FRIENDS OF ARRAN LAKE WIND ACTION GROUP
BRUCE COUNTY, ONTARIO

CALCULATING THE REAL COST OF INDUSTRIAL WIND POWER

AN INFORMATION UPDATE FOR ONTARIO ELECTRICITY CONSUMERS

Compiled by

Keith Stelling, MA (McMaster), MNIMH, Dip. Phyt., MCPP (England)

November, 2007

CALCULATING THE REAL COST OF INDUSTRIAL WIND POWER

AN INFORMATION UPDATE FOR ONTARIO ELECTRICITY CONSUMERS

INTRODUCTION

1.0 The history of human technological innovation is littered with projects that have had to be abandoned because they were based on a narrow *theoretical* view that failed to take into account the *whole* picture. The commercial exploitation of wind energy is fast showing signs of such failure.

The last ten years in Europe has provided ample opportunity to evaluate the *real* costs and claimed benefits of industrial wind turbines based on *actual* operating statistics.

- Studies by public electricity distributors now challenge the very assumption upon which the ecological value of commercial wind power is based: that it reduces carbon emissions.

- Energy experts report that industrial wind power is proving to be *exceptionally expensive to consumers* once required backup and additional infrastructure are factored in. The high cost is caused by (a) the need to maintain backup generating reserve to cover times when the wind does not blow. (b) The need to

stabilize the grid when wind produces power that is not needed by current demand. (c) Government subsidization and tax benefits for the wind industry.

- New studies show that the perceived benign environmental footprint of the industrial wind turbine does not correspond with the latest field studies of migratory bird and bat mortality. Growing public protests over noise and health effects are being provoked by wind turbine installations.

In the United States, Senator Lamar Alexander put it bluntly when introducing his Envirnonmentally Responsible Wind Power Act of 2005:

> "*My studies suggest that at a time when America needs large amounts of low-cost reliable power, wind produces puny amounts of high-cost unreliable power. We need lower prices; wind power raises prices."*

In Ontario, - Tom Adams, formerly of *Energy Probe*, wrote in the *National Post* on 20 November, 2007:

> *"Without radical technological advances, wind power will only burden Ontario consumers."*

The first section of this report explains **why the real cost of wind power is much higher than previously understood.** It examines some of the actual operational reports of electricity distributors with installed wind power. It looks into studies by experts in the field who explain the difficulties involved when industrial wind turbines are taken beyond the theoretical stage and actually integrated into a mixed electricity grid system. And it discusses why they fail to deliver the benefits once promised.

The next section looks at public dissatisfaction with industrial wind power and the issues involved.

The report concludes with specific recommendations and requirements.

2.1 THE CARBON EMISSION REDUCTION FALLACY

Until recently, one of the most persuasive arguments in support of industrial wind power was the theory that wind farms significantly reduced planetary carbon emissions.

Politicians have been in the habit of boasting about their investment in "green" wind power as evidence of their concern for the planet, regularly posing in front of wind turbines in an effort to enhance their own green image.

The assumption of substantial carbon emission reductions has been largely responsible for the lack of any meaningful discussion about the merits of publicly subsidizing industrial wind power. Few people questioned the cost of wind energy believing it had a potential to provide up to 20% of our electrical energy needs without producing any carbon emissions. By replacing conventional fossil-fuelled generating plants it was thought that the installation of wind turbines would substantially cut back planetary CO2 emissions. According to the eminent U.K. energy expert, David White, "renewable electricity has become synonymous with CO2 reduction. However, the relationship between renewables and CO2 reduction in the power generation sector does not appear to have been examined in detail, and the likelihood, scale, and cost of emissions abatement from renewables is very poorly understood."

White[1] has made one of the most valuable contributions to the discussion with his report, *Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution from Wind Power,* published in December 2004 by the Renewable Energy Foundation in the U.K.[2].

In his report, White explains that there is now a wide range of technical literature that questions whether wind turbines can achieve their anticipated goal of emissions reduction.

He demonstrates that throughout the experience gained by developing wind power in Europe over nearly twenty years, wind generated power has proven to be *variable, unpredictable, and uncontrollable.* In fact, he says, "the European experience shows conclusively that the annual production is routinely disappointing." Using technical data from Germany, Denmark, Ireland, the United Kingdom and the U.S.A., he reveals that

> the CO2 saving from the use of wind … is probably much less than assumed by Government advisors, who correctly believe that wind could displace some capacity and save some CO2, but have not acknowledged the emissions impact of matching both demand and wind output simultaneously. As a result, current policy appears to have been framed as if CO2 emissions savings are guaranteed by the introduction of wind-power, and that wind power has no concomitant difficulties or costs. **This is not the case.**[3]

The reason for this lies in the inherent nature of wind power and the need to supply fossil fuel generated backup to compensate for the variable, unpredictable and uncontrollable production of wind energy. White explains:

> Electricity differs from other forms of energy, and ***cannot be stored directly on an industrial scale.*** Consequently, generation and demand have to be balanced on the grid continuously, and second by second. Policy-makers appear to have only a weak grasp of this critical fact and its implications. Indeed, the accommodation of the variable output from wind turbines into the transmission system is complex and the technical challenges are barely understood outside professional circles.
>
> **Fossil-fuelled capacity operating as reserve and backup is required to accompany wind generation and stabilise supplies to the consumer. That capacity is placed under particular strains when working in this supporting role because it is being used to balance a reasonably predictable but fluctuating demand with a variable and largely unpredictable output from wind turbines.**
>
> Consequently, **operating fossil capacity in this mode generates *more* CO2 per kWh generated than if operating normally. This compromising effect is very poorly understood**, a fact acknowledged recently by the Council of European Energy Regulators.

White asks: "Is wind-power CO2-free?"

> Nobody disputes the fact that wind-generated power is free of CO2 emissions *at the point of generation*…. However, **the assessment of the national emissions benefit is a much more complicated matter, and has to be based on the extent to which wind generated power can displace conventionally generated power from the total electricity supply system on a minute by minute basis**….
>
> Consequently, the accommodation of wind-generated power into the … power system is more complex than simply shutting down fossil-fuelled capacity whenever the wind happens to be blowing. Starting up and shutting down power plant may take minutes or hours, depending on the type of plant, while power may be needed in seconds, and firm [always available] thermal generation cannot be treated in this way if the lights are to be kept on.
> Consequently, **any calculation of the CO2 emissions reduction from wind must take into account the quantity of conventional generating capacity that has to be retained in varying states of readiness while the wind-generated power is taken into the grid.**
>
> Furthermore, existing generation capacity [in the U.K.] is being asked to simultaneously accommodate the intermittent input of wind-produced power and satisfy the needs of nearly 60 million electricity users, and this necessitates changes in operational behaviour which are highly significant and cannot be brushed aside. **In fact, *analysis of data from the UK, Denmark, Ireland, Germany and the USA***

***shows that a substantial part of the theoretical CO2 saving does not accrue in practice*. In some circumstances there may be only minimal benefit.**

White relies on the reports of actual operation published by the electricity distributors themselves. In Ireland, the Electricity Supply Board (ESB) National Grid published its study of installed wind power in Ireland in February, 2004: *Impact of Wind Power Generation in Ireland on the Operation of Conventional Plant and the Economic Implications*. The evidence shows that **as the level of wind capacity increases, the CO2 emissions actually *increase* as a direct result of having to cope with the variation of wind-power output.**

