FINAL TECHNICAL REPORT

Project Title: State Technologies Advancement Collaborative

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DISCLAIMER

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ATTACHMENT

Attachment A -- STAC Project Profiles

Executive Summary

The U. S. Department of Energy (DOE), National Association of State Energy Officials (NASEO), and Association of State Energy Research and Technology Transfer Institutions (ASERTTI) signed an intergovernmental agreement on November 14, 2002, that allowed states and territories and the Federal Government to better collaborate on energy research, development, demonstration and deployment (RDD&D) projects. The agreement established the State Technologies Advancement Collaborative (STAC) which allowed the states and DOE to move RDD&D forward using an innovative competitive project selection and funding process. A cooperative agreement between DOE and NASEO served as the contracting instrument for this innovative federal-state partnership obligating funds from DOE's Office of Energy Efficiency and Renewable Energy and Office of Fossil Energy to plan, fund, and implement RDD&D projects that were consistent with the common priorities of the states and DOE. DOE's Golden Field Office provided Federal oversight and guidance for the STAC cooperative agreement.

The STAC program was built on the foundation of prior Federal-State efforts to collaborate on and engage in joint planning for RDD&D. Although STAC builds on existing, successful programs, it is important to note that it was not intended to replace other successful joint DOE/State initiatives such as the State Energy Program or EERE Special Projects. Overall the STAC process was used to fund, through three competitive solicitations, 35 successful multi-state research, development, deployment, and demonstration projects with an overall average non-federal cost share of 43%. Twenty-two states were awarded at least one prime contract, and organizations in all 50 states and some territories were involved as subcontractors in at least one STAC project. Projects were funded in seven program areas:

- Building Technologies
- Industrial Technologies
- Transportation Technologies
- Distributed Energy Resources
- Hydrogen Technology Learning Centers
- Fossil Energy
- Rebuild America

All 35 STAC projects were successfully performed and completed. All close-out documentation and final technical project reports were submitted through the EERE Project Management Center. Final technical project reports are available at the STAC website – www.stacenergy.org. Attachment A of this final report contains profiles for each STAC project including an overview, project activities, and outcomes/benefits.

Project Overview

The U.S. Department of Energy (DOE), National Association of State Energy Officials (NASEO), and Association of State Energy Research and Technology Transfer Institutions (ASERTTI) signed an intergovernmental agreement on November 14, 2002 that allowed states, territories, and the Federal government to better collaborate on energy research, development, demonstration, and deployment projects as part of a five-year pilot program. The agreement established STAC with an innovation in both the competitive merit-based project selection process and collaborative funding process. STAC was designed to be consistent with the strategies, goals, and objectives of DOE and the States and thereby better leverage Federal and State funds, expedite funding for RDD&D projects and reduce redundancies.

A cooperative agreement signed on April 22, 2003 between the Department of Energy, Golden Field Office and NASEO served as the instrument to obligate federal funding for projects and for NASEO to administer and operate the STAC program. Between April 2003 and April 2006 the cooperative agreement was amended five times to either add additional program funds for solicitations or to extend budget and project period.

Overall the STAC process was used to fund, through three competitive solicitations, 35 successful multi-state research, development, deployment, and demonstration projects with an overall average non-federal cost share of 43%. Twenty-two states were awarded at least one prime contract, and organizations in all 50 states were involved as subcontractors in at least one STAC project. Projects were funded in seven program areas:

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Goal and Objectives

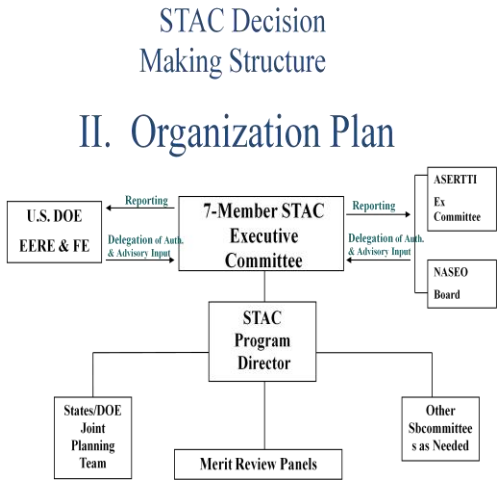
The overall goal of the STAC program was to provide a better way to plan a Federal/State RDD&D agenda, and conduct joint RDD&D through multi-state, efficient, competitive and fair procurement and management practices.

The objectives of the STAC program were to:

- Ensure more efficient and effective utilization of Federal and State research and development dollars through planned leveraging;
- Leverage funding with the States through NASEO, ASERTTI, and third parties;
- Ensure that Federal funding used to finance this program was managed consistent with the Congressionally mandated purpose;

- Create stronger Federal/State relationships that result in selecting the best program investments consistent with DOE and State missions, strategies, goals, and objectives;
- Create multi-State projects;
- Support the RDD&D of new technologies that contribute to the energy security of the States and the Nation;
- Develop more effective and efficient mechanisms for facilitating the deployment of energy technologies that:
    - Create new market choices and opportunities;
    - Encourage investment in clean energy technologies;
    - Facilitate stronger ties with the U.S. business community;
    - Support the Nation's infrastructure;
    - Quantify market segments and characteristics, recognize market realities, and identify areas for market penetration;
    - Baseline and measure the performance of the projects executed under this program against specific project objectives and technical or market barriers; and
    - Disseminate clean energy information throughout the nation to industry, universities and schools, financial institutions, government, and the general public in a manner that maximizes the impact of the message.
- Baseline the performance of the program against current procurement cycle times.

Description of Activities Performed



First step in the STAC program was development of a decision-making structure for STAC that was agreed to by the three main parties – DOE, NASEO, and ASERTTI. This organization plan was the framework for the operation of STAC.

Clearly defining roles and responsibilities for the various parties was crucial to the success of STAC.

- DOE provided program funding through the cooperative agreement; delegation of authority; and advisory input for determination of project areas, assistance in the merit reviews, and input to the final selection of projects.
- The Golden Field Office executed the cooperative agreement with NASEO; obligated program funding; conducted program oversight; and received and reviewed program/project deliverables, including technical and financial reporting.
- NASEO and ASERTTI entered into an operating agreement on January 21, 2003 detailing the working relationship between the two organizations.

- NASEO was defined as the "prime" recipient and administrator of funds under the DOE cooperative agreement and as such was the direct recipient of all STAC program funding. NASEO was responsible for establishing, funding, and maintaining all project agreements; reporting and providing deliverables as required to the Golden Field Office; and providing needed administrative support.
- ASERTTI was responsible for assisting in establishing the merit review process; providing technical support to program planning and development; and providing technical support for the solicitation process as well as technical progress reviews, as needed.
- The STAC Executive Committee was responsible for implementing joint planning processes; addressing organizational conflict-of-interest issues; assuring use of competitive, merit based procedures; assurance of implementation of solicitation requirements; selection of projects; and exercising oversight to assure effective management of the program.
- The STAC Program Director was responsible for the overall conduct of the STAC program including planning, acquisition, project management, and reporting/information transfer. The Program Director used the expertise and resources of NASEO, ASERTTI, DOE, and contract resources to administer the program.

The STAC program was made up of four major activity areas: STAC Management and Planning; Development of Solicitations, Merit Review of Proposals, and Award of Contracts; Project Management and Reporting; and Outreach and Information Dissemination. Each major activity area is described in detail below.

STAC Management and Planning

The STAC Executive Committee was established in December 2002 with two members from DOE, one appointed by the Assistant Secretary for Energy Efficiency and Renewable Energy and one appointed by the Assistant Secretary for Fossil Energy; two members each from NASEO and ASERTTI appointed by their respective boards, and one independent member selected jointly by the parties. The Executive Committee was responsible for implementation of the STAC program with the following responsibilities:

- Appointing a program director;
- Implementing effective and efficient joint planning processes, reviewing planning recommendations and approving a defined program which identifies areas of mutual interest to DOE and the States consistent with their respective missions, strategies, goals and objectives;
- Establishing policies and procedures that avoid organizational conflict-of-interest issues or the appearance of organizational conflict-of-interest;
- Assuring that projects are selected under competitive, merit-based procedures, and that such projects include multi-state participation for a variety of technologies with cost-sharing that meets or exceeds contractual standards;
- Selecting projects for funding;
- Exercising oversight of work to assure effective management of individual projects and the overall program; and
- Reporting results and lessons learned for the program.

The Executive Committee quickly hired an experienced Program Director responsible for the planning and administration of the program including planning, acquisition, project management and reporting/information transfer. The Program Director was advised to use the expertise and resources of NASEO, ASERTTI, DOE, and contract resources as necessary to administer the program.

An important aspect of the STAC program was the provision for joint Federal-State planning for the purpose of developing a mutually agreed upon collaborative RDD&D agenda. The joint planning process

was implemented by Federal program managers from DOE's Office of Energy Efficiency and Renewable Energy and Office of Fossil Energy representing their respective programs in concert with planning representatives from NASEO and ASERTTI.

The joint Federal-State planning teams corresponding to the specific program areas outlined in each solicitation were charged with leading the effort to develop priority topics within their respective program areas. Priority topics focused on developing programs to support cooperative research, development, demonstration, and deployment projects were then provided to the Program Director and Executive Committee for determination of program areas and topics to be included in specific solicitations.

The joint planning teams were given four specific criteria to be considered in recommending RDD&D program areas and topics for consideration:

1. The expected values and costs of the technologies within a wide range of buildings, transportation, industrial, distributed energy resources, utility integrated systems applications, etc.
2. Markets and market impacts;
3. Environmental values (e.g., emissions reductions, displaced energy, productivity gains/losses, etc.); and
4. Technical capabilities and limitations (e.g., system and component performance, reliability, failure rate, etc.).

Development of Solicitations, Merit Review of Proposals, and Award of Contracts

Three competitive solicitations were issued by NASEO under the STAC program. Each solicitation focused on specific program categories. Before final release of each solicitation, a draft for comment version was posted on both the NASEO and ASERTTI websites and e-mails were sent to each State and Territory Energy Office requesting comments. In order to make the contracting process run as quickly and smoothly as possible, NASEO's legal counsel developed a "model agreement" with input from DOE, Golden Field Office, and the States so that each awardee would be aware of contract terms and conditions prior to contract negotiation. Key provisions addressed in the "model agreement" included governing law and venue; dispute resolution; and cancellation/termination. Over 50 state-based organizations provided comments on the "model agreement." DOE, NASEO, and ASERTTI also developed very specific requirements for eligibility. The following stipulation was in each of the three STAC solicitations.

- In order for proposals to be considered eligible, the "Prime Participant" (see *Attachment D:* Model Contract, for definition of Prime Participant) must be either a State Energy Office or State-Chartered Institution as defined below. The multi-State nature of the Solicitation requires that the proposer team with at least one additional State Energy Office or State-Chartered Institution from at least one other State, Territory, or the District of Columbia.

Teaming arrangements with industry, DOE national laboratories, institutions of higher education, non-profit organizations, and Native American organizations, etc. were highly encouraged.

03-STAC-01 – Energy Efficiency Research, Development, Demonstration, and Deployment Projects was announced July 9, 2003 requesting proposals in the following areas:

- Building Technologies
- Industrial Technologies
- Transportation Technologies
- Distributed Energy Resources

A 55% non-federal cost share was required with project periods of one to three years.

Amendment 1 to the 03-STAC-01 solicitation added an additional program area for proposals – Hydrogen Technology Learning Centers. A 25% non-federal cost share was required.

Sixteen proposals, representing a wide range of state participants and other team members, were selected for award from this first solicitation. Summary information for each of the sixteen project awards is provided below.

(1) Building Commissioning-Innovation to Practice
(Building Technologies Category)
This project focused on overcoming owner and industry barriers to the adoption of building commissioning.
Project Lead: California Energy Commission
Project Participants: New York State Research and Development Authority; Texas Engineering Experiment Station; University of Nebraska – Lincoln; Oregon Department of Energy; Portland Energy Conservation, Inc.; Iowa Energy Center; Northwest Energy Efficiency Alliance; Lawrence Berkeley National Laboratory; Omaha Public Power District

(2) Strategies to Increase HVAC Efficiency in the Northeast
(Building Technologies Category)
This project focused on heating and cooling technologies by combining a characterization of the market and analysis of trends with an assessment of HVAC efficiency potential, followed by a field assessment of the effectiveness of training for heating and cooling system installations.
Project Lead: New York State Energy Research and Development Authority
Project Participants: New Jersey Board of Public Utilities, Office of Clean Energy; Northeast Energy Efficiency Partnerships, Inc.; Conservation Services Group, Inc.; Proctor Engineering Group, Ltd.; Nexus Market Research

(3) Development, Implementation and Deployment of Automated Fault Detection and Diagnostics for Vapor Compression Equipment
(Building Technologies Category)
This project targeted improving the technology and reducing the cost of automated fault detection and diagnostics in HVAC equipment. Field-testing was undertaken in residential and commercial buildings, and training programs were developed for technicians.
Project Lead: Purdue University
Project Participants: Ben Franklin Technology Partners of Southeastern Pennsylvania; Field Diagnostics Services, Inc.; Honeywell, Inc.; Aire-Rite Air Conditioning and Refrigeration, Inc.; FieldCentrix, Inc.

(4) Closing the Gap: Getting Full Performance from Residential Central Air Conditioners
(Building Technologies Category)
This project included the development of next-generation central air-conditioning performance ratings, development and demonstration of a central air conditioner for hot/humid climates, and HVAC contractor training.
Project Lead: New York State Energy Research and Development Authority
Project Participants: Advanced Energy; Energy Center of Wisconsin; Florida Solar Energy Center

(5) Real-Time Predictive Optimal Control of Active and Passive Thermal Storage Systems
(Building Technologies Category)
This project developed a real-time optimal controller for thermal storage systems from design through prototype development and testing in laboratory conditions, followed by field implementation in two commercial buildings.
Project Lead: University of Colorado - Boulder
Project Participants: University of Nebraska – Lincoln; Johnson Controls

(6) Field Trial of a High Capacity Gas-Fired Paper Dryer
(Industrial Technologies Category)
This project built on a previous pilot scale dryer project funded by the U.S. Department of Energy. From the results of that project, a preliminary and final design was completed, a gas-fired system constructed, a field trial conducted, and results reported and disseminated.
Project Lead: Minnesota Department of Commerce, State Energy Office
Participants: Western Michigan University; Gas Technology Institute; Boise Paper Solutions; Groupe Laperriere & Verreault; Flynn Burner, Corp.

