)

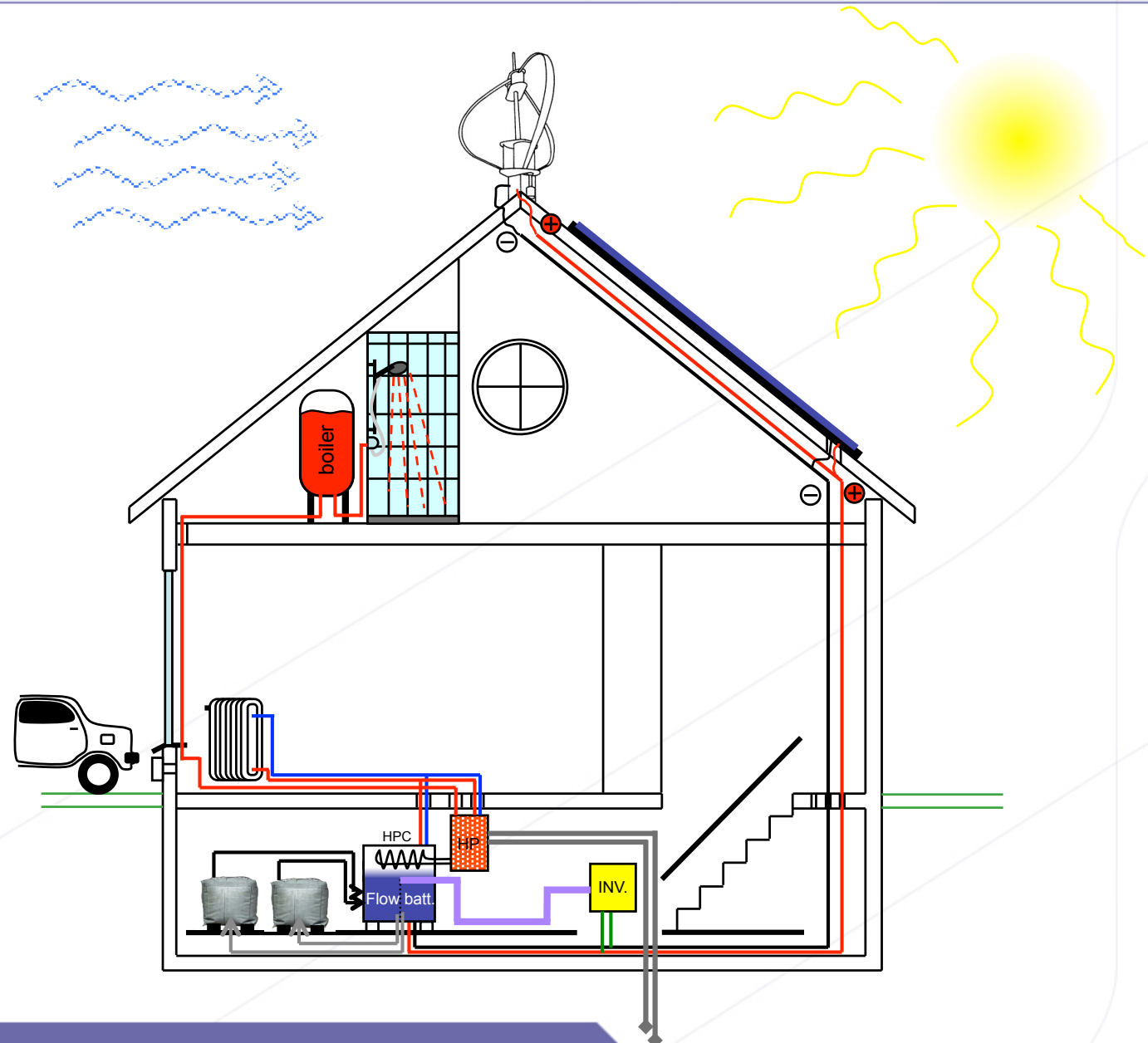
- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit





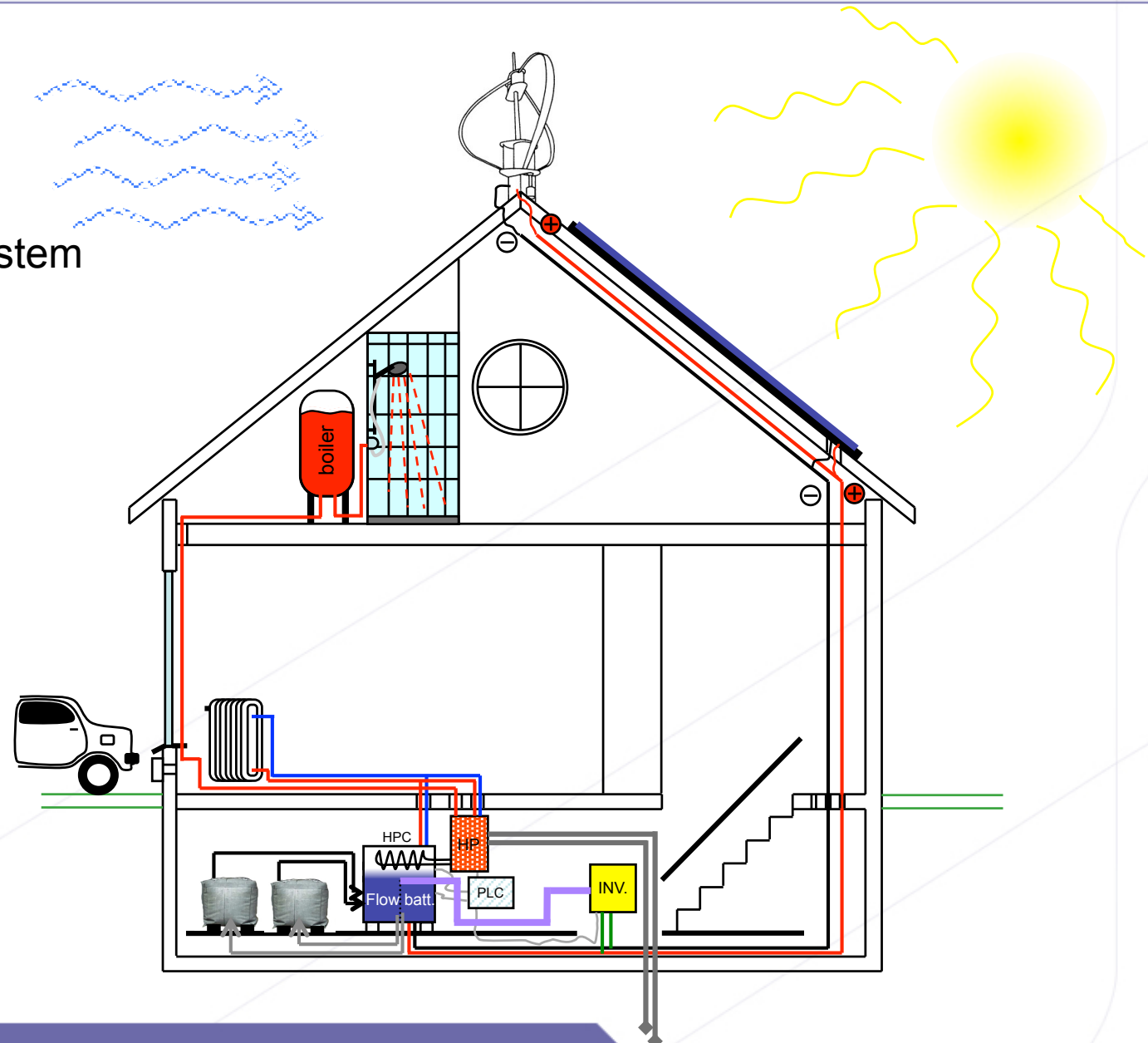
# Build up of a flow battery house (7)

- ✓ House
- ✓ Sun/wind
- ✓ Ren. Energy sys.
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



