CT X1931 PSD New Measures Kickoff

Compressed Air Systems
Advanced Commercial Thermostats
Advanced Lighting Controls

Kathleen Sturtevant, Senior Engineer
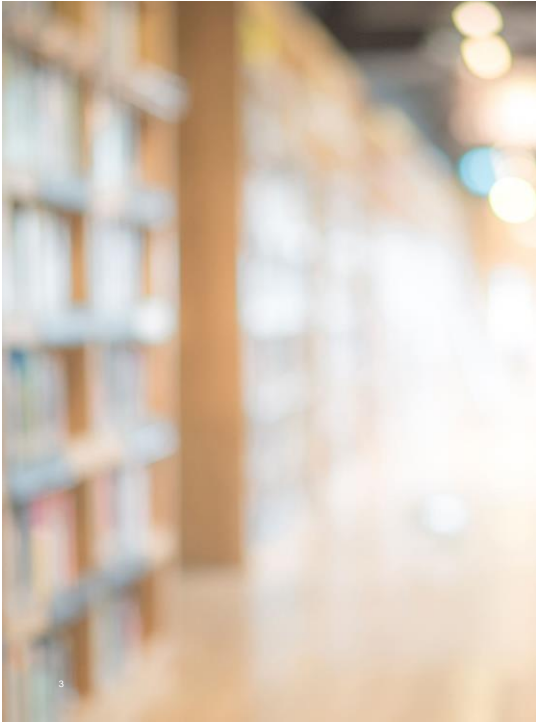
Agenda

❑ Objective Overview

❑ X1931-8 Compressed Air Systems

❑ X1931-3 Advanced Commercial Thermostats

❑ X1931-4 Advanced Lighting Controls

❑ Schedule Overview

Objective Overview

Create entries for the 2022 PSD for the following:

- C&I Compressed Air system measures, supported by secondary research

- C&I and Small Business Advanced Thermostat measure(s), supported by secondary and primary* research

- Residential and C&I Advanced Lighting Controls measures, supported by secondary and primary* research

* Primary research to be extended beyond 2022 PSD timeline

X1931-8 Compressed Air Systems

www.dnv.com

4   DNV ©

Objectives and Deliverables

- 2021 CT PSD (C&I Lost Opportunity and C&I Retrofit) sections do not include any compressed air system measures.

Objectives: Create entries for C&I compressed air system measures to be incorporated into the 2022 PSD, supported by secondary research

- Measures and variables to investigate based on preliminary discussions*:

Measures
- High Efficiency (VFD) Compressors
- Refrigerated Air Dryers
- Engineered Air Nozzles
- Zero Loss Condensate Drains

Variables
- Annual Electric Energy Savings
- Summer Peak Coincident Demand Savings
  - Per ISO-NE's definition for a Seasonal Peak Demand Resource
- Coincidence Factor
- Effective Useful Life / Measure Life
- NTG
- Limitations on Applicability for Deemed Savings

DNV ©

*The measures and variables are subject to change based on study findings

DNV

Identified Sources – Literature Review

- IL, MA, Mid-Atlantic, NH, NY, RI, WI TRMs, and others

- Department of Energy, Improving Compressed Air System Performance, 3rd Edition

- NMR Group Inc, Massachusetts Sponsors' Commercial and Industrial Free-ridership and Spillover Study, August 2018

- DNV GL, Impact Evaluation of Prescriptive Chiller and Compressed Air Installations, October 2015

- ERS, Measure Life Study, November 2005

- *Others*

DNV ©

DNV

Detailed Tasks

- Task 1: Secondary Research*
  - Literature Review (Analysis/Vetting)
    - Previous studies
    - TRMs
- Task 2: Reporting and Presentation
  - Draft and final write-up for C&I compressed air system measures for 2022 PSD
  - Presentation of results

Tasks 1 and 2 will be completed for 2022 PSD submission

*No data requests for Phase 1 research

Budget

Task / Study	Compressed Air Systems
Secondary Research	$3,000
Draft and Final Measures for 2022 PSD	$4,000
Primary Research	$0
Reporting and Presentation	$0
Total	**$7,000**

X1931-3 Advanced Commercial Thermostats

www.dnv.com

9   DNV ©

DNV

Objectives and Deliverables

- 2021 CT PSD
  - C&I Lost Opportunity: Does not include thermostat measures
  - C&I Retrofit: Includes a programmable (setback) thermostat measure
  - Residential: Includes a WiFi thermostat measure
  - *Smart thermostat measures are not incorporated in the current PSD.*

__Objectives:__ Develop a commercial (and small business) advanced thermostat measure(s) to be incorporated into the PSD, supported by primary and secondary research.

