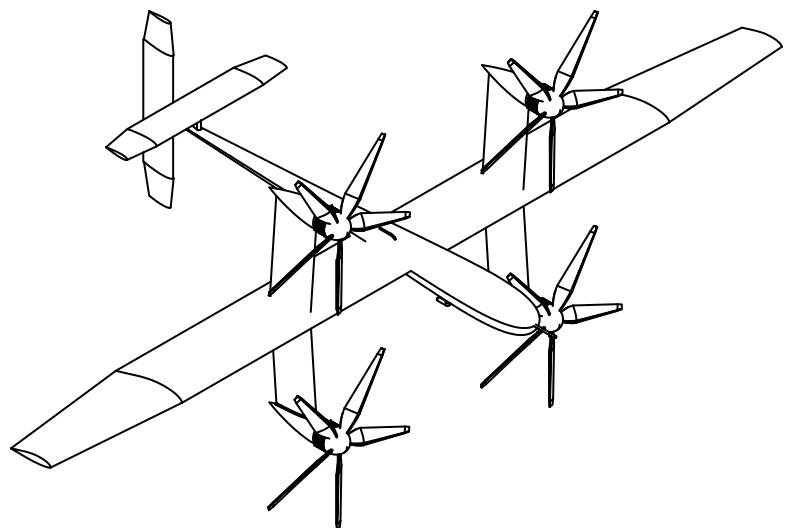
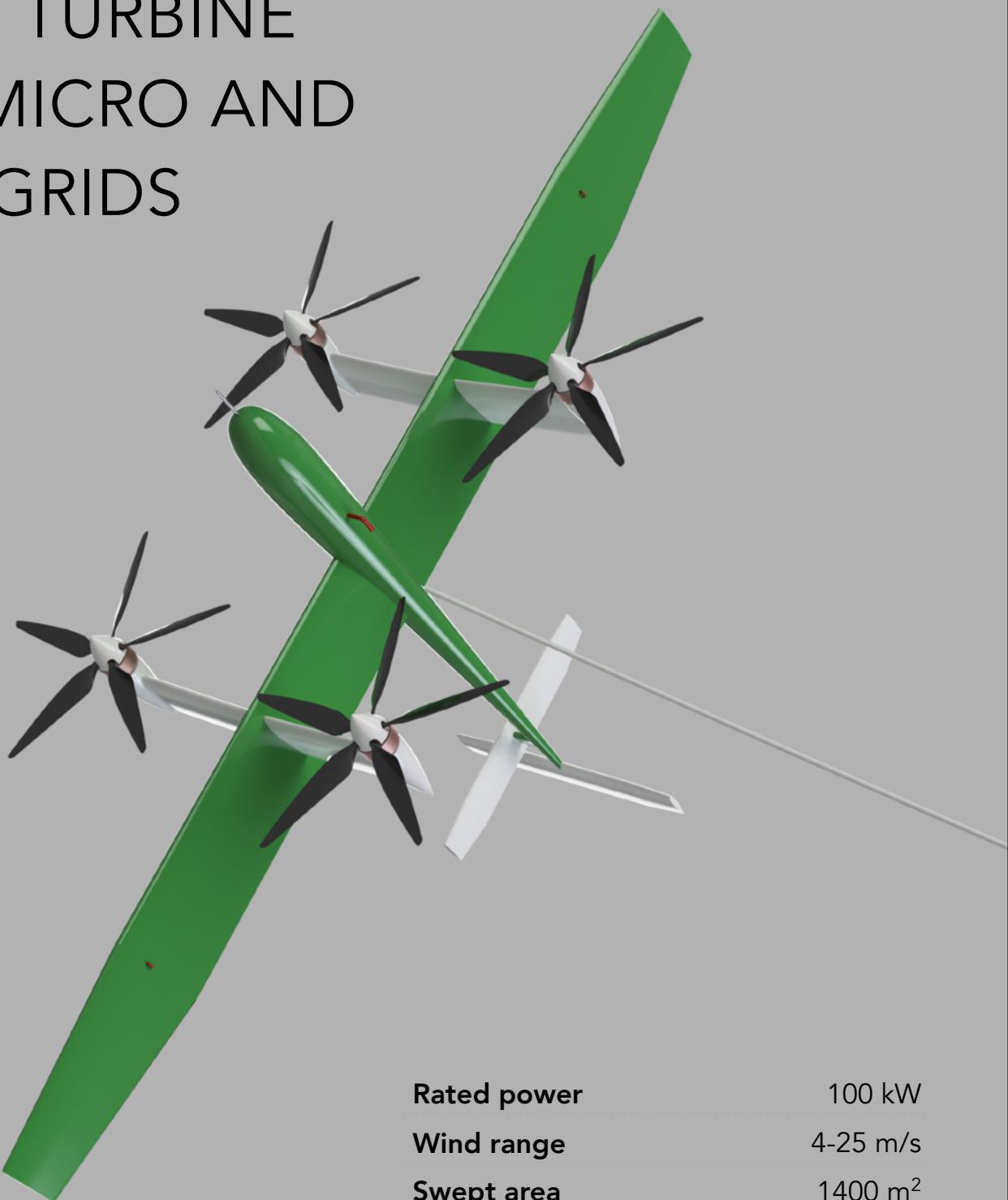


