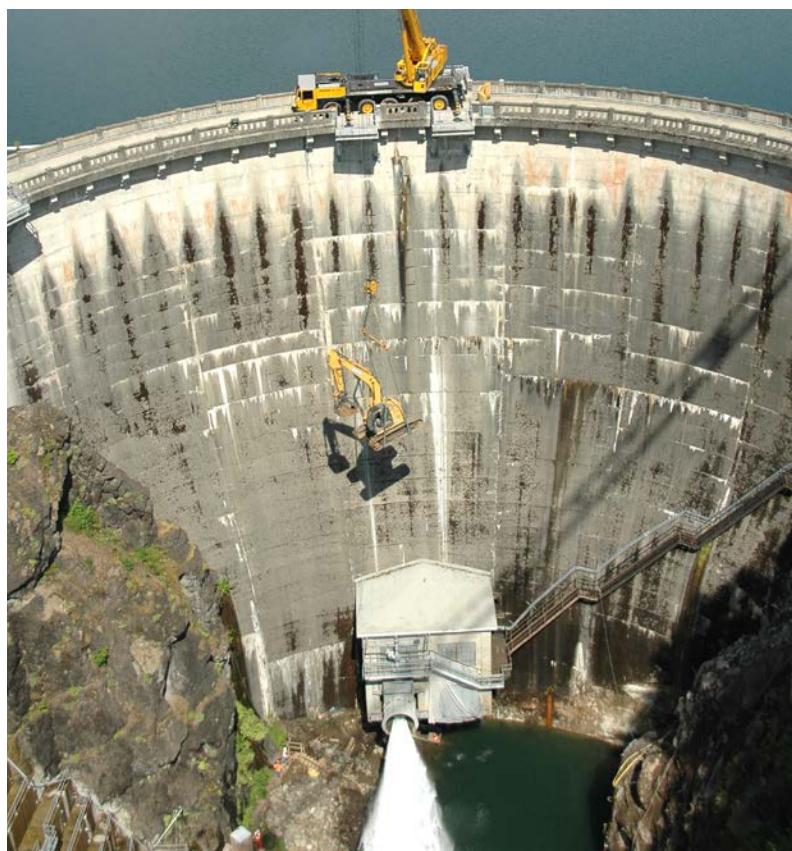


This Washington State Summary educates policymakers and the public about EERE investments and their positive impacts in Washington.

# Washington

The U.S. Department of Energy (DOE) is pursuing an all-of-the-above approach to developing every source of American energy. The Office of Energy Efficiency and Renewable Energy (EERE) leads DOE efforts to build a strong clean energy economy, a strategy that is aimed at reducing our reliance on foreign oil, saving families and businesses money, creating middle-class jobs, and reducing pollution.

This strategy will position the United States as the global leader in clean energy, increasing our nation's competitiveness. In 2012, \$268 billion was invested globally in clean energy, a 500% increase since 2004.<sup>11</sup> Trillions of dollars will be invested in the coming decades. Clean energy represents one of the most important economic development races of the 21st century. We face a stark choice—the clean energy technologies of tomorrow can be invented and manufactured in Washington and the rest of the United States for domestic use and export around the world, or we can cede global leadership and import those technologies from China, India, Germany, and elsewhere.



An EERE investment helped expand the generating capacity at Washington's Cushman Dam No. 2, while also helping reintroduce steelhead and salmon upstream of the dam. *Photo from Harbor Pacific contractors*



## Washington's Clean Energy Resources and Economy

- Clean Economy Jobs (2010): 83,600+
- Average Annual Growth Rate of Clean Economy Jobs (2003–2010): 2.8%
- Average Annual Wage of Clean Economy Jobs (\$2009): \$46,457<sup>1</sup>

With 90% of its electricity generated from hydropower and other renewable resources, Washington is a leader in U.S. clean power generation.<sup>2</sup> Its strong rivers provide the bulk of this energy—nearly 70% of the state's total electricity output.<sup>3</sup> The Grand Coulee Dam alone has a generating capacity of 6,809 megawatts, more than any other power plant in the nation.<sup>4</sup> Washington also ranked sixth in the nation in net electricity generation from wind energy in 2011, and has significant biomass resources, particularly from wood waste, to generate biopower or biofuel.<sup>5</sup>

