PHILEOLE

Make the wind your friend

SOLAR IMPULSE EFFICIENT SOLUTION JANUARY 2021

100 SOLUTIONS THE ARCH FOR THE PLANET

1. PHILÉOLE PRESENTATION

Philéole was born out of the desire to **use the power of the wind to produce energy (green energy)** using bio-based and ecological means.
To this end, Philéole, a small innovative Belgian company, is developing a **mini bio-sourced and recyclable wind turbine with a vertical axis.**

Size of the single mini wind turbine:

- 90cm height, 33cm width and weight 10kg
- 90cm height, 45cm width and weight 12kg

The main objectives of Philéole are **energy independence and ecology**. By offering a unique product, Philéole wishes to take advantage of the elements of nature for energy independence.

Wind is all around us, with different intensities, more or less stable or turbulent. Today, Philéole is interested in the energies developed by **small winds, gusts, turbulence and currents.**

A mini wind turbine as a response to the current ecological and energy crisis.

1. PHILÉOLE PRESENTATION

To take the **ecological aspect** further, Philéole decided to produce its mini wind turbine in **recycled PETG** (plastic bottles), with either **carbon powder or fibreglass powder;** and its structure in **aluminium.**

All these elements are **recycled and recyclable**, making the Philéole mini wind turbine **95% recyclable**.

Philéole wants to reduce its carbon footprint by offering a unique product, described as **"local and circular"**.

2. SOLAR IMPULSE LABEL

A "Clean & Profitable" solution

January 2021: Philéole obtains the **"Solar Impulse"** company label, created by Bertrand Piccard, for its mini wind turbine.

Philéole is one of the **1350 solutions (including 62 in Belgium)** selected to **reduce the carbon footprint** on earth.

The Solar Impulse Efficient Solution label is designed to highlight existing solutions that **are both clean and cost-effective with a positive impact on quality of life.**

"Solutions exist that are logical more than just ecological, that can create jobs and generate profit while also reducing polluting emissions and preserving natural resources".

-Bertrand Piccard

2. LABEL SOLAR IMPULSE

To comply with this label, Philéole must meet the following **conditions**:

- Lowest possible carbon impact
- Use of the recycling chain
- Circular and local economy
- Be supplied >2000 km from the production site

"Solutions exist that are logical more than just ecological, that can create jobs and generate profit while also reducing polluting emissions and preserving natural resources".

-Bertrand Piccard

3. EVOLUTION DESIGN & PERFORMANCE

Developments since September in relation to the marine specification

BLADE

Initially, the mini wind turbines were made of corn starch PLA.
Today, Philéole uses **Reform PETG, with recycled glass fibre particles.**
RPETG is a **recycled material (plastic bottles) and is recyclable.**

The aim of the new material is to provide greater **resistance to UV rays and the climate of the sea (tropicalisation).**

DESIGN

The design of the wind turbine has been changed from a 240° twisted twin-blade to a **90° offset twin-blade**.
The aim is **to smooth the torque of the wind turbine and increase its stability**, which considerably reduces vibrations and increases performance.

