

QUANTUM GRID (QGRID)

Gaining electricity almost completely from renewable energies, e.g. wind and solar systems, has the following advantages:

- In comparison to limited fossil primary energy, sun and wind is not limited.
- Major reduction of the CO₂ problems by using renewable electricity as central energy source.
- Possibility of sufficient power supply for the second and third world.

A central challenge of such a regenerative power supply is the volatility of sun and wind. This requires a flexible and dynamic power network. The current power network is not up-to-date anymore to cover those challenges (see "Quantum Grid whitepaper"). The current power network is centralized and rigid. It is managed top-down and controlled by transmission system operators via control stations. The manual interventions of staff to keep the network stable increased significantly. This does not only mean a rise in costs but also an increasing risk for an extensive blackout.

In summary we have to deal with the following problems when it comes to renewable power generation:

- Very high "manual" regulation effort
- Very high IT investment for the smart grid
- The borders of the rigid power network will be exhausted
- Instability of the power network due to the volatility and therefore risk of an extensive blackout. For the consequences see the book blackout.

Alternatively: Das Quantum Grid: A grid like the internet.

The Quantum Grid, which is inspired by the concept of the internet, is an intelligent, self-organized and automatic power network concept that is perfectly made for these challenges.

Key element of the quantum grid is the quantum grid router that determines the route of the power flow from the producer to the consumer, just like the router in the internet. Inside the quantum grid router, the power flow will be controlled on a DC-line with the help of power electronics just like they are used in E-locomotives and in inverter of solar systems.

For the operating principle and structure see the publication "Quantum Grid whitepaper" on our homepage:

Quantum Grid -> Energie-Internet -> Downloads:

https://www.gip.com/files/gip_whitepaper_quantumgrid_en.pdf

The Quantum grid could be operated with alternating current; by converting inbound AC to DC and out bounding DC to AC; nonetheless DC is more suitable for the concept of the Quantum Grid because the influencing of the power flow takes place on a DC-line within the Quantum Grid.

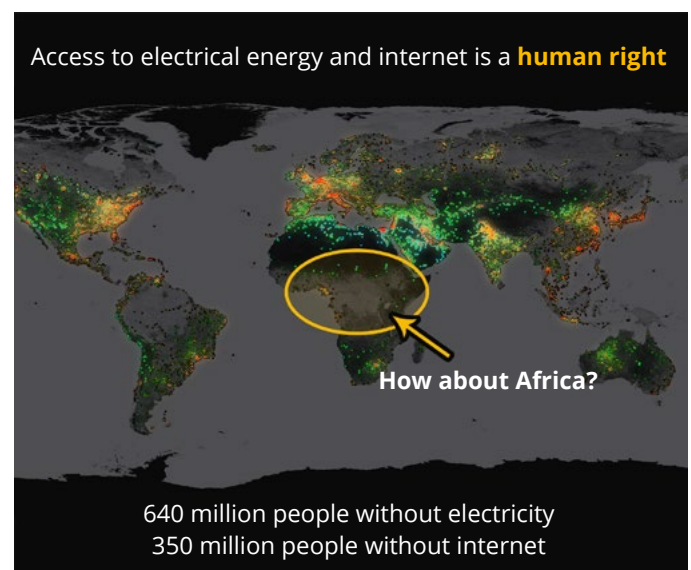
Therefore it stands to reason that a Quantum Grid should be built on a DC base. Especially for the second and third world the DC basis brings considerable benefits. This also counts for the first world.

An alternating current network is not up-to-date anymore. More and more consumers can be operated with DC or are equipped with inverter that convert the incoming 50 Hz AC into DC to then generate the necessary frequency response with pulse width modulation (PWM). A DC Grid instead of an AC Grid brings many advantages, e.g. cost savings through the elimination of AC to DC converter and reduction of losses through the elimination of conversion losses.

The Quantum Grid is universally applicable, here in our region as well as in regions without infrastructure.

