

Dear Colleague:

This document summarizes the comments provided by the peer reviewers at the U.S. Department of Energy (DOE) Biomass Program's Peer Review meeting, held on November 14-15, 2007 in Baltimore, MD and Platform Reviews conducted over the summer of 2007. The Platform Reviews provide evaluations of the Program's projects in applied research, development and demonstration. The Program Review provides evaluations of the Program's projects in analysis and an evaluation of the overall program strategic approach, balance across research areas, resource allocation and future plans.

This Report includes first a review of the presentations from the Program Review (analysis and the program element overviews) then includes project reviews from the Platform Reviews (feedstock production and logistics, biochemical conversion, thermochemical conversion, integrated biorefineries, infrastructure, and biodiesel and other). Each presentation was evaluated and scored. The weighted scores are based on a 4-point scale involving five criteria. The scores and peer review comments are included in this report. To furnish all presenters with direct feedback, all evaluations and comments are provided to each presenter; however, the authors of the individual comments remain anonymous. The principal investigator of each project is instructed to fully consider these summary evaluation comments, as appropriate, in their FY 2008 plans. Additionally, the recommendations of the reviewers have been taken into consideration by DOE Technology Development Managers in the generation of future work plans. This report includes highlights of program adjustments in response to reviewer comments.

I would like to express my sincere appreciation to the reviewers. It is they who make this report possible, and upon whose comments we rely to help make project and programmatic decisions for the new fiscal year. Thank you for participating in the 2007 Peer Review meetings.

The Biomass Program plans to conduct their next Peer Review in the spring of 2009. Details about the next review will be posted on our website at www.eere.energy.gov/biomass. We look forward to your participation.

Jacques Beaudry-Losique
Biomass Program Manager
Office of Energy Efficiency and Renewable Energy

Program Peer Review Summary Report	1
Introduction.....	1
Discussion of Program Direction:	2
Program Funding:.....	2
Specific Program Responses to Select Reviewer Comments:	3
Initial Reviewer Feedback	4
Program Peer Review Full Comments and Scores	5
Platform Overviews (from the Program Peer Review)	12
Platform Peer Review Summary Reports	38
Process Overview.....	39
Platform Review Summaries	44

Program Peer Review Summary Report

Introduction

The first section of this report focuses on the Peer Review Panel at the 2007 DOE Biomass Program Merit Review, held on November 15-16, 2007, at the Tremont Plaza Hotel in Baltimore, Maryland. The purpose of the program review was to evaluate the Program's performance and strategic planning as well as the contribution of the individual Platforms to Program goals, and alignment with the President's "20-in-10" plan.

The Peer Review process followed the guidelines of the Peer Review Guide developed by the Office of Energy Efficiency and Renewable Energy (EERE). The Peer Review Panel members, listed in Table 1, attended the meeting and provided comments to the Biomass Program on the Multi-Year Program Plan, Program Overview Presentation, Platform Overview Presentations, Platform Peer Review Reports and Presentations, and Analysis presentations. Peer review panel members include experts from a variety biomass related backgrounds representing academia, industry, finance environmental and the environmental communities. Additional members of the panel served as chairs of the platform reviews across the biofuels supply chain (feedstock, conversion, biorefineries, infrastructure and end use, and other). Each of the eleven panel members was screened from a conflict of interest perspective per the Peer Review Guide.

Name	Organization	Expertise/Area
Ralph Cavalieri	Washington State University	Academia
Terry Jaffoni	Clean Transportation Fuels	Ethanol industry
Irvin Barash	Vencon Management, Inc.	Finance
Daniel Sonke	Protected Harvest	Environmental
Todd Werpy	Archer Daniels Midland	Products
Lyle Stevens	John Deere (retired)	Feedstocks
Donald Johnson	Grain Processing Corporation (retired)	Biochemical Conversion
Mark Jones	Dow Chemical	Thermochemical Conversion
Bill Cruickshank	Natural Resources Canada (retired)	Biorefineries
Mike Tumbleson	University of Illinois	Biorefineries/Neutraceuticals
David Terry	Governors' Ethanol Coalition	Infrastructure and End Use
Shaine Tyson	Rocky Mountain Biodiesel	Biodiesel and Other

In addition to the program peer review panel comments this section of the Peer Review Report gives an overview of the program direction and funding as background for the comments that follow. The second section of the report provides a description of the process used for the Platform Peer Reviews and the peer review panel comments on individual projects.

Discussion of Program Direction

President Bush laid out aggressive goals for moving biofuels into the marketplace to reduce the nation's dependence on foreign sources of energy and reduce greenhouse gas emissions from the transportation sector. Specifically, the President's goals are to:

- Foster breakthrough technologies needed to make cellulosic ethanol cost competitive with corn-based ethanol by 2012¹
- Increase the supply of alternative and renewable fuels to 35 billion gallons per year by 2017 (the 20-in-10 plan)²

The federal government responded to the 20-in-10 plan by increasing the membership of the Biomass Research and Development Board (Board) and the frequency of meetings. The Board is co-chaired by the DOE and Department of Agriculture (USDA) and includes senior level members from eleven federal agencies. The Board is developing a National Biofuels Action Plan that supports the 20-in-10, which is planned for release in the summer of 2008. Even though the Plan has not been released publically, the Board has already begun to organize and oversee Interagency Working Groups to begin implementation of the Plan.

Additionally, the DOE Biomass Program has laid out an aggressive strategy in research and development of biomass feedstock and conversion technologies; demonstration and deployment of large-scale, integrated biofuels production facilities; and development of biofuels infrastructure in support of the President's goals. The Program strategy is currently focused on cellulosic ethanol; however, a study will be conducted in FY2008 to evaluate the potential contribution of fuels other than ethanol toward the 20-in-10 plan and the federal role in developing those fuels. The study will inform future Program planning to add targets and goals for additional biofuels to the Biomass Program Plan.

The Program recognizes the need to continue to increase emphasis on feedstock production and logistics. More emphasis is also planned for thermochemical conversion through platform research and development and demonstration in integrated biorefineries. Distribution Infrastructure and End Use development was initiated in FY2007 in partnership with the Vehicle Technologies Program with testing of intermediate blends of ethanol (E12, E15 and E20) as a potential pathway to enable full utilization of increased ethanol production, while minimizing cost and infrastructure challenges. The testing will evaluate potential environmental, health and safety impacts of these intermediate blends. Additional Distribution Infrastructure and End Use plans will be developed in FY2008.

Program Funding

The Biomass Program budget more than doubled from FY2006 to FY2007 with an appropriation larger than the request and no congressionally directed projects within appropriated funds. As a result, FY2007 was a planning year with several active solicitations for key program areas including: commercial scale integrated biorefineries; integrated biorefineries that are 10% of commercial scale; saccharification enzymes; fermentation organisms; and synthesis gas clean up and fuel synthesis.

¹ Advanced Energy Initiative. (February 2006) The White House National Economic Council
http://www.whitehouse.gov/stateoftheunion/2006/energy/energy_booklet.pdf

² 2007 State of the Union Address, 20-in-10: Strengthening America's Energy Security,
<http://www.whitehouse.gov/stateoftheunion/2007/initiatives/energy.html>

Specific Program Responses to Select Reviewer Comments

Reviewer Comment	Program Response
Program Overview (Initial Reviewer Comments)	
Program should better define “transportation fuels”, and use the standard definitions to set R&D priorities (Need to articulate why the fuel of choice is the priority)	The Biomass Program agrees and is evaluating the potential of biofuels other than ethanol to contribute to the President’s 20-in-10 plan. Fuels that have the potential to be deployed within the next 10 years will be given priority. The Program plans to release a report on the potential of transportation biofuels other than ethanol in the fall of 2008.
Appreciate use of systems approach to decision making. Review panel encourages further use of analysis results to effect program changes and decisions. (tracking vs. managing)	The Biomass Program agrees and will seek to implement the reviewer recommendation.
Resource allocation does not seem to mirror the needs of industry <ul style="list-style-type: none"> • Thermochemical is underfunded • Feedstocks funding increase is applauded, but should continue to be increased 	The Biomass Program agrees and will seek to implement the reviewer recommendation. The study to evaluate the potential of fuels other than ethanol to contribute to the President’s 20-in-10 plan will inform the direction of the thermochemical area and resource allocation.
Platform-level Comments	
Feedstock Logistics and Integration are instrumental pieces to the Program. Resources should be allocated accordingly.	The Biomass Program agrees and is conducting a 10-year planning process to update the biofuels strategy and evaluate resource needs across the supply chain. Feedstock logistics and integration activities will support both the conversion R&D activities and the integrated biorefineries. As such resources will be allocated appropriately.
Applaud the creation of an infrastructure and end-use platform	The Biomass Program has initiated end use activities of evaluating the impact of intermediate blends of ethanol on vehicle emissions, performance and lifetime. The Program will coordinate with other Federal agencies, specifically the Department of Transportation and the Environmental Protection Agency to inventory biofuels distribution infrastructure and end use activities and develop a cohesive federal plan.
Middle distillate replacement potential needs to be quantified and evaluated to help define priorities of “diesel replacement”	The potential opportunities and needs for middle distillates will be included as part of the study to evaluate the potential for fuels other than ethanol. This study will be completed in the fall of 2008.
Other Comments	
The reviewers encourage the Program to review and implement the Reviewer Comments noted at the Platform Reviews.	The platform reviewer comments are included in the appropriate sections of this report with Biomass Program response.
Would like to see more coordination in intra- & inter-agency relationships (i.e., USDA and DOE feedstock activities)	The Biomass R&D Board is a federal interagency Board with senior level representation from eleven agencies. Since May 2007, the Board has been meeting monthly to coordinate federal biomass activities with a focus on biofuels to support the President’s 20-in-10 plan. The Board is developing a National Biofuels Action Plan that is planned for release in the summer of 2008. Implementation is through interagency working groups across the supply chain and in cross cutting areas.

Initial Reviewer Feedback

- Applaud the program's portfolio expansion to include alternative biofuels in addition to ethanol
- Program should better define "transportation fuels", and use the standard definitions to set R&D priorities (Need to articulate why the fuel of choice is the priority)
- Appreciate use of systems approach to decision making. Review panel encourages further use of analysis results to effect program changes and decisions. (tracking vs. managing)
- Resource allocation does not seem to mirror the needs of industry
 - Thermochemical is significantly underfunded
 - Feedstocks funding increase is applauded, but should continue to be increased
- Reviewers recognize increased diversity of feedstocks in Program focus, and encourage linking between all platforms' feedstock work to maximize effort

Platform-level Comments

- Feedstock Logistics and Integration are instrumental pieces to the Program. Resources should be allocated accordingly.
- Biochemical Platform is well organized and focused correctly
- Conduct a critical review of the thermochemical conversion program – if the potential for fuel production exists – additional funding should be applied
- How will the results of program success be used in terms of setting future direction (i.e., UOP – pyrolysis, syngas conversion)
- Applaud the creation of an infrastructure and end-use platform
- Middle distillate replacement potential needs to be quantified and evaluated to help define priorities of "diesel replacement"
- Potentially include biodiesel in the end-use platform

Other Comments

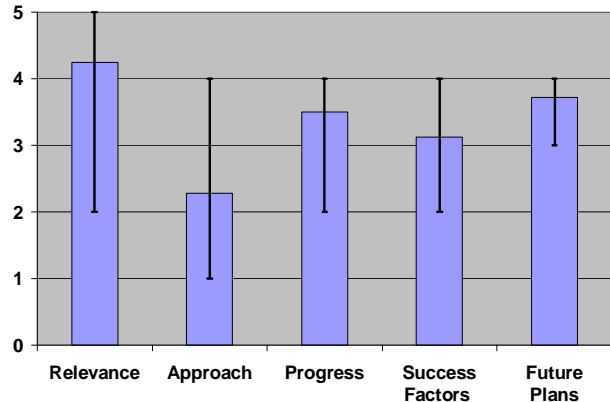
- The reviewers encourage the Program to review and implement the Reviewer Comments noted at the Platform Reviews.
- Would like to see more coordination in intra- & inter-agency relationships (i.e., USDA and DOE feedstock activities)
- The reviewers thought some of the presenters could have done a better job of relating their efforts to the program goals and conversion technologies discussion

Program Peer Review Full Comments and Scores

Program Overview

Presenters: Jacques Beaudry-Losique (Biomass Program)

	Average Score	Delta Minimum	Delta Maximum
Relevance	4.25	2.25	0.75
Approach	2.29	1.29	1.71
Progress	3.50	1.50	0.50
Success Factors	3.13	1.13	0.88
Future Plans	3.71	0.71	0.29
Average	3.38		



Question 1: Program Planning

- How many people are involved in the program? How many department heads? What is the mechanism to solicit external changes? What are reporting relationships? How is the program monitored as quarterly?
- The MYPP is of very high quality. Barriers, targets, goals et al. are appropriate, logical and considered sufficient to meet Program objectives.
- Rigorous impressive document. Clearly establishes rationale for focus on biofuels as most immediate path to achievement of program goals. Strategic goal aligns well with DOE, EERE vision, mission and strategy, with key drivers (climate change, petroleum fuel displacement) and with President's "20-in-10" and Advanced Energy initiatives. Supply chain model provides correct framework. Plan achieves an appropriate balance between focus on ethanol and other biofuels
- The document is excellent and a treasure trove of information, targets and plans.
- The program is well aligned and managed to about the 85% level. There are issues that seem to be addressed to balance the portfolio.
- This is my first interaction with the Biomass Program and I was quite impressed by the way the Program has utilized planning, analysis, systems integration, and related tools to develop and guide its MYPP. Overall, the MYPP does an excellent role at targeting its resources at appropriate and logical activities. I am also pleased at the way industry resources are utilized, such that the Program supports the development of the industry rather than competing or working against it.

