PSRP Name: Fossil Energy Research & Development (R&D)		
PSRP Lead Program Office and/or Laboratory/Site Office: Office of Fossil Energy (FE)/National Energy Technology Laboratory (NETL)		
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Does this program align with an existing PART program? Y

Does this program align with an existing CFDA program? N

1. Objectives

Program Purpose

The American Recovery and Reinvestment Act of 2009 (ARRA, or Recovery Act) provides an additional $3,400,000,000 for Fossil Energy Research and Development to develop and demonstrate CCS technology, in partnership with industry, and to transition this technology to industry for their deployment and commercialization. The primary objectives of the Fossil Energy portion of the Recovery Act are to:

- Demonstrate CCS technology to reduce greenhouse gas (GHG) emissions from the electric power and industrial sectors of our economy;
- Become the world's leader in CCS science and technology; and
- Implement projects to support economic recovery by creating many new jobs in pursuit of a secure energy future.

Recovery Act projects will leverage federal funding, stimulate private sector investment, accelerate delivery of CCS technology, and demonstrate the integration of coal-based energy systems and industrial processes with capture and permanent storage of carbon dioxide (CO_2) in geologic formations. The specific objectives of each component of the Fossil Energy research and development (R&D) portion of the Recovery Act are presented below.

Recovery Act projects will become logical extensions of several important ongoing Fossil Energy Coal Program baseline activities.

- Accelerate integrated CCS demonstrations by expanding and extending the opportunity for several additional CCS demonstrations for both existing and new electricity generation plants under the Department's ongoing Clean Coal Power Initiative (CCPI) Round 3 of competition (2.1.2).
- Expand the Department's focus of CCS on advanced coal power systems to additional CCS applications, including the use of petroleum coke as a feedstock for the industrial sector (2.2.2).

- Accelerate the comprehensive characterization of large volume geologic reservoirs augmenting existing data under the Department's Regional Carbon Sequestration Partnerships (2.3.2).
- Develop the next generation of scientists and engineers by expanding ongoing training and research efforts conducted primarily through the Department's University Coal Research and Historically Black Colleges and Universities programs (2.4.2).
- Pursue the design, construction, demonstration, and analysis of one fully integrated advanced coal gasification-based power plant with utility-scale CCS technology. (2.5.2).

Public Benefits

To achieve the President's stated goal of aggressively reducing our country's GHG emissions by 80 percent by 2050, we must address carbon dioxide (CO_2) emissions from today's fleet of coal-fueled electric power plants and industrial sources. These sources combined produce about 50 percent of the nation's CO_2 emissions. Given the high cost and energy required to capture and sequester CO_2 with existing CCS technology, if advanced low-cost CCS technology is developed with broad commercial deployment beginning in the 2020 timeframe, it could play a central role in helping to affordably achieve the reductions in CO_2 emissions required to meet the President's goal.

Our nation could begin to immediately see benefits that are directly attributable to projects resulting from the Recovery Act. The investments made by the Recovery Act are targeted at developing CCS technology as it may prove to be an effective means to address our near-term climate change concerns without forfeiting our economic competitiveness. Recovery Act investments will:

- Demonstrate that large volumes of CO_2 can be safely and permanently stored in geologic formations.
- Accelerate the opportunity for the early commercial learning experience needed to develop affordable CCS technology for the electric power and industrial sectors;
- Train the next generation of scientists and engineers that will be needed to support the commercial deployment and future industrial advancement of CCS.
- Enable the U.S. commercial, industrial and service sectors to compete in a carbon constrained world.

Absent the development of advanced technology and successful demonstration of CCS, meaningful reductions of CO_2 emissions from the power and industrial sector could only occur at high, potentially unacceptable cost. In order for CCS to be a commercially viable and affordable option, we are developing technologies to reduce the increase in the cost of electricity, caused by CCS integration, from the current increase of 30 to 85 percent to approximately a 10 to 35 percent increase by the 2020 timeframe (for advanced gasification and post-combustion capture, respectively).

Given the tremendous scale of the energy industry and the ubiquity of electricity, optimizing the responsible use of coal can help with meeting the challenges of not only reducing CO_2 emissions, but also improving energy security and maintaining living standards. The environmentally responsible use of coal could promote the maintenance of energy security in electricity

production and offers economic solutions to reduced oil consumption, whether through the provisions of CO_2- emissions reducing fuel or through the provision of clean electricity for advanced automotives.

The cost effectiveness and public benefit gained from an aggressive and successful demonstration of CCS technology at fully-integrated coal-fueled utility-scale facilities will be enhanced by CCS' availability for application to natural gas combined cycle power plants, thereby covering the sources of 70 percent of U.S electric power generation, and 90 percent of power sector CO_2 emissions. ARRA funding will also advance technologies for industrial applications of CCS with target coverage of 10 % percent of industrial CO_2 emissions. In addition, ARRA funding could support new applications with low or even negative lifecycle CO_2emissions, notably coal-biomass co-firing for electricity generation. ARRA funding will not be used for oil/gas processing (stripping CO_2 and H_2S from produced natural gas and crude oil production) since it is a mature technology. Projects will result in the early implementation of approximately 8 to 10 large-scale tests and commercial scale demonstrations that will collectively capture and store 7.5 million tons of CO_2 emissions (beyond the FE R&D Program baseline) over the 2 to 3 year operating period covered by Recovery Act funding. To demonstrate CCS at the large scale needed for significant impact on carbon emissions, DOE has set a target of selecting 2 or more projects that will each capture and store approximately 1 million tons of CO_2 per year. Here it must be recognized that DOE is limited to the scale of proposals received. These facilities, which will provide the early learning commercial experience, will be well positioned to continue to operate with CCS throughout the balance of their commercial life.