For the first world: Segmentation of the network through "QGG" (Quantum Grid Gateway) which means integrating the Quantum grid into the existing power network. This guarantees highest stability (prevention of black outs, flexibility, integration of distributed storages, E-mobility, etc.)

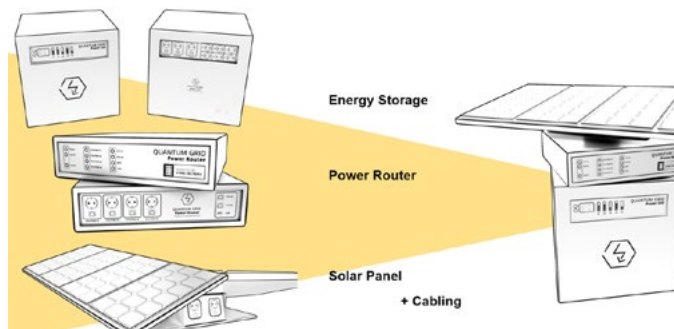
In the second and third world there is a lack of infrastructure for electricity and internet. Therefore a quantum grid out of the box would be suitable in a bottom up system. This plug & play solution does not only offer power supply but also access to the internet and therefore access to communication. Further on it offers access to the digital world. By means of the virtualization of the IT of the quantum grid computer functions can be provided. This has the advantage that the expensive IT of the Quantum Grid can be used in a multifunctional way; e.g. Internet, telephony, television, cloud and app services as well as general computer functions.



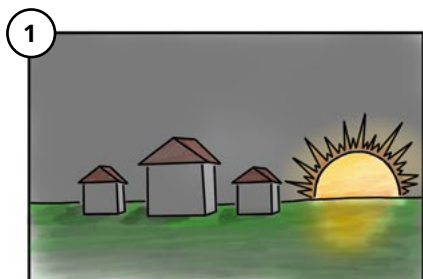
QUANTUM GRID OUT OF THE BOX (QGB)

The QGB is composed of:

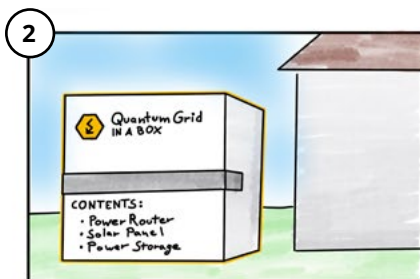
- A solar panel without inverter
- A battery without charging electronics
- A Quantum Grid router
- Prefabricated cable to connect the panels and the battery to the router, a combined power and data transmission cable to connect with the neighbors, as well as a cable with DC sockets as port for DC-devices like LED-lamps, television, refrigerators and computer



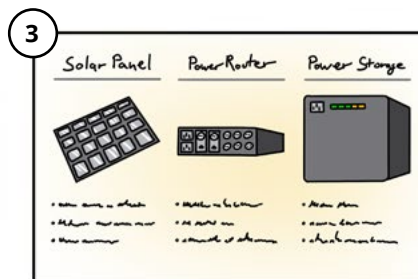
STORYBOARD - QUANTUM GRID OUT OF THE BOX



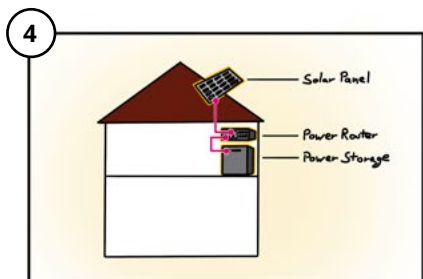
No electricity, no internet, no telecommunication & no computing



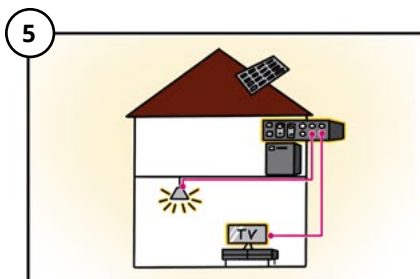
The Quantum Grid Box will be delivered eg. by a local agent, for instance using a bike fitting to the box



