

## CHSD Backgrounder

Cochrane High School's Sustainable Development Committee (CHSD) looks at our school's operations and attempts to improve efficiency and reduce waste. Our past projects have focused on energy production (solar panels), energy use (LED lights, motion sensors, light sensor, solar collectors), water consumption (custom eaves trough, water barrels, dual flush toilets, waterless urinals) and waste reduction (plastic recycling bins, no-idling signs in main parking lot).

It is our vision to continue acting on our commitment to a more sustainable future by installing an Evance R9000 small wind turbine on our school site. We feel it important that the administration of the Town of Cochrane and other stakeholders have the opportunity to study the results of our research. ([www.sustainabledevelopment.ca](http://www.sustainabledevelopment.ca))

## CHS Small Wind Turbine Analysis

**Website:** <http://cochrane.rockyview.ab.ca/>

Since the summer of 2011, the Cochrane High School Sustainable Development Committee has been pursuing the implementation of a small wind turbine on school property. The committee has compiled the data collected into summary format. The objective of this thorough process was to demonstrate to the public the committee's commitment to respond intellectually and in an informed manner to concerns expressed by stakeholders. Urban Systems has been holistically researching the town of Cochrane's Renewable Energy Framework for months. The Cochrane High School Sustainable Development Committee has specifically researched SWT's (small wind turbines) for years. This comprehensive research, specific to urban small wind turbines and recently to the concerns of some Cochrane residents, encompasses noise, health, safety, site suitability, shadow flicker, property taxes, visual and economics. The committee feels that it can contribute to this important process and framework, and appeal to stakeholders to seriously consider its findings.



The full scale demo Evance R9000 rotor is mounted on a 9' pole and is located here in the photo in one corner of our small gymnasium called the Lyceum. Our proposal is to have the rotor on a 60' tower.

## Choice of Turbines in our Research - Summer 2011

| <b>Turbine</b> | <b>Country</b>   | <b>Size (kW)</b> |
|----------------|------------------|------------------|
| ARE/Xzeres     | USA (Oregon)     | 2.5 and 10       |
| Bergey         | USA (Oklahoma)   | 10               |
| Kestrel        | South Africa     | 3                |
| ReDriven       | Canada (Ontario) | 5 and 10         |
| Skystream      | USA (Arizona)    | 2.5              |
| UGE            | USA (New York)   | VAWT, 1          |
| Windspot       | UK               | 3.5 and 7.5      |

In summary we evaluated VAWT and HAWT and discovered that HAWT are still the most efficient on the market to date. From there we looked at 2.5 up to 10 kW and ruled out 7.5 and 10 kW turbines on the basis of size and cost. That left us with 2.5, 3 and 5 kW turbines to view. After the first community meeting on April 22, 2012, where Cochrane High presented the Xzeres 110 and the Evance R9000, noise and visual aesthetics were definite issues and that is when we decided on the Evance R9000 5 kW turbine.

## CHSD Scope of Research (2011 to present day)

| <b>Concern</b>  | <b>Number of Sources Use In Our Research</b> |
|---|--|
| Noise   | 29   |
| Health  | 48   |
| Safety  | 19   |
| Property Values   | 19   |
| Visual Aesthetics   | 10   |
| Animals   | 13   |
| Site Suitability  | 15   |
| Other - examples, municipal law, appeal material, pics, U of L, etc | > 30   |

# Evance R9000 Research Results 2014

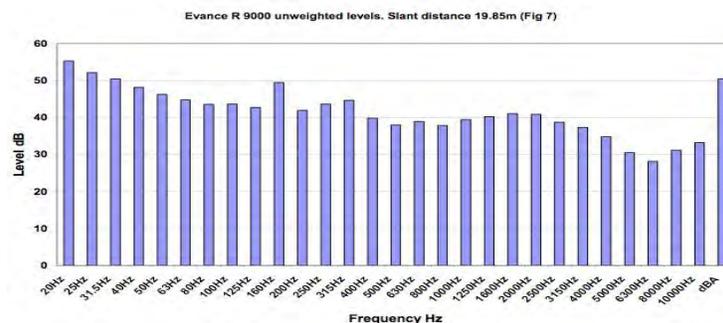
## Health (<http://ucalgary.ca/oikos/node/251>)

Four independent engineers/engineering firms analyzed the third octave frequency analysis provided to us by Evance. These individuals or firms include: Dr Geoff Leventhall, UK Acoustic Specialist, Dr David Woods, Faculty Manufacturing and Maintenance University of Calgary, RWDIair Consulting Engineers and Scientists Calgary (<http://www.rwdi.com/>), Aercoustics Engineering Ltd Toronto ([www.aercoustics.com](http://www.aercoustics.com)). None of these specialists have any affiliation with Evance Wind.

