Demystifying + Democratizing the Energy Use Conversation
To support the Net Zero Challenge

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+  

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### Portfolio

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project: pEUI (kWh/m²)</td>
<td>259</td>
</tr>
<tr>
<td>Number of Projects</td>
<td>42</td>
</tr>
<tr>
<td>Annual Energy Use (kWh)</td>
<td>212,188,599</td>
</tr>
<tr>
<td>A. Gross Floor Area (m²)</td>
<td>819,817</td>
</tr>
<tr>
<td>Annual Energy Cost ($)</td>
<td>13,421,945</td>
</tr>
<tr>
<td>LEED Certified Projects</td>
<td>28</td>
</tr>
<tr>
<td>Carbon (tons CO₂e/yr)</td>
<td>26,819</td>
</tr>
<tr>
<td>Total Construction Cost ($)</td>
<td>2,521,120,000</td>
</tr>
<tr>
<td>Avg. Construction Cost ($/sf)</td>
<td>296</td>
</tr>
</tbody>
</table>

**Legend:**
- Complete
- Design Progress

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**Key Metrics:**
- **DSAI pEUI:** 497
- **2030:** 225
- **2006:** 0

**Energy Model:** ecoMetrics v2.0

**Design Firm:** Diamond Schmitt Architects

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**Note:** The table and map display aggregated data for energy consumption, construction costs, and LEED certification across multiple projects.
Energy Literacy
<table>
<thead>
<tr>
<th>Energy Use Reduction kWh/yr</th>
<th>Energy Cost Reduction $/yr</th>
<th>CO2 Reduction eCO2/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OBC & TGS Performance Path**  
36.25% vs. MNECB

**CSR**  
*Walmart*  
*Save money. Live better.*

**ROI**  
*LEED / EBOM / ENERGY STAR*  
*ISO 14064*
Number of Projects: 52
Annual Energy Use (kWh): 287,963,312
A. Gross Floor Area (m²): 1,017,531
Annual Energy Cost ($): 16,616,382

LEED Certified Projects: 29
Carbon (tons CO2e/yr): 10,135
Total Construction Cost ($): 3,036,118,045
Avg. Construction Cost ($/sf): 300

DSAI Avg: -36%
Compliance with OBC can be demonstrated by modelling performance equivalent to ASHRAE 90.1 2010 + SB-10 or NECB 2011.
Energy Efficiency Metrics For Buildings

LEED GREEN BUILDING RATING SYSTEM

Reference Building: Design Building

Energy use intensity (EUI) kWh/m²-yr

Total building energy consumed per year
Conditioned Floor Area

fuel + electricity = Energy Consumption

relative to 2006 baseline for specific building type and region

SBE16
Benchmarks

Toronto Green Standards
Diamond Schmitt Architects

<table>
<thead>
<tr>
<th>Project</th>
<th>Number of Projects</th>
<th>LEED Certified Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>pEUI (W/m²)</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Annual Energy Use (KWh)</td>
<td>109,083,982</td>
<td>11,543</td>
</tr>
<tr>
<td>A. Gross Floor Area (m²)</td>
<td>336,343</td>
<td>1,122,200,000</td>
</tr>
<tr>
<td>Annual Energy Cost ($)</td>
<td>6,959,499</td>
<td></td>
</tr>
<tr>
<td>Avg. Construction Cost ($/ft²)</td>
<td>304</td>
<td></td>
</tr>
</tbody>
</table>

DBAI pEUI:
- 2000: 322
- 2002: 327
- 2010: 708

Energy Use Reduction vs. Ref. Bldg:
- Uni. Class: -29%
- Uni. Lab: -36.25%
- Uni. Supp.: -43.75%

Reference Standard:
- ASHRAE 90.1 1999
- ASHRAE 90.1 2004
- ASHRAE 90.1 2007
- ASHRAE 90.1 2010 + SB-10
- MNECB 1997
Design – Leveraging Data
## Diamond Schmitt Architects

### Project Information
- **Number of Projects**: 20
- **Annual Energy Use (kWh)**: 109,925,175
- **A. Gross Floor Area (m²)**: 338,843
- **Annual Energy Cost ($)**: 7,064,264

### LEED Certified Projects
- **Carbon (tons CO₂e/yr)**: 948
- **Total Construction Cost ($)**: 1,122,200,000
- **Avg. Construction Cost ($/sf)**: 304

### Building Characteristics
<table>
<thead>
<tr>
<th>Sector</th>
<th>Multiple values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gov. Lab</td>
<td>270</td>
</tr>
<tr>
<td>Uni. Library</td>
<td>173</td>
</tr>
<tr>
<td>Uni. Class Bldg</td>
<td>142</td>
</tr>
<tr>
<td>High-Rise Lab</td>
<td>427</td>
</tr>
<tr>
<td>Uni. Class Bldg</td>
<td>190</td>
</tr>
<tr>
<td>Uni. Lab Bldg</td>
<td>510</td>
</tr>
<tr>
<td>Student Centre</td>
<td>156</td>
</tr>
<tr>
<td>Health Class Bldg</td>
<td>128</td>
</tr>
<tr>
<td>Uni. Lab</td>
<td>545</td>
</tr>
<tr>
<td>Uni. Lab Support Bldg</td>
<td>310</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>All</th>
</tr>
</thead>
</table>

| Status      | All |

### Key Metrics
- **DSAI pEUI**: 324
- **P-EUI (kWh/m²)**: 321
- **2006 Support Bldg**: 708

### Energy Performance
- **A/B = GFA to Volume Ratio**: 0.40
- **A/(D+E) = GFA to Envelope Ratio**: 1.34
- **C/D = Window to Wall Ratio**: 24%

