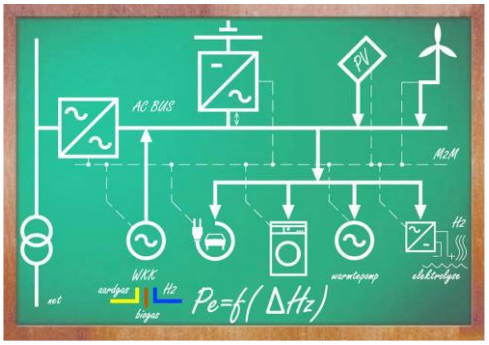
Development and validation of the concept of local autonomous grids using a hydrogen-based CHP with combustion engine and storage.

The integration of renewable energy sources creates a multitude of decentralised production units. However, these are put on the grid with no eye for synchronisation between production and consumption. This can lead to instability in the grid, grid congestion and variable prices on the energy market. In the case of weaker grids, this entails a need for additional grid infrastructure, possibly preceded by expensive studies into the strength of the grid. In that future context, the cost price of electricity will increasingly be determined by the cost price of energy storage and flexible production units. As a solution for (long-term) storage and a flexible CHP based on an internal combustion engine, hydrogen is opted for here.

The aim is to connect a local grid to the higher grid via a power electronic converter. This creates a virtual separation between the local grid and the higher grid and allows the local grid to be operated autonomously. The elements below are typically connected to this local grid:

- variable renewable production units (such as PV and wind)
- electrical energy users (such as heat pumps, consumption, electric cars, ...)
- thermal energy users
- electrical and/or thermal storage



This local grid is made possible by adding a mini-CHP based on an internal combustion engine with hydrogen as fuel and an intelligent control system. The intelligent control, including hydrogen storage and electrical storage, regulates the power balance of the local grid and ensures autonomous behaviour. By autonomous, we mean that the total production can be brought into line with demand at any time on the local grid, without necessarily having to resort to demand control or curtailment.

By adding the mini-CHP and hydrogen-based storage, as well as linking the local grid via a power electronic converter to the higher grid, it will even be possible (in due course) to provide grid support services to this global grid. This typically involves (i) making capacity available, (ii) providing reactive power.