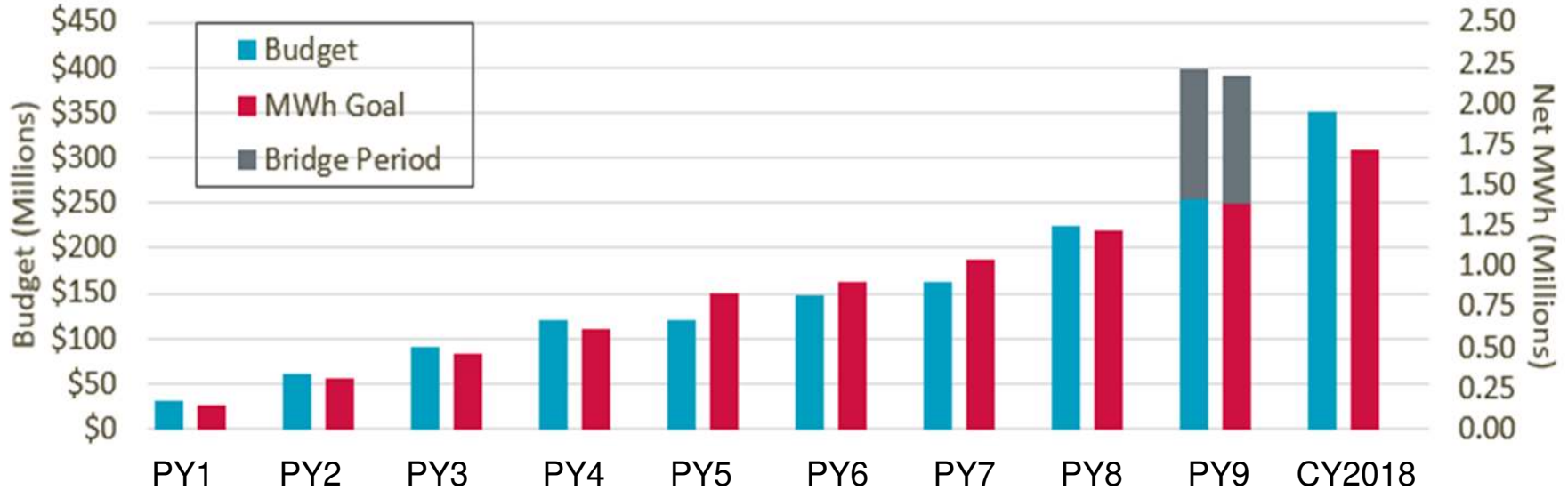


# Monitoring-Based Commissioning and Retro-Commissioning

**BOMA Energy & Sustainability Committee  
May 8, 2019**

# ComEd Energy Efficiency Program

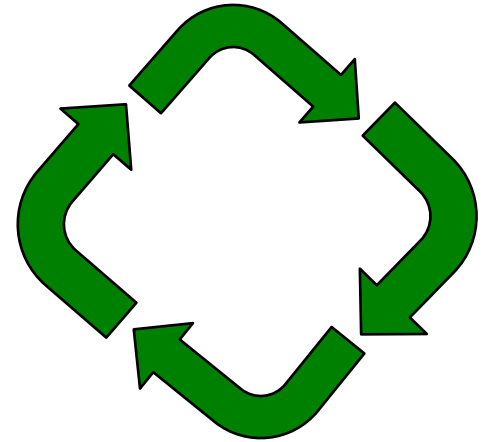
Budget v. MWh Goal



Incentives and energy savings are available!

# A Strategic Approach to Energy Efficiency

- ✓ Ongoing improvement over time
- ✓ Incorporate EE into long-range energy planning
  - Benchmarking (i.e. EPA Portfolio Manager)
  - Assessment of building performance
  - Development of an Energy Management Plan
  - Whole-building upgrades
  - Performance monitoring and verification
- ✓ Web-based tools for analyzing energy use
  - Business Energy Analyzer
- ✓ Take advantage of ComEd financial incentives and technical assistance



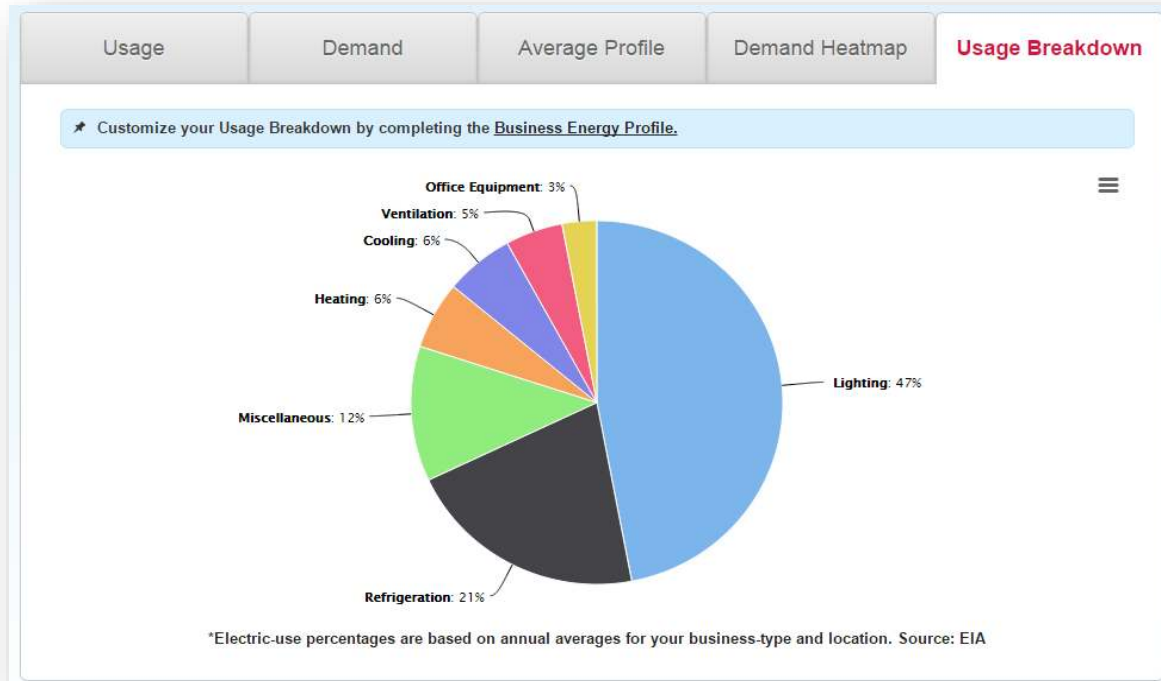
# Business Energy Analyzer (BEA)

