# Opportunities for small wind turbines in urban areas: Recommendations from the SWIP Project

Improving small wind turbines: Technological solutions from the SWIP project

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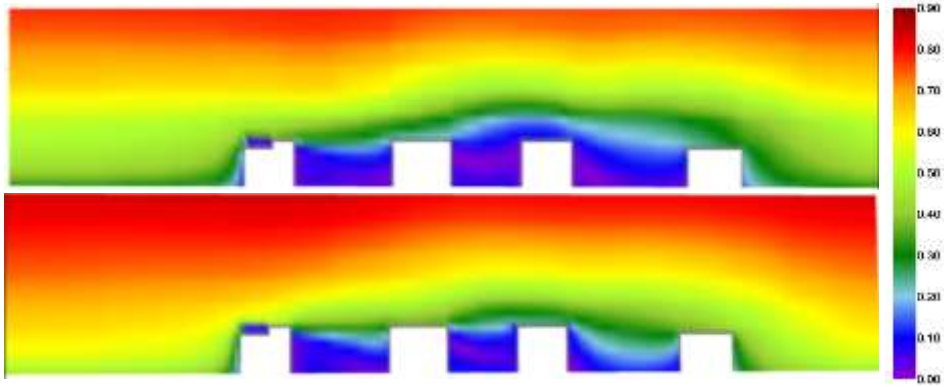
# SWIP project Overview

The SWIP project will develop and test innovative solutions to tackle barriers in the market for Small Wind Turbines (SWTs).

- Social acceptance
- Wind resource assessment
- Generator and converters
- SCADA systems
- Mechanical parts for wind turbines
- Noise, vibration and safety solutions
- Guidelines for integrating SWTs in urban areas
- Demonstration

# Software for wind resource assessment



A **new model** has been developed which allows for better predictions of the wind characteristics in areas where wind has turbulent behaviors

The assessment in urban areas will help to select better **the location** to install SWTs

Operational engineering tool (UrbaWind) which is **twice as fast and twice as cheap** as other commercial CFD tools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# New modular Permanent magnet Generator

Can achieve **up to 15% more efficiency** than current commercial generators.

**Power production is higher** in all wind range than commercial generators

These generators are **cheaper** than regular generators since less material is used to build the generator.

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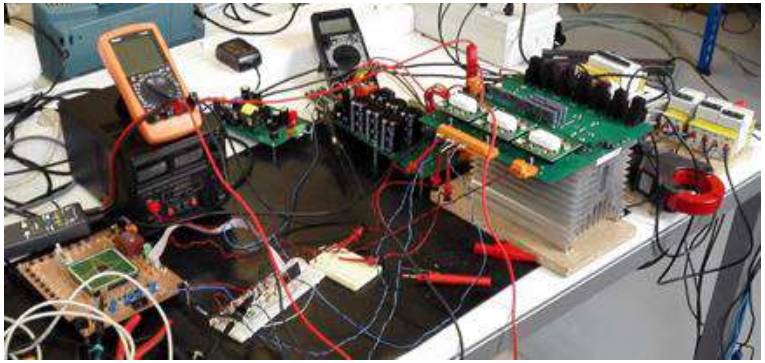
# Converters



The coordinated design of the PM generator and the Power electronic block allows the system to take advantage of lower wind speed **increasing the operation range**

**95% efficiency**

Implement innovation in this field like the **regenerative brake** normally used for train and electric vehicle applications

# New post assembly magnetization technique

**Handling magnets is difficult and hazardous,** due to their magnetic nature and brittleness.

- Handler injury
- Magnet chipping or breakage
- Errors in magnet positioning, causing poor generator performance

**Aim to reduce manufacturing costs and to improve manufacturing efficiency and safety.** The magnetization process is carried out after the generator is fully assembled.

