



***Bajog electronic***<sup>GmbH</sup>

*Fuel Cells*

**ENERGY OF  
THE FUTURE**



Our products – Our services – Our contribution to the energy transition

What and from which we gain energy:



Biomasse / Biomass



Solarenergie / Solarenergy



Wasserstoff aus Solar / Hydrogen from Solar



Biografit aus Biomasse / Biographit from Biomass



Wasserstoff aus Biomasse / Hydrogen from Biomass

Welche Energieform wir zusätzlich nutzen:



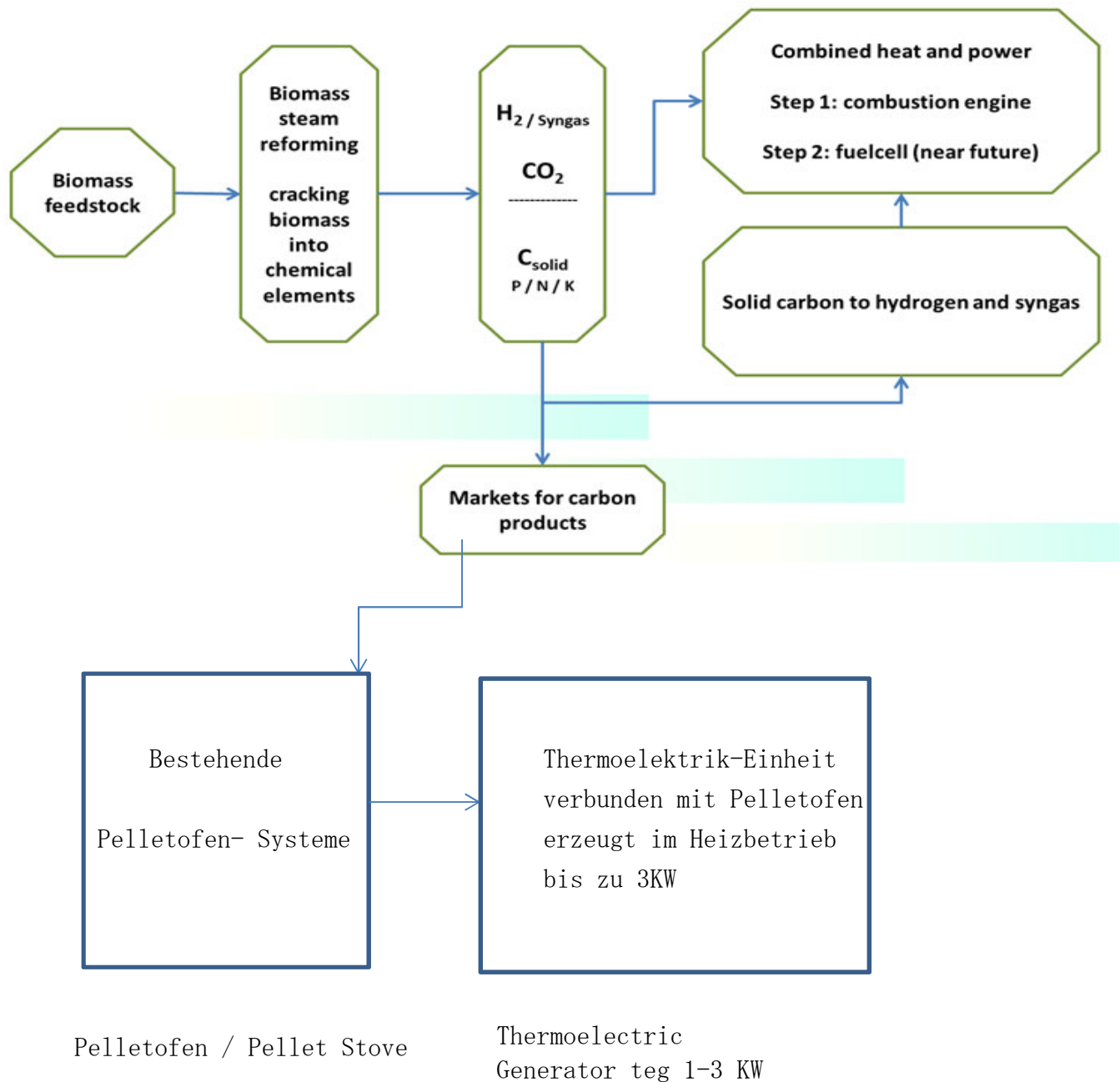
Windenergie / Windenergy



Wasserenergie / Waterpower

How do we use biomass as an energy source? (Patent)