# Build up of a flow battery house (8)

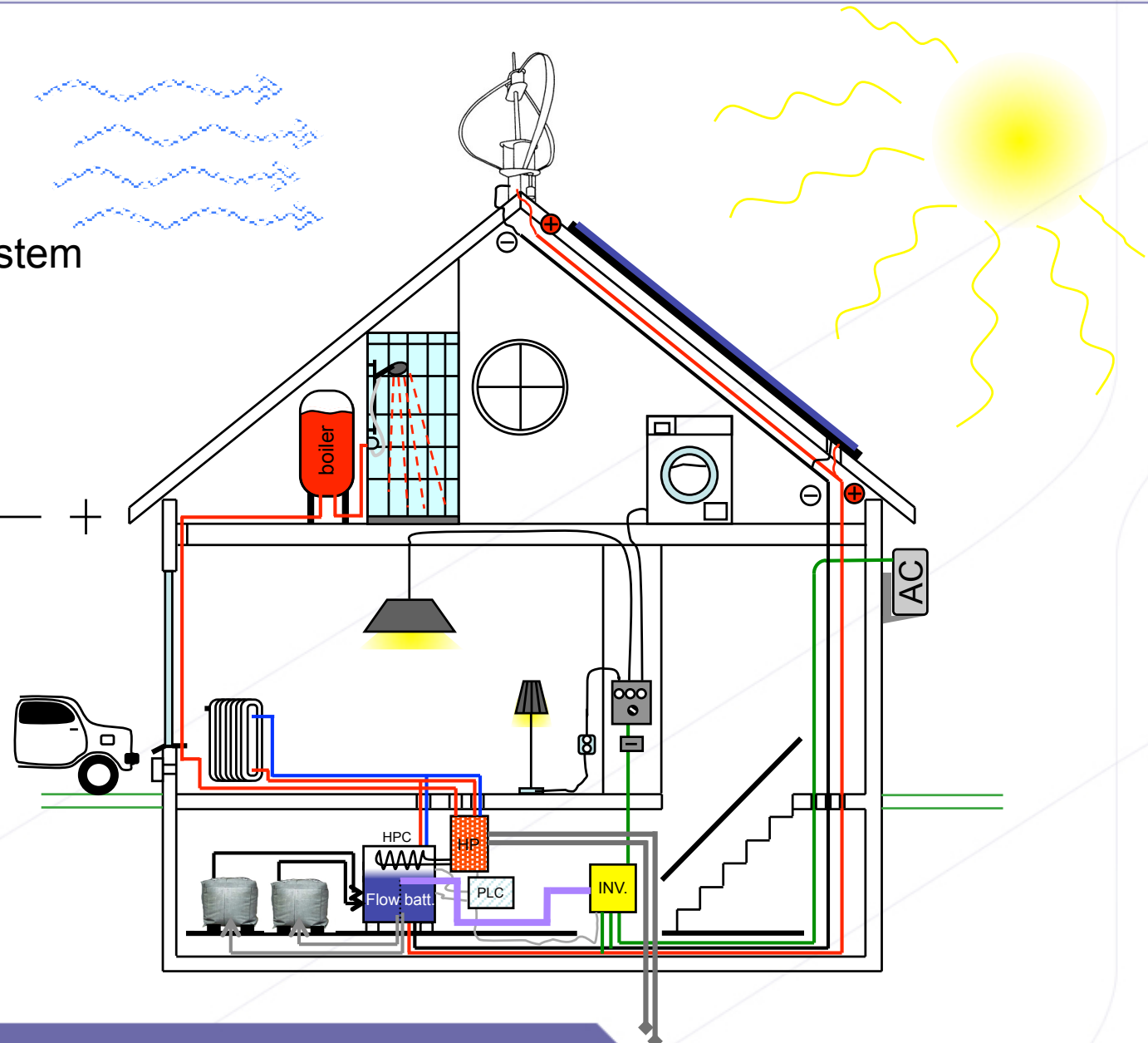
- ✓ House
- ✓ Sun / wind
- ✓ Renewable energy system
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit



# Build up of a flow battery house (9)

- ✓ House
- ✓ Sun / wind
- ✓ Renewable energy system
- ✓ Flow batt. / HPC / HP
- ✓ Inverter
- ✓ Control unit

Total system



- An autonomous energy system with use of renewable energy sources.
  - No emissions that are harmful for the environment;
  - Not depending on finite availability of fossil fuels;
  - Political independent from countries with fossil fuel supplies.

- The goal of the OTB group is to build a flow battery driven house with renewable energy sources at the basis of the energy chain of the system.
  - Integration of all modules in one system;
  - Development of software for the control unit (PLC);
  - Ready-to-use autonomous system for integration in houses;
  - Low cost, efficient, easy to use and environmentally friendly.

Thank You

OTB Group