

Test&Measurement

YOKOGAWA ◆

# Empowering Energy Infrastructure

Precision Making



## Adapting to Rising Energy Demands

The global energy landscape is undergoing a rapid transformation driven by technological progress, sustainability goals, and increasing consumption. As households adopt more electrical devices, industries automate further, and datacenters grow to support AI and emerging computing technologies, the traditional energy infrastructure faces unprecedented pressure. At the same time, the shift toward renewable energy introduces new dynamics that must be managed effectively.



### Aging of infrastructure

Aging energy infrastructure is increasingly unable to keep up with rising electricity demand, leading to higher risks of failures, inefficiencies, and costly maintenance. As critical components reach the end of their lifecycle, the grid becomes more vulnerable, highlighting the urgent need for modernization and targeted reinvestment.



### Increased energy demand, grid reliability and cyber risks

Rising energy demand places additional stress on grid reliability, making the system more susceptible to overloads, blackouts, and operational disruptions. At the same time, increasing digitalization exposes the energy infrastructure to growing cyber risks, requiring stronger protection measures to safeguard critical assets and maintain uninterrupted power supply.



### Integration of renewable energy sources

Integrating renewable energy sources introduces fluctuating and less predictable power generation, which challenges the stability and coordination of the existing grid. To ensure reliability, the system must incorporate advanced forecasting, flexible storage, and smarter distribution technologies that can adapt to these dynamic energy flows.





# Precision Measurement for Reliable and Efficient Energy Systems



## Energy Generation

The shift to renewable generation from wind turbines and solar panels to advanced hydro and hybrid systems brings challenges in efficiency, reliability, and compliance. Complex drivetrains, inverters, and power electronics all need to perform under demanding environmental conditions.

Yokogawa provides precision data acquisition and power analysis solutions that capture electrical, mechanical, and thermal behavior with unmatched accuracy, enabling engineers to optimize designs, validate performance, and accelerate innovation in renewable generation.



## Distribution and Storage

Transformers, high-voltage switchgear, and energy storage systems form the backbone of reliable power delivery. They face constant pressure to minimize losses, reduce downtime, and ensure safety over decades of operation.

With high-accuracy power analyzers, high-speed recorders, and advanced test platforms, Yokogawa supports loss measurement, fault analysis, and storage system validation. From transformer compliance testing to switchgear verification and battery optimization, our solutions ensure efficiency and sustainability throughout the distribution chain.



## Maintenance and Monitoring

As grids and power plants become more complex and decentralized, ensuring continuity of supply is increasingly critical. Operators must monitor energy flows, isolate faults, and predict anomalies before they disrupt service.

Yokogawa delivers synchronized measurement, versatile data acquisition, and integrated analysis platforms that provide system-wide insight. By capturing transient events and long-term trends across electrical and mechanical domains, our solutions give operators the precision needed to safeguard stability and reliability in modern energy networks.



# Energy generation



## Hydro, Thermal & Geothermal Power Assets

Once assembled, steam, combustion, and hydroelectric turbines undergo acceptance testing to verify they can deliver the designed energy output. Power analyzers provide high-precision measurements of electrical output, while torque and speed sensors capture mechanical behavior using our data acquisition systems. Standard monitored parameters of power plant assets include turbine performance and vibration, boiler efficiency, steam temperature and pressure, generator output, harmonics, and transient events, ensuring safe, reliable, and efficient operation under real-world conditions.



## Wind Turbines

Wind turbines are evolving to deliver lower costs per kWh and higher efficiency. In large turbines, the drivetrain must operate efficiently while remaining reliable over decades. Direct-drive turbines eliminate the gearbox to reduce maintenance but require rare materials and higher upfront investment. Step-up transformers, placed in the nacelle for large turbines or at the tower base for smaller ones, also face strict efficiency and reliability demands. Yokogawa power analyzers accurately evaluate drivetrain and transformer efficiency under real conditions, while high-speed data acquisition systems capture mechanical and electrical behavior simultaneously to verify long-term reliability.



## Solar Panels & Photovoltaics

Research into new materials aims to make PV panels more efficient, cost-effective, and widely available. To support this, measurement systems are needed to track efficiency and thermal effects on performance. Meanwhile, inverters that convert DC to AC have reached high efficiency but now must evolve into smart systems for intelligent energy management, optimizing both consumption and storage. Power analyzers provide ultra-accurate efficiency and harmonic measurements required to validate inverter performance, while high-speed data acquisition systems monitor thermal and environmental influences. Oscilloscopes deliver detailed visibility into fast switching and control behavior inside the inverter, ensuring reliability and compliance in real-world conditions.

