# Cost-Effectiveness and Non-energy Impacts: Valuing Efficiency

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# National Standard Practice Manual: Update and Plans

Julie Michals, E4TheFuture

# National Standard Practice Manual (NSPM):
## A Year Post-Publication

Julie Michals – E4TheFuture

NEEP EM&V Annual Public Meeting:
Advancing EM&V in the Region and the Industry

May 8, 2018

# About E4TheFuture

## Energy - Economy - Equity - Environment

A nonprofit dedicated to *bringing clean, efficient energy home* for every American. E4 goals include:

1. Advance clean energy and efficiency policies and best practices at state and national levels
2. Build a vibrant residential energy efficiency and clean energy industry sector
3. Support clean energy integrated solutions for communities

# Sharing with you today…

1. NSPM 101
2. NSPM referencing and application to date
3. Cost-benefit impact resources – data, methods and tools
4. Expanding NSPM to other DERs

# NSPM 101

# Overview of the NSPM Process

**NESP:**

- Group working to improve cost-effectiveness analyses
- Over 75 organizations representing a range of perspectives.

**NSPM Drafting Committee:**

- Tim Woolf, Synapse Energy Economics
- Chris Neme, Energy Futures Group
- Marty Kushler, ACEEE
- Steve Schiller, Schiller Consulting
- Tom Eckman (Consultant)

**NSPM Review Committee:**

- ~40 experts representing a variety of organizations from around the country
- Provided several rounds of review/feedback on draft manual

**Project Coordination and Funding:**

- Coordinated and funded by E4TheFuture, managed by Julie Michals
- Earlier work on NESP-NSPM managed by Home Performance Coalition.

**For more information:** www.nationalefficiencyscreening.org

# The Need for an NSPM

- Traditional tests (UCT, TRC, SCT) not meeting state needs
  - No underlying principles
  - Don’t directly address policy goals/needs
  - Lack of clarity on their conceptual constructs
  - Only 3 options, despite greater variability in jurisdiction needs
- Asymmetry of costs and benefits → EE is under-valued
- Absence of standard guidance on proper application of tests
- Inputs to tests are often problematic
- Lack of transparency on why/how tests were chosen/developed

*Developing the right test is critical to ensuring utility investments are economic.*

# Purpose and Scope of NSPM

## Purpose

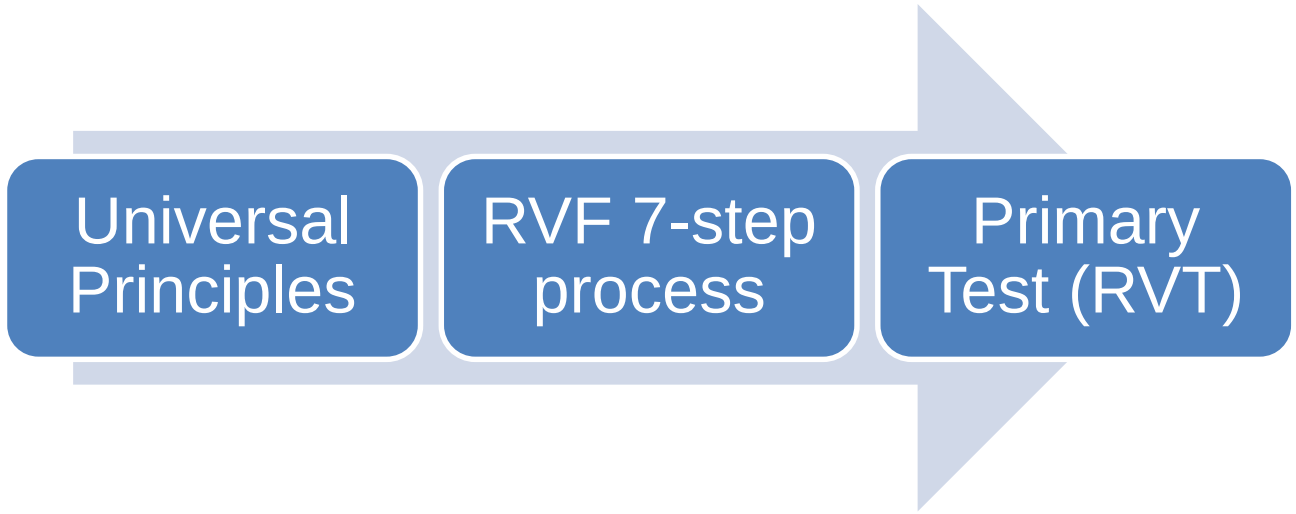
- Fundamental principles – both test selection & application
- Framework for primary test selection/development
- Guidance on key test inputs/application issues

## Scope

- Focus on efficiency resources
- Focus on utility rate-payer funded efficiency acquisition
- Focus on static cost-effectiveness analysis
  - Not dynamic IRP modelling…
  - Though principles and key elements could theoretically be applied to IRP too
- Addresses 1st order question:  “which EE resources merit acquisition?”

# NSPM Table of Contents

# Part I: Developing a Cost-Effectiveness Test Using the Resource Value Framework



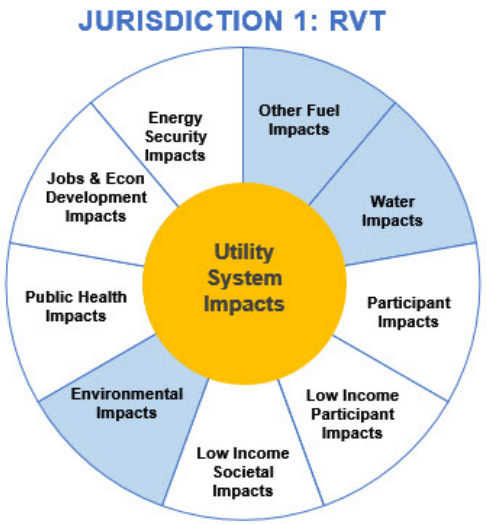
# NSPM Principles

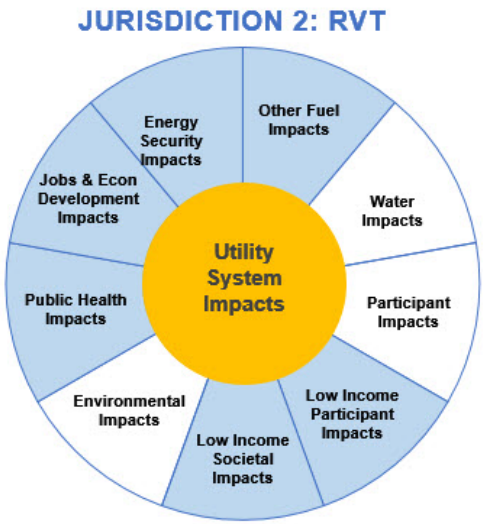
1. Recognize that energy efficiency is a resource.
2. Account for applicable policy goals.
3. Account for all relevant costs & benefits, even if hard to quantify impacts.
4. Ensure symmetry across all relevant costs and benefits.
5. Conduct a forward-looking, long-term analysis that captures incremental impacts of energy efficiency.
6. Ensure transparency in presenting the analysis and the results.

