ONSITE GENERATION

CUTTING COSTS & CUTTING CARBON EMISSIONS

How businesses can reduce long-term energy costs and carbon outputs with onsite wind power

CONTENTS

WELCOME

A decision to build onsite renewable energy capacity is no longer simply an act of environmental or social responsibility. Beyond these benefits, there is a compelling business case for reducing energy expenditure. Over the lifetime of an onsite renewable energy project, the cost of electricity bought from the grid, and the taxes paid on it, will continue to rise, while pressure on businesses to reduce their carbon footprint will also continue to increase. For many businesses, building renewable energy projects to generate and consume power on their own property can offer an attractive way to manage long-term energy costs.

Far from being an experiment undertaken by business leaders eager to show their green credentials, onsite generation and self-consumption projects, as this report highlights, can add real value to a business, while cutting carbon emissions. The wind industry offers tailored solutions to businesses across many sectors and will provide support at all stages, from development and funding through to construction and operation.

In this report we will outline how businesses can approach building their own renewable energy generating capacity, the options available, and the most important ingredients for a successful wind energy self-consumption project. We will explain how businesses can use an investment partner to minimise the financial burden of a project, and ensure a strong return on investment.

I hope you find this Buyer's Guide to renewable energy for self-consumption informative and valuable. If you want to know more about the approach, do contact our team - they'll be glad to answer any questions.

Enjoy the read.

With my best wishes,

ROB VAN DE VEERDONK

CHIEF MARKETING & SALES OFFICER,
EMERGYA WIND TECHNOLOGIES

ENERGY SELF-CONSUMPTION FEASIBILITY CHECKLIST

You want to build an onsite renewable energy power project for self-consumption, but you're not yet certain that your business meets key qualifying criteria?

At EWT, our team investigates project development feasibility for new and prospective commercial and industrial project sites every day.

It's the very first step to take, and to aid your decision making we've outlined the key questions you need to consider in a project feasibility check list below.

The check-list builds on two primary questions that drive business energy procurement change:

- Can we cut the electricity costs of our business?
- Can we reduce our carbon footprint and use it to gain commercial advantage?

If you'd like us to help you answer these questions and provide an open and transparent assessment of the potential of your commercial site, get in touch.

To book a free initial site feasibility assessment with Rob Van De Veerdonk email **feasibility@ewtdirectwind.com**, or call **+31 (0)33 454 05 20**.

PART 1:
CONSIDERING THE ECONOMICS

Does your site use at least 1 GWh of electrical energy per year?

A self-consumption project will benefit high-energy commercial and industrial sites, ensuring they consume as much as possible of the electricity produced to maximise project value.

Do you have onsite energy usage visibility over the past 24 to 36 months?

A clear understanding of the long-term electricity consumption by the site improves the ability of a feasibility study to predict the likely future value of a project for a business.

Do you have clarity regarding the initial investment and its projected return?

Balanced against the long-term nature of a self-consumption project, the medium-term investment allows a business to reduce the cost of their energy significantly over a more than 20-year project lifetime, compared with the cost of grid energy.

Do you have plans to increase or extend the footprint of your site?

Extending and expanding your facility will likely increase the amount of energy your business consumes in the future and may also have a net positive impact on future financial returns that a self-consumption project can deliver against. Aligning site development plans with your self-consumption power project from the outset, is key.

PART 2:
ASSESSING PLANNING RISKS

Do you lease or own the location at which you intend to develop a renewable energy focused self-consumption project?

As site owner, you won't have to negotiate with another third-party during the development phase. However as a tenant, the compelling appeal of low-cost, renewable energy, and the value it adds to a commercial site can be attractive to many landlords.

Is your site near a protected nature reserve or a built-up area?

Planning authorities approach any application to build wind turbines near nature reserves with caution, this will slow the process, even if the eventual outcome for the business is positive. Consideration also needs to be given to the disrupting effect of other buildings on the flow of wind. For sites in built up areas, expert analysis often delivers a satisfactory self-consumption solution.

Do you have space on your site to develop and build a wind turbine?

A wind turbine big enough to generate sufficient energy for a business consuming more than 1 GWh of electricity per year requires no more than 20-30 m^2 of space, or ca. three car parking spaces. However, early consideration should be given to site access and space throughout the development and construction phase. Consideration also needs to be given to minimum setback requirements, noise and shadow flicker.

