Advancing Net-Zero Buildings

Adam McMullin

City of Barrie

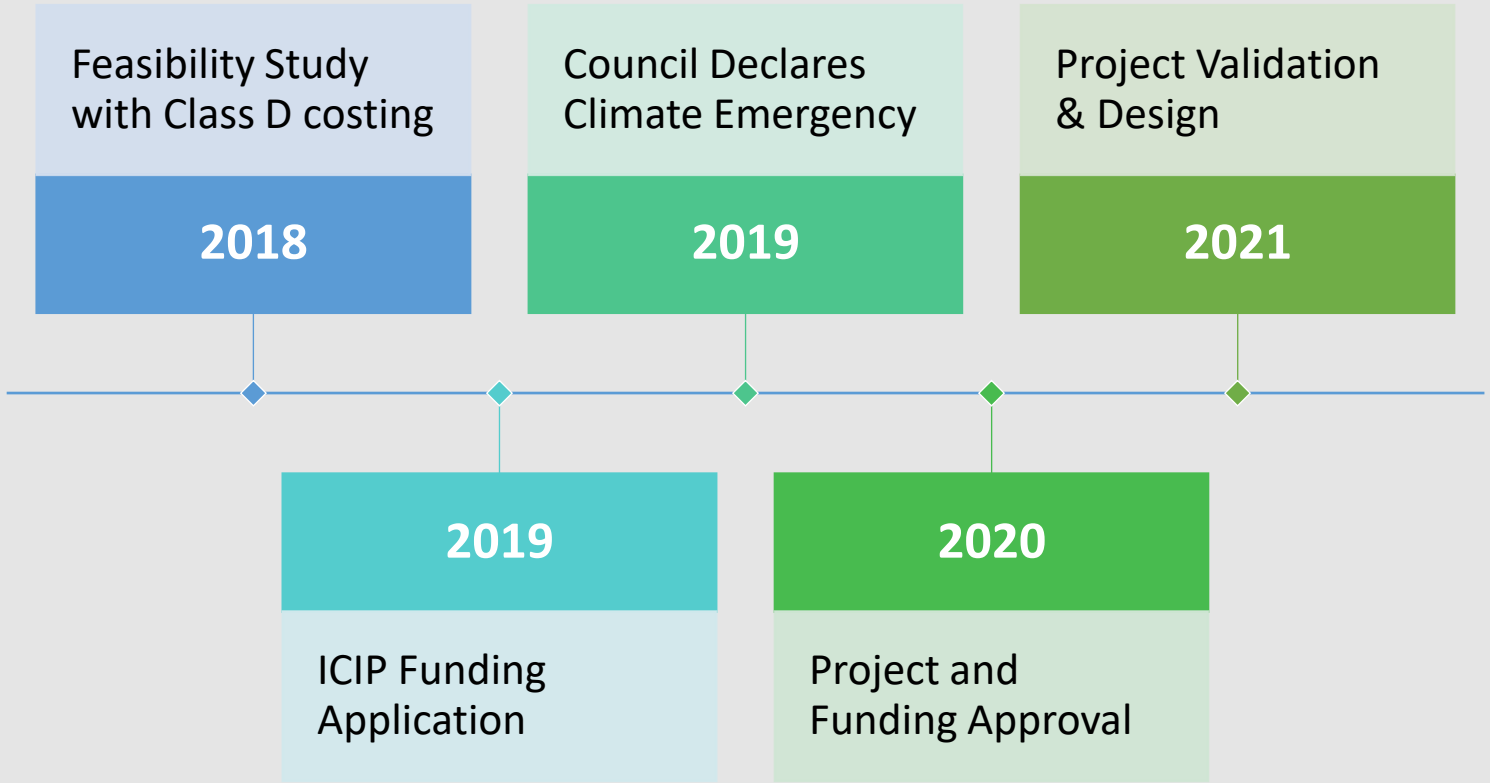
The Challenge…

- What is the premium / incremental cost of a net zero building?
  - Net zero design considerations and construction costs can vary significantly from project to project
  - Limited published costs / literature for ICI facilities
  - Shift in the market (IE LEED -> Passive House / Net Zero)

Project Example: Transit Hub

- New facility to replace existing transit terminal
- Approximately 2,000ft^2
- Integrated Project Delivery Model

Timeline


Feasibility Study with Class D costing
2018
Council Declares Climate Emergency
2019
Project Validation & Design
2021
2019
ICIP Funding Application
2020
Project and Funding Approval

Study!

1. Compare standard building code construction design (reference/baseline) to a net zero and passive house construction design
2. Establish which features are needed or recommended to get to net-zero (i.e.geothermal system, airtight envelope/design, orientation/passive strategies for heating and cooling etc.)
3. Perform an economic analysis/lifecycle cost on each of the recommended features
4. Investigate renewable energy generation options on site
5. Quantify the environmental, social, and economic impacts of implementing net zero sustainable construction features
6. Quantify the incremental costs of achieving net zero construction (compared to baseline)
7. Quantify the life-cycle operational implications of constructing a net zero facility (compared to baseline)

Findings (draft):

- Recommendation to pursue net zero (N20) design pathway. Estimated a 3 – 5% cost premium.
- Additional energy cost savings associated with Passive House (PH) pathway does not justify increased capital investment (envelope)
- Most efficient design option: Passive House
  - Air Handling Unit + in floor heating + Energy Recovery Ventilator (84%)
  - Variable Refrigerant Flow HVAC system with ground source heat pump
- Similar embodied carbon for N20 / PH
- Small differences in efficiency between air source and ground source heat exchangers (due small building footprint)
- System requires a 25 – 30kW solar PV system to fully offset energy usage

Lessons Learned / Limitations:

- Modeling a building without preliminary design limits the usefulness of recommendations and analysis
- There are distinct differences between the modelling methodology of Passive House and Net Zero Buildings
- CaGBC certification does not require 100% renewable energy
- For smaller sized buildings:
  - Ground source heat exchange and added envelope insulation may not represent best investment value
  - Investing in higher efficiency ERV and utilizing VRF heating / cooling system provides good return
  - The energy costs savings potential are limited
- Unclear if pursuing formal certification is necessary
- The sustainable design pathway and associated incremental constructions costs will likely vary substantially for project to project. Evaluations of each sustainable design element should be considered during the building design phase of the project
- Compiling actual constructions costs for PH and N20 buildings will assist MEP in budgeting in the future