



U.S. Department of Energy
Office of Inspector General
Office of Audits and Inspections

Audit Report

Follow-up Audit of the Department
of Energy's Financial Assistance for
Integrated Biorefinery Projects

DOE/IG-0893

September 2013




Department of Energy

Washington, DC 20585

September 9, 2013

MEMORANDUM FOR THE SECRETARY

FROM:


Gregory H. Friedman
Inspector General

SUBJECT:

INFORMATION: Audit Report on "Follow-up Audit of the Department of Energy's Financial Assistance for Integrated Biorefinery Projects"

BACKGROUND

The Department of Energy's Bioenergy Technologies Office (Program) supports the development of biomass resources into commercially viable biofuels, bioproducts and biopower. The Program provides financial assistance for integrated biorefinery projects to assist in building and operating facilities at each scale of development: pilot, demonstration and commercial.

The *Energy Policy Act of 2005* (EPAct) directed the Department to carry out a program to demonstrate the commercial application of integrated biorefineries. Subsequently, the *Energy Independence and Security Act of 2007* established additional goals involving advanced biofuel production. In response, the Program issued three Funding Opportunity Announcements (FOAs) in 2006, 2007 and 2009, resulting in the selection of 29 projects. As of March 2013, the Department had obligated over \$929 million, including \$561 million from the American Recovery and Reinvestment Act of 2009, for the 29 projects, and had expended approximately \$603 million (65 percent) of those funds. Each recipient was required to contribute an agreed upon cost-share that ranged from 50 to 60 percent of the total project cost. The Department's goal was to demonstrate operation of three integrated biorefineries by 2012, and validate annual production capacity of 100 million gallons of advanced biofuels by 2014. The annual production capacity was to be derived from 10 demonstration-scale and commercial-scale projects funded by the Program.

In our prior audit, *Financial Assistance for Biomass-to-Ethanol Projects* (DOE/IG-0513, July 2001), we reported that the Department had not met its goal to build a full-scale commercial biomass production facility by the year 2000, and provided recommendations for improving Program performance. Management concurred with the recommendations, and agreed to examine its policies and practices relative to the award, monitoring and termination of financial assistance. Due to the importance of the Program, we initiated this audit to determine whether the Department was meeting its integrated biorefinery performance goals.

RESULTS OF AUDIT

Despite over 7 years of effort and the expenditure of about \$603 million, the Department had not yet achieved its biorefinery development and production goals. Specifically, the EPAct mandate

to demonstrate the commercial application of integrated biorefineries had not been met and the Department was not on target to meet its biofuels production capacity goal. While the Program reported meeting its goal to demonstrate the successful operation of three integrated biorefineries by 2012, we noted that none of these refineries were at the commercial scale. Rather, these biorefineries were primarily much smaller pilot projects. Additionally, we found that the Program had not fully addressed independent review panel recommendations to improve Program management.

The Department had not successfully achieved commercial-scale operations even though the FOAs issued in 2006 and 2007 indicated that the proposed projects should be operational at the commercial scale within 3 to 4 years. Further, the 2009 FOA indicated proposed demonstration projects would be operational as soon as possible after award and proceed rapidly to commercial-scale operations. In fact, 6 of the 15 (40 percent) demonstration-scale and commercial-scale projects selected from the FOAs were mutually terminated by the Department and the recipients after expending more than \$75 million in Government funds, including one recipient that had spent \$44 million before losing its primary investor. The nine remaining projects have experienced technical and/or financial problems such as difficulties with ethanol meeting technical specification requirements, problems with acquiring private industry partners, and extended environmental reviews. As a result, the projects have experienced delays, including three projects that have been delayed 2 or more years.

Additionally, we found that the Department was not on target for achieving its 2014 production capacity goal of 100 million gallons of advanced biofuels. More than half of the projects specifically identified to contribute to the goal were terminated. As a result, in November 2012, the Program reduced its 2014 goal to 80 million gallons. Officials stated that one demonstration project achieved ethanol production in July 2013 and that two other projects expected to contribute to the goal were nearing completion and are slated to be operational by the end of 2014.

Contributing Factors

The Program's inability to achieve the EPO Act mandate and the original 2014 production capacity goal occurred because selected projects were not at the level of technical readiness needed for commercial development, and, because of poor market and financial conditions. Specifically:

- The Program awarded funding for commercial-scale projects even though the proposed technology had not been fully validated at pilot-scale or demonstration-scale facilities. The Merit Review Committee for the 2006 FOA noted that none of the projects fully met the selection criteria and that each of the proposed projects possessed high-risk elements. Program officials acknowledged the projects selected were not fully ready for commercial-scale operations and that the projects were high-risk. However, they indicated that the EPO Act required them to move forward with commercial-scale projects and the experience gained from the projects would enable them to accelerate development and commercialization efforts by increasing their knowledge of feedstock systems, process operations, and providing a better understanding of scale-up issues for future facilities.