3. EVOLUTION DESIGN & PERFORMANCE

Design evolution

Double bi-blade offset by 90°

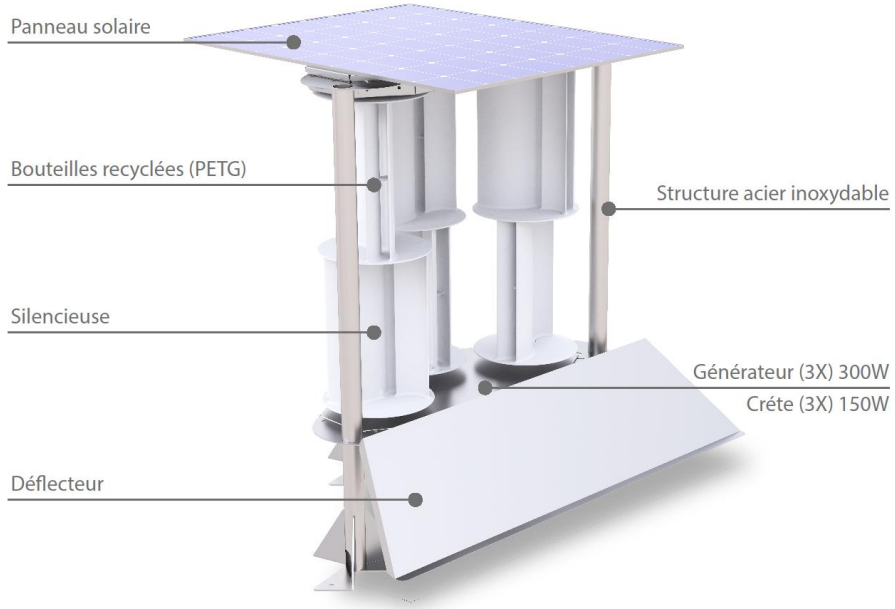
3. EVOLUTION DESIGN & PERFORMANCE

Design evolution of the single vertical wind turbine

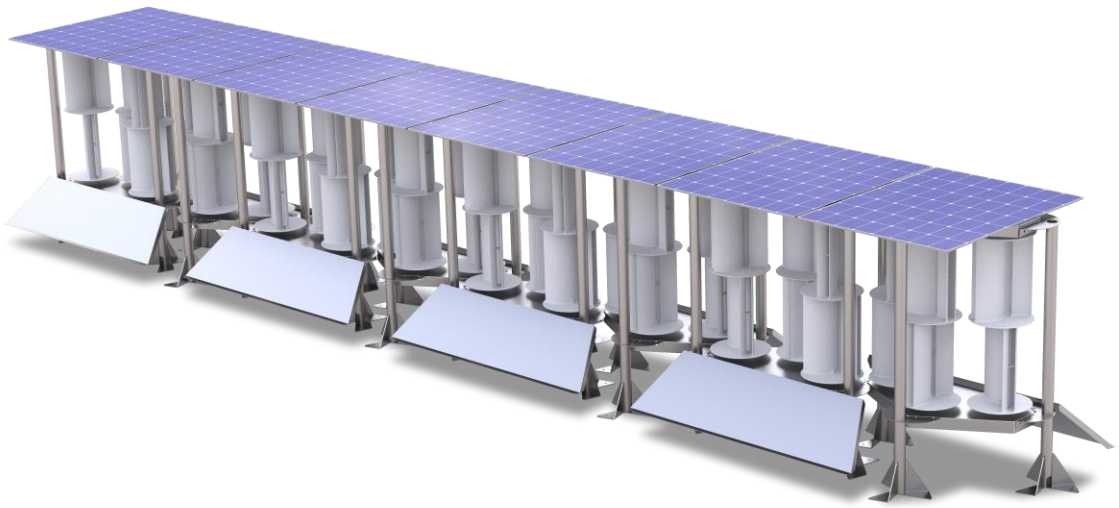
Single wind turbine with aluminium frame

3. EVOLUTION DESIGN & PERFORMANCE

Design evolution of the triple wind turbine



Hauteur: 1450 mm
Largeur: 1500 mm
Profondeur: 1200 mm
Poids: 170 Kg



Triple wind turbine with stainless steel structure and deflector and possibility of solar panels

3. EVOLUTION DESIGN & PERFORMANCE

Design evolution

Triple wind turbine with stainless steel structure and deflector

3. EVOLUTION DESIGN & PERFORMANCE

DESIGN OF THE BLADE

After testing dozens of different blade designs we discovered a blade design with a **performance coefficient of 0.296** which is exceptional for a vertical wind turbine!

GENERATOR

Philéole has developed its **own 300 WATTS axial generator, which has very little starting torque.**

REGULATOR

A **tailor-made regulator**, which has an efficiency of **92%**. The **MPPT** is adapted to the specific performance of the wind turbine. In addition, the regulator maintains the speed of the wind turbine at its maximum production point. We have also developed **a safety system** for the wind turbine in case of high winds (120km/h).