- Measures and variables to investigate based on preliminary discussions*:

Measures	Variables
• Smart (Learning) Thermostats	• Measure Baseline
• WiFi (Communicating) Thermostats	• Energy Savings Factor
	• Annual Electric Energy Savings
	• Annual Fuel Savings
	• Effective Useful Life / Measure Life

10   DNV ©   *The measures and variables are subject to change based on study findings*

DNV

Definition of Thermostats Included in Study

WiFi (Communicating) Thermostats

- Connected to the internet through IP network
- Controlled remotely, allowing the user to change settings from connected devices (cellphones, laptops, tablets, etc.)
- Provides alerts when temperature conditions change to allow user to update settings remotely
- **Can't do anything about settings on its own**

Smart (Learning) Thermostats

- Also connected to the internet through IP network
- Also controlled remotely, allowing the user to change settings from connected devices (cellphones, laptops, tablets, etc.)
- **Learns and adjusts settings for the user**
- Able to learn temperature preferences and establish schedules that automatically adjust settings to energy-saving temperatures when able
- **To qualify as "smart", the thermostat must be Energy Star certified or meet Energy Star Smart thermostat requirements.**

DNV

Approach

Phase 1 – Before 2022 PSD

- Literature Review

Phase 2 – After July 1

- Expert Interviews
- Primary Research, potentially:
  - Baseline survey
  - Data collection in small businesses
  - Metered/billing analysis
  - Aggregate analysis of existing data*
    - *pending available data

DNV

Preliminary Literature Review – TRMs

Region	Measure Description	Baseline	Savings Source
Mid-Atlantic TRM 2020	Smart thermostat that controls capacity up to 300,000 Btu/hr	Retrofit: Manual thermostat New Construction: Programmable thermostat	Based on regional residential evaluations performed by CLEAResult (2017)
Wisconsin TRM 2020	Smart or communicating thermostat installed in a small business	Option of manual or standard programmable thermostat	Based on regional billing analysis of a residential pilot study performed by Cadmus (2016)
Illinois TRM 2020	Installation of either a programmable or an advanced thermostat	Manual thermostat	Based on IL residential evaluations and a study of IL small commercial thermostats installations performed by Guidehouse (2020)

DNV

Identified Sources – Literature Review

- Mid-Atlantic, WI, IL, and other TRMs

- Guidehouse, Small Commercial Thermostats TRM Research, May 2020
  (Illinois, C&I, Programmable Thermostats)

- DNV, Impact Evaluation of Smart Thermostats in Residential Sector - Program Year 2018, April 2020
  (California, Residential, Smart Thermostats)

- Cadmus, Focus on Energy 2016 Evaluation Report, May 2017
  (Wisconsin, Residential, Smart Thermostats)

- Navigant, MEMD Calibration Research – Commercial and Industrial Programmable Thermostats, June 2015
  (Michigan, C&I, Programmable Thermostats)

- DNV, Nest Learning Thermostats: A good fit for commercial buildings?, Jan 2014
  (Michigan, C&I, Smart Thermostats)

- *Others*

DNV

Detailed Tasks – Phase 1 (Before 2022 PSD)

Task 1: Secondary Research*

- Literature Review (Analysis/Vetting)
  - Previous studies
  - TRMs

Task 2: Develop draft and final measure(s) for 2022 PSD

- C&I and Small Business Advanced Thermostat measure(s), likely developed based on residential data (or commercial data if available)

*No data requests for Phase 1 research

Detailed Tasks – Phase 2 (After July 1)

Task 3: Primary Research

- Primary research methods will be decided based on Phase 1, possibilities include:
  - Expert interviews
  - Conduct survey of baseline conditions in small business
  - Potential data collection and/or billing analysis in a sample of small business
  - Data review/analysis of existing and new data, based on available data

Task 4: Analysis

- Quantification: convert qualitative findings into quantitative data points where possible
- Triangulation: use results of primary and secondary research to create new entries in the PSD

Task 5: Reporting and Presentation

- Draft and final write-up for C&I and Small Business Advanced Thermostat measure(s)
- Draft and final report of research results
- Presentation of results

PSD measure entries may be updated between Phase 1 and 2 based on Phase 2 findings.