We recognize the inherent risks associated with projects of this scope and complexity and that we are not in a position to fully evaluate the scientific and/or technical merits of integrated biorefinery projects. However, reviewers with the requisite background and expertise identified significant technical issues with many of the projects selected for funding, including concerns about the readiness for applying technology at the commercial scale. In our opinion, if the Department had validated the technology at the pilot and/or demonstration scales, it would have had greater assurance that the projects were ready to move to commercial scale. This would have strengthened the likelihood for success by reducing project scale-up risks. We noted that the Department had planned to award up to three commercial-scale projects in the 2006 FOA. However, the Department moved forward with negotiations with six applicants, ultimately awarding funding for four projects.

Further, even given management's assertion that the legislative intent of the EPAct required the award of commercial-scale projects, we noted that the Department more than doubled the funding for commercial-scale projects called for in the 2006 FOA. This action was taken despite technical concerns about readiness of the projects. Specifically, the Department increased the available funding from \$160 million to \$385 million, even though the Merit Review Committee had raised concerns about the technical readiness and high-risk nature of these projects.

- Program officials also attributed project shortfalls to deteriorating market and financial conditions beyond their control, which significantly reduced recipients' revenue streams, negatively affected their ability to attract and maintain private sector investors, and prevented them from meeting their cost share requirements. Program officials remarked that the world-wide financial collapse beginning in 2008 was a significantly greater factor to Program performance than normal competitive forces. The Program's assertion is supported by similar conclusions reached by the U.S. Government Accountability Office (GAO). In its August 2009 report, *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use* (GAO-09-446), GAO stated some biorefineries had suspended operations or delayed planned construction due to tight credit markets and other ethanol producers had shut down facilities or filed for bankruptcy because of unfavorable market conditions. A 2009 peer review of the Department's Integrated Biorefinery Program, conducted by a panel of external experts, also expressed an overall concern that projects appeared to be at serious risk due to financial stress caused by economic conditions.

We also determined that the Program had not fully addressed recommendations to improve operations that had been made by a 2011 integrated biorefinery peer review conducted by a panel of external experts. In particular, the Program had not formalized lessons learned and best practices from ongoing and terminated projects or conducted a "Blue Ribbon" review of the pertinent aspects of a terminated project. Program officials acknowledged that they had not implemented the recommendations, but asserted that they took alternative actions that met the intent of the recommendations. For example, they informally shared lessons learned and best practices with peers and had incorporated lessons learned from the 2006 FOA into the subsequent FOAs. Additionally, they had implemented Comprehensive Project Reviews, which covered all aspects of each project including technical progress, risk management, and business

and financing measures. These actions are notable, but do not fully meet the panel's recommendations and were not always successful in preventing the problems we observed during our current review.

Finally, we did not identify any material issues with payments made to three recipients that we selected for detailed review. We reviewed the allowability of approximately \$6.1 million in costs claimed by the three recipients. Our work identified \$12,000 in costs claimed by one recipient that were incurred and paid outside the authorized grant period. We notified the Department and it subsequently recovered nearly all of these costs.

Impacts and Path Forward

During the course of our audit, we identified positive steps that the Program had taken to reduce risk. For example, the Program implemented budget phases and released funding to recipients only after specific project milestones and performance metrics had been validated. Additionally, Program officials stated that in some cases, they put projects on hold because recipients failed to meet their cost-share requirements. As a result, the Department had released only 56 percent of the obligated funds for commercial-scale and demonstration-scale projects as of March 2013, an improvement since our 2001 audit revealed that, despite a significant lack of progress, the Department had released all available funding to its financial assistance recipients. Additionally, the Program's action to obtain the assistance of independent engineers and its implementation of annual Comprehensive Project Reviews strengthened its project monitoring, review and oversight. We also found that subsequent to the 2006 FOA, the Department reduced its risk by issuing FOAs at demonstration and pilot scales instead of commercial scale. Finally, the Department modified the requirements in these subsequent FOAs to request more specific information to include credible, validated data and clearly defined success factors.

As a result of the challenges we noted, the Department is likely to be further delayed in the successful implementation of a commercial-scale integrated biorefinery, negatively affecting achievement of the Department's Strategic Plan goal to promote energy security and the *Energy Independence and Security Act of 2007* national goal of increasing the supply of advanced biofuels to 21 billion gallons by 2022. Additionally, project delays and terminations increase the risk of wasteful spending as the Department may continue to fund projects that ultimately are terminated without achievement of the project objectives. Finally, in some cases, project completion delays have negatively affected the Department's implementation of the Recovery Act. Specifically, job creation estimates and the intended economic stimulation have not always been realized.

