

The slide features a dark brown background with a vertical line of yellow dots on the right side. The company name 'aercoustics' is written in white lowercase letters, with 'engineering limited' in a smaller font below it. To the left of the dots, the words 'Acoustics', 'Noise', and 'Vibration' are listed in yellow. At the bottom right, the title 'Modeling Challenges with Renewable Projects' and the speaker's name 'Rob Jozwiak B.A.Sc., P.Eng. - Project Engineer' are displayed in white.

aercoustics  
engineering limited

Acoustics  
Noise  
Vibration

Modeling Challenges with Renewable Projects  
Rob Jozwiak B.A.Sc., P.Eng. - Project Engineer



The image shows a landscape with several white wind turbines on a green grassy hill under a blue sky with light clouds. A semi-transparent dark brown box with rounded corners is overlaid on the bottom right, containing the word 'Agenda' in white and a bulleted list of topics.

Agenda

- Aercoustics: a little about us
- Wind
- Transformer
- Solar
- Uncertainty
- Auditing
- Closing remarks & questions

## a little about us...

Since Aercoustics' inception in 1971, we have become Canada's premier engineering firm in acoustic design, noise control and vibration control. And increasingly well known around the world: in the United States, Central America, Europe, Australia, China and the Middle East.

+ decades  
decibels

acoustic  
design +  
retrofit

noise  
control

vibration  
control



## Ontario's policy history

- Strong noise regulations – early 1970's
- Wind specific noise guidelines - 2004
- Clarification to standardize wind assessment – 2008
- Compliance protocol development – 2010
- Compliance protocol adoption – 2011

aercoustics  
engineering limited

## Ontario and wind turbines

- Governed by Ontario's Ministry of Environment
- Wind turbine policy developed specifically for wind farms, *Noise Guidelines for Wind Farms – PIBS 4709E*
  - 550m setback distance to receptors
  - Progressive sound level limit

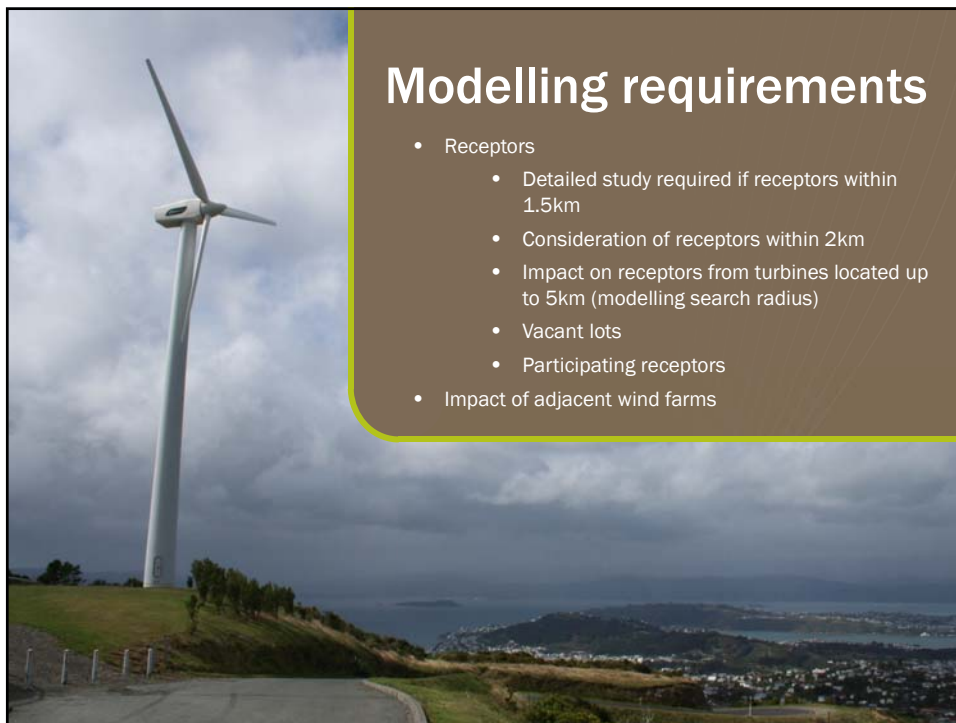
Wind Speed (m/s)	6	7	8	9	10
Sound Level Limit (dBA)	40	43	45	49	51

- Detailed modelling requirements for assessment as per ISO-9613-2 and detailed review process for environmental approval



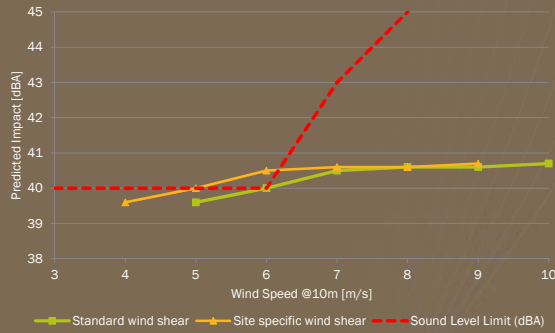
## Modelling requirements

- Receptors
  - Detailed study required if receptors within 1.5km
  - Consideration of receptors within 2km
  - Impact on receptors from turbines located up to 5km (modelling search radius)
  - Vacant lots
  - Participating receptors
- Impact of adjacent wind farms



## Modelling requirements

- Assessment from 6 to 10 m/s
- Detailed requirements on atmospheric absorption
- Ground absorption of  $G = 0.7$
- Adjustment of turbine data for site specific wind shear



## Transformer modelling



- 5 dB tonal penalty (as per NPC-104)
- Data obtained as per IEEE C57.12.90
- Data supplied as sound pressure level
  - ONAN/ONAF
  - To model the data, understand the data!

## Solar farm modelling



## Uncertainty in the assessment



- ISO-9613-2 intended application
  - Based on long term average
  - Distances up to 1,000m
  - Source height up to 30m
- Estimated accuracy for broadband noise (ISO 9613-2):

Height	Distance (0m to 100m)	Distance (100m to 1,000m)
0m < h < 5m	+/- 3 dB	+/- 3 dB
5m < h < 30m	+/- 1 dB	+/- 3 dB

- Noise data for your sources
  - Based on prediction or measurement?
  - Uncertainty?
  - Intended operational conditions?



## Ontario's road to environmental compliance

- Two (2) acoustic audit clauses for wind farms
  - Immission (at the point of reception)
    - Undertaken in accordance with Part D of the Compliance Protocol for Wind – developed by Aercoustics
    - The acoustic audit measurements shall be performed on two (2) separate occasions within a period of twelve (12) months
  - Emission (individual turbine)
    - Undertaken in accordance with the IEC Standard 61400-11
    - Typically one test per each turbine type (including Noise Reduced Operation, \*NRO modes\*)



# thank you

Comments or Questions?

Rob Jozwiak B.A.Sc., P.Eng. – Project Engineer  
RobJ@aercoustics.com - 416-249-3361 ex.305

