



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Bioenergy Technologies Office

Program Management Review

Steering Committee Observations

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BETO Portfolio

- What are the overall strengths and weaknesses of BETO's project portfolio?

- **Strengths:**

- IBRs constructed and in commissioning or operations

- **Weaknesses:**

- More than 50% of DMT annual budget going to DPA project funded by BETO and managed by DoD.
 - Not clear how integration of program goals and lessons learned are accomplished.
- Existing DMT projects are maturing but without replacement DMT projects entering the portfolio.
 - Additional conversion pathways moving to demo stage.
 - DMT is vital to reducing technical, investment, and societal risk.
 - » Balance of pilot, demonstration, and IBR ?

BETO Portfolio

- What areas are performing well?
 - Analysis and Sustainability efforts are making great progress.
 - Algae program now has data to support refocusing upstream to algal biomass yields and overcoming productivity limits.
- Where are improvements needed?
 - Social elements, including water and public health, are lacking from analysis models and TEA type documents.
 - Need societal permission to build out the bio-economy.
 - Need better ways to communicate with various publics & decision makers.
 - Lexicon, stories, videos, lessons learned, ... need to be audience specific.
 - Need to improve conversion process economies to support distributed (50-250 tpd) biorefinery business models, depots, and producers of intermediates.

BETO Portfolio

- Does BETO's portfolio of projects adequately address key 'threats' to the commercialization of an advanced bioenergy industry?
 - Program's techno-economic focus does not effectively counter well organized and funded opponents of biomass and biofuels that are part of the operating landscape now and for the future.
 - Failures at and of pioneer facilities provide fodder for opponents.
 - Role and services from BETO and partners to respond or assist not well defined .
 - Risks and uncertainties extend well outside technology risks and are not well understood or internalized – particularly social license to operate.
 - Lack of societal acceptance, concern, and skepticism is a critical weakness that is non-technical in nature. Need to build buy-in at all levels by focusing on how bioenergy provides benefits and solutions to societal challenges that cannot be met other ways.
 - Program not positioned to respond to the magnitude and speed of price volatility in the fuels markets. Need to communicate the "long view."

BETO Portfolio

- Does BETO's portfolio seek to appropriately capitalize on key opportunities?
 - Need to support urban, “small” and “local” successful deployments with cost-effective bioenergy under well-understood value propositions.
 - Home heating oil blendstock, marine fuel oil,...
 - Need to better capitalize on leveraging opportunities with other federal agencies, states, communities, interest groups, and industry in the U.S. and abroad.
 - Opportunities arise from increasingly available data on environmental, public health, and other negative effects of carbon intensive fossil fuels.
 - Need to address social issues on what bioenergy can solve with regards to the environment, public health, and international carbon/sustainability policies.
 - Opportunities to more-strategically collaborate with industry, investment community, and other nations on demonstration scale facilities, pioneer facility construction, etc.

BETO Portfolio

- Are there any gaps in the funding portfolio?
 - Insufficient support for intermediate liquids business/technology models.
 - Sugars, syrups, hydrolysate, py-oil, HTL liquids,...
 - High moisture biomass supply chains for conversion processes desiring high moisture feedstocks – biochem, HTL, HTC, Biogas, algae.
 - More funding for DMT. Pilot and demo projects are costly, but vital.
 - Waste streams to fuels, power and products.
 - Both the Algal area and Terrestrial Feedstocks areas note that increased focus on the upstream supply chain rather than downstream conversion is warranted.
 - Need to increase the emphasis on high value co-products to improve cost-effectiveness of relatively low-and-volatile-price transportation fuels .
 - Portfolio does not adequately consider co-locating to reduce capital and operating costs – with downstream refiners, co-product users, energy sources, ...

- Are there areas along the bioenergy supply chain where BETO should place more or less focus?
 - Feeding feedstocks across temperature & pressure boundaries, separations, and catalyst life continue to be big deal common-core technical risk issues.
 - More emphasis on pilot, demonstration scale, and pioneer facilities.
 - Increase utilization of national, university, and private pilot facilities.
 - More emphasis on chemicals and non-transportation fuels (bio-fuel oil).
 - Less emphasis on algae conversion technologies and maintain or increase emphasis on algal biomass production technologies.

Coordination of Technology Areas

- Is there adequate coordination between the different technology areas?
 - Coordination is mostly effective and getting stronger in areas identified as weaknesses two years ago.
 - Need enhanced coordination between R&D and lessons from DMT.
 - Identify and communicate non-proprietary research questions and data needs
 - Significant need for greater interagency cooperation and coordination such as with the USDA and the DOE Terrestrial Feedstocks area, and with DoD in conversion.

Synergies

- Are there synergies or lessons learned that BETO should be better taking advantage of?
 - Need to fully document lessons learned and issues surfaced from pioneer facilities (POET, Abengoa, INEOS...) and translate them into research questions to guide labs and FOAs.
 - Many scale-up issues cannot be discovered or identified without operating pioneer commercial scale facilities. Other perceived issues may be found to be irrelevant after full-scale operations.
 - Need improved systems to capture and disseminate technical, economic, operational, and financial lessons learned.
 - High turnover both in DOE/BETO as well as within the research participants creates risks that learnings may not be captured or retained for future use. This was identified as an issue in the 2013 Program Review.