1) From biomass - we gain hydrogen and biography



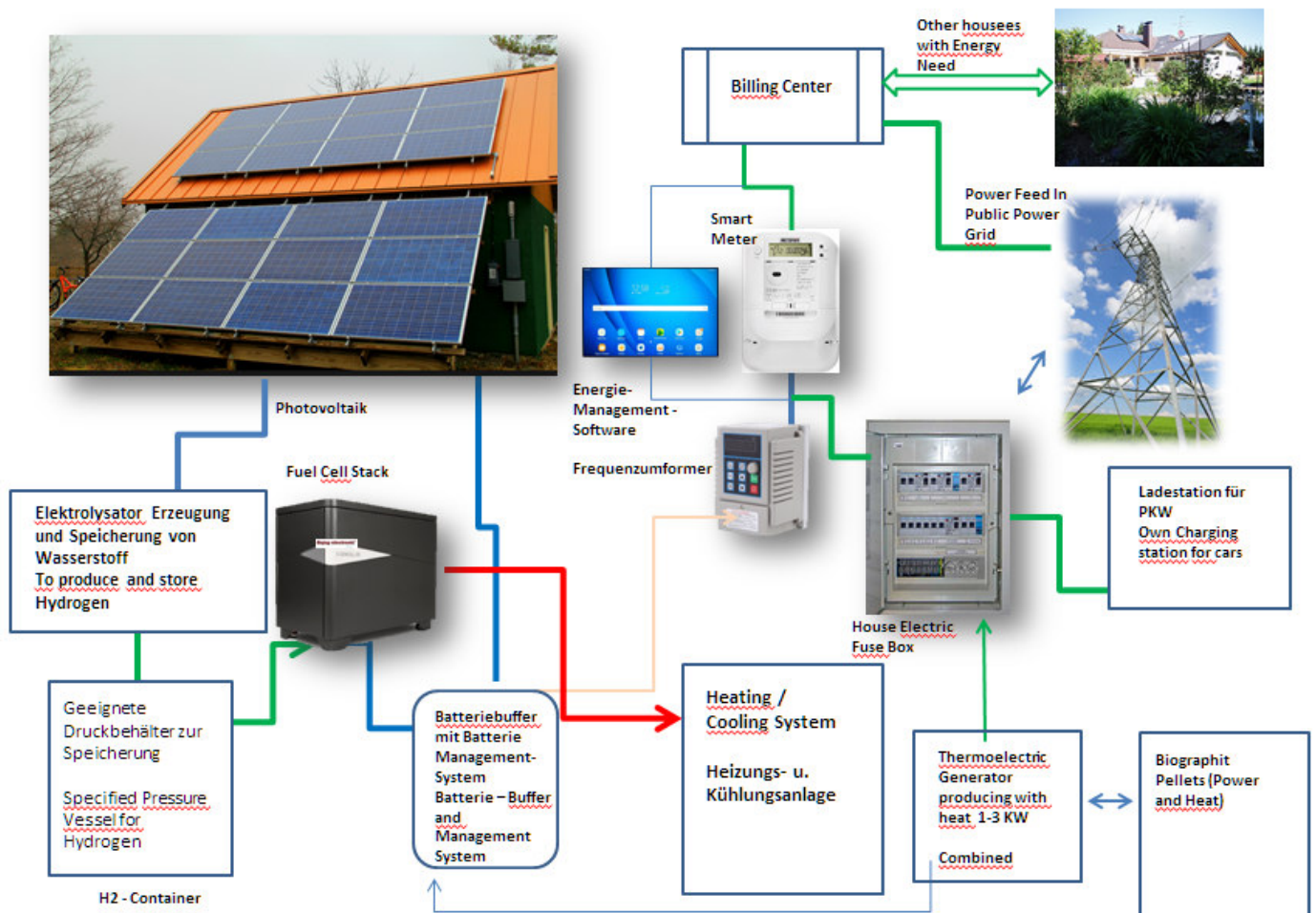
The biographical pellets are burning with a high energy density CO<sub>2</sub> - neutral. In addition to the generated heat, we generate additional electricity depending on the configuration up to 3KW.

