



Task 34 Pyrolysis Business Meeting Minutes 7-8 November, 2016 Novotel Hotel, Rotorua, New Zealand

Attendees

National Team Leaders (NTL):

Fernando Preto (FP) – CanmetENERGY, Canada

Christian Lindfors (CL) – VTT, Finland [representing Anja Oasmaa (AO)]

Nicolaus Dahmen (ND) – KIT, Germany

Bert van de Beld (BvB) – BTG, Netherlands

Ferran de Miguel Mercader (FM) – Scion, New Zealand

Magnus Marklund (MM) – SP-ETC, Sweden

Alan Zacher (AZ) – PNNL, USA: Task 34 Leader

Observers

Antti Arasto (AA) – VTT, Finland

Luc Pelkmans (LP) – Technical Coordinator IEA Bioenergy, Belgium

Kirk Torr (KT) – Scion, New Zealand

Monday November 7, 2016

1. Greetings and Introductions

FMM and AZ welcomed everyone to the meeting and ran through the agenda for the day. AO sent her regards.

2. Presentation of Participating Organizations

Presentation of participating organizations. Each research group presents their research (maximum 10 min per presentation) according to the following headings:

- History/background
- Current activities and focus
- Future aims

As there have been a lot of changes in the NTLs, and that we had not met in a year, it was decided to give a background on the participants as context. Presentations ran much longer than 10 minutes each, but it was valuable because a lot had changed with the addition of HTL and SvTL technologies to the Task. It was suggested in the future for similar activities to expand the time slot or actively manage the presentation length.

Presentations about direct thermal liquefaction activities at their organisations were given by Fernando Preto (CanmetENERGY), Christian Lindfors (VTT), Nicolaus Dahmen (KIT), Bert

van de Beld (BTG), Ferran de Miguel Mercader and Kirk Torr (Scion), Magnus Marklund (SP-ETC/RISE), and Alan Zacher (PNNL).

It was reported that UK is currently not part of Task 34, and it is unclear if that will change this triennium. Norway is also not part of the task and there is no additional news.

Suggested that Australia may consider participation in the task, and China may consider participation in IEA Bioenergy.

Action Items:

- 1) Presentations from Task 34 Rotorua: pdf and sent to AZ: ALL
- 2) Circulate presentations and minutes to members, and put on protected members area of website: AZ
- 3) Establish protected area on website and get passwords to NTL: AZ

3. Scheme for DTL technologies/ Systematization of Direct Thermochemical Liquefaction

Joined by LP for the afternoon.

ND presented a framework for a harmonized framework for seeing direct thermochemical liquefaction, with a presentation to set up the discussion and thoughts.

This was determined to be a valuable exercise because:

- 1) Can highlight the differences and similarities among FP, HTL, SvTL and their various liquid products.
- 2) Creates a uniform framework for reports on DTL within our individual countries.
- 3) One possible output is a version of the pyrolysis brochure that can be a liquefaction brochure.
- 4) A good starting point for explaining why (or why not) a particular technology fits into the framework.
- 5) Shows the interfaces between the feedstock, outputs, and other tasks
- 6) Can be the framework with which to navigate the technology in communications and on the webpage.

Many of the methods for liquefaction are actually combined pathways from liquefaction including catalytic, solvent, and reactant (included) and reactant (added)

If the process produces a liquid via a thermochemical process, then it fits into this framework.

Need to determine what is included and what is not, and where those interfaces are.

The focus should be on a liquid bio-liquid as a output, regardless of what it is used for.

There was some questions around the terminology to be used. Bio-oil versus bio-crude, and questions if it is clear enough. Bio-oils are more free flowing associated with FP, while bio-crudes are associated with HTL and higher viscosity. The consensus appeared to be that the existing terminology was sufficient.

The point was made that for liquid phase technologies, both solvolytic and thermolytic processes occur simultaneously and can be affected by different factors.

There is significant amounts of historical experience in the groups that have solvothermal liquefaction that need to be examined. Twente, Albany oil, some small scale work in many of the countries.

An outcome of the discussion is that it makes sense to consider FP, HTL, and SvTL as three separate lines of processing, each with catalytic and non-catalytic variants, for the production of either bio-oils or bio-crudes.

Inputs are different biomass sources as well as common co-feeds and solvents that are considered.

Applications would be similar to those considered for the original pyrolysis framework.

In addition, it would be good if the interface to other tasks could be captured (gasification, etc.)

The potential outcomes are:

- 1) DTL brochure
- 2) 1 or 2 page summary
- 3) The “framework” diagram could be a clickable index for the webpage descriptions
- 4) ND proposed that a review paper would be a good outcome of this effort.