4. PERFORMANCE

The performance of mini wind turbines depends mainly on the quality and quantity (gusts) of wind.

Energy from the wind!

Knowing **the instantaneous power of the wind** is one thing, but what interests us is its **energy**. Therefore, the notion of **time** will have to intervene somewhere.
To find out the energy of the wind over a period of time, you have to integrate its **power** over the same period.
Knowledge of the average wind speed is insufficient, it is necessary to have the **evolution of the wind speed over the period studied and to sum the contributions.**

Let's take a 24-hour period and compare **three windy days** with an average wind speed of **6m/s** for each, but with a different distribution profile:

4. PERFORMANCE

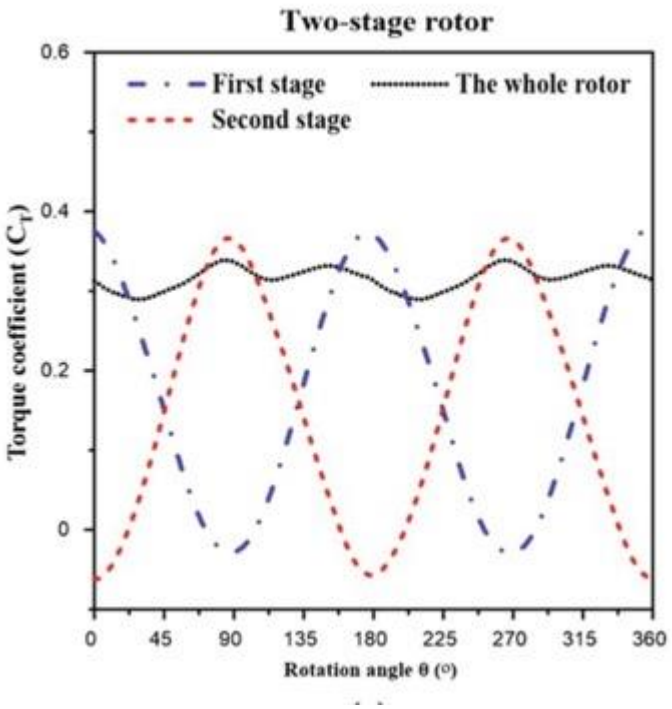
If the **average speeds are the same**, the **distribution profile is very different** between these three days. A simple calculation allows us to observe that the **amount of energy** that the wind will have provided over 24 hours per m² for each profile is drastically different.

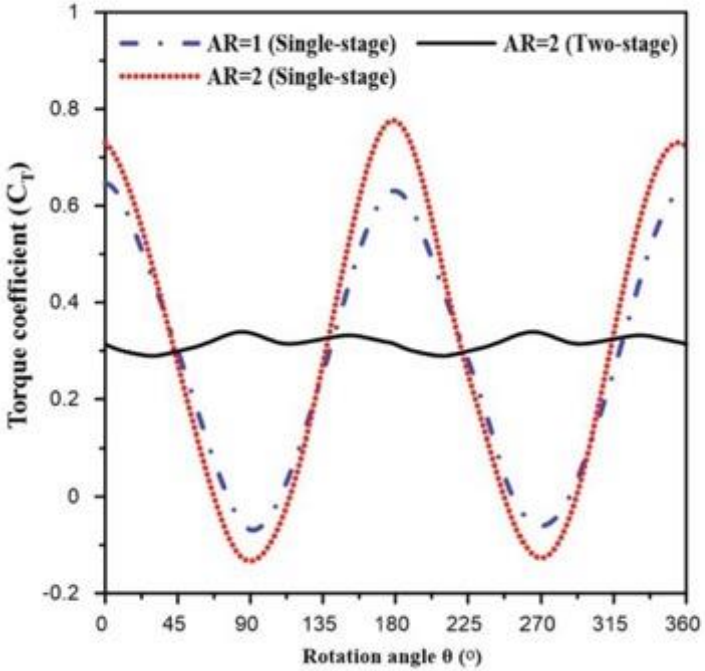
Day1 : 24 [h] x 6 [m/s]³ x 0,54 [m²] x 1,2 [kg/m³] = 3 359 Wh = 3,36 kWh x cp0,25 = 0,84 kWh
Day2 : 12 [h] x 12 [m/s]³ x 0,54 [m²] x 1,2 [kg/m³] = 13 436 Wh = 13,4 kWh x cp0,25 = 3,36 kWh
Day3 : 6 [h] x 24 [m/s]³ x 0,54 [m²] x 1,2 [kg/m³] = 53 747 Wh = 53,74 kWh x cp0,25 = 13,43 kWh

