

Section 3: Program Portfolio Management

This section describes how the Biomass Program develops and manages its portfolio of RDD&D activities. It identifies and relates different types of portfolio management activities, including portfolio decision making, analysis, and performance assessment.

Overview

The Biomass Program manages a diverse portfolio of technologies across the spectrum of applied RDD&D. Management of the Program's technology portfolio is a vital and demanding activity, made even more challenging by the fact that management of the portfolio must occur within the dynamic context of changing federal budgets and evolving administrative priorities.

To meet this challenge, the Program has developed a coordinated framework for managing its portfolio of RDD&D projects. The framework is based on systematically investigating, evaluating, and down-selecting the most promising opportunities across a diverse spectrum of emerging technologies and TRLs. This approach is intended to support a diverse technological base in applied R&D, while identifying the most promising targets for follow-on industrial-scale demonstration and deployment. The RDD&D pipeline is shown diagrammatically in Figure 3-1.

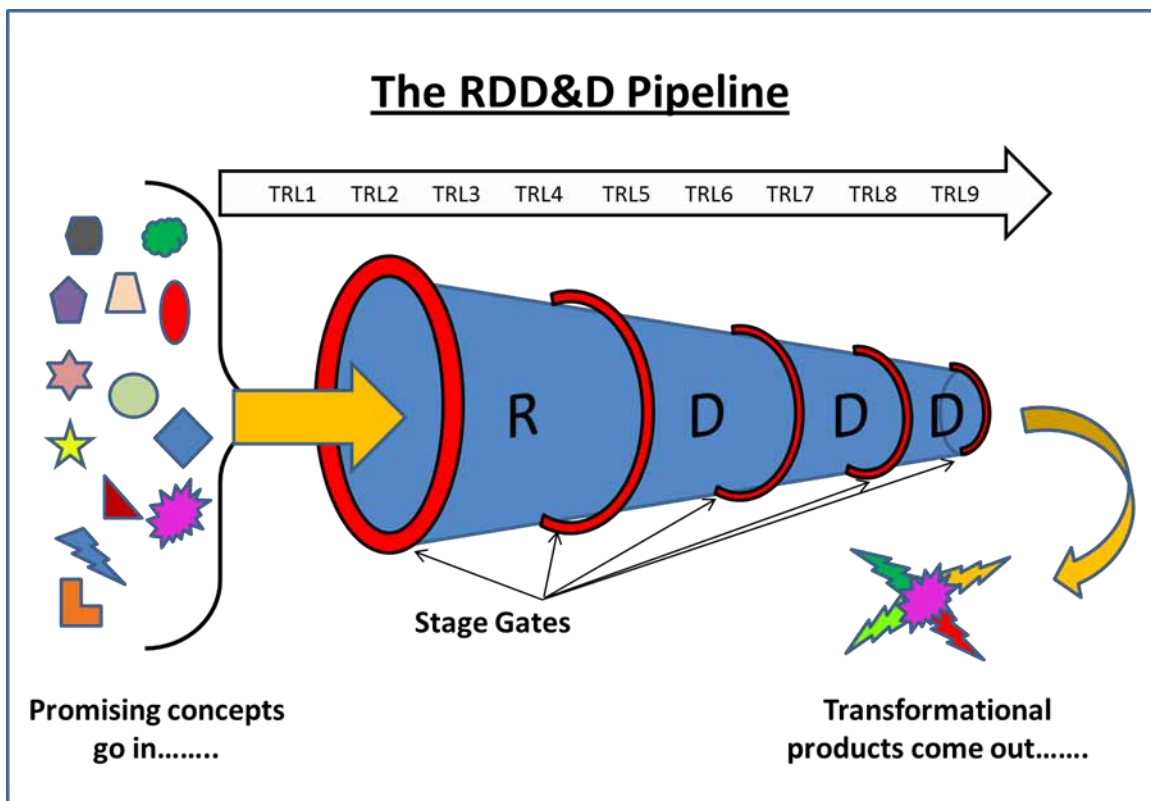


Figure 3-1: The RDD&D Pipeline

This approach has several distinct advantages:

- It ensures the Program will examine diverse feedstocks and conversion technologies for producing biofuels, biopower, and bioproducts.
- It effectively links resources with the stages of technology readiness, from applied research through commercial deployment.
- It successfully identifies gaps within the portfolio, as well as crucial linkages between the stages of RDD&D.
- It is adequately flexible to accommodate new ideas and approaches as well as various combinations of feedstock and process in real biorefineries.
- It incorporates a stage-gate process, which guarantees a series of periodical technology readiness reviews to help inform the down-selection process.

3.1 Program Portfolio Management Process

The Biomass Program manages its portfolio based on the approach recommended under the EERE Program Management Initiative,¹ complemented with processes derived from classical systems engineering for managing technically complex programs. The five major steps in the Program portfolio management process are shown in Figure 3-2 and described on the following pages.

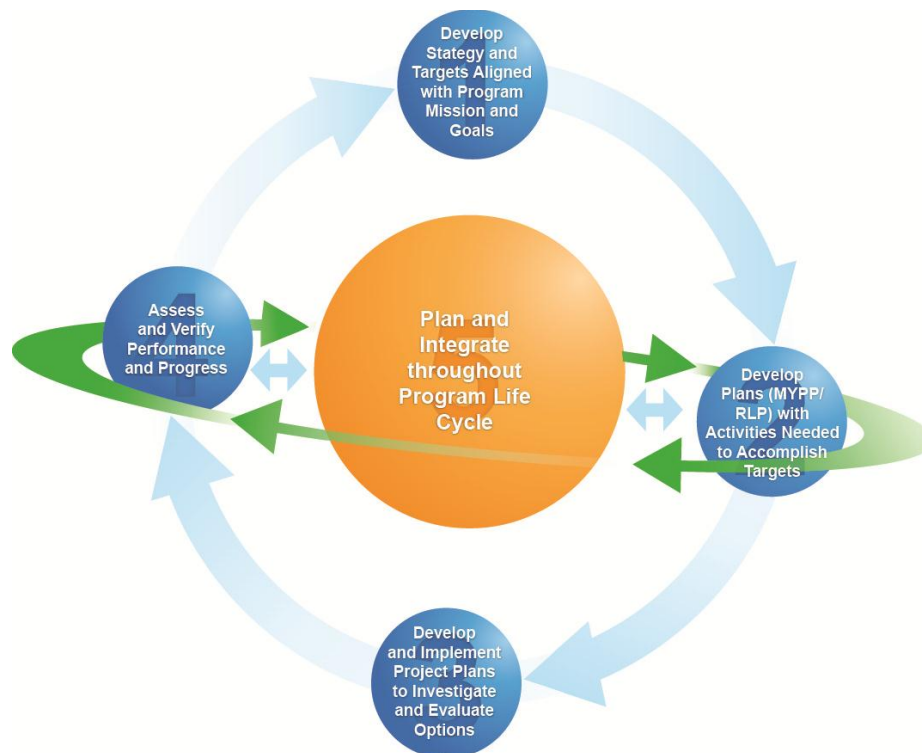


Figure 3-2: Program Portfolio Management Process

Step 1: Develop Program Strategy and Targets Aligned with Program Mission and Goals.

Step 1 encompasses the process of developing the Program mission and goals (outlined in [Section 1](#)), both of which are developed from a combination of the Program's strategic goal hierarchy (Figure 1-5) based on national goals, administrative and legislative priorities, and DOE and EERE strategic goals and priorities, in alignment with the goals of other federal agencies.

The Program design and logic (Figure 1-7) detail how the mission and goals fit within the planning and budgetary framework of the Program. Combining the Program design and logic with an understanding of market needs and technical scenarios leads to the definition of Program targets that are consistent with government objectives. Targets are allocated to the Program elements responsible for managing and funding research related to the targets.

