LABORATÓRIO DE AERODINÂMICA E ENERGIAS RENOVÁVEIS - LAERO

TEAM

Carla Freitas de Andrade (UFC):
- PhD in Civil Engineering.
- Research Productivity Scholarship - CNPq PQ-2;
- http://lattes.cnpq.br/1903591824850643

Mona Lisa Moura de Oliveira (UECE)
- PhD in Mechanical Engineering from Instituto Superior Técnico, Lisbon/Portugal;
- Research Productivity Scholarship - CNPq PQ-2.
- http://lattes.cnpq.br/8485796147369478

Francisco Olimpio Carneiro (UNILAB)
- PhD in Mechanical Engineering from UNICAMP.
- Applied MFC/CFD researcher and wind energy.
- http://lattes.cnpq.br/2364823409007529

LOCATION

LAERO

AERODYNAMICS AND RENEWABLE ENERGY LABORATORY
Universidade Federal do Ceará (UFC)
Campus do Pici - Centro de Tecnologia - **Fortaleza – Ceará/Brazil**
@laero_ufc

LCE+ LABORATÓRIO DE CONVERSÃO ENERGÉTICA E INOVAÇÃO

ENERGY CONVERSION AND INNOVATION LABORATORY
Universidade Estadual do Ceará (UECE)
Campus Itaperi - Centro de Ciências e Tecnologia - **Fortaleza – Ceará/Brazil**
@laceuece and @laisuece

CONTACTS

UNIVERSIDADE FEDERAL DO CEARÁ

carla@ufc.br

UNIVERSIDADE ESTADUAL DO CEARÁ

mona.lisa@uece.br

LABORATÓRIO DE AERODINÂMICA E ENERGIAS RENOVÁVEIS - LAERO

EXPERTISE

- **Technical**, Economic, and Financial Feasibility Analysis;
- **Testing and validation** in Wind Tunnel;
- **CFD Simulation** and Computational Modeling;
- **Optimization** of solar and wind energy;
- **Life Cycle Assessment (LCA)** of renewable
- energy technologies;
- **Forecast** of mechanical properties;
- **Evaluation** of fatigue on offshore wind turbines;
- **Optimization** of wind plant layouts;
- **Potential** of wind energy analysis;
- **Method for selecting** places for floating wind farms based on spatial optimization;
- **Optimization Project:** focusing on cost reduction
- **Performance evaluation** of airline blades;
- **Wind blade prototypes production :** Wind turbine designs (vertical and horizontal axis?
- **Study of green hydrogen potential:** with hybrid system power;
- **Potential fiber coconuts shell composites** for wind turbine blade development;
- **Vibration analysis** for blade unbalance.

PRODUCTION OF WIND BLADE AND OTHER PROTOTYPES:
Wind turbine designs (vertical and horizontal axis) and wind tunnel testing

PROCESS

PRODUCTION OF WIND BLADE PROTOTYPES:
Wind turbine designs (vertical and horizontal axis) and wind tunnel testing

Obtaining an available commercial **wind generator** suitable for the study

- Wind Tunnel Assesment → Assessment of the efficiency and generation curve
- Computational modeling → Validation results

Rotor development optimizes available wind conditions

- Wind Tunnel Assesment → Assessment of the efficiency and generation curve
- Computational modeling → Validation results

PRODUCTION OF WIND BLADE AND OTHER PROTOTYPES:
Wind turbine designs (vertical and horizontal axis) and wind tunnel testing

PROTOTYPE PRODUCTION INFRASTRUCTURE

PRODUCTION OF WIND BLADE AND OTHER PROTOTYPES:
Wind turbine designs (vertical and horizontal axis) and wind tunnel testing

PROCESS AND ANALYSIS INFRASTRUCTURE

DEVELOPMENT OF WIND BLADES WITH GREEN MATERIALS IN THEIR COMPOSITION:

Use of coconut shell fibers and renewable composites

PROCESS

DEVELOPMENT OF GREEN MATERIALS IN THE COMPOSITION OF WIND BLADES:
use of coconut shell fibers and renewable composites

Printing of Blades on a 3D printer

- Wind Tunnel Assesment → Assessment of the efficiency and generation curve
- Computational modeling → Validation results

Making blades using green materials

- Wind Tunnel Assesment → Assessment of the efficiency and generation curve
- Computational modeling → Validation results

