

Renewable Generation - Program 84

Program Overview

Program Description

The need for industry engagement in development and deployment of renewable energy for generation is more critical than ever before. Growing concerns about global climate change and sustainability, evolving climate policy and ever more stringent limits on emissions are expected to drive up demand for greater use of renewable generation. Power generators must make informed decisions about acquiring renewable energy resources, and up-to-date, unbiased information is critical if utilities are to take advantage of new opportunities for deployment, operation, and maintenance of renewable generation as part of the overall low-carbon generation mix.

The Electric Power Research Institute's Renewable Generation program (Program 84) assesses the status, performance, and cost of renewable generating technologies and provides a variety of important information and research opportunities for technical comparison, selection, operation, and maintenance of these resources.

Research Value

Renewable energy resources and their applications in generating electricity, including their roles in renewable portfolio standards (RPS), most often are considered collectively. However, wind, photovoltaic, solar thermal, biomass, and geothermal energy options are largely unrelated technologically; each has its own developmental status, readiness, and economic challenges. EPRI's Renewable Generation program provides objective cost and performance information for renewable technologies, helping participants to:

- Capitalize on market opportunities for renewable compliance and power purchases, resulting in improved decision making and better revenue potential;
- Identify the appropriate role of diverse renewable resources in expanding new and sustainable generation capacity; and
- Apply results from modeling, simulation, and future energy scenario analyses that will help guide investments in renewable energy.

Approach

EPRI keeps members abreast of global technical developments through advisory meetings, webcasts, and networking to share experience and capitalize on the lessons learned by others. Participants also benefit from the leveraged development of solutions to common problems that they could not afford to solve individually. Through joint activities with EPRI's Energy Technology Assessment Center, Waterpower Program, Renewable Integration and Energy, and Energy Storage activities, this program helps members learn about the latest technologies to improve energy recovery from renewable resources, understand the role of these energy resources, and address common issues. Integration of renewables into existing generation portfolios and grid operations is also covered. The program features technology-specific projects that enable members to focus on specific areas of interest. Participation in various technology interest groups is provided.

Accomplishments

- The Renewable Energy Technology Guide (RETG) provides unbiased and up-to-date information on renewable energy status, performance, cost, installed capacity, and markets. It provides technology status information on solar photovoltaic, solar thermal, wind, biomass, and geothermal resources, as well as grid integration technologies. River-in-stream and hydrokinetic resources are also covered.
- Interest group activities in geothermal, biomass, and solar, and industry meetings, including technical tours and workshops, provide overviews of current technologies issues.

- Modeling and analysis examine the role of renewables in different environmental and climate policies, effects of a federal RPS, and other possible future energy scenarios. Results are intended to support strategic planning for renewable portfolio standards and analysis of CO₂ emissions costs and related constraints. Products include economic and energy scenario analyses and topical reports on renewable technology issues.
- Specific technology projects and field evaluations help gauge the cost and performance of generation resources, including wind, photovoltaic, solar thermal, biomass, water, and geothermal power.
- Leading studies in solar energy augmentation of existing gas and coal plants. The solar augmented steam cycle collaborative projects identify options for utility-scale solar power generation without the significant challenges of siting a new plant and developing a new power block.

Current Year Activities

The Renewable Generation program in 2010 will continue to deliver unbiased cost and performance information to allow comparisons and better define the role of renewable generation among all generation options. Expanded in 2010 are the technology-specific project options for collaborative R&D, to enable participants to focus on individual renewable technologies of interest. The 2010 plans include technical forums, conferences, site visits, and workshops on topics of common interest, which allow participants to leverage their R&D investments to develop solutions to common problems. Through joint activities with EPRI's Energy Technology Assessment Center, Waterpower Program, Renewable Integration and Energy, and Energy Storage activities, members learn about the latest technologies to improve energy recovery renewable resources, understand the role of these energy resources, and address common issues.

Estimated 2010 Program Funding

\$3.0M

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Summary of Projects

PS84A Renewable Energy Economics and Technology Status (069178)

Project Set Description

This project set provides basic information on the status of all renewable technologies. Electricity sector analyses help better define the role of renewable generation and to understand policy implications. The projects will deliver the renewable energy technology guide (RETG), newsletters, perspectives on current topics, engineering and economic analysis, industry tours, presentations from industry experts, and forums for participants to exchange information.

Project Number	Project Title	Description
P84.001	Renewable Energy Technology Guide and Updates	The information generated by this project will address the need for timely, objective, and consistent data on the status, performance, and cost of renewable technologies and their likely penetration over time.
P84.002	Renewable Engineering and Economic Evaluations	This project provides updated cost and performance for selected renewable technologies based on changes or improvements in design or deployment as well as variation in renewable resources.
P84.003	Renewable Energy Analysis and Strategy	The analysis and strategy project provides strategic information on current renewable technology issues, and modeling and analysis to better define the role of renewable energy in future generation portfolios.