Noise Data From Evance - our closest resident is 140 m away from the turbine.

| Wind speed at 10m height (m/s) | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Slant distance (m)             |       |       |       |       |       |       |       |       |       |
| 60                             | 32.41 | 32.18 | 33.64 | 35.77 | 37.78 | 39.34 | 40.59 | 42.09 | 44.84 |
| 80                             | 29.87 | 29.64 | 31.11 | 33.24 | 35.24 | 36.80 | 38.05 | 39.55 | 42.31 |
| 100                            | 27.90 | 27.66 | 29.13 | 31.26 | 33.26 | 34.82 | 36.07 | 37.58 | 40.33 |
| 120                            | 26.28 | 26.04 | 27.51 | 29.64 | 31.64 | 33.20 | 34.45 | 35.95 | 38.71 |
| 140                            | 24.90 | 24.67 | 26.13 | 28.26 | 30.27 | 31.83 | 33.08 | 34.58 | 37.33 |
| 160                            | 23.70 | 23.47 | 24.94 | 27.06 | 29.07 | 30.63 | 31.88 | 33.38 | 36.14 |
| 180                            | 22.64 | 22.41 | 23.87 | 26.00 | 28.01 | 29.57 | 30.82 | 32.32 | 35.07 |
| 200                            | 21.69 | 21.45 | 22.92 | 25.05 | 27.05 | 28.61 | 29.86 | 31.37 | 34.12 |
| 220                            | 20.82 | 20.59 | 22.06 | 24.18 | 26.19 | 27.75 | 29.00 | 30.50 | 33.26 |
| 240                            | 20.03 | 19.79 | 21.26 | 23.39 | 25.39 | 26.95 | 28.20 | 29.71 | 32.46 |
| 260                            | 19.29 | 19.06 | 20.53 | 22.66 | 24.66 | 26.22 | 27.47 | 28.97 | 31.73 |
| 280                            | 18.61 | 18.38 | 19.85 | 21.98 | 23.98 | 25.54 | 26.79 | 28.29 | 31.05 |
| 300                            | 17.98 | 17.74 | 19.21 | 21.34 | 23.34 | 24.90 | 26.15 | 27.65 | 30.41 |

Noise Data From Dr Leventhall - Third Octave Frequency Analysis Unweighted dB at 7 m/s



Conclusion: This turbine has very little low frequency noise emission (Aercoustics). There is no evidence that the wind turbine will affect the health of people through low frequency noise (Leventhall). The committee has all the data at various wind speeds unweighted for actual noise levels coming from the turbine at a slant distance of 19.85 m.

Evidence Supporting SWTs Not Impacting Health of People: Olympics Heights Elementary school (Skystream), resident off Hwy 22 (ARE 2.5), Calgary zoo (Skystream) - no reports of impacting health

## Noise

The noise from the Evance R9000, as seen from the table below will be well within the Noise Bylaw of Cochrane (Daytime 65 dBA; Nighttime 50 dBA). As well, the noise from the turbine is consistent with AUC's Rules 007 and 012.

