

## Using Drones to Inspect Wind Turbines

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Thursday January 31, 2019

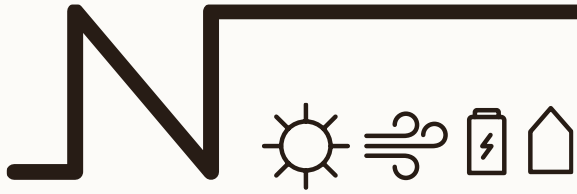


## Our mission

### Creating new opportunities for renewables

Nergica is a centre of applied research that stimulates innovation in the renewable energy industry through research, technical assistance, technology transfer and technical support for businesses and communities.

In concrete terms, Nergica is synonymous with an accomplished expert team and unique research infrastructures installed in a natural environment and unavailable elsewhere in Canada.



## Activity Sectors



### Wind Power Energy in the Air

Trusted partner of the growing wind sector since 2000, Nergica boasts undisputed expertise in the field of optimizing wind farm performance.

Increased production in cold climates, best O&M practices: get the most out of your wind farms.



### PV Solar Energy Shining Bright

Centre of expertise in a rapidly expanding sector, Nergica puts its know-how to work to promote the optimal integration of solar PV.

Energy supply for remote communities and off-grid sites; solar arrays; industrial, commercial and residential applications: take the leap into solar!



### Renewables Integration Redefining Energy Supply

It's a well-known fact that energy issues are at the core of community life and development.

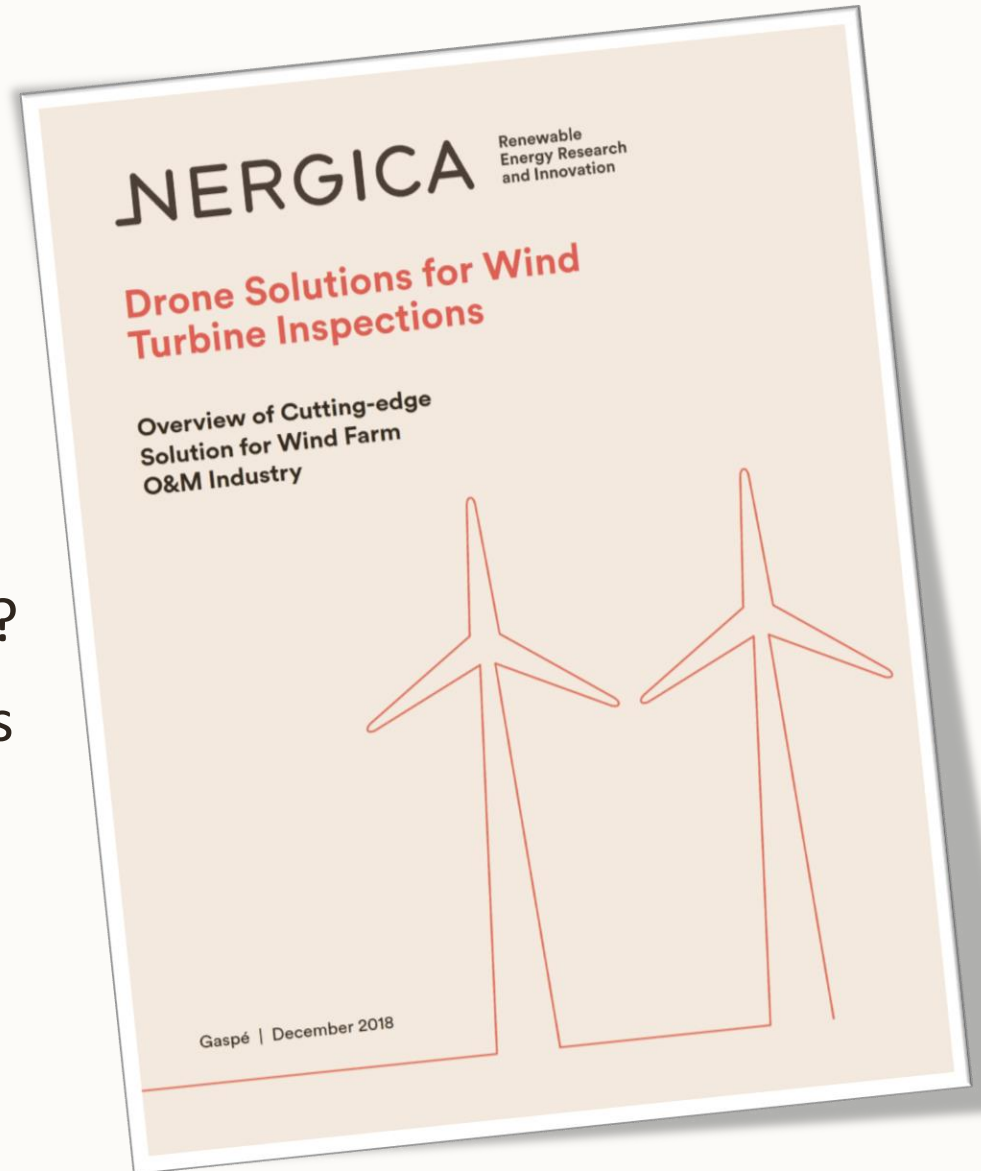
This is why Nergica lends its expertise to innovation as it relates to integrating renewables.