This option serves as an additional buffer in the winter time and can be used by existing pellet stoves. The CO<sub>2</sub>-neutral bio graphite pellets do not dust, cause no contamination and have an extremely high calorific value.

With this method, we also realize a CHP in the MW range, which is currently planned in Straubing (Lower Bavaria) and two other places in Germany

## How do we use solar energy as a source?

2) From solar - we buffer the batteries and we get hydrogen for storage



## Fuel cell concept based on hydrogen

by Gerd Bajog

### Introduction:

For many photovoltaic owners (housetop), the promised energy feed - in tariff (EEG) will end in the next few years (starting from 2019).

So far, the energy self - buffering of solar, wind, bio, water - energy is actual limited to the batteries. These are expensive, sometimes maintenance-intensive and not suitable for the environment. As a result, the self-generated energy in the future will be lost in the grid, without any countervalue, because photovoltaic owners are usually at work during the day and can only make a limited use of their own photovoltaic energy.

<https://www.eupd-research.com/aktuelles/detail-ansicht/auslaufen-der-einspeiserverguetung-ist-treiber-fuer-speichernachrustungen/> (sorry is only in German available, describe the running out of EEG feed)

This results in an enormous potential in the field of energy generation and storage in the near future.

The "zero emission" solution is hydrogen production. The electrolysis of water is simple and there are already numerous, different procedures:

<https://de.wikipedia.org/wiki/Elektrolyseur>

#### **Solar parks and wind turbines:**

Many solar u. Wind farms have to be disconnected from the grid in summer times in order to avoid a grid overload. Many solar parks are not allowed to feed into the public grid at any time due to regional overload risks and still receive the guaranteed government feed-in tariff.

<https://www.handelsblatt.com/unternehmen/energie/rekordkosten-fuer-noteingriffe-stromnetz-unter-druck/20802746.html?ticket=ST-553267-cQfpDa4R6qHvsm6Kft3x-ap2>

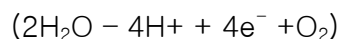
#### **Concept idea:**

Solar Parks, Wind, Water, Bio u. Heating plants could generate enough hydrogen via large-scale electrolysis plants to supply hydrogen to the filling station network throughout Germany in the future. In addition, excess hydrogen could be supplied to natural gas and widely used.

<https://zukunft.erdgas.info/markt/erneuerbares-erdgas/wasserstoff>

#### **What does this mean for homeowners with photovoltaics without feed-in tariff?**

The photovoltaic system on the roof initiates the electrolysis process



and get compressed in a built-in compressor to 3 bar (Sufficient for domestic use).

Depending on the size and consumption calculation, this hydrogen can be stored in suitable pressure vessels. The safety precautions for this are to be equated with a natural gas installation.

#### **Own energy consumption and own use:**

The pressurized hydrogen is supplied to the fuel cell.

The fuel cell is subject to a converter technology. It converts chemical reaction energy into electricity and heat.

