CONTINUOUS OPTIMIZATION
OF ENERGY IN BUILDINGS

Presented by:
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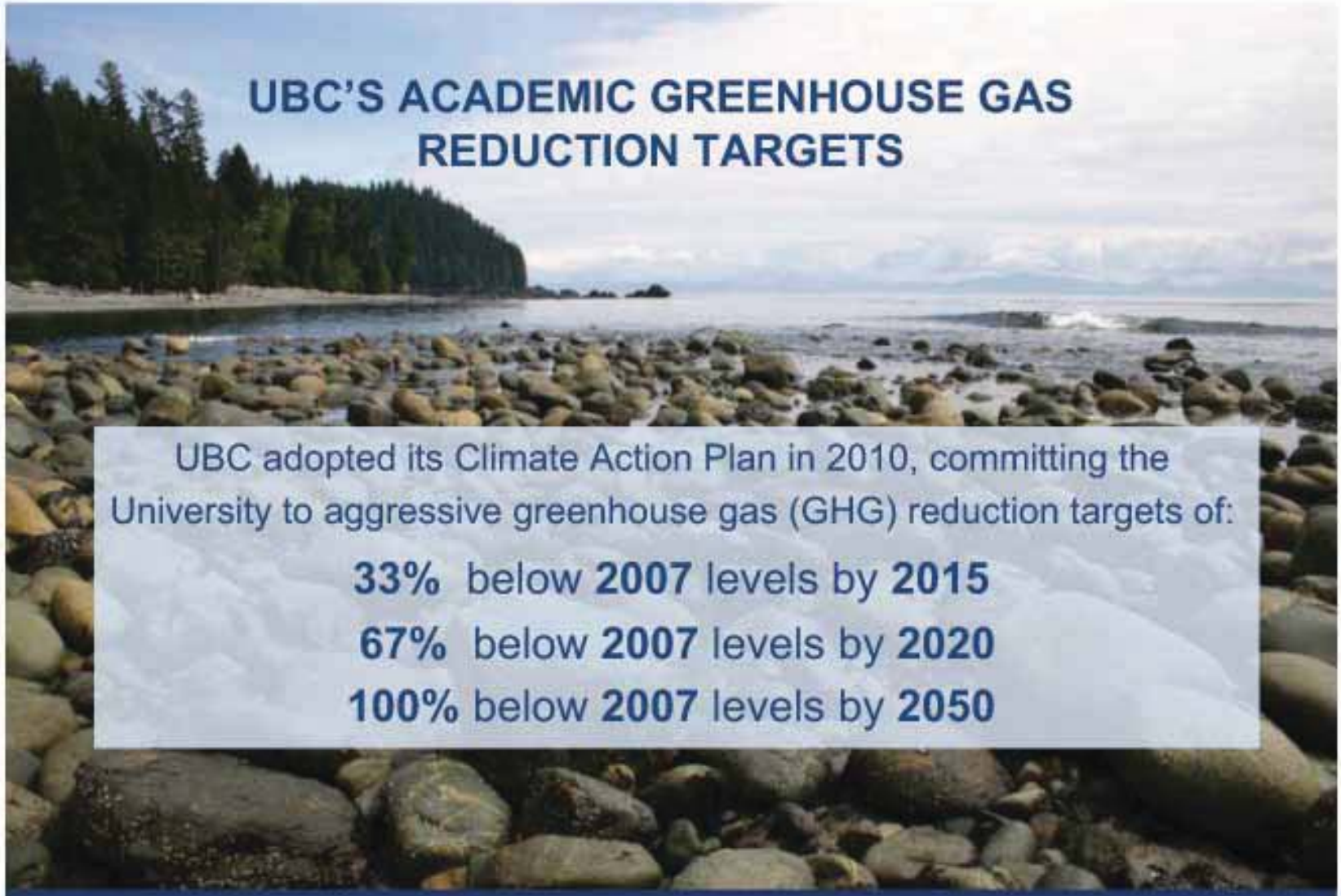

UBC'S ACADEMIC GREENHOUSE GAS REDUCTION TARGETS

UBC adopted its Climate Action Plan in 2010, committing the University to aggressive greenhouse gas (GHG) reduction targets of:

33% below **2007** levels by **2015**

67% below **2007** levels by **2020**

100% below **2007** levels by **2050**


ACHIEVING THE 2015 GHG REDUCTION TARGET
CONTINUOUS OPTIMIZATION in buildings is one of three projects that will achieve the short term 2015 GHG reduction target of 33%:
1. CONTINUOUS OPTIMIZATION in buildings
2. UBC Bioenergy Research and Demonstration project
3. Steam to hot water conversion of district heating system
a place of mind
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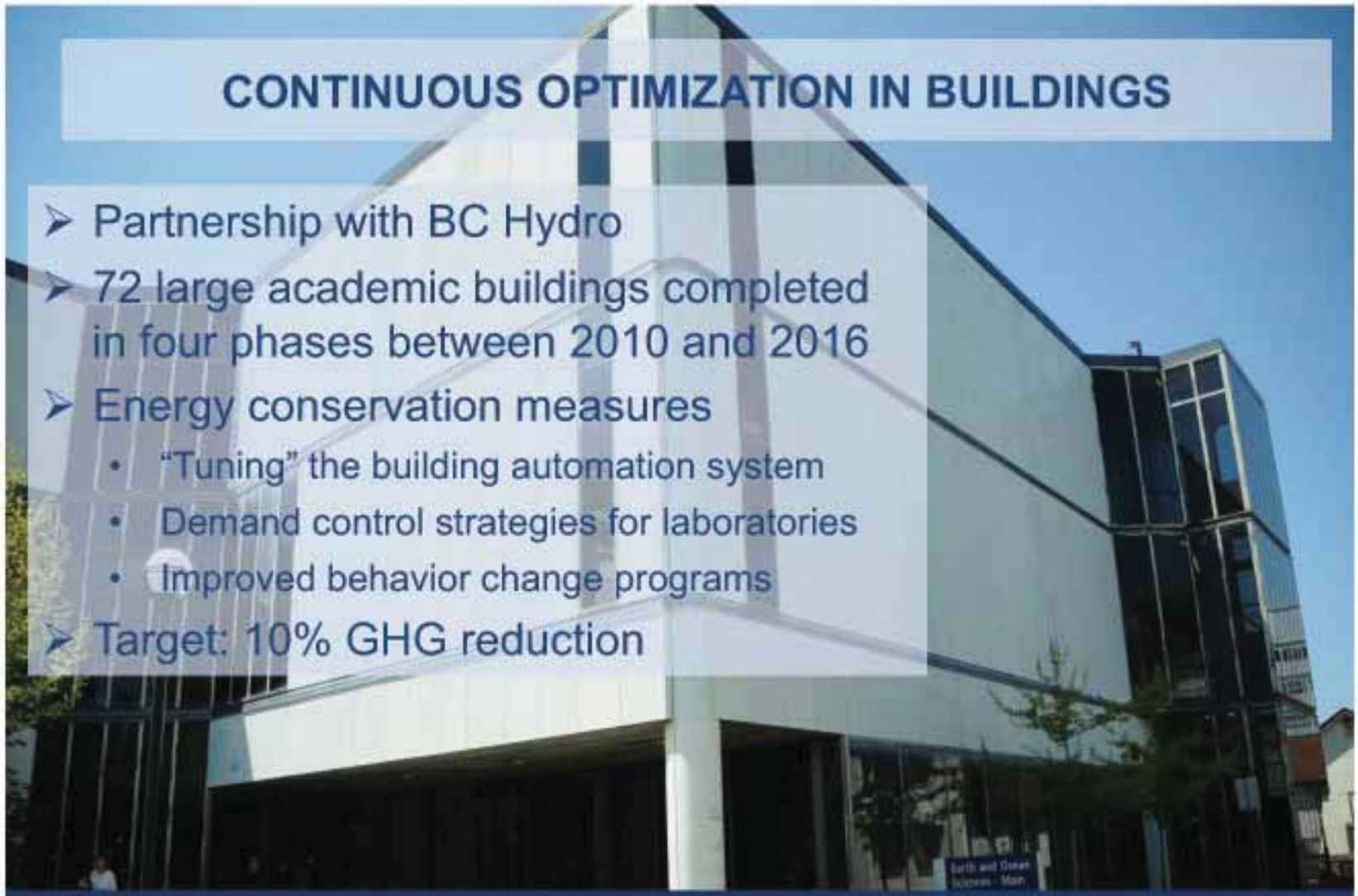
CONTINUOUS OPTIMIZATION IN BUILDINGS

- Partnership with BC Hydro
- 72 large academic buildings completed in four phases between 2010 and 2016
- Energy conservation measures
  - "Tuning" the building automation system
  - Demand control strategies for laboratories
  - Improved behavior change programs
- Target: 10% GHG reduction



