Combustion Performance and NOx Control - Program 71

Program Overview

Program Description

As the most cost-effective means of reducing emissions from coal-fired power plants, combustion considerations should be viewed as the first step in any compliance strategy. Anticipated regulations will make an even stronger case to deploy cost-effective combustion-based nitrogen oxide (NO_x) control solutions, to be used in lieu of or in combination with selective catalytic reduction (SCR) and other post-combustion control systems. Forced outages due to fireside corrosion and circumferential cracking, in many cases initiated or significantly exacerbated by low-NO_x operation, will require cost-effective solutions. Rising fuel costs and potential carbon dioxide (CO_2) regulations will increase the need to improve plant heat rate and combustion performance. Emission and performance mandates demand more accurate measurement and control of coal and air flow to individual burners. And changing operating conditions and fuel diversification require improvements in traditional boiler performance measures.

The Electric Power Research Institute's (EPRI's) Combustion Performance and NO_x Control program (Program 71) provides the knowledge and resources needed to develop, demonstrate, and apply cost-effective combustion-based emissions reduction solutions and plant performance enhancements that minimize risk and impact on boiler reliability and downtime.

Research Value

The Combustion Performance and NO_x Control program focuses on a holistic approach to combustion and fuel quality impacts, including emissions, performance, and reliability.

- Avoiding a single forced outage due to fireside corrosion, circumferential cracking, or slagging and fouling can save more than $1 million per unit.
- Heat rate improvements yield significant savings in fuel costs and are by far the lowest-cost and only commercially available method of reducing CO_2 at this point in time. A 1% heat rate improvement on a single 500-MW baseloaded unit will save close to 1M $/year in fuel cost alone, and will reduce CO_2 emissions by approximately 40,000 tons per year.
- Enhancing NO_x reductions with cost-effective combustion modifications, even on units equipped with SCR systems, may yield significant revenues through the anticipated NO_x credit market.

Approach

Projects in five distinct groups help mitigate fireside corrosion and waterwall wastage in low-NO_x systems; develop and demonstrate cost-effective NO_x control through combustion modifications and assessments of emerging technologies; find solutions for fuel quality issues; measure and control coal and air flow; and optimize heat rate and cost.

- Mitigation of the impacts of combustion and fuel quality on boiler tube longevity, including waterwall wastage and circumferential cracking, will significantly reduce the number of costly forced outages. Participation in EPRI's Waterwall Wastage Interest Group (WWIG) helps members identify specific projects, disseminate results, and share best practices regarding all aspects of the impacts of combustion and fuel quality on boiler tube longevity.
- Members also receive assistance in analysis of wastage and circumferential cracking problems, fuel quality and blend ratio impacts, and appropriate selection of protective coating alternatives. State-of-the-art modeling tools are used to develop guidelines to assess waterwall wastage based on coal quality, furnace design, and operability.
- Combustion modifications may provide the most cost-effective first step in controlling a number of pollutants in addition to NO_x. Development of guidelines and best practices, data from full-scale demonstrations, and assessments of emerging technologies provide important information to make

informed decisions. Value to members may include the ability to capitalize on the emerging NO_x credit market and avoidance of higher-cost emissions controls.

- Solutions for fuel quality issues enhance fuel flexibility, unit reliability, and combustion performance. Members can achieve substantial cost savings through improved boiler performance, increase revenue through regained lost capacity, and benefit from increased flexibility in fuel sourcing.
- Coal and air flow measurement and control R&D investigates solutions for controlling the distribution of air and pulverized coal flow to individual burners. Members can use project findings and deliverables to resolve coal and combustion air flow distribution issues at their coal-fired facilities, resulting in lower emissions, reduced fuel costs, improved boiler operation, and minimized operability issues such as fireside corrosion and unburned carbon in ash.
- Heat rate and cost optimization can reduce the cost of operation through fuel savings and increased availability. In addition, improving heat rate is by far the most cost-effective method and the only “ready now” method of reducing CO_2 emissions. Members can use project deliverables to assess and implement tools and technologies to improve plant performance and lower heat rate and CO_2 emissions. Participants in full-scale demonstrations, available to all program members, will gain firsthand experience with issues and solutions.