Despite these improvements, further actions by the Department are needed to fully validate the technology, analyze factors leading to the termination of an integrated biorefinery project, and to formalize its lessons learned. Accordingly, we made recommendations to the Department to improve the management of the Program.

MANAGEMENT REACTION AND AUDITOR RESPONSE

Management concurred with the recommendations and the corrective actions, taken and planned, were generally responsive to our recommendations.

The comments from management are discussed in more detail in the body of the report and are included in Appendix 3.

Attachment

cc: Deputy Secretary
Chief of Staff
Acting Under Secretary of Energy
Assistant Secretary for Energy Efficiency and Renewable Energy

REPORT ON FOLLOW-UP AUDIT OF THE DEPARTMENT OF ENERGY'S FINANCIAL ASSISTANCE FOR INTEGRATED BIOREFINERY PROJECTS

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FOLLOW-UP AUDIT OF THE DEPARTMENT OF ENERGY'S FINANCIAL ASSISTANCE FOR INTEGRATED BIOREFINERY PROJECTS

Background

The Office of Inspector General (OIG) has previously reviewed the Department of Energy's (Department) biomass efforts. In our prior audit, *Financial Assistance for Biomass-to-Ethanol Projects* (DOE/IG-0513, July 2001), we reported that the Department had not met its goal to build a full-scale commercial biomass production facility by 2000. We recommended that the Department: (1) prior to award, address merit reviewer concerns and recommendations, and verify the ability of financial assistance applicants to meet project financial commitments; and (2) restrict project funding when recipients do not comply with award terms, including withholding, suspending or terminating funding. Management concurred with the recommendations, and agreed to examine its policies and practices relative to the award, monitoring and termination of financial assistance.

Due to the importance of the Department's Bioenergy Technologies Office (Program), we initiated this audit to determine whether the Department was meeting its performance goals. Our audit focused on the 15 demonstration-scale and commercial-scale integrated biorefinery projects selected under the Funding Opportunity Announcements (FOAs) and did not include a review of 14 pilot-scale projects.

Program Management

Despite the expenditure of about \$603 million, the Department had not yet achieved its biorefinery development and production goals. Specifically, the Program had not satisfied its *Energy Policy Act of 2005* (EPA) mandate to demonstrate the commercial application of integrated biorefineries and was not on target to meet its biofuels production capacity goal.¹ While the Program reported meeting its goal to demonstrate the successful operation of three integrated biorefineries by 2012, we noted that none of these integrated biorefineries were at the commercial scale. Rather, these biorefineries were primarily much smaller pilot projects. Additionally, we found that the Program had not fully addressed independent review panel recommendations to improve Program management.

Program Performance

Despite awards to 15 demonstration-scale and commercial-scale integrated biorefineries since 2007, the Department had not successfully achieved commercial operations of its projects. This, despite the fact that the FOAs issued in 2006 and 2007 indicated the proposed facilities should be operational within 3 to 4 years, or soon thereafter, and the 2009 FOA indicated proposed demonstration-scale projects be operational as soon as possible after award and proceed rapidly to commercial-scale operations. In fact, 6 of the 15 (40 percent) demonstration-scale and

¹The Program's Multi-Year Program Plan, published in April 2012, included a goal to validate annual production capacity of 100 million gallons of advanced biofuels by 2014. The Program planned to meet the goal through the completion of ten demonstration- and commercial-scale projects that would each contribute from 1.5 percent to 24 percent of the desired 100 million gallon production capacity. The Program also included a goal to demonstrate successful operation of three integrated biorefineries by 2012.

commercial-scale projects were mutually terminated by the Department and the recipients after expending more than \$75 million in Government funds. Of the \$75 million, one recipient spent \$44 million before losing its primary investor. The projects were terminated for a variety of reasons. For example, one project never met required performance specifications and the recipient was unable to obtain additional equity investment. Another project was terminated because the recipient was unable to complete the scope of work outlined in its financial assistance agreement.

The nine remaining projects have all experienced technical, financial, and regulatory problems such as difficulties with ethanol meeting technical specification requirements, problems with acquiring private industry partners, and extended environmental reviews. As a result, the projects have experienced delays, including three projects that have been delayed 2 or more years. Specifically:

- One project was delayed more than 3 years because it was unable to secure additional Federal financial support due to the recipient's financial condition;
- One project, also delayed more than 3 years, encountered difficulty with its biofuel not meeting required technical standards; and
- Another project, delayed over 2 years, had been unable to attract additional private equity partners.

Despite these delays, Program officials stated that one demonstration project achieved production in July 2013, and two other projects were nearing construction completion, but noted unexpected complications may still occur, common for scale-up projects of this type, which move from pilot to demonstration to commercial scale.