(7) Western U. S. Food Processing Efficiency Initiative
(Industrial Technologies Category)
This effort developed a body of knowledge about the food processing industry's energy and water efficiency opportunities. At least six demonstration projects were completed, and an analysis and best practices portfolio was assembled. Results were disseminated via training and workshops.
Project Lead: Oregon Department of Energy, State Energy Office
Project Participants: Washington State University Energy Program; California Energy Commission; Idaho Department of Water Resources Energy Division; Northwest Food Processors Association; California League of Food Processors; Northwest Energy Efficiency Alliance; Lawrence Berkeley National Laboratory; Del Monte Foods

(8) Achieving More with Less: Efficiency and Economics of Motor Decision Tools
(Industrial Technologies Category)
A total of 100 NEMA Premium motors were installed while the displaced motors were tested to develop a strong industry case study. An analysis of the economics of motor reliability was conducted, and a previously published document on horsepower breakpoint curves was updated. Seminars were held in five areas of the country.
Project Lead: Advanced Energy
Project Participants: Washington State University Energy Program; California Energy Commission; New York State Energy Research and Development Authority; Baldor; Brithinee Electric; Emerson Motor Technologies; General Electric; Regal Beloit; TECO-Westinghouse; WEG Electric Motors

(9) Use of Pressurized Ozone and Compressed Air Flotation with Membrane Filtration for Industrial Process Water Treatment at a Forest Products Facility
(Industrial Technologies Category)
This project focused on demonstration of a membrane filtration system at a molded fiber paper mill. The process reduced the amount of fresh water needed for mill operations. The project expanded upon a complementary project, which focused only on the ozone system in the plant stream. Integrating the ozone process with efficient membrane filtration provided an overall efficiency not available with separate independent systems.
Project Lead: New York State Energy Research and Development Authority
Project Participants: Michigan Department of Consumer & Industry Services, State Energy Office

(10) Development of a Total Assessment Audit Protocol for the Chemical Industry in the Midwest
(Industrial Technologies Category)
This effort included selection of candidate firms in the chemical industry, as well as on-site multi-day audits covering energy management, process safety, supply chain management, information systems, waste minimization and quality improvement, technology and innovation, and green chemistry.
Project Lead: University of Illinois at Chicago, Energy Resources Center
Project Participants: Illinois Department of Commerce and Economic Opportunity, Bureau of Energy and Recycling; City of Chicago, Department of Environment; Ohio Department of Development, Office of Energy Efficiency; Indiana Department of Commerce, Energy and Recycling Office; Indiana Clean Manufacturing Technology and Safe Materials Institute; Purdue University

(11) Advanced Travel Center (Truckstop) Electrification for Reducing Idling from Heavy-Duty Vehicles
(Transportation Technologies Category)
In less than one year, 150 electrified truckstop parking spaces, Advanced Travel Center (Truckstop) Electrification (ATE), were installed at existing truck parking spaces at truckstops in three states. These spaces demonstrated fuel conservation, improved air quality, and short-term payback to truckstop operators. It is hoped that this demonstration will provide impetus to widespread application of such technologies to the heavy-duty vehicle market.
Project Lead: South Carolina Energy Office
Project Participants: Georgia Environmental Facilities Authority; South Carolina Department of Health and Environmental Control; North Carolina Division of Air Quality; IdleAire Technologies Corporation

(12) Distributed Energy Infrastructure Analysis and Pilot Project for New Jersey and Pennsylvania Targeted in the Small and Medium Sized Commercial and Industrial Sectors
(Distributed Energy Resources Category)
This project evaluated a baseline of distributed energy resources (DER) for all markets, as well as the financial, regulatory and technical barriers to expanding DER in the two states. Based on the analysis, a policy manual was produced.
Project Lead: New Jersey Board of Public Utilities, Office of Clean Energy
Project Participants: Pennsylvania Department of Environmental Protection, Office of Energy; Madison Energy Consultants, LLC; The Center for Energy, Economic, and Environmental Policy at the Bloustein School of Planning and Public Policy at Rutgers, The State University of New Jersey; PJM; Conectiv; National Council on Electricity Policy; National Association of Regulatory Utility Commissioners

(13) Distributed Energy Resources – Expanding DER Applications in Target Markets
(Distributed Energy Resources Category)
This two-year project developed and demonstrated a two-phase biofermentation system to produce methane from dairy manure and reuse resulting solids as a beneficial amendment to the soil while producing heat for internal use and electricity for sale. The process also involved a low water usage technology.
Project Lead: New Mexico Energy, Minerals, and Natural Resources Department
Project Participants: Texas State Energy Conservation Office; New Mexico State University; Terra Verde; North American Development Bank; Burcham & Associates; New Mexico Economic Development Department, Office of Science and Technology; Public Citizen; West Texas A&M; Gonzalez Dairy, Inc.

(14) Hydrogen Technology Learning Centers for California, Florida, and New York
(Hydrogen Learning Centers Category)
This project focused on the development of interactive displays and exhibits, development of a website, production of information publications, and conduct of a national conference to improve the understanding of hydrogen technology.
Project Lead: University of Central Florida-Florida Solar Energy Center
Project Partners: California Energy Commission; New York State Energy Research & Development Authority

(15) Virginia-Maryland Hydrogen Technology Education Center (H2TEC)
(Hydrogen Learning Centers Category)
This project worked to establish a new undergraduate course in hydrogen technology in the two states, as well as graduate study in the hydrogen area. Short courses and seminars for professionals were offered. In addition, presentations for non-technical audiences were developed as well as K-12 outreach activities.
Project lead: Virginia Polytechnic Institute & State University
Project participants: University of Maryland; Breakthrough Technologies Institute; Hampton Roads Clean Cities Coalition

(16) Development of a Regional Hydrogen Technology Education Consortium (HyTEC)
(Hydrogen Learning Centers Category)
This effort led by a consortium of four universities from four states provided education and training for students, professionals, and the public. The consortium established centers at each university, developed courses, workshops, and established a quarterly electronic newsletter.
Project lead: North Carolina A&T State University, Center for Energy Research & Training
Project participants: University of South Carolina; University of Florida; University of Georgia

04-STAC-01 – Energy Efficiency and Fossil Energy Science was announced April 7, 2004 requesting proposals in the areas of:

- Materials Sciences
- Fuels and Chemical Sciences
- Sensors and Controls Sciences
- Energy Conversion Sciences
- Emissions Reduction and Environmental Sciences

This solicitation concentrated on "science" subjects that were research and development oriented, and focused on breakthrough technology or "bridge" technology which falls between exploratory technology and pre-commercial technology.

A minimum of 20% non-federal cost share was required with project periods ranging from one to three years.

Thirty-five proposals were submitted. Eight project selections and awards were made from this solicitation. Summary information for each of the eight project awards is provided below.

(1) Determination of CO2 Storage Capacity and ECBM Potential of Lignite Coals
(Emissions Reduction and Environmental Sciences Category)
This three-year effort developed estimates of the gas content and CO_2 storage capacity of lignite coals in the Fort Union Group of the North Dakota and Montana portions of the Williston Basin and determined the potential for application of the CO_2-based ECBM in those coals.

Project Lead: University of North Dakota, Energy and Environment Research Center
Project Participants: North Dakota Industrial Commission, Oil and Gas Division; the North Dakota Department of Commerce, Division of Community Services, State Energy Program; and the Montana Board of Oil and Gas

(2) Preventing Solidification Defects in Large Superalloy Castings Used in Advanced Electric Power Systems (Materials Sciences Category)
This two-year effort studied macrosegregation in superalloy remelting processes. Weaknesses in existing models, particularly the inability to accurately predict partition coefficients of key elements under real operating conditions, were addressed. Compositional effects of individual allowing elements in different alloys were characterized so that a comprehensive database would be available in a useable format. A predictive methodology incorporating advanced computation technologies was developed. Alloy index of freckle and center segregation formation can be determined for complex alloy compositions with efficient computational and laboratory analysis. The ultimate goal was to develop a predictive technology that can be applied commercially to prevent solidification defects for large superalloy castings used in advanced electric power systems.
Project Lead: West Virginia Research Corp. on behalf of West Virginia University
Project Participants: GE Energy; Special Metals Corp.; Pennsylvania State University

(3) The Use of Real Time Measurement and Artificial Intelligence to Improve Efficiency and Reduce Emissions at Coal-Fired Power Plants (Sensors and Controls Sciences Category)
This two-year effort developed a technique to measure coal properties in real time, and to process the data such that coal-fired electric utility plants can adjust their operation to avoid slagging and fouling.
Project Lead: New York State Energy Research and Development Authority
Project Participants: Brayton Point Generating Station; Energy Research Company; Lehigh University

(4) Development of a Pilot Scale module for Hydrogen Separation
(Fuels and Chemical Sciences Category)
The key objective of this two-year effort was to advance Research Triangle Institute's hydrogen separation membrane technology to a pilot scale unit. The effort optimized membrane synthesis parameters to reduce the cost of the membranes while meeting the hydrogen flux and selectivity targets as well as to make them robust, long-term, durable, and tolerant to impurities including sulfur species typically present in synthesis gas derived from a variety of feedstocks, e.g. natural gas, coal and biomass feedstocks.
Project Lead: New York State Energy Research and Development Authority
Project Participants: North Carolina State Energy Office; Research Triangle Institute; Pall Corporation

(5) Utilizing the National Corn-to-Ethanol Pilot Plant to Develop a Predictive Model for Distillers Dried Grain for the Fuel Ethanol and Animal Feed Industries
(Sensors and Controls Sciences Category)
The objective of this two-year effort was to develop and validate a neutral network predictive plant model for the composition of Distillers Dried Grain with Solubles (DDGS), a coproduct resulting from the dry grind fuel ethanol process.
Project Lead: Southern Illinois University Edwardsville: National Corn-to Ethanol Research Center
Project Participants: Washington University, St. Louis; Missouri-Department of Chemical Engineering; Emerson Process Management; Illinois Department of Commerce and Economic Opportunity

(6) Iron-Based Mixed Metal Carbide Fischer-Tropsch Catalysts

(Fuels and Chemical Sciences Category)

This three-year effort developed a more active, selective, attrition resistant and stable Fe Fischer-Tropsch Synthesis catalysts based on formulations containing a second metal (besides Cu) capable of forming mixed metal carbides with Fe.

Project Lead: Clemson University

Project Participants: Louisiana State University; RTI; Rentech; Sud-Chemie, Inc.; South Carolina Energy Office; Louisiana State Energy Office

(7) Energy Conversion Sciences for Operation and Security of Large-Scale Systems

(Energy Conversion Sciences Category)

The project effort expanded and/or supplemented the research presently underway as part of the Center on Security of Large Scale Systems.

Project Lead: Purdue University

Project Participants: Wright State University

(8) Motor Control and Power Conversion Technologies Using FLEXMOD

(Energy Conversion Sciences Category)

This 18-month program developed a flexible, universal, modular inverter platform that can be applied to a range of electric motors from fractional horsepower to 100 horsepower or more.

Project Lead: Advanced Energy

Project Participants: Raser Technologies, Inc., Washington State University Energy Program

05-STAC-01 – Energy Efficiency Research, Development, Demonstration, Deployment, and Rebuild America was announced May 2, 2005 and requested proposals in:

- Building Technologies
- Industrial Technologies
- Transportation Technologies
- Distributed Energy Resources
- Rebuild America

A minimum of 55% non-federal cost share was required for all projects except for Rebuild America which had a 20% non-federal cost share requirement. Project periods were from one to three years.

Sixty-one proposals were submitted. Eleven projects were selected and awards made from this solicitation. Summary information on each of the eleven project awards is provided below.

(1) Reducing the Waste: Improved Fossil Fuel Water Heating Systems

(Building Technologies Category)

This project developed and evaluated three alternative storage-type gas water heater technical concepts; mapped performance of and developed performance curves for Integrated and Domestic Hot Water (DHW)-only Systems; documented infiltration impacts of gas-fired water heaters with draft hoods; reviewed test procedures, economics, and routes to market transformation; and disseminated information to aid market transformation and market incentives.

Project Lead: Energy Center of Wisconsin

Project Participants: New York State Energy Research and Development Authority ; California Energy Commission

(2) Residential Heat Pump and Air Conditioner Research, Demonstration and Deployment; Improving Pacific Northwest Utility and State HVAC Programs.
(Building Technologies Category)
The project focused on discovering the simplest means to diagnose and optimize the new generation of high performance heat pumps and air conditioners and to integrate these diagnostic and optimization tools into the energy efficiency programs operated by the State Energy Offices and utilities of the Pacific Northwest.
Project Lead: Idaho Department of Water Resources, Energy Division
Project Participants: Northwest Power and Conservation Council; Bonneville Power Administration; Energy Trust of Oregon; Oregon Department of Energy; Washington State University Extension Service; Ecotope Inc.; Stellar Processes; NEEA; NW Power and Conservation Council

(3)Reliability Development and Field Demonstration of CO_2 Heat Pump Water Heaters
(Building Technologies Category)
This project focused on improving and verifying the reliability of CO_2 heat pump hot water heaters and other heat pumping systems through assessment of oil circulation and retention. A key feature of this work is that carbon dioxide is used as refrigerant, which has been shown to lead to very compact and highly efficient hot water and other heat pump systems. This effort focuses on low-cost, highly compact systems for commercial applications where long operating hours lead to very favorable payback periods in the range of one to five years depending on utility rates. The results of this effort will position CO_2 heat pump technology to change the state of the art in the marketplace.
Recipient Organization: University of Maryland
Partners: Tennessee Tech University, Maryland Energy Administration, United Technologies Research Center

(4) Development and Field Trial of an Advanced Indirect Heating System for Metal Heat Treating Applications (Industrial Technologies Category)
Through this project, the partnering team finalized development and demonstration of a novel industrial indirect heating concept at the Ohio-based heat treating facility. This technology will provide energy, environmental and economic benefits to the end-user in ferrous heat treating applications.
Project Lead: Ohio Department of Development, State Energy Office
Project Participants: GTI Sustaining Membership Program; Akron Steel Treating Company; North American Manufacturing Company; University of Texas at Austin, Energy Solutions Center

(5) Hybrid Electric School Buses: the Road to Reduced Fuel Consumption, Healthier Children and Cleaner Air
(Transportation Technologies Category)
The project promoted the market adoption of an efficient, sustainable, near-term advanced vehicle technology through direct market intervention. More specifically, the project stimulated market production of existing heavy-duty hybrid systems in a school bus application and demonstrated the technology to school districts throughout the U.S. through daily operation of these vehicles.
Project Lead: Advanced Energy
Project Participants: NYSERDA; NYPA; NC Department of Public Instruction; NC Department of Public Instruction; FL Department of Education; Durham School Services; Little Rock School District; Sigourney/Keokuk Community School District; Keota Community Schools; and Nevada Community Schools

(6) Multi-Fleet Demonstration of Hydraulic Regenerative Braking Technology in Refuse Truck Applications (Transportation Technologies Category)

This 22-month project demonstrated the use of hydraulic regenerative braking through an in-use demonstration in two refuse trucks – one in New York City and one in Baltimore, Maryland. The project included development of the specifications and design for the two platforms, installation and instrumentation of the systems, pre-trial testing of the trucks, and field-testing and data collection for a minimum of 12 months.

Project Lead: New York State Energy Research and Development Authority

Project Partners: Maryland Energy Administration; Maryland Department of the Environment; New Jersey Board of Public Utilities; Bosch Rexroth Corp; City of New York Department of Sanitation; City of Baltimore, Department of Public Works, Bureau of Solid Waste

(7) Creating and Demonstrating Incentives for Electricity Providers to Integrate DER (Distributed Energy Resources Category)

This project created, though stakeholder collaboration, business models and regulatory approaches that reward electricity providers for integrating DER where there are societal benefits as well as customer and non-participant benefits. The project team conducted demonstration projects that showed the effectiveness of those business and regulatory approaches towards stimulating DER markets.

Project Lead: Massachusetts Department of Energy, State Energy Office

Project Participants: Massachusetts Division of Energy Resources; Massachusetts Technology Collaborative; California Energy Commission; Electric Power Research Institute; San Diego Gas & Electric Company; Southern Project California Edison; National Grid; Real Energy; New Jersey Board of Board of Public Utilities; Solar Turbines

(8) Expanding small-scale CHP opportunities through the more efficient use of trading programs: an Analysis of Market Opportunities and Regulatory Issues (Distributed Energy Resources Category)

The project team conducted a multi-faceted study to examine procedures and protocols for facilitating participation by clean, efficient CHP projects in the Northeast Region (Mid-Atlantic and new England States) ERC markets, as well as in the markets for NOX Emission Allowances (EA's). Through the review of the environmental permitting records and other sources, the Project Team determined the scope of the opportunity for replacement of aged and inefficient oil-and coal-fired boilers with high efficiency CHP, and recommended a regulatory and administrative framework for ERC/EA creation through small-scale CHP.

Project Lead: New York State Energy Research and Development Authority

Project Participants: Connecticut Department of Environmental Protection; Pace Law School Project; Energy and Environmental Analysis, Inc.

(9) National Database of Energy Efficiency Policies and Incentives (Rebuild America Category)

The *National Database of Energy Efficiency Policies & Incentives* project developed and provided a single online source of information on all available government and utility incentive programs and policies that promote increased efficiency in the building sector, with a focus on K-12 schools, universities & colleges, state & local government buildings, commercial buildings, multi-family residential, and public housing.

Project Lead: North Carolina State University

Project participants: Texas State Energy Conservation Office; Washington State University; PA Department of Environmental Protection, Bureau of Energy, Innovations and Technology Deployment; and North American Insulation Manufacturers Association

(10) Midwest Rebuild Application Center

(Rebuild America Category)

This effort developed a Midwest Regional Rebuild America Application Center that provided the Midwestern States with the information, education, and technical assistance necessary to continue and expand, in a coordinated manner, their Rebuild America program activities.

