

Floating renewable power for offshore energy systems



The global challenge

Our planet is facing a complex mix of challenges. At SeaTwirl we want to make our contribution to the green transition and eliminate the use of fossil fuels and reduce its devastating long-term effects on the environment and climate. We define the challenge as addressing three important goals:

CO2 Reduction
Reducing carbon emissions to a sustainable level, a.k.a. a net zero carbon footprint. We want to be actively involved in keeping the global rise in temperature below the two degree threshold.

Critical resources
Our whole design philosophy is to minimise the need for resources. That is both for materials like steel and rare earth minerals but also precious capacity in important supply chains.

Local energy = Local independence
We believe that clean and affordable energy is vital for societies to prosper. Enabling floating wind in places with limited resources or infrastructure can build independence and resilience.

A new generation of floating wind power

Wind power is an endless source of renewable and clean energy. As wind power on land and near shore are facing increasing challenges, the focus is now on enabling wind power on the deep oceans. Commercial offshore wind power is currently built almost exclusively on bottom fixed foundations in waters up to approximately 60-80 meters. More than 90 percent of the world's oceans are deeper and would require floating turbines.

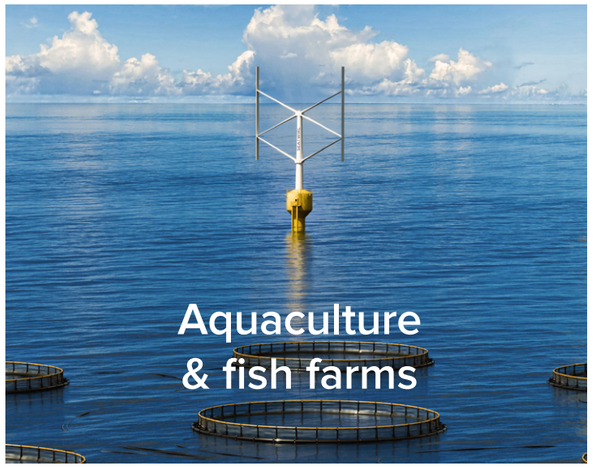
The vertical-axis wind turbine on a rotating spar is a robust solution designed for the deep-water offshore environment from the start. A low centre of gravity, enabled by integrating the tower and the SPAR into one rotating unit, provides many beneficial qualities. It means the floater can use less steel than conventional floating solutions, the Gendeck enables easier access for service and maintenance which results in lower maintenance costs and the possibility of using smaller vessels and eliminates the need for large offshore cranes.

Markets

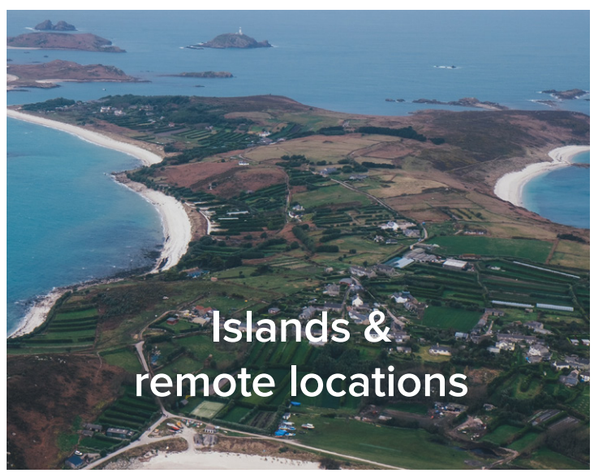
A fundamental focus for nearly 15 years has been the development of modelling and simulation tools of floating vertical axis turbines. These, combined with the control system, is now a world-leading toolbox of software and know-how that can open a new chapter in the offshore wind industry - A new generation of floating wind turbine technology.

The combined demand of niche markets like offshore oil & gas assets, islands, remote seaside communities, aquaculture, and subsea military applications is substantial. Starting with pilot projects of a few MW in size, scale and cost-out should make it possible to achieve an LCOE competitive in merchant market conditions in the early 2030's.

Near term application areas:







Utility scale:



Renewable power close to the point of use

Aquaculture sites, remote islands, ports, and offshore operations often rely on diesel generation or costly grid extensions. SeaTwirl's floating vertical-axis wind turbine is designed to bring renewable electricity directly to marine energy users, helping reduce fuel dependency, logistics, operational emissions, and exposure to volatile fuel prices.

