Section 3: Office Portfolio Management

This section describes how the U.S. Department of Energy's (DOE's) Bioenergy Technologies Office develops and manages its portfolio of research, development, demonstration, and deployment (RDD&D) activities. It identifies and relates different types of portfolio management activities, including portfolio decision making, analysis, and performance assessment.

Overview

The Bioenergy Technologies Office manages a diverse portfolio of technologies across the spectrum of applied RDD&D. Management of the Office'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 Office 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 Technology Readiness Levels (see Table 3-1). This approach is intended to support a diverse technological base in applied research and development (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.

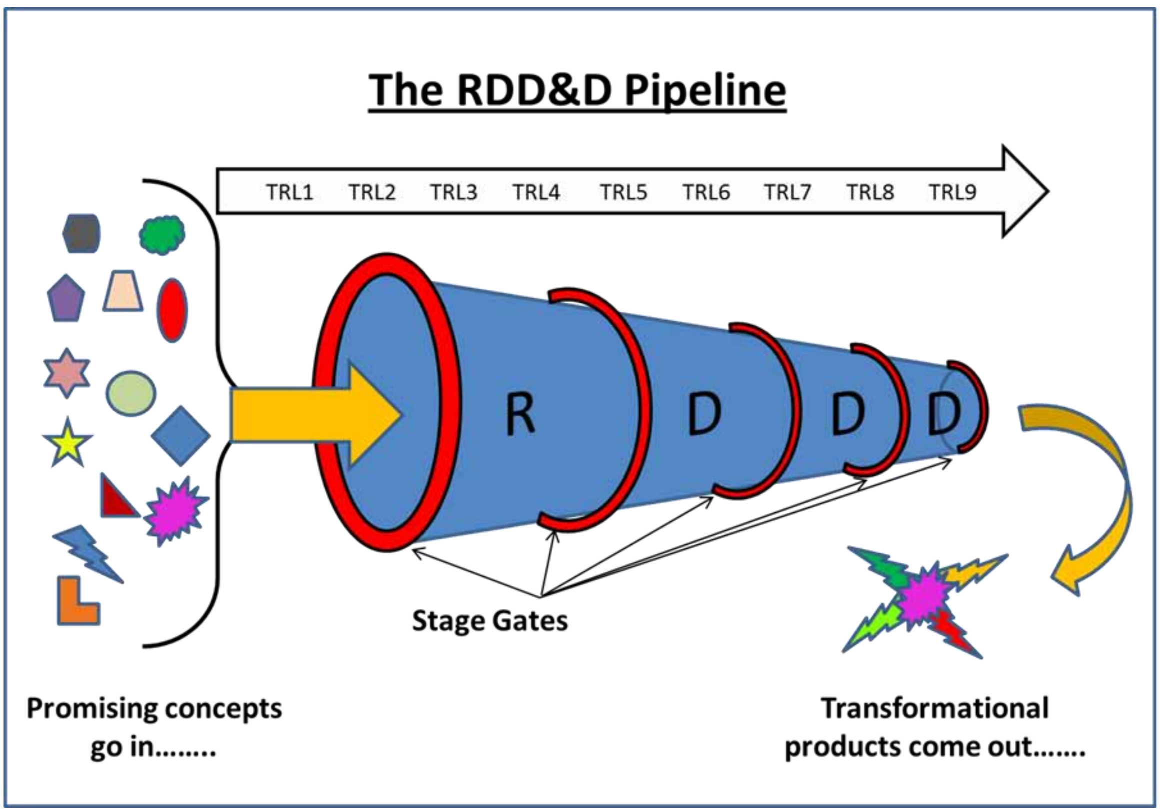

Figure 3-1: The RDD&D pipeline

Table 3-1: Technology Readiness Level (TRL) Definitions

TRL 1	Basic Research: Initial scientific research begins. Basic principles are observed. Focus is on fundamental understanding of a material or process. Principles are qualitatively postulated and observed. Supporting information includes published research or other references that identify the principles that underlie the material process.
TRL 2	Applied Research: Once basic principles are observed, initial practical applications can be identified. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Potential of material or process to satisfy a technology need is confirmed. Supporting information includes publications or other references that outline the application being considered and that provide analysis to support the concept. The step up from TRL 1 to TRL 2 moves the ideas from basic to applied research. Most of the work is analytical or paper studies with the emphasis on understanding the science better. Experimental work is designed to corroborate the basic scientific observations made during TRL 1 work.
TRL 3	Critical Function: Applied research continues and early stage development begins. Includes studies and initial laboratory measurements to validate analytical predictions of separate elements of the technology. Analytical studies and laboratory-scale studies are designed to physically validate the predictions of separate elements of the technology. Examples include components that are not yet integrated. Supporting information includes results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical components. At TRL 3 experimental work is intended to verify that the concept works as expected. Components of the technology are validated, but there is no strong attempt to integrate the components into a complete system. Modeling and simulation may be used to complement physical experiments.
TRL 4	Laboratory Testing/Validation of Alpha Prototype Component/Process: Design, development, and lab testing of technological components are performed. Results provide evidence that applicable component/process performance targets may be attainable based on projected or modeled systems. The basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of ad hoc hardware in a laboratory and testing. Supporting information includes the results of the integrated experiments and estimates of how the experimental components and experimental test results differ from the expected system performance goals. TRL 4–6 represent the bridge from scientific research to engineering, from development to demonstration. TRL 4 is the first step in determining whether the individual components will work together as a system. The laboratory system will probably be a mix of on-hand equipment and a few special purpose components that may require special handling, calibration, or alignment to get them to function. The concept is there but the details of the unit process steps are not yet worked out. The goal of TRL 4 should be the narrowing of possible options in the complete system.
TRL 5	Laboratory Testing of Integrated/Semi-Integrated System: Component and/or process validation in relevant environment- (Beta prototype component level). The basic technological components are integrated so that the system configuration is similar to (matches) the final application in almost all respects. Supporting information includes results from the laboratory scale testing, analysis of the differences between the laboratory and eventual operating system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. The major difference between TRL 4 and 5 is the increase in the fidelity of the system and environment to the actual application. The system tested is almost prototypical. Scientific risk should be retired at the end of TRL 5. Results presented should be statistically relevant.
TRL 6	Prototype System Verified: System/process prototype demonstration in an operational environment- (Beta prototype system level). Engineering-scale models or prototypes are tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness. Examples include fabrication of the device on an engineering pilot line. Supporting information includes results from the engineering scale, testing and analysis of the differences between the engineering scale, prototypical system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. TRL 6 begins true engineering development of the technology as an operational system. The major difference between TRL 5 and 6 is the step up from laboratory scale to engineering scale and the determination of scaling factors that will enable design of the final system. For PV cell or module manufacturing, the system that is referred to is the manufacturing system and not the cell or module. The engineering pilot scale demonstration should be capable of performing all the functions that will be required of a full manufacturing system. The operating environment for the testing should closely represent the actual operating environment. Refinement of the cost model is expected at this stage based on new learning from the pilot line. The goal while in TRL 6 is to reduce engineering risk. Results presented should be statistically relevant.
TRL 7	Integrated Pilot System Demonstrated: System/process prototype demonstration in an operational environment-(integrated pilot system level).This represents a major step up from TRL 6, requiring demonstration of an actual system prototype in a relevant environment. Supporting information includes results from the full-scale testing and analysis of the differences between the test environment, and analysis of what the experimental results mean for the eventual operating system/environment. Final design is virtually complete. The goal of this stage is to retire engineering and manufacturing risk. To credibly achieve this goal and exit TRL 7, scale is required as many significant engineering and manufacturing issues can surface during the transition between TRL 6 and 7.
TRL 8	System Incorporated in Commercial Design: Actual system/process completed and qualified through test and demonstration- (Pre-commercial demonstration). The technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include full scale volume manufacturing of commercial end product. True manufacturing costs will be determined and deltas to models will need to be highlighted and plans developed to address them. Product performance delta to plan needs to be highlighted and plans to close the gap will need to be developed.
TRL 9	System Proven and Ready for Full Commercial Deployment: Actual system proven through successful operations in operating environment, and ready for full commercial deployment. The technology is in its final form and operated under the full range of operating conditions. Examples include steady state 24/7 manufacturing meeting cost, yield, and output targets. Emphasis shifts toward statistical process control.

This approach has several distinct advantages:

- It ensures that the Office 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 Office Portfolio Management Process

The Bioenergy Technologies Office manages its portfolio based on the approach recommended under the Office of Energy Efficiency and Renewable Energy (EERE) Program Management Initiative,[1] complemented with processes derived from classical systems engineering for managing technically complex programs. The five major steps in the Office portfolio management process are shown in Figure 3-2 and are described on the following pages.

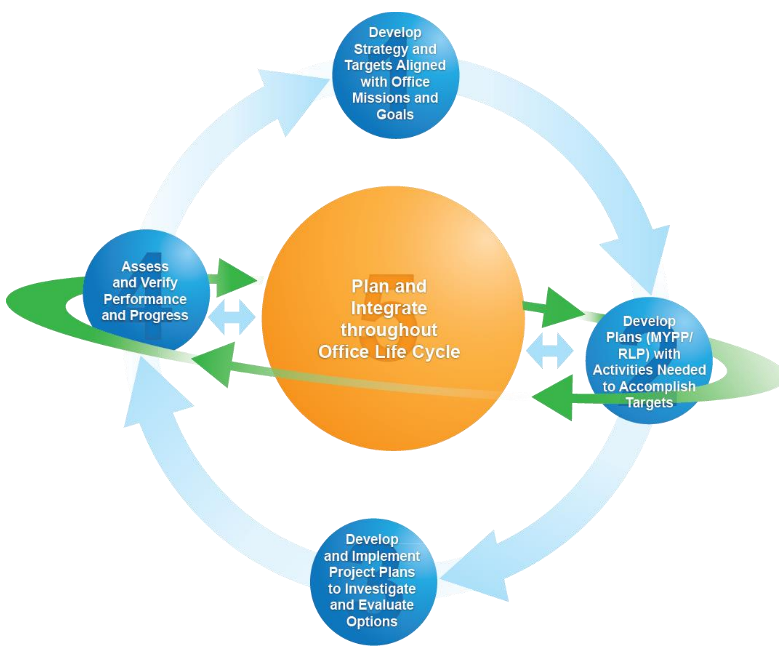

Figure 3-2: Office portfolio management process

[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/office_eere/bo_pmi.html.

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

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

The Office design and logic (see Figure 1-7) detail how the mission and goals fit within the planning and budgetary framework of the Office. Combining the Office design and logic with an understanding of market needs and technical scenarios leads to the definition of Office targets that are consistent with government objectives. Targets are allocated to the Office 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 Office 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 Office develops its multi-year plan to outline the path to achieving the high-level Office technical and market targets defined in Step 1.

Each program has performance goals and barriers identified through internal evaluation and public-private collaborative meetings. To meet the Office's performance goals and address the associated barriers, each program develops a multi-year Resource-Loaded Plan (RLP) that identifies the strategic activities and associated resources to achieve respective targets. Program 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 program RLPs are then integrated into an Office-wide plan and evaluated for gaps and linkages. Gaps that are identified are addressed, while linkages between the technology areas 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 Multi-Year Program Plan (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 Project Management Plans (PMPs) that are aligned with the MYPP and the program technology area RLPs. The PMPs define the work selected to investigate and evaluate the chosen approaches for achieving the 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 Office targets. Factors considered at the project level are similar to those considered at the Office 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 Office. 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 Office 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 Office is implemented (described in detail in Section 3.2). The Office evaluates project performance on a quarterly basis against baseline schedule, scope, and cost provided in the PMP. The Office's program peer reviews and an overall Office peer review are conducted biennially to provide decision making on future funding and direction. Stage-gate and comprehensive project 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 Office contribute to project risk assessments and go/no-go decisions.

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

Step 5 includes cross-cutting technical and 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 Office's performance and market targets. Factors considered include the level of benefits expected, scope, cost, schedule, and risk to realizing the Office 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 Office reevaluates its goals and barriers, technical and market targets, and portfolio of technologies across the RDD&D spectrum; the Office 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, 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 Office's goals.

The Bioenergy Technologies Office'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 Office's technical areas. Top-down technical baseline management evaluates the links between the Office's mission and strategies, performance and goals, and milestones and decision points. Bottom-up programmatic baseline management evaluates the links of the scope, budget, and schedule of each individual project, as well as activities of the Office.

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 Office in reevaluating its decisions, goals, and approaches, and tracks the actual progress being made. By design, the assessment processes provide input from other government agencies, stakeholders, and independent expert reviewers on effectiveness and progress towards Office mission and goals.

Table 3-2: Office and Project-Level Assessments that Support Decision Making

Assessment Type		Assessment Synopsis	Documentation
Performance Monitoring	*External Monitoring*	DOE's Annual Performance Target Tracking System	Annual Performance Target Reports
	Internal Monitoring	EERE's Corporate Planning System (CPS)	CPS Database/Website
		Project Monitoring with Quarterly Reports	Project Management Database
		Portfolio Monitoring with Technical Baseline Update	Biomass database and IBR performance monitoring reports
Office Evaluation	*Peer Reviews*	Conducted by independent experts outside of the Office portfolio to assess quality, productivity, and accomplishments, as well as relevance of Office success to EERE strategic and Office goals; and management[2]	Public Summary Documents (including Office Response)
	General Office Evaluation Studies	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 Office Evaluation	*Technical Office Reviews*	EERE Senior Management	EERE Internal
		Biomass R&D Technical Advisory Committee	Report to Congress (including Office Response)
	Technical Project Reviews	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

Performance Monitoring

External Performance Monitoring

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

Internal Performance Monitoring

The Office utilizes the Corporate Planning System (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 to track progress against technical milestones.

Standardized processes used to monitor and manage the performance of the projects ("agreements" in CPS) include the following:

- 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

[2] U.S. Department of Energy: Energy Efficiency and Renewable Energy, *Peer Review Guide* (2004), Washington: Government Printing Office, http://www1.eere.energy.gov/analysis/pdfs/2004peerreviewguide.pdf.

[3] U.S. Department of Energy: Energy Efficiency and Renewable Energy, *EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need* (2006), Washington: Government Printing Office, http://www.seachangecop.org/sites/default/files/documents/2006%2002%20EERE%20-%20EERE%20Guide%20for%20Managing%20General%20Program.pdf.

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 Office 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 through comprehensive annual project reviews and ongoing performance monitoring and analysis. The results of the reviews and performance monitoring are used for portfolio management and planning.

With nearly 350 projects in the Office portfolio, the project plans and progress information must be summarized and synthesized in order to evaluate overall Office performance in a meaningful way. The Office has implemented a systems engineering approach which integrates resource loaded technical plans across Office elements to assess portfolio balance and progress towards Office goals. The Office is also developing an integrated baseline, which links the technology-area-based project activities with resource-plan-based milestones. This illuminates gaps/issues in the current program portfolios and provides the foundation for data-driven decision making by Office management.

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

Office Evaluation

Peer Reviews

The Bioenergy Technologies Office uses an external peer review process to assess the performance of the programs, as well as of the Office as a whole. The Office implements the peer review process through a combination of program technology area peer reviews and an overall Office peer review, which are conducted at least biennially. The emphasis of the Office 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 program technology area reviews is on the composition of projects that comprise the respective program portfolios and whether or not those projects are performing appropriately and contributing to program technology area goals.

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

The program peer reviews are conducted prior to the Office review. Information and findings from the program peer reviews are incorporated into the comprehensive Office peer review process. The objectives of the program peer review meetings are as follows:

- Review and evaluate RDD&D accomplishments and future plans of projects in each program portfolio following the process guidelines of the EERE Peer Review Guide and incorporating the project evaluation criteria used in the Office Stage-Gate Management Process[4]
- Define and communicate Office strategic and performance goals applicable to the projects in that program portfolio
- Provide an opportunity for stakeholders and participants to learn about and provide feedback on the projects in that 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 Office analyzes all of the information gathered at the review and develops appropriate responses to the findings for each project. This information, including the Office response, is documented and published in a review report that is made available to the public through the Office website.[5]

General Office Evaluation Studies

The Bioenergy Technologies Office 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 Office is conducting general program evaluations based on this guide, including:

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

<u>Needs/Market Assessment Evaluations</u>: In the past several years, the Bioenergy Technologies

[4] "Stage-Gate Management in the Biomass Program: Revision 2," Oak Ridge National Laboratory (2005), http://feedstockreview.ornl.gov/pdf/stage_gate_management_guide.pdf.

[5] The most recent Program Review Portal website can be found at: http://obpreview2011.govtools.us/.

Office has held a number of workshops 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, home heating oil, conversion technologies for advanced biofuels, and algae.

Outcome, Impact, and Cost/Benefit Evaluations: These types of evaluations are carried out by the EERE Office of Planning Budget and Analysis and were described previously in the Benefits Analysis portion of Section 2.5.

Performance Monitoring and Office Evaluation

The Bioenergy Technologies Office uses several forms of technical review to assess Office and program progress and promote improvement. These include the Biomass R&D Technical Advisory Committee Office reviews, EERE strategic office reviews, the project stage-gate management process, and comprehensive project reviews.

Technical Reviews

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 office review meetings with the Bioenergy Technologies Office Director for various purposes, including preparation for Congressional budget submission and evaluation of strategic direction.

Technical Project Reviews

The Office also conducts project-level technical reviews. R&D projects are subject to the stage-gate management process and IBR D&D projects are subject to annual comprehensive project reviews.

Stage Gate Management Process

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 Office uses the stage-gate process to inform decisions regarding the following:

- Continuation of projects in the Office's technology portfolio
- Alignment of R&D project objectives with Office objectives and industry needs
- Distribution of Office 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 Office portfolio.

[6] The most recent report, Annual Report to Congress on the Biomass Research and Development Initiative for 2006, can be accessed at http://www.biomassboard.gov/pdfs/biomass_initiative_report_to_congress_fy_2006.pdf.

[7] "Stage-Gate Management in the Biomass Program: Revision 2," Oak Ridge National Laboratory.

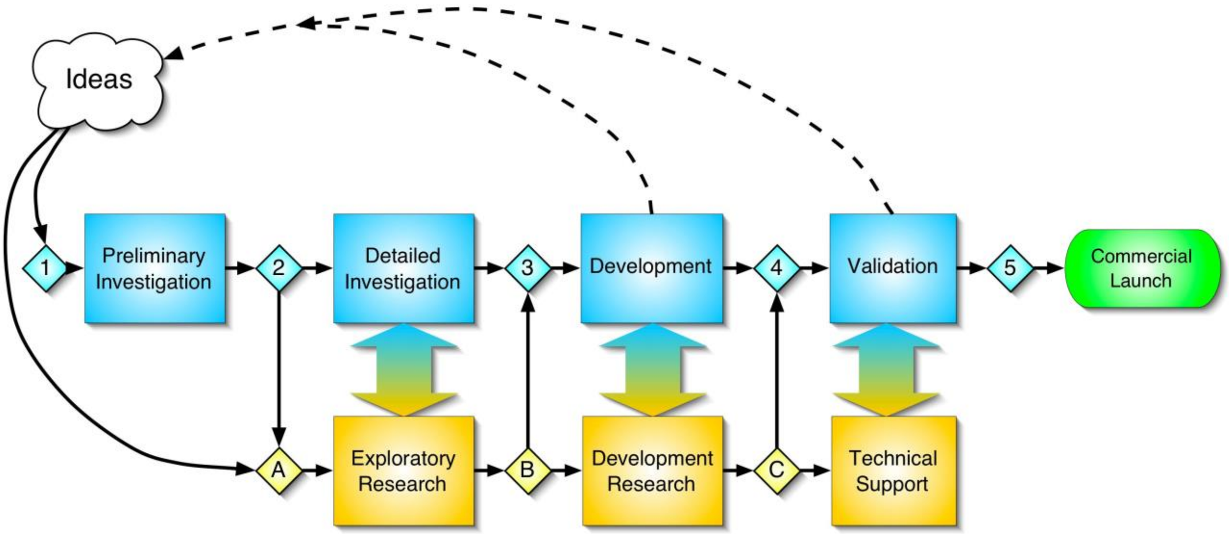

Figure 3-3: Bioenergy Technologies Office stage-gate process

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. 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 acceptable 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 promising potential.

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 work breakdown structure, 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 to establish 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 Bioenergy Technologies Office stage-gate process is available online.[8] The stage-gate process is a key portfolio management tool because it integrates a number of challenging key decision areas, which include the following:

- Project selection and prioritization
- Resource allocation across projects
- Business strategy implementation.

The gates and gate reviews allow the Office 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.

Comprehensive Project Reviews

The Office conducts annual comprehensive reviews on each of its major demonstration and deployment projects to monitor progress, identify key risks, and assess commercial viability. These in-depth reviews consider company structure and project management, technical performance, financial health, and commercial viability. Table 3-3 shows the key areas being assessed.

[8] http://feedstockreview.ornl.gov/pdf/stage_gate_management_guide.pdf

Table 3-3: Comprehensive Project Review Evaluation Criteria

Evaluation Category	Specific Evaluation Criteria
COMPANY STRUCTURE AND PROJECT MANAGEMENT	
1A: Project Management	• Project team is aligned to manage completion of performance baseline (cost/schedule) • Risks identified and mitigated • Key expertise and staff retained • Intellectual property secured / licensed
1B: Performance Against Baseline Scope, Budget and Schedule	• Execution plans for operations are complete or appropriate for project stage • Performance baseline is well defined and complete • Earned value management metrics consistent with expectations, variances are addressed, plans for baseline are credible and achievable
1C: Risk Mitigation	• Risks adequately identified and risk mitigation plan maintained
TECHNICAL PERFORMANCE	
2A: Process Operations and Technical Targets	• Minimal new or untested technologies and process integrations • Technical performance appropriate for current stage and technical targets met • Environmental sustainability issues considered, measured, and addressed
2B: Feedstock Supply	• Feedstocks supply demonstrated at adequate scale to support commercial applications • Project feedstock(s) same as experimentally demonstrated and future commercial applications • Feedstock secured at reasonable cost to support long-term operations and feedstock supply logistics addressed • Environmental implications of feedstock production, logistics, and procurement assessed and addressed
FINANCIAL HEALTH AND MARKETING APPROVAL / COMMERCIALIZATION PLANS	
3A: Marketing Approval and Commercialization Plans	• Off-take agreements secured, production volumes aligned, and achievable path to market penetration defined • Marketing plan including fuel testing and approval coordinated with long term project plans • Commercialization plans developed
3B: Project Financing	• Adequate access to financing and cost-share secured • Post-construction working capital sources defined • Future financing needs supported by performance baseline and critical path • Financing risks adequately addressed in contingency plans
3C: Project Economics	• The projected *pro forma* for the envisioned first commercial plant incorporates achievable performance targets and cost goals adequate for financial returns and debt coverage required for future commercialization