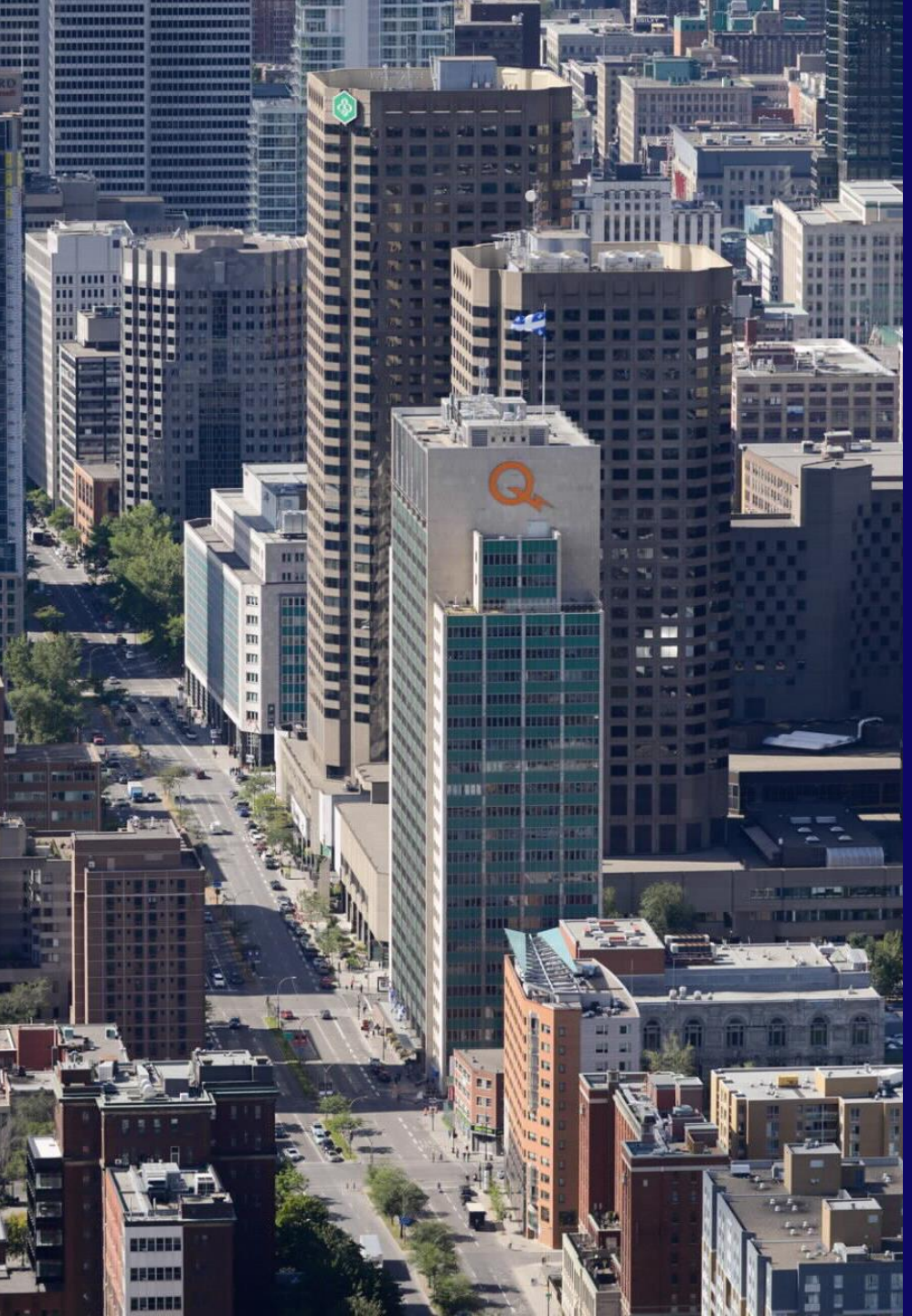

Presented at

2021 Asset Leadership Network Online
reStructuring America
Rethinking the concept of value in national assets and infrastructure.
Building on Success