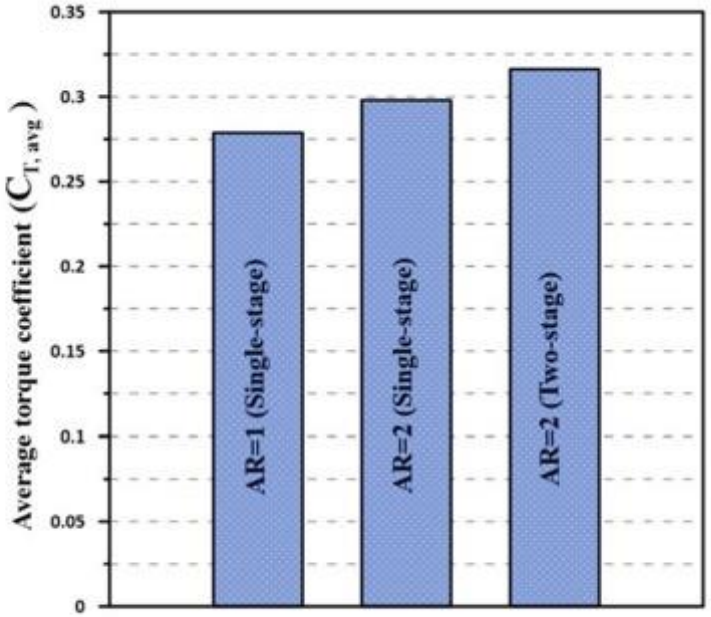
We can clearly see that we **cannot average the wind speed** and that **the distribution of the wind is decisive** in the calculation of the energy delivered by the wind over a given period and area.

4. PERFORMANCE

Vibration-reducing torque distribution (1)