> The study highlights the fact that: unlike conventional plant, the *(wind)* output is not related to customer demand. Maximum wind production may occur during low customer demand periods, or conversely at times of peak demand there may be little or no wind generated power. [...] As a consequence, the output required from the other sources of electricity is more volatile in nature. One key message is the need to operate fossil-fuelled capacity in parallel with wind. . . . Another is the type of technology used for backup, because much of the Irish generating capacity is now based on combined-cycle gas turbines (CCGT). The variable output from the wind turbines has to be matched by controlled changes in the output of their coal and CCGT plant. The ESB National Grid point out that **a single start-up of one of their large thermal plants would use €10,000 worth of fuel, and produce significant quantities of CO2 without generating a single kWh**. In other words, **operating gas turbines by ramping up and down generates more CO2 per kWh of electrical generation than if the gas turbines were operated on the normal planned load.** Dependent on the weather forecasts, it may be possible to shut down some capacity for brief periods, but this may frequently be for only a matter of hours. Fuel is then wastefully consumed and CO2 emitted as the plant is started up again, without any power being generated, before it is returned to load-bearing grid service. **This frequent ramping and start-up pattern was not taken into account when the turbines were designed and such a mode of operation not only increases the CO2 emissions, but also causes otherwise avoidable wear and tear, and so shortens the periods between overhauls thereby adding to maintenance costs.**
>
> While gas turbines can be started up relatively quickly, this is not true of coal-fired stations, and if this capacity is used to balance the wind generators, the control is achieved merely by reducing power output while continuing to burn fuel. Obviously, this causes an increase in CO2 emission per kWh generated. CO2 emissions from the fossil-fired plant will also vary according to the level of wind capacity installed.
>
> These larger swings will necessitate the ramping up and down of both mid-merit and high-merit capacity, **and the introduction of coal-fired plant. In the Irish report, the ESB stresses *the consequential cost-effects of wind generation and their assessment in meeting the EU target will entail a 15% increase in electricity cost.*[4]**

A technical paper presented by the Tallinn Technical University of Estonia at the International Energy Workshop at Laxenburg, Austria in 2003 reached a similar conclusion:[5]

> **The fuel economy and emissions reduction in the power systems consisting mainly of thermal power plants are not proportional with the electricity production of wind turbines. *Participation of thermal power plants in the compensation of fluctuating production of windmills eliminates the major part of the expected positive effect of wind energy.*** (A method for calculation of real fuel economy and emissions reduction is described and a calculation example based on Estonian and Danish data is given).
>
> Thermal power stations constantly have to keep additional spinning [standby] reserve capacity equal to the maximum total power of windmills (e.g. for the case when too high wind speed stops full power operating windmills). This makes the thermal plants run inefficiently and increases fuel consumption (emissions).
>
> In reality, only keeping the necessary additional reserve capacity will increase the fuel consumption (emissions) by up to 8.1%. To get a more realistic fuel consumption (emissions) estimate that considers also fluctuations of wind power reduced to the mean power of windmills, the initial fuel consumption curve should also be raised by 8.1%. The calculations were repeated for several values of power system load and *the results showed at least 8-10% increase of fuel consumption and emissions compared with the steady operation of thermal stations under constant mean power of wind turbines.* **In some cases the environmental gain from the wind energy use was lost almost totally.**

The Tallinn report concludes:

> ***It seems reasonable to ask why wind-power is the beneficiary of such extensive support if it not only fails to achieve the CO2 reductions required, but also causes cost increases in backup, maintenance and transmission, while at the same time discouraging investment in clean, firm generation capacity.***

Similar calculations have been made in other jurisdictions. It should be pointed out that one reason for the overly-optimistic theoretical predictions of wind power's carbon emission saving potential has been the failure to take into account the whole picture—that is, to calculate in the *actual cost* of keeping backup generation on standby. Earlier predictions for electricity output from wind turbines were often inflated and are still being exaggerated.

The historical reality, however, is very different. With over 14,000 MW, Germany has the largest installed wind capacity in Europe. A report on annual load capacity, for 2003 was only 18.7% and for the previous six years averaged only 14.7%, according to the Reuters *Power News* report.[6] And the E.ON Netz (German electricity generating authority) report for 2004 suggests an actual figure of around 15%.[7] UCTE (the Union for the Co-ordination of Transmission of Electricity) in continental Europe note that for two thirds of the year, output will not exceed 20% of the installed capacity while for one third it will not exceed 10%. They also mention that in five of the last ten periods of peak demand, there has been zero input of wind-power.

Tom Adams of Ontario's *Energy Probe* pointed out in a recent article in *The National Post* the implications of this fluctuation for wind installations in Ontario:

> . . . The little output our wind turbines do generate comes in wild swings from high production to dead calm. Compared to all available generation technologies, wind power is uniquely intermittent. Over one-hour intervals, production changes for individual wind farms are as great as 73%, and 39% for the overall fleet. Over five-minute intervals, changes of 13% for individual farms have been measured.
>
> Intermittency creates a major challenge for grid reliability, which requires instantaneous balancing of overall power generation to exactly match consumption. **Combining nuclear generators, which have almost no ability to increase or decrease output, with intermittent wind power is particularly problematic.** Balancing nuclear and wind power while keeping the lights on requires other, typically costly, generators to quickly ramp up, down or stand by. **With one of the most nuclear-dependent grids in the world, Ontario is poorly suited to host wind power.**
>
> Predicting wind output changes has proven difficult, but one pattern is clear: Winds tend to be calm when consumers need electricity most. Ontarians use the most electricity in summer -- the weakest season for wind. In July and August of 2006 and 2007, Ontario was frequently becalmed and average monthly output fell within the lowly 13% to 19% range. Although winter is the strongest season, on the coldest days, when we use most power, wind output tends to be poorest. Over the typical day, wind output peaks around midnight and bottoms out around 8 a.m., contrary to our daily consumption pattern.
>
> **Diversifying the geographic location of wind farms has provided little output stability because, even when widely dispersed, output from individual farms tends to rise and fall in sync.** Although limited data is available, the production pattern of New York's largest wind farm appears to closely match the hourly output of Ontario's overall wind production. New York's farm even matches fairly closely the output of a similar farm at Sault St. Marie, 840 kilometres away.[8]

The 2006 *Energy Probe* report[9] on Ontario's installed wind capacity pointed out the same need (and cost) for backup fossil fuel generation as has been observed in Europe.

> Prior to the development of wind power in Ontario, coal generation and to a much lesser extent oil and gas generation has been used extensively to meet ramping [rebalancing the grid by taking generators on and off line] requirements. Other available methods, such as hydroelectric operational flexibility, have been fully deployed. **The tendency of wind generators to decline in the morning while load is rising has increased ramping requirements on fossil generation. While Ontario's new wind generation has reduced fossil fuel generation *when wind output is available*, the wind production pattern whereby output falls during**

> **the early morning has offset this benefit somewhat by lowering the fuel efficiency of the flexible fossil generators used for ramping, *increasing air emissions per unit of production*, and . . . *increasing maintenance costs*.**[10]

The *Energy Probe* report continues:

> A 2004 study was conducted to examine the grid and reliability impacts of wind power in Germany. [11] ***The German study found that the proposed tripling of wind capacity in Germany by 2020 is, in and of itself, driving a need for quintupling generation reserve requirements.***
>
> During July and August 2006, the actual average frequency of hours when there was little or no wind output in Ontario – output less than 2% – was 18.6%. These very low production hours were about as likely to occur during the daily peak period as any other time during the day. **Ontario's experience in 2006 shows that the conclusion of the GE study that wind can reliably supply power in summer equal to 17% of its rated capacity significantly over-estimated the actual results.** The actual results for the summer of 2006 also suggest that the IESO should review its forecast that even 10% of the installed wind capacity should be considered as firm capacity for meeting peak demands. **During the summer of 2006, wind power provided no firm generation capacity during the peak months.**

White emphasizes the cost implications of this level of performance. Media reports say that proponents estimate that 2 mgW of wind energy costs approximately 4 to 5 million dollars including infrastructure. The costs of other production methods are much lower when it is remembered that thermal plants produce 90% of the time and wind only 25%. According to White,

> ***These low load factors for wind obviously illustrate a very poor utilisation of high cost assets.*** . . . If these comparative costs are applied in conjunction with the need for continuous fossil-fuelled backup and its associated CO2 emission, **the cost of using wind turbines as a method of CO2 avoidance is very high. In fact, it emerges as the highest cost option.**

Another recently released report from the United States comes to the same conclusion. The *National Academies' National Research Council* (NRC) report on the environmental impacts of wind energy projects was released on 18 May 2007. (Although this report focused upon the Mid-Atlantic Highlands, it provides detailed information and recommendations relevant to the entire country).