Accomplishments

For more than two decades, EPRI has led the power industry in developing, advancing, and demonstrating cost-effective NOx control technologies and best operating practices for achieving compliance at minimal cost and maximum reliability. More recently, EPRI has led the power industry in identifying, quantifying, and seeking cost-effective solutions to operability and performance issues associated with low-emissions operation, such as fireside corrosion, circumferential cracking, heat rate, and fuel quality impacts. Accomplishments include:

- Development of advanced models to predict and assess methods of combating fireside corrosion consequential to implementation of low NO_x systems
- Deployment of the Coal Flow Loop (CFL), a full-scale facility to develop and evaluate methods of measuring and controlling coal flow from pulverizers to individual burners
- FLAME DOCTOR™ Flame Diagnostics System, an advanced burner diagnostics tool to improve performance and reduce emissions on wall-fired and cyclone boilers
- Innovative, cost-effective technologies for combustion NO_x controls, such as advanced staging methods
- Slagging and Fouling Guidelines that offer quantifiable methods of identification and mitigation methods for ash deposition issues

Current Year Activities

The program R&D for 2010 will continue to focus on a holistic approach to combustion optimization, including combustion and fuel quality-related impacts on emissions, performance, and operability. Specific efforts will include:

- Cost-effective solutions for the impacts of low-NO_x combustion and fuel quality on boiler tube longevity, such as fireside corrosion and circumferential cracking.
- Advanced sensors and feedback loops to quantify gaseous species distributions online and initiate corrective actions.
- Impacts of combustion modifications on mercury speciation for downstream capture (with Program 75).
- Novel slag management methods and predictive software.
- Guidelines, demonstrations, and conferences and workshops for improved heat rate for lower fuel costs and as a first step in minimizing CO_2.
- Assessments of coal flow control devices (at EPRI’s Coal Flow Loop and at full scale) for coal/air balancing — found to have a first-order impact on plant emissions, performance, and operability.

Estimated 2010 Program Funding

$3.8M

Program Manager

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Summary of Projects

Project Number	Project Title	Description
P71.001	Combustion and Fuel Impacts on Boiler Tube Longevity	This project develops assessment and mitigation strategies for combustion-related boiler tube failures due to low-NO_x operation, such as fireside corrosion and circumferential cracking, based on coal quality, boiler design, and operational considerations.
P71.002	Cost-Effective NOX Control via Combustion Modifications and Assessments of Emerging Technologies	This project develops guidelines and best practices that enable implementation of cost-effective combustion modifications to minimize NO_x levels and other pollutants such as mercury and unburned carbon, as well as optimize combustion performance.
P71.003	Solutions for Fuel Quality Issues	This project develops integrated solutions for fuel quality-related issues such as slagging and fouling experienced with units firing Powder River Basin (PRB), lignite, and bituminous coals, and biomass fuels and fuel blends.
P71.004	Coal and Air Flow Measurement and Control	The project develops solutions for improved boiler operation (including emissions and combustion performance) through validated coal and combustion air flow metering and control methods.
P71.005	Heat Rate and Cost Optimization	This project develops and demonstrates a variety of deliverables and services to promote optimal heat rate and minimal cost of operations, including demonstrations of intelligent sootblowing and flame diagnostics, and focused conferences and workshops on key topics prioritized by participants.