Question 1b. What improvements can be made to improve the MYPP effort?

- The quality of the plan is best understood from the tasks of the individual managers and their resources for accomplishing the tasks.
- The MYPP and the Biomass Program's movement toward a more comprehensive approach to a variety of biofuels from a larger variety of feedstocks as well as its response to the 20-in-10 challenge are admirable. While the draft I reviewed still has some incomplete sections and some inconsistencies of structure, it reflects an excellent effort at strategic, programmatic planning.
- Specific Comments: The role of biodiesel/renewable diesel needs to be critically evaluated and its role in achieving Program goals better defined.
- I don't have much to say in the way of changes-I think the plan is outstanding and we need to move forward with it. Suggest more thought be given to how current petroleum

distribution system works e.g. how a single fuel and a fungible system keeps costs down and assures reliable supplies. Diversity of fuels will be problematic in the marketplace as there is no practical way to identify and preserve fuels. Performance targets are important but they may actually end up being irrelevant- \$1.33/gal by 2012 and \$1.20/gal by 2017 are based on EIA gasoline price projections which I think are too low---given uncertainties in commodity price relationships and policy environment, it is entirely possible that higher cost targets would work-thus lowest cost technologies should be developed and deployed as quickly as possible. Biodiesel should be given special emphasis as it is a fuel that is commercially available today, however, I don't think a separate platform should be established for Biodiesel.

- Need to get a better handle on real cost of feedstock.
- Re-examine the thermo-conversion (why is it so attractive now when it was shelved twenty or so years ago by NREL.)
- There are still projects that are carry-overs or are inserted into the program. This detracts from the overall program. As already stated, this seems to be improving.
- My major suggestion is that the Biomass Program seek a forum with high-level USDA administration to specifically pursue coordination of feedstock (and, to some extent, infrastructure) platform activities. There certainly seems to be cooperation occurring, and staff report that this has improved from previous years. However, there still seems to be a sense of the right hand not knowing what the left is doing. While DOE certainly can't force action from USDA, if I was to attend a review in future years I would like to hear that this had been attempted. A similar relationship with the EPA may also be beneficial. My suggestion in #1 is primarily out of concern that the Biomass Program not be caught behind the curve on sustainability issues. The utilization of biomass has much potential for environmental benefit; however, it also has potential for harm. The Program cannot afford to be caught unprepared on these issues, even if the production of feedstocks technically falls into the domain of USDA. I am pleased to see the Program looking into issues of water conservation. While this is a hot button issue right now, it is hardly the only sustainability issue. I am pleased to see the Program pursuing non-ethanol renewable fuels, thermochemical production pathways, and integration of production systems. These may prove to be important in the future and hopefully the Program will be responsive if and when these investigations show promise. That said, I think that Program has done a good job, for the most part, at using systems integration to prioritize its current activities.
- Consumer participation is required to achieve fuel displacement goals. The Plan should emphasize paths that are least disruptive to consumers; e.g. produce fuels that are most similar to current fuels. No pressurized gases, maximum vehicle driving range reduction of 10%.

Question 2: Resource Allocation

- It appears that the resources are inadequate. 15 staff at DOE HQ and a similar amount in Golden, although the labs contribute, requires substantial adjustment. A significant budget increase for this program is required. The capabilities of the individuals in the program are excellent.
- The total resources dedicated to this effort are insufficient to meet the challenge. While it appears that success is likely on the conversion processes, there is a huge gap in effort and resources in feedstock development, which is of immediate concern due to the long term nature of such development activities. There should also be more resources dedicated to strategic analysis activities, including life cycle assessment (LCA).

- More resources should be allocated to feedstocks, particularly with regard to logistics. Thermochemical resources should be increased if justified following a full re-evaluation of its potential to contribute to meeting Program goals.
- FY08 request of \$179 million is double that received in FY05-this seems reasonable in light of Herculean effort required. Need to beef up funding for thermochemical platform and in particular for gasification, which was cut 40% in FY08 request. Don't know what FY08 funding request is for integrated biorefineries and distribution and end use platforms as well as crosscutting market transformation activities so I cannot comment. Prioritization must be given to generic pathways that have best chance of generating immediate and impactful results. Support public-private partnerships to mitigate risk, leverage expertise and funds, which improve overall chances for successful demonstration and deployment.
- A critical look at thermochemical conversion technology is needed, and if the technologies hold promise, more funding should be afforded. Also, more funding is appropriate to get at real cost of feedstocks when they are being utilized at volumes anticipated.
- Feedstocks and thermochemical seem to be underfunded. Other funding is about OK, congressionally directed not figuring into this comment.
- I would suggest an increase in the feedstock and thermochemical platforms to address some of the suggestions made by reviewers.
- The potential for the thermochemical platform to produce fuels that are more compatible with existing infrastructure than ethanol requires that it be given as serious a look as ethanol has gotten.

Question 3: Program Strategic Approach

- The new MYPP reflects the responsiveness of the program to changing national and stakeholder priorities.
- The conversion platforms and integrated biorefinery platform are responsive to stakeholder needs.
- There is no evidence that the feedstock platform is responsive to the needs of feedstock growers or providers.
- Strategy exhibits good understanding of biofuels market dynamics, competing technologies, barriers and policy issues. More focus is needed on outreach to environmental community, auto/oil stakeholders. Program must consider economics in mandated markets separately from economics in so called discretionary markets whereas in mandated markets there are no substitutes for meeting requirements of RFS, in discretionary markets, refiners can chose to blend their gasolines using more iso-octane and alkylate, thereby reducing demand for ethanol.
- Good planning, targets. The updating of strategies is being done incorporating externalities such as market changes and societal concerns.
- There is too little involvement of the oil industry and too little international involvement. It might be that neither can be addressed, but they are lacking.
- The use of systems integration tools and independent analyses certainly paints a picture of a program which is responsive to external market changes and stakeholder needs. Based on my limited knowledge of the Program's past, it appears there has been a response to new developments, but with an increasing focus on investing resources where they will have the greatest impact.
- The number of flexible fuel vehicles (FFVs) and E85 fueling stations needed to meet gasoline displacement goals is far more than the general public (stakeholders) will be willing to invest in.

Question 4: Biomass Program Portfolio R&D Balance

- (Balance over Biomass Supply Chain (i.e., Feedstock Production, Feedstock Logistics, Conversion, Integration, Deployment and End Use))
- More activities should regard infrastructure requirements and impacts.
- More effort is needed in feedstock production. The biomass projects assume a doubling of productivity. The only way to drive down the cost of purposely grown feedstock is to improve per acre and per input cost productivity. It is also necessary to improve the cost of feedstock logistics including in field and off field technology.
- The Program is considered balanced with respect to the platforms included in it i.e. no new platforms needed (save for the decision regarding the future of biodiesel). However as indicated above, there is need for rebalancing within and/or between several platforms.
- Balance over supply chain appears to be good but would like to see more emphasis on areas downstream of the biorefinery-lack of adequate and efficient distribution infrastructure will be a critical barrier to overcome ---this is an area not well understood and often overlooked-also more emphasis needed on end use.
- I thought the work breakdown structure for these areas as described in the MYPP was lacking substance.
- The program appears to be on target for the 2017 objectives. The supply chain needs more emphasis, to get at the real cost of feedstock when done on a large scale. An integrated pilot plant must be run soon on a continuous basis to uncover issues with recycle streams.
- Feedstock area seems under funded.
- The issues related to Feedstock Production are my biggest concern for the Program. I would advocate for more investment here to invest more in sustainability issues, feedstock development (not just corn and switchgrass, though these are certainly worth of attention too), and regional resources outside of the Midwest.
- I think it wise to add the infrastructure platform, as this might otherwise be a weak link in the chain.
- Inadequate funding for feedstock production. DOE's version of the supply chain really starts at logistics.

(Balance over Research Categories (i.e., Analysis, R&D, Deployment, Demonstration, Communications))

- I think more funding should be directed at analysis. Good policy and program direction is based on adequate analysis. R&D should not be decreased.
- Communications can be enhanced through partnerships.
- To this point the balance is good. However as commercial scale biorefineries near reality, there will be a need for increased outreach and communication to the public and stakeholders.
- More focus needed on communications and outreach, especially to environmental community, and the general public.
- Core R&D remains an important activity, but analysis should be done to identify policy initiatives that will support program goals.
- Good balance of tasks to reach targets.
- Overall I am very pleased with the way the Program has targeted its investments in R&D. A slightly greater look at non-ethanol processes and non-switchgrass energy crop development might be worthwhile, but overall it is impressive.

- Demonstrations need something important to demonstrate, such as a solution to the fuel mileage problem of ethanol.
- Analysis requires a lot of ground truth to be sure models reflect reality. Not sure I see adequate stakeholder input to analyses.

Question 5: Proposed Future Research

- As noted above, feedstock development (across all potentially significant production and collection sources) must be increased. Genetic improvements come slowly, so efforts that will be successful in 10 to 20 years have to be supported now and for the duration. Implicit in feedstock quantity and diversity is the need to develop the collection and related logistical systems.
- There is an urgent need to enhance the funding in thermochemical conversion as it can be useful for the 20-in-10 plans through its ability to convert heterogeneous biomass (already collected woody materials and MSW in particular) into useful imported petroleum replacement fuels and chemicals.
- As identified in the reviewer report-out, it appears that thermochemical conversion is under-represented and should be critically evaluated for an increase in resources. Thermochemical conversion can provide several alternative transportation fuels or blend stock not available via biochemical conversion.
- The feedstock platform requires an increase in resources. This is considered to be the most critical requirement for the Program. No reliable supply of feedstock to any biorefinery equals no biofuels and bioproducts, no matter how great the conversion technology.
- Higher priority should be given to 1) gasification 2) environmental impacts of biofuels 3) energy balance well to wheels definitive analysis 4) food vs fuel economic analysis 5) LCA carbon footprint of biofuels 6) pipeline R&D, 7) policy research and in particular how biofuels can tie in to Climate Change cap and trade program 8) market research (if needed) to demonstrate value of branding program like “Energy Star” 9) research on ethanol corrosivity, permeability, volatility, biodiesel NOx emissions 10) feedstock logistics R&D.
- As mentioned above, more emphasis on feedstock cost is needed and perhaps specific availability. This may be achieved with the 10% of commercial scale and commercial biorefinery demonstration programs, but they are down the road a spell and the data are needed now. It was also mentioned above that an integrated continuous pilot run is needed soon for a reasonable length of time to uncover the many recycle issues that are bound to appear.
- The program generally holds together well, meeting the stated goals. It is generally well managed and funded. It is an important program and DOE funding broadly probably does not reflect this importance. As already stated, within the Program, feedstocks and thermochemical seem anemic.
- My comments related to exploration of non-ethanol processes and a wider array of energy crops stem mainly from a desire to see the Program remain nimble to take advantages of developments which may come from any sector. Overall, I think the Program has done a good job at targeting its R&D resources to technical barriers in cellulosic ethanol production and furthering the expansion of ethanol use. However, if our goal is to maximize the production of renewable fuels there may be other avenues of opportunity which could assist, especially regionally.
- Dedicated energy crop production needs fundamental research, not demonstrations.

