

ISGAN Annex 4 - Online Smart Grid Workshop

Supporting Innovation in Smart Grids:
A Global Challenge

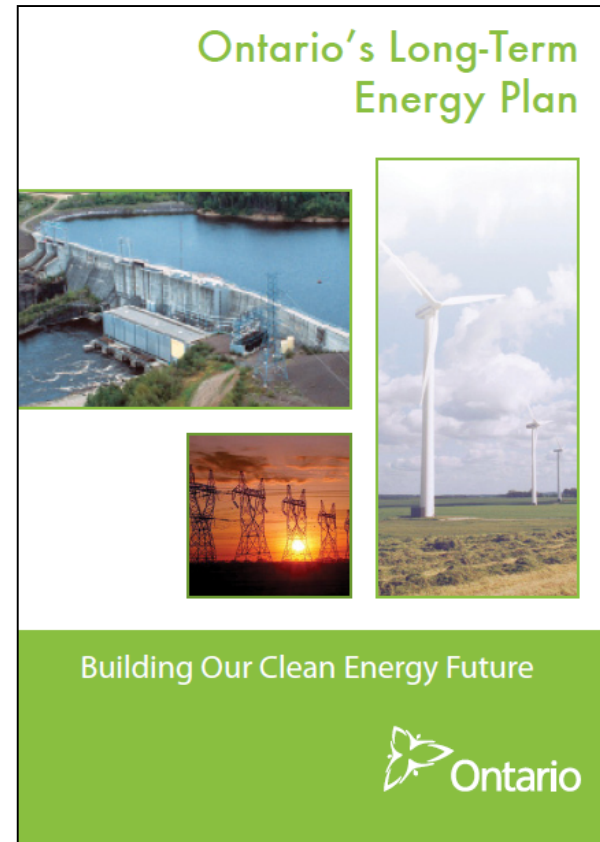
Ontario (Canada)

- 13 million inhabitants
- GDP of \$638 billion (CAD)
- Energy-intensive industries remain an important part of the provincial economy
- Hybrid market electricity structure
- Home to some of North America's densest urban areas, as well as a number of remote and isolated Northern communities



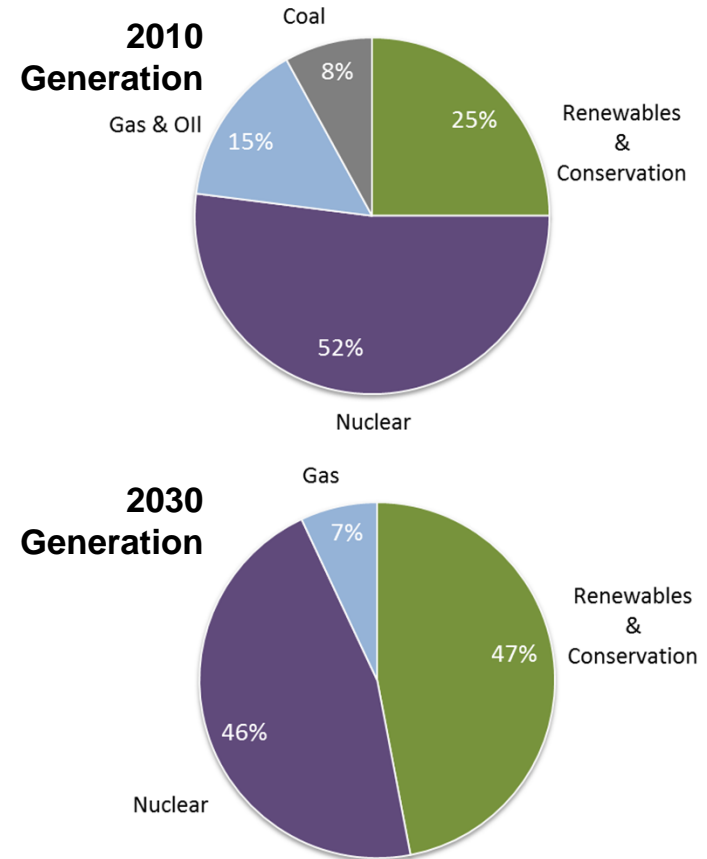
Ontario's Long-Term Energy Plan

- In November 2010 the government released its Long-Term Energy Plan
- The document lays out a vision for the electricity sector through 2030
- Highlights include:
 - Coal Closure
 - Significant increase in renewable generation
 - Aggressive conservation targets
 - Acceleration of smart grids



