



ESEE2026

European Society for Ecological Economics



FRANKFURT
UNIVERSITY
OF APPLIED SCIENCES

[ESEE2026 | Fra-UAS]

European Summer School on Environment and Sustainable Energy

Fra-UAS / Polytech Marseille / ISEL Lisbon / VSB-Ostrava

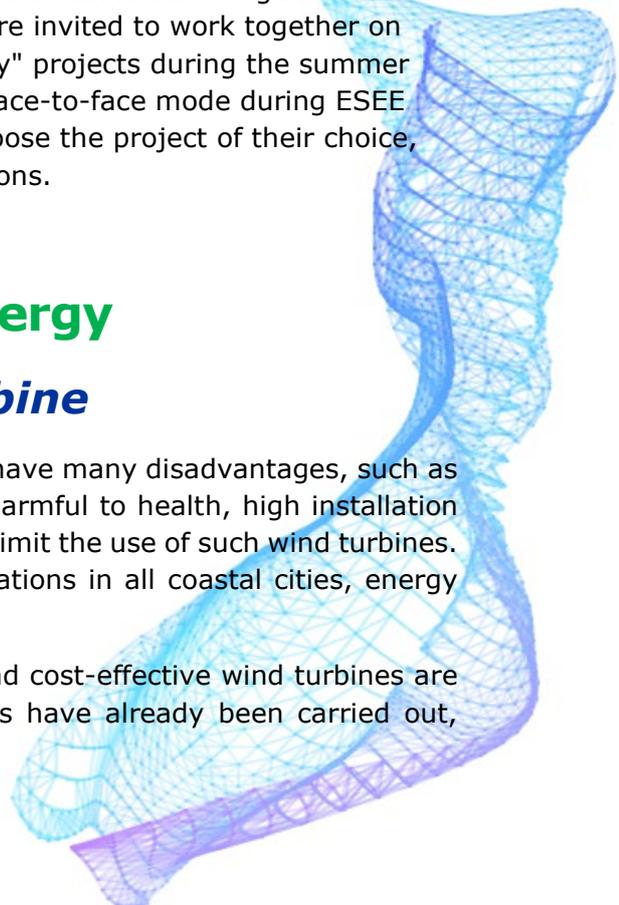
ESEE Week 2026 will take place at Polytech-Marseille, University of Aix-Marseille, and will be attended by students and teachers from partner universities. Academic guests and Students from the 4 university and institutes partners are invited to work together on projects related to "Environment and Sustainable Energy" projects during the summer semester, both through distance learning as well as in face-to-face mode during ESEE week. Using the project list below, each student can choose the project of their choice, which will be supervised by teachers from several locations.

The A1 Project: **Sustainable Energy**

Compact and efficient wind turbine

The large rotating blades of conventional wind turbines have many disadvantages, such as a high bird mortality rate, noise pollution that is very harmful to health, high installation costs, a very large installation area, ... which drastically limit the use of such wind turbines. These disadvantages have led to a ban on such installations in all coastal cities, energy communities and tourist and densely populated areas.

To address these problems, compact, efficient, silent and cost-effective wind turbines are strongly required. A first design and first positive tests have already been carried out,



which revealed several technical problems that are being sought to be resolved in this project.

In all coastal and seaside towns, this type of turbine can be easily integrated and fused into the landscape. Moreover, this type of vertical wind turbines can be efficiently used on the edge of highways and railways to gain electricity, reduce visual impacts and even reduce the noise.

This project is divided into 2 parts that can be carried out simultaneously:

A1a Project: Outer Casing of the Turbine

This part concerns the design and production of the outer casing/envelope of the wind turbine that can be carried over by 2 teams:

Team 1: Simulation (VSB-Ostrava)

An initial simulation work is very necessary to optimize the dimensions and shape of the wind turbine casing. To integrate these wind turbines into the Marseille landscape, an analysis of numerous photos, particularly of the coastal promenade, led us to the following dimensions: Height 1000-1200 mm, Diameter 400-500 mm.