P84.001 Renewable Energy Technology Guide and Updates (065781)

Key Research Question

The principal drivers for renewable generation include government-mandated production goals, customer preferences, and environmental regulations. Examples of these are RPS, system benefit charges, net metering laws in the United States, and the goal in Europe of up to a 32% future share of renewables in overall electricity generation. It is increasingly important for energy providers to have the best available information about cost and performance of renewable generation options.

Approach

This project provides technology status, installation history, and performance cost information for a range of renewable energy technologies. Project activities include production of the annual edition of the EPRI Renewable Energy Technology Guide (RETG) in both CD-ROM and electronic format; an eMedia renewable technology newsletter, and perspective reports that address market, regulatory, and other renewable energy issues.

Impact

- Conduct effective resource planning, avoid deployment mistakes, capitalize on market opportunities, lower O&M costs, and improve plant availability
- Increase revenue while maintaining a balanced generation portfolio that includes effective maintenance and reliable operation.

How to Apply Results

This project will provide annual updates of the Renewable Energy Technology Guide (RETG), and at least four newsletters and one perspective report addressing markets, regulatory impacts, and deployment over time. Members can use the energy information and data to:

- Assess the status and potential of renewable generation technologies
- Forecast the penetration of renewable energy into the generation portfolio mix for a range of scenarios, and
- Estimate the incremental impacts of adding renewable generation on fuel requirements, capital and O&M costs, and greenhouse and other pollutant emissions.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Renewable Energy Technology Guide CD: The annual RE Technology Guide report provides the latest information and perspectives on the status, performance, cost, and markets for renewable energy technologies. The technologies include wind, biomass, solar photovoltaic, solar thermal, geothermal, low-impact hydro, emerging ocean energy technologies. The Guide is delivered in a CD format.	12/31/10	Technical Report
Renewable Energy Technology Guide Electronic Media Update: The annual renewable energy technical guide electronic media is updated twice yearly and provides the latest information and perspectives on the status, performance, cost, and markets for renewable energy technologies. The technologies include wind, biomass, solar photovoltaic, solar thermal, geothermal, low-impact hydro, and emerging ocean energy technologies.	12/31/10	Technical Resource
Renewable Energy eMedia Newsletters: The Renewable Energy eMedia Newsletters provide detailed ongoing market updates and intelligence on technologies, customers, competitors, and regulatory issues. The newsletter is delivered four times annually in electronic format.	12/31/10	Technical Resource
Renewable Energy eMedia Perspective Report: The Renewable Energy eMedia Perspective Report covers a current high-interest topic or issue with a perspective relevant to the utility industry. The report is delivered in electronic format.	12/31/10	Technical Resource

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Renewable Energy Technology Guide CD: The annual RE Technology Guide report provides the latest information and perspectives on the status, performance, cost, and markets for renewable energy technologies. The technologies include wind, biomass, solar photovoltaic, solar thermal, geothermal, low-impact hydro, and emerging ocean energy technologies. The Guide is delivered in a CD format.	12/31/11	Technical Report
Renewable Energy Technology Guide Electronic Media Update: The annual renewable energy technical guide electronic media is updated twice yearly and provides the latest information and perspectives on the status, performance, cost, and markets for renewable energy technologies. The technologies include wind, biomass, solar photovoltaic, solar thermal, geothermal, low-impact hydro, and emerging ocean energy technologies.	12/31/11	Technical Resource

Product Title & Description	Planned Completion Date	Product Type
Renewable Energy eMedia Newsletters: The Renewable Energy eMedia Newsletters provide detailed ongoing market updates and intelligence on technologies, customers, competitors, and regulatory issues. The newsletter is delivered four times annually in electronic format.	12/31/11	Technical Resource
Renewable Energy eMedia Perspective Report: The renewable energy eMedia perspective report covers a current high-interest topic or issue with a perspective relevant to the utility industry. The report is delivered in electronic format.	12/31/11	Technical Resource

P84.002 Renewable Engineering and Economic Evaluations (065782)

Key Research Question

All utilities face the question of exactly where renewable energy will fit in their future low-carbon and diversified choices for electricity generation. There is a significant level of business and technical uncertainty as to which emerging renewable technologies will be most cost-effective, reliable, and durable in the long run. Utilities need a clearer understanding of the opportunities and risks of relying on renewable generation and how this likely will affect the bottom line. It is increasingly important for energy providers to have the best available information about cost and performance of renewable generation options for use in corporate planning and strategy.

