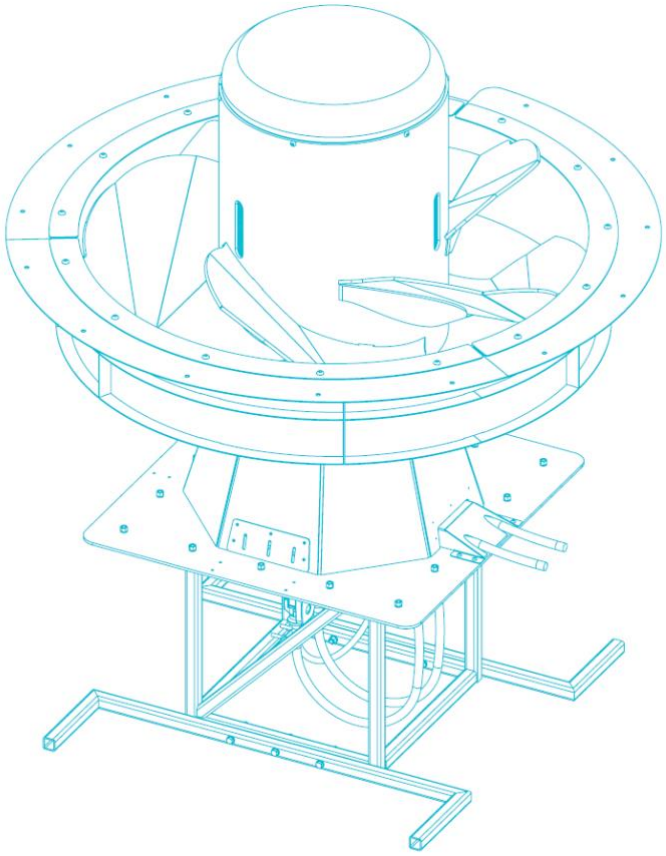
TURBULENT



SEAL OF EXCELLENCE

European Commission

# 15 - 70 kW Vortex Turbine

- Fish-friendly hydrodynamic rotor with flow-optimized blades and low turning speeds.
- Compact low-noise submerged design.
- Core unit designed to operate for over 25 years.
- Submersible gearbox and generator that can withstand floods.
- Sealing system for continuous heavy-duty use in harsh environments.
- Impeller and structural parts manufactured from stainless steel.
- Carbon steel parts coated with impact- and abrasion-resistant paint.
- Equipped with maintenance-free induction generator from European manufacturers.

