

## 2019 Meeting minutes

### 2019 S-1075 Meeting Notes

Meeting Opened: 9:07 am

Day 1:

Attendees: Dorin Boldor, David Brune, Sergio Capareda, Danielle Julie Carrier, Chengci Chen, Shulin Chen, Ming-Hsun Cheng, Sabyasachi Das, Ali Demirci, Yanhong He, Gal Hochman, Haibo Huang, Jameson Hunter, Loren Isom, Yuyao Jia, Qing Jin, Haider Kadhum, Ryan Kalinoski, Ajay Kumar, Xiaolu Li, Carl Lira, Can Liu, Enshi Liu, Jose Martinez-Fernandez, Jessica McCord, Ganti Murthy, Rilwan Oyetunji, Vivek Patil, Scott Pryor, Kent Rausch, Ken Reardon, Timothy Rials, Roger Ruan, Christopher Saffron, Ajay Shah, Jian Shi, Scott Strobel, Wei Wen Su, Bernie Tao, Mike Tumbleson, Lisbeth Vallecilla Yeppez, Makua Vin-Nnajiolor, Terry Walker, Yi Wang, Sanjita Wasti, Mark Wilkins, Alvin Womac, Fei Yu, Ning Zhang, Yi Zheng, Nan Zhou.

Scott Pryor welcomes attendees. Introductory comments, 35 participating institutions, ~100 participants; feedstocks, conversion, and systems analysis are the three primary goals; thanks to NREL for providing the venue; thanks to Mike Tumbleson and Kent Rausch for composing the proceedings; thanks to Chris Saffron for writing the NSF grant that funds graduate students; thanks to Mark Wilkins for organizing the meeting location. 9:12

Jim McMillan (NREL) discusses the need for bioenergy. IEA task leader, cost of feedstock is the single biggest cost. Fuels must be co-produced with high value niche products. NREL works on biochemical and thermochemical platforms, performs TEA, and algae growth and conversion. 9:15

Tim Rials, University of Tennessee, thanks to organizing committee. Sees and uptick in bioenergy and biorefining programs. Encourages the attendees to develop collaborations. Thanks NREL. 9:20

Mark Wilkins provides an update on USDA NIFA, who are being moved from Washington DC to Kansas City. Timothy Connor is this meeting's NIFA representative, bioenergy and bioproducts program lead. Move to Kansas City will happen by September 30<sup>th</sup>. 68% of NIFA is refusing to move to Kansas City.

Members introduce themselves. 9:23

Station reports at 9:35. Nebraska, University of Minnesota—microwave pyrolysis, pilot microwave pyrolysis, applied pyrolysis to plastic conversion; Penn State—moved into a new building, modeling feedstock production, mechanical conditioning of Miscanthus bales, biomass conversion into methane by AD, hydrolytic enzyme production from DDGS, metabolic engineering, aviation biofuels; Oklahoma State University—syngas fermentation to C2 to C6 alcohols, syngas cleanup, LCA and TEA; Michigan State University—engineering tools for modeling of polar fluids, bio-oil upgrading, microbubble fermentations, anaerobic digestions, cellulosic biofuels using decentralized pretreatment and pelletization; University of Illinois—energy sorghum, corn germ use; University of Texas—gasification technology, graphene production, graphene sheets from biochar; University of Tennessee—use field measurements for equipment performance for switchgrass (cost of feedstock to biorefinery = \$55-68/dry ton), 63-85% of lignin converted to phenols using supercritical fluids, cross ties are being processed and >95% of creosote is recovered; Clemson University—enzymatic conversion of cottonseed oil, algae oil, hemp-seed oil, biodiesel facility is operating converting waste oils to biodiesel on campus;

