Welcome

Conservation Applied Research & Development (CARD) Webinar

January 21, 2021

Minnesota Codes and Standards Program Roadmap

Minnesota Codes and Standards Program Roadmap



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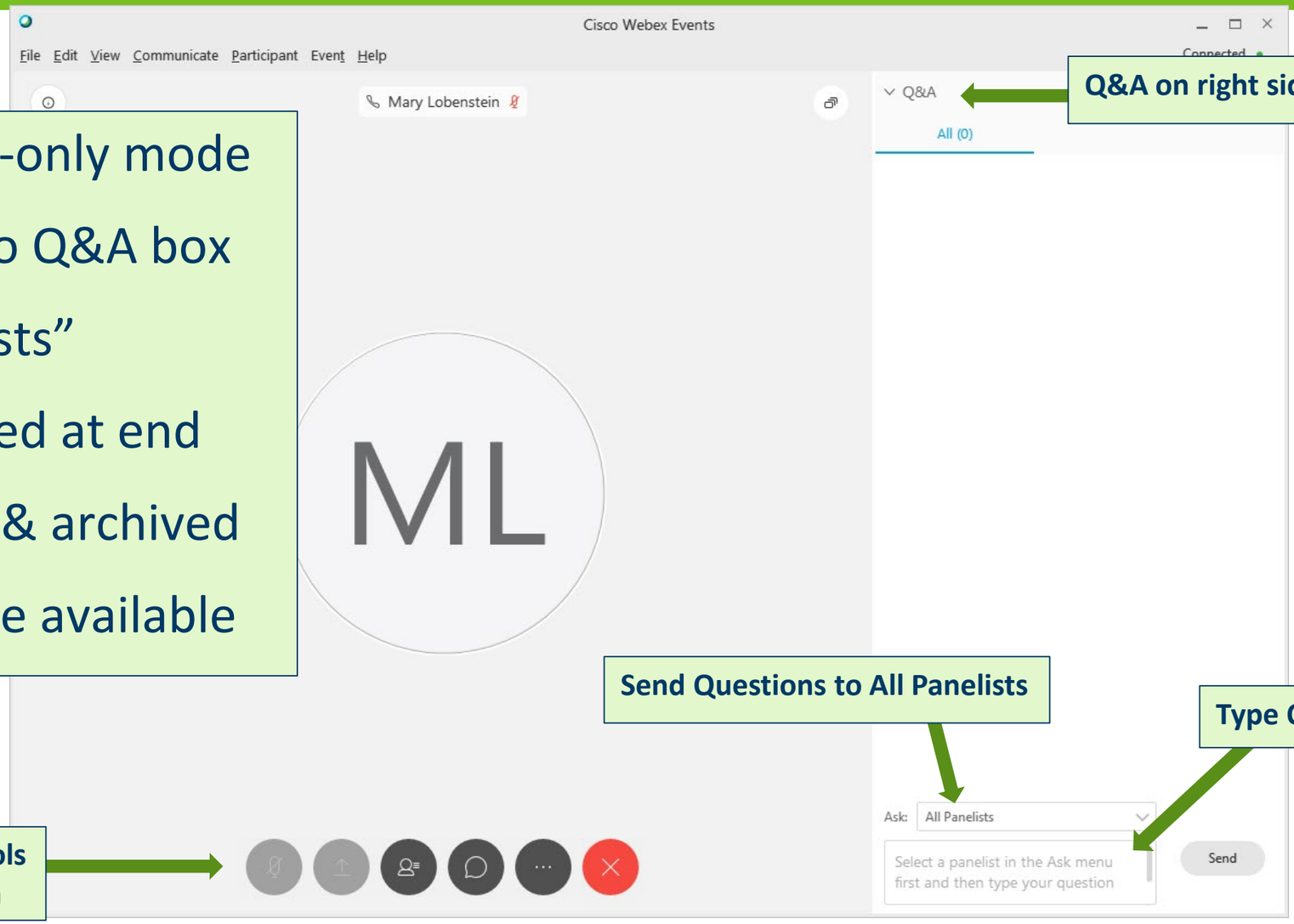
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Webinar Basics

- Attendees in listen-only mode
- Type questions into Q&A box
- Send to “All Panelists”
- Questions addressed at end
- Webinar recorded & archived
- Slide set will also be available



Q&A on right side of WebEx panel

Send Questions to All Panelists

Type Questions in Q&A box

Additional WebEx Controls at Bottom of Your Screen

Minnesota Applied Research & Development Fund

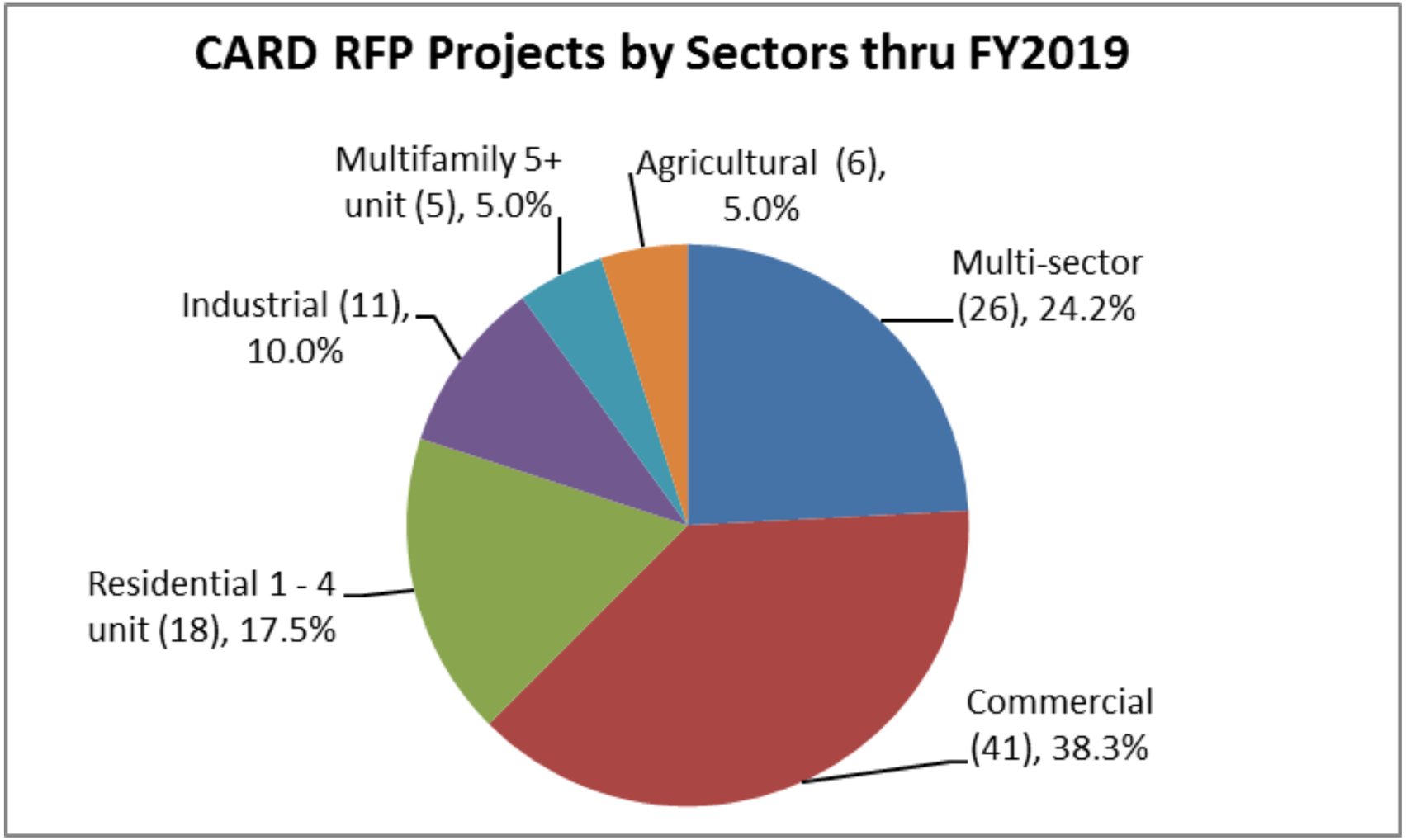
- **Purpose to help Minnesota utilities achieve 1.5% energy savings goal by:**
  - ***Identifying new technologies or strategies to maximize energy savings;***
  - ***Improving effectiveness of energy conservation programs;***
  - ***Documenting CO_2 reductions from energy conservation programs.***

Minnesota Statutes §216B.241, Subd. 1e

- **Utility may reach its energy savings goal**
  - **Directly through its Conservation Improvement Program (CIP)**
  - **Indirectly through energy codes, appliance standards, behavior, and other market transformation programs**

State Capitol Image: Courtesy Minnesota Department of Administration

CARD RFP Spending by Sector thru FY2019



RFP Summary

- 10 Funding Cycles
- 472 proposals
- 121 projects funded
- $27.4 million in research

Project Background

Project Team and Technical Advisory Group

Project Team:

2050 Partners

LHB

MEEA
Midwest Energy Efficiency Alliance

slipstream

Technical Advisory Group (TAG):*

CenterPoint Energy

Great River Energy

Minnesota Energy Resources

Minnesota Power

Otter Tail Power Company

Xcel Energy

cee
Center for Energy and Environment

CSBR
Center for Sustainable Building Research

Fresh Energy

Minneapolis
City of Lakes

*Participation in TAG does not necessarily imply affiliation or endorsement of report or its recommendations.

Project Goal

Develop an actionable Roadmap document that:

- Provides the foundation for developing a robust Minnesota Codes and Standards (C&S) program that contributes to delivering cost-effective energy savings, and

- Recommends pathways for Minnesota utilities to participate in and claim savings from C&S activities.

What is a “Codes and Standards Program”?

- This project focuses on “Codes and Standards Programs” that are run by program administrators, including utilities, within their broader energy efficiency and/or demand-side management portfolios.

