Wind Energy in Canada

Ken Gordon & Fraser Summerfield

Currently, the Canadian Power Grid provides approximately 250,000 MW of power across the country. This power is generated primarily by traditional fossil fuel plants (25%), nuclear plants (13%), hydro electricity and other power generation means. Currently wind power has an installed capacity of in Canada of 439 MW or about 0.2% of the total energy capacity. While this is certainly not substantial, wind power has been the world's fastest growing energy source, with global growth, on average, of 30% per year for the past five years. Indeed, some forecasters predict that by 2010, wind power has the potential of providing 50,000 MW or 20% of Canada's total power needs. A more conservative goal made by the Canadian Wind Energy Association (CWEA), however, puts that figure at 10,000 MW by 2010, or 5% of Canada's power needs. Clearly wind energy is an important consideration for the Canadian government. Currently there are three major policy considerations that the Canadian government is faced with. These include plans to reduce fossil fuel pollution, subsidization of new wind power business, and the new industry's effect on Canada's terms of trade. This paper will focus on these policy considerations and their economic impacts in Canada.

Wind power has been the focal point for organizations pushing for cleaner power sources which do not emit so-called greenhouse, or NO_x gases. In that sense, wind power, provides society with pollution abatement, which for the purposes of this report can be modeled as a positive externality (for a graphical analysis, refer Figure 1).

Currently, Canada is producing 'Q' MW of wind energy, where the socially optimal quantity is at Q^*. Similar to a positive externality, increasing wind power production will allow society to reach a higher level of welfare.

Society is quickly accepting that alternative energy sources must be exploited to reduce our economic dependence on oil, and reduce pollution. Traditional fossil fuels both consume natural resources and emit pollution for each MW produced by a power plant, while wind turbines consume a completely renewable resource and do not emit pollution. A study conducted by the EU Commission on external costs relating to different forms of energy conversion (2001, Denmark) showed that wind power reduced external costs (in DKK/MWh) from coal by 60% and natural gas by 40% (refer to Figure 2).

The major policy decision that can be made by the Government of Canada with respect to wind power generation comes in the form of monetary assistance. Having enough money to start a business is always a drawback for many potential entrepreneurs, and the case of wind power is no exception. Many large wind farms have over 50 individual turbines, and manufacturing, transportation and installation of large sets of wind turbines (wind farms) require large amounts of capital (exceeding $1 million per turbine). An average lone turbine may only net its owner approximately $60,000/annum. Since engineers have determined that when installed in groups, wind turbines operate more efficiently, we can assume this figure approaches $100,000. Therefore, based on purely cost benefit principals, individual wind turbines aren't necessarily economically practical (presently). Accordingly, many energy investors rely on traditional methods of energy such as fossil fuels. An important factor in the viability of wind power may come in ensuring economies of scale, which requires more than a single turbine. Since wind energy is considered the most promising form of emerging green energy (compared to fuel cells, for example), many countries offer policy support for wind turbine manufacturers and wind farm owners. These policies include feed-in tariffs, production and investment subsidies, pollution tax breaks and investment incentives. These are especially important in light of the assumption that we prefer to install multiple turbines, which presents ever-increasing startup costs.

The current situation in Canada is a good example of subsidization. Right now there is an assistance program in place for companies

who are willing to contribute to producing clean energy for the country. The program specific to wind energy is called the WPPI, which stands for Wind Power Production Incentive. There are certain qualifications one must meet, which will not be addressed in this paper due to their small influence on the policy effects of the subsidy program. The results of the program are expected to "generate 1.5 billion in capital investments"[1] while supporting the installation of 100- megawatts of wind energy. For companies who embark on wind power generation, a contribution of one cent per kilowatt hour of generated power is given by the government currently, with that subsidy dropping to eighty cents in March of 2006.