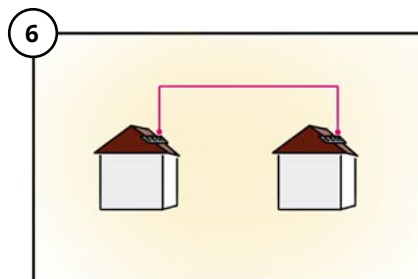
The Box comprises: see above



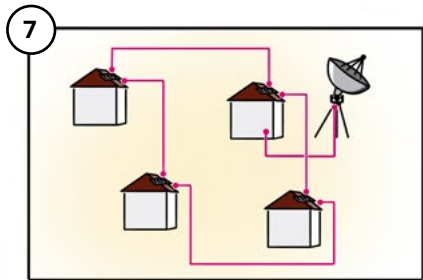
The solar panel cell will be placed where maximal yield can be achieved e.g. somewhere on the roof



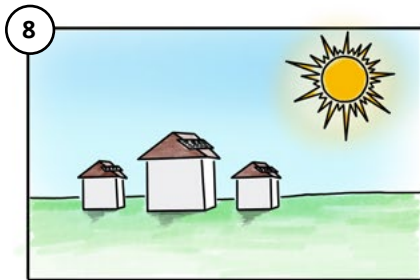
The battery will be placed somewhere in the house such that the prepared wires will last in length



The same happens to the QGrid Router. Since the QGrid Router delivery also computing, internet, TV & telecommunication services the placement in the living room next to the kitchen should be preferred.



When the house is equipped with power supply, meshing up with neighbors can start by using the routing cables by linking the different houses. By meshing up Quantum Grid cells are formed which themselves can be connected to form Quantum Grid super cells



Villages can be connected to the internet e.g. by satellite connections to the internet or by mobile connections



Connecting Quantum Grid cells and Quantum Grid super cells form then an global quantum grid

QUANTUM GRID OUT OF THE BOX (QGB)

Description of the functioning of the Quantum Grid out of the box (QGB):

Key element of the QGB is the Quantum Grid router. It has the following port classes:

- Solar generator ports to connect to the PV panels
- Storage ports to connect with the battery
- Load ports to connect with the DC consumers and the DC-sockets
- Router ports to connect with other routers

The generator port provides the inverter function for the optimal power outcome and power feeding into the grid. The battery ports provide the charging electronic functions for the battery. The router ports provide the routing function of the power and data packets for the Quantum Grid while the load ports provide the power for the consumers.

When sun shines on the PV-cells, power can be provided depending on the intensity of the ray of sunshine. The quantity of energy packets that can be provided for the period T result from the power generation forecast. Depending on the storage condition of the battery, a certain amount of energy packets can be stored. This balance sheet reveals the necessity to obtain packets or provide packets from/for external router knots.

Besides the power plane the router also has a routing plane. This plane is responsible for the forecast, the communication functions, the routing functions, as well as other computer functions; for details see “Quantum Grid whitepaper” published on our homepage.

The power plane consists of power electronics components and control technology – this is where the physical transmission of energy packets takes place.

The routing plane is realized by standard computer hardware, just like they are used for PCs and graphic cards.

The following functions can be realized by the QGB:

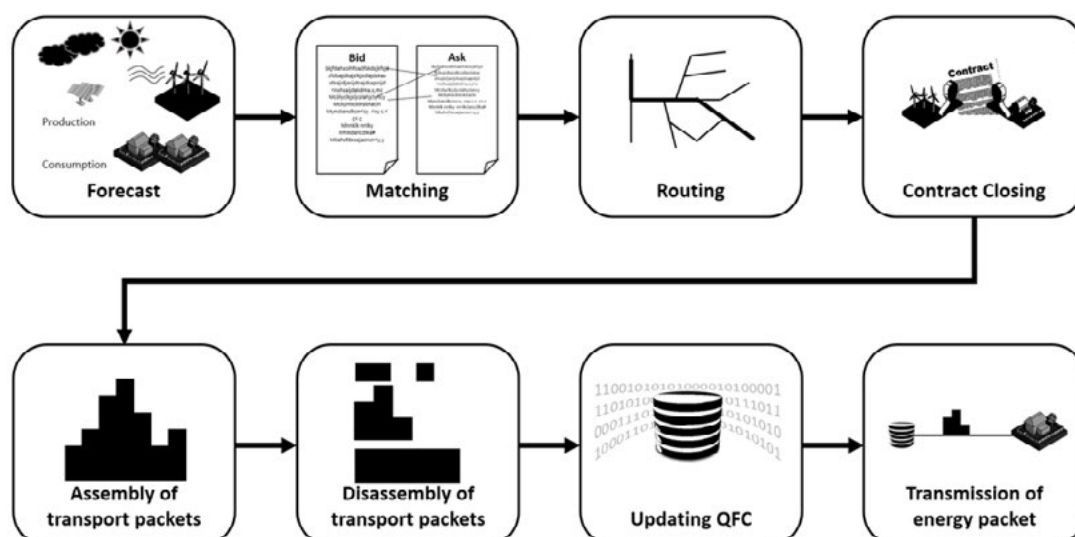
- Routing and control functions for the QG
- The control functions for the power plane to control the power electronics to realize the power control for the transport of packets
- Generation and load profiles by means of artificial intelligence
- Internet functions, e.g. routing functions for landline and mobile network communication
- general computer functions
- Provision of data center services or so called cloud applications
- Provision of applications
- WLAN, connections to mobile devices
- Provision of storage for data services

By having multiple uses for the computers the costs allocated to the individual functions decrease. This is one concept of virtualization.

This concept enables users to have access to electricity as well as internet and communication functions. Furthermore they will have functions of computers in form of APPs or other applications programs at their disposal and have access to memory space to store electronic data.

We call this single system of PV, battery and router a Quantum Grid knot. Linking the Quantum Grid knots creates the Quantum Grid cells. These can be connected to Quantum Grid supercells which finally form an extensive Quantum Grid.

Linking the Quantum Grid knots also means linking the control units of the single Quantum Grid router. This forms the Quantum Grid cloud in which computer functions can be virtualized and spread. This enables a better computer performance for a more exact forecast of the local weather.



This is the fundamental of a solar producing forecast.

This weather forecast is also significant for agricultural use. This way water consumption, water purification and water storage can be administered.

The QGB enables the participation in economic trading locally and improves e.g. agricultural and technical work because electricity has to be provided for the machines.

The electricity will be generated in an own PV-installation and stored in a battery. Due to the transmission of energy packets trade with electricity can also be realized. This guarantees that only ordered electricity will be delivered and consumed.

Because of the quantification or rather digitalization a simple billing mode is feasible. A mechanism similar to the block chain would be suitable for the order management and the execution of the transport. In this way communities can establish their own trade with electricity. This order and billing system on the block chain basis is also realized on computers of the Quantum Grid.

By means of the order and billing system other products and services can be settled. Independency from central locations or large companies can be reached. The integration of the mobile payment mode Micro payments for mobile communication provider is conceivable.

As already mentioned, housing areas can be connected via the corresponding exchange line and therefore cells can be formed. An electricity network is constructed bottom-up. Single cells or houses can be connected over mobile connections, e.g. via directional radio or LTE. Via satellite the access to internet can be realized.

After the communication connection it is possible to link single cells with the corresponding lines so that the transmission of electricity is possible. The concept of the QGB is designed so that the majority of the value chain can be realized locally. Due to the modular and fixed concept of linkage with prefabricated lines no electrician is necessary.

The system can be put together easily and put into operation by everyone. It is easy, safe and effective.