The NRC report found that the environmental benefits of wind power were not certain, particularly in the Mid-Atlantic area. The report states that,

> wind energy development will provide no reduction in emissions of sulfur and nitrogen oxides, the pollutants responsible for acid rain and ground-level ozone. Regarding carbon dioxide, industrial wind turbines will offset national emissions by only 1.2-4.5% from the levels that otherwise would occur from electricity generation. [Most expert estimates are much lower however, usually around .0003%]. Consequently, **wind power will not reduce carbon emissions of the U.S., but merely will slow the increase by a small amount.**[12]

In a paper given at the British Institution of Mechanical Engineers, David Tolley described the *actual UK operating experience* with the accommodation of modest wind output as follows:

> When plant is de-loaded to balance the system, it results in a significant proportion of de-loaded plant which operates relatively inefficiently. […] Coal plant will be part-loaded such that the loss of a generating unit can swiftly be replaced by bringing other units on to full load. In addition to increased costs of holding reserve in this manner, **it has been estimated that the entire benefit of reduced emissions from the renewables programme has been negated by the increased emissions from part loaded plant.**[13]
>
> While the trading arrangements can be modified, the underlying need for backup fossil-fired capacity working below optimal efficiency persists.
> The Council of European Energy Regulators comes to similar conclusions in its recent survey of European experience of wind energy, where it observes that while the Spanish market is better designed for the introduction of wind this does not address the fundamental issue: . . . the question of actual real cost of wind and effect on carbon emissions (in light of additional thermal generation needed for balancing and compensation) remains.[14]

3.0 ONTARIO CONSUMERS MUST PAY FOR *ALL* INDUSTRIAL WIND ENERGY THAT IS PRODUCED—WHETHER IT CAN BE UTILIZED AT THE TIME OF PRODUCTION OR NOT.

Just as underproduction by wind turbines (caused by the failure of the wind to blow) can destabilize the grid, so too can production that is not required when it is produced. This happens when the wind is blowing forcefully during low demand hours.

The Ontario *Energy Probe* report pointed out that **"high but highly variable wind production during low demand periods was common".**

Whenever wind turbines are producing electricity in excess of what is required by the grid, the overproduction has to be compensated for in order to maintain grid stability. This is done by taking the already producing thermal plants off-line and substituting the wind

energy for the power they were producing at a fraction of the cost. However the thermal generators cannot be shut down but must be kept running inefficiently on standby for the moment when the wind might drop. As more wind farms are added to the grid, the need to stabilize the grid is greater.

Normally the spot market for electricity would mean discount prices for power consumed during the off peak period. But Ontario's standard offer contract now guarantees purchase of wind energy produced at 11 cents kWh premium even when cheaper energy could be purchased from other sources.

The inefficiency of such a system is obvious. Ontario consumers are being forced to purchase electricity at inflated prices during low demand periods. As has been shown above, the cost of running backup generating facilities is considerable. And more CO2 emissions are produced than if wind were not part of the energy mix.

As Tom Adams writes: "In Ontario, the McGuinty government is currently buying wind power for 11¢ per kilowatt hour -- about double the current price homeowners pay for reliable, available-on-demand power. A little competition would mitigate this. Before the wind industry convinced the McGuinty government to adopt sole-sourcing for wind power as it was done for nuclear and some gas generators, competitive auctions in 2004 to supply wind power revealed a price of 8¢ per kilowatt hour and 8.6¢ in 2005."

Clearly, the present arrangement works entirely to the benefit of wind energy producers and increasingly raises the cost of electricity to consumers in proportion as more wind facility is installed on the grid.

This phenomenon reaches absurd proportions in Denmark which has one of the world's highest concentrations of wind turbines. There 80% of the wind energy that is produced, has to be sold to Denmark's neighbours, Norway and Sweden, at a price far below the cost of production in order to stabilize the grid because it is produced during periods of low consumer demand. Conversely, because of its extensive investment in wind, Denmark is frequently forced to buy hydro and nuclear power from its neighbours. The net outcome is that Denmark with the highest amount of installed wind energy has the highest consumer electricity charges in Europe. Danish households already pay 100% more for their electricity than other European consumers.

The recent Ontario government proposal to pay wind energy producers *an additional* bonus for the wind energy that is actually available during peak demand will simply add to the consumer cost burden. In Ireland, on the other hand, regulations have *restricted* wind producers from supplying energy *except* when it is actually needed by the grid. Certainly this is a more reasonable approach. According to White,

> "The most recent outcome of the review of wind-power in Ireland is ESB National Grid's creation of a new Grid Code. The 'Wind Farm Power Station Grid Code Provisions' place stringent constraints on owners of new capacity. **The general intent may be summarised as requiring generators to accept responsibility for contributing to the security of the power supply system, and to discourage the speculative building of wind farms the output of which the grid operator is**

> **required to accept at all times.** The new provisions dictate some very specific steps that the owner must take to 'manage' the input to the grid with careful control of frequency, % Active Power and other relevant matters, thereby making the owner a responsible member of the generation/distribution team. If successful this will limit the fluctuations the impact on conventional capacity acting in the backup role. It is premature to judge the outcome of this new Grid Code, but it is worth noting that the requirements though onerous are entirely justifiable, and may well curtail investment in randomly intermittent generation".

Nevertheless, as more wind turbines are installed on the grid, the problem of managing grid stability becomes more difficult, despite the costly use of backup generation. The report investigating Europe's electricity black out of November, 2006 laid the blame at a sudden influx of wind power onto the grid in Germany. [15] An earlier E-ON Netz report (2004) had predicted increasing black outs as more wind energy is added to the grid.

4.0 HIDDEN COSTS OF INTERLINKING TRANSMISSION LINES FOR WIND POWER WILL BE PAID FOR BY THE CONSUMER.

There are still even greater "hidden costs" awaiting the electricity consumer as wind is added to the grid. Unlike conventional coal or gas plants which were usually located close to large concentrations of consumers in the cities, commercial wind generation must be dispersed over a very wide area. The 19th century rural wind mill operated a single water pump on the farm where it was needed. Industrial wind power must be transmitted long distances to consumers. But the industrial turbines are spread over large tracts requiring hundreds of miles of interlinking transmission lines. This requires massive construction of new infrastructure in order to facilitate delivery of the electricity to the consumer.

The public is left to pay for the infrastructure.

