Operating Results of Wind Farms in New Jersey

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Atlantic County Utilities Authority

ABSTRACT

Located at the Atlantic County Utilities Authority (ACUA) Wastewater Treatment Plant in Atlantic City, New Jersey, the Jersey-Atlantic Wind Farm (JAWS) is the first coastal wind farm in the Northeast. JAWS, an 8 megawatt system, became operational in December 2005, and has performed better than anticipated. The ACUA purchases almost 70% of the total energy produced by JAWS under a long-term purchase agreement. The price discount the ACUA benefits from saved our ratepayers over $400,000 in 2006.

ACUA WASTEWATER TREATMENT OPERATIONS

As the world's first wind powered wastewater treatment plant, ACUA is on the cutting edge. Operating 365 days around the clock, it is a 40 million gallon per day activated sludge treatment plant with 20 regional pumping stations serving 14 member municipalities in Atlantic County.

Total energy usage at the plant is 2.5 megawatts. There are 24 mixers at 100 horsepower each, effluent pumping to the ocean at 1250 horsepower, and dewatering centrifuges at 1000 horsepower. With such large demand, energy costs are 25 percent of the ACUA wastewater budget.

Figure 1 shows the plant's electric use from 2001 through 2006 with and without renewables. It is important to note that rates increased from $0.0085 to $0.0115 during this period. Figure 2 shows the plant's natural gas expense for the same time period.

The location of our wastewater treatment plant coupled with amount of energy used and the cost of this energy placed the ACUA in

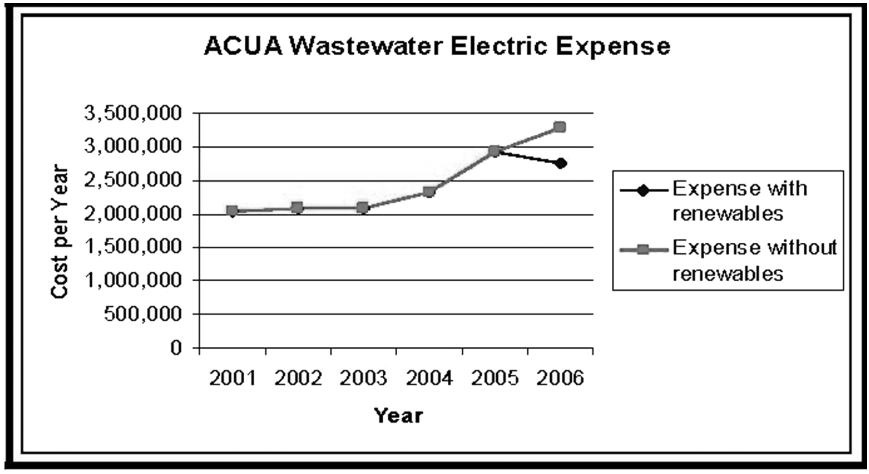


Figure 1. ACUA Wastewater Electric Expense

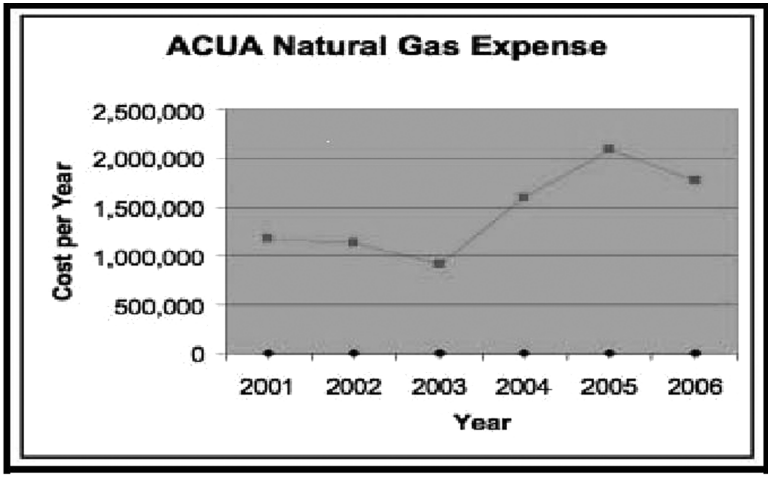


Figure 2. ACUA Natural Gas Expense

the unique position of becoming home to the first coastal wind farm in the United States.