Additional Comments

Strengths

- This program, as document in the new MYPP, demonstrates a comprehensive understanding of the nature of the challenge it is confronting. Given adequate resources and allowed to follow its MYPP, with the adjustments noted above, it likely will lead to successful achievement of the 20-in-10 and subsequent biomass program goals.
- The quality of the personnel managing and implementing the Program. The strategic integration and analysis components of the program. The efforts to seek stakeholder input.
- Program strategy focused on generating near term results. Program achieves right balance of core R&D and demonstration/deployment. Direct investment in new technologies. Good collaboration with other agencies, state/local groups, key stakeholders. More targeted approach than in previous years-focus on cellulosic ethanol. Government providing markets i.e. reverse auction is terrific idea. Enhanced communication activities (but more is needed here)
- Strengths include good project management, good communication across platforms, excellent industry academia and national laboratory partnerships and a strong cohesive plan driving the program.
- The program generally holds together well, meeting the stated goals. It is generally well managed and funded.
- The use of systems integration to target limited resources is a real strength for the Program. I hope that the staff can weather politics and use this tool appropriately. Funding seems to be largely adequate for the Program

Weaknesses

- As discussed, the program appears to be severely underfunded.
- The Program is understaffed. The biodiesel component is weak (but not beyond redemption)
- Not enough people resources at the program management level (only 15 people). More target outreach needed to general public i.e. radio/TV. Lack of standardized definitions. Must be close collaboration with USDA especially in feedstock area. More sense of urgency in feedstocks logistics R&D. Downstream R&D needed (see above). More funding for thermochemical. Too much redundancy in review process. Avoid reinventing the wheel...there is huge quantity of information already out there on Biofuels.
- A concern is that the national labs will have difficulty recruiting and maintaining the technical staff at this critical time to maintain the momentum seen in the program. Competition for bio-engineers and scientists is only going to get more intense.
- There are clearly still pockets that aren't really addressing the overall program goals. These need to be pruned and replaced with additive programs.
- Sustainability should be made more visible. Human resources, as reported in response to a question, sounded less than adequate for the number of projects being managed. A clear strategy for dealing with codes and standards was not apparent to me during the review.

Recommendations for Additions/Deletions to Project Scope

- Consider having a platform/activity to consider various entities that could be appropriate and bear some of the budget requirements of the program to meet the President's objectives. This could involve a government/private sector entity, funded principally by private sector development financing.

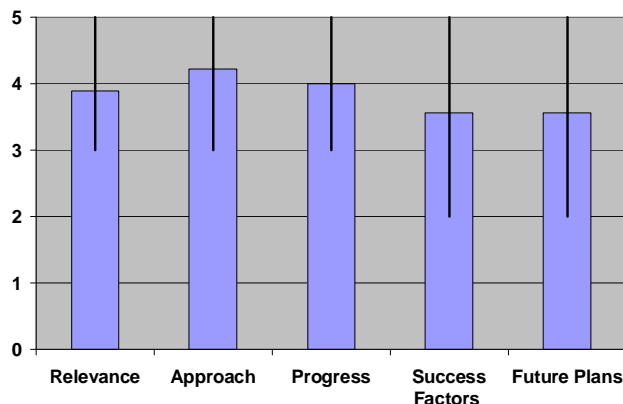
- Some of the communications methodologies used in the Technology Revitalization Program (TRP) of about 15 years ago should be considered. In this Defense Advanced Research Projects Agency Program, there were stakeholder meetings in many cities for communications and input. Such meetings usually had many hundreds of attendees. To gain public acceptance and expand media awareness, such programs would be worthy of consideration.
- The Program should estimate what the requirements will be for suitably trained /engineering technical staff to operate the number of biorefineries that will be in production if Program goals are achieved. There may be a requirement for post-secondary technical colleges and university engineering/science programs to adjust their curriculums to meet the aforementioned requirements.
- Given size and complexity of the task at hand, I strongly recommend greater oversight role for Biomass R&D Board. This will be especially important to ensure effective collaboration across agencies. Platform strategic and performance goals must align with program goals but must also be in sync with what is going on in other platforms. Biochemical platform FY08 funding request is 4X that of request for the feedstock platform—why such a difference? Crosscutting market transformation needs to be its own platform—a lot of work is needed in this area and stand alone platform will give it focus in particular more policy research needs to be done as mandates, incentives account for nearly all biofuels growth to this point---in addition, growth in international biofuels trade is raising many complex trade policy issues.
- This is a strong program, well run, and achieving positive results. The targets are crucial to the well being of the United States.
- I would encourage the communications and outreach staff to utilize new media (e-mail newsletters, web, podcasts, etc.) to achieve wide distribution and even to increase penetration into the old media. I am glad to see an effort to penetrate key conferences and workshops as well. One last note about the review process. I would encourage a bit more up front explanation of the process, perhaps even one-on-one during the initial contact with each reviewer. I would also encourage the Program to assemble the Steering Committee earlier in the process, and even utilize them to assist with the platform review process. This would likely result in the reviewers having a better understanding of the Program when they walk into the MYPP review later.
- The MYPP describes the feedstock production component of the Feedstock Platform as “selecting feedstocks and resolving production issues”. The Feedstock Platform review had only one production presentation, an earmark project of switchgrass establishment. The MYPP describes a grower payment of \$13 per ton in 2012. In high yielding corn (200 bu. per ac.) it may be possible to remove 3 tons per acre and still meet erosion control goals. However the \$13 must buy replacement Potassium and Phosphorus nutrients at a cost of perhaps \$6 (current prices may be higher), leaving a net of perhaps \$20 per acre. That is the price of 5 bushels of corn, which may be the amount of yield reduction due to the loss of soil carbon. We don’t know the value of soil carbon, but farmers know it has value. The MYPP predicts a price of \$26 per ton in 2017, but only if the industry grows, which it will not do if farmers aren’t willing to sell for \$13 in 2012. USDA doesn’t seem to be doing this research, either, but it needs to be done. I think this is a modern version of “For want of a nail (soil carbon management) a kingdom (cellulosic biofuels) was lost”.
- The MYPP includes an enzyme cost target of 33 cents per gallon of ethanol in 2009 and 10 cents in 2012. Is there any support for that figure?

Platform Overviews (from the Program Peer Review)

Feedstock Platform

Presenters: John Ferrell (Biomass Program) & Lyle Stevens (Formerly of John Deere), Review Chair

	Average Score	Delta Minimum	Delta Maximum
Relevance	3.89	0.89	1.11
Approach	4.22	1.22	0.78
Progress	4.00	1.00	1.00
Success Factors	3.56	1.56	1.44
Future Plans	3.56	1.56	1.44
Average	3.84		



Question 1: Platform Approach

- In general, the approach is moving the R&D effort forward. I believe it is too little effort and one that does not recognize the location specificity of feedstocks and the challenge of developing new genetics that will improve the amount, characteristics, and cost structure of new feedstocks.
- Well directed projects, focused targets across a somewhat narrow arena. Projects appear to be diverse, but localized to particular area, no apparent overarching tie among them. Especially with new crops, i.e. switchgrass, unless a broad large acreage is harvested, we won't know the real cost.
- Seems like all angles are being investigated and direction of platform is valid.
- My assessment from the presentation and materials is the feedstock platform is just getting up and running. Some broad assessments have been done of the potential supply, but much work remains to be done on logistics and more detailed analyses.
- In the realm of platform organization, I continue to desire to see more high-level coordination with USDA. From the comments I heard, I recognize cooperation but not overarching coordination. I would recommend that an effort be made to seek an audience with the new Agriculture Secretary as soon as he is confirmed.
- This platform is well planned and managed. It uses good engineering and science to attack the objectives spelled out.
- Feedstock logistics and logistics technology from the farm to the delivery point is key to the Program's success. Funding level of 5% of total Biomass Program budget is too low unless one major project is selected and tightly defined. The Biomass Program has too many feedstocks and regions for the money, and the benefit of this diversification is questionable other than political support.
- The platform concept—harvest, collection, storage, preprocessing, transport, queuing, and handling is well defined and can create scenarios (if integrated together as scenarios or pathways) that can help the program identify what the current cost of existing systems are, what the barriers are or what the cost hurdles are that need to be reduced, where money should be invested, what R&D targets should be, what the value of the investment should achieve, and whether or not one or more pathways/scenarios are needed to be successful in the first facility, the second facility, etc. The Program's organization has diversified from ORNL to include INL, which is good, but still needs a Midwest partner to succeed.

- Unfortunately, no clear allocation of funding between residues and energy crops, or between each technology stage (harvesting, storage, preprocessing, queuing, handling); and no justification for these allocations.
- The division between production, logistics and system integration is well balanced. The attention to sustainability is key. More work on preprocessing should be done.

Question 2: Platform Goals (in relation to the Program)

- The platform is engaged in important aspects of the program's goals and the recent effort to engage in regional feedstock development is a very positive platform enhancement.
- Good support for overall program. Need this information to move program forward. A lot of diversity, innovation not apparent in presentation. Addressing sustainability issues, Potassium and Phosphorus replacement, Carbon issue in doubt. Need better handle on real availability at what price.
- As explained, the platform is identifying and addressing issues.
- My impression was that the platform goals are generally in line with the Program's goals. I appreciated the references to "not betting on one winner." I think it would be prudent to continue investing in research on multiple feedstock crops and forest residues, as sustainability and geographic issues will likely result in regionally appropriate feedstocks.
- Feedstock logistics are crucial to the success of the Biomass Program.
- Integration with USDA agriculture and forestry services appeared weak, which is the biomass program's responsibility to ensure better coordination. DOE should focus on one major project that can be succeed, such as a fully integrated design for corn stover to ethanol at some achievable scale and target date that can meet DOE's cost and performance goals. Targeted focus, such as the "man on the moon" focus is more likely to succeed than to "put a little money into three or four feedstocks and three or four regions for political reasons." These diversified investments should be employed only after the main project (stover to ethanol) is fully funded. Without this one major stover to ethanol integrated system, the biomass program's feedstock activity is not fully integrated with their biochemical conversion activity. Without a single objective or focus, it will be very difficult to get USDA to coordinate with the biomass program.
- The platform goals are considered to fully support the Programs goals.

Question 3: Platform Goals (in relation to industry)

- The overall goal and the specific performance goals in the MYPP are clear. I believe the performance goals are too narrowly focused and ignore the enormous challenge of conducting cropping systems research, pest mitigation research, etc. The partnership with USDA is critical. However I did not find any acknowledgement that the platform must cooperate closely with each state's agricultural experiment station system. Connection with Extension was made in the report by the peer review team, but the critical connection with the land grant university agricultural experiment station system was not mentioned. It is the scientists in the agricultural experiment stations that conduct the genetics, breeding, cropping systems, and economics studies that are needed.
- Goals are realistic for the way things are now, but need some "out of the box" thinking is needed on moving the biomass around.
- I felt that the presentations and reports could have been clearer about the specific objectives of the platform. My impression was that there is much activity to be done. I think some strong coordination with USDA (not just cooperation or "friendly competition") needs to help give firm delegation of activities.

