


 New York State Pollution Prevention Institute

Clean Energy Upgrades and Audits


NYSP2I: Local Municipality Support
November 15, 2019

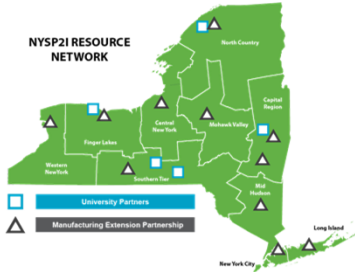
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NYS Pollution Prevention Institute

- HQ at RIT
- Established in 2008
- \$3.9M in annual NYS funding administered through the NYS Department of Environmental Conservation
- Focus areas include:
 - Sustainable Manufacturing Assessments
 - Supply Chain Sustainability
 - Technology Commercialization
 - Food Waste Diversion
 - Outreach & Education
 - Research & Development
 - Emerging Contaminants

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NYS P2I RESOURCE NETWORK

Regions: North Country, Capital Region, Mohawk Valley, Central New York, Finger Lakes, Western New York, Buffalo-Tonawanda, New York City, Long Island

Partnerships: University Partners (blue square), Manufacturing Extension Partnership (black triangle)


NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

NEW YORK Manufacturing Extension Partnership

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Assistance for NYS Companies, Municipalities & Non-Profits

- **Must be NY-based**
- **Typical project cost range is \$15-\$50k**
- **NYSP2I funding offsets most of the project cost to the organization**
 - Expenses are non-capital expenses
 - RIT's engineering, technical and project management services
- **Post-project reporting**
- **Typical project takes about 2-6 months**



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Connection to GFLRPC

- **Through Department of Environmental Conservation (DEC), Office of Climate Change (OCC)**
 - Research on High GWP refrigerants
 - Supermarkets
 - Municipalities
 - Support Climate Smart Communities on outreach
 - Connect to Clean Energy Communities

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NYSP2I Agenda

- **What are we doing?**
 - Brief Assistance
 - High level energy audits
- **What should municipalities do?**
 - Collect energy data
 - Collect building data
 - Analyze data
 - Look for Energy Efficiency Measures (EEM)

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Developed Building Re-Tuning curriculum

- National Institute for Standards and Technology, Building Construction Technology Extension Program (NIST-BCTEP) grant administered through Empire State Development
- In cooperation with Pacific Northwest National Laboratory (PNNL)
- Small to Medium sized industrial buildings
- Industrial buildings are similar to commercial and municipal buildings with added industrial processes

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Energy Management

- **BRT process**
 - Building and energy analysis
 - Investigative Phase
 - Implementation Phase
 - Measurement and Verification
 - Repeat

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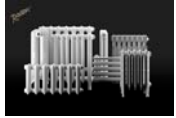
Basic Energy Management Principles

- If you don't need it, turn it off
- If you don't need it at full power, turn it down
- Make "smart" energy decisions when adjusting systems to the real building needs
- Learn and know your building's personality
- Save energy without negatively impacting the comfort of the occupants
- Consider efficiency in your Preventative Maintenance plan. Include tasks that reduce energy consumption, not just those that reduce downtime.

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Building and Energy Analysis

- **Building information**
 - Age
 - Size
 - Use schedule
 - Mechanical Equipment
 - Boilers, Chillers, Air Handlers, Furnaces, Heat Pumps
 - Maintenance logs and occupant complaints



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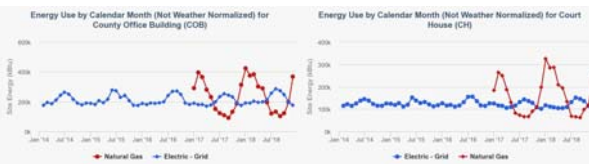
Building and Energy Analysis

- **Energy Information**
 - Utility Bill Analysis
 - EPA Portfolio Manager
 - Plots of electricity, gas, water, waste
 - Energy Use Index (EUI) kBTU/ft²
 - Compares to similar buildings
 - Shows changes over time

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Building and Energy Analysis

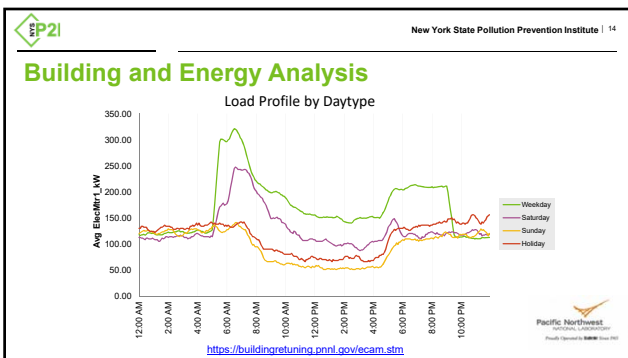
- **Energy Information**
 - EPA Portfolio Manager
 - 83,000 ft²
 - 72,000 ft²

