



# 2020 – 2021 COMMERCIAL CUSTOM IMPACT EVALUATION FINAL REPORT

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PREPARED FOR CENTRAL HUDSON

DECEMBER 2022

## CADMUS



**Demand Side Analytics**  
DATA DRIVEN RESEARCH AND INSIGHTS

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# Executive Summary

## Evaluation Overview

- **Program:** Commercial Custom (Gas and Electric)
- **Implementer:** ICF
- **Program period:** Q1-2020 to Q4-2021
- **Prior evaluation:** The evaluation team conducted a 2019 impact evaluations of this program.<sup>1</sup>

## Key Findings:

### Ex Ante Savings Assumptions and Methods varied in accuracy and consistency.

- Both self-installed and contractor-installed projects had inconsistent documentation.
  - Self Install
    - 33% of therm savings: 0.60 RR
    - 61% of kWh savings: 1.31 RR
  - Contractor Install
    - 67% of therm savings: 1.05 RR
    - 39% of kWh savings: 0.75 RR

Realization Rates			
Fuel	Energy (MWh)	Demand (MW)	Gas (MMBtu)
Electric	1.10	0.71	N/A
Gas	N/A	N/A	0.91
<b>Overall</b>	<b>1.10</b>	<b>0.71</b>	<b>0.91</b>

- New construction lighting is the most common electric measure.
  - Gross savings baseline assumptions are out-of-date with New York building code.
- Several large cannabis horticulture projects.
  - High pressure sodium baseline may become questionable as LED becomes industry standard.
  - Improved data collection is needed on flowering versus vegetative schedules and HVAC configuration in grow operations.

# Executive Summary

## Comparison with Prior Evaluation

Comparison of Realization Rates

Metric	2019 VGS RR	2020-2021 VGS RR
Electric Energy (MWh)	.95	1.10
Electric Demand (MW/year)	.94	0.71
Custom Gas Savings (MMBtu)	.99	.91

Recommendations From Prior Evaluation	Findings from Current Evaluation
<p>To improve project documentation:</p> <ul style="list-style-type: none"><li>• Develop a standardized pre-installation inspection process to ensure that baseline information is accurate and documented.</li><li>• Provide savings calculation workbooks in excel format.</li><li>• Provide reference to the algorithm used to determine the savings.</li></ul>	<ul style="list-style-type: none"><li>• The evaluation team saw some improvement in baseline equipment photos and documentation.</li><li>• Self-installed projects had improved documentation.</li><li>• Larger installers continued not to submit full documentation (in particular, images of spreadsheet calculations were provided, in lieu of workbooks)</li></ul>

# Executive Summary

## Evaluation Objectives and Activities

Evaluation Objective	Evaluation Activities				
	Tracking Data Review	Desk Reviews	Site Visits	Metering	Engineering Model Analysis
Determine if hours of use, coincidence factor, and HVAC interactive factors used to estimate gross savings align with the actual operating characteristics of the business	X	X	X	X	X
Assess if tracking data captures quantities, equipment details, and baseline information used to calculate gross savings in a way that is accurate and unbiased	X	X	X		X
Assess if gross savings was calculated in accordance with the NYS TRM	X	X			X
Calculate program level verified gross savings (VGS) and VGS realization rate	X	X	X	X	X

# Introduction

## Program Description

The **Commercial Custom** program incentivize the installation of energy efficient commercial gas and electric equipment by providing customer rebates that reduce the capital cost of these projects.

- Projects are generally completed by a trade ally, but can be installed by the customer in some cases.
- Central Hudson issues rebates upon project completion and submission of the project application (either to customer or trade ally).

### Commercial Custom Program

**Determination of savings:** Uses cost-benefit analysis to determine eligibility of custom measures not included in the TRM and calculates incentive value based on the proportion of energy-savings the measure delivers to the project.

**Customer eligibility:** Non-residential, commercial, industrial, government, institutional, and non-profit electric and gas service customers in CHGE service territory.

