

New Hampshire EM&V Working Group

January 23, 2018

EM&V Functions and Activities

EM&V

EM&V planning, scoping,
contract oversight

EM&V Results

Measured savings factors from
impact evaluations (kWh, kW,
coinc. factors, realization rates)

Non-Energy Impacts

Technical Reference Manual

Process evaluation findings and
recommendations

Other EM&V results (potential
studies, market assessments, etc.)

**Apply
EM&V
Results**

Other Functions/Activities

Regulatory,
Policy, Planning

Implementation

Program design

Planning

Goals & Budgets

Benefit/Cost Model

Reporting

Lost Revenue

Engineering

Project development,
implementation

Custom project savings
calculations (use
engineering data,
algorithms, specs, etc.)

Customer Service

Marketing

Product Development

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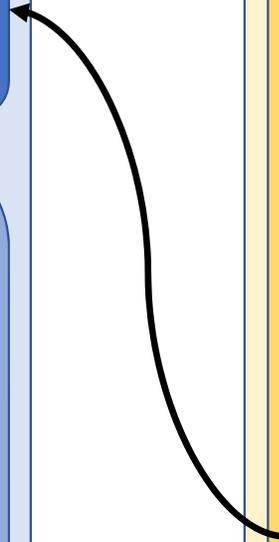
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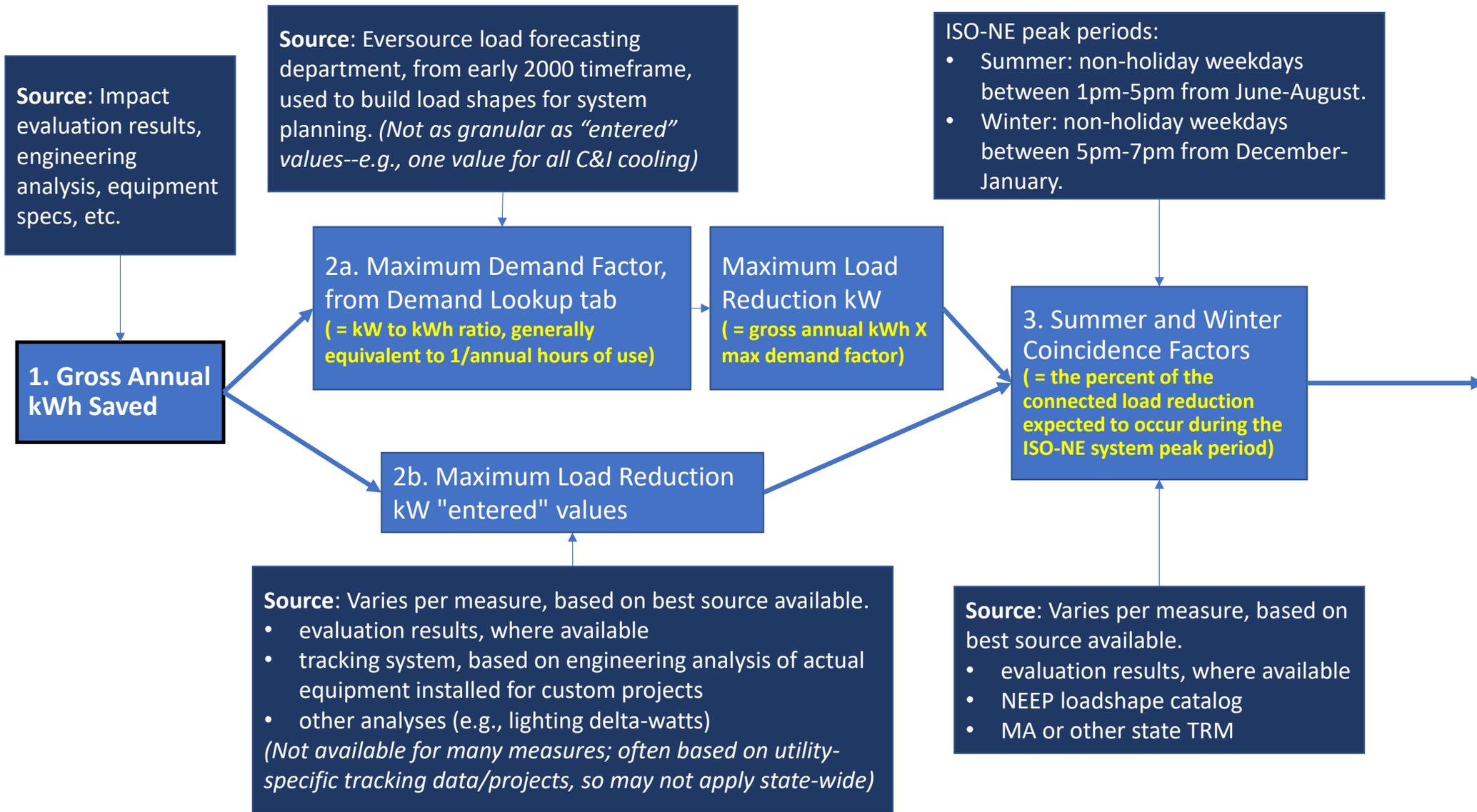


