



AQPER SYMPOSIUM

6,7 February 2019

Quebec City, QC

DRIVE

DRIVE PERFORMANCE. DRIVE RESULTS. DRIVE PROFITS.

POWER
FACTORS
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R E I G



Complete monitoring and O&M for solar and renewable infrastructure.



Comprehensive field services for wind and solar power plants.

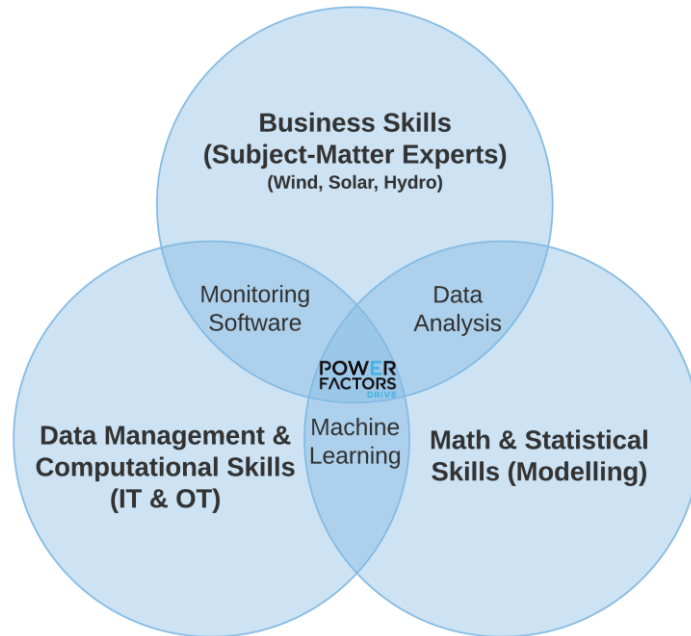


Asset management, Operations and Performance analytics for renewables.



Asset and event management platform.

POWER FACTORS WHAT WE DO



Visit us at:

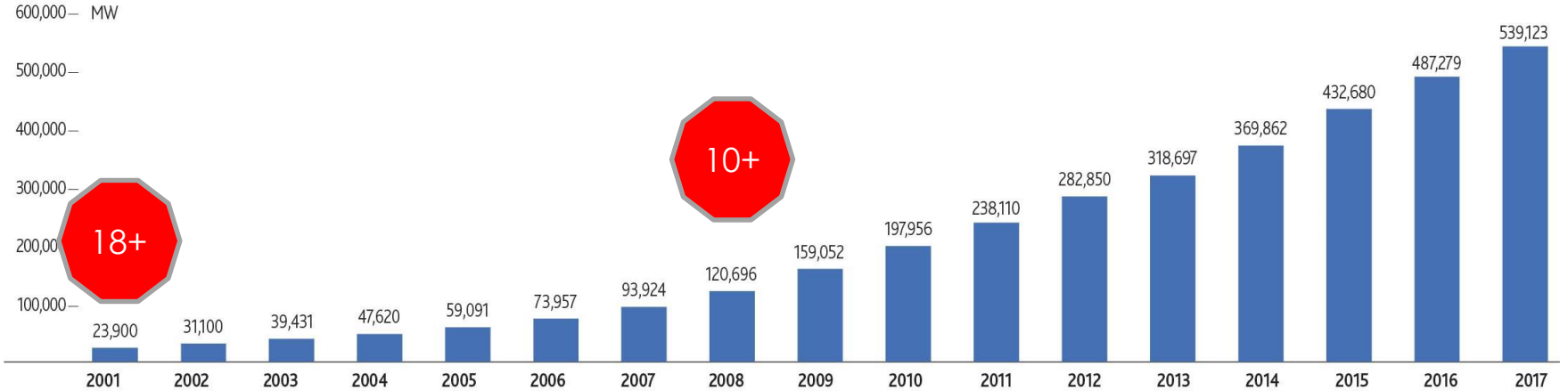
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AGENDA WHAT NEWS OF REPOWERING