**Measures:** Custom rebates are available for non-residential projects that achieve energy savings through measures not included in in the Prescriptive program. Used or refurbished equipment is not eligible.

**Pre-approval requirements:** All custom projects require pre-approval prior to purchasing and installing equipment.

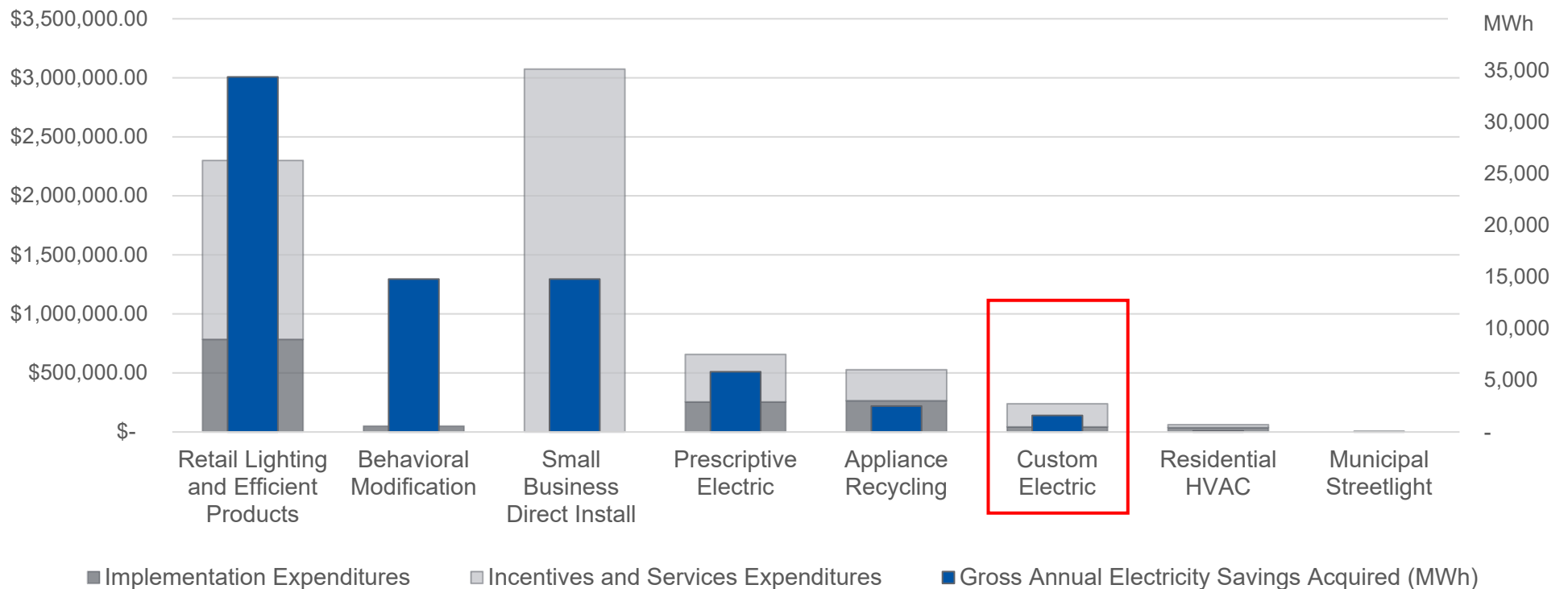
# Introduction

## Electric Program Contributions

- The Custom program contributed less than 3% of total electric portfolio savings in 2021.