Additionally, we found that the Department was not on target for achieving its 2014 production capacity goal of 100 million gallons of advanced biofuels. More than half of the projects specifically identified to contribute toward the goal were terminated. As a result, in November 2012, the Program reduced its 2014 goal to 80 million gallons. Officials stated that other remaining projects expected to contribute to the goal are slated to be operational by the end of 2014.

Questioned Costs

We did not identify any material issues with payments made to three recipients that we selected for review. We reviewed the allowability of approximately \$6.1 million in costs claimed by the three recipients. Our work identified \$12,000 in costs claimed by one recipient that were incurred and paid outside the authorized grant period. We notified the Department and it subsequently recovered nearly all of these costs.

Technical, Financial, and Peer Review Concerns

The Program's challenges in meeting its performance goals occurred primarily because selected projects were not at the level of technical readiness needed for commercial development and

poor market and financial conditions. Specifically, for many projects, the proposed technology was not ready for commercial-scale operations at the time of award. Program officials also attributed project shortfalls to deteriorating market and financial conditions beyond their control, which significantly reduced recipients' revenue streams and negatively affected their ability to attract and maintain private sector investors. Additionally, the Program had not fully implemented peer review recommendations because officials believed that other actions they had taken met the intent of the recommendation.

Technical Readiness

The Program issued a commercial-scale FOA in 2006, and awarded funding to projects even though the proposed technology had not been fully validated at pilot-scale or demonstration-scale facilities. Program officials acknowledged the projects selected were not fully ready for commercial-scale operations; however, they indicated that EPO required them to move forward with commercial-scale projects. Officials stated they would have preferred to issue pilot-scale and demonstration-scale FOAs first, but told us they were advised by the Department's Office of Congressional Affairs that: (1) pilot-scale and demonstration-scale projects for the initial FOA would not meet the intent of Congress; (2) the Program's approach must define commercial-scale and produce an acceptable biofuel to satisfy requirements of the legislation; and (3) once the intent of Congress was satisfied, the Program could consider demonstration-scale and pilot-scale projects in future FOAs.

During the award selection process for the 2006 FOA, the Merit Review Committee noted that none of the projects fully met the selection criteria outlined in the FOA and that each of the proposed projects possessed high-risk elements. The criteria were developed to ensure compliance with EPO, which required the Department to "select only proposals that: (1) demonstrate the project will be able to operate profitably without direct Federal subsidy after initial construction costs are paid; and (2) enable the biorefinery to be easily replicated." In fact, none of the projects selected were rated above satisfactory by the Merit Review Committee, with scores ranging from 565 to 670 on a scale of 0 to 1000. Despite these issues, the Merit Review Committee recommended six projects that it felt had the best potential to address the risks and provide a demonstration of a commercial facility. We noted that the Department had planned to award up to three commercial-scale projects in the 2006 FOA. However, the Department moved forward with negotiations with six applicants, ultimately awarding funding for four projects.

We acknowledge that projects of this scope involve inherent risk and that the OIG is not in a position to evaluate or conclude on the scientific and technical merits of integrated biorefinery projects. However, internal and external reviewers with the requisite technical background identified significant technical issues with many of the projects selected for funding, including concerns about the projects' readiness for applying technology at the commercial scale. In our view, if the Department had validated the technology at the pilot and/or demonstration scales, it would have had greater assurance that the projects were ready to move to commercial scale, which, in turn, would have strengthened the projects' likelihood for success by reducing scale-up risks.

Further, even given management's assertion that the legislative intent of EPO required the award of commercial-scale projects, we noted that the Department more than doubled the

funding for commercial-scale projects called for in the 2006 FOA despite technical concerns about readiness of the projects. Specifically, the Department increased the available funding from \$160 million to \$385 million, even though the Merit Review Committee had raised concerns about the technical readiness and high-risk nature of such projects. At the time, the Department announced the funding ceiling was raised to expedite energy goals and to front-end more funding to "reap the benefits" sooner. Department officials believed the experience gained from the projects selected would enable the Department to accelerate cellulosic ethanol development and commercialization efforts by increasing its knowledge in feedstock systems and process operations, and providing a better understanding of scale-up issues for future facilities. Program officials told us they had achieved this knowledge.

Program officials acknowledged there were risks associated with the projects and stated that they had instituted more extensive monitoring of the projects to address those risks. For example, the Program hired independent engineers to assist in project monitoring, review and oversight. Further, the Program implemented budget phases and released funding to recipients only after specific project milestones and performance metrics had been validated. Finally, as a result of a 2009 peer review, the Program implemented annual Comprehensive Project Reviews, which covered all aspects of each project including technical progress, risk management and business and financing measures.