- Of the two goals—production and logistics—the majority of the focus of the program is on logistics, and presumably the production focus is integrated with the USDA, although this is not clearly articulated nor are any USDA integration activities identified or connections shown with DOE program goals. There needs to be more detailed USDA integration. The goals are a good start, since the program is moving from practically zero to \$10 million, but as a result, the goals appear to be generic and do not demonstrate strategic focus or priorities yet, even though there was a “discussion on priorities”, there wasn’t any prioritization presented.
- The cost reduction goals for dry herbaceous materials appear to stagnate, which tends to imply that the program should focus on the wet herbaceous materials that show significant cost reductions with R&D. As an aside, INL does not appear to be well informed about current cost for stover harvesting, transport and storage. It would also tend to imply that INL is not up to date on material degradation based on previous NREL work. Program needs a feedstock production interface, technologies that may modify or improve any of the logistical steps. Program needs a conversion interface to the biochemical platform, which is focused on stover and switchgrass. Including this interface will help focus the entire feedstock program.
- Sufficient detail was not provided to discern the realism or logic of each goal. Any focus on woody biomass should be prioritized on the fraction of resources the program invests in the thermochemical platform.
- The program lacks realistic risk reduction strategies. The program will need to develop a good database of variability to support equipment manufacturers. What is the scale of the first plant? Scale will have a significant impact on technology.
- There was a high level attempt to quantify the value of each goal, but an aborted attempt to transfer those estimates into strategic priorities. There wasn’t an attempt to focus on which step of the process chain (from harvest to handling) is the key barrier? Is it storage, densification? Not all steps can be equally important all the time. Some good technology focus was provided, but how these are crucial to the entire effort not clear. Too much focus on modeling and not enough ground truth data development and identification of key barriers and technologies necessary to overcome.
- Work to date has been largely done by universities and/or government laboratories. More industry involvement should be sought.

Question 4: Focus and Balance of the Platform R&D

- The necessity to conduct the work that is the focus of the feedstock platform is unquestionable. However, the need to invest in improved genetics and to understand the role of energy crops in sustainable production in the diversity of production areas is under-emphasized.
- Focused on meeting feedstock goals, will need continued scrutiny to get good handle on actual costs at refinery.
- I would like to see more specific activities in the realm of exploring sustainability issues (soil carbon, nitrogen leaching and phosphorus runoff, pest and disease issues, etc.). Alternatively, I would like to know what Program/platform activities are being done to support EPA USDA in this sector.
- Too much focus on political expediency, such as multiple regions and multiple feedstocks and not enough focus on making the first facility successful, where ever that may be. Within the various steps (harvesting, storage, preprocessing, handling, etc.) there are numerous gaps that should be addressed as an integrated scenario with well-justified investments into each. Do the future developers really have a lack of data? Which regions are developers focusing in? Which feedstocks are the developer’s

focused on? Focus on lifecycle pathways and environmental impacts is good, but should be prioritized to the regions and feedstocks that the developers are interested in. Building an inventory by crop/residue and region should start with where the priority is.

- The platform would benefit from more work on preprocessing and storage logistics.

Question 5: Platform Progress

- The peer review team for this platform noted that there is a sound plan and progress is being made. It is my perspective that substantially more effort (i.e., funding) will be necessary to achieve the biomass feedstock goals.
- This platform is expanding to meet the needs of the integrated refineries. It must keep doing more, because of the importance of feedstock cost. We do need more innovation in harvesting and transporting these bulky materials.
- My impression is that the platform is gearing up its activities, but needs some focus which may not be able to come until some technological advances are made. I am not sure that this platform is ready to meet the targets of the Program.
- Need Midwest partnership, perhaps USDA Peoria Laboratory. Need more integration on corn stover. Need to have a better vision of what is a real priority and what will become a priority in the future once the first plant gets off the ground. One year of funding does not give a track record for the program, but the program is too diffuse and needs a better focus on what the developers are going to focus on. Bring in the developers. INL needs to diversify its area of interests. Good start on one year but now is a key time to refocus.
- It's not clear if the platform is on course to meet the feedstock cost targets for 2012 and 2017.

Additional Comments

Strengths

- Strong teams working on gathering this important information.
- As explained, the parts of the platform are working together well and are logically derived.
- The program is making progress on complex issues. The realization that a diversity of feedstocks is needed to fulfill program goals is positive. This will be important in regions outside the Midwest.
- Good organization using good science. Work at INL on storage and queuing as well as harvest and collection appears to be on target.
- The platform has identified the key areas necessary to achieve program goals.

Weaknesses

- Not enough switch grass has been collected to get a handle on real cost. The fertilizer the biomass removed does not appear to be factored into the cost of the biomass. Current phosphate, nitrogen and potassium costs are significant.
- It screams for DOE and USDA involvement that don't appear to be happening sufficiently.
- I appreciate the Program's (and platform's) growing consideration of sustainability issues. I think that many of the issues which may emerge have readily available answers, but the Program and Department need to be prepared to respond when questions are raised. An example is the realm of nitrogen and phosphorus contamination of water. In the short term, there are concerns about the expansion of corn production for biofuels. However, there are long-established production practices and agronomic research which can be implemented in production to mitigate these concerns (if

implemented). Also, a sustainable harvesting technique to protect soil carbon levels may assist (but will not completely mitigate) this effort. Additionally, a long-term shift to perennial crops may involve dramatically lower nitrogen and phosphorus needs, depending on the crop species selected and the production practices which emerge. Some research on these emerging species is needed, but likely would not take much effort.

- Scaling up to handle corn stover will create new challenges. Need to lay out a plan now.
- Critical concern for separation of biomass components must be reviewed with appropriate scientists and engineers. Perhaps this area is for early treatment studies; however, some separation may be accomplished in the field
- Lack of industry partnership/involvement. Lack of clarity as to how DOE and USDA activities are complimentary/synergistic.

R&D Portfolio Gaps

- I agree with the gaps assessment which was identified.
- The gaps identified by the review team are OK, but they do not go far enough. The yield productivity anticipated by the Billion Ton Study requires sustained funding of genetics and breeding programs across most production areas. Likewise, there is an urgent need for longer term sustainable production research.
- The real cost of biomass has not been convincingly determined.
- As noted above, I agree with the need for sustainability attention. The need for life cycle analyses likewise is an important area for attention. Increasingly, the science of environmental analysis is focused on this methodology, as are international corporate social reporting standards. I don't have the resources/information to analyze the recommendation to resolve different cost targets; however, it was reported that this effort has already progressed. Similarly, I don't feel prepared to comment on the econometric recommendation. The comment that the platform should conduct statistical analysis on yield trials is worthy of attention from the Program. Yield variability is a fact of life and is well document for grain crops. It will surely be an issue in future feedstocks.
- If giant biorefineries are needed in order to obtain low operating costs, logistics is crucial. That critical weakness in the Program justifies research to identify conversion technologies that can operate at acceptable cost at smaller scale (thermochemical processing is one option). Pyrolysis oil is much more energy-dense than wheat straw. A number of feedstocks were identified (MSW, forest residues) were identified that are quite different from wheat straw, and will have quite different handling, storage, and pretreatment needs and will broaden the research challenges even more than corn stover will.
- A critical area of interest for accomplishing the overall goals with respect to conversion of cellulose (and perhaps hemicellulose at a later date) is procurement of feedstocks. Considerable discussion has occurred about source of material as well as delivering functional, microorganism free fiber. However, minimal data are available for ascertaining realistic economic numbers with respect to possible tons to be delivered during the next five years. Also, conflicting information has been presented with respect to cost/ton delivered. A specific area of need is for appropriate interagency personnel involvement for convincing growers (farmers) to select change with little enticement for:
 - Sale of present planting, tilling and harvesting equipment and purchase of needed equipment; however, necessary modifications to possible equipment have not been achieved.
 - Ability to collect straw, stover, corncoobs etc without contact with the soil (which will result in hydration as well as bacterial and fungal contamination).

- Storage sites and equipment.
- Equipment to transport chips, straw, stover etc, which often is ¼ the density of cereal grains and debarked trees.
- A major need is to identify opportunity costs of fiber production. Tons/acre often do not encompass duration from planting to harvesting, altering soil quality, need for nutrient replacement or productivity of land utilized. Duress to plants grown without pesticide protection, adequate nutrients and concern of harvesting time is paramount; this may result in plant chemical production and/or cohabitation with fungi to produce appropriate chemical compounds to repel predators.
- Cooperation with machinery manufacturers should proceed early in the overall game plan, rather than after arbitrary decisions on source materials have been made. Subsequent to elucidating enhanced value of current products or value of to be identified fractionated products, contact can be initiated with possible agricultural and forest producers. Questions about drying of material in the field or forest need to be identified and answered. Harvesting dates and methods will be site specific, e.g., dry air in KS is a bit different than wet air in SD; also, ability to harvest without deleterious effects on soil quality must be delineated.

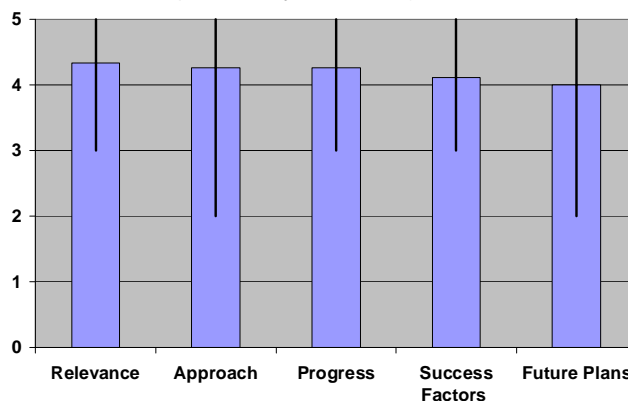
Additional Recommendations, Comments and Observations

- I would have appreciated hearing about the Regional Biomass efforts in conjunction with this platform. I understand that this is a new endeavor, but the presentation on Thursday afternoon about the NW regional study seemed to indicate that there are opportunities in this realm.

Biochemical Conversion Platform

Presenters: Amy Miranda (Biomass Program) & Don Johnson (Formerly with GP), Review Chair

	Average Score	Delta Minimum	Delta Maximum
Relevance	4.33	1.33	0.67
Approach	4.25	2.25	0.75
Progress	4.25	1.25	0.75
Success Factors	4.11	1.11	0.89
Future Plans	4.00	2.00	1.00
Average	4.19		



Question 1: Platform Approach

- Clearly moving in the right direction
- This platform has the weight of history behind it and therefore was the best “packaged” of all the platforms presented. It appears to have adequate funding, a good sense of mission and corresponding activities (fundamental and applied science, enzymes and organisms, etc.).
- R&D portfolio and funding distribution well presented. Benefits of biochemical platform accomplishments are excellent, and demonstrate value of R&D investments (page 12 of Miranda’s presentation). The milestones and R&D portfolio was clear and well presented.
- Overall, the platform approach is well set up to reach the proposed goals. Consideration should be given to decreasing the emphasis on C5 conversion to ethanol and redirecting those resources to production of other bioproducts from C5 sugars.

Question 2: Platform Goals (in relation to the Program)

- Completely consistent.
- This platform seems to have a clear understanding of the Program’s role in relation to the biochemical industry and research needs. As is true for the whole program, the platform should remain able respond to emerging technologies and feedstocks while being focused on current needs.
- Clearly the platform is core of the liquid fuels program. However, there is a tendency for the program to focus on the high liquid yield potential of the program, no matter how far out into the future it may be and no matter how complex it will be and how difficult it may be to duplicate these highly complex facilities; compared to a lower yield, and more simplistic approach that could produce liquid fuels in the near term through gasification.
- For the most part, the platform goals support the Program’s goals.

Question 3: Platform Goals (in relation to industry)

- The only suggestion I have after reviewing MYPP 3.2.1.2 is that the goals for energy crop pathway should include other, high volume energy crops, such as poplar, and not just switchgrass.
- Good goals and good involvement of Government labs and universities.
- This platform was presented in a logical and clear manner and it appears that the goals are very appropriate to the Program’s role in relation to the industry.

- There is still a perception that the complexity of the entire biochemical system will be very difficult to achieve, much less multiply facilities successfully. Need more industry involvement throughout the biochemical system, primarily to prepare the industry to provide various approaches to success without reinventing the wheel once these technologies are presented as a first facility.
- No major changes to the goals are needed and if achieved will meet the needs of industry.