Project Lead: University of Illinois

Project participants: Energy Center of Wisconsin; Illinois State Energy Office; Indiana State Energy Office; Michigan State Energy Office; Iowa State Energy Office; Minnesota State Energy Office; Ohio State Energy Office; Wisconsin State Energy Office; Missouri State Energy Office; Iowa Energy Center; Midwest Energy Efficiency Alliance

(11) Southeast Rebuild Collaborative Public Sector Energy Efficiency Project

(Rebuild America Category)

The Southeast Rebuild Collaborative (SRC) is a partnership of the state energy offices of Florida, Alabama, Georgia, Mississippi and South Carolina created to establish a self-sustaining energy efficiency program to ensure that local governments, school districts, higher education institutions and the low-cost, multi-family housing sector pursue superior energy management.

Project Lead: Florida Department of Environmental Protection

Project Participants: Mississippi Development Authority; Alabama Department of Economic and Community Affairs; Georgia Environmental Facilities Authority; South Carolina Energy Office; Jackson Electric Membership Corporation; Southface Institute & Sustainable Atlanta Roundtable; Sarasota County Rebuild Partnership; Georgia PTA; Cadmus Group; Catalyst Financial Group; Public Technology Institute; Institute of Building Technology and Safety; Florida Solar Energy Center; Council of Educational Facility Planners International

Merit Review Process

Merit Review Committees, made up of three or more members, at least one of which represented NASEO, one of which represented ASERTTI, and one of which represented DOE, were utilized by the Program Director and Executive Committee to provide thorough, consistent, and independent review of the technical merit of proposals in specific programmatic areas. The Merit Review Committees provided a thorough, consistent, and independent review of the technical merit of proposals in a specific program area using the criteria specifically set forth in the solicitation, for use by the Executive Committee in selecting projects for funding. The scoring of proposals was based on evaluation and scoring criteria as well as program policy factors, specifically included in each solicitation. The technical criteria for selection of projects was developed by the Executive Committee and included:

a. Technical excellence, including the degree to which a project is innovative; advances the state of the art of technology, broadens the knowledge base, or contributes to market transformation or deployment; has potential advantages over other approaches or creates breakthroughs that overcome technical or market barriers; can be cost effectively replicated; or leads to improvements in technical performance, technology utilization or lower cost.

b. Anticipated benefits, including the extent of anticipated benefits in terms of energy impacts; environmental benefits; economic benefits; commercial applicability, potential market penetration, and the extent to which barriers to the implementation of the technology are addressed; timing of benefits; broad geographic impact; and leveraging of public/private funds.

c. Feasibility of approach including adequacy of the proposed approach, work plan, deliverables, schedules, and reporting relationships among participants; clearly defined

tasks and project activities, identifying the performer and having adequate milestones and timeline for task completion; reasonableness of measurement methods for validating public benefits, technical excellence, and market value; and adequacy of technical and information transfer plans.

d. Demonstrated experience and past performance, including the appropriateness and experience of the project team; the proposed organization and roles and responsibilities of partners and subcontractors; adequacy of previous experience; and experience of key personnel in the specific technology area of interest.

Recommendations from the Merit Review Teams and the Program Director were prepared and forwarded to the Executive Committee for review and selection of winning proposals. Upon selection of proposals for funding, the Program Director, with the assistance of NASEO legal and administrative staff, negotiated and signed contracts based on the "model agreement" included in the solicitation.

Project Management and Reporting

NASEO's experience in managing similar multi-state applied research and development projects for a period of years and its relatively sophisticated accounting and project management system which is compatible with DOE requirements allowed for the smooth award and management of the project contracts and development of systems to track and assess performance and progress of individual STAC projects. In addition, NASEO included certain reporting aspects of the system on a dedicated website that was operational in late October 2004 so that a wider audience would have access to project progress and other non-confidential information. The website is www.stacenergy.org. NASEO developed a Project Management Plan that was approved by DOE for management of the STAC technical projects. Key points from the plan included:

On a quarterly basis, NASEO will:

- Communicate by telephone and email with each project team on progress and problems with project;
- Perform substantive review of each project's quarterly report, including analysis of project objectives and progress, cost-share, and other relevant information; and
- Prepare a combined quarterly report on the activities and progress associated with each solicitation's projects and submit it to the Golden Field Office.

On a general basis, NASEO will:

- File necessary NEPA documentation to meet DOE contract requirements;
- Identify technical experts for consultation, as necessary, in the evaluation of project activities;
- Coordinate information sharing with DOE Program Managers and DOE Regional Offices;
- Create a separate public STAC website for dissemination of quarterly reports, project-related articles, and other general STAC data of wide interest; and
- Work with the Program Director to assure that relevant project status reports are provided at public forums, particularly NASEO and ASERTTI meetings, through:
    - Status reports by the Program Director at such meetings; and
    - Reports, on a voluntary basis, by project participants of significant results and progress.

In the conduct of these project management activities, NASEO provided regular information sharing with the STAC Program Director and the STAC Executive Committee.

In performance of its project management responsibilities, NASEO developed an individual project profile, providing a project overview, activities, and outcomes/benefits for each of the 35 STAC projects. The project profiles are included as Attachment A.

NASEO also conducted a benefits analysis of sample STAC projects by innovation category -- research, development, demonstration, and deployment -- that is provided below.

Benefits Analysis

Through STAC, an innovative funding process was established to solicit, select, and help fund innovative energy research projects in energy efficiency, fossil energy, and renewable energy as a means of accelerating the development and market adoption of clean, sustainable and efficient energy technologies.

These projects included research, development, demonstration, and deployment (RDD&D) efforts, were multi-state in nature, and supported technologies where common Federal and State priorities in energy efficiency, fossil energy, and renewable energy existed. Further, these projects were chosen because the States or industry had identified specific assistance that was needed to help a specific product or service advance through a particular stage of technology innovation. Because the STAC projects worked on technologies in various stages of commercial acceptance, this summary describes benefits that resulted from the STAC RDD&D projects in terms of how the technology advanced through the innovation process.

Background

Industry, states, regulatory agencies, and non-profit organizations were concerned that the enormous potential to deploy energy efficiency and renewable energy products and services was being limited by factors related to uncertainties in the process by which innovative products and services are adopted. DOE, in collaboration with its stakeholder community, concluded that there was such a breadth of energy efficiency and renewable energy products and services available for adoption by potential users and the maturities of these products and services were at such different levels of development that a comprehensive, state-Federal partnership effort for RDD&D was needed.

Given this market pull factor, the STAC effort was developed to provide DOE the means to encourage states, industry, universities, and non-profit organizations to collaborate on projects that would:

1. reduce technical or product performance uncertainty,
2. remove technical or regulatory barriers, or
3. provide educational or technical information needed to move energy efficiency, fossil energy, and renewable energy products and services through the technology adoption process.

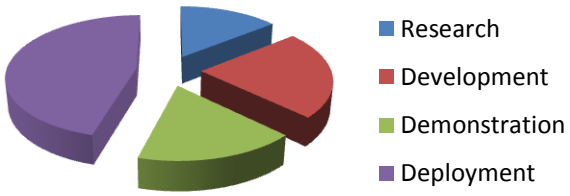
STAC, using NASEO as its operating agent, issued three annual competitive solicitations (2003-2005) requesting proposals that spanned not only innovative product development, demonstration, and deployment efforts but, much needed, targeted research that supported these projects. Solicitations covered a range of technologies and programs including buildings, industrial, transportation, distributed energy resources, hydrogen learning centers, and fossil energy.

Approach to Assessing STAC Benefits

Specific criteria, such as cost share, geographic diversity, make-up of proposing team, and balance of RDD&D projects funded were developed and applied in each of the three solicitations.

Twenty-two states were awarded at least one prime contract, and organizations in all 50 states were involved as subcontractors in at least one STAC project. Project teams included the full spectrum of organizations including: state energy organizations, universities, small business, national laboratories, private industry, Native American organizations, and others.

Portfolio of Projects

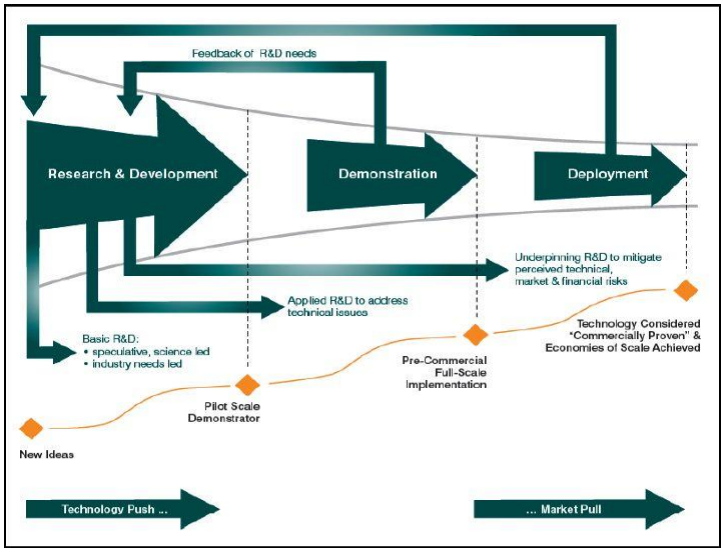


Total STAC projects awarded through the three solicitations showed a balanced portfolio of RDD&D selections.

DOE wanted to utilize the STAC approach to provide support not only to different industries and end users, but also to support adoption of different energy efficiency and renewable products and services at different stages of developmental maturity. For example,

- commercial building architects and engineers designing new structures were in the early adopter stage of using building performance models to predict and manage energy use and needed actual deployment quality data to help understand how to profitably exploit these models;
- the mature food processing industry was losing sales abroad but analyses had shown that U.S. processors could recapture market share by reducing energy costs; and
- the emerging fuel cell and hydrogen fuel industries needed to create interest in these opportunities through education by disseminating the latest technical information and helping decision-makers fully understand the potential of these applications.

Innovation covers the full research, development, demonstration and deployment process. It is rarely a linear process and almost always has important interaction among different actors – government, academia, businesses, financiers – and involves feedback loops across stages as shown in the classic Innovation Funnel concept.



Products and services developed in the R&D stage do not automatically (or successfully) move through the various stages and transform into a technology that is ready for commercial deployment. Companies with technologies at the demonstration stage may identify problems and need to revisit earlier stages or industries may need assistance at the deployment stage from regulators.

STAC funded projects across the full gamut of the RDD&D process. Most of the STAC projects produced benefits that were only able to be described in qualitative terms because of their location in one of the early stages of these four innovation categories. Some of the more mature product or service projects did produce quantifiable results in terms of energy saved or measureable environmental improvements. Benefits from all these projects are described in the final reports on the STAC website at www.stacenergy.org.

To illustrate how diverse but important the STAC project benefits were, the following examples describe specific individual project benefits with respect to the innovation category of the project.

STAC Research Projects – (needed to address specific product or service problems):

1. Iron-Based Mixed Metal Carbide Fischer-Tropsch Catalysts
   Prime Contractor – Clemson University
   Partners - Louisiana State University, Research Triangle Institute, Süd-Chemie Inc., Rentech, Energy Technology Partners LLC, the South Carolina State Energy Office, and the Louisiana State Energy Office

   The U.S. has large domestic coal reserves and using the Fischer-Tropsch (FTS) process is of great interest for upgrading low-value coal and biomass to high-value liquid fuels and chemicals especially if biofuels are the feedstock since there would essentially be no net CO_2 emissions. The total biomass produced each year as waste material from agriculture and forest operations could be converted into roughly 40 billion gal/yr of liquid fuel, roughly 25% of the current US gasoline usage.

   The project team achieved a significant success by demonstrating two catalysts that are equal to or better than other potential commercial Fe-based catalysts for the Fischer-Tropsch synthesis. Each of the two catalysts has the potential for exploitation in a slurry phase design which is the preferred configuration for a FTS reactor. Even though this project has now reached its completion date, Clemson University has continued in 2010 to move the work forward by collaborating with Energy Technology Partners LLC and Clemson's cost-share partner, Rentech, to carry out additional long term (500-3000 h) slurry phase runs with at least the FeMnK catalyst.

2. Motor Control and Power Conversion Technologies Using FLEXMOD
   Prime Contractor – Advanced Energy
   Partners - Raser Technologies, Inc., Washington State University Energy Program

   DOE estimates that improved system controls including variable speed drives for pump, fan, and compressed air systems alone could save nearly 15,000 gigawatt-hours and potentially $900 million in annual energy savings. These estimates are based on the fact that many of the more than 13 million electric motors used in industrial applications are operating inefficiently due to changing loads or less than optimum control schemes.

   This project team developed a more efficient, modular, motor controller capable of operating with a range of motor sizes and types. The controller has a substantial market penetration potential benefit because it can be manufactured at reasonable cost and tests show its use can result in substantial energy savings in industrial and residential applications. The project had a further substantial innovation benefit because the motor controller has significant potential for development and then deployment in the emerging hybrid vehicle market.

STAC Development Projects (support for a specific commercial application):

1. Building Commissioning – Innovation to Practice
   Prime Contractors – California Energy Commission (CEC), New York State Energy Research & Development Authority, Texas Engineering Experiment Station, Oregon Department of Energy, University of Nebraska
   Partners - Iowa Energy Center, Northwest Energy Efficiency Alliance

Since 1998, when the DOE's National Strategy for Building Commissioning determined that deployment of building commissioning tools in commercial buildings would reduce energy annual consumption and save owners literally millions in operating costs, two significant barriers have prevented widespread adoption of such tools:

- the need for proven tools and technologies that standardize and simplify commissioning approaches and reduce implementation costs; and
- concern about the uncertainty of cost savings and other benefits.

The project team developed and tested an Automated Building Commissioning Analysis Tool (ABCAT) in multiple buildings of various size, climate zones, space utilization, and HVAC system types. The testing determined that ABCAT is affordable and reduces loads in commercial buildings by identifying significant energy consumption changes that go undetected by building energy management personnel. ABCAT has the potential of decreasing energy consumption levels by 15-30%. Although similar attempts have been made in fault detection and diagnostic (FDD) tools at the whole building level, ABCAT is simpler and more flexible to use – traits that are desired by industry professionals.

2. Development, Implementation and Deployment of Auto Fault Detection & Diagnostics for Vapor Compression Equipment
   Prime Contractor – Purdue University
   Partners - Ben Franklin Technology Partners, Field Diagnostic Services, Inc., Honeywell Corporation

   Automated fault detection and diagnostics (FDD) systems for HVAC applications have the potential to significantly improve energy efficiency and comfort and reduce operating and service costs in both residential and small commercial buildings. These cost reductions are possible because approximately 60% of the installed cooling within the U.S. is associated with packaged air conditioners having relatively small individual cooling capacities, and these systems require regular, scheduled maintenance. This project involved the development of new FDD algorithms for both a portable tool device and an embedded (during manufacturing) diagnostic system.

   The technology developed by the project team clearly showed it was of use as a commercial product and is already being marketed as a field retrofit to existing packaged air conditioning equipment. Honeywell expanded a four branch RCI (rooftop unit retrocommissioning initiative) pilot service program in 2006 to a full North American deployment in 2007. HVAC tune-up utility programs throughout the U.S. have adopted the generalized service assistant platform including PG&E, NYSERDA, SMUD, and AVISTA. The project also leveraged other industry products and capital formation related to the wireless technology evolution by incorporating diagnostic algorithms into a personal data assistant (PDA) linked to the portable tool device.

STAC Demonstration Projects (pre-commercial demonstration of technologies at scale to give a stronger indication of production and operating costs and the opportunities for cost reduction)

1. Western Food Process Efficiency Initiative
   Prime Contractor – Oregon Department of Energy
   Partners - WA State University Energy Program, ID Department of Water Resources, Energy Division, California Energy Commission, Lawrence Berkeley National Laboratory, Del Monte Foods, Northwest Food Processors Association, Northwest Energy Efficiency Alliance

   This project was a collaboration among four Western states where food processing is one of the largest energy using industries in these states. The project was important to this regional industry by helping it

increase market share and compete internationally and domestically through energy cost reduction and increasing efficiency, productivity, and product quality distinction.

From a relatively small investment of funds, this STAC project was very productive – it created a portfolio of regional energy management and system optimization best practice resource tools from fourteen case study reports that implemented energy cost saving demonstration projects. The estimated annual energy savings from just these demonstration projects was 3,175,627 kWh (2,281 Metric Tons CO_2) and 39,955 net natural gas therms (200 Metric Tons CO_2). The project team was also able to create an emerging technologies resource base for the food processing industry and disseminate the information across the region through an Energy Web portal (the only such U.S. site for the food processing industry) designed and created during the project and maintained by two food processing associations that collaborated in the project.