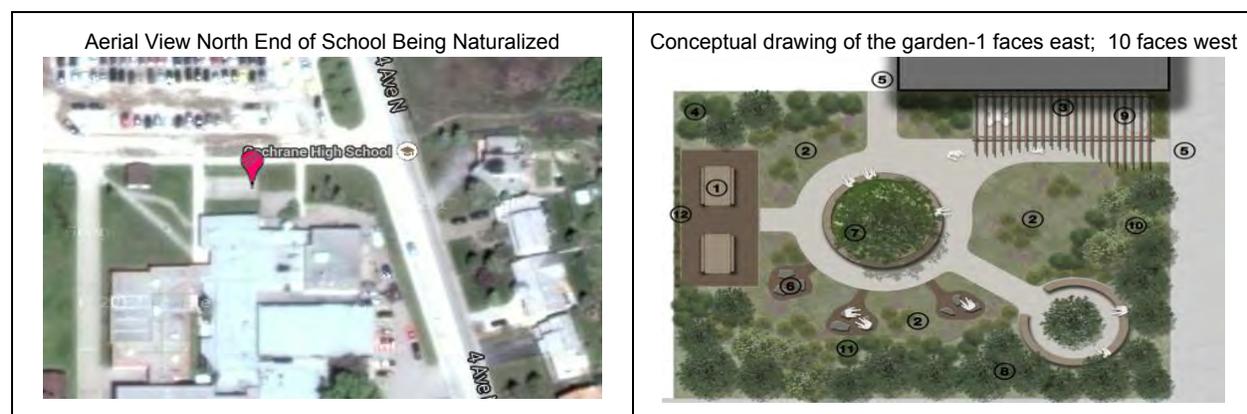
| Wind speed at 10m height (m/s) | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Slant distance (m)             |       |       |       |       |       |       |       |       |       |
| 60                             | 32.41 | 32.18 | 33.64 | 35.77 | 37.78 | 39.34 | 40.59 | 42.09 | 44.84 |
| 80                             | 29.87 | 29.64 | 31.11 | 33.24 | 35.24 | 36.80 | 38.05 | 39.55 | 42.31 |
| 100                            | 27.90 | 27.66 | 29.13 | 31.26 | 33.26 | 34.82 | 36.07 | 37.58 | 40.33 |
| 120                            | 26.28 | 26.04 | 27.51 | 29.64 | 31.64 | 33.20 | 34.45 | 35.95 | 38.71 |
| 140                            | 24.90 | 24.67 | 26.13 | 28.26 | 30.27 | 31.83 | 33.08 | 34.58 | 37.33 |
| 160                            | 23.70 | 23.47 | 24.94 | 27.06 | 29.07 | 30.63 | 31.88 | 33.38 | 36.14 |
| 180                            | 22.64 | 22.41 | 23.87 | 26.00 | 28.01 | 29.57 | 30.82 | 32.32 | 35.07 |
| 200                            | 21.69 | 21.45 | 22.92 | 25.05 | 27.05 | 28.61 | 29.86 | 31.37 | 34.12 |
| 220                            | 20.82 | 20.59 | 22.06 | 24.18 | 26.19 | 27.75 | 29.00 | 30.50 | 33.26 |
| 240                            | 20.03 | 19.79 | 21.26 | 23.39 | 25.39 | 26.95 | 28.20 | 29.71 | 32.46 |
| 260                            | 19.29 | 19.06 | 20.53 | 22.66 | 24.66 | 26.22 | 27.47 | 28.97 | 31.73 |
| 280                            | 18.61 | 18.38 | 19.85 | 21.98 | 23.98 | 25.54 | 26.79 | 28.29 | 31.05 |
| 300                            | 17.98 | 17.74 | 19.21 | 21.34 | 23.34 | 24.90 | 26.15 | 27.65 | 30.41 |

The Cochrane High small wind turbine is sited 140 m from the nearest residential property which is beyond the recommended setback distance by Evance. This distance will increase away from the properties when consider an 18 m tower. Also, portables and schools are constructed to meet the requirements of Parts 3 to 8 of the Alberta Building Code. Residential construction is according to part 9 of the Alberta Building Code.

Conclusion: This turbine will not be a noise disturbance for residents or for individuals using public buildings in Cochrane Heights.

Evidence Supporting SWTs Not Causing Noise Disturbance: Olympics Heights Elementary school (Skystream), resident off Hwy 22 (ARE 2.5), Calgary zoo (Skystream) - children and their parents playing under the turbine in the playground, attendees at zoo walking right next to the turbine and not noticing it; people boarding horses at the ranch beside Hwy 22 resident are not bothered by the turbine when it is spinning

Mitigation Measure: currently CHSD Committee is in the process of doing a grounds beautification project on a sect of land at the north end of the school. This project will act as a buffer between the turbine and the neighbours along 4th Avenue North. We are committed to ensuring that there will be no noise disturbance for northernmost residents along 4th Avenue.