Question 4: Focus and Balance of the Platform R&D

- Good balance
- The platform research seems to be balanced very well. A small amount of research into feedstocks other than corn stover, poplar and switchgrass may be valuable. As indicated in both presentations, knowledge of plant science is needed to address differences in plant chemistry at different harvest dates, regions, etc. Storage may additionally impact results dramatically and should be considered as research continues.
- WBS needs to show interaction of partners, solicitations, outside of core program. The budget associated with the fermentation/saccharification area does not reflect the potential benefit of investment in that technology. Related to this comment, the integration investment may be premature to some degree, allowing the program to move some funding from that area to fermentation.
- I disagree with the reviewers who wanted to include more feedstocks, such as wood. It would dilute near term success. Once near term success has been achieved, future industry partners will assist with the harder to integrate feedstocks such as wood.
- The focus of the platform is excellent.

Question 5: Platform Progress

- As documented in the peer review, many of the projects are performing quite well. There are some that are lagging or even virtually irrelevant.
- Program is varied and complete.
- Funding to attract quality staff and/or utilize private industry partnerships will be needed. I'm not qualified to analyze the progress on enzymatic pathways and genomics; however, I appreciate their importance and am pleased to see a focus on these research needs.
- Needed to put more effort into getting more presentations into the program review: only 17 out of 27 attended.
- I support the recommendation that the program build an integrated processing structure as soon as possible. It is not clear that the pilot plant at NREL is suitable for this effort without substantial remodeling and reworking. It may be cheaper to abandon the NREL pilot plant and build a pilot plant somewhere else in partnership with a major construction and engineering company and a funding partner. Perhaps building more than one pilot plant will accelerate commercial development and allow for more variations and novel cost improvements. NREL and Midwest Research Institute will need to make licensing agreements clear, easy, and quick to accommodate.
- Publication of unique testing and evaluation standards would be highly beneficial for creating an industrial structure for success. The program should continue identifying and retaining high quality partnerships, particularly as the R&D moves from bench scale to pilot and pre-commercialization stages. Creating these partnerships may allow for more access to personnel and engineers that the program has difficulty retaining.
- Elimination of disruptive NREL management (occurred in FY2007) may also reduce turn over.

- The platform is progressing well and the degree of process integration is commendable.

Additional Comments

Strengths

- This platform is noted for its strong progress and focus on critically important topics. The quality of much of the science and engineering is internationally recognized for its excellence.
- Integration and singularity of focus are good. The program really seems to be abiding by guiding principals.
- I appreciate this platform's understanding of its role as a government program and how it has utilized its resource to focus on technical barriers. This platform appears to be well funded. Utilization of university consortium taps a wider intellectual resource base. I am pleased to note increased interaction with USDA. I hope that a coordination relationship can be developed as well. I would recommend an early request for an audience with the new Secretary of Agriculture (once confirmed).
- Good liaison with industry. Work on process integration. Correct focus on work required to meet platform and Program goals.

Weaknesses

- Several programs were mentioned in a negative light, indicating that better management could be warranted.
- Focusing on switchgrass and hybrid poplar is a logical development, but a small amount of research of other feedstock species may be valuable. For example, woody biomass was mentioned by the platform review.
- No major weaknesses; however, decreased emphasis on C5 fermentation to ethanol should be considered.

R&D Portfolio Gaps

- Review was of summer proceedings. It was needed to close the loop of what will be done with the assessments and if comments are taken seriously.
- I find the list of critical gaps (challenges and barriers) discussed in MYPP 3.2.1.3 to be fairly comprehensive, if not daunting.
- The platform review recommended use of pilot runs as soon as is practical. This seems to be a theme of the week and therefore deserves attention.
- No significant gaps were identified.

Additional Recommendations, Comments and Observations

- I agree with the peer review team's recommendations, in general. However, while I agree that woody biomass be included in the platform's goals, such work must be limited to those feedstocks that are in sufficient abundance and logistic availability to justify their incorporation into this platform. I suspect that the thermochemical platform can more readily handle a temporally varying mix of heterogeneous woody materials.
- I have to express some disappointment that we have to revisit the enzyme development process. We have been given misleading information about the cost of enzymes in the past, and I have no reason to be any more confident in the future. The enzyme cost goals shown in the MYPP seem to be drawn from thin air.
- Pretreatment and enzymatic hydrolysis program at NREL is focused to the overall objectives. A project which encompasses both esoteric and applied research aspects; therefore, finding should be of benefit to the industry while utilizing background

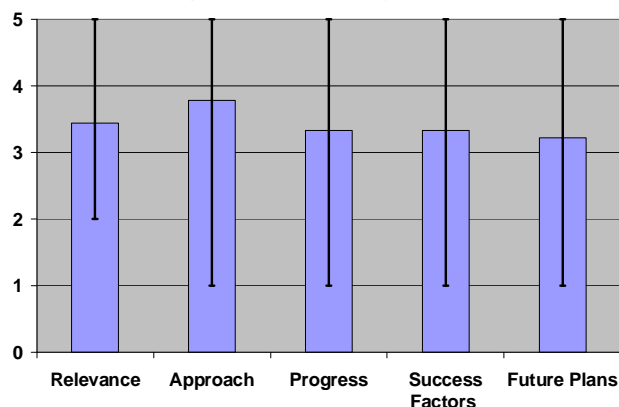
information. As scientists and engineers within the NREL program continue to relate with those individuals with knowledge about needed outcomes, this program will flourish.

- Biochemical Process Integration Task has been designed to provide samples and relevant findings to other NREL programs as well as extramural researchers. Perhaps a bit more coordination with feedstock needs would be helpful. A critical portion of this program will be to provide state of the art instrumentation as well as data generated from the analytical objectives.
- As work continues towards converting cellulose to ethanol, the fundamental drivers in this project will be critical to future investigations. Well designed studies to assess relevance of providing clean cellulose from samples containing hemicellulose and/or lignin will be imperative to advancing cellulose conversion science. Continued extra and intra-agency discussions and joint projects will be relevant to future success.
- A higher sense of urgency on planning and operation.
- Ongoing evaluation of the value of CAFI work to achieving platform goals. The work is very academic and several of the pretreatment processes CAFI is studying are unlikely to ever be implemented at commercial scale.

Thermochemical Conversion Platform Overview

Presenters: Paul Grabowski (Biomass Program) & Mark Jones (Dow Chemical), Review Chair

	Average Score	Delta Minimum	Delta Maximum
Relevance	3.44	1.44	1.56
Approach	3.78	2.78	1.22
Progress	3.33	2.33	1.67
Success Factors	3.33	2.33	1.67
Future Plans	3.22	2.22	1.78
Average	3.42		



Question 1: Platform Approach

- The immediate focus on only agricultural residues and energy crops as feedstocks as documented in the MYPP is too narrow. Robust processes, able to handle a wider variety of materials will solve many problems associated with seasonal availability of feedstock and limitations in amounts of certain types of feedstocks. Connecting with other DOE groups working on gasification of coal makes sense.
- As presented the projects are doing an excellent job of supporting platform goals and are on track and meeting goals. The results are so encouraging that the reasons for shelving this approach twenty or so years ago must be revisited.
- This platform has much potential. I can understand the political and budgetary reasons for the focus on agricultural residues and energy crops, but there is a logical role for government to play in utilization of wastes and forestry residues in this platform. Likewise, the historical focus on gasification is not enough. I am pleased to hear of a new focus on pyrolysis. This should be funded well. Fischer-Tropes processes appear to require more investigation as well.
- The thermochemical platform has the potential to produce a wide variety of end products that are compatible with existing infrastructure. It deserves greater funding.
- The MYPP comment on page 3-45 “The Program, therefore, has prioritized gasification R&D in its near term efforts” is overblown, and would be more accurate to say that program has recognized the value of modest funding to the program commiserate (or perhaps not) to its near term benefits. Similarly any claims that pyrolysis R&D may be increased in the future is premature until a clear and unbiased evaluation of the cost and benefits and fuel supply impact is fully evaluated. Any pyrolysis fuels used as refinery feedstocks should include petroleum industry partnerships to achieve these goals. Rather than continue in a point-by-point debate, the thermochemical portion of the MYPP document is not fully integrated in terms of near term impacts, barriers, costs, supply impacts, and, byproduct market saturation risks compared with other program areas such as biochemical. The relative merits of each program area should be clearly defined and not shown as a debate between each program area. As a program area with new funding, the biomass program should show what the benefits would achieve, the costs, the risks, and the impact to fuel supply compared with other strategies.
- Since many of the “10% pilot scale projects” were thermochemical, the maturity of the thermochemical technology is much advanced and the rationale for investing in this area is in doubt unless clearly defined and always associated with a commercial partner. As

like the biodiesel and corn ethanol industry, the program should not invest in program areas that are commercial.

- The platform approach supports achievement of its goals.

Question 2: Platform Goals (in relation to the Program)

- This is a very important platform area that is critical to achieving program goals. It is good to see that it has received renewed emphasis.
- The estimated capital costs and plant gate price are where we want to be. So why aren't we doing it. What is missing?
- The platform goals do support the Program's goals, but need to be expanded.
- Feedstocks and feedstock interface targets should include water/moisture reduction and biochemical lignin quality assessment as a priority, and a focus on feedstocks residues and crops as a secondary priority unless the thermochemical area can show that value to the public that is equal to the value of the biochemical area.
- The lack of focus on the co-product produced from the biochemical area shows that this program area is not supporting the other program areas, but competing for existing feedstocks.
- Barrier Tt-B should be a priority over Tt-A.
- Feedstock selection processes are too broad and display a lack of prioritization. The cost performance goals and dates are the same as the biochemical areas cost goals and performance data, which is unusual as these two technologies are different and may have different cost starting points and different milestone achievement dates.
- Grabowski's modeled ethanol price on slide 9 (see also slide 13) in his presentation conflicts with his slide on slide 5. The Biomass Program should clarify current ethanol costs and performance dates for each technology area (biochemical and thermochemical). They should not be the same unless serendipity occurs.
- Funding all feedstocks and all fuel pathways denotes a lack of strategic planning and prioritization. Only one or two of these will offer the best options. This type of approach denotes the lack of prior analysis and independent review of technologies.
- Production of mixed alcohols will require a high degree of biofuels distribution area investment in ASTM fuel standards, fuel registration, and demonstration with fuel infrastructure partners; not shown in program. Ditto with pyrolysis fuels, product is clearly not ASTM quality diesel fuel and does not meet EPA's fuel registration of diesel fuel.
- The platform's goals are well aligned with those of the Program. The milestones selected are relevant and the dates for their achievement are reasonable.

Question 3: Platform Goals (in relation to industry)

- The goals as outlined in the MYPP 3.2.2.2 are nearly comprehensive and are good, as far as they go. However, it strikes me as odd that there are challenges noted but no goal for woody biomass and MSW. This seems to ignore the opportunities to use these abundant feedstocks for which logistical challenges are solved or nearly solved, but which will require some research and development to achieve commercial viability.
- The goals are reasonable and logical, and if met can be easily implemented into existing petroleum processing facilities. It will take capital to implement, as will all, and could require less capital than biological processes. Need to verify at larger scale, and let industry run with it (verified).
- The platform review was well done and pointed out some clear needs for this platform. I support the recommendations of the reviewers, which were specific and logical.

- There is little analysis, less strategic planning, poorly defined goals, and given all that, the results cannot be clear, realistic or logical. Projects such as Tt-G for alcohol synthesis with better selectivity and better yields should be a priority. The pyrolysis investment should equal the impact of a homogenous fuel infrastructure opportunity (e.g., very little opportunity, similar to Oxygen Diesel). The value of pyrolysis over gasification should be questioned and the answer should be clearly articulated. Given the pre-commercialization nature of thermochemical technologies; how much of the R&D should be bench scale, how much should be pilot scale, and how much should the R&D be partnered with private industry? Task Tt-H has low value to the program, e.g., small market impact to gasoline displacement, high barriers to fuel distribution commercialization, etc.
- The goals will definitely meet the needs of industry i.e. clean syngas and new catalysts for mixed alcohol production.
- Recognition of increased profile for pyrolysis is good.

