FAQ

Frequently asked questions about a self-sufficient energy supply with - Fuel cell, electrolyze battery buffer and hydrogen storage:

- Question: How does this energy system work?
  - ♣ It is a closed circuit. When the sun is shining and even on cloudy days, the PV modules produce direct voltage. This direct voltage is primarily used to cover daily household requirements via the 3-phase inverters and at the same time charge the battery buffer. Excess energy is used to produce hydrogen via the electrolyze.
  - ♣ Important! The number of PV modules (power) must be selected so that sufficient energy can be generated to ensure the charging functions. ¬ Question: What do I need to be grid self-sufficient?
  - ♣ Various energy sources are possible (individually or in combination) such as:
  - ♣ PV – modules, wind generator, hydropower, bio plant
  - ♣ Battery backup
  - ♣ Inverter,
  - ♣ Electrolyze
  - ♣ Fuel cell
  - ♣ Compressor
  - ♣ Hydrogen container

- Question: Can the energy system be accommodated completely in the house (basement)?
  - ♣ Yes, but there are a few safety criteria to consider when storing hydrogen:
  - ♣ Ventilation must be guaranteed, just like in a boiler room
  - ♣ Similar to an oil tank, a vent pipe must be led outside in which the hydrogen can be drained away
  - ♣ An H2 sensor must be installed in the room ¬ Question: Can the hydrogen storage be stored outdoors?
  - ♣ Yes, this saves the need for various installation and monitoring devices, because the hydrogen can escape unhindered.
  - ♣ Direct sunlight should be avoided because otherwise the produced, stored hydrogen could escape through the pressure relief valve and that would be a shame.
  - ♣ Subzero temperatures are ideal for hydrogen storage.

- Question: What information is required to define the system size?
  Important! The energy requirement in a household is made up of two consumption quantities:
  1) The electricity consumption, which is listed by the energy supplier on the annual bill and
  2) The heat requirement, which is usually generated by gas, oil heating, wood chips, pellets, etc
  In order to ensure a completely self-sufficient power supply for both consumption levels, it is essential that there is sufficient PV area on the roof available as an energy source. Better to have too many PV modules than too few!
  - ♣ Electricity – annual consumption (shown in the energy supplier's bill)
  - ♣ How big is the roof area (length / width)
  - ♣ Is there already a PV system in place? If so, what peak performance does the system still provide?
  - ♣ If the electricity and heat requirements in the household are to be generated independently of the network, then precise information on the previous consumption of the heat energy source (oil, gas, etc.) is required.
  - ♣ See information in the appendix on page 4
  - ♣ In the appendix you will find a list with the conversion values in kwh (page 6)
  - ♣ Are there already inverters available that are also suitable for island operation?
  - ♣ Is there already a battery backup? If yes, what size?

- Question: Who can assemble and connect the system?
  - ♣ An installation specialist who is familiar and approved with hydrogen / high-pressure systems. Recommendations can be made depending on the location
- Question: How much hydrogen can be produced with a 2.4KW electrolyze and how long does it take?
  - ♣ With a 2.4KW Ely, 1 kg of H2 can be produced in 23 hours
  - ♣ With a 5KW – Ely, 2 kg of H2 can be produced in 23 hours
  - ♣ With a 14KW Ely, 6 kg of H2 can be generated in 23 minutes
- Question. How much tap water / well water is required to produce 1 kg H2?
  - ♣ 1Kg H2 requires 9 liters. Water
- Question: If my household and thus my consumption increases, will it then be necessary to expand fuel cells and electrolyzes?
  - ♣ If there is sufficient PV area available so that a surplus of energy can be stored in the hydrogen containers in summer, it is not necessary to expand the devices, but rather the cheaper solution is to add one or two H2 - Storage bottles can be installed (33 kWh/area at 150-200 bar each) - or the PV modules can be expanded.
- Question: How big should a PV system be in order to be able to generate electricity consumption of approx. 4,000 KWh / p.a. even in isolated operation?
  - ♣ There should be around 25 modules, each with 325W/module, which corresponds to around 8KWh (peak).
- Question: What battery buffer capacity should the battery have in order to be able to adequately buffer approx. 4,000 KWh / p.a.?
  - ♣ It would be ideal if the household's electricity needs could be supplied from the battery for 24 hours and only then would hydrogen (H2) be used. With an electricity requirement of 4,000 kWh per year, this would be around 10 kWh of battery power.
- Question: How large should the fuel cell be chosen in order to be able to sufficiently charge the battery buffer for approx. 4,000 KWh / p.a.?
  - ♣ approx. 2.5KW
- Question: How large should the electrolysis unit be chosen in order to be able to produce enough hydrogen for approx. 4,000 kWh per year?
  - ♣ approx. 2.4KW
- Question: How many hydrogen bottles should be installed in order to be able to store enough hydrogen for approx. 4,000KWh / p.a. (energy consumption)?
  - ♣ At least 5 bottles of 50 liters each are required, which are filled with 150-200 bar; 7-10 bottles would be better. With 5 bottles, approx. 5kg H2 can be stored, which corresponds to approx. 156kwh (gross).
- Question: How much energy (PV) is required to produce 1KG H2?
  - ♣ 55KWh (solar) are required via the PV modules to generate 1 kg of H2.
- Question: How much H2 can be stored in a 50 liter special H2-bottle?
  - ♣ Pressure determines the amount of storage. 1Kg of H2 can be stored at approx. 200 bar
- Question: How much energy is contained in 1 kg of H2?
  - ♣ 1Kg H2 contains at a storage pressure of 150-200bar = 33.3 KWh of energy (gross). After deducting conversion losses, approximately 21 kwh actually remains
- Question: What maintenance does the electrolyze require?
  - ♣ Basically “None”. A small amount of potassium hydroxide solution (1L) only needs to be refilled once a year if the Bajog electronic unit is used. And the fine dust filters at the fan inlet should be cleaned or replaced. Various sensors monitor the flow, temperature and pressure conditions. The containers should be protected from sunlight. The safety criteria must be taken into account.

