

Summer semester 2024

# Project Lab Renewable and Sustainable Energy Systems

## Notes on registration

If you are interested in participating in this project internship, please proceed as follows:

1. Select the topic relevant to you for the project internship in the topics listed below. Also consider which other topics would be suitable for you.
2. Get in touch with the supervisors of the topics of your choice and make an appointment for a short video call.  
Procedure of the video call:
  - a. First, the supervisors will give you a brief overview of their topic.
  - b. Afterwards you can speak with the supervisors for 3-5 minutes to get an impression of whether the topic is suitable for you.
3. If you would like to apply for one or more topics after talking to the supervisors, please send an email at the latest on Wednesday, April 17, 2024, to [propens.ens@ed.tum.de](mailto:propens.ens@ed.tum.de). Indicate the topics (no more than three) and please make it clear which topic would be your first priority.
4. Please register at the latest on Wednesday, April 17, 2024, in TUMonline for the lab course.
5. By Tuesday, April 23, 2024, at the latest, we will inform you whether and, if so, in which topic you can work on the project internship.

If you have questions concerning the organization of the lab course, please contact Dr. Kuhn ([pkuhn@tum.de](mailto:pkuhn@tum.de)).

If you have any questions about the content of the different topics, please contact the supervisor directly.

## **Please be sure to pay attention!**

In order to participate in the project internship, it is essential that you

1. had a **short video-call with the supervisor** of the topic **AND**
2. write an **email which the topic selection you apply for** to Dr. Kuhn **AND**
3. register **in TUMonline for the course**.

If you do not meet one of the three requirements, you will not be included in the selection for participation.

## **Organizational matters**

Weekly attendance times are mandatory for the project internship. These are planned to take place in presence. However, to some extent a "hybrid" format with online meetings is also possible. The format of the weekly meetings will be agreed for each group with each supervisor.

Unless noted otherwise, each topic is available in both German and English.

## Topics

No.	Topic	Students	Brief description	Supervisor (email)	Time slots for meetings
1	Ghana – PV Education hub	10	<p>The KNUST-TUM PV Education hub project is one of the first steps from the TUM ENS chair as a long-term vision for strategic and sustainable partnership with KNUST, Ghana. In the shorter-term, we are attempting to cultivate an entrepreneurial mindset among students and enhancing renewable energy skills through block-course format, short education camps. More details – see <a href="#">proposal</a></p> <p><b>IMPORTANT:</b> The online meeting indicated under point 2 in the notes will take place for <b>all</b> interested students on April 10, 2024, at 14:00 under the following link: <a href="https://tum-conf.zoom-x.de/j/66444740552">https://tum-conf.zoom-x.de/j/66444740552</a> Meeting ID: 664 4474 0552 Passcode: 038937 It is therefore not necessary to contact Mr. Mohapatra in advance.</p> <p>In this topic, students of the Master's program "<b>Management &amp; Technology – Specialization: Sustainable Energies</b>" will be given preference in the allocation of places. Participation in the online meeting and the e-mail for the choice of topic are also mandatory here. If the demand exceeds the available places, the places for students of this degree program will first be allocated according to semester and then according to the time of registration on TUMonline.</p>	<a href="#">Mohapatra, A.</a>	tbd

No.	Topic	Students	Brief description	Supervisor (email)	Time slots for meetings
2	Future Energy-Ecuador	10	<p>Despite many political challenges, Ecuador has the potential to become a pioneer in the intensive use of renewable energies. The country has considerable potential for hydropower and biomass. As a tropical country, solar energy and, in selected places, wind energy are also available.</p> <p>The project internship is intended to develop an outlook on the further energy development of the country. It is intended to be usable by administration and industry in order to secure individual decisions on the construction of infrastructures. The aim is to make simple estimates of further developments.</p> <p>The result is Excel spreadsheets that contain all the important results and extrapolations. It will also produce a report and presentation that can be used by governments and other relevant stakeholders.</p> <p><b>IMPORTANT:</b> The online meeting indicated under point 2 in the notes will take place for <b>all</b> interested students on April 15, 2024, at 14:00 under the following link: <a href="https://tum-conf.zoom-x.de/j/67483341832">https://tum-conf.zoom-x.de/j/67483341832</a> Meeting ID: 674 8334 1832 Passcode: 535956 It is therefore not necessary to contact Prof. Hamacher in advance.</p> <p>In this topic, students of the Master's program "<b>Management &amp; Technology – Specialization: Sustainable Energies</b>" will be given preference in the allocation of places. Participation in the online meeting and the e-mail for the choice of topic are also mandatory here. If the demand exceeds the available places, the places for students of this degree program will first be allocated according to semester and then according to the time of registration on TUMonline.</p>	<a href="#">Hamacher, T.</a>	tbd