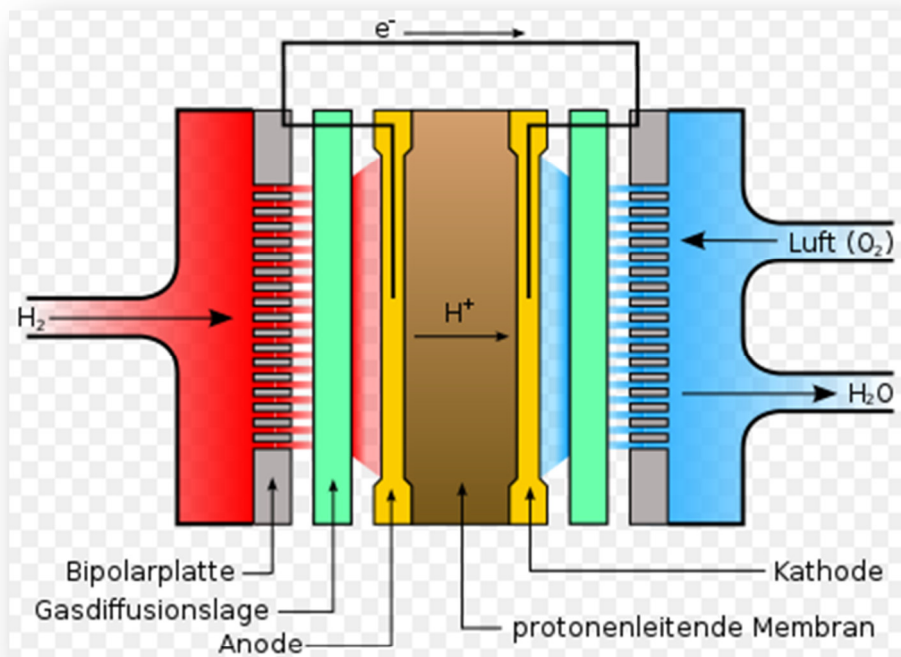
Two electrodes anode u. Cathodes (different principle substances) are separated by a separating layer, the so-called electrolyte. Hydrogen flows in on one side, oxygen on the other side.

Function: In the fuel cell, this hydrogen reacts with oxygen from the air. This creates water, electricity and heat. This electrochemical reaction is also referred to as "cold combustion".

Depending on the application, there are low temperature PEM and high temperature fuel cells SOFC.

In heating technology CHP, the high - temperature fuel cell is primarily used. If possible, she should go through 365 days 24 hours a day.

In vehicle technology, as well as in the energy supply of "small plants, single - family houses etc", the low - temperature fuel cell is predominantly used (PEM polymer electrolyte fuel cell).



Principle fuel cell

See: Wikipedia

### Energy distribution concept of the future for stationary applications (house, see page 4)

#### Principle:

1) Photovoltaic system supplies DC voltage for the electrolyzes = this unit generates the hydrogen

and compresses it to working pressure (about 3 bar in the household)

2) Hydrogen is buffered in H2 tanks and fed to the fuel cell as soon as power is required

3) Photovoltaic additionally charges the buffer batteries (batteries)

4) Fuel cell generates heat and voltage (distribution depending on type and design)

5) The generated DC voltage is provided to the frequency converter. This generates from DC voltage

the required AC voltage 230VAC / 440VAC

6) The generated heat can be used in winter for space heating - and used for cooling in summer

7) Frequency converter supplies power for its own use or feeds into the supply network / other

energy demand customers via a central point via a smart meter. The billing / credit will be

processed via the central clearing office

8) The central distribution and billing takes over a certified administrator or energy company.

9) Frequency converter automatically switches to batteries when no hydrogen is available and vice

versa

10) Is controlled Pos. 3-5-7 and 9) on a tablet with an installed energy management program \*\*

11) Hydrogen is self-generated as described above and can be obtained from a supplier if required

12) Hydrogen can also be transported in a coordinated ratio with natural gas in a common supply

pipeline and fed to the natural gas consumer

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The energy management program records all consumers in the house and calculates the required energy consumption, compares the energy demand with the available, available energy and takes into account the expected energy supply for the current day based on the current weather forecast and the prevailing energy supply.