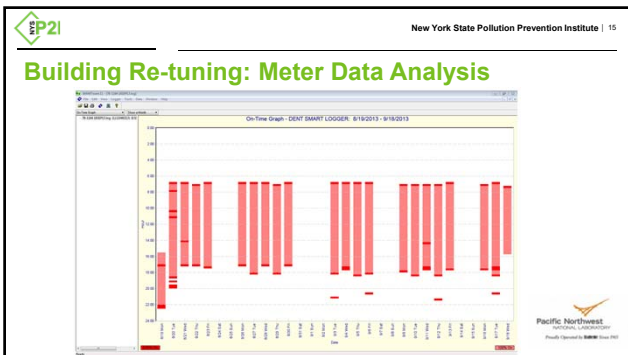


Energy Information

- EPA Portfolio Manager

The screenshot displays the EPA Portfolio Manager interface. It includes a 'Metrics Comparison for Your Property & Your Target' table with columns for Metric, Baseline, and Target. Below this is an 'Assessment & Targets' section with a table for Energy, Water, and Greenhouse Gas metrics, comparing 'Baseline' and 'Target' values. The interface also shows 'Year Project Investment' and 'Year Estimated Savings' as \$0.00.





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Back of Envelope Calculator

Courtesy of Energy Center of Wisconsin <http://www.seventhwave.org/boecalc>

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Building Walk-through Guidance

- While walking-down to investigate the building condition and operations, be vigilant, use your senses – look, listen, smell and touch (be careful!)
- If possible, perform the walk-down during:
 - Occupied hours & unoccupied hours (nights and weekends)
 - A lot of energy waste typically occurs during unoccupied periods and holidays
 - Heating season & cooling season
- Log all information on the log sheets provided – these logs will be useful in the Implementation Phase

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Major Focus Areas

- Building Envelope
- Heating, Ventilation and Air-Conditioning Systems and Controls
- Lighting and Lighting Controls
- Hot Water
- Office Equipment
- Indoor Environmental Conditions
- Meter Profile
- Chillers
- Demand Reduction

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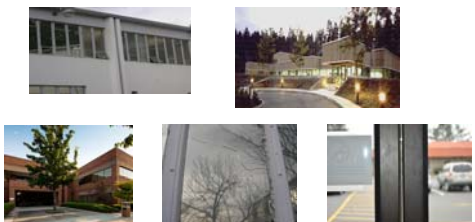
Building Envelope

- Building Envelope
- HVAC Systems and Controls
- Lighting Systems and Controls
- Hot Water
- Office Equipment and other plug loads
- Indoor Environmental Conditions
- Air Distribution Systems

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Doors and Windows – What to look for



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Windows – Implementation

- Double Pane are the standard
- Insulating gas between panes
- Typical energy cost savings when replacing windows with ENERGY STAR rated windows
 - \$146 & \$71 yearly for single-pane & double-pane windows respectively (CA)
 - \$501 & \$208 yearly for single-pane & double-pane windows respectively (New England)

[ENERGY STAR QUALIFIED WINDOWS](#)

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Windows and what else to look for



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HVAC Systems and Controls


- Building Envelope
- **HVAC Systems and Controls**
- Lighting Systems and Controls
- Hot Water
- Office Equipment and other plug loads
- Indoor Environmental Conditions
- Air Distribution Systems

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HVAC Systems and Controls – What to look for

- Small/medium-sized buildings typically have:
- Packaged air conditioners with gas furnaces or heat pumps
 - Gas-Fired Equipment
 - Packaged units are typically controlled by wall mounted thermostats with varying functionality




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HVAC Systems – What to look for

- Missing or damaged panels/access doors or seals for them
- Damaged indoor or outdoor coils
- Missing or damaged mechanical items (fan motors/blades/belts)

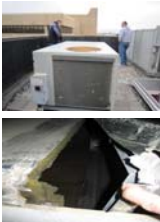


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HVAC Systems – What to look for

- Oil leaks or drips from the refrigeration system or components of the unit.
- Coil condition
- Air leaks around exposed ductwork or the roof curb for a rooftop unit.
- Refrigerant line sets
- Uninsulated low pressure suction lines




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HVAC Systems - What to look for

- **Check the P-trap on the cooling coil**
 - P-trap should have water in it, if the equipment is located in a mechanical space that does not freeze
 - P-traps that are located outside need to have water in them when the cooling is running and allowed to go dry when the weather changes to fall or winter.