P71.001 Combustion and Fuel Impacts on Boiler Tube Longevity (100465)

Key Research Question

Boiler system owners and operators need cost-effective solutions to reduce the number of costly forced outages stemming from fireside corrosion, circumferential cracking, and other boiler tube impacts consequential to low-NO_x operation and fuel quality considerations. Low-NO_x operation often results in fireside corrosion and waterwall wastage related boiler tube failures, and although weld overlays may alleviate this situation in many instances, associated problems with circumferential cracking may be exacerbated. Addressing the impacts of low-NO_x combustion and fuel quality on boiler tube longevity are paramount to maintaining and improving unit reliability and performance.

Approach

EPRI's multifaceted approach to understanding and resolving the costly consequences of accelerated fireside corrosion, circumferential cracking, and other impacts of low-NO_x combustion and fuel quality on boiler tube longevity will include:

- Role of chlorine, sulfur, and fuel blends
- Effects of boiler design and various modes of low-NO_x operation; and
- Material-based solutions and issues

The advanced Corrosion Predictor Model and other state-of-the-art modeling tools will be used to develop guidelines to assess waterwall wastage based on coal quality, furnace design, and operability. Cost-effective solutions will be developed and demonstrated. The issue of circumferential cracking, exacerbated both by low-NO_x operation and utilization of weld overlays, will be addressed, and alternative material solutions such as thermal spray and ceramic coatings will be assessed.

Impact

- Reduce the number of costly forced outages due to fireside corrosion-related boiler tube failures that result from low-NO_x operation.
- Reduce O&M costs by selecting appropriate protective coatings and weld overlays, as well as by taking into account coal quality considerations.
- Participate in EPRI's Waterwall Wastage Interest Group (WWIG), which helps members identify specific projects, disseminate results, and share best practices.
- Receive assistance in all aspects of fireside corrosion-related issues, including analysis of wastage problems, weld overlay cracking, fuel quality and blend ratio impacts, and appropriate selection of protective coating alternatives.

How to Apply Results

Plant personnel responsible for boiler systems reliability and performance can employ project findings and deliverables to mitigate accelerated fireside corrosion. Mitigation methods may be applied to boiler operation (especially combustion considerations), material-based coatings such as weld overlays and thermal sprays, and fuel quality.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Lab test Results of Weld Overlays and Other Protective Coatings: Lab tests will assess the impacts of corrosion fatigue and cracking on a variety of weld overlays, spray coatings, and deposits (e.g., reducing sulfur and chlorine species). Tests will investigate the impacts of temperature, surface roughness and defects, and new alloys (including advanced formulations and thinner overlays), and assess crack initiation mechanisms.	12/31/10	Technical Report
Annual WWIG Workshop: This annual interest group meeting will include technical presentations on all EPRI WWIG-related activities, as well as member presentations and group discussions of case studies and issues.	12/31/10	Workshop, Training, or Conference
Weld Overlay, Ceramic and Thermal Spray Coatings, and Bare Tube Database: This database will continue to compile experiences with weld overlays, spray coatings, and bare tubes, including data analysis. Information from database may be used to assess when cracking, hardening, and fatigue are problematic, as a function of fuel quality, unit operation and design, and other factors.	12/31/10	Assembled Package
WWIG Webcasts: Webcasts will be held on specific technical topics of key interest to members. Topics may include ceramic and thermal spray coatings, impacts of fuel quality, combustion modifications, and weld overlay longevity.	12/31/10	Workshop, Training, or Conference
Corrosion Prediction Assessments for Members: Boiler tube wastage and circumferential cracking estimates will be provided as a function of fuel quality and changes in fuel blend ratios using the Thermo-Chemical Equilibrium Simple Predictor, provided to funders on an as-needed basis.	12/31/10	Technical Resource