Portfolio decision making at the strategic level is based on three main criteria:

- Does the portfolio contain the correct elements across the RDD&D spectrum of activities to meet the technical and/or market targets required to achieve Program goals?
- Does the portfolio sponsor diverse technologies that can buy down the risk of producing competitively priced bioenergy?
- Does the portfolio support the establishment of the bioenergy industry in the United States?

Step 2: Develop Plans (MYPP/RLP) with Activities Needed to Accomplish Targets.

Step 2 guides how the Program develops its multi-year plan to outline the path to achieving the high-level Program technical and market targets defined in Step 1.

Each Program technical area has performance goals and barriers identified through internal evaluation and public-private collaborative meetings. To meet the Program's performance goals and address the associated barriers, each technical area develops a multi-year RLP that identifies the strategic activities and associated resources to achieve respective targets. Programmatic priorities to address the barriers are determined by balancing the needs and driving forces behind the emerging industry within the context of inherently governmental activities.

The RLPs for each platform are then integrated into a Program-wide plan and evaluated for gaps and linkages. Gaps that are identified are addressed, while linkages between the platforms are highlighted so that all parts of the supply chain are developed iteratively to comparable levels of maturity over time. The RLPs form the basis for activities described in the MYPP. The MYPP is designed to undergo review and be updated on a regular basis to incorporate technology advances, Program learning, and changes in direction and priority.

Step 3: Develop and Implement Project Plans to Investigate and Evaluate Options.

Step 3 involves developing individual PMPs that are aligned with the MYPP and the platform RLPs. The PMPs define the work selected to investigate and evaluate the chosen approaches for achieving the Program-level technical and market targets, as well as milestones in the MYPP.

Project development and analysis are used to define a portfolio of projects that, when combined, will most effectively achieve Program targets. Factors considered at the project level are similar to those considered at the Program level in Step 2 and include potential benefits, scope, cost, schedule, and risk. Also, like Step 2, this is an iterative process that weighs benefits against costs and risks; however, the emphasis stays on the specific projects under consideration and how they compare to each other, as well as their relevance to the Program. At the initiation of a project, a PMP is prepared to describe the entire project duration, with special attention to the activities planned for the year. PMPs are updated annually based on actual progress, results of interim stage-gate reviews, and updates to the Program MYPP.

Step 4: Assess and Verify Performance and Progress.

Step 4 involves a system of performance assessments held on multiple levels to monitor and evaluate performance and progress as the Program is implemented (described in detail in section 3.2). The Project Management Center (PMC) evaluates project performance on a quarterly basis against baseline schedule, scope, and cost provided in the PMP. The Program's subprogram element peer reviews and an overall Program peer review are conducted biennially to provide decision making on future funding and direction. Stage-gate reviews are conducted at the individual project level to assess technical, economic, environmental, and market potential, as well as risk.

In large-scale demonstration projects and pioneer conversion facilities involving public-private partnerships, independent expert analysis, stage-gate decision making, and evaluation by the Project Management Center (PMC) contribute to project risk assessments and go/no-go decisions.

Step 5: Plan and Integrate throughout the Program Life Cycle.

Step 5 includes cross-cutting technical and Program integration efforts designed to help Program and Project Managers strengthen their management approaches to ensure a coordinated R&D effort, in addition to a well-integrated approach to technology demonstration and deployment. The diversity of technology options in each supply chain element and the distribution from applied science through development to demonstration and deployment lead to significant decision-making challenges.

3.1.1 Portfolio Analysis and Management

Portfolio analysis is carried out to determine the optimum portfolio of technologies and projects to achieve the Program's performance and market targets. Factors considered include the level of benefits expected, scope, cost, schedule, and risk to realizing the Program benefits. This is an iterative process that weighs benefits against costs and risks while taking into account the latest external information regarding market, technical status, and barriers. The process also incorporates the updated status of portfolio efforts based on verified, externally reviewed progress.