- ✓ Free online energy analytics tool for all business customers
  - Energy tracking dashboard
  - Easy-to-use, exportable energy data
  - Benchmarks against similar businesses or multiple locations
  - Provides customized analysis with suggested energy solutions

Register using your account number and zip code at [www.ComEd.com/BEA](http://www.ComEd.com/BEA)

# Load Disaggregation

- ✓ Complete Business Energy Profile to improve accuracy



# Energy Efficiency Recommendations

- ✓ Retrofits and available incentives
- ✓ Operational improvements
- ✓ Behavioral strategies for saving energy

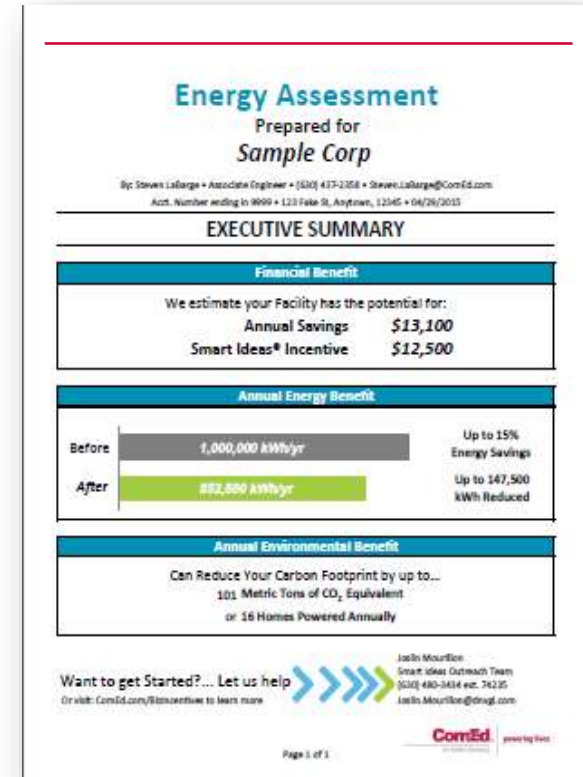
The screenshot displays the ComEd Solutions dashboard. At the top, the ComEd logo and tagline 'powering lives' are visible, along with a user profile 'ComEd Demo'. A navigation bar includes 'Location #1', 'Dashboard', 'Account Ranking', 'Analysis', 'Solutions', 'Energy Data', and 'Resources'. The main content area is titled 'Solutions' and features a grid of six categories, each with an icon, a count of solutions, and the number of solutions completed:

- Lighting** (7 Solutions): 2 of 7 Solutions Completed
- Refrigeration** (7 Solutions): 1 of 7 Solutions Completed
- Cooling** (10 Solutions): 1 of 10 Solutions Completed
- Ventilation** (4 Solutions): 1 of 4 Solutions Completed
- Office Equipment** (5 Solutions): 1 of 5 Solutions Completed

Below the grid, there is a section for 'Install Lighting And Fan Controls' with a detailed description of the benefits and a 'Get Started' section. The 'Get Started' section includes two buttons: 'Find a Contractor' (with a 'Search Now' button) and 'Need More Info?' (with a 'Get In Touch' button).

# Getting Started

- ✓ **FREE** energy efficiency facility assessments
  - Visit [www.ComEd.com/FacilityAssessment](http://www.ComEd.com/FacilityAssessment) to schedule an appointment
  - ComEd engineer will visit your building to identify energy efficiency opportunities
  - You'll receive a report with recommended projects, including projected savings, costs, and incentives
    - Cash back for installing EE measures and technologies
    - Recommendations for operational improvements
    - Direct install available for smaller buildings (<100 kW peak demand)



# Commercial, Industrial and Public Sector



## FREE Assessments

- Facility
- Combined Heat & Power
- Water and Wastewater Treatment



## Incentives

- Standard
- Custom
- Small Business
- Public Small Facility
- New Construction
- LED Streetlights



## Discounts

- Instant Discounts



## Optimization

- Retro-Commissioning
- Monitoring-Based Commissioning
- Rooftop Units
- Compressed Air
- Refrigeration
- Process Cooling

