Energy Efficiency and Renewable Energy
Public-Private Partnerships
Representative Examples

Entrepreneur-in-Residence (EIR)

Summary: This is a new effort initiated by EERE's Commercialization Team in the past year that identifies a qualified Venture Capital (VC) firm with an interest in RE technologies and provides them access to one of DOE's labs for the purpose of identifying some outgrowth of the R&D process that is sufficiently market-ready that it can be started on the road to commercialization.

1. Who participates and how are they recruited?
In EIR-1, three labs were identified as hosts, then a solicitation was issued for purposes of competing the VC partners. In EIR-2, additional labs were identified, and a solicitation is still open for competing new VC partners.

2. What type of legal formulation vehicle was used? (contract, informal arrangement, etc.)
The EIR process first yields an agreement with labs as to how they will host the EIR. Then a competition is held among interested VC firms. Once a VC firm is matched with a specific lab, DOE uses a financial assistance arrangement with the VC firm. The VC firm then identifies a specific individual (the EIR) who works directly with a specific lab.

3. What is the management structure?
EERE maintains ongoing dialogue with both the labs and the EIR as to plans and progress.

4. How is the program funded?
EERE provides a nominal amount of funding directly to the VC firm. The VC firm makes whatever financial arrangement they want to with the EIR.

5. What are the goals of the PPP and how is the outcome measured?
The overall objective for this effort is to facilitate moving a market-ready technology or process across the commercialization "Valley of Death", and to position it in such a manner that it will be adopted by - and used in - market opportunities.

Energy Savings Performance Contracts

1. Who participates and how are they recruited?
DOE has recently competitively awarded contracts to 16 private firms. The contracts are available for use by any Federal Agency.

2. What type of legal formulation vehicle was used?
Energy Savings Performance Contracts (ESPCs), which are shared savings contracts. (contract, informal arrangement, etc.)

3. What is the management structure?
DOE manages this through a program office in DC and a contract management organization in Colorado.

4. How is the program funded?
Entirely by private financing. Contractors complete energy assessments of federally owned facilities and submit proposals for facility improvements that will improve energy efficiency. If the Federal Agencies that own the facilities accept the contractors' proposals, they issue task orders against the DOE contracts. The contractor arranges for private financing so no appropriated funds are required. Contractors are repaid by the Federal Agencies from the cost savings that result from the improvements.

5. What are the goals of the PPP and how is the outcome measured?
Improve energy efficiency of Federal facilities. The outcome is measured by the energy savings that result from the task orders placed against the contracts.

On-Site Solar Electricity Generation at NREL

1.Who participates and how are they recruited?
The participants in DOE's project to generate solar electricity for on-site consumption at NREL include the solar developer, Sun Edison, LLC; the Department of Energy, Golden Field Office; the Western Area Power Administration; the National Renewable Energy Laboratory; and the local utility, Xcel Energy.

For the Mesa Top Solar Generation Project, the developer had approached Buckley Air Force base looking for an opportunity to develop a project using stranded renewable energy credits. Buckley was not ready to move on the project and referred the company to DOE. For the NWTC and STM Solar Generation Projects, DOE recruited the solar developer by teaming with NREL to issue a Notice of Opportunity for partnership arrangements. DOE was looking for a company that would be willing to work with us to submit a proposal on our behalf for on-site solar generation in response to Requests for Proposals issued by Xcel Energy, who was looking to comply with the state Renewable Energy Standard.

2.What type of legal formulation vehicle was used?
In order to accomplish the project objectives, DOE used a tri-partite arrangement between the developer, DOE and Western Area Power Administration. The three agreements are interdependent and all work together. They include a Solar Power and Services Agreement, an Easement, and an Intra-Agency Agreement. The Solar Power and Services Agreement is between Western and Sun Edison, the Easement is between DOE and Sun Edison and the Intra-Agency Agreement is between DOE and Western.

3.What is the management structure?
DOE granted the developer a long-term Easement to use federal property for the installation of a solar generating facility. The developer designed, installed, and financed the installation. The developer will own, operate and maintain the solar generating equipment for the duration of their 20-year commitment to provide solar renewable energy credits to Xcel Energy. Western will buy all of the electricity generated and sell it to DOE for on-site consumption. Xcel Energy will buy the solar renewable energy credits from the developer and pay a rebate directly to the developer.

4. How is the program funded?
The developer financed the entire cost of installing a 1.2 megawatt solar generating facility at NREL. As a private company, the developer is able to take advantage of the Investment Tax Credit to help finance the generating equipment. In addition, the developer receives a payment stream from Xcel for the RECs and a payment stream from DOE for the electricity. In Phase 1, DOE will buy the electricity at rates equal to what it would have paid Xcel Energy for grid power. In Phase 2, DOE will pay higher electricity rates at the beginning of the agreement and lower rates toward the end of the agreement.