JAWS: A BRIEF PROJECT HISTORY

The wind farm is owned by Jersey–Atlantic Wind, LLC, (JAWS) a partnership of Babcock and Brown, a San Francisco based investment

banking firm, Central Hudson Energy Group, Inc., a New York utility, and original developer Community Energy, Inc. (CEI). Founded in 1999, CEI is a marketer and developer of wind energy generation headquartered in Wayne, Pennsylvania. JAWS rents the land from ACUA, paying a lease fee of $3,000 per year for each of the five turbines and is responsible for maintaining and operating the windmills. From the outset of construction to its dedication on December 12, 2005, JAWS become operational in approximately one year.

Project Cost

Project cost for JAWS was $12.5 million. The New Jersey Board of Public Utilities Clean Energy Incentive paid $1.7 million, or 14 percent of the total cost. Community Energy also applied for a $1.92 million customer supply grant through Atlantic City Electric. The remaining costs have been funded by equity investments and/or debt financing.

Project Details

JAWS is comprised of five General Electric 1.6 megawatt windmills. Each turbine tower is 14 feet in diameter and 262 feet high (see Figure 3). The blades of the turbines are 120 feet long so that the total height of the wind turbines from ground to the tip of the blade is more than 380 feet, approximately the height of a 35-story building.

WHY JAWS?

With soaring energy costs and the opportunity to lock in fixed energy prices while meeting the objectives of our mission statement, ACUA viewed JAWS as a cost effective and environmentally responsible way to serve our ratepayers.

Cost Benefit

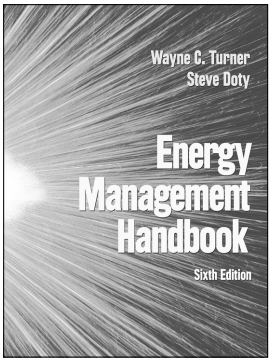
In 2004, ACUA's Wastewater Division paid 9.42 ¢/kWh, with costs increasing to 13.00 ¢/kWh in 2005. JAWS enabled ACUA to lock in a flat rate of 7.95 ¢/kWh for the next 20 years. The savings is primarily attributed to energy transmission costs. Wind energy has no transmission cost amounting to a savings of approximately 3.5 ¢/kW while energy purchased from the grid includes this cost. Figure 4 speaks for itself. With more than 12 million kWh of renewable energy produced

Figure 3. Wind Turbine Construction Photo

and over $400,000 in savings, the first full year of operations exceeded expectations on every front.

Environmental Benefits

"…The Authority is an environmental leader and will continue to use new technologies, innovations and employee ideas to provide the highest quality and most cost effective environmental services." Our energy initiatives are many and JAWS joined the Landfill Gas to Energy Project, our Solar Array Project, our bio-diesel fleet of 105 vehicles and our five hybrid vehicles exemplifying the continued dedication ACUA has to the environment by becoming a true leader in sustainability. Figure 5 gives a snapshot view of the ACUA's alternative energy projects. By itself, JAWS saves the equivalent of 23,613 barrels of crude oil annually, produces enough energy to serve 2,500 homes, has the carbon dioxide emission offset equivalent of planting almost 1.5 million trees, or not driving over 19 million miles.



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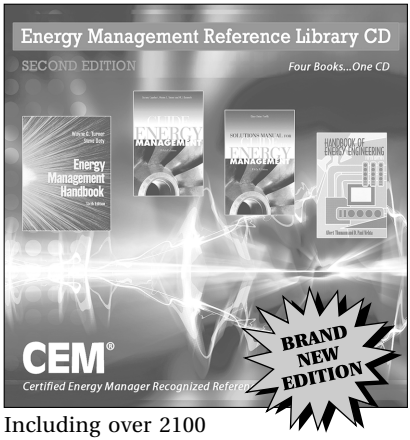

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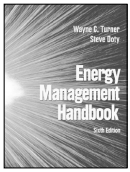

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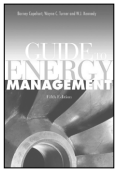

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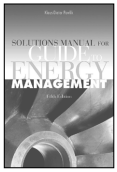

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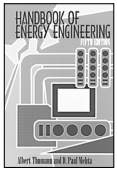

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Renewable Energy Savings and Total Megawatt Capability: Wind Energy

WIND ENERGY:

- Five 1.6 megawatt GE turbines
- Fully operational in January 2006
- Total of 8 Mw capability
- Rate per kilowatt hour: $0.0795
- On average provides 70% of Wastewater Treatment Facility's energy needs
- Energy Savings in 2006: $421,779.67

