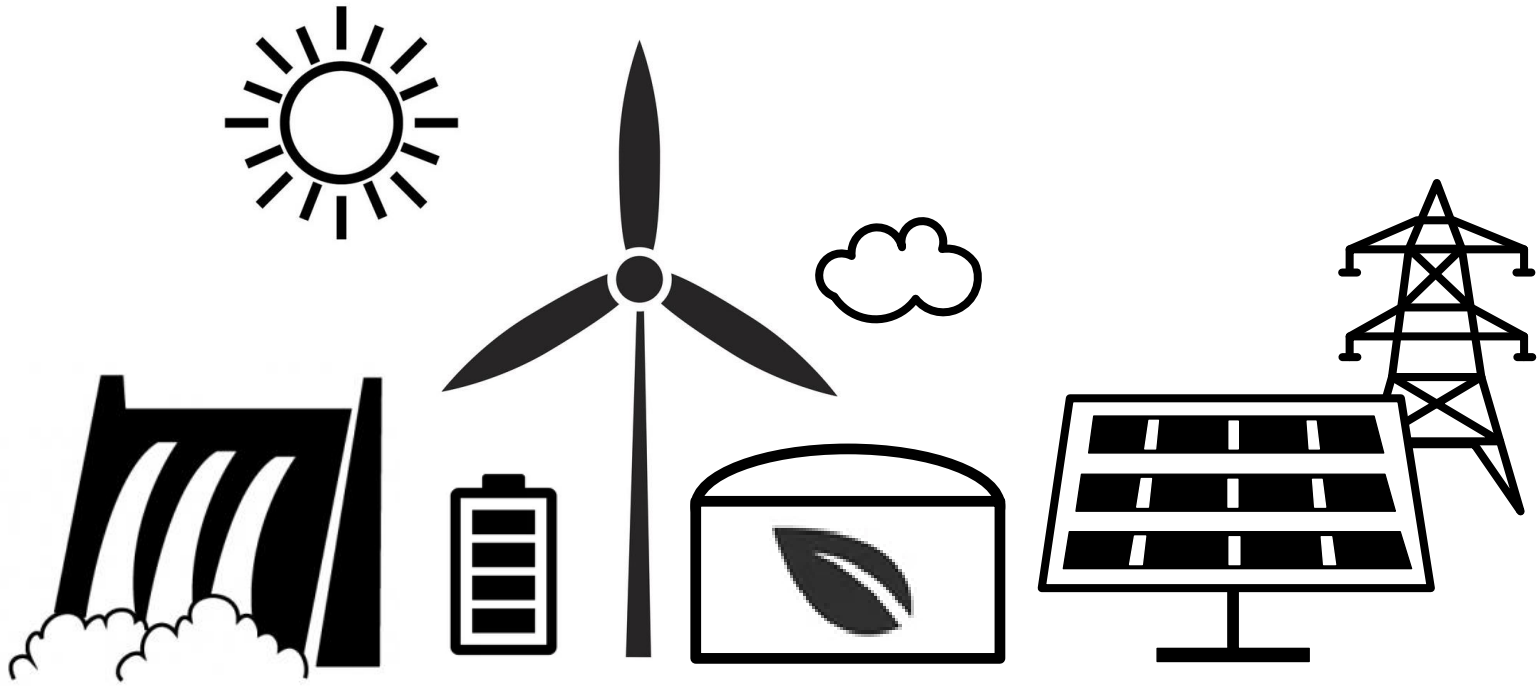


TURNER MCS

Monitoring and Control System

EASYHYBRID

the microgrid controller

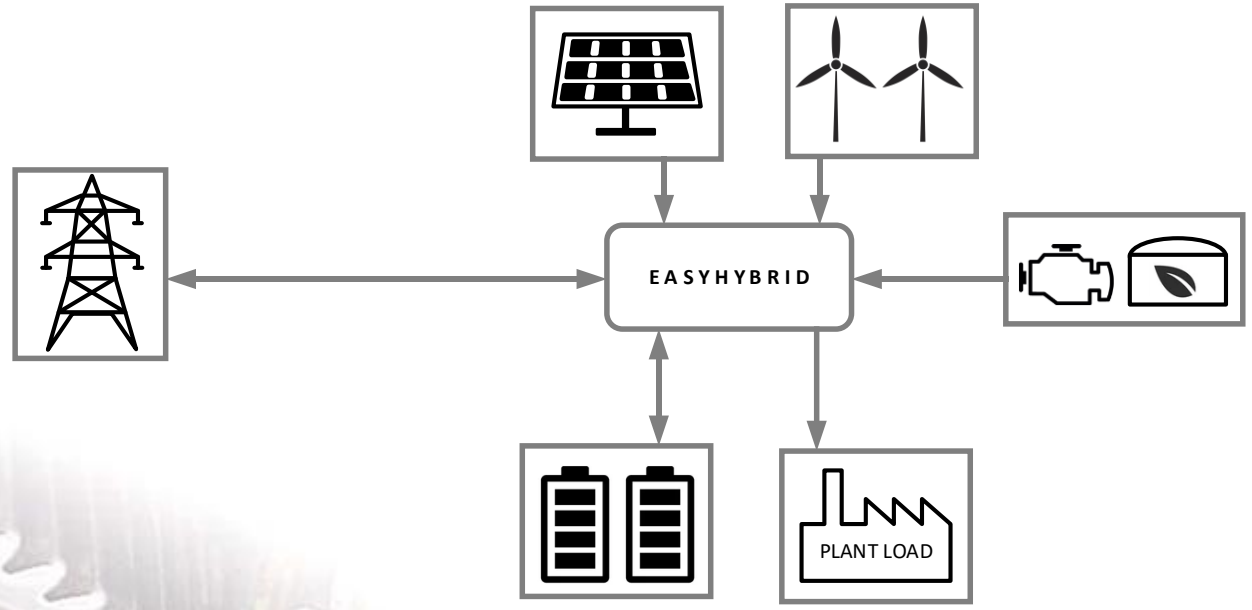
Version 1.00

Diffuse generation

The global energy scenario is evolving towards a **fragmentation of energy production sources**, often of decreasing sizes, according to the principle of diffuse generation.

We are witnessing the birth of micro production plants, composed of a **mix of