

Low Boiler Emissions with Cost Competitive Liquid Biofuels

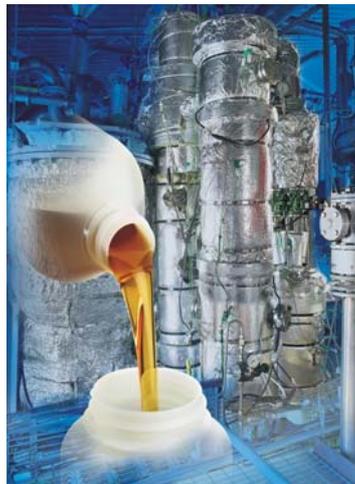
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Summary

The aim of the project is to verify and improve a new liquid biofuel chain for heat production. Main tasks are following:
 1) Production of pyrolysis liquid (PL) in a pilot plant, 2) Improving PL fuel quality (PDU-scale), and 3) Utilization of PL in boilers (laboratory and industrial scale).



Tasks and Results

- Vapo has delivered biomass feedstock (**Photo**) for PL production. About 40 tonnes of PL from wood fuels has been produced by Fortum Oil & Gas at their pilot plant (product storage area in **Photo**) in southern Finland. PL has been transported both to Stockholm, Sweden and central Finland for combustion tests. ETA is evaluating feedstock potential in Italy.
- So far about 18 tonnes of PL has been combusted in a 10 MWth district heat boiler for Fortum Värme in Stockholm April 2004. Tests were successful, and result analysis is underway. 5 tonnes of PL has been combusted in a 300 kWth industrial boiler by Fortum Oil & Gas in Finland September-October 2003. Combustion emissions were very low (**Table**), nearly as low as with fossil oil boilers, and lower than with comparable wood boilers. Single droplet combustion tests to study combustion phenomena are carried out by Istituto Motori.
- Two technologies are developed to improve PL fuel quality, PL emulsions with fuel oils, and hot vapor filtration (HVF). Both technologies are employed to facilitate use of the new liquid biofuel. The first is developed to make it possible to use PL in existing equipment, and the second to enhance PL fuel quality (no solids, more stable and less viscous product). A continuous emulsion unit is under construction in Florence by the CSGI. A 20 kg/h unit has been equipped with a HVF (**Photo**) in Espoo by VTT.
- Pyrolysis liquid production costs need to compete with fuel oil prices. This goal may be feasible for example by using certain waste woods (**Figure**).

Fuel Boiler Size	Light Fuel Oil 500 kW	Pyrolysis Oil 300 kW	Heavy Fuel Oil 1 MW
Flue Gas O ₂ , %	4	4	4
CO, mg/MJ	10	15	15
NO _x , mg/MJ	30	30-100 ¹⁾	100-150
Tar, mg/MJ	0	~0 ²⁾	0
PAH, µg/MJ	0	8 ³⁾	1

- 1) Depends primarily on fuel N-content
 2) Method used SP-1686
 3) Method used SP-1686, Analysis EPA 610

