

Distributed Energy Resources (DERs) and electricity sector evolution: an Ontario perspective on challenges and opportunities

Presentation to the Electric Power Industry of Quebec (EPIQ)

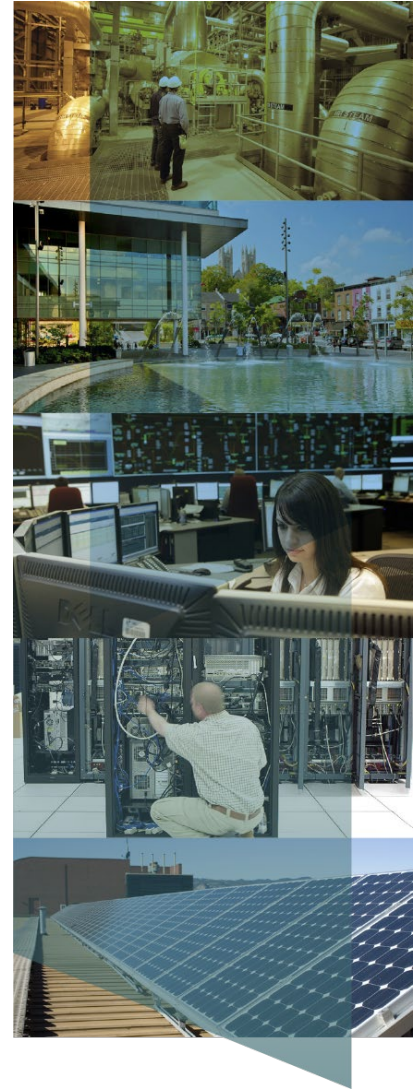
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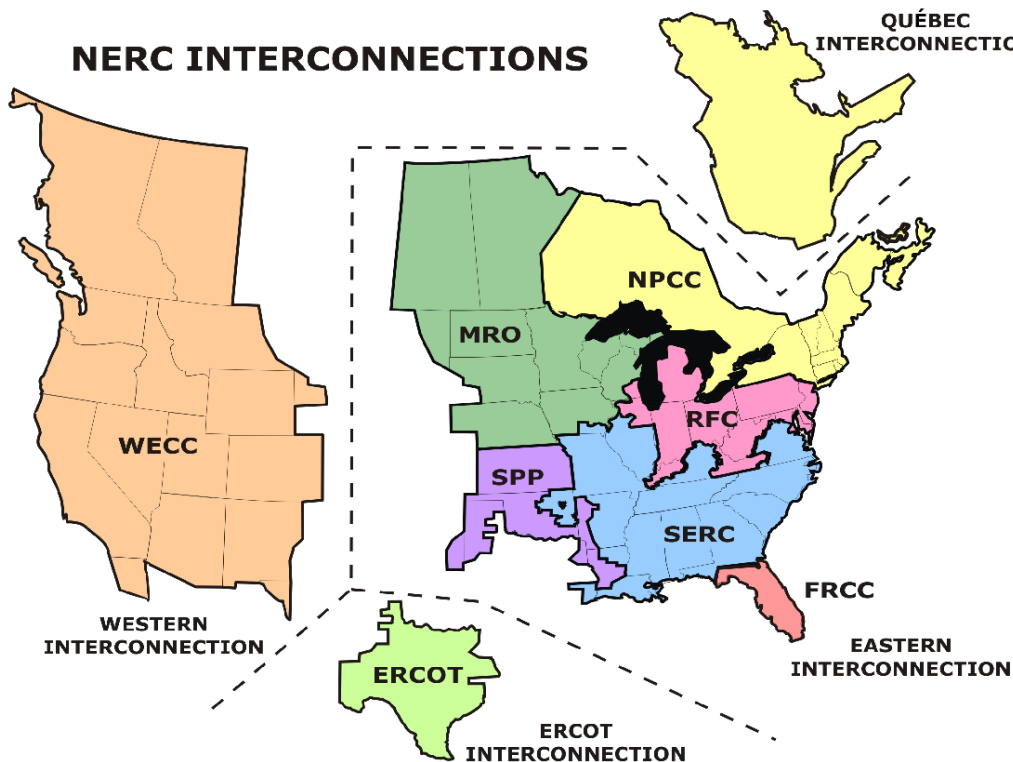
About the IESO