02.
DEVELOPMENT OF WIND BLADES WITH GREEN MATERIALS IN THEIR COMPOSITION:

Use of coconut shell fibers and renewable composites

BIOMASS AND WIND ENERGY

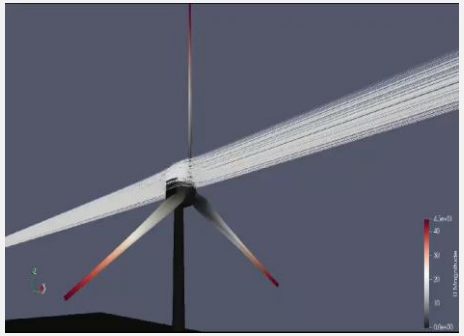
Coconut Shell

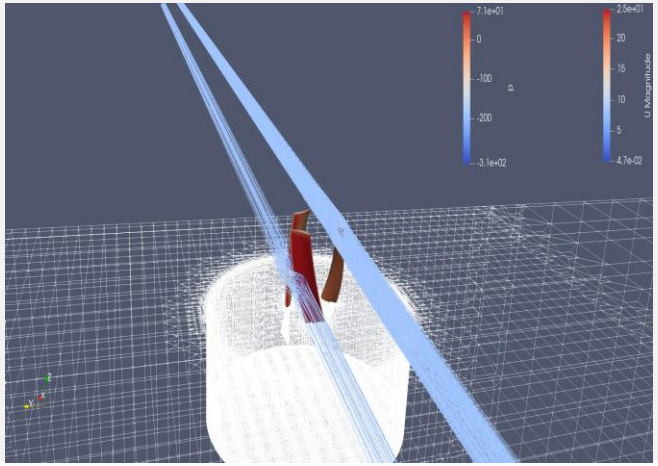
Renewable composites research

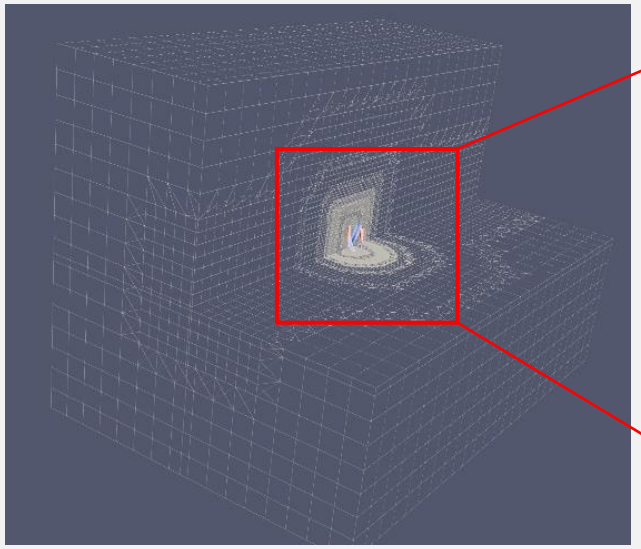
02.
DEVELOPMENT OF WIND BLADES WITH GREEN MATERIALS IN THEIR COMPOSITION:
Use of coconut shell fibers and renewable composites

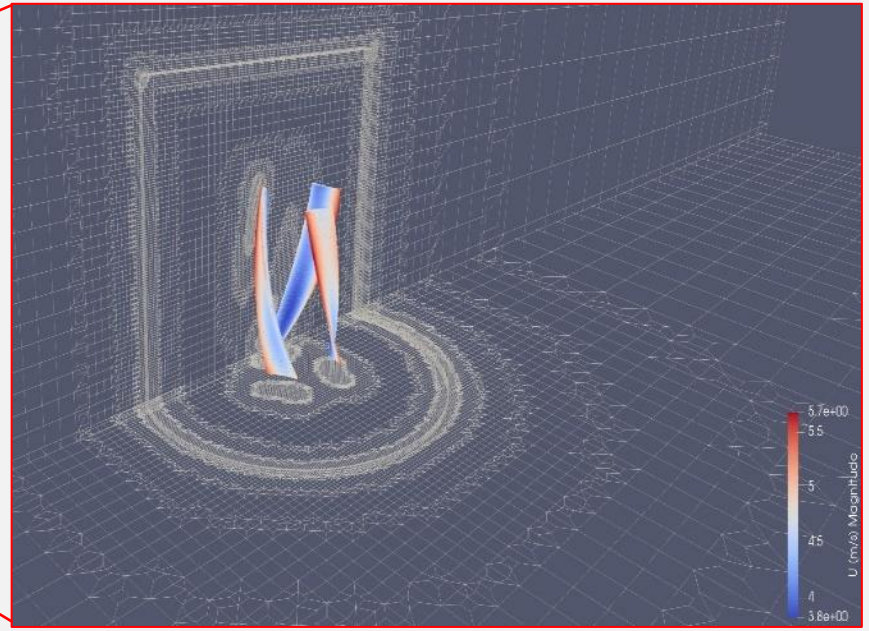
RENEWABLE ENERGY GENERATION SYSTEMS EVALUATION

Modeling and testing in a Wind Tunnel



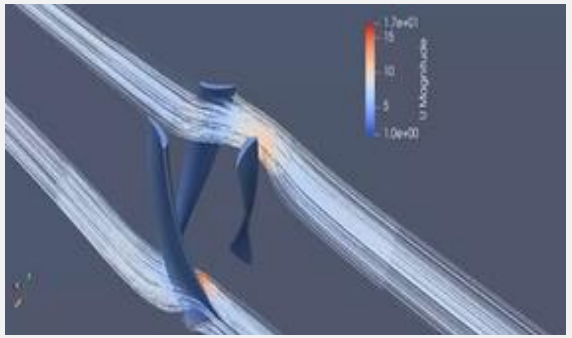
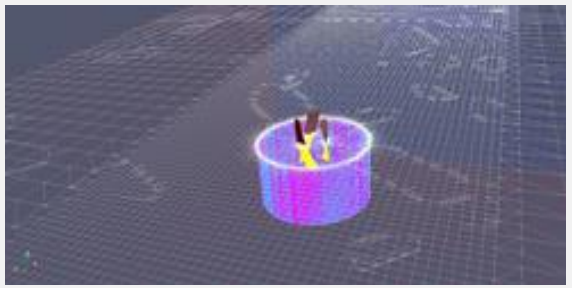


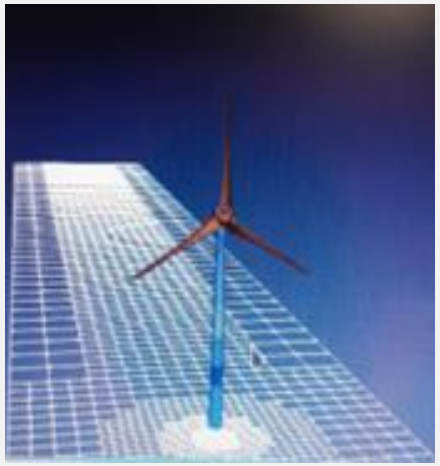
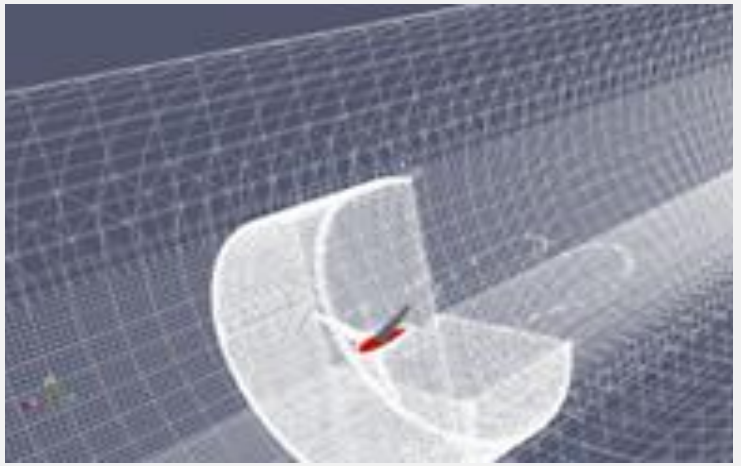