energy sources** more often exploiting natural sources, such as sun, wind, with non-continuous availability.

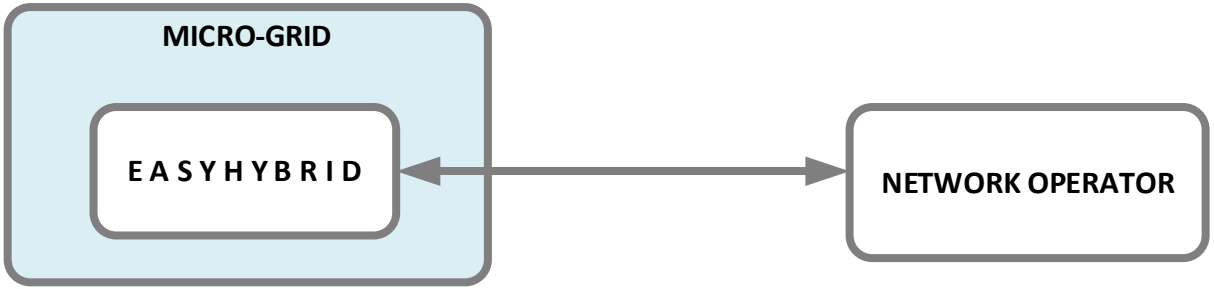
This new condition makes it difficult to link production and consumption. Consequently, the development and engineering of storage systems that can help to fill this discontinuity is strong. These changes lead to the emergence of increasingly complex power grids composed of micro-grid interconnected.