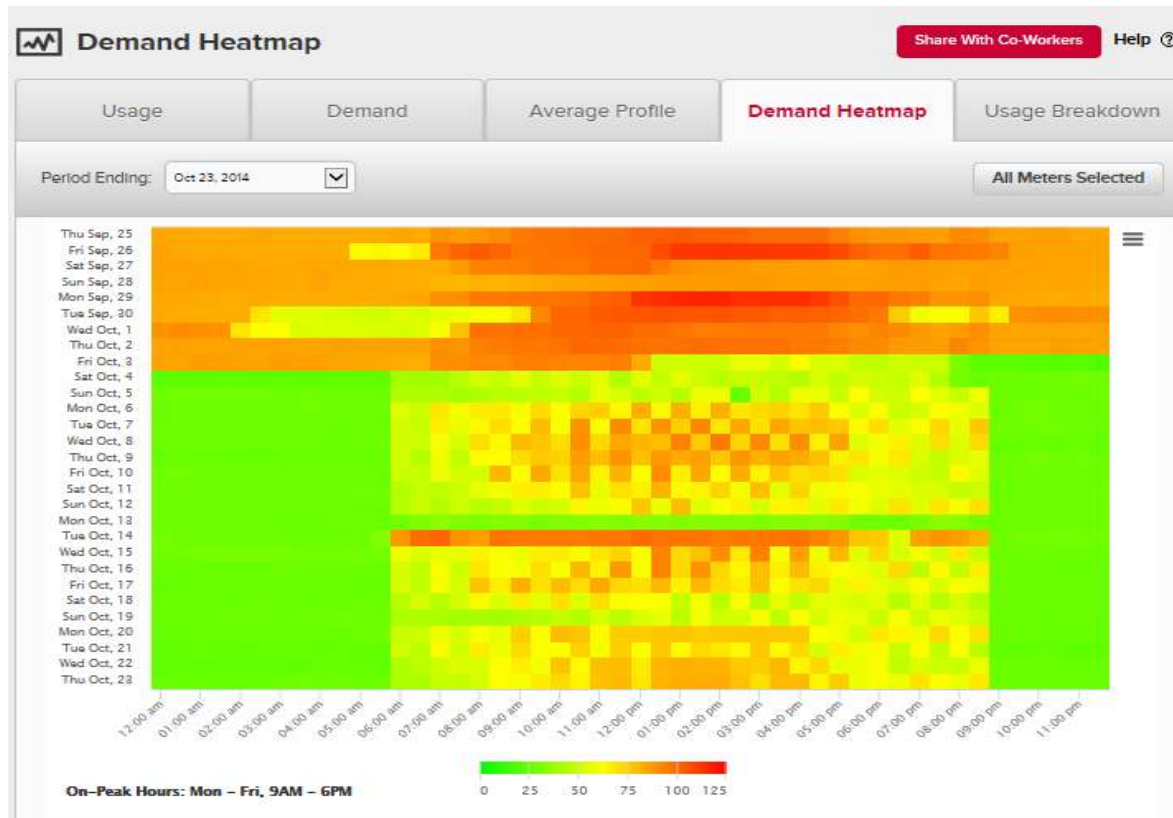


# Building Optimization (RCx and MBCx)

- ✓ Engineering study to find operational improvements for control of building systems such as HVAC and lighting
  - Project conducted by approved EE Service Provider firm
  - ComEd pays for engineering study
  - Customer pays for implementation
  - Targets measures with simple paybacks < 18 months
  - May yield gas as well as electric savings
  
- ✓ What makes a good project?
  - Building automation system
  - No major retrofits planned
  - Customer buy-in
  - Good first step, good follow-up to equipment upgrades



# Impact of RCx Operational Improvements



# Applicable RCx Market Segments

## ✓ Private

- Office buildings
- Commercial real estate
- Multi-family
- Retail
- Colleges and universities
- K-12 schools
- Healthcare
- Places of worship
- Nonprofit
- Non-process space in industrial facilities
- Grocery stores

## ✓ Public

- Colleges and universities
- K-12 schools
- Federal, state, local government building
- Municipal corporation buildings
- Distressed communities
- Public housing authorities
- Park district and recreational
- Nonprofit
- Healthcare
- Community colleges

# Top Participants in RCx

- ✓ Office buildings (~ 50% of total square footage and kWh savings)
- ✓ Hospitals/health care (over 40% of therm savings)
- ✓ Private/public educational facilities
  - School district participation growing rapidly
- ✓ Other (retail, lodging, multi-family, warehouses, etc.)



# Paths to ComEd RCx/MBCx

- ✓ Past RCx participant customers
  - Can repeat RCx – check for eligibility
  - Immediate segue from RCx into MBCx
- ✓ ComEd Facility Assessments (FA)
  - Recommended by FA Engineer
  - Interest expressed by customer at the FA
  - Customer timeline or preceding energy-efficiency projects respected
- ✓ Outreach efforts
  - RCx Service Providers
  - Outreach Service Providers (segmented)
  - Implementation Contractor for RCx
  - Customer-initiation or referral

**ComEd.**  
Energy Efficiency Program

**CASE STUDY**

## 200 W Madison Retro-Commissioning (RCx)

**PROJECT SUMMARY**

200 West Madison is a 45-story, 928,040 square foot office building located in the heart of the Chicago Loop. With the help of an Energy Efficiency Service Provider (service provider), this Transwestern-managed property completed a RCx study through the ComEd Energy Efficiency Program.


**THE SOLUTION**

In 2014, a new building automation system was installed to control the building's HVAC system – a huge capital investment and the first significant upgrade since the 1980's. To ensure the investment was fully optimized, 200 West Madison completed an RCx study. The study provided the owner, Multi-Employer Property Trust, an opportunity to further reduce energy consumption and optimize current systems.

Katie Sakach, Vice President of Management Services at Transwestern, noted, "You can spend the capital investment, install the system and let it run. What we were able to do through the RCx study was have access to a fantastic team of experts to ensure the system was installed correctly, running correctly and as efficient as it should be."