2. Full-Scale Trial of High Capacity Gas-Fired Paper Dryer
   Prime Contractor – Minnesota Department of Commerce, State Energy Office
   Partners - West Michigan University, Gas Technology Institute

   Dryer capacity is usually the limiting production factor at papermaking plants, and the drying process consumes nearly two-thirds of the total energy in papermaking. This project demonstrated a full-scale unit designed for significantly higher drying drum surface temperatures that increased drying speed and energy efficiency.

   The paper industry has expressed strong interest in the project results because, for those facilities which can adopt the process changes, the payback period for the modifications is estimated to be less than one year. It is likely the higher capacity gas-fired paper dryer concept has significant market penetration potential because it can increase production of dryer-limited paper machines by 10-20% and result in substantial capital savings for both retrofits and new capacity.

3. Multi-fleet Demonstration of Hydraulic Regenerative Braking Technology in Refuse Truck Applications
   Prime Contractor – NYSERDA
   Partners – Maryland Energy Administration, Maryland Department of the Environment, New Jersey Board of Public Utilities, Shorepower Technologies, LLC, New West Technologies, LLC, Bosch Rexroth Corp., City of New York Department of Sanitation, City of Baltimore, Bureau of Solid Waste

   Hydraulic Regenerative Braking (HRB) technology has proven to be effective in urban stop and go applications of heavy-duty vehicles because it significantly reduces fuel consumption, emissions, and brake maintenance while at the same time improving vehicle performance. During braking, HRB technology recovers a vehicle's kinetic energy that is otherwise lost as heat generated by friction brakes.

   This project involved a long-term field demonstration of HRB technology which collected data on operational performance, efficiency, emissions, maintenance and cost using standardized testing procedures on two refuse truck fleets in New York City and Baltimore. This project has the potential for major market penetration by providing large cities with final design specifications developed for HRB systems based on realistic route and vehicle data that included extensive debugging of HRB systems using advanced data acquisition instrumentation of baseline and HRB equipped vehicles.

4. Hybrid Electric School Buses: The Road to Reduced Fuel Consumption, Healthier Children and Cleaner Air
   Prime Contractor – Advanced Energy (AE)
   Partners - New York State Energy Research & Development Authority, NC Department of Public Instruction, FL Department of Education, Durham School Services, Little Rock School District,

Sigourney/Keokuk Community School District, Keota Community Schools, Nevada Community Schools

Almost all school buses sold in the U.S. are traditional, fossil fuel designs. Manufacturers have resisted adopting new, significantly more efficient, less-polluting hybrid technologies because of the economic investment needed to move from initial technology development to successful market deployment.

This project team included partners from a number of states to form a buyer's consortium that assisted AE in developing detailed specifications used to issue an RFP to several bus manufacturers. The environmental and economic benefits from this project are expected to be far-reaching because of the broad geographic participation and industry participation. Fifteen hybrid demonstration efforts were begun in 2007, and the monitoring and data collection and analysis has already provided significant information on how route selection for buses is critical to performance; how driving style affects hybrid fuel economy even in buses; why proper training of maintenance personnel is essential for deployment of hybrid school buses; and that multiple charging locations help improve fuel savings. This project resulted in the development and sale of the first commercially available plug-in hybrid vehicle in the US. Additionally, the project increased the acceptance and dissemination of advanced transportation technologies that use less fuel, save money, and are gentler on the environment.

STAC Deployment Projects (integration of products and services into existing markets by providing needed information, reducing barriers or creating subsidies to ensure fair, competitive markets):

1. National Database of Energy Efficiency Policies and Incentives
   Prime Contractor – North Carolina State University – NC Solar Center
   Partners - WA State University, Texas State Energy Office, PA Department of Environmental Protection, North American Insulation Manufacturers Association

   Prior to this project, the Database for Renewable Energy Incentives (DSIRE) was a modest database designed to share information about renewable energy incentives, only providing information on incentives for business, government, industry, and the public on all state policies specific to renewable energy. It had quietly built up a nationwide following as the best source for helping policy-makers and the public keep up with renewable energy incentive programs across the U.S. states and territories.

   The project goal was to significantly enhance and expand the effectiveness of DSIRE to include building energy efficiency (EE) financial incentives and regulatory policies from state, local, Federal, and utility sources. Its benefits have been broad and far-reaching. The addition of energy efficiency and regulatory policy information organized by state and territory has led to over a ten-fold increase in traffic on the DSIRE+EE site, and now average monthly visits to the site are in excess of 250,000. The enhanced database has proven to be a critical resource for a wide audience from consumers and businesses who need timely information on incentives in order to make purchasing decisions to government officials who have approval or influence over the creation of incentives and regulations.

2. Creating and Demonstrating Incentives for Electricity Providers to Integrate Distributed Energy Resources
   Prime Contractor – Massachusetts Division of Energy Resources
   Partners - Massachusetts Technology Collaborative, California Energy Commission, Electric Power Research Institute, San Diego Gas & Electric Company, Southern California Edison, National Grid, RealEnergy, New Jersey Board of Public Utilities, Solar Turbines

Distributed Energy Resources (DER) technologies and programs have been shown to have demonstrable benefits by states that have used regulatory strategies to help electricity providers integrate these systems into utility-specific businesses through creation of new business models.

This project has the benefit of broad geographic impact because two large states, one eastern and one western, demonstrated the most promising DER approaches through actual pilot projects. Results from the pilots were used to identify and address key state-specific business and regulatory barriers to DER. These results are a significant benefit to states and electricity providers because they provide a tested comprehensive set of business models and regulatory templates for integrating DER solutions into existing systems.

Outreach and Information Dissemination

Over the entire STAC program period, NASEO and ASERTTI used the results of the STAC projects to educate Federal, State, educational institutions, industry, non-profit research institutions, and others on the value and benefits of the technologies funded by these projects. Outreach and information dissemination efforts included:

- Development and continuous updating and improvement of a dedicated website for STAC projects – www.stacenergy.org.
- Preparation and release of timely press articles, approximately twelve, related to the various STAC solicitations and projects – www.stacenergy.org/news/default.htm
- Presentations and group meetings related to STAC projects by program area at the annual NASEO and ASERTTI National meetings
- Conference calls and webinars to highlight and review STAC projects
- Articles placed in the *State and Local Energy Report* (http://www.stateenergyreport.com/category/stac)
  The *State & Local Energy Report* is a quarterly magazine sponsored by the Energy Programs Consortium (EPC) and published by Project Energy Savers LLC. EPC is a nonprofit organization that conducts energy policy research and manages pilot projects for the four national organizations representing state energy officials: National Association of State Energy Officials, National Association for State Community Services Programs, National Association of Regulatory Utility Commissioners, and the National Energy Assistance Directors' Association. The mission of the State and Local Energy Report is to facilitate greater dialogue on energy-related issues among federal, state and local energy officials. The magazine reaches nearly 8,000 readers representing all levels of government and industry energy policy-makers and implementers. Articles on STAC projects included:

  - The Phoenix Factor versus the Atlanta Aspect: Regionalizing Central Air Conditioner Performance Ratings Promises Big Savings (03-STAC-01 -- Building Technologies) February 10, 2010
  - DSIRE - Navigating the Maze of Energy Incentives (05-STAC-01 -- Rebuild America) May 12, 2010
  - A Green Yellow Bus Arrives (05-STAC-01 -- Transportation Technologies) August 4, 2010
  - Water is Lifeblood of the Fiber Industry (03-STAC-01 – Industrial Technologies) February 3, 2011
  - STACking the RDD&D Deck: Accelerating Technology Development and Deployment, August 13, 2009

Other Information Dissemination/Outreach Activities:
ASERTTI created the University Center Database operated in conjunction with the State and Local Energy Report magazine to serve as the foundation for STAC outreach activities. The database identifies candidate outreach institutions. ASERTTI developed a strategy for STAC outreach activities to insure full dissemination of STAC project results to targeted audiences in the energy arena.

During the 2010-2011 timeframe, ASERTTI and NASEO worked together to develop several technology panels and presentations for a national meeting of state energy and research officials in Washington, D.C. The event attracted approximately 200 attendees. In addition, program technology specific presentations were made including the following:

District Energy/Combined Heat and Power Success Stories
Explained how district energy systems with combined heat and power are able to provide reliable, efficient thermal energy services to dozens or hundreds of buildings in a city or campus setting. Collaborative efforts and lessons learned under STAC distributed energy resources projects and other such projects were used as the basis for examination of options such as biomass, biogas, wood waste, geothermal and surplus heat from industry.

Industrial Opportunities in Food Processing
State Opportunities to Transfer Knowledge
This session was focused around a discussion of food processing and other compressed efficiency efforts
Chair: Jake Fey, Director, Washington State University; Vice Chair and Treasurer, ASERTTI Executive Committee.

The Global Competition for Clean Energy Technology Advancement
This session was designed to learn about approaches to collaborative state technology advancement and build on the information and results of STAC and other efforts. Moderator: Frank Murray, President and Chief Executive Officer, New York State Energy Research and Development Authority; Chair, ASERTTI; Regional Representative, NASEO Board. Presenter: Karina L. Edmonds, Ph.D., Technology Transfer Coordinator, U.S. Department of Energy.

STAC Information Dissemination and Outreach to State and DOE officials
During the period March through July 2010, ASERTTI worked with NASEO staff to provide a series of presentations to inform new State Energy Office staff about the results of STAC, the approach of the program and the opportunities that could be gained from building on these efforts. Presentations followed by discussion-oriented sessions were provided at each of seven regional events around the nation.

ASERTTI met with U.S. Department of Energy Officials and provided an overview of the STAC program and a number of the efficiency projects resulting from STAC. Newer DOE staff was not familiar with the program and wanted information on the lessons learned, etc.

Lessons Learned
A review of the management and operation of the STAC program brought about a number of insights gained during that time. These insights will be useful going forward on programs similar to STAC.

STAC was highly successful in the following areas:

- Integrating RDD&D to accelerate project progress,
- Engaging the States as true partners
- Recognizing the resource contributions some States can make;
- Leveraging of Federal funding by 50% or more,
- Leveraging of State and private expertise,
- Engaging private energy companies,
- Use of model agreement to streamline contracting,
- Expedited procurements: six months from solicitation to award; two month average from award to contract,
- Wide geographic and multi-state participation,
- Delivering a greater degree of joint State-Federal energy action, and
- Keeping program administrative costs at a minimum.

While STAC was successful, it came at a time of limited private investment and was broad in nature. Going forward, recommendations for addressing these issues and improving STAC include:

- Develop an expedited national process to identify priority energy RDD&D opportunities for coinvestment among potential State and Federal partners (e.g., investment firms, companies, utilities) in order to avoid duplication and increase effectiveness of programs;
- Encourage investment from state economic development agencies and private investors;
- Focus on greater integration of Federal, State, national laboratory and private industry energy activities to promote and support innovation;
- Require an overall leverage of Federal funding of 66% or more;
- Ensure selected priority projects reflect the integration of RDD&D; and
- Greater focus on larger, impact projects.

Conclusions and Recommendations

Nine years ago, the National Association of State Energy Officials (NASEO), the Association of State Energy Research and Technology Transfer Institutions (ASERTTI), and the Department of Energy (DOE) embarked on a partnership aimed at advancing energy technology in a comprehensive manner – integrating RDD&D – under a single program, which included the creation of joint priorities with the private sector in advance of a competitive proposal process. It was a true Federal-State-private partnership and the pilot became known as the State Technologies Advancement Collaborative (STAC).

STAC included three annual competitive solicitations requesting proposals that strategically linked research and innovative product development with demonstration and deployment efforts, as well as the integration of various technologies. Solicitations covered a range of programs including buildings, industrial, transportation, distributed energy resources, hydrogen learning centers, institutional buildings, and fossil energy. The total non-federal cost share requirements ranged from 20% for basic R&D projects to 55% for demonstration and deployment projects. Cost share across all projects averaged 43%, with states and private partners providing significant amounts over the required cost share for certain projects. The overall leverage made a significant statement about the importance states and private industry placed on these projects. Speed of placing contracts was a hallmark of STAC requiring only 6 months from solicitation to award; and an average of two months from award to contract. The rapid process allowed for quicker results, and was attractive to all participants as they moved quickly to meet their respective organization's goals.

While STAC successfully pulled together Federal, State, and private industry to address joint priorities, it was a pilot that focused on a relatively small number of technologies. A nationally coordinated effort to identify priority energy RDD&D opportunities for co-investment among these potential state and federal

partners in order to avoid duplication, focus efforts, and increase effectiveness across state, federal, and private partners is essential. Collaborating on only a modest portion of these investments with DOE, for example, presents an enormous opportunity, however challenging, in the current economic environment. More importantly, integrating RDD&D efforts offers a more systematic way for State, Federal, and private energy leaders to prioritize energy opportunities in ways that are most responsive to the market and more clearly define government and private sector roles in advancing energy technologies. Rarely, however, are State, Federal, and private efforts combined at the outset to jointly plan and implement energy RDD&D in priority areas.

Many State and private energy leaders have stressed the value in approaching technology advancement in an integrated manner that includes all phases of applied research, demonstration and deployment. This approach includes collaboration among the private sector, state universities, and other public interest research entities, working with state energy leaders to deploy new energy solutions in an integrated manner that offers market feedback. These efforts, coupled with state and local policy, combine to become an important source of innovation. Similarly, Federal energy programs, working with National Laboratories, sometimes follow this more integrated course of technology advancement.

Building on STAC's proven RDD&D approach and focusing on a means to attract a broader range of State and private funds would allow DOE to vastly improve leverage of existing Federal resources – a step that seems essential in the current financial environment. STAC provides the means to better focus the work of states, universities, private companies, and utilities, on priority crosscutting projects that reduce technical or product performance uncertainty, remove technical or regulatory barriers, and result in the state and local policy signals needed to move energy products through the technology adoption process. It is a truly integrated approach to RDD&D, which would establish a more dynamic national model for accelerating energy technology commercialization in a manner that better aligns costs, risks, and benefits among Federal, State, local, and private sector partners.

Attachment A

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PROJECT PROFILES

November 2011

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

ABOUT STAC

The National Association of State Energy Officials (NASEO), Association of State Energy Research and Technology Transfer Institutions (ASERTTI), and the Department of Energy (DOE) signed an agreement in 2002 that allows states, territories, and the Federal government to better collaborate on energy research, development, demonstration, and deployment projects as part of a five-year pilot program. The agreement established STAC with an innovation in both the competitive merit-based project selection process and collaborative funding process.

Since its initial funding awards in 2003, STAC has provided, through three competitive solicitations, a total of almost $35 million for energy projects — approximately $14 million provided by states and private sector partners and $21 million by DOE. Projects were funded in seven program areas including:

- Building Technologies
- Industrial Technologies
- Transportation Technologies
- Distributed Energy Resources
- Hydrogen Learning Centers
- Fossil Energy
- Rebuild America

Twenty-two states were awarded at least one prime contract, and organizations in all 50 states and some territories were involved as subcontractors in at least one STAC project.

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

Projects from 03-STAC-01— Energy Efficiency Research, Development, Demonstration and Deployment Projects

- *Building Commissioning — Innovation to Practice*
- *Strategies to Increase HVAC Efficiency in the Northeast*
- *Development, Implementation and Deployment of Automated Fault Detection and Diagnostics for Vapor Compression Equipment*
- *Closing the Gap: Getting Full Performance from Residential Air-Conditioners*
- *Real-time Predictive Optimal Control of Active and Passive Thermal Storage Systems*
- *Field Trial of a High Capacity Gas-Fired Paper Dryer*
- *Western U.S. Food Processing Efficiency Initiative*
- *Achieving More with Less: Efficiency and Economics of Motor Decision Tools*
- *Use of Pressurized Ozone and Compressed Air Flotation with Membrane Filtration for Industrial Process Water Treatment at a Forest Products Facility*
- *Development of a Total Assessment Audit Protocol for the Chemical Industry in the Midwest*
- *Advanced Travel Center (Truckstop) Electrification for Reducing Idling from Heavy -Duty Vehicles*
- *Distributed Energy Infrastructure Analysis and Pilot Project for New Jersey and Pennsylvania Targeted in the Small and Medium Sized Commercial and Industrial Sectors*
- *Distributed Energy Resources — Expanding DER Applications in Target Markets*
- *Hydrogen Technology Learning Centers for California, Florida, and New York*
- *Virginia-Maryland Hydrogen Technology Education Center (H2TEC)*
- *Development of a Regional Hydrogen Technology Education Consortium (HyTEC)*

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PRIME PERFORMERS
California Energy Commission
New York State Energy Research & Development Authority
Texas Engineering Experiment Station
Oregon Department of Energy
University of Nebraska

PARTNERS
Iowa Energy Center
Northwest Energy Efficiency Alliance

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Building Commissioning: Innovation to Practice

Overview

Most commercial building HBAC systems operate with inefficiencies or faults that lead to energy consumption levels 15% - 30% greater than what is possible with existing products and control methods. Fault detection and diagnostics (FDD) tools are not widely used by commercial building owners and operators because they are expensive, complicated, and give false alarms/negatives in real building settings.

