



part of the **Natural Power** group



ADVANCED RESOURCE ASSESSMENT

We measure, model and define wind resource and quality issues with industry leading accuracy and resolution, using state-of-the-art tools and methodologies. Our key focus is defining and reducing risks at all stages of development.

The aim is to derive a high-resolution understanding of the site wind resource and wind quality across the extent of the project area, enabling you to make informed design and investment decisions with confidence.

Our resource assessment services are used by banks, private equity institutions and developers worldwide for project evaluation, financing and risk management.

Our services include:

- **ADVANCED MEASUREMENT & DATA COLLECTION**
- **ADVANCED RESOURCE MODELLING & VERIFICATION**
- **COMPLEX FLOW STUDIES**
- **SITE CLASSIFICATION STUDIES**
- **LAYOUT DESIGN AND OPTIMISATION**
- **LIDAR & SODAR ADVICE**
- **RESOURCE MAPPING**



OUR ADVANCE RESOURCE EXPERTISE HAS BEEN APPLIED TO OVER 25 GW OF PROJECTS GLOBALLY



ADVANCED MEASUREMENT & DATA COLLECTION

Natural Power have 15 years of experience in downloading, screening and reporting field-collected wind data. We manage a global network of anemometry equipment on behalf of a diverse client base. We are fully conversant with international best-practice in anemometry equipment installation, management and data treatment. Our focus is on providing our clients with a high-quality, quality controlled data set that is suitable for use in finance-level wind resource and turbine siting studies:

- Anemometry campaign design and implementation
- Rigorous anemometry campaign management including data downloading, quality check, reporting and secure archiving
- Wind measurement campaigns using ZephIR laser anemometers to refine the wind flow models and reduce uncertainty across potential sites
- Interpretation and communication of data



ADVANCED RESOURCE MODELLING & VERIFICATION

We provide comprehensive and proven wind resource analysis and mapping throughout all stages of a project, including full finance level energy yield and uncertainty studies, including:

- Full wind data screening
- Long-term data correlation
- Wind flow analysis
- Energy, wake and loss modelling
- Uncertainty analysis
- Reporting, presenting and interpretation
- Post-construction energy yield analysis

We have specialist knowledge and tools such as VENTOS Computational Fluid Dynamics (CFD) to address the complexities of wind flow in complex terrain and forested regions, leading to the identification and mitigation of wind quality issues in the wind farm layout design and analysis process. We provide model verification in the form of traditional met mast anemometry as well as new remote sensing equipment such as our ZephIR lidar.

Our global team of 25 wind analysts and engineers play an active part in pioneering new tools and methods, allowing us to provide our clients with access to cutting edge technologies and methods for risk mitigation.

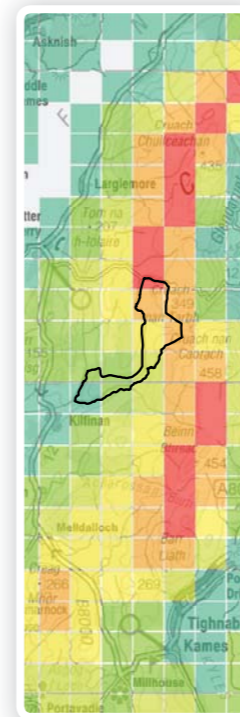


COMPLEX FLOW STUDIES

When a wind farm site is located in complex or forested terrain, linear wind flow prediction models are generally unable to accurately reproduce the full physics of the flow. In these cases we employ our VENTOS methodology for complex site resource analysis and wind quality classification. This application of cutting edge technology aids developers, lenders, manufacturers and owners to realise projects with optimised returns and minimised risk of turbine under-performance or long-term operational issues.

VENTOS provides state-of-the-art flow computations in complex and forested terrain. It enables accurate quantification of turbulence intensity, wind shear, inflow angle, wind speed and veer over complex sites. VENTOS also enables time-dependant computations when necessary. Our dedicated CFD engineers translate the results of computations into recommendations on turbine locations and their ongoing management.

To derive CFD flow modelling results that you can trust is a task that requires the right tools combined with specific expertise and experience. Our fluid mechanic engineers have successfully applied and validated VENTOS on more than 4GW of client wind energy projects worldwide.



RESOURCE MAPPING

Natural Power have proven experience in delivering resource mapping exercises for wind, wave and tidal energy projects, from regional scale right down to device scale.

We employ a wide variety of tools, methods and data sources to create resource maps for any given purpose or region, allowing us to optimise our approach on a case by case basis.