White notes:

> The issue of cost is particularly sensitive. Wind-power increases the complexity of the transmission and distribution system, and it is therefore inevitable that transmission losses [often estimated at 10%] will increase because of the additional miles of cabling required, both factors increasing costs. Overall, not only will the incentives offered by Government to drive the investment in wind farms be paid for by consumers; increases in electricity prices will also be necessary to cover other secondary costs. [16]

Actual calculations of the cost of infrastructure needed to facilitate the introduction of industrial wind production onto the grid are staggering.

According to R. A. Dyer writing in the Texas *Star-Telegram,*

> Proposals are now before regulators and transmission planners to add $1 billion in transmission lines so a South Texas electric company can connect to the state's principal power grid, at least $3.5 billion in lines to get access to more wind power and about $6 billion to reduce congestion on the expanding grid.[17]

Tom Adams warns Ontario consumers:

> Connecting wind power to the grid is also costly. The ***first of many*** high-voltage transmission investments mainly directed at wind is currently pegged at $635-million. Connecting large wind generators to low-voltage distribution networks will require costly re-engineering. Whether high voltage or low, grid connections must be vastly oversized relative to average wind output to support infrequent bursts of full production."[18]

The complete cost is likely to be phenomenally high, given the experience of other jurisdictions. Glenn Schleede, former Vice President of the New England Electric System, [19] explains the uneconomical unused capacity that is required for such transmission lines:

> Electricity from wind turbines generally makes inefficient use of the transmission capacity that serves the turbines. Enough capacity must always be available to handle the peak output of a "wind farm."

However, that peak output is very rarely if ever produced.

> The capacity may not be used at all by the electricity from wind turbines for 50 to 70% of the time. Also, as noted above, costs tend to be high because acceptable sites for "wind farms" are often distant from load centers – which mean both higher capital costs due to longer lines and greater line losses of electricity.[20]

In a 2004 study of the hidden costs of wind energy, Thomas Tanton pointed out:

> Already, the transmission system is unable to keep up with demand for electricity. Among the various parts of the electrical system, transmission has suffered the lowest level of investment. One reason is that transmission capacity is inherently costly. . . . Estimates of the investment required to modernize the electric grid in just the eleven western states range upwards of $30 billion (EPRI 2001).[21]
>
> Already, siting of transmission lines is very contentious and fraught with local opposition. It can take two to five times as long to site and build transmission lines as it does to site and build new electricity generation capacity—often ten years or more. Siting will likely become even more difficult as transmission lines built to serve wind farms increasingly encroach on environmentally sensitive areas.
>
> It has to be large enough to carry a lot of electricity at peak times, but most of the time the electricity flowing through is low. It is as if major freeways were built for only a few days of use.

Adding significant amounts of wind will only push the total costs upward due to the spread-out nature of wind development, while making any investment less likely due to environmental concerns and operational difficulties.

Meanwhile, the ability of our system to handle the heavy flows that occur only a few times during the year is decreasing. The nation's transmission network is already the primary cause of power outages. Additionally, utility companies maintaining the electrical power grid must meet a new requirement—that the wires to the customer be available for delivering power produced by others who don't maintain the delivery network. In the case of wind (and often solar as well), FERC (Federal Energy Regulatory Commission) has placed the costs of those requirements on the transmission owner, not the wind generator. In most other cases, transmission upgrade costs are borne by those who create the need.

All in all, expanded development of wind generation is likely to create additional negative environmental consequences and also discourage investment. Federal policy should not be encouraging wind power through continuation of the production tax credit. It should focus instead on educating the public about the ancillary impacts of various energy sources.[22]

5.0 OTHER COSTS PAID BY THE COMMUNITY FOR WIND TURBINES.

There are additional costs which are less easily calculated that accrue to the community hosting wind turbines.

5.1 Devaluation of real estate for neighbouring properties

The drop in real estate values of neighbouring homes is an unfair burden to those who have chosen to live or retire to the country. International property consultant Savills states: 'the value of a farmhouse may be affected by as much as 30% if it is in close proximity to a wind turbine.' North American records show similar percentages as well as many properties that simply cannot be sold because of the presence of wind turbines in the vicinity.

5.2 Degradation of natural heritage habitats and mortality of migratory birds and bats

The Ontario Government has avoided its obligation to protect our natural heritage sites by failing to lay down firm regulations to restrict the siting of wind turbines near migratory bird routes and stopovers and conservation areas. Instead of designating the vicinity around significant conservation areas, ANSIs (Areas of Natural and Scientific Interest) and outdoor recreation landscapes currently used for boating, canoeing, fishing, and nature study as out of bounds for wind turbines, it has left planning to rural local authorities with no overall restrictions to keep industrial wind development well away from future expansion of towns and villages. Under Bill 51, it has also denied the local authority's right to restrict wind development on the grounds that it is essential "infrastructure". (All of the above information questions such a premise).

The government has also shirked its responsibilities under international treaties to protect migratory birds by failing to stipulate that wind turbines shall not be placed in the vicinity of migratory bird stopovers, diurnal and seasonal migration routes and important bird areas (IBAs). Instead, it has left protection of our irreplaceable heritage to the efforts of individual citizens, even requiring them to enter into negotiations with wind turbine developers, and routinely accepting the developers' own environmental assessments, despite their obvious bias.

Developers repeatedly argue that wind turbines do not endanger birds. The usual claim is that a wind turbine kills only two birds a year and that your household cat kills a lot more than that.[23] However scientific studies indicate a much higher bird and bat mortality. And the cat does not kill eagles and other raptors, one of the groups that has been found most at risk from blade collision.[24]

In his May 1, 2007 testimony to the U.S. Senate Committee on Natural Resources Subcommittee on Fisheries, Wildlife and Oceans, Mike Daulton of the National Audubon Society outlined the impacts of Wind Turbines on Birds and Bats.

> Wind energy facilities can have detrimental impacts on birds, bats, and other wildlife in four fundamental ways: 1. Collision mortality; 2. Loss or degradation of habitat; 3. Disturbance and subsequent displacement from habitat; 4. Disruption of ecological links.[25]

In another testimony to the U.S. House Subcommittee on Fisheries, Wildlife and Oceans Oversight Hearing on impacts of wind turbines on birds and bats, Donald Michael Fry, PhD, Director, Pesticides and Birds Program, American Bird Conservancy, stated:

> At the current estimated mortality rate, the wind industry will be killing 900,000 to 1.8 million birds per year. While this number is a relatively small percentage of the total number of birds estimated to live in North America many of the bird species being killed are already declining for other reasons, and losses of more than a million birds per year would exacerbate these unexplained declines. Data from the FWS Migratory Bird Management and Breeding Bird Survey by the US Geological Service indicate that at least 223 species of our native bird species are in significant decline (about 1/4 of all species in US). The mortality at wind farms is significant, because many of the species most impacted are already in decline, and all sources of mortality contribute to the continuing decline.

5.3 Human health issues

Widespread complaints about noise projected from wind turbines onto neighbouring residences has led to medical investigations of symptoms experienced by those living nearby. The French National Academy of Medicine has warned that

> the harmful effects of sound related to wind turbines are insufficiently assessed. Wind turbines . . . will have to be considered as industrial installations and to comply, by that fact, to specific regulations that take account of the harmful effects of sound as particularly produced by these structures.).

> People living near the towers, the heights of which vary from 10 to 100 meters, sometimes complain of functional disturbances similar to those observed in syndromes of chronic sound trauma. . . . The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind, . . . constitute a permanent risk for the people exposed to them.