Energy transition, smart grids: en route to a sustainable energy supply.



## Overview

- The wind market
- Why and how to inspect?
- Wind turbine inspections
- Using drones
- Market opportunities



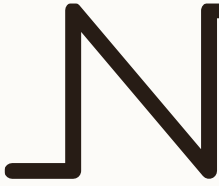


# The Wind Market

- Saskatchewan
  - 2018: 377 MW
- Alberta **139 GW**
  - 2017: 596 MW
  - 2018: 763 MW

Source : GWPCE Alberta Wind Report 2017

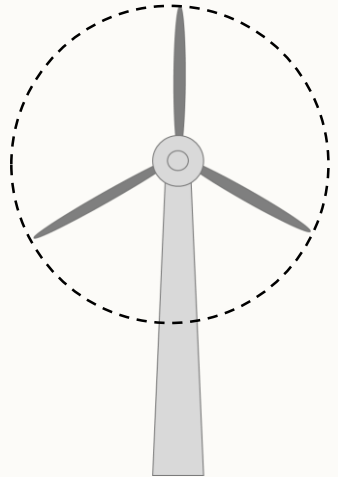




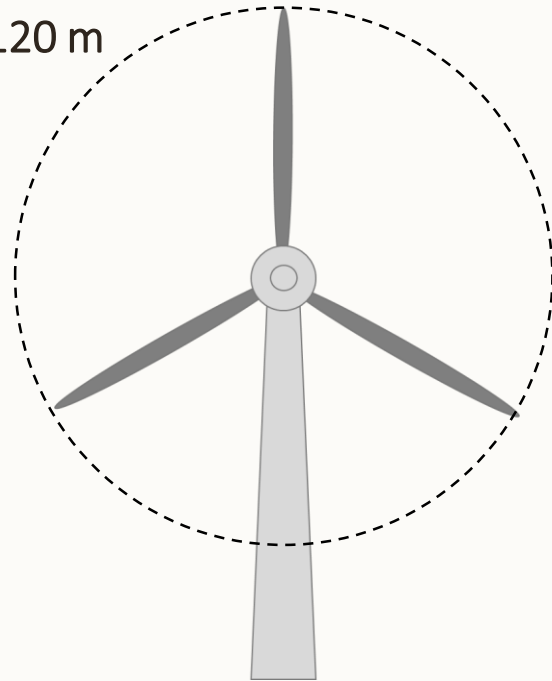


# The Wind Market

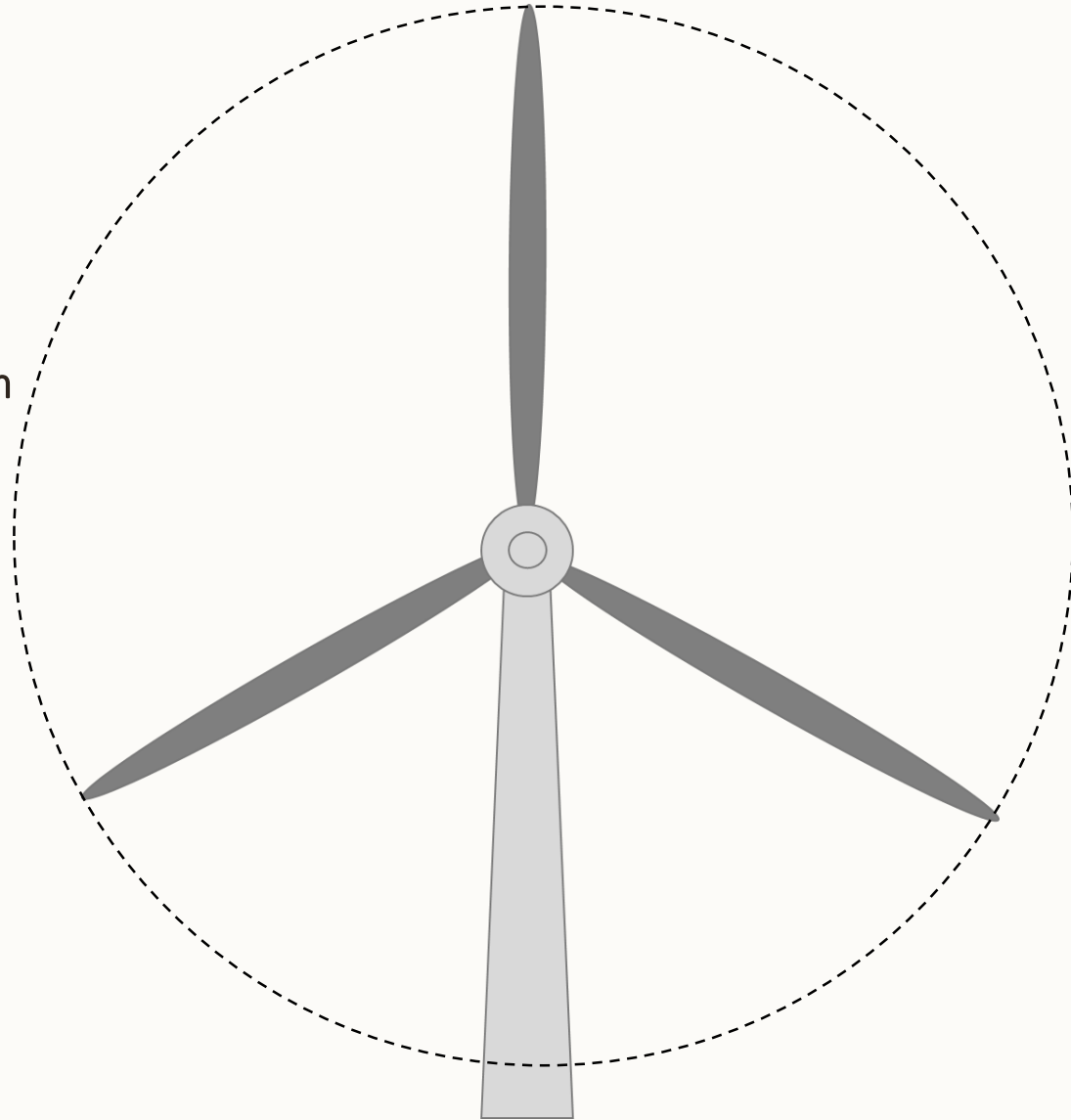
80 m



120 m



220 m





## What to inspect?

- Access stairway
- Transformer
- Tower
- Nacelle roof
- Interior components
- **Blades**