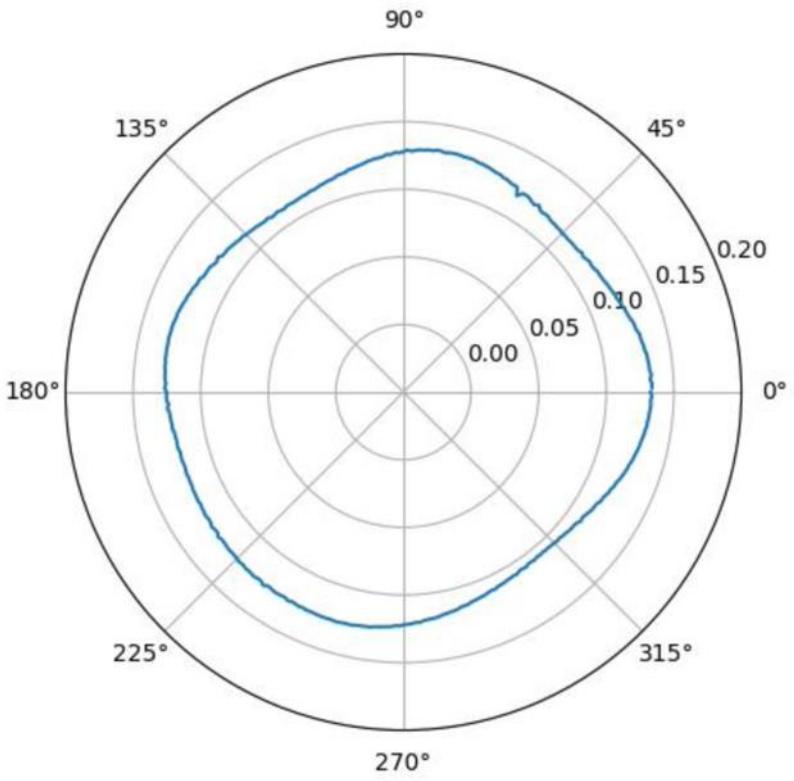




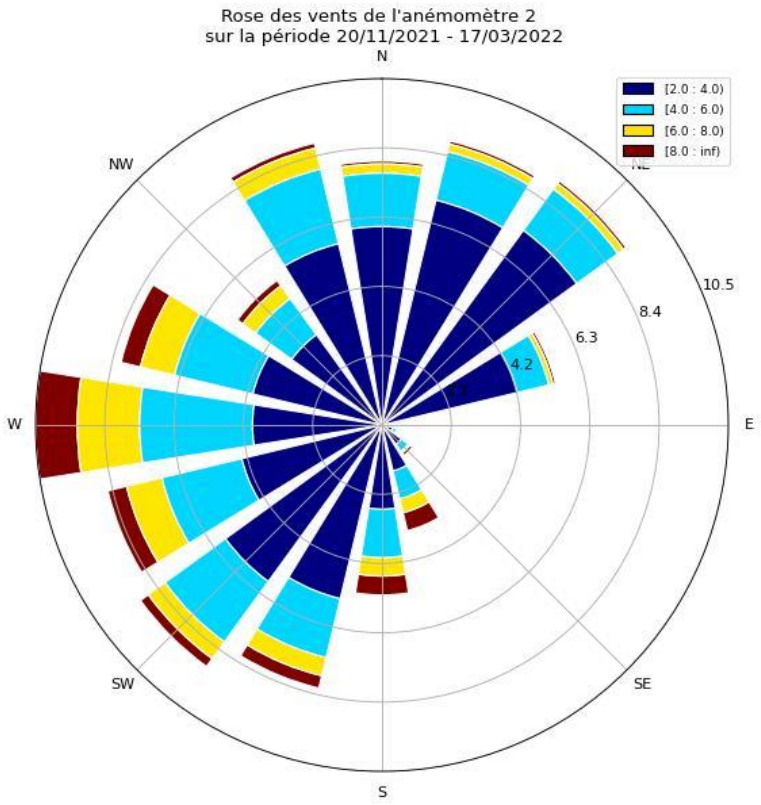


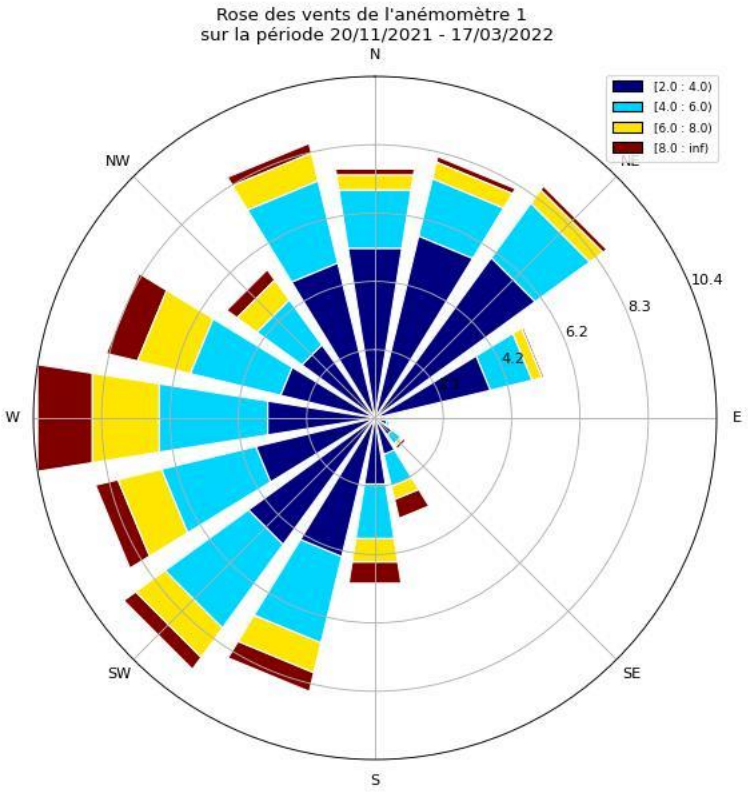
4. PERFORMANCE

Vibration-reducing torque distribution (2)



