

# Using Energy Management Information Systems in the Continuous Optimization Program

CEE Industry Partners Meeting  
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**BChydro** 

# Part 1: Organization Overview and Context



- BC encompasses 366,000 square miles (>Ca+Or+Wa)
  - 75% of people live in SW corner of province
- Population of 4.5 million
  - BC Hydro services 95% of population (1.8 million accounts)
- BC Hydro is a regulated electric utility
  - >90% hydro power
  - Net importer of electricity
  - Population and demand growing
  - Commercial marginal rate
    - 3.93¢/kWh
    - \$8.02/kW

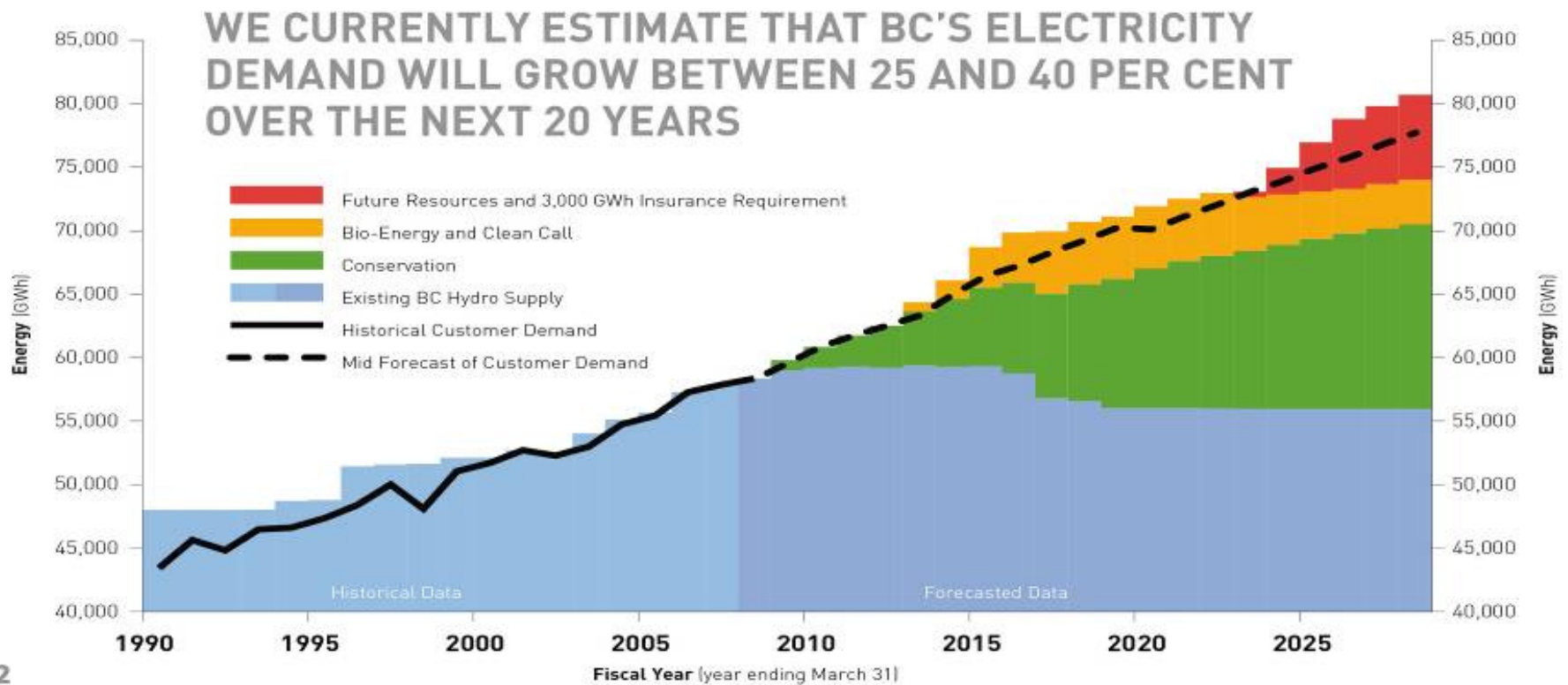
# The BC Energy Plan

## A Vision for Clean Energy Leadership

- **Environmental Leadership**
  - Net zero greenhouse gases emissions
  - Focusing on our advantages of clean and renewable energy resources
- **Energy Security**
  - Achieve electricity self sufficiency by 2016
- **Investing in Innovation**
  - Support innovation and bring new technologies to commercial stage
  - Take advantage of BC's abundant sources of renewable energy
- **Ambitious Energy Conservation and Efficiency Targets**
  - Acquire 66% of BC Hydro's incremental resource needs through conservation by 2020



# BC's electricity gap is growing...



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## What is Power Smart?