# *DRONE WIND POWER*



**D-100**  
**NEXT GENERATION**  
**WIND POWER**

# A RADICALLY NEW 100 kW WIND TURBINE FOR MICRO AND MINI GRIDS

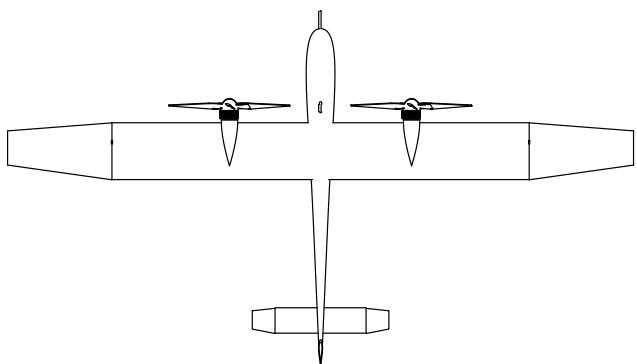


<b>Rated power</b>	100 kW
<b>Wind range</b>	4-25 m/s
<b>Swept area</b>	1400 m <sup>2</sup>
<b>Typical capacity factor</b>	35-55 %
<b>Typical annual savings*</b>	€ 80,000
<b>Typical turn-key price**</b>	€ 125,000

\*Assuming 35% capacity factor and € 0.35 diesel

\*\*Including average shipping & installation costs € 23,000

# DRONE WIND MEANS WIND ENERGY **ANYWHERE**



**D-100** from Drone Wind Power is a flying wind turbine system consisting of two wings and a small ground station. It ships in a standard container and is exceptionally easy to install — it can be installed almost anywhere, without cranes or expensive machinery. In fact, the € 125,000 price example includes average shipping and installation costs to an island location outside Europe.

With a peak power output of 100 kW it happily integrates into existing diesel or hybrid systems where the investment is typically paid back within 2 years, and continues to provide substantial savings.

Attractive PPA options are also available.

# SIMPLE INSTALLATION AND LOW COSTS



## EASY INSTALLATION

The entire D-100 system weighs 500 kg, ships in a standard 20 foot container that doubles as tower, and can easily be installed almost anywhere.



## EASY MAINTENANCE

All maintenance work is carried out at ground level. Annual service can be carried out by the client using tools and parts included with the system.



## LOW WASTE

Uses 90% less material than traditional turbines. This means not just easier shipping and installation, but also much lower environmental impact and simpler decommissioning.