**THE TEAM**

The success of this project was a direct result of the effective collaboration between the service provider, Transwestern and the program. Sakach notes, "We definitely had the right team on this project and it was a great collaboration." The team found opportunities to



**PROJECT SNAPSHOT**

Facility	45-story office building
Energy-saving improvements	» Reduce simultaneous heating and cooling
	» Optimize snow melt system
Estimated annual savings	444,149 kWh
ComEd Energy Efficiency Program Incentive	\$49,500
Implementation cost	\$33,550
Estimated annual electric cost savings	\$28,509
Estimated payback after incentives	1.2 years

# Top 10 Energy Conservation Measures (ECMs)

	Measure Names
1	Scheduling Equipment: AHUs, Fans, Pumps, Electric Heat, VAV/FPBs, Lighting
2	Economizer and Outdoor Air Control
3	Duct Static Pressure Reduce/Reset
4	Chilled Water Temperature Reset
5	Supply Air Temperature Reset
6	Reduce Ventilation
7	Condenser Water Temperature Reset
8	Setback Space Temperature
9	Reduce Simultaneous Heating and Cooling
10	Reduce Pump Differential Setpoint

Majority of operational savings typically captured by small number of measures

# RCx Options (100kW to 10 MW Peak Demand)

Offering Name	Target Building Size	Incentive	Average Duration
<b>Retro-Commissioning (RCx)</b>	Greater than 500,000 ft <sup>2</sup>	Study worth up to \$100,000	12 months
<b>Monitoring-Based Commissioning (MBCx)</b>	Greater than 150,000 ft <sup>2</sup>	Fully funded MBCx study covering the costs of monitoring software and engineering services, with no cap	12+ months
<b>Retro-Commissioning Express (RCxpress)</b>	150,000 to 500,000 ft <sup>2</sup>	Study worth up to \$60,000	9 months
<b>RCx Building Tune-Up</b>	Less than 150,000 ft <sup>2</sup>	Study worth up to \$35,000, also \$0.04 per verified kWh	7 months
<b>Virtual Commissioning</b>	Smaller buildings	Free identification of energy-saving measures and technical assistance for implementation	1-3 months

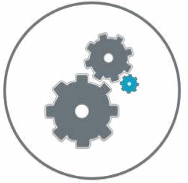
# General RCx Project Flow



- ✓ Application phase
  - Customer works with Service Provider to determine savings potential
  - Application submitted to program for review



- ✓ Investigation phase
  - Service Provider analyzes building and system performance
  - SP recommends energy-saving operational improvements to customer



- ✓ Implementation phase
  - Customer selects measures from report for implementation
  - Customer hires contractor or uses in-house labor to perform work

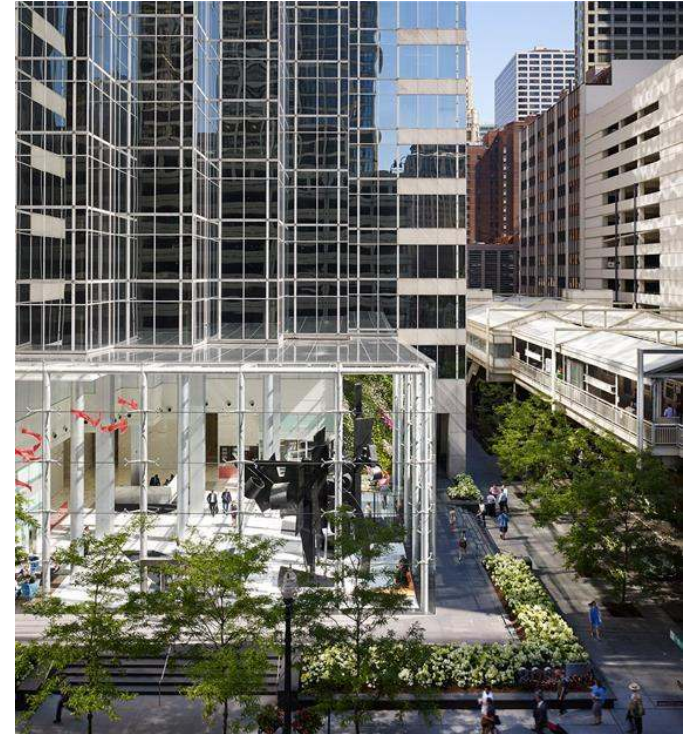


- ✓ Verification phase
  - Service Provider confirms that improvements are working correctly
  - Final energy savings quantified