Washington is striving to improve its already impressive renewable energy sector and energy efficiency efforts through a renewable portfolio standard that requires large electric utilities to obtain 15% of their electricity from new renewable resources by 2020;<sup>6</sup> utilities can count gains achieved by increasing the efficiency of existing hydroelectric plants.<sup>7</sup> The standard challenges utilities to improve pursue cost-effective energy conservation measures,<sup>8</sup> such that utilities are offering rebates to households and businesses that upgrade to energy-efficient buildings and equipment.<sup>9</sup>

The wealth of clean energy resources has enabled Washington's leadership in clean economic development—with 14,570 new clean jobs added to the economy from 2003 through 2010. Total clean economy jobs in Washington numbered 83,676 in 2010. Renewable energy services, remediation, and battery technologies were among the fastest growing segments of Washington's clean economy from 2003 through 2010.<sup>10</sup>

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



## EERE and Washington

EERE helps create Washington's clean energy economy today, developing and delivering innovative, market-driven solutions for the following:

- **Sustainable transportation** – making transportation cleaner and more efficient through solutions that put electric drive vehicles on the road and replace oil with clean domestic fuels
- **Renewable electricity generation** – reducing the cost of renewable energy through solutions that squeeze more usable power from sustainable resources and improve the economics of manufacturing and installation
- **Energy-saving homes, buildings, and manufacturing** – developing cost-effective energy-saving solutions that help make our country run better through increased efficiency—promoting better plants, manufacturing processes, and products; more efficient new homes and improved older homes; and other solutions to enhance the buildings in which we work, shop, and lead our everyday lives.

## EERE Investments in Washington

EERE invests in Washington through a broad range of clean energy projects, from energy efficiency to wind, vehicles, biofuels, and other technologies including through projects with the Pacific Northwest National Laboratory (PNNL). EERE supports cities, communities, and families to develop innovative, cost-effective energy solutions through the research, demonstration, and deployment activities we conduct with Washington and its businesses, universities, nonprofits, and local governments.



Pacific Northwest National Laboratory, in Richland, Washington, works with EERE to bring clean energy solutions to the United States. The lab's efforts are helping to develop new energy-efficient technologies that are creating jobs and protecting the environment.  
*Photo from PNNL*

## Sustainable Transportation



### PNNL and ADM Partnership Leads to Commercial Production of Renewable Propylene Glycol



Richland, Washington  
EERE investment: \$2.5M

EERE funding enabled **PNNL** and **Archer Daniels Midland Company** (ADM) to develop and commercialize a new process for catalytically producing propylene glycol—the foundation for a wide variety of commercial and household products—from renewable sources. To date, commercial production of propylene glycol has been petroleum-derived, but it may also be made from glycerol, a by-product of conventional biodiesel production (e.g., made from vegetable oils, waste fats, and grease). The new process, which is cost-competitive with petroleum-derived products and highly selective for propylene glycol (90% efficient), was recognized by the *Wall Street Journal*, and PNNL and ADM were selected as runners up in 2012 Technology Innovation Awards. Renewable propylene glycol created from this process was also recognized, earning the U.S. Department of Agriculture Certified Biobased Product Label, which indicates that a product is 100% biobased. Since then, KOST USA and ADM have developed BioChill® Heat Transfer Fluids, a product line using renewable propylene glycol.

### Refining Bio-Oil Alongside Petroleum



Richland, Washington  
EERE Investment: \$3.5M

**W.R. Grace**, a leading provider of refining technologies, and **PNNL** are co-leading an effort to accelerate the development of technologies that enable the processing of bio-oils in petroleum refineries. The ability to leverage existing petroleum-refining infrastructure to produce “drop-in” biofuels (biofuels that can substitute freely for gasoline and conventional diesel fuel) brings significant potential for reducing the cost of biofuels. The goal of the project is to establish a viable bio-oil refining process that can be implemented using existing infrastructure.<sup>12</sup>



## Working with Pacific Northwest National Laboratory



Richland, Washington

EERE works closely with Washington's Pacific Northwest National Laboratory (PNNL) to develop and deploy energy-efficient technologies in the United States. PNNL's work is streamlining processes and moving the nation forward by creating practical, sustainable energy solutions.