Approach

This project melds current engineering and economic evaluations with recent deployment cost experiences. The evaluations are periodically updated for a range of renewable energy technologies and will use consistent bases for cost and performance estimates to ensure that the resulting data are consistent between technologies. In addition, each evaluation will address local renewable resource properties and cost indices for different sites in the United States and the world to allow the cost and performance estimates to be generated for site-specific applications.

Impact

Up-to-date cost and performance data will make it possible to accurately assess the potential for renewable energy in future generation portfolios.

How to Apply Results

Members will apply the resulting renewable energy information and data to assess the status and potential of renewable generation technologies for site specific conditions.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Renewable Technology 1: Each engineering and economic evaluation updates the status, performance, cost, and prospects for future improvement of a renewable energy. The scope of the evaluations includes design and economic assumptions; conceptual design descriptions; raw material requirements, material and energy balances, and environmental emissions where applicable; and capital, O&M, and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of renewable resource properties, material and labor cost indices, and labor productivities. Probability distributions will be generated for capital, O&M, and levelized cost of electricity to indicate the range of uncertainty of the estimates.</p>	11/30/10	Technical Update
<p>Engineering and Economic Evaluation of Renewable Technology 2: Each engineering and economic evaluation updates the status, performance, cost, and prospects for future improvement of a renewable energy. The scope of the evaluations includes design and economic assumptions; conceptual design descriptions; raw material requirements, material and energy balances, and environmental emissions where applicable; and capital, O&M, and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of renewable resource properties, material and labor cost indices, and labor productivities. Probability distributions will be generated for capital, O&M, and levelized cost of electricity to indicate the range of uncertainty of the estimates.</p>	11/30/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Renewable Technology 3: Each engineering and economic evaluation updates the status, performance, cost, and prospects for future improvement of a renewable energy. The scope of the evaluations includes design and economic assumptions; conceptual design descriptions; raw material requirements, material and energy balances, and environmental emissions where applicable; and capital, O&M, and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of renewable resource properties, material and labor cost indices, and labor productivities. Probability distributions will be generated for capital, O&M, and levelized cost of electricity to indicate the range of uncertainty of the estimates.</p>	11/30/11	Technical Update

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Renewable Technology 4: Each engineering and economic evaluation updates the status, performance, cost, and prospects for future improvement of a renewable energy. The scope of the evaluations includes design and economic assumptions; conceptual design descriptions; raw material requirements, material and energy balances, and environmental emissions where applicable; and capital, O&M, and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of renewable resource properties, material and labor cost indices, and labor productivities. Probability distributions will be generated for capital, O&M, and levelized cost of electricity to indicate the range of uncertainty of the estimates.</p>	11/30/11	Technical Update

P84.003 Renewable Energy Analysis and Strategy (069179)

Key Research Question

Utilities face the question of where renewable energy will fit in their future low-carbon and diversified choices for electricity generation. There is a significant level of business and technical uncertainty as to which emerging renewable technologies will be most cost-effective, reliable, and durable in the long run. Utilities need a clearer understanding of the opportunities and risks of relying on renewable generation and how this likely will affect the bottom line.

Approach

This activity will build on existing modeling and planning tools, such as the National Energy Modeling System (NEMS) and the EPRI National Electric System Simulation Integrated Evaluator (NESSIE) electricity sector model, to address utility industry issues. Assumptions and future scenarios developed under this activity will include associated uncertainty and risk factors. Test simulations will be run, and model results will be tested and analyzed. The tools and strategies will be delivered as technical reports, workshops, and modeling and simulation results.

Impact

- Provides a comparison of how different policies, fuel prices, CO₂ costs, and technology advancement scenarios will affect the electricity sector and the role of renewables.
- Results help guide and provide analytical support for EPRI's renewable energy and climate change programs, as well as members' resource planning and renewable strategy development.
- Close cooperation with other R&D organizations and energy modeling efforts, such as those at the National Renewable Energy Laboratory (NREL) and the Energy Information Administration (EIA), enhances information available to EPRI members and policymakers.