Subsidies are important in encouraging an industry such as wind energy, as it can arguably be considered an infant industry. Wind energy, which provides huge environmental benefits, needs to be ensured successful growth within the industry. As a result of the high fixed costs associated with building wind turbines, a policy to subsidize for a short time frame (ideally, this will be 5-10 years, depending on the project) will better position businesses to be able to overcome barriers to entry in the industry. A subsidy to the wind power industry has the economic effect of offsetting some of the costs of production (from the producer to the government) in order to produce at a socially optimal level. Referring to Figure 1, this optimal level can be achieved by providing $[(P_1-P_0)(Q^*-Q)]$. Higher supply translates to a lower price for the consumer. With the subsidy helping to keep prices low, it is more likely that wind power will be seen as a viable alternative or substitute for current power sources by those purchasing the energy. It is therefore recommended that a subsidy to the infant industry of wind energy is a key policy move to promote entry to the market because startup costs are high.

Externalities are always a concern to governments, since they have the greatest power to stop the resulting market failures. One negative implication of wind power is the use of land. By installing wind farms, the industry is displacing other potential industries from using the land (i.e.: agriculture). Thus, the Canadian Government must assist in the allocation of land between the wind energy industry and other industries who have land intensive production processes.

With respect to agricultural farms, some production must be foregone in order to use the land for wind power generation. Assuming the decision maker is a rational person, a tradeoff should be made only if the new use provides a greater return than the prior use. With respect to wind power generation, turbines produce more profit per acre on average than farming does, and so wind can be "considered a cash crop."[2] However an added bonus in this situation is "only two percent of land must be sacrificed in order to install roads and the turbines themselves," and the remainder of the land may also be used to farm. It must be considered, however, that this value was estimated by lobbyists, and is most likely higher, but not excessively so. Here we see that a farmer is not operating on their PPF unless they are using the land for both uses. In other words, a small sacrifice of farm land allows for large profits from the wind turbines, leading the farm to overall higher profits. There is still a tradeoff being made, but it is not as simple as originally observed, and clearly it is wasteful only to farm agriculturally on land that is also suitable for wind turbines. The other popular location for turbines is the coastline. Here we observe a more standard tradeoff.

Several special interest groups such as CWEA have pointed out some inter-economical benefits to wind energy, apart from the obvious environmental benefits. For instance, the international trade potential for Canada, should it have a strong wind energy sector, is substantial. Primarily, we can begin exporting wind turbines to other countries (similar to Denmark's growing industry). A secondary, but possibly more valuable benefit for Canada is the reduction in the domestic consumption of oil and natural gas. This would increase our export supply, while maintaining the current high price of oil, thus increasing Canada's terms of trade. The government has realized this potential. As a result, in 2002 the Canadian government subsidized $23 million for a $100 million wind farm in Alberta[3], the largest subsidy in Canada thus far. It is interesting to note, that Alberta is far and away the largest oil producer in Canada, as well. It can be concluded that the province is

attempting to raise its terms of trade from oil, as well as providing benefits from wind energy.

Furthermore, the Quebec Government has invested an astounding $1.9 billion[4] into a network of wind farms, which upon completion will be the largest wind operation, easily surpassing Alberta's. In the wake of the August 2003 blackout, caused by grid instability in U.S., this operation will allow Quebec more energy surplus to trade with the Eastern States.

Presently, Canadian society has expressed increasing concern for the environment, evidenced by our interest in the Kyoto accord, emergence of environmentally focused political parties, and educational environmental initiatives. Wind energy has proven to be a very promising alternative to traditional fossil fuel based energy. While it cannot totally replace natural gas or coal as the primary provider of energy, it will provide a substantial supplement for the Canadian power grid. As a result of this, it is becoming clear that our government must engineer policies to support this important and emerging industry. Without subsidies and government support, the wind industry will not gather enough momentum to achieve will not achieve what is considered to be its socially optimal goals.

