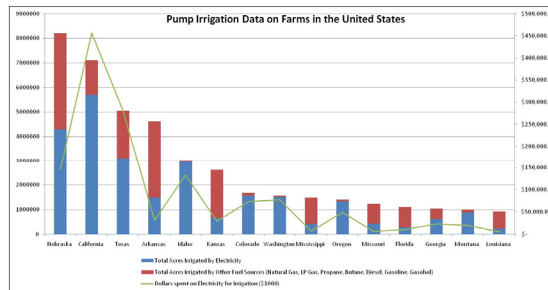
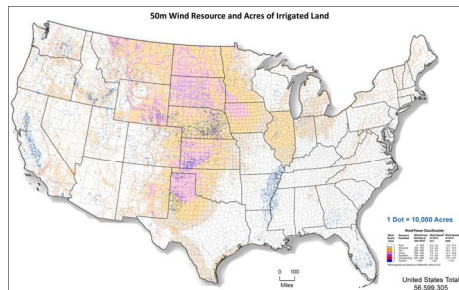


THE VIABILITY OF SMALL WIND DISTRIBUTED GENERATION FOR FARMERS WHO IRRIGATE

Becki Meadows, NREL Trudy Forsyth, NREL Scott Johnson, CWEC Dave Healow, Two Dot Wind, LLC

Key Considerations

- Approximately 14% of U.S. farms are irrigated, representing ~57 million acres of irrigated land
- 61.5% of irrigation systems in the US are powered by electric energy
- In 2008, the energy expenses for pumps totaled \$2.68 billion, an increase of 73% from 2003
- More than half of the top 15 irrigation states have good to excellent wind resources
- Wind reduces the impact on the environment, including significant water savings, as it does not require the cooling of thermal generators



State	System Capacity Limit	Net Excess Generation	Applicable Utilities
California	1MW	Credited to customer's next monthly bill at retail rate. After 12 month period, customer may opt to have net excess generation roll over indefinitely, or to have the utility pay for any net excess at a rate to be determined by the rate making authority.	All utilities (except LADWP)
Colorado	120% of the customer's average annual consumption.	Credited to customer's next bill at retail rate. IOUs pay customers at end of calendar year at average hourly incremental cost, or customer may opt for indefinite roll-over.	Investor Owned Utilities
Arkansas	300kW	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle	All utilities (municipal utilities not subject to commission rates)
Colorado	25kW	Credited to customer's next bill at retail rate. Muni and co-ops provide annual reconciliation at a rate they deem appropriate.	Muni and co-op customers
Kansas	200kW	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle	Investor Owned Utilities
Missouri	100 kW	Credited to customer's next bill at avoided-cost rate; granted to utility at end of 12-month period	All utilities
Montana	50kW	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle	Investor Owned Utilities
Montana	100kW	Credited to customer's next bill; granted to utility at end of 12-month billing cycle	Electric cooperatives (MCEA members)
Nebraska	25kW	Credited to customer's next bill at avoided-cost rate; excess reconciled at end of annual period	All utilities
Texas	20kW	Credited to customer's next bill (monthly) at avoided-cost rate	Austin Energy

Sources: The National Agriculture Statistics Service (NASS) 2008 Farm and Ranch Irrigation Survey; NREL 50-m Wind map; Database of State Incentives for Renewable Energy

As illustrated in the case studies below, in states with a good wind resource and large amounts of irrigation by electricity, a net metering policy with an annual true up can lead to the greater expansion of distributed wind and significant savings for farmers who irrigate.



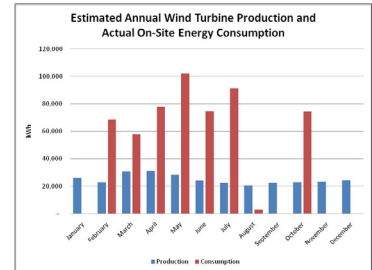
One of the two 50 kW turbines located at H2O Farms in Walsh, CO. PIX# 17246