How to Apply Results

Members will apply the resulting renewable energy information and data to:

- Assess the status and potential of renewable generation technologies;
- Forecast the penetration of renewable energy in the generation portfolio mix for a range of scenarios; and
- Estimate the incremental impacts of adding renewable generation on fuel requirements, capital and O&M costs, and greenhouse and other pollutant emissions of the generation portfolio.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Modeling and Analysis of Renewable Generation in a Sustainable Portfolio: Updates and documentation of the NESSIE model, including the latest generation cost, performance, and resource data, regional supply and demand requirements, and climate and environmental policies/incentives that affect the deployment and generation mix. Modeling and analysis results will be provided as an annual update, as well as results from coordination with EIA and NREL modeling efforts.	12/31/10	Technical Update
Presentations and Webcasts Addressing Current Policy Implications on the Electricity Sector: This product will provide at least two updates and downloadable presentations, showing data on how proposed or current policies may affect the electricity sector, including specific regions of the United States.	10/31/10	Technical Resource

PS84B Biomass (069180)

Project Set Description

The biomass set of projects addresses:

- Security of fuel supply issues and durable fuel delivery for power stations
- Technologies for biomass power generation in technology transfer, cofiring systems, direct-firing systems, fuel upgrading, and gasification systems.
- Life-cycle analyses of biomass-based power, including all aspects of the carbon life-cycle of biomass

Project set participants will identify, scope, and prioritize collaborative research activities to be funded by the group, and EPRI will provide a forum for information exchange among members on key issues.

Project Number	Project Title	Description
P84.004	Biomass Supply Management Study	This project provides analyses of critical biomass supply issues to develop vigorous, durable fuel delivery for power stations.
P84.005	Power Generation from Biomass	This project develops information and technologies that allow utilities to cost-effectively adopt biomass power within their generation and renewable energy portfolios.
P84.006	Life-Cycle Analysis of Biomass-based Power	This project provides information on biomass carbon lifecycle issues for developing utility renewable energy strategies and informing the public.

P84.004 Biomass Supply Management Study (069181)

Key Research Question

The increasing number of renewable portfolio standards will drive many organizations to deploy biomass-to-electricity plants. For them, a more complete understanding of the existing and future biomass supply market is necessary to make informed fuel procurement decisions. Utilities have vast experience in procuring coal and natural gas, and have developed considerable understanding of the key aspects of those fuels. However, procuring biomass in large, dependable supplies places utilities in unfamiliar territory, potentially dealing with a whole array of new issues, including:

- Large number of smaller suppliers rather than a few large suppliers;
- Sharply defined supply seasonality;
- New, unproven supply chains and infrastructure developments, including the potential for aggregation and fuel upgrading;
- Uncertain future resource availability due to competition from other biomass consumers and critical water/land use priorities; and
- Poor understanding of biomass markets, including cost structure and price risk mitigation options.

Approach

This project will gather information from existing sources and industries, such as the fiber industries. Lessons will be collected from the infrastructure development of industries such as pulp and paper and food products, and existing research will be mined for insights into land use. Best practices in procurement from other bio-based industries will be surveyed. Because the utility sector's needs are different from existing bio-products sectors, many of the practices and analyses will need to be adapted for deployment in the utility business framework. More specific modeling will be undertaken to understand biomass fuel procurement risk and risk management strategies.

Impact

In the late 1980s in California, the demand for biomass supply for power stations outstripped production. The result was a significant industry restructuring, including ownership changes and plant shutdowns. As the utility sector moves strongly into biomass-to-power, the importance of understanding the ever-evolving biomass fuel supply situation is even more important. In particular, the results of this work can be used to:

- Build a robust fuel supply chain;
- Manage supply and price risk;
- Understand competing uses for land, water, and biomass; and
- Develop improved contracting methods.

How to Apply Results

Members can use the results of this project to gain a deeper understanding of the biomass markets from lessons learned from other industries and implications of land-use modeling. Members also can develop their biomass procurement processes through improved contracting, application of risk management techniques, or employing supply chain hardening methods used by other industries.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Analysis of Critical Biomass Fuel Supply Issues: Analysis of supply chain risk, assessment of regional cost curves over time, and summary of high-value contracting protocols.	12/31/10	Technical Update

P84.005 Power Generation from Biomass (069182)

Key Research Question

Most of the biomass combustion research issues have their roots in the biomass fuel itself. The fuel has very low energy density, contains high alkali and moisture contents, and is generally fibrous. These characteristics can lead to handling issues, poor capacity or conversion efficiencies, potential deposition issues within the unit, premature deNO_x catalyst degradation, and difficulty in milling and transport to the boiler. In non-combustion biomass systems, these same fuel properties can cause similar problems, including poor-quality syngas and difficulty in gas cleanup.

Approach

For 2010, this project will work in five areas: technology transfer, cofiring systems, direct-firing systems, fuel upgrading, and gasification systems. The work in technology transfer will consist of webcasts and meetings to transfer experiences among funders. The work in cofiring will continue the ongoing testing of catalyst degradation and investigate methods for high- percentage cofiring (greater than 10%). Work on direct-firing systems will analyze the growing body of repowering projects to provide cost/performance profiles for each type. The effort in fuel upgrading will consist of test burns of torrefied biomass in utility-scale power generating units. The gasification work will assess biomass syngas cleanup technologies.