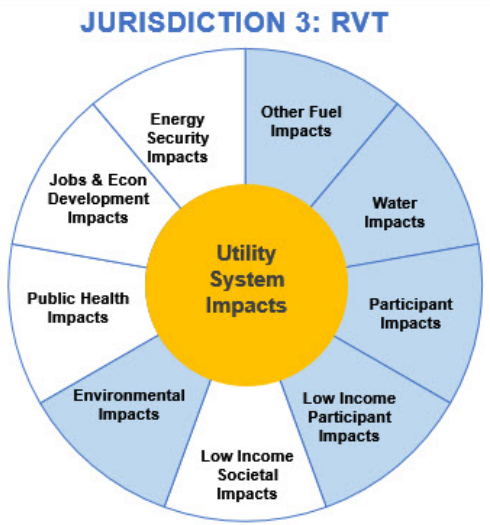
# 7-Step Resource Value Framework

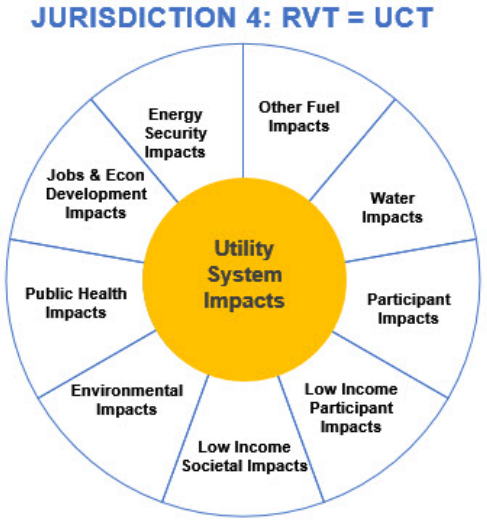
| | |
|---|---|
| Step 1 | Identify and articulate the jurisdiction's applicable policy goals. |
| Step 2 | Include all utility system impacts in the test. |
| Step 3 | Decide which additional *non-utility* system impacts to include in the test, based on applicable policy goals. |
| Step 4 | Ensure the test is symmetrical in considering both costs and benefits. |
| Step 5 | Ensure the analysis is forward-looking, incremental, and long-term. |
| Step 6 | Develop methodologies and inputs to account for all impacts, including hard-to-quantify impacts. |
| Step 7 | Ensure transparency in presenting the analysis and the results. |

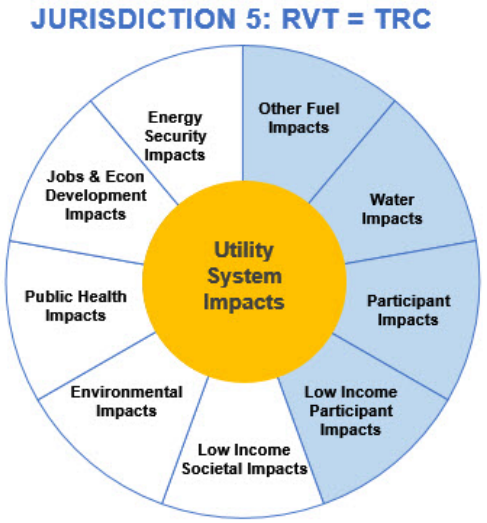
# Relationship to Traditional Tests - Examples

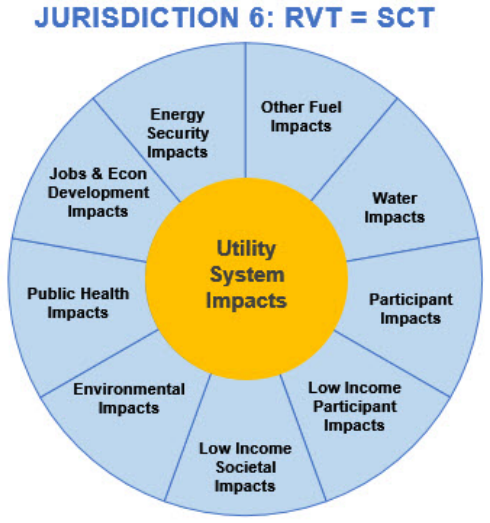


# NSPM Referencing and Application to Date

# NSPM References to Date

| State / Other | Docket/Bill Number | State/ Other | Docket/Bill Number |
|---|---|---|---|
| **AR *** | 13-002-U Order No 40<br>10-100-R Order No. 27 | **NV** | 17-08023 |
| **CA** | 15-02-007<br>14-10-003 | **RI** | Least Cost Procurement Standard |
| **CT** | 2017 Comprehensive Energy Strategy | **SC** | H 4425 |
| **IA** | RMU-2016-0018 | **VA** | PUR-2017-00047 |
| **ID** | IPC-E-17-13 | **WA **** | UE-171087, PSE<br>UE-171091, Avista<br>UE-171092, Pacific Power |
| **IL** | EE Stakeholder Advisory Group Evaluation Plan | **WV** | 17-0401-E-P |
| **KS** | Senate Bill 347 - draft | **US DOE** | SEE Action: EM&V Framework for States |
| **MI** | 2010-AD-2 | **US DOE** | EERE-2017-OT-0056 |
| **NH** | DE-17-136 | **ACEEE** | ACEEE Report: Role of EE in a DER Future (2018) |

* AR Commission order ** WA UTC Staff recommendation

See NSPM References website page for more details

# NSPM Application - Case Studies Purpose and Scope

- Provide real-world examples of states/jurisdictions that are applying, have applied, or could apply the NSPM principles and concepts to develop a primary cost-effectiveness test
- Case studies can serve as NSPM tutorials for regulators, utilities, and other stakeholders
- Case study scope - each case study identifies how a state's current practice has applied (or could apply):
  - The key NSPM principles
  - The seven steps in the RVF to develop its RVT
  - Other elements of the NSPM (e.g., discount rates)
  - Data sources for inputs

# NSPM Application
# Case studies in the works…

1. **Rhode Island** – adopted the NSPM principles, developed "RI test" which applies to all DERs; case study complete, to be released later this summer
2. **Arkansas** – in process, commission order directs PSC staff to consider the NSPM; stakeholder process underway; PSC staff has taken inventory of applicable policies; utilities are documenting what costs and benefits are currently accounted for; report to PSC by Oct 1
3. **Minnesota** – in process. MN Dept of Commerce, Division of Energy Resources RFP retained Synapse to review MN CE testing practices, apply NSPM and prepare recommendations. Aug 2018
4. **Washington** – in process. WA UTC has taken inventory of applicable policies, now reviewing utility practices. Fall 2018