Are you prepared to accept a 1-2 year development period?

The development process of an on-site wind turbine depends on several factors that are influenced by local considerations. A partner with experience and expertise will manage all elements of the development process to deliver a successful project.

PART 3:
SECURING INTERNAL SUPPORT

Have you confirmed who in your business will take responsibility for this?

Delivering on the executive decision to invest in a self-consumption renewable energy project can be demanding on executive time. Delegating authority to experts within a business, such as a site manager, operations manager or energy manager can smooth the process and significantly reduce the project development cycle. Ensuring they work with an EPC overseeing the whole project reduces the time burden on executives still further.

Are you the sole decision maker for this project?

Securing internal buy-in may not be essential for proceeding with the project, but building consensus can be an effective way to avoid future internal challenges. This report sets out the many compelling arguments for building a self-consumption project that will help you present your case to your investors, the executive team, and your company employees.

Have you considered how you will finance your onsite power project?

While many companies fund self-consumption projects themselves, it is also common to work with a specialist wind investor, who will develop, build and own the project, then contract to sell electricity to the business at a much lower price than the grid.

INTRODUCTION

For energy-conscious businesses, the onsite generation and consumption of renewable energy is a highly effective way to make the most of the resources available in a company's natural environment. Alongside the reduction in carbon footprint, rethinking a site's energy consumption can be as healthy for a company's finances as it is for the environment.

As public awareness around environmental issues increases, building a reputation as an environmentally- and socially-responsible business is becoming important in every industry. Many businesses have led the way by installing renewable energy technologies to cut their carbon outputs. As well as showcasing their commitment to cutting their environmental impact, these businesses have also found onsite renewable energy generation to be an efficient way to consume electricity and save on energy costs.

Businesses that are heavy users of energy can cut their annual carbon emissions significantly by producing renewable energy on site, significantly reducing their reliance on electricity from fossil fuel power stations.

Reducing the reliance on electricity from the grid means using less energy at high business tariffs. Self-generation projects allow owners to establish long-term energy budgets with confidence, and over the lifetime of the project make savings in energy costs that would not otherwise be achievable.

A technology for high energy users

Different technologies are available to generate and consume renewable energy onsite and reduce or eliminate dependence on the grid. Solar panels often seem a simple option, able to be efficiently installed on a roof with little need for advance planning. However, solar power can only make up a small proportion of a site's power needs, where wind energy self-consumption projects can generate larger capacities for heavy users of energy. Solar power requires three key considerations.

The first is to consider whether your roof is able to bear the weight of the solar array and the cost of retrofitting it if not. Secondly, as solar needs around one square metre for every 200W of capacity, it takes up a lot of space. An array would cover an area equal to several football pitches to meet heavy energy-user's needs. Thirdly, solar panels only work during daytime, when the sun shines.

If the goal is to produce and consume large amounts of energy around the clock, wind energy is often a much better choice. A wind turbine with a footprint of 20-30 square meters – the same space needed for around three car parking spaces – is suitable for businesses consuming multiple gigawatt hours of electricity per year. This means that, unlike for a solar array, a business doesn't have to sacrifice site space to generate a large amount of electricity.

Long-term results

A typical onsite generation and self-consumption project using a single wind turbine can generate a significant portion of a company's energy needs and prevent the production of between 400 and 1000 tonnes of CO_2 per year.

In this guide we will explain the steps involved in developing and constructing an onsite wind energy project for self-consumption, as well as how to ensure it continues to efficiently generate low-cost power for years to come.

From initial studies to identify project feasibility, through securing project funding and permissions, to construction and operation, picking the right technologies and the right partners are essential to delivering a successful self-consumption project that reduces energy costs and cuts carbon outputs.

STEP-BY-STEP GUIDE TO A SELF-GENERATION WIND TURBINE PROJECT

1 FEASIBILITY STUDY

2 CHOOSING THE RIGHT TECHNOLOGY

3 PROJECT DEVELOPMENT & PERMITTING

4 FUNDING METHODS

5 CONSTRUCTION AND INSTALLATION

6 OPERATIONS AND MAINTENANCE

1. FEASIBILITY STUDY

Before a hole is dug, before a crane is raised, before a low-loader hits the road carrying rotor blades, a tower and a nacelle, every self-generation wind energy project undergoes a feasibility study.

