Reflections

We are approaching the end of the year 2013 and by that the end of the STOP project. This is therefore the last newsletter that will be published in this project.

After working for a period of four years, it is inevitable not to feel somehow sad for being close to the end but also happy for having achieved so much. With the help of two PhD students and very good cooperation with NTNU, the deliverables were numerous and exceeding what was promised prior to project startup. This is however not a criterion for a successful project in itself, even though it is an important achievement. The project was developed and applied for in 2009 at a time when many were trying to establish themselves as the leaders of this thermal biomass pretreatment technology.

Now, 4 years later, the world of torrefaction is swarming more than ever but everyone seems to hold their cards even tighter to their chest fearing that the competition might gain an edge by learning details on the technologies of the others. As a research institute, SINTEF is sitting somewhat on the sideline and has been concentrating on basic and applied research and mapping the potential benefits of torrefaction in commercial appliances from this angle.

Being among the first ones to prove the benefits of torrefaction in such appliances is in our opinion the final proof for a successful research and development work. The finalizing of the last publications in STOP will continue after the official project termination and as many as 11 are planned to be published in international conference proceedings and in acknowledged journals. This project has also resulted in the construction of a unique torrefaction reactor that has been used actively in the STOP project and also in other SINTEF projects. The torrefaction reactor was an investment decision made and paid for by SINTEF, which shows the commitment and belief that SINTEF has in this technology.

It is not revolutionary to postulate that biomass, as a solid and inhomogeneous fuel in its raw form, is not the perfect energy carrier even though biomass in itself is looked upon as part of the energy solution in all scenarios that have been prepared with the mitigation of greenhouse gases in mind. The contribution of biomass utilization in such scenarios is given high importance in the short term solution perspective while awaiting the realization of the long awaited so-called "hydrogen society". The hydrogen dream is the ultimate idea for a CO_2 free society. However, even though hydrogen is the most common element in our universe, it is not an energy carrier that can be excavated from our oceans or from any other place on earth for that matter. Hydrogen needs to be extracted from other energy carriers which make biomass an important contributor even in a society based on hydrogen. In that sense, working on the development of a biomass pretreatment method such as torrefaction is not only important for our current energy solutions (i.e. as a means for achieving stable operating conditions in combustion plants) but also for future conversion technologies where biomass is needed.

As an example, torrefaction is present in Siemens' plans for the construction of their new methanol production plant based on entrained flow gasification of biomass. A consortium consisting of BioMCN, Siemens, Linde, and Visser & Smit Hanab, have received €199 million in grants for construction of this large-scale biomass refinery. This initiative, also known as the Woodspirit project, will make a significant contribution to the availability of sustainable and advanced biofuels, and to the bio-based economy in the Netherlands. It is interesting to notice that such enormous projects are being realized in a country that does not have the necessary biomass resources, and which relies on imported biomass. This means that for a country such as Norway, the possibility for playing an important role in sustainable energy production should be promising through export of biomass, including thermally upgraded biomass fuels. Especially when taking into account the large unused biomass resources in Norway in addition to the lack of finding a feasible alternative for the replacement of the biomass use in the pulp and paper industry.

But what about the current bioenergy situation in Norway and can torrefaction have a role in it?

The total energy conversion based on biomass in Norway is estimated to ca. 17.5 TWh (SSB, 2012). The above number is an estimate that also includes fractions that are irrelevant for torrefaction such as municipal solid waste, bio-oil and bio-gas.

The main energy conversion that is based on wood is distributed as follows:

- Private households (mainly residential heating through wood stoves) 7.3 TWh
- Industry 5.5 TWh (3.7 TWh of this comes primarily from the wood processing industry)
- Plants for heat and CHP 1.5 TWh

From the above distribution we can see that the biggest contribution comes from wood stoves. The traditional wood stove depends on wood logs, which will not be suitable for torrefaction because of its large size. However, as demonstrated in the STOP project, todays pellet stoves can benefit directly from mildly torrefied wood pellets. Pellet stoves, on the other hand, are still not the first choice for the Norwegian consumer due to the higher investment cost for this appliance compared to the normal wood stove. The clear advantage of the pellet stove lies in the more continuous combustion process compared to a wood stove, resulting in less emissions of unburnt, which is further improved with torrefied wood pellets.