Jim's spreadsheet

"1-9-2018 follow-up to today's EMV meeting"

Note: This spreadsheet is based on the B/C model and represents *planned* values: the best available estimates prior to the program year. Actual reported values are used to determine lost base revenues.

DE 17-136									
Eversource									
Derivation of Summer kW Savings									
Large C&I Business Energy Solutions - Retrofit									
Eversource Proposed - Year 2018									
Description	Summer kW Savings for Purposes of Calculating Lost Revenue								Total
	Cooling	Heating	Lighting	Retrofit Lighting-LED	Lighting OS Only	Park Lot Lights	Process		
Proposed Summer kW Savings:									
Quantity	10	4	10	167	6	47	37	281	
Gross Annual kWh Saved	28,263	57,916	52,667	68,517	186,496	99,963	51,330	545,150	
Maximum Demand Factor (Lookup)	0.00034332	0.00024455	0.00021516	0.00021516	0.00001000	0.00001000	0.00011644		
Maximum Load Reduction kW	10	14	11	15	2	1	6		
Maximum Load Reduction kW "entered" values	6	20	17	12	12	22	26	116	
Extended Maximum Load Reduction kW	62	76	174	2,072	76	1,038	979	4,478	
Summer Coincident Percentage	44.4%	0.0%	60.2%	82.7%	40.3%	0.0%	73.8%		
Sub-Total	28	-	105	1,714	31	-	722	2,599	
Net to Gross Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Sub-Total	28	-	105	1,714	31	-	722	2,599	
In-Service Rate	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Sub-Total	28	-	105	1,714	31	-	722	2,599	
kW Summer Realization Rate	100.0%	100.0%	97.7%	97.7%	94.9%	100.0%	100.0%		
Summer kW Savings	28	-	103	1,674	29	-	722	2,556	



Source: Varies per measure/program

- C&I projects (usually 100%) are typically inspected, and incentives provided based on successful installation
- For retail lighting, evaluations have verified the % of purchased lightbulbs installed vs. in storage

4. Net to Gross ratio
(= ratio of net savings to gross savings; typically = 1 – free-ridership + spillover)

5. In-Service Rate
(= the portion of efficient units sold/rebated that are actually installed)

6. Realization Rate
(= ratio of savings based on impact evaluations, to savings based on savings algorithms [e.g., TRM for deemed savings, engineering analysis for custom project savings])

7. Summer and Winter kW Savings

Source: Assumed to be 1.0.