# Disclaimer

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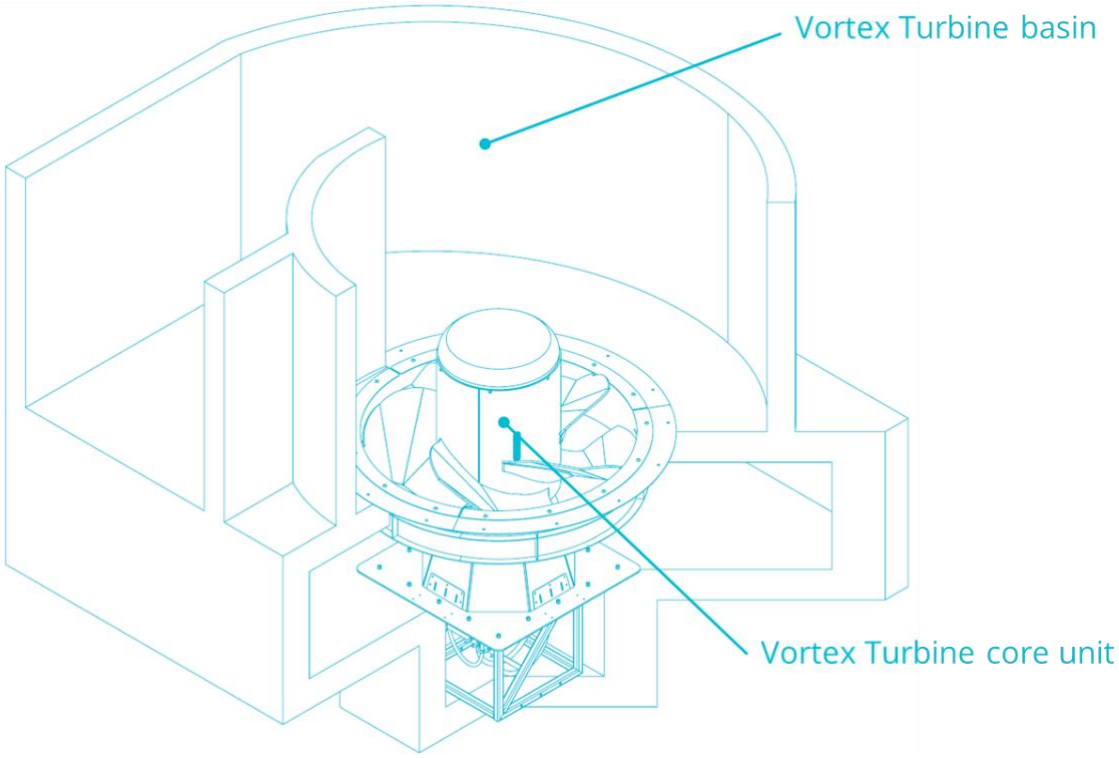
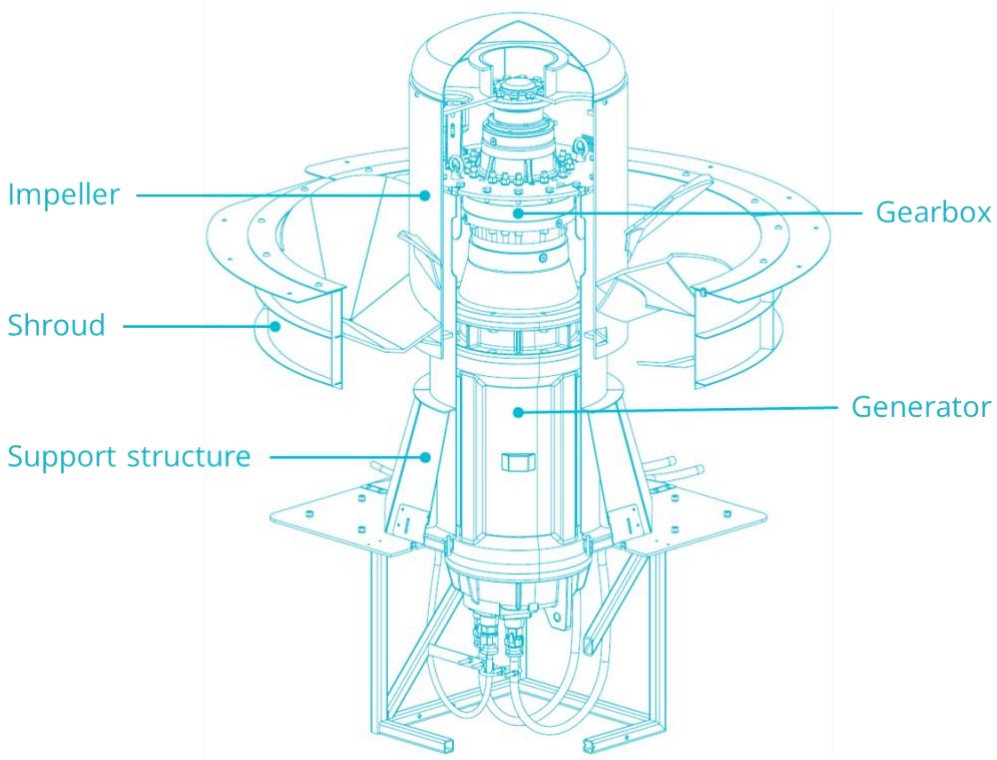
Revised 04/23

Our technology was designed with the collaboration of several Universities and recognized by MIT for its promising innovations. All components are produced with partners and suppliers following ISO 9001:2015 standards.

