



# Environmental Studies Program

## Issues Update: WIND ENERGY

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### Keywords

- *Kilowatt-hour (kWh)*: used to estimate electricity production and consumption; one kWh means kW of energy used or consumed in one hour.
- *Rotor*: the portion of a wind turbine that is moved by the wind (usually consisting of blades).

### Overview

- The basic explanation for the formation of wind is that when hot air rises from the Earth's surface, cooler air is drawn in to replace it, causing a kinetically energetic shift.<sup>1</sup>
- Wind turbines convert this kinetic energy into electrical energy. The most common type is the horizontal axis turbine, which is composed of several propeller-like blades attached to a vertical tower.<sup>1</sup>
- The tower is made of steel, and the blades are made of fiber-glass reinforced polyester or wood-epoxy.<sup>1</sup>
- Utility turbines can be as tall as 90 m with a 90 m rotor diameter, while residential turbines can have 40 m-tall towers with rotors only 8 m in diameter.<sup>1</sup>
- Electricity production per turbine depends on the size of the turbine and the wind's speed through the rotor. A typical 1 MW utility turbine could produce 2.4 to 3 million kWh per year, which could power 225 to 300 households.<sup>1</sup>
- Small-scale turbines require an average wind speed of a least 9 mph; large-scale turbines at least 13 mph.<sup>1</sup>
- Electricity produced from wind farms can cost as low as 5 cents/kWh, which is competitive with electricity from plants powered by fossil fuels.<sup>1</sup>
- Every MW of wind energy makes about 4.8 job-years of employment. Every \$1 billion invested in wind energy creates 3000 jobs.<sup>2</sup>
- Environmental impacts of wind power: air pollution, water use and quality, climate change, radiation-near zero; wildlife-can kill birds; some land use.<sup>2</sup>

### WHAT'S NEW...

- The Production Tax Credit (PTC) that was included in the Energy Policy Act of 1992 was renewed October 2008. Anyone who invests in wind energy receives 1.8 cents/kWh back in taxes, which provides more incentive for investment.<sup>7</sup>
- The recent Stimulus package improves the PTC by removing the previous \$2,000 cap on tax credits and by providing a 30% tax credit to consumers who buy small 10-kW turbines (usually used for homes or small businesses).<sup>7</sup>
- Cape Wind: 130 turbines on Horseshoe Shoal in Nantucket Sound, would produce enough energy to meet the needs of almost  $\frac{3}{4}$  of Cape Cod, Martha's Vineyard, and Nantucket Island. Cape Wind may soon receive a "super-permit" that could overturn the Cape Cod Commission denial of the project.<sup>4</sup>



## CASE STUDY: Expanding the Tehachapi Wind Farm

### Introduction

- Wind farm in CA that began in 1979.<sup>5</sup>
- Tehachapi Valley has tremendous wind power potential – how to take advantage of this?

### Approach

- December 2006: signed an Energy Power Purchase Agreement that stated that Tehachapi Farm would sell its energy to California Edison Utility to power a large portion of the LA area.<sup>6</sup>
- This contract allowed Tehachapi to expand and utilize its potential more.

### Results

- Currently has 4,600 turbines and produces largest output of energy of all wind farms worldwide.<sup>5</sup>
- Produces 1500 MW of electricity per year.<sup>6</sup>
- Generates over 120 million dollars in revenues by selling the electricity it produces each year.<sup>5</sup>

### Outstanding/Unresolved Issues

- Areas like the Tehachapi Valley have the potential to produce massive amounts of energy but this electricity is difficult to transport.

### Lessons Learned

- It is possible to have a large-scale wind project NOW.
- Wind farms have the ability to produce enormous amounts of energy and are very profitable at the same time.

[Include charts or diagrams to illustrate trends, etc.]

## Resources

- American Wind Energy Association:  
[www.awea.org](http://www.awea.org)
  - Great overview of the basic mechanisms of wind power and advantages and disadvantages.
- Cape Wind: [www.capewind.org](http://www.capewind.org)
  - Website for the potential first off-shore wind project in the US.
- Southwest Windpower:  
[www.windenergy.com](http://www.windenergy.com)
  - Covers news stories on all wind projects and developments.

## References

- <sup>1</sup>American Wind Energy Association (AWEA). "Wind Web Tutorial." 2009. [http://www.awea.org/faq/www\\_basics.html](http://www.awea.org/faq/www_basics.html).
- <sup>2</sup>Renewable Energy Policy Project. "Wind Turbine Development: Location of Manufacturing Activity." 2005. <http://www.repp.org/articles/static/1/binaries/WindLocator.pdf>
- <sup>3</sup>Union of Concerned Scientists. "Production Tax Credit." 11 November 2008. [http://www.ucsusa.org/clean\\_energy/solutions/big\\_picture\\_solutions/production-tax-credit-for.html](http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html)
- <sup>4</sup>Cape Wind. Cape Wind Associates, LLC. 13 March 2009. [www.capewind.org](http://www.capewind.org)
- <sup>5</sup>Chapo, Richard "The Massive Tehachapi Wind Farm." EzineArticles.com. 28 Jan 2007. <http://ezinearticles.com/?The-Massive-Tehachapi-Wind-Farm&id=434343>
- <sup>6</sup>Edison International. "Southern California Edison Signs Largest Wind Energy Contract in U.S. Renewable Industry History." 21 December 2006. <http://www.edison.com/pressroom/pr.asp?id=6487>
- <sup>7</sup>Southwest Windpower. "Stimulus May Get Small Wind Turbines Spinning." 9 March 2009. [http://www.windenergy.com/news/news\\_CNN\\_3-9-09.html](http://www.windenergy.com/news/news_CNN_3-9-09.html)