Louisiana State University—Epscor grant acquired, laser-based pyrolysis of lignin, lignin dimer and trimer deconstruction using different solvents, PU-based foams, lignin-based nanoparticles, anti-cancer applications of lignin, molecular simulations of lignin interactions with solvents and cells, utilization of algae waste, biodiesel production; Ohio State University—logistics and systems analysis, new method of harvesting corn reduced cost 20-30%, logistics of pennycress, anaerobic digestion of organic waste, hydrothermal carbonization of digestate; University of California Davis—food waste conversion to make PHA, fertilizer products from AD food waste and economic model being developed, treating almond hulls with alkaline pretreatment, consolidated bioprocesses using fungi to eliminate the need for cellulases, decision support tool to determine optimal fuels and electricity from biomass; University of Kentucky—lignin-derived antimicrobials, endocarp lignin for Li-ion based batteries, industrial hemp for fiber development, Jim Beam is donating money for a new institute; Montana State University—camelina research as per \$1 MM grant from DOE, attempting to increase sugar content in sugarbeets, industrial hemp development; Washington State University—biopolymers and biomaterials development, pyrolysis (received a grant with PNNL) to convert crop and forest residues to jet fuels, functionalization of biochar, bio-oil upgrading to improve qualities, fractionating lignocellulose into different constituents to make jet fuel by oxidation using hot water, lignin valorization, sequential hydrothermal liquefaction, engineering a yeast that produces lipids, anaerobic digestion with hyperthermophiles (>60C); Mississippi State University—gasification of pine wood chips to make liquid hydrocarbons, olefins, and aromatics, reforming of biogas including catalyst development; Virginia Tech University—biotechnology to convert biomass (food waste), brewing industry collaboration, wet fractionation to collect protein to feed fish, residues converted into biochar, USDA Foundational program funds to convert food waste to butanol using membrane system to separate butanol and ethanol from fermentation broth; University of Hawaii—alternative protein to replace fish meal, utilizing lipids as alternative feedstock using microbial methods of conversion, products from papaya; North Dakota State University—biomass densification, e.g. pelleting, TEA of cost-benefits, can reduce enzyme loadings and hydrolysis times, MESP can be reduced by \$0.58/gal; Purdue University—new building opening at the end of 2020, high value products from biomass, enzyme catalysis of cellulose, metabolic flux analysis, hemp fiber conversion to high capacity ion exchange resins, low-energy plasma to sterilize food; Rutgers—producing a consistent flow of duckweed, direct nitrogen reduction, decentralized system using ammonia; University of Missouri—aquaculture waste conversion into products, tilapia is needed with brine shrimp in the system ensures health; Oregon State University—ultra high solid hydrolysis reactors, geospatial and temporal analysis to determine biomass growth areas; Kansas State University—high efficiency pretreatment; Auburn University—hydrophobic bio-oil epoxy binders to wood composites, enhanced biofuel production using *Clostridium beijerinckii*, enzyme production.

Approval of agenda—approved 12:31

Approval of minutes—approved 12:32

Update to meeting list—station director must fill out Appendix E for list to be populated 12:33

New business—New secretary elected for the 2020 meeting—Ajay Kumar (Oklahoma State University) 12:34

Next meeting location; two destinations nominated: 1. Lincoln, NE, July 9-10 (just prior to ASABE in Omaha, NE); 2. Auburn, AL. Votes for Lincoln = 18; votes for Auburn = 2. The 2020 meeting will be held in Lincoln, NE on July 9 and 10.

Business meeting closed 12:47

Mike Guarnieri—NREL 1:00, presentation:

Photoautotrophic biocatalysis, i.e. microalgae; Methane conversion by Methanotrophs—making muconic acid; Novel bioreactor design; Electro-biochemical methane production

Justin Sluiter—NREL 1:30, presentation: Biomass characterization and carbohydrate quantification

RIN prices for cellulose are ~\$1.13/gal; starch EtOH credit is \$0.50/gal; Need to discern between cellulose and starch in biomass samples; NREL LAPS being altered/improved

Day 2:

Anne Starace—co-processing of pyrolysis bio-oils 8:05

Fluid catalytic cracking is an insertion point; Petrobras performed study with vacuum gas oil with some success showing the potential of co-feeding biomass and vacuum gas oil; 13C Oak from Isolife used as feedstock; Do see isotope scrambling with zeolite catalysts for aromatics, oxygenates and alkenes; CO<sub>2</sub> comes from biomass; Impetus is to show refiners that biogenic carbon is being incorporated; La MFI reduces; coke percentage

Nick Rorrer—Plastics upcycling 8:35

Performance advantaged biofuels with better thermal, barrier, mechanical properties; plastics are the “answer to the artist’s dream”; beta ketoadipic acid has lower embodied energy and CO<sub>2</sub> emissions than petro-based adipic acid; PET upcycling to valuable products; PETase and MEHTase convert PET to terephthalic acid; PET conversion to thermosets; PET sells for \$0.90/lb; energy savings and reduced greenhouse gas emissions with bio-based feedstock

11:25

Student poster awards: 3<sup>rd</sup> place Enshi Liu, 2<sup>nd</sup> place Xiaolu Li (Washington State University), 1<sup>st</sup> place Yanhong He (Virginia Tech)

End of next week is when reports are due. No breakout sessions this year, but maybe next year.

Thanks again to NREL for providing presentations, posters, and tours of their facility.

## **Tentative Agenda for S1075 Multistate Committee Meeting**

*Organizing Committee:* Scott Pryor, Mark Wilkins, Chris Saffron, Kent Rausch, and M.E. Tumbleson

**Lookout Mountain Ballroom 1, Hampton Inn Denver West Golden, 17130 W. Colfax Ave., Golden, CO**

29<sup>th</sup> July, 2019 (Day One): **Symposium on “Science and Technology Driving the Bioeconomy”**

8:15 am-9:00 am : Poster set up

9:00 am-9:05 am: Welcome and introduction

9:05 am-9:15 am: Opening remarks by NREL representative

9:15 am-9:30 am: Welcome and opening remarks by Tim Rials, S-1075 liaison, and USDA, National Institute of Food and Agriculture representative.

9:30 am-9:45 am: Introduction of attendees

9:45 am-10:45 am: Station reports

10:45 am-11:30 am: Poster session

11:30 am-12:00 pm: Business meeting

Old Business

Approval/Additions of 2019 Meeting Agenda

Approval of 2018 meeting minutes: Mark Wilkins

Progress on updates to S-1075 email list and station representatives contacts

New Business

Election of secretary

Symposium topic, location, and dates for 2020

Other additional items for discussion

12:00 pm-1:00 pm: Lunch break with posters

1:00 pm-1:30 pm: Mike Guarnieri, NREL Molecular Biologist

1:30 pm-2:00 pm: Justin Sluiter, NREL Research Chemist

2:00 pm-3:00 pm: Break, travel to NREL, security badging

3:00 pm-4:00 pm: Tour Biochemical Platform facilities

4:30 pm-5:30 pm: Self-selection of attendees into working groups (Perhaps focused on the four foci areas: feedstock selection; preprocessing and pretreatment; conversion and product separation; technoeconomic feasibility and environmental sustainability). Working groups to identify critical research issues.

5:30 pm – Meeting adjourned until 8:00 am, July 30. Dinner is on your own.

30<sup>th</sup> July, 2019 (Day Two): **Symposium on “Science and Technology Driving the Bioeconomy”**

8:00 am-8:30 am: Nic Rorrer, NREL Polymer and Biomaterials Development

8:30 am-9:00 am: Anne Starace, NREL Chemist

9:00 am-9:30 am: Travel to NREL

9:30 am–10:30 am: Tour Thermochemical Platform facilities

11:00 am-11:30 am: Reporting by group leaders and synthesis of the comments received from the group

11:30 am-11:45 am: Closing remarks and meeting adjournment

11:45 am: Box lunch, attendees depart.