Impact

The work in biomass power generation will allow utilities to comply with renewable standards with the greatest efficiency, lowest cost, and with the most reliability.

How to Apply Results

The results of this work will support utilities as they formulate the details of their renewable energy strategy, providing clarity about equipment life (in the case of cofiring) or in selecting technology options (in the case of direct-firing systems). The information about economics and performance of upgraded fuel systems will be useful as utilities evaluate fuel supply scenarios, as well as operational impacts of biomass.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Biomass Topical Meetings and Webcasts: Meetings and webcasts on areas of interest selected by funders.	12/31/10	Workshop, Training, or Conference
Test Burn Results of Torrefied Wood: Results of full-scale testing of torrefied wood, including power consumption, environmental performance, and handling issues.	12/31/10	Technical Update
Biomass Impact on Catalyst Life Test Results: Results from slipstream mini-reactor testing on the impact of biomass cofiring on catalyst life.	12/31/10	Technical Update

P84.006 Life-Cycle Analysis of Biomass-based Power (069183)

Key Research Question

Biomass power generation is considered a renewable energy source by many governments, yet questions remain about its overall carbon footprint. These questions typically revolve around the renewability of the biomass supply.

Approach

Ongoing work includes carbon requirements of local soils, impacts of mono-culture energy plantations, transportation and processing carbon implications, waste utilization/fate, and direct carbon life-cycle calculations. At the same time, the structural elements of sustainability criteria — standards, accreditation, certification and supply chain management — are beginning to be implemented. EPRI will summarize the key aspects of the ongoing work and develop a preliminary tool to help utilities calculate the carbon footprint of their biomass activities.

Impact

The project results will provide funders with important information to aid in formulating internal corporate sustainability initiatives and communicating biomass project values to regulators, customers, and other stakeholders.

How to Apply Results

Project results can be integrated analyses used to develop corporate renewable energy strategies and in communications materials to inform the public on key biomass life-cycle issues.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Biomass Carbon Life-Cycle Perspectives: A summary of the ongoing work in biomass carbon life-cycle perspectives and a preliminary analysis tool for determining site-specific biomass carbon footprints.	12/31/10	Technical Update

PS84C Solar (069184)

Project Set Description

The project set will address integration of solar thermal energy into existing and new power plant steam cycles, benchmarking of current and new solar technologies at the SolarTAC demonstration site, and incorporating solar thermal energy storage into solar thermal power plants. It will provide a forum for participants to exchange information on all solar electric technologies, applications, and market developments. Participants will learn about ongoing research and solar technology developments through industry tours, presentations from industry experts, and interaction with their peers.

Project Number	Project Title	Description
P84.007	Solar Augmented Steam Cycles Applications Analysis	The integration of solar thermal energy into power plant steam cycles promises a potentially low cost way to add solar capacity into generation portfolios without compromising plant dispatchability and operational flexibility. Multiple applications for solar integration will be reviewed as part of this study.
P84.008	Solar Technology Assessment Center (SolarTAC)	The project will begin with a benchmarking study of current solar technologies options that will be used as a basis for comparison as new technologies are demonstrated at the SolarTAC site. Pilot-scale and demonstration scale projects will be conducted to generate performance results and build experience with emerging solar technologies.
P84.009	Solar Thermal Storage Technology Assessment	Incorporating solar thermal energy storage into solar thermal power plants has the potential to lower the levelized cost of electricity and provide greater operational flexibility. Multiple technology options will be reviewed as part of this study, and plans for demonstrating promising thermal energy storage options will be developed.

P84.007 Solar Augmented Steam Cycles Applications Analysis (069185)

Key Research Question

More than 8 gigawatts of concentrating solar power capacity is planned worldwide over the next five years, and more than 300 megawatts of solar augmentation currently is under development. The evaluation of new solar integration applications will provide expanded options to energy companies seeking to implement cost-effective solar capacity that will provide firm, dispatchable power.

Approach

EPRI will continue the analysis of new applications for solar augmentation of steam cycles applications that began as a supplemental project in 2008. This may include Greenfield applications for natural gas and coal plant technologies, solar integration with biomass or geothermal cycles, or oil-fired steam cycles. Emerging solar technology options that may provide expanded integration options also will be considered.

Impact

This project will provide guidance on new solar capacity options for energy companies.