The Independent Electricity System Operator (IESO) works at the heart of Ontario's power system and has a broad mandate that includes:

- Planning to meet electricity needs
- Operating the electricity grid
- Administering the electricity market
- Fostering a conservation culture
- Engaging stakeholders and communities
- Enabling innovation
- Acting at the province's Smart Metering Entity



Ontario's Reliability Co-ordinator

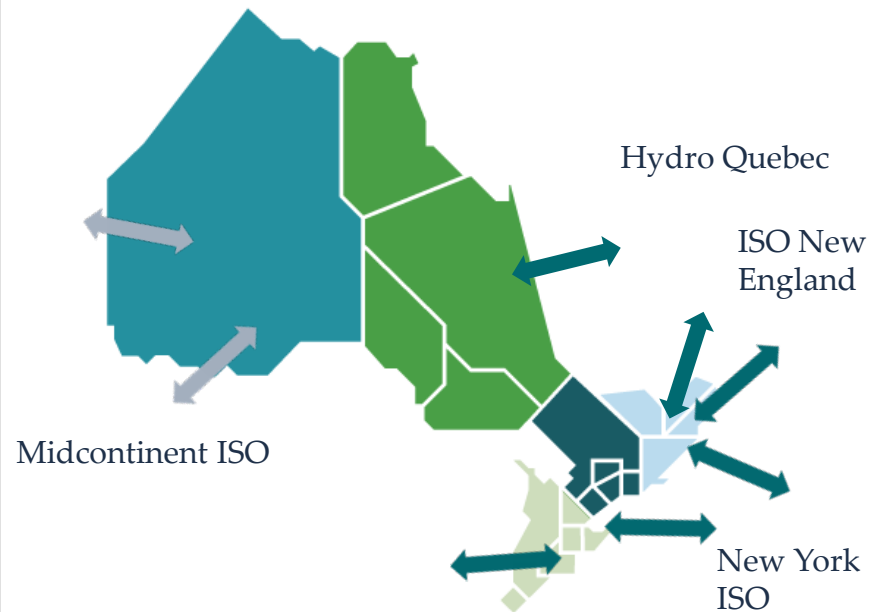


- IESO is responsible for monitoring and enforcing reliability standards in Ontario
- IESO represents Ontario's interests as member of North American Electric Reliability Corporation (NERC) and Northeast Power Coordinating Council (NPCC)
- IESO is active in the interconnected community in emergency preparedness related activities

Ontario's System at a Glance

Installed Capacity (December, 2017)	36,853 MW
Record Summer Peak (August 1, 2006)	27,005 MW
Record Winter Peak (December 20, 2004)	24,979 MW
Grid Energy Consumed (2017)	132.1 TWh
Customers	~ 5 million
Transmission Lines	30,000 km
Planning Regions	21
Import/ Export Capability	6,500 /6,100 MW
Interconnections	New York, Quebec, Manitoba, Michigan, Minnesota

The IESO is the Reliability Coordinator and the Planning Coordinator for Ontario and works closely with other jurisdictions across North America to ensure reliability of the interconnected power system.