CONTINUOUS OPTIMIZATION PAYBACK OPTIONS

- **BC HYDRO: TWO YEAR PAYBACK** - The BC Hydro Continuous Optimization Program funds 100% of UBC's cost of retaining Service Providers to perform the consulting associated with investigation / hand-off / coaching of energy saving measures with a maximum payback period of two (2) years:
  - Investigation,
  - Hand-off (at the end of Implementation), and
  - Post Project
- NOTE: The Implementation Phase follows the Investigation. UBC is responsible for all costs associated with Implementation

- **UBC: SIX YEAR PAYBACK** - Included in the Service Provider Scope of Work for UBC is the identification of potential measures, including major retrofits, with a payback period of between two (2) years and a maximum of six (6) years

CONTINUOUS OPTIMIZATION PAYBACK OPTIONS

Energy Management Information System (EMIS)

- Part of the BC Hydro Continuous Optimization Program is the provision of electric interval pulse meters and an energy management software service for monitoring energy usage
  - A pulse meter provides data on energy use every 15 minutes
  - The reporting system software collects and analyzes the pulse meter data, and reports the building's real-time energy use
  - BC Hydro has engaged Pulse Energy to provide their EMIS web-based energy management software for the Phase 1, 2, & 3 buildings.
  - Software implementation: July 1 - October 8, 2010

CONTINUOUS OPTIMIZATION PAYBACK OPTIONS

TYPICAL TWO YEAR PAYBACK ENERGY SAVING MEASURES

- **Weather Predictor**
  - A program on the DDC to predict the daily high temperature (DHT).
  - The program can be set so if the DHT is >= 20°C, then the early morning heating is locked out.

CONTINUOUS OPTIMIZATION PAYBACK OPTIONS

TYPICAL TWO YEAR PAYBACK ENERGY SAVING MEASURES

- **Demand Controlled Ventilation**
  - Addition of CO_2 Sensors to provide a measure of air quality in the building.
  - Ventilation levels can be controlled based on occupancy.

- **Energy Saver Fluorescent Lamps**
  - Standard efficiency fluorescent lamps are 32W each.
  - Use of high efficiency 25W fluorescent lamps with imperceptible reduction in light level.

CONTINUOUS OPTIMIZATION PAYBACK OPTIONS

OTHER TYPICAL TWO YEAR PAYBACK ENERGY SAVING MEASURES

1. Daily, Weekly, and Monthly HVAC Scheduling to reflect occupancy
2. Optimization and Auto Control of Heating in transitional occupancies such as corridors and lobbies
3. Room Temperature Optimization
4. Ventilation Fan Speed Reduction
5. Radiation Temperature Optimization

CONTINUOUS OPTIMIZATION PHASING STRUCTURE

- Phase 1 — February 2010 – July 2013
  17 research intensive laboratory buildings
  Area: ~1.98 million ft^2
- Phase 2 — January 2011 – March 2014
  18 laboratory and resource buildings
  Area: ~1.94 million ft^2
- Phase 3 — January 2012 – March 2015
  28 laboratory, office, & classroom buildings area
  Area: ~2.35 million ft^2
- Phase 4 — January 2013 – March 2016
  6 buildings under construction or in planning stage
  Area: ~912 thousand ft^2

CONTINUOUS OPTIMIZATION PHASING STRUCTURE

- Phase 1 February 2010 – July 2013
  - Investigation July 2010 – July 2011
  - Implementation September 2011 – August 2012
  - Post Project Coaching August 2012 – July 2013

- Phase 2 January 2011 – March 2014
  - Investigation April 2011 – March 2012
  - Implementation May 2012 – April 2013
  - Post Project Coaching April 2013 – March 2014

CONTINUOUS OPTIMIZATION PHASING STRUCTURE

- Phase 3 January 2012 – March 2015
  - Investigation April 2012 – March 2013
  - Implementation May 2013 – April 2014
  - Post Project Coaching April 2014 – March 2015

- Phase 4 January 2013 – March 2016
  - Investigation April 2013 – March 2014
  - Implementation May 2014 – April 2015
  - Post Project Coaching April 2015 – March 2016

CONTINUOUS OPTIMIZATION

UBC ENERGY DASHBOARD

Pulse Energy's EMIS, web-based energy management software delivers a building's energy data to three user groups:

1. Building occupants and the public
2. Students and researchers
3. Bldg Ops & senior management

- Engaging building occupants and the public in a building's energy management is becoming increasingly important.
- The Pulse™ Dashboard can be a key component in promoting end user energy conservation and tracking the effectiveness of occupant engagement programs.
- The Dashboard provides real-time feedback to the building occupants about their energy conservation measures