- Market overview
- Options for repowering
- Cost considerations

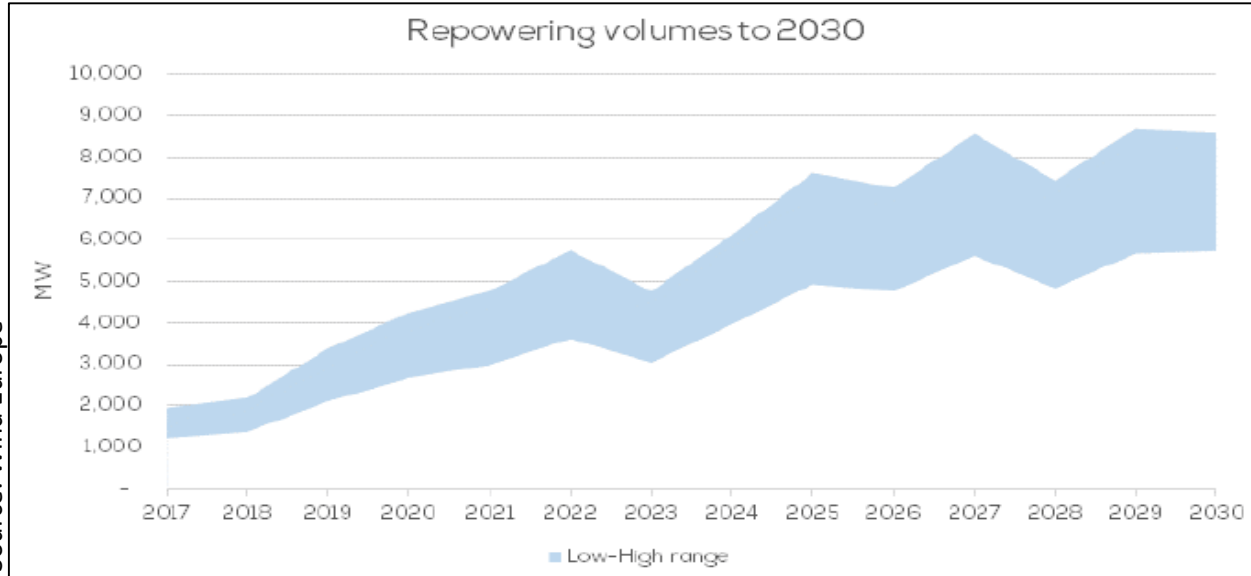
MARKET REVIEW GLOBAL

GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 2001-2017



Source: GWEC

MARKET REVIEW EUROPE



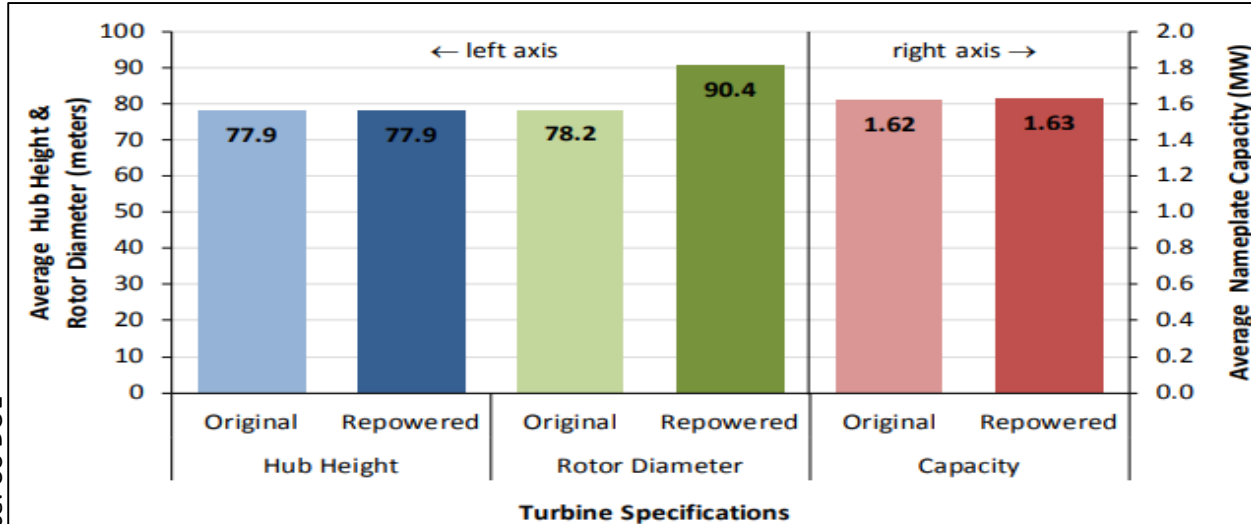
Mainly driven by:

- Policy
- Incentives

Main markets:

- Germany
- Spain
- Denmark
- ... France & Italy

MARKET REVIEW USA



Mainly driven by:

- Incentives

Main characteristics:

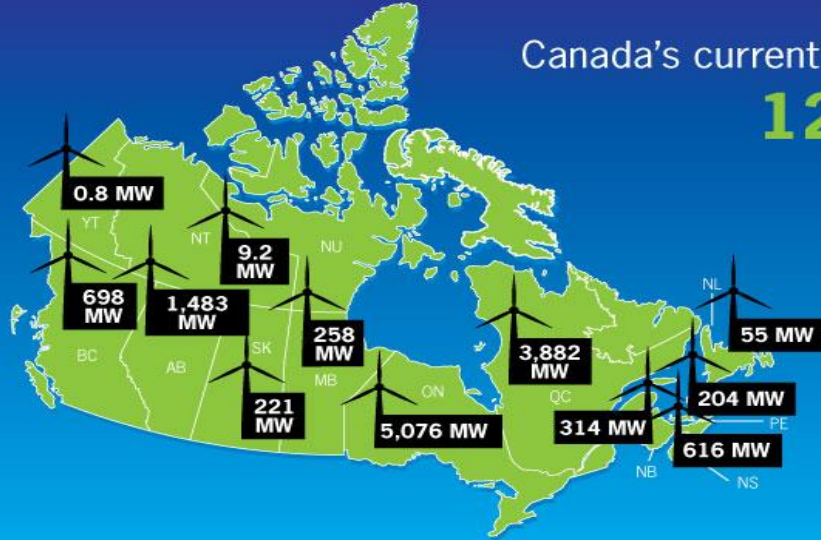
- 9-14 years, or
- PTC extension
- 1317 WTG (2 GW) in 2017

Source: US DOE

Figure 32. Change in average physical specifications of turbines that were partially repowered in 2017

MARKET REVIEW CANADA

Canada's current installed capacity:
12,816 MW



(as of December 2018)
May not sum to total due to rounding

Repowering:

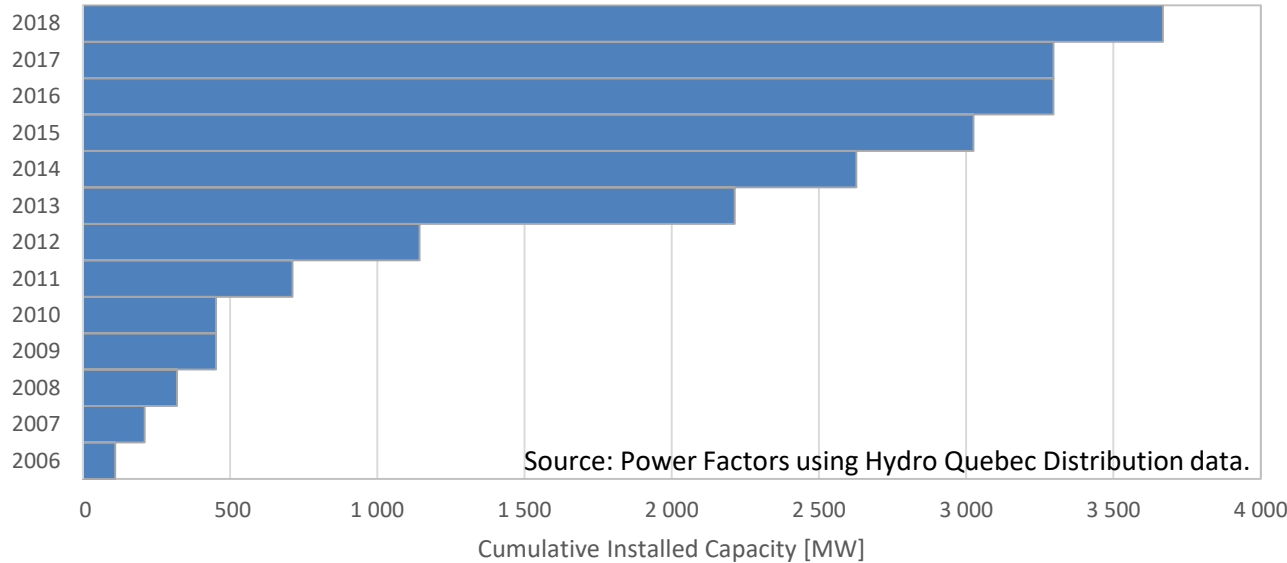
- Le Nordais, QC (COD 1998)