### PNNL Advances Lightweight Components, Electric Vehicle Technologies, and More

With \$9.9M support from EERE, PNNL researchers are developing several advanced vehicle technologies, including lightweight materials, energy storage components, standards for electric vehicles, new manufacturing techniques for electric motors, models for advanced combustion processes, and emissions after-treatment systems. PNNL is currently working to validate computer models that describe certain properties of carbon fiber composite materials. These models will help manufacturers expand the use of lightweight composite materials, which can boost the fuel economy of cars and trucks while maintaining and improving safety and performance.<sup>13</sup> Specifically, replacing cast iron and traditional steel components—including advanced high-strength steel, magnesium, aluminum, and carbon fiber composites—with lightweight materials allows vehicle manufacturers to include additional safety devices, integrated electronic systems, and emissions control equipment on vehicles without increasing their weight.

### PNNL Advances Hydrogen-Fueled Vehicles Technology

Through multiple projects, PNNL is improving the performance and decreasing the cost of hydrogen fuel production and fuel cell technologies. PNNL's research is developing new materials—like a durable, high-performance cathode support—and is improving the manufacturing processes by using a “drop-on-demand” process to produce membrane electrode assemblies, the heart of the fuel cell. PNNL research is also on hydrogen fuel processing, including producing hydrogen fuel from biomass. PNNL is also advancing hydrogen and fuel cell applications—for example, through developing smaller, lighter, higher-capacity hydrogen storage systems for fuel cell electric vehicles; developing fuel cell auxiliary power systems for commercial aircraft; and designing fuel cell systems that will produce combined heat and power in industrial settings. Finally, as the leader of the Hydrogen Safety Panel, PNNL provides hydrogen emergency response training for first responders. Training materials PNNL developed have reached more than 23,000 code officials and first responders.

### PNNL Works to Bring Bio-Oil to the Marketplace

Through work on several fronts, PNNL is also helping move bio-oil into the transportation and heating fuels market. Bio-oil is produced from biomass via a process called fast pyrolysis, and it can be further processed into biofuels that have the potential to replace petroleum fuels. PNNL's work to define the characteristics of bio-oil and develop bio-oil standards has helped address barriers to market, such as storage conditions, longevity, and transportation logistics, as well as environmental, health, and safety concerns. This work has helped to advance and facilitate cost-effective and safe transportation and storage of bio-oils.<sup>14</sup> An additional effort includes leading the International Energy Agency working group for pyrolysis of biomass, which developed standards by which bio-oil properties are measured and defined. Thanks in part to PNNL's efforts, the American Society for Testing and Materials established its first bio-oil standard, The Chemical Abstracts Service, a division of the American Chemical Society, also recognizes the resulting definition of bio-oil—a significant step in the marketplace for bio-oil.

### Competition Provides Students with Real-World Engineering Experience



Seattle, Washington

EERE investment: About \$1M for the entire EcoCAR 2 initiative

A **University of Washington** team participates in EcoCAR 2, EERE's latest advanced vehicle competition. Undergraduate and graduate students with backgrounds in engineering, business, and information technology are competing with 15 other universities across North America in a three-year engineering competition to construct and demonstrate vehicles that reduce fuel consumption, greenhouse gas emissions, and other harmful emissions relative to conventional gasoline vehicles, while still maintaining consumer acceptance in the areas of performance, utility, and safety. The teams must also develop business, marketing, and education strategies for their vehicles. Students will gain hands-on experience designing and building these advanced vehicles. They use the same hardware and software tools as professional vehicle manufacturing engineers and receive expert guidance and mentoring from the competition's 30 national sponsors. The sponsors also provide students with access to components and systems that might otherwise be unavailable or too expensive. Since EERE-supported advanced vehicle competitions began in 1988, more than 16,500 students have graduated and gone on to work in the automotive industry all over the world.



PNNL researchers are helping to advance hydrogen-powered vehicle technology through a variety of EERE-funded projects and applications. *Photo from PNNL*

## Alternative Fuel Vehicle and Infrastructure Expansion Improves Energy Security



Puget Sound area, headquartered in Seattle  
EERE investment: \$14M

EERE funding, in concert with \$22.3 million from project partners, has helped support the **Puget Sound Clean Cities Petroleum Reduction Project** that the Puget Sound Clean Air Agency heads. The project is deploying more than 200 alternative fuel and charging stations, as well as supporting the deployment of more than 600 alternative fuel vehicles, including electric drive, propane, and natural gas vehicles. The project will help install charging stations for plug-in electric vehicles, train drivers to use their vehicles more efficiently, and provide access to alternative fuels for fleets; it is estimated to reduce fuel consumption by the equivalent of more than 3 million U.S. gallons of gasoline per year. The activities also support the local economy by helping small taxi fleets adopt affordable alternative fuel vehicles.

