



Harvesting and storing light

More and more dairy farmers in the Netherlands are investing in solar, wind, biogas etc. But there is one drawback here: the electricity generated from such sustainable energies cannot be stored efficiently. However, this problem has now been solved by a CellCube FB 10-100 – a vanadium redox flow-based battery – from GILDEMEISTER energy solutions that has been installed on the farm of Jan Borgman and Erna Roeterdink in Vierakker in the Netherlands.

Cow number 658 has just pushed her way into one of the high-tech boxes and is now munching away at her feeding trough. At the same time the arm of the milking robot moves down and washes her udder with rotating brushes. Red laser beams then feel the teats. They guide the teat cups that are then attached and start their work with unbelievable precision. However, the milk is not only pumped but also analysed simultaneously.

The milking robot first made its appearance on the farm of Jan Borgman and Erna Roeterdink in Vierakker in 2009 and in the meantime it saves around half the milking time required previously. The cows move about freely and simply trot over to the milking robot when they feel they need to be milked.

Jan and Erna operate their family farm with two milking robots and around 100 dairy cows. They have a milk yield of 890,000 litres. However, in contrast to traditional milking systems, the milking robots need electricity virtually all day long. And this energy comes from the sun and is stored in a CellCube FB 10-100 vanadium redox flow battery which has the size of a small sea container. Their farm is a modern enterprise and has very little in common with our idyllic images of farm life.

“Farming and energy generation go well together,” says Jan, because farmers have the space necessary for solar and wind power plants and the raw materials that are needed, for example, to operate biogas plants.

STORING SOLAR ENERGY

The photovoltaic systems installed on the roof of the farm’s barn has a surface area of 360 m² and generates 50 KWh of electricity. They call themselves “photon farmers” because they convert light particles collected by the solar cells into electricity. This solar energy is buffered in the CellCube. This stores the electricity that can then be supplied when the dairy farmer needs it.

Jan and Erna have been photon farmers since 2010. The dairy farm ‘t Spieker, that has been owned by the Borgmann family since 1750, is the first farm in the Netherlands to become self-sufficient by generating its own electricity. “We wanted to go that extra mile,” says Jan. “By upgrading our farm with renewable energy sources we hope to make it more economically attractive and viable. This is still something of a rarity in the Netherlands.”

“But there is more to it than that. We want to encourage other farmers to invest time and effort in expanding their operations in the same way. Generally farmers who focus exclusively on dairy farming opt for a rather lonely existence. We are proud of our operations here and are keen to show others how modern farming techniques work. We are also glad of any opportunity to boost the image of agriculture and dairy farming.” »

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CELLCUBE FB 10-100

The CellCube FB 10-100 allows customers to use electricity generated from alternative energy sources independently and flexibly round the clock. The storage device from GILDEMEISTER energy solutions is a turnkey system. In order to meet the different demands of customers and different circumstances, the batteries are available in different versions with varying outputs and storage capacities. So the CellCube can be configured and combined flexibly as required. Nominal outputs from 10 kW up to the MW-class and storage capacities from 40 kWh up to several MWh can be offered.



POSSIBLE APPLICATIONS:

- » For storing electricity from solar, wind power or biogas plants
- » As an electrical backup system to ensure sensitive systems continue operating in the event of a power cut
- » As an isolated solution where there is no power grid
- » For transferring loads in the network over time (peak shaving)
- » As a solar charging station for electric vehicles
- » In parallel operation with the grid in the case of instable networks

GROUNDBREAKING PROJECT

Photon farmer 't Spieker in Vierakker is a joint project developed by Courage, InnovatieNetwerk (which was set up by the Dutch Ministry of Agriculture, Nature and food quality LNV), Alliander, Trinergie and the province of Gelderland. Courage develops and realises groundbreaking innovations intended to strengthen dairy farming in the Netherlands.

"The project is intended to serve as a reference project to show how dairy farming can take on a new position on the energy market," explains Jeroen de Veth, project leader at the energy agency Trinergie. "It also indicates that the Dutch dairy industry is open to experimentation, to new technologies and to taking responsibility for a sustainable society."

As the project team started to look around on the market for a suitable vanadium redox flow storage medium at the end of 2008, the solution from GILDEMEISTER energy solutions proved to be the only viable large-scale storage system available at the time. The storage device was delivered and installed in the summer of 2010.

The CellCube FB 10-100 has specially designed inverters that enable connection to different energy sources. Its storage capacity of up to 100 kWh and its nominal output of 10kW mean that on sunny days energy for eight hours can be stored on the farm.

AUTONOMOUS ELECTRICITY SUPPLY

So the photon farmer can take control of his own electricity supply. Firstly, he can use the electricity for his own operation and feed any surplus electricity into the power grid at a time that suits him and when the price is right.

This is a far better solution with regard to sustainability and waste of energy than only supplying the grid, says Jeroen. That is why electricity storage is the core element of the photon farmer model.