Photos: Nergica



## How to inspect? From the ground



Photo: Jacques Gratton



# How to inspect? From the air

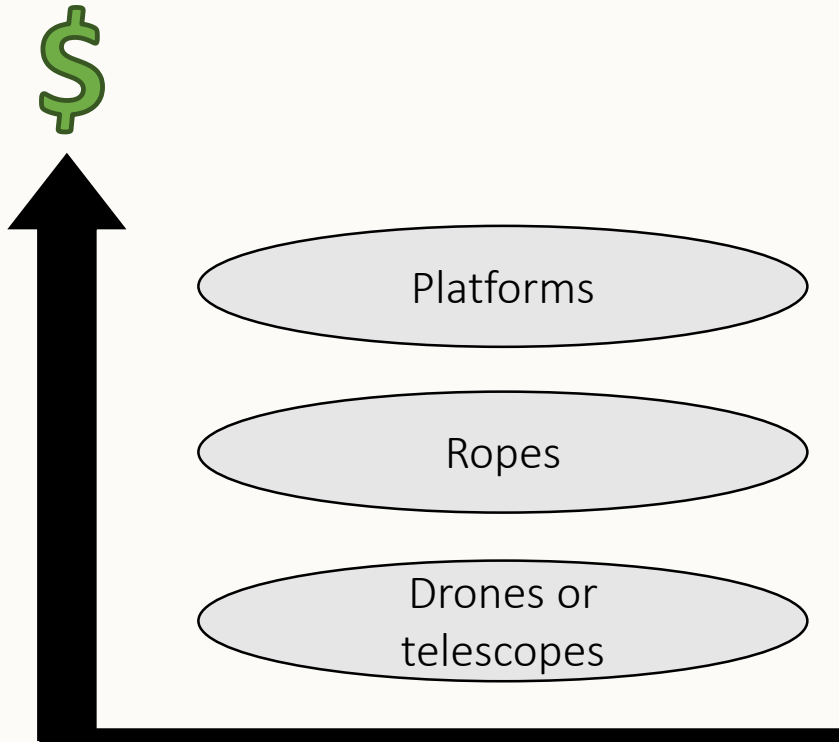


Photos: MagBag

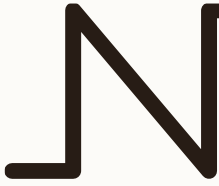


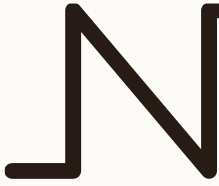


## How to inspect?



- \$100 to \$10,000/turbine
- Ropes and platforms inspection beneath the surface