Dr. Nina Peirpont of New York State and Dr. Amanda Harry of Cornwall England have both catalogued specific cases related to wind turbine noise. Dr. Harry advises a space of 1.5 miles between turbines and inhabited houses.

5.4 Potential loss for tourism industry

Concerns about the adverse effect of wind turbines on the tourism industry have been expressed by tourism agencies in Wales, Scotland, England, Australia and the United States. Claims by the industry that wind turbine towers are tourist attractions have not been substantiated by reality. In England, two wind turbine visitor centres were forced to close due to bankruptcy owing to a dearth of visitors. In fact, in a number of visitor surveys, tourists have said that they prefer to avoid areas where wind turbines have been installed because they feel their presence spoils the natural beauty and takes away from the quality of their holiday. Entrepreneurs in this sector are concerned that their investments will be jeopardized by the arrival of wind turbines in their areas. Once again, the Ontario Government has done nothing to demarcate wind turbine-free tourism zones to preserve this important source of livelihood in many rural parts of the province.

6.0 THE GROWING INFLUENCE OF PUBLIC DISSENT

The public has been kept almost entirely uninformed about the *real* costs and *actual* benefits of commercial wind power. There has been no public debate. But this situation could last only as long as commercial wind energy retained its idealized, theoretical reputation in the public mind.

In the words of Glenn Schleede,

> the facts about wind energy are just beginning to catch up with the false and misleading information that has led to faulty government policies, tax breaks and subsidies. While government officials lavish tax breaks and subsidies on the wind industry, ordinary citizens around the world where "wind farms" have been built or are proposed are learning that the public, media and government officials have been badly misled about the costs and benefits of wind energy. As the facts are becoming known, opposition to "wind farms" is growing rapidly in US and other countries, including the UK, Germany, Denmark, Spain, Italy, France, Australia and New Zealand.[26]

Hundreds and hundreds of citizen-led opposition groups have emerged. Typical of the growing public outrage was the October 6, 2007 1,500-strong demonstration of heritage and countryside associations which marched on Paris and *obtained the redirection of French industrial wind energy policy*. President Sarkozy has now pledged to protect public health from wind turbine nuisance, review price support for wind turbines, disclose the true numbers of wind energy development and restrict turbines to brownfields keeping them away from the idyllic French countryside. Similar protests in Denmark have put an end to all further installation of onshore commercial wind facilities. Public outcry in Spain has ended government subsidies and in Holland, the public has insisted on laws that restrict the installation of wind turbines within 1800 metres of inhabited dwellings.

Citizens' opposition groups around the world are increasingly networking, speaking out, sharing information publicly, collating research, and questioning the real cost of industrial wind power and the logic of government subsidies. Evidence of their efforts is readily available on such internet sites as: www. industrial wind action.org

According to Schleede, there are at least 10 major reasons why "wind farms" have become controversial:

> **1. Tax avoidance – not environmental and energy benefits – has become the prime motivation for building "wind farms."** Briefly, the tax breaks include federal and state accelerated depreciation, production tax credits, and reduced or

forgiven property and sales taxes. [These are similar in Canada and the most generous in Ontario].

2. Huge windmills – often taller than the US Capitol -- produce very little electricity. Some 15,000 windmills are now scattered across thousands of acres of land in 30 states in the US, with total generating capacity of 6,740 megawatts (MW) as of January 5, 2004. If those thousands of windmills average a generous 27% capacity factor, the total amount of electricity they would produce annually would be 15,941,448,000 kilowatt-hours. That sounds like a lot of electricity, but it is equal to **41/100 of 1%** of the electricity produced in the US during 2003.

3. Electricity from wind turbines has less real value than electricity from reliable generating units and they detract from electrical system reliability. Wind turbines produce electricity only when the wind is blowing within the right speed range. Today's models may begin producing some electricity at wind speeds of about 8 miles per hour, reach rated capacity around 33 MPH, and cut out around 56 MPH. Because their output is *intermittent*, *volatile* and *largely unpredictable*, the electricity they produce has less value than electricity from reliable ("dispatchable") generating units.

Electricity grids must be kept in balance (supply & demand, voltage, frequency), so some reliable, dispatchable generating unit(s) must be immediately available at all times – and operating at less than peak efficiency and capacity -- to "back up" the unreliable wind generation. The reliable, backup unit(s) must ramp up and down to balance the output from the wind turbines. Wind turbines detract from grid reliability and would be of no value in restoring an electrical grid when there is a blackout. Further, when electricity demand increases, reliable units must be added to meet growing electricity demand even if wind capacity has been built. Wind turbines have virtually no "capacity value." ***Thus, electricity customers pay twice; once for the wind energy and again for reliable capacity.***

4. The true cost of electricity from wind is much higher than wind advocates admit. Wind energy advocates ignore key elements of the true cost of electricity from wind, including:

• The cost of **tax breaks and subsidies** which shift tax burden and costs from "wind farm" owners to ordinary taxpayers and electricity customers.

• The **cost of providing backup** power to balance the intermittent and volatile output from wind turbines.

• The full, true **cost of transmitting** electricity from "wind farms" to electricity customers and the extra burden on grid management.

5. Claims of environmental benefits of wind energy are exaggerated. The wind industry typically overstates claims of potential emission reductions that might result from displacing electricity generated by fossil-fuelled generating units. They tend to ignore the fact that backup generating units must be immediately available and running at less than their peak efficiency or in spinning reserve mode, and that backup units continue to emit while in these modes. Also, the generation that may be

offset may not be powered by fossil fuels. Further, under "cap and trade" programs, *credits* for sulphur dioxide or nitrogen oxides emissions that are displaced by wind can be sold to other emitters, with NO reduction in those emissions.[27]

6. "Wind farms" have significant adverse impacts on environmental, ecological, scenic and property values. Citizens in various states (and other countries) where "wind farms" have been constructed have become painfully aware that – in addition to the high true cost of the electricity -- "wind farms" impair environmental, ecological, scenic and property values. Among the adverse impacts are noise, bird kills, interference with bird migration paths and animal habitat, destruction of scenic vistas and ecological rarities (such as the Flint Hills and Tallgrass Prairie in Kansas), distracting blade "flicker" and aircraft warning lights, and lowering the value of properties located near the huge structures.

7. "Wind farms" produce few local economic benefits and such benefits are overwhelmed by the higher costs imposed on electricity customers through their monthly bills. DOE (Department of Energy), the National Renewable Energy Laboratory (NREL) and the wind industry have falsely claimed that "wind farms" provide significant economic benefits in the areas and states where they are constructed. They often claim benefits from the capital investment, jobs, tax revenues, lease payments to landowners, and "other" economic activities. Sometimes they claim increased tourist traffic.

In fact, as explained in detail elsewhere, there are few economic benefits and these are overwhelmed by the higher true cost to electricity customers and taxpayers of the electricity produced by the "wind farms."

8) Various other subsidies shift large amounts of cost from "wind farm" owners to ordinary taxpayers and electricity customers. The wind industry benefits from subsidies in addition to the tax breaks mentioned above. Other subsidies are in the form of artificially created, high price "markets" for wind generated electricity. These include guaranteed markets for electricity which result from (i) insidious "renewable portfolio standards" mandated by several states that require electricity suppliers to obtain some share of their electricity from "renewable" sources, (ii) additional markets due to mandated purchases of "green electricity" by federal and state government agencies, and (iii) state programs requiring or encouraging electrical utilities to offer "green" electricity at premium prices. Electricity customers can elect to pay premium prices but these programs generally do not attract enough "volunteers" to pay the utilities' costs of buying the "green" electricity and administering the program. The cost not recovered from customers paying premium prices is then spread across all of the utility's customers and hidden in monthly electricity bills.[28]

9) The big "winners" are "wind farm" owners and a few landowners who lease their land.