2021 Electric Portfolio Contributions	Custom
Savings	2.2%
Expenditures	2.9%

2021 Electric Energy Efficiency Program Savings and Expenditures



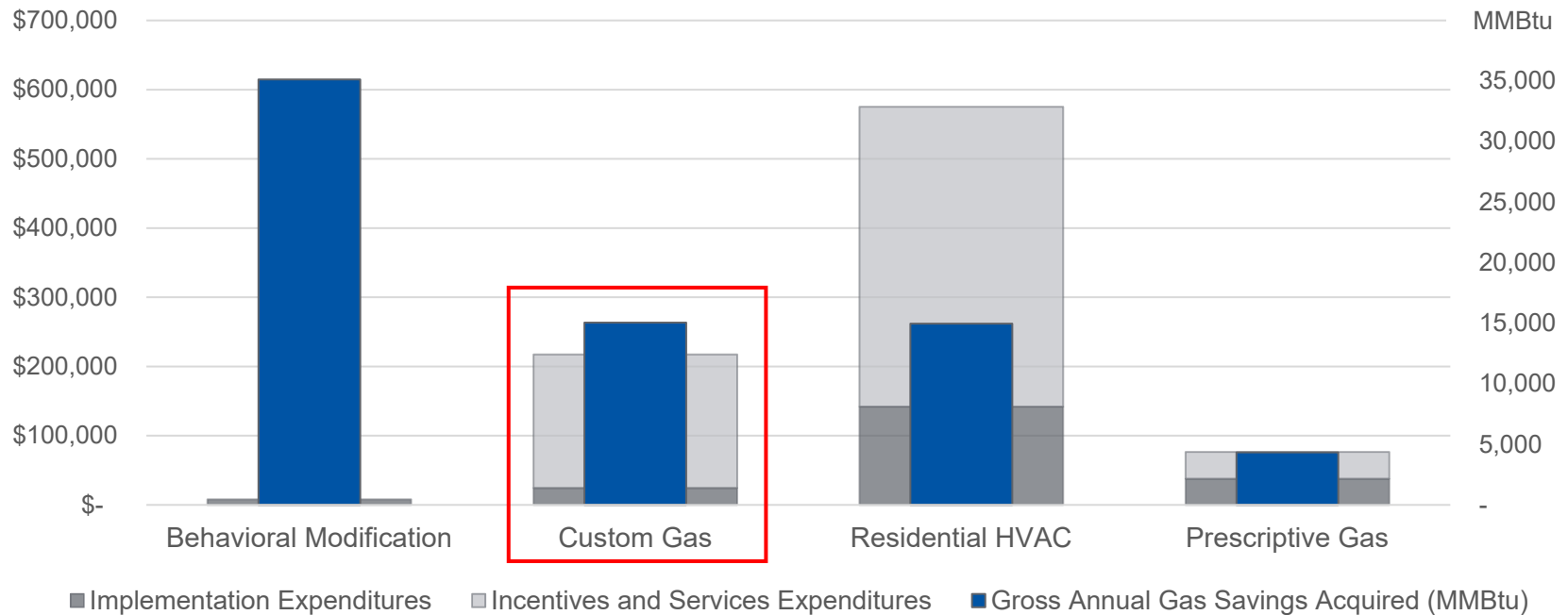
# Introduction

## Gas Program Contributions

- The Custom program contributed over 20% of total gas portfolio savings in 2021.

2021 Gas Portfolio Contributions	Custom
Savings	21.7%
Expenditures	24.7%

2021 Gas Energy Efficiency Program Savings and Expenditures



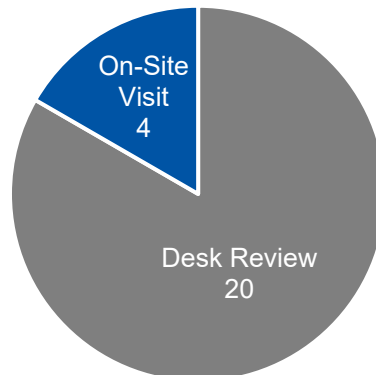


# Methodology

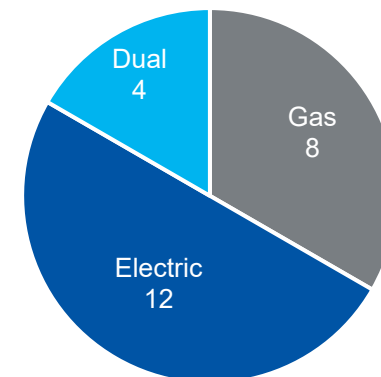
## Site-Specific Analysis to Determine Verified Gross Savings

- A sample of 24 projects was selected for evaluation from a total of 54 projects completed in the 2020-2021 study period.
- To establish verified savings from custom projects, the evaluation team performed a desk review of each specific site and project in the sample.
- For select projects, a virtual or in-person site visit was performed to verify equipment installation and characteristics, as well as operating conditions.
- Lighting loggers were installed at custom project sites that included lighting measures when an in-person site visit was performed. The loggers were retrieved after at least 6 weeks of logging and the data was used to establish lighting hours of operation and coincidence factors used in calculating verified gross savings.