Tech support available to other states interested in applying the NSPM

# Cost-Benefit Impacts Supporting Resources

# NSPM Supporting Resources

> Data (plug and play), methods and tools (repository) to support key cost and benefit categories such as:

- Outdoor health and environmental impacts (ACEEE, EPA resources)
- Indoor health impacts
- Job impacts
- Avoided costs, Avoided T&D
- Energy security, risk, reliability, resilience
- Identify major gaps (for potential future research)

> Current state CE testing practices workbook documenting:

- Type of current test used (and any references to NSPM)
- Benefits and costs accounted for in test
- Discount rate used
- Link to relevant regulatory/policy docs
- Will cover approx. 20 states (2018 scope)

# Expanding NSPM to Other DERs

# Interest in NSPM DER Expansion

- Address categories of costs and benefits for other DERs in more detail, with focus on “to whom does value accrue”
- Address locational/temporal value of resources (for EE and other DERs - avoided T&D, net locational benefits, relevance to NWAs)
- Address in context of distribution planning
- Lots of DER valuation studies done to date – inconsistent approaches
- Space is evolving – wild west, need some guidance but premature to write ‘the bible’
- Build on current / existing work or guidance

# Distributed Energy Resources Utility System Impacts

| | | Energy Efficiency | Demand Response | Distributed Generation | Distributed Storage |
|---|---|---|---|---|---|
| **Costs** | | | | | |
| **Utility System** | Measure costs (utility portion) | ● | ◑ | ○ | ○ |
| | Other financial incentives | ● | ● | ◑ | ◑ |
| | Other program and administrative costs | ● | ◑ | ◑ | ◑ |
| | Evaluation, measurement, and verification | ● | ● | ● | ● |
| | Performance incentives | ◑ | ◑ | ◑ | ◑ |
| | Interconnection costs | ○ | ○ | ● | ● |
| | Distribution system upgrades | ○ | ○ | ● | ● |
| **Benefits** | | | | | |
| **Utility System** | Avoided energy costs | ● | ◑ | ● | ◑ |
| | Avoided generation capacity costs | ● | ● | ● | ● |
| | Avoided reserves or other ancillary services | ● | ● | ● | ● |
| | Avoided T&D system investment | ● | ● | ● | ● |
| | Avoided T&D line losses | ● | ● | ● | ● |
| | Wholesale market price suppression | ● | ● | ● | ● |
| | Avoided RPS or EPS compliance costs | ● | ◑ | ● | ◑ |
| | Avoided environmental compliance costs | ● | ◑ | ● | ◑ |
| | Avoided credit and collection costs | ◑ | ◑ | ◑ | ◑ |
| | Reduced risk | ● | ● | ◑ | ◑ |

# Distributed Energy Resources: Non-Utility System Impacts

| | | Energy Efficiency | Demand Response | Distributed Generation | Distributed Storage |
|---|---|---|---|---|---|
| **Costs** | | | | | |
| **Non-Utility** | Measure costs (participant portion) | ● | ● | ● | ● |
| | Interconnection fees | ○ | ○ | ◕ | ◕ |
| | Annual O&M | ○ | ○ | ● | ● |
| | Participant increased resource consumption | ◑ | ◑ | ◑ | ◑ |
| | Non-financial (transaction) costs | ◔ | ● | ○ | ○ |
| **Benefits** | | | | | |
| **Non-Utility** | Reduced low-income energy burden | ◑ | ◑ | ◑ | ◑ |
| | Public health benefits | ● | ◑ | ● | ◑ |
| | Energy security | ● | ◑ | ● | ◑ |
| | Jobs and economic development benefits | ● | ● | ● | ● |
| | Environmental benefits | ● | ◑ | ● | ◑ |
| | Participant health, comfort, and safety | ◑ | ○ | ○ | ○ |
| | Participant resource savings (fuel, water) | ◑ | ○ | ○ | ○ |

# Other Types of DERS

## Existing Studies and General Interest Level

| Type of DER | Existing Studies of Cost-Effectiveness | General Interest or Need |
|---|---|---|
| Demand Response – Price Based | Very Few | Low – in several states |
| Demand Response – Incentive Based | Several | Low – in several states |
| Distributed Gen - PV | Many | High – in many states |
| Distributed Gen – NEM (overlap with PV) | Many | High – in many states |
| Distributed Storage | Few | Moderate – in a few states |
| Electric Vehicles | Few | Moderate – in a few states |
| Other Environmentally Beneficial Electrification (heat pumps etc.) | Few | Moderate – in a few states |
| Distribution System Planning (integrated planning, optimizing DERs) | Few | High – in a few states |

# Other Types of DERs
## Cost-Effectiveness Challenges

| Type of DER | Challenges |
|---|---|
| Demand Response: Price-Based (TVR) | Cost-shifting is the biggest issue |
| Demand Response: Incentive-Based | Relatively few challenges |
| Distributed Gen: PV | Lots of momentum in the wrong direction, RIM test is common, cost-shifting not addressed properly, benefits are mostly societal |
| Distributed Gen: NEM | Cost-effectiveness is conflated with rate design |
| Distributed Storage | Getting the right inputs |
| Electric Vehicles | Getting the right inputs, benefits are societal |
| Other Environmentally Beneficial Electrification (heat pumps etc.) | Getting the right inputs, benefits are societal |
| Distribution System Planning (integrated planning, optimizing DERs) | Very complex process, different from resource screening<br>Note: LBNL working on a Framework for iDER Analysis. |

# NSPM DER Expansion - Scoping Tasks

1. Review landscape of key DER studies/reports and B-C frameworks upon which to build
2. Develop scope for guidance on benefit cost issues for each DER of interest
3. Develop scope for general guidance on core DER integration issues and CE testing
4. Develop scope for guidance on avoided T&D (e.g., net locational benefits) for EE and other selected DERs
5. Estimate budget for developing guidance docs
6. Timeframe: May-Aug approx.
7. NSPM Adv Comm sub-group to help review scopes, budget estimates and prioritize
8. E4TheFuture with Adv Comm to seek leveraging funds

# Thank you!

Julie Michals
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# Lessons from Across the Pond