Team 2: Production (Fra-UAS)

The above results then lead to the production of the prototype, e.g. using 3D printing. Here, the material type, the production of the various parts and their assembly represents a quit time and effort consuming issue that suits a 2nd team.

Team 3: Electromechanical optimization (ISEL)

Develop high specific power electrical generators for direct-drive wind turbines. This work reviews the state of the art, develops an electromagnetic and thermal model of a large-scale PMSG, and extends the framework to include HTSG technology. Finally, both generator concepts are compared using consistent metrics such as specific power, efficiency and loss distribution.

A1b Project: Induction Coils

In conventional blade turbines, the blade shaft is connected to a gearbox, which in turn is connected to a generator with its coils. This forms the small head, which we can see directly behind the blades: a rather tiny size compared to the size of the blades. In our project the coils will use the whole volume available. Two teams are needed:

Team 1: Simulation-Calculation (Polytech)

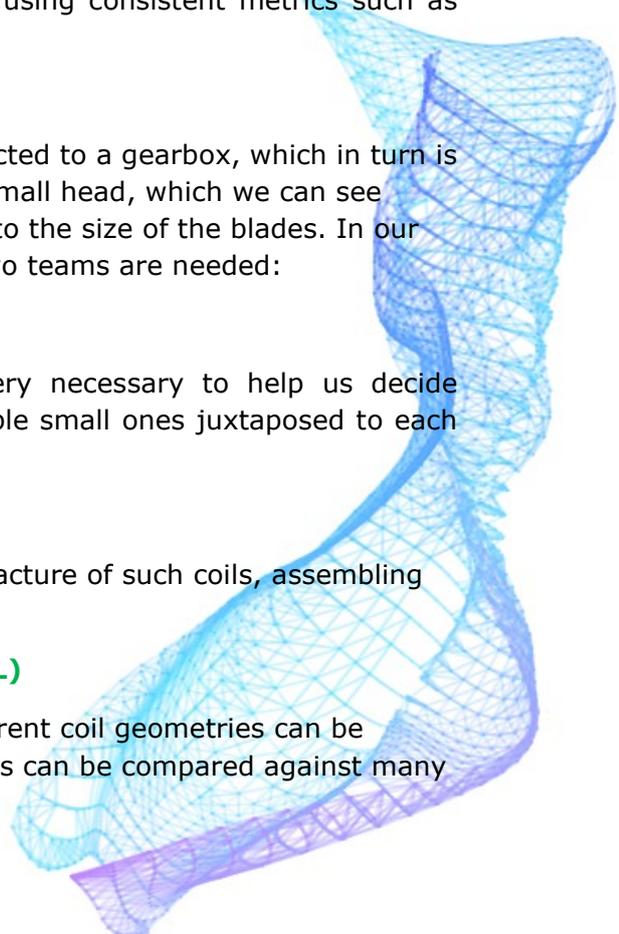
Simulation work and basic calculations are very necessary to help us decide between a few long neighboring coils and multiple small ones juxtaposed to each other.

Team 2: Production (Fra-UAS)

This team is responsible for the purchase/manufacture of such coils, assembling and commissioning the induction phase.

Electromagnetic modelling of the coils (ISEL)

Using ANSYS Maxwell, the magnetic field of different coil geometries can be simulated and configurations with fewer long coils can be compared against many



short coils. The analysis enables evaluation of useful magnetic flux, air-gap flux density, induced electromotive force, inductance and coupling. It also allows assessment of magnetic saturation effects in ferromagnetic materials.

A1c Supporting webinars: (To be confirmed)

- Electromagnetic Design Challenges in Compact Wind Turbine Generators
- Sound Monitoring and Classification in Smart Wind Energy Installations
- Electromagnetic Design and Optimization of Generator Windings Using ANSYS Maxwell

The A2 Project: **Sustainable Energy**

Smart Photovoltaics

Smart solar panels are designed with intelligent electronics that can autonomously track the sun's path and rotate the panels optimally to maximize the photoelectric effect at any time of the day or year. In addition, they can also remotely report their status and that of the power plan.