Co-funded by the Horizon 2020 programme of the European Union

# Turbulent Vortex Turbine



# Vortex Turbine Data

**Turbulent offers standard turbines in the range of 15 to 70 kW. Depending on the head and flow combination Turbulent will select the best fitting standard turbine, both in size and power.**

**The table below shows the range in which Turbulent offers standard hydro-turbines.**

| **Vortex turbine models 15 to 70 kW** | | **unit** |
|---|---|---|
| Flow min. … max. | 1.5 … 5 (*) | m3/s |
| Head min. … max. | 1.5 … 3 (*) | m |
| Frequency | 50 – 60 | Hz |
| Voltage | 380 – 480 | V |
| Number of Blades | 5 | - |
| Impeller speed min. … max. | 50 … 120 | rpm |

*(*) for a standard model, single turbine.*

A turbine of a certain power rating is available with different impeller sizes, and vice versa. The first table below indicates our turbine specifications related to power, the second table lists the specification related to the turbine impeller size. For every particular site, Turbulent will advise the best combination of power and size.

| **Turbine models by power** | **15 kW** | **30 kW** | **50 kW** | **70 kW** | **Unit** |
|---|---|---|---|---|---|
| Turbine hydraulic output | 17.4 | 34.9 | 56.8 | 79.5 | kW |
| Electrical output | 15 | 30 | 50 | 70 | kW |
| Typical energy generation per year | 100,000 | 200,000 | 350,000 | 500,000 | kWh |
| Nominal flow (*) | 1.7 | 2.7 | 3.9 | 4.7 | $m^3/s$ |
| Nominal head (*) | 1.7 | 1.9 | 2.3 | 2.7 | m |
| Generator and gearbox weight | 350 | 750 | 950 | 1300 | kg |
| Electrical cabinet dimensions (**) | 800x2200x 500 | 800x2200x 500 | 1200x2200x 500 | 1200x2200x 500 | w x h x d (mm) |
| Electrical cabinet weight (**) | 260 | 280 | 320 | 350 | kg |

*(*) A wide range of head and flow combinations is available; the table lists typical values.*

