

# Master Thesis Work:

## Biomass to bio-fuels and bio-carbons by use of microwave enhanced pyrolysis

### **Background & objective**

The value chain for lignin feedstock to bio-oils and bio-carbons is focused in this Master Thesis work.

The objective is to clarify/identify the technical and commercial potential to develop a business case, where kraft lignin or kraft lignin mixed with solid biomass (for example saw mill residues) is depolymerized to a biooil (for different purposes where one example is transportation fuel) and a bio-char (bio-carbon) by-product. Consequently, there is a need to identify different potential applications for both the bio-oil and the bio-char (bio-carbon). The depolymerization technology studied in this work is microwave-enhanced catalytic pyrolysis (MWDP) technology developed by Bionic BTL GmbH.

The bio-oil could have many different uses. The bio-oil could for example be hydrogenated to meet public standards for transportation fuel. The value chain summarized, and the best business concept proposed in more detail by a draft technology and commercialization roadmap for industrialization.

The commercial benefit of this technology is two product streams, i.e. bio-oil and char, targeting different market needs and customers. The technology is suitable for medium-sized, perhaps large, operations and will facilitate independent regional bio-economy in regions, potentially rural areas, with resources of lignin, saw dust and forestry residues. This has the potential to strengthen the local economy by local job creation and contribution on a national level to the "green conversion" of bio-oils and potentially transport fuels.

### **Challenges**

- Cost structure for feedstocks, applications and creation of a complete business concept
- The technology which is in a quite early development phase
- Quality of products (bio-oil and bio-char), need for further purification/refining and production capacity
- Identification of funding & entrepreneurial forces
- Market interest – Market pull? Market push?
- A serious technology and commercialization roadmap for industrialization

### **Project Plan**

The thesis work is suitable for one or two master students with excellent background in both technology and economy.

The objective with this master student work is to clarify if it is possible to find a concept with good potential to form a business case in Värmland for a regional or national market. The work will focus use of available information which the master student/-s develop and refine. Limited experimental work can be justified in some cases.

### **Candidate**

As a candidate for this Master Thesis work you should preferably like independent and creative work where you collect a lot of information by different contacts with the established actors in the field. A suitable background is industrial economy, chemistry, chemical technology and analytical chemistry. The work is planned for Q1 and Q2 2019.

**Location**

The LignoCity Initiative in Bäckhammar – cooperation with Karlstad University, Paper Province and RISE Bioeconomy.

**Contact persons**

The LignoCity Initiative:

- Karlstad University: Zane Rowe ([zane.rowe@kau.se](mailto:zane.rowe@kau.se))
- RISE Bioeconomy in Stockholm: Per Tomani RISE ([per.tomani@ri.se](mailto:per.tomani@ri.se))

Operative supervisors will be discussed and decided together with the master student.