No.	Topic	Students	Brief description	Supervisor (email)	Time slots for meetings
3	<b>Seed Himalaya – Energy System</b>	3	<p>Seed Himalaya is a project committed to bringing sustainable energy solutions to remote mountain communities in the Himalayas. The project goal is to develop decentralized renewable energy systems that are not only technologically advanced but also socially inclusive and economically viable. One central aspect is the investigation of synergies between productive energy use and mini-grid capacities.</p> <p>Therefore, this project focuses on the full-stack development of a user-friendly web-based interface for optimizing the sizing and design of renewable mini-grids in rural Himalayan communities. The platform will consider critical inputs such as energy sources, solar radiation, water/wind potential, and hardware costs to provide users with efficient and sustainable solutions. The primary goal is to simplify the complex process of mini-grid planning, making it accessible to users without extensive technical knowledge.</p>	<a href="#">Erhart, M.</a>	tbd
4	<b>Impact of residential EV Car-Sharing on urban energy systems</b>	3 - 4	<p>The ComfficientShare project, a part of the MCube - Mobility Cluster, tries to analyse the viability of an electric vehicle (EV) car-sharing scheme, made directly available in the regular parking spots of a residential building in Munich. The user base for car-sharing is picked from within the building community, a closed group of trustworthy neighbours. The project expectation is this grouping, leading to higher adoption of the sharing concept and a better management of the car fleet.</p> <ul style="list-style-type: none"> <li>• Extend an existing MILP formulation of Car-Sharing process within an energy system.</li> <li>• Create a residential travel behaviour profile based on the Munich building stock map.</li> <li>• Combine these with the synthetic LV grid generation tool <i>pylovo</i> and energy system optimisation tool <i>urbs</i>.</li> </ul> <p>Prior knowledge of optimisation frameworks in Python, and GIS tools would be beneficial.</p>	<a href="#">Mohapatra, M.</a>	tbd

No.	Topic	Students	Brief description	Supervisor (email)	Time slots for meetings
5	<b>Sustainable Ethylene production</b>	3-4	<p>For the sustainable transformation of the chemical industry, many of the currently existing fossil-based processes need to be replaced by alternative, carbon-neutral production processes. The focus of this student group is on developing a urbs model centered on ethylene, a critical component in chemical manufacturing.</p> <p>Project objectives:</p> <ul style="list-style-type: none"> <li>– Comprehensive Analysis: Investigate current and future applications of ethylene across industries to understand its role in the market.</li> <li>– Data collection: Gather capacity data and techno-economic data for different ethylene production processes</li> <li>– Model development: Utilize the linear optimization model urbs to setup a model for ethylene production and integrate the collected data for accurate simulations</li> <li>– Scenario analysis: Explore various scenarios to analyze their impact on the model results</li> <li>– Techno-economic Evaluation: Assess the feasibility and economic viability of different scenarios</li> </ul>	<a href="#">Honig, L.</a>	tbd
6	<b>Business Models for regional Virtual Power Plants</b>	5	<p>In order to navigate around the hesitant and reluctant rollout of digitization solutions in the electricity grid and to overcome limitations with regards to transmission capacity, the objective of this project is to identify and analyze opportunities for regional virtual power plants, e.g. the aggregation of generation as well as demand in a specific area on the distribution grid. When applying for this project you should be prepared to do extensive data collection, processing, and financial modelling. Advanced Excel and programming skills are a plus, however, not a prerequisite. Experience in the energy trading space is more than welcome. The deliverable will be a business plan for a regional virtual power plant.</p> <p>Key objective of the course is getting familiar with the concepts of unit economics and market places for designing products and business models.</p>	<a href="#">Achter, S.</a>	tbd