5. What are the goals of the PPP and how is the outcome measured?
The goals of the agreement included replacing grid power with on-site renewable production of electricity and contributing to Xcel Energy's ability to comply with state laws requiring them to include solar generation in their portfolio. In addition, the projects meet the goal of attracting private sector investment to improve infrastructure at a federal facility.

Building Technologies

The Next Generation Lighting Industry Alliance (NGLIA) was formed in 2003 to foster an industry-government partnership to accelerate the technical foundation, and ultimate commercialization, of solid-state lighting systems.

1. Who participates and how are they recruited?

The Alliance was competitively selected in 2005 as the “industry partner” by the U.S. Department of Energy for its Solid-State Lighting (SSL) program.

The current members of the NGLIA are:

3M
Acuity Brands Lighting
Air Products & Chemicals, Inc.
Applied Materials, Inc.
CAO Group Inc.
Corning, Inc.
Cree Inc.
Eastman Kodak Company GE-Lumination
Light Prescriptions Innovators, LLC (LPI, LLC)
LSI Industries
OSRAM Sylvania Inc.
Philips Solid-State Lighting Solutions
QuNano, Inc
Ruud Lighting, Inc.

Any private, for profit firm substantially active in solid state lighting research, development, infrastructure, and manufacturing in the United States may be a participant in the Alliance. Each firm must execute a Collaboration Agreement and agree to share in the costs and pay fees in a manner approved by the Agreement and the Board of Directors of the Alliance.

2. What type of legal formulation vehicle was used?
The DOE and the NGLIA entered into a Memorandum of Agreement (MOA) under the authority of, among others, the Department of Energy Organization Act (Pub. L. 95-91) section 301, 42 U.S.C. § 7151; and the Energy Reorganization Act of 1974 (Pub. L. 93-438) section 103, 42 U.S.C. § 5813.

3. What is the management structure?
Member and Board of Directors.

4. How is the program funded?
As part of the MOA, DOE notifies NGLIA when funding opportunities are announced.

5. What are the goals of the PPP and how is the outcome measured?
The SSL Program is being undertaken to research, develop, and conduct demonstration activities on advanced solid-state white lighting technologies based on inorganic and organic light emitting diodes (LEDs and OLEDs).

Vehicle Technologies

Two of the major partnerships are with the United States Advanced Battery Consortium, LLC (USABC) and the United States Automotive Materials Partnership, LLC (USAMP). Both USABC and USAMP are wholly owned subsidiaries of the United States Council for Automotive Research, LLC (USCAR).

The U.S. Council for Automotive Research was formed in 1992 by Chrysler, Ford and General Motors to provide an umbrella organization for joint, pre-competitive research to strengthen the technology base of the domestic auto industry. USCAR monitors current research projects and considers new opportunities, coordinates the industry's interaction with government researchers, shares results of joint projects with

member companies, and seeks and recommends funding from public and private sources for joint research and development.

The United States Advanced Battery Consortium

1. Who participates and how are they recruited?

The U.S. Council for Automotive Research was formed in 1992 by Chrysler, Ford and General Motors. It is composed of five divisions: the Automotive Composites Consortium, the Automotive Metals Division, the Auto/Steep Partnership, Non-Destructive Evaluation, and the Multi-Materials Vehicle Division.

2. What type of legal formulation vehicle was used?
The DOE has performed cooperative research with USABC since its inception. This continues through the current Cooperative Agreement (DE-FC26-05NT42403).

3. What is the management structure?
Steering Committee and members

4. How is the program funded?

The DOE provides 50% of the funding for the 5-year, $125M project, which is matched by industry sources.

5. What are the goals of the PPP and how is the outcome measured?
USABC sponsors the development of advanced high-performance batteries for electric and hybrid electric vehicle applications. The USABC has a number of battery development programs now in progress, focusing on low-cost, long-life, high-power technologies. Presently the USABC is pursuing the development of advanced lithium ion systems.

USAMP

The United States Advanced Materials Partnership was formed in 1993 to conduct vehicle-oriented research and development in materials and materials processing.

1. Who participates and how are they recruited?

The U.S. Council for Automotive Research was formed in 1992 by Chrysler, Ford and General Motors. The United States Advanced Materials Partnership was formed in 1993 to conduct vehicle-oriented research and development in materials and materials processing

2. What type of legal formulation vehicle was used?
The DOE has performed cooperative research with USAMP since its inception. This continues through the current Cooperative Agreement (DE-FC26-02OR22910).

