City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	March 30, 2010
From:	Robert Gonzalez, P.Eng. General Manager, Engineering and Public Works	**File:**	01-0370-01/2010-Vol 01

Re: **Proposed Demonstration Wind Turbine Review**

Staff Recommendation

That :

1. The concept of installing a wind turbine at a City owned site in Richmond be endorsed subject to external funding and further site-specific review.
2. The Chief Administrative Officer and the General Manager, Engineering and Public Works be authorized to sign:
   a. grant application(s) as required for the UBCM Innovation Fund and other applicable funds, and
   b. applications and agreements as required for BC Hydro's Net Metering program,

for supporting the wind turbine study and implementation.

Robert Gonzalez, P.Eng.
General Manager, Engineering and Public Works
(604-276-4150)

Att: 1

FOR ORIGINATING DEPARTMENT USE ONLY					
ROUTED TO:	**CONCURRENCE**		**CONCURRENCE OF GENERAL MANAGERS**		
Parks	Y ☑ N ☐				
REVIEWED BY TAG	YES ☑	NO ☐	**REVIEWED BY CAO**	YES ☑	NO ☐

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Staff Report

Origin

The City of Richmond has undertaken several initiatives to reduce energy consumption, increase energy efficiency and increase use of renewable energy sources. These energy initiatives support Council Term Goal #7 that states:

> *"Sustainability and the Environment – Demonstrate leadership in and significant advancement of the City's agenda for sustainability through the development and implementation of a comprehensive strategy that among other objectives includes incorporating sustainability into our City policies and bylaws".*

This report recommends that Council endorse the concept of installing a small wind turbine on a civic site as a means to further advance efforts in using more renewable sources of energy. This endorsement is required for the City to seek external funding which would be needed for actual project implementation. Further review of site-specific socio-environmental considerations would also be conducted prior to any implementation.

Background

About Renewable and Clean Energy

Conversion to 100% use of renewable and clean sources of energy is one key component of achieving a sustainable energy system. The City of Richmond has undertaken a number of renewable energy projects, including the implementation of solar thermal systems in City-owned aquatic Centres and water turbines in the City's surface water management system. The City also recently completed a showcase pilot project for a hybrid solar/wind turbine in Garry Point Park parking lot. Various other renewable clean energy technologies have also been studied for District Energy Utility projects, including biomass, river heat, ground source and ground water heat pumps.

Wind Energy

Electricity from wind energy is one of the fastest growing methods of electrical generation in the world. By providing energy on-site, wind energy can also potentially increase energy security by reducing dependencies on centralized systems. Wind energy is also considered to be a clean energy source, producing no greenhouse gas emissions or other known pollutants. In addition to the benefit of producing clean and safe energy, the growth of a wind power industry could also mean result in economic benefits.

The placement and use of wind turbines, however, needs to be well-considered. Turbines need to be assessed to make sure they make a wise use of capital investment. Turbines need to be well-situated in places of sufficient wind velocity to ensure that they are functional and generate acceptable wind energy. The placement of turbines also needs to be conducive with their surroundings. Considerations needs to be given to potential adverse environmental impacts and social concerns related to noise, intrusion and other factors (see **Attachment 1**).

Analysis

Preliminary Scoping Assessment

A preliminary scoping assessment was conducted on the conceptual proposal of installing a wind turbine on a civic site based on the following four criteria:

- Merit/Need
- Viability (technical and regulatory)
- Cost-Effectiveness
- Socio-Environmental Considerations.

Key findings were:

- there is merit as a demonstration project; widespread investment by the City would need further assessment
- a turbine is likely to be viable (there is likely sufficient wind speed and is likely to meet necessary regulations)
- a turbine may be cost-effective if external funding sources are provided
- Socio-environmental considerations need to be assessed.

Detailed results of the assessment are provided in **Attachment 1**. Based on the results of the preliminary assessment, staff recommend that the City proceed with undertaking a more detailed review. The review would include:

- community consultation;
- site-specific environmental assessment;
- more detailed cost analysis and development of a recommended financing strategy, including the application for Innovation Funding as a means to finance a turbine implementation. The application of external funding is contingent upon Council endorsement of the project.

