Case Study: MOUNT DENNIS CHILDCARE

PRESENTOR: SHEENA SHARP, PRINCIPAL, COOLEARTH ARCHITECTURE INC.
The Apology

To my colleagues Dejan Skoric, City of Toronto – Energy Efficiency Office, and Susan Lewin, CS&P Architects, whose slides I stole.

To the entire team at Coolearth Architecture, CS&P Architects, Masongsong Civil Engineering, PMA Landscape Architects, Stephenson Engineering, Ingersoll & Associates and Mancini and Associates, who did most of the work.
The Weather

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Source Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Temperature Maximum</td>
<td>44°</td>
<td>2040-50</td>
</tr>
<tr>
<td>Celsius</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Days</td>
<td>66</td>
<td>2040-50</td>
</tr>
<tr>
<td>Above 30°</td>
<td></td>
<td></td>
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<tr>
<td>Extended Heat Waves</td>
<td>2.5</td>
<td>2040-50</td>
</tr>
<tr>
<td>Per Year</td>
<td></td>
<td></td>
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<tr>
<td>Daily Rainfall Maximum</td>
<td>166</td>
<td>2040-50</td>
</tr>
<tr>
<td>Millimeters</td>
<td></td>
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<tr>
<td>Global Forces Have Local Implications</td>
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</tbody>
</table>
The CLIENT

The CITY of TORONTO
The POLICY

TransformTO
Climate Action for a Healthy, Equitable, and Prosperous Toronto

The CITY of TORONTO
The GOALS from CITY’S PLAN

65% reduction in GHG emissions by 2030 as an interim target

100% of existing buildings are retrofitted by 2050

30% of total floor space uses low-carbon thermal energy by 2050

75% of trips under 5km are walked or biked by 2050

100% of new buildings are near zero GHG emissions by 2030

75% of energy use from renewable or low-carbon sources by 2050

100% of transportation uses low or zero carbon energy by 2050

95% of waste is diverted in all sectors by 2050
The GOALS for CITY’S PROPERTIES

Corporate Leadership Goals

100% of new City-owned facilities will be near zero GHG emissions by 2026

100% of existing City-owned buildings will be retrofitted achieving an average 40% energy savings by 2040

45% of City-owned fleet will be low-carbon vehicles by 2030

Net Zero Waste achieved at all City-owned facilities by 2030

1.5 million gigajoule (GJ) of energy generated from biogas by 2030

24MW installed capacity of renewable energy on City property by 2020
The OPPORTUNITY
Mount Dennis wants to be Toronto's first 'Net Zero' community!


Mount Dennis is striving to become carbon neutral as Toronto's first "Net Zero" neighbourhood and its community association is hosting a public meeting Monday to discuss how residents can...
The Context
The SITE
The FUNCTIONAL DESIGN
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The
The FUNCTIONAL DESIGN
The ENERGY BUDGET
The ENERGY BUDGET

Total Potential Power Generation
= 142,000 kwhr/year

Target Energy Budget:
= 113,600 kwhr/year

Target Energy Budget / sm:
= 71 kwhr/year /sm
The BENCHMARKS

Okanagan College Childcare (2017)
Okanagan, BC
- 372 m2
- 4,109 Degree Days (Toronto 4,180)
- TEDI = 15 kWh/m2/yr
- EUI = (Unknown) – (Primary Energy 44 kWh/m2/yr)
- R-values: Walls = 59, Roof = 111, Slab = 48
The BENCHMARKS

**Hollis Montessori School (2015)**
Nashua, NH, USA

- 1,201 m²
- 7,400 Degree Days
- TEDI = PASSIVE HOUSE (Assumed max. 15kWm/m²/yr)
- EUI = 34 kWh/m²/yr
- R-value: Walls = 44, Roof = 116, Slab = 54
The FIRST ENERGY MODEL
The DETAILS
The DETAILS
The DETAILS
The DETAILS
Mount Dennis Childcare Centre  
Thermal Bridges  
Step 1-2  Step 3  Step 4  Step 5  Step 6-7  