Such solar panels already exist on the market, but they are relatively expensive, unreliable and not yet mature, as the solutions used rely on brand new and specially designed hardware. This makes their use in solar power plans, which are designed to last at least 20 years, an unattractive choice, and explains the deployment of solar panels on a static base.

The goal of this project is to introduce as automotive hardware inexpensive, reliable and robust automotive compounds, specially designed to operate in all weathers and to last at least 10 years: the minimum requirement for automotive devices that are not subject to wear (such as brakes, etc.).

This project is divided into 2 parts that can be carried out simultaneously:

A2a Project: Mechanics, Actuators and Motorization

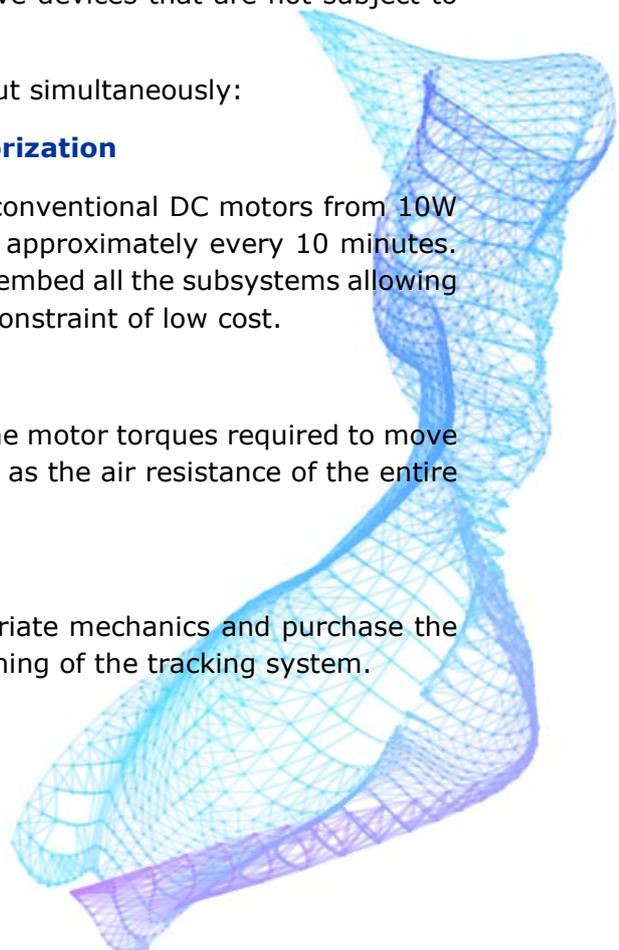
The movement of the solar panel will be ensured by 2 conventional DC motors from 10W to 30W. The position of the solar panel will be updated approximately every 10 minutes. The development of the electronic controller will have to embed all the subsystems allowing the proper functioning of the solar panel with a strong constraint of low cost.

Team 1: Solar Tracking

Calculations are needed to accurately estimate the motor torques required to move the solar panel in calm and strong winds, as well as the air resistance of the entire system to derive a functioning air velocity zone.

Team 2: Production

The above results will help to design the appropriate mechanics and purchase the necessary (12 V-BDC) motors for the commissioning of the tracking system.



Team 3: Control, modelling, and validation of the solar tracking drive (ISEL)

The work should cover dynamic modelling of panel inertia, required torque and wind loads, followed by the design of a closed loop motor position controller with a safe stop strategy for high wind conditions. The team should also measure the real energy consumed per tracking cycle and validate results through a small bench setup, recording torque, current draw, response time and thermal behavior, so that the mechanical sizing is directly tied to verified operating performance and overall system efficiency.