Custom Program Sample: Review Method



Custom Program Sample: Fuel Savings Type



# Evaluation Results

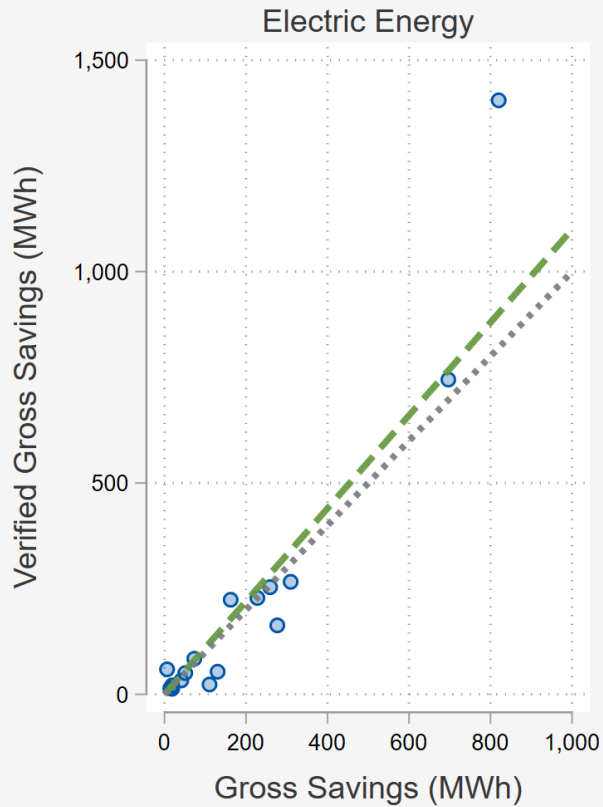
## Program Level Findings

- Verified gross electricity savings were higher than claimed (110%).
- Verified gross demand savings were lower than claimed (71%).
- Verified gross natural gas savings were lower than claimed (91%).

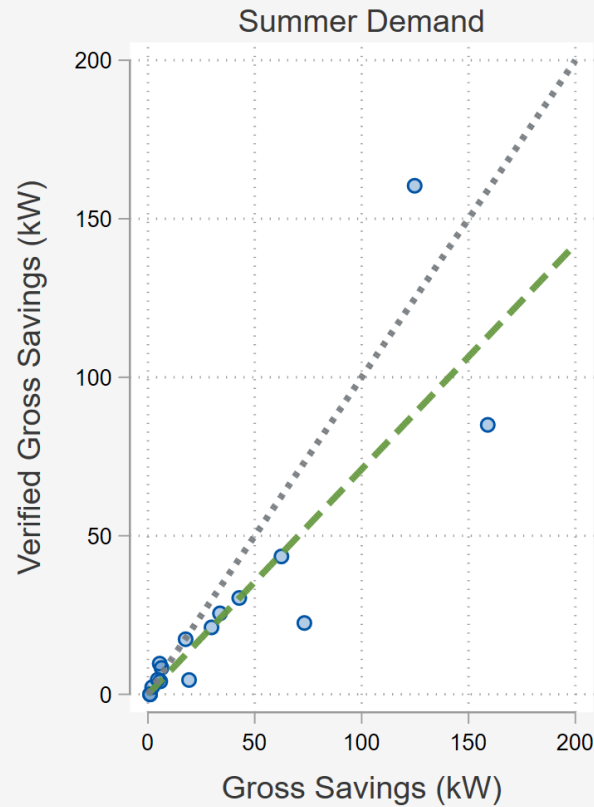
Metric	Gross Savings (GS)	Verified Gross Savings (VGS)	VGS Realization Rate (VGS RR)	RR By Contractor Type
Electric Energy (MWh/year)	4,800	5,256	110%	Self-Install: 1.31 Contractor-Install: 0.75
Electric Demand (MW/year)	0.82	0.58	71%	Self-Install: 0.85 Contractor-Install: 0.49
Gas Savings (MMBtu/year)	58,381	53,014	91%	Self-Install: 0.60 Contractor-Install: 1.05

