



Newsletter 2-2015

Progress in 2015

In 2015 focus has been on further work connected to the resource base, biocarbon production and logistics, as well as biocarbon end use properties. In 2014 focus was on startup of the project and the planned activities and deliverables for 2014. Various studies were started connected to the resource base and costs of these, fuel properties, feeding solutions, carbonization technologies and biocarbon conversion applications. The PhD position on modelling of biocarbon production was also announced, and filled.

BioCarb+ workshop at SINTEF

The annual BioCarb+ workshop was arranged 3 December 2015 at SINTEF, Trondheim, Norway. BioCarb+ research and industry partners gathered to present and discuss project activities.

BioCarb+ at Bioenergidagene

BioCarb+ was invited to present itself at Bioenergidagene, the annual conference arranged by NoBio 18-19 November 2015, Gardermoen, Norway. Øyvind Skreiberg presented the project in the session "Bioenergi i det nye energimarkedet" (Bioenergy in the new energy market). Presentations are available [here](#).

BioCarb+ at IConBM 2016

Two BioCarb+ abstracts were accepted for submission of full papers for presentation at the 2nd International Conference on Biomass 19-22 June 2016, Giardini Naxos-Taormina, Sicily, Italy. The accepted abstract titles are:

- 1) CO₂ reactivity assessment of woody biomass biocarbons for metallurgical purposes
 - 2) Value chain analysis of biocarbon utilisation in residential pellet stoves
- The manuscripts have now been submitted, and will go through a peer review process for final publication in Chemical Engineering Transactions.

BioCarb+ in Energy & Fuels

A manuscript entitled "[Biomass pyrolysis in sealed vessels. Fixed-carbon yields from Avicel cellulose that realize the theoretical "limit"!](#)" has been accepted for publication in Energy & Fuels. The abstract is given below.

"In agreement with prior experimental work, thermodynamics predicts differences in the outcome of biomass pyrolysis conducted in sealed, constant volume systems as opposed to constant pressure systems. In particular, much higher values of the fixed-carbon yield can be expected in constant volume systems. Avicel cellulose is known to give very low char and fixed-carbon yields; therefore we emphasized it in this work. Our tubing bomb results reveal: i) fixed-carbon yields that realize the theoretical "limiting" values when the vessel is pre-pressurized to a modest pressure with N₂ gas, ii) a gas product composed of steam (water), CO₂, with traces of CO, and virtually no tars. Above a small range of modest temperatures and pressures the char endures a molten phase and becomes a hard coke. The ash content of the char/coke reflects the composition of the glass wool and kao wool materials used to hold the Avicel powder in place."

This work is a key work in the efforts of maximizing the biocarbon fixed-carbon yield.

Remembering Michael Jerry Antal, Jr.

Prof. Michael Jerry Antal, Jr. sadly passed away October 21. He was a key research partner in BioCarb+ and a great colleague and friend through decades of many of us. His contribution to the scientific community really stood out from the crowd and he submitted the above mentioned Energy & Fuels manuscript just days before he passed away. He will be greatly missed, but never forgotten.

BioCarb+ students

A number of students have been or are connected to BioCarb+. In 2014 two students (Charissa Higashi and Kathryn Hu) from Hawaii visited Trondheim during the summer. In 2015 a summer student (Benedicte Hovd) financed by BioCarb+ within the SINTEF summer job program was working with aspects connected to biocarbon reactivity. This work is continued by a master student (Hau Bui) from Vietnam and a project student (Maria Zabalo Alonso) from Spain. Also in 2015, a PhD student from Hungary (Eszter Barta-Rajnai) visited Trondheim Aug-Sept, as well as an assistant professor (Zsolt Barta) from Hungary in September. A Belgian master student (Sam van Wesenbeeck) at University of Hawaii worked in the BioCarb+ project and there is also a link to a PhD student (Maider Legarra) at University of Hawaii. In addition the BioCarb+ PhD student (Kathrin Weber) is continuing her work. Hence, a significant educational activity is connected to BioCarb+.

New publications

Sam Van Wesenbeeck, Charissa Higashi, Maider Legarra, Liang Wang, Michael Jerry Antal Jr. [Biomass pyrolysis in sealed vessels. Fixed-carbon yields from Avicel cellulose that realize the theoretical "limit"](#). Accepted for publication in Energy & Fuels.

Øyvind Skreiberg (2015). [BioCarb+ Verdikjeden for biokarbon: Fra biomasse til energi](#). Bioenergisdagene 2016, 18-19 November 2015, Gardermoen, Norway.

Øyvind Skreiberg (2015). [BioCarb+](#). Presented in the session "Grensesprengende forskning" at Energiforskningskonferansen, 21 May 2015, Oslo, Norway.

Liang Wang, Gábor Várhegyi, Øyvind Skreiberg, Morten G. Grønli, Michael J. Antal, Jr. (2015). [Combustion Characteristics of Biomass Charcoal Produced at Different Carbonization Conditions](#). Proceedings of 23rd European Biomass Conference and Exhibition, 1-4 June 2015, Vienna, Austria, pp. 1196-1199.

Liang Wang, Charissa Higashi, Øyvind Skreiberg, Morten G. Grønli, Michael J. Antal, Jr. (2015). [Charcoal Production from Forest Residues](#). Proceedings of 23rd European Biomass Conference and Exhibition, 1-4 June 2015, Vienna, Austria, pp. 1184-1187.

Liang Wang, Kathryn Hu, Charissa Higashi, Øyvind Skreiberg, Viktor Myrvågnes, Morten G. Grønli, Michael J. Antal, Jr., Gábor Várhegyi (2015). [Effect of Storage Time and Conditions on Biomass Charcoal Properties](#). Proceedings of 23rd European Biomass Conference and Exhibition, 1-4 June 2015, Vienna, Austria, pp. 1180-1183.

BioCarb+ in the media

Lars Martin Hjorthol, Øyvind Skreiberg (2014). Lopwood and brushwood make high-grade charcoal. [Gemini](#).

Lars Martin Hjorthol, Øyvind Skreiberg (2014). Kvist og kvas blir edelt kull. [Gemini](#). Reproduced on [forskning.no](#), [Aftenposten nett](#) and [Adresseavisen nett](#).

Other news

IEA Task 32 Biomass Combustion and Co-firing

An [IEA Bioenergy Task 32](#) meeting was arranged in Berlin in connection with the [IEA Bioenergy Conference 2015](#), October 27-29. Final planning of activities for the next triennium (2016-18) was on the agenda. For more information about IEA Bioenergy Task 32 activities, see the recent [newsletter](#), and for IEA Bioenergy news, see this recent [newsletter](#).

EERA Bioenergy - Stationary Bioenergy

After arrangement of the EERA Bioenergy - Stationary Bioenergy Sub-Program workshop ECN in the Netherlands June 15-16, where the goal was to align efforts towards joint proposals, to e.g. H2020, within the stationary bioenergy area, the effort now is focused on selection of topics and coordination of efforts to establish joint proposals. For more info on EERA Bioenergy, visit the [website](#), and see the most recent [newsletter](#).

RHC technology platform

The activity level of the [RHC platform](#) has been limited this year, as new financing solutions have been sought and the originally planned strategy documents have been delivered. However, the activity level is expected to pick up in 2016, see the recent [newsletter](#) for more information.

Links (click on the links or logos to get there)

[BioCarb+](#)

[SKOG22](#)

[Energi21](#)

[Renewable Heating and Cooling technology platform](#)

[EERA Bioenergy](#)

[IEA Task32 Biomass Combustion and Cofiring](#)