The feasibility study looks at all aspects of the project to determine overall how favourable the project will be to the commissioning company and whether it is advisable to proceed. Specifically, a feasibility study looks at the project planning environment, the constraints on its construction; the energy demand of the business and resource availability at the site; finally it conducts financial modelling to determine the lifetime commercial benefits of the project.

Feasibility studies are the first thing a self-consumption consultant will do for a client or prospective client, and though they form only a small part of the overall project costs are essential for ensuring the project meets the returns and carbon goals set for it.

THE COMPONENTS OF A FEASIBILITY STUDY

PLANNING & CONSTRUCTION	Location assessment	Planning requirements	Summary
DEMAND & CAPACITY CALCULATIONS	Customer demand profile & site wind resource data	Data comparison: Grid feed vs onsite generation	Results
FINANCIAL ANALYSIS	CAPEX, OPEX	Financial model inputs	IRR & Amortisation

Planning & construction

Obtaining planning consent is key for any wind energy project. Local planning requirements are evaluated first and then physical site assessments are conducted to determine important considerations in securing planning consent. These include the impact of the project on the local landscape and ecology and whether shadow flicker and noise may affect neighbours. For local authorities the answers to these questions all factor in a decision to provide consent and for applicants it will give an idea of how long it may take to secure consent.

Together with looking at planning requirements, this assessment phase will determine the accessibility of the site for construction traffic. Large cranes used in the installation process and trucks carrying blades and heavy generators must be able to access to the site, or access routes may need to be developed for them.

Demand & capacity calculations

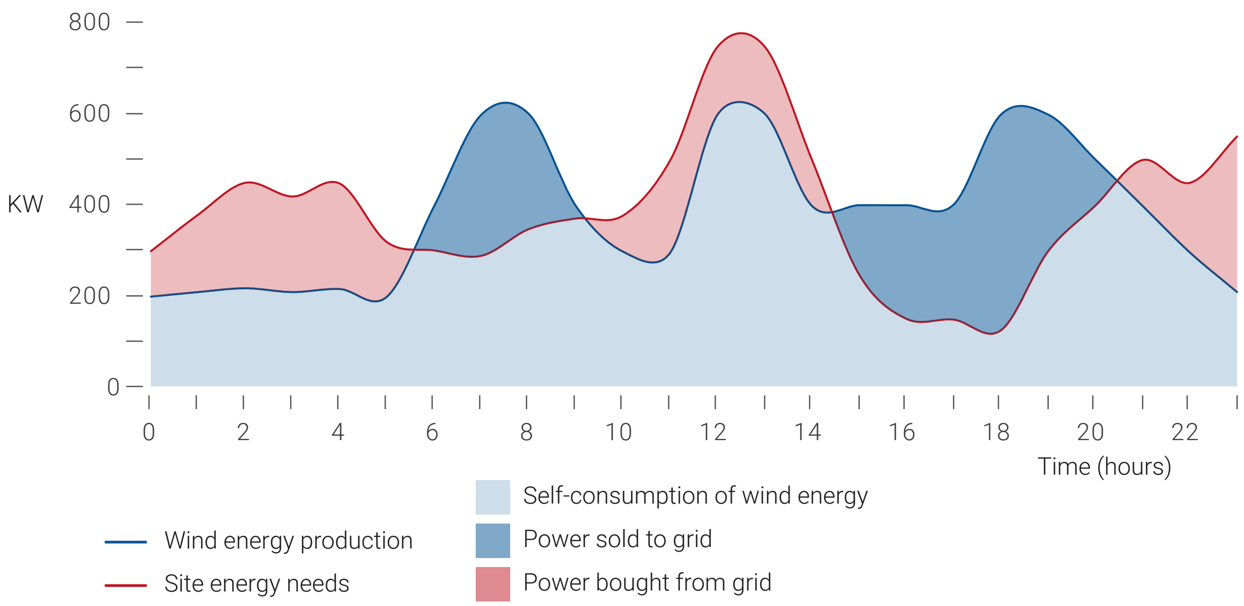
A comparison of a site's energy demands and the availability of wind resource to meet them is central to understanding the feasibility of a self-consumption project. The stage of a feasibility assessment will require two main inputs:

- Quarterly or hourly energy consumption data for the business, for at least one year.
- Quarterly or hourly historical wind data from a local source or EWT's database.