Market Conditions

Program officials also attributed the difficulties in achieving successful commercial-scale and demonstration-scale operations to dramatic changes in market and financial conditions in 2008, resulting in projects losing key partners, significant reductions in projected revenue streams, and the inability to meet cost-share requirements. Program officials remarked that the world-wide financial collapse beginning in 2008, was a significantly greater factor to Program performance than the normal competitive forces that influenced the Program's progress in 2001. For example, one project was unable to secure a loan guarantee because its projected operating costs were too high while another project lost its key partner due to the downturn in the economy. Program officials stated that they put several projects on hold due to the recipients' inability to meet cost-share requirements. The Program's assertion is supported by similar conclusions reached by the Government Accountability Office (GAO). In its August 2009 report, *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use* (GAO-09-446), GAO stated some biorefineries had suspended operations or delayed planned construction due to tight credit markets, and other ethanol producers had shut down facilities or filed for bankruptcy because of unfavorable market conditions. A 2009 peer review of the Department's Integrated Biorefinery Program, conducted by a panel of external experts, also expressed an overall concern that projects appeared to be at serious risk due to financial stress caused by economic conditions.

Peer Review Recommendations

We found that the Department had not fully addressed recommendations to improve operations that had been made by the 2011 integrated biorefinery peer review conducted by a panel of external experts. Specifically, the Program had not formalized lessons learned and best practices from ongoing and terminated projects. The peer review had recommended the Department use appropriate resources to report on common issues that delay projects or cause cost overruns, as well as project successes and best practices. A key step in the Department's *Peer Review Guide*

is to implement action plans in response to the peer review recommendations and communicate lessons learned within the Department. Additionally, the Program had not conducted a "Blue Ribbon" review of the pertinent aspects of one of the Program's terminated projects and the circumstances surrounding its failure. The peer review had recommended that the "Blue Ribbon" review: (1) evaluate the origins and approval of the award; (2) evaluate the input and advice from the Department and its Independent Engineer at critical decision points; (3) assess the decision-making steps that approved the use of public funds to proceed to construction and on multiple changes in scope and product mix; and (4) consider the lack of impact or influence of the 2009 peer review process in which the project was rated low and the peer reviewer's skeptical comments were largely dismissed by the recipient in its response to those comments.

Program officials did not implement the 2011 integrated biorefinery peer review recommendations because they believed that alternative actions they took met the intent of the recommendations. Specifically, while Program officials acknowledged they did not formally document lessons learned, they stated that they informally share lessons learned and best practices with peers and had incorporated lessons they learned from the 2006 FOA into the subsequent FOAs. For example, to mitigate risk, the Department clarified in a subsequent FOA that projects were required to use Earned Value Management and establish a contingency in their budgets. Additionally, Program officials said they formally collected and documented results from Comprehensive Project Reviews. While these actions are notable, they do not fully meet the panel's recommendation to formalize and report on lessons learned and best practices from ongoing and terminated projects. To its credit, the Program has committed to formally publish its lessons learned in May 2014.

Program officials also expressed their belief that the Comprehensive Project Reviews met the intent of the recommendation for conducting a "Blue Ribbon" review. However, the 2011 peer reviewers disagreed with this conclusion. Program officials plan to present this issue to an independent committee in 2013 to achieve resolution. In our view, the Comprehensive Project Reviews were a notable improvement made by the Program, but do not specifically address the four aspects the peer reviewers recommended to be covered in a "Blue Ribbon" review.

Increased Risk

As a result of the challenges we noted, the Department is likely to be further delayed in the successful implementation of a commercial-scale integrated biorefinery, negatively affecting achievement of the Department's Strategic Plan goal to promote energy security and the *Energy Independence and Security Act of 2007* national goal of increasing the supply of advanced biofuels to 21 billion gallons by 2022. Additionally, project delays and terminations increase the risk of wasteful spending as the Department may continue to fund projects that ultimately are terminated without achieving project objectives. Finally, in some cases, project completion delays have negatively affected the Department's implementation of the American Recovery and Reinvestment Act of 2009 (Recovery Act). Specifically, job creation estimates and the intended economic stimulation have not always been realized. For example, one Recovery Act integrated biorefinery project expected to create up to 750 construction and 65-70 permanent jobs had only created or retained a total of 13 jobs as of June 2012. The project was scheduled to be complete

by May 2009, but was delayed because it had been unable to secure third party financing for its cost share. However, Program officials stated that other projects were on track with job creation estimates.