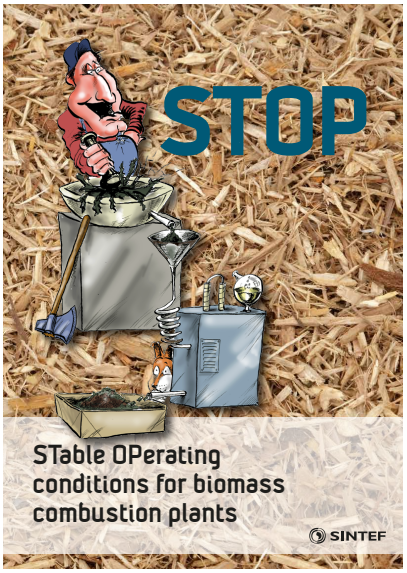
The second largest biomass consumer is the industry with an annual production of 5.5 TWh. This is usually an energy form that is used by the industry itself and is based on a feedstock that is a byproduct from their industrial process. An example is the wood processing industry that typically produces sawdust that is used onsite for energy purposes. This fraction will most likely be unavailable for torrefaction.

The third main consumers of woody biomass are producers of heat (mainly) and electrical power (a relatively small portion). These are distributed across Norway in the form of energy plants mainly connected to the district heating grid. Usually plants operators/owners are not research focused and are confined to feedstocks that are available in the Norwegian market. As always, the main drivers, profitability and operational improvements, are usually influenced by changes in the governmental emission regulations. There should be a potential for increased profitability for some of the plants, which can be gained through improved operational stability and increased efficiency. This can be attained by using upgraded fuels such as torrefied biomass. However, an accurate prediction can only be made through a case by case study. Operators that have instability problems in their operation should consider using torrefied biomass or as well the integration of torrefaction as a pretreatment method in their respective plants.

Other news

Project summary

A handbook has been finalized for the STOP project. The handbook summarizes the project and its results, and explains in an easily understandable manner what torrefaction is and what you can achieve by torrefying biomass. The handbook is available on the STOP website.



PhD work progress

The STOP PhD student will continue his study also next year, with further work and several planned publications mainly on wet torrefaction.

Task 33 and other conference participation

This year 2 meetings were held in connection to Task 33. The first meeting was hosted by NREL in Denver, Colorado where the new laboratory for energy integration was shown. The laboratory was built with self-efficient energy consumption in mind and presented interesting energy utilization solutions. The second meeting was held in Gothenburg where SINTEF presented its plans for the upgraded bio laboratory infrastructure. Details were given for the newly designed entrained flow gasification reactor and for the newly purchased pressurized TGA system. SINTEF was also present at the SGC (International Seminar on Gasification) conference in Gothenburg mainly for network building and for keeping an eye on new developments within biomass gasification technologies. On the last day of the seminar we had the opportunity to visit the GoBiGas gasification plant which was still not fully operational at the time of the visit. The GoBiGas is a gasification plant of 20 MW capacity built by Metso under a licence from Repotec for the production of bio-methane to be used as transport fuel. Repotec own the twin fluidized bed gasification technology that was developed by the Technical University of Vienna and is known for their demonstration and research activity at the well-known Gussing plant in Austria, which has been in operation for more than 10 years.

Illustrations: Kjetil Strand

STOP – STable OPerating conditions for biomass combustion

Contact: Roger Khalil • Roger.A.Khalil@sintef.no
SINTEF Energi AS (SINTEF Energy Research) • Trondheim, Norway • Phone: + 47 73 59 72 00 • www.sintef.no/energi

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