Project Impacts

- Overall, is BETO funding high impact projects that have the potential to significantly advance the state of technology for the industry?
 - Yes –
 - Pioneer commercial-scale conversion facilities across regions and feedstocks.
 - High-tonnage feedstock projects leading to new systems and equipment.
 - Commodity feedstocks for the second 100 IBRs.
 - The 3 new demonstrations/pioneer facilities appear to need substantial support to achieve DOE/BETO mission outcomes.
 - Continue to support high-risk, unconventional incubator research and stepout concepts that may have breakthrough and paradigm-changing potential if their technical goals can be reached.

Project Impacts

- Does BETO's portfolio include novel and innovative projects that represent the newest industry thinking?
 - Portfolio does not adequately cover distributed intermediates business models and smaller local-based biorefineries/bioproductions.
 - Technology needs should be considered to enable petroleum refinery co-location and abandoned asset repurposing for biorefinery development.
 - A number of research projects focus more on studying problems rather than providing knowledge and data to enable solving problems. All projects should have meaningful economic goals as well as their technical research goals.
 - Need to understand international strategies and tactics of firms and consortia to appropriately leverage DOE/BETO programs.

Project Impacts

- Is the focus of BETO support appropriate in light of private sector investments in these technologies?
 - The use of workshops, RFI, and round-table events provides important industry guidance as to what is appropriate role and activities for BETO.
 - Need to understand international finance and policy drivers for early-stage and mature firms that drives off-shoring of facilities.

Technology Pathways

- What feedback can you provide on BETO's technology pathways, as described in the Wednesday morning (3/25) plenary session?
 - Need to identify the common core elements that span pathways, common science needs, technological innovations, environmental impacts, needs for permitting data, engineering data, etc.
 - Need to identify and support relevant co-products that improve economics and sustainability for each pathway.
 - Need to understand scalability implications, emissions implications, ...
 - Maintain and increase attention and mitigate risks ensuring raw materials sustainability.
- Can you provide feedback on the pathways themselves and BETO's Techno-Economic Analysis?
 - Use of DMT data to inform and validate techno-economic analyses is a strength.

Technology Pathways

- Are there new technology areas that you would recommend BETO start to invest in more significantly?
 - Waste streams to energy
 - solid, liquid, organic gases, food, forest, biosolids, agricultural processing, industrial, ...
 - Petroleum refinery co-location and other site-leveraging opportunities.
- What feedback can you provide on BETO's proposed new areas of focus, including fuels/vehicles systems optimization, aviation and marine biofuels, and other early market-adopters?
 - Early market adopters outside of automotive fuels are likely to improve biofuels acceptance by public and diffuse the debates over renewable vs fossil fuels.
 - Early supply chain and conversion adopters are likely to have regional and local supply and product contexts.
 - Leveraging DOE funds with other agencies.
 - DOT, NASA, FAA, USDA and DoD
 - Seek areas to collaborate with industry groups, advocates, public health, environmental and conservation groups, community economic development ...

Budget Priorities

- Are BETO budget priorities adequately aligned to overcome key barriers and meet the goals and objectives of the Office?
 - Science budget is probably ok.
 - Funding conversion technologies versus feedstock is very skewed in favor of conversion technologies. Rebalance towards terrestrial feedstock supply chain improvements and algal productivity/yield appears necessary.
 - BETO budget should emphasize quantifying and reducing uncertainties and risks to ensure other financing parties (government and/or private sector) can move promising projects to demonstration and pioneer scale.
 - Leveraging with USDA, DoD, federal Loan Guarantees and state/local programs to fully address the gap between funding research and demonstration plants and the actual commercialization of larger scale biofuels developments.
 - More dissemination of accurate information to educate public and decision makers.

Budget Priorities

- In which technology areas should BETO put more or less focus on for future budget planning?
 - More focus on analysis and knowledge about social, community, siting, environmental permitting, and related topics that will delay or kill siting of depots, producers of intermediates, and IBRs.
 - Provide data and knowledge to support others in this arena.
 - More focus on understanding how the investment and public policy community defines and quantifies risks, uncertainties, and other factors that drive up cost of money and willingness to invest.
 - What does investment risk calculation consider?
 - How do communities decide to be supportive or not?
 - More dissemination of accurate information to educate public and decision makers.

Other Technologies & Market Trends

- Are there other technologies and market trends that could impact BETO's goals, such as the increase in natural gas production and the fall in oil prices?
 - Price/supply volatility and rates of change for gas and oil costs.
 - As feedstocks become commodities or just better quality through preprocessing, new competing markets and uses outside of fuel will emerge.
 - More work is needed to improve understanding issues of market acceptance of increased ethanol blends with gasoline - not in the sense of 'marketing ethanol,' but better understanding market resistance to it.
 - BETO contribution to achieving International Climate Change goals are important today and into the future.

Other Technologies & Market Trends

- Can you provide recommendations on ways to mitigate the impact of these technologies and market trends, on achieving the goals of the Office?
 - To counter perception of biofuel as uncompetitive, emphasize “long-view” and the need to develop technology now to address society’s needs - not for next three years, but for the next three decades.
 - Biomass/bioenergy can address local energy needs in stranded communities/regions that are not benefitting from lower oil and gas costs.
 - Better dissemination of analysis results with regards to sustainability and competitiveness and how it contributes to the bioeconomy.

Key Summary Points

- Social Systems are as important as technical and economic systems
- Investment Community Needs for information and data
- Leveraging / Interagency cooperation to achieve shared goals
- Demonstration – Increase believability, improve certainty, reduce perceived and real risks
 - Environmental, health, sustainability, economic impact, investment return
 - Direct personal connections to and benefits of bioenergy – “Thanks to what you are showing and telling, I know how this technology, site, product makes my life better”