Portfolio management is not just a static annual activity, but rather is ongoing and synchronized to the budget cycle over several years. Each year, on a continuing basis, the Program re-evaluates its goals and barriers, technical and market targets, and portfolio of technologies across the RDD&D spectrum; the Program then uses that information to assess its progress. Every year, there is a new set of decisions associated with populating the RDD&D pipeline with new R&D projects, assessing the performance of ongoing development and demonstration projects, and down-selecting—via the Stage-Gate process—the most promising projects and ceasing to fund those projects that are not performing or otherwise failing to address the Program’s goals.

The Biomass Program’s efforts to improve its portfolio management, analysis, and assessment efforts are supported by the Biomass Systems Integration Office. The focus of systems integration analysis is to understand the complex interactions between new technologies, system costs, environmental impacts, societal impacts, system tradeoffs, and penetration into existing systems and markets. The goals of integrated baseline management are to provide and maintain the links between the Program’s technical areas. Top-down technical baseline management evaluates the links between the mission and strategies, performance and goals, and milestones and decision points of the Program. Bottom-up programmatic baseline management evaluates the links of the scope, budget, and schedule of each individual project, as well as activities of the Program.

3.2 Performance Assessment

Performance assessment includes performance monitoring, as well as Program and project evaluation. It provides the means to measure relevant outputs and outcomes that aid the Program in re-evaluating its decisions, goals, and approaches and tracks the actual progress being made. By design, the assessment processes provide input on Program progress and effectiveness from other government agencies, stakeholders, and independent expert reviewers.

Table 3-1: Program and Project-Level Assessments that Support Decision-Making

Assessment Type		Assessment Synopsis	Documentation
Performance Monitoring	<i>External Monitoring</i>	DOE's Annual Performance Target Tracking System	Annual Performance Target Reports
	<i>Internal Monitoring</i>	EERE's Corporate Planning System (CPS)	CPS Database/Website
		Project Monitoring with PMC Quarterly Reports	PMC Project Management Database
		Program Monitoring with Integrated Baseline Update	CORE ¹ Integrated Baseline Reports
Program Evaluation	<i>Peer Reviews</i>	Conducted by independent experts outside of the program portfolio to assess quality, productivity, and accomplishments, as well as relevance of program success to EERE strategic and programmatic goals; and management ²	Public Summary Documents Including Program Response
	<i>General Program Evaluation Studies</i>	Conducted by independent external experts to examine process, quantify outcomes or impacts, identify market needs and baselines, or quantify cost-benefit measures as appropriate ³	Public Reports and Documentation
Performance Monitoring and Program Evaluation	<i>Technical Program Reviews</i>	EERE Senior Management	EERE Internal
		Biomass R&D Technical Advisory Committee	Report to Congress (Including Program Response)
	<i>Technical Project Reviews</i>	Stage-Gate Reviews conducted by DOE only for public-private demonstration projects, DOE plus independent industry, academia, or other government for precompetitive R&D projects	Internal Reports for Public-Private Demonstration Projects and Public Information for PreCompetitive R&D Projects

¹ CORE is a systems engineering software package.

Performance Monitoring

External Performance Monitoring

The Office of Management and Budget monitors Program performance against technical Annual Performance Targets. Each program is responsible for establishing and monitoring quarterly milestones, as well as meeting Annual Performance Targets established in Congressional Budget Requests.

Internal Performance Monitoring

The Program utilizes CPS to help formulate, justify, manage, and execute Congressional Budget Requests. CPS also serves as a management tool to enable prospective spend planning, project data collection, and portfolio performance assessment. The system stores project-level management data, such as scope, schedule, and cost and tracks progress against technical milestones.