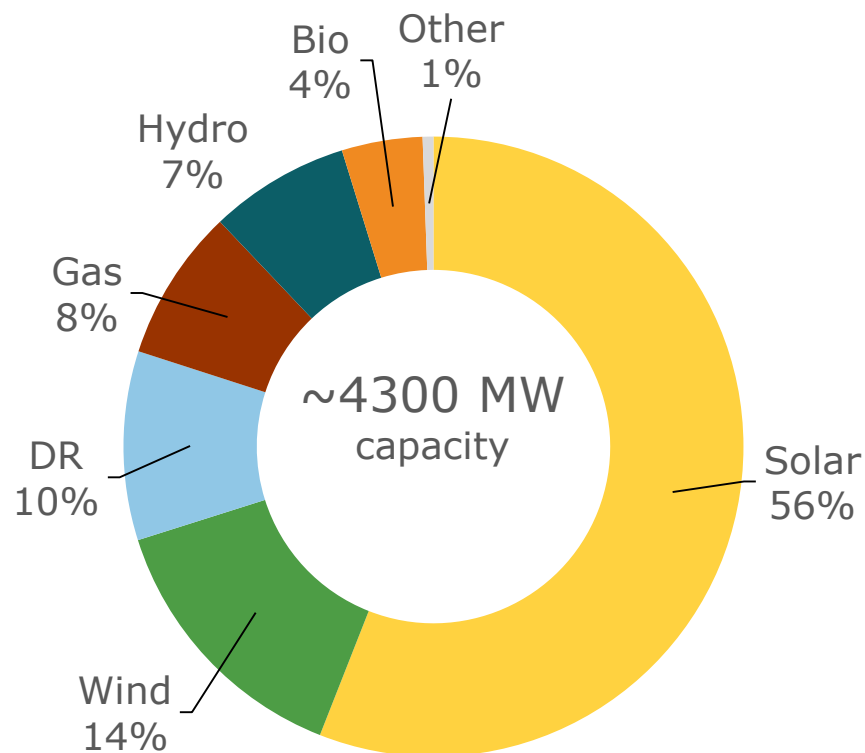
A story: the great Toronto rainstorm of July 2013