## Animals

Dr Robert Barclay, bat expert, University of Calgary, states that our turbine is short (18 m) and will not affect migratory bats (three species); that our turbine is not near a source of water which is where the bats will be found as they are insect eating mammals; they are inactive during roosting (Oct - Apr); and that our turbine represents minimal threat to bat populations.



Little Brown Bat - may be present although no official study has been conducted in Cochrane Heights Community

Nature Calgary, Bird Study Group, Cochrane Area stated that if present, our turbine could pose a threat because of the small area that the blades encompass; and that if present, the spinning action of the blades may act as a collision deterrent to birds passing by; that they may collide with tower like other structures, such as windows and streetlights; and that it is unlikely to have a significant impact on local bird populations.



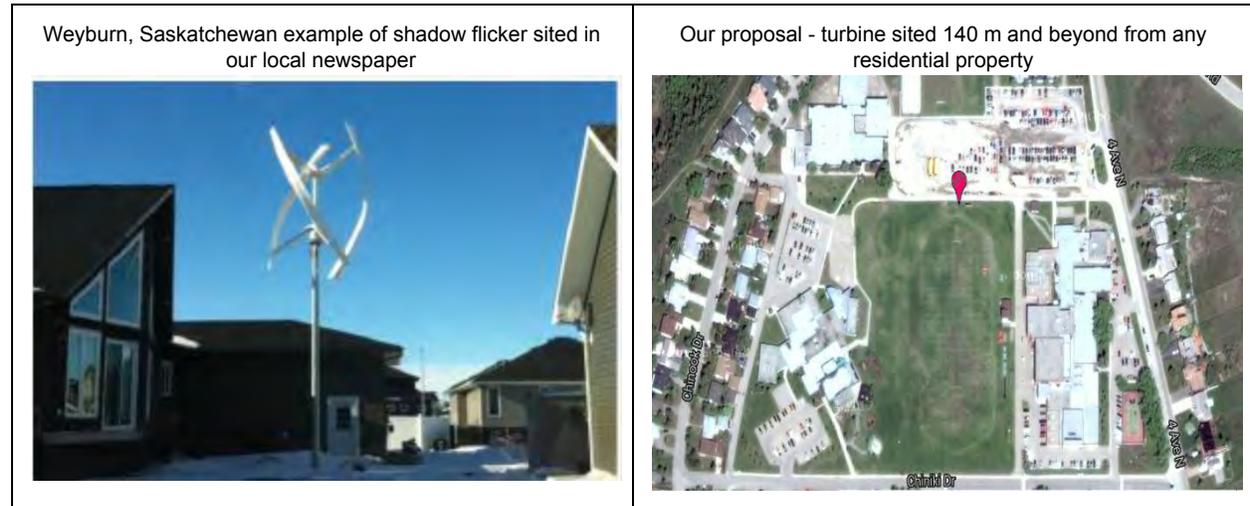
Merlin sited in Cochrane Heights Community by Bird Study Group

Conclusion: Currently our bat and bird experts anticipate that it is unlikely our proposed turbine will pose any significant risk to bird or bat populations. However, no official study has been conducted here.

Mitigation Measure: the City of Calgary currently requires a before and after biophysical impact assessment with their micro generation wind turbine bylaw

## Shadow Flicker

To avoid shadow flicker Evance R9000 recommends no property with a window facing the turbine should be within 25 m of the turbine location from due east to due west. Furthermore, Evance R9000 recommends that no occupant with a patio or conservatory be within 50 m at a direction of 120 degrees west to 120 degrees east of the turbine.



Conclusion: Our turbine is 140 m and beyond from our surrounding neighbours and will not cause shadow flicker

## Property Taxes

In January 2014 the committee contacted Mr David Imrie, Alberta Minister of Municipal Affairs and asked for information regarding SWTs in urban settings and property taxes. He referred us to Ms Susan Carlisle, Department of Energy, Director, Alternative and Renewable Energy Electricity and Sustainable Energy Division. She in turn spoke with AESO and AUC and they referred us to our local tax assessor.