Product Title & Description	Planned Completion Date	Product Type
Fireside Corrosion and Circumferential Cracking "101": A course will be conducted for those relatively new to the issue of fireside corrosion, circumferential cracking, and other impacts of combustion and fuel quality on boiler tube longevity. The course will coincide with the annual Waterwall Wastage workshop.	12/31/10	Workshop, Training, or Conference
Thermal Spray and Ceramic Coatings Assessments: Assessments will be made of available options for thermal spray and ceramic coatings, including costs, performance data, and issues. The latest findings from field demonstrations will be incorporated.	12/31/10	Technical Update
Crack Growth Model: Finite element modeling assessments of the effects of weld overlay materials and temperatures on cracking potential will be conducted.	12/31/10	Technical Update
Waterwall Thermal Monitoring Survey: Industry survey on how utilities monitor and control waterwall temperatures under low-NOx conditions. This survey will help utilities identify key elements based on plant size and design. It will include data from thermo-monitoring and wall-cleaning technologies used to monitor thermal impacts on waterwall. This report will assist members in identifying high-temperatures areas and finding ways to minimize temperatures with the minimum impact on operation.	12/31/10	Assembled Package

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Weld Overlay Corrosion Fatigue/Cracking Lab Testing: Lab tests will continue to assess the impacts of corrosion fatigue and cracking on a variety of weld overlays, spray coatings, and deposits (e.g., reducing sulfur and chlorine species). Tests will investigate the impacts of temperature, surface roughness and defects, and new alloys, and assess crack initiation mechanisms. Advanced coating materials will be assessed.	12/31/11	Technical Report
Crack Growth Model: A final report will be published on the finite element predictive model of the effects of weld overlay materials and temperatures on cracking potential.	12/31/11	Technical Report
Annual Workshop: This annual two-day interest group meeting will include technical presentations on all EPRI WWIG-related activities, as well as member presentations and group discussions of case studies and issues.	12/31/11	Workshop, Training, or Conference
Webcasts on Specific Topics: Webcasts on specific topics pertaining to the impacts of combustion and fuel quality on boiler tube longevity (e.g., circumferential cracking and fireside corrosion) will be conducted.	12/31/11	Workshop, Training, or Conference
Corrosion Prediction Assessments for Members: Boiler tube wastage and circumferential cracking estimates will be provided as a function of fuel quality and changes in fuel blend ratios using the Thermo-Chemical Equilibrium Simple Predictor, provided to funders on an as-needed basis.	12/31/11	Technical Resource

P71.002 Cost-Effective NOX Control via Combustion Modifications and Assessments of Emerging Technologies (050311)

Key Research Question

Combustion modifications are the most cost-effective first-line approach to reducing emissions—primarily NO_x but also mercury, sulfur oxide (SO_x), and unburned carbon in ash. This project will assess emissions reductions achievable with combustion modifications by considering fuel quality, boiler design, boiler operating modes, and other site-specific factors. The consequences of candidate combustion modifications on boiler performance, reliability, and other pollutants will also be addressed.

Approach

This project group will develop guidelines and best practices that enable funders to exploit cost-effective combustion modifications to the fullest extent for the purpose of reducing emissions and improving performance. Activities will include:

- Objective assessments of emerging in-furnace NO_x control technologies (including field data)
- Impacts of combustion modifications on mercury capture
- Case studies documenting combustion factors influencing achievable NO_x emissions
- Methods of improving mill performance such as throughput, particle size, and distribution, which will in turn improve combustion performance and emissions
- Demonstration of continuous in-furnace and economizer gaseous species monitoring devices

Impact

- Capitalize on the NO_x credit market, and avoid higher-cost NO_x controls required to comply with present and future regulations.
- Access performance data and third-party assessments of emerging combustion-based NO_x control options to help select the most appropriate technologies.
- Apply results of the development and demonstration of the impacts of combustion modifications on control of mercury, sulfur trioxide (SO_3), and other pollutants.

