Vestas®

Electrical PreDesign

Wind. It means the world to us.™

Safeguarding your investment

The complexity and specific requirements of grid connections vary considerably across the globe, making optimal design of electrical components for your wind power plant essential for your business case. By precisely identifying the costs early in the process, you minimise the risk on your project significantly.

Armed with our Electrical PreDesign report, customers are well placed for discussions with their own in-house power system experts, external power system consultants and transmission system operators. The report - reinforced with a presentation by our specialists and a detailed Q&A session – also describes optimal control strategies for use with Vestas' Power Plant Controller.

Making profitability predictable

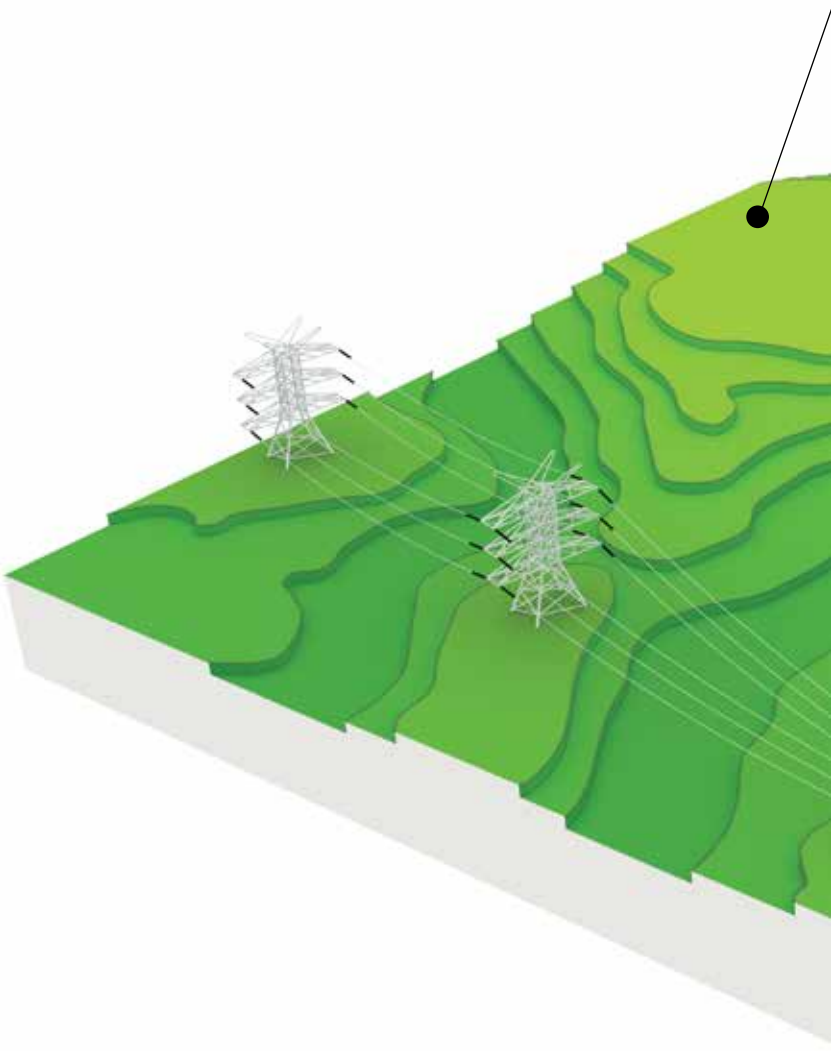
By identifying early grid code issues and simulating extreme operating conditions, Vestas' Electrical PreDesign provides the surest way of building a grid compliant, productive and highly profitable wind power plant.

By combining our experience of grid connections and turbine technology, along with our cutting-edge capabilities in turbine generator modelling, we can provide a highly accurate simulation of the wind power plant. This allows us to customise collector network cabling, substation protection and reactive power compensation, all of which boost the cost efficiency of your business and provides certainty that your power plant meets all local requirements.

Electrical PreDesign.
Knowledge in power.

Electrical PreDesign delivering **grid compliance** for your wind power plant

In the rapidly-evolving energy landscape, Electrical PreDesign provides the certainty you need, ensuring that the state-of-the-art technology of our turbines is matched by the layout of electrical components for your wind power plant. With Vestas' experience in installing more than 68.000 wind turbines on thousands of sites across the globe, your investment is in safe hands.