In addition, the program records the consumption statistics of the residents and uses them to determine an energy demand forecast, which is transmitted to the central office as an actual value and anonymously.

The control program switches off appliances and systems which are in stand-by mode, depending on the energy status in the house, or depending on requirements and wishes. In addition, there is a remote function to use the smart phone / tablet, the energy u. Control switching operations in the home and be able to control manually.

The hydrogen supply is on an average for min. 3 days dimensioned and can be extended up to several weeks, installed in the soil.

Energy that can no longer be consumed or stored by itself is used by the central distributor. Settlement centers, also regulates the coordination of all affiliated members.

A comprehensive energy supply network, similar to the data internet, secures the global decentralized power supply.

In addition, large hydrogen depots can be created nationwide. A specially developed binding liquid allows the storage and transport of hydrogen without any risk of explosion. Even a lit match goes out immediately upon contact with the bound hydrogen.

## Ortschaft 1 / Village 1

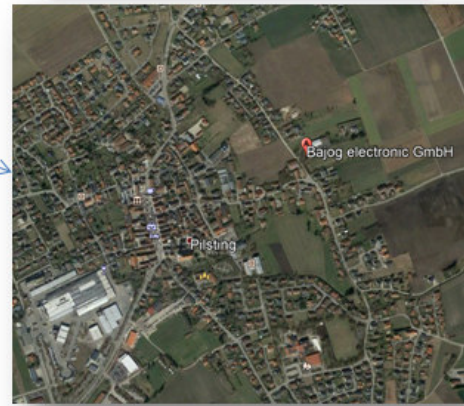


Ortsübergreifender Energieaustausch ähnlich dem Internet und Zentrale Verteiler und Abrechnungsstelle Prinzip Verhindert „Black OUT“ - Gefahr

Cross – local - energy exchange similar to the internet and Central distributor and clearinghouse Principle avoid “blackout” risk

