Bioenergy Technologies Office

2017 Program Management Review

Waste To Energy

Luca Zullo

Arlington, Virginia

July 13, 2017

Presentation Outline

1. Peer Review Process (2 slides)
   - Review Panel Members
   - Review Panel Approach
2. Project Scores (1 slide)
   - Data Summary (range, median, min, max, etc.)
   - Top performing projects
3. Overall Impressions (5 slides)
   - Impact
   - Innovation
   - Synergies
   - Focus
   - Commercialization
4. Overall Recommendations (1 slide)
   - Actionable Recommendations (~3 suggestions to program)

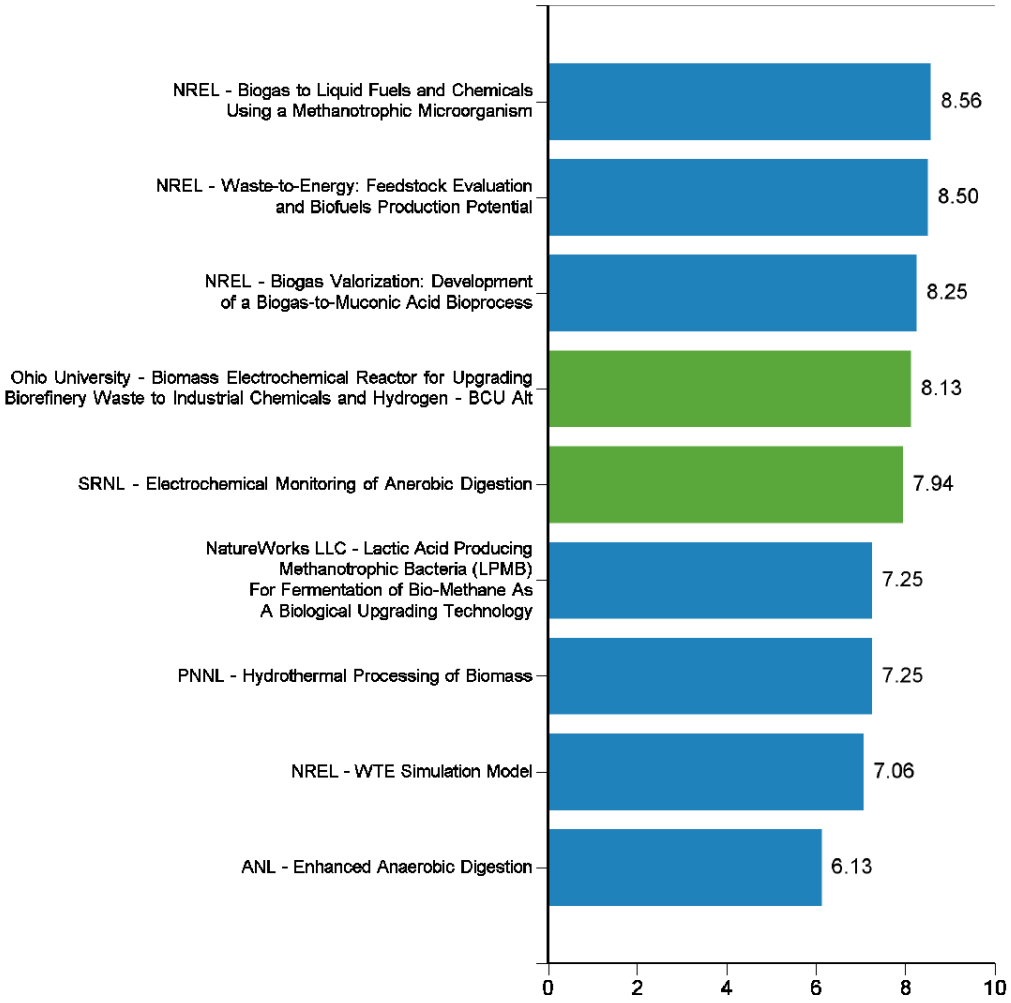
Peer Review Process

Waste To Energy Review Panel	
Name	Affiliation
Luca Zullo*	VerdeNero LLC
Phillip Marrone	Leidos
Brandon Emme	ICM, Inc.
Jeremy Guest	University of Illinois at Urbana-Champaign

Review Panel Approach

- It is the unanimous opinion of the Review Panel that the introduction of WTE area is consistent with the larger BETO mission and a welcome addition to the portfolio.
- While technical issue specific to individual projects are discussed in the relevant review, the panel tried to identify common threads and synergies in the program.
- Reference to specific projects in general comments are made when relevant to the general area.
- Criticism in the area of focus and commercialization are not detracting from the overall value of the portfolio
- As a new area of the portfolio, WTE is still being defined and we aim to help with improving its scope and definition for the future.

Project Scores



Project Categories: SunSetting | Ongoing | New

Overall Impressions: Impact

- High potential impact
  - Leveraging the existing massive waste handling infrastructure with its captive and known economics provides the opportunity for very large impact.
- To maximize the impact it is necessary to acknowledge some unique characteristics:
  - Localization and distribution of resources
  - Scale
  - Existing regulatory framework which offers both challenges and opportunities
  - Other beneficial services which are provided by converting waste into energy beyond the “BTU value”
- Focus on “wet” waste could logically expand to include also the organic fraction of MSW which is not part of an existing recycling program.

Overall Impressions: Innovation

- Excellent
  - We observed a positive innovation drive even its execution and focused was at time dispersed
  - One of the oldest technologies around – Anaerobic Digestion - is ripe for innovation and the program reflects it.
    - New uses of biogas/biogas as a carbon source for advanced bioprocessing
    - Enhanced/Modified digestion
    - Enhanced control and monitoring of digestion
    - Whole biogas utilization
  - Electrochemical upgrade of wet lignin shows a novel and very relevant approach.

Overall Impressions: Synergies

- Considerable synergies with other important area. Excellent leverage from those.
  - Methane as a carbon source for bioprocess creates an obvious synergy between natural gas and biogas.
    - Scalability and whole biogas utilization
  - Organic fraction of MSW. Not directly discussed in WTE, but an obvious synergy
    - Blend stock for other cellulosic feedstock.
  - Integration of ”wet” feedstock in the available domestic supply of biomass

Overall Impressions: Focus

- Some improvement needed
  - As a relatively new area we notice some lack of focus.
    - Some project may have started in different programmatic areas
  - Lack of consistent presentation/metrics between projects
  - Lack of consistency in TEA
  - Unclear or excessively optimistic commercialization pathways.
  - On the positive side, clear identification of wet feedstock as an unique opportunity.

Overall Impressions: Commercialization

- Acknowledged, but too often not a priority or a confused one.
  - The benchmarks used are not always relevant or easily linked to the current industrial practice.
    - HTC is not well known outside the R&D community
  - Regulatory constraints and common industry practices were not considered as they should. While it should not be seen as an obstacle to innovation, the implication for commercialization are important and should not be ignored.
  - The panel found in general found that TEL was at times overestimated and the TEA parameters too optimistic.
  - Some but all not project had identified strong third party commercial partners. More of those and more of their involvement is needed.

Overall Recommendations

- Continue and extend the focus on fundamental of AD and biogas utilization from Microbiology of complex consortia to enhanced control and monitoring with an improved approach to TEA and assessment of technology maturity
- Develop methods and standards that the industry may be able to adopt. Use realistic benchmarks which relate to the industry and can be used by practitioners.
- Continue the modeling and inventory effort, but recalibrate it by starting at the local level. This can be a clear area of leadership for BETO.