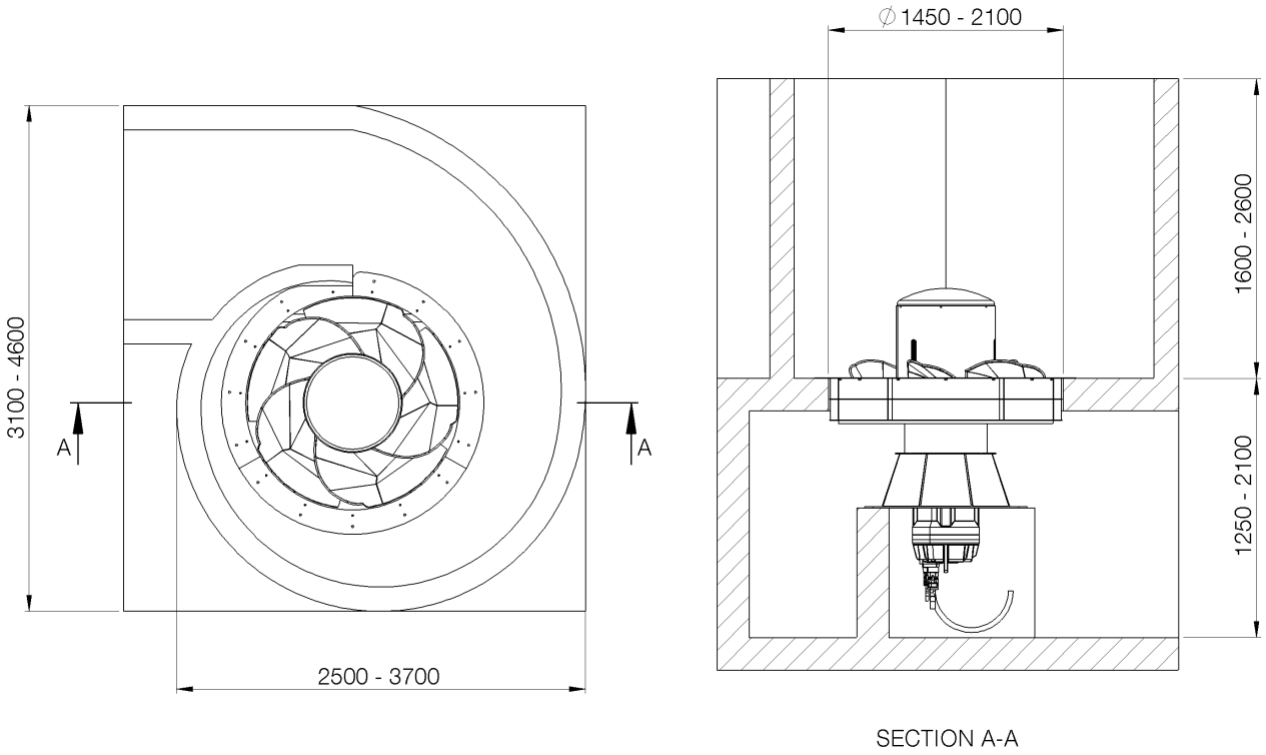
*(**) A cabinet can contain the control & power elements for 1 to 4 turbines; the values indicated in the table are for single turbine cabinets. For example, a 2x30kW will be W1200xH2200xD500.*

| **Turbine models by size** | **1.3 m** | **1.5 m** | **1.7 m** | **1.9 m** | **Unit** |
|---|---|---|---|---|---|
| Impeller diameter | 1300 | 1500 | 1700 | 1900 | mm |
| Core unit dimensions | 1400x1400x 2150 | 1600x1600x 2300 | 1850x1850x 2500 | 2050x2050x 2550 | l x w x h (mm) |
| Core unit weight – excl. generator and gearbox | 500 | 650 | 950 | 1100 | kg |

The packaged turbine fits inside a 40 feet High Cube (40’ HC) container for overseas shipping. HS code for customs: HS841011

# Vortex Turbine basin

It is required to place the turbine in the appropriate spiral-shaped basin to create the optimal vortex. The figure below shows the basin shape, including the minimal and maximal dimensions depending on the actual turbine size. Turbulent will deliver a detailed blueprint of this basin for each particular turbine.




SECTION A-A

# Additional Works and Requirements

Supplied by the client or local partner

- All civil and installation works
- Power station infrastructure (earthing and grounding, lightning protection system, light, sockets, FAS)
- Necessary permitting processes
- Cabling from the electric cabinet to the grid or end consumer
- Extra cabling from the generator(s) to the electrical cabinet if the length > 20m
- Cabling from the sluice(s) to the electrical cabinet
- Ambient climate conditions: 5 … 35°C and 5 … 95%RH (*)
- Grid transformer if necessary