"Currently small consumers are invoiced at the end of the year in the Netherlands, for the actual net amount of energy taken from the grid," he explains. "Here on the farm around



PHOTON FARMER

62,000 kWh are needed, of which 42,000 kWh are generated from solar energy. So the farmer only pays for the remaining 20,000 kWh he took from the power grid."

The situation in Germany, for example, is different says Jeroen. The EEG (Renewable Energy Sources Act) also rewards a high level of personal consumption. On the other hand systems with energy storage systems are more suitable for the future "Smart Grid".

ENERGY FOR THE FUTURE

The project has proved quite impressively that the solar energy that has been generated can be stored for later use. So it really is quite literally "energy for the future," a sustainable innovation. "We can balance energy consumption very well and can ensure an uninterrupted energy supply, a fact that is important for hospitals, for example," he explains. "Together with GILDEMEISTER we have designed a software and control system that guarantees optimum battery operation and that is very stable."

The jointly developed software can monitor energy production and the status of the storage device continuously: the measured temperature, the load percentage of the battery, the exchange of energy with the public power grid can all be read off exactly. Peaks in demand, for example when the milking robots start up, can be seen immediately.

Jeroen points to a monitor on the wall that has an impressive display of lines and circles. "That," he says, "is the heart of the photon farmer." And it is true – the monitor shows a small red heart beating, indicating that CellCube is alive and working. The intelligent control system diverts the solar power to the place where it can be of most benefit. It can either be delivered directly to the dairy farm, to the storage device or to the national power grid. "Let's say sunny weather is forecast for tomorrow, then the system will respond by ensuring that the storage device is discharged to the best economic effect before then."

A farm's crops usually include corn, grass and milk. But on the dairy farm 't Spieker in Vierakker in the Netherlands (near the town of Zutphen) photons are now being "harvested" by a solar system installed on the roof of the barn.

Buildings on dairy farms often have large roof areas which, if they are facing south, are ideally suited for the installation of solar cells. The drawback of this kind of renewable energy is that the yield is dependent on the weather. A CellCube FB 10-100 vanadium redox flow storage device from GILDEMEISTER energy solutions can be used to catch and store the surplus capacity so that the energy can be used later, either for the milking robot or other electrically powered devices or for feeding it into the grid at an opportune time.

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Efficient: Thanks to the modern feeding robot, 70% of the original diesel costs can now be saved.

The farmers in Vierakker are always on the lookout for new opportunities. Two new solar boilers, for example, have been installed on the roof. The farm also makes use of the warm water generated during the milk cooling process. Another clever innovation is the use of an LED lighting system in the cow shed, because trials have shown that good lighting can really improve cow milk, especially in winter. Sixteen hours of light and eight hours of darkness are ideal for a cow. In addition the farmer has saved 70% of his costs for diesel since a state-of-the-art feeding robot has been in operation that now no longer needs to be powered by his generators.

WIND IN THE MIX

"We are currently evaluating a possible investment in a WindCarrier for additional energy generation," says Jeroen. "The CellCube has been running smoothly now for two and a half years and we are very satisfied with its performance, but it by no means operates at full capacity in winter, because the photovoltaic system itself does not even operate at its full capacity then. If we take wind power on board, we will be able to generate more renewable energy even in winter and then really work independently from the grid. That is the aim."

The Netherlands plan to increase the percentage of renewable energies from currently 4% to 14%.

"It is very important that everybody in the agricultural sector keeps a close eye on the new alternative energy sources," says Erna. "These are opportunities to boost your income." Today this involves subsidies, but this may not be the case in the future.

The project participants' vision for the future: filling up with charged electrolytes at the photon farmer. The charged vanadium solution in the storage device can be pumped, so it can also be used for mobile systems, in commercial vehicles, for example, or even in cars. But it will be a little while before we reach that stage.

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A STEP IN THE RIGHT DIRECTION

Renewal energy is one of the many political topics in the Netherlands. The working program "Clean and Efficient" plays an important role here. Its goals include reducing the emission of greenhouse gases by 30% by the year 2020 compared with the figures from 1990. The percentage of renewable energies is to be increased from currently just 4% to 14%. Already in force is the so-called SED regulation, a program for promoting renewable energies. Subsidies are made available in the sectors of solar energy, on-shore wind energy, biomass, bio-production and power-heat coupling. Wind energy is to be expanded.

The solar market has remained steady in the last few years, but has only developed slowly. Nevertheless, photovoltaic systems are at the top of the wish list for Dutch dairy farmers. Around 16% of this want to invest in renewable energies. Currently the major part of electricity generated from renewable energies comes from biomass, as energy production from the combustion of organic materials such as plants, dung and green waste.

Being a flat and windy country, the Netherlands also set their sights on the utilisation of wind energy. Thanks to the goals set in the year 1990, there was a boom in this sector from 1992 onwards. Over 600 wind power stations were built at that time. But a lot remains to be done in the sector of renewable energies if the targeted 30% is to be achieved.

More off-shore wind parks are among the plans in this respect. However, this means that investments must be made in the laying of power supply lines and energy storage systems.

Source: www.sonnenertrag.eu



The state-of-the-art feeding robot is fed with renewable energy from the CellCube storage system.