Positive Steps

We identified positive steps that the Program took to reduce risk. As previously noted, the Program implemented budget phases and released funding to recipients only after specific project milestones and performance metrics had been validated. As a result, the Department released only 56 percent of the obligated funds for commercial-scale and demonstration-scale projects as of March 2013. These actions represented an improvement because the previous audit had discovered that, despite a significant lack of progress, the Department released all available funding to its financial assistance recipients. Additionally, the Program's action to obtain the assistance of independent engineers and its implementation of annual Comprehensive Project Reviews strengthened its project monitoring, review and oversight. We also found that the Department reduced its risk subsequent to the 2006 FOA by issuing the 2007 and 2009 FOAs at demonstration and pilot scales rather than commercial scale. Finally, the Department modified the requirements in these subsequent FOAs to request more specific information to include credible, validated data and clearly defined success factors.

Despite these improvements, further actions by the Department to fully validate the technology, analyze factors leading to the termination of an integrated biorefinery project, and to formalize its lessons learned are needed to improve overall Program performance.

RECOMMENDATIONS

To improve the Program's efforts to achieve integrated biorefinery commercial-scale and demonstration-scale operations, we recommend that the Assistant Secretary for Energy Efficiency and Renewable Energy ensure that Program officials:

1. Validate biomass technology at each scale of development, including pilot and demonstration, before awarding funds for the next scale;
2. Implement the recommendation of the 2011 integrated biorefinery peer review to formally document common issues that delay projects or cause cost overruns, as well as project successes and best practices, establish action plans consistent with Department procedures, and communicate lessons learned within the Department; and
3. Resolve the recommendation of the 2011 integrated biorefinery peer review to conduct a "Blue Ribbon" review of a project failure.

MANAGEMENT REACTION

Program management concurred with the recommendations and noted that it had initiated actions to address them. Management stated it had implemented the recommendation to validate biomass technology at each scale of development by requiring every biorefinery project to pass a Critical Decision review, which included verification that results at the prior scale support the

process design for the larger facility. In addition, Management stated subsequent biorefinery FOAs required additional data and on-site validation before release of Government funds. Management noted it had taken steps to address external peer review recommendations regarding lessons learned and best practices. In particular, the Department held a public presentation regarding common issues with the American Institute for Chemical Engineers and informally shared lessons learned and best practices with parts of the Department of Defense. Management agreed to continue to prepare and publish reports on the issues in the recommendations and make the reports available to other offices internally and externally. Further, Management agreed to create a formal lessons learned document to be published in May 2014.

Regarding our recommendation to address the external peer review recommendation to conduct a "Blue Ribbon" review of a terminated project, Management stated in its written response that it was addressing this recommendation by capturing lessons learned in project and merit reviews, during award selection, and in its project management procedures. Subsequent to its written response, Management informed us that a decision had been made to gather appropriate information on the specific terminated project identified by the Peer Review and produce a report that would address the four aspects that the Peer Review requested be covered in the "Blue Ribbon" review.

AUDITOR COMMENTS

The Department's corrective actions, taken and planned, are generally responsive to our recommendations.

Management's comments are included in Appendix 3.

Appendix 1

OBJECTIVE

The objective of the audit was to determine whether the Department of Energy (Department) was meeting the Bioenergy Technologies Office's (Program) integrated biorefinery performance goals.

SCOPE

The audit was conducted between February 2012 and August 2013, at the Department's Golden Field Office in Golden, Colorado. Our audit included a review of the Program's demonstration-scale and commercial-scale integrated biorefineries.

METHODOLOGY

To accomplish our objective, we:

- Interviewed key Program officials.
- Reviewed and evaluated applicable laws, regulations, policies and procedures, and Funding Opportunity Announcements pertaining to the Program including the Program's selection, award, and monitoring of integrated biorefinery projects.
- Reviewed prior Office of Inspector General and U.S. Government Accountability Office reports and other related reports.
- Reviewed and discussed with the Department various external and internal integrated biorefinery reviews including merit and peer reviews, independent engineer reviews and comprehensive project reviews.
- Evaluated the Program's progress towards meeting its performance goals.
- Assessed the extent to which legislative mandates were realized, such as whether the number of jobs estimated for integrated biorefinery projects.
- Judgmentally selected 3 of the 15 demonstration-scale and commercial-scale integrated biorefinery projects to perform a detailed review (e.g., cost and schedule parameters, goals and milestones, cost share, and award modifications). Attributes considered in selecting the projects included award amount, expenditures to date, and variety of feedstock and conversion technologies.
- Selected a judgmental sample of reimbursements to the three selected projects to test for cost allowability. Of the \$42.5 million reimbursed to the recipients as of April 2012, we selected a sample of \$6.1 million in payments for testing. Attributes considered in selecting our sample included, reimbursement amount and different cost categories, such as construction, licensing fee and personnel. Because the sample was judgmental, we could not project the results to the population.