# Evaluation Results

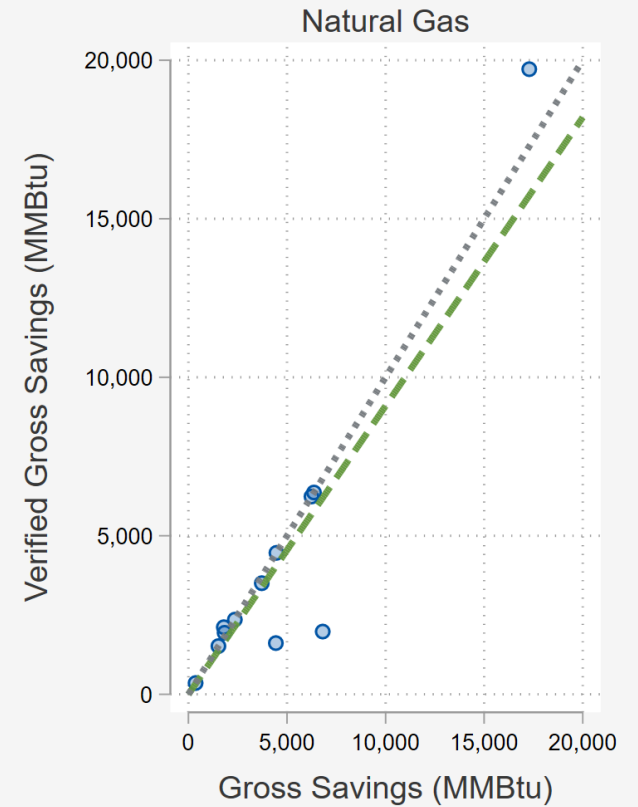
## Sampled Project Findings by Resource Type



- Project-Level Results
- VGS Realization Rate
- ⋯ y=x Reference Line



- Project-Level Results
- VGS Realization Rate
- ⋯ y=x Reference Line



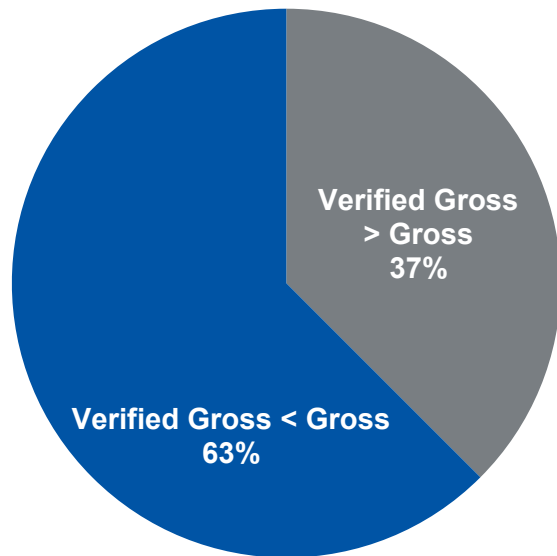
- Project-Level Results
- VGS Realization Rate
- ⋯ y=x Reference Line