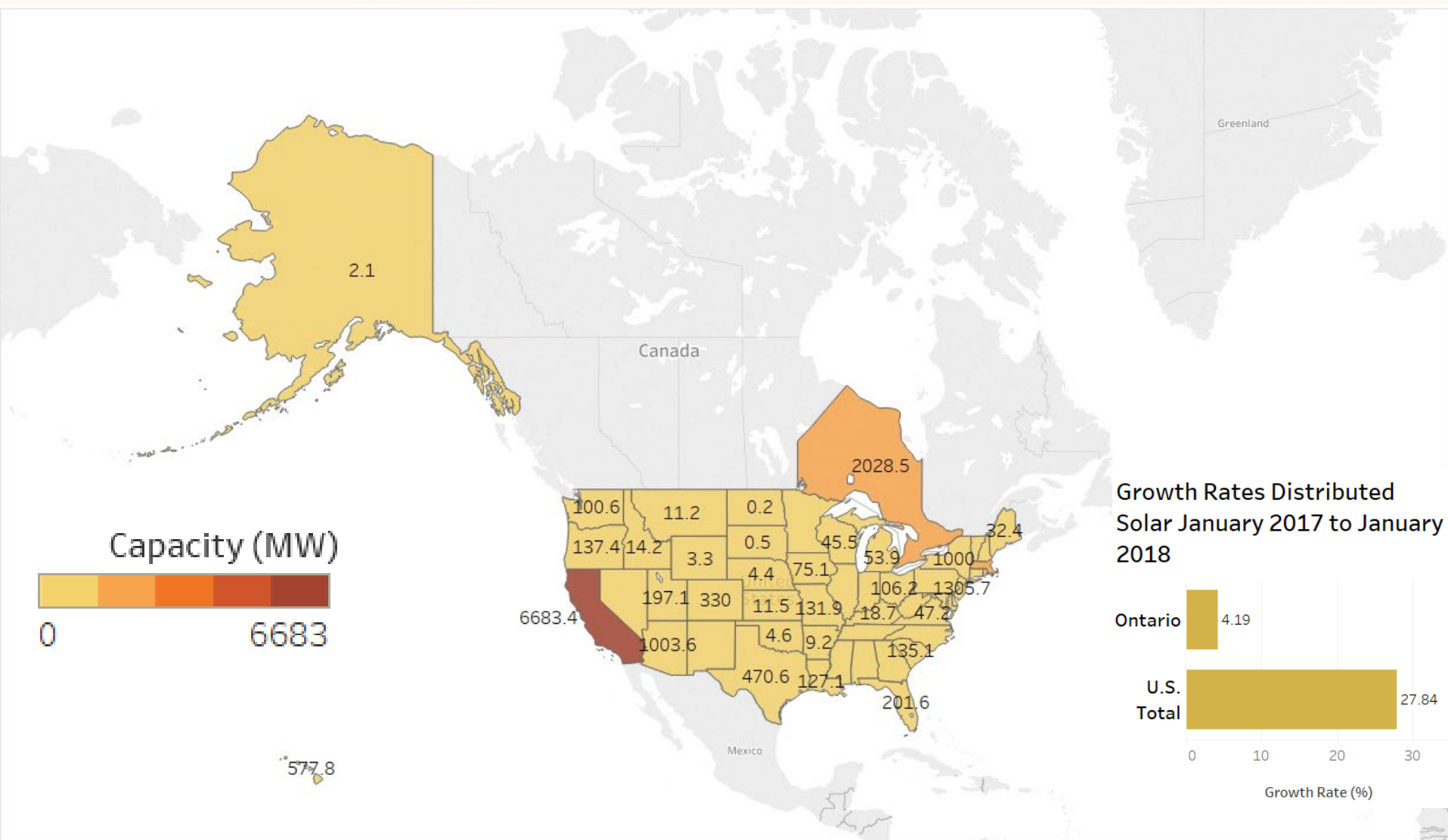
Distributed Energy Resources in Ontario

- Most DER supply is from embedded generation facilities
- Ontario electricity system has 4300 MW of DERs in service or under development, including regulated, contracted, and merchant facilities

- 4300MW is about 10% of Ontario's installed resource capacity
- Approximately half of DER capacity is solar PV resources
- Nearly all DER in Ontario was secured through incentive programs