- Program models vary by state and jurisdiction but often include one or more of the following activities:
  - Provide technical support for **building energy code advancement** (base codes and/or stretch codes),
  - Provide technical support for **appliance and equipment standards advancement** at the state or national level,
  - Support **compliance improvement** through training programs and other stakeholder engagement strategies,
  - Conduct **“code readiness” data collection** efforts to support future C&S rulemakings, and
  - Facilitate stakeholder **planning & coordination** between stakeholders impacted by C&S rulemakings.

Stakeholder Engagement



TAG Interviews and Feedback



Key Contact Interviews



Public Webinars*

*See project website for slides, notes, and recordings from three public webinars: https://www.mn-cs-roadmap.org

Stakeholder feedback excerpts - benefits

"C&S programs are extremely cost-effective. From a utility perspective, cost effectiveness of codes and standards is a top benefit"

"C&S program can enable utilities to be involved in capturing "one-time savings opportunities"

"C&S programs can help to reduce carbon emissions and lower consumer energy bills"

"C&S programs can bring relief to utilities looking for the 'next thing' in savings"



"C&S programs support grid flexibility and EV adoption"

"Opportunity to create important new stakeholder touchpoints"

"C&S programs can help to capture savings that are not being captured by traditional EE programs"

Stakeholder feedback excerpts – concerns

"Increasing code baselines can impact some voluntary EE programs"

"New or updated C&S could increase first costs"

"Complex"



"Uncertainty with new utility role and stakeholder interactions"

"Staffing and resource constraints"

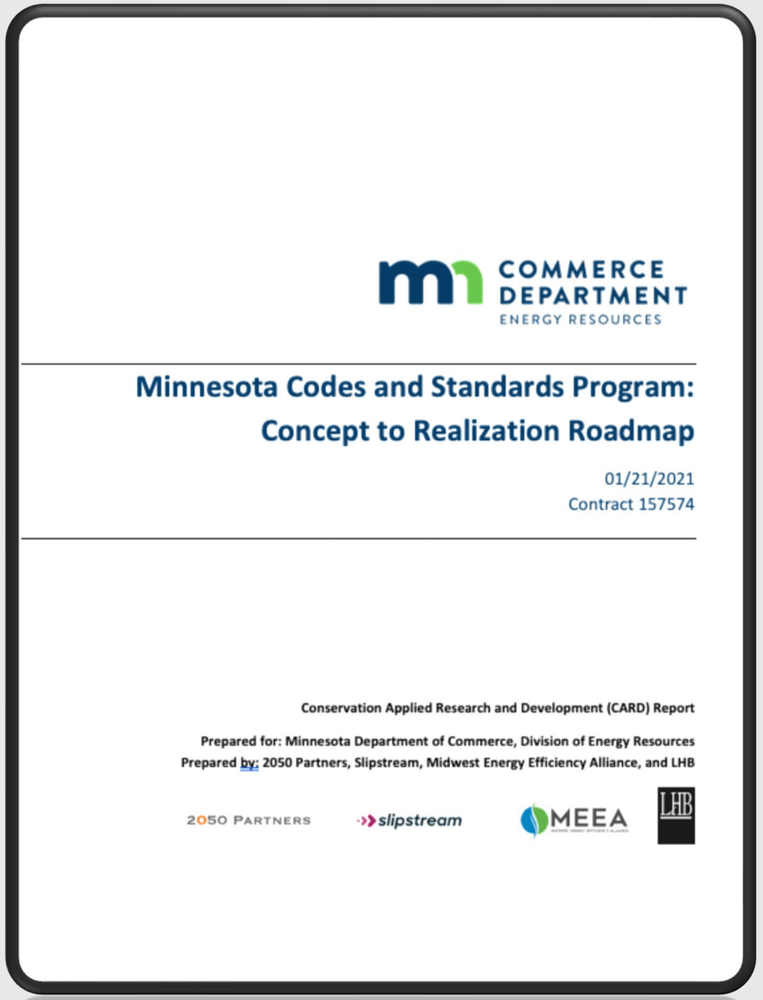
"How to ensure that the savings are real and fair?"

Report Outline and Today's Focus

- Executive Summary
- Methodology
  - Overview
  - Stakeholder Engagement
  - Minnesota Codes & Standards Program Scenario Model
- Introduction and Background
  - Project Goals and Motivation
  - Codes & Standards Primer
  - Codes & Standards in Minnesota
  - Estimating Energy Savings Potential in Minnesota
  - Codes & Standards Program Approaches
  - Examples of C&S Program Models Outside Minnesota
  - Evaluation and Attribution Models for C&S Programs
- Results
  - Introduction
  - Stakeholder Engagement and Feedback
  - **Savings Estimates for a Potential MN C&S Program**
- Conclusions and Recommendations
  - Opportunities and Challenges
  - **Recommendations**
- Appendices A-F

Useful background for those new to C&S programs

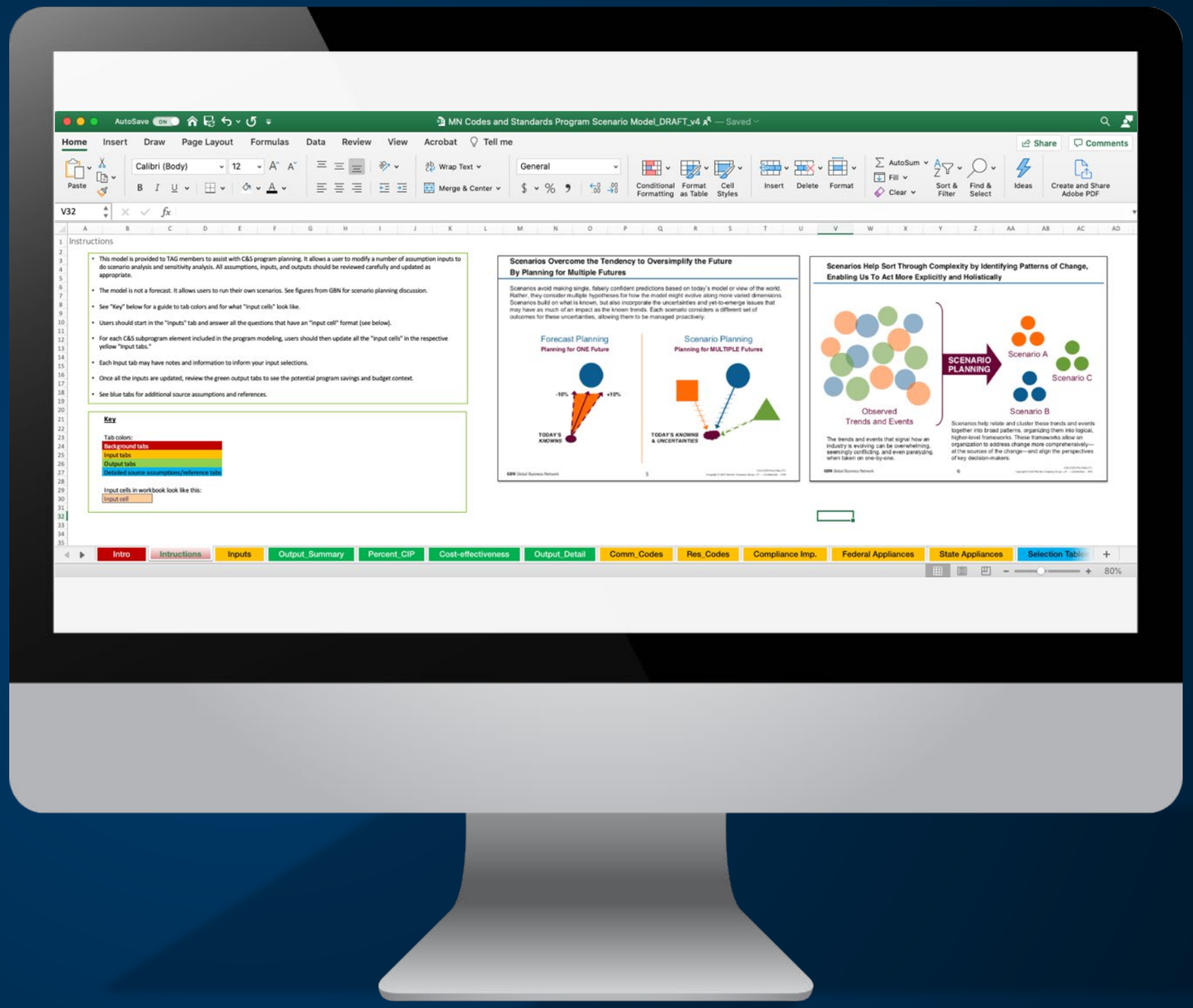
Today's Focus



Savings Analysis

Minnesota Codes and Standards Program Scenario Model

- Can run different scenarios by changing multiple input assumptions
- Final report shows one scenario for a robust program, but many future scenarios exist
- Intended to inform (but not replace) inputs for CIP planning and filings



Recent recommendations from Minnesota Department of Labor and Industry (DLI) and Minnesota Department of Commerce on future building codes

DEPARTMENT OF LABOR AND INDUSTRY

COMMERCE DEPARTMENT

"The departments recommend the current statewide commercial energy code be advanced and accelerated such that it achieves net zero by 2036."