How to Apply Results

The results and insights gained in this program provide expanded options to plant owners who wish to leverage existing plant assets or develop new solar assets, reduce their carbon footprint, and gain valuable experience with solar thermal electric systems.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Solar Augmented Steam Cycles Applications: The report will cover results of technical and economic evaluations of new solar-augmented steam cycles applications.	12/31/10	Technical Update
Webcast: One or more webcasts will be held to present findings of the solar-augmented steam cycles applications analysis and determine member interests in new technology evaluations.	06/30/10	Workshop, Training, or Conference

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Solar Augmented Steam Cycles Applications	12/31/11	Technical Update
Solar Augmented Steam Cycles Applications	12/31/12	Technical Update

P84.008 Solar Technology Assessment Center (SolarTAC) (069186)

Key Research Question

Numerous solar technologies are under development worldwide, but there is not a central location for new technology demonstration and testing in the United States. Energy companies need a place to test and validate new solar technologies at commercial scale in order to make accurate comparisons of technology options.

Approach

EPRI is a sponsoring member of the Solar Technology Acceleration Center (SolarTAC), where industry research projects can be conducted. Focus areas include comparisons of photovoltaic technologies and pilot-scale testing of solar generation and storage technologies.

Impact

This program offering will provide real data on emerging solar technologies that will allow energy companies to make educated solar investment decisions.

How to Apply Results

The results and insights gained in this program provide critical knowledge to energy companies who wish to develop new solar assets and understand the technology options.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Workshop on Solar Technology Demonstration Options: A workshop will be held for members to learn about potential projects at SolarTAC and prioritize work for 2010.	06/01/10	Workshop, Training, or Conference
Benchmarking Study of Existing Solar Projects: The benchmarking study will include information and data, as available, from current solar demonstration projects throughout the world. The collected information will be used as a basis of comparison for projects performed at SolarTAC.	06/30/10	Technical Update
Solar Technology Webcast: One or more webcasts will be held throughout the year to update members on SolarTAC project results and new project opportunities.	10/31/10	Workshop, Training, or Conference
SolarTAC Performance Results: The results of demonstration projects performed at SolarTAC will be compiled into a technical update report.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
SolarTAC Performance Results	12/31/11	Technical Update

P84.009 Solar Thermal Storage Technology Assessment (069187)

Key Research Question

More than 8 gigawatts of concentrating solar power capacity is planned worldwide over the next five years, but few projects include thermal energy storage. Cost-effective thermal energy storage systems need to be developed and demonstrated at commercial scale to improve the operating flexibility of large solar thermal plants.

Approach

Building on work completed in 2009 on the state-of-the-art of solar thermal storage, this project will obtain field data for actual installations. Both pilot- and full-scale solar thermal storage plants will be identified as hosts for collaborative evaluations of the thermal storage performance relative to solar plant operations and plant output characteristics.

Impact

Moving thermal energy storage technologies from the pilot-testing phase to commercial-scale demonstrations will allow solar thermal technology to be more readily adopted into utility generation portfolios.

How to Apply Results

Comprehensive knowledge about the state of thermal energy storage technology development will allow project developers to make educated decisions about solar projects with storage options.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Solar Thermal Energy Storage Webcast: A webcast will be held to update members on existing solar thermal energy storage applications and opportunities for collaborative demonstration of new storage technologies.	04/30/10	Workshop, Training, or Conference
State of Solar Thermal Energy Storage Development: This report will highlight existing applications of solar thermal energy storage and discuss research trends and opportunities for the industry.	09/30/10	Technical Update

PS84D Wind (069188)

Project Set Description

The wind project set covers advanced wind turbine technology assessments and wind asset management. Advanced technology assessments will include review of relevant reports and patents, analysis of technology strengths and weaknesses, and forecasts of likely paths for R&D. Asset management research will address the application technology to allow condition monitoring and provide understanding of major component reliability and reductions in O&M costs, with field data collection to guide the efforts.

Project Number	Project Title	Description
P84.010	Wind Power Technology Assessment	This project provides advanced wind turbine technology assessments, which include reviews of relevant reports and patents; analyses of technology strengths and weaknesses; forecasts of likely paths for R&D, demonstration, and early deployment of promising technologies; and assessments of the likely current and future performance and cost impacts of applying the new technologies.
P84.011	Wind Power Asset Management	This project develops applications of new technologies to allow condition monitoring, understanding of major component reliability, and reductions in O&M costs. It will include collecting field data to guide the efforts.

P84.010 Wind Power Technology Assessment (069189)

Key Research Question

Objective assessments are needed of the status, technical and economic feasibility, and need for further development and demonstration of new wind turbine and associated technology. The technology R&D scope includes blades and rotors, drive train, gearbox, generators and power electronics, sensors and controls, towers and foundations, and other components for both land-based and offshore wind projects.

Approach

Review technical papers, reports, and patents; make site visits to technology developers and field demonstration projects; and prepare annual reports on new wind turbine and associated technology.