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HVAC Systems – What to look for : Belt Driven Fan Motors



- Visually Inspect:
 - Fan motor, wheel, housing and belts
 - Pulley/sheave are in good condition
- Check fan mounts
- Check fan bearings for tightness
- Ensure that the fan is rotating the correct direction
- Check pulley alignment
- Listen for unusual noises or vibrations




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HVAC System - Implementation: Lack of Maintenance

- This maintenance problem has energy implications because the fan must work harder to move air that needs to be delivered to the conditioned spaces
- Solution: Replace the filter!
 - Consider Seasonal Loading – e.g. pollen, dust
 - Consider Surrounding environment also – Nearby construction or landscaping

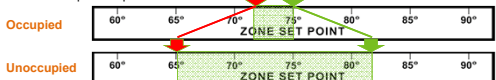




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HVAC System Controls – Programmable Thermostat Set Points

Check the set points

- Are there unoccupied set back and set up set points?
- Is there at least 5°F difference between occupied and unoccupied set points? Is there at least 2°F difference between occupied heating and cooling set points? If not, recommend widening to a minimum of 2°F.
- In heating mode, the recommended occupied set point is 72°F and the recommended unoccupied set point is 65°F
- Similarly, in cooling mode, the recommended occupied set point is 75°F and the recommended unoccupied set point is 82°F

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HVAC System Controls – Programmable Thermostat Schedules

- If the building has programmable thermostats, what type of scheduling capabilities do they have?
 - 5+2 – one weekday and one weekend
 - 5+1+1 – one weekday and two weekend
 - 7 day – schedule for each day of the week
 - How many scheduled operations per day?
 - Are the weekday schedules consistent with the building operations?
 - Are weekend schedules enabled and are they consistent with the weekend operations?
 - If it supports holiday schedules, are the holidays programmed?

Weekdays

Weekends

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Lighting System and Controls

- Building Envelope
- HVAC Systems and Controls
- **Lighting Systems and Controls**
- Hot Water
- Office Equipment and other plug loads
- Indoor Environmental Conditions
- Air Distribution Systems

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Inside Lighting– What to look for

- Are there lighting controls – manual switches, dimmers or time clocks?
- Type of lights (T-12, T-8, T-5, LED, CFL, Incandescent?)
- Are proper light levels being maintained or over-lit?
- Is there opportunity to de-lamp?
- Use light meter to verify that light levels meet IES (Illuminating Engineer Society) recommendations and/or user needs for the spaces.
- Day lighting opportunities?
- Educational signs at manual light switches (as in figure at bottom right of the slide)?
- Are lamps and fixtures clean?

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Inside Lighting Systems and Controls

Guidelines for Acceptable Lighting Levels
(all values are in foot candles)

Area	Guideline Average	Recommended Minimum	Recommended Maximum
Parking lot	N/A	5-1	5
Elevator	N/A	5	10
Inactive storage	5	5	10
Active storage	10	5	15
Stair	10	10	15
Restroom	10	10	20
Corridor	10	10	30
Dining area	10	10	30
Lounge	10	10	30
Atrium	10	10	30
Lobby	10	10	30
Mechanical room	30	20	40
Enclosed office	30	20	50
Open office	30	30	50
Conference Room	30	30	50

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Outside Lighting – What to look for

- What type of lights are used outside the building in parking lots and other places?
- Number of lights?
- Are they controlled with photocell or any other time-of-day control system (time clock)?
- Is the photocell working correctly (location)?
- Exterior lights on during the day or coming on too early or staying on too late?

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Hot Water Systems



- Building Envelope
- HVAC Systems and Controls
- Lighting Systems and Controls
- Hot Water**
- Office Equipment and other plug loads
- Indoor Environmental Conditions
- Air Distribution Systems

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Hot Water Systems – What to look for


- Type of hot water system – domestic hot water or heating hot water or both?
- Energy Star rated appliances?
- Domestic hot water temperature?
- Are the tanks insulated?
- Are the plumbing lines insulated?
- Are there any observable leaks? Faucets or relief valves?
- Temperature Set Point?
- Set back controls in place and working?