## Washington State Ferries Run Cleaner with Biodiesel



Olympia, Washington  
EERE investment: \$165K

**Washington State Ferries**, owned and operated by the Washington State Department of Transportation, is the largest ferry service in the United States and the third largest in the world. Thanks in part to an American Recovery and Reinvestment Act of 2009 (ARRA) investment from EERE, the ferries now run on a blended biodiesel fuel that will prevent more than 29,000 metric tons of carbon dioxide from being emitted into the environment each year, which is the equivalent of taking more than 6,000 passenger vehicles off the road. Each year, 22 ferries transport 11 million passengers across Puget Sound—consuming 18 million gallons of fuel in the process.<sup>15</sup> EERE's investment paid for a blending system that combines biodiesel with conventional petroleum-based diesel.



Washington State Ferries is reducing greenhouse gas emissions by fueling up with a biodiesel blend. *Photo from iStock 14793954*



## Renewable Electricity Generation



### Establishing a Testing Center for Tidal Energy Technologies in the Pacific Northwest



University of Washington  
EERE investment: \$10.7M

The **University of Washington** (UW) is researching tidal energy at the Northwest National Marine Renewable Energy Center, which EERE established in partnership with UW and Oregon State University as one of three National Marine Renewable Energy Centers. Tidal energy can be harnessed wherever changing tides move a significant volume of water, including off the coasts of many U.S. cities where there is high electricity demand; once built, tidal power installations emit no greenhouse gases or other pollutants. These installations also have low operation and maintenance costs, because their fuel—seawater—is free. Researchers are evaluating turbine designs and potential ecosystem effects via mathematical modeling, as well as by testing reduced-scale turbines in laboratory flumes. Turbines are also tested in Puget Sound, which provides a useful natural “laboratory” for studying tidal energy. UW is also developing methods to measure tidal velocity, ambient noise, biological activity, and other properties of potential tidal energy sites. This research will help UW both maximize the energy extracted by tidal power installations and understand the potential impact of tidal power development on the marine ecosystem.

### Columbia Power Technologies, Inc. Deploys Its Direct Drive Wave Energy Buoy



Seattle, Washington  
EERE investment: \$2.9M

In preparation for a full-scale bay/ocean demonstration and with EERE support, **Columbia Power Technologies, Inc.** (CPT) deployed an intermediate-scale wave energy converter to demonstrate and validate its Direct Drive Wave Energy Buoy technology, which extracts energy from passing waves. The testing in Puget Sound is now complete, and data and design analyses are currently underway, as are substantial design modifications for CPT’s next-generation wave energy buoy. All of these activities are helping to advance the prototype to commercial readiness. CPT and other project participants contributed \$2.9 million to this project.

### Hydropower Generators to Deliver New Energy from an Old Dam



Tacoma, Washington  
EERE investment: \$4.67M

The **City of Tacoma**, with EERE support, is installing two Francis turbine/generator units to an existing dam, Cushman No. 2, which is part of the Cushman Hydroelectric Project owned by Tacoma Power. The new generating units will add approximately 3.6 megawatts in generating capacity by using currently diverted, but unutilized water flow. This expanded capacity is expected to produce more than 23,000 megawatt hours of electricity annually—enough to power approximately 2,000 homes. The project will also develop an innovative fish collection and passage system that will reintroduce Washington’s endangered steelhead and salmon populations upstream of the Cushman Hydroelectric Project for the first time since the dams were constructed in the late 1920s. The City of Tacoma and other project participants are contributing \$18.9 million to this project.

### DNV Renewables to Help Train Wind Energy Professionals



Seattle, Washington  
EERE investment: \$270K

**DNV Renewables**, with funding from EERE, is developing curricula for six 2–3-day courses designed to familiarize professionals transitioning into the wind industry—from elsewhere in the energy sector or from other fields, such as engineering or finance—with a wide range of wind industry topics. DNV has already developed draft curricula for all six topics and is in the process of developing guidelines on how to present the material. The planned short courses include Introduction to Wind Energy, Wind Resource and Energy Assessment, Turbine Operation and Components, Turbine Integration and Installation, Project Feasibility, and Project Economics. This series of courses addresses all aspects of developing a wind project, providing an effective foundation of directly applicable knowledge for professionals joining the U.S. wind industry.