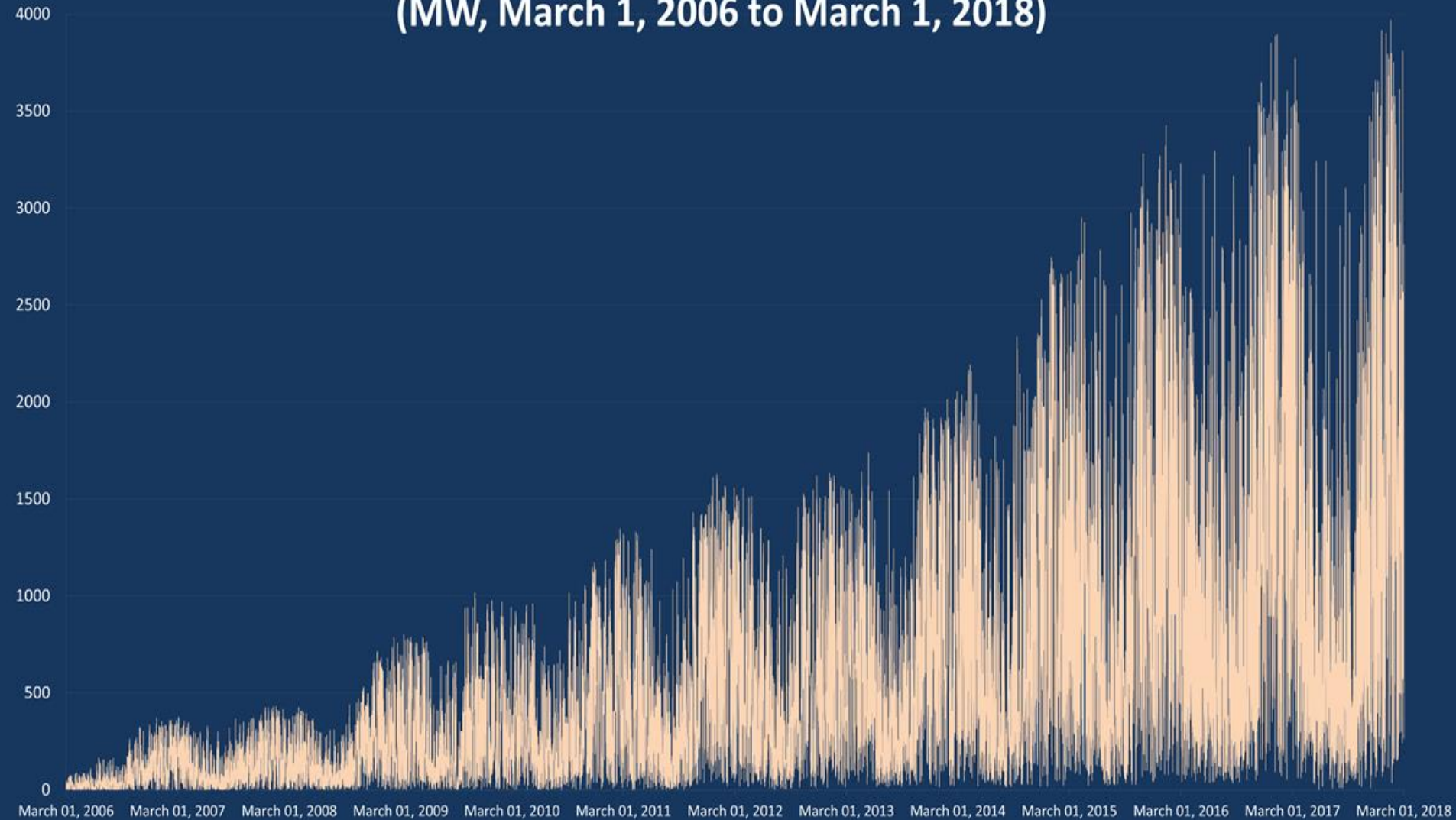


Small Scale Solar (MW) in U.S. and Ontario, Jan 2018

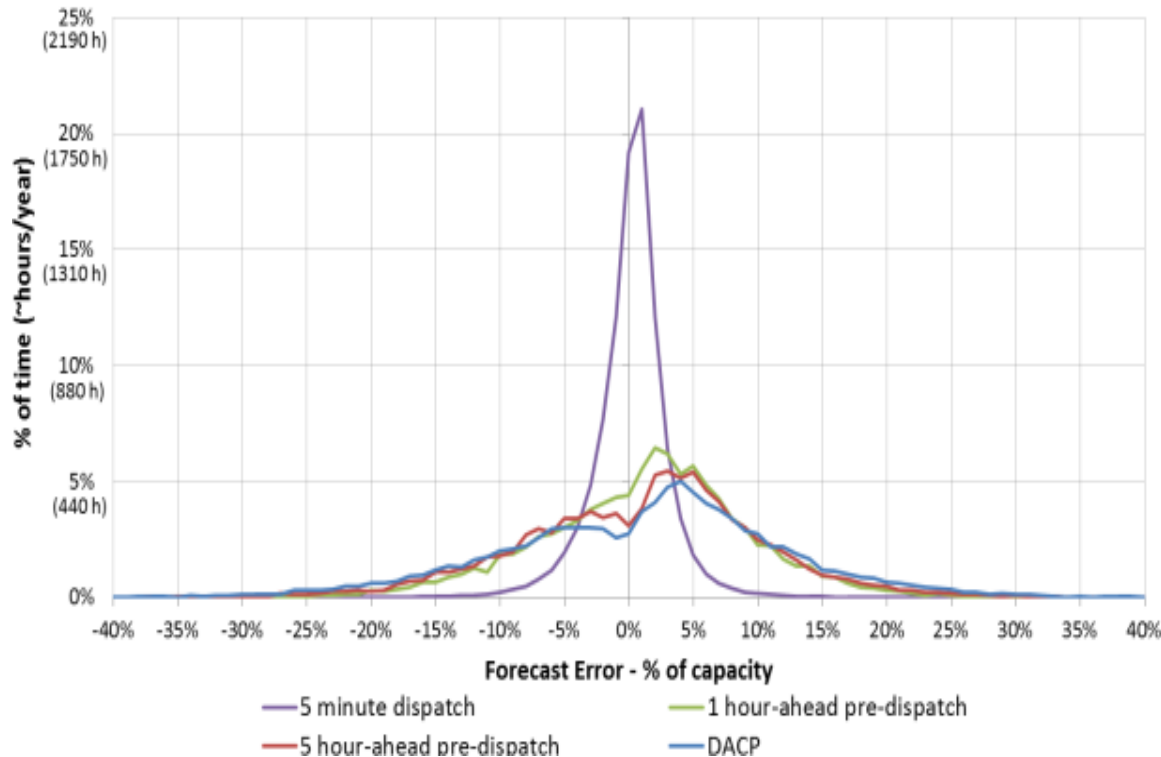


12 Years of Wind Output in Ontario