Appendix 1 (continued)

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe the evidence obtained provides a reasonable basis for our conclusions based on our audit objective. Accordingly, the audit included test of controls and compliance with laws and regulations to the extent necessary to satisfy the objective. In particular, we assessed the implementation of the *GPRA Modernization Act of 2010* as it relates to the audit objective and found that the Department had established performance measures related to Program. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. We did not rely on computer-processed data to accomplish our audit objective.

An exit conference was held with management on August 20, 2013.

RELATED REPORTS

Office of Inspector General

- Audit Report on [*The McNeil Biomass Project*](#) (DOE/IG-0630, December 2003). The Department of Energy (Department) was directed by Congress to award financial assistance to the McNeil Biomass Project to assist it in achieving its goal of demonstrating commercial-scale biomass gasification. The Office of Inspector General found that the Department continued to fund this project even though there was little or no progress, program officials did not closely monitor the project, and officials did not ensure that objectives and milestones were appropriate. The Department invested approximately \$37 million in this project in financial support. Further, the Department continued to provide reimbursement to this project up until the recipient filed Chapter 11 bankruptcy.
- Audit Report on [*Financial Assistance for Biomass-to-Ethanol Projects*](#) (DOE/IG-0513, July 2001). The Department awarded financial assistance to two firms under the biomass program, which had a goal to build a full-scale commercial biomass production facility. The Office of Inspector General found that: the Department did not meet its program goal to have a full-scale commercial biomass production facility; the biomass program faced significant technological and financial risk; and proposals were not solicited competitively. The Department invested approximately \$15 million in these projects in financial assistance and construction of the two facilities had not started as of July 2001.

U.S. Government Accountability Office

- Report on [*Potential Effects and Challenges of Required Increases in Production and Use*](#) (GAO-09-446, August 2009). The report found that biofuels production has had mixed effects on U.S. agriculture, but the effects of expanded production are less certain. Among other things, the report stated that some biorefineries had suspended operations or delayed planned construction due to tight credit markets and other ethanol producers had shut down plants or filed for bankruptcy because of unfavorable market conditions.

MANAGEMENT COMMENTS



Department of Energy

Washington, DC 20585

July 17, 2013

MEMORANDUM FOR: RICKEY R. HASS
DEPUTY INSPECTOR GENERAL
FOR AUDITS AND INSPECTIONS
OFFICE OF INSPECTOR GENERAL

FROM: STEVEN G. CHALK *S. Chalk*
DEPUTY ASSISTANT SECRETARY
FOR RENEWABLE ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

SUBJECT: Management Response to Office of Inspector General (OIG) Draft Examination Report on "Draft Audit Report on "Follow-up Audit of the Department of Energy's Financial Assistance for Integrated Biorefinery Projects"

The Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) appreciates the opportunity to review and comment on the subject report. The attachment outlines steps we are taking to address the three recommendations.

Over the last decade, the primary goal of the EERE Bioenergy Technologies Office (Program) was to research and develop technology to convert cellulosic, non-food feedstocks to ethanol at \$2.00 per gallon (\$2.60 per gallon of gasoline equivalent (gge)) by 2012. In partnership with the National Renewable Energy Laboratory (NREL), the Program achieved its major goal on time, with validation at the pilot scale. These efforts have been widely published and independently peer reviewed.

While the Program invests a majority of its resources in research, the government needs to help industry validate the process technologies and plant economics beyond the pilot scale to lower the technical and financial risks to commercialization by the private sector. Given the lack of experience in scaling these advanced energy technologies, the significant capital required to build large-scale integrated biorefineries, and the market risk associated with volatile transportation fuel prices, investment solely by private industry would not occur without government assistance. Therefore, over the last several years, the Department has established a portfolio of larger-scale integrated biorefinery projects. The Department requires a minimum of 50% private cost share for these larger scale projects to lower taxpayer burden and to validate that the private sector has a large stake in the outcome of these projects. The Department established a capacity goal for this project portfolio that was the aggregate sum of the individual project capacities.

In specific response to Section 932 of the Energy Policy Act of 2005, the Department conducted a competitive solicitation in 2006 for commercial scale integrated biorefineries to convert cellulosic materials to ethanol. Given the maturity of the technology, the Program selected more applications

Appendix 3 (continued)

than originally conceived to allow for a down select after initial design and technology demonstration phases. Ultimately, four projects proceeded to the construction phase after an evaluation of private cost share and technology progress. Each of the commercial biorefinery projects committed 60% or more private cost share.