The turbine can supply a local electrical network or form part of a hybrid power system incorporating battery storage, solar power, diesel backup, or existing site infrastructure. A site-specific battery energy storage system can smooth short-term variations in wind generation, support stable voltage and frequency, cover short-duration demand peaks, and reduce diesel-generator starts and low-load operation.

SEATWIRL



Key value proposition

- Floating wind power solution for offshore and coastal energy needs.
- Designed for aquaculture sites, islands, ports, and remote marine operations.
- Compact vertical-axis turbine concept with low visual complexity.
- Floating concept avoids fixed seabed foundation requirements.
- Modular delivery and assembly concept.
- Can support reduced diesel consumption and lower operational emissions.
- Suitable for hybridization with battery storage and backup generation.
- Can reduce long-term exposure to diesel fuel cost, logistics, and emissions.

Typical applications

- Aquaculture farms.
- Nearshore monitoring stations.
- Remote islands and coastal communities.
- Ports and harbors.
- Offshore industrial loads.
- Hybrid power systems with battery storage, solar, diesel, or grid connection.
- Defense applications.

SEATWIRL



SeaTwirl VAWT, 200kW

Compact floating vertical-axis wind turbine designed to provide renewable electricity in marine environments where grid connection is limited, costly, or unavailable.

3
Number of blades

26,5M
Height above sea level

APPROX. 506M²
Swept area

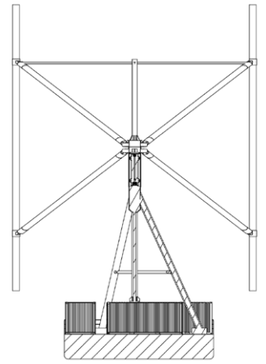
200KW
Rated power

23M
Rotor blade lenght

30RPM
Maximum rotor speed

22M
Rotor diameter

APPROX. 2M
Draft



Product overview

The turbine is a floating vertical-axis wind turbine intended for marine deployment. The rotor, tower, generator enclosure, electrical equipment, and floating platform are configured as an integrated energy unit.

The turbine can be integrated with a battery energy storage system and site energy management system. The battery can absorb excess wind generation, smooth short-term power variations, support voltage and frequency stability, and supply short-duration loads when wind output is below demand. Battery power and energy capacity are selected based on the site load profile, wind resource, required operating autonomy, and backup strategy.

Site-specific energy simulations can be used to optimize battery size, renewable penetration, diesel savings, and cost of energy before deployment. An example is that the turbine can deliver up to 700 MWh per year at an average wind speed of 7.5 m/s.

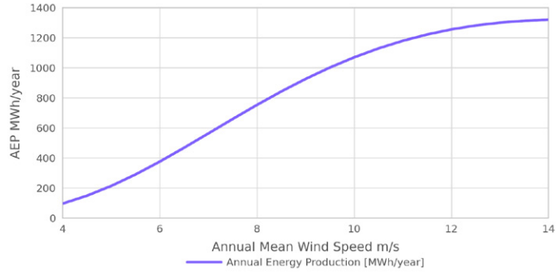
Key technical data

Turbine type	Floating vertical-axis wind turbine
Rated power	200 kW at 12 m/s
Rotor diameter	22 m
Blade lenght	23 m
Number of blades	3
Draft	Approx. 2 m
Swept area	Approx. 506 m^2
Maximum rotor speed	30 rpm
Annual energy production	Up to 700 MWh per year at 7.5 m/s average wind speed
Deployment environment	Marine, coastal, offshore, sheltered or semi-sheltered sites
Electrical integration	Site-specific, suitable for hybrid systems
Platform concept	Floating barge / floater, site-specific configuration

Power production

Annual energy production increases significantly with the available wind resource. The most cost- effective system is achieved by matching the expected energy production from the local wind resource with the site's energy demand.