Question 4: Focus and Balance of the Platform R&D

- Program is narrowly focused and has enough projects to be comprehensive and balanced within the scope.
- An increased emphasis on pyrolysis and Fischer-Tropes should be made. The infrastructure benefits could lead to a more rapid achievement of 20-in-10.
- If the Tt-A project is poorly defined, redefine the name of the project to reflect the goals.
- Balance and focus is good and appropriate to achieving the goal of producing a range of biofuels from a broad range of biomass feedstocks.

Question 5: Platform Progress

- As noted in the peer review report, there is good progress in a number of the platform's projects and there are some projects that have little connection with the platform and have not contributed to achievement of its goals.
- The information presented showed that the platform is progressing well and meeting important targets. I am still concerned with what has changed in the last twenty years to make this now feasible and better than the biochemical route.
- I am pleased to see that the platform is making some course corrections in recognition of emerging technologies because this is such a diverse collection of processes; it was difficult to assess platform progress in the brief time frame of this review.
- The Gasification of Biorefinery Residues was ranked midway between all the projects reviewed; and either that was because the reviewers don't think that is a priority or that the presentation was poor, is unclear from the comments. At a minimum, the relevance should have been higher.
- There are few projects in task Tt-G in the reviewer's lists, where R&D invested in this category (higher yields, higher alcohol selectivity) would provide major benefits to the program.
- The platform is making satisfactory progress.

Additional Comments

Strengths

- The program is based on an excellent understanding of the issues.
- Good partnering with UOP who has experience in both petroleum processing and biochemical processing. Good university, industry and national lab cooperation. Using technology that for the most part has long experience.

- This platform has potential in addressing multiple issues – biorefinery integration, integration with existing fuel infrastructure, utilization of multiple feedstocks, etc. In the gasification focus of the platform, there seems to have been an appropriate focus on bottlenecks (catalysts/tar removal).
- Innovative dryer designs would benefit a wide range of technologies if successful, including the biochemical projects.
- Decision to increase focus on pyrolysis. Focus on producing a range of biofuels, several of which would be attractive to the existing petroleum industry.

Weaknesses

- The weakness is in the goals as articulated in the MYPP, which seem to not be in agreement with the MYPP's statements about the opportunities and challenges with a wider variety of feedstocks. This platform is the primary platform to address their use.
- Concern about what has changed that makes this attractive now, and worth reopening.
- As previously noted in the platform review, the platform should widen its scope to reach its potential in achieving the President's goals.
- Subsequent to many years of funding projects to produce syngas, perhaps work should be oriented to separation of producer gas components. A review of current data should be accomplished to delineate relevance of simple and/or multiple technology procedures.
- Numerous projects were not focused; a shotgun approach often was evident. Economic assessments could have been made with current available information.
- It is not clear that DOE has been under funding gasification and pyrolysis R&D once the DOD and DOE coal R&D activities and the commercial R&D investments are considered. The Program clearly needs to integrate these technologies into their Biochemical conversion platform but a more rigorous effort is needed to define what needs to be done for the Program and program goals, not necessarily to benefit the industry at large. I want to reiterate one of the reviewer's comments as I support these strongly.
 - Techno-economic modeling is needed to help determine the priority direction for platform funding.
 - The industry and platform would benefit from an analysis effort to determine the state of gasifier technologies available; the review team suggests a "Consortium for Applied Fundamentals and Innovation (CAFI)" style approach.
 - The reviewers urge the thermochemical platform to evaluate the benefit to attempting to partner with other DOE (coal) and DOD R&D.
- Duplication of effort regarding cellulosic biomass gasification and coal gasification as they pertain to the use of the syngas produced.

R&D Portfolio Gaps

- There wasn't a separate slide for gas, but this matter was embraced in comments and recommendations. The most important gap is to increase funding. Other gaps cited are acceptable to this reviewer.
- The challenges (gaps) identified in the MYPP 3.2.2.3 are comprehensive. I suggest that Tt-E include a partnership with the feedstock platform (and probably Office of Science) as it may be possible for plant scientists to modify plant structures to facilitate the desired chemistry in the bio-oil.
- I agree with the platform review's analysis of the existing gaps.
- The potential of this platform is so great it deserves additional funding to determine whether the remaining challenges can be resolved. This may be the same state of affairs

that existed when the platform was downsized some years ago, but the world has moved forward since that time.

- Project outlines need to be developed to focus on particular, relevant objectives. Perhaps because of considerable past work, the researchers did not feel the need to define specific items, rather to continue with general approaches which can be projected well with enthusiastic show persons. In particular studies, there appeared to be little awareness of DOE goals.
- Available dollars may have been spent on state of the art equipment; however, there is a lack of researchers capable of utilizing the equipment as well as interpreting the data.
- There is a need to have projects present coherent approaches to posed questions.
- No additional gaps to those identified in the platform review report.

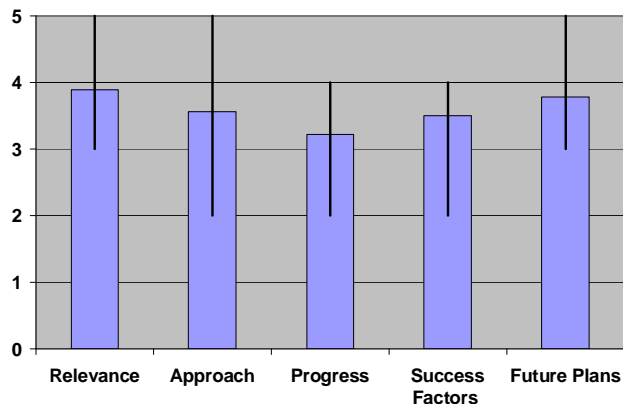
Additional Recommendations, Comments and Observations

- Excellent presentation. The appropriate amount of details was covered in a short presentation.
- Look for opportunities to share research and development with some of the Fossil Energy programs.
- The platform review was nicely presented.
- It would be beneficial (but probably very difficult), for the thermochemical conversion program to establish criteria for validating the claims of the plethora of companies purporting to have viable, operating gasifiers.

Integrated Biorefinery Platform

Presenters: Larry Russo, Biomass Program & Dr. William Cruickshank (formerly of National Resources Canada) and Dr. Michael Tumbleson (University of Illinois, Co-Review Chairs

	Average Score	Delta Minimum	Delta Maximum
Relevance	3.89	0.89	1.11
Approach	3.56	1.56	1.44
Progress	3.22	1.22	0.78
Success Factors	3.50	1.50	0.50
Future Plans	3.78	0.78	1.22
Average	3.59		



Question 1: Platform Approach

- The integrated biorefinery platform's approach is largely sound, yet its effectiveness is clearly dependent on the performance of the feedstock, biochemical conversion, and thermochemical conversion platforms. The generalized approach documented in the MYPP 3.3.4 is logical.
- Seems like a potpourri of projects to develop high valued products concurrently with ethanol that can enable economic production of fuel alcohol.
- Seems like to be taking the whole view.
- The platform seems to have a good focus within the program. The current focus on building the commercial scale and pilot scale plants is appropriate.
- This platform supports a wide range of projects, some of which (wet mill/dry grind improvements) are in the "commercialized" category.
- Too many work breakdown structure (WBS) elements. Need to focus on the things that the Program is investing in. May simplify WBS to include feedstocks (a-z), conversion technologies (a-z), byproduct production with linkages to feedstocks and/or technologies,
- Project definition (techno-economic analysis, LCA, Food vs Fuel, environmental, waste minimization, etc.). Technology verification and integration (including solicitations, 2nd plants, process integration, risk minimization, etc.).
- Since the Program is trying to get TECHNOLOGIES into commercial use in order to achieve some 20% gasoline displacement goal, why are the milestones not technology based? At least we could see if a technology is successful or not, and it's a lot more difficult to say that a feedstock is successful (see Milestones for this discussion).
- Need to focus on program priorities: why oil processing, forest resources, waste processing, etc.? OK as part of WBS as defined above, but begs the question of priorities if broken out separately.
- No milestone deadline targets. No info on solicitations, so not clear as to how well defined or the value of the partnerships to date.
- How much co-product benefits are enough?
- Platform area is new and under various definitional changes, but so far, we don't see much substance, although substance is possible and desirable.
- The platform organization and milestones facilitate reaching its goals as well as those of the Program.

- The R&D portfolio is constrained to some degree by the availability of relevant industrial partners and/or their willingness to partner in projects.

Question 2: Platform Goals (in relation to the Program)

- The general platform goal (MYPP 3.3.1) clearly is supportive of the overall Program goals. I have some concern about one of the two pathways selected for initial performance goals inasmuch as collection and transport of agricultural residue is still under development whereas collection and transportation of forest materials (not slash) and MSW is already commercially available. Somewhat in mitigation of this point is its recognition as a barrier in the MYPP.
- As reported, some projects do not support program goals, but most of them do. Could have better tie in or linkage among projects to see they function together to meet platform goals, which would support program goals.
- The platform seems to have focused well on the technical and market barriers.
- The goals are critical but poorly defined at this time. Some good progress has been achieved such as solicitations and analyses. Some good partnerships have been developed. But all in all, the platform is still too nebulous to be as useful as it could be. The goals of the platform need to be better defined via a better defined WBS.
- The goals may also be improved by created a list of partnerships that would provide specific benefits to the Program and then design around that (using solicitations). The scattergun approach is no different than the earmark approach. While the solicitations for the pilot plants and the 10% facilities are crucial, the solicitations should be more targeted to define Program benefits.
- Technology transfer products need to be improved, especially the publications of patents, standardized leasing agreement, or at least the identification of trade secret processes. The benefits would be quantified via technical improvements (yields, etc.) and costs.
- More thought should be invested in personnel training programs. Where are all the complex biochemical experts going to come from?
- Consider a solicitation that invests in multiple biochemical pilot plants rather than reinvest in the NREL pilot plant.
- No change to platform goals is considered necessary.

Question 3: Platform Goals (in relation to industry)

- If successful, they will clearly achieve the goal of achieving commercially acceptable performance. Achieving the cost goals likely will be dependent on optimization of plant designs and creation of maximum value from all mass and energy flows. Such optimization may take longer than the 2017 time horizon.
- Goals for projects are clear and realistic, but how they tie together to meet platform goals is not clear. Platform does pull different platform performers together.
- Issues raised by separation of C5 and C6 sugars give impression that there are issues around clarification of goals.
- The goals are clear, but broad. In this case, the activities chosen to support the goals will be more important to success than the goals themselves.
- Need more quantifiable goals and milestone dates.
- Need better targeted solicitations, for example a challenge/solicitation to densify dry corn stover in wrapped cubes for flat beds (may also include stacking height demonstrations). Or demonstration of using ethanol plant gases (such as CO₂ gases) for drying and stabilizing dried materials. Etc. Identify the integration needs and focus them as solicitations. Try waste minimization, biochemical inhibitors.

- Present industry partnerships are contributing well to the platform's goal and meet industry needs.

Question 4: Focus and Balance of the Platform R&D

- Looking at the specific projects that were included in the materials, it does not appear that they all meet the needs of this platform's goals.
- Not clear whether platform R&D is focused and balanced, seems more like a collection of projects which don't fit elsewhere.
- Comments indicate lack of concern for the animals and final land disposal of the solids.
- By necessity, the platform has its fingers in a lot of pies. It appears the platform reviewers felt that some of the projects were not useful to promote the overall Program goals. This may include earmark projects. However, the 10% scale plants appear to be a beneficial focus as the platform moves forward.
- The Techno economic portion of the platform is excellent and investment in this task area should continue. This should provide better focus on where portions of integration are weak and need to have more focused solicitations. Specifically the market barriers are very poorly defined and not clearly needed as a platform barrier with the exception of Im-D.
- Focus on deployment is commendable. Water issues need to be a focus area. Need to focus on cross-cutting technologies.