<table>
<thead>
<tr>
<th>Transmittance Type</th>
<th>Quantity</th>
<th>Transmittance</th>
<th>Heat Flow [W/K]</th>
<th>% of Heat Flow on Walls Above Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WALL ABOVE GRADE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Clear Field - North Wall</td>
<td>124.44 m²</td>
<td>0.103 W/m² K</td>
<td>12.80 W/K</td>
<td>17.15%</td>
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<tr>
<td>Clear Field - East Wall</td>
<td>102.87 m²</td>
<td>0.103 W/m² K</td>
<td>10.58 W/K</td>
<td>14.18%</td>
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<tr>
<td>Clear Field - South Wall</td>
<td>121.00 m²</td>
<td>0.103 W/m² K</td>
<td>12.44 W/K</td>
<td>16.67%</td>
</tr>
<tr>
<td>Clear Field - West Wall</td>
<td>135.00 m²</td>
<td>0.103 W/m² K</td>
<td>13.88 W/K</td>
<td>19.60%</td>
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<tr>
<td><strong>ERV Intake</strong></td>
<td>1500+300 x Length</td>
<td>12.78 m²</td>
<td>0.192 W/m² K</td>
<td>2.45 W/K</td>
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<tr>
<td><strong>ERV Exhaust</strong></td>
<td>900+900 x Length</td>
<td>7.92 m²</td>
<td>0.153 W/m² K</td>
<td>1.22 W/K</td>
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<tr>
<td>Windows Perimeter - NORTH</td>
<td>69.50 m</td>
<td>DET TB20.D</td>
<td>0.017 W/m K</td>
<td>1.18 W/K</td>
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<tr>
<td>Windows Perimeter - EAST</td>
<td>32.09 m</td>
<td>DET TB20.D</td>
<td>0.017 W/m K</td>
<td>0.55 W/K</td>
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<tr>
<td>Windows Perimeter - SOUTH</td>
<td>146.70 m</td>
<td>DET TB20.D</td>
<td>0.017 W/m K</td>
<td>2.49 W/K</td>
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<tr>
<td>Windows Perimeter - WEST</td>
<td>37.50 m</td>
<td>DET TB20.D</td>
<td>0.017 W/m K</td>
<td>0.64 W/K</td>
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<tr>
<td><strong>Roof Deck to wall - N-E-W</strong></td>
<td>81.94 m</td>
<td>DET TB20.D</td>
<td>0.072 W/m K</td>
<td>5.90 W/K</td>
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<tr>
<td><strong>Roof Deck to wall - N-E-W Split the perimeter with and without the metal plate</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.0%</td>
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<tr>
<td><strong>Roof deck to wall - Inside Patio E-S</strong></td>
<td>24.855 m</td>
<td>DET TB20.D</td>
<td>0.072 W/m K</td>
<td>1.79 W/K</td>
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<tr>
<td><strong>Roof Deck to wall - S</strong></td>
<td>22.40 m</td>
<td>DET TB20.D</td>
<td>0.072 W/m K</td>
<td>1.61 W/K</td>
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<tr>
<td><strong>Soffit to Wall 2nd floor - SOUTH</strong></td>
<td>22.40 m</td>
<td>DET TB20.D</td>
<td>0.13 W/m K</td>
<td>2.91 W/K</td>
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<tr>
<td><strong>Soffit to Wall Ground floor - SOUTH</strong></td>
<td>22.40 m</td>
<td>DET TB20.D</td>
<td>-0.01 W/m K</td>
<td>-0.22 W/K</td>
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<tr>
<td><strong>Patio 2nd Floor to Wall Ground</strong></td>
<td>9.76 m</td>
<td>DET TB20.D</td>
<td>0.203 W/m K</td>
<td>1.98 W/K</td>
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<tr>
<td><strong>Patio 2nd Floor to Wall 2nd - Interior S-E</strong></td>
<td>24.85 m</td>
<td>DET TB20.D</td>
<td>-0.048 W/m K</td>
<td>-1.19 W/K</td>
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<tr>
<td><strong>Corner 1 - TYPICAL</strong></td>
<td>23.70 m</td>
<td>DET TB20.D</td>
<td>0.124 W/m K</td>
<td>2.94 W/K</td>
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<tr>
<td><strong>Corner 2 - S SHAPE GROUND</strong></td>
<td>3.85 m</td>
<td>DET TB20.D</td>
<td>0.031 W/m K</td>
<td>0.12 W/K</td>
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<tr>
<td><strong>Corner 3 - S SHAPE 2ND FLOOR</strong></td>
<td>4.05 m</td>
<td>DET TB20.D</td>
<td>0.114 W/m K</td>
<td>0.46 W/K</td>
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<tr>
<td><strong>Kitchen Hood vent x 2</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.00 W/K</td>
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<tr>
<td><strong>Dryer vent x 2 (CONDENSING DRYERS - no penetrations)</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.00 W/K</td>
</tr>
<tr>
<td><strong>Hosebib x 5 + 1</strong></td>
<td>0.03 m</td>
<td>DET TB20.D</td>
<td>1.716 W/m K</td>
<td>0.10 W/K</td>
</tr>
<tr>
<td><strong>TOTAL CLEAR FIELD</strong></td>
<td>483.31 m²</td>
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</table>

Nominal R-Value: 55 hr ft² F / BTU  
Overall R-Value: 37 hr ft² F / BTU  
33% Difference
The RESULTS : ISSUED FOR TENDER DWGS

>25% above SB-10 2017
REFERENCE 99.42kWh/m2.a vs. 53.56kWh/m2.a
46.1% Above

CaGBC Zero Carbon Building Standard
For Zone 5 – TEDI 32 kWh/m2.a
TEDI 30.97 kWh/m2.a

Zero Carbon Balance
Consumption 101,830kWh/a vs. Production 119,320kWh/a
(Estimted at 678m2 – 20 degrees South)
The OTHER RESULTS, EXTREME SUMMARY

RESILIENCE PLAN:
THE BUILDING CAN OPERATE FOR
12 HOURS ON BATTERIES

EMBODIED CARBON
220 TONNES/M²
The QUESTIONS