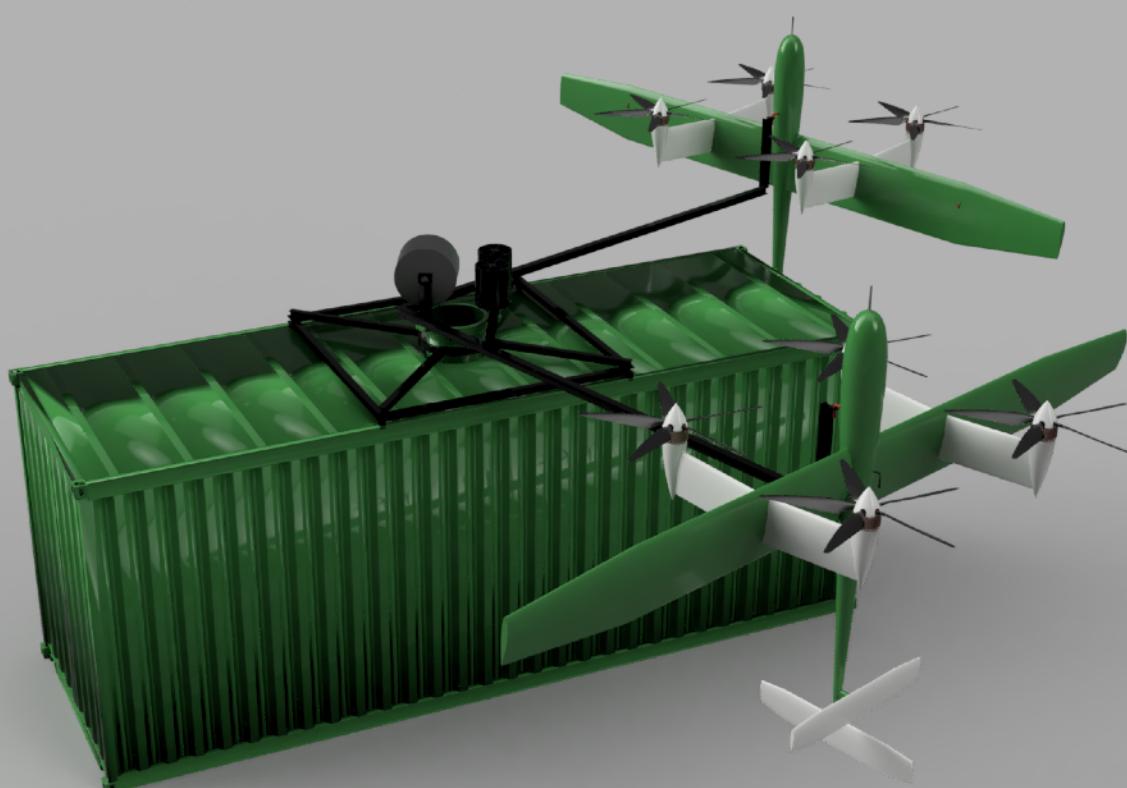
## LOW COST

Thanks to easy handling and very simple installation and service, the lifetime cost of the system is very low.

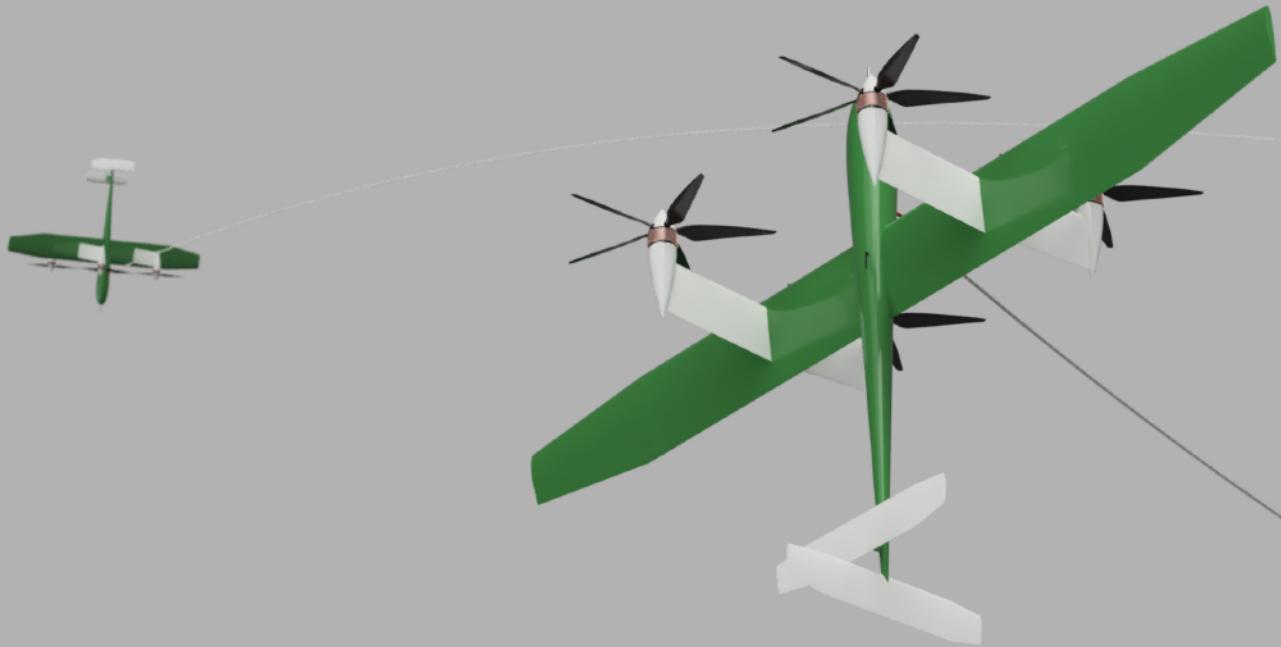


## LOW NOISE

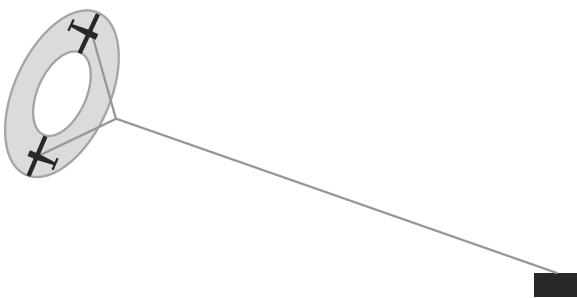
While in operating mode the wings are located 300 meters downwind from and about 100 meters higher than the ground station, so very low noise levels can be achieved.