The purpose of this project was to develop and test a more robust advanced prototype Automated Building Commissioning Analysis Tool (ABCAT) version, proven in real building settings, that would depict the true impact of failed (or failing) systems and that would also simplify setup requirements.

Project Activities

The project team developed and tested an Automated Building Commissioning Analysis Tool (ABCAT) in multiple buildings of various size, climate zones, space utilization, and HVAC system types. The tool was able to track energy consumption changes that went undetected by building energy management personnel. The methodology used also does not appear to be prone to false positives or false alarms.

Outcomes/Benefits

Although the ABCAT test was on a small scale, it showed the tool is affordable and reduces loads in commercial buildings by identifying significant energy consumption changes that go undetected by building energy management personnel. ABCAT has the potential of decreasing energy consumption levels by 15-30%. Although similar attempts have been made in fault detection and diagnostic (FDD) tools at the whole building level, ABCAT is simpler and more flexible to use – traits that are desired by industry professionals.

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PRIME PERFORMER
New York State Energy Research & Development Authority

PARTNERS
New Jersey Board of Public Utilities; Office of Clean Energy
Northeast Energy Efficiency Partnerships, Inc.
Conservation Services Group, Inc.
Proctor Engineering Group, Ltd
Nexus Market Research

Non-Federal Cost Share:
55%

Funded by:
U. S. Department of Energy
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STAC Project Profiles

Strategies to Increase HVAC Efficiency in the Northeast

Overview

In the Northeast region annual residential heating and cooling accounts for roughly one-fourth of the region's oil and gas consumption and for 60 percent of average household energy consumption. Residential energy efficiency improvements have the potential to displace electric and gas peak demand and total electric, gas, and oil consumption. The project goal was to develop recommendations for energy efficiency strategies that addressed all primary HVAC fuels in the region.

Project Activities

This project analyzed a comprehensive set of residential HVAC efficiency opportunities and strategies. The analysis covered all major fuels – electricity, gas, oil and propane – for single-family homes in New York, New Jersey, and the New England states combined. The study considered achievable energy efficiency potential from 2007 through 2016 for most HVAC efficiency measures.

Outcomes/Benefits

The recommendations developed in the study comprise a regional strategy for achieving HVAC energy efficiency potential by helping states understand how they can pursue four interrelated steps:

1. Coordinate efficiency program efforts across fuels and sectors
2. Cultivate industry partnerships
3. Upgrade state and federal building energy codes and equipment standards
4. Support continued research and development of emerging and new technologies that reduce HVAC energy and peak demand.

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PRIME PERFORMER
Purdue University

PARTNERS
Ben Franklin Technology Partners
Field Diagnostic Services, Inc.
Honeywell Corporation

Non-Federal Cost Share:
55%

Funded by:
U. S. Department of Energy
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STAC Project Profiles

Development, Implementation and Deployment of Automated Fault Detection and Diagnostics for Vapor Compression Equipment

Overview

Automated fault detection and diagnostics (FDD) systems are a proven way to increase energy efficiency and comfort and reduce operating and service costs in HVAC equipment. This project was based on a successful commercial portable tool product developed by Honeywell to diagnose air conditioning service related problems. Such hand tools are very effective because a single FDD can be used for many pieces of equipment, but this project explored the possibility for embedding diagnostics in HVAC equipment at the factory with the goal of making integrated FDD technology an industry standard.

Project Activities

This project involved the development, implementation, and deployment of new FDD algorithms for both the portable tool platform and an embedded (during manufacturing) diagnostic system. A major focus was to develop methods to embed FDD systems during manufacturing for packaged rooftop air conditioners used in small to medium size commercial buildings because these small air conditioners are widely used and tend not to be well maintained. The technology developed is already being marketed as a field retrofit to existing packaged air conditioning equipment.

Outcomes/Benefits

The project developed new applications for the portable tool including heat pumps and walk-in coolers. The project also leveraged the wireless technology evolution by incorporating diagnostic algorithms within the portable tool platform based on integration into a personal data assistant (PDA).

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PRIME PERFORMERS
New York State Energy Research & Development Authority
Florida Solar Energy Center
Energy Center of Wisconsin
Advanced Energy

PARTNERS
American Council for an Energy Efficient Economy
CDH Energy
California Energy Commission
Lawrence Berkeley National Laboratory
Wisconsin Energy Conservation Corporation

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Closing the Gap: Getting Full Performance from Residential Air-Conditioners

Overview

The Seasonal Energy Efficiency Rating (SEER) is the method used to rate cooling output of air conditioners for the amount of electricity consumed. Industry analysts and researchers have known for years that SEER ratings did not take into account strong regional differences in seasonal climates throughout the United States. Because revising efficiency standards involves many stakeholders, from industry groups and national energy organizations to state and federal agencies as well as Congress, STAC acted as the catalyst for an important review of the strengths and weaknesses of SEER ratings for air conditioners and heat pumps.

Project Activities

Funding provided from STAC and team member's project cost share underwrote a two-year project (integrating research, development, initial deployment, and data dissemination) that evaluated the efficiency of residential central air conditioners.

Outcomes/Benefits

The research results pointed strongly to the value of different standards for different climate zones. These findings helped shape key provisions in the Energy Independence and Security Act of 2007 that requires DOE to rely on consensus agreements by stakeholders for regional standards. In October 2009, leading manufacturers of residential central air conditioners, furnaces, and heat pumps signed a groundbreaking, voluntary agreement with energy efficiency advocates representing the states in support of new federal standards for these products.

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PRIME PERFORMER
University of Colorado-Boulder

PARTNERS
University of Nebraska—Lincoln
Johnson Controls

Non-Federal Cost Share:
55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Real-time Predictive Optimal Control of Active and Passive Building Thermal Storage Systems

Overview

Cooling of commercial buildings is a major component of peak electricity demand. Because time-of-use electricity rate tariffs encourage shifting of electrical loads to off-peak periods at night and weekends, commercial buildings can respond to these pricing signals. Typically such demand management approaches shift cooling-related electrical loads either by pre-cooling the building's passive structural mass, by using an active energy storage system, or combining these in a systems approach. Using thermal energy storage systems to reduce operating costs in this manner exploits lower electricity costs at night, improved cooling system performance from lower outdoor air temperatures, and subsequent reductions in peak demand tariff factors.

Project Activities

This project performed simulation analyses on a prototypical three-story office building to develop optimal control strategies for active and passive building thermal storage systems. The objective was to develop and test in a laboratory setting a real-time optimal controller for commercial buildings that could utilize both the capacity of building thermal mass and thermal energy storage systems to optimize cooling and ventilation equipment operation under dynamic electricity rates in real-time.

Outcomes/Benefits

The project analyses simulation tool predicted 10% to 50% better utilization of passive thermal storage inventory was achievable depending on the climate, building construction, and utility rate structure. The analytical predictions from the simulation tool were validated by laboratory testing in controlled structures in both Colorado and Iowa.

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PRIME PERFORMER
Minnesota Department of Commerce, State Energy Office

PARTNERS
West Michigan University
Gas Technology Institute

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Full-Scale Trial of a High Capacity Gas-Fired Paper Dryer

Overview

Paper drying consumes about 67% of the total energy required in papermaking, and the production capacity of papermaking plants is often limited by dryer capacity. Conventional paper drying passes the wet paper web over a series of metal drums that are internally heated by condensing steam. Pressure vessel codes limit the steam pressure to 160 psi and, therefore, the steam temperature to about 370°F.

Project Activities

This project investigated the feasibility of using drums that are heated by burning natural gas inside the drum. These drums could operate at higher temperature, increasing energy efficiency and improving production capacity. In a previous effort, the drum concept, Gas-Fired Paper Dryer (GFPD), was successfully tested in a pilot paper plant at Western Michigan University. This project approach combined a premixed low-emission ribbon flame and advanced heat transfer enhancement technique to provide combustion stability and significantly improve the operating efficiency. A full-scale unit was developed, fabricated and demonstrated for the papermaking community as a part of this project.

Outcomes/Benefits

Performance results showed reliable operation and the capability to achieve significantly higher drying drum surface temperatures that increased drying speed and energy efficiency. Successful GFPD commercialization will help the paper industry increase production of dryer-limited paper machines by 10 to 20%, resulting in significant capital savings for both retrofits and new capacity. Although the payback period will be site-specific, it is estimated to be less than one year. A corresponding energy efficiency increase from 65% to over 85% will provide large energy savings.

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PRIME PERFORMER
Oregon Department of Energy

PARTNERS
Washington State University Energy Program
Idaho Department of Water Resources, Energy Division
California Energy Commission
Lawrence Berkeley National Laboratory
Del Monte Foods
Northwest Food Processors Association
Northwest Energy

Non-Federal Cost Share: 55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Western U.S. Food Processing Efficiency Initiative

Overview

Food processing in the four states that participated in this STAC project is responsible for over $60 billion in product shipments each year and accounts for over 15 percent of the gross national product in food processing. Food processing is also the fourth largest energy using industry in the four states.

Project Activities

The project goal was to improve access to information on energy and water use efficiency for the food processing industry in Western states. The project team developed a compendium of best practice recommendations for energy and water efficiency in the western U.S. food processing industry and supported this effort by producing fourteen case study reports describing results from implementation of energy cost saving demonstration projects.

Outcomes/Benefits

The two trade association team members are now able to provide comprehensive energy and process efficiency services to their members and other interested food processors. The project will be of value to the regional industry beyond the Western states because the collaborative initiative is being branded as the Food Processing Resource Efficiency Initiative (FIRE) and marketed by team partners. The project was also important to the regional industry by helping it compete internationally and domestically through energy cost reduction and increasing efficiency, productivity, and product quality distinction. Additional project accomplishments included:

- Designed and created an Energy Web portal, maintained by the trade association team members (the only such U.S. site for the food processing industry),
- Created an emerging technologies resource base for the food processing industry, and
- Conducted 11 DOE Best Practices training workshops for large- and medium-sized food processing plant personnel.

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PRIME PERFORMER
Advanced Energy

PARTNERS
Washington State University Energy Program
California Energy Commission
New York State Energy Research & Development Authority

Non-Federal Cost Share: 55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Achieving More with Less: Efficiency and Economics of Motor Decision Tools

Overview

Electric motors consume approximately 70% of industrial electricity, and there is still tremendous energy saving potential available by converting to new, higher efficiency motors. However, existing decision tools often cannot compare the economic efficacy for replacement of old motors with the newer, high efficiency motors available today.

Project Activities

The objective of the project was to provide fact-based information that has the potential to significantly affect motor choices in U.S. industry. This project conducted analysis and testing in two areas: energy efficiency of in-service motors and motor reliability of new vs. repaired motors. The test cycles were established to predict what percentage of motors are properly sized for the intended purpose and how the actual load affects the motor cost of operation. The project also developed a decision tool to estimate the economic benefits possible for replacing an existing motor with a new unit or repairing the older motor.

Outcomes/Benefits

The project provided valuable information to decision-makers responsible for purchasing or repairing industrial motors:

- Industrial motors operate below their nameplate ratings, below the projections of many standard motor decision tools, and differences were appreciable,
- The tool refined during the project, MotorMaster+ 4.0, provides relatively accurate efficiency information for evaluating the economics of motor repair versus replacement (when operating at rated load), and
- Motor reliability appears to have a great impact on the life-cycle cost of motor operations. Although preliminary, the project data suggests that the value of motor reliability may be greater than the value of energy efficiency, and that motor reliability alone may justify the selection of a new motor versus rewinding.

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PRIME PERFORMER
New York State Energy Research & Development Authority

PARTNERS
Michigan Department of Consumer & Industry Services

Non-Federal Cost Share: 55%

Funded by:
U. S. Department of Energy
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STAC Project Profiles

Use of Pressurized Ozone and Dissolved Air Flotation with Reverse Osmosis Membrane Filtration for Industrial Process Water Treatment at a Forest Products Facility

Overview

Most mills in the Pulp and Paper Industry are older facilities (especially in New York and Michigan) and face increasingly difficult challenges including fresh water procurement, increasing costs for water heating and for effluent treatment and disposal and environmental implications, production efficiencies and product quality, and global competitiveness. Mill process water has a considerable amount of process-added energy (in the form of heat). In addition, extraction of Total Dissolved Solids (TDS) from industrial process water is a difficult challenge when mill water is re-circulated.

Project Activities

The project objective was to design, install and demonstrate a full-scale, new technology system that used pressurized ozone along with clarification and filtration to effectively remove TDS from mill process water, compile the data, and then disseminate results to water intensive industries.

Outcomes/Benefits

Based on successful pilot studies a full-scale, integrated system, with pressurized ozone, Krofta dissolved air flotation (DAF) clarification, and spiral wound reverse osmosis (RO) membrane filtration, showed the approach could remove almost 100% of the Total Suspended Solids (TSS), TDS and mineral contaminants, and produce a fresh water substitute. The integrated system has shown great promise including large energy cost savings for the Pulp and Paper Industry. The technology has potential for use in other water intensive industries to convert dirty mill process water TDS to TSS for more efficient removal and for the production of clean process water and fresh water substitute.

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PRIME PERFORMER
University of Illinois at Chicago—Energy Resources Center

PARTNERS
Illinois Department of Commerce and Economic Opportunity
Ohio Department of Development, Office of Energy Efficiency
Indiana Department of Commerce, Energy &

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Development of a Total Assessment Audit Protocol for the Chemical Industry

Overview

The DOE's Industrial Technologies Program has identified the Chemical and Allied Products Industry as one of the primary industries for where energy usage can be improved. This industry is also very important to the U.S. economy – one of the nine DOE Industries of the Future.

Project Activities

The model for this STAC project was a business assistance program that delivered on-site services to members of the metal casting industry within the State of Illinois. That metal casting project developed a Total Assessment Audit (TAA) protocol tool based on industry process observations to categorize process flows, problem areas, production bottlenecks, incongruities, opportunities for improvements and efficiencies, and methods for implementation of corrective measures. The STAC project team found that the TAA process used to help manufacturers in the metal casting needed to be modified substantially to be used in an industry as diverse as the chemicals industry.

Outcomes/Benefits

The project team of multi-disciplinary engineers was able to take the core ideas and function of the original Metal Casters TAA Program – improving manufacturing competitiveness through audits that concentrate on a wide variety of critical manufacturing issues – and develop a protocol for applying them to the chemicals industry. The refined audit protocol is concise and efficient but also flexible and broad enough to be effective for a diverse industry such as the chemicals industry.

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PRIME PERFORMER
South Carolina State Energy Office

PARTNERS
Georgia Environmental Facilities Authority
IdleAire Technologies
South Carolina Department of Health and Environmental Control

Non-Federal Cost Share:
55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Advanced Travel Center Electrification (ATE) for Reducing Idling from Heavy-Duty Vehicles

Overview

There are over 4 million large diesel trucks in the U.S. and over 1.3 million are long-haul units with sleepers, A/C, heating, and other appliances in the cab. Engine idling has traditionally been used to power these amenities while drivers wait on loads or during required rest periods. Estimates are that each of the 1.3 million long-haul units consume about 2,400 gallons of diesel each year just while idling. Generally locations where these idling diesel engines supply power are in urban areas often affected by poor air quality and noise pollution.