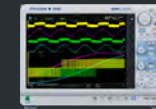


## Fuel Cells

Hydrogen, solid oxide, and PEM fuel cells production require precise measurement of key parameters such as cell voltage and current behavior, stack efficiency, thermal profiles, gas flow and pressure, humidity levels, and degradation trends. Power analyzers and DAQs verify power-conditioning and inverter performance by monitoring output stability, harmonics, response to dynamic loads, and conversion efficiency ensuring safe operation, optimal energy output, and reliable long-term performance of fuel cell systems.

## Data Acquisition Units

Capturing a wide variety of signals simultaneously



Desk-top  
DL950 ScopeCorder



SL2000 High-Speed  
Data Acquisition Unit



GM10 data logger

## Precision Power Analyzers

High-precision power analysis



WT5000  
Highest Precision  
Power Analyzer



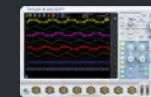
WT1800R  
High Performance  
Power Analyzer



PX8000  
Transient  
Power Analyzer

## Oscilloscopes

Detailed signal integrity analysis



DLM5000  
Mixed Signal Oscilloscope



DLM3000  
Mixed Signal Oscilloscope  
Including high-definition oscilloscope series



# Energy generation

“The flexibility of Yokogawa DL950 ScopeCorder for multi-parameter testing in power plant maintenance helps reduce the number of instruments needed for routine checks. With a single device, we can monitor generator output power and evaluate actuator and valve control signals to quickly detect any abnormal conditions,”  
– Hydro Power Station Engineer



# Energy Distribution and Storage



## Transformers

Transformers, both conventional and solid-state, are essential components of the power grid, enabling efficient, stable, and high-quality energy transmission. As manufacturers pursue cost-effective and environmentally friendly designs, minimizing losses during development becomes increasingly important. With advanced testing tools even small deviations in no-load or switching losses can be measured with high precision. This level of accuracy is vital for validating solid-state transformer performance, avoiding costly compliance penalties, and strengthening customer confidence in next-generation grid technologies.



## High-Voltage Switch Gears

High-voltage switchgear ensures the safe operation of power generation and distribution systems by controlling energy flow and isolating faults to prevent widespread outages. Reliability is essential in their design. To reduce equipment size while providing effective insulation and arc-quenching performance requires rigorous testing. Data acquisition using Yokogawa DL950 or SL2000 units simplifies the measurement process, enabling precise evaluation of switchgear behavior under demanding conditions.



## Battery Storage Systems

Energy storage systems help balance supply and demand, provide backup power, and stabilize the grid. Beyond improving lithium-ion efficiency and density, manufacturers are exploring alternative materials to reduce dependency on lithium. Advances include solid-state batteries for longer lifetimes and faster charging, and flow batteries for scalability. At larger scales, hydrogen and pumped hydro storage are gaining traction, with hydrogen offering the added benefit of use across multiple applications. Power analyzers and data acquisition units are used to measure precisely for the longevity and efficiency of these systems.

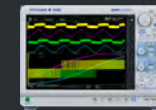


## Fast Chargers Power Demand

EV fast-charging stations create high, rapidly varying power demand that affects power quality and stresses distribution equipment, requiring real-time monitoring and grid control. To reduce this impact, stations use Battery Energy Storage Systems, DC-coupled storage, or solar-plus-storage hybrids to smooth load spikes and maintain charging even when grid supply is limited. Test and measurement tools optimize these designs by capturing transients, assessing efficiency, and validating battery and power-conversion performance, ensuring reliable, grid-friendly fast-charging operation.

## Data Acquisition Units

Capturing a wide variety of signals simultaneously



DL950 ScopeCorder



DL350 Portable ScopeCorder



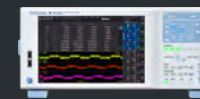
SL2000 High-Speed Data Acquisition Unit



GM10 data logger

## Precision Power Analyzers

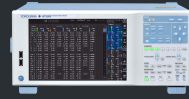
High-precision power analysis



WT5000  
Highest Precision Power Analyzer



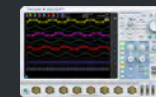
WT1800R  
High Performance Power Analyzer



WT5000  
Transformer Version

## Oscilloscopes

Detailed signal integrity analysis



DLM5000  
Mixed Signal Oscilloscope



DLM3000  
Mixed Signal Oscilloscope  
Including high-definition oscilloscope series



# Energy Distribution and Storage

“The power analyzer WT5000 Transformer version delivers the stability needed to assess even the smallest power losses in large transformers. Its high accuracy and multi-channel capabilities make it indispensable for verifying efficiency and compliance in modern transformer designs,” –  
**Leading Transformer Manufacturer, Netherlands**