# IN DRONE WIND TURBINES THE BLADES AND NACELLE ARE REPLACED BY TWO ULTRALIGHT WINGS ON A TETHER



Drone wind turbines have no tower, and the function of the blades of a traditional wind turbine is fulfilled by two ultralight wings that fly in a large circle. The wings are computer controlled and anchored to the ground with a strong tether. Propellers on the wings generate electricity that is sent down the tether.



The main advantage of this construction compared to traditional turbines is that the system can be made much lighter and more compact for the same power output since it does not need a large tower or foundation. This saves over 90% of the material.

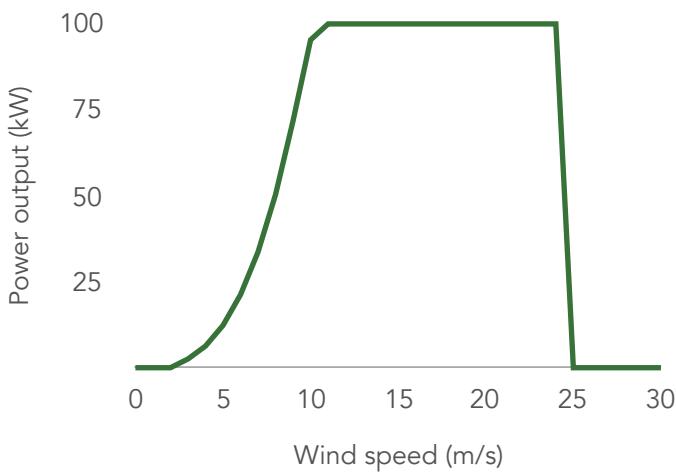
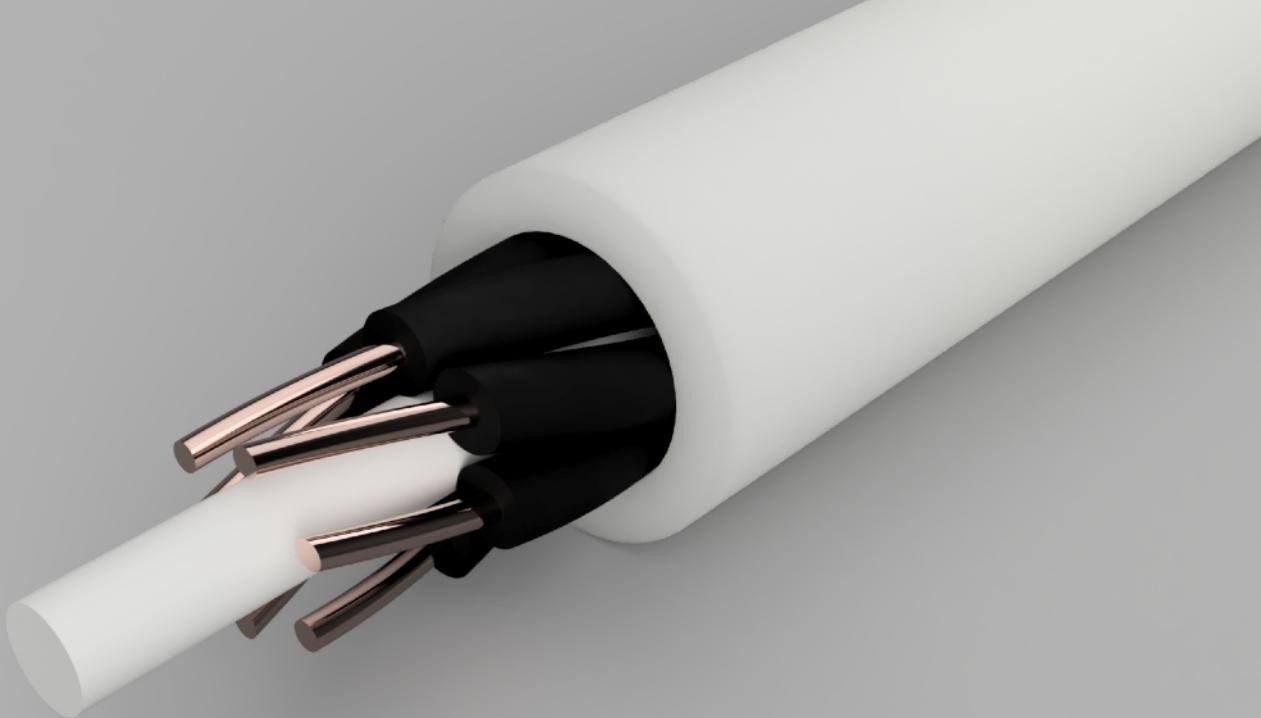
This translates into much lower costs and greater flexibility when installing the system at a site, but also easier maintenance. Typical installation costs are less than € 25,000, including integration into an existing diesel system — even at sites where traditional wind turbines are infeasible.

