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Fuel Cells

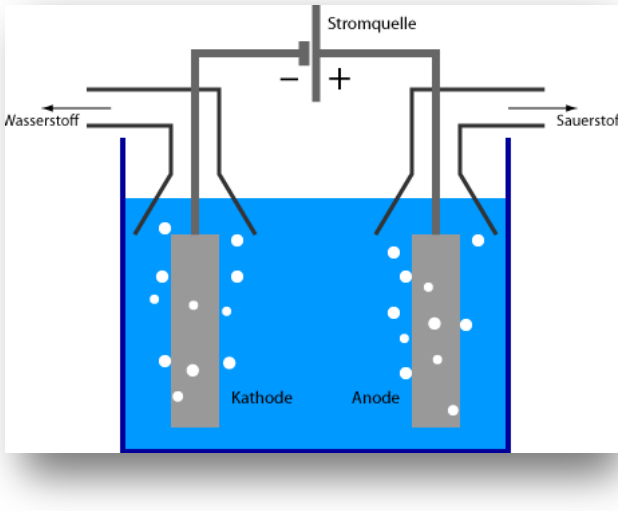
Fuel cell concept based on hydrogen (by Gerd Bajog)

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 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 grid will evaporate in the future, without any counter value, because photovoltaic owners are usually at work during the day and can only make limited use of the energy from photovoltaics = in-house production.
https://www.eupd-research.com/aktuelles/detail-ansicht/auslaufen-der-einspeiseverguetung-ist-treiber-fuer-speichernachruestungen/
This will result 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 simple and there are already numerous, different methods: https://de.wikipedia.org/wiki/Electrolysis

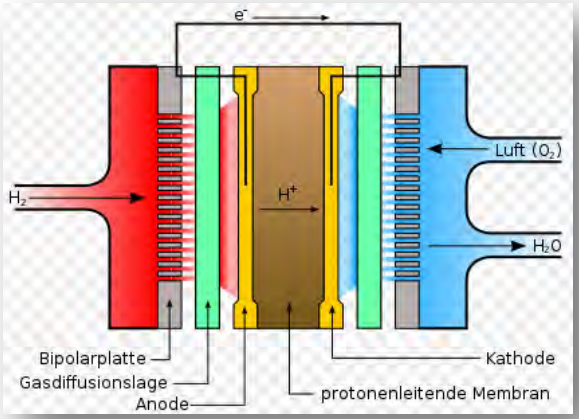
**Solar parks and wind turbines:**
Many solar u. Wind farms have to be disconnected from the grid during summer weddings to avoid network congestion. Many solar parks are not allowed to feed into the public grid at any time due to regional overload risks and still receive the guaranteed feed-in tariff.
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 fed into natural gas and used extensively.
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 (2H2O - 4H + + 4e- + O2) and compressed in a built-in compressor to 10 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 and. Cathodes (different principles) 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 and high temperature fuel cells. In heating technology, the high temperature fuel cell is primarily used. In vehicle technology, mainly the low-temperature fuel cell is used (PEM polymer electrolyte fuel cell).

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## Energy distribution concept of the future for stationary applications (house)

Principle: See page 4

1) Photovoltaic(roof) system supplies DC voltage for the electrolyzer = this generates the hydrogen and compresses it to use pressure
2) Hydrogen is buffered in H2 tanks and feed 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 (depending on the type)
5) The voltage is provided to the frequency converter. This generates the required AC voltage from DC voltage
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 in phase via a smart meter into the supply network / other energy demand customers via a central point
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 tray with an installed energy management program **
11) Hydrogen is self-generated as described above and can be obtained from a supplier if required

++ The energy management program records all consumers in the house and calculates the required energy consumption from them,
compares the energy requirement with the available energy and takes into account the expected energy supply for the current day based on the weather forecast.
In addition, the program records the consumption statistics of the residents and uses them to determine an energy demand forecast
Program shuts down consumers in the home, or as needed and desired. There is also a remote function to control and intervene with the smart phone.
The hydrogen supply is on an average for min. 1 week and can be extended up to several months.

