



Kinetic Battery

THE SPACE SAVER




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The increasing electrification of port-based central logistics processes is putting power grids to the test. Electrically powered, high-performance equipment, such as heavy-duty cranes, can cause enormous and volatile power surges. Quick storage solutions can reduce these peaks and relieve the strain on the power grid. QuinteQ, based in Culemborg, Netherlands, has taken flywheel storage technology - originally developed for outer space - and adapted it for use in mobile containers. The Dutch company is facilitating port electrification worldwide. How is this possible? Electrical capacity can be expanded at anytime, anywhere - eliminating the need for expensive, time-consuming grid expansion.



»The M200 system's extremely fast and accurate grid measurement and protection functions are ideal for high-performance port facilities with short-term peaks in energy demand.«

Timo Pael

New Business Development Manager
QuinteQ

QUINTEQ

- Established in the Netherlands in 2016
- Driving the energy transition forward with flexible flywheel energy storage solutions
- Used in ports, construction sites, railway applications, and microgrids

www.quinteqenergy.com

Kinetic energy storage

Battery storage systems are becoming increasingly prevalent. It is hard to imagine many modern applications without them. However, due to technological limitations, production-ready lithium-ion storage systems have several disadvantages, including a limited number of charging cycles, high flammability, and dependence on sensitive supply chains.

The specialists at QuinteQ have designed a flywheel solution to eliminate many of these disadvantages. "Our flywheel contains almost no rare earth materials. It doesn't require electrochemical cells, so operational safety is higher. The storage system is virtually maintenance-free and allows over 350,000 charging cycles, with an operating life of 15 years or more," says Timo Pael, QuinteQ's New Business Development Manager, proud of his team and their work.

Speed is compact

QuinteQ's flywheel design focuses on speed rather than mass. "The amount of storable energy is linearly related to the flywheel's mass. However, speed has a quadratic effect on storage capacity," says Pael, explaining the physical principles. Thanks to a high rotational speed of over 10,000 revolutions per minute, a flywheel can be compact in diameter. This makes them ideal for use in mobile containers, which can be deployed temporarily or permanently in a wide variety of locations, to reduce peak loads.

Adapted for terrestrial conditions

It took a while for this sophisticated storage technology to find its footing on the Dutch coast. It was originally developed by Boeing for use in space. However, in 2016, the US government dropped the project, forcing Boeing's R&D department to abandon it. QuinteQ subsequently acquired around 200 patents from Boeing, and has continued to develop the concept ever since.

"Applications in space demand extremely compact and safe storage solutions. Functionality comes first; cost comes second. That's not the case on Earth," Pael smiles. "We did everything we could to reduce complexity, improve cost efficiency, and increase power output with flywheel dimensions almost comparable to those of other systems."

Winning pilot projects

QuinteQ tested the developed technology in several pilot projects and continuously optimized the design.

In Rotterdam, for instance, a 400-kVA flywheel storage system supported the port's primary power supply. There are three electric cranes in operation, causing high load peaks during loading and unloading. Thanks to QuinteQ's solution, power consumption from the grid decreased by 65% during the pilot project, significantly reducing load peaks.

In another Dutch installation, QuinteQ's flywheel relieved the grid in Moerdijk. The port operator added another transshipment area with another heavy-duty crane. In the pilot project, peak power consumption decreased by over 70%. Thanks to the storage solution, both cranes can now operate in parallel without exceeding their contractually defined limits.

For its pilot installations, QuinteQ relies on the Bachmann M200 control system, which features grid measurement and protection functions. "We received targeted support from Bachmann in engineering our control systems. During the development process, our programmers approached the Bachmann experts repeatedly with specific questions. We did a lot of short online sessions, and got valuable tips for possible solutions – the collaboration was really efficient," says Pael happily.

Series production with Bachmann

Following successful completion of the pilot projects, series production of the flywheel storage systems is now underway.

In addition to an M200 controller, the series version uses the M100 I/O system with space-saving UI0108 high-density modules. These modules offer up to 50% more channels than standard I/O modules, with the same compact form.

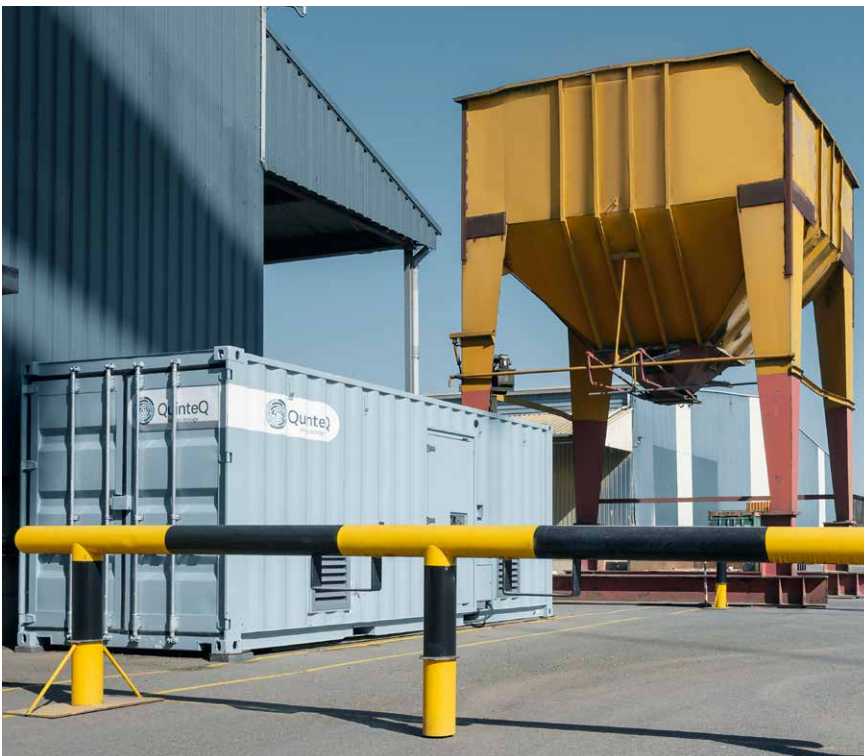
The flywheel is available with 300 kVA and 600 kVA power ratings. Depending on the application, QuinteQ will configure the appropriate total power with several flywheels. "Our scalable solution can be installed in 10-, 20-, and 40-foot containers. We can fit up to 4 MVA of power in one container."

The QuinteQ container solution is plug-and-play, and includes the flywheel and the Bachmann control system. QuinteQ defines the exact charging

and discharging behavior parameters for each application in advance. Once connected to the port grid, the storage system immediately relieves the main grid, with no further preparation necessary.

Expansion ahead!

Timo Pael is certain that QuinteQ's pioneering storage solution will relieve the burden on Dutch port networks over the coming years. "Our flywheel solution paves the way for the global use of an advanced storage technology – in the maritime sector and beyond. The Bachmann control systems are just as robust as our technology. Nothing stands in the way of long-term application in regions with challenging climates across the world."



Scalable and flexible: With QuinteQ's modular flywheel design, containers can be combined into large energy storage systems. Capacity, charging and discharging can be precisely adapted to local energy requirements.

An electric flywheel storage system features a rotating body, or flywheel, that is powered by an electric motor for the storage of kinetic energy. When required, the motor acts as a generator, converting the stored kinetic energy back into electrical energy.





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*Renewable Energy
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CONTACT

*Michael Backhaus
Manager Business Unit
Renewables*

*T: +43 5522 3497-0
info@bachmann.info*

bachmann.



www.bachmann.info

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