MINNESOTA

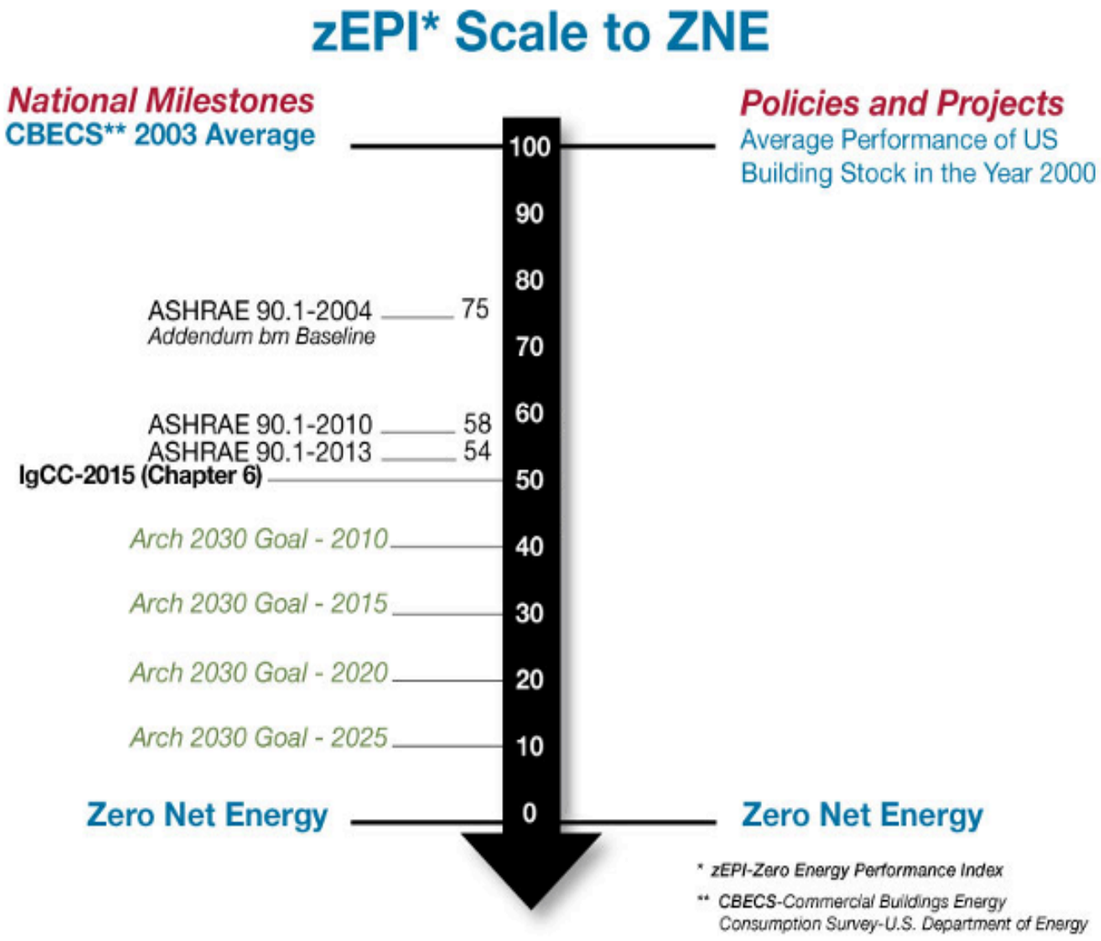
Improving building energy efficiency in commercial and multi-family construction

Recommendations from the Minnesota Department of Labor and Industry and the Minnesota Department of Commerce informed by stakeholder workgroup activities and discussions.

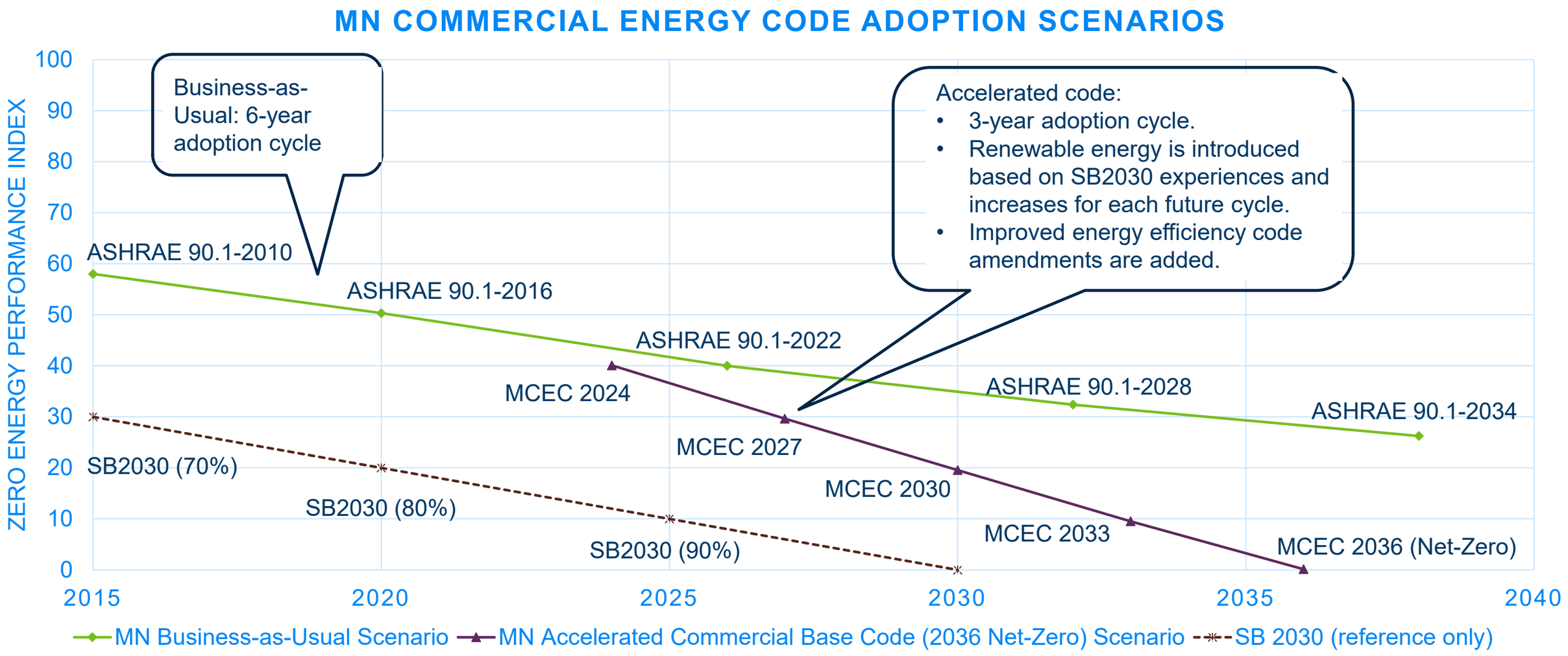
December 2020

Source: http://www.dli.mn.gov/about-department/boards-and-councils/building-efficiency-workgroup

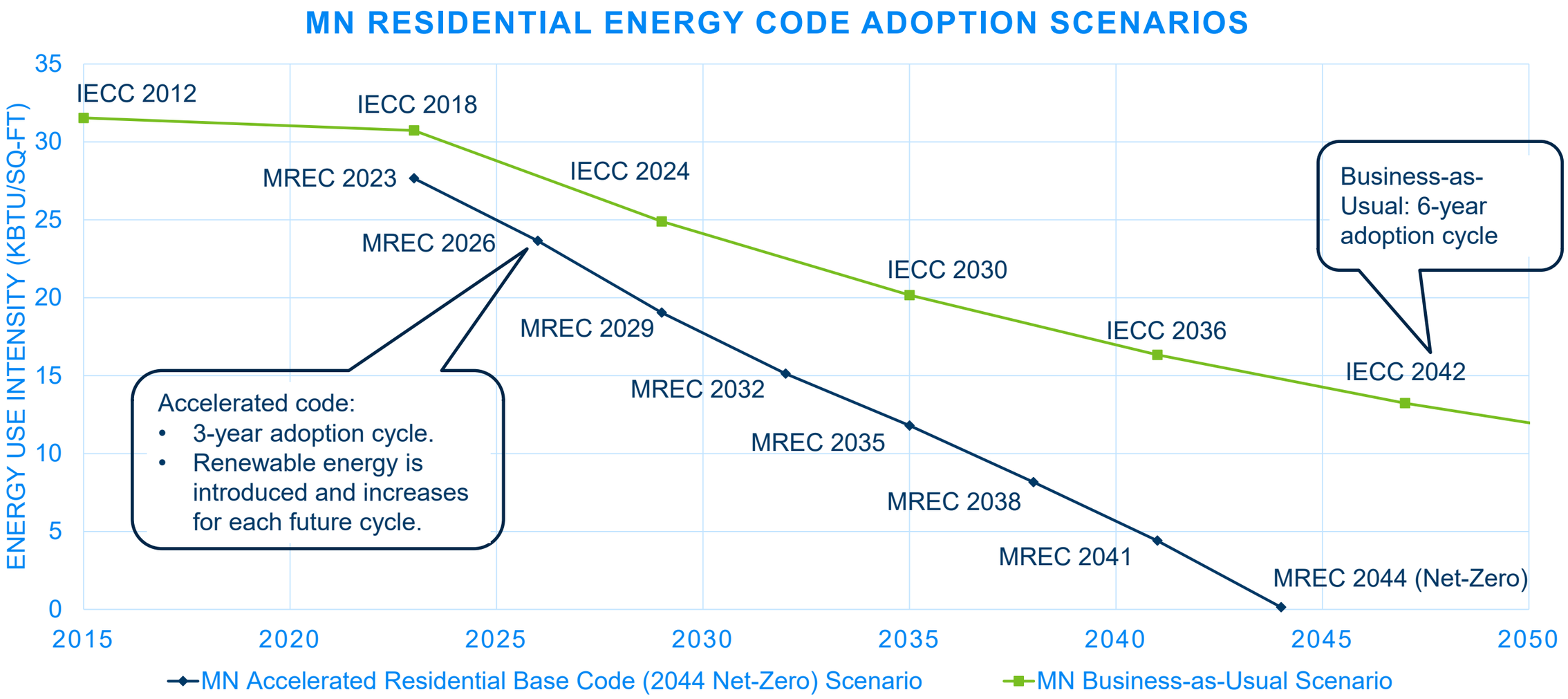
Commercial Energy Code: zEPI Scale



MN Commercial Energy Code Adoption Scenario



MN Residential Energy Code Adoption Scenario



Hypothetical “Potential Energy Savings”

Energy efficiency savings between Business-as-Usual code and Accelerated code

Commercial

- EUI difference by building type between ASHRAE 90.1-2016 and ASHRAE 90.1-2013
- Additional savings factor to account for improved energy efficiency code amendments
- New construction area and major renovation area, by building type
- New construction growth rate
- Energy code compliance rate