Next Steps

The wind turbine study will be co-led by Engineering and corporate Energy Management in collaboration with Parks, Environment, Planning and Finance. The study would also be conducted in collaboration with BC Hydro. Results from the study will be used to inform the City's Community Energy and Emissions Plan (CEEP), a strategic plan being developed to identify priority areas of action for advancing energy sustainability.

Financial Impact

There is no financial impact at this time. The required reviews will be led by staff and conducted within existing budgets.

Conclusion

Utilization of renewable and clean sources of energy has become a priority in recent years due to climate change, energy security and increase in energy costs. Richmond's location, where the Fraser River meets the Pacific Ocean, provides strong opportunity for harnessing wind energy and increasing use of clean and renewable sources of energy. This report recommends that the City proceed with undertaking a study for implementing a wind turbine on a City-owned site to serve as a demonstration project and learning laboratory.

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March 30, 2010

Attachment 1: Preliminary Scoping Assessment of Wind Turbine At Civic Site

1. Merit

To-date the City has pursued a number of initiatives aimed at advancing energy sustainability and reducing related greenhouse gas emissions. These initiatives range in their level of effectiveness. The City is currently undertaking a strategic Community Energy and Emissions Plan (CEEP) to identify those initiatives that most effectively guide the City towards an energy-wise and low-carbon future, with key focus on reducing the City's reliance and use on fossil fuels. While most of the City's electrical energy is being supplied by renewable and clean energy source, the increasing demand for energy may place increasing demand on non-renewable electricity generating sources.

As a demonstration project, a small functional wind turbine is likely to serve as an effective icon to help raise awareness of the need for more sustainable energy systems and support, generate more community dialogue, engagement and support for City energy initiatives. The demonstration project would also serve as a "living laboratory" providing on-the-ground information on actual effectiveness and provide helpful learning on the process for implementation (e.g., challenges, opportunities, etc.) and key opportunities for policy changes needed to support broader applications.

Further assessment would be required prior to expanding the initiative beyond a demonstration project .

2. Viability

Technical Viability

A preliminary review was conducted using the Canadian Wind Atlas to determine whether sufficient wind velocities were present. Best practices indicate that wind velocities of 5 m/s or greater are required for effectively generating energy. Four sites were identified as potential candidates based on their likely wind generating capacities (see attached map for site locations). All four sites met the 5 m/s with 2 of sites exceeding the criteria (Table 1).

Table 1: Wind Energy Assessment for Potential Richmond Civic Sites

Potential City Owned Sites	**Avail. Strong Wind Energy[1] (1)**
Steveston o Garry Point o Scotch Pond	moderate to high
North of Dyke Rd between Gilbert and No. 2 Rd.	moderate
East of Lulu Island STP (No.3 Rd and Dyke Road	high
Terra Nova Park -- adjacent to/outside dyke	moderate

Actual wind energy generated however, is dependent upon both the amount of wind and size of the wind turbine. Different sizes and types of wind turbine systems are available in the market. Given that the turbine would be introduced into an urban setting, it is anticipated that a relative small horizontal wind turbines, such as those commonly used on farms, residential and commercial sites, would be used. While initial scoping indicates high likelihood of technical viability, specific wind energy generation capacity would need to be assessed based on the combination of specific site conditions and turbine type.

[1] Annual average wind speed of 5m/s is considered to generate moderate wind energy.

Regulatory Compliance

A preliminary scoping of the regulatory requirements for implementing a wind turbine did not identify any immediate constraints. The Wind Turbine would require both building and electrical permits. Further assessment on other potential legislative requirements, such as compliance with environmental legislation, would be conducted in the detailed review phase. Any turbine implementation would adhere to Canadian wind turbine codes and standards (see section 5 below).

3. Cost-Effectiveness

Wind energy systems have high initial capital costs with comparatively low operating costs. Total net present cost of a small wind turbine suitable for Richmond, including installation, is estimated to be approximately between $55,000 to $300,000 (for 5 kW to 50 kW), depending the size and efficiency of the turbine. Annual maintenance is estimated at $500 to $1500.00 per year.