	Actual Per Cent Windpower	Actual kWh from Wind	Savings from Grid price	Wind Kwh/Rate	Total Windmill Electric Cost	Actual Kwh from Grid	Actual Total Delivered Rate (adder and transport)	Actual Grid Delivered (Adder & transport)	Total Electric Cost Windmill plus Grid
January	69.80%	1,195,114	$ 44,415	0.0795	$ 95,011.56	517,044	$ 0.11666	$ 60,320.47	$ 155,332.03
February	70.96%	1,072,090	$ 40,964	0.0795	$ 85,291.16	438,827	$ 0.11771	$ 51,654.21	$ 136,885.36
March	68.32%	1,063,754	$ 40,785	0.0795	$ 86,156.44	502,510	$ 0.11713	$ 58,860.62	$ 145,019.06
April	69.95%	1,079,922	$ 41,032	0.0795	$ 85,853.80	463,862	$ 0.11750	$ 54,503.67	$ 140,357.67
May	57.17%	921,309	$ 32,036	0.0795	$ 73,243.35	690,152	$ 0.11427	$ 78,865.80	$ 152,109.15
June	[illegible]	[illegible]	$ [illegible]	0.0795	$ [illegible]	[illegible]	$ [illegible]	$ [illegible]	$ [illegible]
July	[illegible]	[illegible]	$ [illegible]	0.0795	$ [illegible]	[illegible]	$ [illegible]	$ [illegible]	$ [illegible]
August	48.93%	881,280	$ 28,911	0.0796	$ 70,061.76	919,768	$ 0.11231	$ 103,294.29	$ 173,356.05
September	50.45%	882,268	$ 28,966	0.0795	$ 70,140.31	866,546	$ 0.11233	$ 97,339.81	$ 167,480.12
October	60.59%	1,108,032	$ 30,712	0.0795	$ 88,093.31	545,940	$ 0.10722	$ 58,533.59	$ 146,626.90
November	56.83%	914,312	$ 23,592	0.0795	$ 72,687.80	694,549	$ 0.10530	$ 73,138.36	$ 145,826.17
December	69.37%	1,115,808	$ 29,657	0.0795	$ 88,690.84	495,013	$ 0.10626	$ 52,601.54	$ 141,292.38
		17,163,800	$ 406,779.67		$ 967,023.68	7,614,401	$ 0.11254	$ 856,891.15	$ 1,823,914.84
	Rental income*		$ 15,000.00						
	Total Savings 2006		$421,779.67						

* The ACUA receives $3,000 rent per windmill per year

www.acua.com

The Atlantic County Utilities Authority is responsible for enhancing the quality of life through the protection of waters and lands from pollution by providing responsible waste management services.
The Authority is an environmental leader and will continue to use new technologies, innovations and employee ideas to provide the highest quality and most cost effective environmental services.