**PM generators (up to 15 kW) reaching up to 80% reduction** in the magnet assembly costs.

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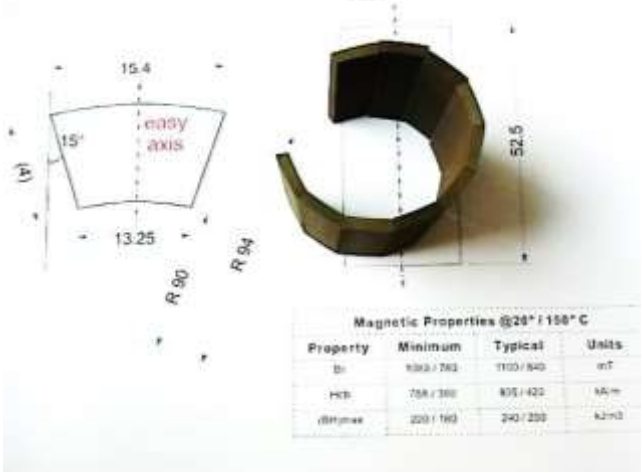
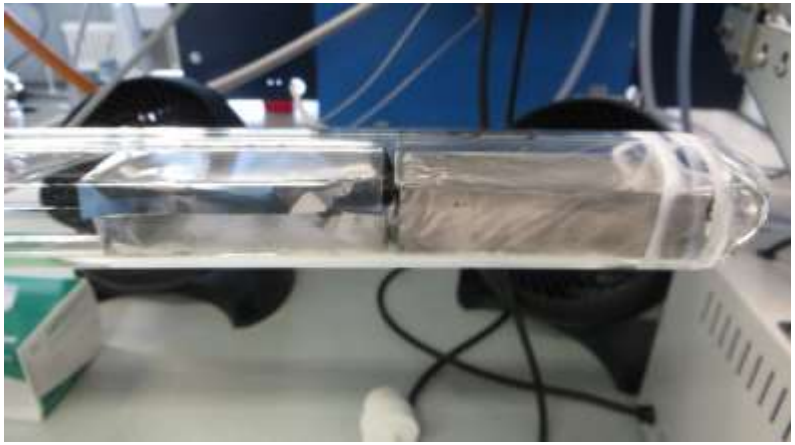
# Rare Earth- free magnets




Nd-Fe-B magnets with only 1.5 to 2 wt. % of Dy. **Reduction of 75 %,** compared to the commercially available permanent magnets (6-8 wt. % of Dy)



Reduction **from 23€ to 30€ per kg** of Permanent Magnets

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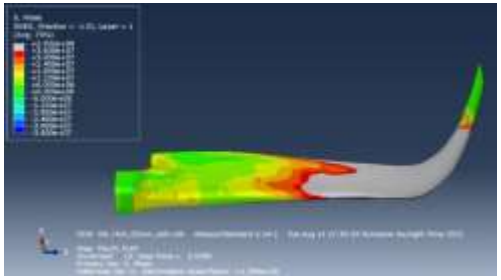
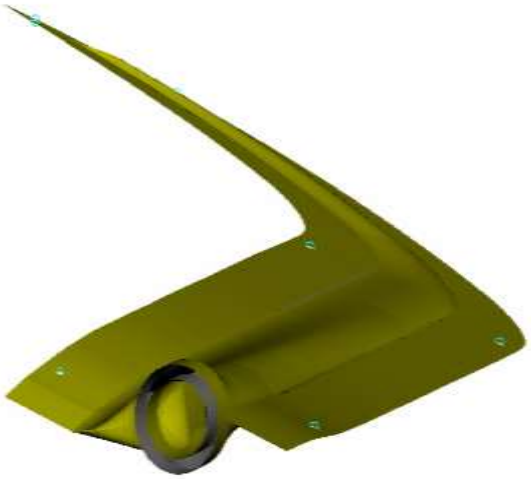
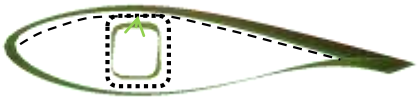
# New Blades



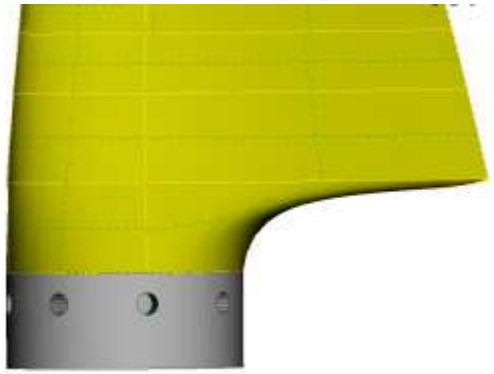
**Curved tip of the blade** to produce pitching moment at blade root that will be used to **move the pitch**





