Critique of
Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario
Authors: Canning et al

By Wayne Gulden
wayne@windfarmrealities.org
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Introduction

This introduction is very similar to what I wrote in my critique of the Hoen study, available at http://windfarmrealities.org/wfr-docs/hoen-critique.pdf , so feel free to skip this one if you've read the other.

The issue of wind turbines and their effect upon nearby property values has long been a contentious one, and for good reason. We generally accept the "wisdom of the market", and if wind turbines are as disruptive as opponents claim, surely this would show up in market prices of nearby properties. Opponents, politicians and wind developers can make all sorts of statements about noise, flicker, birds and so on, but talk is cheap. House prices, on the other hand, can be quite dear, and there's no easy or cheap way to hide the effect of wind turbines on house prices if in fact there is an effect. Plus house prices can serve as a single and quantitative proxy for all the effects that wind turbines may have on the neighbors.

Given the long history of the real estate industry figuring out house prices (commonly called "comps") you'd think this issue would be easily settled. Unfortunately, it is possible to arrange the data in these studies to suit the sponsor – as Mark Twain famously observed, "figures don't lie, but liars figure". But couldn't one just take the prices of houses sold "in the area" before and after a project went in? But how big should "the area" be? And if there's only a small number of sales – these are, after all, generally remote areas – what conclusions can you draw?

For the wind industry and its allies in government and academic circles, persuasive studies showing no effect would go a long way to quiet the protests of the neighbors and make wind projects easier, quicker and cheaper to install. Almost needless to say, they have been working on such studies for a number of years. A major one was the REPP study (aka Sterzinger et al), and which is available at http://windfarmrealities.org/wfr-docs/reppreport.pdf . It was not persuasive (except among wind proponents), having used a large and undefined area in which most homes were so far from the project that any effect would be minimal. But the REPP study did reveal the underlying argument the wind industry could use to try to convince the willing and the gullible. They justified the large study area by asserting the main problem with

turbines was *how they looked*. So if you could just see them (and you can see them for miles) they ought to affect the prices and since there was no measureable effect on prices there must be no problems whatever with the turbines. Nice logic, if you can convince someone to accept it, and many politicians and reporters have done so.

This theme of the people objecting to wind projects mainly because of how they look is mentioned prominently in wind industry literature as the main reason people object to them. Never mind the noise, flicker, sleep problems and so on that are much more important for the actual close-in neighbors. The only place where serious visual objections are raised is where the scenery has a special value, like shorelines. Unfortunately, no property value study has ever been done specifically on projects in high-scenic-value locations. There's just not enough data.

Regardless of what the wind industry asserts, the serious concerns for property values come from people who think they might be able to *hear* or *feel* the turbines enough so they cannot escape the noise and vibration even when they are just trying to enjoy their property, and especially when they are trying to go to sleep. For a home affected by this sort of problem the reduction in value might be very large indeed, certainly into double digits and in the worst cases approaching 100%. This is what home owners really fear.

To simplify it, there are three main ways to analyze house prices, in decreasing accuracy.

> First, you could study houses within audible distance (i.e. one mile) that sold (or perhaps independently appraised) fairly recently before the project was known about and then sold after the project went in. As long as the sales are "arms-length" and the proper adjustments made for area house price trends, this is the best indication of property value changes.
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> Second, you could study just the house prices within audible distance of a turbine and compare them with similar houses (aka "comps") further away, like 10 miles. This technique is commonly used in the Real Estate industry to estimate property values.
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> Third, you could use regression analysis. You start by taking all the sales within a certain distance of a wind project (5 miles is typical) and assign a series of descriptors to each house within that group – things like size of the house, number of bathrooms, distance from the wind project and so on. You then look for correlations between the different descriptors and the price, trying to assign the contribution of each. With enough computer processing you can assign the effect of each of these on the final price.

The Canning study, published in February 2010, is the latest effort to analyze this issue and uses the third and weakest of these techniques, regression analysis. I go into more details later, of course, but in summary he found no "statistically significant" effect of

turbines on house prices. Unfortunately this study has a number of significant, and in my opinion fatal problems. The complete study is available at: http://windfarmrealities.org/wfr-docs/canning-prop-values-c-k-2010.pdf .

Overview of the Study

This study was funded by CanWEA, the Canadian Wind Energy Association. They are a trade group and lobbyist for the wind energy industry. While that in itself does not allow us to automatically discard their findings, it would be prudent to keep in mind their mission is not the discovery and dissemination of truth; rather, they are a money-making organization that makes its money by advocating for the wind energy industry.

