Report to the Planning Advisory Committee

Date: July 21, 2005

Re: Wind turbines

RECOMMENDATIONS:

I That Zoning By-law 8600 **BE AMENDED** to permit small wind systems on the following basis:

Add to Section 7, Definitions-

A **small wind system** means a wind energy electrical generating system consisting of a bladed turbine and supporting structure and all appurtenant electrical and mechanical systems used for the generation of electrical power for direct consumption by the owner/operator.

Add to Section 21, Supplementary Use Regulations, the following subsection:

(21) Wind Energy Systems

(a) A small wind system shall be permitted as an accessory use in any Zoning District in accordance with the following regulations:

(i) Minimum lot area- 0.2 hectares;

(ii) Maximum tower height- 30 meters (subject to special restrictions near the airport)

(iii) The tower of the small wind system shall have a minimum separation from a dwelling a distance equal to 110% of the total height of the tower and highest blade position.

II That Zoning By-law 85-18 **BE AMENDED** to permit a small wind system as set out in Recommendation I above.

Background:

In spring of this year a vendor and installer of wind turbines asked us to consider amendments to the zoning by-law to permit wider use of wind turbines. He had been advised by the Department of Building and Development that the zoning by-law, By-law 8600, limited the installation of wind turbines to certain zones, primarily industrial zones, and imposed restrictive height limits. Such restrictions made the use of wind turbines, as an alternative source of energy, either impractical or impossible.

We agreed to review the situation and report our conclusions to the Planning Advisory Committee and Council and suggest changes to the zoning by-law if merited. Our review

revealed that the by-law was indeed restrictive and that consideration of amendments to encourage the use of wind turbines was warranted.

Comments:

A discussion paper on alternative energy solutions and policies is being presented to the Planning Advisory Committee and this will lead to a more comprehensive energy study and to the introduction of new energy policies in the Official Plan. In the interim, it is our opinion that action can be taken to introduce more liberal regulations to the Zoning By-law to allow wind turbine installations.

We live in a global society largely dependent on fossil fuels as the primary source of energy (80% of world energy needs). The ability to sustain such a dependency is bleak, given rising populations, annual increases in energy demand and the depletion of oil and natural gas in excess of our ability to find, develop and refine them.

Wind turbines are just one option for renewable "green" energy. The US Department of Energy hopes to see 100GW of wind electricity in use by 2020 which would equal 3 quadrillion BTUs of primary energy (fossil fuels/hydro electricity) annually and represents a reduction of 65 million metric tones of carbon. Wind generating capacity in Europe, which has been much more aggressive in instituting new green energy initiatives, topped 28,000 MW, serving 35 million Europeans and helping to meet the European Union's goal of obtaining 22 percent of its power from renewable energy resources by 2010. Germany alone, which assists green energy based community co-ops, has 14,000 MW of wind power capacity, the equivalent of 60 per cent of Ontario Power Generation's total generating capacity from all sources.

Canada's commitment to meeting the goals of the Kyoto Accord, which requires a 6 percent reduction in greenhouse gases by the end of the decade, will require extensive investment in alternative forms of non-polluting energy production. Canada ranks only 13th in the world in installed wind generating capacity and the pace of greenhouse gas emissions is still on the rise (20% above the target 1990 emission level). The Province of Ontario, by 2010, hopes to generate 2,500 MW of wind-derived energy, equal to 10 per cent of our current generating capacity.

Wind turbines have "near-negative" emissions in respect to air pollution. In 2000 the Ontario Medical Association forecast 1900 premature deaths and 47 million minor illnesses directly attributable to air pollution in that year. According to the OMA, poor air quality represents over $10 billion in direct health costs to taxpayers and businesses in Ontario annually.

Windsor is well known for its frequency of smog alert days and any action that can reduce the negative impact of air pollution is beneficial. High temperatures on smog advisory days actually result in a surge in electricity demands from the use of air conditioners, which in turn raises the demand for more generating capacity. It is imperative that Canada and Ontario make greater efforts to curb air pollution and ensure access to a safe and reliable power supply and it is in the interest of municipalities like Windsor to assist in this effort.

Wind Turbine Overview

The rotation of a wind turbine produces an electric current, which is either transferred to storage batteries or to a generator or alternator to be used directly as a power source. The energy output varies with the height of the turbine, blade size, wind speed, temperature, geography, built form and altitude. Energy available in wind is a cube of wind speed. Generally, in wide-open spaces, wind speed increases by 12 per cent with each doubling of height.