A good understanding of available wind resource on the site can be gathered from historic databases or through data collected by sensors on nearby meteorological stations or other local turbines. A more accurate understanding of wind resource may be gathered by installing sensors at the site itself and collecting data over a period of several months.

The wind resource data can then be mapped against historic energy consumption data provided by a site's management team. A comparison of the energy produced and consumed on site against energy consumed from the grid will highlight the efficiency of a self-consumption project, and help inform the modelling to determine the lifetime value of the project to the business.

EXAMPLE ENERGY PRODUCTION & CONSUMPTION OVER A 24-HR PERIOD



Financial analysis

With clarity on how planning and construction can be undertaken, and a model for energy production and consumption in place, the last step in a feasibility assessment is the financial modelling. This will look at how much the project will cost to build and run, and compare this against the cost of purchasing the energy from the grid over the lifetime of the turbine.

In general, high energy users with a 1MW turbine can expect to produce between 2GWh and 3.5GWh of electricity per year, depending on average wind speed and the dimensions of the turbine. And with energy production costs being far lower than retail energy prices, a business consuming 1GWh of energy generated by an onsite wind turbine, can annually save €120-160,000 in energy costs.

Depending on how much of the total energy generated it consumes, a business may also have surplus electricity to sell into the grid. Currently, the difference between the wholesale price of energy and what businesses and consumers pay for it, is about €0.08-€0.10 per kilowatt hour in markets such as the UK and Germany. This price difference makes electricity generated onsite and sold to the grid worth less to the business than what it consumes.

In its final assessment a feasibility study will make recommendations on a turbine specification suited to the energy needs of the business, which will minimise surplus electricity, and optimise the lifetime value of the project to the business.

A feasibility study, whether it determines project go-ahead or not, is typically a low-cost and low-time investment for a business considering a self-consumption project. But, before setting out on the development, construction, installation and eventually operation of an on-site wind turbine, it will answer the crucial strategic question – should the business invest in such a project?

If the answer is yes, the feasibility study will guide the project's next steps, helping to inform decisions about what turbine technology to use, where to site the turbine and how to finance the project. A sound feasibility study provides a clear pathway for businesses undertaking a self-consumption project and supporting informed decision making as they work with experts to bring a good idea from planning through construction to operations.

2. CHOOSING THE RIGHT TECHNOLOGY

Together with wind resource, turbine selection - its size, the technology used, and its track record for reliability - is crucial for determining the potential returns of a project.

Turbine size

Turbine size is influenced by the onsite wind resource, the amount of energy consumed by a business, and planning restrictions on tip heights or shadow flicker. Turbine dimensions are then chosen to optimise the amount of power that can be produced in the specific conditions of that site.

Turbine capacity

It is also important to choose a turbine with a capacity matched to your site's needs. Choosing a turbine that is more powerful than necessary will force a business to export the excess electricity to the grid, reducing the benefit of the self-consumption project to the business. EWT has developed a range of turbines to meet customers' needs.

Drivetrain technology

Wind turbines convert wind energy into electrical energy by driving a generator either directly connected to the driveshaft, or through a gearbox. A gearbox steps up the rotational speed of the rotor blades and the driveshaft from around 12-26 rotations per minute (rpm) to 1000-1,800 rpm, the rotational speed required by most generators to produce electricity. Direct-drive technology, like that used in EWT turbines, uses generators that can produce electricity at the same speed as the rotor, i.e. 12-26 rpm, eliminating the need for a gearbox.

