

The 4th International Conference on Biofuels Standards: *Current Issues, Future Trends* hosted three Panel Discussions, in addition to the presentations, to provide opportunities for discussion of broad-based topics and to articulate possible future actions. Brief summaries are provided on each of these Panel Discussions to share some of the overarching issues that were identified.

Panel on Future Trends

The **Panel on Future Trends** was chaired by Dan Friend, the Technical Program Director for Energy Research within the Material Measurement Laboratory at the National Institute of Standards and Technology. Dan leads strategic planning in NIST's broad energy portfolio and provides support and representation in the energy sector in domestic and international arenas.

In order to focus the panel discussion, three questions were drafted and discussed with the panel members prior to convening the panel session. The questions are listed below:

- a) *Prediction.* What do you see as the future in the regulatory/policy/treaty realms? Are things stable or evolving? Include, if you will, definitions/requirements/metrics for sustainability. Consider a 5-10 year horizon.
- b) *Suggestion:* What would be your roadmap toward a mature biofuels industry? What are the decision points and time scale? Would you like to see a fairly homogeneous and centralized industry ("big oil") or de-centralized multi-path and flexible industry? How would you get there? Consider a 25 year horizon.
- c) *Request:* What is your highest priority for a research goal and/or a new standardization process?

The panel members were selected based on their activity, participation and leadership in the broad arena of biofuels standards and provided representation from a variety of stakeholder perspectives. The list below shows each panel participant, the affiliation and the aspect of the biofuel community they represented based on experience and knowledge.

- Ortwin Costenoble (ortwin.costenoble@nen.nl) from the Netherlands Standardization Institute provided the perspective of the European standards development organization
- Humberto Brandi (hsbrandi@inmetro.gov.br) from INMETRO provided the perspective from the Brazilian national metrology laboratory
- Mark Rumizen (mark.rumizen@faa.gov) from the U.S. Federal Aviation Administration provided a perspective on the certification process for aviation biofuels
- Rosangelo Araujo (rmoreira@anp.gov.br) from the National Agency of Petroleum, Natural Gas and Biofuels in Brazil provided a perspective on testing of finished biofuels
- Anders Røj (Anders.Roj@volvo.com) from Volvo GTT, Sweden provided a perspective from the land transport industry
- Laurel Harmon (laurel@lanzatech.com) from LanzaTech provided a perspective from a biofuel producer
- Chuck Corr (corr@adm.com) from Archer Daniel Midland provided a perspective from an agricultural commodity company and biofuels producer.

In response to the questions presented to the Panel, a range of topics were covered including:

- a) difficulty of establishing a robust, scientific definition of sustainability (especially when social and human factors are included);
- b) difficulty of predicting the interplay between utilization of different alternative energy sources (wind, electric vehicles, inexpensive natural gas, biogas, biofuels, etc.) and maintaining the efforts to develop biofuels;
- c) concerns about safety in the aviation field, and possible slowing down of developments in utilization of biofuels in aviation;
- d) need for expansion of utilization of biofuels in marine applications;
- e) harmonization of regulatory and policy environments in international markets to encourage development and use of biofuels on a global scale;
- f) need for standards to address fuel quality issues and migration to performance-based standards; need to move away from individual pathway approach, to make the certification processes manageable;
- g) cost of implementing regulations for fuel quality, for example the number of samples required to meet regulatory requirements;
- h) need to keep in mind the interplay between biofuels and other bioproducts, when assessing the economics of specific pathways.

Some of the overarching issues that were identified were the following:

- There was a general consensus that biofuels, and more generally bioenergy, will continue to be a factor in all energy discussions, but it was noted that electric vehicles, natural gas, and biogas will compete with liquid biofuels.
- There was a concern that a projected lack of stability in the regulatory environment hinders strategic planning and investment, and there was a continuing discussion of the scientific metrics that inform sustainability policies.
- The variety of fuels and processes in the biofuels sector—a complex system—was seen as both a benefit and difficulty in achieving progress under the forecast regulatory regime.
- Performance-based standards and quality systems were seen as key features in the biofuels portfolio.
- Globally accepted standards and test methods were seen as keys to a mature biofuels industry; a scientific basis must underpin such standards.
- Within a harmonized standards/testing model, regional and diverse feedstocks and technologies were seen as the path forward. There was the concept of achieving economies of scale through a “small big oil” concept.
- Among the most immediate research needs identified were those related to:
 - (1) fuel economy (standards and materials for the current fleet and optimized vehicles in the future);
 - (2) developing next generations of biological organisms (from plants to microbes) and related reference materials;
 - (3) maintaining and advancing fuel quality through analytical processes and advances in test methods;
 - (4) improving the scientific basis of sustainability and risk/technology assessments; and
 - (5) moving the industry to a larger scale – via process intensification.

CONFERENCE CONCLUDING REMARKS

It was generally agreed that this has been an enjoyable discussion. We have seen a divergence of opinions, and we shared a lot of thoughts and viewed truly wonderful presentations. For example, the effect of water has been called out at this conference and is something we need to look at seriously. This conference brought together many communities, the aviation and transportation communities, the standards organizations, and the research community; with that, it enabled cross talk, and exchange of information and technology. We had a wonderful program and great speakers, and provocative panel discussions. We thank our speakers for interesting and informative presentations. We thank the organizers and the Program Committee for their outstanding work. We thank the attendees for being here, participating in the discussions and sharing their thoughts.