Due to the relative high initial capital cost and currently low prices of electrical energy, business case evaluations of wind turbines typically identify the requirement for external funding to ease the capital investment and lower the payback. The UBCM Innovation Fund has been identified as potential source of project funding. Costs can also be potentially reduced through BC Hydro Net Metering Program which allows site energy producers to sell energy back to the grid (currently at a rate of $0.0816 per kWh). It is estimated that this program could result in $1,000 to $9,000 annual savings from annual electricity cost avoidance[2]. As a result, it is anticipated that a grid-connected turbine is likely to have a better business case in comparison to a stand-alone system. Regardless of external financial support, the City would be required to provide 100% capital investment upfront.

Leasing a small turbine would be an option that is considered in the more detailed feasibility assessment. Leasing provides flexibility, enabling the City to upgrade after a few years or easily remove the infrastructure should it not meet desired performance (technical, financial, social and/or environmental) levels.

A comprehensive cost evaluation should also compare the unit cost of energy generating through wind with the unit cost of energy generating from alternative clean and renewable sources[3]. Given that the proposed project is demonstration, this detailed cost analyses is not deemed necessary. However, should the City be interested in expanding beyond a demonstration project, this level of analysis would need to be conducted.

4. Socio-Environmental Considerations

While wind is identified as a renewable source of energy and reduces emissions, bird mortality could be an issue at certain sites. As Richmond is situated on the Pacific Flyway, a major north-south route of travel for migratory birds, site specific assessments will need to be done to ensure that sufficient mitigation and compensation measures are in place to avoid any net environmental impact.

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[2] BC Hydro recently announced that electricity costs will be increased this year by 6.11 percent along with an additional increase from 1 percent to 4 percent, both effective April 1, 2010. As electricity costs increase, the business case for renewable energy projects like wind turbines improve.

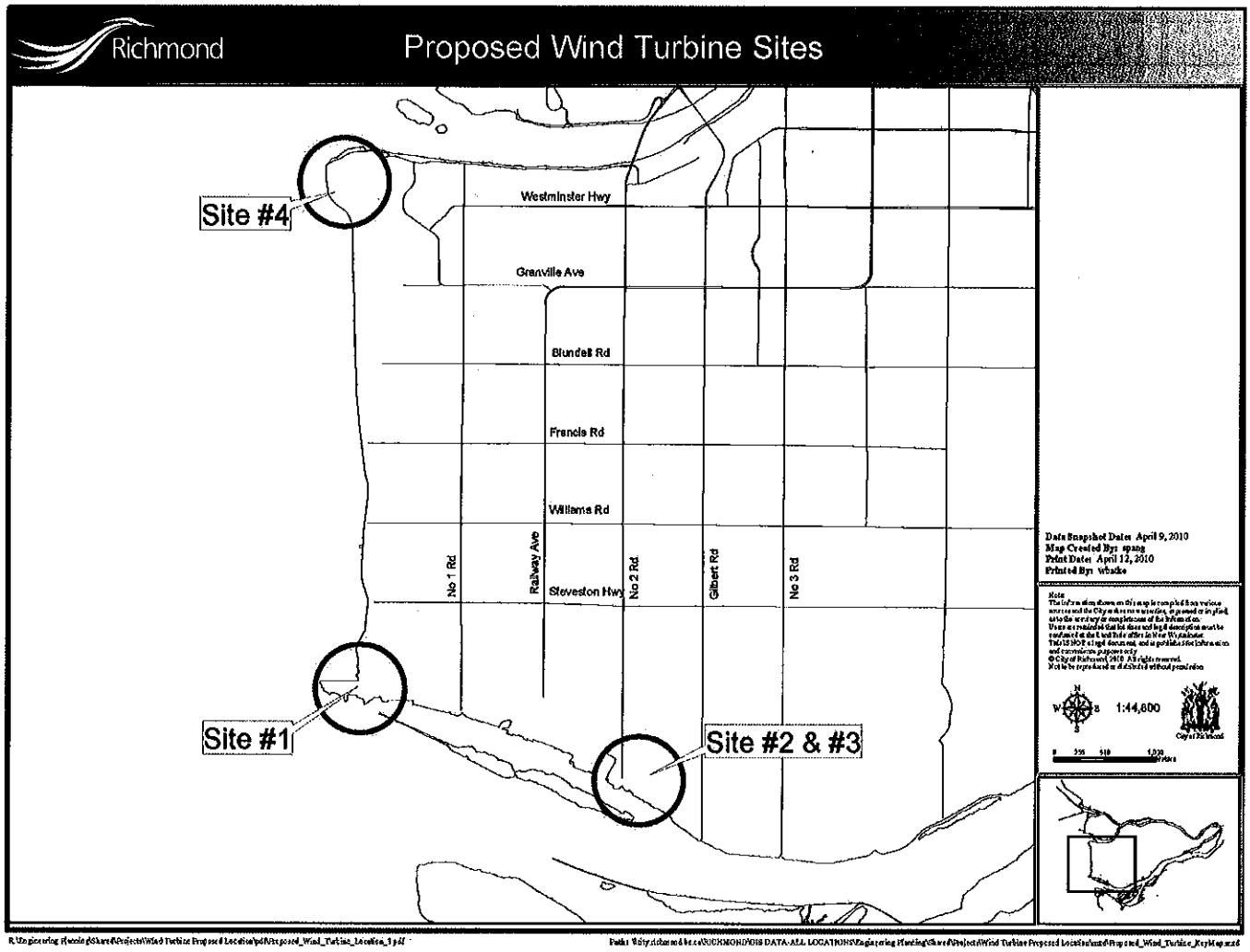
[3] It is noted that other sources of renewable and clean energy which replace fossil fuel usage to a more significant degree provide much greater cost benefits.