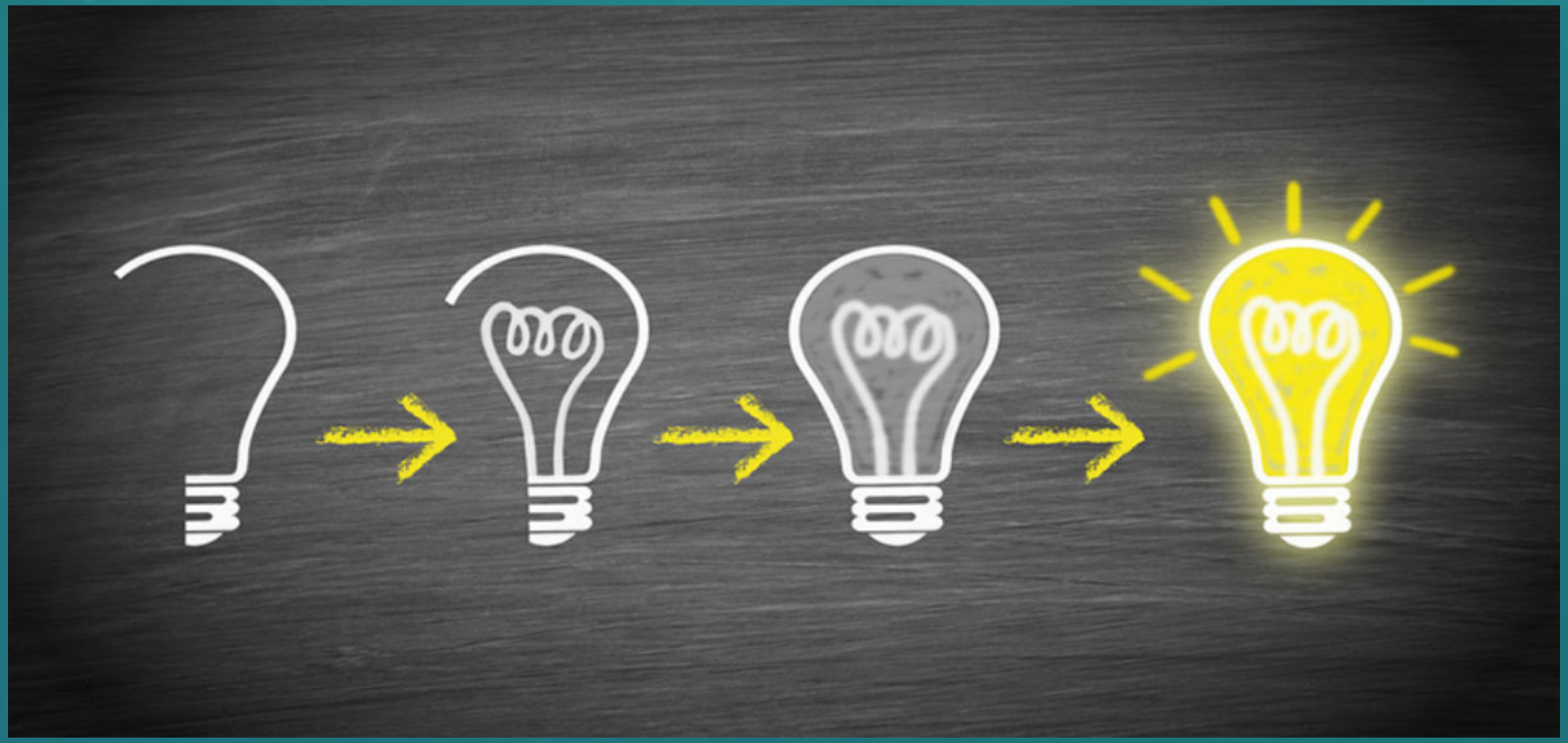
Samantha Caputo

*Policy and Research*

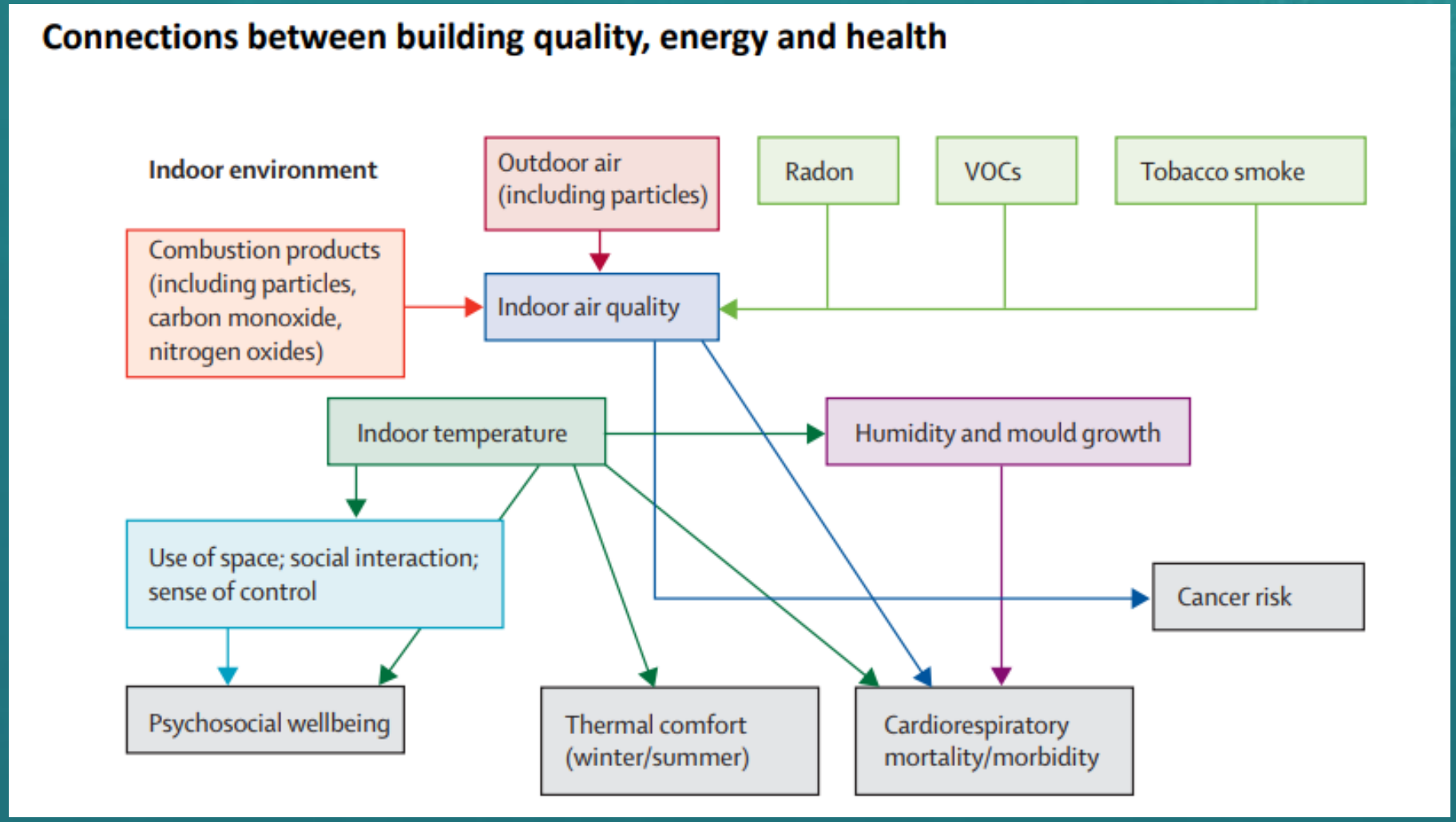
# *International Energy Agency (IEA) Workshop Beyond energy savings - The multiple benefits of energy efficiency*