Washington boasts substantial wind power generating capacity, ranking sixth in the nation in net electricity generation from wind energy in 2011. *Photo from Energy Northwest, NREL 12308*



## Power through Policy: Helping Policymakers Evaluate Distributed Wind Options



Vashon Island, Washington  
EERE investment: \$133K

With EERE support, **eFormative Options** is helping policymakers, utilities, advocates, and consumers evaluate the effectiveness of policies that promote distributed wind—wind turbines installed at homes, farms, and businesses. Distributed wind allows Americans to generate their own clean electricity, cutting energy bills, while preventing greenhouse gas emissions. Incorporating a customized feed from the Database of State Incentives for Renewables and Efficiency, eFormative Options created a Web-based Distributed Wind Policy Comparison Tool (Policy Tool). The Policy Tool helps state, local, and utility officials understand the financial impacts of different policy options aimed at reducing the cost of distributed wind technologies. The Policy Tool can be used to evaluate the ways that federal and state policies and incentives impact the economics of distributed wind. eFormative Options and other project participants contributed \$37,000 to this project.

## Energy-Saving Homes, Buildings, and Manufacturing



## RePower's Energy Dashboard Spurs Change on Bainbridge Island



Bainbridge Island, Washington  
EERE investment: \$4.9M

EERE has provided \$4.9 million to **Conservation Services Group (CSG)** to develop RePower, a community-wide initiative to increase the energy efficiency of homes in Bainbridge Island, Washington. RePower Bainbridge is using energy assessments, cash-back incentives, energy-efficiency financing, a network of skilled local contractors, and innovative marketing efforts to reach its goal of upgrading 2,000 homes and creating 65 new jobs. RePower Bainbridge has also developed an Island Energy Dashboard that displays how electricity loads fluctuate throughout the day. This dashboard helps residents not only understand what causes energy peaks, but also recognize how to mitigate them where possible. With these collective efforts, island residents are seeing results. One Bainbridge Island homeowner and RePower Bainbridge participant saw a heating bill reduction of 50%—with overall energy costs dropping 35%. As of summer 2012, the program has completed 430 total residential energy upgrades. CSG has since expanded its program to the cities of Bremerton and Kitsap under the RePower brand.<sup>16</sup>

## Community Power Works is Building a More Efficient Seattle



Seattle, Washington  
EERE investment: \$20M

The **City of Seattle** partnered with EERE and several community organizations to meet its energy efficiency and carbon reduction goals. Seattle and its program partners created Community Power Works (CPW) to provide a comprehensive energy efficiency program that combines outreach, financing, and incentives. CPW helps existing residential, commercial, and institutional buildings across the city lower their energy use by 15%–45% and reduce their greenhouse gas emissions. Seattle partnered with Craft3, a community development financial institution, to allow Seattle residents to finance efficiency improvements through monthly Seattle City Light electric billing. In addition, the city formed a partnership with Puget Sound Cooperative Credit Union to offer residential energy efficiency loans. Seattle has committed roughly \$1.9 million into a revolving loan fund and an additional \$1 million into a loan loss reserve for the residential sector. These funds will allow for more loans to be available at lower interest rates than would otherwise have been the case—resulting in more energy and cost savings for the community.

## Washington State Energy Efficiency Appliance Rebate Program (SEEARP) Spurs Local Economy, Promotes State-Wide Partnership



Statewide  
EERE investment: \$6.2M

As part of EERE's ARRA funding, the **State of Washington** implemented a residential appliance rebate program. The program aimed to save the greatest amount of energy possible, spur economic activity, promote energy-efficient options in the appliance market, and complement existing rebate programs from utilities in the state. Rebates ranging from \$75 to \$750 were offered for ENERGY STAR® qualified clothes washers, refrigerators, dishwashers, ductless air source heat pumps, and water heaters. Between March and November of 2010, more than 41,000 rebates were paid to Washington residents. Sales of ENERGY STAR® clothes washers and dishwashers from the program will save more than 161 million gallons of water. Annual energy savings generated from Washington's SEEARP program totaled 35 billion British thermal units—enough energy to power the Washington State Legislative Building for three years. Retailers and utilities contributed \$937,000 to this program.