How to Apply Results

Utility personnel who are involved in economic assessments, applicability issues, and considerations of combustion modification-related technologies can apply project deliverables. Information on emerging technologies, which will be maintained in real time on the EPRI website, may be applied by project participants assessing emerging technologies. In addition, participants in full-scale demonstrations of advanced technologies, which are available to all project participants, will gain firsthand experience with technology performance and the advantages and shortcomings of emerging options relative to more established approaches.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Results of Site Assessments on Methods of Improving Pulverizer Performance: This technical report will summarize data and findings on advanced methods of improving pulverizer performance through add-on hardware and other methods.	12/31/10	Technical Report
Emerging Combustion NOx Control Technologies Web Site: This project provides for the continuation of the Emerging Combustion NOx Control Technologies website, a “living document” providing up-to-date findings, performance data, and performance impacts of all combustion-based NOx controls.	12/31/10	Technical Resource

Product Title & Description	Planned Completion Date	Product Type
Demonstrations of FTIR / TDL Applications: Site demonstrations will be conducted of advanced Fourier Transform Infrared Spectroscopy (FTIR) and tunable diode laser (TDL) technologies for combustion optimization and alternate NOx measurements.	12/31/10	Technical Report
Continuous Combustion Optimization Through Multipoint O2/CO Measurement: A demonstration will be conducted of continuous multipoint oxygen/carbon monoxide (O_2/CO) measurement technologies with sufficient resolution across the duct to provide operators with real-time information regarding fuel/air distribution. Host site applications will document potential boiler efficiency improvements and associated NOx reductions.	12/31/10	Technical Update
Demonstration of a Continuous Unburned Carbon Monitor: One necessary component associated with identification of mill or boiler combustion performance is the real-time monitoring of fly ash unburned carbon levels. The current project focuses on a new approach that was initially explored within the Cyclone Interest Group that relates changes in fly ash size distribution to fly ash carbon content, which can be potentially monitored in real time on an *in situ* basis.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Field Test Results of Mercury Capture Methods: A final report will be published on demonstration of methods of minimizing mercury levels through changes in the combustion process.	12/31/11	Technical Report
Integration of Multipoint O2/CO Measurements with an Optimizer: Full benefit of multipoint O_2/CO measurements are best realized in real time, with potential coordinated use with an optimizer. The current project will assess how best to utilize concentration gradient information in coordination with an optimizer to maintain efficient boiler operation.	12/31/11	Technical Update

P71.003 Solutions for Fuel Quality Issues (103508)

Key Research Question

Fuel quality issues, such as slagging and fouling of furnace and convection tubes, significantly affect unit reliability and operations, leading to increased number of forced outages and negatively affecting heat rate. Solutions developed through this project can enhance fuel flexibility, unit reliability, and combustion performance.

Approach

Specific tasks and goals include:

- Site demonstrations to assess innovative methods of mitigating ash deposition, including ceramic coatings, pulse-based sootblowers, additives, and other advanced methods
- Further development and application of ash deposition predictive models based on Computer Controlled Scanning Electron Microscope (CCSEM)/Fractionation
- Participation in the Coal Quality Interest Group (CQIG) to share best practices and experiences
- Enhancement of guidelines for identifying and solving ash deposition-related problems

Impact

- Achieve substantial cost savings through improved boiler performance
- Increase revenue through regained capacity
- Benefit from increased flexibility in fuel sourcing

How to Apply Results

Participants involved in boiler performance can use project findings and deliverables in their efforts to mitigate ash deposition and other coal quality issues at their coal-fired facilities. Predictive tools and guidelines developed through this program will allow more accurate assessments of the costs and performance impacts of alternative coal selections.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Slagging & Fouling Guideline Addendum: The EPRI Slagging and Fouling Guidelines will be enhanced, based on the latest case studies conducted at members' sites and the best practices that have been documented. The emphasis of this addition will be on mitigation methods such as coatings, additives, and advanced sootblowing systems.	12/31/10	Technical Report
Slagging Prediction Assessments for Members: Slagging and fouling estimates will be made as a function of ash mineralogy, using the advanced slagging predictor, provided to funders on an as-needed basis.	12/31/10	Technical Resource
Coal Quality Interest Group: This interest group will provide a forum in which participants can share information, exchange ideas, and define and prioritize coal-quality-related efforts. A minimum of one webcast and one on-site meeting will be held.	12/31/10	Workshop, Training, or Conference

