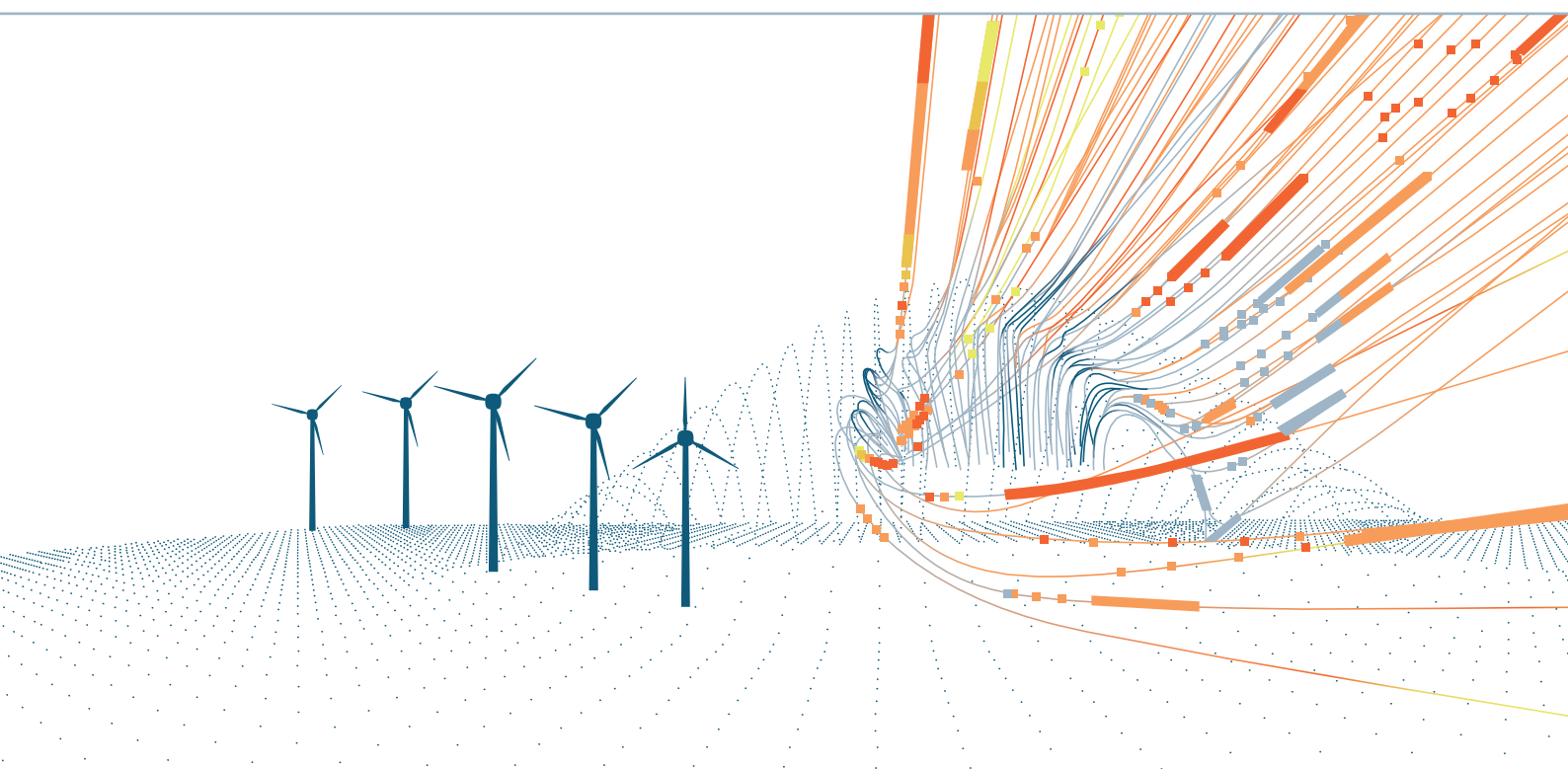


WIND

IS WIND POWER

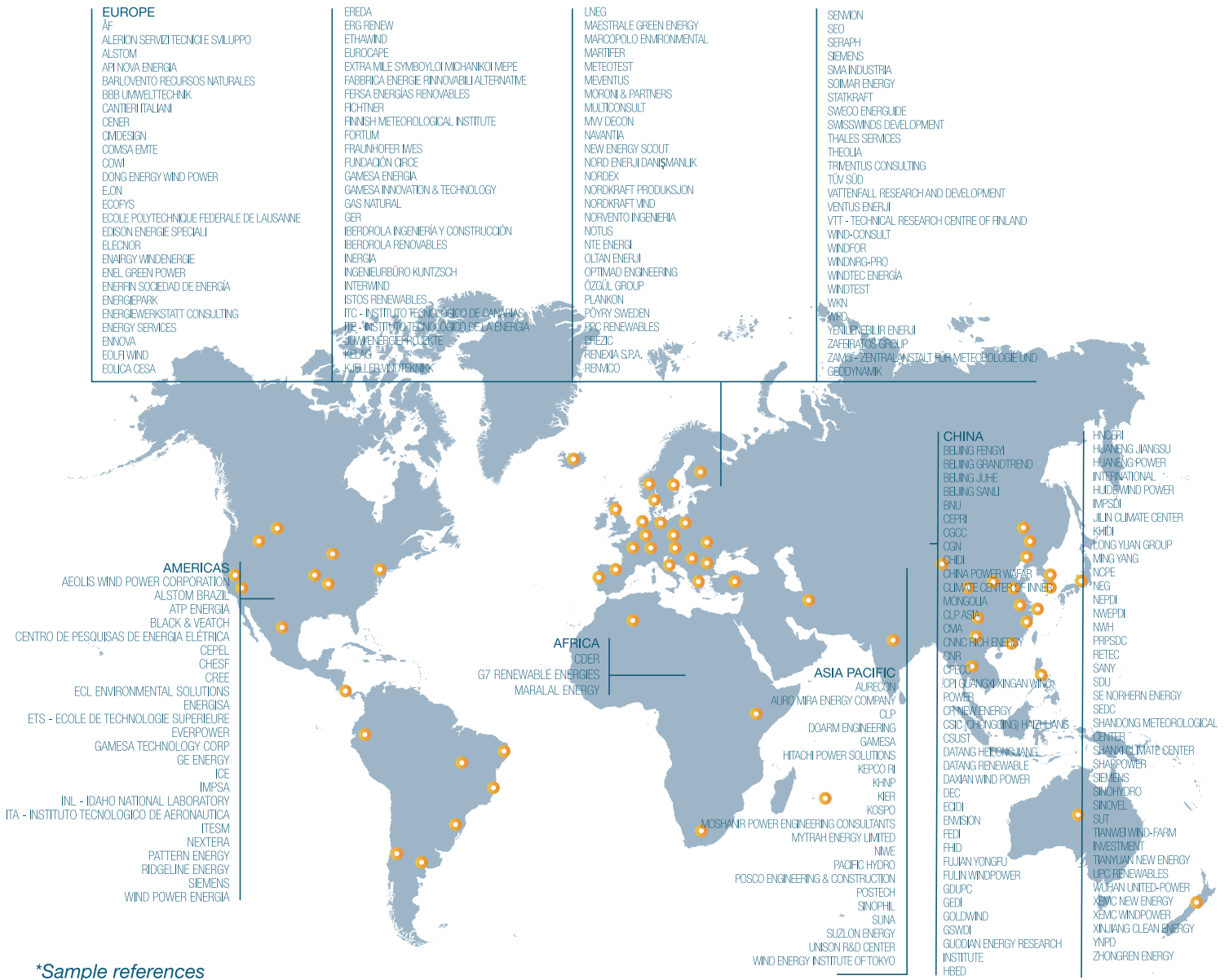
KNOWLEDGE



SOFTWARE

windsim

Software | Consulting | Forecasting



*Sample references

FROM WINDSIM MANAGEMENT



ARNE REIDAR GRAVD AHL
 CTO & Founder



JOHN OLAF RØMME
 CEO

SUSTAINABILITY – The obvious choice

The idea of sustainability stems from the concept of sustainable development set forth at the World's first Earth Summit in Rio in 1992. Today sustainability is a part of everyone's vocabulary. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. We are proud of working towards a sustainable energy supply - The obvious choice for the future.

THE VALUE OF WINDSIM FOR WIND PROJECTS

WindSim delivers accurate and proven simulation software and consulting services that help the wind energy industry worldwide design and operate more profitable wind farms.

- Maximize production and wind farm performance while minimizing risk, downtime and maintenance cost.
- Using WindSim from early concept evaluation, through engineering to operation, secures overall capital and operating cost effectiveness.
- Successful design and operation of wind farms rely on detailed understanding of the wind field. WindSim provides solutions through accurate modeling of true dynamics.
- Advanced simulations maximizing energy production for every type of terrain, from the simplest to the roughest locations.



YOUR PARTNER
IN WIND ASSESSMENT.
MAXIMIZE PRODUCTION
AND WIND FARM PERFORMANCE

**WHILE MINIMIZING
RISK, DOWNTIME AND
MAINTENANCE COST.**

CFD **THE VALUE OF COMPUTATIONAL FLUID DYNAMICS**

Many comparisons have been carried out between CFD and the traditional linear tools in wind energy assessment. It is widely proven that linear tools very often give less accurate wind speed estimations compared to CFD tools, especially in complex terrain. Identifying areas with high wind speeds is vital to maximizing energy production. A 10% increase in wind speed can give a 30% increase in Annual Energy Production. The fundamental equations of fluid flow consist of a set of non-linear partial differential equations, the so-called Navier-Stokes equations. These equations are known to be difficult to solve due to their non-linear nature. Nevertheless, in numerous flow situations—and in various industries over many years—CFD reproduces the measured flow patterns and is therefore considered a proven method. CFD can take all the different effects of turbulence, variable density, topography, and vegetation into account using fundamental equations.