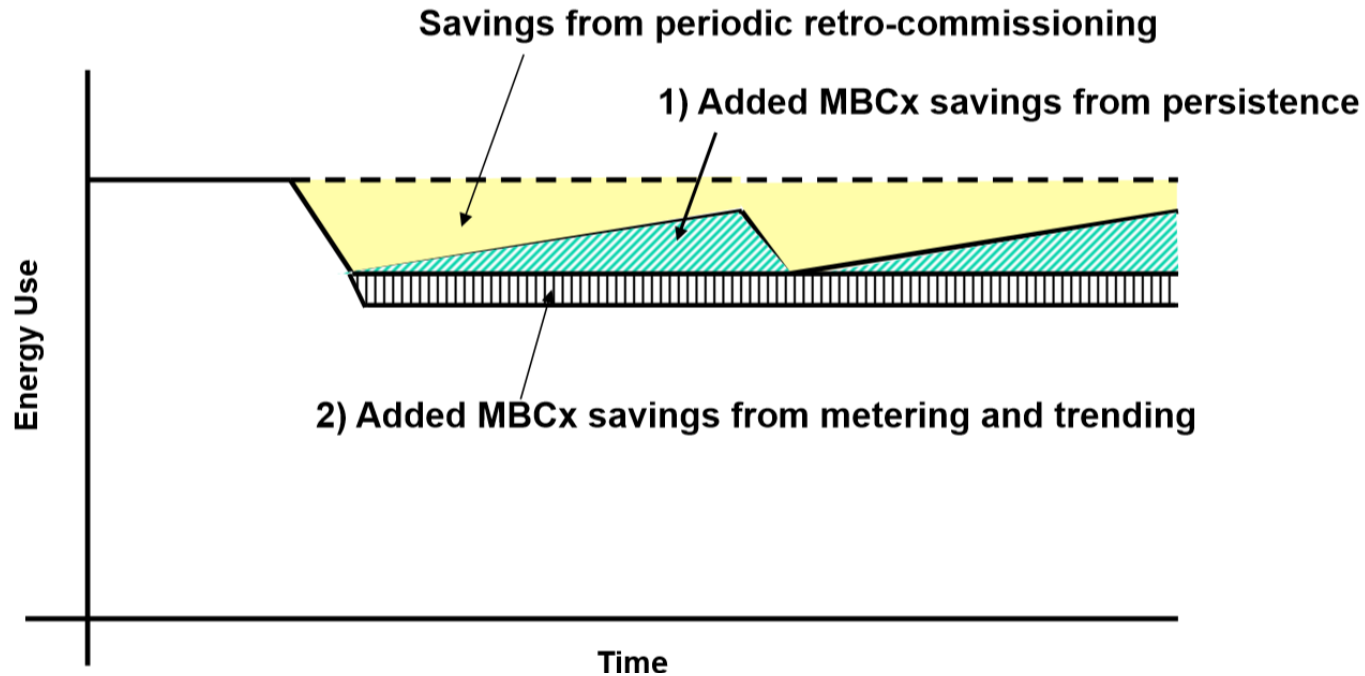


# RCx Case Study – 200 West Madison

- ✓ Project snapshot
  - 45-story office building
  - Installed new building automation system in 2014
- ✓ Energy-saving improvements
  - Reduce simultaneous heating & cooling in offices
  - Optimize snow melt system to operate only when needed
- ✓ Results
  - 444,149 kWh annual savings
  - Study cost paid by ComEd: \$49,500
  - Implementation cost: \$33,550
  - Estimated annual electric cost savings: \$28,509
  - Estimated payback after incentives: 1.2 years



# Deeper, More Persistent Savings - MBCx



Graphic source: *Monitoring-based Cx: An Update* (Karl Brown, CIEE June 2011, Presentation to the California Cx Collaborative)

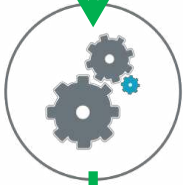
# General MBCx Project Flow



- ✓ Application phase
  - Customer works with Service Provider to determine savings potential
  - Monitoring software integrated into building automation system



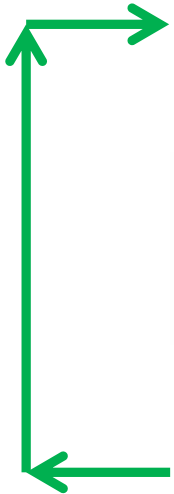
- ✓ Integration & monitoring phase
  - Service Provider analyzes building and system performance
  - SP presents recommendations for operational improvements



- ✓ Implementation phase
  - Customer selects measures from report for implementation
  - Customer pays contractor or uses in-house labor to perform work



- ✓ Verification phase
  - Service Provider confirms that improvements are working correctly
  - Final energy savings quantified



# MBCx Challenges

- ✓ Long sales cycle
- ✓ IT involvement
- ✓ Integration feasibility
- ✓ Competition with other budgetary needs
- ✓ Prioritization of energy efficiency projects

# MBCx Process Overview



- ✓ Application phase
  - Peak demand of 100kW and less than 10MW
  - **MBCx software solution required to perform fault detection diagnostics (FDD)**
  - Existing and functional Building Energy Management System (EMS) with direct digital control (DDC)
  - Building exceeds 150,000 square feet in air-conditioned floor space and/or 500,000 square feet in total floor space
  - Setting annual energy savings goal (min. 200,000 kWh)

# MBCx Process Overview – cont'd



- ✓ Integration phase
  - **Work begins to install the monitoring equipment and software to enable identification of Energy Conservation Measures (ECMs) through FDD**
  - Ensures that the system operates at a level meeting the participant and MBCx program needs
  - Proof on Integration checklist submitted for review

# MBCx Process Overview – cont'd



## ✓ Integration checklist

- List of monitored equipment
- Points list – all monitored points
- Sample trend data file pulled remotely from BAS
- **List of top 10-20 algorithms to identify energy conservation measures (from MBCx FDD)**
- Sample exception/error report
- Customer MBCx Web Portal
- Draft MBCx customer facing report

# MBCx Process Overview – cont'd



- ✓ Monitoring and investigation phase
  - **Facility procedures and equipment are evaluated for energy-saving opportunities using monitoring software**
  - Data collection to establish energy usage pre- and post-ECM implementation
  - Service provider provides details of identified ECMs:
    - Energy and cost saving estimates
    - Implementation cost based on in-house labor or contractor quotes and payback
    - Scope for implementation



# MBCx Process Overview – cont'd



- ✓ Implementation phase
  - Contractor or in-house staff implement selected ECMs
  - Service provider provides technical support the customer and the implementation team to:
    - Ensure recommended measures are installed correctly
    - Make adjustments if needed during the installation
  - **Customer manages project contractors to complete installations as recommended**

# MBCx Process Overview – cont'd



- ✓ Verification phase
  - **Service provider quantifies energy savings from the implemented ECMs**
  - Customer support service provider requests for:
    - Data acquisition
    - Access to facility
    - Invoices to assemble Summary Report
  - Review final results

# MBCx Case Study: Michigan Plaza

- ✓ Project snapshot
  - 44-story and 25-story office towers
  - Completed RCx in each tower previously
- ✓ Results
  - 4,742,514 kWh total annual savings from RCx/MBCx
  - Total study costs paid by ComEd: \$158,272
  - Implementation cost: \$11,990 plus software/monitoring fees
  - Estimated annual electric cost savings: \$141,632
  - Estimated payback after incentives: less than one month



