



# 2023 Master internship at University of Napoli Parthenope



**TITLE: Energy recovery from residual biomass**

## LAB & PEOPLE

- Name of the hosting lab: **Laboratory of Thermo-fluid dynamics, Energy, and HVAC systems**
- General activities of the lab: **Computational thermo-fluid dynamics, finite elements, heat and fluid flow through porous media, hydrogen and fuel cells, geothermal energy, energy planning, polygeneration systems, renewable energy sources, thermo-economic analysis of energy systems and biomedical engineering**
- Website : **<http://www.latec.altervista.org/>**
- Number of staff / PhD: 4 full professors, 1 associate professor, 1 assistant professor, 2 post-docs, 6 PhD students
- Supervisor name and contact: Simona Di Fraia, [simona.difraia@uniparthenope.it](mailto:simona.difraia@uniparthenope.it)

## TOPIC OF THE INTERNSHIP

- Scientific context of the internship (max 20 lines)

Depending on its chemical-physical properties, biomass can be converted into useable forms of energy, such as thermal/electric energy or fuels for the transportation sector. The main technologies used for the conversion are based on thermochemical processes, biochemical/biological treatments, or mechanical extraction of oils. Obviously, the conversion process influences the eventual needed pre-treatments as well as the available final energy.

In the European Union, energy from biomass (bioenergy) is the main source of renewable energy, with a share of almost 60% that is expected to further increase, especially in the sectors of electricity and transport biofuels. However, the increase in the biomass demand for energy generation causes concern for several problems, such as land-use competition, deforestation, crops for food vs. biofuels, use of food, and water systems. These issues can be addressed by using residual biomass for energy generation.

For this reason, assessing the available energy potential from residual biomass and the best route for its recovery considering energy, environmental and economic analyses is becoming more and more attractive. Indeed, compared to other renewables, due to the quite mature technological level, low economic costs, high availability and easy accessibility residual biomass may be a sustainable and reliable energy source.

Keywords : biomass energy potential, energy recovery, renewables, techno-economic analysis.

## Bibliography

- Carotenuto, A., Di Fraia, S., Uddin, M. R., & Vanoli, L. (2022). Comparison of Combustion and Gasification for Energy Recovery from Residual Woody Biomass. Journal homepage: <http://iieta.org/journals/ijht>, 40(4), 888-894.
  - Brachi, P., Di Fraia, S., Massarotti, N., & Vanoli, L. (2022). Combined heat and power production based on sewage sludge gasification: An energy-efficient solution for wastewater treatment plants. *Energy Conversion and Management: X*, 13, 100171.
  - Moretti, L., Arpino, F., Cortellessa, G., Di Fraia, S., Di Palma, M., & Vanoli, L. (2022). Reliability of equilibrium gasification models for selected biomass types and compositions: an overview. *Energies*, 15(1), 61.
  - Petrillo, A., Travaglioni, M., Di Fraia, S., Vanoli, L., Cirillo, D., & La Villetta, M. (2021). Experimental study and Life Cycle Assessment of biomass small-scale trigeneration plant. *Journal of Cleaner Production*, 326, 129234.
  - Di Fraia, S., Fabozzi, S., Macaluso, A., & Vanoli, L. (2020). Energy potential of residual biomass from agro-industry in a Mediterranean region of southern Italy (Campania). *Journal of Cleaner Production*, 277, 124085.
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- Tasks and duties entrusted to the student: during the internship period, students are required to comply with current regulations of the host structure. An internship project will be assigned that students have to complete to a large extent independently under the supervision of a tutor. Students have to manage with academic and specialist literature to improve the background knowledge on the assigned topic. Carrying out the internship activities, they have to apply the knowledge acquired to gain practical experience that will result in the development of a case study. Finally, once the internship has been completed, students will have to write a final report describing all the activities carried out and the main results obtained.
  - Skills to be acquired or developed: the internship experience aims to train and empower the students' skills necessary to build a successful future working path. Through the activities carried out, students strengthen communication skills, develop operational orientation by objectives, promote cooperative synergies within working groups, and, through an active and proactive participation in the work group, develop an awareness of internal organizational and relational dynamics that characterize the working context. As specific skills, the internship will strengthen students' abilities in the assessment of energy efficiency, environmental impact and economic feasibility.

## PROFILE OF THE DESIRED STUDENT

- Minimum level of study required: **Batchelor degree**
- Field(s) of study: ***Engineering, Mathematics, Business***
- Scientific skills: Basic knowledge of thermodynamics and heat transfer
- Language skills required: ***English***

## **THE INTERNSHIP ASSIGNMENT:**

Desired duration of the internship (in months): **3/6 months**

Desired Starting date of the mission: *(please indicate the level of flexibility)*: **Starting preferred dates are October or March, however, the position is open all year round (except for August).**

Indicative weekly schedule: **35h / week**

Remuneration: **Not provided**

*Erasmus grant* **Erasmus grant could be asked to your own sending university**

Internship agreement: **an internship agreement will be signed.**

*To SEA-EU students:*

*If you're interested please send your CV and letter of motivation to the scientist in charge, email:*  
[simona.difraia@uniparthenope.it](mailto:simona.difraia@uniparthenope.it), before the date 31/12/2023.