Residential

- EUI difference between IECC model codes
- New construction area as well as growth rate
- Energy code compliance rate

Appliance and Equipment Standards Savings Analysis



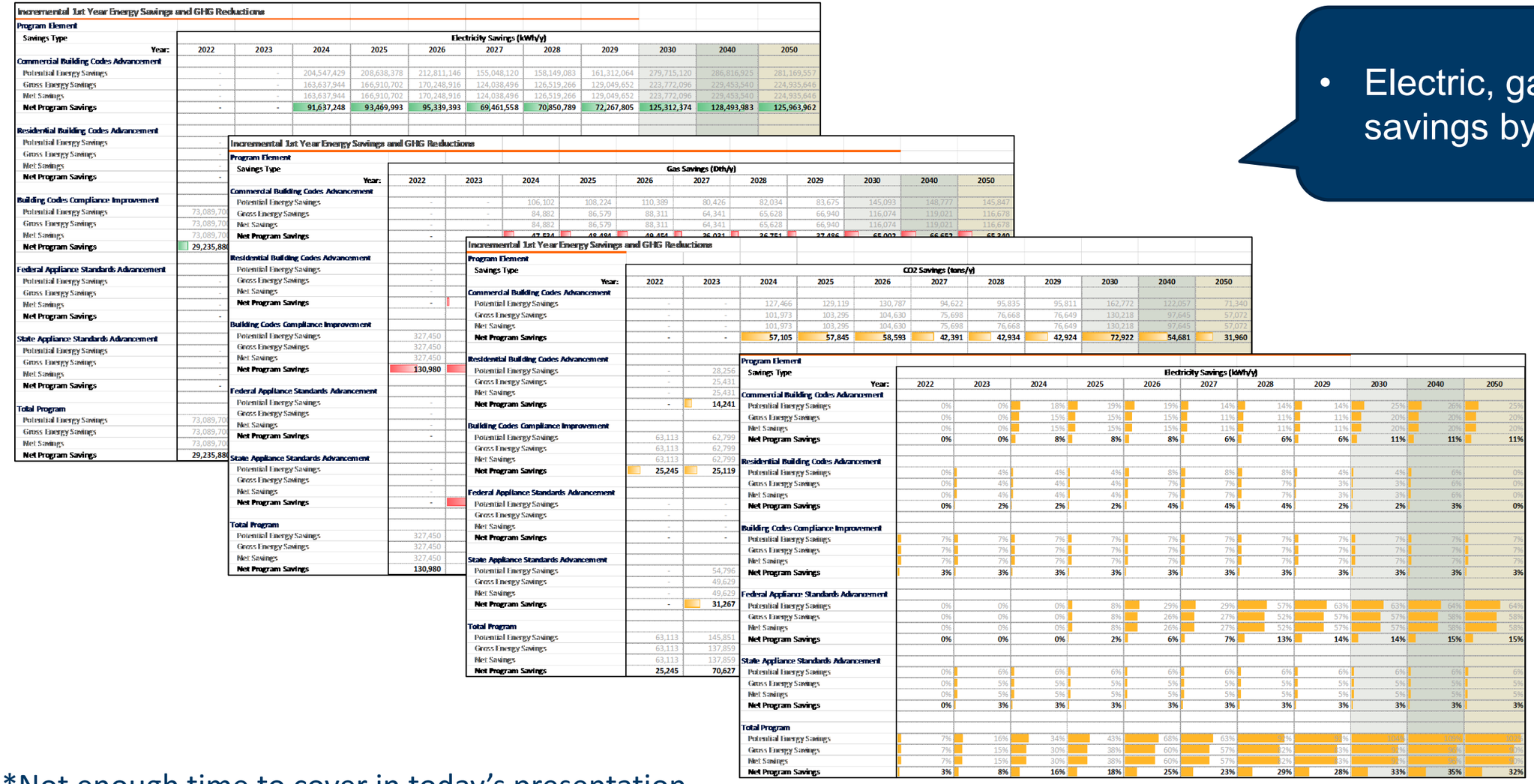
19 state standard product categories analyzed



47 federal standard product categories analyzed

Note: appliance standards savings potential is >50% of savings potential for a C&S program.

See report for detailed savings discussion*



Incremental 1st Year Energy Savings and GHG Reductions

Program Element

Savings Type: Electricity Savings (kWh/y)

Year:	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Commercial Building Codes Advancement											
Potential Energy Savings	-	-	204,547,429	208,638,378	212,811,146	155,048,120	158,149,083	161,312,064	279,715,120	286,816,925	281,169,557
Gross Energy Savings	-	-	163,637,944	166,910,702	170,248,916	124,038,496	126,519,266	129,049,652	223,772,096	229,453,540	224,935,646
Net Savings	-	-	163,637,944	166,910,702	170,248,916	124,038,496	126,519,266	129,049,652	223,772,096	229,453,540	224,935,646
Net Program Savings	-	-	91,637,248	93,469,993	95,339,393	69,461,558	70,850,789	72,267,805	125,312,374	128,493,983	125,963,962
Residential Building Codes Advancement											
Potential Energy Savings	-										
Gross Energy Savings	-										
Net Savings	-										
Net Program Savings	-										
Building Codes Compliance Improvement											
Potential Energy Savings	73,089,70										
Gross Energy Savings	73,089,70										
Net Savings	73,089,70										
Net Program Savings	29,235,88										
Federal Appliance Standards Advancement											
Potential Energy Savings	-										
Gross Energy Savings	-										
Net Savings	-										
Net Program Savings	-										
State Appliance Standards Advancement											
Potential Energy Savings	-										
Gross Energy Savings	-										
Net Savings	-										
Net Program Savings	-										
Total Program											
Potential Energy Savings	73,089,70										
Gross Energy Savings	73,089,70										
Net Savings	73,089,70										
Net Program Savings	29,235,88										

Incremental 1st Year Energy Savings and GHG Reductions

Program Element

Savings Type: Gas Savings (Dth/y)

Year:	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Commercial Building Codes Advancement											
Potential Energy Savings	-	-	106,102	108,224	110,389	80,426	82,034	83,675	145,093	148,777	145,847
Gross Energy Savings	-	-	84,882	86,579	88,311	64,341	65,628	66,940	116,074	119,021	116,678
Net Savings	-	-	84,882	86,579	88,311	64,341	65,628	66,940	116,074	119,021	116,678
Net Program Savings	-										
Residential Building Codes Advancement											
Potential Energy Savings	-										
Gross Energy Savings	-										
Net Savings	-										
Net Program Savings	-										
Building Codes Compliance Improvement											
Potential Energy Savings		327,450									
Gross Energy Savings		327,450									
Net Savings		327,450									
Net Program Savings		130,980									
Federal Appliance Standards Advancement											
Potential Energy Savings		-									
Gross Energy Savings		-									
Net Savings		-									
Net Program Savings		-									
State Appliance Standards Advancement											
Potential Energy Savings		-									
Gross Energy Savings		-									
Net Savings		-									
Net Program Savings		-									
Total Program											
Potential Energy Savings		327,450									
Gross Energy Savings		327,450									
Net Savings		327,450									
Net Program Savings		130,980									

Incremental 1st Year Energy Savings and GHG Reductions

Program Element

Savings Type: CO2 Savings (tons/y)

Year:	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Commercial Building Codes Advancement											
Potential Energy Savings	-	-	127,466	129,119	130,787	94,622	95,835	95,811	162,772	122,057	71,340
Gross Energy Savings	-	-	101,973	103,295	104,630	75,698	76,668	76,649	130,218	97,645	57,072
Net Savings	-	-	101,973	103,295	104,630	75,698	76,668	76,649	130,218	97,645	57,072
Net Program Savings	-	-	57,105	57,845	58,593	42,391	42,934	42,924	72,922	54,681	31,960
Residential Building Codes Advancement											
Potential Energy Savings		-									
Gross Energy Savings		-									
Net Savings		-									
Net Program Savings		-									
Building Codes Compliance Improvement											
Potential Energy Savings	63,113	62,799									
Gross Energy Savings	63,113	62,799									
Net Savings	63,113	62,799									
Net Program Savings	25,245	25,119									
Federal Appliance Standards Advancement											
Potential Energy Savings		-									
Gross Energy Savings		-									
Net Savings		-									
Net Program Savings		-									
State Appliance Standards Advancement											
Potential Energy Savings		54,796									
Gross Energy Savings		49,629									
Net Savings		49,629									
Net Program Savings		31,267									
Total Program											
Potential Energy Savings	63,113	145,851									
Gross Energy Savings	63,113	137,859									
Net Savings	63,113	137,859									
Net Program Savings	25,245	70,627									

Program Element

Savings Type: Electricity Savings (kWh/y)

Year:	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Commercial Building Codes Advancement											
Potential Energy Savings	0%	0%	18%	19%	19%	14%	14%	14%	25%	26%	25%
Gross Energy Savings	0%	0%	15%	15%	15%	11%	11%	11%	20%	20%	20%
Net Savings	0%	0%	15%	15%	15%	11%	11%	11%	20%	20%	20%
Net Program Savings	0%	0%	8%	8%	8%	6%	6%	6%	11%	11%	11%
Residential Building Codes Advancement											
Potential Energy Savings	0%	4%	4%	4%	8%	8%	8%	4%	4%	6%	0%
Gross Energy Savings	0%	4%	4%	4%	7%	7%	7%	3%	3%	6%	0%
Net Savings	0%	4%	4%	4%	7%	7%	7%	3%	3%	6%	0%
Net Program Savings	0%	2%	2%	2%	4%	4%	4%	2%	2%	3%	0%
Building Codes Compliance Improvement											
Potential Energy Savings	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Gross Energy Savings	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Net Savings	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Net Program Savings	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Federal Appliance Standards Advancement											
Potential Energy Savings	0%	0%	0%	8%	29%	29%	57%	63%	63%	64%	64%
Gross Energy Savings	0%	0%	0%	8%	26%	27%	52%	57%	57%	58%	58%
Net Savings	0%	0%	0%	8%	26%	27%	52%	57%	57%	58%	58%
Net Program Savings	0%	0%	0%	2%	6%	7%	13%	14%	14%	15%	15%
State Appliance Standards Advancement											
Potential Energy Savings	0%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Gross Energy Savings	0%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Net Savings	0%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Net Program Savings	0%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Total Program											
Potential Energy Savings	7%	16%	34%	43%	68%	63%	98%	98%	104%	103%	103%
Gross Energy Savings	7%	15%	30%	38%	60%	57%	92%	93%	97%	96%	96%
Net Savings	7%	15%	30%	38%	60%	57%	92%	93%	97%	96%	96%
Net Program Savings	3%	8%	16%	18%	25%	23%	29%	28%	33%	35%	32%