The Fossil Energy R&D portion of the Recovery Act, in combination with the Department's baseline Coal Program, will produce the data and knowledge needed to establish the technology base, reduce implementation risks by industry, and enable broader commercial deployment of CCS to begin by 2020. The funding of revolutionary research for CCS will help the U.S. to realize continued improvement in technology and potentially transform our energy infrastructure.

Cost-sharing requirements will be applied as follows:

- A minimum 20% non-Federal cost share will apply to the Industrial CCS project, the Geologic Sequestration Site Characterization project, and the Carbon Capture and Storage project.
- Cost sharing will be waived for the Geologic Sequestration Training and Research project.
- For the Expand and Extend CCPI Round 3 "demonstration" project, FE will require a minimum 50% non-Federal cost share and give preference to projects offering larger non-federal shares.

For FE projects, "demonstration" is defined as the last stage of development before a technology is ready for commercial deployment. Consistent with GAO recommendations for coal demonstration projects, the federal share for any demonstration project is limited to a maximum 25% increase of the federal contribution at the time of project inception with any additional funds to be provided at the federal government's discretion. To ensure that public funds are

spent cost-effectively, cost-effectiveness criteria will be included as part of the evaluation of applications under the Expand and Extend CCPI Round 3 and Industrial CCS projects.

2. Projects and Activities

2.1 Funding Table

The five programs within the Fossil Energy R&D account and the associated funding levels are:

Program Name	**Amount** ($M)	**Activity Category**
Clean Coal Power Initiative	800	Coal Energy Technology
Industrial Carbon Capture and Storage	1520	Coal Energy Technology
Geologic Sequestration Site Characterization	50	Coal Energy Technology
Geologic Sequestration Training and Research Grants	20	Coal Energy Technology
Carbon Capture and Storage	1000	Coal Energy Technology
FE Program Direction	10	Coal Energy Technology

2.2 Kinds and scope of projects and activities to be performed

The long-term strategic objective of the Department's Fossil Energy Coal Program is to foster the development of and facilitate the commercial deployment in the 2020 timeframe, of commercially-vaible near-zero emission highly-efficient coal-based power plants. Recovery Act projects will use federal funding, stimulate private sector investment, accelerate delivery of CCS technology, and in partnership with industry, demonstrate the integration of coal-based energy systems and industrial processes with capture and permanent storage of CO_2 in geologic formations. The Recovery Act activities described briefly below, when integrated with the Department's baseline Coal Research program, will increase in number and accelerate commercial scale demonstrations of CCS technology, thus increasing potential public benefits and reducing program risk.

2.2.1 Expand and Extend Clean Coal Power Initiative Round 3 ($800 million) – Modify the Department's existing CCPI Round 3 competition to permit a higher percentage of opportunity fuel such as petroleum coke to be used as a fuel source, and change the required CO_2 capture efficiency from a minimum of 90% to a target of 90% with a minimum of 50%. Due to the much higher level of funding than originally anticipated, a second closing date will be added to allow for new or revised applications. Increasing the number of competitively selected projects enabled by the Recovery Act will provide a broader CCS commercial-scale experience by expanding CCS technologies, applications, fuels, and geologic CO_2 storage formations, thereby leading to accelerated CCS deployment.

2.2.2 Industrial Carbon Capture and Storage ($1.52 billion) – The Department will issue a 2-part competitive solicitation to advance technology for large-scale CCS from industrial sources, such as chemical plants, refineries, steel and aluminum plants, manufacturing facilities, opportunity fuels to power (petroleum coke, municipal waste, etc.), and cement plants. These types of facilities currently produce the majority of the CO_2 emissions generated by the industrial sector and have limited experience with CCS technology. The

solicitation will also be open to potential new applications of CCS technology. Co-fired coal and biomass electricity generation plants offer compelling economic opportunities to demonstrate CCS and optimize the use of biomass resources. Production of synthesis gas and synthetic natural gas from coal or coal and biomass is another potential growth application for CCS technology. The solicitation will target projects that capture CO_2 from high concentration and low concentration CO_2 streams, including capture technologies that are applicable to both industrial and post-combustion power generation applications. The second part of the solicitation will include a new opportunity to pursue innovative concepts for beneficial CO_2 use (e.g. CO_2 mineralization and algae production in conjunction with power plant operation). In addition, two existing industrial and innovative reuse projects, previously selected via competitive solicitations, will be expanded to accelerate scale-up and field testing. An accelerated development and testing program will facilitate earlier commercial deployment, which is required to reduce technology risk and ultimately reduce cost.

2.2.3 Geologic Sequestration Site Characterization ($50 million) – Initiate a competitive solicitation to comprehensively characterize a minimum of 10 geologic formations. It is encouraged for applicants to utilize the experience and expertise of U.S. State Geologic Surveys and desirable for applications to build upon the research and development already accomplished under the Department's Carbon Sequestration Program. Projects will be required to complement and build upon the existing characterization base created by the Regional Carbon Sequestration Partnerships and U.S. State Geologic Surveys thus looking at broadening the range of geologic basins that have been studied to date.

