Breakout Track 3 Operating at Zero and Delivering Value

- **Buildings Operating at Zero**
  Maintaining ZNE performance is a process that requires owners, occupants and operations managers to work together to ensure outcomes meet expectations. This session will look at two extensively monitored projects—the Bullitt Center in Seattle and TD Bank in Fort Lauderdale—and share what these owners and operators have learned from the data about how to sustain ZNE performance over months and years.

- **Moderator:** Phillip Saieg | Energy & Facilities Solutions, McKinstry

- **Speakers:**
  - Christopher Meek | Associate Professor and Director, University of Washington Integrated Design Lab
  - Jim Hanford | Principal, The Miller Hull Partnership
  - Justin Stenkamp | Associate, PAE Engineers
  - Three Years of Net Positive, Lessons Learned from the Bullitt Center at Full Occupancy

- **David DeRossi** | TD Bank, LEED AP
  - Marjona Larrige | LEED Green Associate Advisory Consultant | CBRE

Instructions NOT Included: lessons learned operating zero net energy
Introductions

Dave Del Rossi, LEED AP
Corporate Architect, TD Bank

Marianne Larrisey
Advisory Consultant, CBRE

TD Bank Group

2,600+ retail locations in Canada and US
~23 million sqft globally
~85,000 employees and ~22 million customers worldwide
6th largest bank in North America, by retail network
To be an Environmental Leader...

TD's Strategy calls for the environment to be embedded across the organization through four pillars:

1. Reducing our operational footprint
2. Engaging employees and communities in the environment
3. Green products and services for our customers
4. Responsible financing

Sustainability Notables

- First CaGBC LEED certification
- First USGBC LEED certification
- First LEED Platinum call center, first LEED CI project (ML)
- Open first zero net energy store in the US (FL)
- First LEED Platinum call center, first LEED CI project (ML)
- Open first zero net energy store in the US (FL)
- 100th LEED certification
- Enterprise Green Buildings Program released
- Completed our first green roof in Toronto
- Received 2nd EPA Green Power Partner Award
- 100th LEED certification
- First WELL certified Building in North America
- First WELL certified Building in North America
- Top 10 finish in Battle of the Buildings
- Received 3rd EPA Green Power Partner Award
Net Zero Background

Where do you Start?

Site Details
Location: Ft Lauderdale, FL
Climate Region: 1A: Very Hot - Humid
Retail: Previously developed land
New construction 3,970 ft²
Lot size: 1.68 acres

Site Selection Pros
Climate - located in the sunbelt
Developed area
Site Orientation

Site Selection Cons
Utility Rates are one of the lowest in the Country – reduced business case
Net-Zero Design
Energy Model Before Construction

26,334 kwh (23 kbtu/sf) Energy production building footprint PV

80,619 kwh (69 kbtu/sf) Ground mounted PV field 6,360 sf

106,953 kwh (92 kbtu/sf) Total PV generation

96,648 kwh (83 kbtu/sf) Modeled Consumption

Net-Zero Design
Energy Model After Store is Opened

Switched out the standard 3 hot plate coffee maker with Eco version insta hot
Reduced energy consumption by 91%

Switched out 400 watt metal halide site lights with 210 watt LED equipped with a step down dimming control
Reduced energy consumption by 64%

January 2012 Energy Consumption Analysis

49% over modeled projection
29% over modeled projection
Measurement & Verification (M&V)

M & V Plan - Before Construction
- How are you going to measure?
- Who will collect Data?
- What will you measure?
- Keep it Simple

M & V Monitoring – After Opening
- Can not just rely on Utility bills
- Good to have a recovery strategy
- Make sure you are monitoring the right components
- How often do you look at the data?

Commissioning

- Enhanced Commissioning (LEED Requirements)
  - Not enough verification for our building
  - What kind of systems are in your building

Commissioning Scheduling - Building Commissioning continued past store opening (5-6 months)
- What were some of the issues?
  - Unable to pull true data from BMS, both commissioning and connection issue
  - Air Handlers were not controlled by BMS, running continuous
  - Dehumidification unit running 24/7
  - Additional energy meters required to record total building consumption
  - Lighting controls were re-programmed to match specifications
  - Temperature settings were reprogrammed to match specifications
TD Net-Zero-Commissioning

- We hired an independent Commissioning agent to perform retro-commissioning – created our own customized net-zero commissioning plan
  - What we found during net zero commissioning
    - Loose fan belts
    - Humidity sensor in direct sunlight – faulty readings
    - Dehumidification unit still running 24/7 supposed to shut down when RH is below 72%
    - CT meters not installed on the energy recovery unit and 2 fan coil units
    - Exterior light circuit wiring was hot to the touch, final connection was loose and drawing close to 45% more power than required
    - CT meter from main PV field was installed in the wrong direction

Net-Zero We made it!!!!

