



## Embedded Platform Solutions in Advanced Wind Turbines

### Use Case: Highly Available Wind Turbine Control Safety Systems



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# Highly Available Wind Turbine Control Safety Systems

## Challenge

Wind turbine manufacturers face the challenge of increasing the productivity (up-time) of their systems whilst reducing the operating cost for utilities. Much of this cost of operation is due to unscheduled maintenance and down-time. Wind turbine manufacturers are looking for a solution that can provide high system availability to increase up-time and robustness to minimize unscheduled servicing. Manufacturers and operators also require that this solution delivers the highest levels of safety for workers on site.

## Solution

TTTech offers an embedded platform for wind turbine control consisting of robust safety networking and control products. Our solutions enable the design of optimized highly available systems which integrate safety, control and maintenance functions, and can be easily integrated in a virtual power plant. TTTech's track record in applications with the highest safety and availability requirements, supplemented with our extensive experience in the automotive industry, allows us to offer unprecedented benefits for the design of distributed control system architectures. Experience from other industries which focus on fail-operational system performance offers unparalleled opportunities for wind turbine control and safety systems.

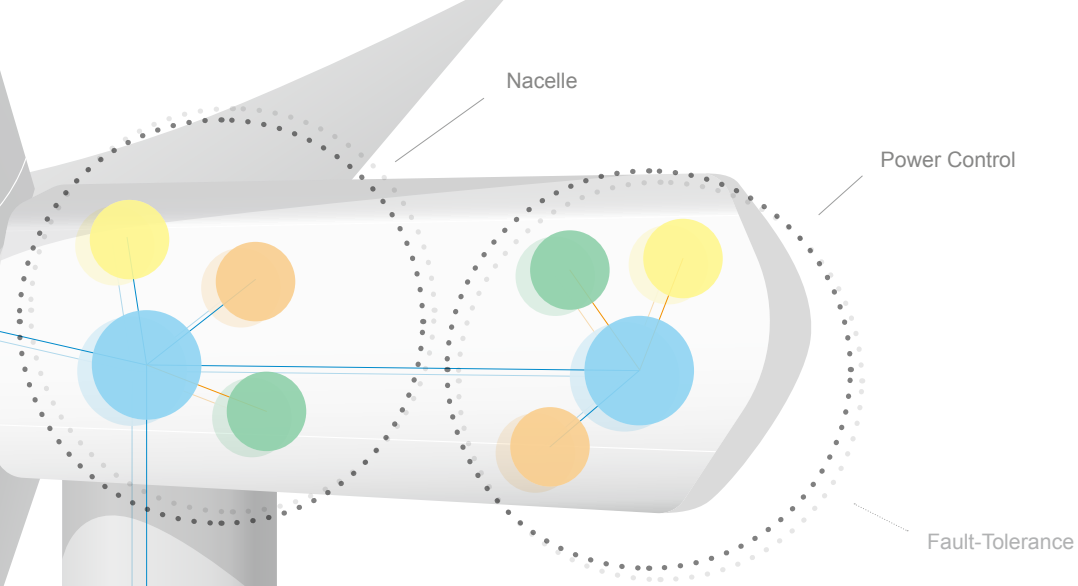
## Key Benefits

TTTech's deterministic embedded platforms can substantially reduce complexity and system life-cycle cost. Furthermore, safety and high availability can be integrated in one fail-operational integrated architecture. Benefits include:

- Reduced system cost with multi-function controllers
- Optimized integrated architecture: safety and control in one system
- Advanced system capabilities: high availability and safety with support for predictive maintenance
- Reduced safety certification efforts: IEC 61508 pre-certified switches, controllers and boards

Hub

Tower



- Deterministic Ethernet Switch
- Safety Nodes
- Control Nodes
- Data & Analytics Nodes
- Deterministic Ethernet
- Standard Ethernet

## Portfolio

TTTech offers a range of components for safety certifiable distributed control systems and Deterministic Ethernet networking. Our products include IEC 61508 SIL 2 certifiable electronic components for integrated safety, high availability and high performance controls. These applications may include pitch and yaw control, generator, gearbox and brake. The Ethernet devices and computing nodes enable fault-tolerant system design and full integration of all system functions, sensors and actuators in real-time.



TTESwitch Chronos  
Rugged



TTEPCIe Card Rugged



TTESafety Controller Board  
with TTTech Safety  
Certified Run-Time  
System and Drivers

# Improving Environmental Sustainability With Solutions for High-Availability Applications

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