# Evaluation Results

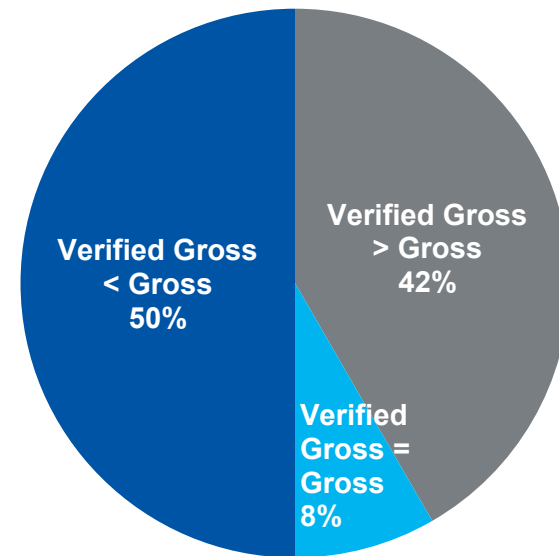
## Verified Gross Savings from Sampled Projects

- 6 out of 16 sampled projects with electricity savings were found to have verified gross savings greater than the reported gross savings, while 10 had less verified gross savings.
- Half of the 12 sampled projects with natural gas savings were found to have lower savings than reported, while 5 of the 12 had greater than reported. One gas saving project had verified gross savings equal to the gross reported savings.

**Sampled Project Results - Electric Energy Savings**



**Sampled Project Results - Natural Gas Savings**



# Evaluation Results

## Issues Identified

**Several issues were identified during the impact evaluation that would improve the accuracy of program's gross savings if addressed:**

- Several projects included project documentation that consisted of PDFs containing screenshots of energy savings analysis spreadsheets. Presenting the analysis in this way makes it difficult for implementers, Central Hudson, or the evaluation team to review and validate the estimated savings. Concerns about sharing proprietary tools or intellectual property are typically alleviated using a non-disclosure agreement in other energy efficiency programs.
- New construction lighting projects were included in the custom program. These projects may be better suited for inclusion in the prescriptive commercial lighting program.
  - While the state of New York has adopted IECC 2018,<sup>4</sup> gross savings for new construction lighting projects were estimated using baseline lighting power density (LPD) values from ASHRAE 90.1 2013.<sup>5</sup> This leads to overestimating energy savings for new construction lighting projects.
- In some cases, the implementer performed post-installation site visits to verify the installation of measures but did not record, or could not locate, specific findings of those inspections.

# Evaluation Results

## Reasons for Adjustments in Verified Savings

- For projects in the custom program sample that included lighting measures, and where lighting loggers were installed at project sites, verified savings were calculated based on logged lighting hours of use when appropriate.
  - This led to both lower and higher savings depending on the project.
- New construction lighting projects administered through the custom program used baseline lighting power densities (LPD) from ASHRAE 2013 instead of IECC 2018 which is the statewide energy code. These projects typically had verified gross savings lower than the reported gross savings due to adjustment of the baseline to reflect IECC 2018 LPDs.
  - The evaluation team recommends Central Hudson update its new construction lighting process to consider the building code applicable at the time of permitting for future projects.
- A set of projects completed for a collection of schools in a school district included project files with limited detail on the method of savings estimation or support for the input assumptions used in the savings calculations.
  - These projects were given the benefit of the doubt and where review of the provided project files led to a reasonable understanding of the general approach to calculating savings, verified gross savings was set equal to the reported gross savings.
- Gross savings calculations for a dormitory water heater upgrade assumed all billed water consumption was hot water usage. Verified gross calculations use per-person typical hot water usage of 17.2 gallons per day from the NYS TRM.
- Some other minor discrepancies and adjustments made to estimate VGS, for example:
  - Evaluators used flow load profile and UMP for air compressor project (implementer used custom calcs).
  - Evaluators updated boiler efficiency assumptions from 50% to 70% based on boiler age and size.
  - Accounting for differences in efficiency between proposed and installed equipment.