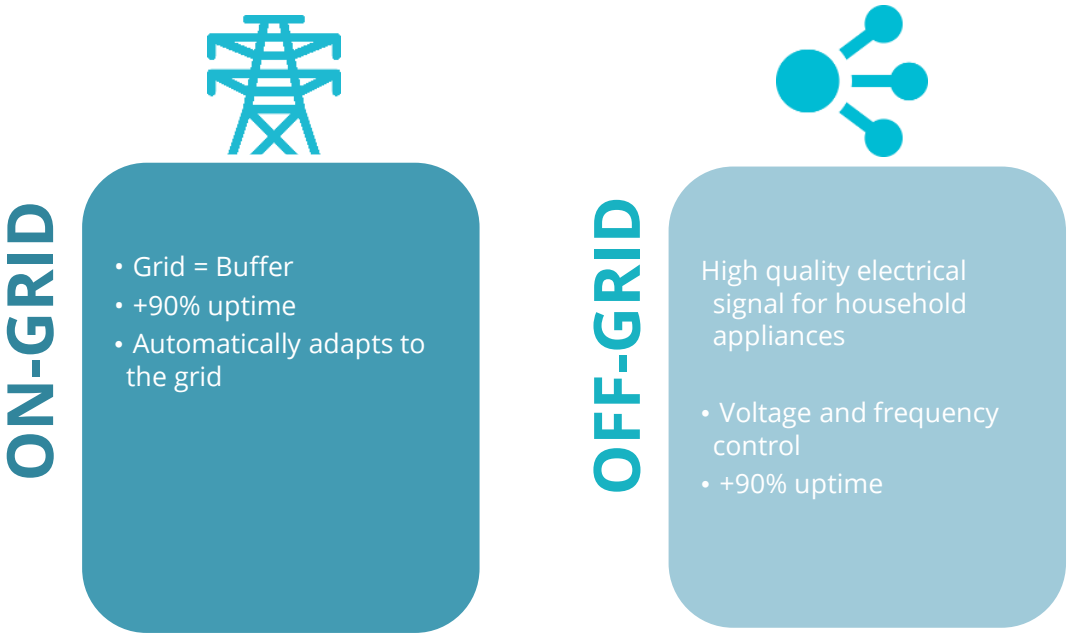
*(*) For extreme climate conditions (floods, warmer or colder climate…), adapted solutions are available*

# Turbine Maintenance

| Maintenance item | Maintenance interval |
|---|---|
| Initial inspection and gearbox oil change | After first 150 h |
| Small maintenance: gearbox oil change + check of fasteners, leakages, noise | 1 year |
| Electrical cabinets check | 2 years |
| Large maintenance: small maintenance + seal replacement + bearing re-lubrication | 3 years |
| Genset lifetime | 10 to 15 years |

# Power Electronics

Our turbines use a 3-phase submersible induction generator. We provide different converter solutions depending on your situation.



# ON-GRID

## Cost-saving with the cleanest possible electricity

A good quality grid is available near the turbine installation & consumers. The turbine will decrease your electricity bill considerably. The backbone is an induction generator that is coupled to the grid.

- Very low maintenance
- Over 90% uptime
- Power factor correction
- MID Certified meter
- 4G modem
- Extended safety monitoring
- Sluice gate control

# OFF-GRID

## Reliable remote electricity

A top quality micro-grid providing energy right from the water. The backbone is also an induction generator but not directly coupled to the grid as with the on-grid solution. Our off-grid solution employs 2 back-to-back inverters: one 4-quadrant VFD to drive the generator and one grid forming inverter to create the micro-grid.

- High quality sine wave output
- Starting battery for generator
- 4G modem
- Extended safety monitoring
- Sluice gate control

## Electrical compliance

- IEC 60364 – Low-voltage electrical installations
- IEC 61439 – Low voltage switchgear and control gear assemblies
- IEC 60204 – Safety of electrical machines

# Remote Monitoring Control

Dashboard is subject to layout updates

The monitoring and control system allows you to remotely control the turbine and to access essential information for preventive maintenance. A range of control solutions can be provided to fit your specific project requirements.

### Manual

- On/Off + emergency button
- Integrated control for genset
- Manual sluice gate and turbine operation
- Flood protection with passive weir
- Basic remote monitoring

### Automatic

- On/Off + emergency button
- Automatic Sluice gate control for active flood protection and increased power output
- Full remote monitoring solution
- Optional: Multiple consumer lines individually controlled