Budget

Task / Study	Advanced Commercial Thermostats
Secondary Research	$4,000
Draft and Final Measures for 2022 PSD	$5,000
Primary Research	$19,000
Reporting and Presentation	$2,000
Total	**$30,000**

X1931-4 Advanced Lighting Controls (Residential and Commercial)

www.dnv.com

2021 CT PSD – Lighting Controls

- C&I Lost Opportunity and Retrofit Lighting
  - Savings methodology offered for occupancy sensors (OS) as part of standard lighting measure.
  - Energy savings calculated using 0.3 as the average hour reduction due to OS.
  - Demand savings calculated with OS CFs.
  - *Lost Opportunity:* Savings for buildings over 5,000 ft^2 if they have OS beyond code-required scheduled lighting controls (per IECC 2018)
  - *Retrofit:* Notes additional savings may be claimed if fixtures have multiple controls (daylighting, personal tuning, or institutional tuning) and/or integrated controls

- Residential Lighting
  - Measure does not include information on lighting controls

Lighting Peak Demand Coincidence Factors (CFs)

Facility Type	Lighting		Occupancy Sensors	
	Summer	Winter	Summer	Winter
Grocery	90.4% (d,1)	85.6% (d,2)	14.7% (d,3)	13.3% (d,4)
Manufacturing	83% (d,1)	66.5% (d,2)	19.8% (d,3)	17.2% (d,4)
Medical (hospital)	82.5% (d,1)	69.6% (d,2)	23.9% (d,3)	22.1% (d,4)
Multifamily Common Area	17.0% (k)	100.0% (k)	18.0% (m)	12.0% (m)
Large Office	70.2% (d,1)	53.9% (d,2)	27.4% (d,3)	29.6% (d,4)
Small Office	76.8% (d,1)	44.1% (d,2)	27.4% (d,3)	29.6% (d,4)
Other	86.9% (d,1)	76.7% (d,2)	2.4% (d,3)	6.6% (d,4)
Restaurant	77.5% (d,1)	77.0% (d,2)	14.7% (d,3)	13.3% (d,4)
Retail	98.4% (d,1)	85.6% (d,2)	14.7% (d,3)	13.3% (d,4)
University/College	36.8% (d,1)	46.0% (d,2)	28.3% (d,3)	23.1% (d,4)
Warehouse	89.3% (d,1)	72.4% (d,2)	24.6% (d,3)	18.3% (d,4)
School	59.9% (d,1)	38.8% (d,2)	20.9% (d,3)	15.9% (d,4)
Parking Lot/Street Lighting	1.5% (g)	87.3% (d,2)	N/A	N/A
Automotive	68.3% (d,1)	36.9% (d,2)	N/A	N/A
Hotel/Motel	40.6% (d,1)	37.5% (d,2)	N/A	N/A
Industrial	83.0% (d,1)	66.5% (d,2)	N/A	N/A
Religious Building/ Convention Center	17.0% (d,1)	9.2% (d,2)	N/A	N/A

DNV

Objectives and Deliverables

Objectives: Create entries for new residential and commercial Advanced Lighting Controls measures to be incorporated into the PSD, supported by primary and secondary research

- Possible technologies and variables to investigate*:

Lighting Control Technologies
- Networked Lighting Control
- Integrated Lighting Control
- Occupancy Sensors
- Daylight Dimming
- Luminaire Level Lighting Controls (LLC) & High-End Trim
- Advanced Lighting Design
- Institutional Tuning
- Demand Responsive Control
- Photocell
- Bi-Level Controls
- Vacancy Sensors