The performance of the projects (“agreements” in CPS) is monitored and managed by the PMC. Standardized processes used include:

- PMPs are developed to provide details of work planned throughout the entire project duration, as well as to establish measures for evaluating performance. The plans include multi-year descriptions, milestones, schedules, and cost projections. The PMPs are updated annually.
- Quarterly project progress reports are submitted by the funded organizations, outlining financial and technical status, identifying problem areas, and highlighting achievements. The PMC performs a quarterly assessment of project progress against the planned scope and schedule and financial performance against the cost projection and documents the assessment in a quarterly management report.
- The performance of major demonstration and deployment projects is also monitored by headquarters staff and the PMC through Comprehensive Annual Project Reviews. The results of these reviews are used for Program portfolio management and Program planning.

With more than 150 projects in the Program portfolio, the project plan and progress information must be summarized and synthesized in order to evaluate overall Program performance in a meaningful way. The Program has implemented a systems engineering approach and established integrated technical plans across Program elements to achieve the Program’s goals. The Program has also developed its integrated baseline, which links the platform-based project activities with resource-based milestones, illuminating gaps/issues in the current project portfolio and providing the foundation for data-driven decision-making by Program management.

The Program uses additional systems engineering approaches, including interface management, independent performance verification, and robust information management tools to monitor overall progress toward achieving technical goals. The integrated baseline is updated annually at a minimum, using project data and information. The updates monitor risks and identify critical technical gaps, cost overruns, and schedule slippages.

Program Evaluation

Peer Reviews

The Biomass Program uses an external peer review process to assess the performance of the platform technical elements, as well as the Program as a whole. The Program implements the peer review process through a combination of subprogram platform element peer reviews and an overall Program peer review, which are conducted at least biennially. The emphasis of the Program peer review is on the MYPP and the portfolio as a whole to determine whether or not it is balanced, organized, and performing appropriately. In contrast, the emphasis of the subprogram platform reviews is on the composition of projects that comprise the respective elements and whether or not those projects are performing appropriately and contributing to platform goals.

The Program peer review evaluates the RDD&D contributions of the subprogram platform elements toward the overall Program goals, as well as the processes, organization, management, and effectiveness of the Biomass Program. The review is led by an independent steering committee that selects independent experts to review both the Program and technical element or platform portfolios. The results of the review provide the feedback on the performance of the Program and its portfolio, identifying opportunities for improved Program management, as well as gaps or imbalances in funding that need to be addressed. By addressing these gaps and imbalances, the Program will continue to stay focused on the highest priorities.

The subprogram platform peer reviews are conducted prior to the Program review. Information and findings from the platform peer reviews are incorporated into the comprehensive Program peer review process. The objectives of the subprogram platform peer review meetings are:

- Review and evaluate RDD&D accomplishments and future plans of Program projects in a subprogram element following the process guidelines of the EERE Peer Review Guide and incorporating the project evaluation criteria used in the Program Stage-Gate Management Process⁴
- Define and communicate Program strategic and performance goals applicable to the projects in the platform element
- Provide an opportunity for stakeholders and participants to learn about and provide feedback on the projects in the Program portfolio to help shape future efforts so that the highest priority work is identified and addressed
- Foster interactions among industry, universities, and national laboratories conducting the RDD&D, thereby facilitating technology transfer.

Technical experts from industry and academia are selected as reviewers based on their experience in various aspects of biomass technologies under review, including project finance, public policy, and infrastructure. The reviewers score and provide qualitative comments on RDD&D based on the presentations given at the meeting and the background information provided. The reviewers also are asked to identify specific strengths, weaknesses, technology transfer opportunities, and recommendations for modifying project scope.

The Program analyzes all of the information gathered at the review and develops appropriate responses to the findings for each project. This information, including the Program response, is

documented and published in a review report that is made available to the public through the Program website.⁵

General Program Evaluation Studies

The Biomass Program sponsors several activities and processes that are aligned with the program evaluation studies described in the EERE Guide for Managing General Program Evaluation Studies. The Program is conducting general program evaluations based on this guide, including:

- Needs/Market Assessment Evaluations
- Outcome Evaluations
- Impact Evaluations
- Cost-Benefit Evaluations.

