Going Beyond the Energy Audit to Achieve Deep Carbon Reductions in Existing Buildings

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Agenda

1. Setting the context
2. Energy audits vs. deep carbon reduction studies
3. Practical challenges of deep carbon retrofits
4. Case study

Setting the Context

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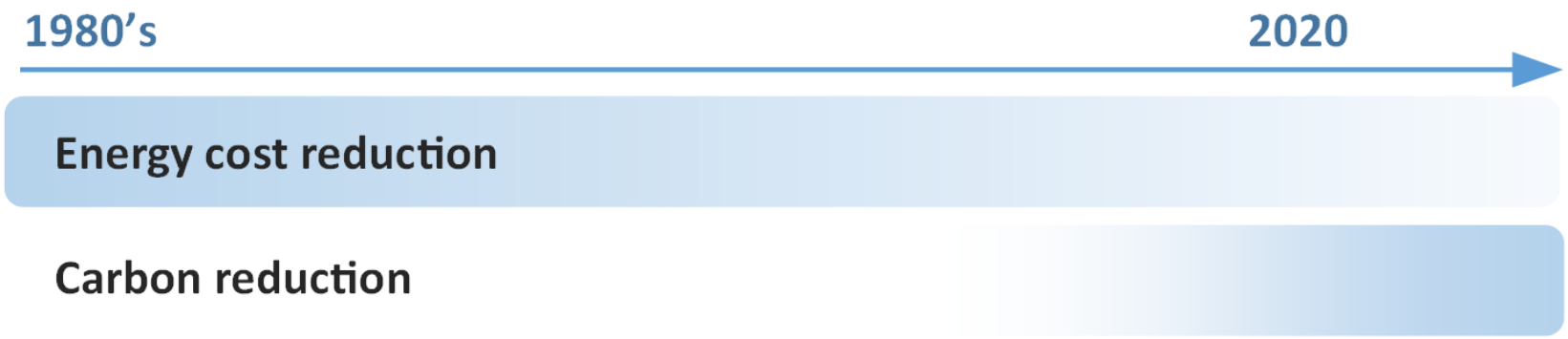
Shift in Priorities



- Historically, commercial energy audits have been the cornerstone of energy reduction programs for existing buildings
- Recently, the global importance of climate change has shifted the focus from strictly cost reduction to carbon reduction

Energy audits vs. deep carbon reduction studies

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Energy Audit - Objective

- The key objective of an Energy Audit is to identify, analyze, and present opportunities to reduce energy consumption and cost in a facility through reducing waste, improving efficiency, and (lastly) optimizing the supply of energy.

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Deep Carbon Retrofit Study - Objective

- The key objective of a Deep Carbon Retrofit Study (DCRS) is to identify available technologies, strategies and the investment required to reduce greenhouse gas emissions to meet specific carbon reduction targets.

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Key Differences

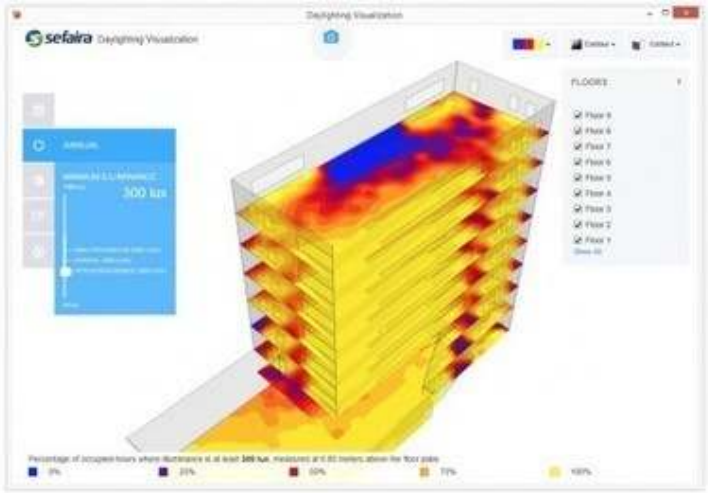
	Energy Audit	Deep Carbon Reduction Study
Minimize waste	x	x
Maximize efficiency	x	x
No-cost / low-cost measures	x	
Investment criteria	ROI	Environmental impact
Investment outlook	Short – Medium	Long term
Climate impact focus	Low	High
Energy resiliency		x
Example measures	Controls improvements Boiler upgrades VFDs on pumps, fans Lighting retrofit Heat recovery	Fuel switching Heat pumps Co-generation Heat recovery chillers Envelope upgrades On-site generation Biomass boilers

DCRS Scope - Systems

- Holistic review of entire facility and the interaction of its systems, including:
  - building envelope
  - HVAC
  - building automation
  - electrical systems (lighting, plug loads and elevators)
  - renewable energy systems

DCRS Scope - Modelling

- A building energy model or simulation will often be required to account for the interaction of the building elements and their cross dependencies.



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DCRS Scope - Recommendations

- Unlike an Energy Audit, the presentation of recommendations in a DCRS is not based solely on ROI
- Recommendations must be presented as business cases
- Approaches include:
  - Bundling of high cost and low cost measures
  - Establishing an internal price on carbon
  - Leveraging **non-energy benefits** including:
    - Environmental impact
    - Equipment renewal
    - Leadership by example

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DCRS Scope - Long Term Planning

- View the integration of long-term capital upgrades to replace outdated equipment as an opportunity to consider low-carbon strategies as part of an equipment renewal plan.
- Low-carbon strategies will be easier to justify when evaluating the option against the incremental cost over a "like for like" capital replacement.

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DCRS Scope – Stakeholder Engagement

- Buy-in and positive participation of all stakeholders is critical to the project success
- Engage staff in the process (both study and implementation) and the importance of building operations and maintenance considerations
- Conduct workshops to review priorities, and concepts with stakeholders on the feasibility of doing deep retrofits

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Practical challenges of deep carbon retrofits

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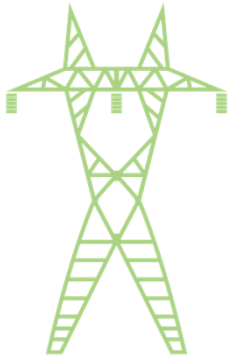
Practical challenges



Technical

- Carbon intensity of electricity grid
- Possible electrical capacity constraints
- Space to accommodate new systems (e.g. solar PV)
- Major mechanical systems may need swing space
- Architectural and heritage aspects of envelope renewal

Practical challenges

People

- Additional operator training requirements for more complex systems
- Renovation impact on tenants
- Expertise of contractors, consultants, operators

Practical challenges

Financial

- High cost upgrades
- Discretionary spending may be challenging as we move out of COVID-19
- Seek out opportunities for incentives, rebates, and loans
- Revise RFP/procurement evaluation to place larger emphasis on firms with experience in this area. (Lowest cost studies are not always the best!)

Case Study: Kitsilano Community Center
(arena multiplex)

- City of Vancouver
- Base-case:
  - Oversized heating plant
  - Independent systems
  - Poor controls
- Deep Carbon Retrofit
  - Right-size HVAC components
  - Integrate all systems
  - Heat recovery chillers for primary heating
  - Modified controls

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GREENEST CITY 2020

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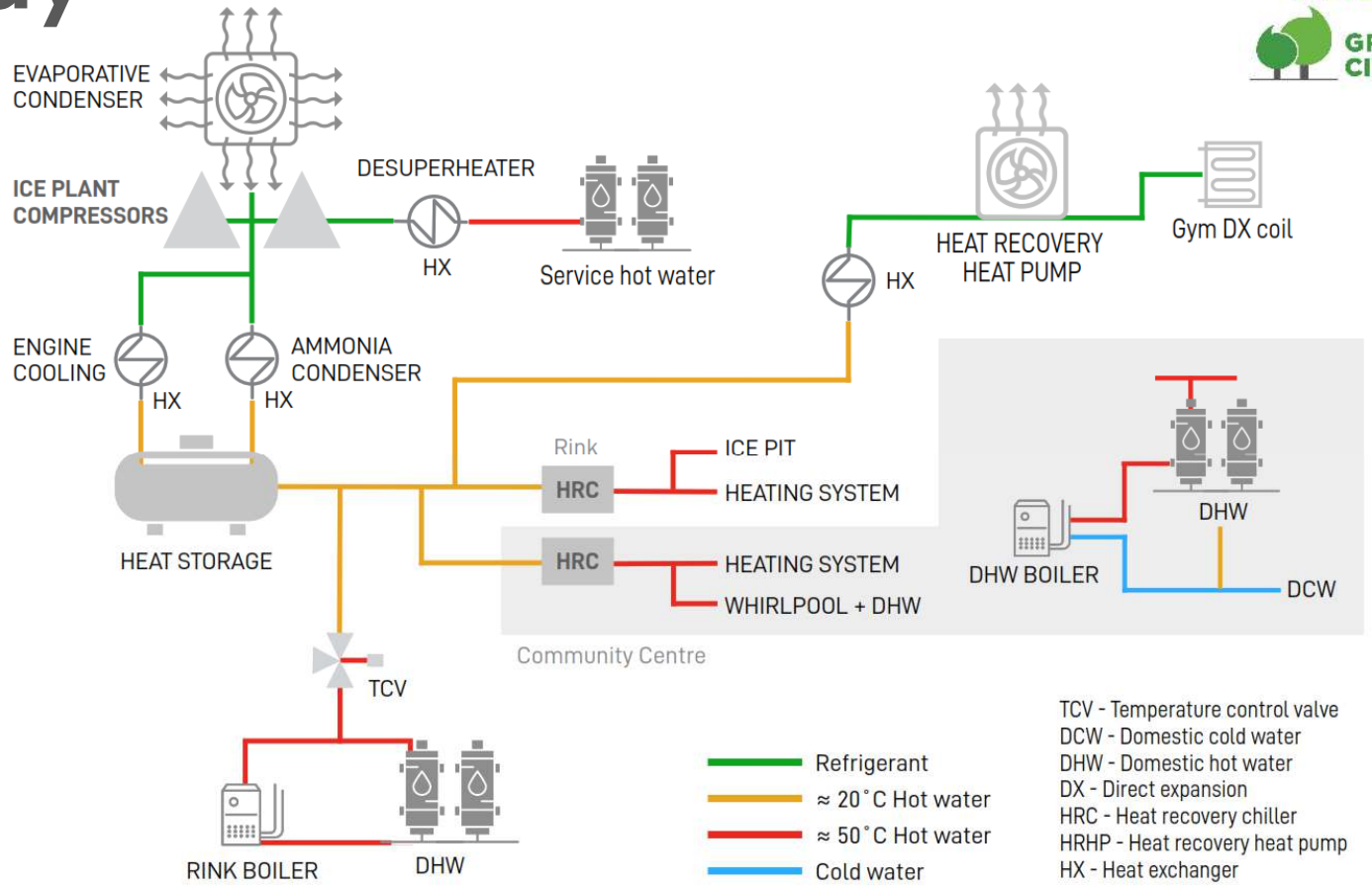
Case Study



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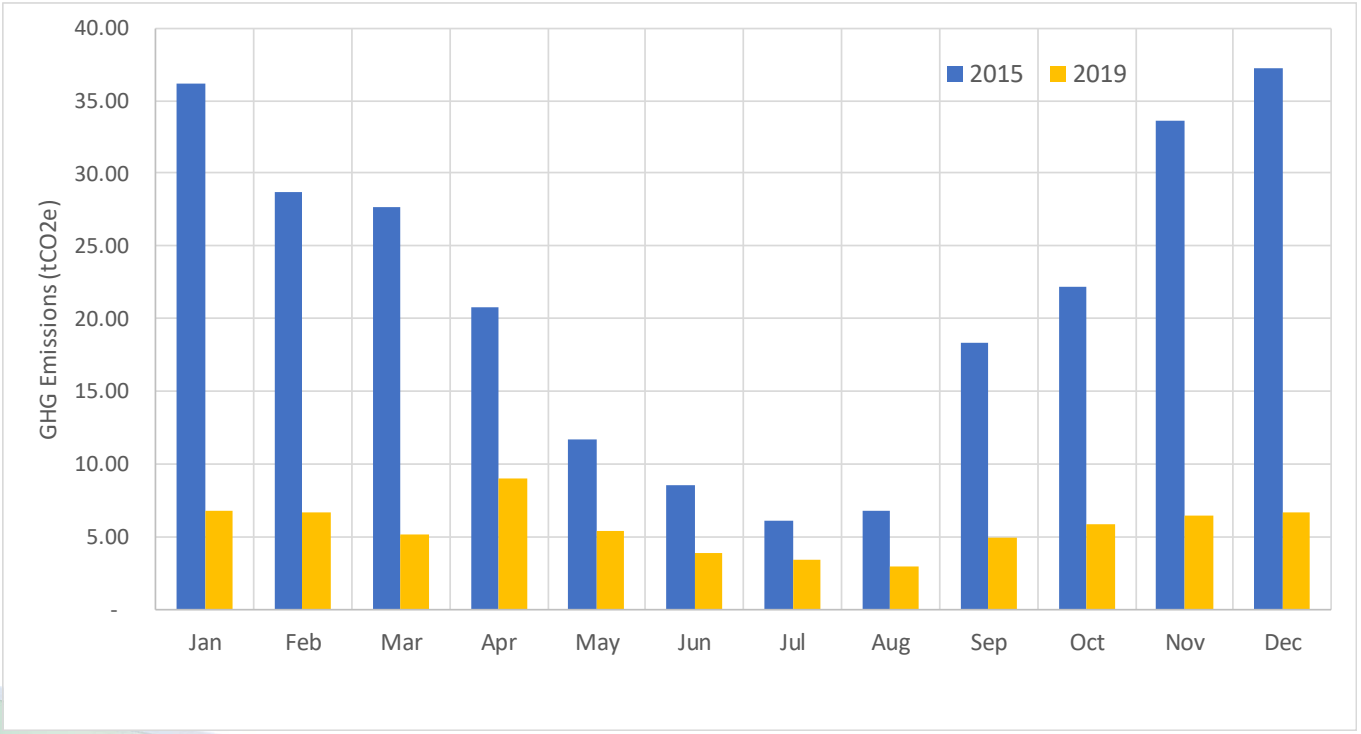
Case Study



4,000 GJ/year
natural gas savings

82 %
GHG emissions reduction

The remaining natural gas use is from domestic hot water, which is expected to be reduced once the gym heat recovery heat pump is operating.

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Closing remarks

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Moving Forward

- While the benefits of an energy audit should not be overlooked, a **new 'big picture' approach is needed**
- **Change in mindset** needed by practitioners and building owners to look beyond energy cost savings
- The engineering and construction sectors have a great **responsibility and opportunity** to reduce carbon output at a much more aggressive rate than generations past. **Deep carbon retrofits in existing buildings are a large part of this future**.

Thank you!

Prism ENGINEERING

saving you energy

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