Variables
- Annual Electric Energy Savings
- Summer Peak Coincident Demand Savings*
  - *Per ISO-NE's definition for a Seasonal Peak Demand Resource
- Annual Fuel Energy Savings
- Coincidence Factor
- Effective Useful Life / Measure Life
- NTG

*These technologies and variables are subject to change based on study findings

DNV

Approach

Phase 1 – Before 2022 PSD

- Literature review
- PA interviews (2)
- Expert interviews (6)

Phase 2 – After July 1

- Market actor interviews (4)
- Aggregate analysis of existing data*

  *pending available data

Detailed Tasks – Phase 1 (Before 2022 PSD)

Task 1: Secondary Research*

- Literature Review (Analysis/Vetting)
  - Previous studies
  - TRMs
- PA Interviews
  - Interviews with PA implementation staff (2)
- Expert Interviews
  - Interviews with designers, installers, manufacturers, suppliers, or other industry contacts sourced from the implementation staff and/or tracking data (6)

Task 2: Develop draft and final measures for 2022 PSD

- Residential ALC measure(s)
- Commercial ALC measure(s)

  *No data requests for Phase 1 research

Detailed Tasks – Phase 2 (After July 1)

Task 3: Primary Research
- Market Actor Interviews
  - Interviews with market actors (4) to identify available data and provide context for the current market
- Empirical Data Review / Analysis
  - Re-processing existing data (based on available data)

Task 4: Analysis
- Quantification: convert qualitative findings into quantitative data points where possible
- Triangulation: use results of secondary research, PA interviews, expert interviews, and primary research to create new entries in the PSD

Task 5: Reporting and Presentation
- Draft and final write-up for commercial and residential PSD ALC measures
- Draft and final report of research results
- Presentation of results

PSD measure entries may be updated between Phase 1 and 2 based on Phase 2 findings.

DNV ©

Identified Sources

Literature Review	PA Interviews (2)
- MA, RI, NH, NY, WI, IL, Mid-Atlantic TRMs, and others - DLC and NEEA, "Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC", September 2020. - PG&E Advanced Lighting Controls System Tool Trial Evaluation, July 2019. - PNW National Laboratory, "Evaluation of ALC Systems in a Working Office Environment", November 2018. - "Lighting Controls in Commercial Buildings." Luekos Vol. 8, No. 3, January 2012. - *Others*	- Implementation staff (2) **Expert Interviews (6)** - Erik Page *(Erik Page & Associates, Inc.)* - Gabe Arnold *(PNW National Laboratory)* - Yao-Jung Wen, Emily Kehmeier, Teddy Kisch, Andrew Springfield, Brittany Luntz, Mark Frey *(Energy Solutions)* – *DLC 2020 study authors* - *Others*
Empirical Data Studies	**Market Actor Interviews (4)**
- CT EO study - CT Upstream Lighting Study - MA Upstream Lighting study - MA C&I Impact Evaluation - *Pursuing data for 2020 DLC Study listed above* - *Others*	- Lutron - Leviton - Daintree - Integrated / networked controls provider TBD - *Others*

DNV ©

Budget

Task / Study	Advanced Lighting Controls
Secondary Research	$13,000*
Draft and Final Measures for 2022 PSD	$7,000
Primary Research	$27,000
Reporting and Presentation	$3,000
Total	**$50,000**

*Includes PA and expert interviews

WHEN TRUST MATTERS

Schedule Overview

www.dnv.com

Schedule Overview

- *May 2021*: Study Kickoff for New Measures

- *May – June 2021*: Phase 1 Secondary Research
  - *Air Compressors:* Literature review
  - *Advanced Commercial Thermostats:* Literature review
  - *Advanced Lighting Controls:* Literature review and interviews

- **Develop New Measures for 2022 PSD**

- *July – September 2021*: Phase 2 Primary Research
  - *Advanced Commercial Thermostats:* Methods to be selected based on Phase 1
  - *Advanced Lighting Controls:* Market actor interviews, potential data processing

- ***Fall 2021*: Final PSD Write-ups, Reports, and Presentation**

DNV ©

WHEN TRUST MATTERS

Thank You

Questions?

Kathleen.Sturtevant@dnv.com
978-521-2550 x268

www.dnv.com