This study uses the third technique I listed from above - regression analysis. While the Hoen Study looked at both visual and noise issues the Canning study just looks at visual aspects of wind turbines, and he provides no indication of how far his sales are from a wind energy project. He doesn't even try to answer the question that most property owners are really asking – which is how much do I lose if I can *hear* the turbines.

So, what is regression analysis? From Wikipedia:

> "In statistics, regression analysis includes any techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables."

In this case the one or more independent variables are things like square footage, number of bathrooms and distance from a wind turbine, while the dependent variable is the sales price of the house.

The general process is to decide which physical areas you want to study and the questions you want to answer. Canning chose the Chatham area, specifically the area around the Port Alma project. Since he was only interested in visual affects, he drew a line around the Port Alma project and any house inside that line (with some adjustments for local conditions) was in the "viz" group, and if outside was part of the "no viz", which served as a control group.

Note the picture below. To give you a sense of the scale, the "line" roads are about a mile apart, i.e. Merlin is about 5 miles from Lake Erie. Anything inside the red line was probably a "viz", so some (perhaps most, he didn't provide that data) of the "viz" sales could be further than 5 miles from a turbine. As an aside, you can clearly see the turbines from the 401, which is 3-4 miles outside the red line. Canning selected sales that took place within an unspecified 2-year period, coming up with 63 "no viz" sales and just 20 "viz" sales. No information was given if any of the sales involved project participants or not.

He then chose 8 relevant variables, i.e. square footage, lot size, age and so on along with the viz variable and regressed them against the sales prices He went through 4 techniques (having gotten the wrong answer the first 3) as discussed below and then came to the conclusion that viz/no viz had no effect on house prices. Quelle surprise!

One potential problem might have occurred to the alert (still awake?) reader is that house prices vary a great deal depending on a large number of often times intangible factors. This type of analysis takes a snapshot of all the sales in the study area, regardless of how big or little, nice or nasty, good shape or not. How likely is it we can accurately ferret out the factor (i.e. view of a turbine) we are interested in? The solution is to have a large number of data points. In Hoen's case, he had 7,459 sales, and he had problems with large standard deviations. Canning has a total of 83 sales.

Note that statistical practitioners do not pose their quest as trying to show there is *not* a relationship between i.e. view and price. You may recall the *null hypothesis* from your student days, where "no relationship" is the starting assumption and the quest to try to prove the relationship. Of course, when your sponsor doesn't want you to find a relationship human nature makes it more difficult to find one.

Discussion

The number of problems with this study far exceeds those of the Hoen study. It is scary that "The following consulting report was prepared in accordance with *the Canadian Uniform Standards of Professional Appraisal Practice* for the APPRAISAL INSTITUTE OF CANADA." Even scarier is "The report, if necessary, may also form the basis of testimony at subsequent hearings." I know that scientific competency and numeracy is dropping in our society, but to think that this report, as problematical as it is, could be used as evidence in a hearing is truly frightening.

The first problem is the reliance on the visual aspects only. This same technique has been used in all industry-sponsored property value studies to make the study size as large as possible so it would include properties that have only minor effects from the project. As mentioned in my Introduction, the big problem is the effect on houses that can hear the turbines, nominally within a mile of a turbine. With this study, the industry shows yet again they have no interest in having an honest discussion about what happens to those near-in properties.