Key benefits:

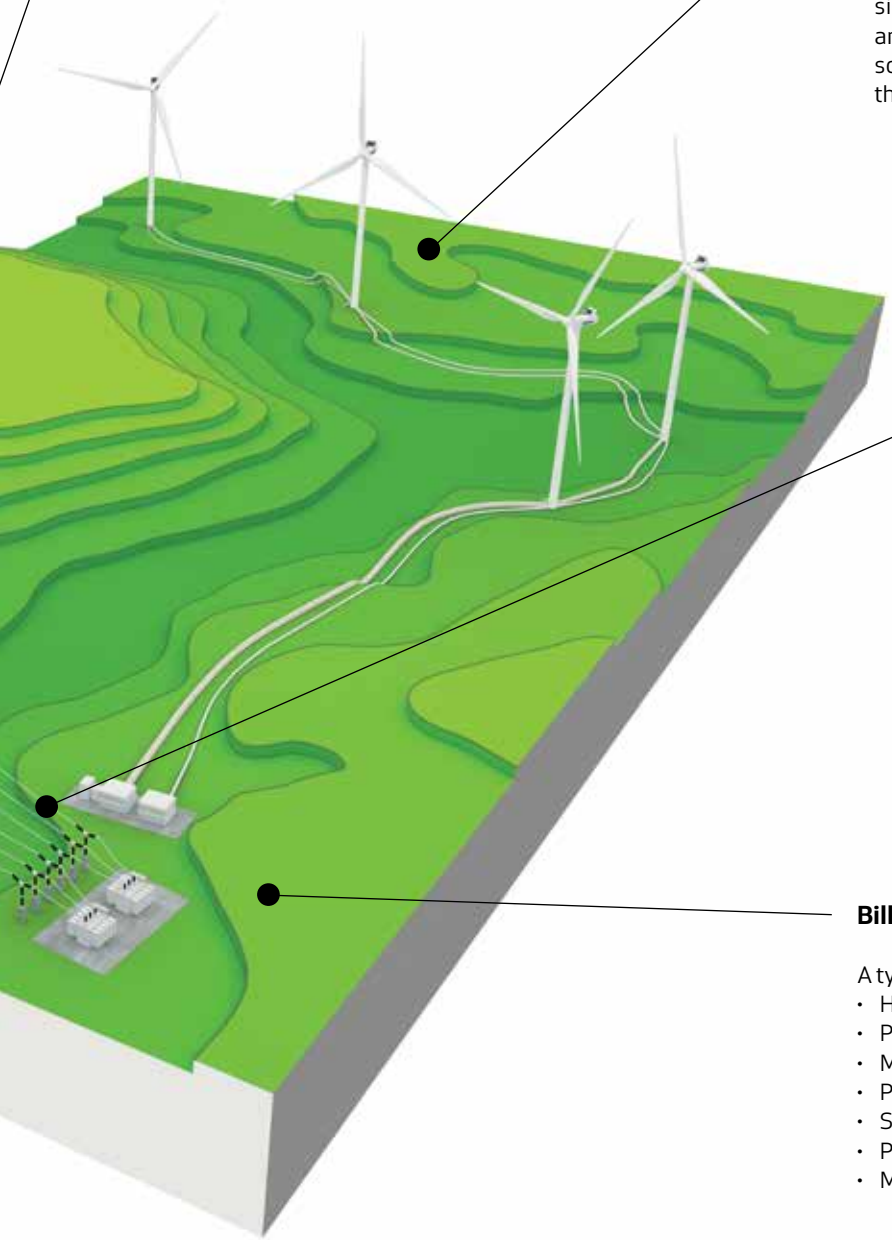
- Increased business case certainty
- Improved cost of energy
- Site-specific grid compliance discussions with Vestas engineers
- Key components identified early for more accurate cost estimates
- Early highlighting of risk areas, development of optimum grid design
- Detailed simulations to reach grid compliance
- Capital expense savings, leading to quicker profits
- Best control strategies for running the power plant
- Balance-of-plant equipment optimisation

Electrical PreDesign deliverables

As part of Electrical PreDesign Vestas delivers:
- A plant single-line diagram
- Cable dimensions
- Transformer data
- Neutral grounding requirements
- Performance estimation
- A detailed bill of materials.

Electrical PreDesign report

Based on specific site and project data you will receive an Electrical PreDesign report. The report contains comprehensive diagrams and simulated results of steady state and transient anlyses, securing optimal electrical balance, scope of supply and dynamic performance of the wind power plant.



Grid codes and compliance

We have a worldwide grid code library with all known codes evaluated against our turbines. By continuously monitoring grid code developments we ensure that your wind power plant live up to your local grid requirements.