The Plan - A Cleaner Supply Mix

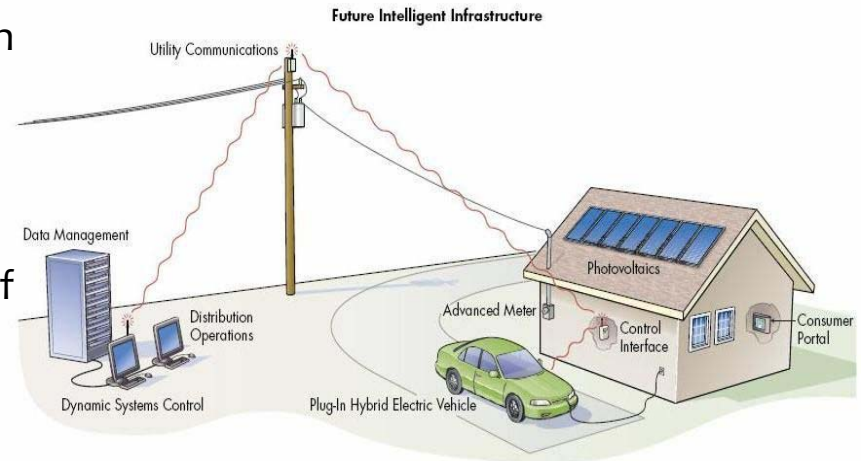
- As coal is phased-out, nuclear and gas generation will continue to play important roles in the supply mix
- Nuclear is to continue to supply approximately 50% of generation through 2030
- Gas will play a strategic role, complementing intermittent generation and nuclear modernization



Source: LTEP

Ontario's Push for Smart Grid

- Ontario has seized the opportunity to become a leader in smart grid to support achievement on various key provincial priorities:
 1. Aggressive integration of renewable, distributed generation into the distribution grid
 2. One of North America's most ambitious conservation targets
 3. One of the largest smart meter and time of use rollouts globally
 4. Significant effort to create conditions for accelerated electric vehicle adoption
 5. Economic benefits being created from the opportunity to leverage existing leading edge assets in manufacturing, research, and electricity distribution systems