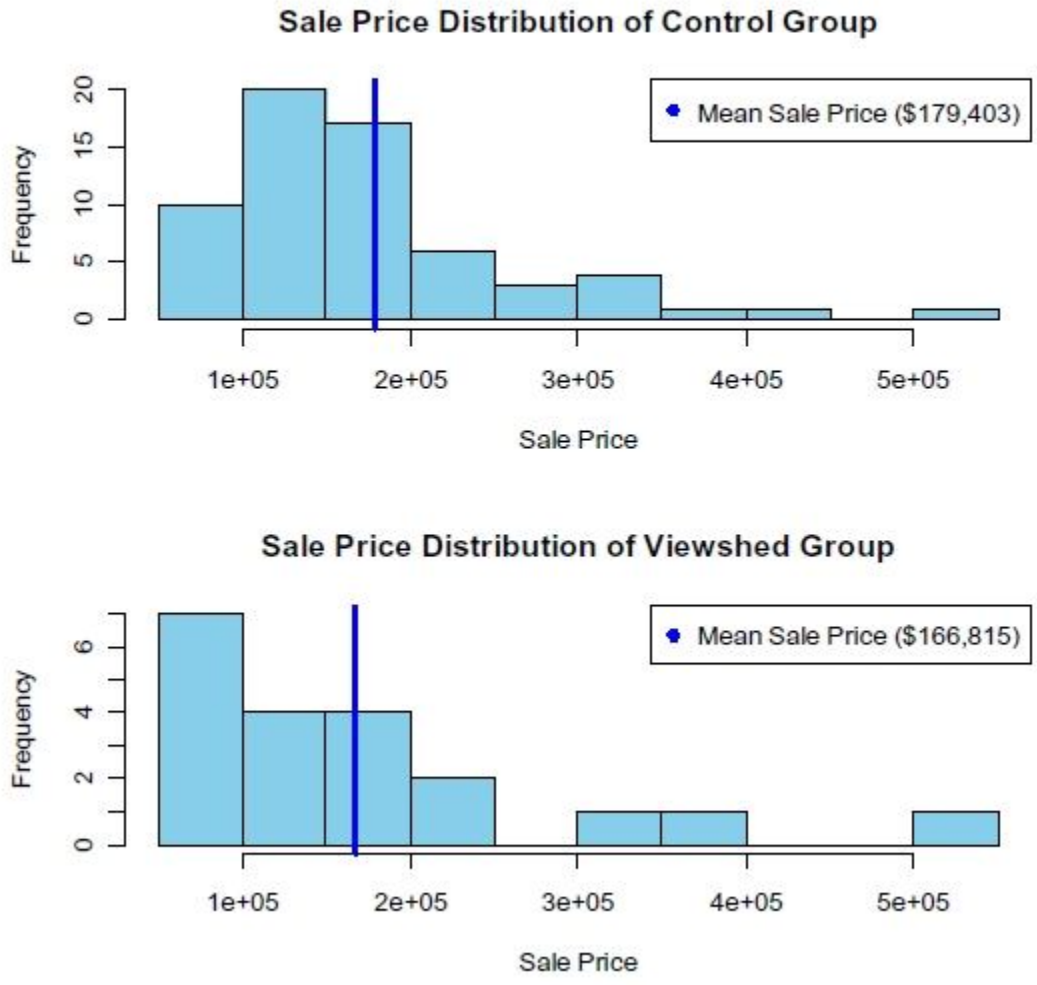
This emphasis on visual aspects only is made more problematical by Canning's simple binary measure of viz/no viz. I would think it intuitive to use the distance from the nearest turbine as the variable. Hoen, for example, grouped the distances into 5 groups so he could do regressions against properties both near and far. In fact, I have to wonder why Canning didn't also use distance in some fashion. Mysteriously, Panel B, page 47, does include "distance" as one of the independent variables along, but he never explains what it is, nor does it appear in any other part of his study. Perhaps it was inadvertently left in. Using this binary measure in place of a number allows all sorts of games to be played with the numbers, and Canning provides no details that would allow the reader to uncover this gaming.

The second problem is the extraordinarily small sample size. As a quick refresher on statistics, you need to fulfill 2 basic conditions to show a relationship. First, the numbers representing the dependent variable (i.e. the sales price) and the independent variable (i.e. the viz binary value) must show some complimentary trend. Second, and almost as important, the values of the variables can't be too spread out among themselves, else you can't separate that trend from any normal random variance. Remember standard deviations? In this case the group we are interested in has just 20 members, so getting the standard deviation small enough to pick out any "statistically significant" trend is pretty much impossible. Hoen at least included some of the characteristics of the raw data, like the standard deviations of the prices of the different groups. Canning does not. This opaqueness is quite bothersome.

A third problem is that after running the analysis with all his variables, he could only explain 84% of the sales price. The International Association of Assessing Officers' standard calls for a lower limit of 90% for a study to be considered valid. This was also a problem for the Hoen study, as detailed at: http://windfarmrealities.org/wfr-docs/wilson-hoen-critique.pdf .

As an aside, one may wonder, couldn't Canning just have taken the average sales prices and compared them with no regression? He did that, and the results are shown in the picture below. The graph unnecessarily uses scientific notation along the bottom axis, the "1e+05" is just $100,000, the "2e+05 is $200,000 and so on.

Figure 2



On the face of it there appears to be a difference between the two groups, and it is not favorable to CanWEA. It comes to 7%, which seems pretty significant. Canning does not provide any raw data, but using the center point of each range I calculate the standard deviation of both groups together is $97,600, which is far larger than their

separation of $12,588. A “statistically significant” result typically needs 2 SD’s of separation, not the 0.13 difference we see here. Plus, as Canning correctly notes, there could be other factors, like age or lot size etc., which cause the difference. Regression analysis is one way to narrow in on the actual cause.

