

Renewable Energy Economics and Technology Status - Program 84

Program Overview

Program Description

Renewable energy is fundamentally changing the electricity industry's strategic landscape. Active industry engagement in development and deployment of renewable energy for power generation has increased significantly, and continued engagement is more critical than ever before. Renewable portfolio standards, financial incentives, concerns over energy security, and efforts to reduce greenhouse gas emissions will continue to drive renewable energy deployment. Over the long term, renewable energy investment will depend on renewables' operating cost-effectively without mandates or subsidies. Up-to-date information is critical to exploring new opportunities for deployment, operation, and maintenance of renewable generation.

The Electric Power Research Institute's (EPRI's) Renewable Energy Economics and Technology Status program provides a portfolio of collaborative opportunities that

- Assesses the status, performance, and cost of renewable generating technologies; and
- Conducts targeted research and development to address critical issues relative to the economics of renewable generation resources.

Participation in this program includes results of engineering and economic evaluations performed for all renewable resource areas, including wind, solar, biomass, solar, geothermal, and waterpower. Participation in any of the individual renewable resource programs (P186-wind, P187-solar, P188-biomass, P189-geothermal, P190-waterpower) will include the associated engineering and economic evaluation project for that specific resource.

Research Value

Renewable energy resources and their application in generating electricity most often are considered collectively when addressing key drivers in renewable energy deployment, including renewable portfolio standards, energy security, greenhouse gas emission reductions, and other issues. However, wind, solar photovoltaic, solar thermal, biomass, geothermal, and waterpower energy options are largely unrelated technologically; each has its own developmental status, readiness timeline, and economic and technology challenges. EPRI's Renewable Energy Economics and Technology Status program assesses the cost-effectiveness of existing renewables technologies and reports on new renewables technologies and applications that could ultimately lead to better performance and cost-competitive renewable generation. This program also provides independent cost and performance information for renewable technologies, helping participants to

- Capitalize on market opportunities for renewable compliance and power purchases for improved decision making,
- Identify the appropriate role of diverse renewable resources in expanding new and sustainable generation capacity, and
- Apply results from research efforts to help guide investments in renewable energy and support long-term generation planning efforts.

Through collaboration with key industry stakeholders, EPRI members guide development and demonstration of technologies that will optimize operating efficiency, reduce overall costs, and facilitate deployment of large-scale renewable generation.

Approach

Value is delivered to members in a variety of ways:

- EPRI keeps members informed on global technical developments through advisory meetings, webcasts, and networking to share experiences and capitalize on lessons learned by others.
- Through collaboration with technical experts across EPRI (e.g., renewable integration and energy storage activities), the program helps members learn about the latest technologies to improve energy recovery from renewable resources, understand the role of these energy resources, and help develop and implement a research portfolio to address identified critical technology issues.
- Transfer of technology to participants is achieved through the generation of technical reports and guidelines, and participation in lessons-learned workshops and activities.

Accomplishments

Historically, Program 84 has produced the *Renewable Energy Technology Guide* (RETG), a comprehensive resource of independent information on renewable energy status, performance, cost, installed capacity, and markets. The guide has included technology status information on renewable generation sources, including solar photovoltaic, solar thermal, wind, biomass, geothermal, and wave and tidal hydrokinetic resources. However, in any given year only two renewable generation types were updated in the RETG. For 2013, the guide is being replaced with detailed technology and economic evaluations for each of the following renewable resources: wind, solar, biomass, geothermal, and waterpower. Each report will be updated on an annual basis to reflect the latest market information. Other recent accomplishments include

- Recent engineering and economic evaluations in the areas of offshore wind, waste-to-energy technologies, central station solar, biomass, and geothermal; and
- Program-sponsored general-interest activities in renewable generation technologies, including industry meetings, technical tours, technology-specific webinars, and technology summits/workshops.