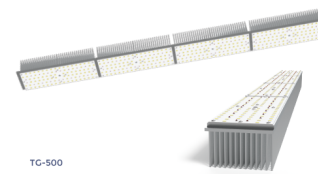
# Evaluation Results

## High Efficiency LED Lighting in Marijuana Grow Operations

- Approximately 30% of Custom Electric gross kWh savings in the study period came from LED lighting installations in new cannabis grow operations.
  - Savings calculations were for a 1:1 design upgrade from 1000W High Pressure Sodium to LED.
  - If the cannabis industry continues to submit projects, Central Hudson should study the appropriateness of this baseline assumption and potentially seek clarification from DPS or coordinate with the Joint IOUs.
- Given the size of these projects, additional data collection is needed during implementation:
  - Whether the operation is sunlight assisted or fully indoor.
  - Breakdown of flowering versus vegetative rooms and schedules for each.
  - HVAC configurations; LEDs produce far less waste heat and will lead to considerable interactive effects in a full indoor operation.



TC-500 SERIES



TC-500

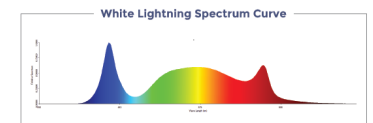
### TC-500

Spectrum	W
Efficacy	up to 2.7 $\mu\text{mol/J}$
PPF	up to 1620 $\mu\text{mol/s}$
Output Power	600 W
Input Voltage*	100-277 V*
Dimensions - Bar	4 in x 4 in x 46 in
Weight - Bar/Fixture	18 lbs
Mounting Height	Truss
Thermal Management	Passive
Dimming	0-10 V
Operating Temp	-20°C - 40°C
Power Factor	>0.95
Supply Frequency	50/60 Hz
Heat Output	2150 BTU/hr
Long life	50,000 - 100,000 hours
Warranty	3 years, optional 5 years

\*additional input options available

+ TSRgrow Plug'n Play 600W LED top light is specifically designed for greenhouses and is leading the way for efficiency and product yields. With a minimized profile for mounting on greenhouse struts, the TC-500HVL is designed to eliminate wasted electricity and heat while delivering full spectrum high performance DLI control of supplemental greenhouse lighting. Features include a local high efficiency driver for easy installation, full dimmability with 0-10V instant on-off and dimming to your DLI needs.

- + Full Spectrum targeting optimized plant growth
- + Integrate into greenhouse control systems
- + Ideal for high DLI crops such as cannabis and hemp
- + Cost effective and high efficiency
- + No bulb replacements, fast ROI
- + Long life <50,000 hrs
- + Passive forged cooling technology



### TECHNICAL DIAGRAM



# Conclusions and Recommendations

Program Component	Key Drivers of Results	Conclusions	Recommendations
All	Documentation for some projects consisted of PDF screenshots of energy savings analysis spreadsheets.	Strengthening project documentation requirements would better equip implementers, Central Hudson, and the evaluation team to review and validate estimated savings.	ICF should require transparent, working calculations. Project documentation should include equipment invoices, equipment spec sheets, and documentation of baseline assumptions. Central Hudson can offer non-disclosure agreements to alleviate concerns about sharing proprietary tools or intellectual property.
Gas	Assumptions (efficiency, GPD DHW) could be improved	Gross Savings assumptions that did not align with the NY TRM lowered the VGS RR.	Align with or compare to NY TRM assumptions whenever possible. If deviating from NY TRM, provide rationale.



# Conclusions and Recommendations

Program Component	Key Drivers of Results	Conclusions	Recommendations
Electric	Gross savings for new construction lighting projects were calculated using LPD allowances from ASHRAE 90.1 - 2013.	Using LPD allowances from ASHRAE 2013 instead of IECC 2018 which is the statewide energy code, lowered the VGS RR for new construction lighting projects.	Align LPD allowances with the energy code in place at the time the building was permitted.
Electric	<p>Approximately 30% of Custom Electric gross kWh savings in the study period came from LED lighting installations in new cannabis grow operations.</p> <p>LED lighting installations in new cannabis grow operations assumed a 1:1 design upgrade from 1000W High Pressure Sodium to LED.</p>	The scale of savings coming from the cannabis industry merits additional study to establish industry-specific baseline assumptions and procedures.	<p>Study the appropriate baseline assumption for this industry and potentially seek clarification from DPS or coordinate with the Joint IOUs.</p> <p>Collect additional project data during implementation including whether the operation is sunlight assisted or fully indoor, room uses and schedules, and HVAC configurations.</p>