3. What is the management structure?
Steering Committee and members

4. How is the program funded?
The DOE provides 50% of the funding for the 8-year, $110M project, which is matched by industry sources.

5. What are the goals of the PPP and how is the outcome measured?

The objective of the cooperative agreement is to continue the development of lightweight, high-strength materials that can improve fuel economy without compromising reliability, safety, cost-competitiveness, and recyclability. The current USAMP portfolio contains research projects on carbon fiber and other composite structures; aluminum, magnesium, and titanium alloys; and advanced high strength steel.

Weatherization Program

DOE EERE partners with state and local-level agencies to implement the Weatherization Assistance Program, awarding grants to state-level agencies which then contract with local agencies. The Weatherization program operates in all 50 states, the District of Columbia, and among Native American tribes, with approximately 53 grants awarded for conserving energy while improving health and safety in homes of low-income citizens. In FY 2009, Weatherization funding will be granted to American Samoa, Guam, Northern Marianas, Puerto Rico, and the U.S. Virgin Islands for the first time.

Approximately 900 local agencies deliver weatherization services to eligible residents. Approximately 95,000 homes were weatherized in FY 2008 by the local agencies. This number is expected to increase slightly after all FY08 reports have been received. The FY08 appropriation was $227M and reduced gas heating consumption in those homes by 32 percent and overall heating bills by an average of $413 per year. Each dollar of DOE investment in weatherization returns $2.69 in energy- and non-energy related benefits. Across the nation, the Weatherization Assistance Program generates approximately 8,000 direct jobs and decreases U.S. energy use the equivalent of 18 million barrels of oil annually.

State Energy Program

The State Energy Program (SEP) provides grants to all states, territories, the Commonwealth of Puerto Rico and the District of Columbia. The grantees develop programs that increase energy efficiency, reduce energy use and costs, develop alternative energy and renewable energy sources, promote improved environmental quality, stimulate economic development, and reduce reliance on imported oil. In FY 2008, $33M in federal funds was provided to 56 grantees. Grantees contributed another $150M in cost share and leveraged funds. Examples of projects that are completed under the SEP include Pennsylvania's "Energy Harvest Program" which awarded $5.4M to 28 recipients. The program will help generate clean and renewable energy, reduce pollution, conserve natural resources, and educate the public on the benefits of renewable energy technologies. The grants will leverage almost $14M in private investments and create or retain more than 100 jobs. Another example is the State of Kansas Facility Conservation Improvement Program which began in 2000. The program has made over $140M in energy improvements in public buildings which has reduced public utility costs by over $10M annually. The program enables public entities to use energy savings performance contracting to access financing for planning and implementing energy performance projects.

Industrial Technologies Partnerships

EERE's Industrial Technologies Program provides no-cost assessments to industrial companies to identify energy savings opportunities. Large and medium size manufacturers are recruited through direct contact by DOE, by our energy experts and Industrial Assessment Center universities, and also through various publications and other outreach mechanisms. The assessments are conducted by qualified energy experts for large facilities and by 26 university based assessment centers for medium size facilities. Energy experts are funded through purchase orders and the university based Industrial Assessment Centers are funded through grants both using with ITP program funds, and both managed and executed out of the Golden Field Office. ITP tracks the results of the assessments, both recommended energy improvements and also actual implementation data provided by the industrial partners. Approximately 250 large facilities and 300 medium sized facilities are assessed each year. Since 2006, these assessments have resulted in implemented savings of approximately 25 trillion Btu per year in energy savings and a reduction of nearly 2 million metric tons per year of carbon dioxide emissions.

Wind Program

Examples of DOE Wind Program industry partnership resulting in improved turbine designs and technology for the wind industry.

Collaboration on the GE 1.5 S-series - The Predominant American Turbine

Wind Energy Program researchers at the National Renewable Energy Laboratory (NREL) have worked with *GE Energy* and its predecessors, *Zond* and *Enron Wind*, since the early 1990s to test components such as blades, generators, and control systems on various generations of machines, largely through DOE supported testing and technology development support funding. This work led to the development of GE's 1.5-megawatt (MW) wind turbine. By the end of 2007, more then 6,500 of these turbines, generally considered the predominant American wind turbine, had been installed worldwide.