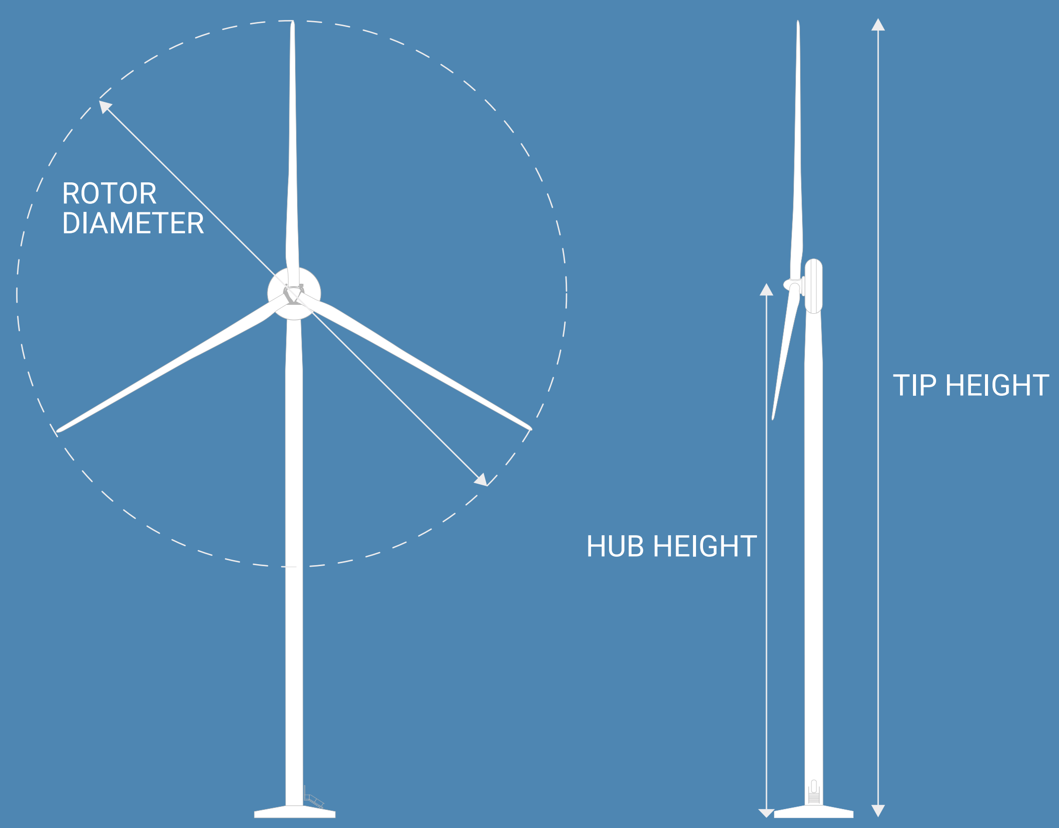
Gearboxes are susceptible to breakdown, making wind turbines that use them more expensive to run. With a typical lifetime of 10 years, replacing a gearbox is costly. As well as paying for a new gearbox, owners must hire a suitable crane, which is expensive. In contrast, direct-drive turbines have a certified lifespan for all parts of at least 20 years, spreading the capital costs and eliminating the expense of early gearbox replacement.

Gearboxes are a significant proportion of the cost of a wind turbine.

Their failure, even if it is not critical or even catastrophic can be expensive. Typically gearboxes need to be replaced after about ten years, about halfway through a project's life. Costs involved can be equal to 10 per cent of project CAPEX.

EWT DIRECT-DRIVE TURBINES

EWT turbine	Wind speed (m/s)	Hub height (m)	Rotor diameter (m)	Tip height (m)	Rated power
DW54-X	8.5-10	50	54	77	900KW, 1MW
DW58	7.5-8.5	46, 69	58	75, 98	1MW
DW61	< 7.5	46, 69	61	77, 100	750KW, 1MW
DW52	< 8.5	35, 40, 50	51.5	61, 66, 76	900KW



3. PROJECT DEVELOPMENT AND PERMITTING

Securing planning permission to build a self-consumption wind turbine can be a complex process. Building support from the project among local influencers and decision-makers can make a reasonable timeframe achievable. Any plan should consider local circumstances and neighbours, while working with an experienced wind energy consultant during planning will make obtaining permits easier, reducing delays and the cost of the process.

Being a good neighbour

A thorough consideration of effects on neighbours will include an assessment of the wind turbine's visual impact, and an assessment of its effect on wildlife, possibly requiring surveys of bat and bird populations during the appropriate seasons.

The turbine will also need to comply with regulations on noise levels and shadow flicker as they affect near neighbours, and an archaeology appraisal may be required to assess the need to consider the impact on local heritage sites.

The planning process typically works to a specific timetable with applications being presented to a committee, and consultation periods typically lasting for a mandated minimum period. In some markets this can be as brief as two months, in others it may be six or more. Medium scale turbine wind projects are generally not subject to the same processes as utility scale wind developments.

A simpler planning phase

While wind power enjoys strong public support in the UK (76% back it, according to a 2018 UK government public attitudes tracker), planning applications for the construction of single wind turbines for onsite generation and self-consumption are rigorously scrutinised by local authorities.