- Electric, gas, and carbon savings by year thru 2050

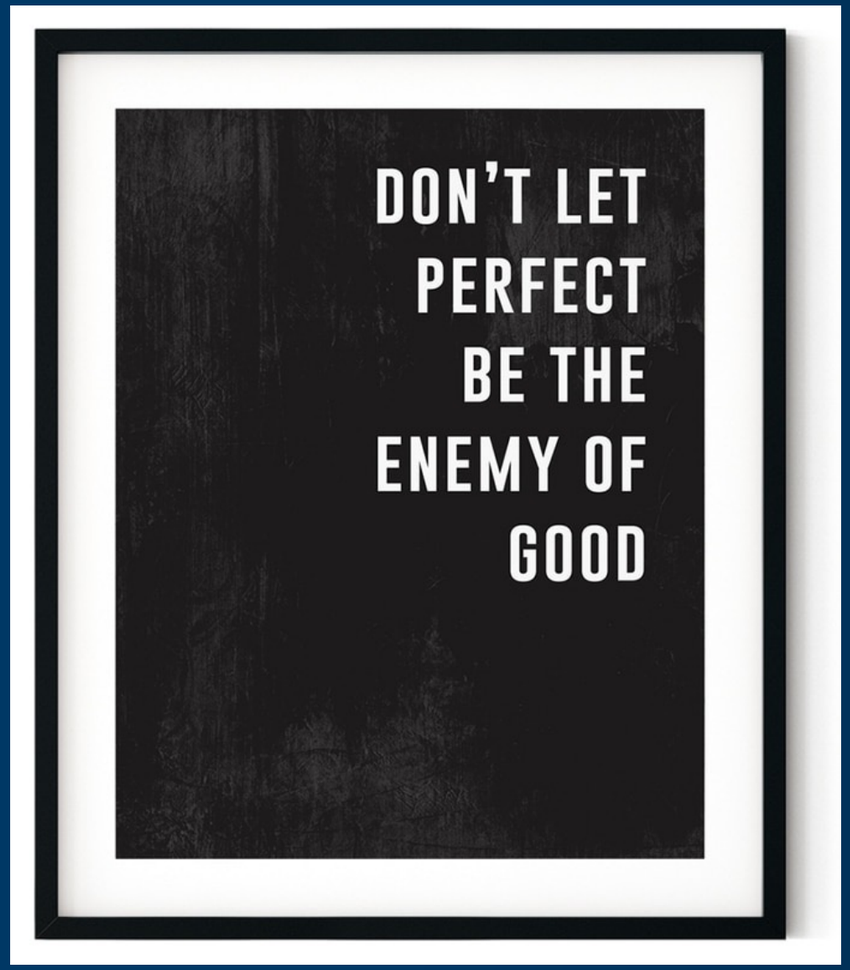
*Not enough time to cover in today's presentation.

Recommendations (Partial)

A successful program can start small and build overtime

- The most successful programs have started relatively small and expanded after building up experience.





Program Launch and Administration Recommendations

Aim for statewide coordination

Establish a Minnesota Energy Codes and Standards Utility Working Group

Minnesota's largest utilities jointly develop and launch a statewide C&S program

One or two utilities take lead role in program initiation, CIP program filings, and utility coordination

Recommend that Utilities Working Group meets 6-12 times a year and coordinate on:

- CIP Plan development
- Co-funding arrangements
- Subprogram activity review and prioritization
- Stakeholder engagement coordination
- Savings estimates and program evaluation
- Contractor review and selection.

Ongoing study topics

MN C&S Utilities Workgroup and other stakeholders should continue to assess impacts of the following areas on a potential C&S program:

- Renewable energy requirements as building code approaches "net zero”
- Beneficial electrification policies*
- Savings in non-enforcement jurisdictions
- Market Transformation programs**

*Study based savings analysis based on current CIP rules and did not include any fuel substitution.
**Discussions on potential market transformation program models in Minnesota are underway. C&S is a core element of a market transformation program.

Recommendations for Program Savings Methodology and Allocation

- **Utilize the C&S Program General Evaluation and Attribution Model framework as a basis for estimating and reporting CIP savings.**

- **Contract with an independent EM&V firm with C&S program evaluation expertise to guide the savings evaluation and reporting process.**

- **Allocate savings to participating utilities based on the percentage of electricity or gas they provide to the Minnesota customers—as long as they fund the MN C&S program in a roughly equivalent proportion.**

- **The next update to Minnesota's Energy Efficiency Potential Study include savings potential from MN C&S program activities.**

C&S Program Staffing and Budget*

Lead Utility/Utilities	Support Utilities	Implementation Contractors	EM&V Contractors
• 0.75 to 1.5 initial FTE • Potentially grow to 2 to 4 FTE over time • Ideally build staff overlap with new construction programs	• ≥0.25 FTE • Attend C&S Utility Working Group and to support other administrative activities	• 2 to 4 initial FTE • Potentially grow to 4 to 10+ FTE over time	• 0.5 to 1 initial FTE • Potentially grow to 1 to 2 FTE over time

"A strong, broad set of consulting teams is important. Important to develop dedicated, stable staff to avoid turnover in projects that often take 5 years or more. In-house, you need staff with a technical and policy background who can provide the operational support and contract management."

-Utility C&S Program Manager

*Can vary significantly based on subprogram activities and utility priorities.

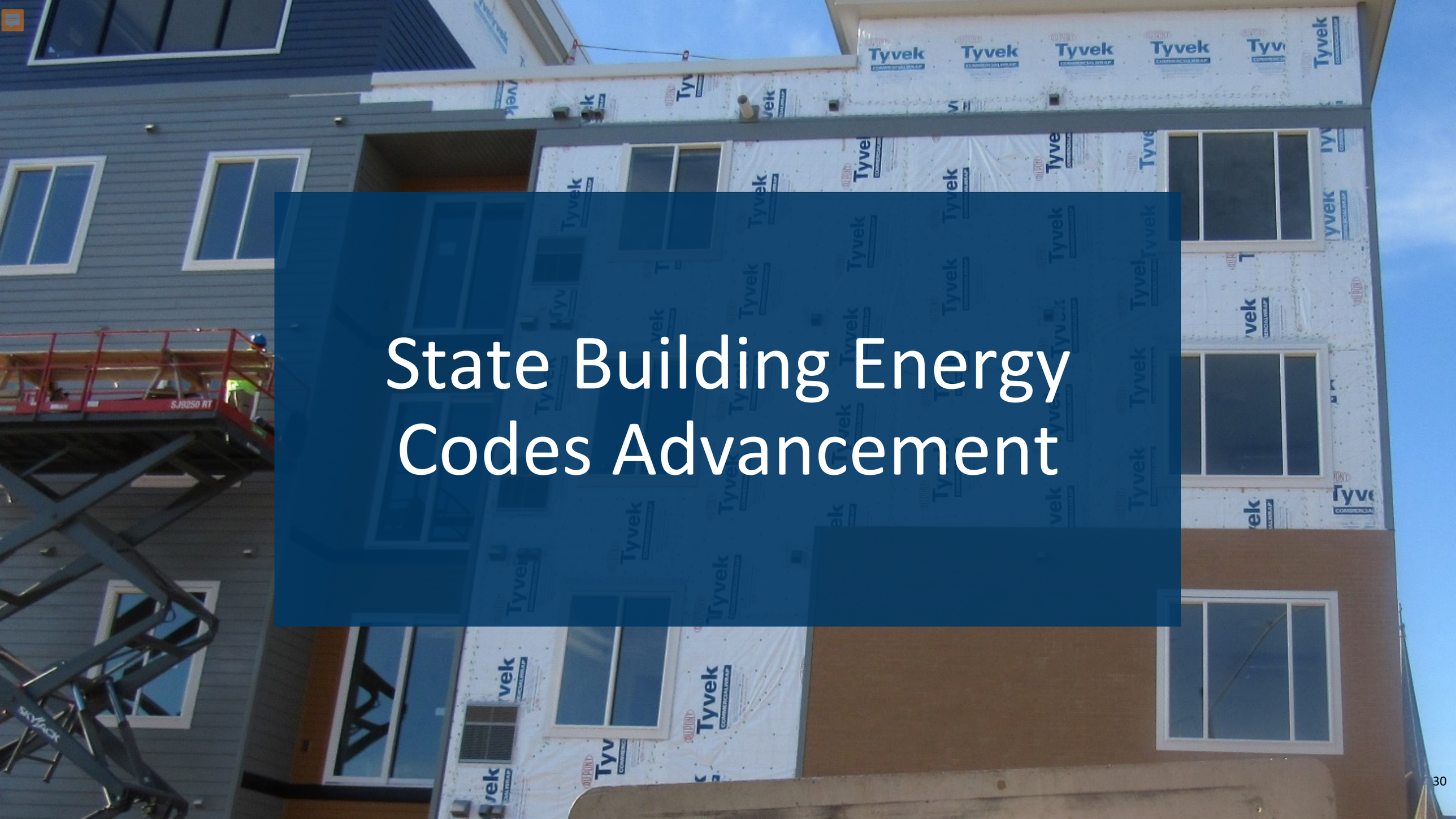
C&S “Subprogram” Recommendations

- We recommend organizing a MN C&S Program into subprograms.

