



**RENEWABLE ENERGY  
PROGRAM MANAGER**

*Bill Haman, P.E.*

# RENEWABLE ENERGY

## PROGRAM OVERVIEW

Iowa is one of the nation's leaders in its policymaking and investment in renewable energy. Iowa is the top producer of ethanol and biodiesel liquid fuels and ranks third nationally in wind energy installed capacity. Solar energy, not previously adopted broadly by Iowans, has benefited from recent steep price declines coupled with lucrative tax incentives and is now one of the fastest growing energy generation sectors in the state. Thousands of manufacturing and construction jobs related to those renewable energy technologies have helped Iowa maintain a strong economy throughout the recent economic downturn. The Iowa Energy Center continues to invest in renewable energy research that offers advancements to wind and solar energy technologies and their operations.

## ECONOMIC DEVELOPMENT

The Iowa Energy Center is:

- Leading an effort with the Iowa Economic Development Authority and the Iowa Innovation Corporation to promote Iowa participation in the Clean Energy Challenge, a regional business plan competition that encourages energy entrepreneurship and provides exposure to technology investors.
- Building relationships with federal sponsors to promote Iowa renewable energy innovation.
- Actively seeking funding opportunities for Iowa and facilitating partnerships to capture new investment in the state.
- Spurring innovation through its grant programs that help Iowa colleges, universities, and nonprofits secure sustainable funding from federal agencies and other external sources.

## ABOUT THE ALTERNATE ENERGY REVOLVING LOAN PROGRAM (AERLP)

The Iowa Energy Center's Alternate Energy Revolving Loan Program (AERLP) was created by the Iowa legislature in 1996 to promote the development of renewable energy production facilities in the state. Through this program successful applicants receive a low-interest loan that consists of a combination of AERLP and lender-provider funds. The AERLP provides up to 50% of the total loan, up to a maximum of \$1 million with a maximum term of 20 years. The lender manages the entire loan and arranges repayment of the AERLP share to the Energy Center, which is then revolved back into the program and made available to new applicants.

By 2010 the Iowa legislature had provided a total of \$15.9 million to the AERLP through a combination of appropriations and a one-time assessment on Iowa's investor-owned utilities. Since these funds continually revolve back into the program as loans are repaid, the AERLP has supported the development of hundreds of alternate energy production facilities throughout the state including wind, solar, biomass, biofuel, and hydroelectric installations.

Over the past 18 years, the AERLP has received 550 loan applications that have led to 263 total projects generating an excess of 2 million megawatt-hours annually. A total of \$33.3 million in AERLP loans through FY 2014 have been leveraged against nearly \$230 million of other capital investment.

This fiscal year the Energy Center funded primarily solar energy projects and a few wind energy projects, totaling 51 new projects with an estimated annual generation of 3,221 MWh, for a total of \$3,565,580 in AERLP loans made.

### ALTERNATE ENERGY REVOLVING LOAN PROJECTS

Technology	ANNUAL TOTAL FROM FY 2014		TOTAL SINCE 1996	
	Annual Projects	Annual Energy (MWh)	Total Projects	Total Annual Energy (MWh)
<b>SOLAR</b>	48	2,803	74	3,765
<b>LARGE WIND<sup>2</sup></b>	1	324	114	317,388
<b>SMALL WIND<sup>2</sup></b>	2	94	47	1,481
<b>BIOMASS<sup>1</sup></b>	-	-	22	1,748,922
<b>HYBRID<sup>3</sup></b>	-	-	5	108
<b>HYDRO</b>	-	-	1	2,863
<b>TOTAL</b>	<b>51</b>	<b>3,221</b>	<b>263</b>	<b>2,074,527</b>

<sup>1</sup>Includes the electrical equivalent of projects producing fuels such as ethanol, biodiesel and wood.

<sup>2</sup>Small Wind = 20 kW nameplate rating or less; Large Wind = more than 20 kW nameplate rating.

<sup>3</sup>Includes a combination of solar, hydro, small wind, large wind or biomass.

### ALTERNATE ENERGY REVOLVING LOAN PROGRAM EXPENDITURES

	FY 2014	SINCE 1996
<b>AERLP LOANS MADE</b>	\$3,565,580	\$33,300,549
<b>LEVERAGED RESOURCES</b>	\$3,783,462	\$229,547,114
<b>CONSTRUCTED PROJECT COSTS</b>	\$7,349,042	\$262,847,663

## IMPACT AWARD RECIPIENT RENEWABLE ENERGY

Hui Hu and Anupam Sharma, Aerospace Engineering,  
Iowa State University

### INNOVATIVE DESIGN TO IMPROVE WIND POWER EFFICIENCY

Professor Hui Hu and Assistant Professor Anupam Sharma of Iowa State University received a 2014 Iowa Energy Center Impact Award for their center-funded project to design an innovative dual-rotor wind turbine that will improve turbine performance and wind farm efficiency. Their novel concept of adding a second, smaller, aerodynamically optimized rotor can help an individual turbine capture more of the wind's energy that would otherwise be lost near the main rotor's hub. In addition, the added blades promote rapid mixing of air streams in the turbine's wake, disrupting wake fields that would reduce the productivity of downwind turbines.



We look at all the wind turbines on the wind farm; there are hundreds of wind turbines. We look at all the wake interference, which can cause up to 40-50% energy loss for the downstream wind turbines. So with this dual-rotor concept we can actually reduce that wake interference loss and improve downstream wind turbines by 15%. That's a huge improvement compared to traditional ways. - Hui Hu



These wake losses are often substantial, as high as 40% under some conditions. Another key advantage of this design is that it can extract energy at lower wind speeds than current, single-rotor turbines can. This should improve the operational flexibility of wind systems, which often suffer from dramatic cutoffs in power production when the wind dies.

The Iowa State team estimates that a 5% improvement in wind farm efficiency, which they believe the dual-rotor design can achieve, would bring benefits of approximately \$100 million to current Iowa wind farms. This would bring the percentage of power Iowa receives from wind to 30% without any new wind farm construction projects.

With an Energy Center Opportunity Grant, they were able to complete early concept-demonstration work, which included complex fluid dynamic analyses and laboratory-scale experiments in an instrumented wind tunnel. As a result, the team was able to successfully compete for a \$330,000 award from a National Science Foundation program that supports fundamental engineering research related to the sustainable production of electricity and transportation fuels.

The ability of the Energy Center to help Iowa organizations be more successful in securing sustainable funding from outside sponsors is key to helping the state become a leader in clean energy technology development and commercialization.

## GRANT PROGRAM HIGHLIGHTS

The Iowa Energy Center endorsed and supported 15 renewable energy projects in FY 2014. Under the new grant programs the Energy Center endorsed two Planning Grants, two Opportunity Grants, and nine Matching Grants. Eight of these projects received funding, representing a commitment of over \$524,000. Here is one example in the area of solar energy.

### SOLAR | VIKRAM DALAL IOWA STATE UNIVERSITY

Under the leadership of Professor Vikram Dalal, Director of the Microelectronics Research Center at Iowa State University, and with support from the Energy Center, new discoveries in solar energy are being made. Dalal's research focuses on increasing the energy efficiency in solar cells by reversing the performance degradation traits of organic photovoltaic solar cells. As a result, his work has identified and created a new type of device that combines a tandem organic cell with an inorganic top cell that has shown improvements in cell efficiency beyond 10%. These discoveries address a significant market barrier for low-cost solar cell technology. Professor Dalal's team of Ph.D. students will continue their research through FY 2015 using Energy Center funding leveraged with funding from other sponsors.