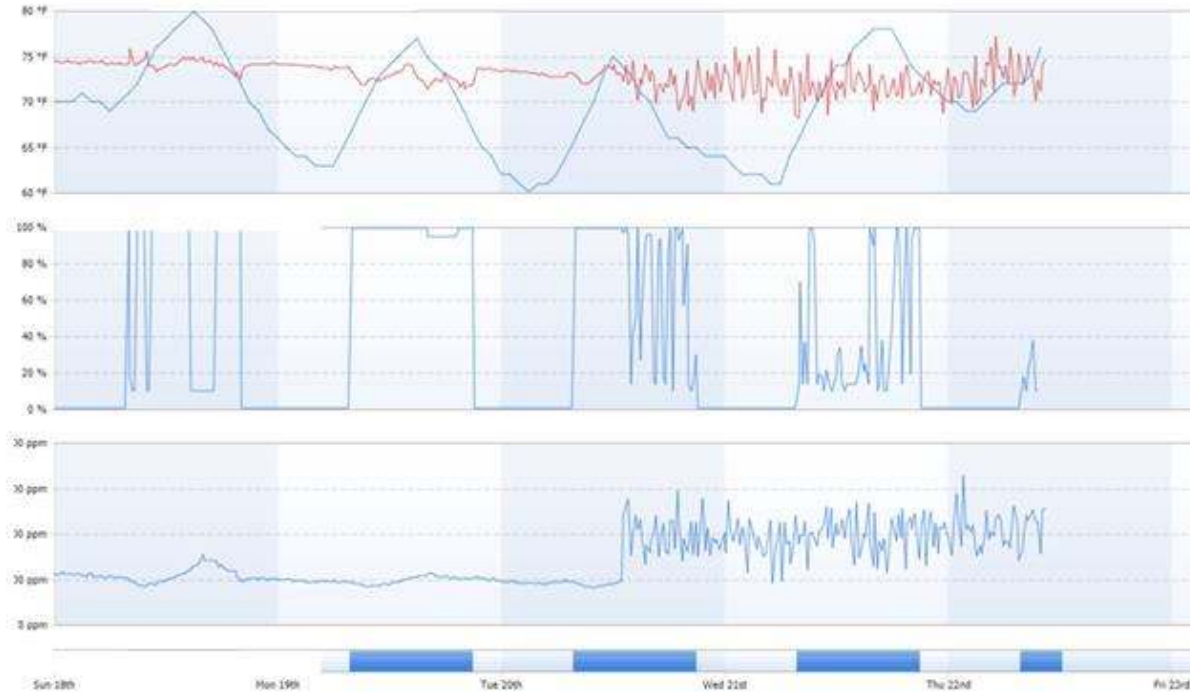
# MBCx Case Study: Michigan Plaza

- ✓ Key energy-saving improvements
  - Replacing electric baseboard heater control relays at 225 N. Michigan
  - Modifying baseboard heating schedule for both buildings
    - These two measures saved 1.4M kWh annually, or \$108K
  
- ✓ Other Energy Conservation Measures (ECMs) implemented
  - Optimize use of outside air
  - Adjust night setback temperature setpoint
  - Implement optimum start on air handling unit (AHU) fans
  - Reduce the use of supply fan heaters
  - Use differential enthalpy economizer instead of fixed temperature setpoint

# ECM Example: Economizer Adjustment

- ✓ DLR Group performed the following (from another project):
  - Set up trends for outside air temperature (OAT), return air temperature (RAT), discharge air temperature (DAT), supply fan status, exhaust fan status, building pressure, outside air damper position, economizer set point
  - Utilized FDD to identify the need to adjust the economizer
  - Verified whether or not the actual damper position corresponded to BAS command in field

