

Clean power, created in an environmentally friendly and durable way that is what we all are looking for. We are all familiar with the large wind turbines in wind farms but they have a number of disadvantages: they are very expensive, they pollute the horizon and they produce a lot of noise. **The Provane** with its height of 12 metres can be placed without virtually being noticed and without producing noise.

Technical aspects of small wind turbines.

To better understand the demands for a small windmill it is important to know under which condition the windmill would operate. A small windmill has a tower of less than 15 metres. At this height there is a lot of turbulence. Also, the wind speed is less at this height. Turbulence and height decide whether a small windmill design is economical and technically reliable.

Height.

The average wind speed in Munster at a height of 10 metres is 13 mph (5.8 m/sec). This means that a windmill at this height should have a low starting speed. The sooner the turbine creates energy the better.

The Provane starts generating energy already at a wind speed of 1 metre per second.

Turbulence.

The closer to the ground and the more obstacles in the vicinity, the more turbulence there will be. This means that a small windmill should react to unforeseeable turbulence fast and without loss of energy.

The Provane operates with a vane system, which reacts very fast and without any loss of energy.

Maintenance.

The smaller the windmill, the lower the energy production is. It is therefore essential that a small design needs as little maintenance as possible. Because all maintenance costs money, this should always be relative to the production. **The Provane** has very few parts that need maintenance, only a generator and a transformer. The transformer needs to be checked every two years to guarantee a 100% reliability. The generator at its turn only should be revised after 10 to 15 years. The interior should be cleaned and two bearings need to be replaced. Of course, during maintenance the complete windmill will be inspected but the simplicity of the system and the quality of the materials used will assure that no other parts need to be replaced.

Pollution of the horizon.

Windmills with a height of 12 to 15 metres will, in a rural area, hardly be recognized. **The Provane** especially is hard to recognize because of the structure of its design. Also important is the colour, the traditional white of windmills makes them very present and reflects the sun. **The Provane** has a low profile colour that makes it unobstrusive.

Noise production.

The Provane has a direct drive to the generator. There is no gearbox and so the major cause of noise has been eliminated. Tests have shown 10dB at a wind speed of 10 m/sec.

Into more detail of the Provane windmill

For a good working windmill several parts are essential. These parts are not only responsible for the production of energy but also for its safety and stability. To give a better understanding of **the Provane** windmill here are for details:

The generator.

The generators produce 2 kW/hr for **the Provane 5**. It is a so-called permanent magnet generator. This means that there is no direct contact between the magnets and the windings. There is a short distance between these two elements and therefore no abrasive wear as with sliding contacts will occur. Bearings on both ends of the generator assure a smooth turning of the anchor, which is fixed directly to the blades. This smooth turning point is extremely important, because it decides at what wind speed the blades start turning and energy production starts.

The brake.

The brake is a very important part of the windmill: safety comes before energy production. When problems occur or during maintenance the braking system should function always perfectly. **The Provane** has a very special braking system: a short circuit on the generator. The generator has been developed as a 2 kW system but has a generator body of 10 kW. This body makes sure that the excess of heat will be transmitted to the air. As the heat will be transmitted from a 2kW winding to a 10kW body, burning will never occur. The resistance of a short circuited engine is so high that the blades will come to a hold instantly. When stopped a short-circuited engine cannot be restarted unless the short circuit has been resolved. This braking system is extremely reliable and will never fail.

The transformer.

The energy production of the windmill is of low voltage. The generator gives its energy to the transformer between 24 and 55 volts. Our appliances will not function at this voltage therefore the transformer need to adapt the current to the network. The transformer will make the right current at any time, which makes it possible to give energy back to the network.

The vane system.

The odd looking vane at the end of **the Provane** windmill is typically for this unique model. It is weird to see but this method is an important contribution to the success of **the Provane**. By the fact that the shaft of the generator is not positioned in the centre, the blades will be blown away by the wind until they are positioned completely square to the wind. To resist this the vane gives the necessary counter pressure. Through this system the blades will always be positioned in the perfect direction. The size, distance and angle of the vane are calculated in such a way that in the eventuality of a storm the blades are turned away from the wind slightly. As a result of this the windmill continues to produce energy even in extreme situations. A turbulent wind does not affect the windmill. Placing **the Provane** at low heights, behind obstacles and in urban environment is possible through this system.

The roof model.

Everybody knows the windmill on a pole and a fundament in the ground. But **the Provane** with its characteristics can be placed on a flat roof with a special construction at the bottom of the windmill. This construction is placed on rubber tiles to avoid vibrations being transmitted to the building. This construction makes it unnecessary to fix the windmill to the roof.

Various models

- Provane 5D This model has a rotor diameter of 5 meters and a maximum capacity of 2kW. The tower height is 6 meters and has a construction to be placed on a roof.
- Provane 5M This model has also a rotor diameter of 5 meters and a maximum capacity of 2kW but the tower is 12 meters. This tower is fixed to the ground.

Energy production.

We have just seen that the characteristics of **the Provane** windmill are ideal to guarantee in most of the circumstances a maximum production of energy. Of course the climate in the chosen locations will decide the result. During tests in the Netherlands at a location with the worst conditions, that means with the least wind, **the Provane** showed to give a satisfactory production.

- Provane 5D 5.000 kW/hr a year
Provane 5M 5.000 kW/hr a year