This is the first newsletter in 2011 of the STOP project. This issue focuses on the new torrefaction reactor and STOP deliverables in progress. The newsletter aims at providing glimpses of recent research activities at SINTEF and NTNU within the bioenergy area.

Torrefaction reactor

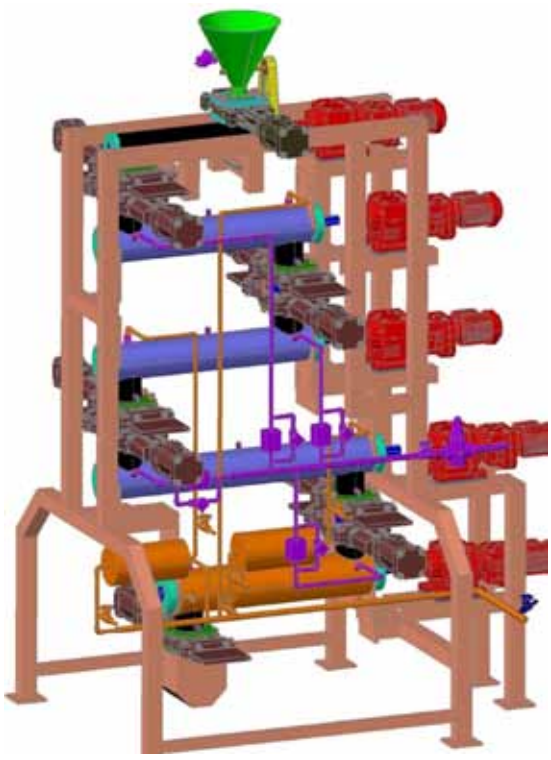
The main aim of the STOP project is to improve stable combustion conditions for biomass and biomass residues combustion plants. The project concentrates on fulfilling this goal through fuel-upgrading with main focus on torrefaction which is known to improve many of the fuel characteristics of biomass.

Briefly explained, torrefaction is a mild-pyrolysis process (200-300 °C) that can be employed as a pre-treatment step to improve properties of biomass fuels. The treatment can result in not only increased energy density, but also enhanced grindability, better homogeneity and better storage and transport characteristics for biomass fuels.

A new torrefaction reactor is an important element in this work. The reactor is under construction and will stand in the SINTEF/NTNU laboratory by the end of the summer. During the autumn the reactor will be thoroughly tested to be ready for detailed torrefaction studies starting in the beginning of 2012. The reactor is mainly composed of the following elements which are shown in the figure:

- Bin for raw material
- Feeding screw
- Drying conveyor
- Heating conveyor
- Torrefaction conveyor
- Sliding feeder between conveyors
- Product container
- Piping
- Instrumentation (not shown in the figure)
- Electrical and cabling (not shown in the figure)

The most important design parameters along with minimum and maximum operation range for the torrefation reactor are shown in the table on next page. As can be seen, the reactor is designed with broad parameter flexibility in mind. It will be able to process a wide variety of fuels and fuel sizes. In addition, the different temperature zones are controlled independently. The setup will be fully automated allowing a complete control over all the inputs and outputs of gases and solid materials.



Reactor layout

The setup will also be fully instrumented in order to have a complete characterization of the product gases from all the high temperature zones. The liquids produced during torrefaction will be collected for off-line characterization.

	Design values	Variations
Feed type	Woodchips, sawdust, straw, pellets	
Capacity	1.50 kg/h	0.17 – 6.96 kg/h
Pressure	‹ 300 mbar	
Temperature	250 °C	200 – 300 °C
Exhaust Temperature	‹ 300 °C	
Size	‹ 25 mm	1 – 25 mm
Bulk density	300 kg/m^3	100 – 600 kg/m^3
Conveyor filling	30 %	15 – 45 %
Product yield	70 %	50 – 90 %
Residence times (by section)		
	Design values	**Variations**
Drying	20 min	10 – 30 min
Heating	20 min	10 – 30 min
Torrefaction	60 min	10 – 90 min
Cooling	20 min	20 – 30 min

Important deliverables for 2011

The plan for this year concentrates on carrying out work that will result in two journal publications. The first one will focus on producing different torrefied materials in a macro-TGA with variations in fuel types (soft and hard wood), holdup time in torrefaction zone (30 and 60 minutes), particle size (cubes of 1x1 and 4x4 cm), and torrefaction temperature (225 and 275 °C). These experiments are now completed and have resulted in the production of 16 different types of torrefied materials. The produced fuels will be characterized in terms of physical and combustion properties. Among the planned measurements are; proximate and ultimate analysis, heating value, hydrophobicity (the fuel's ability to resist water absorption), grinding energy requirements and particle size distribution of the grinded materials. In addition, the produced gas from all the experiments was measured with a FTIR and a GC. A partial stream was also cooled down to −50°C in order to collect the liquid fraction.

The produced fuel from this deliverable will also be used in the second publication. This work is planned to start in September, and combustion kinetics studies will be performed in a micro-TGA. In addition, surface area measurements which also influence the reaction rates of combustion will be performed.

Other news

Biopower and biomass CHP seminars

A SINTEF seminar on biopower is planned 13 October in Oslo. The start-up of a Norwegian green certificate marked in 2012 and its influence on the profitability of biopower in Norway will be presented and discussed. The following day a biomass CHP seminar will be arranged within the KRAV project. The major results of this project and recommendations for small-scale biomass CHP in Norway will be presented. Seminar programs will be published on the SINTEF and the KRAV website.

www.sintef.no/KRAV

Nordic Bioenergy 2011

Nordic Bioenergy 2011 is arranged in Jyväskylä, Finland 5-9 September this year. SINTEF Energi will give 4 presentations in this conference, of which one is related to the STOP project. The titles of the SINTEF presentations are: 1) Cost-effective small-scale CHP solutions for the Norwegian market, related to the KRAV project, 2) Stable operating conditions in bioenergy plants through utilization of torrefied biomass, related to the STOP project, 3) Achieving low emissions and stable heat release from wood stoves and fireplaces firing at low load, related to the StableWood project and 4) Biofuels in Aviation – an overview, related to the GasBio project.

www.nordicbioenergy.finbioenergy.fi

IEA task 32 activities

IEA Task 32 "Biomass combustion and cofiring" arranged their first meeting this year in Graz in January. In conjunction with the meeting they organised two workshops; "Development of torrefaction technologies and impacts on global bioenergy use and international bioenergy trade" and "Aerosols from small-scale biomass combustion". The presentations are available on the Task 32 website. Liang Wang, SINTEF, participated in both the meeting and the workshops. Next IEA meeting is planned 19-20 October this year in Ireland.

www.ieabioenergytask32.com

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