Supported Development of the Clipper Liberty Turbine – a New Benchmark

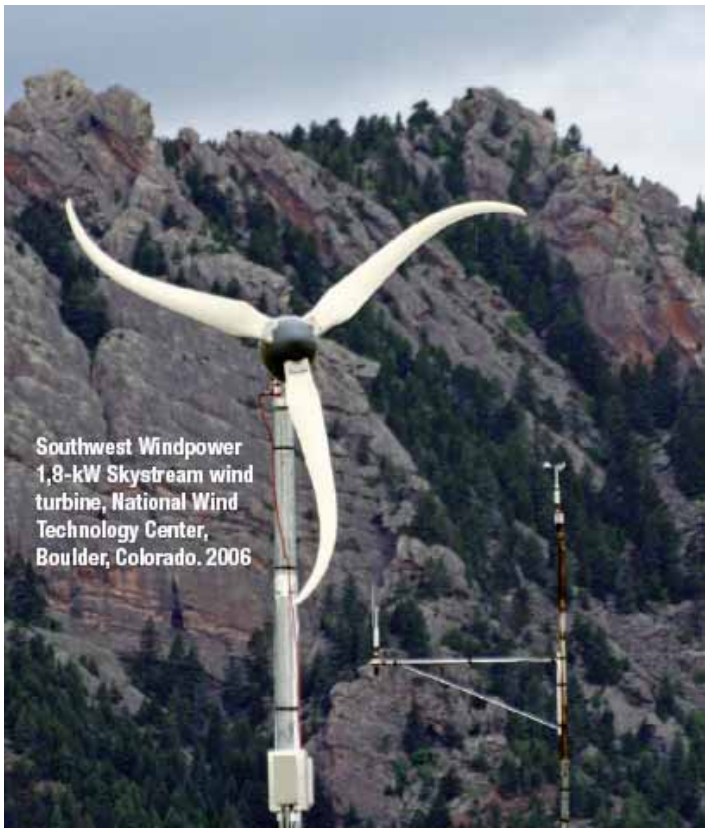
At the start of this decade, the Wind Energy Program launched an effort to develop the next generation of wind turbine technology through cost shared collaboration with industry. Thanks to its support for cutting-edge research and close partnership with industry, the *Clipper* 2.5-MW Liberty series was introduced in 2006. The Liberty turbine features a new light-weight, enlarged rotor that increases power production and a revolutionary generator design that improves reliability. Its design sets a new standard for turbine size. According to U.S. Department of Energy Secretary Samuel W. Bodman, "Clipper's Liberty Turbine is not only one of the most advanced wind turbines ever produced, it may well be the most efficient wind turbine in the world." Researchers expect this advanced design to set the benchmark for future turbines developed in the United States and in Europe.

New Facilities for a Growing U.S. Wind Market

In response to the increased industrial activity across North America and the larger blades being deployed on wind turbines, NREL began working with consortiums in Massachusetts and Texas through a Cooperative Research and Development Agreement (CRADA) to develop two new blade test facilities in FY2007. The purpose of the new facilities is to provide industry with the neutral, technical environment it needs to ensure that the new larger blades meet design and certification standards. The blade test facility in Massachusetts will be largely funded, owned and operated by the *Massachusetts Technology Collaborative* (MTC) and will be located at the Boston Autoport in Boston Harbor. The design for the new facility allows for the installation of three 80-m test stands with room for expansion. The blade test facility in Texas will be funded by a larger Texas consortium and then owned and operated by the *University of Houston*. The facility will be located in Ingleside, Texas, and its proposal includes two 70-m test stands and one 100-m test stand.

Teaming to Develop the First 'Plug-and-Play' Small Wind Turbine

The award-winning *Southwest Windpower* 1.8-kW Skystream wind turbine represents state-of-the-art technology within the small wind market. From drawing board to market, the Wind Energy Program assisted with the development and certification of this machine. The Skystream represents the first "plug and play" small wind energy system. It's easier to install, operate, and maintain and was designed as a renewable energy appliance for the residential market.