Engineering Asset Management at Hydro-Quebec

Dragan Komljenovic, Ph.D., PEng., FISAM
Senior Research Scientist
Hydro-Quebec's Research Institute (IREQ)
Komljenovic.dragan@ireq.ca

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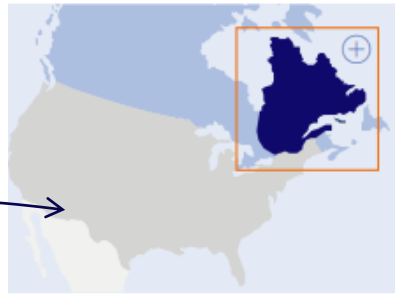
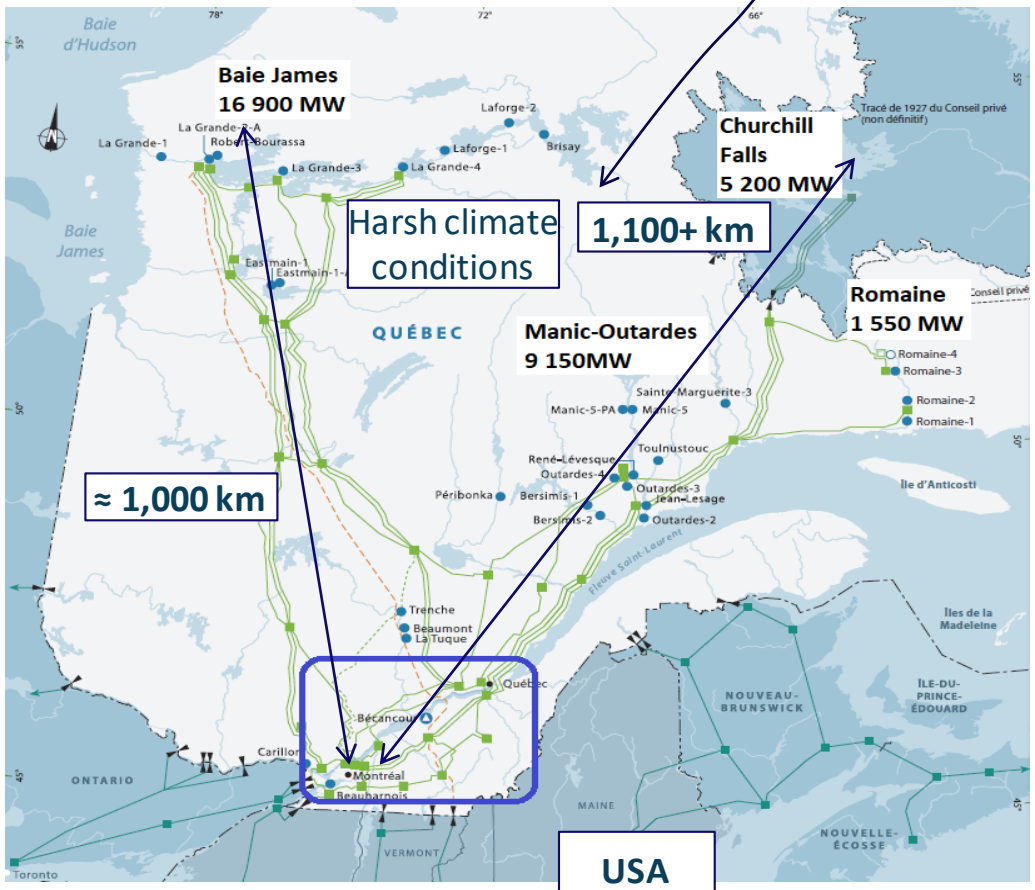
Hydro-Quebec in numbers (2020)



HQ is only N-A electrical utility with a major research institute (IREQ) (500+ staff)