There is also the potential for community concern on aesthetics and noise which would need to be considered and addressed prior to implementation and will be included for discussion through public consultation. A picture of a small wind turbine is provided on the next page.

5. Additional Resources - List of Guidelines, Standards, References and other Useful Links

1) CSA Guide to Canadian wind turbine codes and standards CSA-F418-M91 http://www.csa.ca/standards/energy/CSAGuidetoCanadianWindTurbineCodes.pdf
2) CAN/CSA-F416-87, Wind Energy Conversion Systems (WECS) — Safety, Design, and Operation Criteria;
3) CAN/CSA-F417-M91, Wind Energy Conversion Systems (WECS) — Performance;
4) CAN/CSA-F429-M90, Recommended Practice for the Installation of Wind Energy Conversion Systems; and
5) CAN/CSA-F418-M91, Wind Energy Conversion Systems (WECS) — Interconnection to the Electric Utility (withdrawn by CSA in 2004). See Clause 10 (Electrical connections — Grid connected) for interconnection information.
6) Stand-Alone Wind Energy Systems: A Buyer's Guide, NRCan http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/wind_energy/publications.html?ISBN 0-662-37706-0
7) An Introduction to Stand-alone Wind Energy Systems, NRCan http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/wind_energy/publications.html?M27-01-1246E
8) Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radio communication, Radar and Seismoacoustic Systems http://www.canwea.ca/images/uploads/File/FINAL-CanWEAPositionOnSetbacks-2007-09-28.pdf
9) Wind Turbines and Sound: Review and Best Practice Guidelines http://www.canwea.ca/images/uploads/File/FINAL-CanWEAPositionOnSetbacks-2007-09-28.pdf
10) Canadian Grid Code for Wind Development: Review and Recommendations http://www.canwea.ca/images/uploads/File/Resources/Canadian_Grid_Code_for_Wind_Developments_-_Integrated_French-English_-_Final.pdf
11) Applicable version of BC Building Code or similar codes for structural and seismic design
12) Applicable version of National Electrical Code
13) www.Homepower.com buyers guide
14) Canadian Wind Energy Association www.Canwea.com

Map of Potential Sites



March 30, 2010

Picture of a Small Horizontal Wind Turbine