BC Hydro’s Smart Grid Experience

Presentation to Smart Energy Canada
February 24, 2009
Toronto, ON
• Who is BC Hydro?
• What is a Smart Grid? – A definition
• Smart Grid Applications
• BC Hydro’s Smart Grid Program
• BC Hydro’s Smart Grid Experience
• Questions
Who is BC Hydro?

• Crown Corporation
• 1.7 Million Customers
• 51,000 GWh Domestic Load
• Serve 94% of British Columbia
• Triple Bottom Line Performance
• Distribution Assets: $5.7B
• 2,200 Field Employees
Who is BC Hydro?

The BC Hydro System:

**Generation**
- 41 Dam sites, 30 Hydro facilities and 9 Thermal units

**Transmission**
- 18,000 km of Transmission lines
- 260 substations, 22,000 steel towers
- One Control Center
  - Consolidation of 4 regional systems (including back-up)
- Interconnect to Alberta and US

**Distribution**
- 56,000 km of Distribution lines
- Approx. 900K poles, over 300K of transformers
- Serve 17 Non-integrated areas
What is a Smart Grid?

The BC Hydro Definition of Smart Grid:

“A modern, intelligent electricity transmission and distribution system that incorporates elements of traditional and advanced power engineering, sophisticated sensing and monitoring technology, information technology, and communications to provide better grid performance and to support a wide array of additional services to customers and the economy.”

In other words:

Modernization and automation of the current power delivery system
What is a Smart Grid? (con’t)
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Smart Grid Benefits

• Reliability and Power Quality
  – SAIDI improvement of 40% anticipated

• Safety
  – Public and Worker

• Conservation and energy efficiency
  – Behaviour (Peak use and consumption)
  – Energy diversion detection
  – Voltage optimization

• Enhanced Customer Service
  – Two way information flow in real time including outage notification
  – Customer Choice (Reliability, Rates, Generation)

• Operational Efficiencies
  – Asset Optimization
  – Utility Efficiency
BC Hydro has tangible Smart Grid progress in the following areas:

- Distribution Management System
- Smart Meter and Infrastructure Program
- Distribution Automation
- Substation Automation/VVO
- PEV/Microgrids/Distributed Generation
- Other - Industry Forum Participation
Distribution Management System (DMS)

- A Decision Support System to assist the control room and field operating personnel with the monitoring and control of the electric distribution system
Smart Grid Applications

DMS (Cont’d)

Little or No Decision Support Capability within the Control Room Environment

Past *

Present *

Future

The Transformation
Current State → Future Vision

Electronic Mimic with Advanced Apps for Decision Support
DMS Status

- Investment of $10M in capital commencing in F2009 will be used to procure and implement a primary and standby DMS for the main control centre located in Langley and back-up control centre located in Vernon.
- An ongoing investment of $4.1M in OMA between (F2010 – F2025) to sustain the DMS, as well as $6M in capital in 2019 to update the DMS.
- Currently evaluating responses to RFP received this month.
- Expect system to be operational by 2010.
Smart Grid Applications

Smart Meter and Infrastructure Program (SMI)

- Involves installation of new equipment
  - ~1.7 million meters
  - ~200,000 transformer meters and/or
  - ~10,000 feeder meters
  - ~600,000 in-home displays (IHD’s)
  - ~100’s of telecom repeater sites

- Telecommunications infrastructure
  - Network Operations Centre (NOC)
  - WAN, LAN, HAN

- IT infrastructure
  - Meter Data Management System
  - Data Historian
  - Enterprise Services Bus
  - Integration with legacy systems including update to dynamic and static Topology models
SMI – Joint Solution Design

Seeking a Systems Integrator that will work with us to deliver the solution end-to-end.