**Ontario's Wind Power Output
(MW, March 1, 2006 to March 1, 2018)**



Challenges: emerging operability needs



IESO is addressing near-term operability needs through:

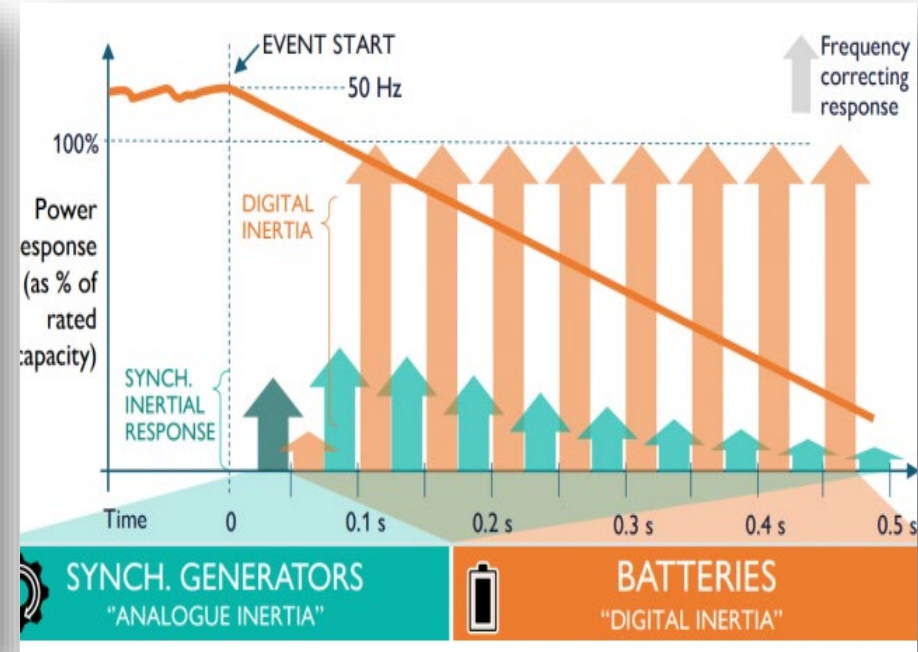
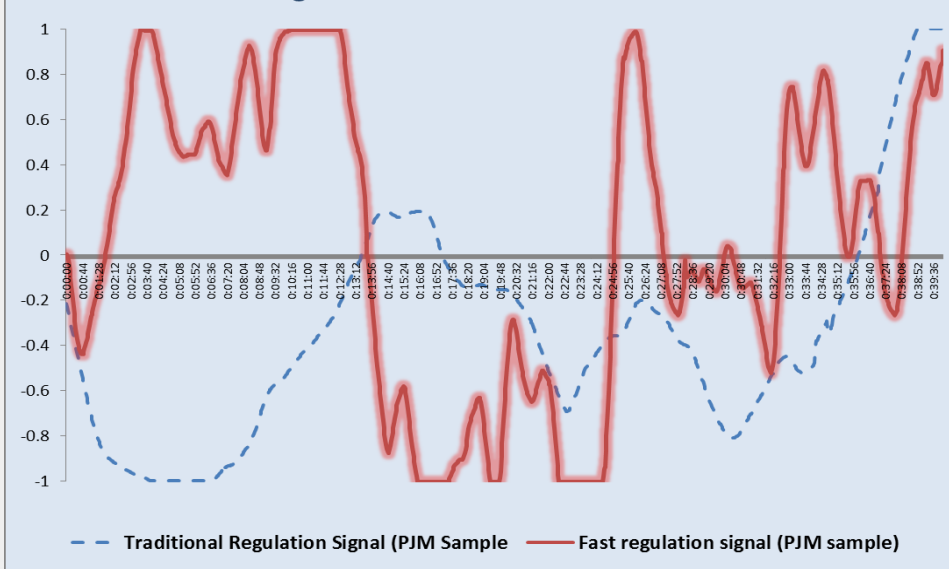
- ✓ Use of 30-minute Operating Reserve (Enabling System Flexibility stakeholder engagement)
- ✓ Expansion of regulation capacity (2017 RFP)
- ✓ Specific rules for renewable integration