Ideally, an annual average wind speed of 15 kph will be prevalent but speeds above 10 kph will still generate some power. In some jurisdictions, efficient use of wind energy can result in a surplus of power at times and this can be added to the larger electrical grid through "net metering". Net metering means that the addition of surplus energy to the power grid is credited toward an owner's future energy use. At times of higher personal usage, energy credits can offset the owner's higher energy costs.

Note: Net metering in Ontario is permitted for commercial energy producers only. No enabling policies yet exist for domestic producers. Any household benefit from energy production from wind turbines relates to the possible overall reduction in energy cost, assurance of a reliable power supply in times of outages and the satisfaction of using green energy.

There are a number of local areas with good wind resources for commercial grade wind turbines, particularly, on the leeward side of the Great Lakes. Windsor/Essex County is a suitable location for more modest wind generation, primarily in the three seasons, fall through spring. Summer is not generally suitable for wind generation, as is typical of a modified continental climate. Wind speeds are higher by day, which corresponds with peak electrical load demands.

While large-scale individual commercial grade wind turbines can be 300+ feet in height and generate 2500 KWs of electricity, we are addressing more modest facilities suitable for urban locations. They range from micro systems of less than 100 watts, suitable for portable communications and emergency lighting, to mini systems of 100 watts to 10 kilowatts, suitable for lighting and refrigeration and electric heating, to small wind systems of 10 KWs or greater, which would supply the normal electrical needs of a house or small business.

While micro systems would be largely portable and not regulated by a zoning by-law, mini systems would normally be mounted on a rooftop or on a small freestanding tower. Small wind systems would normally be on a freestanding tiltable or climbable tower 9m (30 feet) to 30m (100 feet) in height, the design and construction of which must meet engineered standards in accordance with the Ontario Building Code. The life expectancy of a small wind turbine system is in excess of 20 years. Annual maintenance costs average 3% of the initial capital cost.

For horizontal axis wind turbines (HAWT) the most common type, where the blades are perpendicular to the ground, a yaw system, usually a tail vane, aligns the blades to the

wind. Special release systems use the yaw system to turn the blades away from the wind when wind speeds exceed design parameters. Large or high-end systems use computer control of yaw and electrical current generation/regulation. The other much less common variation is the vertical axis wind turbine (VAWT), which roughly resembles a squirrel cage or concave blades (eggbeater style) mounted horizontally on a base.

For HAWT systems, the required height of the tower is quite dependent on the surrounding terrain or, in urban areas, the surrounding land uses. Optimally, a tower would have exposure over a relatively unobstructed 100m (330 foot) range at turbine height and exceed the height of nearby intervening structures by 10 meters. These numbers differ with the variability of wind speed over time at a given location and the "porosity" of the intervening barriers.

Environmental Aspects and Capacity Issues of Wind Turbines

A. Noise

Moving blades generate noise. Studies of small wind turbines show measured noise levels of 55-58 dba (decibels) near the blades at normal operating wind speeds. Noise levels would fall off to 45 dba at 60m (200 feet). Background noise in urban areas, termed "Urban Hum", is typically around 50-55 dba. Consequently, at normal operating speeds, small wind turbines generate noise levels at the ground consistent with or close to the general background noise. Noise levels do increase with higher wind speeds, the size of the blades and the location of the receptor e.g. up or down wind. Relative noise levels will also be higher in less urbanized and rural areas, because background noise levels are lower, around 40-45 dba.

Since noise levels from a noise generator decrease the greater the distance between the generator and the receptor, distance separation regulations are justified. Quieter designs are being achieved through new technology related to such aspects as blade design. Further, the mid level frequency range generated is also much less offensive than common loud or high frequency sound sources such as air conditioners, power saws and weed trimmers and it is hoped that, ultimately, wind turbine noise will blend into the background better than many other modern urban noise sources.

B. Birds

Even with the extensive development of wind systems, the impact on birds is projected to be less than 1 percent of the impact caused by an one of these: tall buildings, transmission lines, towers, houses. European studies show that birds will change their flight (day and night) by 100 to 200 meters from a wind turbine. Moving blades generate sufficient sound and motion to warn birds of their presence. The maximum annual mortality rate at any commercial wind farm in North America is 2 birds/turbine. In general, predation, acid rain and global warming are having a much more significant impact on wildlife.