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Office Equipment

- Building Envelope
- HVAC Systems and Controls
- Lighting Systems and Controls
- Hot Water
- **Office Equipment and other plug loads**
- Indoor Environmental Conditions
- Air Distribution Systems



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Office Equipment – What to look for

- Over the past 2 decades use of office equipment increased significantly and still continues to increase
- While walking-through the building, notice if computer screens are off when the office is not occupied
- Are portable space heaters or fans running in unoccupied spaces?
- Energy Star rated appliances and computing resources?



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Indoor Environmental Quality


- Building Envelope
- HVAC Systems and Controls
- Lighting Systems and Controls
- Hot Water
- Office Equipment and other plug loads
- **Indoor Environmental Conditions**
- Air Distribution Systems

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Indoor Environmental Quality – What to look for

- Look at discharge air diffusers. Are they fully or partially closed?
 - Closed or partially closed diffusers can be signs of discomfort
- Are the return air grills blocked or covered?
- Look for space heaters in offices
- Are there areas that are stuffy or have unusual odors?




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Indoor Environmental Quality – What to look for

- Partially covered grills or diffusers and space heaters located under a desk are signs of comfort problems
- The building may need the HVAC air distribution system balanced to address excess air and air shortage issues





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Air Distribution Systems (Ductwork)


- Building Envelope
- HVAC Systems and Controls
- Lighting Systems and Controls
- Hot Water
- Office Equipment and other plug loads
- Indoor Environmental Conditions
- **Air Distribution Systems**

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Air Distribution System


- Studies show between **10% and 30%** of the conditioned air (heated and cooled for comfort) is **wasted** because of leakage thru ductwork
- For new construction, **<10% air loss is considered "acceptable"** expected air loss when putting in a new ductwork system (per SMACNA & ASHRAE)
- Air leakage may increase over time because of:
 - Construction (adding to or disturbing the ductwork)
 - Damage (maintenance, exposure to elements, other activities)
 - Operational changes in duct static pressure set points (increased static)



Source:
http://www.thecharlottesville.com/newsletters/energyandclimate/Dec_11_2012



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Additional Resources

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NYSERDA Programs



- **Existing Facilities Program (EFP)**
 - Provides incentives for larger scale energy-improvement projects
 - Incentives from \$30K up to \$2 million
 - Must show measurable improvements
- **Pre-Qualified Incentives Program**
 - Small-sized energy upgrades and equipment replacement
 - Pre-qualified measures include qualifying electric and NG equipment and materials (e.g. Lighting, chillers, VFDs, HVACs, furnaces, space and water heating equipment etc.)
 - Reimbursements up to \$60K

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NYSERDA Programs

- **The Industrial and Process Efficiency (IPE) Program**
 - Designed to offset the cost of energy efficiency gained through process improvements
 - Operations and maintenance, process efficiency (throughput increase, quality improvements), energy efficiency, operations and maintenance (compressed air leak management, burner tune-up, tec.)
 - Incentives are calculated from total annual kwh savings resulting from implementing the improvements
 - Up to \$600,000


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NYSERDA Incentives

Electric Efficiency Performance-Based Incentives

- Performance-Based electric incentives are offered for cost-effective energy efficiency projects to an Applicant that delivers verifiable annual electric energy savings. Incentives are also provided for peak demand reductions associated with energy or thermal (ice) storage systems and high capacity, high efficiency electric chillers.



Base Incentive	Upstate	Downstate	
Electric Efficiency	\$0.12 kWh	\$0.16 kWh	
Energy Storage	\$300/kW	\$600/kW	https://apps.cio.ny.gov/apps/cfa/assets/programquestions/round2776.pdf
Demand Response	\$100/kW	\$200/kW	
Super Efficient Chiller Bonus	\$1,400/kW - Full Load - or - \$1,000/kW - NPLV	\$1,400/kW - Full Load - or - \$1,000/kW - NPLV	
Monitored Based Commissioning	\$0.05/kWh	\$0.05/kWh	



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NYSERDA Assessments

- **Flexible Technical Assistance (FlexTech) Program**
 - Shares the cost to produce an objective study on how to best implement clean energy and/or energy efficiency technologies
 - Provides objective and customized information to help customers make informed energy decisions, which include:
 - General Energy Feasibility Studies
 - Peak-Load Reduction and Load Management
 - Industrial and Process Efficiency Analysis
 - Data Center Efficiency Analysis
 - Energy Efficiency Retro-Commissioning
 - Long-Term Energy and Carbon Management
 - Combined Heat and Power (CHP) Studies
 - Peak-Load Curtailment Plan (PLCP)

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Thank You

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