  - Depending on method
  - + repairs
  - Depending on number of turbines





## A Healthy Blade

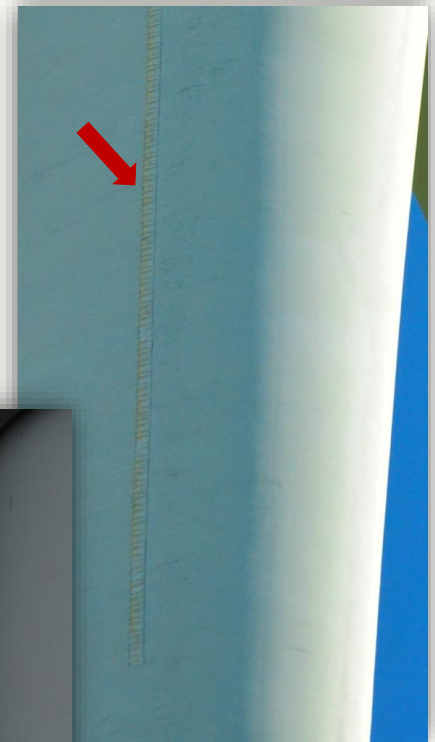
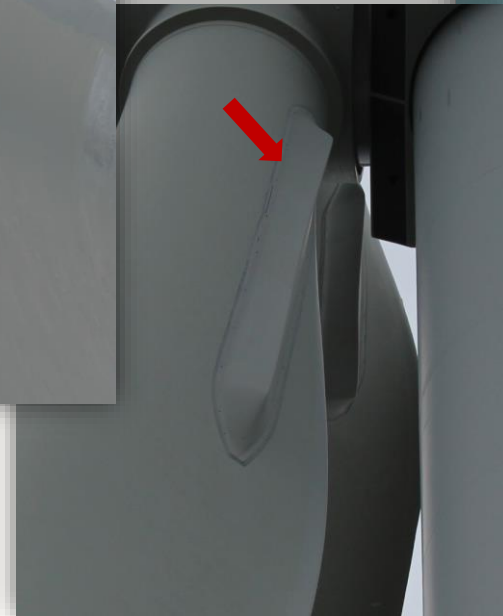
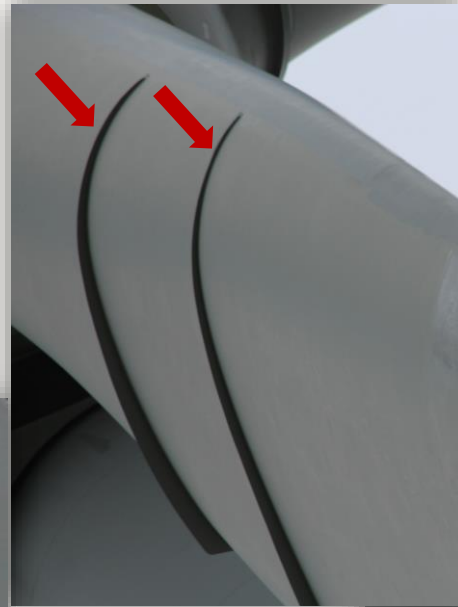
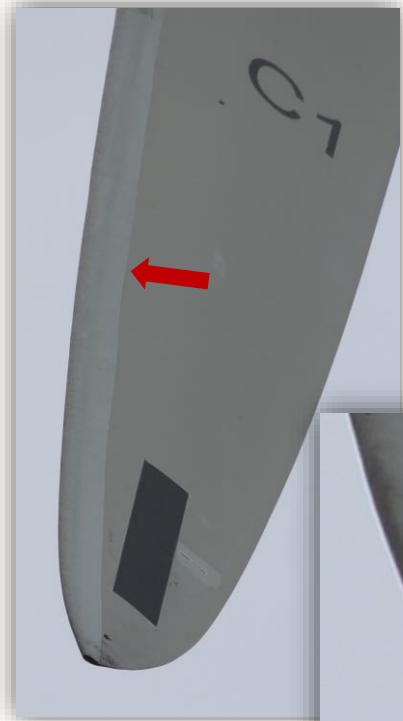
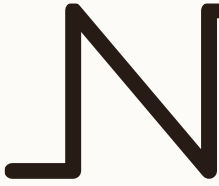
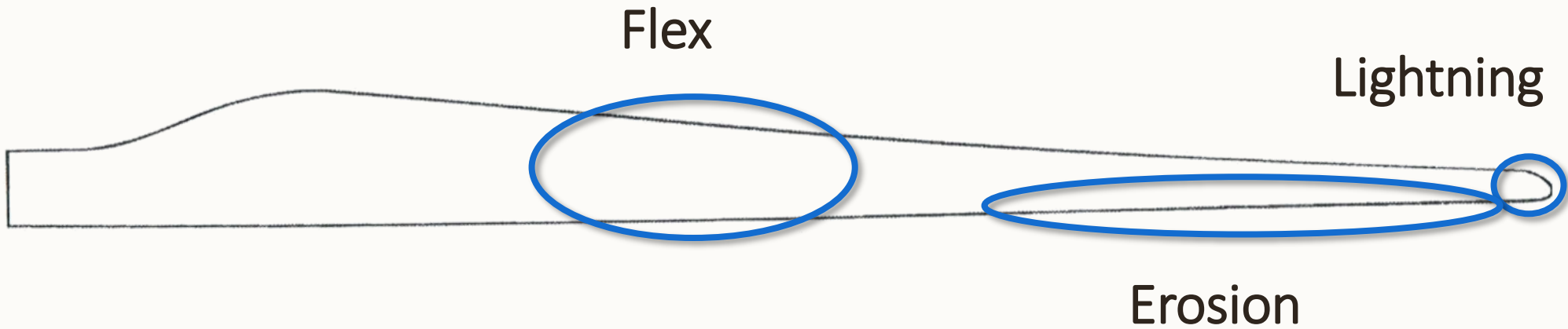