# APPENDICES

Appendix A – References

Appendix B – Glossary of Key Terms

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# References

1. Central Hudson Q1 2019 – Q2 2020 Commercial Custom and Prescriptive Impact Evaluation Report, July 1, 2021. Available at <https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={3E99D31B-DAA3-4332-B2DC-456345EE4DB7}>
2. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures. Version 9. Effective January 1, 2022. Available at [https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23decff52920a85257f1100671bdd/\\$FILE/NYS%20T%20RM%20V9.pdf](https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23decff52920a85257f1100671bdd/$FILE/NYS%20T%20RM%20V9.pdf)
3. New York Department of Public Service Gross Savings Guidance: [https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/255ea3546df802b585257e38005460f9/\\$FILE/GSVG%2008\\_23\\_2019.FINAL.pdf](https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/255ea3546df802b585257e38005460f9/$FILE/GSVG%2008_23_2019.FINAL.pdf)
4. IECC 2018. International Energy Conservation Code. A model code adopted by many states and municipalities (including New York) for the establishment of minimum design and construction requirements for energy efficiency. Available at: <https://codes.iccsafe.org/content/iecc2018>
5. ASHRAE 2013. American Society of Heating, Refrigeration, and Air Conditioning Engineers. The ASHRAE 90.1 standard provides minimum requirements for energy efficient designs for buildings. [https://www.techstreet.com/ashrae/standards/ashrae-90-1-2013-si?ashrae\\_auth\\_token=&product\\_id=1865967](https://www.techstreet.com/ashrae/standards/ashrae-90-1-2013-si?ashrae_auth_token=&product_id=1865967)

# Glossary of Key Terms

- **Coincidence Factor (CF):** A ratio with the numerator being the simultaneous demand of a similar group of electrical appliances (measures) within a specified period, to the sum of their individual maximum demands within the same period.<sup>1</sup>
- **Gross Savings (GS):** Energy savings that result directly from program-related actions taken by participants in an energy efficiency program, regardless of why they participated and unadjusted by any significant factors. This is sometimes referred to as program-reported savings and may include some level of refinement such as modeling or adjustments for QA/QC to address sources of uncertainties in Planned Savings, including baseline assumptions or deemed values. Gross Savings is determined prior to an independent evaluation.<sup>3</sup>
- **Hours of Use (HOU):** The hours over a prescribed period which the measure is on and using energy.
- **HVAC Interactive Effects:** The extent to which the measure increases or decreases the demand on a buildings HVAC systems. For instance, LED lighting produces less heat than incandescent lighting, so upgrading an incandescent lamp to an LED lamp will increase HVAC system demand in the heating season and decrease AC demand in the cooling season.
- **Lighting Power Density (LPD):** Lighting wattage divided by space square footage. Used to determine baseline energy consumption for new construction lighting because energy code provides maximum allowable LPD, by facility and space type.
- **Uniform Methods Project (UMP):** Industry guidelines for estimating energy savings published by the US Department of Energy in 2017.
- **Verified Gross Savings (VGS):** VGS is the value reported by an independent evaluator as energy efficiency program activities and Gross Savings Analysis are complete. VGS is distinct from GS in two ways: 1) it is the product of a complete gross savings analysis using methods consistent with industry standard best practices, and 2) it is produced by an independent evaluator, not by the program administrator.<sup>3</sup>
- **VGS Realization Rate (VGS RR):** The ratio of VGS to GS, expressed as a decimal; indicates the performance of a program's reported GS relative to actual realized savings.<sup>3</sup>

# CONTACTS

**Jesse Smith** | Partner

Demand Side Analytics

[jsmith@demandsideanalytics.com](mailto:jsmith@demandsideanalytics.com)

**John Walczyk** | Principal

Cadmus

[john.walczyk@cadmusgroup.com](mailto:john.walczyk@cadmusgroup.com)

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