Electricity customers and taxpayers are the big "losers." First . . . "wind farm" owners benefit enormously from the generous tax breaks and other subsidies that shift tax burden to ordinary taxpayers. "Wind farm" owners also benefit from the

revenue from the sale of electricity while shifting costs (e.g., backup generation and transmission costs) to electricity customers.
Secondly, a few landowners who lease their land may be "winners" but their neighbours are the "losers." [In Canada, landowners are being paid only $3,000 to $10,000 per turbine—only a fraction of what we are paying to wind developers. Signing secret leases is also destroying the social fabric of our communities]. It would be cheaper for the electricity customers to pay the landowners to NOT allow wind turbines to be built on their land!

10) The wind industry falsely claims that they deserve tax breaks and other subsidies because other energy sources have received even larger government-imposed benefits.
Ideally, subsidies for all energy sources would be reduced significantly, but the wind argument is fundamentally flawed because it does not take into account either the existing or potential contribution of wind energy in supplying US energy requirements. When the expected contribution of wind energy toward supplying US energy requirements is taken into account, wind energy is among the most heavily subsidized of all energy sources. EIA expects wind to provide less than 1/2 of 1% of US energy requirements by 2025.

The tax breaks and subsidies that are attracting big money interests to "wind energy"
As indicated above, the tax breaks and subsidies for the wind industry are at the expense of ordinary taxpayers and electricity customers whose interests are not well represented in government circles. **The practical effects of the tax breaks and subsidies are to:**
• Misdirect hundreds of millions of investment dollars into energy projects that produce only small amounts of low value, low quality electricity.
• Transfer substantial wealth from ordinary taxpayers and electricity customers to "wind farm" owners by shifting tax burden from "wind farm" owners to ordinary tax payers, and passing along the high priced electricity from "wind farms" to electricity customers.[29]

Although Schleede refers to American tax incentives, similar programs are in operation in Canada and other countries.

7.0 CONCLUSIONS

In his study, White concludes:

Price increases for electricity cause a domino effect in the rest of the economy.

There are cheaper and more certain methods of reducing CO2 emissions and it is almost certainly wiser to place more reliance upon those, and less upon wind. A

> greater reduction in CO2 could be achieved by building CCGT at much lower cost. As natural gas prices rise, it will be economic to convert coal into gas and burn the fuel in systems equipped with CO2 capture.
>
> The focus on wind power for new generating capacity is likely to lead to the retention of old, low-efficiency, coal-fired plant for an extended period because market forces hold prices at a level that discourages new investment.
>
> **It seems reasonable to ask why wind-power is the beneficiary of such extensive support if it not only fails to achieve the CO2 reductions required, but also causes cost increases in backup, maintenance and transmission, while at the same time discouraging investment in clean, firm [always available] generation capacity.**

"An extremely important part of the Ontario Auditor General's mandate is the value-for-money component. Value-for-money audits are assessments of whether or not money was spent with due regard for economy and efficiency and whether appropriate procedures were in place to measure and report on the effectiveness of government programs. Under the *Auditor General Act*, the Office is required to report to the Legislature significant instances where it is observed that the government is not fulfilling its responsibilities in these areas." [30]

As the public increasingly learns the *real costs* of wind turbine development, publicly subsidized industrial wind power projects are rapidly becoming unacceptable. **Many Ontarians now believe that public support of industrial wind turbine development and premium prices paid for wind energy by the Ontario Government are not money spent with due regard for economy and efficiency. We believe that it is imperative that Auditor General's Office investigate this wasteful investment of public funds and that Ontario's Legislature place an immediate moratorium on the building of new wind turbine facilities in the province as well as end subsidies and tax incentives paid to the wind industry.**

We also believe that the Ontario Government must immediately put into place an effective constraint planning law requiring all provincial wind installations to avoid a five mile area around local conservation areas, ANSIs, tourism areas, migratory bird stopovers, towns and villages and be kept at least 1800 metres from inhabited human dwellings.

Jon Boone wrote:[31]

> The history of environmentalism chronicles the effort to restrain corporate excess and mitigate the unintended consequences of uninformed decisions wrought by wishful thinking. The public and its political representatives should take the time to learn about the wind industry in this context
>
> Above all, none should continue to drink from the well of wishful thinking. Industrial scaled wind complexes . . . offer no real response to the threat of global warming and only token gestures for improving air quality. A much more meaningful

action would redirect the substantial tax subsides available for wind energy to fund conservation and efficiency incentives, for these would have a far greater impact in reducing the effects of fossil fuel combustion and toxic emissions responsible for endangering the world.

Robert M. MacIntosh, past president of the Canadian Bankers Association, said in 'Overblown Wind', in the *Financial Post* 10/21/05: "It's time for reality to replace ideology in energy policy".

DOCUMENTS CITED:

David White: *Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution from Wind-Power*, commissioned and published by the Renewable Energy Foundation, December 2004: www.windaction.org/documents/225 .

Tom Adams: *Review of Wind Power Results in Ontario: May to October 2006* published in Energy Probe, November 15, 2006: www.energyprobe.org/energyprobe/articles/EPreviewofwindpowerresults.pdf.

E.ON Netz GmbH *Wind Report, 2004*: www.ref.org.uk/pages/press/061004.html...REPORT.

E.ON Netz GmbH *Wind Report, 2005*: www.ref.org.uk/images/pdfs/eon.2005.REF.pdf. These reports provide the most comprehensive summary of the way in which extensive wind facilities affect grid operations in Germany.

National Research Council of the National Academy of Science, at the behest of Congress, published its conclusions after a year of study about the *Environmental Effects of Wind Energy Projects in the nation's Mid-Atlantic region* (www.vawind.org/Assets/NRC/NRC_Wind.htm).

Jon Boone: The Wayward Wind (www.stopillwind.org/lowerlevel.php?content=WaywardWind), a speech delivered in June, 2006 to the citizens of Wyoming County, New York.

Glenn Schleede: 2 Wind Industry False Claims about Grid Impact 0806.pdf (126.6 kB)

Top Ten False and Misleading Claims the Wind Industry Makes for Projects in the Eastern United States: www.stopillwind.org/lowerlevel.php?content=topten_intro. Detailed debunking follows.

ENDNOTES

[1] David White, BSc, C Eng, F I Chem E is an energy consultant, and has held a range of senior management posts with Esso Petroleum Co. and the Exxon Group over a 30 year period. He spent the first 10 years in plant

operations management at their UK refinery. He was one of few chemical engineers to switch from refining to marketing where he was responsible for a wide range of market developments in the UK. He held appointments with Esso Europe in London, Exxon Corporation in New York, and Exxon Coal International. He took early retirement from Exxon Coal International in 1987, and created an energy consultancy practice. He has focused on technologies that offer solutions to emission problems from a range of fossil fuels and wastes by the application of energy conversion technologies. He monitors developments in EU and US environmental legislation along with data prepared by the Inter-Governmental Panel on Climate Change on ways to ameliorate global warming. He has directed courses on "Advanced Power Generation Technologies" and "Understanding the Refinery-Petrochemical Interface" for the College of Petroleum and Energy Studies, Oxford. Until recently, he chaired the Institution of Chemical Engineers Gasification Conference Steering Committee. He also sits on the IChemE Energy Technology Subject Group Committee and represents IChemE on a number of Inter-Institutional Committees and the Parliamentary Group for Energy Studies. He also drafts many of the Institution's responses to government consultation papers on energy related issues.