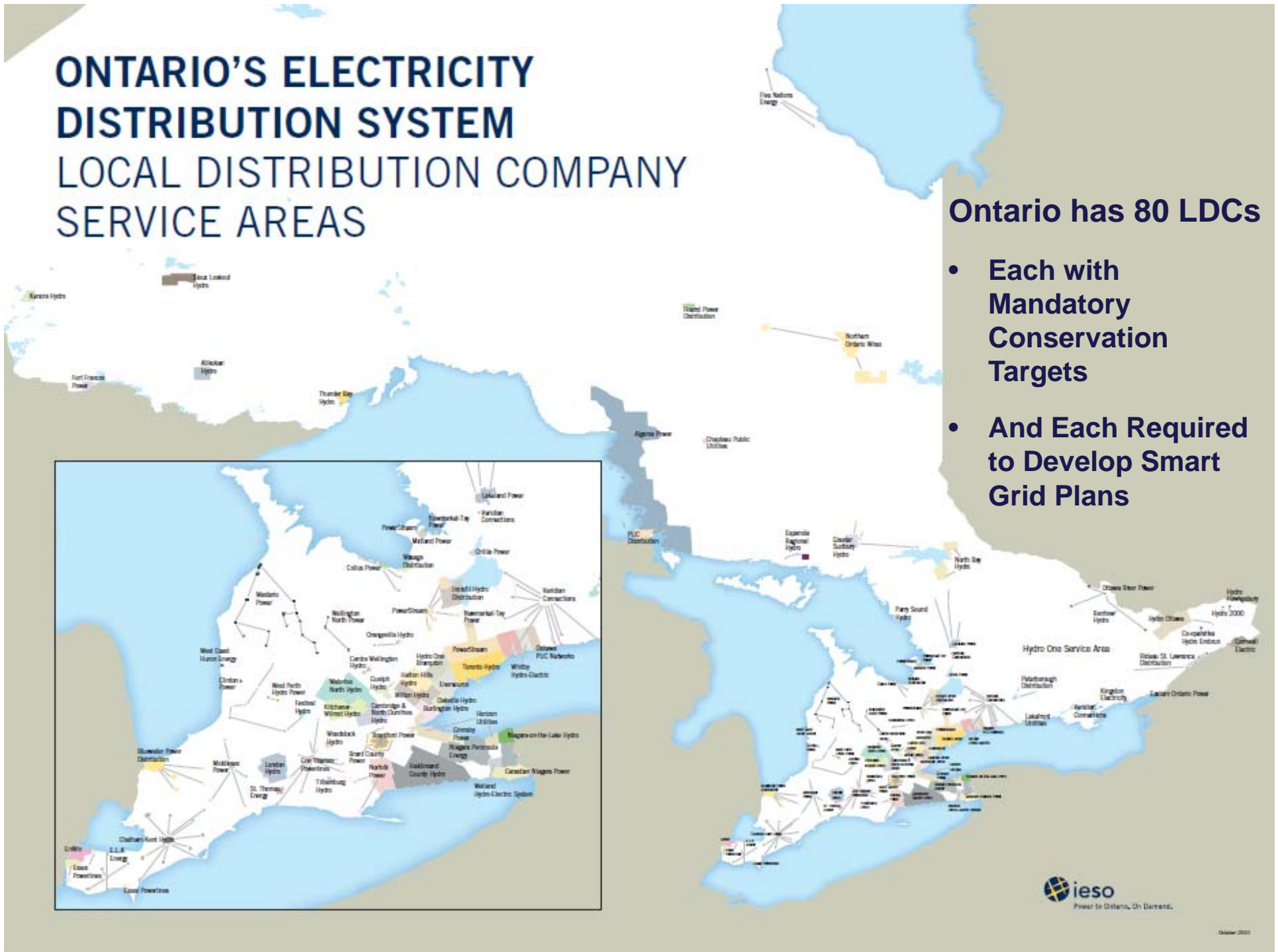


ONTARIO'S ELECTRICITY DISTRIBUTION SYSTEM

LOCAL DISTRIBUTION COMPANY SERVICE AREAS

Ontario has 80 LDCs

- Each with Mandatory Conservation Targets
- And Each Required to Develop Smart Grid Plans

