



# Country report - Finland

**Anja Oasmaa**

**20.5.2015**

**IEA Bioenergy Task 34**

**Meeting in Hengelo, The Netherlands**

## Country report - Finland

- Commissioning of Fortum's Joensuu plant going on
- VTT's experimental facilities have been transferred to Bioruukki, Espoo
- Recent publications
  - Anja Oasmaa, Tom Sundqvist, Eeva Kuoppala, Manuel Garcia-Perez, Yrjö Solantausta, Christian Lindfors. Controlling Phase Stability of Biomass Fast Pyrolysis Bio-oils. Accepted to Energy & Fuels 2015
  - Oasmaa, Anja, Bert van de Beld, Pia Saari, Douglas C. Elliott, Yrjö Solantausta. Norms, Standards & Legislation for Fast Pyrolysis Bio-Oils. Energy Fuels 2015, 29, 2471–2484
  - Sundqvist, T., Oasmaa, A., Koskinen, A.. 2015. Upgrading fast pyrolysis bio-oil quality by esterification and azeotrop: American Chemical Society. Energy and Fuels, Vol. 29, No. 4, pp. 2527-2534
  - Wikberg, Hanne, Grönberg, Vidar, Jermakka, Johannes, Kemppainen, Katariina, Kleen, Marjatta, Laine, Christiane, Paasikallio, Ville, Oasmaa, Anja. 2015. Hydrothermal refining of biomass – an overview and future perspectives: TAPPI. Tappi Journal, Vol. 14, No. 3, pp. 195-207
  - Onarheim, Kristian, Solantausta, Yrjö, Lehto, Jani. 2015. Process simulation development of fast pyrolysis of wood using aspen plus: ACS Publications. Energy & Fuels, Vol. 29, No. 1, pp. 205-217
  - Paasikallio, Ville, Kihlman, Johanna, Sanchez Sanchez, Cesar Andres, Simell, Pekka, Solantausta, Yrjö, Lehtonen, Juha. 2015. Steam reforming of pyrolysis oil aqueous fraction obtained by one-step fractional condensation: Elsevier. International Journal of Hydrogen Energy, Vol. 40, No. 8, pp. 3149-3157

# Gasification and Pyrolysis Platforms at BioRuukki

- VTT will move its Gasification and Pyrolysis test facilities to an industrial area in Kivenlahti, Espoo
- New pilot plants will also be constructed
- Start-up at new site in Q4/2014
- Efficient development from laboratory to industrial realization



## Horizon 2020-projects, 2015-2020

- Biofuels for transport sector, renewable chemicals
- Fuel gas & pyrolysis oil for CHP and industrial applications
- Waste-to-Energy with material recovery

## VTT RES-Infra Investment

New R&D Platform  
2013-2015

## Industrial projects

- Pyrolysis and gasification R&D
- Testing and piloting services
- Platform for new pilot plants

## 2G Biofuels R&D and Piloting project

7.2 M€: 2012-14, 2nd phase planned for 2015-16



# Fast Pyrolysis Technology Platform

**Fast pyrolysis test facilities are used for studying and developing new processes for producing liquid fuels and chemicals from biomass**

- Unique 0.5 tpd pilot unit suitable both for thermal and catalytic fast pyrolysis process development
- World class bio-oil chemistry know-how
- Cutting-edge tools for techno-economic evaluations and process modeling (CFD, ASPEN)
- Track record on industrial development and demonstrations
- IPR on fast pyrolysis technologies

- Fast Pyrolysis Pilot Plant
  - Bio fuel oil test production – fuel for boilers and ovens
  - Catalytic fast pyrolysis – feed for hydro-treatment of co-feed to a refinery
- Fast Pyrolysis BFB Bench-Scale
  - Characterization of biomass for fast pyrolysis –
  - Both inert and catalytic operation
  - Capacity 1 kg/h feed
- Batch Unit for Slow Pyrolysis
  - Indirect heating of samples
  - Volume 100 liter, maximum temperature of heating oven 1100 °C
- Pyrolysis Bio-Oil Test Rig
  - Development of filtration, pumping, heating, homogenization, and for material testing in pilot-scale
  - Feed vessel 1 m<sup>3</sup>, volume flow up to 2 m<sup>3</sup>/h
- Lab scale reactors: HTL-test facility, FCC simulator





# VTT Fast Pyrolysis Pilot Plant