Annual Energy Production



System configuration

Depending on the selected project scope, the system can include:

- Rotor with composite blades and struts
- Tower / support structure
- Bearing arrangement
- Generator and drivetrain system
- Electrical and control system
- Floating platform / barge
- Mooring and electrical export interface, site-specific
- Battery energy storage system, including battery modules and bidirectional power conversion system
- Hybrid power controller and energy management system
- Backup generation or grid interface, site-specific

SEATWIRL



Benefits for aquaculture operators

Aquaculture operators require reliable power for daily operations, often in remote marine locations where energy logistics are challenging. A floating wind solution can provide renewable electricity close to the point of use and reduce reliance on diesel generation and associated fuel handling.

The turbine can support:

- Feeding systems
- Sensors and monitoring equipment
- Lighting
- Communication systems
- Pumps and auxiliary loads
- Battery charging
- Hybrid energy systems with backup generation
- Aeration and oxygenation systems

Key operational benefits may include:

- Renewable electricity close to the point of use
- Reduced dependency on diesel logistics
- Potential reduction of fuel cost and emissions
- Reduced noise from diesel generator operation
- Lower fuel transport and storage requirements
- Reduced spill risk and fuel-handling exposure
- Floating concept avoids fixed seabed foundation requirements
- Battery-supported operation provides smoother, more controllable power and can increase the proportion of renewable energy used on site.

Diesel fuel savings potential

Replacing diesel generation with renewable wind power and battery-supported energy storage can reduce fuel logistics, operating cost, emissions, noise, and local pollution for marine energy users. For a site requiring 700 MWh per year, diesel generation would typically consume approximately 180,000 liters of diesel per year, assuming a generator efficiency of approximately 4 kWh per liter.

Annual diesel fuel cost

Assumption	Recommended value
Electricity displaced	700 MWh/year
Diesel displaced	4 kWh/litre
Diesel displaced	180,000 litres/year
Illustrative diesel price	€1.98/litre
Annual diesel cost	Approx. €356,000
Fuel cost	Approx. €0.49/kWh
25-year diesel cost	Approx. €8.65 million

At an illustrative delivered diesel price of €1.98 per litre, producing 700 MWh with diesel generators would require approximately 180,000 litres and cost approximately €356,000 per year in fuel alone. This is equivalent to approximately €0.49 per kWh and €8.9 million over 25 years, excluding escalation.

These figures represent fuel costs only. They do not include maintenance, servicing, engine overhauls, capital costs, emissions charges, diesel transport, storage infrastructure, or other operational expenses. Including these costs would increase the total cost of diesel-based electricity generation.

25-year environmental gain

Over a 25-year operating period, replacing diesel generation of 700 MWh per year with a renewable wind and battery-supported energy system can deliver significant environmental benefits.

Key assumptions

- Annual electricity production replaced: 700 MWh
- Diesel generator efficiency: approximately 4 kWh per liter
- Annual diesel consumption avoided: approximately 180,000 liters
- Assessment period: 25 years
- Diesel CO_2 emission factor: 2.68 kg CO_2 per liter
- Diesel lifecycle GHG emission factor: approximately 3.35 kg CO_2e per litre, well-to-wake

Diesel baseline over 25 years

Item	Annual	25 years
Electricity produced	700 MWh	17,500 MWh
Diesel consumed	180,000 liters	4,500,000 liters
Lifecycle GHG emissions	603 tonnes CO_2e	15,075 tonnes CO_2e

Fuel cost avoided over 25 years

Diesel price	Annual fuel cost	25-year fuel cost
€1.80/litre	€324,000	€8.09 million
€2.25/litre	€405,000	€10.11 million

Values are approximate and assume a constant diesel price over 25 years.