Question 5: Platform Progress

- The platform peer review report that was presented indicated that the platform is moving in a commendable way toward emphasis on deployment. It also stated that integration with feedstock platform is exceptionally important, and I agree with this statement. I also agree with the recommendation to focus on water management and cross-cutting technologies – particularly those that can handle heterogeneous and time-varying feedstock supplies.
- The review is essential to keep program on track and mission oriented. Progress is made in the individual projects and with the scope as explained at this review; it will mitigate the issues with the 632 and 10% projects.
- While Congress appears to have put a hiccup in the platform's methodology, I am pleased that the platform is simultaneously moving forward on the 10% scale plant development and has a stepwise plan of implementation.
- The platform is on track but still in its infant stage of development and planning. It will be critical to bring this platform up to speed as soon as possible. The solicitations have generated a lot of interest but it isn't clear yet if the responders are high quality or will provide value, since none of that information has been presented yet.
- The analysis and strategic planning component of the platform must be used not only for tracking but also for effectively managing the platform's progress.

Additional Comments

Strengths

- Projects are well managed to meet specific goals.
- Liked the discussion of the options.
- The platform seems to have done a good job of assessing the barriers which are appropriate for the Program to address. The program is well funded. The development of commercial scale plants may be premature for technical reasons, but may also help identify new areas of research needed to remove impediments for future plants. The

recognition that 10% scale plants are more desirable is to be commended. I applaud the program's utilization of "investment banker" philosophy and risk analysis in the 932 process. Risk mitigation is necessary for success. I am happy to see the platform planning to look at utilization of new feedstocks and conversion technologies in the months and years ahead.

- Good industry partnerships. Good synergy with the biochemical conversion platform.

Weaknesses

- There are many gaps in the program.
- Needs to have better explanation of how they fit together in this platform.
- Clarity of purpose, and option development were expressed as concerns.
- No work on utilization of perennial crops, forest residues and post consumer waste. Insufficient focus on full life cycle analysis specifically, full life cycle GHG emissions and energy balance.

R&D Portfolio Gaps

- There are many gaps in the program, as cited by the presentation. These include little or no work on logistics of feedstock supply; issues around water supply and management; no work on utilization of perennial crops, forest residues or post consumer waste; lack of full life cycle energy balance and GHG emissions; and insufficient focus on unit process integration.
- The report noted little or no work on logistics of feedstock supply. While I agree that this is a paramount need for the overall program, I don't think it is a gap in this specific platform. I agree with the other four gaps noted by the peer review for this platform.
- Gaps were well pointed out.
- I agree with the comment that water supply issues need attention.
- There are opportunities in biorefinery integration to tell a good public relations story.
- I agree that perennial crops/forest residues could use more attention, especially regionally. Likewise wastes such as cobs are logical opportunities for attention.
- Full life cycle analyses are increasingly important in the investment and marketing world. In my experience, they are emerging as a real environmental and corporate investor focus.
- Agree with gaps identified in the platform review presentation.

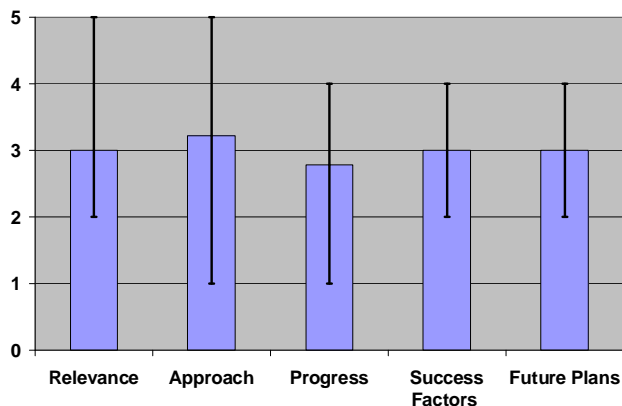
Additional Recommendations, Comments and Observations

- The reviewer recommendation to publish more and encourage information sharing is understandable, but I question whether or not it is practical. Where possible, the use of public funds to develop resources that can be shared is to be encouraged, but the leveraging of private resources is so helpful it would not be wise to restrict it.
- This platform is ideally situated, by virtue of its being at the interface with commercial implementation, to provide feedback to the feedstock, thermochemical and biochemical platforms as to what R&D adjustments, refocusing, etc. is required in those platforms in order to assure commercially viable biorefinery processes.

Infrastructure Platform

Presenters: Joan Glickman (Biomass Program) & David Terry (State Line Energy for Governor's Ethanol coalition), Review Chair

	Average Score	Delta Minimum	Delta Maximum
Relevance	3.00	1.00	2.00
Approach	3.22	2.22	1.78
Progress	2.78	1.78	1.22
Success Factors	3.00	1.00	1.00
Future Plans	3.00	1.00	1.00
Average	3.00		



Question 1: Platform Approach

- The issues of product distribution infrastructure and product standards are important and their recognition as a platform component is a positive development.
- A very important component of the biomass program. Once we double the amount alcohol in the pool, we will need to know how to move it around.
- This was a workshop review, not a platform peer review.
- It is wise for the Program to add this platform to address the final link in the chain.
- The platform approach could support the Program goals, except that the platform as described does not have enough content to achieve anything. The platform as presented does not contain any substance, no key milestones or date, no focus or strategic value, no priorities.
- Clearly this platform needs to differentiate its self from the Freedom Car and create a focus that has value. For example, shooting for an E22 world, realistic or not, would be a goal.
- The conception of existing and future Infrastructure does not accommodate new facility locations, or incentives to get new facilities to build in the right places. That would minimize rail, pipeline, etc.
- Focus on new fuels creates a huge chicken and egg issue. If you are going to add new fuels, then why not mixed alcohols with better fuel economy and lower conversional costs? At least there is a rational here. Furthermore, how will you prioritize the fuel choices? Where are the following platform activities necessary to support a new fuel: fuel registration, demonstration, ASTM standards, fuel quality optimization activities, engine design, material compatibility, etc. Where are the partnerships to achieve all that? How will you justify some new fuels (based on volume and cost) versus other new fuels with limited niche markets, limited volumes, limited cost benefits, etc?
- Who really cares about lawnmowers, trimmers, etc? How much volume for how much investment will be needed for these? Tractors are NOT small engines. They are larger than all transportation fuel vehicles except semi-tractor trailers. Alcohols have not been good fits for large engines, what will you do differently?
- Isn't there enough private investment in automotive alcohol engine research? You will need to focus on a large blend such as E22.
- Your list of potential partners is good, but how the partnerships will be managed and directed is nebulous.

- There are adequate federal incentives for ethanol blending infrastructure.
- Given that some issues regarding infrastructure fall outside DOE's mandate, the platform approach is considered satisfactory.
- Since this is a new platform, it is expected future reviews will indicate refinements to its approach.

Question 2: Platform Goals (in relation to the Program)

- Based on the slide presentation, which updated the MYPP, this platform's goals are fully supportive of the program goals.
- Not a platform, but certainly supports the program.
- The goal at this point seems to be simply exploring what is the national infrastructure status, and what are the early-identifiable bottlenecks. From what I saw, the emerging concerns seem to be appropriately identified.
- No, the platform goals don't seem to support Biomass Program goal of 20-in-10 or any other related vision except for the vague decision to do something in the ethanol and biodiesel arena.
- To generate a volume equal to 20 Billion or 20% of gasoline industry, you are not going to play around with lawnmowers.
- The key areas are storage infrastructure and investment and pipeline incentives—no one has given the pipelines any incentive to move ethanol. The rest (material compatibility, standards, etc.) will be partially driven by industry if they decide to get invested.
- The platform's goals support the Program goals.

Question 3: Platform Goals (in relation to industry)

- As noted in the presentation, the platform is evolving rapidly. It is important that the goals address the range of biofuels and develop the platform's goals in consultation with the appropriate industrial partners.
- No goals, but a number of recommendations came out of project, and more outreach planned to get input on this important area.
- These goals will have the benefit of making a lot of people feel good about the biofuels program. The history of slow acceptance of E10 by uninformed car owners (still a problem) shows the benefit of public education.
- There are good Geographic Information System programs already available for liquid fuel transportation and storage. In addition to research on stress corrosion cracking, pipeline and storage infrastructure research to move ethanol will require research on pumps, seals, cleanout operations, safety, environmental impact analysis, risk analysis, etc.
- The goals of the platform are realistic, but the platform will need to expend a major effort on consultation/communication with other agencies, industry groups, standards, organization etc. in order to achieve them.

Question 4: Focus and Balance of the Platform R&D

- Need to focus on infrastructure to get good data on how we distribute the large amount of biofuels planned.
- The platform R&D portfolio could perhaps focus on some larger issues (small engines are very important in emissions for certain regions, but maybe this is EPA's responsibility?). I trust that R&D will mature as the program matures.

- All over the map, needs some real focus with solid value. They may be on the right track with some issues but unable to prioritize and identify where the value is for some of the things they want to include.
- The platform is as well balanced as can be expected given that it's new and subject to influence by many stakeholders.

Question 5: Platform Progress

- The workshop was an excellent first step.
- Good progress (held workshop) and plans to generate much more information.
- Since this platform is new, there is no progress to report.
- Just getting started.
- Poorly, who ever is supporting this area, they should bring focus groups specific to fuel storage firm and pipelines and even rails for unit train operations, and see exactly what the barriers are and how important each barrier is and what to do about it and who to do it.
- Too early to assess how well the platform is progressing. Progress of the platform may well be limited by factors beyond its control and/or mandate.

Additional Comments

Strengths

- Outreaching to end users and addressing issues on fuel ethanol.
- The platform is to be commended for its early effort to coordinate with other agencies, industry, and organizations to determine the needs and the work being done by others. Outreach to the public is wise. Partnering with private industry will likely allow greater penetration into media markets than government efforts alone. I am glad to see the door being left open for efforts for other renewable fuels, though I agree that, for now, a priority focus on ethanol and biodiesel is appropriate.
- Outline of work to be accomplished was provided. Need for intra and interagency cooperative efforts were described.
- The platform's initiative to engage all relevant stakeholders right from its beginning is a key strength.

Weaknesses

- Distribution and storage of the feedstocks will likely be a serious issue and should have some attention from this platform and/or close communication with the feedstock platform.
- The weakness of this progress is that its ability to achieve its goals may be limited or prevented by the actions of organizations beyond its influence.

R&D Portfolio Gaps

- Gaps were not identified, but this reviewer is in agreement with the programs objectives, of:
 - Identify challenges, barriers, and opportunities that need to be addressed in order to promote the increased use and distribution of biofuels, and,
 - Gain industry (i.e., producers, petroleum wholesalers and retailers, pipeline operators, rail, etc) insight into how the Biomass Program can best focus its infrastructure efforts.
- It appears that this program is its early stages. This reviewer believes it should be accelerated and that investor considerations and interests being part of the program. As

important as any of the other presentations, this should be considered to be a major externality towards meeting the overall program goals. This reviewer emphatically agrees with the conclusion that an infrastructure plan be prepared.

- I don't believe gaps were presented to the reviewers.
- Efforts to achieve goals were not apparent.
- The weakness of this progress is that its ability to achieve its goals may be limited or prevented by the actions of organizations beyond its influence.

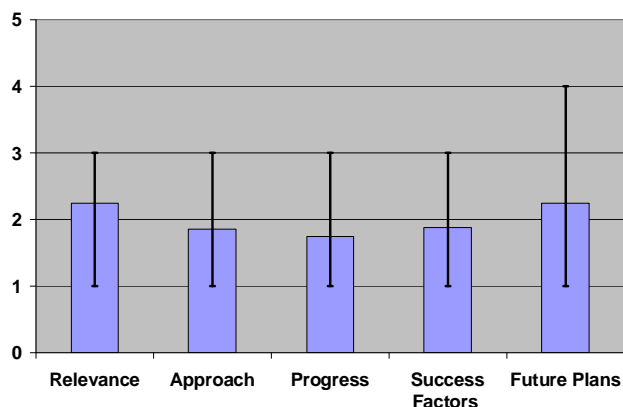
Additional Recommendations, Comments and Observations

- Focusing on transporting fuel, may learn useful information about moving around biomass.
- Explore partnership with the state of CA on your emissions work for possible synergy with their San Joaquin Air Quality District needs.
- Infrastructure issues can deter the growth of biofuels consumption, so workshops like this can help. Their outcomes need to be communicated more broadly, however.
- This reviewer was unable to glean the relevancy of the direction presented.
- Will there be joint presentations and deliverables provided to the public, staffers on the hill, DOE administrators and industrial organizations?