4,371 KWH (14.9 KBTU)

Annual Projected Net Zero Energy Analysis

- **Annual Energy Consumption (Original Projected):** (329,763 kbtu, 83 kbtu/sf/year) - Kwh, 99,848
- **Annual Energy Consumption (Revised Projected):** (360,044 kbtu, 91 kbtu/sf/year) - Kwh, 105,523
- **Annual Energy Consumption (Metered):** (364,449 kbtu, 92 kbtu/sf/year) - Kwh, 108,814
- **Annual PV Generation (Projected):** (364,924 kbtu, 92 kbtu/sf/year) - Kwh, 105,963
- **Annual PV Generation (Metered):** (379,563 kbtu, 96 kbtu/sf/year) - Kwh, 111,185

The original energy model assumptions were revised based on the actual building use.
Year two on Zero Net Energy Status 2012 - 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Building Consumption</th>
<th>PV Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>106,814</td>
<td>111,385</td>
</tr>
<tr>
<td>2013</td>
<td>106,024</td>
<td>104,179</td>
</tr>
<tr>
<td>2014</td>
<td>106,936</td>
<td>102,455</td>
</tr>
<tr>
<td>2015</td>
<td>106,100</td>
<td>104,487</td>
</tr>
</tbody>
</table>

2012 Building Consumption: 106,814
2013 Building Consumption: 106,024
2014 Building Consumption: 106,936
2015 Building Consumption: 106,100
What Went Wrong in 2013

Cypress Creek Monthly ZNE Analysis

Modeled Consumption/Generation
Actual Consumption/Generation

Monitoring Strategy

Key Stakeholders

Weekly Check
Monthly Call
Mid-Month Comparison
M&V Report
Monthly Comparison

Energy Consumption Update - August 2016 (7/30/2016 - 8/31/2016 total 33 days)

<table>
<thead>
<tr>
<th>Items</th>
<th>System</th>
<th>Items in Electrical Panel (Submetered)</th>
<th>Units</th>
<th>Modeled Performance (kWh/M)</th>
<th>Billowed (kwh/m)</th>
<th>Utility Bill (FPL)</th>
<th>Variation from Modeled Performance (%)</th>
<th>Variation from Modeled Performance (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Interior Lighting</td>
<td>Panel L1-1, 3, S, and E</td>
<td>kwh/m</td>
<td></td>
<td>1,832</td>
<td>854</td>
<td>N/A</td>
<td>(178)</td>
<td>-17.2%</td>
<td></td>
</tr>
<tr>
<td>2 Exterior Lighting</td>
<td>Panel L1-17, 18, 21, 19</td>
<td>kwh/m</td>
<td></td>
<td>771</td>
<td>762</td>
<td>N/A</td>
<td>41</td>
<td>6.8%</td>
<td></td>
</tr>
<tr>
<td>3 Water Heater</td>
<td>Panels P1-12 E5</td>
<td>kwh/m</td>
<td></td>
<td>50</td>
<td>32</td>
<td>N/A</td>
<td>(21)</td>
<td>-39.3%</td>
<td></td>
</tr>
<tr>
<td>4 HVAC</td>
<td>ERU1, ACC1, ACCU2, FCU17, PCUB-11</td>
<td>kwh/m</td>
<td></td>
<td>3,366</td>
<td>3,366</td>
<td>N/A</td>
<td>(0)</td>
<td>-0.0%</td>
<td></td>
</tr>
<tr>
<td>5 Receptacle and Miscellaneous Equipment</td>
<td>Calculated Plug Loads</td>
<td>kwh/m</td>
<td></td>
<td>4.144</td>
<td>4.700</td>
<td>N/A</td>
<td>524</td>
<td>15.1%</td>
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</tr>
<tr>
<td>Building Total</td>
<td></td>
<td>kwh/m</td>
<td></td>
<td>9,505</td>
<td>9,032</td>
<td>267</td>
<td>-2.8%</td>
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</tbody>
</table>

PV Generation:
Solar Field, Drive Thru, Roof
kwh/m: 10,740 - 10,853
113 - 1.1%

<table>
<thead>
<tr>
<th>Items</th>
<th>System</th>
<th>Descriptions</th>
<th>Units</th>
<th>Modeled Performance (kWh/m)</th>
<th>Billowed (kWh/m)</th>
<th>Utility Bill (FPL)</th>
<th>Variation from utility’s bill (kWh/m)</th>
<th>Variation from utility’s bill (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchased from FPL</td>
<td>kW/m</td>
<td>Cypress Creek was provided from FPL</td>
<td>kwh/m</td>
<td>6.921</td>
<td>4.702</td>
<td>(41)</td>
<td></td>
<td>-6.9%</td>
<td></td>
</tr>
<tr>
<td>PV Credit (Net Meter kWh)</td>
<td>kW/m</td>
<td>Cypress Creek PV systems sent back to the electric grid (excess kWh)</td>
<td>kwh/m</td>
<td>5.793</td>
<td>5.825</td>
<td>(12)</td>
<td></td>
<td>-1.8%</td>
<td></td>
</tr>
</tbody>
</table>

2015 Usage Breakdown

- **Interior Lighting**: 11%
- **Exterior Lighting**: 7%
- **Water Heater**: 33%
- **HVAC**: 49%
- **Plug Load**: 40%

ATM's account for 8% of the plug load.
Trends By System

Reports Lead to Success
Apply Lesson’s Learned

Issues at Cypress

Consolidate and Communicate

TD Portfolio

Rough Start in 2016
Additional Solar Installation

So Far in 2016....

Cypress Creek Monthly Net-Zero Analysis

- Modeled Consumption/Generation
- Actual Consumption/Generation


Values: -12,000, -10,000, -8,000, -6,000, -4,000, -2,000, 0, 2,000, 4,000
Q&A

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