Decommissioning:

- Cowley Ridge, AB
- Repowering?

Source: CanWEA

MARKET REVIEW QUEBEC



Mainly driven by:

- HQD PPAs

Main characteristics:

- 20-year PPAs
- A few 25-year PPAs

OPTIONS FOR REPOWERING LIFE EXTENSION

- Certification
 - SCADA data analysis
 - Modeling
 - Inspection
 - Certification
- High-quality SCADA data is critical
- See next presentation

OPTIONS FOR REPOWERING PARTIAL REPOWERING

- Major equipment replacement
 - Blades
 - Gearbox
 - Main bearing
 - Complete nacelle
- High-quality SCADA data is critical

OPTIONS FOR REPOWERING FULL REPOWERING

- Advantages
 - Historical knowledge
 - Existing infrastructure, service network ...
 - Resale value
- Challenges
 - PPA
 - Impact assessment, legal, ...

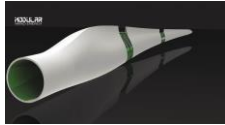
REMARKS ENHANCERS, UPGRADE PACKAGES ...



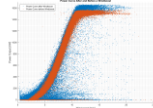
Chord Extension & Dynotail



Vortex Generators (VGs)



Blade Extension



Software Update & Settings Optimisation



Yaw System Alignment & Optimisation



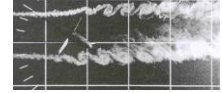
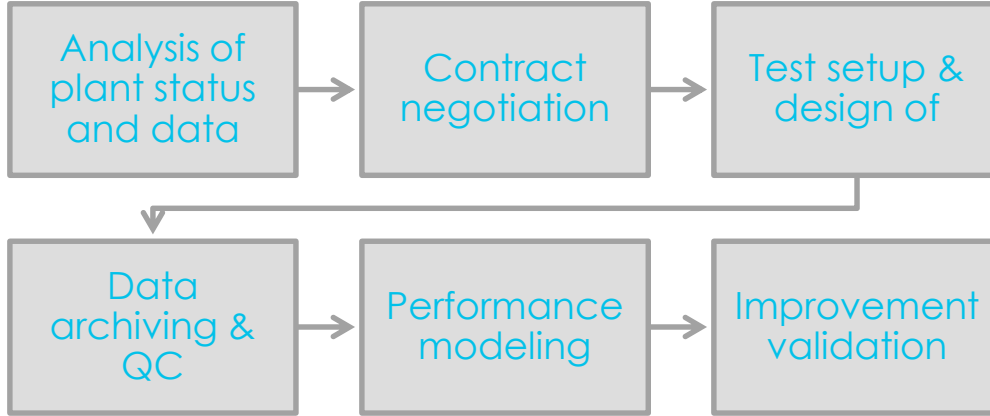
Anti/De-icing System