Environmental gain if replaced by renewable power

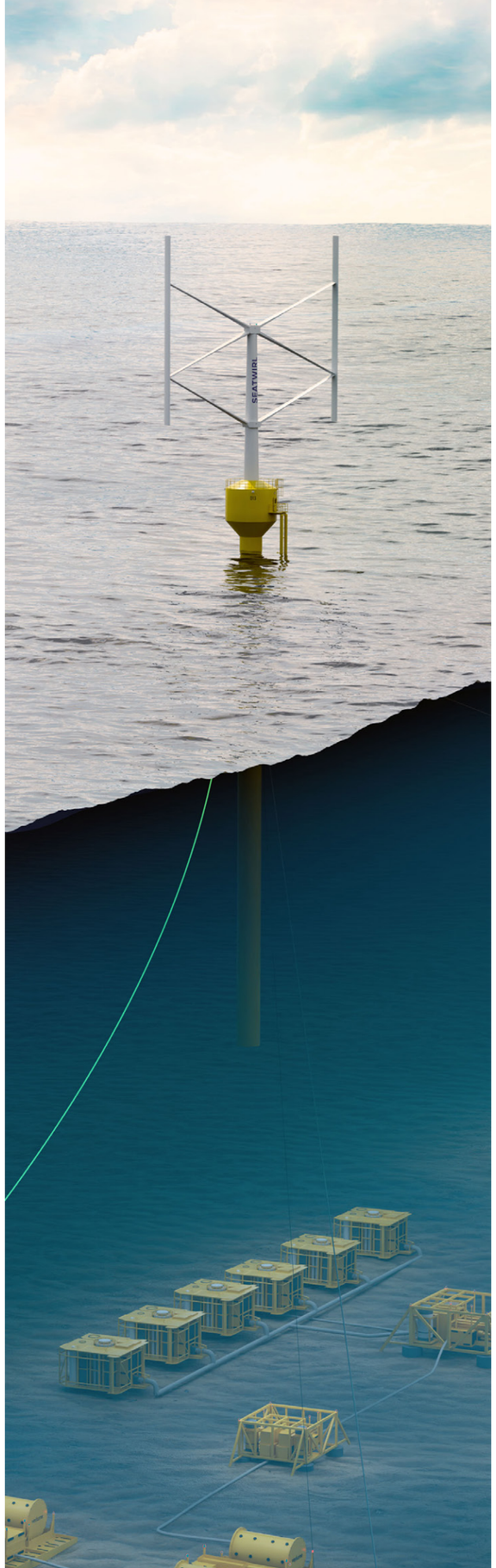
Over 25 years, avoiding diesel generation could save approximately:

- 4.5 million liters of diesel
- 15,000 tonnes tonnes of CO_2e
- Significant reductions in NOx, soot, and particulates
- Lower noise from diesel generator operation
- Reduced fuel transport, storage, and spill risk
- Reduced engine maintenance waste and servicing requirements
- NOK 90–112.5 million, approximately €8.09–10.11 million, in avoided fuel cost alone before service, logistics, and emissions-related costs

Summary statement

In the illustrative case, displacing 700 MWh per year of diesel-generated electricity could avoid approximately 4.5 million litres of diesel and 15,000 tonnes of diesel-related lifecycle GHG emissions over 25 years. At the assumed diesel price, this represents approximately €8.9 million in avoided fuel cost alone.

Actual diesel displacement depends on the match between wind generation and site demand, battery capacity and efficiency, curtailment, and the backup-generation strategy. Annual turbine production should therefore not automatically be assumed to equal annual diesel displacement.





Delivery and installation concept

The turbine is intended for modular fabrication, transport, and assembly. Composite rotor parts, equipment containers, generator systems, and electrical systems can be delivered as pre-manufactured modules. Final assembly and integration can be performed by an appointed yard or installation partner. The floating platform can be supplied, manufactured, or adapted depending on project scope and site requirements.

Site requirement inputs

Final performance and configuration depend on:

- Wind resource
- Water depth
- Wave and current conditions
- Distance to load or grid connection point
- Local electrical demand profile
- Mooring requirements
- Regulatory and permitting conditions
- Installation and maintenance access

Available project scope

Available scope may include:

- Turbine supply only
- Turbine and floating platform
- Full floating energy unit
- Hybrid power system integration
- Site assessment and application engineering
- Installation support
- Operation and maintenance support

Performance and environmental note

Performance values are indicative and depend on site-specific wind conditions, operating strategy, electrical configuration, and final project design. Final energy yield, loads, mooring design, platform design, and electrical integration shall be confirmed during application engineering.

Fuel savings and environmental figures are indicative and depend on actual diesel generator efficiency, fuel quality, operating profile, renewable penetration, battery configuration, backup generation strategy, and site energy demand. Final environmental and financial impact should be confirmed during site-specific application engineering.

SEATWIRL

Contact us today!

SEATWIRL AB
LILLA BOMMEN 1
411 04 GOTHENBURG
SWEDEN

+46 72 17 485 27
info@seatwirl.com
www.seatwirl.com

SEATWIRL