EWT turbine designs aim to minimise planning demands. With tip heights of less than 100m, EWT turbines avoid having to commit to conducting an Environmental Impact Assessment (EIA), saving time in the planning and assessment stages.

4. FUNDING METHODS

A critical step towards ensuring the success of a wind energy project for any business is securing funding. The right financing structure will secure the key project objective to reduce the cost of energy for the business.

Outlined below are potential funding methods for a wind energy project. Funding needs to be tailored to the business and the project to provide reliable, long-term and low-cost access to renewable energy.

Self-consumption wind energy project financing options:

- **Commercial loan from a bank or other lender – to buy the project outright.**

  In choosing this approach, the business takes on the risks of the project. This gives a business freedom to make all their own decisions, but it also means they must be confident that the cost of repaying the loan is lower than the cost of buying electricity from the grid.

- **Equity investment partners – to purchase a share of the project.**

  Onsite generation and self-consumption projects have a high upfront capital investment, but can maintain low running costs across their lifetimes. With strong financials, these projects can appeal to backers with a longer investment horizon.

- **Turbine leasing – to reduce hassle through a regular fixed fee.**

  Leasing a turbine from a manufacturer or a leasing company, ensures the renewable energy project remains in the hands of an expert with experience and knowledge to deliver and maintain it successfully.

- **Power purchase agreement – to buy power under an agreement with the turbine owner.**

  An agreement with a third party experienced in developing onsite generation projects, such as a utility or an energy services provider, allows the business to secure a fixed price for the electricity they buy over the long term.

As a turbine supplier and project manager, EWT has worked on projects that have successfully used each of these funding methods and built strong relationships with a variety of finance partners. Through this experience we have developed ways of working to ensure the risks of project gaps are mitigated no matter how a project is financed.

5. CONSTRUCTION AND INSTALLATION

The start of construction and installation on site is the moment every project comes alive, and the process is about much more than simply raising a wind turbine.

From groundworks to electrical infrastructure, a wind energy project requires contractors that are expert in design, engineering, procurement, and construction. Some businesses decide to take on overall project management and handle suppliers for themselves, others prefer to hire an EPC contractor as a single point of contact to coordinate and manage a network of reliable contractors.

Complete project management

The EPC contractor is responsible for engineering, procurement and construction (EPC), as well as for ensuring successful completion of the project. In this role they will manage and eliminate any gaps or misunderstandings between contractors that might cause delays or increase project costs. EPC contractors centralise expertise and contacts for all stages of the project. Technology providers, like EWT, will have experience acting as an EPC contractor, running installation and construction projects hand-in-hand with local contractors all over the world.

/ CASE STUDY /

AG Barr, Scotland, UK – Soft drink manufacturer

AG Barr, the Scottish soft drinks manufacturer, and producer of some of the country's favourite drinks, intended to upgrade and expand their bottling site in Cumbernauld. However, the upgrade costs quoted by the utility were significant. Building a wind turbine allowed the business to secure the additional power it required and benefit the local community.

The location of the facility on the edge of an industrial estate with an open aspect was ideal for the installation of an EWT DW 54-500kW wind turbine on a 50 meter tower, which produces 8-10% of the company's energy needs and cuts up to 1000 tonnes of CO_2 emissions annually.

During construction and installation any activities that required the shutdown of AG Barr's facility were scheduled to coincide with pre-planned shutdowns when production would be minimally effected.

The wind turbine delivers electricity on a private wire to AG Barr under a 20-year power purchase agreement.

6. OPERATIONS AND MAINTENANCE

It can be frustrating for a business owner who wants to cut energy costs and improve their carbon footprint to look out of the window on a blowy day and see their turbine not working.

To realise the full benefits of a wind project, turbine owners need to keep their machines in good condition and make sure they are available to generate electricity as much as possible. Long-term all-inclusive maintenance contracts offer businesses greater peace of mind and assurance of the value of their investment by warranting performance levels. An experienced operations and maintenance partner can ensure high levels of turbine availability and that a turbine meets its power curve. And, in this way ensure returns on the project are secured for all investors.

Remote performance monitoring

Intelligent turbine performance monitoring can identify potential problems with the machinery and ensure repairs and maintenance are conducted swiftly to minimise the time a turbine spends offline not producing electricity.