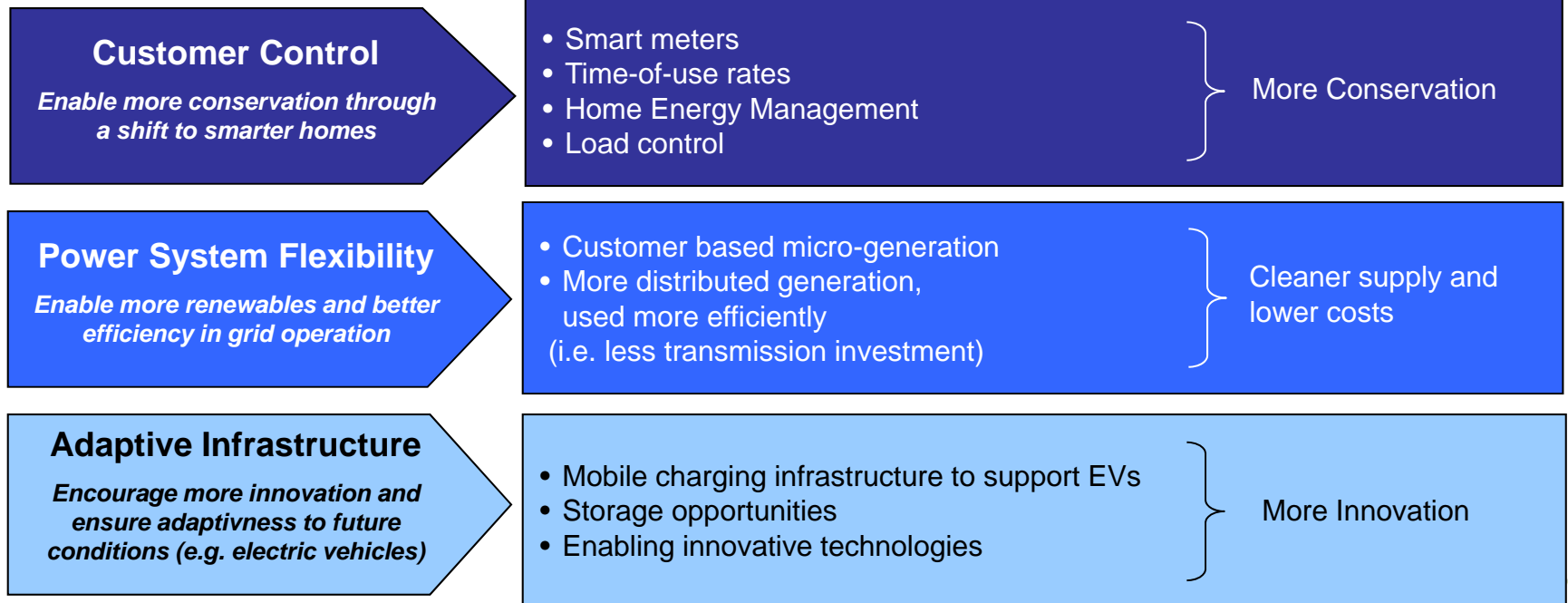


A Framework for Smart Grid

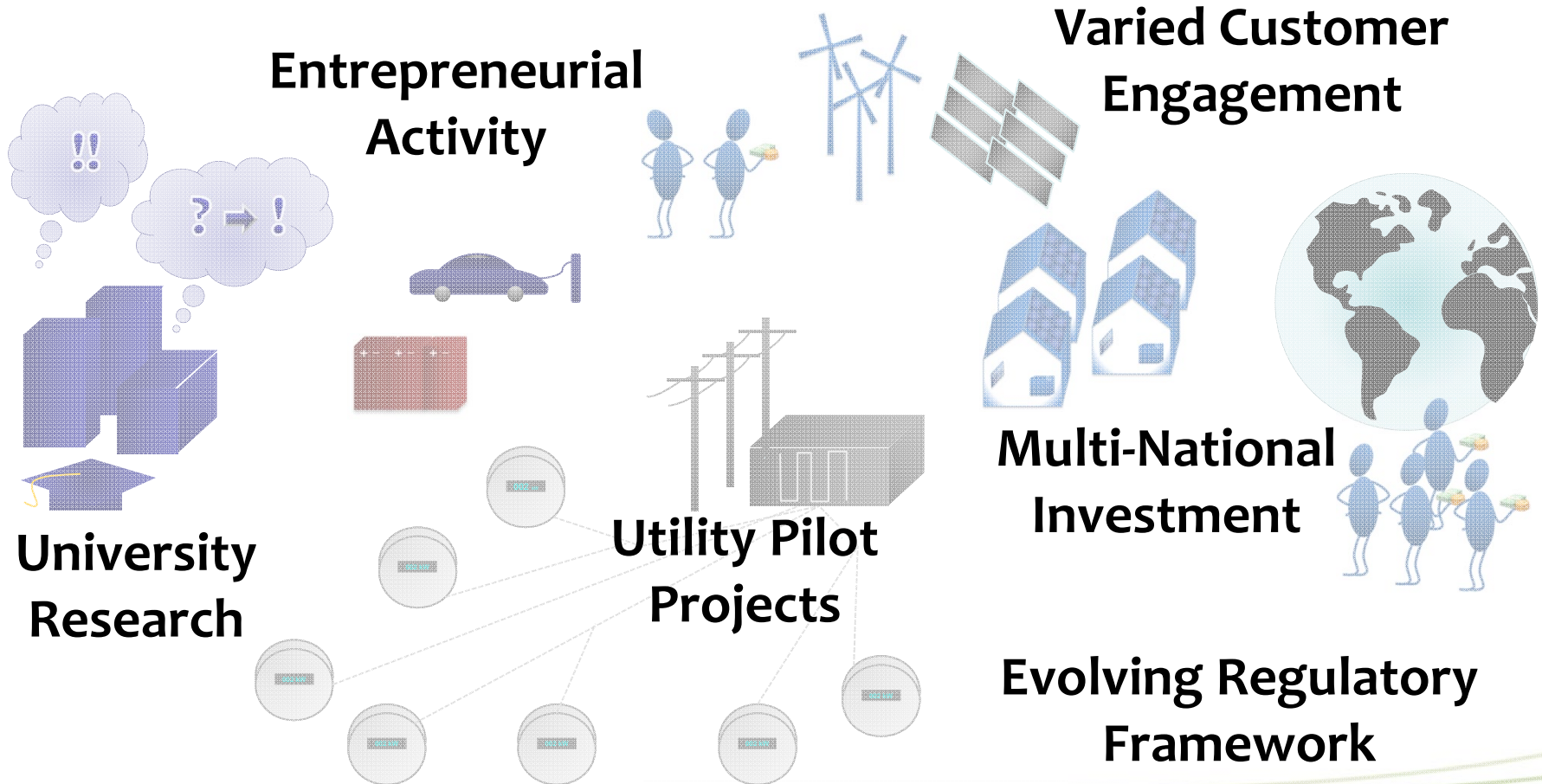
The Green Energy Act has provided guidance on smart grid for Ontario. Our energy regulator is undertaking a regulatory review exercise to respond this policy framework.

