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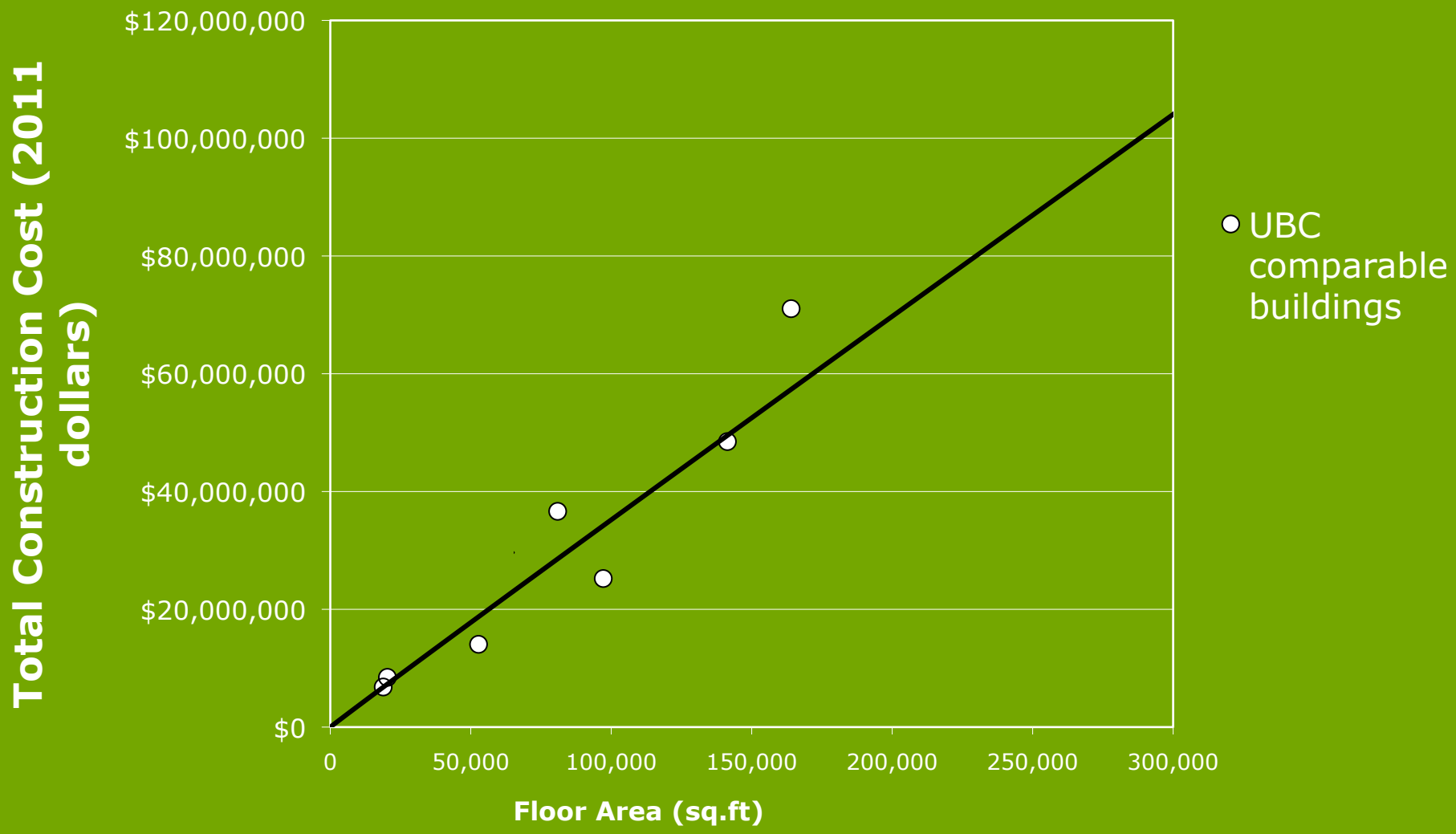