Current Year Activities

In 2013, this program will continue to deliver cost and performance information to allow comparisons and better define the role of renewable generation among all generation options. The 2013 plan includes technical briefings, conferences, site visits, and workshops on topics of common interest, allowing participants to pool R&D investments and develop solutions to common technology challenges. Through collaboration with technical experts across EPRI (e.g., renewable integration and energy storage activities), members will learn about the latest technologies to improve energy recovery from renewable resources, understand the role of these energy resources, and help develop and implement a research portfolio to address identified critical technology issues.

Program Manager

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Summary of Projects

Project Number	Project Title	Description
P84.001	Wind Engineering and Economic Evaluations	This project provides information on the status, performance, economics, and prospects for future improvement of wind energy technologies.
P84.002	Solar Engineering and Economic Evaluations	This project provides information on the status, performance, economics, and prospects for future improvement of solar energy technologies.
P84.003	Biomass Engineering and Economic Evaluation	This project provides information on the status, performance, economics, and prospects for future improvement of biomass energy technologies.
P84.004	Geothermal Engineering and Economic Evaluations	This project provides information on the status, performance, economics, and prospects for future improvement of geothermal energy technologies.
P84.005	Waterpower Engineering and Economic Evaluation	

P84.001 Wind Engineering and Economic Evaluations (073471)

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.

This project provides information on the status, performance, economics, and prospects for future improvement of wind energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and environmental emissions where applicable, and capital, operations and maintenance (O&M), and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of wind 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.

Approach

This project melds current engineering and technology evaluations with recent deployment cost experiences. The wind energy evaluation will address local renewable resource properties and cost indices for different sites, both domestic and international, to allow the cost and performance estimates to be generated for site-specific applications.

The report will be developed with the use of specific wind energy–related reports and studies, information available in the public domain, and, where warranted, external support.

Impact

Up-to-date technology, economic, and performance data will make it possible to accurately assess the potential for wind energy projects in future generation portfolios.

How to Apply Results

Members will apply data, information, and insights about the role of wind energy to

- Assess the status and potential of wind energy technologies for site-specific conditions,
- Forecast the penetration of wind energy in their specific generation portfolio mix, and
- Estimate the incremental impacts of adding wind energy on fuel requirements, capital and O&M costs, and other aspects of the generation portfolio.

2013 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Utility-Scale Onshore Wind Power Plants: The Engineering and Economic Evaluation of Utility-Scale Wind Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of onshore wind energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.</p>	12/31/13	Technical Report
<p>Engineering and Economic Evaluation of Utility-Scale Offshore Wind Power Plants: The Engineering and Economic Evaluation of Utility-Scale Offshore Wind Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of offshore wind energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.</p>	12/31/13	Technical Report

P84.002 Solar Engineering and Economic Evaluations (073472)

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.

This project provides information on the status, performance, economics, and prospects for future improvement of solar energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, 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 solar 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.

Approach

This project melds current engineering and technology evaluations with recent deployment cost experiences. The solar energy evaluation will address local renewable resource properties and cost indices for different sites, both domestic and international, to allow the cost and performance estimates to be generated for site-specific applications.

The report will be developed with the use of specific solar energy–related reports and studies, information available in the public domain, and, where warranted, external support.

Impact

Up-to-date technology, economic, and performance data will make it possible to accurately assess the potential for solar energy projects in future generation portfolios.

How to Apply Results

Members will apply data, information, and insights about the role of solar energy to

- Assess the status and potential of solar energy technologies for site-specific conditions,
- Forecast the penetration of solar energy in their specific generation portfolio mix, and
- Estimate the incremental impacts of adding solar energy on fuel requirements, capital and O&M costs, and other aspects of the generation portfolio.

2013 Products

Product Title & Description	Planned Completion Date	Product Type
Engineering and Economic Evaluation of Central-Station Solar Photovoltaic Power Plants: The Engineering and Economic Evaluation of Central-Station Solar Photovoltaic Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of solar PV energy technologies. The scope of the evaluation includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.	12/31/13	Technical Report
Engineering and Economic Evaluation of Central-Station Solar Thermal Power Plants: The Engineering and Economic Evaluation of Central-Station Solar Thermal Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of solar thermal energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.	12/31/13	Technical Report

P84.003 Biomass Engineering and Economic Evaluation (073473)

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.