[2] About the Renewable Energy Foundation: REF is a newly created foundation which has arisen from widespread and growing public concern that the current renewables energy policy is in itself unbalanced, and causing subsequent imbalances in the rest of the energy sector. The Foundation encourages the development of renewable energy and energy conservation whilst safe-guarding the landscapes of the United Kingdom from unsustainable industrialisation. In pursuit of this goal, REF highlights the need for an overall energy policy that is balanced, ecologically sensitive and effective.
The Renewable Energy Foundation is currently commissioning research and commentary from leading consultants and industry experts in order to foster a full and informed debate. For further information see http://www.ref.org.uk. While focusing on renewable energy technologies, REF recognizes that a non-confrontational relationship with fossil fuels is essential for reasons of economy and social responsibility. Many renewables are intermittent, some randomly so. Consequently, and for the foreseeable future, renewables must work in partnership with fossil generation. It is therefore essential that the UK concentrates on high value renewables that do not degrade the performance of the overall energy portfolio.
[3] White, *op. cit.* p.5.

[4] White, *op. cit.*

[5] *Estimation of real emissions reduction caused by wind generators.* O. Liik, R. Oidram, M. Keel Tallinn Technical University, 5 Ehitajate tee, Tallinn 19086, Estonia

[6] *Reuters Power News* (June 2004)

[7] E.ON Netz, *Wind Report 2004* (2004), p. 3.

[8] *National Post*, Tom Adams and Francois Cadieux, 20 Nov 2007.

[9] *Review of Wind Power Results in Ontario: May to October 2006*. Tom Adams, Executive Director Energy Probe, November 15, 2006.

[10] Ibid, p.9.

[11] *Planning of the Grid Integration of Wind Energy in Germany Onshore and Offshore up to the Year 2020* also known as the *DENA 2004 Wind Report*, issued in English, February 2005.

[12] http://www.vawind.org/Assets/NRC/NRC_Wind.htm

[13] David Tolley (Innogy Plc), *NETA The Consequences – A Keynote Address*, Institution of Mechanical Engineers, Jan. 2003.

[14] Council Of European Energy Regulators (CEER), *Current Experience With Renewable Support Schemes*

In Europe (2004), pp. 57, 59.

[15] Union for the Co-ordination of transmission of Electricity (UCTE) (the association of transmission system operators in continental Europe) *Final Report on the disturbances of 4 November 2000* http://www.ucte.org/_library/otherreports/Final-Report-20070130.pdf

[16] White, *op. cit.* p. 14.

[17] August 5, 2007 by R. A. Dyer in *Star-Telegram.*

[18] *National Post.* 20 November 2007.

[19] GLENN R. SCHLEEDE is semi-retired after working on energy and related matters in government and the private sector for over 30 years. He now devotes a large share of his time to *self-financed* analysis and writing about (a) government policies and programs that are detrimental to consumers and taxpayers, and (b) government or private sector activities that are presented to the media, public and government officials in a false or misleading way. From 1992 until September 2003, Schleede maintained a consulting practice, Energy Market and Policy Analysis, Inc. (EMPA), providing analysis of energy markets and policies. During that time he worked primarily on natural gas and electricity issues. Prior to forming EMPA, Schleede was Vice President of New England Electric System (NEES), Westborough, MA, and President of its fuels subsidiary, New England Energy Incorporated. His time with NEES included responsibilities for procurement and transportation of coal, natural gas and oil for NEES facilities, NEEI's oil and gas exploration and coal shipping ventures, and NEES economic planning and budgeting functions. Previously, Schleede was Executive Associate Director of the U.S. Office of Management and Budget (1981), Senior VP of the National Coal Association in Washington (where he was employed from 1977-1981) and Associate Director (Energy and Science) of the White House Domestic Council (where he served from 1973-1977). He also held career service positions in the U.S. OMB and the U.S. Atomic Energy Commission. He has a BA degree from Gustavus Adolphus College and an MA from the University of Minnesota. He is also a graduate of Harvard Business School's Advanced Management Program.

[20] The *True Cost of Electricity from Wind Power and Windmill "Availability" Factors*. Glenn Schleede.

[21] EPRI (Electric Power Research Institute) 2001. *The Western States Power Crisis: Imperatives and Opportunities*. EPRI White Paper. Palo Alto, CA, June.

[22] *Whirlwind of Troubles- Environmental, Operational and Financial Problems,* Thomas Tanton, January, 2004.Web link: http://www.perc.org/perc.php?subsection=5&id=508#

[23] In a now famous address known as "The Wayward Wind", Jon Boone stated:

The wind industry asserts its technology is safe for migrating wildlife, using avian experts and industry-sponsored studies to bolster its claims. None of these have withstood the scrutiny of evidence. Tall structures—buildings, cell and communication towers-- are responsible for killing millions of migrating species annually. Huge 350-465 feet tall continuously lit wind turbines—with propeller blades moving at nearly 160 miles per hour at their tips and placed atop prominent ridges where large numbers of birds

concentrate in migration-- kill birds of prey, songbirds, and especially bats. Despite industry insistence this won't happen, it already has. When confronted with this reality, the industry argument morphs into a ten wrongs make a right scenario: "Cats and communication towers kill millions of birds annually, and we won't kill that many." When challenged about the appropriateness of this defense, the industry shifts gears once more: "The need for clean energy justifies the loss of wildlife," inferring that wind energy will displace significant fossil fuel production. Some here tonight might recall this same ends justifies the means rationale promoted use of DDT.

Three recent radar studies--one in Vermont, one in Virginia--each documented significant potential problems for migratory wildlife. Last week, I also talked with graduate students from Frostburg University in Maryland who recently used radar to chart numbers of birds and bats flying overhead along the mountains of Western Maryland. The preliminary data shows that wind turbines may pose a high risk to bird and bat populations. On many nights during the season, for example, as many as 300,000 birds and bats fly low enough to collide with huge wind turbines. Last year, Ed Arnett, a biologist with Bat Conservation International, released his study of two Florida Power and Light windplants in Pennsylvania and West Virginia. His research reaffirmed earlier studies showing major bat mortality. Faced with the news that its wind turbines were killing thousands of bats Florida Power and Light, reacted quickly. It barred scientists from pursuing follow-up work, removed its $75,000 contribution from the research cooperative studying bat mortality and ended the doctoral work of a graduate student who had produced two years of data showing unusually high rates of bat death at the Pennsylvania and West Virginia sites. Although Florida Power and Light has pulled the plug on further research into avian and bat mortality on any of its properties, the company plans to construct hundreds more turbines in the mountainous areas of the region.

Braddock Bay near Rochester along Lake Ontario is a major destination point for many thousands of birds of prey, many of which use the ridges along Silver Lake to help guide their spring migration. The July issue of Wildbird contains an excellent article about Braddock Bay and raptor migration. When I told Donald Heintzelman, one of this country's leading bird of prey specialists, about plans to construct several large windplants in this part of New York, he expressed concerned. Avian migration is an extremely complex phenomenon, with many influencing factors, including the changing conditions of weather and climate over many years. Adequate preconstruction study for wind projects does not mean that, because such study is made, therefore windplants should be built. Rather, risk studies should be made to determine whether or not they should be built at all. Wind developers plan thousands of turbines along the major avian migration flyways from Georgia through New Hampshire, creating a gauntlet of risk for birds and bats, some species of which having extremely vulnerable populations. We should take great care to avoid the unintended consequence wrought by uniformed decisions.