- Per the New Hampshire Energy Efficiency Working Group Report, 1999: “Although Group members agree that program designs should attempt to minimize free-riders, the Group concluded that the methodological challenges and associated costs of accurately assessing free-riders no longer justifies the effort required to net these out of cost-effectiveness analyses.” The same report allowed inclusion of spillover, but to date the utilities have not measured spillover or included it in the B/C test. See [https://www.puc.nh.gov/Electric/96-150%20%20NH%20Energy%20Efficiency%20Working%20Group%20Final%20Report%20\(1999\).pdf](https://www.puc.nh.gov/Electric/96-150%20%20NH%20Energy%20Efficiency%20Working%20Group%20Final%20Report%20(1999).pdf)

Source: Impact evaluation results (e.g., http://www.puc.state.nh.us/Electric/Monitoring_Evaluation_Report_List.htm)

Evaluation methods for measuring kW savings

DNV-GL evaluation of NH Large C&I Program

- DNV GL conducted an **on-site based impact evaluation** with metering and verification.
- Each site visit included verifying the type and quantity of measures installed, **gathering baseline information (when available) and hours of use** for all installed energy efficiency measures at the site.
- **Metering time of use and/or true power** was also performed as needed at sites to inform savings estimates.



NEW HAMPSHIRE UTILITIES LARGE COMMERCIAL & INDUSTRIAL
(C&I) RETROFIT AND NEW EQUIPMENT & CONSTRUCTION
PROGRAM IMPACT EVALUATION

Final Report

New Hampshire Electric and Gas Utilities

Date: September 25, 2015

Source:

<http://www.puc.state.nh.us/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf>

Evaluation methods for measuring kW savings

DNV-GL evaluation of NH Large C&I Program

Table 12: Evaluation Approaches Used by Measure Type

Major Measure Categories	Evaluation Approaches Used	Key Evaluation Input/s
Lighting	Retrofit Isolation – Time-of-Use Loggers	Wattage, Hours of Use, HVAC Types (for Interactive)
Compressed Air	Retrofit Isolation – Power Loggers	Capacity, Pressure, kW/CFM, Storage, Controls, Dryer
Process	Retrofit Isolation – Power Loggers, Time-of-Use Loggers, Instantaneous Power Measurements, Energy Management System Trends, Local Digital Control Output, Manufacturers’ Design Performance Criteria	Horsepower (hp), kW, Temperature, Speed, Capacity, Operating Time, Interactive Loads, Production Capacity
Variable Frequency Drives	Retrofit Isolation – Power Loggers, Energy Management System Trends, Local Digital Control Output	hp, kW, Indoor/Outdoor Temperature/Humidity, Motor Efficiencies/Loads, Operating Schedules, cfm/gpm
Weatherization	Retrofit Isolation or Whole Building Approach (Billing Analysis or Building Simulation)	Area, Assembly R-value, Infiltration cfm, Indoor/Outdoor Temperatures, Heating/Cooling Efficiencies
HVAC	Retrofit Isolation – Power Loggers, Time-of-Use Loggers or Whole Building Approach (Billing Analysis or Building Simulation)	Capacity, Efficiency, Operating Schedules, Seasonal Operation
Motors	Retrofit Isolation – Power Loggers, Time-of-Use Loggers	hp, kW, Efficiencies, Operating Hours

Source:

<http://www.puc.state.nh.us/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf>

Evaluation results for kW savings

DNV-GL evaluation of NH Large C&I Program

Table 34: FCA Factor Results by End Use (Evaluation vs. Project File Savings)