- Case studies on energy efficiency policies NEIs
- What do policymakers need?
- Methodologies for quantifying multiple benefits
- Effectively communicate energy efficiency policies and actions
- Impact on the macro-economy, indoor air quality, and transport-related air pollution

# What are the lessons learned?



# Health & Wellbeing Emerging as a Priority




Source: UCL Energy Institute, adapted from : Wilkinson, Lancet, 2009

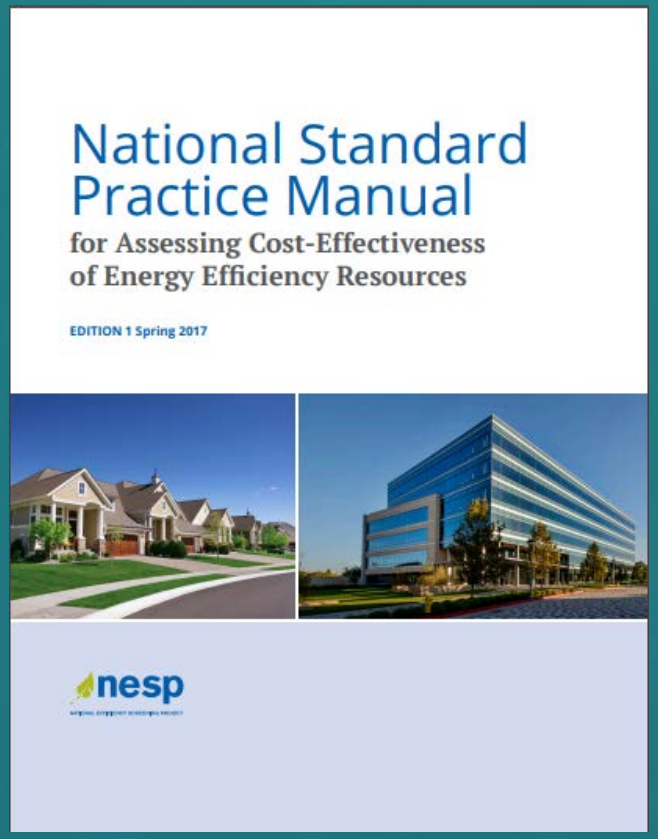
# The geographical coverage of the evidence base is limited

- **Strongest:** North America, Europe and other developed economies such as Australia and New Zealand, where policy evaluation has a **longer history.**
- **There are still gaps**
  - **Interactive effects between exposures to indoor and outdoor air quality**
  - **Single family versus multifamily**
  - **Less evidence for commercial sector**
  - **Health impacts of reduced emissions from transportation**

# Communication is Key

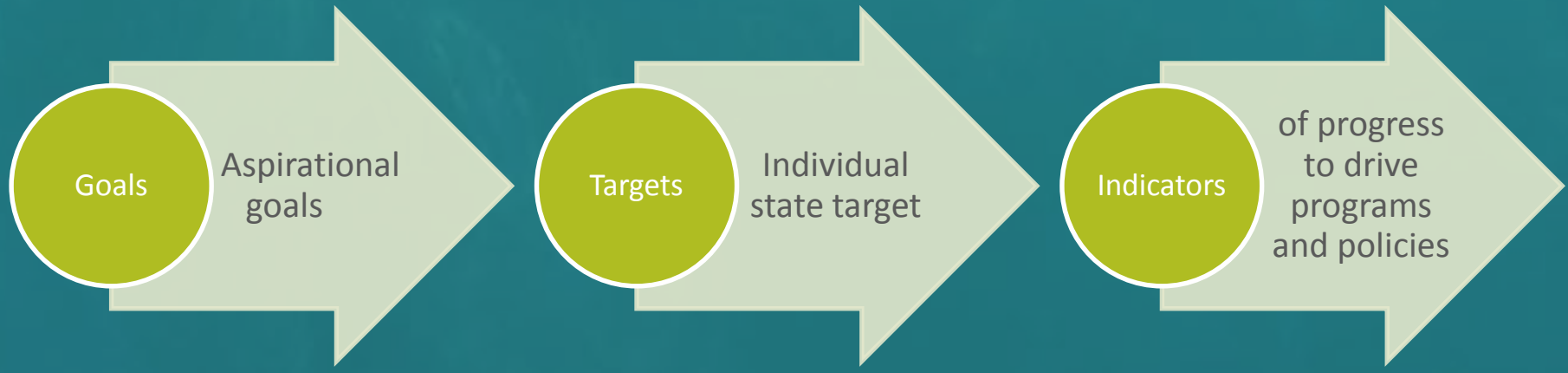
- Engage meaningfully with other communities outside of the energy efficiency community
  - Ireland used health specialist who could speak to health benefits in the Health and Wellbeing program- provides EE upgrades to homes w/ chronic respiratory conditions
- Communication and engagement need to be a work stream in programs and policies to ensure success
  - Create individual narratives with scalability
  - Fit for purpose campaign, not a fit for all campaign
- Understand your target audience and their values.

# Policymakers need a framework





# How to use these frameworks?



# Thank you

**IEA's Beyond energy savings: The multiple benefits of energy efficiency**

Samantha Caputo

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# Cost-effectiveness and Non-energy Impacts – Northeast Experience