## Ortschaft 3 / Village 3 ff.

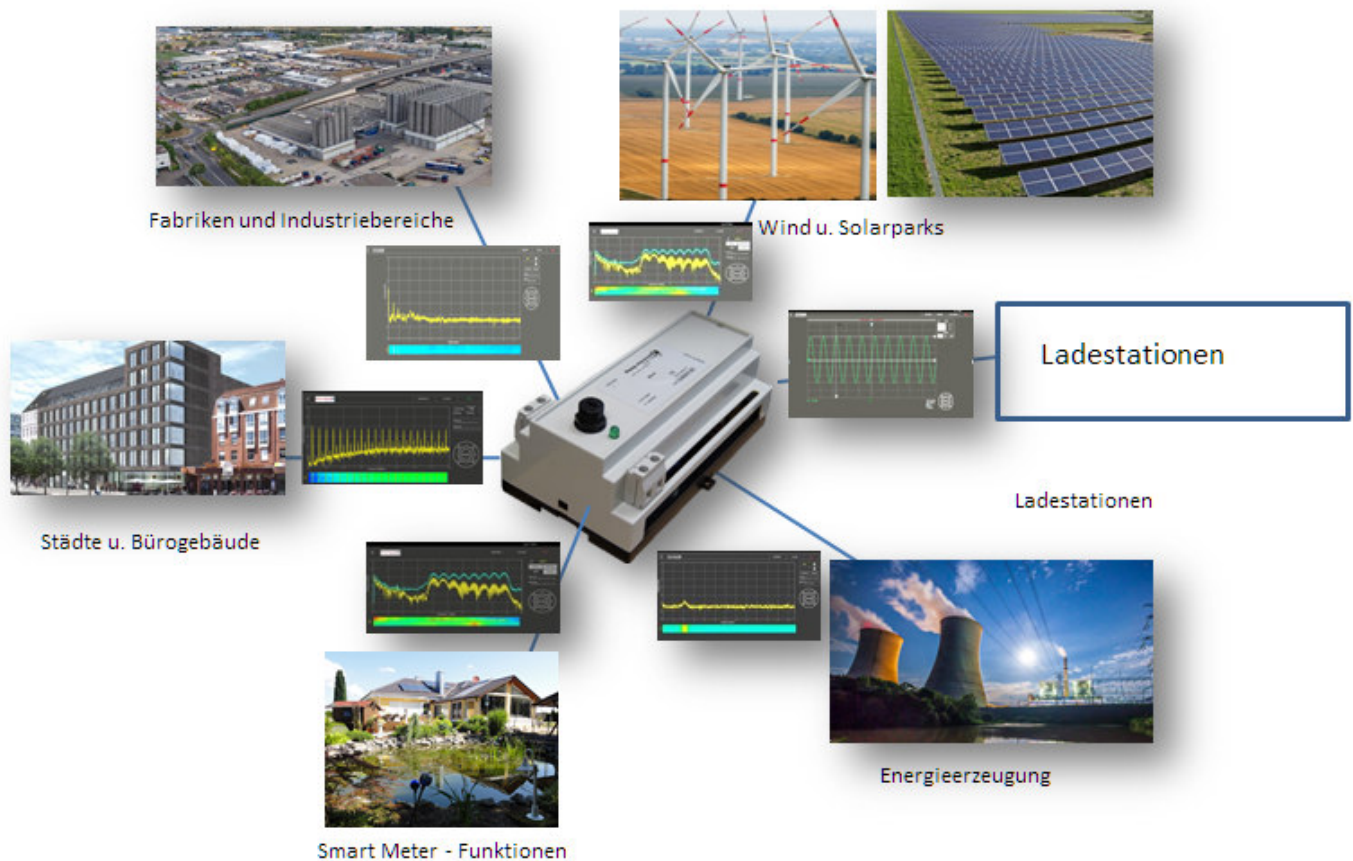
## Ortschaft 2 / Village 2



### Monitoring the power network

With the “MS 04” (developed by Bajog electronic), the entire supply network in the federal territory and beyond can be checked for its quality features (remote). This ensures the safe supply to the supply network and ensures that the energy collection is not affected and thereby incorrect bills are created.

<http://www.bajog.de/de/einsatzbeispiele/ms-04-unterstuetzt-die-stromqualitaet.html>