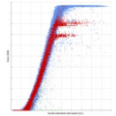
Forestry Optimisation



Power Cone

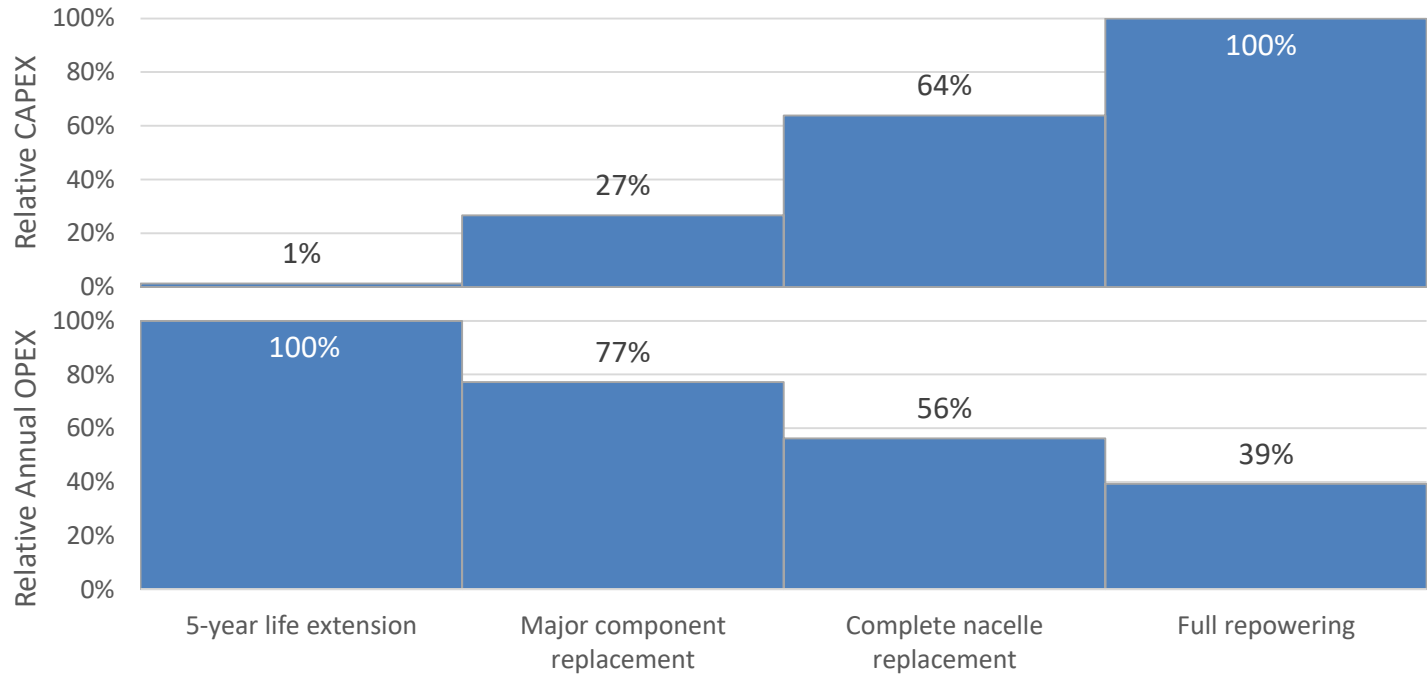


Wake Optimisation



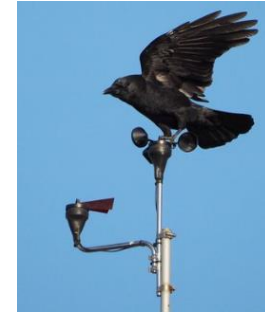
Curtailment optimisation
Storm shutdown, bats, cut-in, cut-out

COST CONSIDERATIONS 100-MW PLANT 1.5-MW TURBINES



CONCLUDING REMARKS WHEN CONSIDERING LIFE EXTENSION

- Choose options wisely
- Plan operations vigilantly
- Store high-quality data dearly
- Apply intelligence ... biologically!





THANK YOU

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