- The MN C&S Utility Working Group should determine which C&S subprograms to prioritize at program launch and which ones to develop in the future.

- The report provides recommendations for each of the following subprograms:
  1. **State Building Energy Code Advancement***
  2. State Appliance Standards Advancement
  3. **National Codes and Standards Advancement***
  4. **Building Codes Compliance Improvement***
  5. Local Engagement
  6. Code Readiness
  7. Planning and Coordination.

*Partially discussed today. See report for full recommendations for all subprograms



State Building Energy Codes Advancement

State Building Energy Code Advancement: Subprogram Recommendations

- **Orient subprogram towards supporting recent DLI/Commerce Building Efficiency Workgroup recommendations.**
- **Coordinate with DLI staff leading the energy code updates to determine what data and activities would be most helpful to support the net-zero by 2036 goal:**

Cost analysis	**Market capacity analysis**	**Education and training**
Stakeholder engagement	**Pilot or test new and emerging building models**	**Learn more about needs of other building segments**

Source: http://www.dli.mn.gov/about-department/boards-and-councils/building-efficiency-workgroup

State Building Energy Code Advancement: Subprogram Recommendations, Con't

- **Seek representation on an Energy Code Technical Advisory Group** (TAG) which is a part of DLI's Construction Code Advisory Council.
- **Determine priority areas** for which the building energy code advancement subprogram should support.
- **Conduct incentive program impact assessments**
- **Develop Codes and Standards Enhancement (CASE) reports**



Building Codes Compliance Improvement

Opportunities for Reaching Full Potential of the Energy Code

Support for…



Code officials in the plan review and inspection process

Design teams to improve understanding of code elements and documentation practices.

Controls documentation and commissioning (commercial)

Mechanical ventilation systems (residential)

Reaching Full Potential: Support for Code Officials

Support for Code Officials

Opportunities

- Educate design teams
- Catch non-compliant code elements during plan review
- Verify commonly non-compliant elements through on-site inspections

Recommendation

Provide a menu of support options for code officials:

- Circuit rider
- Third-party reviewers

Examples: Minnesota's 2018 Commercial Energy Code Compliance Enhancement Pilot, Florida, Massachusetts, Dallas, District of Columbia

Support for Design Teams

Opportunities

Minimize code elements that are either:

- Not specified in the design documents
- Specified, but not meeting energy code requirements

Recommendation

Provide a shared set of resources, including:

- A sample agenda an early design kick-off meeting
- Phase-specific checklists
  - Design phase
  - Construction phase
  - Testing and commissioning phase

Reaching Full Potential: Support for Controls Documentation and Commissioning

Support for Controls Documentation and Commissioning

Opportunities

- Improve documentation of controls and commissioning requirements
- Increase number of projects that are commissioned

Recommendations

- Educate owners on value of commissioning
- Provide commissioning guidance and resources
- Improve enforcement of controls and commissioning

Examples: Washington State, California, and Austin, Texas

Reaching Full Potential: Support for Mechanical Ventilation Systems

Support for Mechanical Ventilation Systems

Opportunities

- Research needed to understand installation and operation of balanced mechanical ventilations systems in new homes

Recommendations

- Support trainings on these systems
- Support incentives for systems that do not require concurrent air handler operations
- Support incentives for HRVs and ERVs with higher heat-recovery efficiency ratings

Opportunities for Reaching Full Potential of the Energy Code

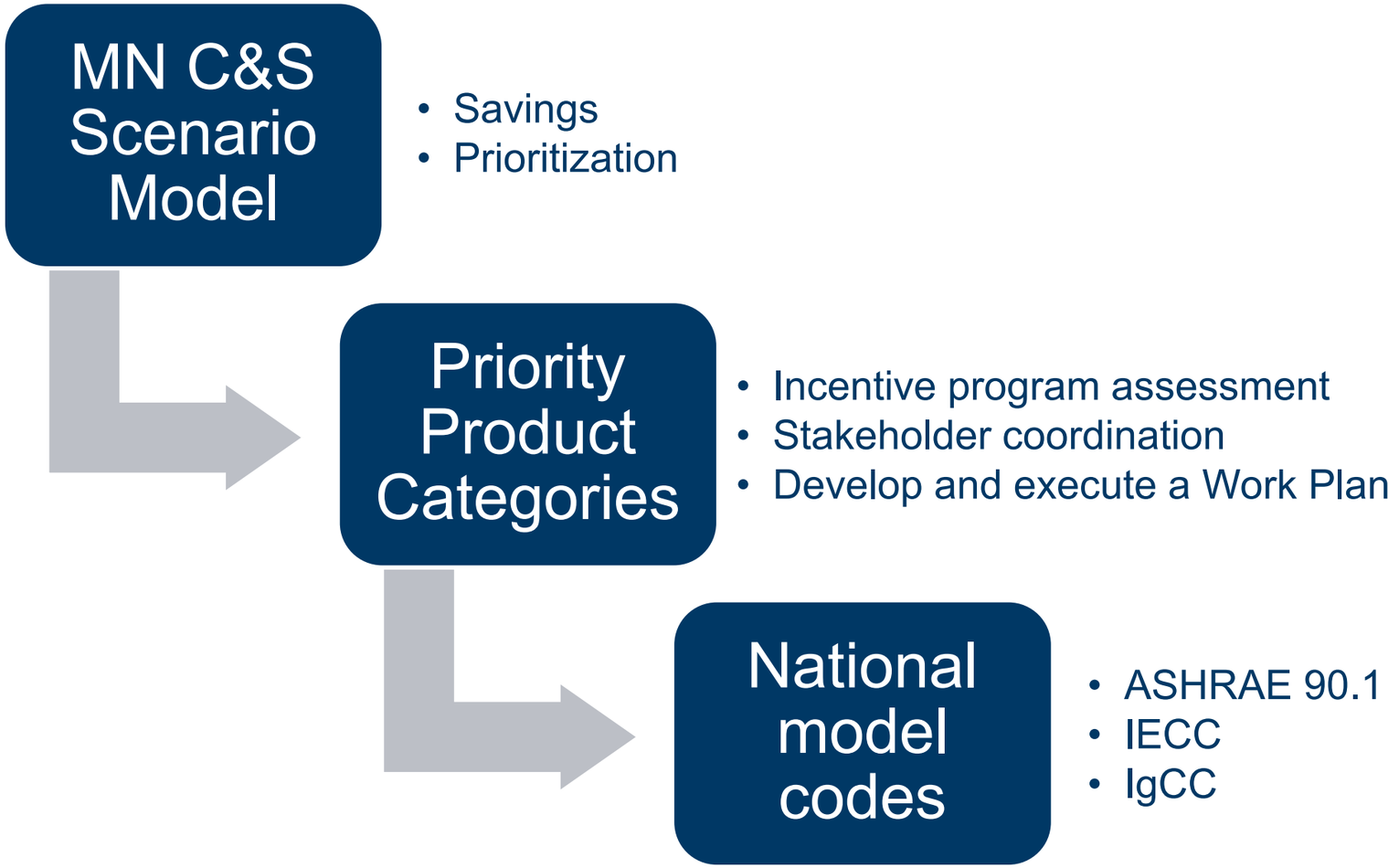
Leverage existing new construction programs:
Energy Design Assistance (EDA)





National Codes and Standards Advancement

National Codes and Standards Advancement Subprogram Recommendations



We hope you check out the final report for additional details…



Launching a successful program requires a long-term vision and commitment

- Savings lag program activities, sometimes by years
- Once savings do occur, they are typically long-term, persistent, reliable, and the most cost-effective in the portfolio



Questions?

COMMERCE DEPARTMENT
ENERGY RESOURCES

Minnesota Codes and Standards Program Roadmap



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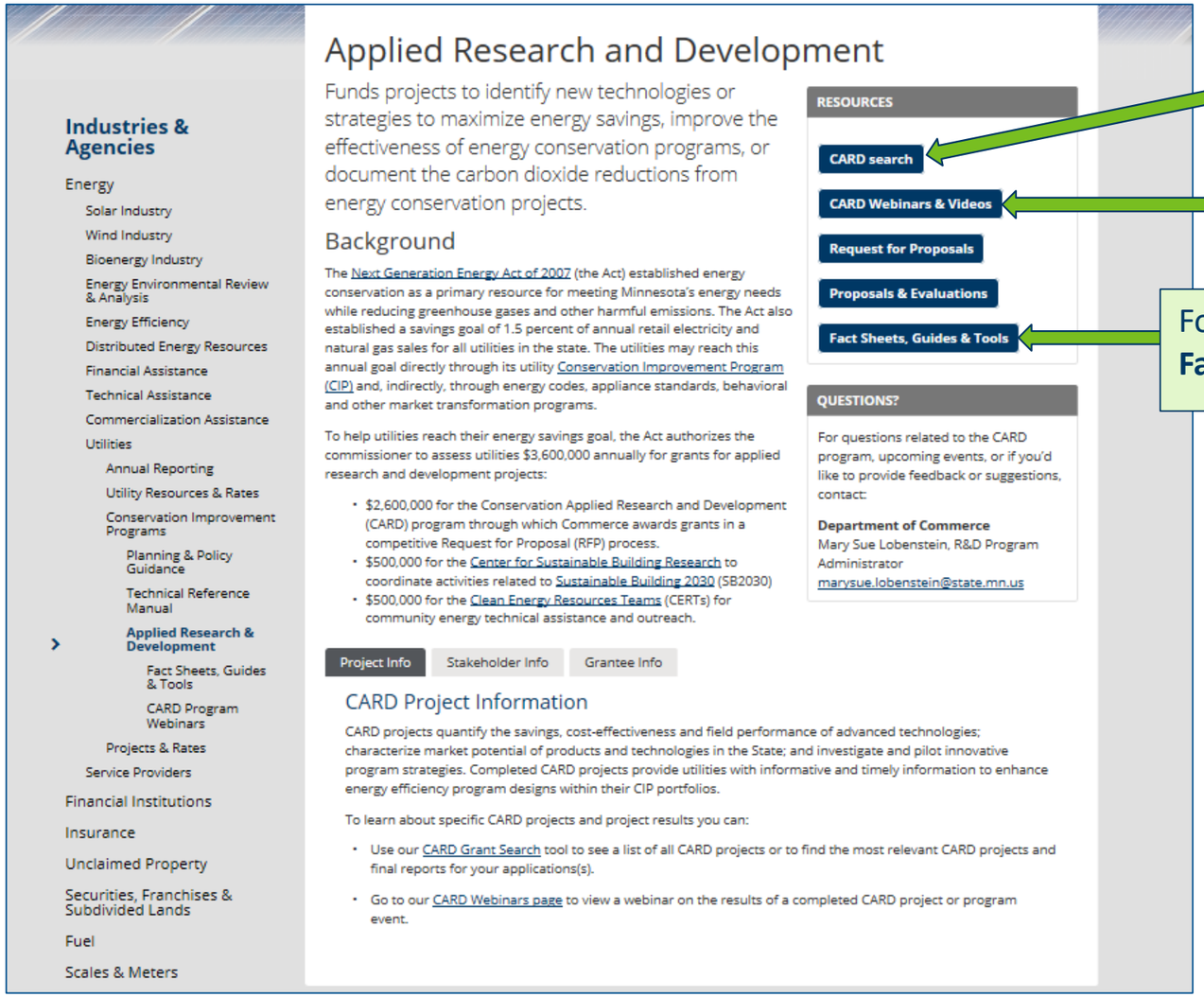
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Send us your questions using the Webex Q&A box