Opportunities: recent events inside and outside Ontario are highlighting an exciting moment in the developmental history of energy storage...

- **November 2017:** Energy storage technologies sweep IESO Regulation RFP
- **February 2018:** U.S. FERC Order 841
- **March 2018:** First fully-dispatchable battery energy storage facilities join Ontario's electricity market
- **May 2018:** IESO commences Energy Storage Advisory Group (ESAG)

Other possibilities: fast regulation service and synthetic inertia from storage

Example: Traditional (RegA) and Fast (RegD) regulation signals in PJM over 40 minutes

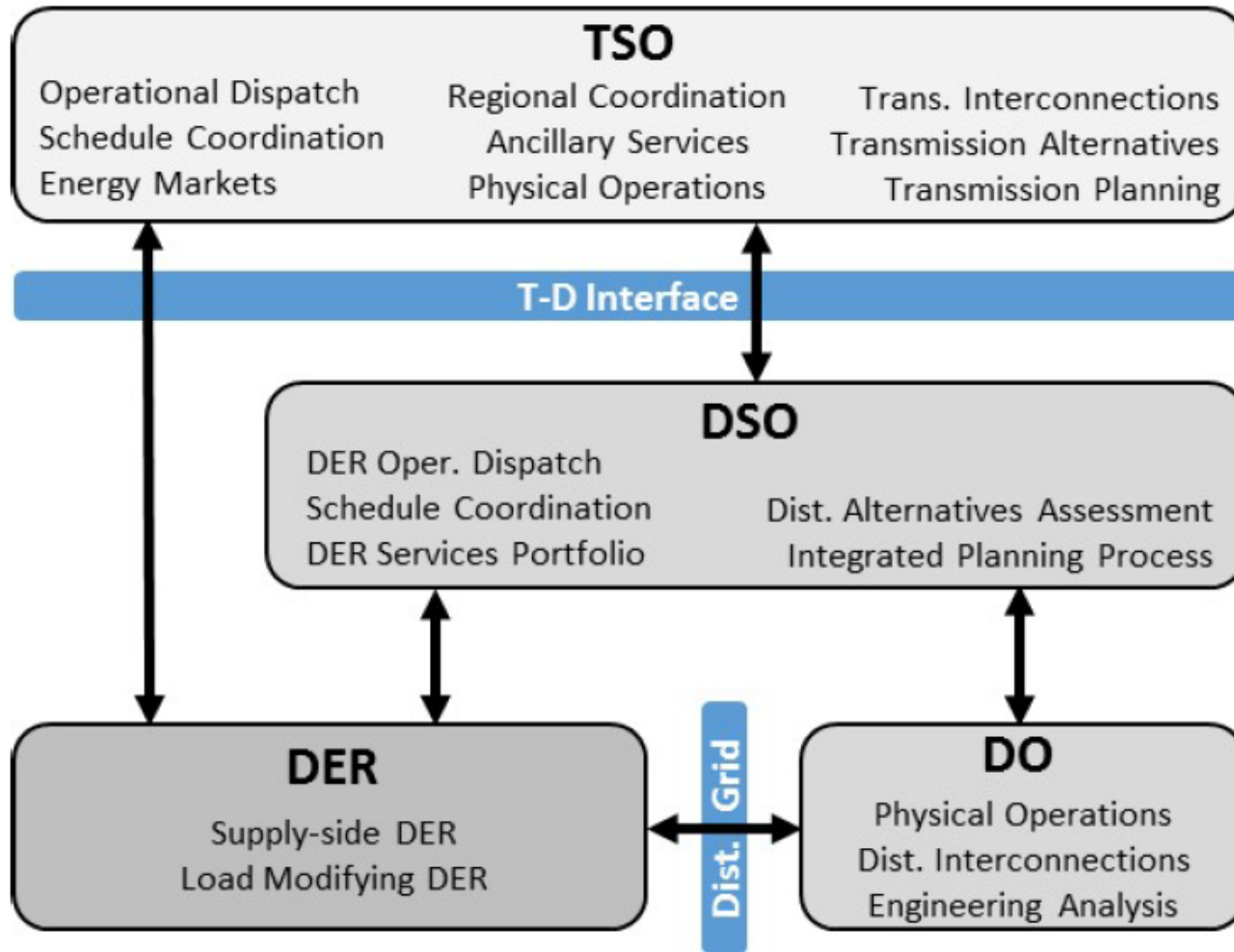


Fast regulation: an efficient means of replacing conventional reg. capacity (i.e. greater than a 1:1 ratio)

Synthetic inertia: reduce the need for regulation at the source of the problem.

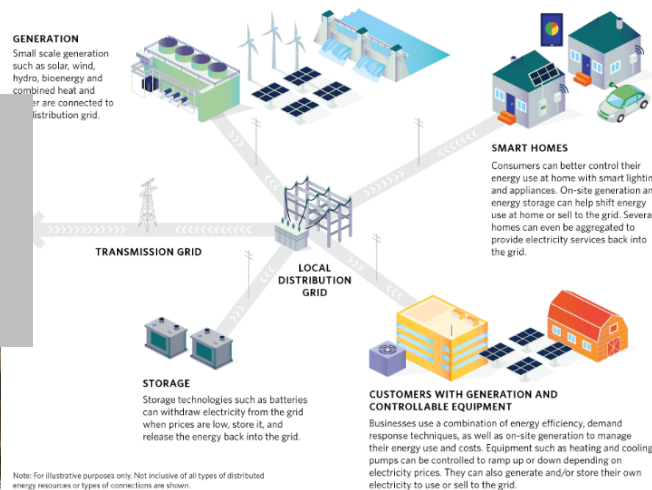
Image source: <http://everoze.com/>

A changing sector: potential pathways for distribution sector evolution in a time of large-scale DER growth (Berkeley Labs)



The story continues....

FERC proceedings
on aggregated DER
participation in
wholesale markets



Certification
requirements for IEEE
1547-2018 (DER
interconnection
standard)



September 27, 2017
Maple Leaf Deltro Storage site
BASIN 2 Battery arrays