Photo: MagBag

Photos: Nergica



## Critical Spots

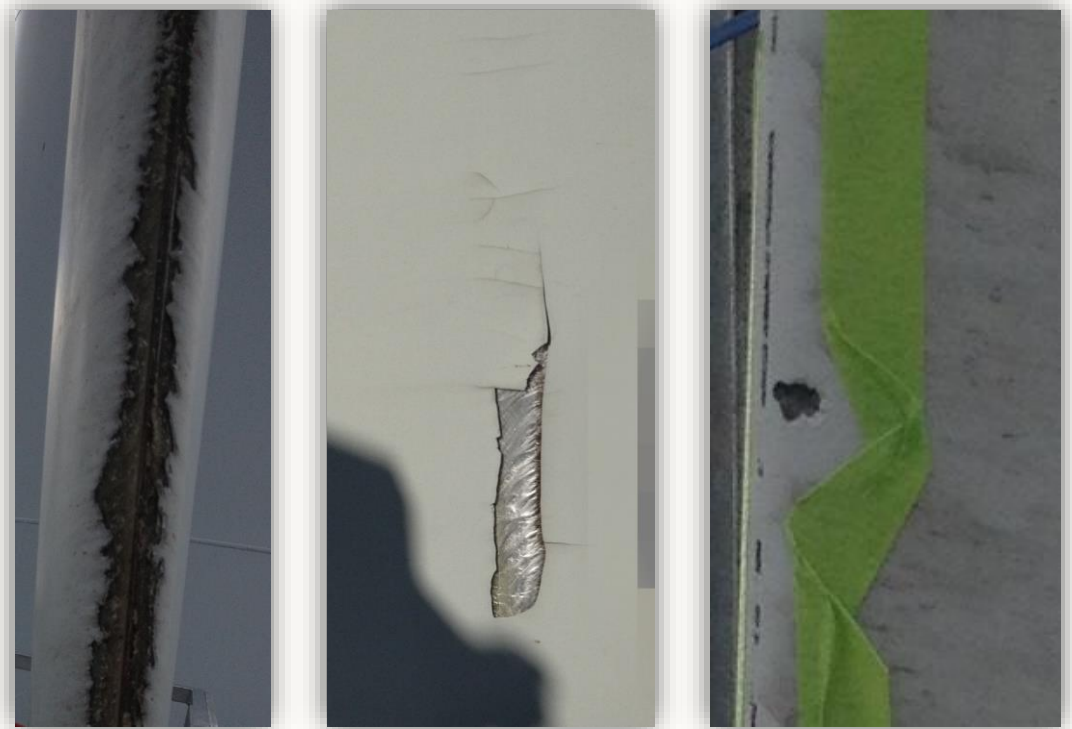




## The Operator's Need

To know the health  
of their blades

- Severity of  
damage



Photos: Swytink-Binnema, N. L'intégration des données d'inspection et de réparation de pales. Colloque de l'AQPER, Quebec City, 10 February 2016.