## Working with Pacific Northwest National Laboratory

### RTU Advanced Controls Could Mean Significant Savings in Richland, Seattle, and Tacoma



Richland, Seattle, and Tacoma, Washington  
EERE investment: \$400K

**Pacific Northwest National Laboratory** (PNNL), with funding from EERE, evaluated an advanced control package for heating, ventilation, and air conditioning (HVAC) equipment. Packaged air-conditioners and heat pumps serve more than 60% of the commercial building floor space in the United States, contributing to about 230 trillion British thermal units of energy consumption annually. Even a small increase in operational efficiency of these units can lead to significant reductions in energy use and carbon emissions. The control package evaluated by PNNL, when retrofitted into an existing unit, was projected to produce energy savings of up to 35% and cost savings of up to 38%, according to detailed simulation analysis.

PNNL then identified a manufacturing partner, Transformative Wave Technologies (TWT) in Kent, Washington. In 2012, PNNL, together with TWT, the Bonneville Power Administration, and Commercial Building Energy Alliance Members, retrofitted over 120 rooftop units using the advanced controller. Preliminary field testing results indicate the savings match the estimates based on simulations. If one-half of packaged HVAC units in the United States are retrofitted with the modified control package option, it will result in annual savings of approximately 55 trillion British thermal units (assuming a 30% savings). The energy savings are equivalent to removing more than 16 200-megawatt power plants. Bonneville Power Administration contributed \$250,000 to this project, and TWT contributed \$50,000.<sup>17</sup>

### EERE Delivers Technical Assistance on High-Performance New Home Prototypes in Seattle



Seattle, Washington  
EERE investment: \$400K

PNNL partnered with **Washington State University Energy Program**, **Habitat for Humanity** (HfH) of Seattle/South King County, and the **King County Housing Authority** to investigate cost-effective ways to decrease energy bills for low-income families in Western Washington. This effort consisted of two studies: The first study evaluated energy efficiency measures in 23 homes recently constructed by HfH. The study suggested efficiency improvements to be included in future HfH home designs, such as rigid foam board insulation, ductless heat pumps, and heat pump water heaters.

The second study investigated the cost effectiveness of retrofitting homes built under older building codes to the standards of the International Energy Conservation Code 2012 and ENERGY STAR®. This study emphasized the importance of constructing high efficiency housing from the beginning, as it is much more expensive to retrofit a home than to build it right the first time. Results from these analyses can help HfH continue to decrease utility bills in new, high performance Habitat Homes—important, since low-income homeowners typically pay as much as 50% of their monthly income for utilities.

### Community Scale Evaluations Improve Homes' Efficiency at the Joint Fort Lewis/McChord Air Force Base



Joint Fort Lewis/McChord Air Force Base  
EERE investment: \$250K

Since 2005, the **Washington State University** (WSU) Energy Program has been working with Equity Residential, the developer on the Joint Fort Lewis/McChord Air Force Base (JBLM) near Tacoma, Washington, to improve the livability, durability, and energy efficiency of housing on the base. This partnership has led to the construction of more than 600 high-efficiency housing units, and WSU Energy Program is providing technical assistance to ongoing projects totaling almost 900 additional units. In 2011, PNNL partnered with the WSU Energy Program to evaluate and document energy savings from efficiency measures at these construction projects, assess the energy performance of existing housing, and make recommendations for improvements. This research program has revealed opportunities to achieve significant energy savings in residential communities. Two communities have realized benchmark savings of approximately 40% and 50%, respectively, where the communities have implemented tankless gas water heaters and improvements to lighting and ventilation systems. If Equity Residential moves forward with a retrofit program based on the recommendations of this study, dramatic energy savings could be achieved in the more than 3,000 housing units at JBLM that were built prior to 2005.<sup>18</sup>

### EERE Brings Deep Energy Retrofits in Oregon and Washington



Richland, Dayton, and Seattle, Washington;  
and other locations across the nation.

EERE investment: \$200K

Over the last two years, **PNNL** has worked with **Florida Solar Energy Center**, **Oak Ridge National Laboratory**, and many local retrofit contractors to retrofit 33 homes across the nation—with estimated site energy savings from 30% to greater than 50%. PNNL assessed seven such homes in Oregon and Washington to determine savings realized and to investigate why achieved savings may differ from modeled predictions. These homes have, on average, been outperforming modeled savings predictions and are realizing savings from 42%–67% annually. An analysis of the data obtained through this research program will help to identify effective strategies to achieve cost-effective, deep energy upgrades that achieve 50% energy savings in different climate zones.



## Nucor Steel to Put Waste Heat to Work with Help from EERE



Seattle, Washington

**Nucor Steel Seattle** processes scrap steel to make reinforcing bars for the construction industry. Nucor's goal is to make its Seattle facility the 'greenest' steel mill in the world. To help Nucor achieve this goal, the EERE-supported Northwest Clean Energy Application Center provided a technical third party analysis and verification of Nucor's 2.8-megawatt waste-heat-to-power, system. Once complete, this system will generate at least \$645,000 in annual power cost savings.