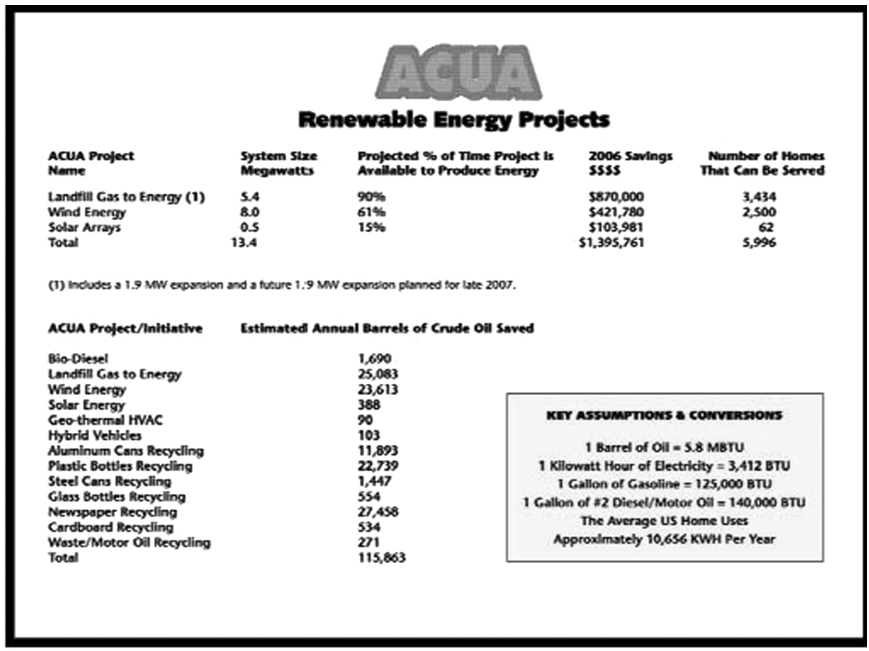
Figure 4. Economic assessment report

ENERGY PRODUCTION

Depending on wind conditions, the blades of each windmill turn at rates between 10 and 20 revolutions per minute. Considering the length of the blades, the tips are traveling at approximately 120 miles per hour. Once the wind is blowing over 12 miles per hour, each wind turbine can produce 1.6 megawatts of electricity. At reduced wind speeds, production decreases. It is important to note that wind velocity over the site can vary by as much as five miles per hour causing the turbines to turn at different rates. When the wind speed exceeds 40 miles per hour, the turbines shut down to protect themselves. Figures 6 and 7, respectively, show JAWS wind energy production and that this production enabled ACUA to purchase more wind energy than energy from the grid.

How does it work?

A weather station located atop each of the wind turbines turns the nacelle, the small building at the top of the tower facing into the



Renewable Energy Projects

ACUA Project Name	System Size Megawatts	Projected % of Time Project is Available to Produce Energy	2006 Savings $$$$	Number of Homes That Can Be Served
Landfill Gas to Energy (1)	5.4	90%	$870,000	3,434
Wind Energy	8.0	61%	$421,780	2,500
Solar Arrays	0.5	15%	$103,981	62
Total	13.4		$1,395,761	5,996

(1) Includes a 1.9 MW expansion and a future 1.9 MW expansion planned for late 2007.

ACUA Project/Initiative	Estimated Annual Barrels of Crude Oil Saved
Bio-Diesel	1,690
Landfill Gas to Energy	25,083
Wind Energy	23,613
Solar Energy	388
Geo-thermal HVAC	90
Hybrid Vehicles	103
Aluminum Cans Recycling	11,893
Plastic Bottles Recycling	22,739
Steel Cans Recycling	1,447
Glass Bottles Recycling	554
Newspaper Recycling	27,458
Cardboard Recycling	534
Waste/Motor Oil Recycling	271
Total	115,863

KEY ASSUMPTIONS & CONVERSIONS

1 Barrel of Oil = 5.8 MBTU
1 Kilowatt Hour of Electricity = 3,412 BTU
1 Gallon of Gasoline = 125,000 BTU
1 Gallon of #2 Diesel/Motor Oil = 140,000 BTU
The Average US Home Uses
Approximately 10,656 KWH Per Year

Figure 5. Renewable Energy Project Summary

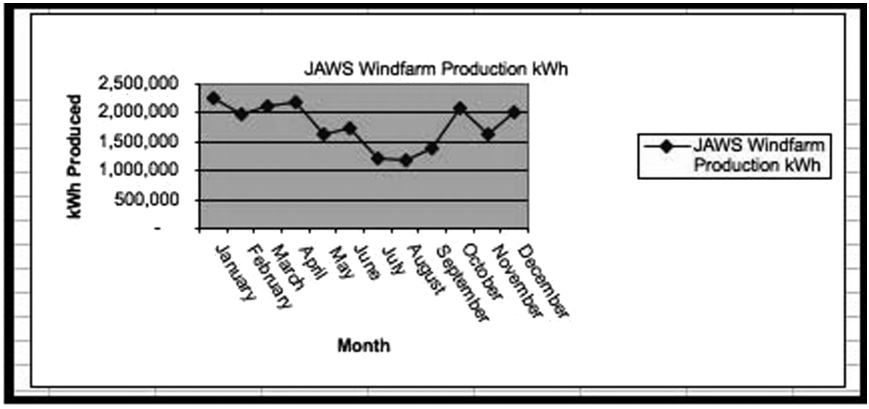


Figure 6. JAWS Wind Farm Production

wind (see Figure 8). Each of the three blades of the turbine pitch to maximize the speed at which the turbine spins. A shaft, attached to the hub of the blades, turns the gears box, which is attached to a generator that processes the electricity. The electricity is then transported to the

ground by wires, which are then attached to the electrical grid at the plant. Electricity not used by the ACUA runs backwards through the electric meter into the power grid.