WINDSIM **HOW DOES IT WORK**

WindSim software has a user-friendly modular structure that makes it easy to use and interpret. First, you start off with the terrain module; this generates a 3D model of the area around your wind farm based on elevation and roughness data. You can model forested areas and physical objects such as buildings, to include the influence these have on the wind field. The next step is the Wind Fields module, where the wind database is generated. This module simulates how the terrain and other factors affect local wind conditions. In the Objects module, you decide on placement of turbines and measurement points. This is done in a fully interactive 3D interface, which makes it easy to get a visual layout of the wind farm from different angles.

The overview of flow variables you get in the Result Module, here you can inspect all of the variables like wind speed, direction shifts, turbulent intensity and wind shear. The wind resource map forms the basis for the energy optimization and is established by weighting the wind database against measurements. The final step is the Energy module where you can calculate the Annual Energy Production for each turbine in the wind farm, as well as compare alternative park layouts and wake losses.



WE HAVE BEEN WORKING ON MAKING UNCERTAINTY CERTAIN

SOFTWARE LIST



WINDSIM

WindSim is a powerful Wind Farm Design Tool (WFDT) based on CFD and has been the thought leader in the application of CFD techniques for the worldwide wind energy industry for more than ten years. The software is used for the design of wind farms both onshore and offshore, maximizing Annual Energy Production while taking the site and terrain constraints into account. The software combines advanced numeric processing with compelling 3D visualization in a user-friendly interface.



WINDSIM EXPRESS

WindSim Express makes CFD based micro-siting a simple three step procedure. First, name your project. Second, load your turbine position and measurement data. Finally, set the resolution of the numerical model. That's all. WindSim Express automatically download a terrain model of the area of interest and runs the simulations.



REMOTE SENSING CORRECTION TOOL

Remote sensing techniques based on SODAR and LIDAR are gaining more traction in the wind sector than ever before. Our customers enjoy a considerable advantage using remote sensing, by sampling data over a large area and measuring vertical profiles at the turbine locations. The Remote Sensing Correction Tool allows you to further leverage remote sensing data for maximum levels of accuracy.



OFFSHORE

Offshore wind farm layouts are traditionally designed using engineering wake models. WindSim includes three thoroughly used engineering models and the advanced Actuator Disk method. By using the state of the art Actuator Disk method during the design phase you will increase your overall profitability by calculating with higher accuracy the wind flow conditions within your farm.



MULTIPLE CORE UTILIZATION

With Multiple Core Utilization, you can run 2, 4 or 36 computations simultaneously enabling you to speed up individual simulations by e.g. running several sectors at the same time, or to simulate several wind projects at the same time. The software automatically checks available memories to optimize the computing processes.



WIND ATLAS

Wind Atlas enables you to perform wind mapping over large areas like regions or countries by combining several WindSim projects enabling generation of a large wind resource map with high accuracy.



CLIENT SERVER / CLOUD

Allows you to run very large number of simultaneous computations by optimizing the use of your available internal servers or using world-wide commercial cloud services.



PARK OPTIMIZER

Park Optimizer uses WindSim simulations plus new optimization techniques to help you interactively design IEC-compliant wind farm layouts. You can include costs and revenues to maximize the wind park profitability with respect to park size finding an optimum number of turbines and location of each turbine.



EXTREME WIND ASSESSMENTS

WindSim Extreme Wind Assessments enables optimal engineering of structural designs such as solar racking systems for commercial and utility-scale projects, reducing CAPEX and risk. In some countries, extreme wind conditions are specified in the national building codes but in regions with limited wind data, such as developing countries, it is not specified increasing engineering uncertainty. WindSim provides accurate wind conditions for areas of interest by transferring reference wind conditions to the area of interest using its advanced CFD based flow modelling software providing accurate basic extreme wind conditions and 3-second wind gust predictions.

WindSim pioneered the use of CFD (Computational Fluid Dynamics) technology to optimize wind turbine placement, and offers CFD software, training, independent technical and engineering services to the wind industry. Headquartered in Norway, and with a global presence in over 20 countries, WindSim has for a long time been the thought leader and expert on CFD within the wind industry.

SOFTWARE LIST

POWER FORECASTING

WindSim Power Forecasting is available as web based application providing precise prediction of the intraday or day ahead power forecasts. Numerical Weather Prediction data and online (SCADA) data is used for training Artificial Neural Network solutions and to run CFD simulations which gives statistical and deterministic forecasts for the next days for trading purposes and maintenance planning.