Biodiesel and Other Technologies

Presenters: Mark Decot (Biomass Program) & Shaine Tyson (Rocky Mountain Biodiesel),
Review Chair

	Average Score	Delta Minimum	Delta Maximum
Relevance	2.25	1.25	0.75
Approach	1.86	0.86	1.14
Progress	1.75	0.75	1.25
Success Factors	1.88	0.88	1.13
Future Plans	2.25	1.25	1.75
Average	2.00		



Question 1: Platform Approach

- Difficult to answer – there is no biodiesel platform. The interest across the nation in this subject makes it seem appropriate to have some effort directed to improve the base of knowledge concerning oilseed feedstocks, conversion processes including co-products, and distribution issues.
- Not a platform, group of congressional mandated projects. Lack of structure at the review. Broad diversity of projects, mostly related to biodiesel. \$1.00/gal subsidy brought scads of people to the table.
- Discord and discontinuity stressed.
- There are no platform approaches or organization to review. I am glad that the Program has put these under review, and hope that the feedback the “platform” reviewers provided will be utilized.
- Many of these projects support local interests, but not national program goals. Platform managers have little ability to refocus project goals or require good quality research.
- This platform’s approach is very scattered and serves as a prime example of how earmarks negatively impact achievement of the Biomass Program objectives.

Question 2: Platform Goals (in relation to the Program)

- There are no platform goals, so the response to this question should be N/A
- Not a platform, but supports the overall program.
- Unclear
- No platform goals to review. Some of these projects should be moved into the new Infrastructure platforms so that they can be judged in light of the goals of that platform.
- No. If the Program decides that biodiesel is worthy of platform status, it should make the effort to define realistic goals etc.

Question 3: Platform Goals (in relation to industry)

- There are no industry reviewers in this program. It appears that this program is a technical activities program.
- There are no stated goals.
- Goals not clearly articulated, but assumed to replace gasoline. No articulation of goals or how much diesel could be replaced.
- Congressionally directed seem to be a problem.
- No goals.

- What goals??

Question 4: Focus and Balance of the Platform R&D

- Since the projects are primarily not directed by the DOE staff, there does not appear to be any planned balance in the set of projects.
- Good assessment by review committee, tried to get answers. Have good handle on how to bring the program together.
- Clearly some disconnects in focus.
- Obviously, the research is not focused or balanced, though I thank the reviewers for highlighting those projects which had some usefulness for achieving Program goals.
- What focus?

Question 5: Platform Progress

- Future assessment should be better detailed.
- Some projects appear to have some value to addressing imported petroleum replacement.
- Needs organization, review committee gave helpful suggestions, recommendations, but no indication that input would be incorporated.
- No platform for which to track progress.
- Fifteen different projects going in fifteen different directions will not contribute to progress towards goals.

Additional Comments

Strengths

- This is not a platform, rather a collection of mandated projects. It was a good review of the projects with many good suggestions/recommendations.
- The reviewers performed a valuable service in analyzing these “orphan” projects. Leveraging with private funding is to be commended. Pipeline testing projects may have use to the new infrastructure platform.

Weaknesses

- As the presentation indicates, a biodiesel platform does not exist. Much more work is needed on this activity.
- Didn't appear likely that many of the recommendations would be followed.
- There is no platform. Some of the projects could be moved into existing platforms for better review. However, I don't fault the Program for conducting the review in the manner they did.
- No focus.

R&D Portfolio Gaps

- Gaps are not indicated.
- The reviewers' comment that a biodiesel/renewable diesel platform is needed is interesting. I don't think that a separate program is appropriate, but should rather be integrated into existing platforms. However, we did not see much attention to biodiesel this week. As clean diesel engines have certain advantages over gasoline engines for improved fuel use, there is a need to give this some attention (at least a cost analysis). I would suggest that the Program follow up on the suggestion that the Program attempt to bring PIs from these types of projects together early and educate them on the Program goals and useful tools for project success.

- Overall, the projects presented were not focused on DOE Office of the Biomass Programs. Project timelines did not appear to be a major area of concern. As some of the projects were earmarked with a lack of coordination with more stable research programs, accomplishments were minimal. Inadequate data on cost benefits from utilizing biodiesel. Prior to demonstration projects, dollars should be spent on basic aspects of bioconversion and sourcing. Studies on engine performance and responses to regulatory requirements must be conducted. Relevant relationships with biorefineries were not apparent. Project innovations must be listed and acknowledged. Economic analyses are needed to ascertain relevancy to utilization of current and proposed materials.
- Too many to comment on.

Additional Recommendations, Comments and Observations

- Much work is required in this activity.
- The need for middle distillates is known. It seems that a biodiesel or middle distillate platform is needed.
- Biodiesel ought to be relegated to niche applications, such as mandated usage in recreational vehicles and boating where it is affordable. Biodiesel costs are prohibitive in view of other renewables. It has value to replace petro-diesel in ecologically sensitive areas.
- I agree with the ideas presented for managing earmarked projects. They can't hurt, and a few PIs might actually cooperate.
- The Program should consider abandoning support for biodiesel (fatty acid esters) and instead focus on renewable diesel as supported by a strengthened thermochemical conversion platform. If the decision is to retain oil based biodiesel, the focus should be on new (as in economically viable) feedstocks.

Platform Peer Review Summary Reports

Process Overview	39
Introduction	39
Review Design and Process	42
Evaluation Criteria.....	43
Platform Review Summaries	44
Feedstock Review Summary	Feedstock 1-69
Biochemical Conversion Review Summary	Biochemical 1-82
Thermochemical Conversion Review Summary	Thermochemical 1-88
Integrated Biorefinery Review Summary.....	Biorefinery 1-51
Biodiesel and Other Technologies Review Summary	Biodiesel 1-98

Process Overview

Introduction

The Technology Platform Peer Reviews for the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE), Biomass Program were conducted over a three month period prior to the November 2007 Biomass Program Peer Review. The summary report of each meeting provided in the following sections includes a summary of comments from the Review Panel, scores and feedback on individual projects and PI responses to the reviewer comments. The primary intent of the peer reviews was to provide information that assists the Program Manager and staff in their efforts to improve program performance. Other important potential outcomes of the reviews include: improving program management, demonstrating public accountability, providing an honest independent review of the projects and program, and transparently communicating the value of the programs to the larger public.

The objectives of this meeting were to demonstrate the R&D projects':

- Relevance to platform objectives
- Progress against planned milestones and likelihood of commercial success
- Relationship to mission and goals and contribution to 20-in-10 targets
- Strategic mix of industry, academic, laboratory involvement in the research
- Appropriateness of industry-government cost share
- Recommendations (i.e. go/no-go decisions, redirection, etc)

The work evaluated at these reviews support achievement of DOE goals and the results of the reviews are used by the Program as inputs for future funding decisions. In addition to the initial reviewer comments, the report anonymously discloses the full comments, scores for each of the criteria rated, and the average project score in the body of this report.

Platform	Date	Location	Projects Reviewed	Project Technology Areas
Feedstocks	August 21 - 23, 2007	Washington, DC	12	<ul style="list-style-type: none"> • Feedstock Supply & Sustainability • Feedstock Logistics Core R&D • Feedstock Systems Integration
Biochemical Conversion	August 7 - 9, 2007	Golden, CO	17	<ul style="list-style-type: none"> • Biochemical Platform Support • Feedstock-Biochemical Conversion Interface • Biochemical Processing Core R&D • Biochemical Process Integration Core R&D • Fundamental New Concepts • Chemicals and Products
Thermochemical Conversion	July 10 - 11, 2007	Golden, CO	18	<ul style="list-style-type: none"> • Thermochemical Platform Support • Gasification/Black Liquor Gasification • Clean-up and Conditioning • Fuel Synthesis • Pyrolysis
Integrated Biorefineries	August 13 - 15, 2007	Golden, CO	14	<ul style="list-style-type: none"> • Analysis and Strategic Planning • Corn Wet/Dry Mill Improvements • Oil Mills Improvement • Agricultural Residue Processing • Other Refinery-Related Projects
Biodiesel and Other Technologies	August 15 - 16, 2007	Golden, CO	18	<ul style="list-style-type: none"> • Biodiesel and Fuels Demonstration • Combined Heat and Power • Associated Products • Anaerobic Digestion • Communications, Outreach, & Partnerships • Other Technologies
Infrastructure	October 30, 2007	Washington, DC	0	

Technology Platform Reviewers (*Review Chairs)

Platform	Name	Organization
Feedstocks	Lyle Stephens*	Lead Reviewer; John Deere (retired)
	Beth Calabotta	Monsanto
	Peter Flynn	University of Alberta
	Tom Miles	T.R. Miles Technical Consultants
	Phil Rasmussen	Utah State University
Biochemical Conversion	Bonnie Hames	Ceres
	Don Johnson*	Retired from GPC
	Dale A. Monceaux	AdvanceBio LLC
	Sharon Shoemaker	Univeristy of California, Davis
Thermochemical Conversion	Jim Frederick	Georgia Institute of Technology
	Lisa Myers	Conoco Phillips
	Mark Jones*	Dow Chemical
	Robert Brown	Iowa State University
	Ron Breault	National Energy Technology Laboratory
	Steve Kelley	North Carolina State University
Integrated Biorefineries	William Cruickshank*	Natural Resources Canada (retired), Consultant
	Carol Babb	R.W. Beck
	Dr. Michael Tumbleson*	University of Illinois
	Jason Denner	Point 380
Biodiesel and Other Technologies	Dr. Shaine Tyson*	Rocky Mountain Biodiesel
	Rodney Boyd	McMinnville Electric Systems
	Dr. Joe Bozell	University of Tennessee
	Rick Handley	Coalition of Northeastern Governors (CONEG)
	Dr. David Sjoding	Washington State University
	Dr. Philip Shepherd	National Renewable Energy Laboratory
	Dr. Matt Smith	USDA – Agricultural Research Service
	Dr. Mark Zappi	University of Louisiana at Lafayette
Infrastructure	David Terry*	Governors' Ethanol Coalition

Review Design and Process

The following outline was provided to the Principal Investigators (PIs) to help them present their project information in a format that addresses the review objectives. Additionally, project background summaries were submitted by the PIs in a similar outline before the meeting.

- 1) Project Overview
 - a) Timeline
 - b) Barriers
 - c) Budget
 - i) Total project funding
 - ii) Funding received in FY06 and FY07, Future funding, if applicable
 - d) Partners
 - e) Stage of Development
- 2) Goals and Objectives
 - a) Project objective(s)
 - b) Relevance to the Biomass Program
- 3) Approach
 - a) Overall technical approach
 - b) Unique aspects of approach
- 4) Technical Accomplishments/Progress/Results
 - a) Describe most important technical accomplishments achieved and their significance
 - b) Describe the significance of the accomplishments by relating the results to the appropriate DOE targets and milestones from the MYPP
 - c) Benchmark progress to previously reported results (if applicable)
 - d) Benchmarks results against technical targets (if applicable)
- 5) Accomplishments/Progress/Results
 - a) What was done leading to technical accomplishments
 - b) Data and results
- 6) Success Factors and Showstoppers
 - a) Top 2-3 potential showstoppers to achieve successful project results
 - b) Window of opportunity to develop the technology
- 7) Future Work
 - a) Plan of work through to the end of the project
 - b) Highlight upcoming key milestones
 - c) Remaining issues
- 8) Summarize key points for reviewers and audience to take away

Evaluation Criteria

Scoring Guide Used by Reviewers

- 4 Excellent** overall.
- 3 Good** overall; no major and only some minor weaknesses.
- 2 Acceptable** overall; no major and some moderate weaknesses.
- 1 Marginal overall**; one or more significant weaknesses that cast doubt on the merit of the program in this area.
- 0 Unacceptable** overall; clearly little or no merit in this area.

Platform Review Summaries