End Use	In-Service Rate		kW Persistence		Connected kW Realization Rate		Summer Coincidence Factor		Winter Coincidence Factor	
	Result	Estimated Precision at 80% CI	Result	Estimated Precision at 80% CI	Result	Estimated Precision at 80% CI	Result	Estimated Precision at 80% CI	Result	Estimated Precision at 80% CI
CI Lighting All	96.4%	±2.4%	101.5%	±1.8%	97.8%	±3.0%	55.4%	±17.0%	48.6%	±21.8%
CI Lighting Interior All	97.7%	±2.8%	100.0%	±6.9%	97.7%	±7.5%	62.9%	±12.9%	50.8%	±16.3%
CI Lighting Interior LED	93.7%	±2.3%	103.3%	±19.4%	96.9%	±19.5%	82.7%	±10.1%	84.3%	±11.7%
CI Lighting Interior Non-LED	99.6%	±3.9%	98.5%	±3.0%	98.1%	±4.9%	60.2%	±8.0%	46.4%	±11.3%
CI Lighting OS	96.2%	±6.4%	98.6%	±3.3%	94.9%	±7.2%	40.3%	±11.5%	26.1%	±18.4%
CI Parking Lot Lights	100.0%	±0.0%	100.0%	±0.0%	100.0%	±0.0%	0.0%	-	100.0%	-
Heating	100.0%	±0.0%	100.0%	±0.0%	100.0%	±0.0%	0.0%	-	60.8%	±27.7%
Cooling	100.0%	±0.0%	100.0%	±0.0%	100.0%	±0.0%	44.4%	±23.0%	0.0%	-
Motors & Drives	97.8%	±1.9%	100.0%	±0.0%	97.8%	±1.9%	72.6%	±7.5%	71.8%	±4.6%
Process	73.9%	±29.2%	100.0%	±0.0%	73.9%	±29.2%	73.8%	±6.8%	57.9%	±15.3%
Custom	100.0%	±0.0%	100.0%	±0.0%	100.0%	±0.0%	5.9%	±79.1%	27.3%	±17.5%

Source: <http://www.puc.state.nh.us/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf>.

Note: Realization rates in this table equal in-service rates X kW persistence. We applied the realization rates from this table to the B/C model. However, since savings in the B/C model are multiplied by both the in-service rates and realization rates, we kept in-service rates at 100% in order to avoid double-penalizing the program.

Evaluation results for kW savings

DNV-GL evaluation of NH Large C&I Program

Table 20: Coincidence Factor Results by End Use

Load Shape	Current Program Assumption	Sample Size	Weighted Evaluation Result	Precision at 80% CI
Summer Demand Coincidence Factors (Weekday, Non-Holidays, Jun-Aug, 1pm-5pm)				
CI Lighting	85%	23	60.2%*	±8.0%
CI Lighting OS	15%	14	40.3%*	±11.5%
CI Lighting LED	85%	9	82.7%	±10.1%
CI Process	100%	16	73.8%*	±6.8%
CI Cooling	34%	8	44.4%	±23.0%
CI Parking Lot Lights	0%	5	0.0%	-
CI Heating	0%	3	0.0%	-
Winter Demand Coincidence Factors (Weekday, Non-Holidays, Dec-Jan, 5pm-7pm)				
CI Lighting	48%	23	46.4%	±11.3%
CI Lighting OS	14%	14	26.1%	±18.4%
CI Lighting LED	48%	9	84.3%*	±11.7%
CI Process	100%	16	57.9%*	±15.3%
CI Cooling	0%	8	0.0%	-
CI Parking Lot Lights	80%	5	100.0%	-
CI Heating	100%	3	60.8%	27.7%

*These results fall outside of the range of our precision estimates.

Source:

<http://www.puc.state.nh.us/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf>

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"1-9-2018 follow-up to today's EMV meeting"

Coincidence Factors from Demand Lookup tab

New Hampshire LS_ID	Summer CF	Winter CF	
CI Cooling	44.4%	0.0%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Generic Large	63.2%	46.7%	
CI Generic Small	63.2%	46.7%	
CI Heating	0.0%	27.7%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Lighting	60.2%	46.4%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Lighting LED	82.7%	84.3%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Lighting OS	40.3%	26.1%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Other	47.6%	42.8%	
CI Parking Lot Lights	0.0%	100.0%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>
CI Process	73.8%	57.9%	<i><--From New Hampshire Large C&I evaluation, DNV-GL, Sept 2015</i>