Needs/Market Assessment Evaluations: In the past several years, the Biomass Program has held a number of workshops in the past several years that have brought together stakeholders from federal and state government agencies, industry, academia, trade associations, and environmental organizations. These workshops identified the key needs and opportunities for biobased fuels, power, and products in the United States. Recent workshops have focused on feedstock supply, bioproducts, biopower, and algae.

Outcome, Impact, and Cost/Benefit Evaluations: These types of evaluations are carried out by PBA and were described previously in the Benefits Analysis portion of [Section 2.7](#).

Performance Monitoring and Program Evaluation

Technical Program Reviews

The Biomass Program uses several forms of technical review to assess progress and promote Program and project improvement: The Biomass R&D Technical Advisory Committee program reviews, EERE strategic program reviews, and technical project reviews according to the Biomass Program Stage-Gate management process.

The Biomass Technical Advisory Committee reviews the joint USDA/DOE Biomass R&D portfolio annually and provides advice to the Secretary of Energy and Secretary of Agriculture concerning the technical focus and direction of the portfolios. Periodic reports are submitted to Congress by the Committee.⁶ Internally, DOE-EERE senior management holds periodic strategic program review meetings with the Biomass Program Manager for various purposes, including preparation for Congressional budget submission and evaluation of strategic direction.

Technical Project Reviews

The Program also holds stage-gate reviews at the project level. The stage-gate process, as depicted in Figure 3-3, is an approach for making disciplined decisions about R&D that lead to focused process and/or product development efforts.⁷ Specifically, the Program uses the stage-gate process to inform decisions regarding the following:

- Which projects to carry forward in the Program's technology portfolio
- The alignment of R&D project objectives with Program objectives and industry needs

- Distribution of Program funding across the spectrum of TRLs within the spectrum of RDD&D activities
- Guidance on project definition, including scope, quality, outputs, and integration
- Evaluation of projects for progress and alignment with the Program portfolio.

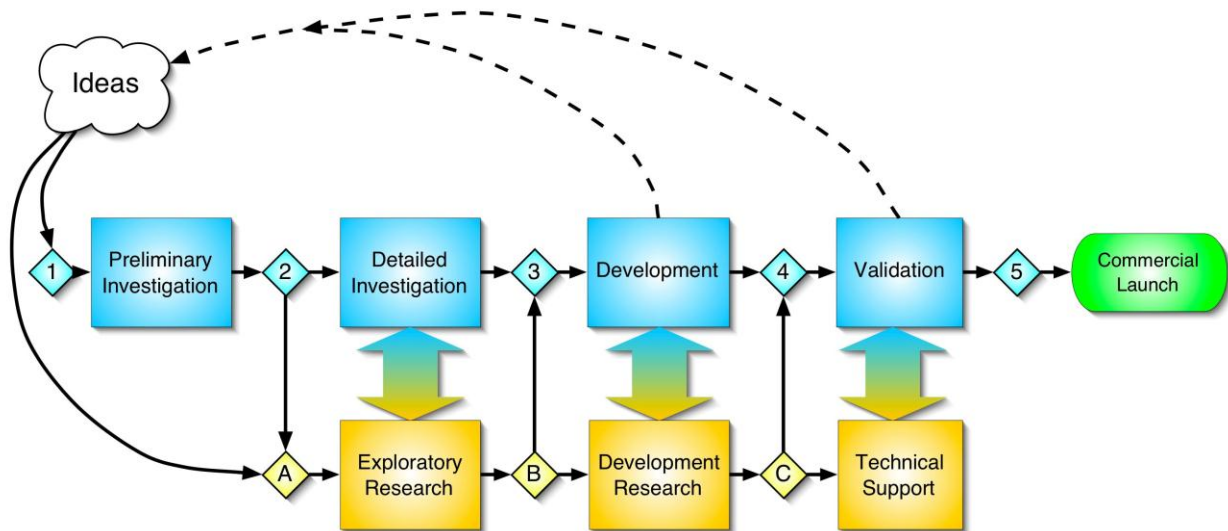


Figure 3-3: Biomass Program Stage-Gate Process

Stage-Gate Reviews: Each stage is preceded by a decision point or gate that must be passed through before work on the next stage can begin. Gate reviews are conducted by a combination of internal management and outside experts or the gate-keepers. The purpose of each gate is twofold: first, the project must demonstrate that it met the objectives identified in the previous gate and stage plan; and second, that it satisfies the criteria for the current gate. A set of seven types of criteria are used to judge a project at each gate:

- Strategic Fit
- Market/Customer
- Technical Feasibility and Risks
- Competitive Advantage
- Legal/Regulatory Compliance
- Critical Success Factors and Show Stoppers
- Plan to Proceed.

Specific criteria are different for each gate and become more rigorous as the project moves along the development pathway.

The possible outcomes of this portion of the review could be pass, recycle, hold, or stop. Passing implies that the goals for the previous stage were met, and everything looks good for authorization to proceed.

Recycling indicates that working longer in the current stage is justified—all goals have not been accomplished, but the project still has a high priority and potential looks promising.

Holding suspends a project because the need for it may have diminished or disappeared. There is an implication that the market demand could come back and the project could be resumed later.

Stopping a project might occur because the technology development is not progressing as it should, the market appears to have shifted permanently, the technology has become obsolete, or the economic advantage is no longer there. In this case, the best ideas from the project are salvaged, but the project is permanently halted.

The second half of the gate review takes place if the decision is made that the project “passes” the gate. The project leader must propose a project definition and preliminary plan for the next stage, including objectives, major milestones, high-level WBS, schedule, and resource requirements. The plan must be presented in sufficient detail for the reviewers to comment on the accomplishments necessary for the next stage, as well as the goals for completion of the next gate. Once the plan is accepted, the project can move to the next stage. Because the stakes get higher with each passing stage, the decision process becomes more complex and demanding. If the decision is made to “recycle” the project, the review panel will provide suggestions to the project leader on work that needs to be completed satisfactorily before the next gate review is held. In the case of a “hold” or “stop” decision, the plan to proceed is not needed.

An overview of the Biomass Program stage-gate process is available online at <http://devafdc.nrel.gov/pdfs/9276.pdf>. The stage-gate process is a key portfolio management tool because it integrates a number of challenging key decision areas, which include:

- Project selection and prioritization
- Resource allocation across projects
- Implementation of business strategy.

The gates and gate reviews allow the Program to filter poor performing or off-the-target projects and reallocate resources to the best projects and/or open the way for new projects to begin.

Endnotes

- ¹ The EERE Program Management Initiative was launched in 2003 to address stakeholder expectations, the President's Management Agenda, DOE and EERE strategic plans, findings and recommendations by the National Academy of Public Administration, and the Government Performance and Results Act. Complete information is available at http://www1.eere.energy.gov/ba/prog_mgmt_initiative.html.
- ² EERE Peer Review Guide. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, August 2004. <http://www1.eere.energy.gov/ba/pdfs/2004peerreviewguide.pdf>, accessed 10/6/06.
- ³ "EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need," DOE/EERE. February 2006.
- ⁴ Stage Gate Management in the Biomass Program, (Revision 2, February 2005). <http://devafdc.nrel.gov/pdfs/9276.pdf>, accessed 10/11/06.
- ⁵ Recent element review website: <http://obpreview2009.govtools.us/>
- ⁶ The most recent report, Annual Report to Congress on the Biomass Research and Development Initiative for 2006, can be accessed at <http://www.brdisolutions.com/Site%20Docs/Biomass%20Initiative%20Report%20to%20Congress%20FY%202006.pdf>.
- ⁷ Stage Gate Management in the Biomass Program, (Revision 2, February 2005). <http://devafdc.nrel.gov/pdfs/9276.pdf>, accessed 10/11/06.