

How battery systems can integrate renewable energy in smart grids

By 2030, 32% of the energy consumed in the EU must be generated from renewable sources, such as water, wind and sun. To achieve this, it doesn't suffice to increase the number of wind turbines and solar cells. Extended and adapted transport and distribution grids are also necessary

Wind and solar energy is not constant and therefore a renewables-based society requires smart grids to transport this power from areas where electricity generation is currently high to those where it is low in order to meet demand. And **to keep these grids in balance, electricity storage systems are needed.**

In several European countries, energy companies, research institutions and local authorities are working together to build such systems. At the end of May 2018, energy producer [Eneco](#) (Netherlands) and Mitsubishi (Japan) inaugurated **the currently largest European battery** in Jardelund, in the north of Germany. It has a capacity of 48 MW and contains around 10,000 lithium-ion batteries. It is connected to the transport grid operated by [Tennet](#).

"Initially the battery will be used for the primary reserve market, where European grid operators purchase the reserve capacity they require to guarantee the 50 Hertz frequency on the grid," says Marc Wegman, director for industrial assets in Germany and The Netherlands at Eneco.

"The [Jardelund battery](#) can take over the role of primary reserve provider from coal and gas-fired plants. **We also investigate possibilities to connect local wind farms to the battery.** In the event of overproduction, the energy can temporarily be stored in the battery. For example, this can mean grid operators don't need to ask wind turbine owners to switch off their turbines to avoid overloading."

"The battery supports the grid in several ways," underlines Ulrike Hörchens, spokeswoman for Tennet in Germany. "We use it to compensate for the imbalance between generation and consumption. This helps to keep the grid frequency at a stable 50 Hz. **We also use it as a source of "reactive" power**, important for maintaining the voltage. In the old energy world, these tasks were performed by conventional, central large power plants, using nuclear or fossil fuels. Batteries are important, because they make it possible for new systems to take over the tasks of conventional power plants."

A smaller pioneering project is owned by the Swedish energy group [Vattenfall](#). In Cymoedd (Wales, UK) it has constructed a 22 MW energy storage facility at its [Pen y Cymoedd](#) 228 MW-wind farm, using batteries manufactured by BMW (Germany). It counters power and frequency fluctuations on the grid within a second.

In Dilsen-Stokkem (Belgium), energy company Restore has inaugurated an 18 MW battery system. Today, this system is integrated into the spare capacity of Belgian electricity transport grid operator [Elia](#).

"Large battery systems can be used to stabilise the frequency and balance the peaks in smart grids. But they can also be used **to make specific users grid independent**," says [Ronnie Belmans](#),

professor in electrical engineering at the [KU Leuven](#) university in Belgium and CEO of research centre [Energyville](#) (Genk, Belgium).

This will most probably be the case of the holiday resort Terhills that will be constructed on the site of a former coal mine in Eisen (Belgium). It will incorporate systems for producing solar energy, such as floating panels that track the sun across the sky.

"Users can be a resort like Terhills, but also industrial companies or even households, clustered as a district," Belmans adds. "**Where this evolution will take us, nobody can foresee today**, but there will be a main challenge ahead for the grid operators. The more consumers who become grid independent in addition to producing their own energy, the **fewer consumers will have to bear the costs of constructing, using and servicing the grids**. This might not become a major problem in densely populated areas such as Holland, Flanders, the Ruhr region or the greater Paris area, but what will be the price of distribution grids in rural areas?" he worries.

"I don't believe this will become a major problem. **Customers going 100% off-grid will remain the exception in Europe**," says Claus Wattendrup, head of the solar & batteries unit at Vattenfall. "However, **batteries at renewable production plants will play an important role in future energy systems, and they can also help to shift peaks of commercial and industrial customers**. In general I believe demand for electricity will go on rising, thanks partly to the growing popularity of electric mobility."

"Besides physical local battery systems, we will also have **virtual batteries**," adds Wegman. "Their main use will be to provide spare capacity. Individual owners of small batteries - installed in combination with solar panels - can offer these, to market players responsible for grid balance, by the use of software combined capacity. **Currently the legal thresholds are higher than the technical limits**. Germany has taken the lead in adapting its legislation to new applications, made possible by the recent evolution of the technology; other countries can see this as an example. I think **the possibility to participate in such virtual batteries can be the tipping point for getting people to invest in a battery system**."

By Koen Mortelmans