### Envelope Parameters
- **Avg Envelope (D+E) R (F-ft²-h/Btu)**: 13
- **Avg Walls R-Value (F-ft²-h/Btu)**: 17
- **Avg Roof R -Value (F-ft²-h/Btu)**: 23
- **Avg Window USI (W/C-m²-h)**: 1.8
- **Typical SHGC**: 0.3
- **Interior Lighting Power Density (W/m²)**: 6.8
- **Skylight (m²)**: 0
Checks and Balances

Local Codes
OBC & TGS

Multiple Lenses are often required to get a clear picture…
Laboratory with a mix of public viewing and animal holding areas.
Modelled performance 38% reduction vs. MNECB.
Modelled performance 1% reduction vs. like portfolio of buildings
Revisit design to reduce airflows based on schedules.
300 kWh/m² reduction in pEUI.
27% reduction vs. 2006.
>$50k in annual savings.

No Change.
38% reduction vs. MNECB.
Vital Signs

Advanced metrics to manage as we head to zero.
Informative Indicators

Buildings are prosthetic devices intended to shelter humans in environments conducive to their health and well being. There may not be a one-to-one correspondence between human health indicators and building performance, but it is interesting how modern medicine has developed highly meaningful and reliable indicators of health. For the most part, heart rate, blood pressure, cholesterol, blood sugar and body mass index can inform physicians about the health status of their patients. Is it possible to develop a simple set of metrics and indicators that can provide a useful assessment of building performance?
Vital Signs

OBJECTIVES

Energy Use
GFA

pEUI (kWh/m2)

Energy Cost
GFA

Energy Cost ($/m2)

SBE16
Vital Signs

**OBJECTIVES**

- Energy Use
  - GFA
  - pEUI (kWh/m2)

- Energy Cost
  - GFA
  - Energy Cost ($/m2)

**KEY METRICS**

- Total Envelope U-Value
- GFA to Volume Ratio
- Heating Supply Eff.
- Cooling Supply Eff.

- External Gains

SBE16
Vital Signs

OBJECTIVES

Energy Use
- GFA

pEUI (kWh/m²)

KEY METRICS

Total Envelope U-Value

Conditioning Required for Outside Air

Internal Gains

Energy Cost
- GFA

Energy Cost ($/m²)

GFA to Volume Ratio

Heating Supply Eff.

Cooling Supply Eff.
"Vital Signs" are a set of performance indicators that are meant to identify the architectural and engineering systems that are driving the performance objectives of a given project.

The green box plots put into context the relative performance of each project. In statistical speak, circles that are outside of the green boxes are beyond the upper or lower quartile. In layman's terms, these circles would be considered outliers and are perhaps performance drivers.
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The green box plots put into context the relative performance of each project. In statistical speak, circles that are outside of the green boxes are beyond the upper or lower quartile. In layman’s terms, these circles would be considered outliers and are perhaps performance drivers.
BIG DATA

A potential driver of disruptive change.
Energy use and greenhouse gas emissions for the Broader Public Sector

Shows the amount of energy used and greenhouse gases (GHG) emitted for the Broader Public Sector, i.e., municipalities, municipal service boards, school boards, universities, colleges and hospitals.

Public agencies play an important role in helping Ontario meet its conservation targets and reduce Greenhouse Gas emissions. Beginning July 1, 2013, the Green Energy Act, 2009 requires Ontario's Broader Public Sector (BPS) to report their annual energy use and Greenhouse Gas emissions, every year, to the Ministry of Energy.

The data contained in this file was provided by broader public sector organizations in accordance with this annual reporting requirement. A number of organizations also reported on facilities not required by the regulation.

This file contains 4 tabs:

- File 1 contains 2011 to 2013 data that has been normalized to account for weather conditions
- File 2 contains 2011 raw energy consumption and GHG emission data
- File 3 contains 2012 raw energy consumption and GHG emission data
- File 4 contains 2013 raw energy consumption and GHG emission data

Normalized data allows BPS organizations and the public to accurately compare the energy consumption of similar BPS operations in one part of the province to those in another part of the province.

Missing or incorrect data is the sole responsibility of the BPS organization. The ministry has attempted to remove duplicate data from this data set to improve data integrity.
17,000 Buildings
Ontario 2013 Public Sector

Energy Intensity (KWh/m²)

Number of 16,963

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Thanks for attending!

QUESTIONS?