Regarding the question of a Review of HTL as a potential task output: May be good to do now that captures a review of the revival of HTL research from 2010+ and reference and rely on the original 2002 review to capture the historical work prior.

UK (Tony) was working on a pyrolysis brochure, per June 2015 Task meeting in Hengelo, but the status of that is unknown. We may propose a modification of that effort that captures all three in one single output. We will need to talk to Tony to incorporate the FP into a single. Also need to understand authorship of the updated brochure. Need to pull up the Review Doug did in Robert Brown's book.

Depending on the status of the pyrolysis brochure, the Task needs to consider if it should be expanded to include HTL and SvTL? Or should stand-alone ones be prepared? Or should a general framework be the subject of the brochure that then references the individual technology brochures? (updates to HTL and SvTL may be more frequent as they are emerging fields.) Also need to make sure that this does not become a huge effort.

FP suggested that for brochure, it will be worth carefully selecting the photos, including the cover photo to avoid featuring a process/company that may go obsolete (as previously) or endorsements.

Need to determine if there is an IEA format, determine if there is any technical editing resources available, consider using ACS style guide.

Action Items:

- 1) Determine status of Pyrolysis Brochure revision at Aston by November: AZ
- 2) Provide potential process pictures and relevant technology papers for ND to work from: ALL
- 3) Prepare draft framework by December: ND
- 4) Agree on contents of framework by January: ALL
- 5) Draft version of brochure by March 2017: ND

4. Round Robin Update / What should be the focus of the upcoming round robin?

AZ provided the update from Dietrich on the manuscript of the RR from 2015 as follows:

“The word file is the draft paper, Doug has written something, mostly the introduction, and Bert had worked on some correlations which I have partly included. The graphs can be linked with the attached excel files through a right mouse click. I think they must be in the same folder. The references are added from my endnote library and have already the correct format

for “Energy & Fuels”. Further references should only be added from my endnote library to maintain the numbering.

I have avoided to present long tables with numbers and have rather tried to detect correlations or interesting parameters to discriminate technologies. I think, all the data (numbers) can be presented in a supplement files. You can discuss it with the group and the editors....”

Documents from DM will be circulated to the group for comment by December if possible.

Presentation was made by AZ on summary of historical RR over the last 20 years from Task 34. Will be circulated to Task.

Future RR: Discussion were held for planning purposes. It is important to get started on a RR soon to ensure it can be finished by the end of the Triennium. It was discussed that one RR would likely be the outcome this year, and the desire is to have something that incorporates HTL and SvTL to honor the new focus.

Comments on the prior lignin round robin: This may be something to consider in the future for SvTL and HTL to determine if it works better than FP

Standardization round robin should be published shortly. Calculated and heating values can be variable. Thus heating value analysis is one that is open and needed work.

Brainstorm of possible topics (assume that both bio-oils and bio-crudes are part):

- 1) Analytical RR, particularly for more individual compounds. Canada may be dealing with a new GHS (Global Harmonized Shipping) standards with strict labeling requirements. One question that needs to be answered is how does it interface with REACH and transition from MSDS. (FP)
- 2) Sensitivity analysis and TEA of integrated energy/materials as a opportunity for collaborations. (ND/FM)
- 3) Upgrading (different catalysts, same oil, to compare products) (MM)
- 4) Advanced analytical. (MM) [this is suggested in the work plan for 2016-18]
- 5) Should we consider collaboration in co-pyrolysis (biomass and plastic)? Sweden. Netherlands and Germany have difficult experience in co-pyrolysis due to different optimal.
- 6) Chemical recovery, must be as a function of knowing how that impacts the energy fraction. New Zealand Opportunity for interaction with Task 42. (ND)
- 7) Inorganics in bio-oils, impacts of these. (ND)
- 8) GPC or sugars analysis of oils.
- 9) Investigate suggestions on improved analytical from prior RR.
- 10) Lignin HTL/DTL (may be in the future, if not enough labs to participate.) Whatever is selected should consider bio-liquids from HTL and FP Suggestions based on REACH analysis: PAH, methanol, HMF. As the current methods may not be as repeatable. However, there may not be enough labs that can do the analysis.
- 11) 2D GCxGC methods
- 12) Heating Value, Sulfur, and Cl.
- 13) NMR
- 14) Thermal stability evaluation (particularly for coprocessing).
- 15) Replicate solvent fractionation method from VTT as an analytical RR (also including HTL oils). It should be done on bio-oils and bio-crudes and an analytical method.
- 16) BvB and ND made a proposal on a RR evaluating methods for heating value (LHV) vs. CHN(O) vs. water content for selected bio-oils, bio-crudes, and organic aqueous product. As heating value of oil may be used to set pricing for liquefied biomass, this could generate a correlation and compare analytical methods for those analyses at the same time.