Impact

Identify the most promising technologies that can be expected to improve the performance, reliability, and cost of future wind power generation.

How to Apply Results

Utilities can use the information provided by this project to assess potential impacts of changing wind turbine technologies on design, performance, reliability, and cost of applying these technologies at future wind generation plants, and analyze potential opportunities for investment in new wind turbine technology.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Assessment of New Wind Power Technology - 2010: The scope of the annual advanced wind turbine technology assessments includes review of relevant reports and patents; analyses of technology strengths and weaknesses; forecasts of likely paths for R&D, demonstration, and early deployment of promising technology; and assessments of likely current and future performance and cost impacts of applying the new technologies.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Assessment of New Wind Power Technology - 2011: The scope of the annual advanced wind turbine technology assessments includes review of relevant reports and patents; analyses of technology strengths and weaknesses; forecasts of likely paths for R&D, demonstration, and early deployment of promising technology; and assessments of likely current and future performance and cost impacts of applying the new technologies.	12/31/11	Technical Update
Assessment of New Wind Power Technology - 2012: The scope of the annual advanced wind turbine technology assessments includes review of relevant reports and patents; analyses of technology strengths and weaknesses; forecasts of likely paths for R&D, demonstration, and early deployment of promising technology; and assessments of likely current and future performance and cost impacts of applying the new technologies.	12/31/12	Technical Update

P84.011 Wind Power Asset Management (069190)

Key Research Question

During 2008, the rated capacity of worldwide wind power generation reached 121,000 MW, and U.S. capacity reached 25,000 MW. Effective management of the resulting large fleet of wind turbines requires asset management tools to monitor, operate, and maintain the wind turbines to maximize reliability and annual power generation.

Approach

This project will apply and test advanced technology to develop a database of wind turbine component reliability and to monitor the condition of major wind turbine components, including rotors and blades, gearboxes, generators, yaw drives, and sensors and controls. The database development will apply Operational Reliability Analysis Program (ORAP) technology now used to tabulate reliability data for combustion turbines. The condition-monitoring technology includes online condition monitoring and SCADA data trend analysis of individual turbines to detect evolving component wear and tear.

Impact

Improves reliability and annual generation of wind turbine fleet.

How to Apply Results

Apply the database of wind turbine component reliability to monitor individual turbine reliability relative to that of the population of wind turbines.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Assessment of Wind Turbine O&M and Asset Management Technology: This report will review the status of wind turbine O&M and asset management technology and the applicability of asset management technology used in fossil generation industry to wind turbines. Technologies include reliability-centered maintenance, online condition monitoring, and nondestructive evaluation of major turbine components.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Wind Turbine O&M and Asset Management Guidebook Progress Report: Begin work to develop a guidebook on wind turbine O&M and asset management. This guide will be a compendium of information and O&M procedures, condition monitoring, and nondestructive testing of gearboxes, cables, turbine blades, and other components. It also will cover technologies for managing large fleets of wind turbines for maximizing energy capture and minimizing O&M costs.	12/31/11	Technical Update
Wind Turbine O&M and Asset Management Guidebook: During 2011 and 2012, the project will develop and test a guidebook on wind turbine O&M and asset management. This guidebook will be compendium of information and O&M procedures, condition monitoring, and nondestructive testing of gearboxes, cables, turbine blades, and other components. It will also cover technologies for managing large fleets of wind turbines for maximizing energy capture and minimizing O&M costs.	12/31/12	Technical Report

PS84E Geothermal (069191)

Project Set Description

The project set will promote collaboration between geothermal plant operators, developers, and owners by documenting common industry problems and providing solution guidelines. Nondestructive evaluation, corrosion management technologies, and reliability-centered maintenance (RCM) will be applied to existing plants to improve performance and reduce costs. New technologies for moderate- and low-temperature geothermal conversion will be evaluated for technology readiness and application limits for commercial viability. Enhanced/engineered geothermal systems will be evaluated as potential candidates for development and demonstration.

Project Number	Project Title	Description
P84.012	Geothermal Operations and Maintenance	The project will promote collaboration between geothermal plant operators, developers, and owners in documenting common industry problems and developing solutions. These will be incorporated in guidelines that include industry best practices and become the bases for a handbook on geothermal O&M.
P84.013	Assessment of Geothermal Power Technologies	This project will provide the engineering and economic analysis of promising new technologies with significant potential for extracting energy from geothermal sources, including: <ul style="list-style-type: none"> Enhanced geothermal systems (EGS), also known as hot dry rock (HDR), building on recent applications under way in Australia and Europe. The project will identify and conduct preliminary engineering and economic analysis to support participation in two demonstration projects by 2012. Moderate- and low-temperature geothermal from water resources common in many countries and new technologies beginning to appear that allow these resources to be developed commercially.