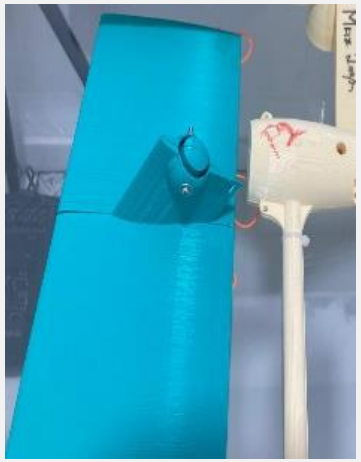
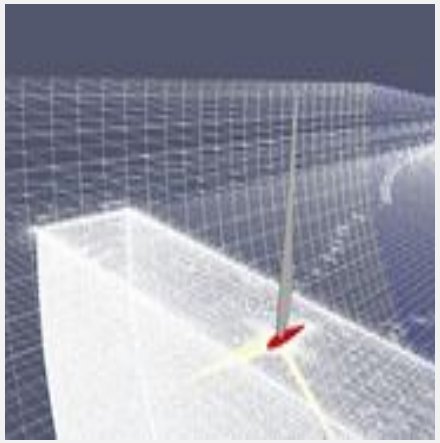
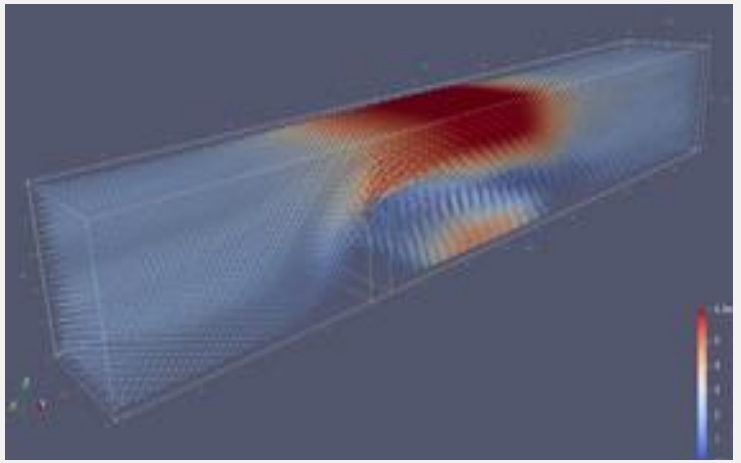


WIND TURBINE BLADE PROTOTYPING AND COMPUTATIONAL MODELING:

Modeling and Evaluation of Distributed Green H_2 Production

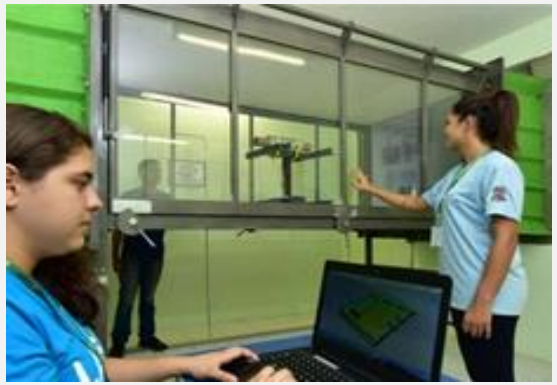





02.

DEVELOPMENT OF WIND BLADES WITH GREEN MATERIALS IN THEIR COMPOSITION:

Use of coconut shell fibers and renewable composites

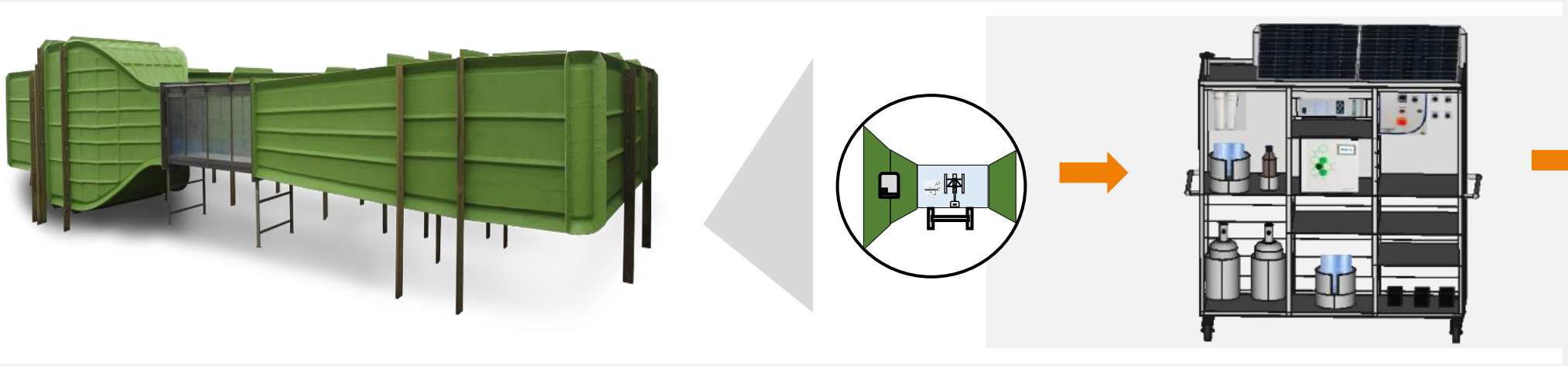
WIND TUNNEL TESTING



02.
DEVELOPMENT OF WIND BLADES WITH GREEN MATERIALS IN THEIR COMPOSITION:
Use of coconut shell fibers and renewable composites

WIND-BASED OFF-GRID HYDROGEN PRODUCTION FROM WASTEWATER TREATMENT

- Work on the modeling and evaluation of distributed H_2 green production prototypes, based on electrolysis of industrial effluent with off-grid wind energy.
- It is also intended to model and simulate prototype wind rotors and analyze which ones are most suitable.