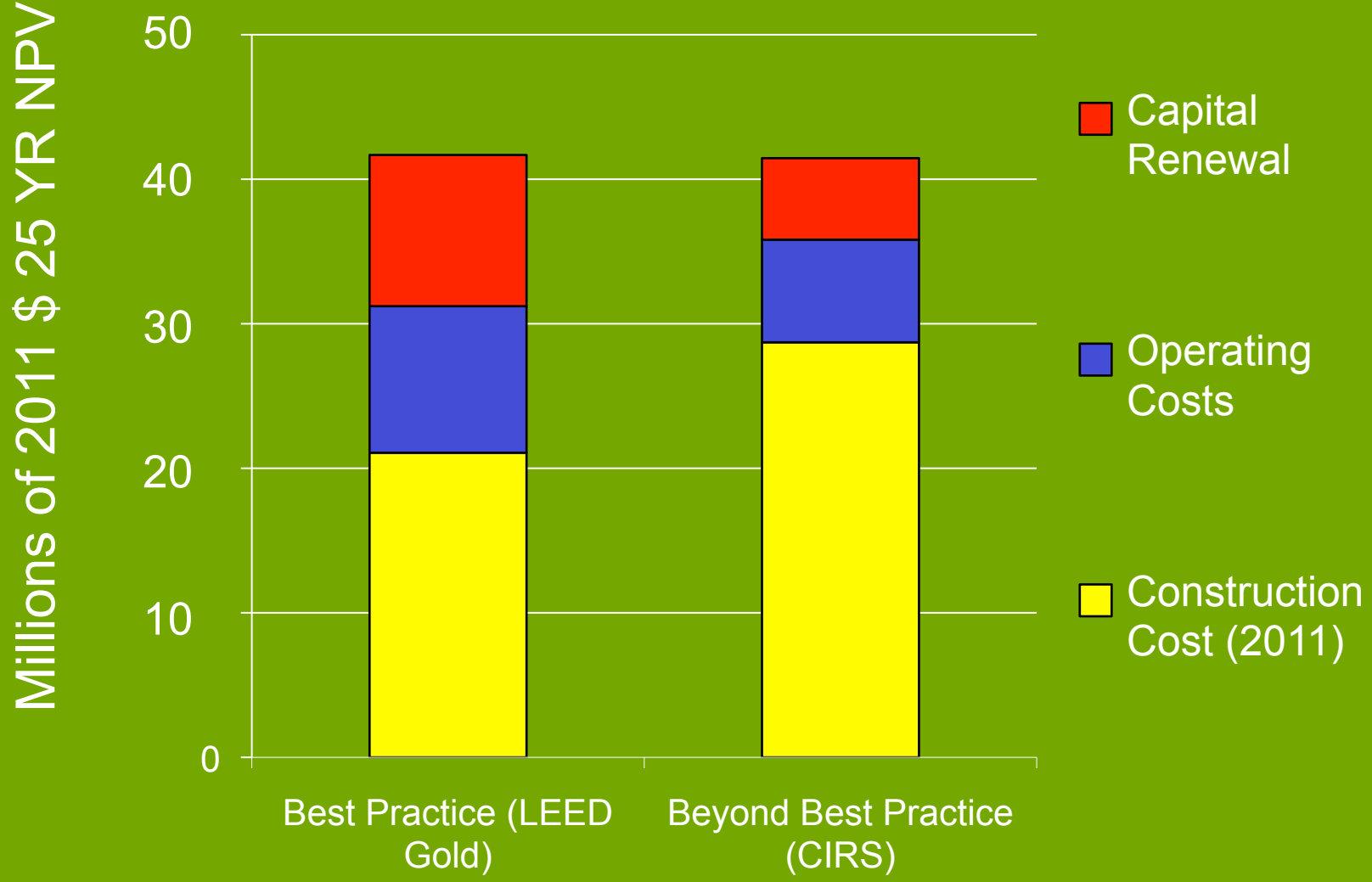
2100: Low-carbon resilient

Capital Cost of UBC Buildings



Total Cost of Ownership
CIRS vs. minimum standard




CITY OF VANCOUVER
MOMA 当代节能
UNA UNIVERSITY NEIGHBOURHOODS ASSOCIATION
NRC·CNRC
BC hydro FOR GENERATIONS
Canada Foundation for Innovation Fondation canadienne pour l'innovation
FCM Federation of Canadian Municipalities
SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA
real estate foundation BRITISH COLUMBIA
THE KRESGE FOUNDATION
BRITISH COLUMBIA The Best Place on Earth Ministry of Environment
BRITISH COLUMBIA The Best Place on Earth British Columbia Knowledge Development Fund
BRITISH COLUMBIA The Best Place on Earth Ministry of Science and Universities
Western Economic Diversification Canada
Natural Resources Canada
mccall macbain FOUNDATION
Honeywell
HAWORTH

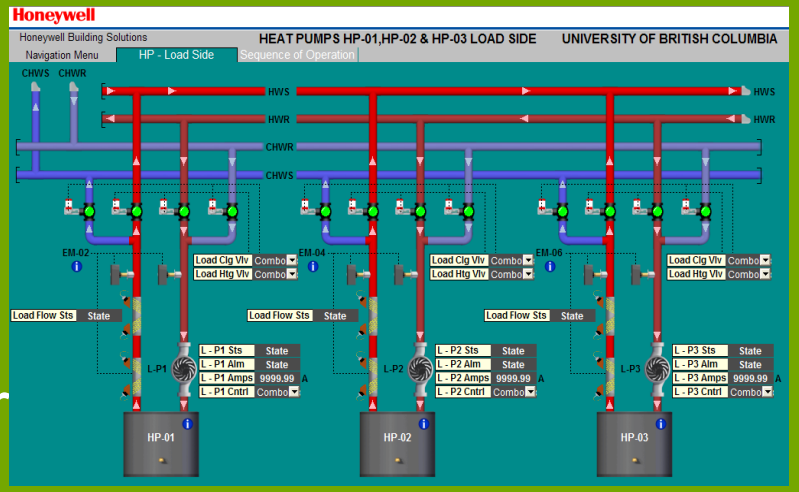
CIRS research projects

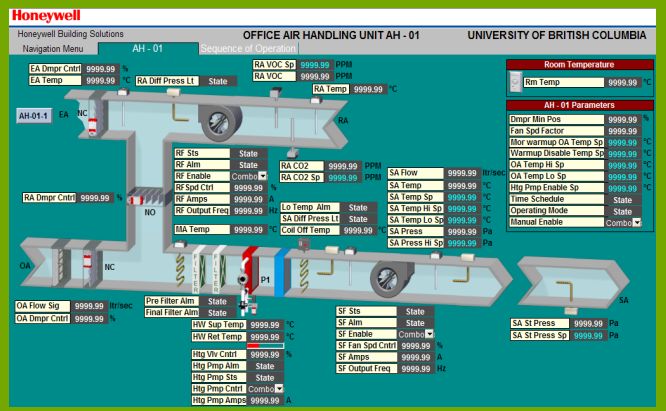
- Behavioural research (6 projects)
- Lifecycle assessment and costing
- PREOE and POE work
- Occupant to inhabitant: engagement processes
- Building performance (ventilation, air quality, acoustics, energy, water)
- Decision-making tools and processes
- IT and sustainability
- Smart energy system work
- Community engagement in Decision Theatre
- Residential sector applications and manual
- Regenerative neighbourhoods project
- CRC2 in behavioural sustainability

3,000 points of monitoring

(excluding F/A)

- Total electricity
- Electrical panels (including plug loads)
- Solar PV
- Solar hot water
- Domestic water supply
- Rainwater harvesting
- Reclaim water
- Storm-water redirected to aquifer
- Available day-light
- Indoor CO2 and VOC
- Weather-related (RH; CO2; air temp)
- Space controls (radiators; air temp)
- Window status and controls
- F/A
- Digital video monitors

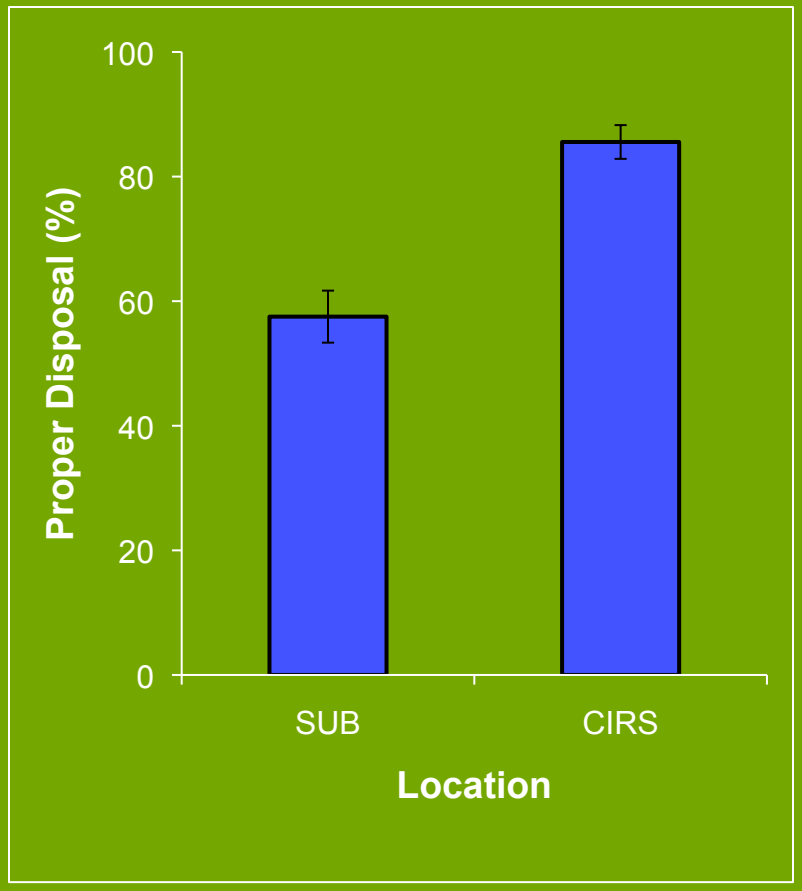


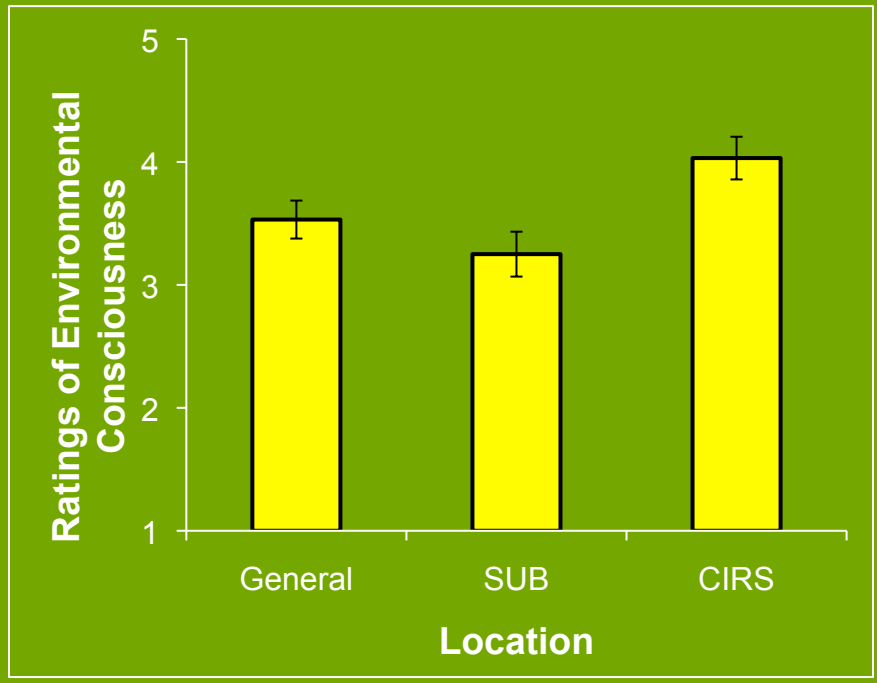


Behavioural research in CIRS

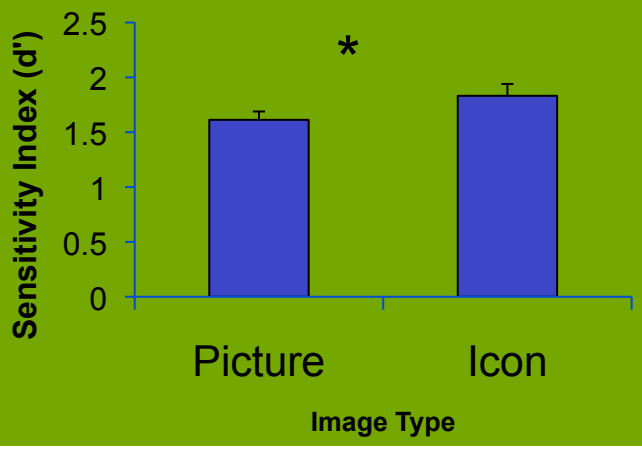
- Recycling behaviour in CIRS
- Recycling and signage
- Mood and creativity: CIRS and Kenny
- Water tasting: CIRS and Kenny
- Learning outcomes in CIRS
- Reactions to efficient lighting

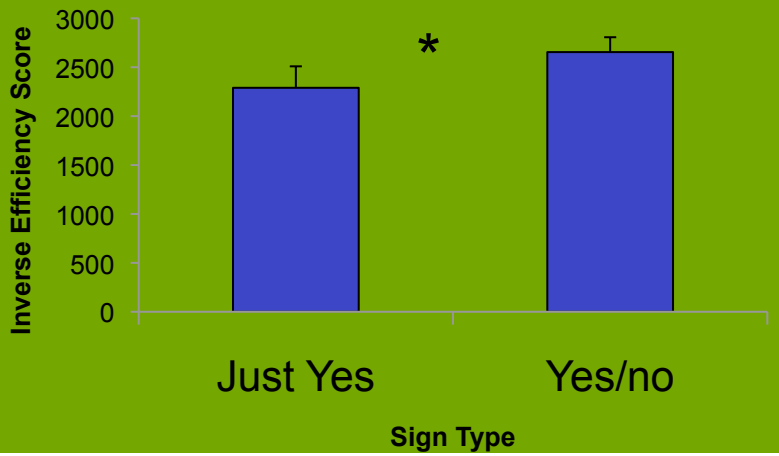
Recycling Behaviour in CIRS





Recycling and Signage study

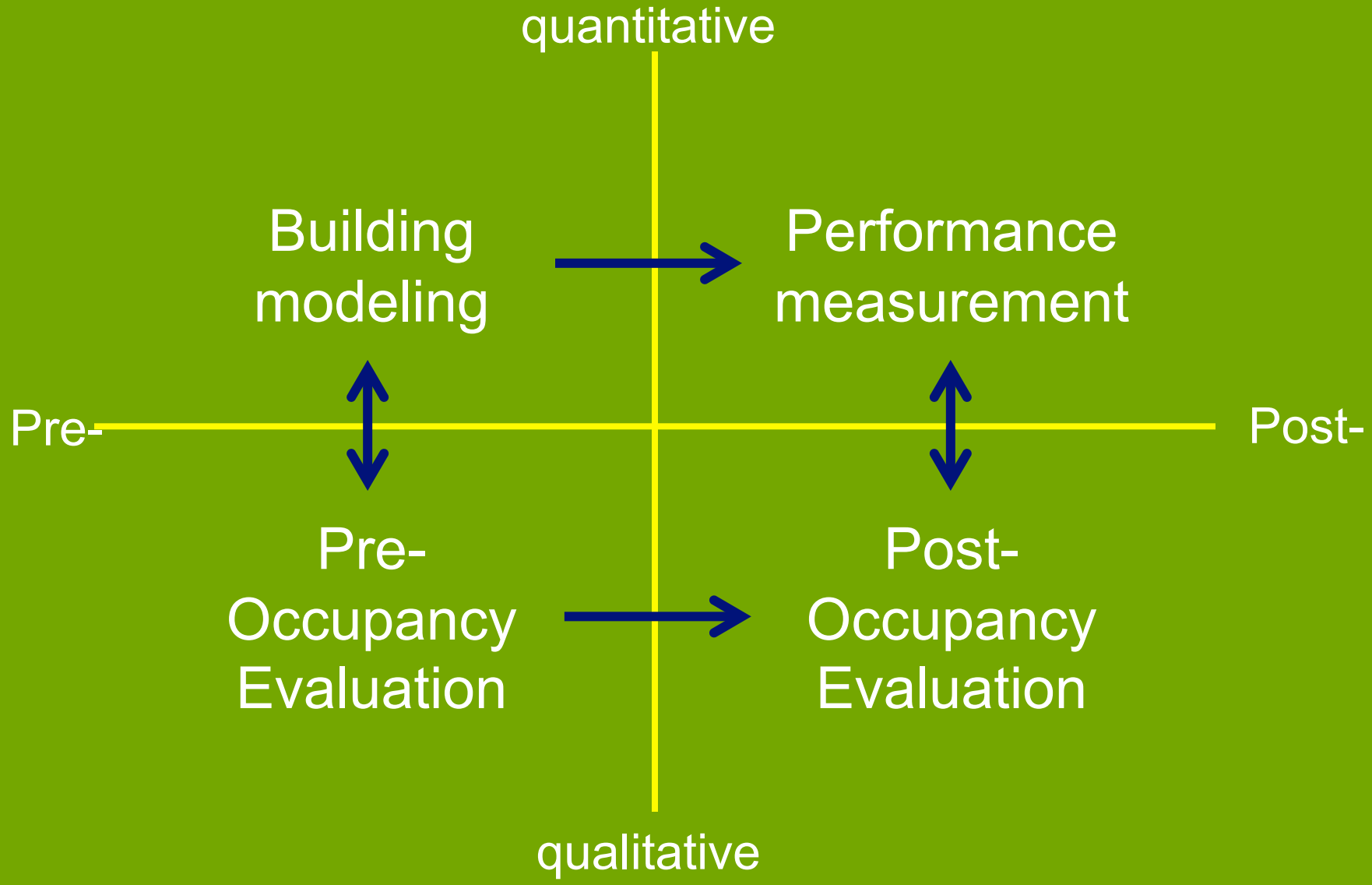




Emerging Research Agenda

- Building performance evaluation
- Integrated approach to building lifecycle
- Regenerative sustainability lens

Sustainable Building Evaluation



Building Lifecycle

Design

Construction

Commissioning

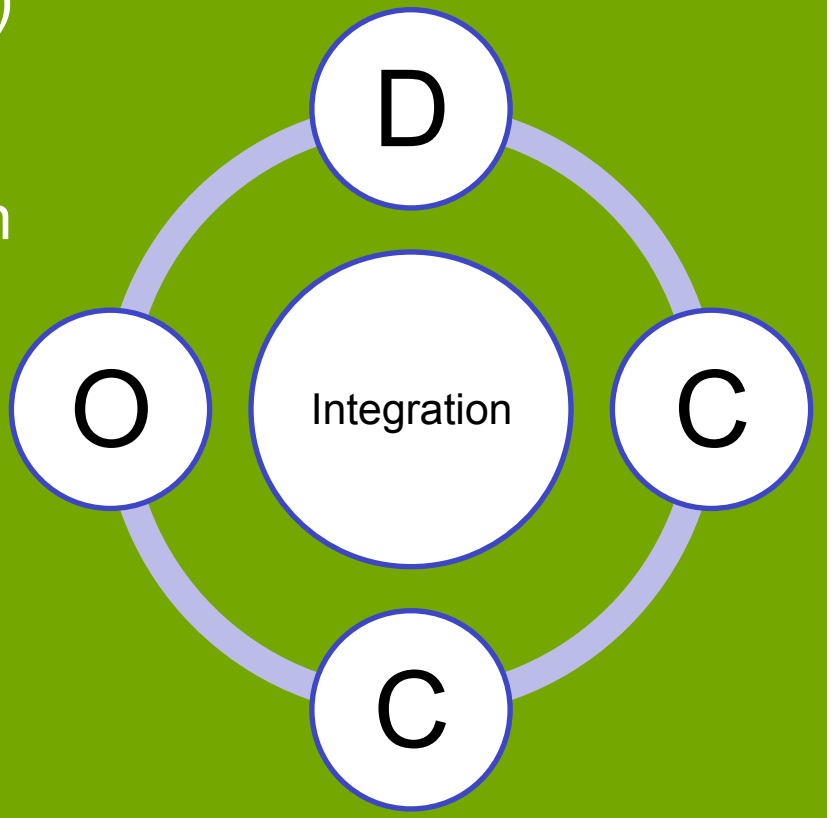
Operations

Integrated Design Process (IDP)

Lean & Green Construction

Lifecycle Planning

Continuous Optimization



Sustainability lens

- Need for consistent and comprehensive sustainability evaluation framework: should incorporate LCA, LCC in regenerative context
- Able to be applied in all four stages of building lifecycle
- Go beyond the building shell: neighbourhood/precinct

UBC Sustainability Initiative

UBC Sustainability Initiative

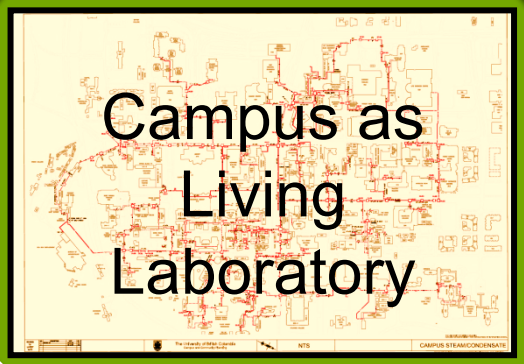
Academic

Academic

Operational

Operational

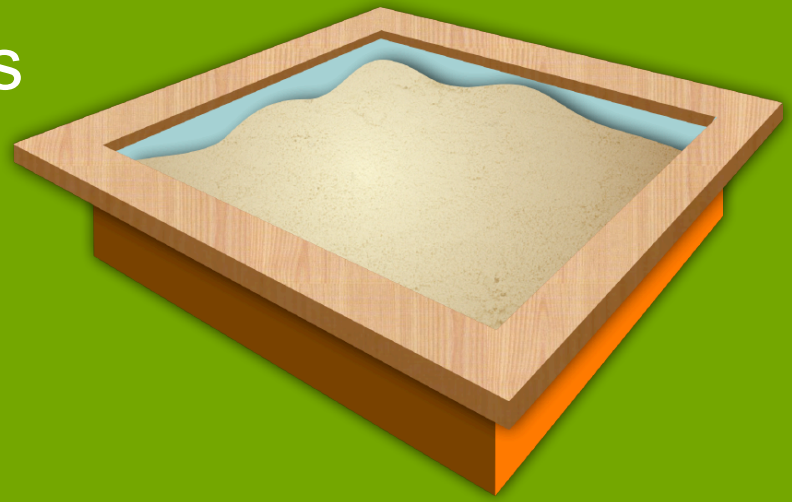
Agent of Change



Campus as sustainability test-bed

Universities uniquely suited for this role

- Single (owner-)occupiers
- Public mandate
- Teaching
- Research



Develop integrated campus-scale systems

- Demonstration and research
- Engage and train students; develop new curricula and programs

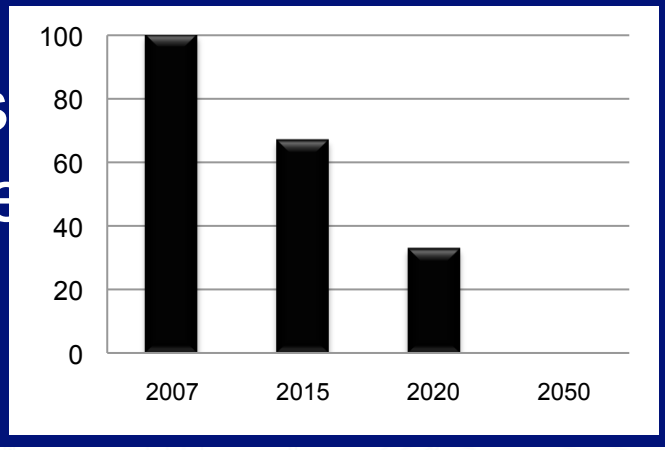
UBC Campus as a Living Lab

UBC Campus Steam System

~14 million sq. ft.
~270 core buildings
~ 300 hectares

Size of energy challenge:

- a
- g
- • eliminate fossil fuels
- • no new electricity transmission lines to campus
- • ~35% growth in res
  residential floorspace
  - 67 % by 2020
  -100% by 2050



The University of British Columbia
Campus and Community Planning
NTS
CAMPUS STEAM/CONDENSATE

Living Lab Roadmap

2015
33% GHG Reduction

Supply:

Bioenergy R&D Project (9%)

Demand:

Steam to Hot water conversion (start) (17%)

Continuous Optimization; Pulse Energy (10%)

New Buildings: Low temperature and energy

2020
67% GHG Reduction

8.5MW Clean Energy: Biomass II, Triumf? (23%)

Steam to Hot water conversion (completion) (5%)

Continuous Optimization; BC Hydro Self-Sufficiency (6.5%)

New Buildings: Low temperature; energy neutral

Smart Energy System

2050
100% GHG Reduction

New clean energy sources: Ocean, Waste, Aquifer?

Extend District Heating system to all campus buildings

Continuous Optimization

New Buildings: energy neutral

Transport changes

Current Signature Projects

Demand Side

Supply Side

Continuous Optimization of Campus Buildings

Center for Interactive Research in Sustainability (CIRS)

Steam to Hot Water Conversion of the Campus District Energy System

Bioenergy Research and Demonstration Project