

# Oradell Public School Board Presentation

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March 13, 2019

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# Introduction of ESIP

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What is ESIP?

## ESIP Timeline of Oradell Public Schools

- RFP issued – Mar/2015
- JCI selected – May/2015
- Contract signed – Dec/2015
- Construction started – Aug/2016



## Measurement & Verification

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Measurement and Verification (M&V) is the process of using measurement to reliably determine actual savings created within an individual facility as the result of an energy management program.

An M&V plan should be developed to obtain a balance between M&V costs and savings certainty.

Johnson Controls follows the guidelines outlined in the International Performance Measurement & Verification Protocol (IPMVP, Vol 1, 2014, [www.evo-world.org](http://www.evo-world.org)):

- Option A – Retrofit Isolation, Key Parameter Measurement
- Option B – Retrofit Isolation, All Parameter Measurement
- Option C – Whole building metering/utility bill comparisons
- Option D – Calibrated computer simulations (used with lack of good baseline data)

In addition to measured, the M&V plan will include Non-Measured Energy Conservation Measures

- Limited to no more than 15% of the total annual energy savings
- Non-Measured does not mean Non-Guaranteed



## The Guarantee

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An annual service agreement to provide the M&V services to the District

The Guarantee period begins the next month following the signing of the project's substantial completion document

Annual reports will be provided reconciling the verified savings (with adjustments) compared to the annual savings guarantee

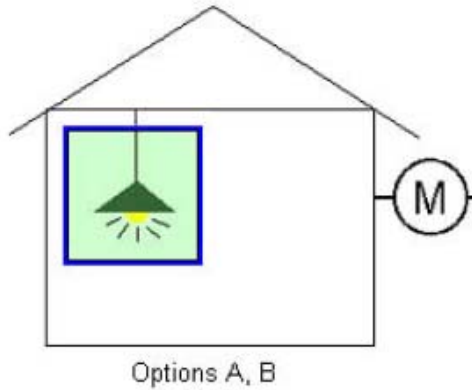
Any savings that exceed the guaranteed savings remain with the District. If the savings fall short of the guaranteed savings, JCI will make up the difference in the form of a check or in-kind services for the value of the shortfall.



# Measurement & Verification

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$$\text{Savings} = \text{Baseline Use} - \text{Post-Retrofit Use} + \text{Adjustments}$$



# IPMVP Option A – Key Parameters Retrofit Isolation

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## Use of Option A

- One-time, short-term or continuous pre and post measurements of at least one key performance parameter
- Non-measured factors agreed upon by all parties (hours of use, manufacturer’s data, etc.)

## Typical examples of Option A conservation measures

- Lighting retrofits & Occupancy Controls
- Building Automation Control Upgrades



## IPMVP Option B – All Parameters Retrofit Isolation

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### Use of Option B

- One-time, short-term or continuous pre and post measurements of all key performance parameters
- Typically, no non-measured factors unlike Option A

### Typical examples of Option B conservation measures

- Solar PV
- Combined Heat & Power





## ECMs and Recommended M&V Options

<u>Energy Conservation Measures (ECM's) &amp; M&amp;V Options</u>				
<u>ECM ID#'s</u>	<u>ECM Description</u>	<u>Option A</u>	<u>Option B</u>	<u>Non-Measurable</u>
ECM-1	Interior Lighting Upgrades to LED Technology	X		
ECM-2	Lighting Occupancy Sensors	X		
ECM-3	Exterior Wall-pack Lighting Upgrades to LED Technology	X		
ECM-4	Weatherization -Infiltration Reduction			X
ECM-5	Pipe Insulation & Blankets			X
ECM-6	Building Automation System Upgrades	X		
ECM-7	Roof Repair			X
ECM-8A	Addition of Cooling to Auditorium			X
ECM-8B	Domestic Hot Water Heater Replacement			X
ECM-9	Replace Heating Hot Water Pump Motors & Install VSD			X
ECM-10	Combined Heat and Power		X	
ECM-12	Replace Unit Ventilators			X
ECM-13	Solar PV		X	
ECM-14	Demand Response - Energy Efficiency Credit			X
ECM-15	Plug Load Management & Smart A/C Control			X
ECM-16	Transformer Replacements			X
ECM-17	Voice Over IP and Phone System Upgrade			X
ECM-18	Vending Miser Controls			X
ECM-19	Rebates			X