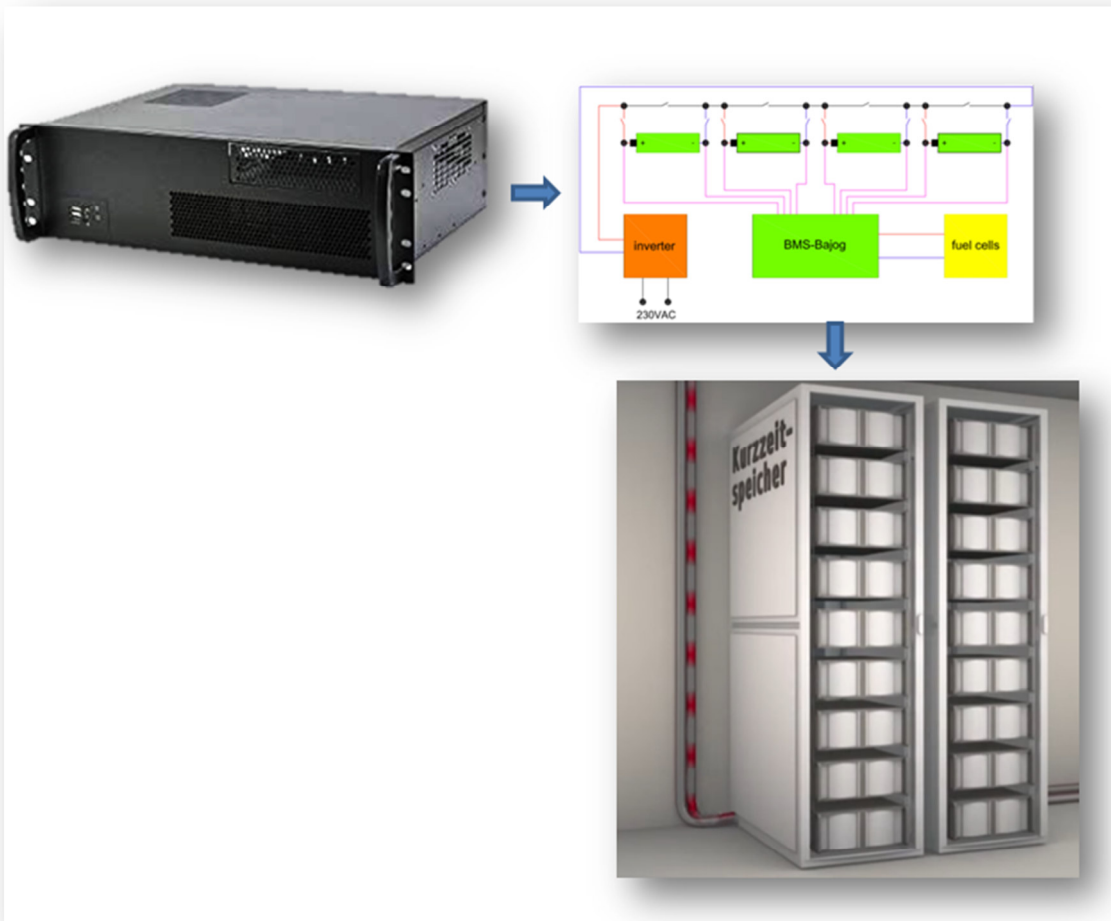
## Battery management system

The battery is and will remain an important building block in the energy supply in the future. This applies to the mobile area as well as to the stationary area. The short-term energy withdrawal for alternating current always takes place via the battery. All shown forms of energy always buffer the available battery units in the first step.

The cost of producing batteries is steadily rising and rare earths are limited in the world market.

This makes it over all more important to monitor battery life, controlling the cells and, and extend the battery life time by a factor of >100.

The battery management system BMS developed by Bajog electronic controls every single battery cell for its performance. Weak cells can be relieved, or completely switched off - and replaced individually in the event of total failure, without having to replace the battery or giving it up



➤ **Conclusion:**

The described energy concept is state of the art. It offers every house u. Homeowners have the ability to generate their own energy (heat, electricity and combinations thereof), store it themselves and then use it themselves. In the event of overcapacity, a central energy distribution and distribution Billing center ensure that the energy surplus is charged as credit - and a nationwide energy network, the general electricity u. Energy supply in the region.

Bajog electronic plans together with its business partners a CHP based on biomass = biographical in MW size, supplemented by hydrogen-based fuel cell units, for example at the Bio Campus in Straubing, Germany.

- BioCampus Straubing GmbH (www.straubing-sand / biocamus /) <https://www.hafen-straubing.de/testfirma/>
- It is a lighthouse project in Bavaria with an optimal environment in terms of "renewable energy".
- Location AWN Abfallwirtschaftsgesellschaft des Neckar-Odenwald-Kreises GmbH ([www.awn-onlinde.de](http://www.awn-onlinde.de))
- The site has been recognized by the EU as a bioregion and is a leader in innovative environmental technologies. AWN has also handled large-scale foreign projects with municipal partners.

We are already active at both locations with the goal of completing a project by the end of 2019. According ISO / TS17225-8: 2016

Decentralized H2 storage depots can provide additional energy reserves decentral at any time and feed them via the natural gas grid, or supply other depots.

The described, decentralized electricity u. Heat supply is already updated, shows our project in Brütten with 14 tenants

<http://www.umweltarena.ch/uber-uns/energieautarkes-mfh-brutten/>

<https://www.wired.de/collection/tech/das-erste-energieautarke-wohnhaus-ist-ein-schweizer>

<https://www.youtube.com/watch?v=gBZYttKIHNY>

<https://www.youtube.com/watch?v=4R9bCPLYapU>

<https://www.youtube.com/watch?v=PtjadUwdJEs>