Project Activities

This project collaboration combined three states and an industrial partner to reduce idling from heavy-duty vehicles along a heavily traveled interstate corridor. IdleAire Technologies Corp. (ITC) had developed a system which provides each long-haul unit parking space with individual heating/cooling, 110 volt power, cable television, phone and internet service and does not require any truck modifications. This STAC demonstration project installed 150 of the ITC systems at three locations along the I-85 corridor in North and South Carolina and Georgia.

Outcomes/Benefits

This project resulted in many benefits to the locations where the systems were demonstrated but also to the general public including:

- Improved air quality and reduced greenhouse gas emissions,
- Increased highway safety,
- Energy independence affects from reduced fuel consumption,
- Increased public revenues due to jobs created,
- Reduced noise, and
- Reduced trucking industry costs.

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PRIME PERFORMER
New Jersey Board of Public Utilities
Office of Clean Energy

PARTNERS
PA Department of Environmental Protection, Office of Energy
National Association of Regulatory Utility Commissioners
Center for Energy, Economic and Environmental Policy, Rutgers
Madison Energy Consultants
National Council on Electricity Policy
PJM Conective

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Distributed Energy Infrastructure Analysis and Pilot Project for New Jersey and Pennsylvania

Overview

Implemented effectively, a significant percentage of the power generation and load management in NJ and PA as well as other Mid-Atlantic states can be obtained from Distributed Energy Resources (DER) technology and tools. Recent blackouts in the area highlighted the fact that the grid needs to be smarter, and DER is one tool that can significantly help. Decoupling of utility revenue from throughput (kwh sales) is considered a key issue for the ultimate success of DER integration into the electricity enterprise. But in order to implement DER and achieve predicted benefits, policy makers must have a comprehensive understanding of how DER can fit into the existing market structure and electric infrastructure.

Project Activities

The objective of this project was to evaluate the baseline of existing DER for all market segments and the financial, regulatory and technical barriers to expanding DER in NJ and PA. The baseline evaluation framed the issues that policy makers in NJ and PA needed to address in order to overcome existing and future barriers to DER. Rate decoupling was identified as a major issue. A task developed a policy manual to expand DER in the target commercial and industrial sectors in NJ and PA.

Outcomes/Benefits

Technology assessment reports and the baseline of NJ and PA DER market potential reports were disseminated through the Rutgers Center for Energy, Economic and Environmental Policy website. A workshop, Value of DER to the Local Grid, was developed and attended by over 60 persons, including senior executives from NJ and PA utilities, commissioners from the state public utility commissioners, numerous renewable and distributed generation developers, and environmental advocates.

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PRIME PERFORMER
New Mexico Energy, Minerals, and Natural Resources Department

PARTNERS
New Mexico State University
Texas State Energy Conservation Office

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Distributed Energy Resources—Expanding DER Applications in Targeted Markets

Overview

Dairy farms and other confined animal feeding operations (CAFO) in New Mexico and west Texas have been under intense public and regulatory pressure to reduce environmental issues by managing animal manure disposal. Anaerobic digestion is an attractive option for large dairy farmers due to economy of cost (typically systems become more cost effective as the size of the farm increases), environmental issues such as manure storage and management, and the potential for utilities to meet portfolio standards obligations by providing credits to dairy farms for generating electricity on site.

Project Activities

This project was designed to develop and demonstrate a two-phase biofermentation system to produce methane from dairy manure and reuse resulting solids as a beneficial amendment to the soil. The two-year field demonstration project involved designing, procuring equipment, constructing, operating and evaluating a small-scale anaerobic digester system to investigate whether anaerobic digestion provides an economically viable waste-management option for the dairy and feed lot industry.

Outcomes/Benefits

The results of this demonstration project pointed to a number of topics for consideration for future biomass research projects:

- Evaluation of other organic waste as feedstock for the digester either individually or mixed with dairy manure,
- Examination of improved revenue source and/or cost displacement options from on-site electricity generation,
- Analysis of the financial impact of standby and backup power rate schedules required for the site,
- Selection of the best metering option available by determining whether load displacement is more advantageous than net-metering or sell-back-metering options, and
- Reduction of fuel costs for heating and cooling of associated facilities and their effect on payback of the application.

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PRIME PERFORMERS
University of Central Florida
New York State Energy Research & Development Authority
California Energy Commission

Non-Federal Cost Share: 25%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Hydrogen Technology Learning Centers for California, Florida and New York

Overview

A hydrogen-based energy infrastructure presents enormous technical challenges related to efficient H_2 production, reliable H_2 transport and storage, and optimal local power generation. Realization of this vision requires major advances in technology as well as major changes in our nation's approach to energy production, distribution, and use. These changes will require research and development by talented scientists, engineers, and informed, knowledgeable decisions regarding research and development directions and public policy.

Project Activities

This project was developed to address these needs by creating three Hydrogen Technology Learning Centers, called H2SA Centers, to educate students, government officials, industry members, the general public and others on the hydrogen economy, technology, and applications. The team included members in California, Florida and New York to begin development of the learning centers in strategic locations in the Northeast, Southeast, and Western U.S. Unfortunately, a reduction in funding caused project activities to be reduced to two centers — one in Florida and one in California.

Outcomes/Benefits

The two Hydrogen Learning Center teams made significant progress in establishing their learning centers:

- Developed educational media including interactive tools, hands-on exhibits, demonstrations, and general and technology information on hydrogen and fuel cell technology,
- Surveyed community colleges and university hydrogen courses and degree programs and built upon this material to develop internet-based curricula on hydrogen technology to maximize the transfer of program materials, and
- Provided outreach and education on hydrogen as a fuel through briefings and presentations to state and local government officials, utilities, industry, the general public and equipment displays at education and public forums.

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STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
Virginia Polytechnic Institute & State University

PARTNERS
University of Maryland Breakthrough Technologies Institute
Hampton Roads Clean Cities Coalition

Non-Federal Cost Share: 25%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Virginia-Maryland Hydrogen Technology Education Center (H2TEC)

Overview

A hydrogen-based energy infrastructure presents enormous technical challenges related to efficient H_2 production, reliable H_2 transport and storage, and optimal local power generation. Realization of this vision requires major advances in technology as well as major changes in our nation's approach to energy production, distribution, and use. These changes will require research and development by talented scientists, engineers, and informed, knowledgeable decisions regarding research and development directions and public policy.

Project Activities

Virginia and Maryland teamed to develop the VA-MD Hydrogen Technology Education Center (H2TEC) as a distributed learning center to enhance the understanding of policy makers, teachers of future scientists and analysts, and students at both the undergraduate and graduate level. The project objective was to provide learning opportunities in the area of hydrogen technology.

Outcomes/Benefits

The two-state team accomplished the following:

- Implemented several hydrogen fuel cell projects as part of on-campus demonstration and test facilities,
- Developed and conducted graduate and undergraduate courses in hydrogen technology, fuel cell systems, and sustainable energy engineering, and
- Provided outreach and education on hydrogen as a fuel through briefings and presentations through the Virginia Hydrogen Network; participated in the Virginia Hydrogen Economy Roundtable; briefed state legislators and congressional delegations; and displayed equipment at public forums.

November 2011

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PRIME PERFORMER
North Carolina A&T State University

PARTNERS
University of South Carolina
University of Florida
University of Georgia

Non-Federal Cost Share: 25%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Development of a Regional Hydrogen Technology Education Consortium

Overview

A hydrogen-based energy infrastructure presents enormous technical challenges related to efficient H_2 production, reliable H_2 transport and storage, and optimal local power generation. Realization of this vision requires major advances in technology as well as major changes in our nation's approach to energy production, distribution, and use. These changes will require research and development by talented scientists, engineers, and informed, knowledgeable decisions regarding research and development directions and public policy.

Project Activities

The University of South Carolina and other state-chartered institution partners established a Hydrogen Technology Education Consortium (HyTEC) to represent similar institutions in the south. The state-chartered institutions shared technologies, facilities, personnel, and other resources for the purpose of providing interactive technology transfer through education and training in hydrogen technologies for students, professionals, and the public.

Outcomes/Benefits

The project team was able to complete a number of actions specific to the needs of state-chartered institutions:

- Developed multi-media course material for university-level courses in hydrogen energy technology, fuel cells, hydrogen production, storage, and transportation, and hydrogen energy conversion,
- Developed a multi-media one-day short course for high school students and science teachers to introduce hydrogen technology and fuel cells,
- Provided outreach and education on hydrogen as a fuel through briefings and presentations to state and local government officials, general public through a quarterly electronic newsletter distributed through the State Energy Offices and various community groups, and equipment displays, such as the fuel cell bus, at public forums.

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

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Projects from 04-STAC-01— Energy Efficiency and Fossil Energy Science

- *Determination of CO2 Storage Capacity and ECBM Potential of Lignite Coals*
- *Preventing Solidification Defects in Large Superalloy Castings Used in Advanced Electric Power Systems*
- *The Use of Real Time Measurement and Artificial Intelligence to Improve Efficiency and Reduce Emissions at Coal-Fired Power Plants*
- *Development of a Pilot Scale Module for Hydrogen Separation*
- *Utilizing the National Corn-to-Ethanol Pilot Plant to Develop a Predictive Model for Distillers Dried Grain for the Fuel Ethanol and Animal Feed Industries*
- *Iron-Based Mixed Metal Carbide Fischer-Tropsch Catalysts*
- *Energy Conversion Sciences for Operation and Security of Large-Scale Systems*
- *Motor Control and Power Conversion Technologies Using FLEXMOD*

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
University of North Dakota

PARTNERS
North Dakota Industrial Commission, Oil and Gas Division
North Dakota Department of Commerce, Division of Community Services, State Energy Program
Montana Board of Oil and Gas

Non-Federal Cost Share: 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Determination of CO_2 Storage Capacity and ECBM Potential of Lignite Coals

Overview

Over 50% of the CO_2 emitted to the atmosphere in North Dakota and Montana is from coal-fired power plants. Although there is no present market value to CO_2 emissions, geologic sequestration of CO_2 emissions may become important as national CO_2 emission policy evolves because coal seams are known to have the ability to absorb and store significant amounts of gases. Western North Dakota and eastern Montana have large lignite coalfields located under or in close proximity to several large coal-fired electric power plants. These lignite beds may have the potential to be a significant sink for the CO_2 generated by these power plants but, under existing market conditions, any CO_2 sequestration investment must produce a value-added product such as natural gas. Until this STAC-funded project, minimal research on CO_2-based enhanced coal-bed methane (ECBM) sequestration had been conducted in lignite coalfields.

Project Activities

The goal of this project was to develop estimates of the gas content, CO_2 storage capacity, and applicability of CO_2-based ECBM production technology in lignite coal beds. Best practice gas content analysis methods for low- gas content, low-rank coal basins were identified (similar fields are in Texas and Alaska). The project team developed estimates of natural gas resource potential, CO_2 storage potential, and applicability of ECBM technology in specific Williston Basin lignite coal-beds and estimated the potential for application of ECBM production at those locations.

Outcomes/Benefits

Evaluations of the gas content, porosity and permeability, and CO_2 storage capacity of the project coal-bed locations were completed and summary reports published. Among the significant findings were:

- Results of laboratory and field work at the North Dakota field site indicate that methane content and consequently methane production potential of the target lignite coal-bed is not promising,
- Results of CO_2 sorption studies however, indicate the seams are likely to provide good sites for CO_2 storage, and
- The results of the project have been used to develop a three-dimensional petrophysical model of the coal seam lignite test site, and this methodology can now be used to facilitate the development of a future injection project.

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PRIME PERFORMER
West Virginia University

PARTNERS
GE Energy
Special Metals Corp.
Pennsylvania State University

Non-Federal Cost Share:
20%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Preventing Solidification Defects in Large Superalloy Castings Used in Advanced Electric Power Systems

Overview

The rapidly growing need for clean, reliable, and affordable power across the United States has resulted in great demand for high-efficiency gas turbine power systems. To improve energy efficiency, reduce operating cost, and lower CO_2 emissions, gas turbines are operated at high temperature because the overall energy conversion efficiency depends on the firing temperature. Each 50 degF increase in firing temperature results in a 1% increase in combined-cycle efficiency. Temperature limits of gas turbine operation are generally determined by the capability of the materials used for components such as turbine wheels and buckets to withstand the severe stresses associated with high-speed operation at high temperatures. Turbine discs cast from Fe-Ni-base superalloys such as IN706 using current casting processes at times suffer from solidification defects caused during the superalloy re-melting process. Because of the difficulty in conducting experiments using molten metal, there is little experimental data on the segregation phenomena.

Project Activities

The objective of the project was to develop improved methodologies for preventing macrosegregation in superalloy re-melting processes. A combination of theoretical modeling and physical experimentation was used to address weaknesses in existing models, particularly the inability to accurately predict the partition of key elements between the liquid and solid phases during solidification. The project was designed to provide information supporting an ultimate goal to develop a predictive technology that can be applied commercially to prevent solidification defects in large superalloy castings used in advanced electric power systems. The partition coefficients of the most important minor and major solute elements of model Ni-based alloys were studied by theoretical simulations and by physical experimentation.

Outcomes/Benefits

A methodology for production of laboratory size alloys was proposed, developed, and refined based on standard experiment instruments. The experimental setup for directional solidification experiments was completed and an experimental plan was proposed to perform verification experiments on model and commercial alloys, and evaluate the influence of the processing parameters on the macrosegregation defects. The experiments showed general agreement with the theoretical calculations in the influence of the solute elements on the solidification characteristics.

November 2011

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PRIME PERFORMER
New York State Energy Research & Development Authority

PARTNERS
Brayton Point Generating Station—U.S. Gen New England, Inc.
Lehigh University
Energy Research Company

Non-Federal Cost Share:
20%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

The Use of Real Time Measurement and Artificial Intelligence to Improve Efficiency and Reduce Emissions at Coal-Fired Power Plants

Overview

Stringent sulfur dioxide (SO_2) and nitrogen oxide (NOx) emission limits, and the economic competition in the power generation market, have forced coal-fired plants that fire a specified type of Eastern U.S. bituminous coals to use coals and fuel blends with different characteristics than the design coals. Subsequently, there has been a recent growth in the international trade with foreign coals, and the use of Western U.S., low-Sulfur coals to replace high-Sulfur Eastern U.S. bituminous coals. However, there are detrimental effects when converting to off-design fuels. These operations constraints are related to increased stack opacity spiking and the development of slagging/fouling which lead to higher emissions and reduced efficiency.

Project Activities

The project team developed a technique to measure coal properties in real time and to process the data such that coal-fired electric utility plants can adjust their operations to avoid slagging and fouling. The team demonstrated and assessed the feasibility of Laser Induced Breakdown Spectroscopy (LIBS) to measure coal ash composition, and a concept to predict coal slagging potential via artificial neural network (ANN) models based on LIBS emission intensity measurements. The LIBS system was tested in the laboratory using a broad set of coal samples that include U.S. bituminous and sub-bituminous coals and imported fuels. Demonstration software was also developed from the results of this project to provide operators with information to guide their actions. After development of the artificial intelligence (AI) models, the LIBS system was tested at a coal-fired power plant.

Outcomes/Benefits

The merit of a LIBS system to produce coal elemental analysis and estimated ash fusion temperature was demonstrated in this project, especially in comparison to ASTM techniques still widely used in coal-fired power plants applications. The LIBS system shows great promise, but further development is needed to equip the system with an automatic on-line coal sampling attachment and to improve higher accuracy and repeatability. Additional development would also be needed to produce a commercially available version of such LIBS-based system. The project team estimates systems can be developed at a price close to $200,000 – capital cost of the equipment would be recovered within twelve months.

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PRIME PERFORMER
New York State Energy Research & Development Authority

PARTNERS
North Carolina State Energy Office
Research Triangle Institute
Pall Corporation

Non-Federal Cost Share:
20%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Development of a Pilot Scale Module for Hydrogen Separation

Overview

For hydrogen to become more competitive as a fuel for power generation, cost and performance characteristics of membranes for separation of hydrogen from synthesis gases need to be improved for both distributed and central station power generation. Membrane technology for hydrogen separation needs to become more robust, durable in the long-term, and tolerant to impurities including sulfur concentrations typically present in synthesis gases derived from a variety of feedstocks such as natural gas, coal, and biomass.