In a storm or when the wind drops, the wings will automatically fly back down and secure themselves to the ground station.



When the wind returns to the operational range the wings will again fly back up and begin operations.

The system works fully automatically and only requires occasional service and maintenance. It is constantly monitored by Drone Wind Power.



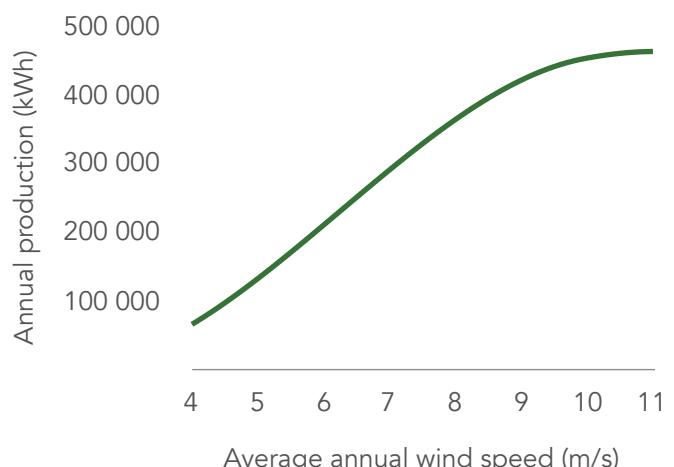
### POWER CURVE

The power output of the D-100 increases from 10 kW at 5 m/s to a maximum of 100 kW at 10 m/s. The output then stays constant with increasing wind speed until 25 m/s at which point the wings automatically fly back to the ground station to land, in order to minimize risks.

The relevant wind speed is measured at 100 m above ground, which is where the wings fly during power generation. The wind at this altitude is usually stronger than the ground wind.

### ANNUAL PRODUCTION

At a typical onshore location the annual power production curve can look like the graph on the right. The capacity factor of the system is usually above 35% and can go as high as 55%, thanks to the wide power curve and the relatively high working altitude.



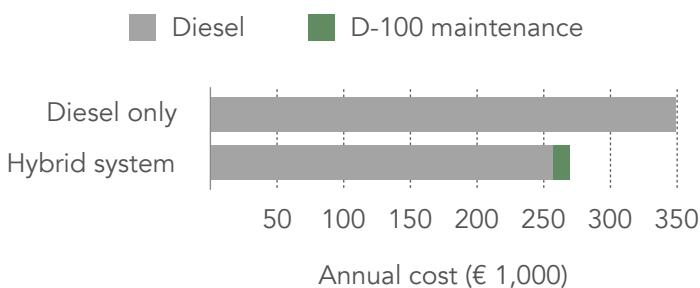
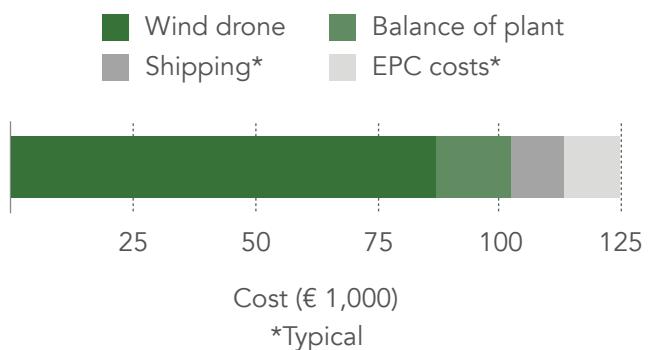
# WITH TYPICAL ANNUAL SAVINGS OF € 79,000, PAYBACK TIME IS USUALLY **UNDER 2 YEARS**

## COSTS

The cost of the drone wind turbine system itself, that is the wings, the ground station and the balance of plant components, amounts to € 102,000.

Shipping costs will on average run to € 11,000 including customs, for a relatively remote location outside of Europe. Installing and integrating with an existing, often diesel based solution (EPC costs), average € 12,000.

Attractive Power Purchase Agreements and leases can also be arranged.