2.2.4 Geologic Sequestration Training and Research ($20 million) – Develop a future generation of geologists, scientists, and engineers that will be needed to fill the gap and provide the skills required for national-scale, large-volume geologic storage projects. This program will emphasize advancing educational opportunities across a broad range of minority colleges and universities and use the University Coal Research and Historically Black Colleges and Universities programs as the models to follow in implementing this new effort. Regional technology training will be implemented that focuses on the applied science and engineering required for CCS projects. No funding will be provided for infrastructure constructions (such as a building).

2.2.5 Carbon Capture and Storage ($1.00 billion) – Pursue the design, construction, demonstration, and analysis of one fully integrated advanced coal gasification-based power plant with utility-scale CCS technology.

2.2.6 Fossil Energy Program Direction ($10 million) – Salaries and related expenses for federal employees and contracts for technical, management, financial and National Environmental Policy Act (NEPA) support services.

3. Characteristics

Types of Financial Awards to Be Used
University Coal Research

Fossil Energy R&D
Project Grants (Cooperative Agreements).

Type of Recipient
University Coal Research
- U.S. Colleges and Universities

Fossil Energy R&D
- States, local governments, universities, governmental entities, consortia, nonprofit institutions, commercial corporations, joint Federal/Industry corporations, U.S. Territories, and individuals

Type of Beneficiary
University Coal Research
- U.S. colleges and universities will benefit. The principal investigator must be a teaching professor and the grant must support at least one student enrolled at the college/university.

Fossil Energy R&D
- Federal, State, local governments, universities, consortia, nonprofit institutions, commercial corporations, joint Federal/Industry corporations and individuals

4. Major Planned Program Milestones

Table 4.1

Major Planned Program Milestones
FE R&D Demonstration-scale Projects

Assumes OMB apportionment of Recovery Act funds to DOE of May 15, 2009

Milestone	Carbon Capture and Storage 2.5.2	Expand CCPI Round 3 2.1.2	Industrial Carbon Capture and Storage 2.2.2
Issue Funding Opportunity Announcement (FOA)	Not Applicable - NA	06/09/09	06/08/09
Receive Applications	NA	08/24/09	08/07/09
Select Projects	NA	10/28/09	09/10/09
Award Projects/Initial Funds Distribution	NA	06/09/10	10/23/09
DOE Decision to Re-start FuturGen Project	06/23/09[1]	NA	05/30/10
Award FutureGen BP-1 Revised Cost Estimate/Funding Plan	08/15/09[1]	NA	NA
Downselect to Phase 2 (Design and Construction)	NA	NA	04/30/10

NEPA Satisfied (Cx, EA)	NA	09/30/10	09/30/10
NEPA Satisfied (EIS)	07/14/09	12/31/10	12/31/10
Project Continuation Decision	01/31/10[2]	NA	NA
Final Funds Distribution	02/01/10	09/30/10	09/30/10
Complete Detailed Design	TBD[3]	09/01/11	01/31/11
1st Major Equipment Arrives on Site	TBD[3]	12/31/11	07/31/11
Complete Characterization of at least the 1st CCS Injection Site	TBD[3]	07/31/12	07/31/12
Gasifier Installation Complete	TBD[3]	NA	NA
Complete Construction and Shakedown	TBD[3]	09/30/13	09/30/13
Begin Operations, CO_2 Injection and Data Collection	TBD[3]	09/30/13	09/30/13
Complete 1st Year CCS Injections	TBD[3]	09/30/14	09/30/14
Project Complete	TBD[3]	09/30/15	09/30/15

Notes: [1] FutureGen restart will use prior year appropriations; no Recovery Act funds to be obligated
[2] FutureGen Project assumes a "Go" decision for subsequent phases and milestones
[3] FutureGen milestone dates will be established upon completion of BP-1

Table 4.2

Major Planned Program Milestones
FE R&D Projects

Assumes OMB apportionment of Recovery Act funds to DOE of May 15, 2009

Milestone	Geologic Sequestration Site Characterization 2.3.2	Geologic Sequestration Training and Research 2.4.2	
		Universities and Colleges	*Establish CCS Training Centers*
Issue FOA	06/02/09	07/01/09	06/02/09
Receive Applications	08/10/09	08/11/09	07/22/09
Select Projects	09/10/09	09/11/09	08/24/09
NEPA Satisfied (Cx, EA, EIS)	12/17/09	12/23/09	12/10/09
Award Projects/Initial Funds Distribution	12/17/09	12/23/09	12/10/09
Final Funds Distribution	12/17/09	12/23/09	12/10/09
Begin Reservoir Data Collection	09/30/10	NA	NA
Begin Field Service Operations	12/31/10	NA	NA

Complete Well Logging	06/30/11	NA	NA
Initiate Population of NatCarb Database	11/30/11	NA	NA
Complete Population of NatCarb Database	11/30/12	NA	NA
Complete Training Center Curriculum Development	NA	NA	09/30/10
Complete 1st Training Classes – All Learning Centers	NA	NA	12/31/10
100 Professionals Trained	NA	NA	07/31/11
250 Professionals Trained	NA	NA	04/30/12
Complete Training Center Workshops – 500 Professionals Trained	NA	NA	12/10/12
100 Undergraduate and Graduate Students Trained	NA	12/23/12	NA
Project Complete	12/10/12	12/23/12	12/10/12

Environmental Review Compliance - NEPA

DOE will determine the appropriate level of NEPA review pursuant to NEPA and its implementing regulations (40 CFR Parts 1500- 1508 and 10 CFR Part 1021) for qualified proposals submitted by applicants in response to Funding Opportunity Announcements. DOE will comply with other applicable environmental requirements as to proposals selected for funding. However, in most situations, the proponents of the selected proposals are responsible for meeting the environmental requirements applicable to their projects, such as obtaining permits and complying with emission limits.