- RFP responses closed on **May 12**, evaluations in progress
- Joint Solution Design workshops will take place in **July**
- Expected to announce the successful proponent(s) in **Nov**
Smart Grid Applications

SMI – Long Term Timeline


Energy Usage Control: 2012 - 2015

Entertainment and Security: 2016 - 2020
Substation Automation/Volt VAR optimization (VVO)

- The ability to reduce energy consumption and demand by lowering the system voltage at the substation medium voltage bus.
- Enabling the customer loads to draw less power and consume less energy.
- Program operational since 2007 to upgrade individual substations.
Substation Automation/VVO (Cont’d)

- Program Run in two stages
- Stage 1 - Develop POCC-VVO interface
- Stage 2 – Upgrade substation equipment
  - Major upgrade of feeder Protection to SEL-351S relays complete with Auto Reclose provision
  - Install/upgrade bus protection
  - Install PLC for LTC control

- Future years ~ 5 subs/yr thru F2018
Substation Automation/VVO - Summary

- VVO is an effective conservation tool to reduce energy consumption
  - 196 GWh saved throughout program at a cost of $47 M NPV

- Merge VVO rollout with DMS implementation as quickly and seamlessly as possible for optimized results

- SMI will introduce substantial incremental VVO savings based on improved resolution from meter data
Smart Grid Applications

Distribution Automation/Circuit Topology

• Enabling SCADA (Supervisory Control and Data Acquisition) and other automation technologies to make the distribution network more intelligent.

• Some automation in place currently
  – Park Royal Open Loop system
  – Recloser project initiated on Vancouver Island this year
  – Vista switches with SCADA being used for 2010 Winter Games

• Maple Ridge automation project is most recent
  – Project initiated in 2008
DA/Topology (con’t)

Maple Ridge automation project

- Step 1 (F2009 March), is installation of reclosers and switchgear at strategic locations.

- Step 2 (F2010) for the full automation project will involve replacement of all station feeder protection relays from electromechanical to SEL electronics relays (part of VVO project).

- As a final step, we will add communication to the equipment and implement the automation scheme with a target date of June 2010.

- Currently considering piloting Distributed Intelligence approach
Smart Grid Applications

Enabled Applications (PEV, DG, Microgrids)

- Plug In Electric vehicles (PEV)
  - By end of 2009, BC Hydro expects to have largest fleet of plug in vehicles in North America (at 10)
- Distributed Generation (DG)
  - Strategy under development for customer based DG
  - Smart Grid is ensuring system will be prepared to accommodate.
- Microgrids
  - In partnership with BCIT we are working to develop a demonstration project of a true Microgrid.
  - BC Hydro is preparing a Microgrid Use Case that defines the term and lays out various scenarios.
Other - Industry Forum Participation

- Gridwise Alliance
  - Membership and Board Seat

- Grid-Interop
  - Participating in various working groups

- Utility AMI/Open AMI, IEEE, EPRI, CEATI, UTC

- Benefits – Driving open standards, sharing information, common voice, coordinated approaches
There are numerous reasons to pursue a Smart Grid:

- **Internal factors**: BC Energy Plan, Legislation for Smart Meters by 2012, Green energy, Ageing assets, Limited labour resources, Employee safety
- **External factors**: Impending energy shortages, Advanced technology, Reliability of service, Customer service, Public safety, Green energy
- Considered to be the lowest cost option to meet long term system operation requirements
Current Status

• Authorized to form Smart Grid Program team in February 2008

• Key deliverables:
  – five year strategic vision and roadmap (both imminent)
  – as well as a cost/benefit analysis of Smart Grid and a 20 year vision (proposed)

• Strategic Group intended to align all programs and applications that reside under the Smart Grid governance umbrella
An organization is in place

Our Purpose:

To advance the deployment of Smart Grid applications
BC Hydro’s Smart Grid Program - Development Process (Conceptual)

Create

Innovate

Develop Business Solutions

Smart Grid Will Become Our System of the Future

Used Ideas Deployed Elsewhere

New Ideas Wow!

Emerging Applications TBL, Risk, Business Values

R&D

Pilots

Studies

Existing Core Investments

Growth Capital

Sustain Capital

Operations

Maintenance

Prioritization & Funding

Implementation

Design

Build

Assess

Evaluate & Learn

Wow!

Will Become Our System of the Future
BC Hydro’s Experience with Smart Grid

What does this all mean?

• Inconsistent understanding of what a Smart Grid is (hence the need for the Pyramid diagram) and therefore how it will be achieved.

• BC Hydro is relatively mature in the Strategic space of Smart Grid (Strategy, Dedicated Team, Interest Group Participation).

• Also a risk averse organization so measurable progress has been slow.
Thank You

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