5. DISTRIBUTION OF WIND OF A TOWER IN BRUSSELS





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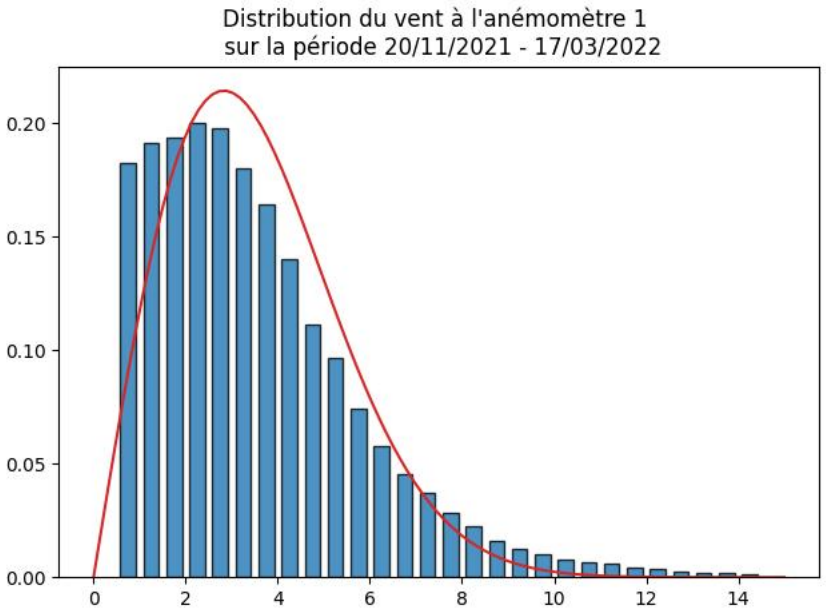

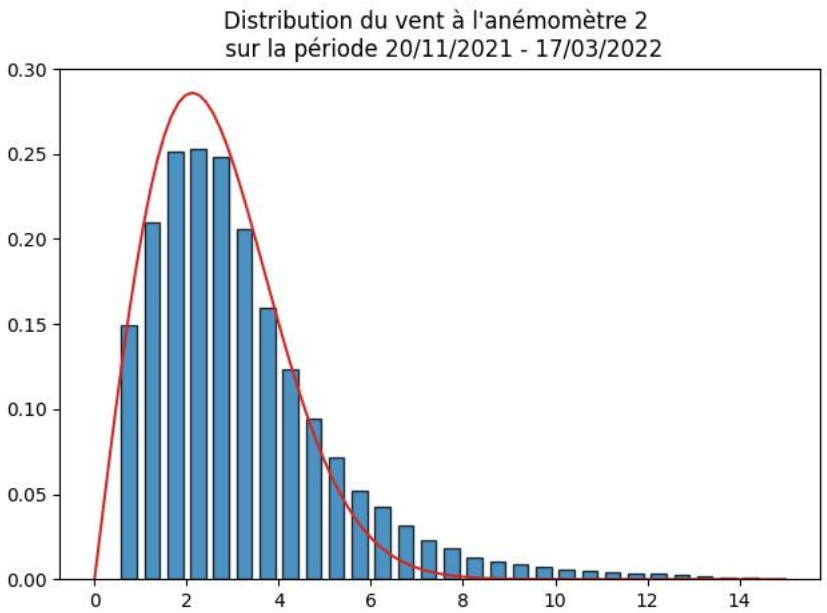

6. CONTACT PHILÉOLE

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