- Power Smart is BC Hydro's Demand Side Management (DSM) initiative
- Power Smart Programs: Industrial, Commercial, Residential, Codes & Standards, Rates

## Part 2: Program Objectives and Design

- **Commercial Power Smart programs**
  - Address the barriers that customers face in undertaking energy conservation and efficiency measures
  - Conservation Culture in the workplace
  - 80,000+ Commercial customer who have a diverse range of needs
- **Power Smart Commercial Sector Programs:**
  - Power Smart Partners: energy studies & retrofit incentives (lighting upgrades)
  - Energy Manager Program: fully funded customer employees
  - Product Incentive Program: small retrofit program
  - New Construction Program: energy studies & incentives
  - What was missing? Operations

# Energy Efficient Building Operation

- Three basic types of energy conservation measures:
  - Retrofit, e.g. lighting upgrade
  - **Operational**, e.g. re-programming a lighting control schedule to sweep off lights
  - Behavioural, e.g. occupant awareness program to turn off lights after leaving a room.
- Focus on **operational** conservation measures:
  - low cost (typically labour only) operational energy (not capacity) savings
  - #1 & #2 items -> shut off lights and fans when building is unoccupied
  - Primary impact is on HVAC systems, through the BAS system:
    - Sequences
    - Schedules
    - Setpoints

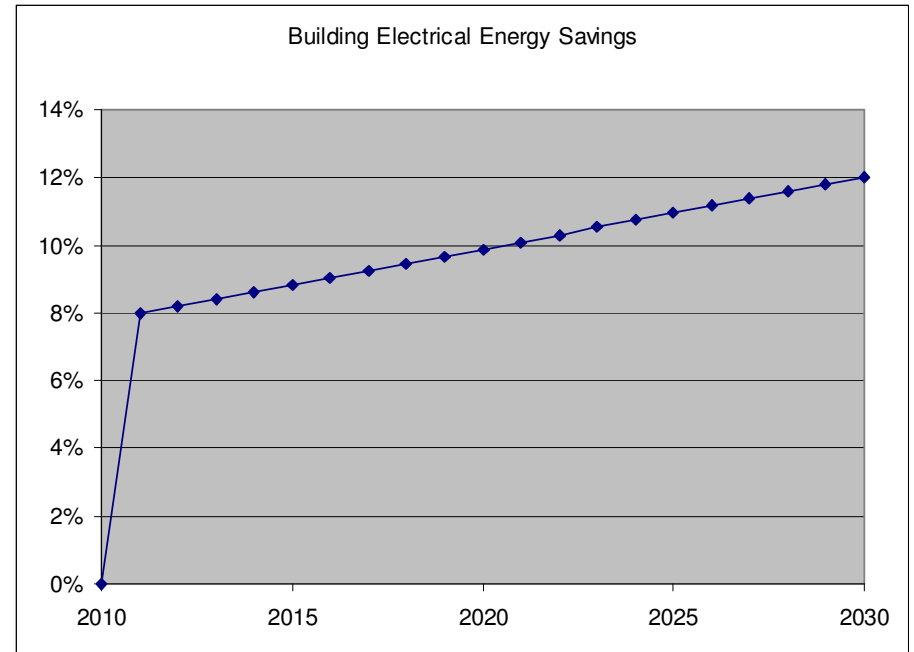
# Market Barriers

- Re-commissioning pilot in 2004
- Customer perspective
  - Value proposition of re-commissioning
  - Willing to implement cost effective measures, but couldn't find them or keep them
- BC Hydro perspective (program design)
  - Find the measures (cost effective)
  - Quantify the savings (M&V)
  - Keep the savings (persistence)
  - Ability and capacity of trade allies
- Trade Allies
  - No RCx offer in market
  - Business opportunity

# Program Design

Create a two step process for improving the performance of existing buildings:

1. Re-commissioning to “tune up” the building.
2. Implement a framework for **continuous improvement** so benefits persist, and continuous improvement is made.



# Step 1: Re-commissioning

- Industry standard scope of work
- Trade ally #1 – Re-commissioning consultant
- Planning Phase
  - Project preparation
- Investigation Phase (similar to Energy Study)
  - Review facility documentation
  - Perform diagnostic monitoring
  - Perform functional tests
  - Perform simple repairs
  - Develop business case
  - Prioritize and select operational improvements
- Implementation Phase
  - Implement selected operational improvements
- Hand-Off Phase
  - Documentation & training
- Coaching
  - Quarterly visits from consultant
    - Viability of implemented measures
    - Best practice for DDC operators

## Step 2: Continuous Improvement

- Framework for continuous improvement: Monitoring, Targeting & Reporting (MT&R).
- Using energy information to manage consumption downward.
- Straight forward statistical approach to inform energy management activities.



*MT&R slides thanks to Prism Engineering*

## MT&R: Practical and Effective (CUSUM)

- How many energy saving measures have been introduced?
- When did each take effect?
- How much energy has each measure saved?
- Are all the energy saving measures still working?
- Have any breakdowns been restored?
- How much energy will be required for a budgeted production of 120 tonnes a week in the next quarter?
- What further savings can be achieved?