According to Cochrane's previous tax assessor, they would not adjust property taxes up or down over a 18 m turbine with a 5.5 m rotor diameter because there are those who accept it as well as those who oppose it in the neighbourhood. We have not yet heard the stance of Cochrane's current property tax assessor.

Conclusion: Yet to be determined

Mitigation Measures: Considering we are building a new outdoor classroom with the grounds beautification project underway, that the turbine is well beyond the recommended setback distance, that there is little low frequency noise that will not pose any health risk to animals or humans, that it's positional setback mitigates shadow flicker, that the turbine has received numerous international safety certifications, and is mechanically sound, we are confident that this RET will not threaten to lower property value.

Evidence Supporting SWTs Not Impacting Property Values: Olympics Heights Elementary school (Skystream), resident off Hwy 22 (ARE 2.5) - has not lowered property taxes in any of the surrounding residential properties at either location.

## Safety

The introduction of accreditation schemes like the [US Small Wind Certification Scheme](#), the [UK's Microgeneration Certificate Scheme](#) and the [Danish Certification Scheme](#) have done much to reduce inconsistent and inaccurate claims of manufacturer's data. The Evance R9000 has received the UK's Microgeneration Certificate as well as Danish certification and US Small Wind Certification. As a result, it will have been tested to IEC 61400-12 standards and so one can expect the data to be of a high standard and consistent.

Health and safety of our staff, students and neighbours is paramount in our school division. The R9000 small wind turbine is the result of nearly 12 years of development and has been system engineered to ensure maximum energy yield and durability. Through specific design, the R9000 is able to capture more energy at lower wind speeds and continues running at high wind speeds. The R9000 has survival wind speed of 60 m/s (216 km/h). The turbine's reliability is backed by 2.5 million operating hours in the field. Evance R9000 has a patented reactive pitch, which automatically limits the blades spinning to 230 rpm while generating maximum energy. It contains an electrobrake for a secondary backup safety system. Below are the international certifications that Evance R9000 currently possess:

- MCS006 2009 Microgeneration Certification Scheme is an independent scheme that certifies microgeneration products and installers in accordance with consistent standards. It is designed to evaluate microgeneration products and installers against robust criteria providing greater protection to consumers.
- MCS011 2009 Testing Acceptance Criteria
- IEC 61400-2 2006 Design requirements for small wind covering safety and integrity of model
- IEC61400-11 2003 International Electrotechnical Commission Acoustic Noise measurements Technique
- IEC61400-12 2006 Power Performance Measurements of Electricity Producing Wind Turbines
- ISO9613-2 1996 International Organization for Standardization Acoustics Attenuation of Sound during Propagation Outdoors
- SWCC 2012 Small Wind Certification Council Consistent Ratings for Wind Turbines

Any MCS-certified turbine which has experienced blade loss, tower failure or any other reported problem, is reported to MCS and evaluated. If the evaluation deems the turbine to be unsafe or not fit, for installation and production, it will be suspended or removed, from MCS certification—causing no incentive money to be paid to the customer—and ordering all turbines to cease operation. This has not occurred with the Evance R9000

Maintenance is recommended annually which covers: tower and supporting structure, core unit and yaw system, pitch system, blades and electrical equipment and connections. Cost is \$CAD 10000.00 and completed in one day. The Sustainable Development Committee Maintenance Fund covers all maintenance and decommissioning costs.

Conclusion: We have confidence in the testing and certification of this state of the art small wind turbine design. This will not pose a threat to anyone's safety.

## Visual

The Evance R9000 is a state-of-the-art design. Its' slender, slim-line design tapers at the top much like a streetlight (a familiar and acceptable structure throughout the neighbourhood). The small turbine head and grey colour integrates the turbine successfully into the landscape and skyline. No ones strategic views across the area will be harmed. The rotor diameter will occupy ~2% of the total field of view of the closest neighbours. As for the height of the tower, there already exist growing spruce and poplar trees that are currently 50-60' in the Cochrane Heights Community. Furthermore, the land in Cochrane Heights is zoned residential/public service. The siting of the proposed turbine is in the centre of public service land which contains three schools, parking lots, and an arena; not in a densely populated residential area.



