

# IEA Bioenergy

## Task 34 - Pyrolysis



### Country report update: Norway

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IEA Task 34 Pyrolysis meeting, Hengelo,  
Netherlands, 20th May 2015

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# Pyrolysis activities in Norway

## R&D actors

- Paper and Fibre Research Institute (PFI)
  - Working with applications for fast pyrolysis liquids since 2009
- University of Bergen - Department of Chemistry
  - Research activities headed by Prof. Tanja Barth
  - Hydrothermal conversion of lignin rich feedstocks
  - Developed a one-step method for solvolytic conversion of lignin termed lignin-to-liquid (LtL) in 2007.  
12 papers in peer-reviewed journals, 16 completed Master's projects, 1 completed PhD and 3 ongoing
- Norwegian University of Science and Technology (NTNU). Department of Chemical Engineering
  - Research activities headed by Prof. De Chen
  - Development of catalysts for biomass conversion

# Pyrolysis activities in Norway

## R&D actors

- SINTEF
  - Combustion
  - Gasification
  - Torrefaction
  - Catalyst engineering

## Industrial initiatives

- Norwegian industry actors intend to establish production of 2<sup>nd</sup> generation transportation fuel however no initiatives are realized yet
- Favorable possibilities for national support for demonstration plants etc

# Paper and Fibre Research Institute (PFI)

## Ongoing topics

- PFI is heading a project termed “ReShip - Renewable wood-based biofuels for Shipping” aiming at developing new marine fuel qualities containing stabilized pyrolysis oils as fuel component.
  - Goal: Develop pyrolysis oil based multicomponent fuels suitable for marine diesel engines
  - Consortium: PFI, Aston University, NTNU, Norwegian forest owners, energy producers, engine producer and shipping companies
- PFI is also heading the establishment of a national research infrastructure in biorefining termed Norwegian Biorefinery Laboratory, NorBioLab.
  - An advanced and flexible continuous fast pyrolysis reactor system is under construction and will be in operation in the autumn 2015.
  - The reactor system possess a vapor upgrading unit and is capable of studying *ex situ* catalytic fast pyrolysis conversion processes.

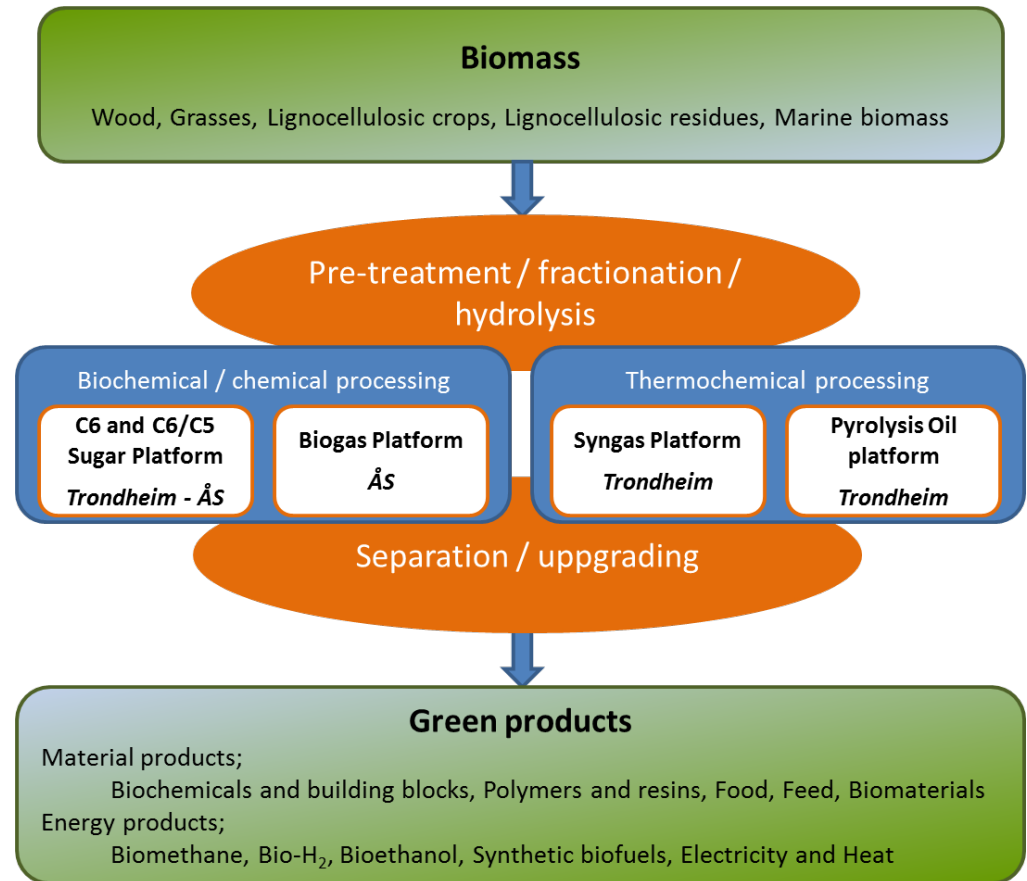
# Norwegian Biorefinery Laboratory (NorBioLab)