- **Total number of employees: 19,477**
- **Total number of customers: 4,357,000**

Generation capacity

- **62** Hydroelectric power plants; **>350** Hydroelectric generators
- **37,243 MW** installed generation power

Transmission grid

- Over **34,802 km transmission lines 49 kV to 765 kV** (almost 12,000 km 735 kV transmission lines)
- **534** Transmission substations
- **15 Strategic inter-connexions** with neighbor grids for exports (Canada, NE USA)

Distribution grid

- **118,500+ km MV** < 25 kV & **120,000+ km LT** distribution grid
- **≈ 3,000+** Distribution substations
- **≈ 680,000+** Arial transformers

Main generation units are in North and **main consumption centers** are in the Southern part of Quebec, Ontario, NE USA **(1,000+ km) – huge technological and scientific challenges to reliably operate the whole system**

https://www.hydroquebec.com/about/
https://www.hydroquebec.com/sustainable-development/

Asset Management at Hydro-Quebec

- HQ faces **an increasingly complex operating and business environment** (market evolution, energy transition, performance requirements, changing regulatory framework, new technologies, pandemic, climate change & extreme weather...).
- Enterprise should deal with the replacement of large parts of its assets as they reach the end of their useful life or become obsolete due to technological changes. Major upgrades are also necessary due to the need to grow capacity.
- **Asset management is considered an efficient approach able to provide an adequate framework and a strong scientific and technical basis** for a rigorous decision-making (combined with risk and resilience management)
- The **strength of HQ's is in a multidisciplinary and holistic approach, collaboration and a long-term vision**

Some future challenges in AM at Hydro-Quebec (list non exhaustive)

Based on HQ's experience, there some challenges in efficiently applying AM

- ❑ Integrate: new technologies, DER, materials, scientific knowledge, AI, "smart things" with existing ones
- ❑ Align all the functions of an organization (engineering and non-engineering)
- ❑ Enhance methods and tools for:
  - Life Cycle Cost modeling and decision making support
  - Diagnostic and prognostic
  - Data acquisition, quality and treatment
- ❑ Understand, model and characterize:
  - Complex operational and business environment, deep uncertainties, emergent and systemic risks
  - Impact of climate change on assets and AM
  - Cyber security issue and its impact on AM (particularly relevant with the introduction of edge technologies)
  - Impact of human and organizational performance on the AM efficiency

Dragan Komljenovic, Ph.D., P.Eng., FISEAM

- Current: **Senior Research Scientist** with Hydro-Quebec's Research Institute (IREQ, Canada) (reliability, risk analysis, asset management, resilience)
- Previously: **Reliability and nuclear safety engineer** at the Gentilly-2 Nuclear Power Plant (Hydro-Quebec, Canada)
- **Adjunct professor (at various intervals):**
  - **University of Waterloo, Waterloo, Canada** (Research Chair *Risk-Based Life-Cycle Management of Nuclear Engineering Systems*)
  - **Laval University, Quebec-City** (Department of Materials, Metallurgy and Mining Engineering)
- **Ordre des ingénieurs du Québec** (OIQ) – *Professional chartered engineer in Québec, Canada*
- **International Society of Engineering Asset Management** (ISEAM) – *Fellow*
- **Society of Reliability Engineers** (SRE) – *Vice-president of Montreal Chapter*
- **Education**
  - 1st Ph.D. (2002): Laval University, Canada (mathematical modeling; Mining Engineering)
  - 2nd Ph.D. (2018): University of Quebec in Trois-Rivieres (UQTR), Canada (Risk-Informed Decision Making in Management of Industrial Assets; Industrial Engineering)

Some of our recent publications related to AM and resilience

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- Blancke, O., Tahan, A., Komljenovic, D., Amyot, N., Hudon, C., (2018), A holistic Multi-Failure Prognosis Approach for Complex Equipment, *Reliability Engineering and System Safety*, 180: 136-151
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