- Question: What maintenance does the fuel cell require?
  - ♣ Basically “None”. However, the fine dust filters at the fan inlet should be cleaned or replaced once a year.
- Question: Fuel cell lifetime?
  - ♣ The fuel cell must be designed so that it recharges the battery approx. 1-5 hours per night in the winter months. The lifespan is around 10,000 hours to 15,000 hours = around 14 years with an average activity of 2 hours/day. It should be noted that the operating time of the fuel cell is only limited to the winter months or when there is not enough solar energy available. Battery charging is usually used at night. During the summer months there is sufficient energy available provided that the backup battery is adjusted to household consumption.

- Question: Lifespan of electrolyze?
  - ♣ Electrolysis production (hydrogen production) begins as soon as excess energy is fed in via the PV system and only switches off at late dusk. The service life is at least approx. 30,000 hours = at least 16 years with an average activity of 5 hours per day over the year. It should be noted that the operating time is only limited to the time of day when the excess solar energy is sufficient to generate hydrogen and the H2 containers are not yet filled. As soon as this has happened, the electrolysis unit switches off.
- Question: How is the system function monitored?
  - ♣ The entire energy unit is transferred to the PC, tablet and iPhone via an IP address. Energy production, consumption and system status are updated and displayed every second and minute
  - ♣ At the customer's request, we as the manufacturer can also control the system via a REMOTE function and inform the customer if maintenance work is required.

- Question: Energy management?
  - ♣ Energy management monitors the current system and energy values. Based on the energy requirements for the household and the available energy sources, the “most economical and efficient” system configurations are activated and constantly optimized
- Question: Hydrogen – safety?
  - ♣ Hydrogen is a very volatile gas and escapes immediately upwards. Once this has happened, hydrogen can no longer be ignited. It is therefore necessary to ensure circulating air in a basement room / operating room and, similar to an oil heater, a ventilation pipe is led to the outside at the highest point in the room. The system itself is monitored for H2 and switched off immediately if a leak is detected. We also propose H2 room monitoring.
- Question: Are fuel cells funded by the federal government?
  - ♣ Yes, there are funding programs from KfW which vary and are adapted according to the changes made by the federal government: https://www.kfw.de/PDF/Download-Center/Förderprogramme-(Inlandsförderung)/PDF-Dokumente/6000003811_M_433_Brennstoffzelle.pdf

- Question: Can heat be generated in addition to power supply?
  - ♣ Yes, depending on the PV size, the energy available could be used to operate electric underfloor heating with heating elements in the buffer boiler.
  - ♣ Solar energy can also be used to heat the domestic water.
  - ♣ Our fuel cells generate exhaust air heat of 48-55°C in winter operation, which can be used as direct heat or supplied to an existing energy source via a heat exchanger (for example in the return of an oil heater, or return in the buffer boiler for hot water).
  - ♣ This means that houses with a lower insulation value can be heated using existing radiators without having to provide large amounts of external insulation, as long as the solar/PV energy is sufficient for this.

- We have attached importance to the fact that our energy system is an “open system” and therefore not only the Bajog electronic product range can be used, but also all energy sources and future market developments that are equipped with a standardized interface.
  If a household has a pellet heating system, wood chips or other approved energy sources, we integrate these into our energy concept and control them specifically according to our weather and energy supply program. This expansion option also provides the basis for starting with a small basic system and expanding it step by step without having to replace or exchange existing components.
  All components are designed in 19 inch sizes and can be added without any assembly effort.
  If you want to cover your annual electricity consumption and heat (heating) with your own generated energy, then it makes sense for a new building to choose suitable house insulation and heat generation as effectively as possible.

  Bajog electronic has been energy self-sufficient for many years and can make suggestions based on its own experience since 2008, as well as from the many installation projects. Since every household is individual, the possible solutions are also complex. In all cases, however, it depends on cost-effectiveness and flexibility in the expansion options.