Micro-grid controller

This energy revolution requires us to have a **distributed intelligence capable of managing the microgrids that are emerging** aimed at optimizing the exchange of energy on site.

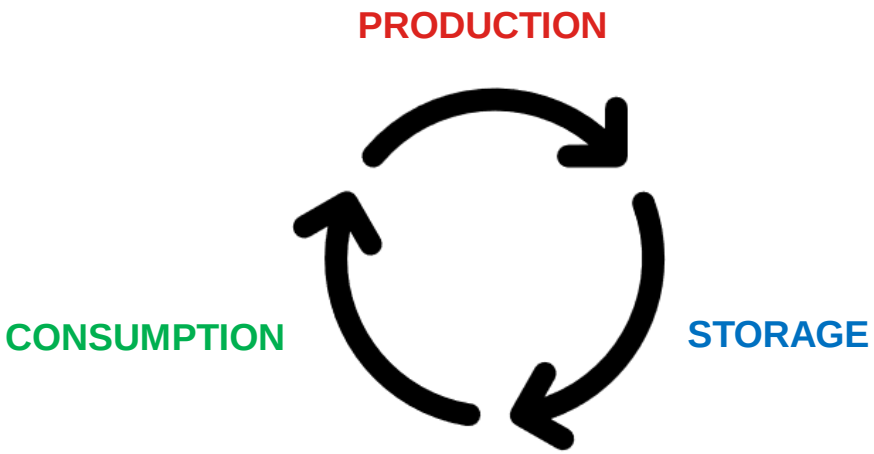
Grid operators across Europe have set the rules for this integration to happen, and in Turner we have taken up the challenge. Wherever you