[24] "The wind industry has touted the safety of its newer technology, maintaining that "monopole towers" and slower moving blades, which rotate no faster than 20 rpms, will not harm wildlife. However, huge 350-465 feet tall continuously lit wind turbines—with propeller blades so long that, at 20 rpms, they are moving at nearly 200 miles per hour at their tips—and placed atop prominent ridges where large numbers of wildlife migrate—will kill raptors, songbirds, and bats. Despite industry insistence this won't happen, it already has. The annual body count at Altamont Pass, California has averaged nearly 5,000 birds for 20 years, prompting several current lawsuits. The wind industry response has been: "We need more time to study the problem while the turbines continue to run full bore. Indeed, when confronted with actual bodies on the ground, the industry argument morphs into a ten wrongs make a right scenario: "Cats and communication towers kill millions of bird and bats annually, and we don't expect to kill that many." When challenged about the appropriateness of this defence,

the industry shifts gears once more: "The strategic need for clean energy justifies the tactical loss of some wildlife."

When pressed hard, wind developers do admit their technology does kill. But the low bird and bat mortality ultimately acknowledged is extremely misleading if not outright disingenuous, for their "experts" often use an apples to orangutans comparison, giving statistics (only two or three birds killed per turbine) derived from western turbines averaging about 150 feet tall and located in fields not known for significant avian migration—then stating these should be comparable to 400 foot turbines located on high forested ridges in areas well known as a major avian flyway. This kind of comparison is no basis for credible prediction, which is the purpose of scientific analysis.

Recent radar studies at proposed industrial windplant locations atop the mountains of Vermont and West Virginia demonstrate that hundreds of thousands of birds and bats fly low enough to collide with huge turbines, placing them at risk—especially birds in times of fog and low clouds. The taller the turbines, the larger the threat. In 2003, a developer-sponsored mortality study conducted over a several week period at a West Virginia windplant revealed that over 2,000 birds and bats had been killed during fall migration in that span. Independent experts have doubled that mortality figure to more than 4,000, concluding that the developer's accounting methodology was insufficient.

While bird mortality has long been a concern, recent studies show that bat mortality may be an even greater problem, for reasons which are not entirely clear. But wind industry proponents press forward. To insure they receive all their tax credits, they continue to insist on post construction studies, a la Altamont Pass, vowing to work on resolving the "problem" in the future. Nonetheless, because of the documented experiences at Altamont and the recent discoveries made by radar analysis on ridgetop migratory routes, the industry has now begun to admit that windplant mortality could be very high. But not high enough to deter the building of windplants in risky areas, since, while the wildlife mortality at these sites may be significant, it is, according to the industry "not likely to threaten any species with extinction... ." Faced with the news that its wind turbines were killing thousands of bats at two windplants on Appalachian mountains ridgelines, Florida Power and Light, the owners of these windplants, reacted quickly. It barred scientists from pursuing follow-up work, pulled its $75,000 contribution from the research cooperative studying bat mortality and ended the doctoral work of a graduate student who had produced two years of data showing unusually high rates of bat death at the Pennsylvania and West Virginia sites. Although Florida Power and Light has pulled the plug on further research into avian and bat mortality on any of its properties, the company plans to construct hundreds more huge turbines in the mountainous areas." From "Misleading industry claims", stopillwind.org

Actual studies from wind farms in Europe and the U.S.A. indicate quite astonishing migratory bird mortality.

> Altamont Pass: Several studies evidenced an on-going massacre at this very large windfarm near San Francisco. In 2002 ornithologist Grainger Hunt estimated, very roughly, that golden eagles were being killed at the rate of 40 to 60 per annum. An in-depth study, performed by Dr. Smallwood more recently, puts the golden eagle mortality rate at 116 per annum, once adjusted for detection and scavenging
>
> Strait of Gibraltar: In 1995, SEO/Birdlife evidenced that 14 species enjoying protected status were being killed at two windfarms in Tarifa. Short-toed eagles, griffon vultures, eagle owls, kestrels, kites, egrets are included in the list.
>
> San Gorgonio, California: Raptors were the main concern. But a study by McCrary (1986) evidenced that passerines were also being killed in numbers: "an overall estimate of as many as 6,800 birds killed per year, most of them nocturnal passerine migrants." Many water birds are on the list as well.
>
> Navarre, Spain: In 2001, a report commissioned by the local government gave evidence that one third of the wind turbines in the region had made 7,150 victims in one year, including 409 griffon vultures,

24 eagles and other raptors, 650 bats and over 6,000 small birds, 40% of them migrants

Flanders, Belgium: At 12 sea-directed wind turbines on the 'East dam' in the port of Zeebrugge the mean number was 39 birds/wind turbine/year.

Cordelia, Solano County, California: S. Byrne monitored a solitary wind turbine for one year, starting in 1992: "The mortality adjusted for scavenger removal and detectability suggests an actual mortality during the study as high as 54 birds."

The Netherlands: In her 1992 study at Urk and Oosterbierum, Dutch biologist J.E. Winkelman estimated mortality to be somewhere between 33,500 and 195,500 birds per 1,000MW.

Sweden: From the PIER Study of the California Energy Commission (2002): In a summary of avian impacts at wind turbines by Benner et al. (1993) bird deaths per turbine per year were as high as 309 in Germany and 895 in Sweden.

[25] Development of wind power facilities results in destruction of habitat from support roads, storage and maintenance yards, turbine towers, and associated infrastructure. It may involve blasting and excavation to bury power lines. Such activity may cause contiguous blocks of habitat to become fragmented, leading to increased abundance of predators, parasites, and invasive species. . . . It can have substantial impacts if the wind energy facilities are sited in areas of pristine or rare native habitats.
Disturbance and subsequent displacement from habitat:
The impacts of wind energy facilities extend well beyond the footprint of the roads, power lines, and other structures. Disturbance from human activity and turbines may displace animals from the habitat. While this is seldom lethal, it may cause birds and other animals to abandon preferred habitat and seek lower-quality habitat elsewhere, where disturbance is less. This may result in reduced survival or reduced breeding productivity, which may cause lower or declining populations.
In cases where the birds affected are already in decline, the turbines could push them closer to extinction.
Disruption of ecological links:
Large wind energy facilities may interfere with the ability of birds and other wildlife to travel between feeding, wintering, and nesting sites. Alternatively, they may cause birds to make longer or higher flights between such areas. This results in higher metabolic costs, and therefore may reduce survival and reproduction.

[26] Glenn R Schleede: *"Big Money" Discovers the Huge Tax Breaks and Subsidies for "Wind Energy" While Taxpayers and Electric Customers Pick up the Tab.* 2004.

[27] [6] For a more general discussion of the relative fecklessness of industrial wind production, see www.stopillwind.org, and click on Misleading Industry Claims. Especially consult Claims 4 and 3, "Windplants are highly efficient and provide power for significant numbers of homes," and "Windplants will reduce the mining/burning of fossil fuels and lessen dependence on foreign oil."

[28] . Today, in places like California, many thousands of earlier, much smaller and no longer functioning turbines litter fields along the landscape, abandoned after investors had secured their profits and their tax credits ran out.[13]

[29] *"Big Money" Discovers the Huge Tax Breaks and Subsidies for "Wind Energy" While Taxpayers and Electric Customers Pick up the Tab.* April 14, 2005

[30] Web site of the Ontario Auditor General's Office.

[31] Jon Boone is an American naturalist who has written widely on the impact of wind turbines on the environment. His work can be seen at stopillwind.org
: