



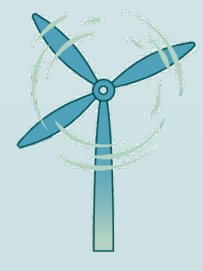
# Small VAWT and HAWT Wind Turbines for Municipal, Low Noise Applications. zEPHYR Marie Skłodowska-Curie project: towards a more efficient exploitation of on-shore and urban wind energy resources

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## PROBLEM DEFINITION

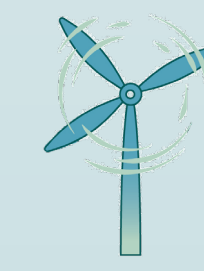
- The work in hand is concerned with small urban wind turbines. This application means that it will be located close to buildings and people. In such an environment, **safety** becomes the most important factor in the choice of the wind turbine type.
- An **innovative concept** has been developed at IMP PAN which was inspired by the conditions of such an application.
- Safety** and **cost** were the key qualities of the development of this innovative concept.
- Another important factor associated with this turbine is **noise** and is a crucial objective of the research work to be carried out.



Fig 1: Savonius wind turbine mounted on the roof of IMP PAN.



Fig 2: Darrius wind turbine mounted on building. [1]



## THE INNOVATIVE DESIGN

- The proposed system suggests that rotors are mounted on the **shielding plates** which are directing the wind towards the rotor's **propulsion side** to improve the effectiveness of the system.
- In this new **twin-rotor configuration** one large Savonius rotor is substituted by two small rotors to reduce the weight and the associated cost.
- The maximum angle of shielding plate has been restricted to  $70^\circ$  as per calculations.

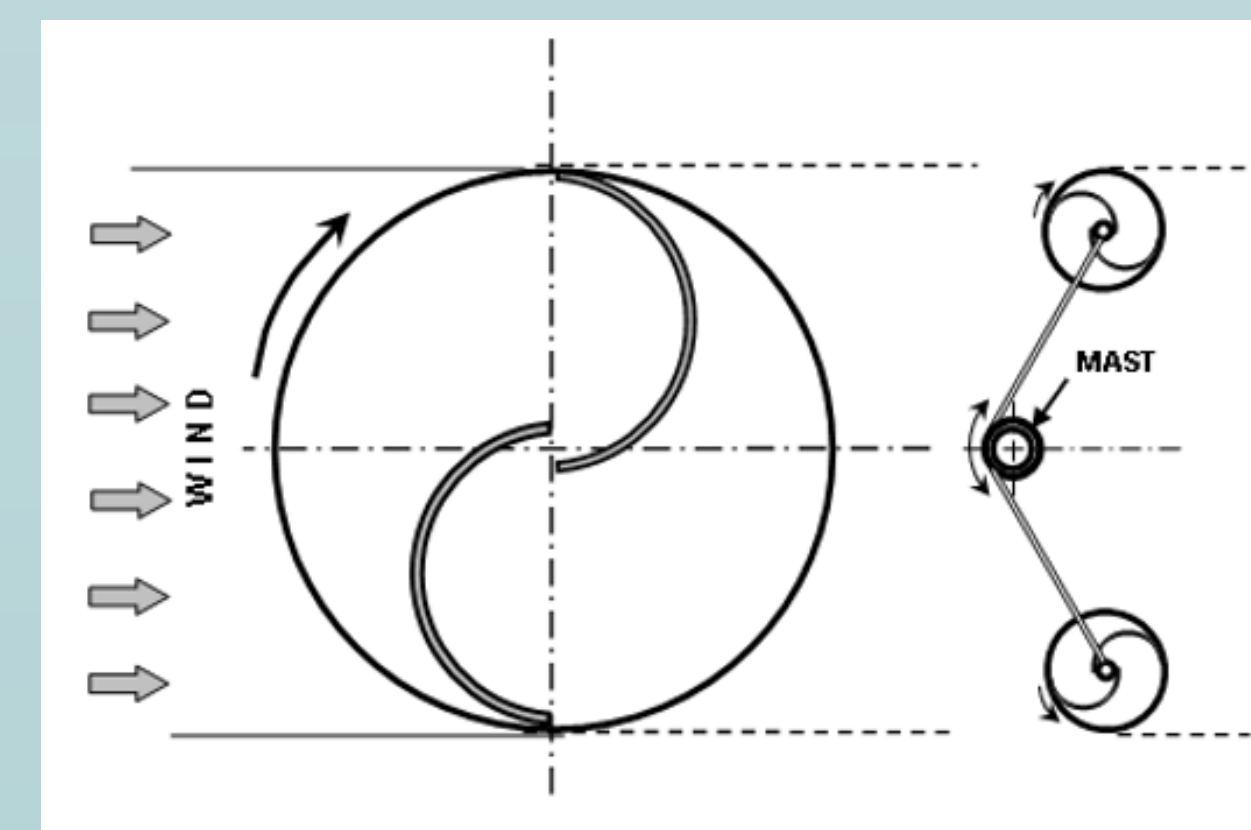
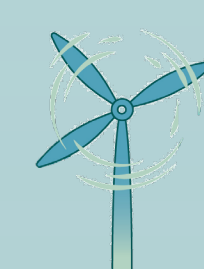


Fig 3: Twin rotor configuration of Savonius wind turbine.



Fig 4: The innovative wind turbine in Przywidz.



## METHODOLOGY

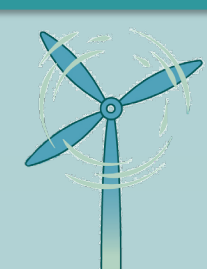
- The main part of the project will take place in **real wind conditions** in Przywidz where three wind turbines have been implemented.
- A **test section** has been setup with similar rotors as the actual wind turbine to analyse their performance in controlled conditions.
- Noise analysis** along with the **rotor deformation** caused due to the centrifugal forces will be performed.



Fig 5: Test section in CEMET.

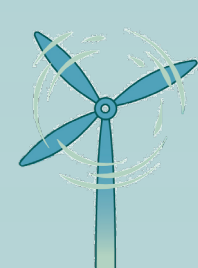


Fig 6: The innovative wind turbine in Przywidz.



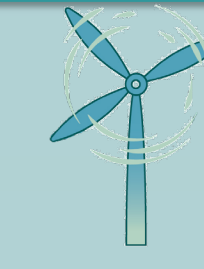
## OBJECTIVES

- Develop a relation between **noise generation** and **energy production**.
- To find a correlation between **simulations** and **experiments**.
- Assess the relationship between **rotor noise** to **background noise**.



## OUTCOME

- Aerodynamic characteristics** of the innovative power plant in real wind conditions.
- Determination of **noise generation** at high winds when only a part of wind energy is utilised.



## INITIAL TASKS

- Measurement system in Przywidz will allow to make detailed study of the wind potential in the location of innovative power plant.
- Weibull curve** coefficients describing local winds will be determined, followed by the determination of **power curve**.

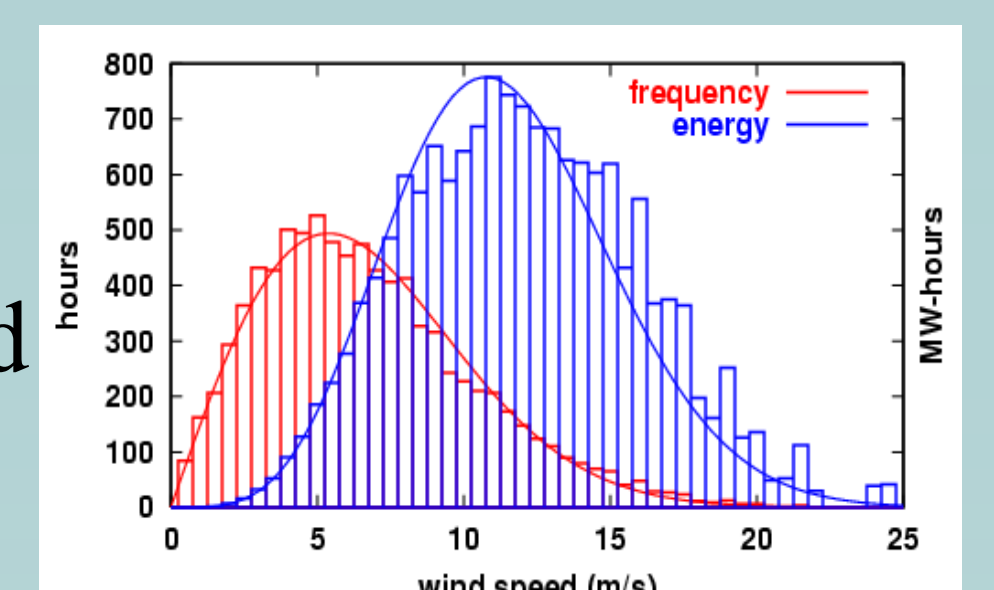


Fig 7: Test section in CEMET.

- This will allow to define the wind energy **potential** at this particular location.
- Having this information the forecast of **energy production** by the constructed wind turbine will be possible.

[1] Ref 1: <https://ases.org/nrel-releases-report-on-urban-turbines/>