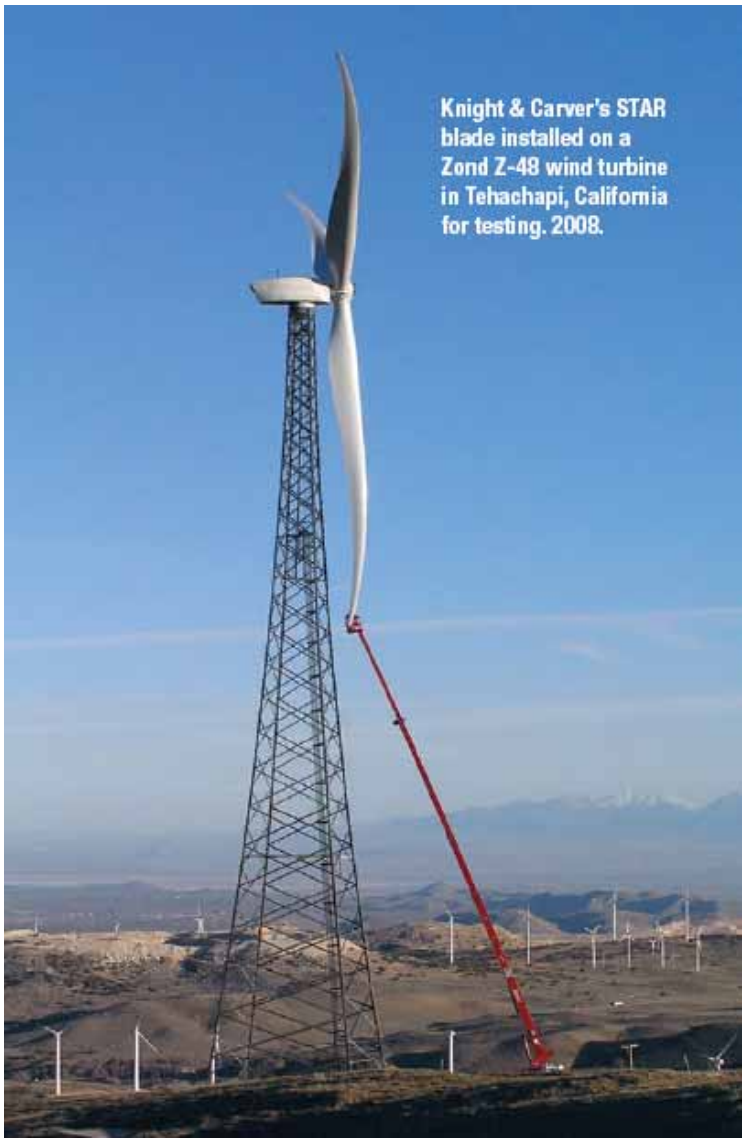
Working to Address Industries Challenges – the Gearbox Reliability Collaborative

The Wind Turbine Gearbox Reliability Collaborative (GRC) launched by the program in 2006 works to help industry identify opportunities for improving gearbox reliability through a series of partnerships, directed research, memorandums of understanding and contracts. One activity under this work is a bearing rating round robin exercise including all the major bearing manufacturers in the world. This exercise should eliminate one of the uncertainties in the wind turbine gearbox design process.

Additionally the GRC analysis team made up of the world's leading manufacturers, consultants, and experts met for the first time in July to compare their preliminary baseline predictions of gear tooth loads and bearing loads. Their analysis will help the GRC understand where design process gaps and discrepancies exist and provide a thorough examination of the value of different levels of modeling detail. When compared to test data, the analysis results will help clarify how much detail is needed to capture relevant design information. All of the meeting's participants from Europe and the United States agreed that this was a truly unique project and extremely valuable in terms of increasing the collective awareness of the unique aspects of the wind turbine gearbox design process.

Improved Component Development – STAR, The New Evolution in Blade Design

The blades of a wind turbine are the bridle that harnesses the energy of the wind. In the 1980s, the Wind Energy Program developed advanced wind turbine blade designs that produced up to 30% more electricity than previous designs and became the industry standard for nearly 20 years. Recent research at Sandia National Laboratories (SNL) and NREL on new blade designs will once again revolutionize the wind turbine market, leading to even larger, more efficient blades while reducing their weight and the loads they exert. In 2005, SNL partnered with *Knight & Carver* through a DOE funded cost shared partnership to develop the first "STAR" (Sweep Twist Adaptive Rotor) blade. This design is distinctive for its gently curved tip that maximizes performance at all wind speeds. The STAR design sets the stage for the next major evolution in wind turbine blade design.



Knight & Carver's STAR blade installed on a Zond Z-48 wind turbine in Tehachapi, California for testing. 2008.

Distributed Wind, from the Arctic to the mid west – The Northwind 100

Initially designed in partnership with DOE, NSF, and NASA the *Northern Power Systems* 2000 R&D 100 award winning Northwind 100 turbine was developed as a state-of-the-art wind turbine for operation in remote, cold-climate conditions and is fully compatible with small or "weak" electrical grids. After deploying this turbine in remote communities, primarily in Alaska, the Wind Program assisted through technical and funding support to reconfigure the turbine for agricultural and community applications in temperate climates. The company began building its new machine in 2007 and tested the prototype at the NWTC starting in early 2008. Based on this collaboration, production turbines have been installed at commercial applications in Massachusetts and Alaska in the fall of 2008, showing good potential for filling a market gap in mid-sized wind turbines.