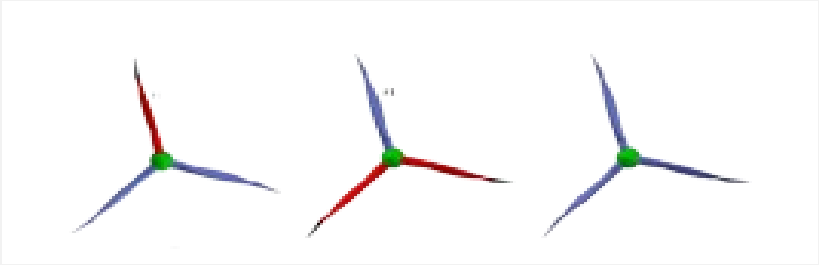


WIND TUNNEL - test section of 1 mx 1 m, for flow speeds of up to 30 m/s, with turbulence intensity less than 2%

Project in cooperation with international articulation: **UECE/UFC + CIEMAT (SPAIN)**

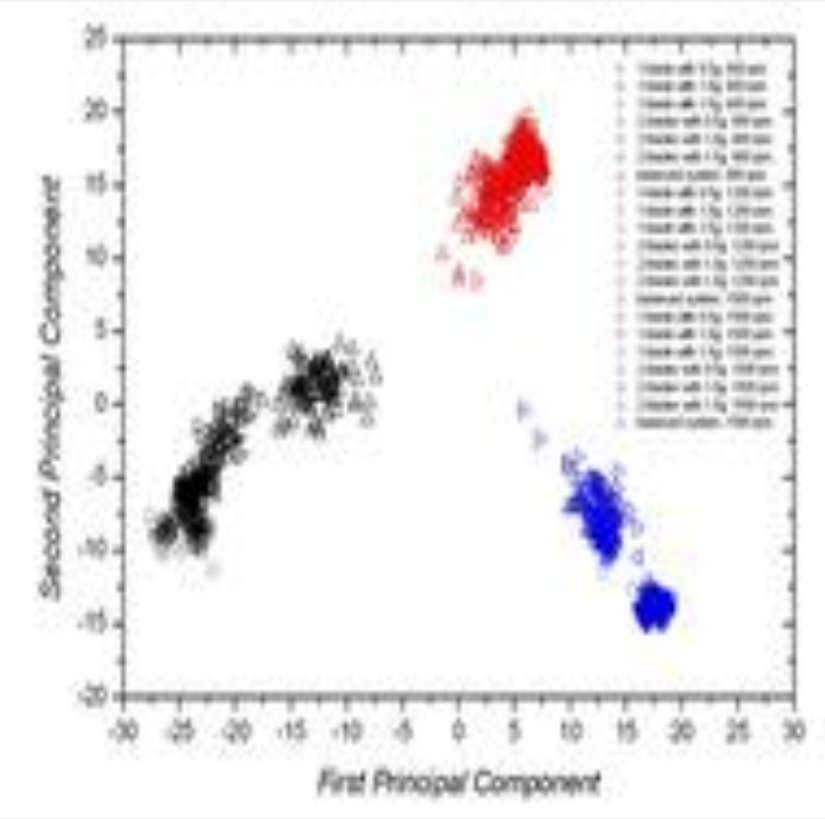
UNBALANCE EVALUATION OF A WIND TURBINE:
Analysis of Vibration

PREDICTION OF MECHANICAL PROPERTIES



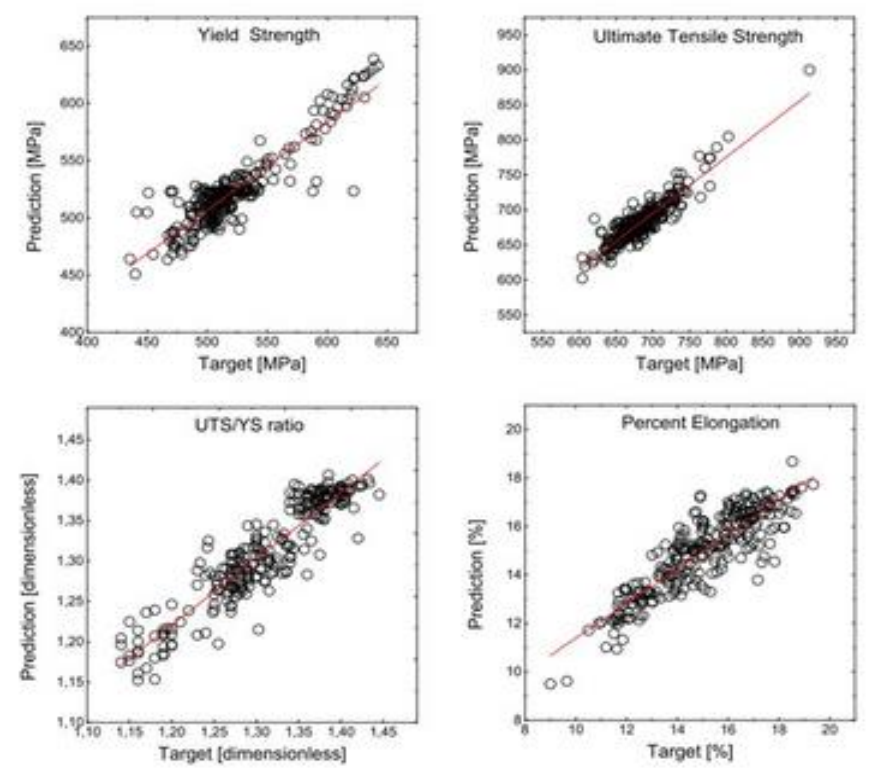
Identify unbalance levels in a scale wind turbine in a wind tunnel by analyzing vibration signals.