Figure 1: Pollution Abatement of Wind Energy[5]

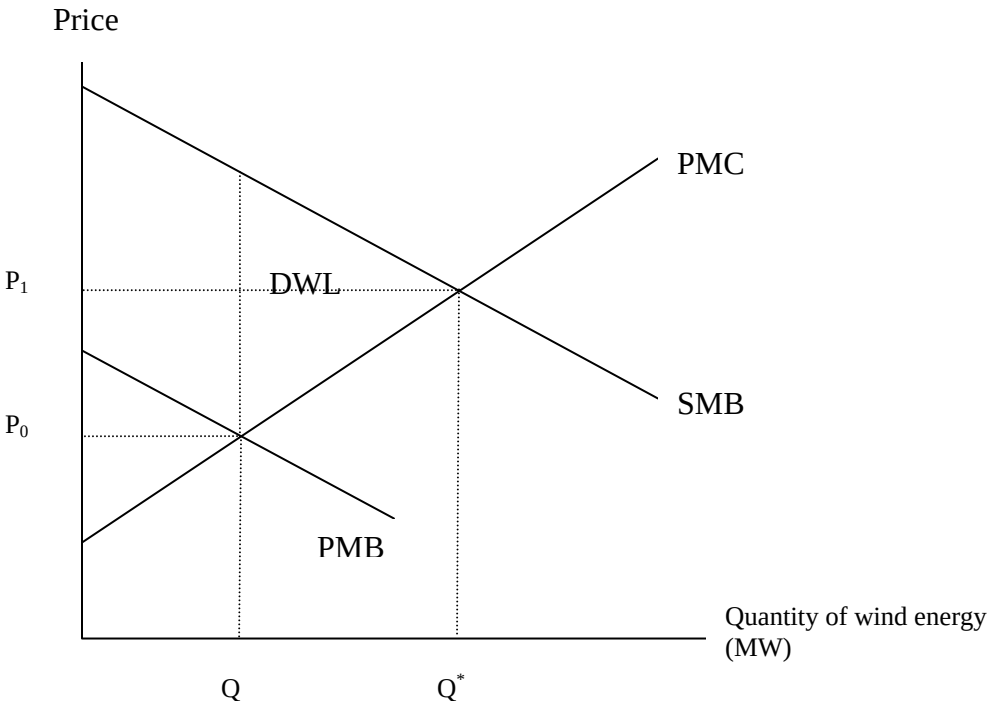
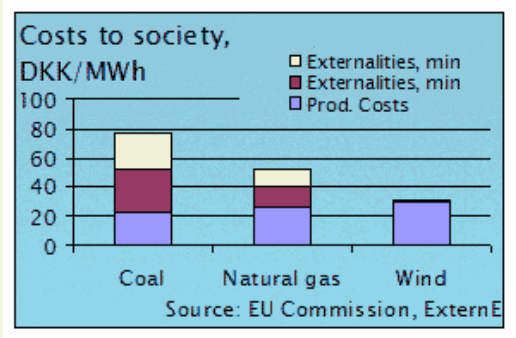


Figure 2: Costs to Society from Energy [6]



Endnotes

1. WPPI, 2002

2. CanWEA, 2004

3. CBC News, 2002

4. CBC News, 2004

5. Brander, 2000

6. DWIA, (n.d.)

Bibliography

"Alberta wind farm to be largest in Canada." *CBC News* (Oct 31, 2002.)
Available:http://www.cbc.ca/story/canada/national/2002/10/31/wind_alberta021031.html

Brander, James A. *Government Policy Toward Business,* Third Ed. Toronto:John Wiley and Sons Inc, 2000. p.255

Canadian Wind Energy Association. *Wind Energy 201,* March 2004. [On-line WWW]
Available: http://www.canwea.ca/downloads/en/PDFS/CanWEA_March04.pdf

Danish Wind Industry Association. [On-line WWW]. (n.d.) Policy.
Available:http://www.windpower.org/composite-180.htm

"Quebec Announces $1.9 Billion Wind Energy Program" *CBC News* (Oct 5, 2004.)
Available:http://montreal.cbc.ca/regional/servlet/View?filename=qc_wind20041004

Wind Power Production Incentive. [On-line WWW]. (May 17, 2002) Programs.
Available: http://www.canren.gc.ca/programs/index.asp?CaId=107&PgId=622