POWER LINE OPTIMIZATION

Power Line provides a CFD based three-dimensional flow model for the transmission line area transferring the measurements from the weather stations along the transmission line onto the whole length of the transmission line, providing an end-to-end high fidelity monitoring solution. Knowing the wind speed and direction at every span, extreme environmental wind conditions can be detected or the conductor thermal capacity can be calculated very precisely and the capacity of the line can be increased through Dynamic Line Rating.

WINDSIM SOFTWARE SUITE WIND PROJECT TIME SPAN

ENGINEERING



- Site Screening
- Wind Atlas
- Virtual Met Mast

- Virtual Wind Data
- Measurement Campaign Design
- Wind Data Analysis (MCP)

- Micro-siting
- Site Suitability
- Park Optimization
- Operation Strategy

CONSTRUCTION



- Bankable AEP Assessment
- Due Diligence
- Numerical Site Calibration

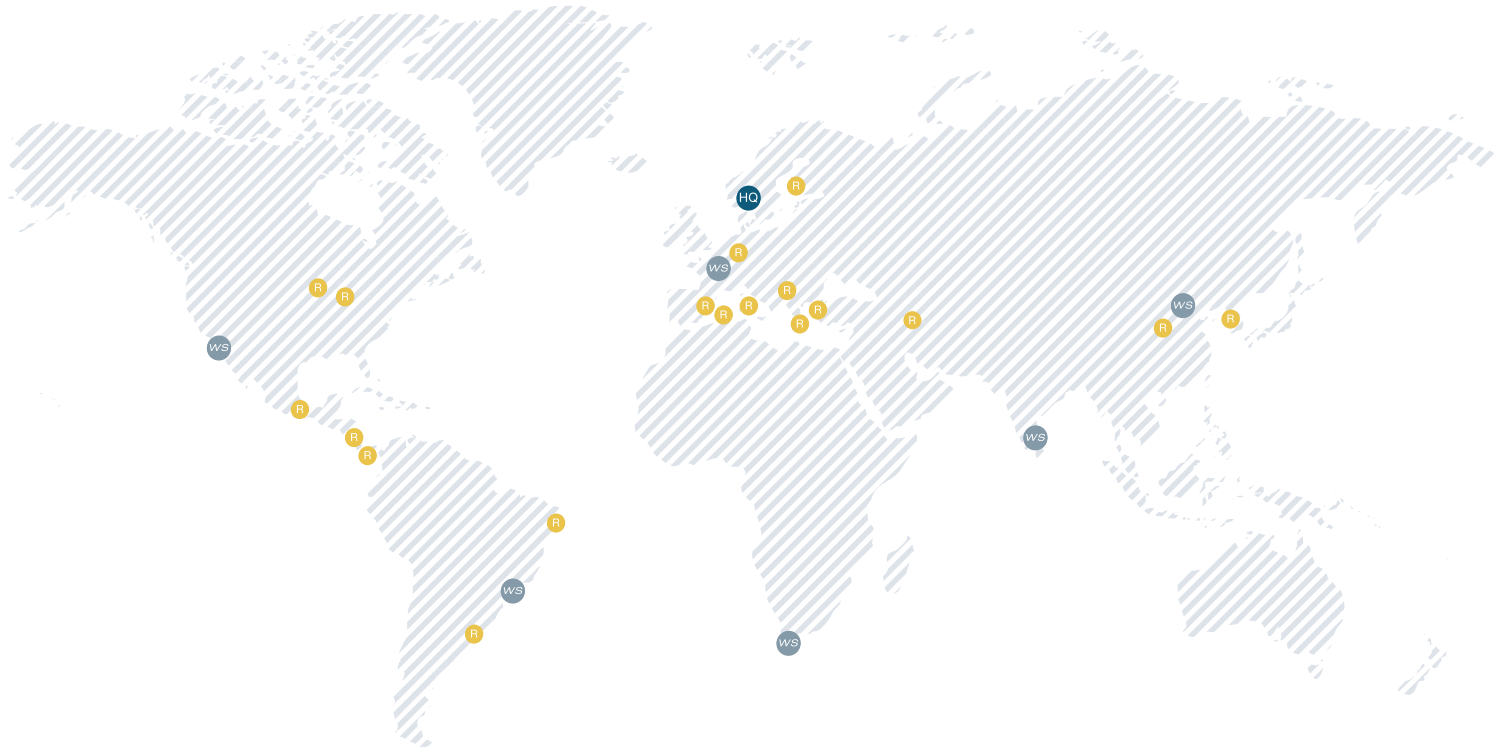
OPERATION



- Post Construction Assessment
- Power Forecasting
- Power Line Optimization

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