The results show that the approach used can be useful in the development of an automatic system for diagnosing unbalance in wind turbines.



03.
UNBALANCE EVALUATION OF A WIND TURBINE:
Analysis of Vibration

ESTIMATION BY THE NEURAL NETWORK



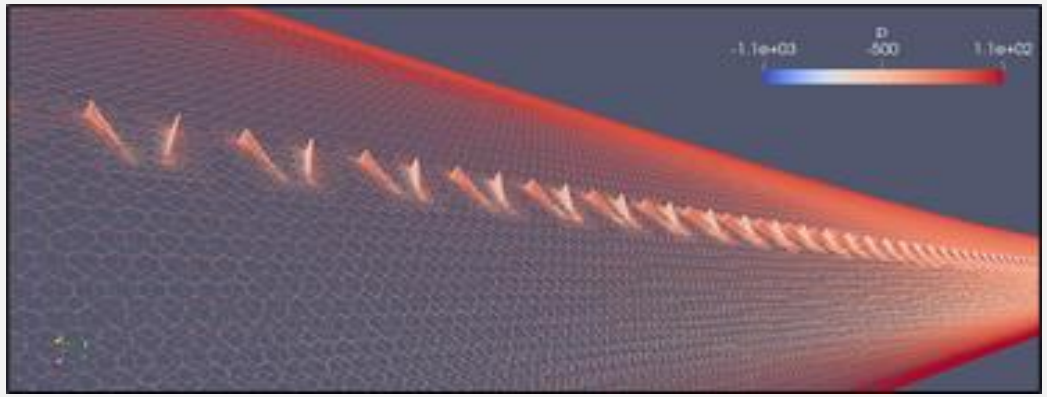
Coefficient of determination between the target and predicted values

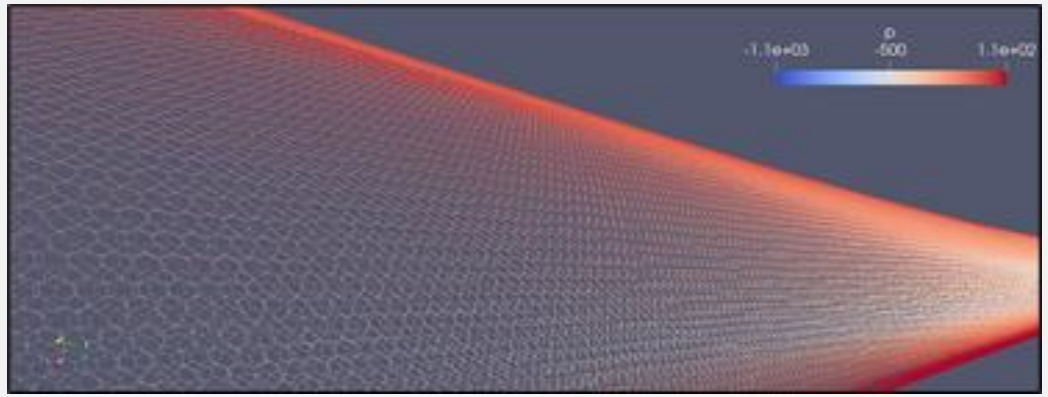
This figure provides a graphical representation of the coefficient of determination between the target and predicted values for each of the four mechanical properties estimated by the neural network.

The values predicted using the neural network are closer to the fitted regression line than those predicted by multiple linear regression.

COMPUTATIONAL SIMULATION:
Analysis

COMPUTATIONAL MODELING AND ANALYSIS





The use of rans turbulence models to investigate flows in engineering problems is currently the most cost-effective approach.

The images show the use of this approach in investigating flow when vortex generators are added to wind turbine blades.

FEASIBILITY ANALYSIS

TECHNICAL, ECONOMIC, AND FINANCIAL FEASIBILITY ANALYSIS

Input
1. Load profile
2. Components quantify
3. Components cost
4. Emissions data
5. Energy resources
6. Others

HOMER
1. Load profile
2. Components quantify
3. Components cost
4. Emissions data
5. Energy resources
6. Others

Output
1. Optimized size
2. Comparasion Cost
3. Capital cost
4. Comparison os diferente case studies
5. Environmental effects
6. Others

PRODUCTION OF WIND BLADE AND OTHER PROTOTYPES:

Wind turbine designs (vertical and horizontal axis) and wind tunnel testing

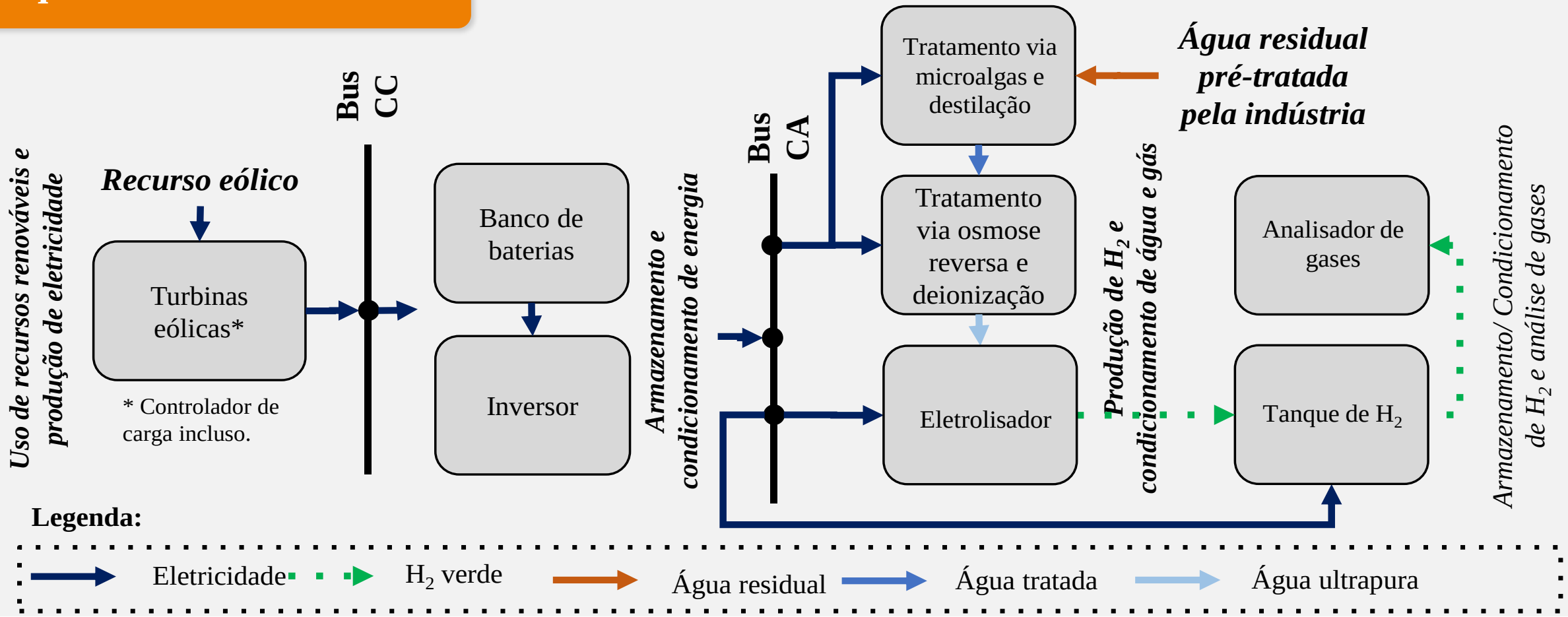
PRODUCTION OF WIND BLADE PROTOTYPES

WIND TUNNEL TESTING

GREEN H2 PRODUCTIONS

USO DE RECURSOS RENOVÁVEIS E PRODUÇÃO DE ELETRICIDADE:

Arquitetura do sistema



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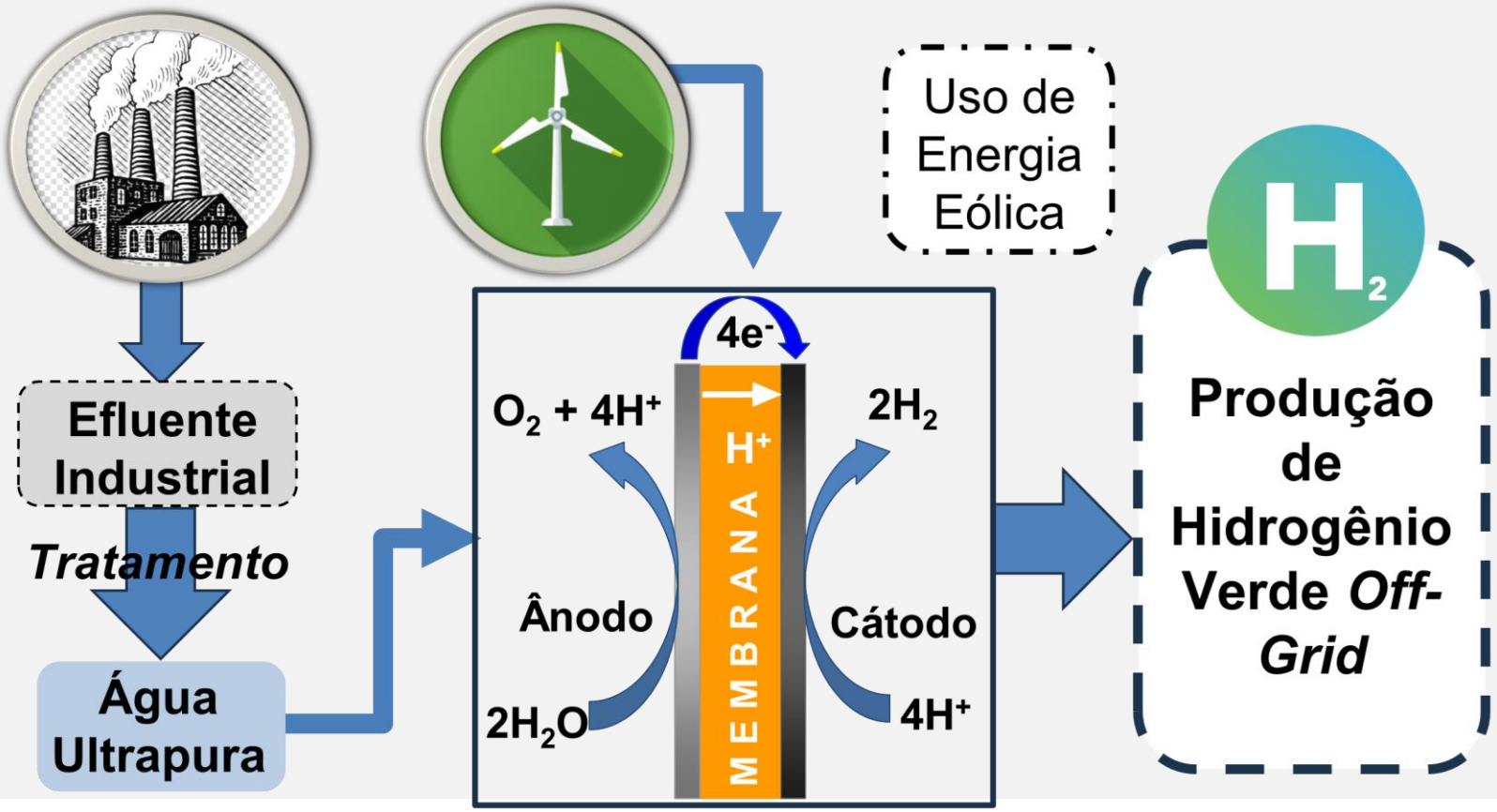
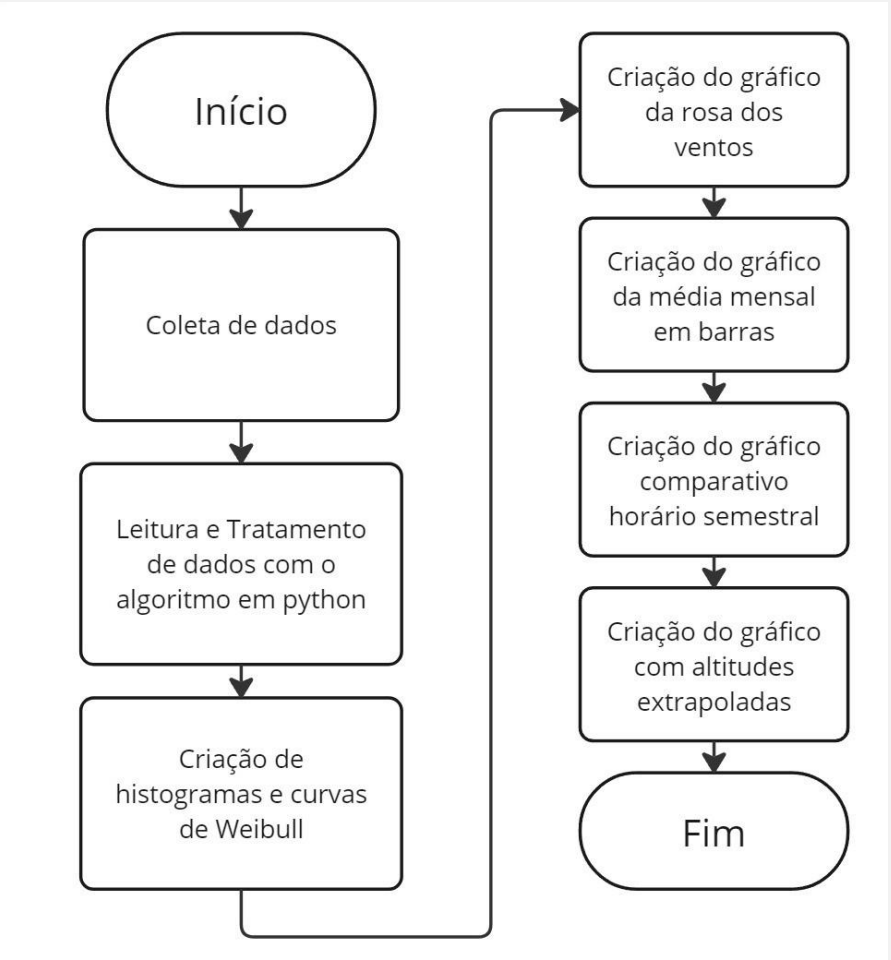
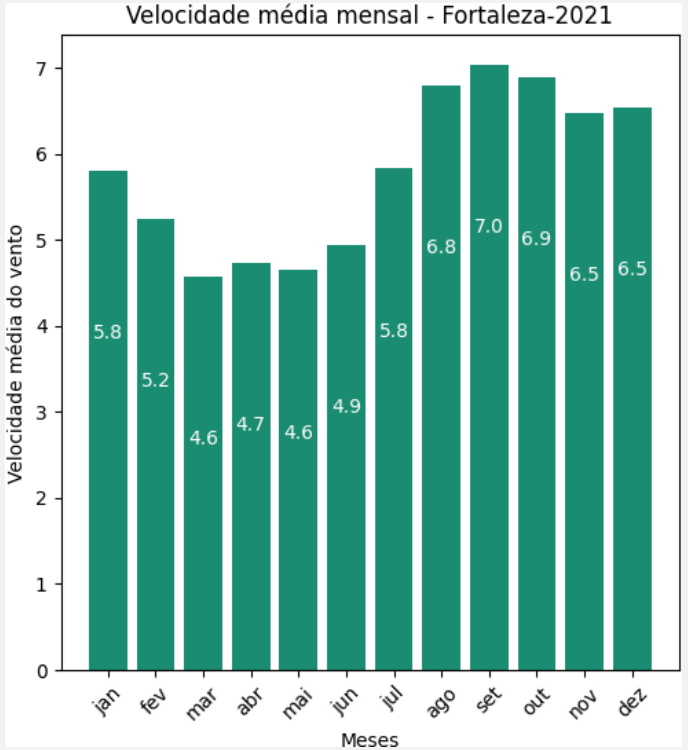
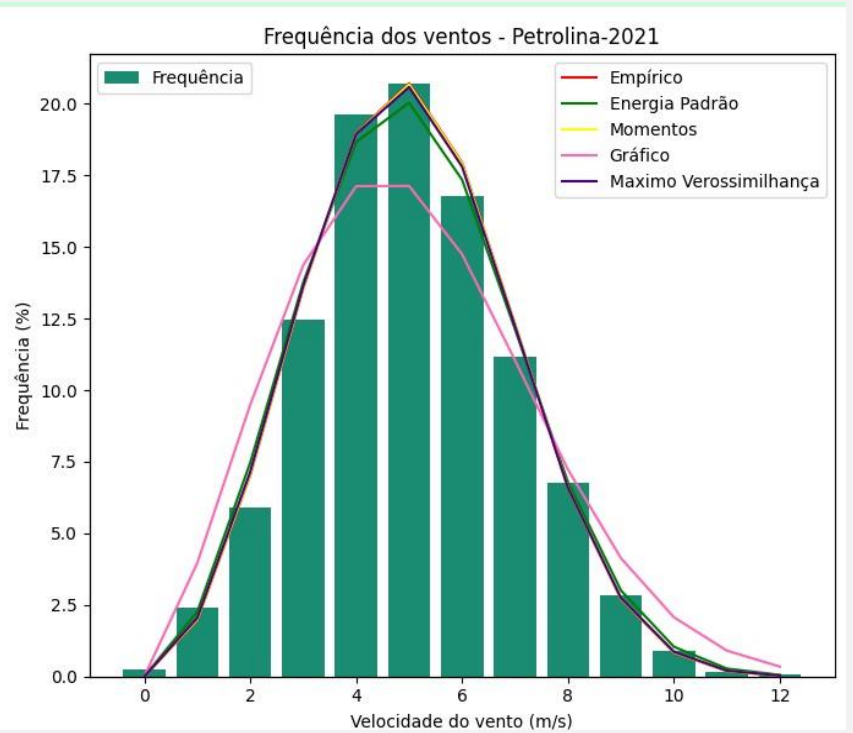