Turbine monitoring has come a long way in recent years. Previously, inspection and monitoring was conducted at timed intervals by technicians visiting wind turbines to collect samples, repair or replace parts and record this information on paper. Today's best maintenance programmes use digital technologies to collect and record data for remote monitoring teams located anywhere in the world.

Experienced operations and maintenance professionals at EWT's headquarters in the Netherlands use proprietary software to monitor and analyse the performance of wind turbines 24/7. Alarms alert the monitoring team when the turbine's performance strays outside of normal parameters, guaranteeing the earliest possible response to any irregularity. As each alarm is diagnosed remotely, teams are instantly able to plan necessary maintenance to minimise the time the turbine is offline.

Local maintenance expertise

An efficient service and maintenance programme will improve the operational management of wind turbines and help keep running costs low. In a system of continuous remote monitoring a team of technicians track turbine performance 24/7 through sensors installed on the machine.

The remote monitoring team can resolve many issues with a turbine, and when they can't, they will schedule site visit by an experienced local team. With access to spare parts and a thorough understanding of the turbine technology, an on-the-ground repair team can respond quickly to resolve issues.

/ CASE STUDY /

Lanchester Group, County Durham, UK – Wine Merchant

Lanchester Group is committed to minimising its carbon footprint in every way possible. The business has installed heat pumps and solar panels at its plant in County Durham, and added low-emission trucks to its distribution fleet. As part of a £4.5m programme of investment by the business, Lanchester Group installed three EWT turbines at its 440,000 square foot site in County Durham, which the business runs entirely on renewable energy.

The three EWT DW54-500KW turbines produce upwards of 5,500KWh of energy each year and together replace more than 2,300 tonnes of CO_2. At present the business consumes around 50% of the energy produced by its turbines and sells the surplus energy produced into the grid. But the turbines are an investment for the future, protecting the business against increases in the cost of grid supplied energy, and as the business plans to expand the bottling plant on the site, ensuring that it will have the capacity to continue to run operations with zero carbon impact once the new facility is up and running.

EWT EXPERIENCE

EWT has worked with businesses across Europe to deploy medium-scale wind turbines specifically designed to generate onsite energy. The business has built a strong network of partners with essential experience for building a successful wind energy project.

As a manufacturer of turbine technology, EWT regularly takes on the role of developer, construction manager and operator, over-seeing the project at every stage. By partnering with civil engineering firms, electrical contractors, planning consultants and renewable energy investors, EWT is able to ensure the successful delivery and operation of premium-quality technology on site and on schedule.

EWT applies its knowledge and expertise accumulated through 15 years in the industry to each and every self-consumption project, helping businesses secure low-cost, low-carbon energy.

/ **CASE STUDY** /

Pohlkemper GbR Hänchenmast, North-Rhine Westphalia, Germany – Poultry Farm

To maintain the right environmental conditions for the livestock it raises, the Pohlkemper poultry farm uses huge amounts of electricity. Regularly heating and cooling the farm buildings resulted in high energy costs for the business.

In September 2018 the business had a 750KW EWT DW61 wind turbine installed, on a project timeline of less than two months. Able to demonstrate that the business would consume more than half of the energy generated by the wind turbine, Pohlkemper secured an exemption to build outside designated wind energy areas in German, and shortened the timeline for delivery. The speedy project timeline also allowed the business to meet the EEG deadline of 1st October 2018.

By reducing reliance on grid energy Pohlkemper was able to reduce the cost of the electricity they used. While any electricity that was not consumed onsite was exported to the grid on the fixed EEG tariff, helping the business to cover the project costs. This flexibility was an important factor for the business in choosing to proceed with the project.

A FLEXIBLE SOLUTION FOR RELIABLE BENEFITS

Wind energy is a tried and tested source of power for onsite generation and self-consumption projects. Against alternative onsite solutions, the technology has proven itself capable of providing a reliable source of power and helping businesses reduce the cost of the energy they use.

The development and construction of projects are tailored to the needs of a business and the conditions prevailing onsite. This means it isn't possible to talk of a 'typical' self-consumption project, but by taking account of the financing and energy needs of a business and providing a wind turbine to suit, self-consumption offers a viable solution for heavy energy users.

The best projects have the solid foundation of a thorough feasibility study, the right turbine technology, a sound development process and efficient and effective funding and construction. Ongoing performance monitoring and expert maintenance ensure maximum availability for projects to protect users against higher grid energy prices and allow them to materially reduce carbon outputs.