## The Navy Realizes Significant Energy Savings by Deploying EERE Expertise



Keyport, Washington

The **Naval Undersea Warfare Center** (NUWC) partnered with **Trane Inc.** to utilize DOE's energy savings performance contract (ESPC). ESPCs are contracts that allow federal agencies to accomplish energy-savings projects without up-front capital costs. EERE's Federal Energy Management Program provides technical assistance and training for federal agencies implementing ESPCs. The NUWC-ESPC project included installing geothermal heat pumps, high-efficiency HVAC and building systems; improved energy management controls; and repairing two significant underground water leaks. Since the completion of this project in the fall of 2011, NUWC has demonstrated an annual energy savings of more than 30%. The project will save the center 69 billion British thermal units per year—enough to power 726 homes—and will significantly reduce NUWC's carbon footprint. This project leveraged \$14.7 million in private investment.

## Deploying Clean Energy Solutions in Washington Communities

EERE invests in the deployment of energy efficiency and renewable energy projects in communities across Washington. These investments catalyze economic development, create jobs, generate clean energy, and reduce utility bills. Many of these investments have been through American Recovery and Reinvestment Act (ARRA) funds. Of the more than \$193 million in ARRA funds allocated to the State of Washington specifically for deployment projects, more than 95% has been spent as of January 2013 through the Energy Efficiency and Conservation Block Grant Program, State Energy Program, and Weatherization Assistance Program.

## Building Clean Energy Infrastructure

With financial and technical support from EERE, energy officials at the state level and in 69 communities have selected and overseen the completion of hundreds of projects that are delivering the benefits of clean energy to citizens throughout Washington. EERE allocated more than \$126 million in ARRA funds to support activities that

- Contributed to increased energy efficiency and cost savings for more than 15,500 buildings (more than 30 million square feet) through building retrofits
- Installed more than 40 renewable energy systems, with more than 2,600 kilowatts in total generating capacity, including wind, solar, and geothermal energy systems
- Funded more than 300 workshops teaching approximately 28,000 people to perform energy audits and install renewable energy systems
- Installed approximately 7,000 energy-efficient streetlights and more than 3,000 energy-efficient traffic signals.

## Weatherizing Homes for Lower Income Families

Washington has spent 100% of approximately \$66 million in ARRA funds it received to weatherize more than 17,000 homes, surpassing its goal. Statewide, this has resulted in annual energy savings of more than 500 billion British thermal units, and has averted nearly 45,000 metric tons of carbon pollution to date—the equivalent of taking more than 9,300 passenger vehicles off the road for a year. These projects have enabled income-eligible families to save hundreds of dollars per year on heating and cooling bills by improving their homes' energy efficiency, as well as the health and safety of home environments.<sup>19</sup>

## Deployment Project Examples in Washington Communities

### Mill Waste Powers Small Business Growth in Colville



Colville, Washington  
EERE investment: \$771K

Leveraging this investment, the owners of **Borgford BioEnergy**, a small business in the City of Colville, outfitted their newly purchased lumber mill with an innovative combined heat and power (CHP) system. The CHP system generates heat and electricity by "cooking" mill waste, such as sawdust and lumber chips, into biochar—a form of charcoal that has numerous agricultural uses. The CHP system produces more than enough heat and electricity to power the mill's operations; surplus electricity is sold to a local utility through the area's power grid. The system is expected to produce enough power to support approximately 3,500 households in Stevens County, Washington.<sup>20</sup>



## Bellingham Opportunity Council Helps Build Stronger, Healthier Homes



Whatcom Island and San Juan, Washington  
EERE investment: \$2.3M

The **Opportunity Council in Bellingham**—a nonprofit agency serving the counties of Whatcom Island and San Juan—used this investment to weatherize 800 units in its service area, more than double its original goal. These efforts created local jobs by hiring private contractors and stimulated the economy with local purchases of equipment. In addition to weatherizing homes, the Opportunity Council performed “healthy home” audits that identified issues such as mold, allergens, vermin, and excess humidity. The National Association for State Community Services Programs, inspired by the Council’s integrated approach to weatherization and home health, initiated a nationwide Weatherization Plus Health project, also with cooperation from EERE. The partnerships and strategies employed by the Council are considered best practices by community organizations nationwide.