ANÁLISE DE DADOS EÓLICOS:
E a Produção de Hidrogênio Verde

Desenvolvimento de Algoritmo

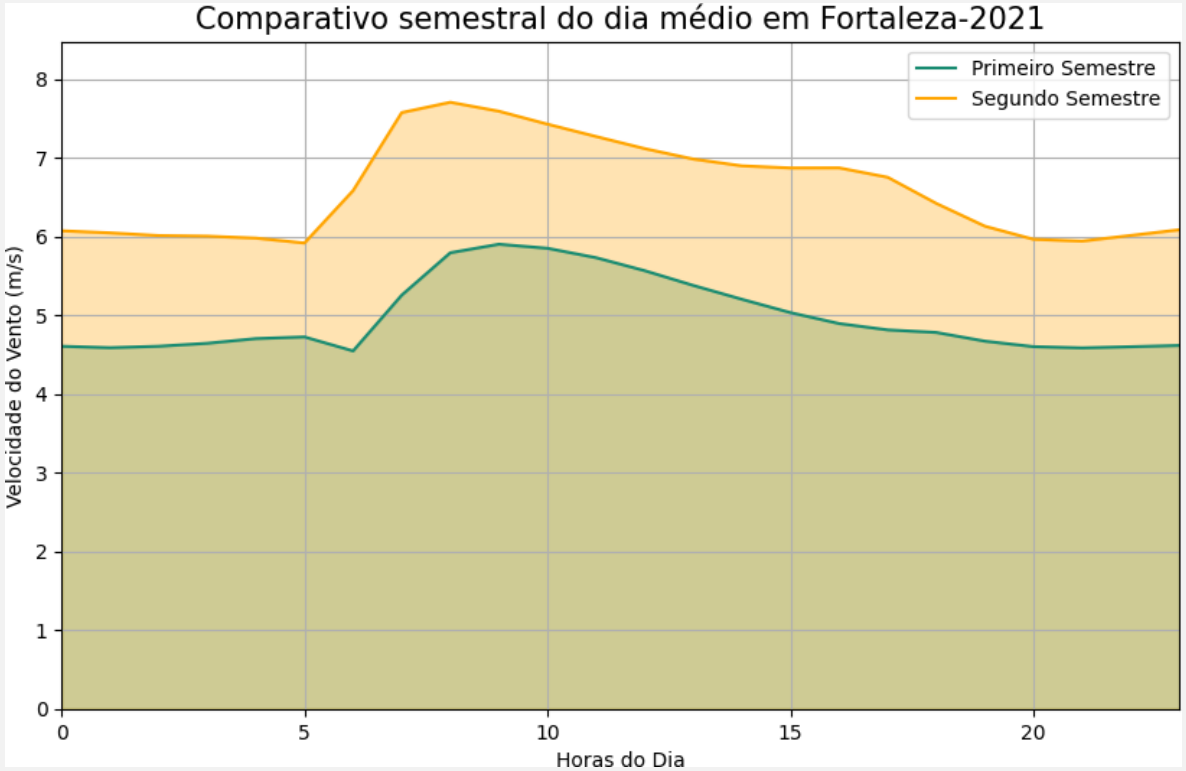




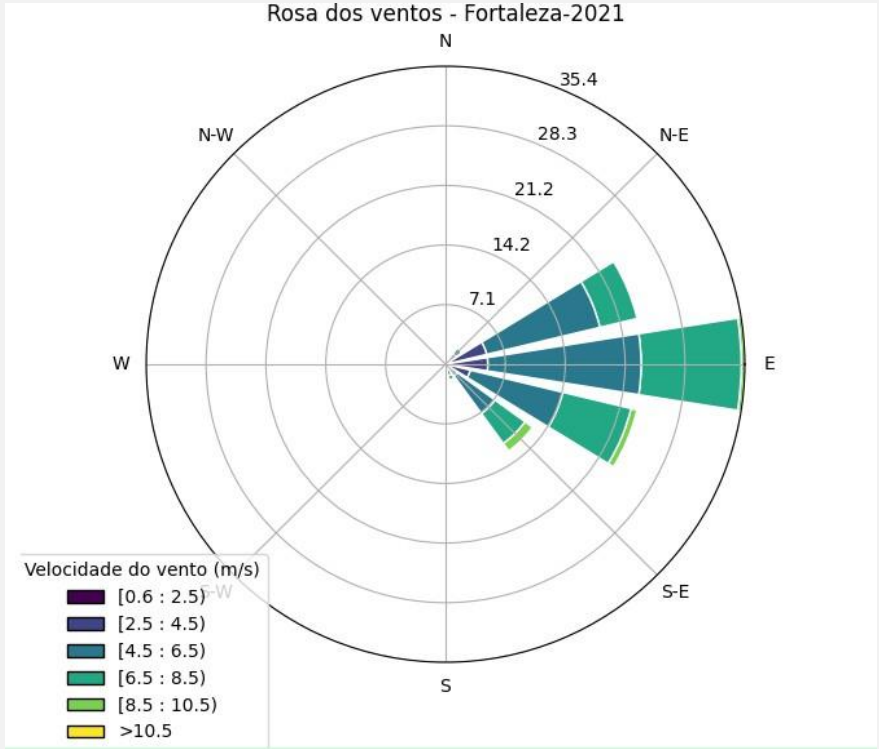


ANÁLISE DE DADOS EÓLICOS:
E a Produção de Hidrogênio Verde

Comportamento Horário



Comportamento da Direção do Vento



THANK YOU!

“Science and Technology are Essential for a **Sustainable Future**”

BRIEF ENERGIA EÓLICA

LAERO

LHMT

ICE+ LABORATÓRIO DE CONVERSÃO ENERGÉTICA E INOVAÇÃO

UNIVERSIDADE FEDERAL DO CEARÁ

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