Saving energy and the environment with Flywheels

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ECE researcher, Dr. Mark Flynn's high-speed flywheel motor controller is reducing fuel consumption and harmful emissions at ports throughout the world. Flynn's design has been incorporated into energy storage systems used in Rubber Tired Gantry (RTG) cranes and sold by VYCON Inc.

The 8,000 RTG cranes operating at sea ports around the world contribute significantly to port emissions and, as such, have become a testing ground for new hybrid technologies. The mobile cranes are powered by a diesel generator set (engine and alternator) and typically move a shipping container every three minutes. Most of the power is expended in the lift, but since containers can weigh up to 50 metric tons, the descent must be carefully controlled. When a given container is lowered with a strictly diesel-based crane, its potential energy is not recovered but rather is dissipated as wasted heat.

Flynn's design captures the braking energy and uses it for the next hoist. More importantly, the addition of a flywheel energy storage system lowers the peak power requirements which saves energy during idle periods. Field tests in China showed that when operators used a genset appropriate for the reduced power requirements and added a flywheel energy storage system, fuel consumption went down by 38%, with significant reductions in NOx and PM emissions.

Flynn's flywheel motor controller is also replacing the industrial batteries used by mission-critical data centers and hospitals. "Industrial batteries

are less expensive initially than a flywheel, but when you factor in maintenance and having to pay for more charge than you need to avoid frequent battery replacement a flywheel-based solution can be considerable less expensive," says Flynn. "A VYCON flywheel will last 20 years and eliminates the problem of what to do with 200 large-scale toxic lead-acid batteries."

Hospitals and data back-up centers cannot afford power outages. Lives and disaster recovery for businesses depend on an uninterrupted flow of energy. A typical power outage is very short and most hospitals and data centers have back-up diesel generators, meaning the extra energy storage of an industrial battery is never fully utilized. Most outages are well within a flywheel's capability, but when the outage persists, the flywheel absorbs damaging power abnormalities then gracefully transfers to the generator—meeting emergency power regulations that stipulate gensets must be able to assume the load within 10 seconds. Flywheels also have a higher tolerance for rapid cycling.

"I am very pleased with the fuel and emissions savings results we are seeing and with additional improvements currently under research that aim to improve the savings further," says Flynn. "Future work will investigate the feasibility of using flywheels in subway rail stations to accelerate one train with the braking energy recovered from another. Doing so will not only save energy but can be used to defer or eliminate the costs of adding utility substations as rail service grows."

Source: University of Texas at Austin (news : web)