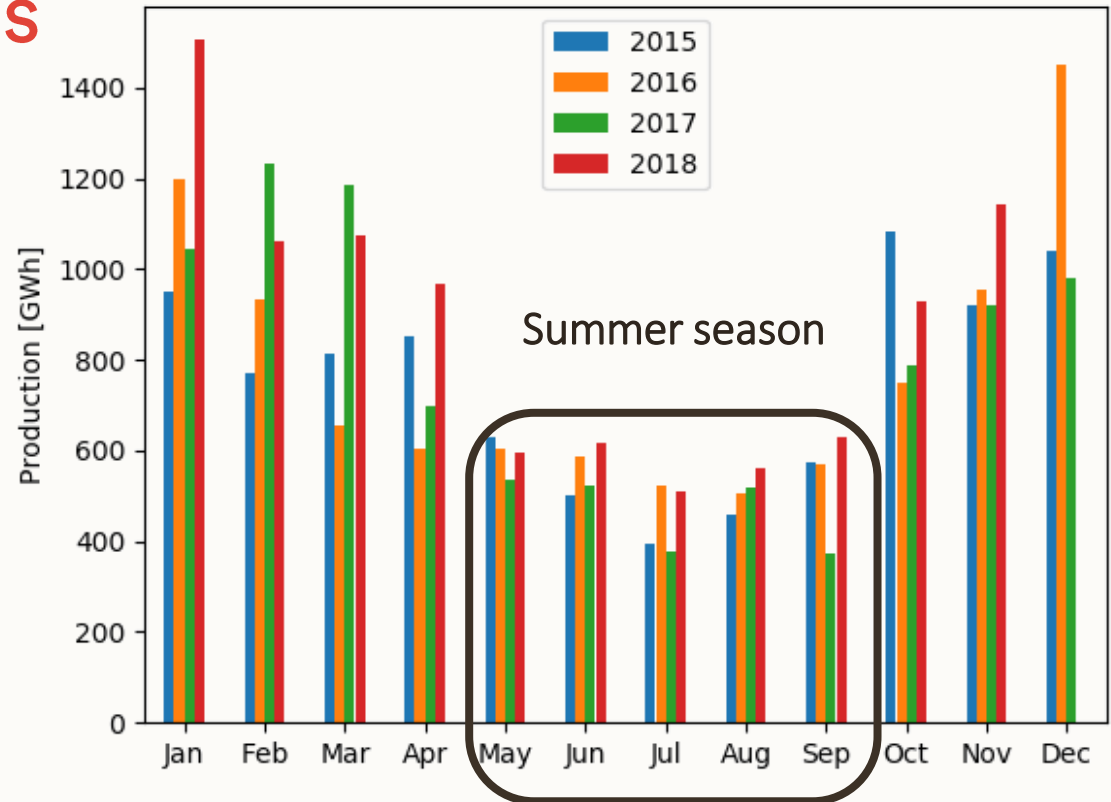


## The Constraints

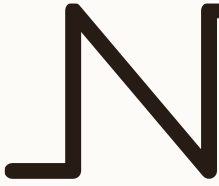
- Far from highways
- Hundred meters above ground level
- Stop for inspection
  
- Winds  $\uparrow$ , production  $\uparrow$ , revenue  $\uparrow$   
     $\rightarrow$  Inspect during low winds