# Facilities Maintenance and Monitoring



## Facility Assets Monitoring

Ensuring continuous power plant operation is critical in today's digital world, where supply disruptions can strongly affect businesses and daily life. System behavior analysis and early anomaly detection requires versatile instruments capable of capturing and analyzing trends across a wide range of electrical and mechanical parameters. These include monitoring vibration and rotational speed in hydro turbines, temperature and pressure in steam systems, generator output quality in thermal and renewable plants, and switching behavior or transient events in substations. By logging and analyzing these parameters in real time, operators can detect anomalies early, optimize performance, and prevent costly unplanned outages.



## Instruments Calibration

Regular calibration of instrumentation ensures that measurement, monitoring, and protection systems operate with the required precision across the energy infrastructure. Without consistent calibration, even minor deviations can lead to inefficient performance, unsafe operating conditions, or miscoordination between critical grid components. Yokogawa instruments enable the verification of energy assets against key standards such as IEC60076-8 through ISO/IEC 17025–accredited instrument calibration.



## Grid Control

Grid control requires close monitoring of energy flow and control systems. Capturing and analyzing failures helps prevent future issues. With GPS time synchronization, measurements across different grid points make it possible to trace the impact of a failure both upstream and downstream. With so many parameters to capture, the data acquisition units are the solution for these measurements.

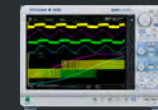


## Battery Backup Testing

Uninterruptible Power Supply (UPS) systems protect critical energy infrastructure by delivering continuous power during disturbances, preventing downtime and equipment damage. Advanced test and measurement evaluate battery health, response time, and power quality, ensuring that UPS designs remain reliable even when grid conditions become unstable.

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Capturing a wide variety of signals simultaneously



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DL350 Portable  
ScopeCorder



SL2000 High-Speed  
Data Acquisition Unit

## Precision Power Analyzers

High-precision power analysis



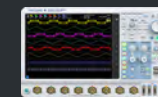
WT5000  
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## Oscilloscopes

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DLM5000  
Mixed Signal Oscilloscope



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## Power calibration



AC Power Calibrator  
LS3300



DC Calibrator  
2560A



# Facilities Maintenance and Monitoring

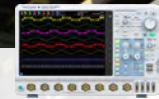
“Monitoring critical signals with the DL950 modular oscilloscope and data acquisition recorder-in-one provides invaluable insight into power plant performance. Its long-duration recording and synchronized data capture allow us to detect early anomalies and improve preventive maintenance”, – **Major European Power Utility, Belgium**



# Successful Applications



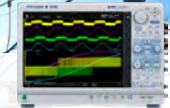
"The power analyzer WT5000 allows us to precisely measure generator and inverter performance under varying wind conditions. This level of accuracy helps us optimize drive train efficiency and ensure long-term reliability," - Global Wind Turbine Producer, Denmark



"High-speed waveform analysis from the high-definition oscilloscope Yokogawa DLM5000HD allows us to evaluate inverter switching behavior in real time, helping improve efficiency and reduce harmonic distortion in our PV systems," - Solar Inverter Producer, Germany



"To manufacture high-power electronic systems for automotive, aerospace, and industrial manufacturers WT5000 power analyzer is used to test and verify EV charging station power efficiency by calibrating pulse counters," - High-Power EV Charging Stations Producer, Italy



"With the DL950 ScopeCorder we can capture transient events during switching operations with exceptional resolution. Its synchronized measurement of voltage and current waveforms helps us validate insulation performance and ensure reliable operation under high stress," - High-Voltage Equipment Manufacturer, Italy



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At Yokogawa, our test and measurement instrumentation supports the reliable performance of modern energy infrastructure - from generation to transmission and distribution, helping operators ensure efficiency, safety, and long-term asset health.

Whether you are testing and validating power transformers for the energy grid, measuring the efficiency and power quality of solar and wind generation assets, evaluating energy storage systems, or supporting condition-based maintenance of hydroelectric plants, Yokogawa provides precise, traceable measurements you can trust.

From factory acceptance testing to on-site commissioning and ongoing maintenance, Yokogawa helps energy professionals turn data into insight, improving power efficiency, reducing losses, and supporting a more sustainable energy future.

<https://tmi.yokogawa.com/eu>

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Precision is all around us.  
In everything we see,  
everything we touch.

It means the  
difference between  
success and failure,  
safe and unsafe,  
sustainable and  
unsustainable.

But precision  
doesn't just happen.  
It's made.

**We are the Precision Makers.**