Focus Area

Expected Outcomes



Lots of Activity...



Smart Grid Fund

- The Smart Grid Fund is a \$50M competitive grant program designed to leverage Ontario's advantages in the energy sector and build the smart grid industry.
- The government recently announced 13 successful projects in the areas of behind the meter, integrating distributed energy resources, regional integration, data management, and grid automation.



ecobee

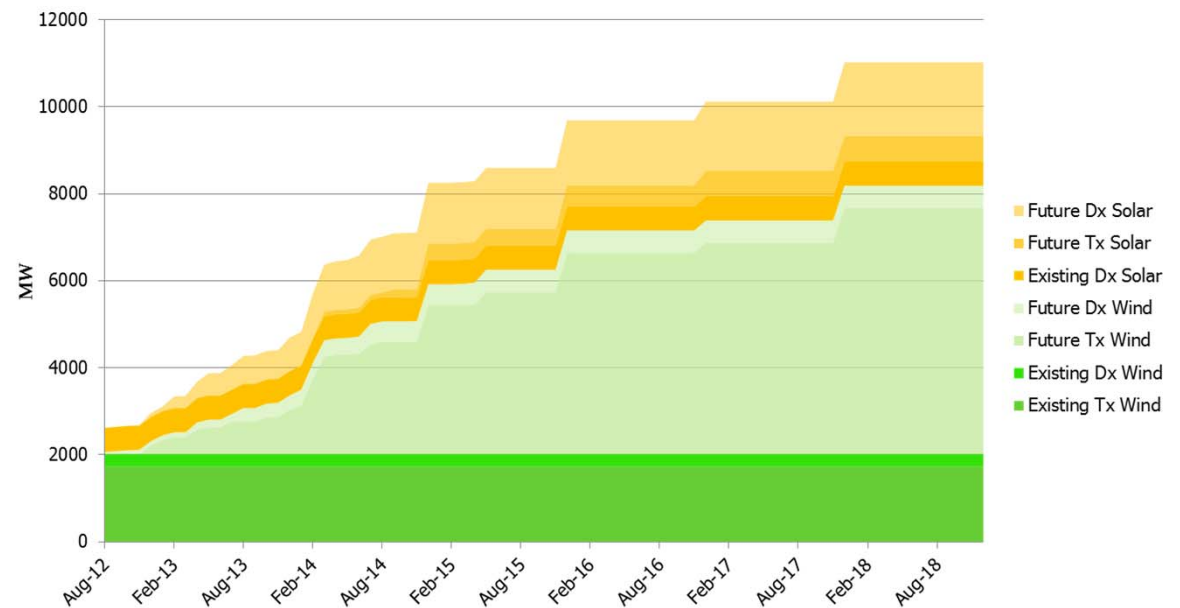


SIEMENS



Renewable Integration at the Distribution Level

- Achieving Province’s renewable integration and conservation goals requires a smart grid and its associated technologies, like storage.
- Already the case for conservation, increasingly more of the renewable impact will be felt on the distribution grid (see right)
- In addition, storage itself can help mitigate potential issues on both the DX/TX system related to power fluctuations in the grid from very high shares of renewable energy