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Photovoltaik

Billing Center

Other housees with Energy Need

Power Feed In Public Power Grid

Smart Meter

Energie-Management - Software

Frequenzumformer

House Electric Fuse Box

Own Charging station

Elektrolysator

Fuel Cell Stack

H2 - Container

Batteriebuffer

Heating / Cooling System

Thermoelectric Generator teg

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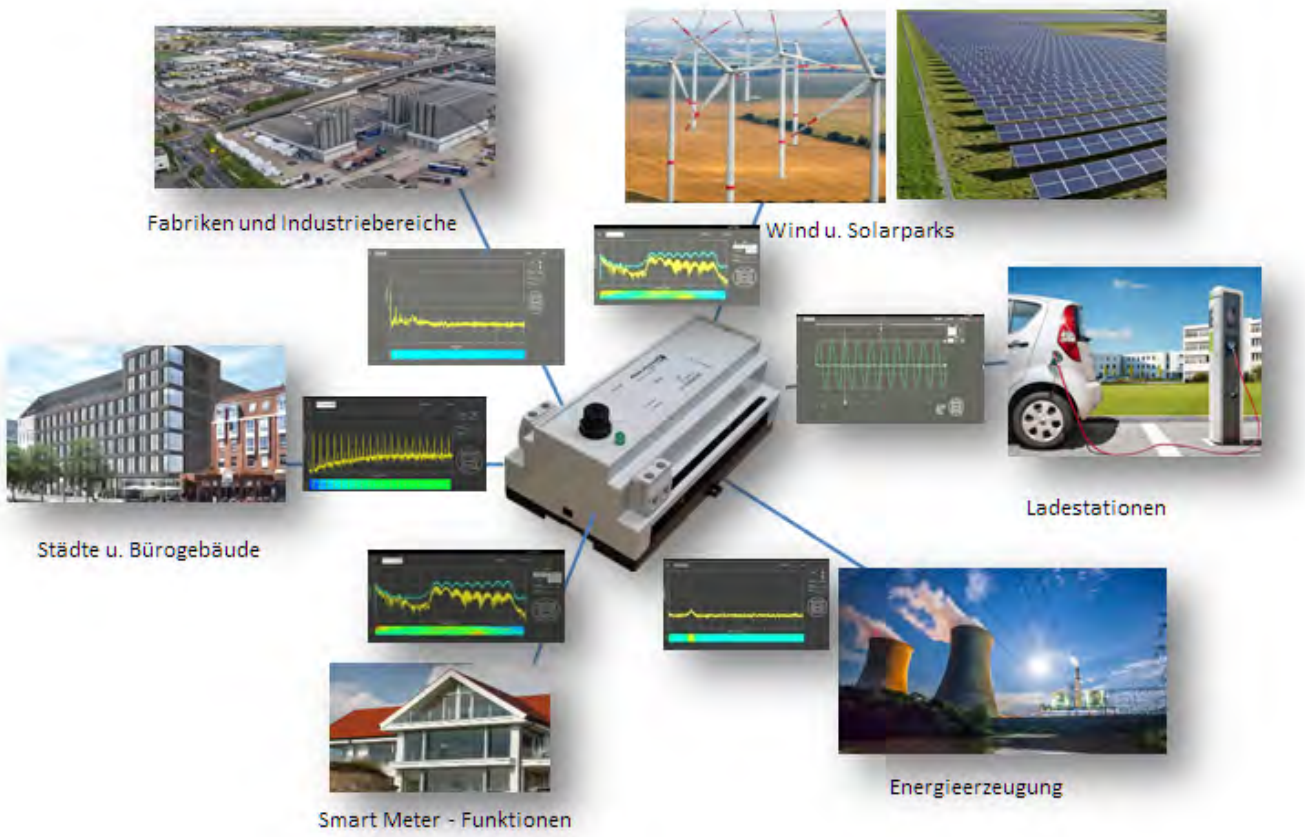
With the device "MS 04" the entire supply network can be checked everywhere for its quality features (remote). This ensures the safe feed-in to the supply network and ensures that the energy collection is not affected; indeed, that would mean the creation of incorrect bills.

https://www.bajog.de/index.php/en/products/mess-und-laborger%C3%A4te/multi-measurement-systems/power-quality-remote-monitoring.html

Bundesministerium für Wirtschaft und Energie




Moreover, Bajog electronic is working on integrating an additional hacker protection against unauthorized network shutdowns (Black Out) in conjunction with the MS 04.

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## Further applications for hydrogen-based fuel cells

Energy supply for industrial buildings

Power supply for transmitters

Energy supply for remote buildings and plants, which are currently supplied with diesel generators

Charging stations for cars (e-vehicles) and forklifts

Emergency generators for hospitals, railway operations, control centers of the fire brigade - police,

E - drives for passenger ships, ferries, boats

E - drives for urban buses, intercity buses and trucks

E - drives for cars

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## Summary:


Energy must be generated where it is needed.
* It is uneconomical and expensive to transport the energy generated in the north over 1,000 km
* homeowner with photovoltaic u. Wind turbines should have the possibility of energy storage and feed into the public grid, even if the EEG is running out next year
* E - charging stations, which are fed from the public network, are not sufficient to load all future e - vehicles nationwide:
It would have to be built alone for charging stations new nuclear power plants to generate the necessary energy.
* The argument that power is not a problem for thousands and millions of charging stations is very common. The assumption is based on the argument that good energy distribution management will guarantee the energy supply for a safe and fast charging of thousands of vehicles in one location.
* In addition, new transformer stations would have to be built and larger cable laying carried out. This would mean that in the cities all laid underground cables would have to be renewed or extended, which is partly connected with considerable earthworks. The costs are not to be quantified.
An energy example only for charging stations in the city of Munich and only for residents of a block of flats:
A Tesla S - Class requires 200KWh (charge capacity); 34 KW are usually available per dwelling unit. A full battery charge of the S - Class takes about 5 hours
If in a high-rise building with 300 units only 150 E vehicles are loaded with an average load capacity of 80KWh,
a need of 12,000 KWh is required. For this, the vehicles would be charged in 139.5 hours (5 days), if the utility provides 86KW / residential unit.

There is nothing left for a warm meal and electricity in the household

Munich has about 1.45 million inhabitants.
If only 50% of them operate and load an e - vehicle with an average of 100KWh, a charging capacity of 72,500 MW is required, when all cars' are loaded. The Munich OHU nuclear power plant supplies 1485 MW. .
It should not be forgotten that the existing nuclear power plants will be shut down soon (energy exit).
Which replacement is provided for this cannot be determined.

¬ Hydrogen filling stations already exist. The tank duration is limited to 2 minutes. Range with an S - Class at 2kg H2 = 1.000KM

¬ The infrastructure (petrol stations) are available. No new nuclear power plants need to be built, no new transformer stations installed and no new cables laid. The gas station customer drives as usual to the pump and refueled in place of E10, Super, or diesel "H2".