CARD Project Resources



For **Reports** use **CARD Search** Quick Link

For **Webinars** use **CARD Webinars & Videos** Quick Link

For **Other** research documents use **CARD Fact Sheets, Guidelines & Tools** Quick Link

Webinar Recording & Final Report
available in couple months

R&D Web Page (https://mn.gov/commerce/industries/energy/utilities/cip/applied-research-development/)

Thanks for Participating!

Upcoming CARD Webinars:

- **No upcoming webinars currently scheduled**

Commerce Division of Energy Resources e-mail list sign-up

If you have questions or feedback on the CARD program, contact:

Mary Sue Lobenstein
R&D Program Administrator
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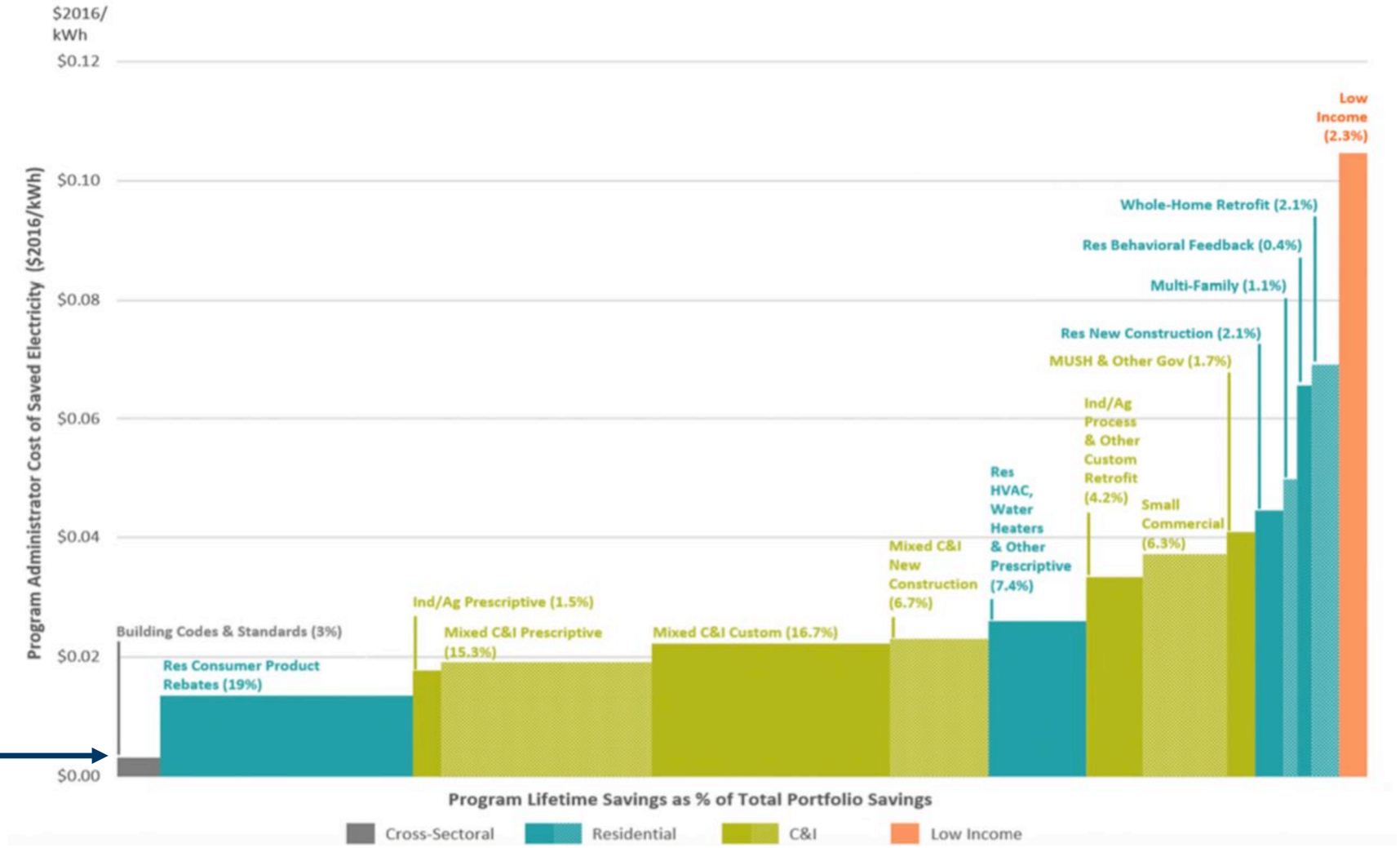
COMMERCE DEPARTMENT
ENERGY RESOURCES

Let us know how we did today!



Appendix

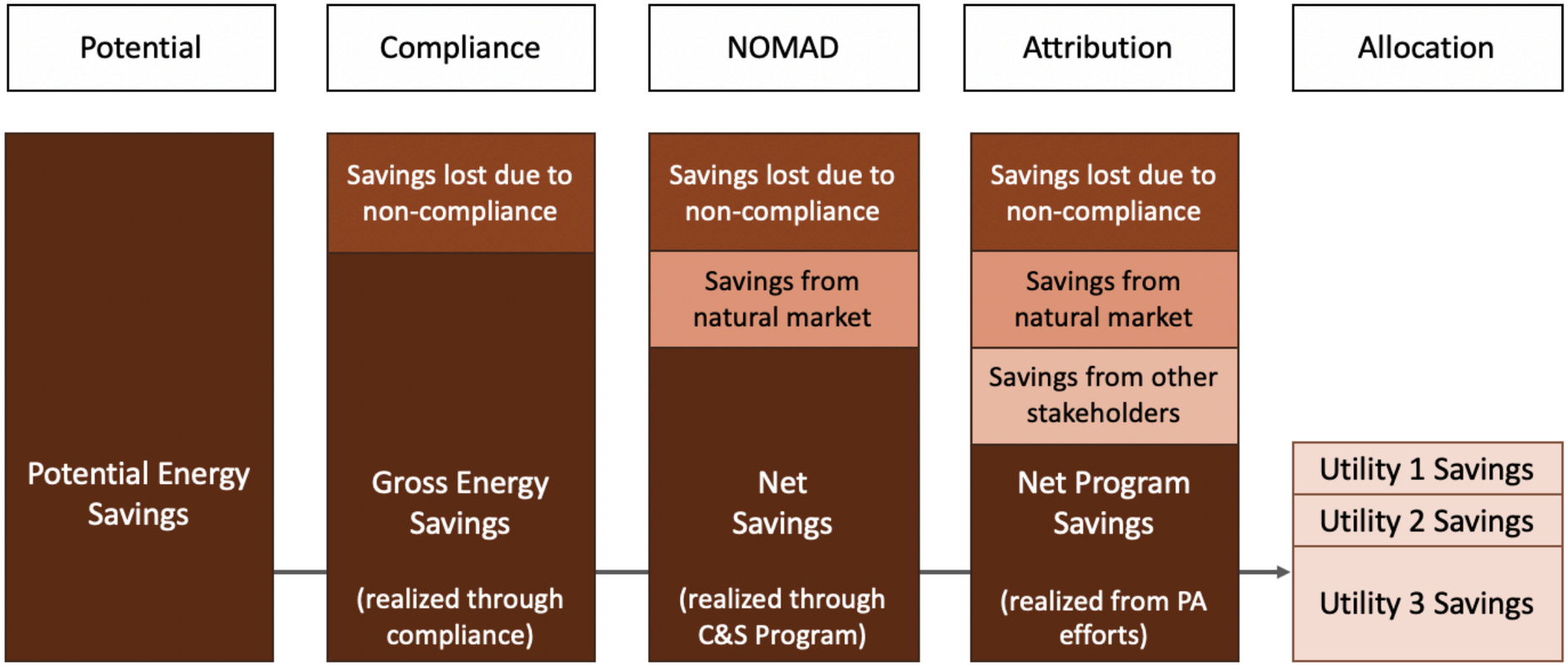
LBNL (2018): C&S Programs are the Most Cost-Effective of All Utility-Funded Programs Studied in the United States



C&S Programs 0.27 cents per kWh

LBNL. 2018. *The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009-2015*

C&S Program General Evaluation and Attribution Model



NOMAD = Naturally Occurring Market Adoption. PA = Program Administrator

See the "Evaluation and Attribution Models for C&S Programs" section in final report for an overview. We recommend that "Net Program Savings" be used as the basis for reporting CIP savings. If this specific terminology creates confusion, or if utilities prefer using other terms (e.g., "claimable savings," "adjusted gross savings with a blended baseline"), we have no objections as long as the evaluation process is transparent in how it addresses compliance, NOMAD, and attribution. This can and should be adapted for a Minnesota program over time as appropriate.