As detailed in the report, many private cost share commitments evaporated with the significant economic downturn in 2008. This was about the same time that these plants would have begun planned construction. Simply put, the biorefinery project schedules slipped because private cost share was not secure. The Department chose to put these projects on hold and to allow its capacity goals to slip rather than forward-fund these plants with taxpayer funding while hoping that private cost share would arrive at the end of the project. This strategy proved wise since some of the biorefineries continue to experience significant difficulties in raising capital under the prolonged economic recovery today. As stated above, there is significant risk that is shared by government and industry; therefore, there is no guarantee that these projects will entirely succeed. We believe we properly stewarded the taxpayer investment. As the report notes, we regulated disbursement of the funding against milestones and performance metrics so that only 56% of the government obligations have been released. In addition, the report notes that only 0.2% of the costs examined were unallowable and costs were subsequently recovered.

In several projects, the Program required piloting and technology validation undertaken at recipient expense for the project to meet the evidence-based go/no-go decision points and independent engineering reviews. These requirements were partially recognized in the “Positive Steps” section of the report, and were in direct response to the original 2001 OIG report. The Program continually seeks to increase rigor in managing these complex projects and is installing best practices based on lessons-learned. As recommended, the Program formally reviews any project that EERE terminates after initial phases because it failed to meet technical milestones. The Program has informally instituted lessons-learned from these projects, incorporated them into all phases of the award, and shared them within DOE and with other government agencies. Some notable examples are the annual Comprehensive Project Reviews of each integrated biorefinery project that addresses technical performance, project management, risk mitigation, and financial status. In addition, we require an independent engineer, project management expert and earned value management system for each project to evaluate schedule, cost, and technical risk. New award selections incorporate both a rigorous technical validation of existing process performance data and a financial validation to ensure cost share. These lessons, along with many others, have been shared with other agencies, such as the Department of Defense in its Defense Production Act biofuels solicitation.

Within the DOE portfolio, two commercial-scale biorefineries and a third plant with a slightly smaller capacity are under construction. These three plants are currently on schedule to be completed within budget. Validation of the process technology and plant economics from these pioneering plants will be invaluable to private investors as they evaluate commercial opportunities. If commercial risk is deemed acceptable, we believe the cellulosic and other advanced biofuels production can scale as fast as the corn-based ethanol industry did over the previous decade. While it's recognized that there are market challenges until E-15 and higher blends are more utilized, we believe the advanced biofuels industry will grow and lead to decreased greenhouse gas emissions for transportation, reduced reliance on imported oil, and increased clean energy manufacturing across the United States.

Attachment 1 Detailed EERE Response to OIG Recommendations

OIG Recommendations: To improve the Program's efforts to achieve Integrated Biorefinery commercial-scale and demonstration-scale operations, we recommend that the Assistant Secretary for Energy Efficiency and Renewable Energy ensure that Program officials:

1. Validate biomass technology at each scale of development, including pilot and demonstration, before awarding funds for the next scale.

EERE Response: EERE has put this recommendation into practice. Every biorefinery project awarded by EERE has a contractual requirement to pass a "CD-3" review prior to proceeding to construction. In order to justify proceeding with a project, this CD-3 review includes verification that results at the prior scale of development support the process design for the larger facility. As noted in the OIG report, as part of the applications, each subsequent biorefinery FOA required additional data on prior work and the most recent biorefinery FOA "Innovative Pilot and Demonstration Scale Production of Advanced Biofuels" (DE-FOA-0000739) required on-site validation of appropriate prior work before release of significant Government funds.

2. Implement the recommendation of the 2011 Integrated Biorefinery peer review to formally document common issues that delay projects or cause cost overruns as well as project successes and best practices, establish action plans consistent with Department procedures, and communicate lessons learned within the Department.

EERE Response: EERE has taken steps to address this recommendation. Common issues faced with integrated biorefinery processes were most recently documented in a public presentation at the American Institute for Chemical Engineers (AIChE) National Meeting in October 2012. In addition, lessons learned and best practices from these projects have been shared within EERE, along with parts of the Department of Defense, to implement a commercial-scale advanced biofuels program through a Defense Production Act initiative. EERE will continue to prepare and publish reports on the issues contained in the recommendation and make the reports available to other offices at the DOE, other government entities, and the public, as determined by DOE management.

3. Resolve the recommendation of the 2011 Integrated Biorefinery peer review to conduct a "Blue Ribbon" review of a project failure.

EERE Response: EERE is addressing this recommendation. The Program has captured lessons learned from both active and terminated projects and has incorporated the learning in the annual Comprehensive Project Reviews and the merit review, award selection, and project management procedures. In addition, the lessons were shared and incorporated into the FY12 Department of Defense solicitation for commercial scale biorefineries through the Defense Production Act. Summary documents addressing many of the issues raised in the 2011 Peer Review have been prepared and will be included in the formal "lessons learned" document

Appendix 3 (continued)

EERE will publish in May 2014 to resolve the recommendation of the 2011 peer review panel.

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