Week	Production (tonnes)	Energy kWh	Specific Energy (kWh/Tonne)
1	150	140726	938
2	80	103223	1290
3	60	90764	1513
4	50	87567	1751
5	170	146600	862
6	180	154773	860
7	120	121575	1013
8	40	81436	2036
9	110	115586	1051
10	90	105909	1177
11	40	83916	2098
12	50	86272	1725
13	140	125892	899
14	155	138966	897
15	165	139922	848
16	190	152274	801
17	40	77788	1945
18	55	82711	1504
	120	124317	829

## MT&R Tasks

- Measure energy consumption and associated drivers over time (e.g. widgets produced, ambient conditions common driver in commercial buildings)
- Create predictive model relating energy consumption to drivers
- Use model & CUSUM to identify periods of, and quantify performance with regards to best practice:
  - Is building performing “good or bad”
  - Set targets for reduced consumption
  - Comparison of actual consumption to best practice
- Report variances
- Take action to correct variances

## Program Requirements

- Re-commissioning – relatively well defined
- Needed tools to help facilitate MT&R:
  - Predictive model
  - M&V, for program and for customer
  - Variance / exception reporting, good or bad?
  - CUSUM, the prime target
- Program decisions for MT&R:
  - Use interval data from the whole building meter, and leverage BC Hydro meter shop resources to assist with upgrades to pulse meter
  - Include gas meters, exclude water meters
  - Include utility bill analysis component (\$)



# Program Objectives

- Re-commissioning
  - Identify operational energy savings opportunities
  - Create business case for customer
  - Enhance persistence of savings = training + “coaching”
- Energy Management Information System
  - Enhance persistence of savings = exception reporting
  - Empower Energy Managers with advanced Energy Information Tool
  - Transform market in terms of availability of building performance metrics
  - Provide feedback to building occupants (dashboards)
  - Quantify savings (M&V) (“nega”Wh generator)
  - Quantify and lock in “best practice”
  - Facilitate setting performance targets
  - Facilitate continuous improvement

## Continuous Optimization – Program Offer

- 100% funding for RCx consultant
- 100% funding for EMIS
  - BC Hydro revenue meter upgrade
  - “other fuel” meter upgrade (limited to pilot)
  - EMIS hardware on site
  - EMIS annual license
- Customer responsibility: 2 year simple payback bundle (25¢/ft<sup>2</sup> - 30¢/ft<sup>2</sup>)
- Eligibility: 50k ft<sup>2</sup>, BAS, no major retrofits
- resources aligned with market barriers

## Continuous Optimization - Variations

- Multi-building offer
  - 3 year phase in of portfolio of buildings
  - EMIS “up front” for all buildings
  - Allows phasing of retrofit projects
- New Construction offer
  - EMIS for first year of operations
  - Followed by standard C.Op scope of work
- MT&R for SMBs
  - Leverage Smart Metering Infrastructure project to provide MT&R tool for Small & Medium Business customers
  - Use of MT&R without re-commissioning
  - SMI reduces transaction cost of access to interval data
- C.Op for Grocery Stores
  - Focus on refrigeration, different set of trade allies

## C.Op and other Power Smart programs

- C.Op + Energy Managers
  - Access to much more comprehensive information (benchmarking, utility bill analysis, load profiles, exception reporting, CUSUM analysis, quantified energy savings) for their buildings, all supported with enhanced reporting functions
  - Use EMIS for deliverables
- C.Op + behavioural program
  - M&V
  - Building performance feedback for occupants

## Part 3: Program Results and Challenges

- What have we learned?
  - Substantial customer appetite for metering and EMIS
- Activity to end of August:
  - Customers enrolled: 79, representing 351 sites (total market ext. 1,670) and 56 million ft<sup>2</sup>
  - Total estimated energy savings: 74 GWh
  - Program has taken on “life of its own”
- Challenges
  - Keeping up with demand / project management
  - Integrating new M&V methodology into Power Smart
  - Significant IT project to interface with EMIS vendors
  - EMIS: training, M&V, exception reporting
  - Re-commissioning: cost effective
  - Joint offer with gas utility
  - Smart Metering Infrastructure co-ordination

## Part 4: Looking Ahead

- Market transformation
  - Customer willingness to pay for EMIS
  - Widely available building performance metrics
- Research into what aspect of the EMIS is most useful
- Tool development:
  - System and component based tools
  - Fault detection and diagnostics
  - Integration with Building Automation Systems

## Take Away

- Program Administrators
  - Cost effective program approach
  - Significant customer appetite for EMIS
- Industry partners
  - MT&R
  - CUSUM
  - M&V
  - Exception reporting
  - Dashboard
  - Training
  - Solution vs. “selling software licenses”