Project Activities

The project team used a pilot scale unit to optimize membrane synthesis parameters to reduce the cost of membranes while meeting the hydrogen flux and selectivity targets. In addition, the tests considered methods to make the membranes more robust and durable. Particular emphasis was placed on developing membranes more tolerant to impurities especially sulfur concentrations typically present in synthesis gas including natural gas, coal and biomass feedstocks. The project was based on existing technology originally developed from the Research Triangle Institute's hydrogen separation membrane research. The membrane tested consisted of a thin film palladium alloy composite and tested alternatives with both porous ceramic and porous metal substrate tubes to optimize pore size distribution.

Outcomes/Benefits

The project developed a specific hydrogen membrane technology for pilot-scale testing and then demonstrated separation of hydrogen from different feedstocks using the test module. The project met its goal of reducing the cost of the Pd-alloy/substrate composite hydrogen separation membranes below $100/ft2 while meeting the hydrogen flux and selectivity targets.

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PRIME PERFORMER
Southern Illinois University

PARTNERS
Washington University, St. Louis, Missouri; Department of Chemical Engineering
Emerson Process Management
Illinois Department of Commerce & Economic Opportunity

Non-Federal Cost Share: 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Utilizing the National Corn-to-Ethanol Pilot Plant to Develop a Predictive Model for Distillers Dried Grain for the Fuel Ethanol and Animal Feed Industries

Overview

In the United States, Distiller's Dried Grain with Solubles (DDGS) is used primarily as a protein supplement for formulating feed for ruminants (e.g., cattle). In 2006, dry-grind ethanol plants in the U.S. produced about 8.5 million metric tons (mmt) of DDGS, and production is predicted to increase to 36 mmt by the year 2010. Use of DDGS in swine and poultry diets is limited by uncertainty regarding the nutrient content. The expected increase in DDGS supply due to growth of the U.S. fuel-ethanol industry provides greater incentive to develop methods for managing DDGS quality in order to maintain the economic value of DDGS and, therefore, the profitability of dry-grind ethanol plants.

Project Activities

The project research objective was to develop and validate a predictive neural network model that relates the composition of DDGS, a major co-product of the dry-grind process for production of fuel ethanol, with plant operating conditions. The relationship was investigated by varying pilot-plant operating conditions, collecting the DDGS produced, and determining its chemical composition and physical characteristics. The data were used to develop and test the neural network model.

Outcomes/Benefits

The results of this research are encouraging with respect to the ability to use sophisticated process-control technologies to improve the consistency and nutritional value of DDGS, which is an important co-product of the dry-grind ethanol industry. However, the neural-network models that were developed proved to be relatively poor predictors of DDGS nutritional quality. The results were important because they strongly suggest that other factors are important, and the effects appeared to be highly nonlinear and interactive. Many of the factors that were shown to affect DDGS quality were consistent through at least two completely independent dryer studies, and these significant factors were consistent with their expected effects based on fundamental principles. More research is required to understand the ways in which plant operating conditions affect specific aspects of DDGS quality and composition.

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PRIME PERFORMER
Clemson University

PARTNERS
Louisiana State University
Research Triangle Institute
Energy Technology Partners, LLC
Sud-Chemie, Inc.
Rentech
Louisiana State Energy Office
South Carolina State Energy Office
Louisiana State Energy

Non-Federal Cost Share:
20%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Iron-Based Mixed Metal Carbide Fischer-Tropsch Catalysts

Overview

The U.S. has sufficient domestic coal reserves to supply most of its fuel needs for more than one hundred years, and since biomass is formed by atmospheric CO2 fixation, its use as a fuel feedstock is attractive because virtually no net CO2 emissions result. The total U.S. biomass produced each year as waste material from agriculture and forest operations could be converted into roughly 40 billion gal/yr of liquid fuel, roughly 25% of the current US gasoline usage. Using the Fischer-Tropsch (FTS) process after gasification is currently the most promising method for upgrading low-value coal and also biomass to high-value liquid fuels and chemicals. Bulk iron (Fe) catalysts are the catalysts of choice for converting low H2/CO ratio syngas to fuels via FTS. These relatively low-cost catalysts have low methane selectivity and high water gas shift activity (which generates H2 in situ). However, development of a bulk Fe FTS catalyst that combines high FTS activity, low methane selectivity, high attrition resistance (i.e., ability to withstand physical breakage), and long-term stability (low deactivation rate) is still elusive and presents a widely recognized barrier to the commercial deployment of FTS for coal and biomass conversion.

Project Activities

This research project addressed the issues of the nature, genesis, and maintenance of active Fe sites from a totally different perspective than previous studies. The FTS process relies on catalysts, and this research project studied and tested ways to develop more active, selective, attrition resistant and stable bulk iron (Fe) FTS catalysts based on formulations containing a second metal. Unlike previous studies of Fe bimetallic catalysts, this work focused on the ability of second and third metals to form mixed-metal carbides with Fe at reaction or pretreatment conditions. The results from the various studies compared to benchmark catalysts were used to evaluate commercial potential.

Outcomes/Benefits

The project achieved success in that its participants proved that at least one and possibly two catalysts from this work are as good or better in overall ability than other potential commercial Fe-based catalysts for the Fischer-Tropsch synthesis. The catalysts were found to be equally beneficial in creating hydrocarbons (liquid fuels and chemicals) from syngas (CO + H2) prepared from coal, biomass, or natural gas. The two potential Fe-based FTS catalysts have commercial potential because they have excellent activities, selectivities, and, especially, attrition resistance (the latter is very important for any commercial candidate catalyst to be employed in preferred slurry phase reactors). The commercial potential for the catalysts is so high that the university project partner and the industrial/investor partner continued the research effort on one of the catalysts after the STAC project was completed.

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

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PRIME PERFORMER
Purdue University

PARTNER
Wright State University

Non-Federal Cost Share: 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Energy Conservation Sciences for Operation and Security of Large-Scale Systems

Overview

Energy security issues and changing markets and technologies have caused research advances in distributed generation of electrical power. Fuel cell hybrid technologies which integrate high temperature fuel cells with another power generation technology have increasing promise for development and commercialization. Integration of the technologies meets many demands of U.S. energy goals of the future including independence from foreign sources, greater security, and pollution free emissions.

Project Activities

The project objective was to expand and supplement on-going research at the Center on Security of Large Scale Systems. The existing research base allowed the project team to design a dc/ac variable-frequency three-phase power inverter, using Silicon (Si) and Silicon-Carbon (SiC) power devices, estimate the inverter power losses and efficiency, and compare the losses and efficiency with Si and SiC devices.

Outcomes/Benefits

The project had many positive aspects including:

- Expanded solid-state research in the area of (SiC) for the purpose of reducing size, weight, and cost of power converters for motor drives and distributed generation,
- Investigated methods of motor control including the advantages of SiC devices to increase efficiency and reduce cost of electric drives,
- Incorporated results of the Center's research in fuel cell testing and modeling to suggest design and operation modifications of these devices in distributed generation systems, and
- Investigated the control and performance of distributed generation during islanding of an electric power grid.

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PRIME PERFORMER
Advanced Energy

PARTNERS
Raser Technologies, Inc.
Washington State University Energy Program

Non-Federal Cost Share : 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Motor Control and Power Conversion Technologies Using FLEXMOD

Overview

Most of the electricity generated in the United States is used to power electric motors. Many of the more than 13 million electric motors used in industrial applications are operating inefficiently because of changing loads or less than optimum control schemes. The Department of Energy estimates that improved system controls including variable speed drives for pump, fan, and compressed air systems alone could save nearly 15,000 gigawatt-hours and potentially $900 million in annual energy savings. Beyond these known efficiency opportunities, relatively new but rapidly growing applications in hybrid electric vehicles will subject electric motors to variable loads at variable speeds. More efficient, modular motor controllers capable of operating with a range of motor sizes and types, if available at reasonable cost, could result in substantial energy savings in industrial, residential, and hybrid vehicle markets.

Project Activities

The overall objective of this project was to develop and evaluate a controller capable of operating with a range of motor sizes and types. The project developed a motor controller design – called FlexMod – using adaptive tuning to optimize performance based on unique motor characteristics. The new controller was tested using a commercially available controller as a baseline for comparisons. The tests were designed to produce a system efficiency map over 300 to 1800 rpm and 25% to 125% rated torque on both 5 hp and 20 hp AC induction test motors.

Outcomes/Benefits

The prototype design can use various power modules and different IGBT designs and uses modular construction methods that should reduce manufacturing costs. The tests demonstrated that the design prototype was up to 10% more energy efficient on average. The results of this project were made available to major motor manufacturers and the utility industry through on-line reports to disseminate information to reduce energy costs in the industrial, residential and hybrid vehicle electric motor markets.

November 2011

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy and

Projects from 04-STAC-01— Energy Efficiency Research, Development, Demonstration, Deployment and Rebuild America

- *Reducing the Waste: Improved Fossil Water Heating Systems*
- *Residential Heat Pump and Air Conditioner Research, Demonstration and Deployment: Improving Pacific Northwest Utility and State HVAC Programs*
- *Reliability Development and Field Demonstration of CO2 Het Pump Water Heaters*
- *Development and Field Trial of an Advanced Indirect Heating System for Metal Heat Treating Applications*
- *Hybrid Electric School Buses: The Road to Reduced Fuel Consumption, Healthier Children, and Cleaner Air*
- *Multi-Fleet Demonstration of Hydraulic Regenerative Braking Technology in Refuse Truck Applications*
- *Creating and Demonstrating Incentives for Electricity Providers to Integrate DER*
- *Expanding Small-scale CHP Opportunities through the more Efficient Use of Trading Programs: An Analysis of Market Opportunity and Regulatory Issues*
- *National Database of Energy Efficiency Policies and Incentives*
- *Midwest Rebuild America Application Center*
- *Southeast Rebuild Collaborative Public Sector Energy Efficiency Project*

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
Energy Center of Wisconsin
California Energy Commission
New York State Energy Research & Development Authority

PARTNERS
ACEEE
Brookhaven National Laboratory
Lawrence Berkeley National Laboratory

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Reducing the Waste: Improved Fossil Fuel Water Heating Systems

Overview

Residential water heating uses 1.68 quads of source energy in single family and related housing types today. Seventy-nine percent of this is attributable to fossil-fueled water heating, almost all in storage water heaters units. Standard efficiency gas and oil-fired water heating technologies typically have field efficiencies in the range of only 40-60% depending on type and application. Combustion limitations and standby losses waste 35% of input energy in the best conventional gravity-draft units, and there is little room for further improvement in these designs. Replacement storage water heaters represent about 70% of all sales. Because they often require new electricity capacity for auxiliary equipment (fans and igniters) and changes in venting systems, replacement units also impose additional cost and design factors not faced in new construction. Success in transforming the water heating market would lead to 30% unit energy savings, or approximately 0.2-0.3 Quads of energy annually.

Project Activities

The objective of this project was to improve the energy performance of residential fuel-fired water heaters. Project activities addressed the most important causes of performance shortfalls especially on problems with oil-fired heating systems for houses and focused on replacement storage water heaters. Tasks developed and evaluated three promising alternative storage-type gas water heater technical designs and mapped performance of integrated and DHW-only systems and evaluated specific improvements to existing designs.

Outcomes/Benefits

The project developed better information on advanced water heater technology that included review of test procedures, air entrainment, energy economics, and routes to market transformation. The information included specific documentation on infiltration impacts and field performance for existing technologies and the three alternative water heaters evaluated. Project results were disseminated through state energy office networks to aid in market transformation and to support the technical basis for a "Golden Carrot" program of incentives for a new generation of fossil-fueled water heating appliances.

November 2011

STATE TECHNOLOGIES ADVANCEMENT COLLABORATIVE (STAC)

A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
Idaho State Energy Office

PARTNERS
Northwest Power & Conservation Council
Bonneville Power Administration
Energy Trust of Oregon
Oregon Department of Energy
Washington State University Extension Service
Ecotope Inc.
Stellar Processes
Northwest Energy Efficiency Alliance

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Residential Heat Pump and Air Conditioner Research, Demonstration, and Deployment: Improving Pacific Northwest Utility & State HVAC Programs

Overview

The cost effectiveness of heat pumps and commissioning depends on performance and on incremental cost above the baseline. A great opportunity exists in optimizing the performance of air-source heat pumps and air conditioners using standard duct delivery systems. Simple commissioning processes, training, and diagnostic tools using laptop computers can significantly improve installed system performance and comfort.

Project Activities

The project focused on discovering the simplest means to diagnose and optimize the new generation of high performance heat pumps and air conditioners and to integrate these diagnostic and optimization tools into the energy efficiency programs operated by the state energy offices and utilities of the Pacific Northwest. Bench testing of heat pumps in both heating and air conditioning modes at a variety of operating conditions was performed to determine critical parameters for optimizing system performance in both heating and cooling modes. The bench test data was used to refine and improve a heat pump modeling tool developed for the NW region by an industrial project partner. Long-term field monitoring in both heating and cooling modes for heat pumps that met the new Federal Standards was conducted in seven homes in three states in the region.

Outcomes/Benefits

The project team was successful at refining and improving the regional heat pump modeling tool to a point where it can be used for improving utility and state HVAC program specifications and utility planning models. In addition the team developed, implemented, and evaluated a field test protocol for verifying system performance that included HVAC commissioning training. The protocol incorporated experiences and insights from project lab, field, and modeling efforts. The project also developed and conducted a program for HVAC technician training that incorporated the field protocol and commissioning process based on the research results.

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A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
University of Maryland

PARTNERS
United Technologies Research Center
Tennessee Tech University
Maryland Energy Administration

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Reliability Development and Field Demonstration of CO_2 Heat Pump Water Heaters

Overview

In recent years, heat pump water heaters (HPWHs) have gained popularity in countries like Japan as a way to reduce energy consumption and mitigate global warming. HPWHs enable substantial primary energy savings over either electric resistance or gas fired water heaters by using the heat pumping effect to move heat from the ambient air into a hot water stream. In the U.S., water heating traditionally has been performed by electric resistance and gas-fired water heaters which are inexpensive on a first cost basis, and until recently, there was no motivation to consider other options for water heating. HPWHs have the potential to surpass both these technologies by operating at coefficients of performance (COP) 3 – 5 times greater than electric resistance water heaters. CO_2 has become a leading working fluid for HPWHs because it is more environmentally benign than conventional refrigerants and because, in most cases, it appears to be the more favorable fluid from an energy efficiency standpoint.

Project Activities

The project objective was to improve and verify the reliability of compressors for CO_2 HPWHs based on field trials in commercial applications. The system's COP and capacity were measured during full tank heating tests at varying ambient temperatures, hot water temperatures, and heating scenarios, and a computer model was then created to simulate system performance. In this project, two potential cycle modifications using internal heat exchangers were investigated.

Outcomes/Benefits

HPWHs are being used in other countries to reduce energy consumption and mitigate global warming, and the results of this effort may begin to position CO_2 heat pump water heater technology as state of the art in the U.S. market-place. The project identified important future research needed that should focus not only on the system's COP and capacity, but the range of ambient temperatures that the system is capable of operating under. Since only two potential cycle modifications could be studied, the project was able to determine that other common cycle modifications, such as the ejector cycle and the expander cycle, need to be studied to further optimize CO_2 heat pump heaters.

November 2011

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A Joint Program of the U.S. Department of Energy, National Association of State Energy Officials, and Association of State Energy Research and Technology Transfer Institutions

PRIME PERFORMER
Ohio Department of Development

PARTNERS
University of Texas at Austin
Gas Research Institute Sustaining Membership Program
Akron Steel Treating Company
North American Manufacturing Company
Energy Solutions Center

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Development and Field Trial of Advanced Indirect Heating Systems for Metal Heat Treating Applications

Overview

There are many applications where radiant heat produced by burning natural gas is needed in furnace applications. Often these applications cannot allow the product gases produced by combustion to come into direct contact with the load in a furnace. Recent work by industry had developed a design optimization of an advanced, indirect heating system (AIHS), and experts in the field concluded the design could be a substantial improvement over existing technology because an improved AIHS could provide quantifiable energy benefits and service life benefits to users of radiant tubes. The new design was based on a Reverse-Annulus, Single-Ended Radiant Tube burner, referred to as the RASERT. Prototype versions of the RASERT had been tested and deployed in an industrial setting, but the prototype versions were still in a relatively early stage of development, and had been deployed only in a setting where the furnace operated under near-steady-state conditions.