Conclusion: The Evance R9000 will visually blend into the surrounding natural and built environment. It will not dominate or be visually intrusive when other factors of the area are taken into account.

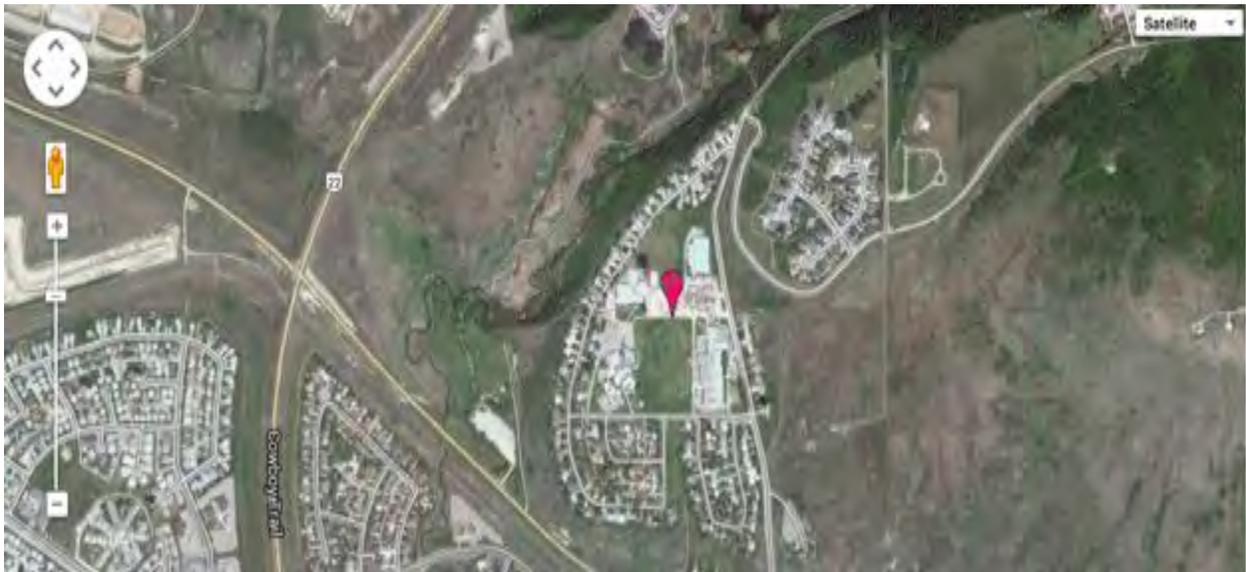




Below is a student's rendition of our phase VII proposal. With the help of engineers from Integrated Sustainability, we used the computer program called SketchUp to superimpose a camera photo on to the program in the proposed site. Due to camera angle you may notice that two streetlights appear out of place. This does not alter the scale of the proposed turbine.

Mitigation Measures: There is a grounds beautification project underway to improve the view of a small parcel of land at north end of the school to mitigate the view for those residents at the north end of 4th Avenue. There are also plans to pave the parking lot in 2015 to improve the aesthetics of the main tri-school entrance.

## Site Suitability



The proposed location of the Evance R9000 is in an open space free of obstacles, on a hill (Cochrane Heights) on the windward side, in an area zoned public service. The proposed location is 140 m from the nearest residential property. It is proposed for 60' as local trees in the neighbourhood reach those heights and do exist. As stated earlier, the land in Cochrane Heights is zoned residential/public service. The siting of the proposed turbine is in the centre of public service land which contains three schools, parking lots, and an arena; not in a densely populated residential area.

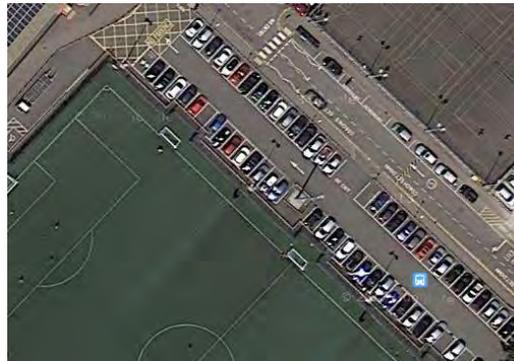
Conclusion: The proposed location of the Evance R9000 5 kW turbine contains several optimal metrics making it a suitable location to place a turbine of its size.