Greg Clendenning, NMR Group, Inc.
Nathan Caron, DNV GL

# Cost Effectiveness and Non-Energy Impacts

## NEEP EM&V Forum

Greg Clendenning, NMR Group, Inc.
Nate Caron, DNV GL

May 8, 2018

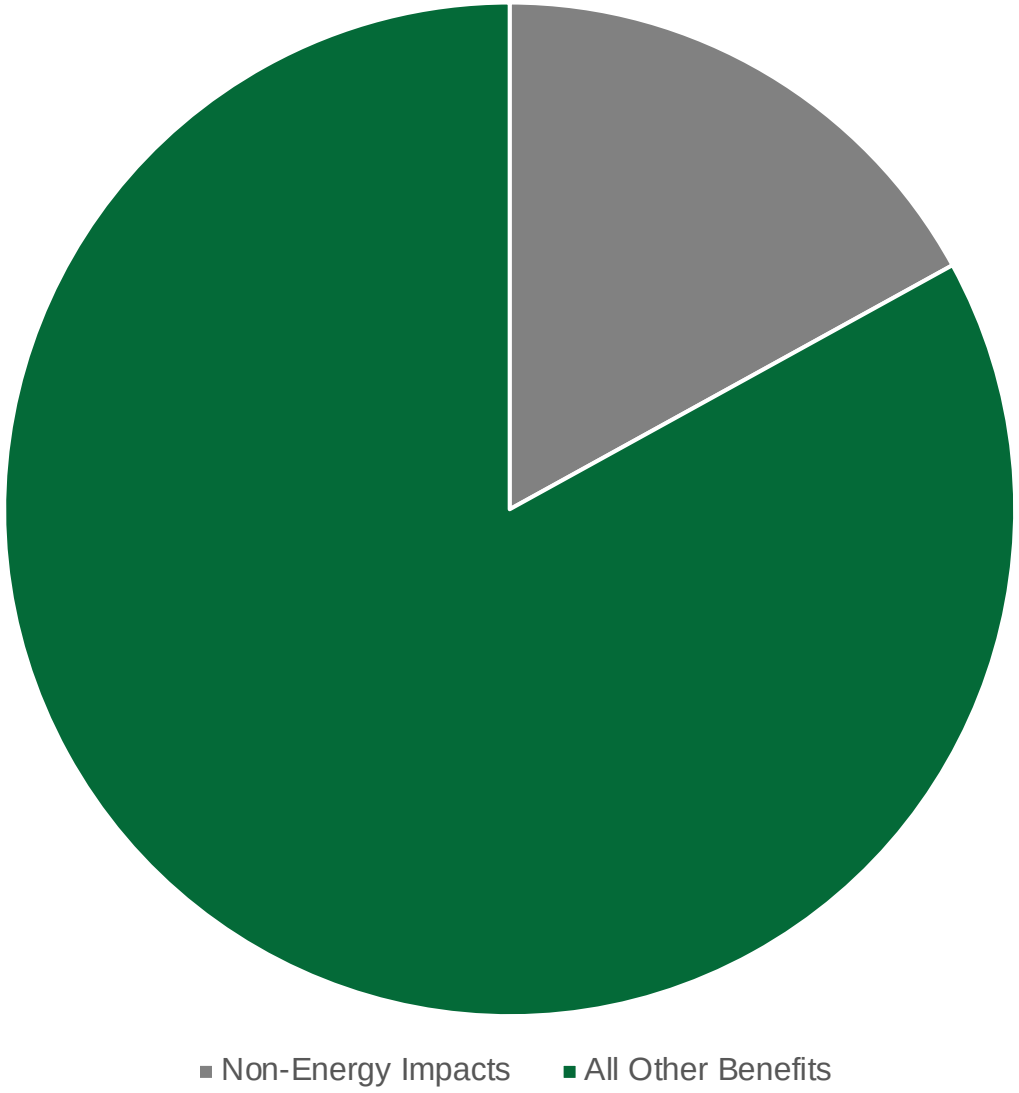
# Overview of Presentation

- Cost Effectiveness Sensitivity Analysis:
  - Massachusetts:
    - Large # of NEIs accepted
      - Magnitude of NEIs
      - Impacts of NEIs on cost-effectiveness on
        - » Portfolio
        - » Individual initiatives
  - Pennsylvania:
    - Narrow set of NEIs first accepted for 2016-17 Program Year
      - Impacts of NEIs on cost-effectiveness on portfolio
- Current Studies: Health and safety impacts
  - Low-income Multifamily Weatherization
  - Energy-efficiency retrofits in schools

# Massachusetts: Background

- MA NEI Framework Study
  - What is the current inventory of NEIs claimed by the MA Program Administrators?
  - How important are NEIs to initiative design and marketing?
  - What are the areas of potential NEI overlap—creating a risk of double counting—within and across residential and C&I initiatives?
  - How important are NEIs to achieving the cost-effectiveness of the Program Administrators' current and planned initiatives?

# Massachusetts – Magnitude of NEIs



# Massachusetts Claimed NEIs

## Residential

- Health benefits
- Home durability
- Lighting quality and lifetime
- Noise reduction
- Thermal comfort
- Property value increase*

## Low Income: Utility Perspective

- Arrearages
- Bad debt write-offs
- Customer calls and collections
- Price hedging
- Rate discounts
- Safety related emergency calls
- Terminations and reconnections

## Low Income: Owner/Occupant Perspective

- Equipment maintenance
- Health benefits
- Home durability
- Improved safety
- Lighting quality and lifetime
- Noise reduction
- Property durability
- Reduced tenant complaints
- Thermal comfort
- Rental unit marketability
- Increased property value*