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UBC ENERGY DASHBOARD

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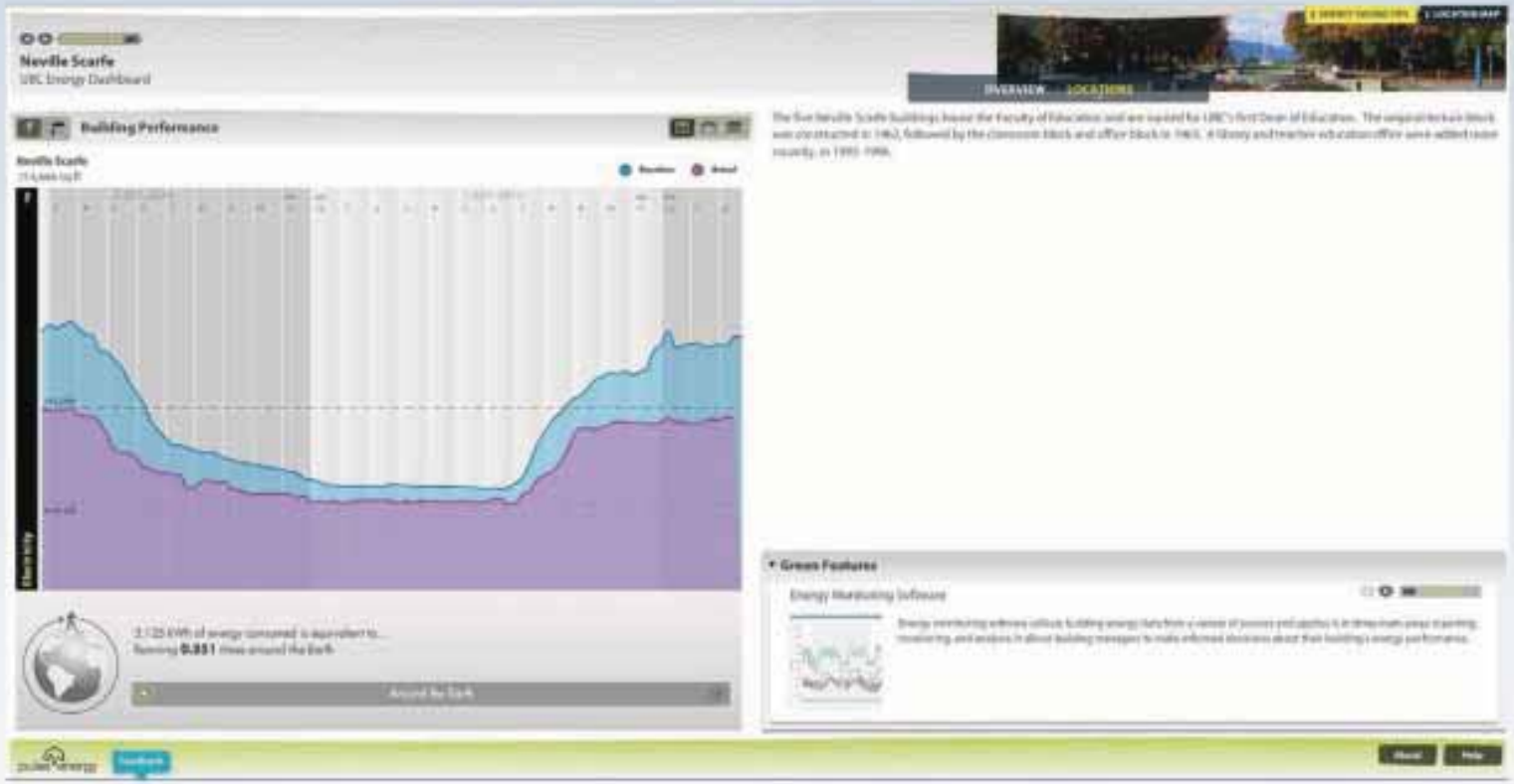

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UBC ENERGY DASHBOARD

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UBC ENERGY DASHBOARD

OCCUPANT DASHBOARD

CONTINUOUS OPTIMIZATION vs ECOTREK

- Ecotrek was introduced to the campus in 2002.
  - Utility cost increases 1997-2002 had almost doubled
  - Reduce utility costs while providing much needed campus renewal due to a major growth in deferred maintenance.

	CONTINUOUS OPTIMIZATION	ecoTrek
Payback period	2 years BCH 6years UBC	Average of all measures – 10.9 years
Target Reductions	GHG/natural gas	Consumption of electricity/gas/water
Granular level of Monitoring	Detailed system level monitoring	Early overall building monitoring
Social changes	A special section to address user behavior	Limited user behavior

CONTINUOUS OPTIMIZATION

THANK YOU