# The Constraints



Source: IESO <http://reports.ieso.ca/public/GenOutputbyFuelMonthly/>





## Advantages of Drones

- Health and Safety
- Access
- Speed
- Cost
- Extent



## Disadvantages of Drones

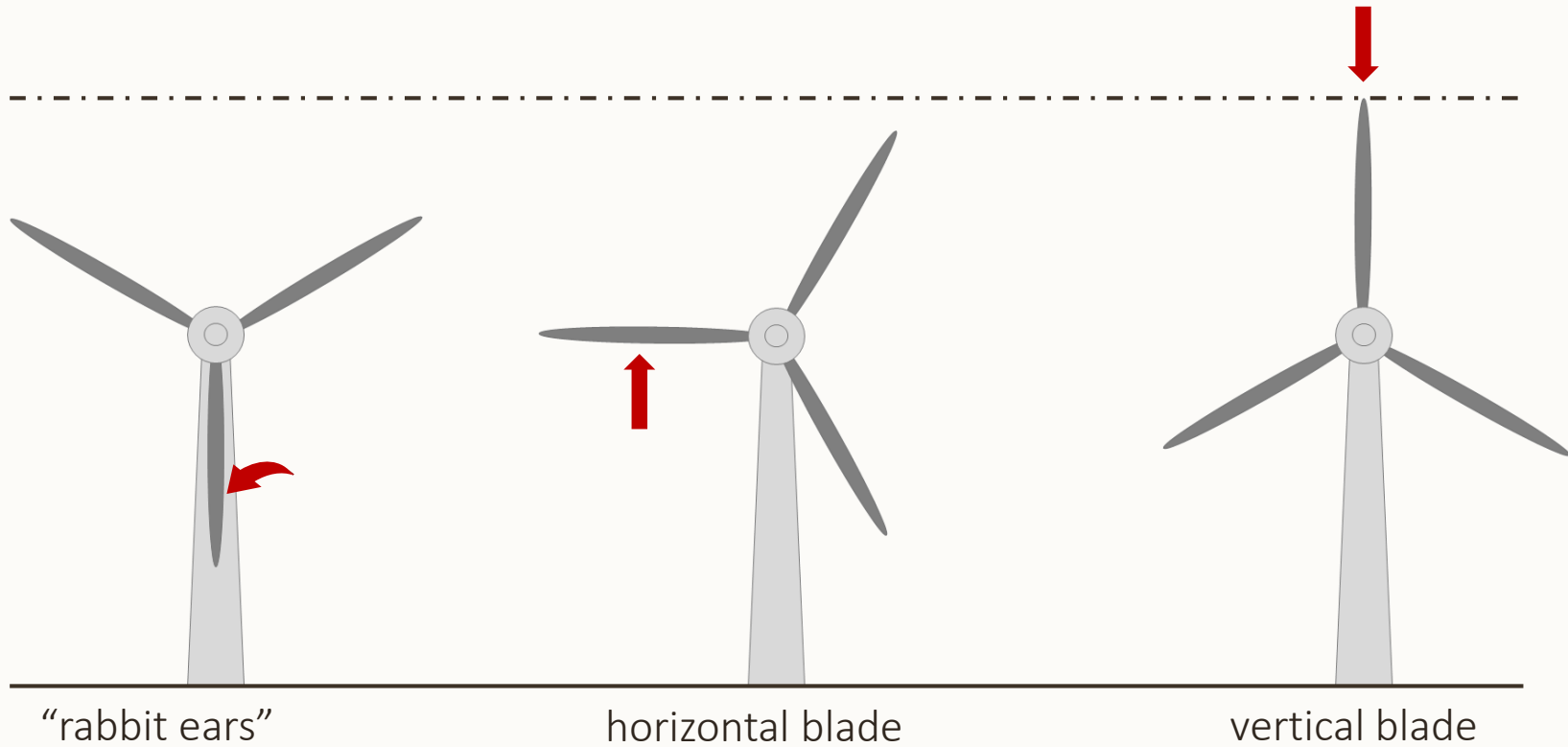
- Image resolution
- Repairs impossible
- See only blade surface
- Composites expertise



Photos: Swytink-Binnema, N. L'intégration des données d'inspection et de réparation de pales. Colloque de l'AQPER, Quebec City, 10 February 2016.



## Key Consideration: flight plan



"rabbit ears"

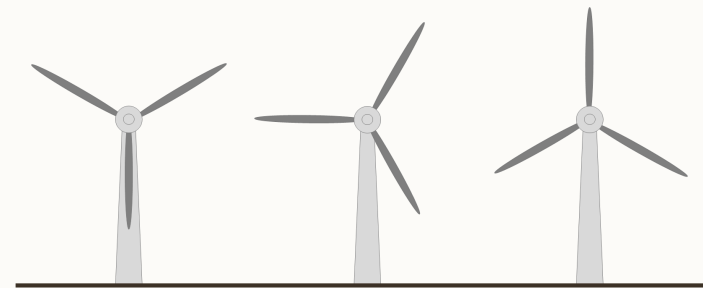
horizontal blade

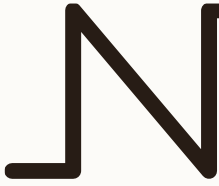
vertical blade



## Key Consideration: flight plan

- Regulations  
(<https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html>)
- Manufacturer
- Human pilot or autopilot
- Camera mount