A2b Project: Energy Management

The objective of this sub-project is to make the solar panel work in its maximum efficiency zone and transmit the maximum energy to the network while ensuring solar tracking actions. Thus, a small amount of energy will be taken and stored in accumulators in order to allow the optimal trajectory to be monitored. Consequently, the intelligence embedded in the controller must allow optimal operation in all circumstances. Two teams are needed:

Team 1: Simulation-Calculation

Simulations and basic calculations are necessary to determine the energy requirements of the entire system, i.e. the motors (at all possible loads), the sensors and the control system for tracking. This determines the size of the battery and the wind speed limits that the design may allow.

Team 2: Production

Based on the information from the 1st team, the 2nd team will implement the required code on the controller.

Team 3: Energy management and grid operation (ISEL)

Develop the control and optimization layer that coordinates PV production, storage, tracker consumption and grid interface, ensuring operation near the maximum efficiency point while maintaining stable and compliant power delivery. The work should include modelling of power flows, definition of dispatch and charging logic, and validation of grid interaction behavior under variable generation and load, so that the full system operates with predictable efficiency and electrical robustness.

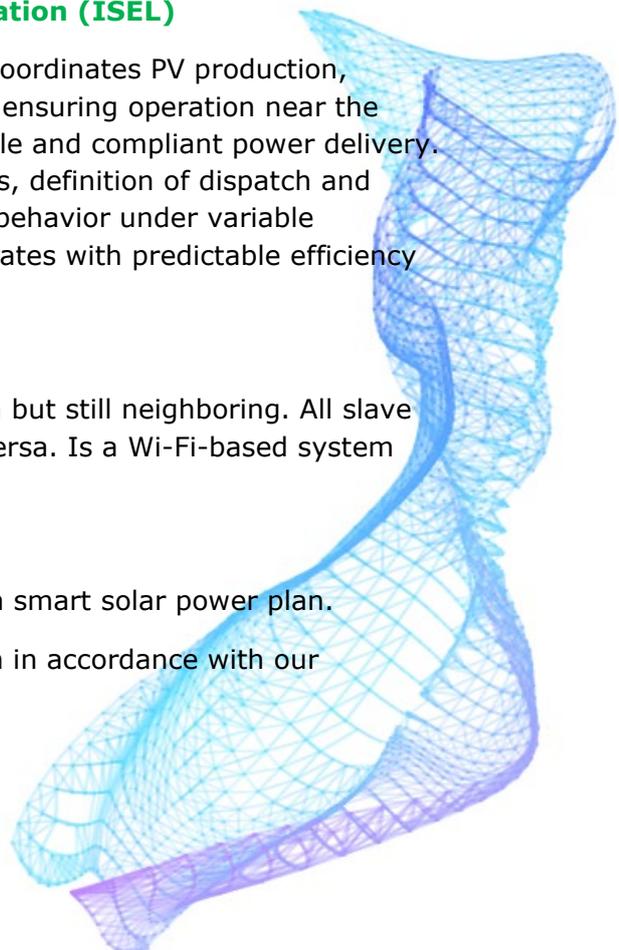
A2c Project: Remote Control and Diagnosis

The solar panels are well distributed over a specific area but still neighboring. All slave modules must communicate with the master and vice versa. Is a Wi-Fi-based system with repeaters a cost-effective solution?

Team 1: Wi-Fi System for broad area

Identify the critical points and requirements for a smart solar power plan.

Design and implementation of a Wi-Fi installation in accordance with our requirements.



Team 2: Solar Panel Controller Equipment

The panel controller must be equipped with a Wi-Fi module, and its coding for data transfer and communication must be implemented.

Team 3: Remote Supervision, Communications and Diagnostic System (ISEL)

The work should define and validate the communication and supervision layer for distributed solar trackers, covering data acquisition, fault detection, remote configuration and secure command channels between master and slave nodes. The team should model network reliability, latency and coverage limits for Wi-Fi based solutions with repeaters, and implement a prototype monitoring stack that proves stable field operation and actionable diagnostics.