More efficient and effective than alternative solutions, wind energy technology offers commercial and industrial businesses the best solution for the onsite electricity generation and self-consumption. Self-consumption projects gather together expertise in development, construction and operation to help businesses reduce energy costs or mitigate carbon outputs.

For further discussion on delivering successful self-consumption wind energy projects tailored to high-energy users, contact **feasibility@ewtdirectwind.com** or call Rob on **+31 (0)33 454 05 20**.

WIND ENERGY LEXICON

Struggling to navigate all the wind industry jargon? While our glossary of terms is by no means comprehensive, we've shared below some of the most common words and phrases that you'll need, to ensure that you know what the market is talking about, from the outset!

TURBINE TECHNOLOGY

Direct drive	A wind turbine drive train that contains no gearbox. The rotor connects directly to an electrical generator specially designed to generate power at low revolutions.
Generator	Uses an electrically excited stator located around a rotating drive shaft to convert mechanical energy to electrical energy.
Medium scale wind turbine	Medium scale wind turbines range in tip height between 60m and 100m and have a rated power capacity up to 1MW.
Hub	The point where the rotor blades attach to the wind turbine.
Hub height	The distance from the ground to the centre of the hub.
Nacelle	The enclosed part of a wind turbine, sitting on top of the mast that contains the yaw motors and to which the generator and main bearing are connected.
Rated power	The stated power capacity of a wind turbine, typically measured in kilowatts or megawatts, also known as the nameplate capacity.
Rotor blade	Wind turbines typically feature three blades, an aerodynamically shaped surface to catch the wind.
Tip height	The height of the wind system from the ground to the highest point of the end of the rotor blade in vertical position.
Yaw motor	A motor used to face the turbine into the wind.

PROJECT PLANNING, DEVELOPMENT & CONSTRUCTION

Anemometer	A device for measuring wind speed.
Balance of Plant (BOP)	The parts of a wind energy project that are not the wind turbine, for example the ground and civil works, internal electrical systems and the connection to the grid or energy user.
Behind-the-meter generation	An electrical generation project connected directly to a consumer, cutting out the role of the utility, electricity is consumed on site, although the excess energy can usually be fed into the grid.
Civil works	The construction work done to lay crane platforms and foundations for the wind turbine and the installation of connecting cables.
Developer	A business specialised in the planning, construction, installation and operation of a wind energy project.
Distributed generation	An energy project that primarily generates and supplies power to local users.
EPC	Engineering, procurement and construction, a particular form of contracting arrangement where the EPC contractor is made responsible for all the activities from design, procurement, construction, commissioning and handover of the project to the end-user or owner.
Feasibility	An assessment, taking into account all variables of site location, planning requirements, funding and energy consumption to determine whether a project will work.
Grid connection	The link between a wind turbine and the national grid that distributes electricity around the country. Specific technical standards for the interconnection are set by national and international authorities.
High-energy users	High energy users are sites or facilities that consume at least 1 GWh of electricity per year.
Power purchase agreement	A contract with the owner of a turbine to buy an agreed amount of electricity from them at an agreed price, with obligations on both sides to supply the electricity and to accept it.
Self-consumption project	An energy generation project specifically designed and built to produce power consumed onsite by the business that commissioned the project.
Wind resource	The nature and amount of wind available to drive a turbine at a given location, as summarised in a wind report. Wind resource is typically established using historical wind data from nearby collection points.

PROJECT OPERATIONS

Availability	The amount of the time a wind turbine is functional, capable of producing power and not out of commission or being serviced and repaired.
Cut-in wind speed	The lowest wind speed at which a wind turbine starts to produce power.
Cut-out wind speed	The wind speed at which a wind turbine control system stops the system working in order to protect it in extreme high winds.
Energy production	The energy output of the wind turbine, measured in kilowatt-, megawatt- or gigawatt hours, also referred to as the energy yield.
Gigawatt hour	A measure of energy equal to 1,000 megawatt hours, or 1,000,000 kilowatt hours.
Intermittency	Renewable energy sources like wind and solar are described as intermittent they only produce power when the wind blows or the sun shines.
Power curve	An ‘S’ shaped curve that charts the amount of power generated by a wind turbine for a given wind speed, necessary for calculating electricity generation.
Turbine monitoring	A system of sensors that measure performance and share the data they collect with the operator through a supervisory control and data acquisition system (SCADA).

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