need to interface different forms of production and consumption, **EasyHybrid allows you to connect energy supply and demand**, ensuring continuity of supply while safeguarding the stability of your network.



Control your energy

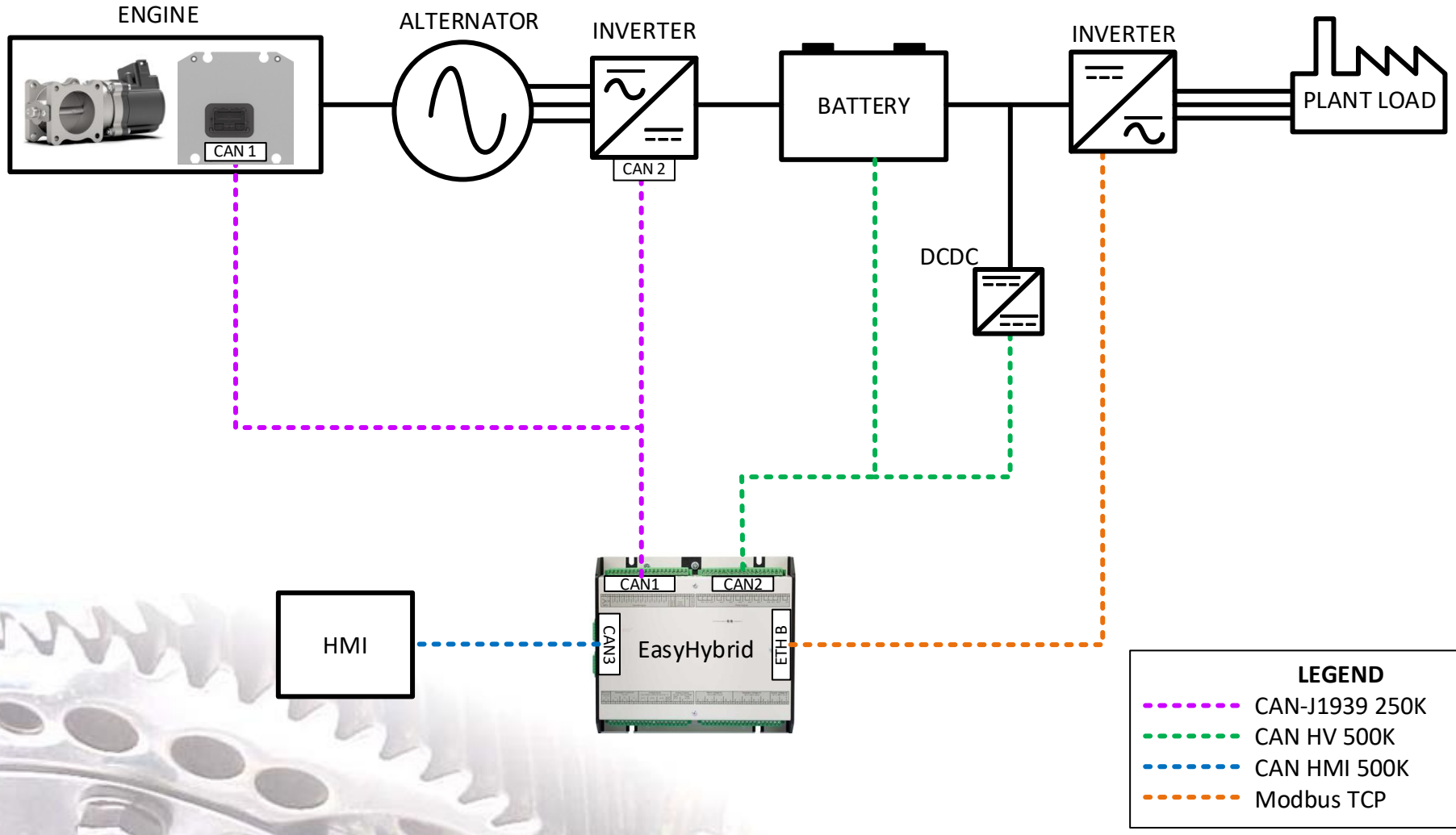
EasyHybrid control the energy production and storage, to ensure continuity of service for a stable micro-grid