P84.012 Geothermal Operations and Maintenance (069192)

Key Research Question

Geothermal maintenance costs are about twice that of fossil fuel plants, fixed O&M costs dominate, and average plant availability in the United States is below 80% due to problems of corrosion, deposition, and erosion, which are characteristic of the geothermal environment. Comprehensive geothermal O&M industry guidelines, based on actual plant experience and applying new technology to ensure high plant availability, are needed if geothermal power generators are to remain competitive with other sources of power. These guidelines will serve as an independent engineering resource to evaluate plant operations and maintenance and to identify best industry practices for improving availability and profitability.

Approach

This project will develop guidelines to support members in obtaining the following services for geothermal plant evaluations:

- Independent evaluation of process requirements, materials selection, and plant equipment specification.
- Guidelines for a preventative maintenance program to minimize forced outages and to maximize turbine in-service periods.
- Training and technology transfer to ensure operators develop the required levels of operational skills.

- Recommendations for systems re-engineering in response to changing production conditions and assessment of deposition problems.
- Turbine performance improvement evaluations, performance testing, and analysis of deposition problems.
- Condenser/cooling circuit optimization and chemical dosing recommendations.

Impact

- O&M cost reduction opportunity on the basis of lessons learned and collaborative experience sharing on materials, nondestructive evaluation (NDE) technologies, and operators training
- Guidelines for a preventive maintenance in-service inspection (ISI) program and turbine performance improvement evaluation will improve availability and production.

How to Apply Results

- Participating in training and technology transfer work-outs to ensure operators develop the required levels of operational skills.
- Developing and applying geothermal O&M guidelines and member handbooks, which reflect new experiences and technology improvements, will support improved practices and procedures.
- Defining technical support on materials, chemical treatments, turbine performance, deposition problems, and reservoir management.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Geothermal Plant O&M Handbook: Develop initial draft of a geothermal plant O&M handbook, addressing most characteristic problems of corrosion of well casings, valves, surface pipelines (steam and condensate), structural steel, cooling towers components, building cladding, and electrical switch gear; deposition of geothermal mineral phases inside production and injection wells, steam/field piping/plant, and steam turbines; and erosion of surface piping, valves, and turbine blades. The handbook will provide guidelines and criteria for a preventive maintenance program to minimize forced plant outages and to maximize turbine in-service periods.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Geothermal Plant O&M Handbook: Update and expand the geothermal plant O&M handbook, addressing most characteristic problems of corrosion of well casings, valves, surface pipelines (steam and condensate), structural steel, cooling tower components, building cladding, and electrical switchgear; deposition of geothermal mineral phases inside production and injection wells, steam/field piping/plant, and steam turbines; and erosion of surface piping, valves, and turbine blades. The handbook provides guidelines and criteria for a preventive maintenance program to minimize forced plant outages and to maximize turbine in-service periods.	12/31/11	Technical Update

P84.013 Assessment of Geothermal Power Technologies (069193)

Key Research Question

Engineering and economic analysis of moderate- and low-temperature geothermal resources and related technologies for power production. Feasibility assessment and proof of technology performance for enhanced/engineered geothermal systems (EGS). Design analysis and preliminary engineering for advanced geothermal EGS.

Approach

The technology selection will be based on member interest. In any case, the approach will be to use available engineering experience from geothermal, oil, gas, and other relevant sectors and identify available resources and data on pre-stimulation flow, injection testing, and well stimulations. Plans for data collection and monitoring to assess long-term performance of the stimulated well and investment and production costs will be developed.

Impact

- Provide detailed engineering and economic evaluations of the potential of geothermal moderate- and low-temperature technology applications to produce electric power. Most geothermal power plants in the future likely will be binary-cycle plants.
- Participate in EGS collaborative cost/risk assessment projects to validate technology potential in the future. Become familiar with expected engineering and economic challenges and operational lessons learned from existing facilities.

How to Apply Results

- Supports preparation and review of renewable RFP's for low-temperature geothermal distributed generation or EGS geothermal plants for renewable electricity to meet RPS requirements.
- Informs development of small (up to 15 MWe) remotely operated, low-temperature geothermal generation projects based on low-cost modular strategies, as well as geothermal EGS plants projects to generate baseload renewable electricity.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Assessment of Moderate and Low-Temperature Geothermal: Engineering and economic analysis of moderate- and low-temperature geothermal resources and related technologies for power production.	11/30/10	Technical Update
Assessment of Enhanced/Engineered Geothermal Systems (EGS): Feasibility assessment and proof of technology performance for enhanced/engineered geothermal systems (EGS).	12/31/10	Technical Update