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# A Proven Track Record

## Snapshot of National Outcomes from EERE Investments

### EERE's Return on Investment for Clean Energy Technologies

- EERE's \$931 million investment in vehicles combustion engine R&D from 1986 to 2007 achieved a net benefit of \$69 billion (2008 dollars) in fuel savings for users of heavy-duty diesel trucks.<sup>22</sup>
- EERE's \$3.7 billion investment in solar photovoltaic R&D from 1975 to 2008 resulted in a net economic benefit of \$15 billion (2008 dollars) due to module efficiency and reliability improvements.<sup>23</sup>
- EERE's \$1.7 billion investment in wind energy R&D from 1976 to 2008 resulted in a net economic benefit of \$8.7 billion (2008 dollars) due to wind turbine efficiency, energy capture, and reliability improvements.<sup>24</sup>
- A 2001 National Academy of Sciences analysis found that investments of \$1.6 billion in energy efficiency R&D in the first two decades of DOE's existence from 1978 to 2000 realized a net economic benefit of approximately \$30 billion (1999 dollars).<sup>25</sup>

### Sustainable Transportation

- EERE research has helped reduce production costs of automotive lithium-ion batteries by more than 50% since 2008 and is on track to reach its goal of enabling cost-competitive market entry of plug-in hybrid electric vehicles within the next 10 years.
- EERE's activities to achieve cost-competitiveness for biofuels have resulted in the recent achievement of reaching a modeled cellulosic ethanol production cost of \$2.15 per gallon of ethanol (or \$3.27 per gallon of gasoline equivalent).
- EERE's efforts have reduced the projected costs of automotive fuel cells (assuming high-volume manufacturing) by more than 35% since 2008 and 80% since 2002—doubling the durability of fuel cells from 950 hours of demonstrated operation in 2006 to more than 2,500 hours of operation on the road.<sup>26</sup>

### Renewable Electricity Generation

- Without EERE involvement, the average solar photovoltaic (PV) module production cost per watt would have been \$5.27 in 2008, rather than \$1.92. EERE has accelerated solar industry progress by an estimated 12 years.<sup>27</sup>
- Without EERE involvement, cumulative wind power deployment through 2008 would have been less than a third of actual 2008 levels. EERE has accelerated the overall progress of the wind industry by an estimated 6 years.<sup>28</sup>

### Energy-Saving Homes, Buildings, and Manufacturing

- More than 6,200,000 homes have been weatherized with EERE funding provided to states or leveraged from other sources with EERE support since 1976—creating an average energy savings of \$350 or more per year and avoiding \$1.6 billion in energy costs during winter 2005 alone for all households weatherized.<sup>29</sup>
- Due to EERE appliance standards implemented through 2012, a typical household today already saves about \$180 per year off its utility bills. Households can expect to save more than \$300 per year by 2030, as they replace their existing appliances with newer models that use less energy—a cumulative savings to consumers of more than \$900 billion by 2020, and more than \$1.6 trillion through 2030. The cumulative energy savings of these standards phased in through 2012 will be about 70 quadrillion British thermal units (quads) of energy through 2020, and will amount to 120 quads through 2030. (The United States consumes a total of about 100 quads of energy per year.)<sup>30</sup>
- EERE and its partners in the manufacturing sector have successfully launched 220 new, energy-efficient technologies, received 78 R&D 100 Awards, and delivered technical assistance to more than 33,000 industrial plants.<sup>31</sup>
- Since 2005, EERE has facilitated \$3.1 billion of efficiency investments in federal government facilities from performance-based contracts, which will result in energy cost savings of approximately \$8.5 billion over the life of the energy-saving measures. The savings on utility bills and operation and maintenance created through the facility upgrades will be used to pay for the project over the term of the contract, and the agencies will continue to save money and energy after the contract term has ended.<sup>32</sup>

The Office of Energy Efficiency and Renewable Energy is at the center of creating the clean energy economy today. We lead U.S. Department of Energy efforts to develop and deliver market-driven solutions for renewable electricity generation; sustainable transportation; and energy saving homes, buildings, and manufacturing. To learn more about the activities of the Office of Energy Efficiency and Renewable Energy, visit [eere.energy.gov](http://eere.energy.gov). If you have questions or comments about the information in this document, please contact us at [EE.Communications@ee.doe.gov](mailto:EE.Communications@ee.doe.gov).