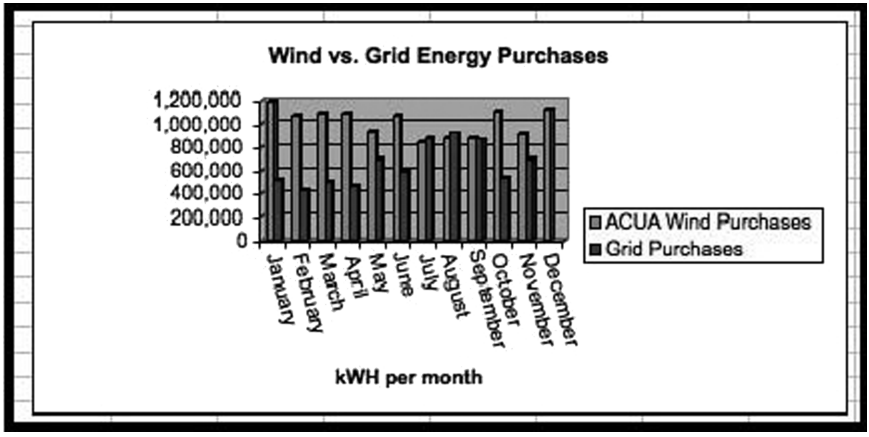


Figure 7. Wind vs. Grid Energy Purchase

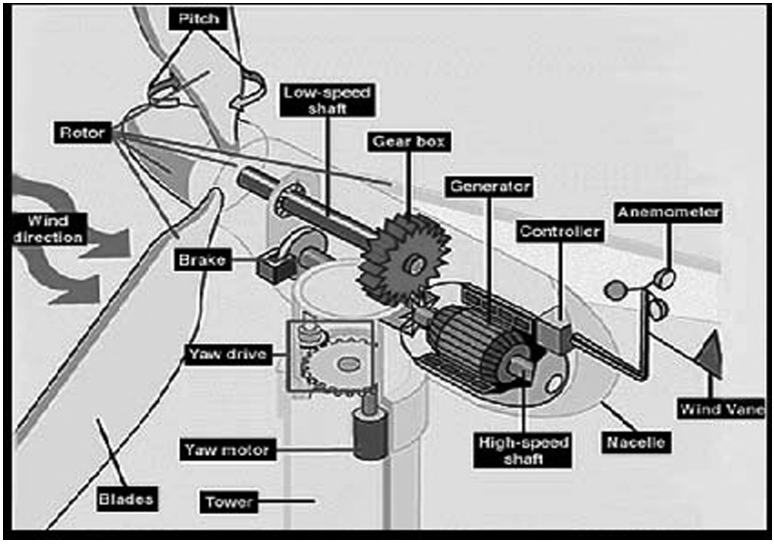


Figure 8. The Parts of a Wind Turbine
(Source: www.eere.energy.gov/windandhydro/wind_how.html)

CONCLUSION

An impressive symbol of new clean energy, the wind turbines have, in many ways, come to symbolize ACUA's leadership in this technology. Driving into Atlantic City they are hard to miss, see Figure 9, and have generated more than just clean energy. They have generated public interest in clean energy. More important than the cost savings detailed in this paper is the awareness of the general public in the environment and clean technology. Over 30 million people visit Atlantic City each year, and the ACUA is proud to put itself in front of this issue to prompt awareness and advance its mission.

Figure 9. The Jersey-Atlantic Wind Farm Photo

References

All information contained in this report was taken from internal ACUA documents and files. For more information on the ACUA wind farm project, see www.acua.com/alternative/a_projects.cfm.

ABOUT THE AUTHOR

Richard S. Dovey is president of the Atlantic County Utilities Authority (ACUA), a position he has held since 1990. While Mr. Dovey has served as president, ACUA wastewater and solid waste operations have been nationally recognized for excellence in innovation, efficiency, and environmental stewardship. Mr. Dovey has been a strong proponent of alternative energy and has initiated many green projects at the ACUA, most notably the construction of New Jersey's first wind farm in Atlantic City. A leader in the New Jersey environmental infrastructure and utility community, Mr. Dovey has served as chairman of the New Jersey Solid Waste Advisory Council and on the Board of Trustees of the New Jersey Association of Environmental Authorities (AEA). Prior to joining the ACUA, he was department head of Regional Planning and Development for Atlantic County Government for eight years, and manager of the Rutland County, Vermont, Solid Waste District for two years. Mr. Dovey graduated from the Richard Stockton College of New Jersey, Pomona, NJ, with a Bachelor of Arts degree in urban studies. Mr. Dovey may be contacted at rdovey@acua.com.