Action Items:

- 1) Send out 2015 RR manuscript to all authors: AZ
- 2) Get 2015 RR comments by December: DE, DM, AO, BvB, AVB, MM
- 3) Prepare a 2-page summary of 2015 RR for public distribution: AZ?
- 4) Prepare a list of the options for RR for 2017 and circulate to task: AZ
- 5) Comment on options: ALL

Tuesday November 8, 2016 Day 2 of Task 34 meeting

5. Recap of Round Robin suggestions

Discussed the proposal from ND/BvB For potential comparison of heating value, water content.

CL reported that Anja had expressed interest in HTL and S and CI measurements as important. Also indicated that feedstock composition is important.

FM reported that there were some correlations on heating value that were evaluated in a prior paper by FM, that also may be considered.

The aqueous phase may be difficult to do calorimeters. Need to capture this to send to the group and to Anja, Dietrich, and Doug for comments.

Action Items:

- 1) Solicit input from Dietrich, Anja, and Doug: ND, CL, AZ

6. Country Reports

Presentation of country reports. Originally scheduled for 20min per country, but similarly to the organizational reports, presentations ran much longer than 20 minutes each, partly due to the year hiatus since last meeting, and due to addition of HTL and SvTL technologies to the Task. It was again suggested in the future for similar activities to expand the time slot or actively manage the presentation length.

Reports were given by Fernando Preto (Canada), Christian Lindfors (Finland), Nicolaus Dahmen (Germany), Bert van de Beld (Netherlands), Ferran de Miguel Mercader (New Zealand), Magnus Marklund (Sweden), and Alan Zacher (USA).

Discussion on the country reports on the website indicated that a mixture of the PPT and text reports were present. This needs to be updated. It is unclear what should be the reporting style going forward, but a public version of the presentation should be considered for the website.

Action Items:

- 1) All presentations from meeting to be sent to AZ: ALL
- 2) Slides to be saved as pdfs and distributed internally to task members: AZ
- 3) **Public version** of the slides need to be saved as pdfs for inclusion into the website.

7. Communication Strategy for IEA Bioenergy

LP reported on the communication strategy for IEA.

Comms and outreach is a focus of the IEA Bioenergy
Looking to put out "Verified information"

ExCo is requesting better profiling of the brand for IEA Bioenergy and for a unified organization. Asking for more emphasis on "IEA Bioenergy Task nn", rather than just "Task nn"

Focus on the relevance of the work, what is the message you want to spread, and who do you want to reach?

They hope that every report should have a 2 page summary and a 1 paragraph summary and a few bullet points, such that policy makers who would not read a journal article can get a useful summary from it. This would be an excellent solution to “making journal articles public” and rather just put out a 2-page summary that can be featured on the website and on the IEA Bioenergy main page.

Webinar: Looking for topics for the webinars and input and looking for ideas for special workshops if you have them.

Website: How to handle the PyNe history.

Leaflets/FAQ on current issues in public debate.

Looking for NTL's to use their individual networks for national outreach, particularly for making contact with potential new member countries.

8. Intertask work

Intertask work was discussed. On the table is the current interest/ability to participate in the two intertask projects that are available.

Success stories: Initial discussions with the three commercializing pyrolysis companies have resulted in two of them declining to participate, and one that will consider participating if other companies do. The hesitation appears that from a previous iteration of a similar request, they would be asked to disclose information that they considered business sensitive or proprietary.

Mitigation: AZ will review the request again and provide to BvB, CL, and FP to determine and appropriate and comfortable level of information to requested. BvB will try again, CL indicates that it is unlikely, FP indicates that they are too busy to respond. An alternate strategy is to work with the communications coordinator to create an alternate means to prepare a 3rd party write-up to publicize the industry successes.

Pretreatment: After review of Heat treatment as a pretreatment strategy, it was the group consensus that their experience has been that torrefaction is unlikely to go forward as a viable strategy. Thus it is unlikely this would make a great contribution.

Acid washing, was suggested as one that has some applications for a case study.

FM and others will consider the current work on it, and AZ will check with the intertask to determine if this would be feasible.

9. Website Review

The new transitional web page on the IEA bioenergy server was reviewed. It is acknowledged that it is currently under construction.