# Lighting Retrofit & Lighting Occupancy Sensors – Option A

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## Parameters affecting energy consumption

- Number of fixtures
- Fixture wattage
- Burn hours

## Verification Methodology

- Quantity and type of fixtures (pre and post)
- One-time wattage measurement on a statistically relevant sample of fixtures (pre and post)
- Measured burn hours (one time measurement)

## Savings Calculation

*Lighting Retrofit Energy Savings = (Baseline Fixture kW – Post Retrofit Fixture kW) x  
Number of Fixtures x Annual Burn Hours*

*Lighting Occupancy Sensor Energy Savings = Post Retrofit Fixture kW x Number of Fixtures  
x (Annual Burn Hours without Sensors – Annual Burn Hours with Sensors)*



# Building Automation System (BAS) Upgrades – Option A

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## Control Strategies

- Decrease temperature setpoint during occupied and unoccupied heating period
- Increase temperature setpoint during unoccupied cooling period
- Optimal Control
- Demand Control Ventilation (DCV) in Auditorium & Gym

## Parameters affecting energy consumption

- Temperature Setpoints during Occupied and Unoccupied time period
- Operation Schedule
- CO2 level in Auditorium & Gym
- Outside Air Damper Opening Position of Units serving Auditorium & Gym

## Verification Methodology

- Baseline scenario operation verified through field audit and existing BAS
- Post-retrofit scenario operation through trending setup on BAS and periodically data collection of BAS data

## Savings Calculation

*Electricity Savings = Savings from increase cooling temperature setpoint + savings from DCV*

*Natural Gas Savings = Savings from decrease heating temperature setpoint + savings from DCV*



# Combined Heat & Power – Option B

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## Scope of Work Change

- Original scope: 75-kW CHP unit
- Final scope: 55-kW CHP unit

## Parameters affecting energy generation

- Fuel input
- Electricity output
- Recovered heat output

## Verification Methodology

- Electric output to be measured on a continuous basis
- Amount of heat recovered to be measured on a continuous basis
- Fuel input to be measured on a continuous basis
- All measurements will be totalized over the course of a 12 month period
- Conversion efficiency will be calculated and benefits will be prorated based on verified conversion efficiency

## Savings Calculation

$$\text{Conversion Efficiency} = (\text{Electricity Output} + \text{Recovered Heat Output}) / \text{Fuel Input}$$



## Solar PV – Option B

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### Parameters affecting energy generation

- Solar Irradiance
- Solar Panel Output

### Verification Methodology

- Solar Panel Output output to be measured on a continuous basis
- Solar Irradiance to be measured on a continuous basis

### Savings Calculation

*Savings = Measured Solar Panel Output + Modeled Solar PV Output – (Modeled Solar PV Output X Reference Irradiance / Measured Irradiance)*



## Non-Measurable ECMs

<u>Energy Conservation Measures (ECM's) &amp; M&amp;V Options</u>			
<u>ECM</u>			
<u>ID#'s</u>	<u>ECM Description</u>	<u>Non-Measurable</u>	<u>Scope of Work Change</u>
ECM-4	Weatherization -Infiltration Reduction	X	No
ECM-5	Pipe Insulation & Blankets	X	No
ECM-7	Roof Repair	X	No
ECM-8A	Addition of Cooling to Auditorium	X	Yes
ECM-8B	Domestic Hot Water Heater Replacement	X	No
ECM-9	Replace Heating Hot Water Pump Motors & Install VSD	X	No
ECM-12	Replace Unit Ventilators	X	No
ECM-14	Demand Response - Energy Efficiency Credit	X	No
ECM-15	Plug Load Management & Smart A/C Control	X	Yes
ECM-16	Transformer Replacements	X	No
ECM-17	Voice Over IP and Phone System Upgrade	X	No
ECM-18	Vending Miser Controls	X	No
ECM-19	Rebates	X	No

### Verification Methodology

- Baseline scenario verified through field audit
- Post-retrofit scenario verified through final as-built & manufacturer specification

## Non-Measurable ECMs with Scope of Work Changes

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- Addition of Cooling to the Auditorium
  - Original plan was to install a 20-ton VRF system. During design phase, VRF was removed from the plan and replaced with a 40-ton rooftop unit
- Plug Load Controls
  - Installed 94 plug load control devices compared to original plan of 92. The mix of devices was different than originally planned.