H2O Farms in Walsh, CO: Installed Two 50-kW Wind Turbines, 2009

Total Project Costs (w/out incentives):	\$360,000	% Irrigation Load Offset:	55%
Incentives:	\$147,750	% Wind Energy Valued at Retail Rate:	80%
*Southeast Colorado Resource Conservation and Development Council Advancing Colorado's Renewable Energy (ACRE) Grant; USDA/NRCS Environmental Quality Incentives Program (EQIP); Investment Tax Credit; MACRS Bonus Depreciation			
Variable Costs:	\$6,000/yr	Average Annual Energy Savings:	\$18,637/yr (over 30 years)
*Operations and Maintenance; Insurance			
Estimated Average Annual Production:	275,000 kWh	Renewable Energy Credit Revenues:	\$6,386/yr (over 9 years)
*Tristate Renewable Energy Credit Program			
Average Retail Cost of Electricity:	\$0.037/kWh	Avoided Cost of Electricity:	\$0.027/kWh
Estimated Payback:	16.3 years	Estimated Payback:	4.5 years
*pre tax, unleveraged		*after tax (including the Investment Tax Credit), unleveraged	

Summary: An annual true up date was set to March 1, at which time all net excess wind generation is purchased by the local cooperative at avoided cost rates. The Investment Tax Credit brought the after tax payback to under 5 years.

Sources: Entegry Wind Systems Incorporation; H2O Farms; Southeast Colorado Resource Conservation and Development Council



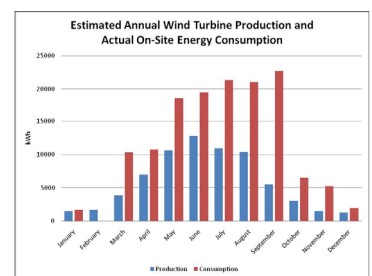
An irrigation pivot shows the use of water on a working farm. iStock #1897682

Salinas Valley Ranch, CA: 50-kW Turbine Feasibility Study Completed, 2009

Total Project Costs (w/out incentives):	\$215,000	% Irrigation Load Offset:	50%
Incentives:	\$125,000	% Wind Energy Valued at Retail Rate:	100%
*USDA Rural Energy for America Program; California's Self-Generation Incentive Program			
Variable Costs:	\$3,000/yr	Average Annual Energy Savings:	\$23,113/yr (over 30 years)
*Operations and Maintenance; Insurance			
Estimated Average Annual Production:	70,000 kWh	Renewable Energy Credit Revenues:	\$700/yr (over 5 years)
Average Retail Cost of Electricity:	\$0.15/kWh	Avoided Cost of Electricity:	\$0.04/kWh
Estimated Payback:	6.8 years	Estimated Payback:	1.7 years
*pre tax, unleveraged		*after tax (including the Investment Tax Credit), unleveraged	

Summary: The high cost of electricity, available incentives, and California's "True Net Metering" policy for all systems smaller than 1 MW allow this project to pay for itself in less than 2 years. Additionally, this location experiences the highest winds in the summer afternoons, corresponding with the utility's peak demand times.

Sources: Entegry Wind Systems Incorporation; California Wind Energy Collaborative (CWEC)



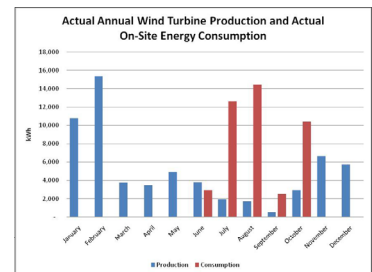
The 65 kW, refurbished Windmatic, erected by Tom Agnew at Agnew Farms. PIX #11947

Agnew Farms, Big Timber, MT: Installed One 65-kW Wind Turbine, 2002

Total Project Costs (w/out incentives):	\$45,000	% Irrigation Load Offset:	>100%
*refurbished turbine			
Incentives:	\$0	% Wind Energy Valued at Retail Rate:	0%
Variable Costs:	\$1,500/yr	Average Annual Energy Savings:	\$5,570/yr (over 30 years)
*includes a monthly wind integration fee of \$81.61			
2009 Actual Annual Production:	61,556 kWh	Renewable Energy Credit Revenues:	\$0/yr
Average Retail Cost of Electricity:	\$0.086/kWh	Avoided Cost of Electricity:	\$0.049/kWh
Estimated Payback:	15.5 years	Estimated Payback:	N/A
*pre tax, unleveraged		*after tax (including the Investment Tax Credit), unleveraged	

Summary: This project exceeds Montana's net metering system capacity limit of 50 kW. In comparison to the other two case studies, the simple payback could be reduced to less than 10 years with an annualized net metering policy.

Sources: Agnew Farms; Two Dot Wind, LLC



Optimal policy design for irrigators include: annualized net metering, single electricity tariff (combined demand and energy costs into kWh charge), 100 kW minimum capacity limit for net metering, buydown and incentives (REAP, ITC, etc.)