A2d Supporting webinars: (To be confirmed)

- Motion control and positioning: Basic control architectures for solar trackers, Sensor options (encoders, limit switches, sun sensors) and Fault detection and safe positioning
- IoT-Driven Remote Monitoring and Fault Diagnosis for Smart Photovoltaic and Renewable Energy Systems
- Artificial Intelligence and IoT for Smart Urban Energy and Mobility Systems

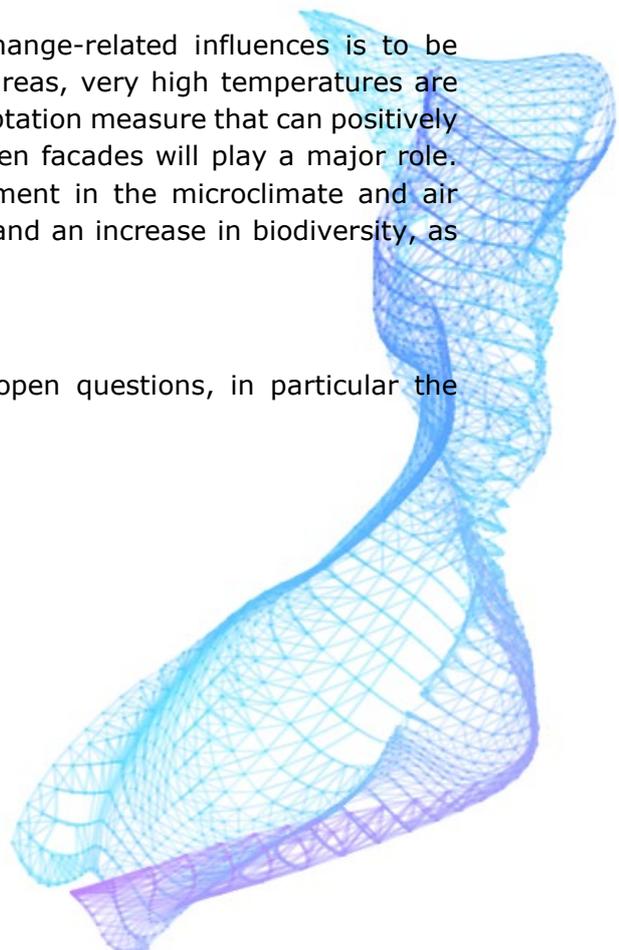
The B1 Project: Environment/ Passive Heating and Cooling

Greening Buildings

In urban areas, a considerable increase in climate change-related influences is to be expected in the future. Compared to the surrounding areas, very high temperatures are particularly relevant as urban climatic effects. As an adaptation measure that can positively address such challenges, the use of green roofs or green facades will play a major role. Several advantages are obvious, such as an improvement in the microclimate and air quality, a reduction in runoff peaks during rain events and an increase in biodiversity, as well as improved building insulation.

Team 1/2:

From a practical point of view, there are still some open questions, in particular the following should be mentioned:



- a) What minimal amount (height) of "soil" should a particular roof take on to ensure a minimum living environment for the plants?
- b) Which climate-adapted plants should be used for greening buildings?
- c) How will the water supply for the various green roofs and facades be ensured in the long term?
- d) How do green roofs and the use of photovoltaic systems for energy generation influence each other?
- e) How can the greening of buildings itself be made "climate change compatible" so that it can continue to fulfill its intended functions in the future?

This project aims to answer such questions with measurements and investigations.

Team 3: Impact of Green Roofs and Green Façades on Indoor Air Quality (ISEL)

This work examines how green roofs and façades modify airflow and contaminant transport at air intakes in nZEB buildings, using CFD to assess their effect under natural and mechanical ventilation. It also evaluates the potential reduction of particulate matter near vegetated surfaces and analyses indoor droplet dispersion to determine whether improved outdoor conditions permit lower mechanical ventilation rates without compromising indoor air quality. The outcome will be design guidance for integrating vegetated envelopes into HVAC systems with measurable air quality benefits.

B1b Supporting webinars: (To be confirmed)

- Indoor Air Quality and HVAC Design;
- Plant-Based Passive Cooling Strategies in Urban Buildings.