PFI granted funding to establish a national laboratory infrastructure for biorefining, NorBioLab. Total project budget ~7 M€

**Key partners:** Paper and Fibre Research Institute, NTNU, SINTEF, Norwegian University of Life Sciences (NMBU)

**Aim:** The laboratory shall contribute to:

- Developing new processes and products based on biomass
- Verify new technological processes before further implementation





## Focus:

- LtL process: Lignin solvolysis at 300-420°C in water or ethanol using formic acid as hydrogen donor. 1-24 hours retention time.
- Small-scale mechanistic studies and catalyst screening in small non-stirred autoclave reactors (25 -75 ml)

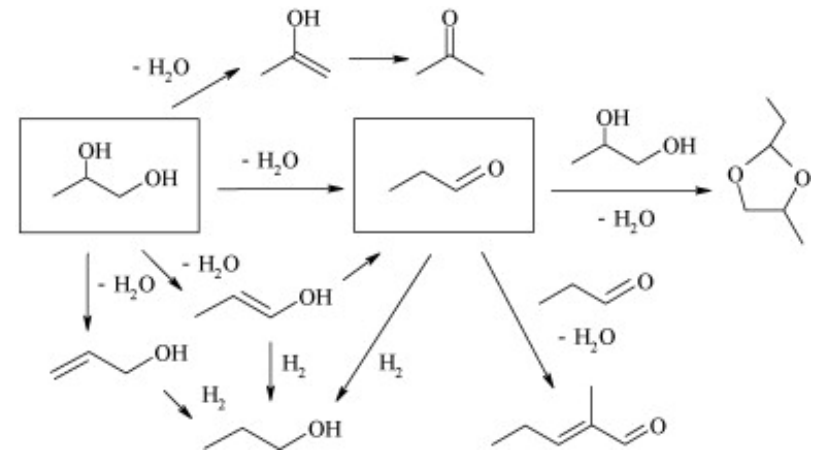
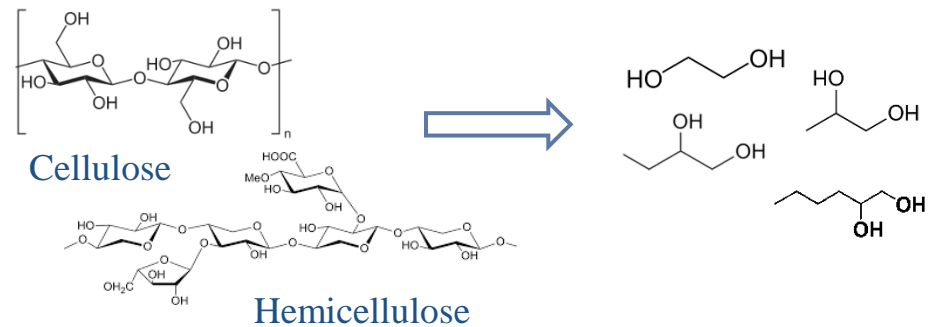
## Ongoing topics

- Upscaling in 5L reactor with stirring and pressure monitoring (established in 2014)
- Mechanics and kinetics, reactor filling catalysis research, alternative hydrogen donors, statistical analysis
- 3 PhD studies ongoing
- Commercialization efforts ongoing through the LtLNOR company



Focus and ongoing topics

- NRC project “Integrated H2BioOil process for efficient biofuel production”
- Catalytic hydrothermal liquefaction of biomass into diols and further conversion of diols into fuel components and biochemicals via hydration, dehydrogenation and aldol condensation reactions.
- Typically 50% diol yield for catalytic liquefaction of cellulose in aqueous solution at 210-230oC and 50 bar in the presence of hydrogen
- One-pot catalytic liquefaction of woody biomass to diols and phenols is in progress



Diols as platform molecules Fuels

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Interested / Questions ?

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