## Key Consideration: sensor

RGB



Thermal



Multi spectral



<https://www.flir.ca/products/a615/>

<https://www.spectralcam.com/maia-tech/>

Photo: Nergica



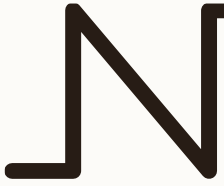
## Key Consideration: peripherals

- Gimbal
- GPS
- RTK system (Real Time Kinetic)
- Laser rangefinder
- lidar



Photo: Nergica

A gimbal





## Market Opportunities / Best Practices

1. Understanding composites
2. Automation



# Understanding Composites

## 1. Identifying the defect

- Type and cause
- Position on the blade

## 2. Identifying the action to take

- Repair required?

## 3. Following trends

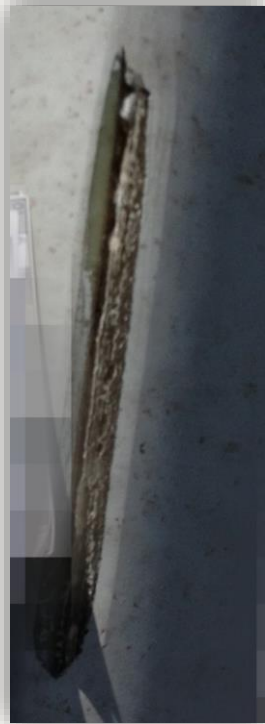
- By defect type
- By farm
- By position on the blade



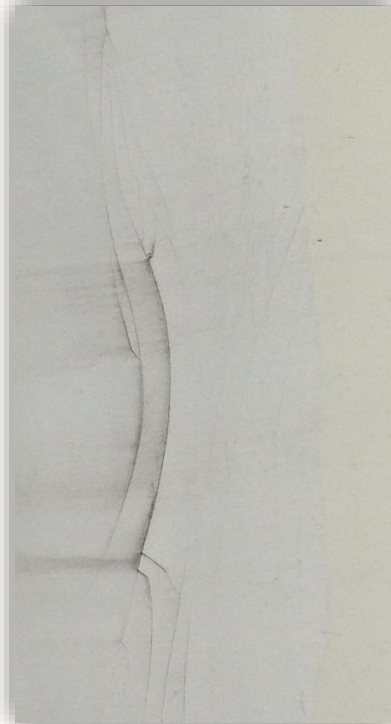
## Example Defect Types



Erosion



Crack –  
Transport



Crack –  
Internal issue



Dry glass



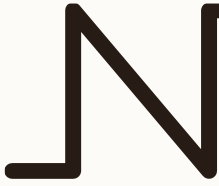
Split joint

Photos: Swytink-Binnema, N. L'intégration des données d'inspection et de réparation de pales. Colloque de l'AQPER, Quebec City, 10 February 2016.



## Automation

1. The flight
2. The image analysis
3. The generation of reports





## Summary

- Wind turbines: lots to inspect
- Inspections: always necessary
- Drones: one solution among many
- Market opportunities: understanding composites, automation
- The future: automation

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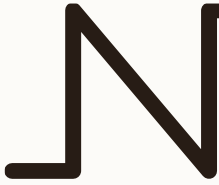
Our main financial partners



Développement  
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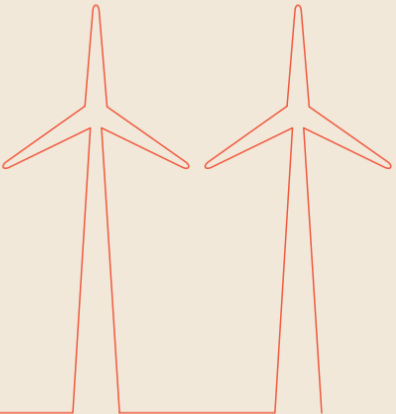
Québec



**NERGICA** Renewable Energy Research and Innovation

**Drone Solutions for Wind Turbine Inspections**

Overview of Cutting-edge Solution for Wind Farm O&M Industry



Gaspé | December 2018

<https://nergica.com/en/drone-for-wind-turbines-inspections/>

**NERGICA**

Quebec Wind Energy **CONFERENCE**

10-11-12 June 2019 | Matane, Quebec



[colloque.nergica.com](http://colloque.nergica.com)  Wind Meetings