## Original Year 1 Savings Guarantees vs. Projected Year 1 Savings Guarantees

<u>ECM ID#'s</u>	<u>ECM Description</u>	<u>Original Year 1 Guaranteed Savings</u>	<u>Projected Year 1 Savings</u>
ECM-1	Interior Lighting Upgrades to LED Technology	\$31,123	\$30,957
ECM-2	Lighting Occupancy Sensors	\$3,717	\$4,513
ECM-3	Exterior Wall-pack Lighting Upgrades to LED Technology	\$6,177	\$6,177
ECM-4	Weatherization -Infiltration Reduction	\$3,333	\$3,333
ECM-5	Pipe Insulation & Blankets	\$876	\$876
ECM-6	Building Automation System Upgrades	\$3,172	\$3,172
ECM-7	Roof Repair	\$113	\$113
ECM-8A	Addition of Cooling to Auditorium	(\$7,406)	(\$12,826)
ECM-8B	Domestic Hot Water Heater Replacement	\$1,120	\$1,120
ECM-9	Replace Heating Hot Water Pump Motors & Install VSD	\$1,121	\$1,121
ECM-10	Combined Heat and Power	\$36,963	\$28,479
ECM-12	Replace Unit Ventilators	\$225	\$225
ECM-13	Solar PV	\$3,509	\$3,509
ECM-14	Demand Response - Energy Efficiency Credit	\$0	\$1,184
ECM-15	Plug Load Management & Smart A/C Control	\$1,740	\$2,072
ECM-16	Transformer Replacements	\$8,448	\$8,448
ECM-17	Voice Over IP and Phone System Upgrade	\$0	\$0
ECM-18	Vending Miser Controls	\$147	\$147
ECM-19	Rebates	\$0	\$22,000
<b>Total</b>		<b>\$94,378</b>	<b>\$104,619</b>

Construction Savings (Sep 2016 – Dec 2018) = \$160,897



## ECM Substantial Completion Dates

Energy Conservation Measures (ECM's)			
<u>ECM ID#'s</u>	<u>ECM Description</u>	<u>Subcontractor</u>	<u>Substantial Completion Date</u>
ECM-1	Interior Lighting Upgrades to LED Technology	Facility Solutions Group	Saturday, December 31, 2016
ECM-2	Lighting Occupancy Controls	Facility Solutions Group	Saturday, December 31, 2016
ECM-3	Exterior Wall-pack Lighting Upgrades to LED Technology	Facility Solutions Group	Saturday, December 31, 2016
ECM-4	Weatherization - Infiltration Reduction	BE Retrofit	Wednesday, August 31, 2016
ECM-5	Pipe Insulation & Blankets	BE Retrofit	Friday, December 09, 2016
ECM-6	Building Automation Controls Upgrades	Johnson Controls, Inc.	Wednesday, May 31, 2017
ECM-7	Roof Repair	GC DynaTech	Friday, November 04, 2016
ECM-8	Addition of Cooling to Auditorium	PowerSecure	Wednesday, May 31, 2017
ECM-9	Domestic Hot Water Heater Replacement	PowerSecure	Friday, October 28, 2016
ECM-10	Replace Heating Hot Water Pump Motors & Install VSDs	PowerSecure	Thursday, November 17, 2016
ECM-11	Combined Heat and Power	EVCO Mechanical	Tuesday, April 30, 2019
ECM-12	Replace Unit Ventilators	PowerSecure	Thursday, August 31, 2017
ECM-13	Solar PV	BOZ Electric	Tuesday, October 09, 2018
ECM-14	Demand Response - Energy Efficiency Credit	Johnson Controls, Inc.	Friday, February 17, 2017
ECM-15	Plug Load Management & Smart A/C Control	BERT	Tuesday, February 28, 2017
ECM-16	Transformer Replacements	PowerSecure	Tuesday, February 28, 2017
ECM-17	Voice Over IP and Phone System Upgrade	Eastern DataComm	Tuesday, January 31, 2017
ECM-18	Vending Miser Controls	Facility Solutions Group	Saturday, December 31, 2016
	Project Substantial Completion	Johnson Controls, Inc.	Tuesday, April 30, 2019

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# Questions?