C. Neighbour Reaction

With the introduction of wind turbines to an urban setting, it is inevitable that they will be received with mixed reactions. This must be tempered by the need to encourage alternative energy resources and reduce dependency on the electrical grid. Like modern communications facilities, they will gradually blend into the urban background as people begin to accept them. They are also a symbol of local commitment to renewable energy and lesser dependence on the electrical grid.

In the near term, the number of wind systems will not be high for several reasons. Most small lot residential areas will be unsuitable for freestanding wind systems for a variety of reasons: (i) lots too small; (ii) too many impediments to wind flow, such as trees and other dwellings or the dwelling itself (therefore greater turbulence and lower overall wind speeds) and (iii) the cost of installation and maintenance.

D. Cost

Many property owners may perceive the capital costs as too high. One local seller of wind systems, prices small wind turbines (1000w output/60 foot tower) at $15,000+ with an additional $4000 for installation. This is a substantial investment for a typical homeowner and one that requires a strong personal commitment to alternative energy sources. The biggest challenge facing the industry is in developing systems that will be able to produce environmentally cleaner technology at a competitive price.

E. Other Factors

Ice can build up on standing blades and be thrown off when the blades rotate. Blade and turbine construction of getting more sophisticated. Much effort has been made to reduce weight and, accordingly, structural support can also be lessened. The use of guy wires can be replaced by more aesthetically pleasing freestanding towers. Stiffer, lighter blades require lower wind speeds, are more efficient and reduce the visual impact.

Due to the need to be largely free from obstructions and turbulence, the moving parts of small wind systems are placed well above ground and out of reach. For climbable towers, care should be taken to ensure that they are secured from unauthorized persons.

Sample Wind Turbine Legislation

In North America, the state of California has the most progressive legislation. In October 2004, a new California law recognized small wind turbines as a “use by right” in all but densely settled municipalities. A small wind system ranges in tower height from 65-100+ feet and generates 10-25 kilowatts of power, sufficient to meet household, farm and small business electricity needs. The state offers a cash rebate of up to 50% of the

purchase price of a small wind turbine and allows net metering for domestic users. These incentives permit homeowners to recoup their initial investment within approximately 5 years.

In Canada, most activity is in the pioneering stage and involves large-scale wind generation systems. The Federation of Canadian Municipalities has two environmental initiatives to stimulate municipal interest in renewable projects such as wind generation. The Green Municipal Enabling Fund (GMEF) provides a grant of up to 50 per cent to a maximum of $100,000 for feasibility studies related to energy service and sustainable community planning. The City of Sudbury and York Region have recently taken advantage of this funding for feasibility studies for wind farms. The Green Municipal Investment Fund (GMIF) finances up to 15 per cent of capital costs to finance the implementation of GMEF pilot projects. The Government of Canada has and will offer support for renewable energy projects as part of the Climate Change Action Program.

Our research to date indicates that the level of efficiency goes down with a reduction in the size of the system. The most kilowatts of energy per unit of capital and operating investment come from large-scale commercial wind generators. Small-scale systems are getting more efficient with, amongst other things, the development of new blade technologies, but units below that class are still controversial. Given the current levels of technology and the general lack of regulatory guidance concerning micro and mini systems, at this point, we are recommending only the implementation of zoning changes to accommodate individual small wind systems.

There is little in the way of municipal legislation dealing specifically with small wind systems, particularly in Ontario. Municipalities in the United States are slowly establishing ordinances under state initiatives. Regulations generally relate to siting relative to dwellings and height and deal primarily with freestanding tower systems.

Ministry of Environment (MOE) guidelines for noise and separation from dwellings relate to commercial grade wind systems. They do not address small wind systems.

Provincial Policy Statement (2005)

Under, the PPS, which was expanded by the Province in 2005, a greater emphasis has been placed on sustainable development and renewable energy. The Province will be issuing more detailed guidelines concerning the implementation of Provincial Policy Statements by municipalities later in the year.

1.8.1- Planning authorities shall support energy efficiency and improvement of air quality through land use and developments which:

e) promote design and orientation which maximize the use of alternative or renewable energy, such as solar and wind energy, and the mitigating effects of vegetation.

1.8.2- Increased energy supply should be promoted by providing opportunities for energy generation facilities to accommodate current and projected needs and the use of renewable energy systems and alternative energy systems where feasible.