Estimated Minnesota Incremental 1st Year Savings in 2030 for Products in the 2021 ASAP Model Bill

Product Category	MN Electricity Savings (kWh/y)	MN Gas Savings (Dth/y)	MN CO2 Savings (tons/y)
Faucets	10,144,444	776,889	87,283
Computers and computer monitors	15,411,111	-	71,499
Showerheads	7,855,556	595,556	67,236
Air purifiers	13,166,667	-	54,299
Commercial fryers	111,111	551,111	32,698
Portable electric spas	6,500,000	-	26,806
Commercial dishwashers	1,244,444	235,556	18,912
Electric vehicle supply equipment	2,577,778	-	10,631
Commercial steam cookers	1,533,333	64,889	10,119
Water coolers	1,666,667	-	6,873
Commercial hot-food holding cabinets	1,433,333	-	5,911
High CRI fluorescent lamps	1,433,333	-	5,911
Commercial ovens	633,333	45,333	5,264
Residential ventilating fans	266,667	-	1,100

Note: Other products are in the 2021 Model but are not shown in the table above either because savings have not been developed yet (gas fireplaces, state-regulated general service lamps) or savings are water only (spray sprinkler bodies, toilets, and urinals).

Percent Total U.S. Impacts in 2050 from Potential Updates to National Appliance Standards

Percent Total U.S. Impacts in 2050 From Updated National Appliance Standards

Product Category	CO_2 Reductions (Low-Carbon Grid Scenario)	CO_2 Reductions (AEO Reference Grid Scenario)	Annual Electricity Savings	Annual Natural Gas Savings	Annual Water Savings	Annual Utility Bill Savings	Peak Demand Reduction	Cumulative Energy Savings (Btu)
Total U.S. Impact in 2050 (units)	*1523.2 MMT*	*3030.1 MMT*	*476.8 TWh*	*912.9 Tbtu*	*575.7 billion gal*	*$73,194B (2019$)*	*117.35 GW*	*80.4 quads*
Water heaters	23.7%	23.0%	21.7%	24.2%	na	21.4%	8.7%	23.1%
Fans	5.0%	7.6%	13.8%	na	na	8.0%	6.4%	8.5%
General service lamps	4.8%	6.0%	4.9%	na	na	4.0%	3.7%	6.5%
Central air conditioners and heat pumps	3.7%	5.6%	9.4%	na	na	7.6%	29.8%	6.2%
Furnaces	14.8%	7.4%	-0.2%	35.3%	na	5.1%	0.0%	5.2%
Refrigerators and freezers	3.1%	4.6%	6.0%	na	na	4.9%	3.4%	5.1%
Commercial refrigeration equipment	3.2%	4.5%	4.8%	na	na	3.0%	2.6%	5.0%
Clothes dryers	3.6%	4.2%	4.5%	2.0%	na	4.0%	2.2%	4.4%
Electric motors	2.2%	3.3%	4.0%	na	na	2.2%	2.2%	3.6%
Distribution transformers	2.1%	3.1%	5.2%	na	na	3.3%	2.4%	3.5%
Commercial packaged air conditioners and heat pumps	1.9%	2.9%	5.5%	na	na	3.5%	10.9%	3.2%
Showerheads	4.1%	3.0%	1.5%	5.0%	24.2%	5.1%	0.6%	2.7%
Faucets	3.9%	2.9%	1.4%	4.7%	33.5%	6.2%	0.6%	2.6%
Room air conditioners	1.1%	1.5%	1.6%	na	na	1.2%	5.0%	1.7%
Ceiling fans	0.9%	1.3%	1.7%	na	na	1.4%	6.3%	1.5%
Commercial water heaters	3.5%	1.8%	0.0%	5.7%	na	0.6%	0.0%	1.2%
Furnace fans	1.1%	2.3%	2.3%	-1.6%	na	1.6%	4.2%	1.2%
Cooking products	1.4%	1.2%	1.0%	1.4%	na	1.0%	0.8%	1.1%
Commercial furnaces	3.1%	1.5%	-0.2%	8.9%	na	0.9%	0.0%	1.0%
Computer room air conditioners	0.5%	0.8%	0.9%	na	na	0.6%	1.8%	0.9%
Air compressors	0.5%	0.7%	1.2%	na	na	0.5%	0.6%	0.9%
Boilers	2.2%	1.1%	-0.1%	5.8%	na	1.0%	0.0%	0.7%
Clothes washers	1.1%	0.8%	0.5%	1.4%	17.0%	2.8%	0.3%	0.7%
Uninterruptible power supplies	0.5%	0.7%	0.8%	na	na	0.5%	0.3%	0.7%
Dedicated-purpose pool pumps	0.5%	0.7%	0.8%	na	na	0.6%	0.3%	0.7%
Circulator pumps	0.5%	0.7%	0.8%	na	na	0.7%	0.0%	0.7%
Battery chargers	0.5%	0.7%	0.6%	na	na	0.5%	0.3%	0.7%
Pumps	0.4%	0.6%	0.8%	na	na	0.4%	0.4%	0.7%
Dishwashers	0.8%	0.6%	0.4%	1.0%	3.7%	1.0%	0.3%	0.6%
Water-source heat pumps	0.4%	0.6%	0.8%	na	na	0.5%	1.4%	0.6%
Commercial boilers	1.9%	1.0%	0.0%	4.7%	na	0.6%	0.0%	0.5%
Pool heaters	0.6%	0.5%	0.4%	0.8%	na	0.4%	0.2%	0.5%
Portable air conditioners	0.3%	0.5%	0.7%	na	na	0.5%	2.2%	0.5%
External power supplies	0.3%	0.4%	0.4%	na	na	0.3%	0.2%	0.5%
Automatic ice makers	0.2%	0.3%	0.3%	na	na	0.2%	0.2%	0.4%
Commercial three-phase air conditioners and heat pumps	0.2%	0.3%	0.4%	na	na	0.3%	0.8%	0.4%
Small motors	0.2%	0.3%	0.3%	na	na	0.2%	0.2%	0.4%
Microwave ovens	0.2%	0.2%	0.2%	na	na	0.2%	0.2%	0.2%
Miscellaneous refrigeration equipment	0.2%	0.2%	0.3%	na	na	0.2%	0.2%	0.2%
Commercial clothes washers	0.3%	0.2%	0.1%	0.3%	3.2%	0.5%	0.0%	0.1%
Direct heating equipment	0.2%	0.1%	na	0.4%	na	0.1%	0.0%	0.1%
Dehumidifiers	0.1%	0.1%	0.1%	na	na	0.1%	0.1%	0.1%
Single-package vertical air conditioners and heat pumps	0.1%	0.1%	0.1%	na	na	0.1%	0.2%	0.1%
Beverage vending machines	0.1%	0.1%	0.1%	na	na	0.1%	0.1%	0.1%
Packaged terminal air conditioners and heat pumps	0.1%	0.1%	0.1%	na	na	0.0%	0.2%	0.1%
Toilets	na	na	na	na	14.7%	1.9%	na	na
Urinals	na	na	na	na	3.8%	0.5%	0.0%	na
Total (%)	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Mauer, J., and A. deLaski. 2020. A Powerful Priority: How Appliance Standards Can Help Meet U.S. Climate Goals and Save Consumers Money. Washington, DC: ACEEE; Boston: ASAP. aceee.org/research-report/a2001.

Savings Scenario in 2030: Percent Historical CIP Savings

	Electric	Gas	Carbon
Commercial Building Codes Advancement			
Potential Energy Savings	25%	4%	18%
Gross Energy Savings	20%	3%	14%
Net Savings	20%	3%	14%
Net Program Savings	**11%**	**2%**	**8%**
Residential Building Codes Advancement			
Potential Energy Savings	4%	1%	3%
Gross Energy Savings	3%	0%	2%
Net Savings	3%	0%	2%
Net Program Savings	**2%**	**0%**	**1%**
Building Codes Compliance Improvement			
Potential Energy Savings	7%	8%	6%
Gross Energy Savings	7%	8%	6%
Net Savings	7%	8%	6%
Net Program Savings	**3%**	**3%**	**3%**
Federal Appliance Standards Advancement			
Potential Energy Savings	63%	29%	50%
Gross Energy Savings	57%	26%	45%
Net Savings	57%	26%	45%
Net Program Savings	**14%**	**6%**	**11%**
State Appliance Standards Advancement			
Potential Energy Savings	6%	7%	6%
Gross Energy Savings	5%	6%	5%
Net Savings	5%	6%	5%
Net Program Savings	**3%**	**4%**	**3%**
Total Program			
Potential Energy Savings	104%	48%	82%
Gross Energy Savings	92%	44%	73%
Net Savings	92%	44%	73%
Net Program Savings	**33%**	**16%**	**26%**

- Percent relative to 2017 CIP levels
- See report for detailed assumptions
- Just one of many potential scenarios

Achieve Beyond Code Savings

Promote high-impact prescriptive strategies

Promote energy modeling

Address operational performance



Achieve Beyond Code Savings: Promote Prescriptive Strategies

Promote Prescriptive Strategies

Opportunities

- Expand use of market-ready efficiency strategies
- Preview future code requirements

Recommendation

- Incorporate into new construction CIPs
  - A la carte
  - Strategy bundles

Achieve Beyond Code Savings: Promote Energy Modeling

Promote Energy Modeling

Opportunities

- Expand use of performance code pathways
- Expand energy modeling analysis of non-regulated elements

Recommendations

- Conduct a market analysis of energy modeling in Minnesota
- Expand energy modeling through CIPs

Achieve Beyond Code Savings Address Operational Performance

Address Operational Performance

Opportunities

- Verify operations-dependent savings are maintained
- Ensure hard-to-verify code elements achieve savings

Recommendation

- Offer a pay-for-performance program