## Other Schools With Evance R9000 (formerly Iskra AT5-1)

Sandwich Technology School, UK: Iskra AT5-1 Installed 2008; 12 m tower  
<https://www.youtube.com/watch?v=HLZ2b5NR3WI> (start at 2:29)  
 Here is another link for sound purposes (make sure the sound is on on the youtube slider):  
[https://www.youtube.com/watch?v=\\_Ws8Wd3X\\_wQ](https://www.youtube.com/watch?v=_Ws8Wd3X_wQ)



Sandwich Technology School (2014) - turbine amidst playing field and parking lot



South Hills High School, Fort Worth, TX, Installed  
2011, 18 m tower



Closest Residences to location of Evance R9000 at  
South Hills High School (75 m)

## Economics

Below is a table of our budget costs for the proposed Evance R9000

| <b>Item</b>   | <b>Cost<br/>(Cdn dollars)</b> | <b>Payment<br/>Received</b> |
|---|-------------------------------|-----------------------------|
| Evance R9000 turbine, slip rings, 5.0 kW inverter, voltage clamps, diversion load – 5 year warranty | <b>\$13,275.00</b>            |                             |
| Lightning Protection System   | <b>\$2,500.00</b>             |                             |
| Foundation installation and Materials   | <b>\$4,500.00</b>             |                             |
| Tower and Turbine installation/Interconnection  | <b>\$7,500.00</b>             |                             |
| Electrical Cable  | <b>\$500.00</b>               |                             |
| Engineering and Permitting  | <b>\$2,500.00</b>             |                             |
| Contingency Fund – installation, permits, construction (digging)                                    | <b>\$5,000.00</b>             |                             |
| <b>Subtotal</b>   | <b>35,775.00</b>              |                             |
| <b>GST</b>  | <b>\$1,788.75</b>             |                             |
| <b>Grand Total</b>  | <b>\$37,563.75</b>            |                             |

Currently the CHSD Committee's budget sits at \$45,000.00. It is our responsibility to maintain and decommission this technology when it has fulfilled its lifespan. There will be zero costs to the town, school or school division. This proposed project is a cradle-to-grave economic model. The turbine is a donation to Cochrane High School, and therefore, the school is receiving payback the moment the turbine is connected. Furthermore, the turbine does not have a cut-out speed which means that it will continue to turn through stormy weather systems producing electricity at its rated power (i.e. 5 kW). This adds to the value of the proposed turbine, unlike other SWTs that cut-out during stormy weather which limits their economic benefit.

Conclusion: Our proposal looks to implementing a project that will not carry any cost to the Town. CHS is responsible for the full cost of the lifecycle of this RET. Since the Evance R 9000 does not have a cut-out speed during stormy weather, there will be times when the proposed turbine will be generating its rated power output thereby mitigating Cochrane High School's energy demand.

## Concluding Thoughts



The early ranchers of Alberta, our forefathers, harnessed wind energy to pump water out of parched lands. Primitive turbines were located beside their humble homesteads. The Man of Vision statue is a reminder of our town's heritage. Cochrane was built with innovation and a vision for the future. The perseverance and values of those before us bestows on us the courage to intelligently map our future. The students of Cochrane High School's Sustainable Development Committee are committed partners as our town moves toward greater sustainability. A report from Natural

Resources Canada concludes: "[communities that seize the opportunity to use local, sustainable resources will be at a competitive advantage, compared to communities that deplete finite resources. (Natural Resources Canada (2004). Sustainable Development – Topic: Energy.

Retrieved from [http://nrcan.gc.ca/sd-dd/sect/ener\\_e.html](http://nrcan.gc.ca/sd-dd/sect/ener_e.html))

The committee recognizes the renewable energy framework as a crucial component of Cochrane's future. What is desperately needed to complete this framework is a policy specific to urban small wind turbines.