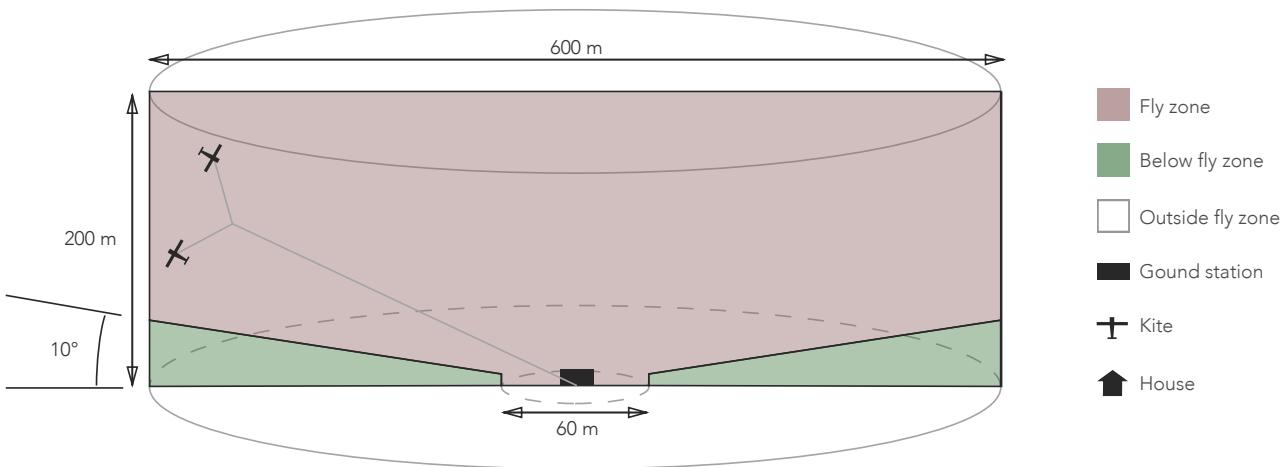


## SAVINGS

A typical customer running a small factory or other business at an island location may have two 100 kW diesel generators and use 1,000,000 kWh annually. With an energy cost of € 0.35 per kWh he would currently be spending € 350,000.

At a capacity factor of 35% and with curtailment at 15%, the customer gets 260,000 kWh annually from the D-100 drone wind system, implying annual fuel savings of € 79,000. This means that the € 125,000 investment in the drone wind system pays for itself in 1.6 years and then continues to deliver substantial savings.

# SAFETY AND FLEXIBILITY ARE PARAMOUNT

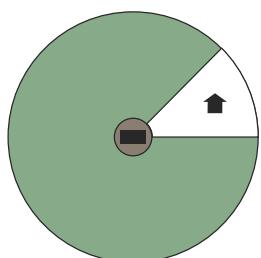
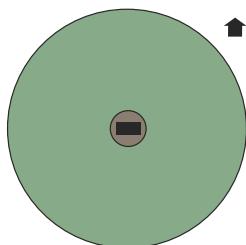


## SAFETY ZONES

During operation the drone wings will be located at a distance of around 300 m from the ground station and at a height of around 100 m. When flying back to and from the ground station they will maintain a height of at least 10 m, except an area that extends 30 m around the ground station in all directions.

No human or animal should be present in the fly zone (in red) during operations and the fly zone has to be closed off to air traffic at all times.

The ground area below the fly zone (in green) is safe for humans to be in and animals to inhabit, but human habitations should be placed outside this zone.



It is also possible to have a wedge shaped area excluded from the fly zone. This area will then be considered safe for human habitation. Doing so will lead to minor losses in power production, in most cases under 5% on an annual basis.

The system is continuously monitored remotely by Drone Wind Power and the wings are immediately and safely grounded at any anomaly.