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Coal Quality Interest Group: This interest group will provide a forum where participants can share information, exchange ideas, and define and prioritize coal-quality-related efforts. A minimum of one webcast and one onsite meeting will be held.	12/31/11	Workshop, Training, or Conference
Slagging Prediction Assessments for Members: Slagging and fouling estimates will be made as a function of ash mineralogy, using the advanced slagging predictor, provided to funders on an as-needed basis.	12/31/11	Technical Resource

P71.004 Coal and Air Flow Measurement and Control (062029)

Key Research Question

Monitoring and control of burner-specific air/fuel ratios must be improved to reduce emission levels (such as NO_x, loss on ignition [LOI], and mercury), optimize boiler efficiency (and consequently fuel costs and CO_2 levels), and minimize performance issues such as fireside corrosion, slagging, and fouling. Fuel/air imbalances will become less forgiving as emission levels become increasingly stringent and as advanced emissions technologies demand tighter controls. The ultimate project goal is to achieve improved boiler performance through dynamic air/fuel ratio control.

Approach

EPRI will continue to investigate and identify cost-effective solutions for controlling the distribution of air and pulverized coal flow to individual burners. Towards this goal, EPRI will continue with studies of novel coal flow measurement and control devices at its Particulate Flow Laboratory (PFL). The efforts could be supplemented by advanced numerical modeling analysis methods, along with field validation testing. This project also will assess methods of improving secondary combustion air flow measurement and control**,** which is equally crucial for optimum NO_x and efficiency.

Impact

- Lower emissions
- Reduce fuel costs
- Improve boiler operation
- Minimize operability issues such as fireside corrosion and unburned carbon in ash

How to Apply Results

Participants can use project findings and deliverables to resolve coal and combustion air flow distribution issues at their coal-fired facilities for the purpose of improving emissions and performance. Benefits and applications may include insights into optimizing existing splitter arrangements; utilizing coal and air flow measurement technologies; addressing operation impacts of spot market fuel purchasing practices; and integrating these technologies into an optimization routine.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Field Evaluation of Dynamic Coal Flow Control Methods: The PFL rig will be deployed to investigate adjustable devices to control coal flow distribution. Potential candidate systems include adjustable rifflers, controllers, and orifices. The effectiveness of each device will be assessed under a wide matrix of conditions that replicate actual plant operation.	12/31/10	Technical Report
Impact of Coal Rank on Transport Properties: Operators burning coals from spot market sources often subject their pulverizers to coals of varying coal quality. The resulting end product may have different coal transport properties than those for which their pneumatic conveying systems were originally designed. The purpose of this project is to investigate pneumatic conveying properties of coals of different rank. PRB, Appalachian, Illinois basin, and Texas Lignite are some candidate coals that can be analyzed. The analysis should allow the identification of potential trouble spots from these differences and recommend solutions.	12/31/10	Technical Update
Effect of Coal Piping Configuration on Fuel and Air Flow: Particulate layout occurs in horizontal piping runs. It may eventually stop all coal flow and, at a minimum, cause unsteady fuel flow, which has a detrimental effect on boiler performance and emissions. Analyzing different piping configurations in the flow loop will provide a better understanding of the phenomena behind coal layout and consistent fuel delivery. Potential limits on horizontal piping runs and minimum transport velocity requirements may be established along with other resolutions.	12/31/10	Technical Update
Field demonstrations of combustion air flow measurement methods: A survey of installed experience will be conducted with emphasis on emerging air flow measurement devices. Emerging air flow measurement technologies for application to primary, secondary, or separated overfire air ducts will be assessed for accuracy, durability, and overall performance.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Guidelines for Installation of Coal Control Devices: Summary of findings for effective application of coal control technologies.	12/31/11	Technical Report
Guidelines for Pneumatic Transport of Coals: New commercial devices offered to the industry will be assessed based on criteria from past studies in this research area. These devices include *in-situ* online systems to measure coal mass flow, coal fineness, air-to-coal ratio, or dirty air flow.	12/31/11	Technical Report
Field demonstration of Effective Coal Control Technologies	12/31/11	Technical Update