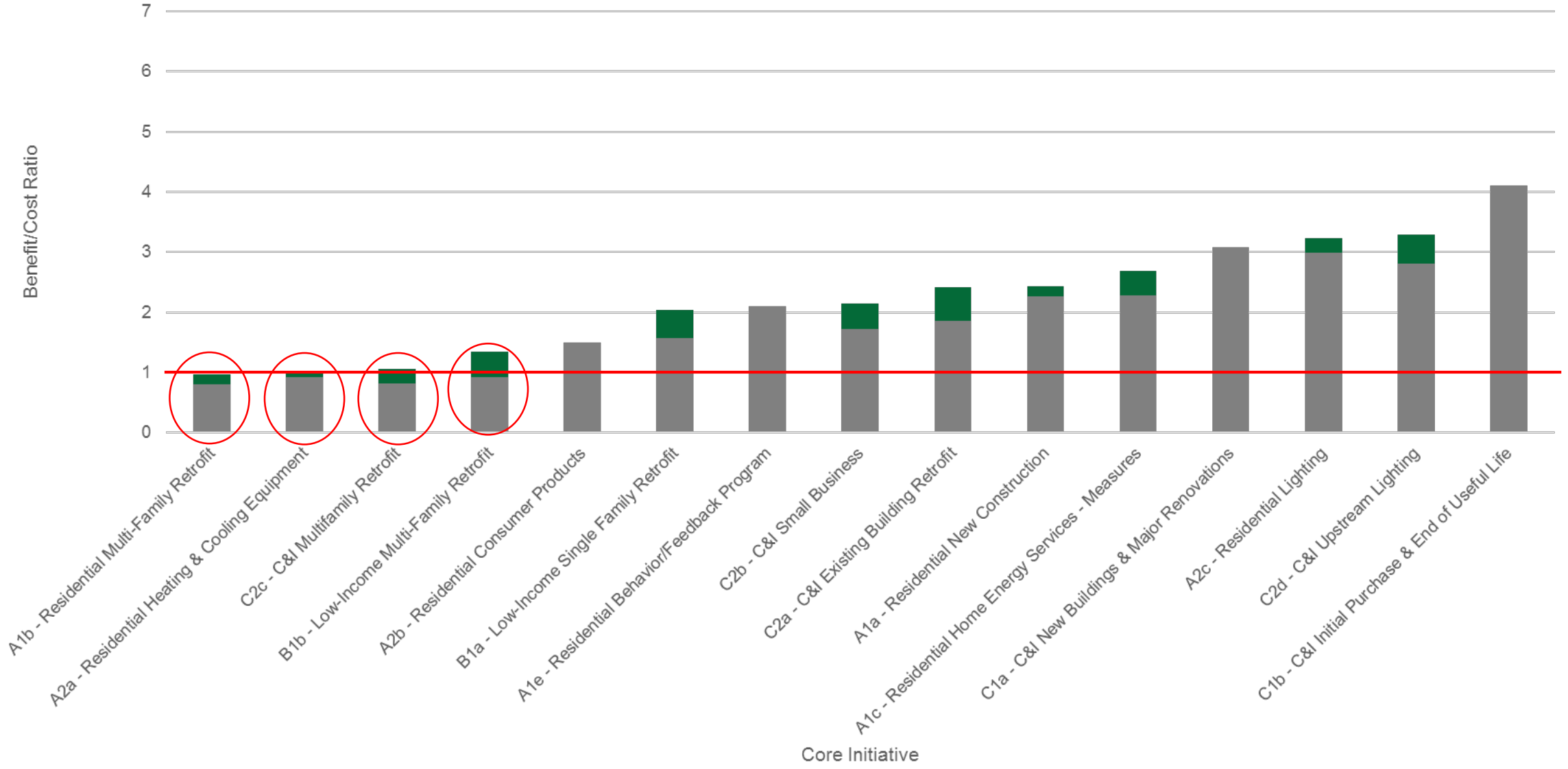
## Commercial & Industrial

- Administrative costs
- Material handling
- Material movement
- Operations & maintenance
- Product spoilage
- Sales revenue
- Waste disposal
- Water and sewer savings
- Rent revenue*

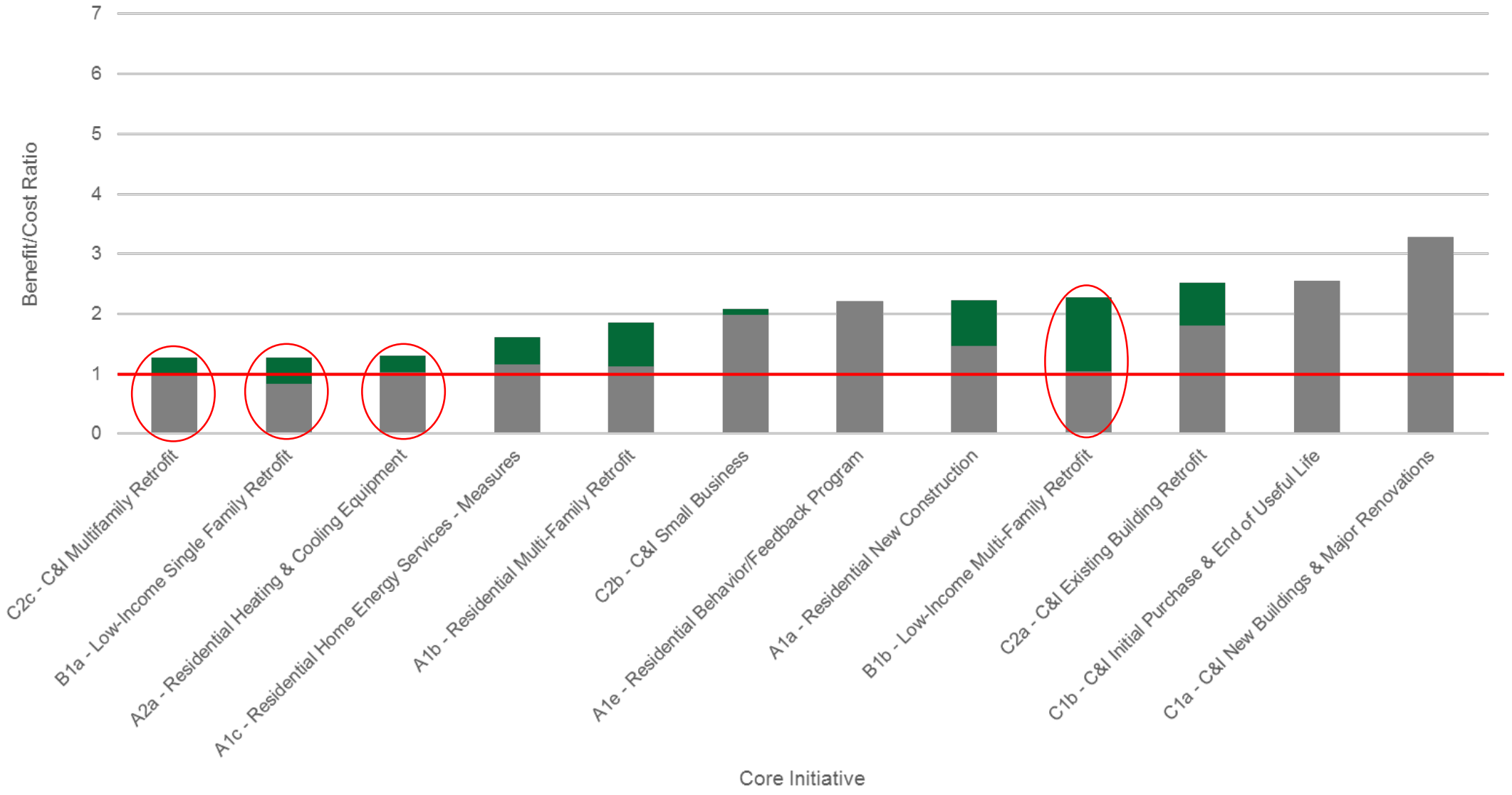
NMR Group, Inc.