Suggestions:

- 1) Strike News from the menu, replace with newsletter.
- 2) About should have a shorter bullet list on what is really covered and a link to the text.
- 3) Members link was broken and needs fixing
- 4) Members only section should be de-emphasized if possible
- 5) Technology applications should be integrated based on the DTL scheme that ND is working on.
- 6) Existing content should be captured from PyNe ASAP

7) PyNe address should be re-routed to the new page and kept to maintain historical link

Action Item: AZ will update website and report back.

10. Newsletter Input

Newsletter was reported as published in October 2016, Issue 39.

Issues were noted on the distribution list:

- 1) It was acknowledged that there may be privacy issues for Aston sharing the prior list
- 2) Can we ask UK to send a message out to the previous distribution list to re-subscribe?
- 3) Can we rebuild the list from scratch?
- 4) Can we look into something like mailchimp. It might cost \$10 or \$15 per month, but would be a good way of keeping an automated mailing list.

Created a list of potential articles for Issue 40, due to be published in January 2017.

All articles detailed below to be sent to AZ by 15 **December 2016**.

All

Topic	Author	Action
Existing article from Eijenhorst that AZ left out of 39	Eijenhorst	AZ
Existing article 1 from Wolter Prins to obtain from Aston or Wolter	TBD	AZ
Existing article 1 from Wolter Prins to obtain from Aston or Wolter	TBD	AZ
Commissioning of Upgrading Demoplant at PNNL	Doug Elliott	AZ
Lycella	Steve Rogers	FM
?	Wim Brilman	BvB
DTL Scheme overview	Nicolaus Dahmen	ND
Alucha	??	??
LignoHTL		AO/CL
Pyrolysis at UMSICHT	??	ND
Staged condensation (or possibly for 41)	MM	MM
Biofuels Roadmap for NZ		FM
Potential article 1 from Canada TBD		FP
Potential article 2 from Canada TBD		FP

11. Plan for Next Task 34 Meeting

Discussion ensued to plan out meetings for the rest of the triennium.

Sweden was suggested for Spring of 2017. Two options were considered:

- 1) May in Gothenburg to coincide with ExCo79, mid may.
- 2) June to coincide with conference in Stockholm

Voiced opinions favored May for Gothenburg (May 17/18). MM with check for arrangements, determine the potential, and check with Task 33 or other tasks to determine if there are potential joint activities or workshops. Report back to NTLs.

Fall 2017 was proposed for Canada. FP will determine potential. Visit maybe to Ensyn. Maybe ABRI. Should be October in Ottawa. Early october if possible due to weather.

Spring 2018 in Netherlands was offered as an option. BvB will advise.

Fall 2018 in San Francisco was suggested in order to coincide with the end or the triennium ExCo.

Meeting closed.

Summary of Actions

Action	Responsible
Presentations from Task 34 Rotorua: pdf and sent to AZ	All
Circulate presentations and minutes to members, and put on protected members area of website	AZ
Establish protected area on website and get passwords to NTL	AZ
Determine status of Pyrolysis Brochure revision at Aston by November	AZ
Provide potential process pictures and relevant technology papers for ND to work from	ALL
Prepare draft framework by December: ND	ND
Agree on contents of framework by January	ALL
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Send out 2015 RR manuscript to all authors	AZ
Get 2015 RR comments by December	DE, DM, AO, BvB, AVB, MM
Prepare a 2-page summary of 2015 RR for public distribution	AZ
Prepare a list of the options for RR for 2017 and circulate to task	AZ
Comment on options for RR	ALL
Solicit input from Dietrich, Anja, and Doug	ND, CL, AZ
All presentations from meeting to be sent to AZ	ALL
Country report slides to be saved as pdfs and distributed internally to task members along with the minutes	ALL
Public versions of the slides need to be saved as pdfs for inclusion into the website.	ALL
Update website with task suggestions and report back.	AZ
Submit ALL newsletter articles to AZ by 15 December	ALL
Obtain existing articles from Wolter Prins (2)	AZ
Article on commissioning of upgrading demoplant at PNNL, Doug Elliott	AZ
Article from Wim Brilman	BvB
Obtain Lycla article from Steve Rogers	FM
DTL Scheme overview article	ND
Alucha article	??
LignoHTL article	CL/AO
Pyrolysis at UMSICHT article	ND
Consider article of staged condensation for this or issue 41	MM
Biofuels Roadmap of NZ article	FM
Obtain two potential articles for newsletter from Canada	FP
Investigate holding May/June 2017 meeting in Sweden	MM
Investigate holding October 2017 meeting in Canada	FP
Investigate holding Spring 2018 meeting in Netherlands	BvB
Investigate holding Fall 2018 meeting in USA with ExCo end of triennium	AZ