Bill of materials

A typical bill of materials could contain:
- HV switch gear
- Park transformer
- MV switch gear
- Potential compensation equipment
- SCADA
- Power Plant Controller
- MV cables

We strengthen your **business case certainty** by bringing financially feasible wind projects to market in the shortest possible time.

Scrutinised, customised, **harmonised**

The detailed Electrical PreDesign report is based on specific site and project data. It contains comprehensive diagrams and simulated results. The report typically includes:

Steady State Analysis
An integral part of Electrical Predesign, is a Steady State Analysis, entailing load flow studies, short-circuit analysis in addition to power and energy loss calculations.

Transient Analysis
We conduct a comprehensive transient analysis consisting of capacitor switching studies, low voltage ride through as well as fault ride through analyses, and reactive power compensation final sizing.

Low Voltage Ride Through and Fault Ride Through
To maximise your turbines' uptime and protect your equipment, it is useful to ensure that the wind power plant remains connected during low voltage phases or during faults at the point of common coupling.

Voltage Control – a dynamic approach
Many modern grid codes require dynamic response to voltage changes at the point of common coupling. This means that the reactive power response of the wind power plant must meet the appropriate 'rise' and 'settle' times for the grid.

Frequency Control
Conducting frequency control provides the ability to control the active power output as a function of frequency excursions for contributing to keeping the power system stable.

Voltage Dip and Over Voltage Analysis
Transformer energisation, reactor and bank switching studies.

Protection studies
As part of a the protection studies, we are performing complete relay setting and coordination of the wind power plant, arc flash analysis, power flow and short circuit currents as well as protection settings.

Power Quality Analysis
To ensure high-quality power, Electrical PreDesign contains harmonic penetration analysis, filter design and flicker calculation.

Securing Optimal Electrical Balance of Plant Design, Scope of Supply and Dynamic Performance of The Wind Power Plant – Through **Steady State Analysis** and **Transient Analysis.**

Steady State Analysis

- Load flow
- PQ chart
- Power loss
- Short circuit

Transient Analysis

- Low voltage ride through and fault ride through
- Voltage control
- Frequency control
- Voltage dip and over voltage

Protection Studies

- Complete relay setting and coordination
- Arc flash analysis
- Power flow and short circuit currents
- Protection settings

Power Quality

- Harmonic penetration analysis
- Flicker calculation

SHARE

The earlier we become involved in your wind power project, the sooner we can share our vast experience and powerful tools to your benefit.

Electrical PreDesign
– keeping our customers ahead of the field

Electrical PreDesign is not the only support package available to customers as Vestas offer a comprehensive set of support packages to support your wind power plant projects. Partnerships begin at the start of the project when, the benefits of competing locations are being assessed, and continue when planning the layout of the chosen site and the right mix of turbines to install.

With the siting work in hand, our dedicated global team of power system engineers, control engineers, PhDs and other electrical experts model and simulate the plant design against the site specific grid codes and point-of-common coupling requirements for documented technical solutions. Our in-house supercomputer is among the most powerful in the world, offering invaluable data made up from fleet-wide monitoring, industry tools and unique Vestas tools.

In addition, we have designed two specialist packages to ensure your business case is powered for success – SiteHunt® and SiteDesign®.

In fact, Electrical PreDesign takes advantage of the extensive amounts of data gathered through these tools.

SiteHunt® – finding a faster route to market

Going even further in strengthening the business case certainty of our clients, we will do our utmost to help them bring their wind projects to market in the shortest possible time.

A critical consideration is the ability to identify the most suitable location for your wind power plant, which is where SiteHunt® comes in.

SiteHunt® is an advanced analytical tool that examines a broad spectrum of wind and weather data to evaluate potential sites and establish which of these provides optimum conditions for your project.

SiteDesign® – data-based decision-making

Once you have chosen a suitable location for your wind power plant, our SiteDesign® service allows you to reliably assess and configure the site to maximise the output and value – based on operational costs as well as actual energy production.

It gives an accurate and reliable way to identify the most appropriate turbines, and the most suitable locations for individual turbines on the site.

This makes SiteDesign® a crucial step in assessing the project's potential – and reducing your overall cost of energy.

The Power of Partnership

At Vestas, we believe in the power of partnerships. The earlier we become involved in your wind power project, the sooner we can share our vast experience and powerful tools to your benefit. We can add value, save time and strengthen your business case at every step of the journey, from site selection and development to operations and maintenance. And Electrical PreDesign plays a crucial role in early discussions, helping to set your vision on the fast-track to profitability.

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