Project Activities

The project objective was to install and test new burner designs in a furnace operated in batch mode, where the temperature of the furnace would change significantly over the course of each production cycle. The new designs were evaluated in a development and field trial using an advanced indirect heating system by retrofitting a carburizing steel heat treating furnace with four RASERT burners. The performance of the burners and furnace was monitored after the retrofit, and major improvements in thermal efficiency and emissions were documented. The fuel consumption of the furnace was also monitored over a month-long period following the retrofit, and was compared with the fuel consumption of the original heating system.

Outcomes/Benefits

The RASERT burners were shown to operate effectively and efficiently during the batch operations carried out in the furnace. The fuel consumption of the furnace was reduced by 50% as a result of the retrofit, and harmful emissions, particularly of carbon monoxide (CO), were reduced significantly. The new heating system provided a heating rate that was essentially indistinguishable from that of the old heating system, and the RASERTs were also found not to affect the cooling rate of the furnace in any measurable way.

November 2011

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PRIME PERFORMER
Advanced Energy

PARTNERS
New York State Energy Research & Development Authority
NC Department of Public Instruction
FL Department of Education
Durham School Services
Little Rock School District
Sigourney/Keokuk Community School District
Keota Community Schools
Nevada Community Schools

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Hybrid Electric School Buses: The Road to Reduced Fuel Consumption, Healthier Children and Cleaner Air

Overview

Three manufacturers (Thomas Built, International Truck, and Bluebird) control over 95% of the school bus market, and almost all buses sold are traditional, fossil fuel designs. Studies in California indicate that a child riding in a diesel school bus may be exposed to four times the level of toxic diesel exhaust as someone riding in a car. Although hybrid school bus designs mitigate this problem, manufacturers have resisted adopting the new technology because of the economic investment needed to move from initial technology development to successful market deployment.

Project Activities

The Hybrid Electric School Bus team was organized among a number of states to leverage expertise, funding, and regional purchasing clout so manufacturers would recognize the hybrid school bus market opportunity. The project evaluated the bus' technical and economic feasibility by organizing a buyer's consortium that developed a detailed hybrid bus specification for an RFP sent to bus manufacturers. The RFP requirements specified by the buyer's consortium included performance standards, battery-depleting ranges, and the life cycle cost of the bus. The consortium helped guide bus manufacture, identified funding options for bus purchases, and served as the initial purchaser of the first generation hybrid bus. The consortium included school districts in 12 states who agreed to rigorous performance monitoring on the bus. The first plug-in hybrid electric school bus was delivered in 2007 – the team then monitored 15 hybrid buses located throughout the country.

Outcomes/Benefits

Real-world operational data from the monitoring program suggests that fuel economy can be increased substantially by adopting plug-in hybrid school buses. When operating during neighborhood driving characterized by stops and starts, hilly terrain, and slow speeds, the hybrids' median fuel economy was about 75% higher than median control bus fuel economy. The monitoring effort has established operations and maintenance parameters that will be used as school districts start hybrid programs:

- Plug-in hybrids perform best on routes that have low average speeds and many starts and stops,
- Driving style affects fuel economy in hybrids,
- Maintenance personnel must be trained to troubleshoot and repair basic hybrid systems to prevent excessive downtime, and
- Availability of multiple charging locations helps improve fuel economy savings.

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PRIME PERFORMER
New York State Energy Research and Development Authority

PARTNERS
Maryland Energy Administration
Maryland Department of the Environment
New Jersey Board of Public Utilities
Shurepower, LLC
New West Technologies, LLC
Parker Hannfin Corp
Autocar, LLC
City of Baltimore, Department of Public Works
City of New York, Department of Sanitation

Non-Federal Cost Share: 55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Multi-fleet Demonstration of Hydraulic Regenerative Braking Technology in Refuse Truck Applications

Overview

Because combustion of petroleum fuels from transportation is responsible for about a quarter of U.S. total GHG emissions, most major U.S. cities struggle to comply with U.S. Environmental Protection Agency (EPA) standards that limit pollutant levels in the lower atmosphere. The introduction of advanced, more energy-efficient and low-emission vehicle technologies can address problems associated with petroleum usage. One technology that holds promise for heavy-duty vehicles is hydraulic regenerative braking (HRB), which captures and reuses a portion of the kinetic energy normally lost as friction heat during braking. The greatest fuel economy and emission benefits of HRB systems are in vehicle applications with primarily "stop-and-go" duty cycles that require frequent braking including light, medium and heavy duty vehicles for delivery, refuse pickup, and transit.

Project Activities

The project team evaluated the most likely, near-term, stop-and-go fleet applications for HRB, including taxis, light and medium delivery vehicles, refuse trucks, and transit buses. A thorough analyses of these fleets determined that research on refuse truck fleets could develop valuable information for New York State in terms of duty cycle, fuel savings potential, emissions benefits, and lifecycle costs. A project plan was developed to assist in the development and commercialization of HRB technology in refuse and other medium- and heavy-vehicle sectors in the U.S. through two multi-fleet demonstrations: an extremely dense urban environment; and a more typical urban fleet environment. The project team compared the two for varying operational requirements, duty cycles, climates, fleet size, and truck platforms, and provided in-use fleet data so other users could assess the HRB technology benefits.

Outcomes/Benefits

Potential benefits resulting from the demonstration effort are significant. With regard to economic benefits, HRB system payback periods can be relatively attractive versus alternatives. Compared with other advanced vehicle technologies such as hybrid-electric power-trains, HRB systems exhibit superior regenerative braking efficiencies at only a fraction of the capital and lifecycle costs. Estimates for HRB system payback periods of between three and seven years can be achieved in many types of heavy-duty fleet applications. A number of important operational and system design lessons are important for others adopting HRB technology. Route selection can have a significant impact on HRB fuel economy improvement potential – to gain the most from HRB refuse trucks, fleet managers should choose routes having a high proportion of low-speed, stop-and go driving, with little idling, and short transits.

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PRIME PERFORMER
Massachusetts Division of Energy Resources

PARTNERS
Massachusetts Technology Collaborative
California Energy Commission
Electric Power Research Institute
San Diego Gas & Electric Company
Southern California Edison
National Grid
RealEnergy
New Jersey Board of Public Utilities
Solar Turbines

Non-Federal Cost Share: 55%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Creating and Demonstrating Incentives for Electricity Providers to Integrate Distributed Energy Resources

Overview

Most distributed energy resources (DER) are customer owned in the United States, and, largely because of the lack of scaleable business models and/or regulatory drivers, utility interest in DER remains limited. However, under existing regulatory structures, utility-owned DER business models are more likely to achieve win-win outcomes than customer-owned DER because benefits are more broadly distributed to all stakeholders, and this option conforms readily to traditional rate-of-return regulation. For customer-owned DER to become important to utilities, regulatory and business structures need to change. While small-scale DER in single customer applications may have cost and scale issues, aggregating many DER units to achieve a critical threshold on the order of 100s of MW s could realize the full array of DER benefits. These benefits, including reducing line losses; providing energy, capacity, and resource adequacy; reducing greenhouse gas (GHG) emissions; and improving reliability, could then be quantified, making new business models more tenable and increasing utility interest.

Project Activities

The project objective was to create business models and possible regulatory frameworks that reward electricity providers for integrating DER in ways that realize societal benefits. These strategies were tailored to California and Massachusetts and then planned for testing through pilot projects. The project team and stakeholders developed tools and resources, but the pilot project portion of the effort was limited because of the difficulty in enlisting pilot opportunity partners in the two states within the project time frame.

Outcomes/Benefits

This project showed that utility-owned DER has a higher likelihood of win-win results in today's regulatory environment and showed potential for capturing utility interest. The existing customer-owned DER model needs to be improved to achieve both win-win outcomes and utility interest. The effort included a broad group of stakeholders and facilitated the collaborative creation of innovative business models and associated regulatory approaches. The collaborative stakeholder process was excellent at bringing different perspectives together in a non-adversarial setting to achieve new models. The project also developed economic calculators to provide insights for understanding allocations of costs and benefits of DER. These economic calculators indicated that to achieve win-win outcomes, DER costs and benefits will likely need to be reallocated according to new business models. The calculators will enable analysis of allocation options, and tracking costs and benefits, especially when the additional benefits of increased penetration of DER can be quantified.

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PRIME PERFORMER
New York State Energy Research and Development Authority

PARTNERS
Connecticut Department of Environmental Protection
Pace Law School Energy Project
Energy and Environmental Analysis, Inc.

Non-Federal Cost Share: 55%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Expanding Small-scale CHP Opportunities Through More Efficient Use of Trading Programs: An Analysis of Market Opportunities and Regulatory Issues

Overview

Commercial and institutional customers can achieve lower and less volatile energy costs, greater reliability, and less pollution from Combined Heat and Power (CHP) – the simultaneous production of electricity and thermal energy from a single on-site combustion process. While up to two-thirds of the energy consumed to generate and transmit grid electricity is wasted, CHP can capture between 60% and 90% of input energy as energy output. The Northeast region has significant numbers of commercial, institutional, and industrial facilities that burn fuel oils. Replacement of old, inefficient, high-emission fuel oil boilers with natural gas-fed CHP systems could provide environmental, economic, and energy saving regional benefits. However, CHP's potential remains largely unrealized because of market barriers, financing constraints, regulatory hurdles, and a lack of knowledge about CHP.

Project Activities

This project assessed markets where CHP benefits could be maximized by replacing the oldest, least efficient equipment burning the most polluting fuels (oil and coal) with new, high efficiency CHP systems. Since fuel oil use for process and heating needs is predominantly concentrated in the Northeast, project analyses focused on four states: Connecticut, Massachusetts, New Jersey and New York. All four states addressed in this report operate Emission Reduction Credit (ERC) programs that permit sites to quantify, certify and sell reductions in criteria pollutants to interested buyers. In order to make investment in CHP systems financially attractive, analyses were designed to examine the potential for investors to gain revenue from pollution trading programs.

Outcomes/Benefits

As late as 2006, prices for allowances in the NOx budget trading program were at $3,900 and some experts were predicting that prices would remain in the range of $2,200 to $2,900/ton which could support CHP project development. In 2009, these prices collapsed, and the demand for ERCs in the four-state region is now largely non-existent. At today's prices and with current demand/supply conditions, the potential for smaller-scale CHP to participate in these markets is small. However, new markets are now being developed for carbon trading. With rules that fairly recognize the CO2 reduction benefits of CHP, these new GHG emission trading programs could provide substantial revenue which would help CHP use grow in the Northeast.

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PRIME PERFORMERS
North Carolina State University-NC Solar Center

PARTNERS
Washington State University
Texas State Energy Office
PA Department of Environmental Protection
North American Insulation Manufacturers Association

Non-Federal Cost Share: 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

National Database of Energy Efficiency Policies and Incentives

Overview

The Database for Renewable Energy Incentives (DSIRE) was originally created in 1995 at the North Carolina Solar Center (NCSC) as a policy database to share information about renewable energy incentives for business, government, industry, and the public on all state policies relating to renewable energy. Although modest and limited to renewable policy issues, the database quietly built up a nationwide following as the best source for helping policymakers and the public keep up with renewable energy incentive programs across the U.S. states and territories. Site content grew steadily, and by 2005, traffic accessing the state-by-state data had grown to 25,000 monthly visitors looking for detailed policy-oriented information on renewable energy incentives.

Project Activities

The objective of this project was to significantly enhance and expand the effectiveness of DSIRE to include building energy efficiency (EE) financial incentives and regulatory policies from state, local, Federal, and utility sources. In addition to expanding the original policy content, the project team re-designed the site so that visitors could more easily investigate existing state and Federal renewable and energy efficiency incentive programs and also find timely news on a broad range of energy policy innovations. The team designed the DSIRE+EE home page on a graphical process that displays a U.S. map allowing visitors to choose either renewables or energy efficiency incentives in any given state or territory. The site was also modified to provide summary, downloadable maps in a useful MS PowerPoint slide format for more than a half dozen key topics.

Outcomes/Benefits

The addition of energy efficiency and regulatory policy information organized by state and territory led to over a ten-fold increase in traffic on the DSIRE+EE site, and now average monthly visits to the site are in excess of 250,000. The DSIRE+EE database has proven to be a critical resource for consumers and businesses who need timely information on incentives in order to make purchasing decisions. The site is also the most used source for searches on renewable and energy efficiency policies by government officials who have approval or influence over the creation of incentives and regulations.

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PRIME PERFORMER
University of Illinois at Chicago—Energy Resources Center

PARTNERS
Energy Center of Wisconsin
Illinois, Indiana, Michigan, Iowa, Minnesota, Ohio, Wisconsin, Missouri State Energy Offices
Iowa Energy Center
Midwest Energy Efficiency Alliance

Non-Federal Cost Share:
20%

Funded by:
U. S. Department of Energy
Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Midwest Regional Rebuild America Application Center

Overview

The Midwestern States, with DOE assistance, had developed a highly effective Rebuild America program. Policy analysts and government officials saw a need to support and continue this asset by developing a site that could centralize existing Rebuild America information, education materials, and technical assistance. This effort was needed in times of shrinking budgets to provide a forum and regional mechanism for the states to tap into and utilize the knowledge, experiences, and best practices of all the states and other energy information entities in the region.

Project Activities

A Midwest Regional Rebuild America Application Center was developed to provide the Midwestern states with the information, education, and technical assistance necessary to continue and expand their Rebuild America program activities. The project team used the specific structure of the Rebuild America program for the Midwest region to support (not replace) the efforts of the states within the region. The project focused on building capacity and documenting results from the regional Rebuild America network and structure. The project team continued and expanded the development of the Midwest Buildings Technology Application Center technical Clearinghouse database and website.

Outcomes/Benefits

This effort produced a number of benefits for the Midwest region including:

- Conducted a series of webinars on building energy efficiency topics for colleges and universities. Webinars including Sustainable Energy Management; Effective Energy Efficient Lighting Opportunities & Strategies; Combined Heat and Power; Utility Risk Management; and Planning, Financing, and Implementing Renewable Energy Projects,
- Developed project profiles highlighting successes in the commercial and institutional market sectors, and
- Conducted targeted workshops across the Midwest region.

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PRIME PERFORMER
Florida Department of Environmental Protection, Florida Energy Office

PARTNERS
Mississippi Development Authority
Alabama Department of Economic & Community Affairs
Jackson Electric Membership Corporation
Southface Institute & Sustainable Atlanta Roundtable
Sarasota County
Georgia PTA-GA Green & Healthy Schools Initiative
Florida Solar Energy Center
Institute for Building Technology & Safety
Public Technology Institute

Non-Federal Cost Share: 20%

Funded by: U. S. Department of Energy Office of Energy Efficiency & Renewable Energy and Office of Fossil Energy in partnership with the National Association of State Energy Officials (NASEO) & the Association of State Energy Research and Technology Transfer Institutions (ASERTTI)

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STAC Project Profiles

Southeast Rebuild Collaborative (SRC) Public Sector Energy Efficiency Project

Overview

Five southern states, Florida, Alabama, Georgia, Mississippi and South Carolina, identified a need to create a self sustaining energy efficiency program to ensure that governments, school districts, higher education institutions and the low-cost, multi-family housing sector could pursue superior energy management policies and approaches using the latest information. These states identified an audience of at least 1,300 institutions that needed assistance to promote a culture of energy efficiency and best management practices.

Project Activities

The project team goal was for the collaborative to be self-sustaining after a 30-month period. The project team established a team of contractors capable of providing quick response to institutions needing guidance to move projects from concept to completion, selection of institutions to assist in defining projects, on-site technical support for projects, and verification and documentation of results. The team also worked to have at least one building upgrade project underway in at least 10% of those institutions in the 30-month time frame.

Outcomes/Benefits

The project team worked with a large number of institutions in performing building energy audits and tracking and assessing energy use and costs by providing technical assistance in using tools such as EPA's Portfolio Manager and the Florida Solar Energy Center's Utility Monitoring Systems. The effort provided specific regional actions that:

- Designed and provided a wide net of support to the institutions to encourage facility managers and decision-makers to apply the energy improvement process in at least one facility at the institution,
- Supported –
    - Online learning sessions for facilities managers and finance Officials,
    - Organized institutional support through on-site group working ses sions focused on use of technical tools, overcoming potential barri ers, and sharing of best practices,
    - Provided dedicated support to create an energy efficiency action plan specific to each institution, and
- Provided on-site technical support in two areas: (a) technical walk through audits and (b) building commissioning.

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