1.8.3- Alternative energy systems and renewable energy systems shall be permitted in settlement areas, rural areas and prime agricultural areas in accordance with provincial and federal requirements. In rural areas and prime agricultural areas, these systems should be designed and constructed to minimize impacts on agricultural operations.

City of Windsor Official Plan Provisions

A healthy and sustainable environment represents a balance between human activities and natural features and functions. Reduction of pollution and the improvement of air quality are prime considerations. However, noise and vibration should be controlled and this can be accomplished through increased setbacks from a noise or vibration source (consistent with general MOE guidelines).

As an accessory or supplemental use, there are no restrictions within the land use section, Section 6, of the Official Plan to preclude wind systems.

That part of the City of Windsor annexed in 2003 is still subject to the Sandwich South Official Plan. It provides that the municipality will promote energy conservation by encouraging developers to implement designs, which attempt to minimize energy use. The municipality shall also encourage involvement in various energy conservation programs.

City of Windsor Zoning By-law Provisions

We are not recommending freestanding wind systems that are used for the commercial generation of electricity. This type of facility will be discussed as part of the larger renewable energy review. Nor, at this stage, are we recommending wind systems attached to buildings. There are few Canadian examples of such systems in place for study and none in this geographic area.

Proof of the efficiency of such systems and a better understanding of their physical requirements is necessary. We would like more technical information as to their safety and general design parameters and the opportunity to view sample zoning by-law and Building Code provisions before we recommend zoning by-law changes to accommodate them. In the interim, the Committee of Adjustment, on a site-specific basis, could consider individual variance applications for rooftop systems.

In Zoning By-law 8600, all zones permit uses accessory to the main uses(s) of the property. An accessory use must be subordinate and exclusively devoted to the main use and carried on with the main use on the same lot. A wind system intended to serve the power needs of a main use is an accessory use.

Generally, wind system height restrictions do not apply for non-residential zones. In residential zones, specific uses/facilities are permitted in required yards. Wind systems are not listed as a permitted use. Public utilities are permitted in residential zones but a maximum height limit of 20 meters applies.

In order to accommodate wind systems in all zones, changes to the supplementary provisions of the zoning by-law are required, in accordance with the Recommendations above.

For the annexed lands, the Town of Tecumseh zoning by-law is still in force, although the City now administers it. Like By-law 8600, under By-law 85-18, accessory uses to listed permitted uses are permitted as of right.

Recommended Zoning Changes:

Wind systems are dependent on a steady supply of wind that can travel with few impediments caused by intervening buildings, trees and other structures. The Official Plan encourages separation between noise sources and sensitive land uses. Safety considerations also favour separation. This is the avenue taken by other jurisdictions in dealing with wind systems.

It is recommended that the two zoning by-laws, By-law 8600 and 85-18, be amended to accommodate small freestanding wind generators in all zones subject to the following regulations:

1. Minimum lot size- 0.2 hectares (0.5 acres)

2. Maximum tower height- 30m (100 feet)

3. The wind turbine tower shall have a minimum separation from any dwelling a distance equal to 110% of the total height of the tower and highest blade position.

   Note: Within the operating area of the airport, wind turbines like any other tall structure will be subject to approval by airport authorities prior to the issuance of a building permit.

The proposed regulations would permit freestanding tower small wind systems. While this opens the door for new wind energy systems, it does, at least for the time being, restrict new facilities to larger parcels where safe separation from a dwelling, either the dwelling on the same lot or one on an adjacent lot, can be maintained. Many industrial, commercial and institutional sites will also have adequate lot areas to permit wind systems to function properly, while still ensuring adequate separation from dwellings. In the annexed lands, farmers will benefit.

It is not expected that these will be the final recommendations for wind generating systems. Rather it is the beginning of our commitment to future energy needs and the concept of promoting renewable energy solutions. Monitoring of new facilities as they

appear in Windsor and elsewhere will be necessary and it is expected that the larger renewable/alternative energy review will also lead to new OP and zoning changes intended to meet future energy needs.

Conclusions:

With much greater interest in renewable and alternative energy sources, changes to municipal zoning by-laws to accommodate wind energy systems are warranted. As a first step, it is recommended that provision be made for freestanding "small wind systems" suitable for use by individual consumers for their own energy needs.

Jeff Watson MCIP, RPP
Senior Policy Planner

Thom Hunt MCIP, RPP
Manager, Planning Policy