Access to Project Information

All FE R&D Recovery Act project awards, project milestones, and reports of progress against established baselines will be available for public review at http://www.recovery.gov. The availability of project cost and performance data will comply with the Special Provisions Related to work funded under the Recovery Act or 2009 which states:

Not later than 10 days after the end of each calendar quarter, each recipient shall submit a report to the Contracting Officer or to an address or website designated by the Contracting Officer that contains:

- The total amount of American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, covered funds received from that agency;
- The amount of American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, covered funds received that were expended or obligated to projects or activities;
- A detailed list of all projects or activities for which American Recovery and Reinvestment Act of 2009, Pub L. 111-5, covered funds were expended or obligated, including:
  - Name of project or activity
  - Agreement number
  - Description of project or activity

- Evaluation of the completion status of project or activity;
- Estimate of number of jobs created and retained by project or activity in the manner and form prescribed
- Infrastructure investments made by State and local governments, purpose, total cost, rationale of agency for funding infrastructure investment, name of agency contact.
- Information on subgrants awarded by recipient to include data elements required to comply with the Federal Accountability and Transparency Act of 2006 (Pub. L. 109-282).

5. Monitoring and Evaluation

I. Corporate Controls

Recovery Leadership & Operations

The DOE Recovery Office is the central point for implementation and execution of Recovery Act activities. A recovery operations team will oversee implementation management, such as monitoring project status, evaluating cost and schedule progress, ensuring thorough reporting, coordinating with external entities, and holding monthly performance and review meetings with senior departmental managers on the implementation status of specific recovery projects.

Recovery Funding Oversight, Performance

In addition to DOE's standard funds control mechanisms, Recovery Act funds are subject to additional process controls to ensure funds are not co-mingled, are tracked to enable reporting, and are spent responsibly. DOE recovery funds are released for implementation in a staged approach. Programs develop initial project plans which include performance metrics and require management approval.

Office of Internal Review (OIR)

DOE's OIR helps programs ensure that internal controls are in place, effective, and support the risk based approach to managing Recovery Act activities. OIR programs are being implemented or expanded to ensure the Recovery Act objectives are met, and DOE managers and partners are both held accountable for successful execution and also have the appropriate tools to ensure that success. These programs include coordinating DOE's "Internal Control Acknowledgment" program, conducting agency wide assessments and analyses and performing oversight of Recovery Act programs, including site and field visits. OIR worked with key impacted programs to produce initial vulnerability assessments identifying potential program specific and cross-cutting risks to ensure successful execution.

II. FE Processes

Program Planning and Project Initiation

Key Coal Program planning documents include the Department's Strategic Plan, the Office of Fossil Energy's Strategic Plan, the Office of Fossil Energy's Multi-year Coal Program Plan, the Annual Congressional Request Budget, pre-established Annual Government Performance and Results Act (GPRA) Program Targets and Annual Program Documentation, such as Annual Operating Plans. Recovery Act program planning is being accomplished with the objective of enhancing the Department's ability to achieve its overall CCS program objectives. Recovery Act projects will be initiated by issuing competitive solicitations for financial assistance awards or by

adding scope, schedule and funding to existing competitively selected projects (more information can be found at http://www.fossil.energy.gov/ and http://www.netl.doe.gov/).

Periodic Agency Reviews

Performance assessment provides essential feedback on the effectiveness of the Program's mission, goals, and strategies. The Office of Fossil Energy (FE) relies on a comprehensive suite of tools to evaluate its programs, ensure relevance to national energy needs, and guide decisions at the project and program level. FE routinely commissions the independent review of key technology areas in accordance with the Department's Guide for Managing General Program Evaluation Studies. Peer Reviews conducted by independent experts from the American Society of Mechanical Engineers (ASME) and the International Energy Agency (IEA) have been completed for key areas of the FE Coal Program, including Advanced Gasification, Advanced Turbines, Carbon Sequestration, Regional Carbon Sequestration Partnerships, Fuel Cells, and Fuels.

The results of these reviews and a summary of the findings developed by Review Panels can be found on the National Energy Technology Laboratory (NETL) web-site under Technologies, Coal and Power Systems, and are routinely posted and made publicly available on the NETL web-site as new reviews are completed. All recommendations and action items resulting from these reviews are evaluated, addressed, and resolved via the development of detailed mitigation strategies and actions that are recorded and tracked through completion (more information can be found at http://www.netl.doe.gov/).

The processes and procedures for conducting these independent expert reviews will be applied to all Recovery Act projects.

Process for Managing Project Risk

The risk assessment and management process to be applied to Recovery Act projects by FE is described in **SSC PMP-IV-1, Project Risk** and addresses **Risk Assessment,** which includes *risk identification (*as to presence) and *evaluation* (as to nature and severity), and **Risk Management,** which addresses *risk response* (as to actions taken on the basis of a completed risk assessment) and *risk mitigation* (as to reduction in the likelihood and/or severity of risk events based on the response actions taken). Project risk assessment and management are ongoing activities at FE. These activities occur continually in the process determining mission need, establishing requirements, considering alternatives, developing a Funding Opportunity Announcement (FOA), evaluating applications, negotiating awards, and monitoring the performance of recipients. The use of a comprehensive formal process is necessary and desirable in order to ensure (1) a high level of awareness and participation across the institution, (2) commonality in approach, (3) documentation of risk assessment and actions, (4) archiving of information on results, and (5) effective extraction of lessons-learned for future application.

Since risk is inherent to all projects, regardless of the level of complexity, cost, or visibility, project risk must be addressed to the appropriate level for every project. FE does not seek to avoid risk in the selection and overview of projects. Rather, FE seeks to ensure that risk is managed both efficiently and effectively. Identifying risk events and corrective actions that may be required, if events occur, will minimize disruption to the project. The depth of analysis,

complexity and cost of the resulting risk management plan will differ from project to project, based on the nature and collective potential or likely consequences of the risk. This concept of "tailoring" risk management acknowledges that different projects require different risk management approaches to appropriately address project risk (more information can be found at http://www.netl.doe.gov/business/solicitations/ssc2008/DE-SO26-08000662/PM_Guidelines.pdf).

Project Planning, Management and Oversight

Recovery Act projects will take the form of financial assistance grant and cooperative agreement awards. These projects will be managed in accordance with "the spirit" of the principles and discipline prescribed in DOE Order 413.3A (Acquisition of Major Capital Assets) as required by departmental guidance provided on June 23, 2006 by the Under Secretary to all Program Secretarial Officers on the subject of Project Management Expectations for Financial Assistance Activities. This guidance established a framework that identified *seven principles* to be incorporated into the project formation and management of all Department-wide financial assistance projects. These principles are:

1. Mission need must be defined and approved by the appropriate management official;
2. A range of alternatives to meet the mission need must be considered, developed, and evaluated;
3. Project objectives must be defined upfront and be used to judge project success;
4. Project performance risks (technical, financial, and otherwise) must be identified and mitigated in an implementation strategy;
5. Projects must be managed by qualified individuals;
6. Scope, schedule and budget must be established for each project and serve as the basis for project management; and
7. Projects must be managed and reported against the established scope, schedule and budget.

As part of its approach to risk management, FE has developed processes to obligate funds responsibly and expeditiously. FE has developed specific requirements for project progress before funds are obligated. For all demonstration projects, FE will require that the following stages are completed before full obligation of funds: concept, design, cost estimate, funding sources identified, and site access. If these stages are not complete by September 30, 2010, FE will terminate the project.

FE builds decision points into projects where, if key milestones are not met, FE reserves the right to withdraw from the project. Projects may also be unilaterally terminated by FE for noncompliance with the terms of the award or for failure to make progress.

Funds from terminated projects that become available before September 30, 2010 may be allocated to the selection and award of a project from a candidate list of highly-ranked projects not initially selected because of a lack of available funding under that particular Funding Opportunity Announcement (FOA) or, in the case of the Geologic Sequestration Training and Research Grant project, allocated to a new project selected from a 3-month rolling closing date established under the original competitive solicitation. Funds from terminated projects that

become available after September 30, 2010 (the date when the authority to re-obligate funds to other ARRA projects will have expires) will be returned to the Treasury General Fund.

Project Management

Recovery Act project management will be based on satisfying the requirements of NETL's Federal Project Management Guidelines. Sound project management principles will be used such as variance analysis and control of project cost, schedule and performance baselines for managing all Recovery Act projects. While total project costs are estimated at the time of the award, Research, Development and Demonstration (RD&D) projects tend to evolve as more definitive performance data, knowledge and analysis are obtained throughout a project's life. Therefore, periodically revising baselines is permitted and may be achieved through formal modification of the financial assistance grant or cooperative agreement award.

As appropriate for the level of maturity of a technology under development within a particular Recovery Act project, a modified stage-gate process will be used to assess progress through the various stages of technology development. Projects will be managed in phases with discrete budget periods. Cost, schedule, and technical status are reviewed prior to the start of any subsequent budget period and at discrete points to determine whether the project should continue into a subsequent phase, be terminated, or be revised to better meet objectives. Depending on the nature of the project, these decisions typically coincide with significant expenditures, such as major equipment purchases, completion of feasibility tests, assessment of scale-up studies, and start of construction. In order to transition from one budget period to another the recipient must submit the following information:

1. A report on the progress toward meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances at the end of the period including how they will be spent in the upcoming budget period.
2. A detailed budget and supporting justification for the upcoming budget period if additional funds are requested, a reduction of funds is anticipated, or a budget for the upcoming budget period was not approved at the time of award.
3. A description of the plans for the conduct of the project during the upcoming budget period.

Continuation funding is contingent on a) availability of funds, b) satisfactory progress towards meeting project objectives, c) submittal of required reports, and d) compliance with the terms and conditions of the financial assistance award.

The Continuation Application is reviewed by the NETL Technology Team, which includes the project manager as well as legal, procurement, and technical personnel. The Technology Team determines whether the applicant has made satisfactory progress toward project objectives and if plans for future conduct of the project are acceptable. If the Technology Team determines the Continuation Application is acceptable, additional funds may then be obligated to the project.

Although agencies do not have a unilateral right to terminate financial assistance agreements for convenience (per OMB requirements), FE builds decision points into projects where DOE

reserves the right to withdraw from the project if key milestones are not met, Projects may also be unilaterally terminated by DOE for noncompliance with the terms of the award or for failure to make progress.

Regarding subsequent use of funds, should negotiations fail and a selected project not be awarded, or if a project is terminated, FE/NETL plans to make another selection if another project is deemed worthy but was not selected due to insufficient funds. Further, funds may be used to cover cost escalation of existing projects, or augment projects to help meet the CCS targets through increased CCS capacity or additional years of CCS operation.

Finally, all projects will go through a Closeout Phase, although closeout is the most unheralded phase of the project, when performed efficiently and effectively, it can protect the government's interests and has been shown to free up significant dollars for other program priorities (more information can be found at http://www.netl.doe.gov/business/solicitations/ssc2008/DE-SO26-08000662/PM_Guidelines.pdf).

6. Measures

Table 6.1

FE R&D Performance Measures

FE Strategic Plan Long-term Objective	FE Performance Goals
To develop technology, in partnership with industry and to transition this technology to industry for their deployment and commercialization, that is capable of addressing air emissions concerns associated with coal use while providing domestically secure, cost-efficient electricity generation, including the development of near-zero atmospheric emissions technologies and, by 2012, completion of a prototype near-zero atmospheric emission plant (including carbon) that is coal fuel-flexible, and capable of multiproduct output and ultimately, by 2015, leading to an advanced class of power plants capable of achieving efficiencies over 60 percent (exclusive of energy consumption for carbon capture) with coal.	• By 2012, validate pre-combustion capture technology(ies) that if integrated with an IGCC power plant, through a rigorous systems analysis, could show 90 percent CO_2 capture at no more than 10 percent increase in the cost of electricity versus a baseline IGCC power plant case without CO_2 capture • By 2012, inject 2 million metric tons CO_2 total at four or more large-volume field test sites to demonstrate the formations' potential to sequester carbon • By 2013, complete bench-scale development of advanced post-and oxy-combustion capture technologies that show, through engineering and systems analyses, meeting the goal of 90 percent CO_2 capture at no more than a 35 percent increase in cost of electricity • By 2020, complete full-scale (>25MW) demonstration of advanced post- and oxy-combustion CO_2 capture technologies that can achieve 90 percent CO_2 capture at no more than a 35 percent increase in cost of energy[1]

Performance Measure	Current FE R&D Program	Recovery Act FE R&D Projects	Total Enhanced FE R&D Program[2]
FE-1: Number and MW of capacity of projects funded to capture CO_2 from anthropogenic sources.	Recovery Act Targets Only – No FE R&D Program Equivalent Targets	8 to 10 projects, representing at least three CO_2 capture technologies applied to a minimum of five diverse industrial and power applications that offer substantial opportunity for	Not Applicable

		future CO_2 reduction and totaling 750 MW to 2,000 MW equivalent	
FE-2: Number of geological reservoirs characterized in detail and incremental CO_2 storage capacity verified as available for commercial development, in preparation for long term storage and Monitoring, Verification and Accounting (MVA).		10 geologic reservoirs representing at least five distinct types of reservoirs; 0.3 to 1 billion tons of CO_2 storage capacity characterized	
FE-3: Total number of students and professionals trained for future Capture and Storage industry.		100 Students conducting over 40,000 research hours; 500 Professional Development Units (PDU) or Continuing Education Units (CEU)	
FE-4: Number of tons of CO_2 captured and stored per year (5 million tons of CO_2 per year target).		5 million tons per year by 2015 with a demonstrated permanence of at least 99 %	
FE-5: Number of tons of CO_2 emissions avoided.[3]	11,800,000 total tons by 2015	7,500,000 total tons by 2015	19,300,000 total tons by 2015
FE-6: Number of barrels of oil consumption displaced (Crude Oil Equivalent) per year.	8,800,000 barrels of foreign oil displaced[4]	4,000,000 barrels of foreign oil displaced per year[5]	12,800,000 barrels of foreign oil displaced

Notes:
[1] Performance Goals needed to achieve PART Targets
[2] Equals Current FE R&D + Recovery Act FE R&D Projects
[3] Calculations equal carbon emission reductions
[4] Equals allocation of 2,200,000 tons of CO_2 to EOR
[5] Equals allocation of 2,000,000 tons of CO_2 to EOR

Measure Text

FE-1: Number and MW of capacity of projects funded to capture CO_2 from anthropogenic sources.

FE-2: Number of reservoirs characterized in detail and incremental CO_2 storage capacity verified as available for commercial development, in preparation for long term storage and Monitoring, Verification and Accounting (MVA).

FE-3: Number of professionals trained for future Capture and Storage industry.

FE-4: Number of tons of CO_2 captured and stored per year.

FE-5: Number of tons of CO_2 emissions avoided.

FE-6: Number of barrels of oil consumption displaced.

Measure Type

FE-1: MW capacity—Outcome

FE-2: CO_2 storage capacity—Outcome

FE-3: Professionals trained—Outcome
FE-4: CO_2 captured and stored—Outcome
FE-5 CO_2 emissions avoided—Outcome
FE-6: Oil consumption displaced—Outcome

Measure Frequency
FE-1: MW capacity—Annual
FE-2: CO_2 storage capacity—Annual
FE-3: Professionals trained—Annual
FE-4: CO_2 captured and stored—Annual
FE-5: CO_2 emissions avoided—Annual
FE-6: Oil consumption displaced—Annual

Direction of Measure (+/-: Chose whether the measure actual should be increasing or decreasing)
FE-1: [+]
FE-2: [+]
FE-3: [+]
FE-4: [+]
FE-5: [+]
FE-6: [+]

Unit of Measure
FE-1: MW capacity (megawatt equivalent)
FE-2: CO_2 storage capacity (million tons)
FE-3: Professionals trained
FE-4: CO_2 captured and stored (million tons)
FE-5: CO_2 emissions avoided (million tons)
FE-6: Oil consumption displaced (million barrels)

Goal Lead
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7. Transparency and Accountability
Performance Tracking
DOE leverages its existing corporate systems to track and report on Recovery Act activities and to ensure effective funds management. The DOE's iManage Data Warehouse (IDW) is a corporate enterprise system integrating financial, budgetary, procurement, and program information to monitor project execution. Each Recovery Act program is tracked using unique Treasury Appropriation Fund Symbols (TAFS), and each component project is identified by a unique Project Identification Code (PIC).

IDW is a central data warehouse linking common data elements from each of the Department's corporate business systems and serving as a "knowledge bank" of information about portfolios, programs or projects including budget execution, accumulated costs, performance achieved, and

critical milestones met. The IDW contains information from multiple corporate systems and will be a tool used to meet information needs for Recovery Act oversight and reporting to Recovery.gov.

The Performance Measure Manager (PMM) is the Department's performance tracking system. PMM tracks high-level budgetary performance and is being expanded to accommodate Recovery Act performance tracking needs. Performance evaluations will be organized and reported along with results from the Department's annual budgetary activities in the Annual Performance Report (APR). Performance results will be uploaded into the IDW for required agency reporting.

See DOE's Agency Wide Recovery Plan for additional information on DOE's financial and performance tracking mechanisms, found here: www.energy.gov/recovery.

Manager's Accountability Standards

Accountability will be written into the performance standards of each manager with such standards applying to all decisions and actions that are within the manager's control.

8. Federal Infrastructure Investments

In lieu of making a direct investment in federally owned facilities, collectively the six FE R&D Recovery Act projects will make a direct investment in CCS-related infrastructure through a diverse portfolio of electric power and industrial facilities, academic institutions and other organizations operating across the United States. FE's portfolio of Recovery Act projects will also stimulate private sector infrastructure investments due to the significant amount of cost sharing that will occur in all large-scale projects to be selected for implementation. These combined public and private investments will also establish a proving ground for the necessary legal and regulatory frameworks that must be an inherent part of creating a safe, reliable, widely-available, environmentally responsible, and affordable CCS infrastructure.

FE Recovery Act investment will also be complimented by the Carbon Sequestration element of the baseline Fossil Energy R&D program. In particular, the efforts of the Regional Carbon Sequestration Partnerships can be viewed as another form of federal infrastructure investment. These Partnerships, spanning our entire nation and parts of Canada, are a capacity building enterprise to aid in understanding all the critical aspects that would be needed to support a wide-scale deployment of CCS technology. They examine regional differences in geology, ecosystem management, land practices, and industrial activity that can affect the deployment of carbon sequestration technologies and support studies providing technical information to support development of a regulatory framework needed for CCS deployment.

9. Barriers to Effective Implementation

The table below summarizes the six projects within the Fossil Energy R&D account and the associated funding levels.

Project Name	Total Funding
Expand and Extend Clean Coal Power Initiative Round 3	800,000,000
Industrial Carbon Capture and Storage	1,520,000,000

Geologic Sequestration Site Characterization	50,000,000
Geologic Sequestration Training and Research	20,000,000
Carbon Capture and Storage	1,000,000,000
Fossil Energy Program Direction	10,000,000

Expand and Extend Clean Coal Power Initiative (CCPI) Round 3
Barriers to Effective Implementation

Barrier: Negotiation Schedule Risk. Failure to successfully make a timely cooperative agreement award will impact DOE's ability to obligate funds by September 2010.
Remedy: Experience in prior negotiations allows DOE to move more directly to well-defined end-points, as a result DOE has streamlined the process for concluding negotiations reducing the time period between project selection and award to 7 months in duration. In addition, DOE will reserve the authority to select additional projects should projects fail during negotiations. As to the non-federal cost-share:

- DOE will perform a comprehensive evaluation of proposed participant project financing prior to selection
- Expert financial consultants will assist DOE in the review of proposals, and
- Weak project financing proposals will be severely penalized.

Gap: Participants ability to complete project financing, business, and environmental pre-award requirements depends on many external factors beyond DOE's control.

Barrier: NEPA Schedule Risk. The median time to complete an environmental impact statement (EIS) for a project at DOE is about 24 months. DOE cannot authorize expenditures of funds for detailed design and construction before completion of the appropriate NEPA review, e.g., Environmental Assessment Finding of No Significant Impact (EA/FONSI) or EIS Record of Decision (EIS/ROD). Delay in issuance of the ROD may impact DOE's ability to provide funding for detailed design and construction, and therefore may impact the overall schedule and the project proponents' ability to expend funds by 2015.
Remedy: NETL will work with DOE Headquarters to streamline internal document review processes. Also, project proponents will be cautioned to avoid making major changes in their project; such changes can require significant changes to NEPA documents that delay their completion.
Gap: Streamlined document review procedures are in development.

Barrier: Project length. Projects are typically 5 years or longer. DOE funding has historically been obligated to the agreements on a phased basis. The Recovery Act requires obligation of all DOE Recovery Act funds by September 30, 2010 with funds authority expiration on September 30, 2015.
Remedy: DOE will time obligations of non-Recovery Act CCPI funds (> $700 million) and Recovery Act CCPI funds ($800 million) to utilize the Recovery Act funds in accordance with the statutory timeframes. All initial phases (6 to 7 projects) will be funded by Recovery Act funds (Estimated $150 million). The remaining Recovery Act funds will be used for the fastest

moving projects. All Recovery Act funds will be obligated no later than September 30, 2010, subject to cooperative agreement provisions restricting expenditure of funds based on defined project phases. DOE will reserve the right to approve project progression to subsequent phases. To accelerate the project schedule, in appropriate cases, DOE will authorize pre-award costs after selection at the Recipient's risk.
Gap: Degree of uncertainty in Recipient's project schedule.

Industrial Carbon Capture and Storage (ICCS)
Barriers to Effective Implementation

Barrier: Property ownership. No authority currently allows DOE to grant clear title of property to project recipients. Material CCS related modifications that alter the operation of commercial (for profit) facilities, without the authority to grant ownership and control of such facility modifications to industrial participants at time of award, may discourage applicants from proposing. Negotiations with selected applicants will likely be delayed or unsuccessful due to property issues thereby jeopardizing DOE's ability to obligate funds by September 2010 and the project's ability to expend funds by 2015.
Remedy: Seek Administration support for a legislative proposal for property vesting authority similar to authority available to DOE's CCPI Program.
Gap: Lack of current property vesting authority.

Barrier: NEPA Schedule Risk. The median time to complete an environmental impact statement (EIS) for a project at DOE is about 24 months. DOE cannot authorize expenditures of funds for detailed design and construction before completion of the appropriate NEPA review, e.g., EA/FONSI or EIS/ROD. Delay in issuance of the ROD may impact DOE's ability to provide funding for detailed design and construction, and therefore may impact the overall schedule and the project proponents' ability to expend funds by 2015.
Remedy: NETL will work with DOE Headquarters to streamline internal document review processes. Also, project proponents will be cautioned to avoid making major changes in their project; such changes can require significant changes to NEPA documents that delay their completion.
Gap: Streamlined document review procedures are in development.

Geologic Sequestration Site Characterization
Barriers to Effective Implementation

Barrier: Inability to gain timely access to required equipment, field services and site may impact the project's ability to expend funds by 2015.
Remedy: Funds will be fully obligated to projects at time of award which enables the applicant to enter into contracts with field service providers early in order to secure these services timely and at a fixed price for the project. Decision points will be built into agreements reserving to DOE the right to withdraw from the project and de-obligate remaining funds if key milestones are not met so that the funds can be utilized for another new project or to augment an existing project.

Geologic Sequestration Training and Research
Barriers to Effective Implementation

Barrier: The FOA schedule does not coincide with academic calendar year such that graduate/undergraduate students may not be available causing a limited response of submissions from qualified institutions.
Remedy: In order to accommodate academic calendars and availability of students to work on research projects, rolling closing dates for the receipt of applications will be established. Closings will occur at 3-month intervals until enough qualified projects are selected. Further, projects will be fully funded at award to eliminate concern with continuing student support for research and the Department will reserve the authority to select additional projects should projects fail during negotiations.

Carbon Capture and Storage
Barriers to Effective Implementation

Barrier: Project Schedule Risk. The participant's ability to deliver to DOE, a valid revised cost estimate and funding plan by December 31, 2009.
Remedy: DOE has developed a comprehensive 2-phased approach that entails a provisional award for BP-1 (Revised Cost Estimate and Funding Plan) on July 23, 2009 that permits work to commence while in parallel definitizing terms of the cooperative agreement.
Gap: Degree of uncertainty in Alliance project schedule is beyond DOE control.

Barrier: Participant Cost Share Risk. With a maximum DOE contribution of $1.073 billion, and the most current project cost estimate of $2.4 billion, the potential exists for a shortfall in private sector funding.
Remedy: The Alliance's total anticipated financial contribution is anticipated to be between $400 million and $600 million. The Alliance, with support from DOE, will pursue mutually agreeable options to close any remaining funding gap by increasing non-federal contributions and/or monetizing the ownership rights to the facility, components, and/or systems.
Gap: Degree of uncertainty in Alliance ability to generate sufficient project financing to satisfy requirement for private cost sharing

Barrier: NEPA Schedule Risk. The FutueGen project may require a supplemental analysis and may result in the need for a supplemental EIS.
Remedy: NETL will work with DOE Headquarters to streamline internal document review and approval processes.
Gap: Streamlined document review procedures are in development.

Barrier: Property ownership. No authority currently allows DOE to grant clear title of property to project recipients. Negotiations with the FutureGen Alliance will likely be delayed or unsuccessful due to property issues thereby jeopardizing DOE's ability to obligate funds by September 2010 and the project's ability to expend funds by 2015.
Remedy: Seek Administration support for a legislative proposal for property vesting authority similar to authority available to DOE's CCPI Program.
Gap: Lack of current property vesting authority.

Fossil Energy Program Direction
Barriers to Effective Implementation

Barrier: The Recovery Act provides $10 million for Fossil Energy Program direction. Annual program direction funding may be inadequate to satisfy Recovery Act management and oversight needs in fiscal years 2011 thru 2015.
Remedy: Fossil Energy out-year budget requests will factor increased Recovery Act program direction needs in Fiscal Year 2011 and beyond.
Gap: Uncertainty in out-year program direction funding.

10. Environmental Review Compliance
DOE will determine the appropriate level of NEPA review pursuant to NEPA and its implementing regulations (40 CFR Parts 1500-1508 and 10 CFR Part 1021) for qualified proposals submitted by applicants in response to funding opportunity announcements. DOE will comply with other applicable environmental requirements for proposals selected for funding. However, in most situations, the proponents of the selected proposals are responsible for meeting the environmental requirements applicable to their projects, such as obtaining permits and complying with emission limits.