This project provides information on the status, performance, economics, and prospects for future improvement of biomass energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, 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 biomass 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.

Approach

This project melds current engineering and technology evaluations with recent deployment cost experiences. The biomass energy evaluation will address local renewable resource properties and cost indices for different sites, both domestic and international, to allow the cost and performance estimates to be generated for site-specific applications.

The report will be developed with the use of specific biomass energy–related reports and studies, information available in the public domain, and, where warranted, external support.

Impact

Up-to-date technology, economic, and performance data will make it possible to accurately assess the potential for biomass energy projects in future generation portfolios.

How to Apply Results

Members will apply data, information, and insights about the role of biomass energy to

- Assess the status and potential of biomass energy technologies for site-specific conditions,
- Forecast the penetration of biomass energy in their specific generation portfolio mix, and
- Estimate the incremental impacts of adding biomass energy on fuel requirements, capital and O&M costs, and other aspects of the generation portfolio.

2013 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Biomass Power Plants: The Engineering and Economic Evaluation of Biomass Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of biomass energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.</p>	12/31/13	Technical Report

P84.004 Geothermal Engineering and Economic Evaluations (073474)

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.

This project provides information on the status, performance, economics, and prospects for future improvement of geothermal energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, 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 geothermal 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.

Approach

This project melds current engineering and technology evaluations with recent deployment cost experiences. The geothermal energy evaluation will address local renewable resource properties and cost indices for different sites, both domestic and international, to allow the cost and performance estimates to be generated for site-specific applications.

The report will be developed with the use of specific geothermal energy–related reports and studies, information available in the public domain, and, where warranted, external support.

Impact

Up-to-date technology, economic, and performance data will make it possible to accurately assess the potential for geothermal energy projects in future generation portfolios.

How to Apply Results

Members will apply data, information, and insights about the role of geothermal energy to

- Assess the status and potential of geothermal energy technologies for site-specific conditions,
- Forecast the penetration of geothermal energy in their specific generation portfolio mix, and
- Estimate the incremental impacts of adding geothermal energy on fuel requirements, capital and O&M costs, and other aspects of the generation portfolio.

2013 Products

Product Title & Description	Planned Completion Date	Product Type
Engineering and Economic Evaluation of Geothermal Power Plants: The Engineering and Economic Evaluation of Geothermal Power Plants report provides an update on the status, performance, economics, and prospects for future improvement of geothermal energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements and capital, O&M, and levelized cost of electricity estimates.	12/31/13	Technical Report

P84.005 Waterpower Engineering and Economic Evaluation (073475)

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.

This project provides information on the status, performance, economics, and prospects for future improvement of waterpower energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, environmental performance, and capital, O&M, and levelized cost of electricity estimates. The cost estimates will be prepared for several specific locations representing a range of waterpower 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.

Approach

This project melds current engineering and technology evaluations with recent deployment cost experiences. The waterpower energy evaluation will address local renewable resource properties and cost indices for different sites, both domestic and international, to allow the cost and performance estimates to be generated for site-specific applications.

The report will be developed with the use of specific waterpower energy–related reports and studies, information available in the public domain, and, where warranted, external support.

Impact

Up-to-date technology, economic, and performance data will make it possible to accurately assess the potential for waterpower energy projects in future generation portfolios.

How to Apply Results

Members will apply data, information, and insights about the role of waterpower energy to

- Assess the status and potential of waterpower energy technologies for site-specific conditions,
- Forecast the penetration of waterpower energy in their specific generation portfolio mix, and
- Estimate the incremental impacts of adding waterpower energy on fuel requirements, capital and O&M costs, and other aspects of the generation portfolio.

2013 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Engineering and Economic Evaluation of Hydropower Plants: The Engineering and Economic Evaluation of Waterpower Generation Plants report provides an update on the status, performance, economics, and prospects for future improvement of waterpower energy technologies. The scope of the evaluations includes design and economic assumptions, conceptual design descriptions, future technical advancements, and capital, O&M, and levelized cost of electricity estimates.</p>	12/31/13	Technical Report