Case Study

# Maximize Wind Farm Performance with Darveen's Rugged Industrial Panel PCs

The 2011 Fukushima nuclear disaster created a significant global impact, leading many countries to adopt a more cautious attitude toward nuclear energy and invest more aggressively in renewable energy development. For instance, Germany officially shut down its last three nuclear power plants in 2023, shifting its focus to solar and wind energy. In Iceland, nearly 100% of electricity is generated from renewable sources like hydropower and geothermal energy. Among these, wind power stands out as a clean energy source with abundant, low-carbon emissions, and has become a crucial element in the global development of renewable energy.

With the advancement of industrial IoT technology, wind power operations have become more precise and efficient. Wind farms can enhance management efficiency by deploying HMIs and sensors on IoT edge devices, enabling the monitoring and management of on-site infrastructure.

## Developing an HMI for Wind Power Main Control Systems

A renowned high-tech company in the renewable energy sector in Asia-Pacific, known for offering integrated wind power solutions, is a globally influential smart energy enterprise. In 2023, it ranked first in the world for newly installed offshore wind power capacity. Their standard products cover full power range main control systems from 1.5MW to 5MW, AC and DC pitch control systems, and SCADA systems. Currently, this energy company has deployed over 150 wind farms worldwide, with more than 15,000 units in operation.

The company needed to add an HMI display to the main control system of their wind turbines, utilizing edge computing to transmit data, control, and optimize the wind turbine units. An industrial panel PC is installed at the front of the main control system cabinet, connected to the PLC via gigabit network. The PLC is responsible for controlling and

receiving data from on-site equipment, sensors, and motors. The industrial panel PC provides a user-friendly human-machine interface, displaying operational data of the wind turbine, such as parameter settings, operational status, historical data queries, and fault records. This data is visually presented in the form of graphics or charts, enabling intuitive monitoring and management.

Due to the challenging environments where wind power facilities are typically installed, such as outdoor, dusty, and windy locations, and even marine environments, customers have higher demands for the performance and stability of industrial panel PCs. These requirements include:

- ESD Protection: The equipment must meet the ESD standards of 8KV for contact discharge and 15KV for air discharge.
- Electromagnetic Compatibility (EMC): The equipment needs to comply with Level 3 EMC standards for power systems, including protection against electromagnetic interference and surges.
- Salt Spray and Corrosion Resistance: The equipment must have excellent resistance to salt spray and corrosion.
- Connectivity with Multiple Devices: The equipment must connect to various on-site devices and sensors, such as PLCs and pitch control systems, requiring sufficient I/O connectivity.
- Ground Insulation: The entire system, including the board and cables, must have a ground resistance of over 100 MΩ to ensure electrical safety.

## Leveraging Darveen's HMI Solutions

After extensive meetings and a series of tests, the energy company selected Darveen's industrial panel PC, the DPC-9080, powered by the Intel® low-power Celeron® J1900 processor, as the HMI for the main control system. Installed at the base of the wind turbine tower, it communicates with the PLC and pitch control system via industrial Ethernet. The DPC-9080 combines durability and robustness, meeting various computing and transmission needs while providing a seamless visual display. Additionally, it enables real-time data uploads to the central cloud management platform, contributing to a larger data repository.

## DPC-9080: The Rugged HMI Computer

The 8" DPC-9080 features a specially treated die-cast aluminum casing, providing excellent corrosion resistance. The internal components are also specially treated to effectively resist salt spray and corrosion. It comes with a 1500V isolated wide-range power input (9V to 36V), capable of withstanding over 1000V surge voltage, and includes an auto-recovery function with protection against electromagnetic interference, overvoltage, and overcurrent. The output to ground can withstand 500V AC at 50Hz for more than a minute without breakdown, ensuring the electrical safety of the integrated equipment. Additionally, the DPC-9080 has an IP65-rated front panel, making it suitable for humid and dusty industrial environments.

The DPC-9080 supports a wide range of features and offers comprehensive industrial I/O connectivity, including 2x GbE LAN, 2x USB, 1x COM, 1x HDMI, and 1x VGA ports. It also supports Wi-Fi and 4G/LTE wireless communication modules via a full-length Mini PCIe slot. With Darveen's unique modular I/O board combined with the CPU board, CPU platform upgrades and updates become more straightforward.

## Implementation Results

The DPC-9080, with its excellent environmental adaptability, has been successfully deployed at multiple wind power plants operated by the energy company worldwide. It has enabled both on-site and remote control and monitoring, with all monitoring data being uploaded in real-time to the cloud management platform. This allows the operations team to monitor turbine performance anytime and anywhere, facilitating remote diagnostics and predictive maintenance, thereby enhancing overall productivity.

## About Darveen

Established in 2007, Darveen has been dedicated to developing rugged industrial computer solutions tailored to the unique needs of various vertical industries. Our product lines include in-vehicle computers, industrial panel PCs, rugged tablets, embedded box computers, and industrial monitors. Darveen's vehicle-mounted computer solutions have successfully helped hundreds of container terminals in streamlining their processes and operations. With nearly 20 years of experience in product design and manufacturing, Darveen's products have gained widespread acceptance in diverse markets, including container terminals, warehousing, manufacturing, industrial equipment, mining, and special vehicle fleets.

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