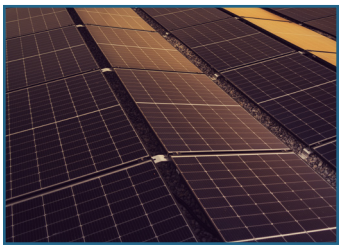
FORCE MEASUREMENT SOLUTIONS

CASE STUDY

Physical Force Is The Earliest Warning Sign In Energy Reserves






About

Energy reserve management assets operate under rigorous duty cycles to stabilize power grids, balance peak capacity, and smooth intermittent renewable generation. Modern grid operators monitor these multi-megawatt installations using building management systems, supervisory control and data acquisition networks, and localized battery management units.

Energy monitoring architectures traditionally rely on electrical and thermal variables such as cell voltage, impedance, current draw, and surface temperature. While these variables confirm active operating states, they do not always reveal mechanical wear, micro-strain, or material fatigue developing within the machinery and enclosures.

Physical force, mechanical pressure, and structural strain are the earliest indicators of degradation in energy storage. By integrating dedicated force measurement hardware directly at physical load points, plant engineers capture mechanical anomalies long before thermal or electrical thresholds are crossed.

Challenge

In critical energy reserve architectures, electrical and thermal variables are lagging indicators. Lithium-ion prismatic and pouch cells physically expand during charge cycles due to lithium intercalation. Continuous cycling, irreversible structural changes produce significant internal pressures. The cells can maintain nominal voltage and ambient temperature while generating thousands of pounds of mechanical force against enclosure containment plates, risking separator collapse and short circuits.



LWHP14 Precision Load Washer Load Cells



WTS-AM-1E Wireless Strain Bridge Transmitter Module



WMC Sealed High Capacity Stainless Steel Miniature Load Cell

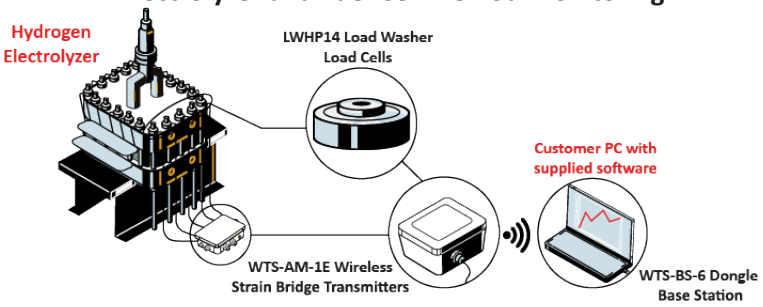


9330 High Speed Data Logger

Interface Solutions

Interface products address these blind spots when users integrate load cells, torque transducers, multi-axis sensors, and signal-conditioning instrumentation directly into mechanical load paths. Instead of inferring asset health from external symptoms, high-accuracy load cells and torque sensors directly record physical stress signatures. The solution pairs sensor hardware engineered for high extraneous load rejection with temperature-compensated strain networks to capture micro-strain changes in harsh electrical environments.

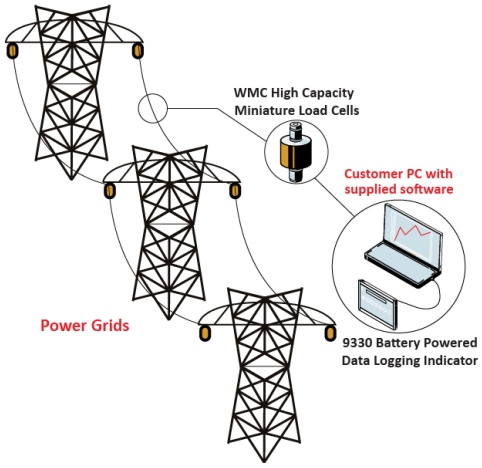
Electrolyzer and Fuel Cell Tie Rod Monitoring



Storage of energy is critical for renewables. Electrolyzers convert power to hydrogen, and fuel cells convert the hydrogen back to electricity. They are both made by stacking multiple anode and cathode plates and a membrane between each, and tie-rods hold them in place. A real-time monitoring system is needed to measure the tension of the tie rods in order to avoid costly preventive and unplanned shut downs. Interface suggests installing LWHP Precision Load Washer Load Cells connected to WTS-AM-1E Wireless Strain Bridge Transmitter Modules, under the bolts of the tightened tie rods. Transmitters are encased in a junction box enclosure. The LWHP's measure the tension between the plates from the tie rods, and the real-time results are transmitted from the WTS-AM-1E's to the WTS-BS-6 Wireless Telemetry Dongle Base Station.

Power Line Tension Monitoring

Ensuring the safety and reliability of power lines is life-saving. Power lines testing and monitoring requires reliable measurements. Interface recommends utilizing WMC Sealed High Capacity Stainless Steel Miniature Load Cells in conjunction with rod-end bearings to record cable tension forces during a maintenance procedure. The tension forces are measured by the 9330 High Speed Data Logger.



Results

Relying solely on voltage, current, and temperature data leaves operators blind to the progressive mechanical stress that precedes equipment breakdown. Physical force, strain, and torque are the primary indicators of structural health across battery racks, rotating shafts, and heavy-payload hoists. Integrating purpose-built sensors directly into mechanical load paths converts physical stress into actionable engineering metrics. This direct-measurement approach enables energy reserve operators to shift from reactive emergency shutdowns to precise, condition-based maintenance, protecting capital investments and ensuring continuous grid stability.