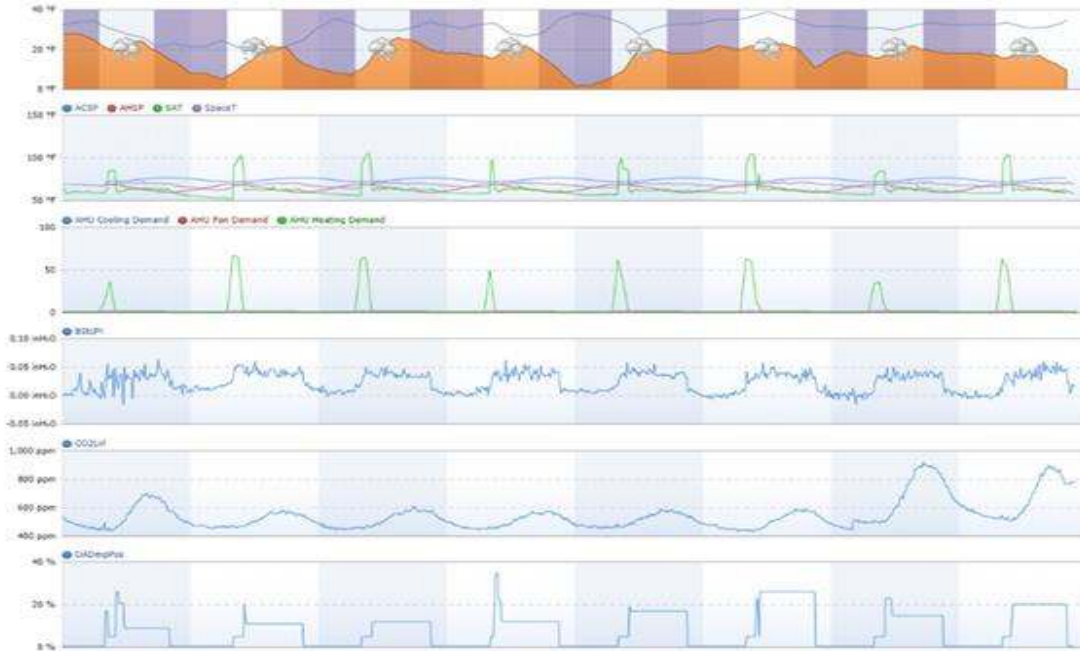
# Economizer Adjustment – cont'd



RTU using 100% OA in summer weather

Courtesy of DLR Group

# Economizer Adjustment – cont'd



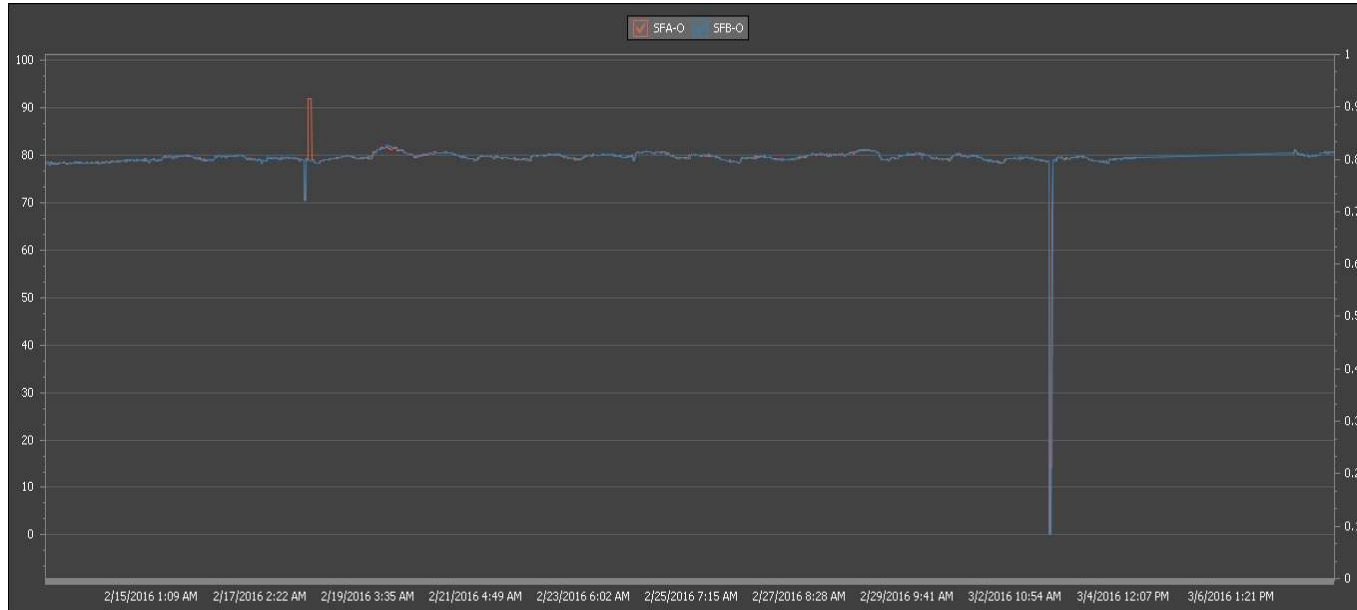
RTU OA Damper open above minimum in cold weather

# ECM Example: AHU Scheduling

- ✓ Aero Building Solutions performed the following (another project):
  - Set up trends for the status and VFD speeds of the AHU supply fan, discharge airflow and temperature, and status and VFD speeds of all exhaust fans
  - Utilized FDD to identify the scheduling opportunity
  - Functionally tested the AHU



# AHU Scheduling – cont'd



Speed of supply fans pre-implementation

Courtesy of Aero Building Solutions

# AHU Scheduling – cont'd



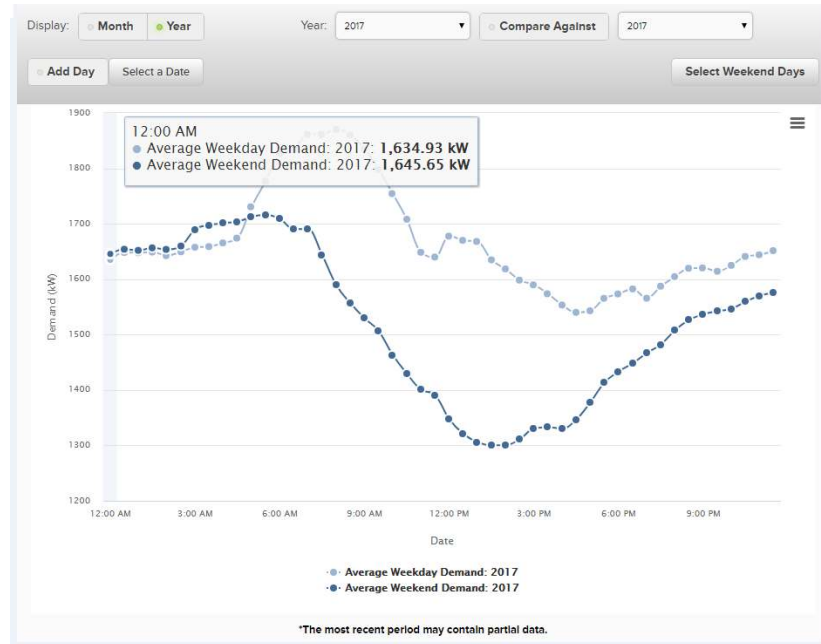
Speed of supply fans post-implementation

Courtesy of Aero Building Solutions

# MBCx Following Commissioning For New Buildings

- ✓ Newly constructed buildings may not be performing optimally when released to owners
- ✓ MBCx would ensure that buildings are running as efficiently as possible
- ✓ Following new building Cx with MBCx will likely result in better building performance and tenant satisfaction