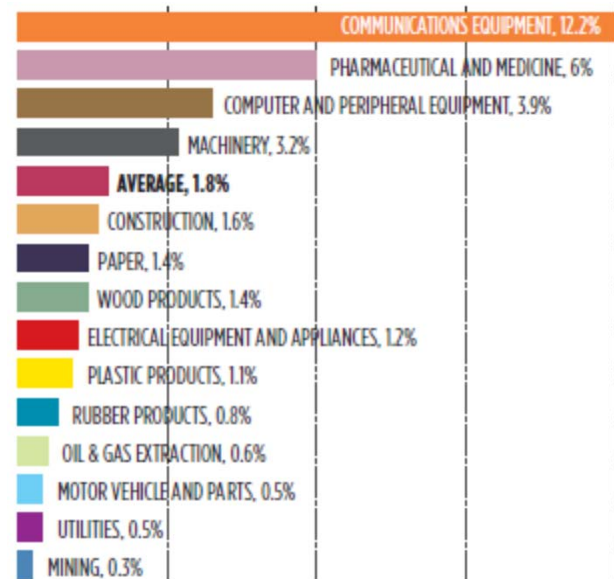


Source: IESO

Sector's capacity to modernize

- Utility investment in R&D is among the lowest across sectors (see graph)
- Only a few of the 80 utilities in the Province have the customer base required to attract large scale technology vendors and the sufficient balance sheet strength to pursue innovation
- Rapidly evolving technology landscape is challenging for the regulator and is hampered by fragmentation of utility efforts

CANADA INDUSTRIAL R&D INTENSITIES
(R&D SPENDING RELATIVE TO REVENUES)

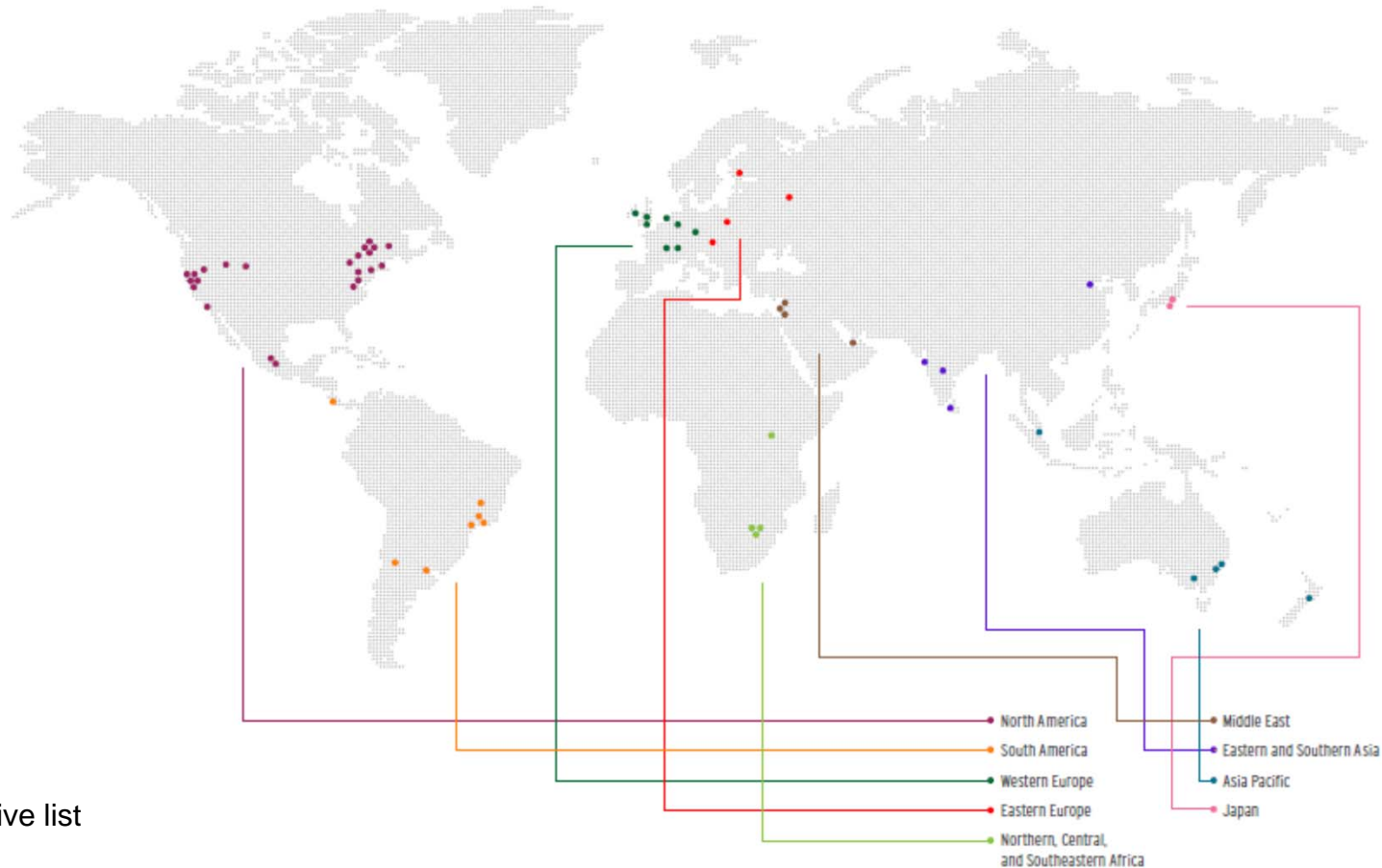


Source: Statistics Canada Intramural Research and Development Expenditures as a percentage of revenues
Data for Utilities and Wood Products* is just for the R&D performed by Canadian-owned firms, while other indicators are of total R&D performed by both Canadian and Foreign-owned firms

Source: Mowat Centre for Policy Innovation

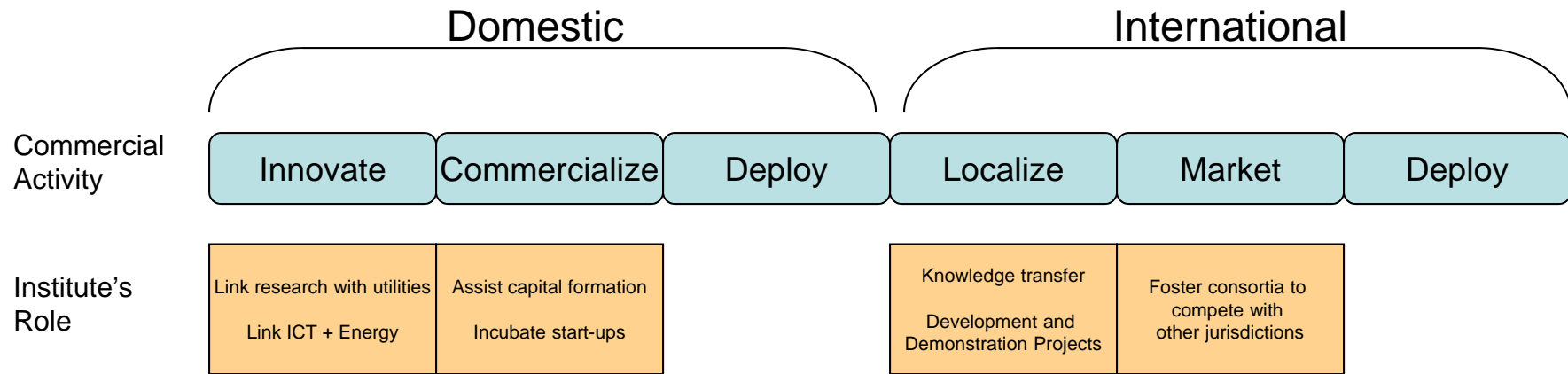
How do we bridge the gap between local strengths and global opportunities?

Global Perspective - Clean Energy Institutes*



* Not exhaustive list

Clean Energy Institute



- Key Points
- Dedicated effort to advance energy-economic goals and enhance coordination of the sector
 - Focus is opportunities in emerging energy technologies, such as smart grid and energy storage
 - Would be funded primarily by private partners with added public sector support
 - Would explore partnerships with foreign institutes in emerging markets to expand footprint
 - MaRS Discovery District – a local regional innovation centre – is working with government to assess the potential of such an Institute

Drivers & Needs

Need for an Innovation Strategy

- *Need to maximize innovation potential through potential regulatory hurdles.*
- *Improvable linkages between two key Ontario strengths: the electric utility and the ICT sectors (information and communications technology),*
- *Opportunity to further align local market (~80 utilities) to foster large scale deployments that can act as proof points for a global audience and spur innovation,*
- *Potential to connect academic research with project partners and international commercial opportunities.*

Need for an International Strategy

- *Low awareness globally of the expertise built up in Ontario around distributed generation, smart grid, conservation, etc.*
- *Additional opportunities to attract strategic energy companies to invest in Ontario*
- *International expansion is key to the long-term growth of the most innovative and competitive companies in Ontario*
- *Expansion of economic benefits for developing cutting edge projects in Ontario with global companies*

Activities of the Institute

1

Link a fragmented market

- Develop industry ‘roadmaps’ and foster a ‘neutral collaboration space’ to link utilities, IT/telecoms, academic community and corporate partners

2

Partner with foreign institute

- International focus to ensure that commercialization efforts are aligned with a global market opportunity

3

Seed money for pilots

- Identify strategic opportunities and co-fund pilots with the utility and corporate partners

4

Encourage industry consortia

- As part of a government export strategy that includes trade missions, international development projects, and B2B partnerships

Examples of Ontario Research Activities

Focus Areas	High Profile Researchers	Centres*	% Research Centres, Laboratories, and Initiatives* Established in Ontario		
			2006 – 2011	2000 – 2005	1999 and Earlier
Grid Auto-mation	Queen's: Power Systems (P. Jain) UWO: Grid Connection (R. Varma) McMaster: Vehicle-to-grid (A. Emadi)	14	58%	20%	23%
Data Mgt.	UofT: High vol. data management (R. Miller) Waterloo: Database structures (F. Tompa)	4	Total		85
Wind Energy	Waterloo: Aerodynamic (D. Johnson) UWO: Grid connection (R. Varma)	6	Federal and Provincial Research Funding		
Behind the Meter	Waterloo: Energy Efficiency (I. Rowlands), Demand-side Management (D. Mountain) McMaster: Modeling & Simulation (S. Chidiac)	3	Funding Source	Year of Funding	Amount (in million)
AMI	Waterloo: Energy Management (I. Rowlands)	3	NSERC	2011 – 2015	\$5.3
Solar PV	McMaster: Ultra-high efficiency PV (R. Kleiman) UofT: PV Quantum Dot (E. Sargent), Organic Solar Cells (T. Bender, D. Seferos)	18	MEDI (MRI) to establish CONII	2006 – 2012	\$13.7
PEV	McMaster: Vehicle to Grid (A. Emadi) UWO: Grid Connection (R. Varma) Waterloo: Power Systems (C. Canizares), Battery Storage for PEV (L. Nazar)	13	Knowledge Infrastructure Program	2009 – 2013	\$122.3
Storage	Queen's: Fuel cell (B. Peppley), Waterloo: Fuel cell reliability (M. Fowler), Materials (L. Nazar)	14	Ontario Research Fund **	2008 – 2013	\$250
			NSERC Canada Excellence Research Chair (CERC), Research Chair (CRC) and Industry Research Chair (IRC)		
			Type of Chair	# of Research Chairs	
			CERC	1	
			CRC	26	
			IRC	14	

* Most research centres are active in multiple areas
** Program funds other non-related energy research

Source: Ontario Centres of Excellence



Conclusion

Ontario is using domestic challenges to push innovation and leverage our utility and start-up efforts into international economic success.

Thank you

Questions?