

Smart Grid – Activities in Canada

Smart grids are being developed in several states and provinces worldwide. Motivated by distinct policies and technical constraints, regional authorities prioritize some applications of the smart grid over others in order to meet their specific needs.

Each application has a different set of economic, environmental and security impacts. Each region has its own variety of energy challenges that may be, capacity constraints, reliability or the integration of more renewable energy.

The table below shows the current Smart Grid developments in Canada by provinces and utilities¹. The table presents “Planned” projects and projects deployed in each province. Pilot projects were categorized as “Ongoing”.

Modernization of electricity networks cannot be simplified to a single technology, but to a collection of applications each requiring precise technologies to operate. Some technologies need to be installed at the customer’s home or business while others target the power company’s network. What is common in every region is the need to build a communication network or to establish partnerships to manage this quantity of data.

Although deployment in various business contexts makes each project unique, Smart Grid technologies can be categorized under five major components, each having various applications:

Advanced metering	Demand response & Prosumers	Utility Storage & Ancillary Services
<ol style="list-style-type: none"> 1. Dynamic Pricing 2. Automatic meter reading (AMR) 3. Theft and outage detection 4. Online energy portal 5. In-Home display 6. Client remote connect/disconnect 	<ol style="list-style-type: none"> 1. Utility Direct load control (A/C, Water heaters, etc) 2. Wholesale Demand Response 3. Embedded generation and peak shaving 4. Customer energy storage (thermal and electric) 5. Smart charging and vehicle to grid 	<ol style="list-style-type: none"> 1. Contingency reserve (Emergency) 2. Regulation reserve (incl. load following) 3. Frequency regulation (Primary reserve & AGC) 4. Stability and voltage support (FACTS) 5. Black Start capabilities 6. Community Energy Storage

Network monitoring	Network automation
<ol style="list-style-type: none"> 1. Fault location (location of outage) 2. Wide Area Situational Awareness (with synchrophasors) 3. Asset monitoring 4. Quality of service monitoring 5. Dynamic equipment rating 	<ol style="list-style-type: none"> 1. Network automation and reconfiguration (incl. FDIR) 2. Remote controlled distributed generation 3. Planned islanding (microgrids capabilities) 4. Voltage & VAR (reactive power) control

Improving customer response to the power system balance is a key element in modernizing electricity networks. Advanced metering makes it possible to provide a price signal and graphic display to inform customers. In addition, the development of intelligent electrical devices may help reducing peak demand. In the near future, many new household appliances will detect disturbances and will disconnect from the network to avoid outages. Research is also seeking ways to alleviate fluctuations in renewable energy with loads housed at the customer’s home or business or on the network. Energy storage in the form of batteries (ex. from electric cars) or thermal accumulation will allow new management method for balancing demand and supply. Other investments in electricity networks are planned to improve their reliability or reduce resources linked to their operation and maintenance. Network automation makes it possible to get a block back on line after an outage, limiting the number of customers affected or makes it possible to create microgrids with the available production on this section of line. Online measuring capabilities permit a quicker detection of faults, wide-area situational awareness, as well as the detection of overloaded equipment.

¹ Ongoing work. Stakeholders are invited to provide updates or comments at david.beauvais@nrcan-rncan.gc.ca

Smart Grid activities in Canada

List of applications by province and organization

Component ⁽¹⁾										
Advanced metering		Demand response & Prosumers		Utility Storage & Ancillary Services		Network monitoring		Network automation		
1-Dynamic Pricing 2-Automatic meter reading (AMR) 3-Theft and outage detection 4-Online energy portal 5-In-Home display 6-Client remote connect/disconnect		1-Utility Direct load control (A/C, Water heaters,etc) 2-Wholesale Demand Response (automated) 3-Embedded generation and peak shaving 4-Customer energy storage (thermal and electric) 5-Smart charging and vehicle to grid		1-Contingency reserve (Emergency) 2-Regulation reserve (incl. load following) 3-Frequency regulation (Primary reserve & AGC) 4-Stability and voltage support (FACTS) 5-Black Start capabilities 6-Community Energy Storage		1-Fault location (location of outage) 2-Wide Area Situational Awareness (with synchrophasors) 3-Asset monitoring 4-Quality of service monitoring 5-Dynamic equipment rating		1-Network automation and reconfiguration (incl. FDIR) 2-Remote controlled distributed generation 3-Planned islanding (microgrids capabilities) 4-Voltage & VAR (reactive power) control		
Planned ⁽²⁾	Ongoing ⁽³⁾	Planned	Ongoing	Planned	Ongoing	Planned	Ongoing	Planned	Ongoing	
Alberta										
Alberta Electric System Operator (AESO)	(1) 7 000 meters - (60% energy in Alb - All 150 kW and above). Mandatory for 1 MW and more.									
ENMAX (DSO)	Smart meters under study		(2) 200-300 MW of Price-responsive Demand Response on the wholesale market		(1)Load could provide supplemental reserve (market). AESO contract with large customers to emergency trip-off. (4) Static VAR Compensators (SVC) and synchronous condensers	(5) Dynamic Thermal Line Rating Technology pilot project	(2)Phasor Measurement Units (PMU) installed (3) Monitoring instruments on critical transformer units			(1)Network automation /S&C Electric/ 186 switches / 14.7 M\$ / end by 2007
ENMAX Energy (Retailer)			(3) 8 300 PV Sites and 700 small wind sites offered for 10 to 15 year lease (3 134 signed up)							
EPCOR		(2) Pilot in 2011 - 10 000 smart meters - 335 000 meters by 2013						(1) Fault Location		(1)Network automation - Edmonton
ATCO Electric	AMI deployment under study	(2) Operating AMR system								
FortisAlberta		(1)160 000+ meters / 90 M\$ / end by 2011								
Lethbridge(City of)		(1) Meters with Automatic Meter Reading								
South Alta Rural Electrification Association -SAREA		Smart Meters deployed, but no dynamic pricing or AMR								
British Columbia										
BC Hydro		(1) all customers by 2012								
		(1) 1.8 M meters by 2012 - Itron OpenWay and Cisco			(1.6) Golden & Field Battery storage -Clean Energy fund demo					(3) Pilot on planned islanding
		(3) theft detection								(1) Golden & Field Battery storage -Clean Energy fund demo
FortisBC		(1&3) Proposal to be submitted to BCUC in 2011								
Manitoba										
Manitoba Hydro		(1) Pilot 5 000 Itron Smart meters in Winnipeg (Itron OpenWay)	(1,2) in lab test		(1) Utility storage with ElectroVaya - Clean energy fund demo		(2) Pilot on synchrophasors measurement with MISO			
New Brunswick										
NBPower						(2) Power shift Clean Energy Fund demo				
Saint John Energy		(2) AMI deployment - Itron with Tantalus (TUNnet) communication technology				(2) Power shift Clean Energy Fund demo				
Newfoundland										
Newfoundland & Labrador Hydro		(2) AMR with 1-way communications for retail customers. AMR with 2-way comms for large Industrial customers.			(3) Pilot Project - Wind/Hydrogen storage for off-grid supply.					(4) Pilot on Conservation Voltage Reduction
Nova Scotia										
Nova Scotia Power		(1,2,3) AMI pilot with 5 000 customers	(2) Thermal accumulator for heating		(2) Power shift Clean Energy Fund demo					

Nunavut										
Ontario		(1,2,3,5) AMI deployment by all utilities. Meter data managed by IESO. By the end of 2012, Time-of-Use (TOU) rates will be implemented across Ontario		(2) OPA - 4 programs DR1/DR2/DR3 & Peaksaver (Smart thermostat) - (3) Provincial Feed-in tariff						
Hydro One		idem		(3) Advanced Distribution System (ADS) project - 10 000 DG in Owen sound		(1,3 & 4) Advanced Distribution System (ADS) project in Owen Sound	(3) Transformer monitoring	(1,2 & 4) Advanced Distribution System (ADS) project in Owen Sound		
Milton Hydro		idem								
Ottawa Hydro		idem								(3) Volt&var optimization pilot in Centerpoint
Chatham-Kent Hydro		idem		(1) With Tantalus technology						
Greater Sudbury Hydro		idem					(1) 12 Faulted Circuit Indication (FCI)			(1) 12 Remotely Controllable Switching
Newmarket Hydro		(5) - Navigant Blue Line IHD								
Niagara-on-the-lake		1,2,3,5 + (4) Sensus web portal		(1) Pilot on load control of thermostat, hot water heater, pools, dehumidifier						
Toronto Hydro		1,2,3,4,5 (567 k meters installed /402 k read daily)	(4) Ice Energy thermal storage	(1) PeakSaver A/C (48 000 subscriptions - 50 MW) (3) 89 MW of distributed generation	(1) Utility storage with ElectroVaya - Clean energy fund demo (6) Three 250 kW/250 kWh units for dynamic load levelling, integrated communication and buffering intermittency of distributed generations		(1) Fault detection through intelligent switches (3) Transformer asset and loss metering (1,2,3) Outage Management system Overhead powerline monitoring.			(1) 400 intelligent switches with Fault Detection Identification and Restoration
				(4) PeakSaver DE (Distributed Energy)						
Powerstream		1,2,3,5						(1) Digital fault indicators (DFI) using Sensus FlexNET (3,4) Meter in a can (transformer monitoring)		(1) Network reconfiguration - Fault Detection Identification and Restoration on 20 feeders. DMS from Survalent
Veridian		1,2,3,5		(4) Ice Energy thermal storage		(1) Self-healing grid in Ajax				
Burlington Hydro		1,2,3,5		GridSmartCity	(1) GridSmartCity V2G project (Rapid Electric Vehicle technology)	GridSmartCity				(1) A "self-healing grid" has been created to protect the city's most mission-critical assets from outages.
Prince Edward Island										
Maritime Electric				(2) Power shift Clean Energy Fund demo		(2) Power shift Clean Energy Fund demo				
Summerside				(1) Electric thermal storage control to balance wind		(3) Tantalus Fiber-To-Meter Demonstration				
Quebec										
Hydro-Quebec		(2&3&5) Landis+Gyr's Gridstream™ RF two-way communications infrastructure (2012-2017) 3.75 M meters	(5) Vehicle-to-grid test with TM4	(1,2) Clean Energy Fund - Smart zone in Boucherville	(1) Utility storage in distribution substation under study (4) ACOR project for power system stability and reactive power compensation	(2) Phasor Measurement Units (PMU) installed	(1,3,4) Clean Energy Fund - Smart zone in Boucherville - 7 feeders on fault location			(1) PARD Program - Deployment of 3 600 automated switches - 200 M\$ - 3 060 switches so far (4) CATVAR - Deployment of volt&var on 130 substation - 2 TWh - (15 by the end of 2012)
Hydro-Sherbrooke				(1) Control of electric water & heat - 3000 customers in 2007. Begin in 1991 (3) Peak shaving with 20 emergency generators						
Saskatchewan										
SaskPower		(2) Provincial smart meter deployment from 2012 to 2014 - 467 000 customers	Demand response initiatives							
North West Territories										
Yukon										
Yukon Electrical (ATCO)		(1) AMR for 750 meters								

1: Information technologies in support of these applications, such as DMS, EMS, MDMS, telecommunication technologies are not detailed in this table
Demonstration of plug-in hybrid vehicle and charging infrastructure that do not involve Smart Charging or Vehicle to Grid are not detailed in this table

2: Planned applications includes all applications announced by the local government, the power authority or presented in the utility roadmap

3: Ongoing applications includes pilots, full deployment or project approved by the energy board

Last update : October 9th, 2012. Contact David Beauvais, Smart Grid - Project Leader, for comment at david.beauvais@nrcan-rncan.gc.ca