These problems by themselves would eliminate this study as a serious and honest attempt to find any trend. But it gets worse. Canning sings the praises of regression analyses, runs his numbers, and – quelle horreur! – comes up with viz properties selling for almost 13% less than no viz properties. And remember, this includes properties that can be more than 5 miles from the project. The standard deviation is now small enough (5%) that the margin of error (2 SD’s) ranges from -3% to -23% (never getting to CanWEA’s hoped-for 0%), showing that there is a statistically significant difference in the prices. I’m pretty sure that if Canning stopped here CanWEA would never have published this study.

As a theoretical exercise, if the 13% had turned out to be, say, the original 7%, the results would no longer be statistically significant. Had that been the case, does anyone really think Canning would have gone on with his additional steps?

So Canning goes to step number two. He massages the data, finding 20 no-viz homes that most closely match the 20 viz homes. He runs his numbers again, and – another quelle horreur! – the difference is 9%. At least it is less than before, and now (because the sample is even smaller than earlier) the standard deviation is so large (12%) that Canning can start to claim that 9% is just the same as 0%. I’m guessing again that if Canning stopped here CanWEA would never have published this study.

So Canning goes to step number three. Again he massages the data, this time coarsening the continuous variables such as house size so he can put them into discrete groups. The difference in price is now just 7%, still negative. The important thing, though, is that this manipulation further reduces the sample size, so the standard deviation gets even larger, now up to 21%. The idea that 7% equals 0% is even easier to justify. Maybe CanWEA would have published this, but it is hard to frame three negative numbers as anything good.

So Canning goes to step number four. He abandons regression altogether and goes to a paired sales analysis, which earlier he had disparaged. He goes outside of his 2-year window and finds 14 properties that sold twice since 2003. The idea is that if he can show the prices of the same properties didn’t change during the construction and operation of the project, he’d make CanWEA very happy. I’d agree, consistent with what I wrote in my Introduction, that this would be the best way to get at the truth.

Obviously, timing here is critical. You’d have to find properties that sold before the project was even on the locals’ radar and then sold again after the project was in operation. Based on information from the Port Alma project’s web site, here is a rough timeline of the project.

Jan 2004 – prospecting starts.

Jan 2005 – development starts.
Jun 2006 – engineering starts.
Apr 2008 – construction starts.
Nov 2008 – operation starts.

Several studies, including Hoen, indicate that the biggest price drops in the general visual area occur early, several years before any official announcement. They then tend to recover, never getting back to parity. [This recovery may well never happen for the close-in properties.] So you'd have to, in Port Alma's case, look for "first" sales before Jan 2004 and "second" sales pretty much any time after that, as the damage has already been done. So, of the 14, how many of the first sales were before Jan 2004? The answer: 2. One of those, property B, had some updating. In neither case was the distance to the project revealed. But the prices of the 14 were mixed up enough that – voila! – Canning could now claim that the project had no effect on prices.

Did Canning offer any reasons why he did the additional studies in the first place? There are no specific reasons given in his report, aside from some general comments about the value of additional studies eliminating bias. He certainly was not looking for a more accurate assessment as the standard deviations continually increased. Maybe the increases were the goal. The additional studies did provide opportunities to manipulate the data, and additionally would tend to make the standard deviations larger, to the point where he could claim there was no "significant" difference in the prices. Without the raw data, which Canning will not publish, there's no way to know what happened behind the curtain.

In his summary, Canning states the following. Read through this paragraph carefully and you'll find a fairly good example of truth without honesty.

"The three regression models in this study returned a similar negative coefficient for the variable "viewshed" supported by a wide Standard Error and low T scores that clearly show that those coefficient results could not be relied upon as being statistically significant. It could not be said that rural residential houses located in a viewshed sold for lower prices."

It is not surprising that the wind industry will play up this report for all its worth. I understand CanWEA has been sending it around to various government agencies. I'm guessing CanWEA figures nobody will read past the summary to find out just how flawed this report is. The sad thing is, they are probably right.

That this report might be used as evidence in a court proceeding is truly scary. Judges are experts in the law, not statistics, so they rely upon testimony from people with lots of letters after names to establish "evidence". CanWEA is very good at playing this game, and sadly the courts and the media are very poor at detecting it.