# MBCx Following Commissioning For New Buildings – cont'd



Demand profile for a newly constructed building

# Virtual Commissioning (VCx)

- ✓ Remote analysis of interval electric usage identifies customers with high potential for operational or behavioral energy efficiency savings
  1. ComEd energy advisor reviews smart meter data
  2. Advisor presents custom savings recommendations
  3. Customer implements low-cost and no-cost changes to building operations
  4. Remote advisor calculates savings using smart meter data
- ✓ Good fit for smaller C&I customers and customers with many locations, including tenant spaces in larger buildings
- ✓ **No site visit required and no cost to customer**



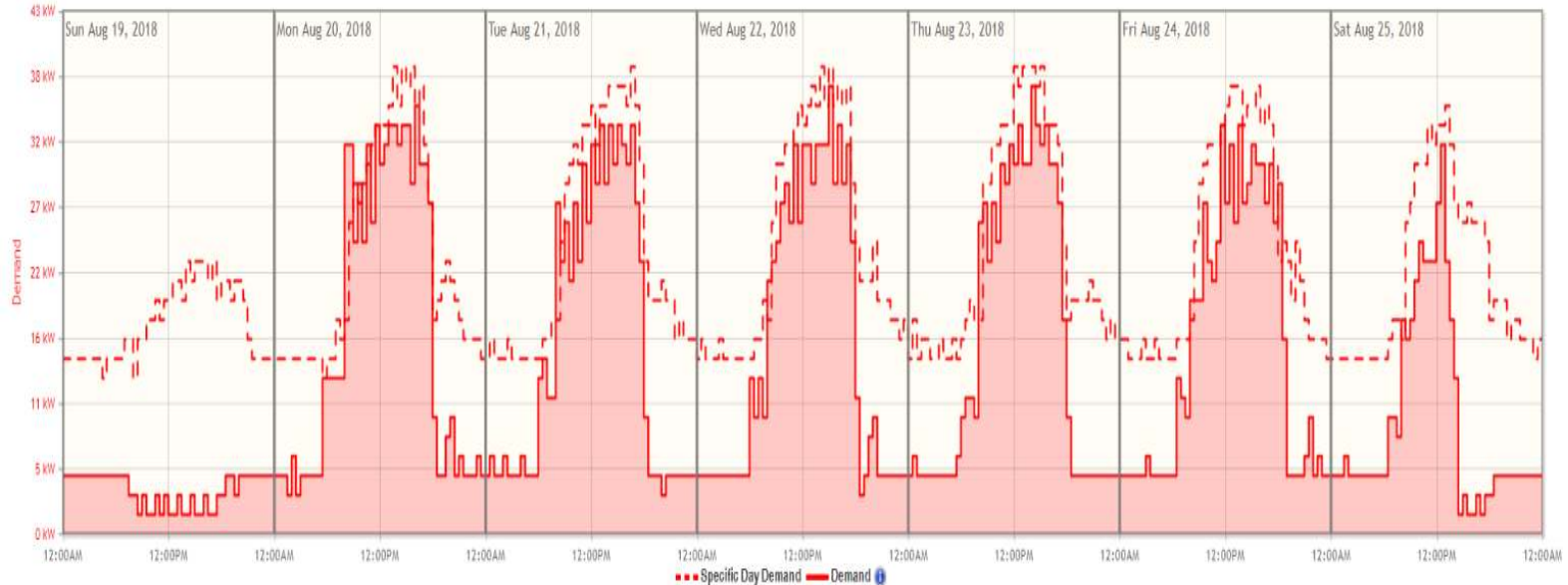
# VCx Pre-Engagement – Bank Branch

- ✓ Overnight baseload was high (15 kW) compared to other Bank locations
- ✓ Significant Sunday usage when branch is closed



# VCx Post-Engagement

- ✓ Sunday systems scheduled off
- ✓ Excess lighting scheduled off overnight



27,178 kWh saved annually, or \$2,092

# Contact

## Call Us:

- 855-433-2700

## Visit Us:

- [www.ComEd.com/BusinessSavings](http://www.ComEd.com/BusinessSavings)

The screenshot displays the ComEd website interface. At the top, the ComEd logo is accompanied by the tagline "powering lives" and the text "An Exelon Company". Navigation links include "Outage", "Pay Bill", "Moving", "Español", and "Contact Us", along with a search bar and a "Sign In" button. A secondary navigation bar features "My Account", "Outages", "Ways to Save", "Smart Energy", and "Safety & Community". Below this is a banner image showing a bowl of strawberries, a laptop, and a coffee cup. The main content area is titled "Home - Ways to Save - For Your Business" and features a sidebar menu with options: "For Your Home", "For Your Business" (highlighted), "Facility Assessments", "Incentives", "Building Optimization", "Energy Management", "Business Types", "Resource Center", "Public Sector", and "Tools & Resources". The "For Your Business" section includes a sub-header "For Your Business" and a description: "Save energy and money by taking advantage of these programs and tools for your business." It features two main content blocks: "Facility Assessments" with an image of a person using a laptop and a pen, and "Incentives" with an image of three business professionals in a meeting. The ComEd logo and "An Exelon Company" text are visible at the bottom right of the page.



# For More Information on RCx/MBCx

- ✓ RCx webpage link:  
[www.comed.com/RCx](http://www.comed.com/RCx)
- ✓ Contact:
  - Rick Tonielli  
[Richard.tonielli@comed.com](mailto:Richard.tonielli@comed.com)  
O: 779-231-1486
  - Tom Wroblewski  
[twroblewski@nexant.com](mailto:twroblewski@nexant.com)  
O: 630-480-8154

 Questions?

THANK YOU!