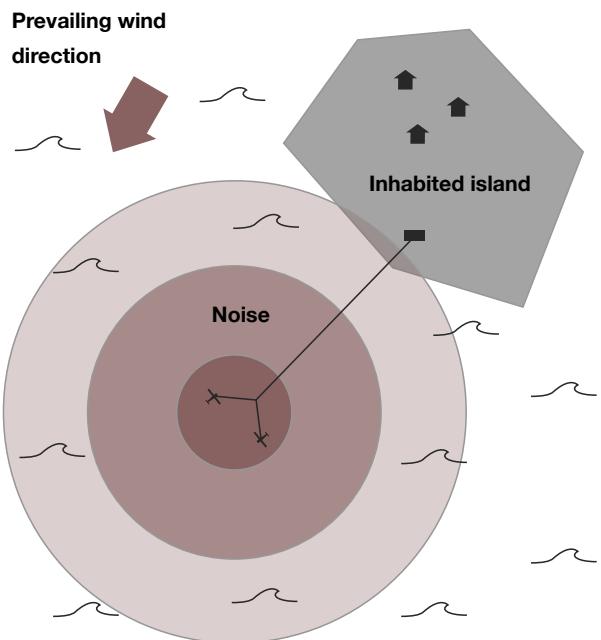
AT HOME ANYWHERE



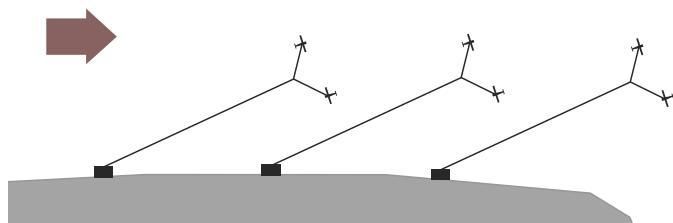
# NOISELESS WIND ENERGY IS NOW POSSIBLE

## NOISE

The noise level at the wings themselves is similar to that of a traditional wind turbine but the system can be placed and configured so that the wings are always down-wind of any noise sensitive areas. This means that noise pollution can be avoided to a very large extent.



## Wind direction

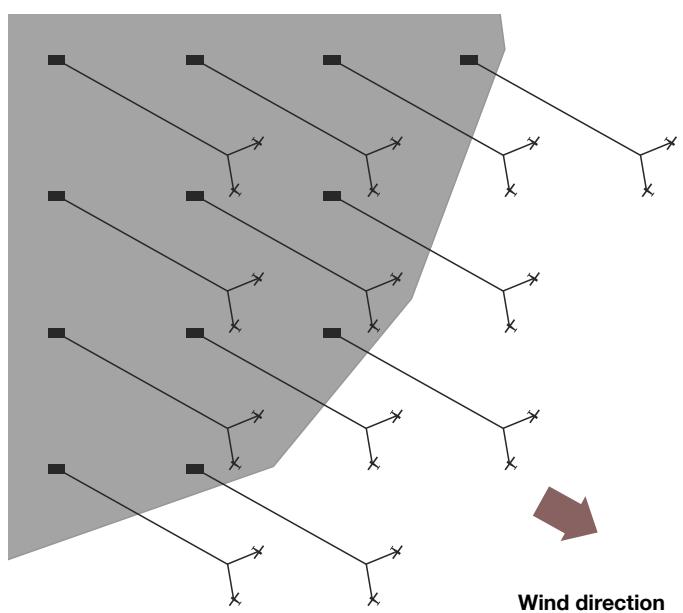


## LAND USE

Multiple systems can be positioned with overlapping fly zones. The minimum distance between two ground stations should be at least 200 m along the wind direction, but can be smaller in the cross wind direction if there is a strongly prevailing wind direction.

When planning the placement of drone wind turbine systems the main limiting factor, just as with traditional wind turbines, is the turbulence found downwind from the wings, the so called wake effect.

Drone Wind Power will help you find the best configuration to suit your needs, based on geography, wind patterns, cost requirements, energy needs, noise considerations and other factors. Contact us to find out more.



# FACTS AND FIGURES

## Wing (x2)

**Power output:** 50 kW

**Total weight:** 52 kg

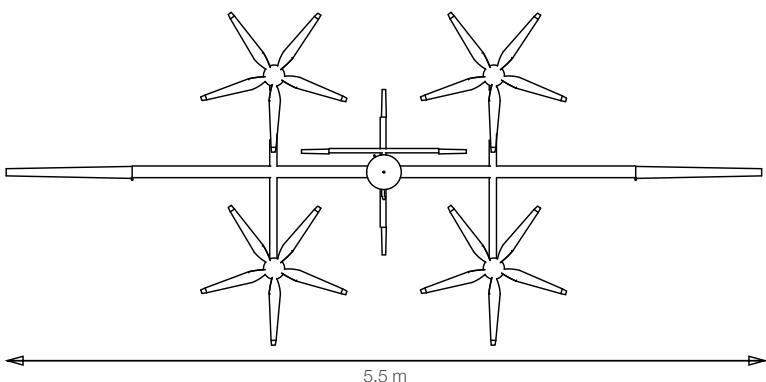
**Electrical system:** 24 kg

**Generators:** 12 kg

**Composites:** 16 kg

**Wingspan:** 5.5 m

**Wing material:** carbon fiber



## Tether

**Length:** 300 m

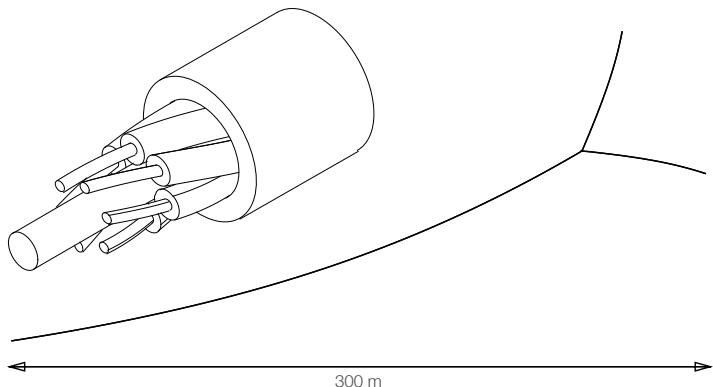
**Diameter:** 19 mm

**Total weight:** 90 kg

**Conductor:** copper

**Strain relief:** Dyneema

**Voltage:** 8kV



## Ground station

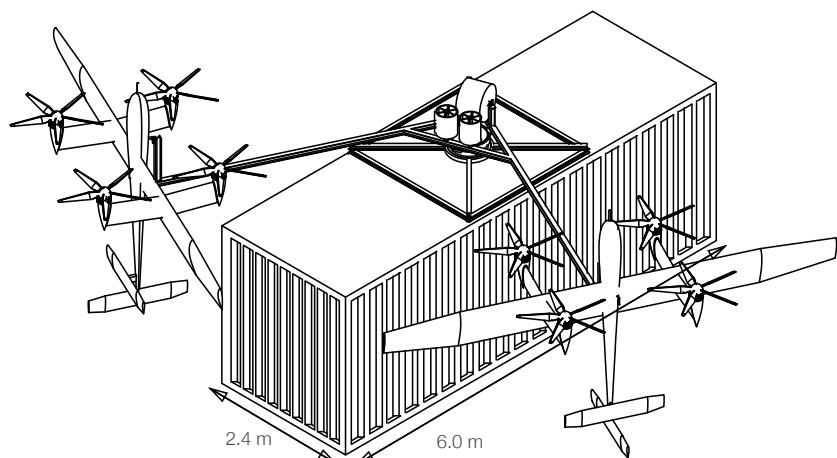
**Beams and winch:** 260 kg

**Electrical system:** 50 kg

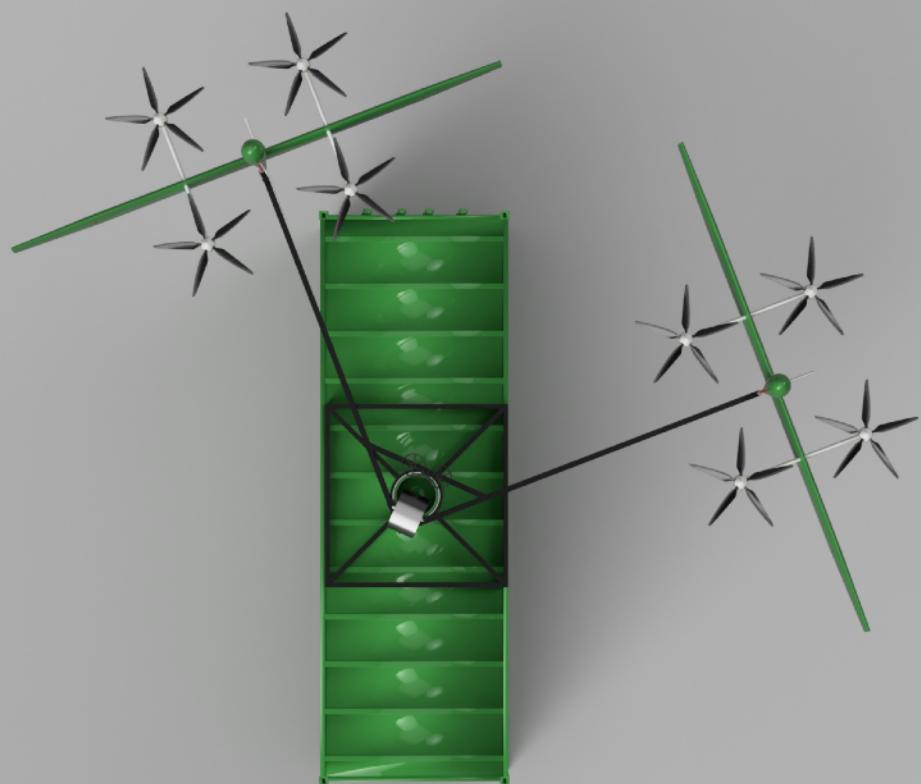
**Container weight:** 2100 kg

**Size :** 2.43m x 6.06m x 2.59m

**Anchoring:** ground spears



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WITH SUPPORT FROM **E.ON**