- **Production** - Interconnecting multiple energy sources guaranteeing the maximum efficiency
- **Storage** – maintaining a storage level for safeguard of the storage system and
- **Consumption** - maximize energy usage preventing power outages



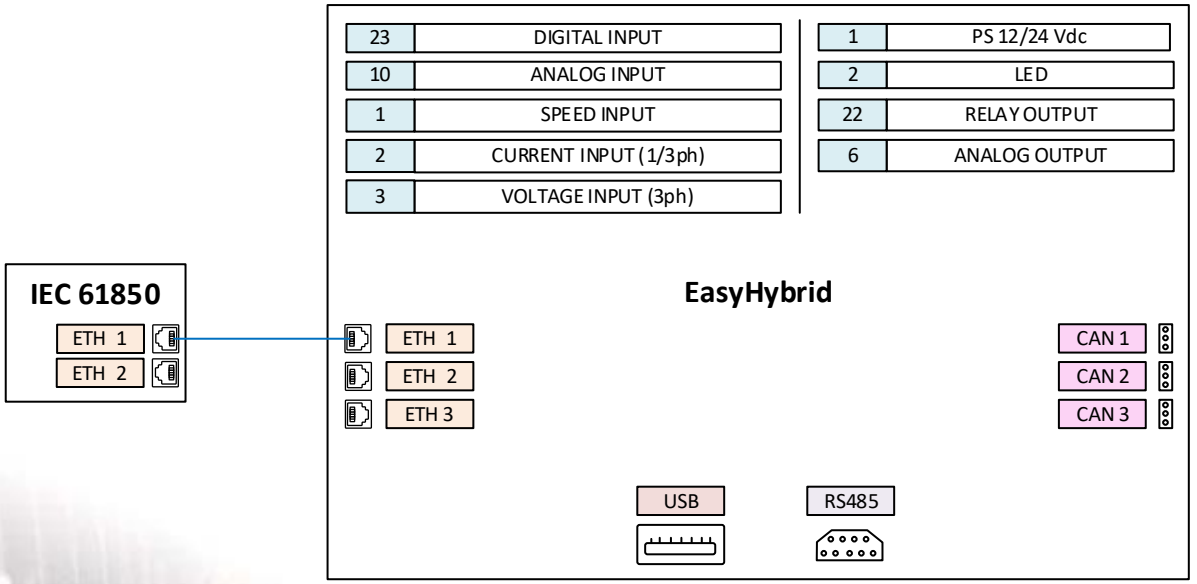
TURNER MCS

EasyHybrid – system overview



Hub

The unit is **hub featured by diverse communication protocol** CAN open/J1939, Modbus (TCP/serial) and via converter to integrate multi-protocol communication ex. IEC61850.
The on-board IO allow also a direct metering and control of the micro-grid.
The combination of **hardwired IO and communication port allow control and diagnostics** of the Energy production unit, storage system and consumption.



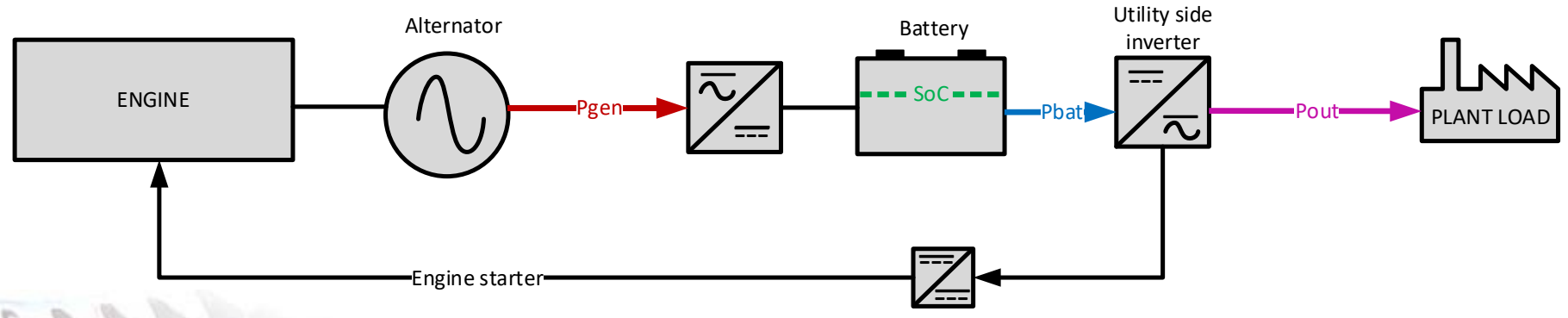
Main system variables

Pgen is the instantaneous electric power supplied by the generator

Pout instantaneous absolute power absorbed by the utility-side inverter

Pbat is the instantaneous power supplied by the battery (**Pout** – **Pgen)**.

SoC is the battery state of charge



System conditions

Scenario	Normal Operation
Stop	Engine is stopped and utility-side inverter is not delivering any power.
Full Electric	Engine is stopped, battery is delivering all required power via the utility-side inverter.
Hybrid	Engine is started and stopped based on system status and requirements. Generator is delivering power. Battery is absorbing/delivering power based on system conditions.

Main system sequence

•**STOP:** package power-up and shutdown condition

•**ELECTRIC:** battery consumption mode without the engine

•**HYBRID:** EasyHybrid will decide whether to start/stop the engine and the setpoints for engine and alternator-side inverter based on system status and operator selection.

- **SoC critical:** disconnecting all load to safeguard the minimum battery charge
- **Load:** battery SoC is above a certain level, then load is powered.
  - **Charging:** battery SoC is below a certain threshold and the system has as objective to charge the battery.
  - **Discharging** battery SoC is above a certain level and the system does not have battery charge as main objective.

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