As well as mapping fundamental criteria such as resource magnitude and density (such as mean wind speed, tidal velocity or wave power density), we are also able to provide clients with a statistical analysis of temporal resource variation (such as monthly or annual), and also to provide maps of crucial resource parameters and flow characteristics, such as turbulence, shear and flow inclination for wind energy applications, or flood / ebb directional offsets for tidal energy applications. Our resource mapping and associated design applications include:

- Wind resource and flow quality from regional to turbine scale
- Design of forestry management plans for turbine performance optimisation
- Layout design and optimisation, integrated with project consenting and surveying services
- Photomontages, wireframe visualisations, visibility mapping, shadow flicker and noise modelling
- Effects of any constraints (environmental, noise, shadow flicker and grid) on energy production
- Rochdale envelope design process for scoping the full range of technical possibilities in terms of site installed capacity and technology



SITE CLASSIFICATION STUDIES

We routinely provide clients with an assessment of site compliance with IEC or GL wind turbine design criteria, including:

- Extreme wind analysis
- Turbulence intensity estimate at each turbine location
- Extreme temperatures, seismic risk, inflow angles and corrosion class

These predictions are a vital stage in the design and financing of a wind farm project, ensuring that turbine selection is optimised for the prevalent climatic conditions of the site, and further ensuring that climatic risks are understood and properly managed. In complex terrain and forested sites we employ our VENTOS CFD methodology – our site classification service for complex and forested projects. CFD is preferred to linear models such as WAsP in cases of complex flows. VENTOS site classification delivers for each turbine location: wind speed, turbulence intensity, vertical inflow angle, shear across the rotor, veer and indications of flow separation.



LIDAR & SODAR ADVICE

Natural Power possess unparalleled experience with the use of remote sensing for wind energy applications. We pioneered the use of lidar in the wind industry with our fully validated and financeable ZephIR technology. We provide qualified expert advice on the use of lidar in wind data collection, and advise on best-practice in campaign design, deployment and data collection.

Natural Power owns and operates the UK's first dedicated Lidar & Sodar test site. A 90 meter met mast enables correlation reports to be made against ground based devices to provide traceability back to traditional anemometry. The site is open to all remote sensing manufacturers, developers, consultancies, research organisations and turbine manufacturers alike. Using Lidars & Sodars with an agreed traceability validation methodology is not only advantageous to the development of the technologies, but the 'good practice' proves beneficial to wind farm developers.

Natural Power's Test Site comprises a meteorological mast equipped with state of the art instrumentation mounted across a total of seven heights, including calibrated Risø cups and Vector 100L cups based at 20m, 45m, 70m and 90m; a pressure sensor logger at 6m and a temperature sensor mounted at 80m.

LAYOUT DESIGN & OPTIMISATION

Natural Power have a proven track record in designing realistic wind farm layouts that optimise the balance between a wide range of technical, environmental and physical constraints and parameters, typically including the following design aims:

- Maximise wind turbine energy yield
- Minimise cost of energy (all project costs)
- Minimise wind flow quality issues
- Minimise environmental impact (ecology, noise, visuals etc.)
- Recognise ground slope and soil conditions to optimise construction activities
- Avoid infrastructure conflicts (pipeline, microwaves etc.)
- Consider future asset management activities and health & safety issues

Our ultimate aim is to deliver realistic wind farm layouts that are consentable, buildable, financable and operable.

We apply our skills throughout the project lifecycle including:

- Conceptual layout studies to inform early project feasibility
- Intermediate designs, iterating through the development cycle
- Optimised final designs for consenting, financing and construction

We have designed over 800MW of consented wind farms onshore, and 1200MW offshore.

KEY CLIENT LIST

| | |
|----------------------|------------------------|
| SSE Renewables | BNP Paribas |
| RWE-npower | Triodos |
| Iberdrola | Climate Change Capital |
| E.ON UK | Allianz |
| Lloyds Banking Group | ING |
| Co-operative Bank | Eneco |
| FORAS | ABO Wind |
| Element Power | Banks Renewables |
| Deepwater Wind | Alcan |
| GE EFS | Imerys Minerals |
| Everpower | Good Energy |
| GDF Suez | Fortis |
| International Power | NUON |
| FIM | Bord na Mona |

ISO CERTIFICATION

Natural Power has established rigorous procedures and work instructions for all aspects of our business. All staff currently work to a list of core procedures for quality & environmental business management. Full details of our integrated QE management system are available on request. The following scopes for ISO 9001:2008 have been achieved, applicable to all our UK operations:



Technical Services UK

Resource management, analysis, modelling and design for the pre-construction phases of onshore and offshore renewable energy projects, including the application of tools and the methods for assessing complex flow environments for wind, wave and tidal environments.

Development Consultancy Services

Project management, consent management, due diligence and consultancy services including initial site feasibility studies, land agreements, management of the EIA process and planning applications, stakeholder consultations, permitting and discharge of planning conditions of renewable energy projects (onshore & offshore wind, wave & tidal, biomass, PV, hydro and associated infrastructure).

Construction & Ecology Management Group

Project Management, due diligence and consultancy services (to include pre and post construction phases) for the construction of wind farms and biomass energy projects with associated site investigation services and onshore/offshore ecological surveys.

Asset Management

Wind Farm Operational Site Management