P71.005 Heat Rate and Cost Optimization (051807)

Key Research Question

Improving heat rate can reduce the cost of operation through fuel savings and increased availability. In addition, improving heat rate is by far the most cost-effective method and the only “ready now” method of reducing CO_2 levels.

Approach

This project group will develop and demonstrate a variety of deliverables and services that promote optimal heat rate and minimal cost of operations. Specific efforts will include intelligent sootblowing (ISB); technology transfer vehicles such as conferences, workshops, and webcasts; optimization guidelines; tuning guidelines; and combustion diagnostics (e.g., the Flame Doctor), applications, and enhancements. In addition, participation will include membership in the Heat Rate Interest Group (HRIG), where best practices, information sharing, and prioritizing available resources are discussed. Finally, this project will house the Production Cost Optimization Interest Group, dedicated to seeking heat rate improvements of 1% or greater through cost-effective operational modifications, and significantly more through more capital-intensive improvements.

Impact

- Reduce fuel costs
- Improve availability and emissions goals with existing hardware
- Realize future benefits, including reducing CO_2 emissions at costs far lower than those of post-combustion options

How to Apply Results

Participants can use project deliverables in assessing and implementing tools and technologies consistent with improved plant performance and lowered heat rate and CO_2 emissions. In addition, participants of full-scale demonstrations, which are available to all program members, will gain firsthand experience with issues and solutions. Deliverables should enable participants to apply findings and best practices at their units, enabling savings in fuel costs, reduced CO_2 emissions, and increased productivity and availability.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Economic evaluation of fuel quality impacts on heat rate: This project will quantify the effects on combustion performance and boiler emissions of key fuel parameters such as moisture content, volatility, and ash.	12/31/10	Technical Report
Web conferences focusing on key Heat Rate related topics: Web conferences will be conducted focusing on key heat-rate-related topics as determined by funders.	12/31/10	Workshop, Training, or Conference
Production Cost Optimization Phase 2 Implementation: Production Cost Optimization (PCO) Phase 2 will add capital projects to the operating improvements in Phase 1 to achieve at least 2% overall efficiency improvement and CO_2 reduction at each unit.	12/31/10	Technical Update
Plant Experiences Meeting: This members-only meeting allows plant operators and engineers to discuss engineering solutions to operating and performance problems.	12/31/10	Workshop, Training, or Conference
Routine Performance Testing Guidelines: The project will complete the development of routine performance testing guidelines for specific components — turbines, boilers, and heat exchangers.	12/31/10	Technical Report
Feedwater Heater Technology Seminar and Conference: This seminar and conference bring together industry experts from utilities and vendors to discuss current issues and R&D needs.	12/31/10	Workshop, Training, or Conference
Feedwater Heater Upgrade Survey: A survey of fossil and nuclear members will be performed to assess their experiences, costs, benefits, and lessons learned with feedwater heater upgrades.	12/31/10	Technical Report

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Production Cost Optimization Phase 2 Completion: The PCO Phase 2 final report will document the sources of the 2% overall efficiency improvement and CO_2 reduction at each unit.	12/31/11	Technical Report
Heat Rate Improvement Conference: This biennial event brings together performance experts from utilities, vendors, and contractors to compare the latest results in heat rate improvement and identify additional R&D needs.	12/31/11	Workshop, Training, or Conference
Condenser Technology Seminar and Conference: This seminar and conference bring together industry experts from utilities and vendors to discuss current issues and R&D needs.	12/31/11	Workshop, Training, or Conference