The curve blade is also designed to **reduce the noise** of the wind turbine

The Cap has an aerodynamic function while the Tube is a reinforcement part with structural function only



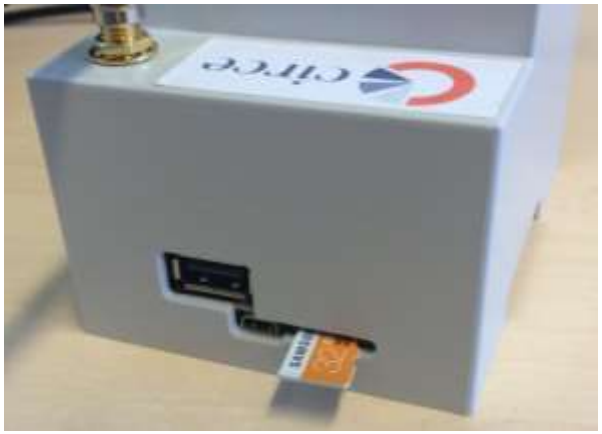
# SCADA system


**Monitors the SWT** key parameters allowing predictive maintenance strategy

**Searches for deviations into the SWT power performance,** the best curve to know the wind turbine health

It can be included in a small wind turbine facility. The small wind turbine owner can order an inspection if the **SCADA system warns about a lack of electricity production.**

Cost-effective SCADA → 300€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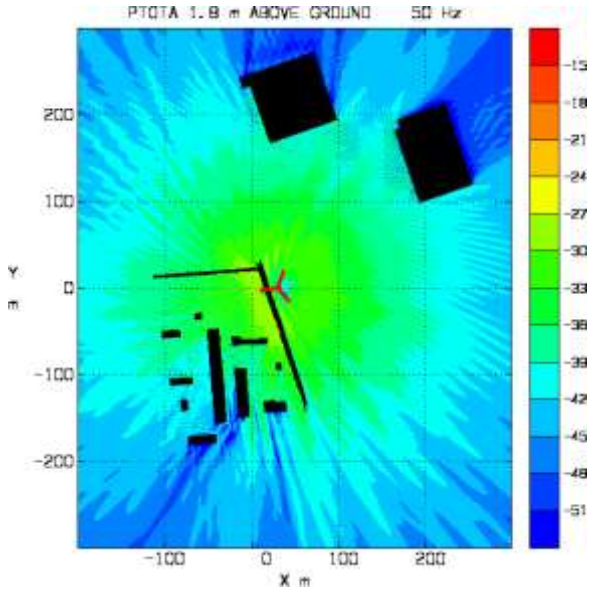
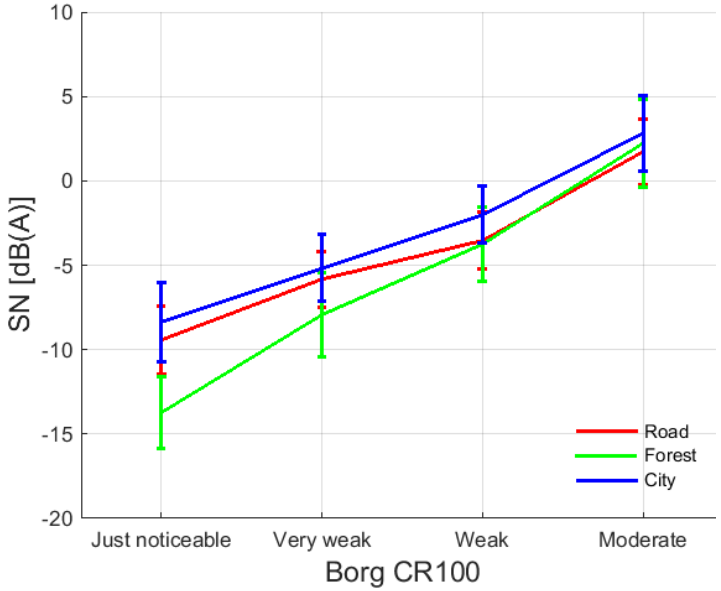
# Noise solutions

**Sound propagation software** in urban terrain has been developed using local terrain.

Range of tools to perform source modelling for VAWT and HAWT designs




Listening tests have shown a stronger acceptance for wind turbine noise in city and road background sound compared to forest background

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# THANK YOU VERY MUCH FOR YOUR ATTENTION

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