DNV·GL

# Massachusetts – Benefit/Cost Analysis - Electric



# Massachusetts – Benefit/Cost Analysis - Gas

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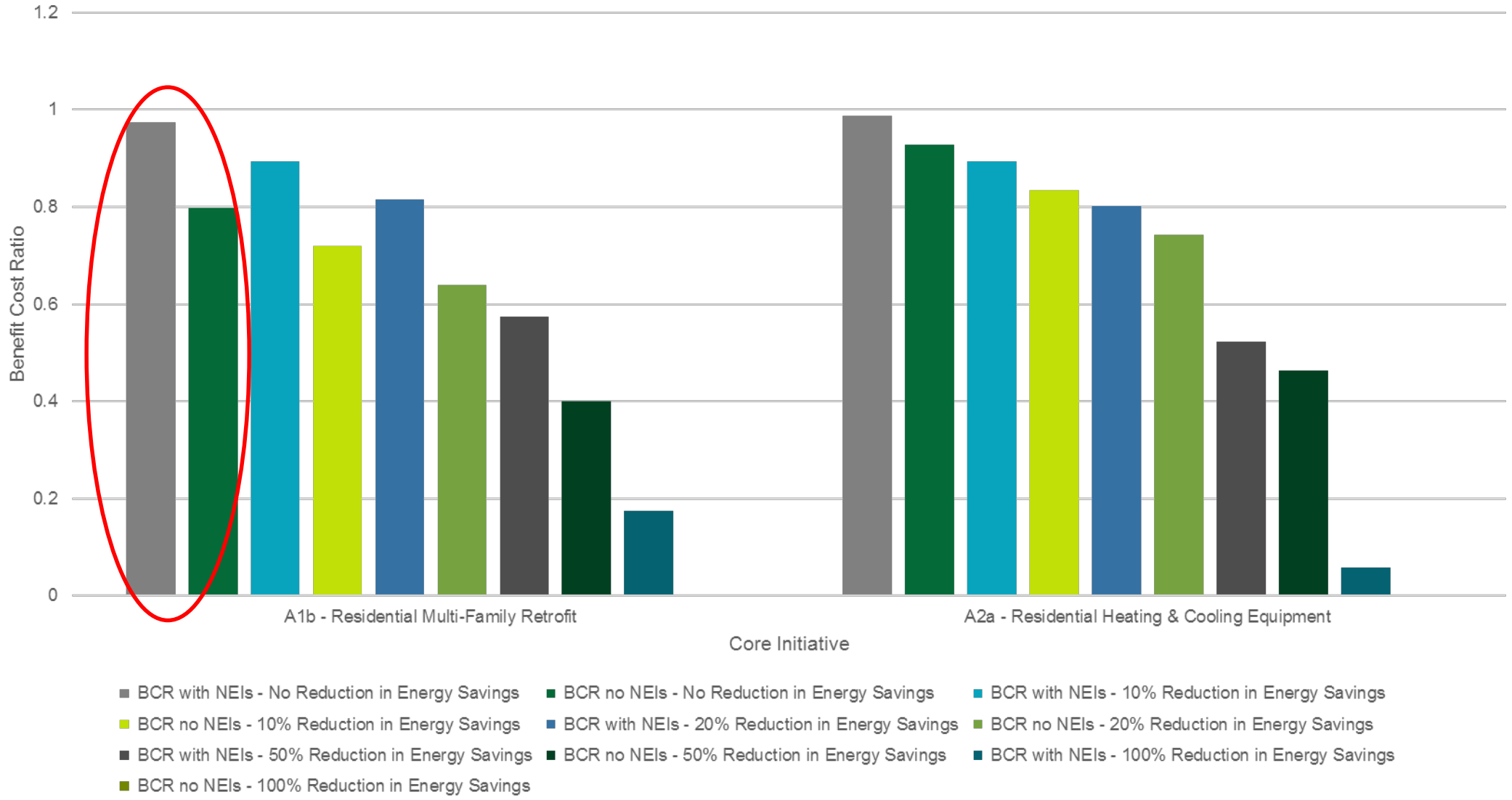
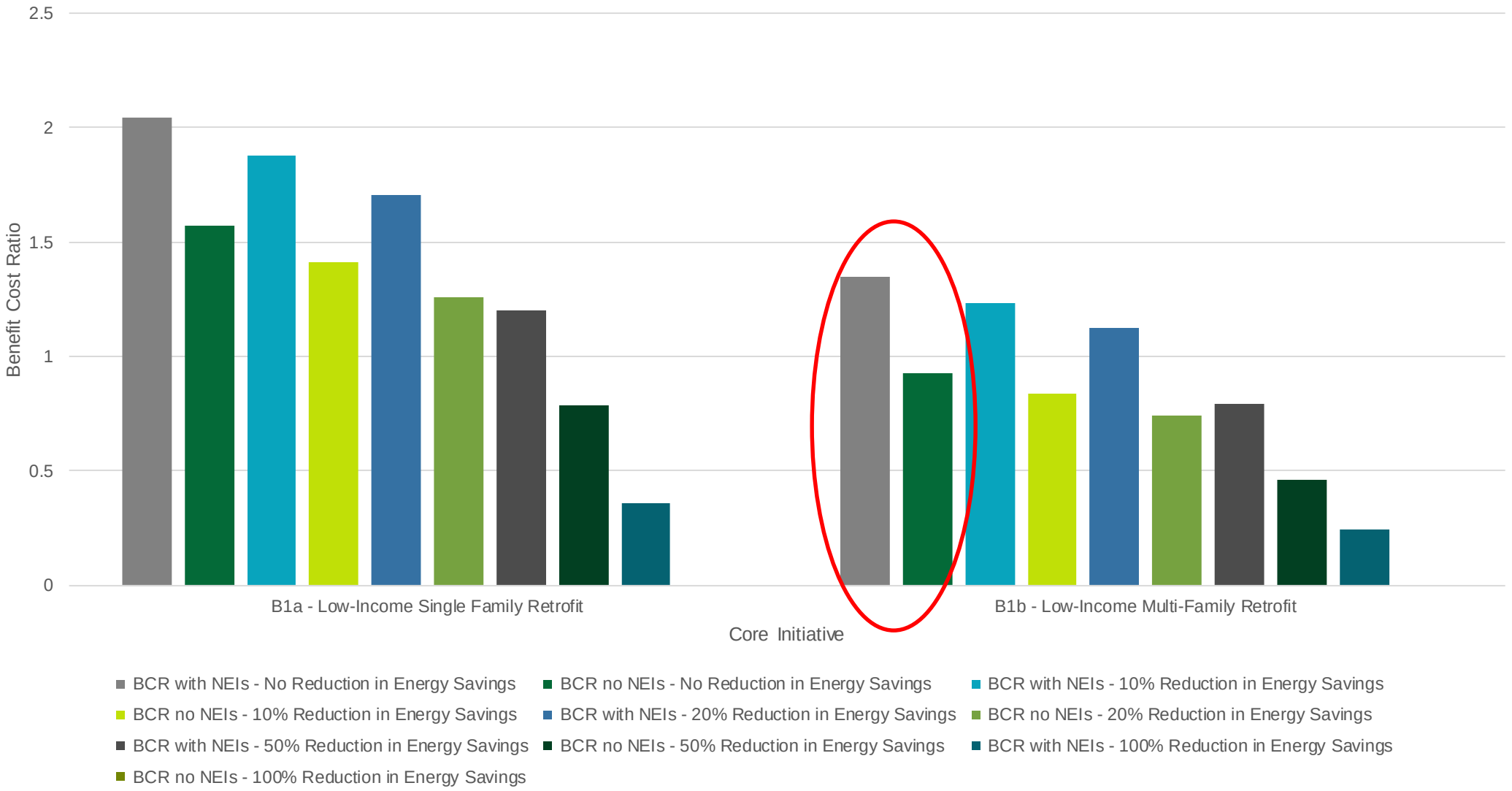
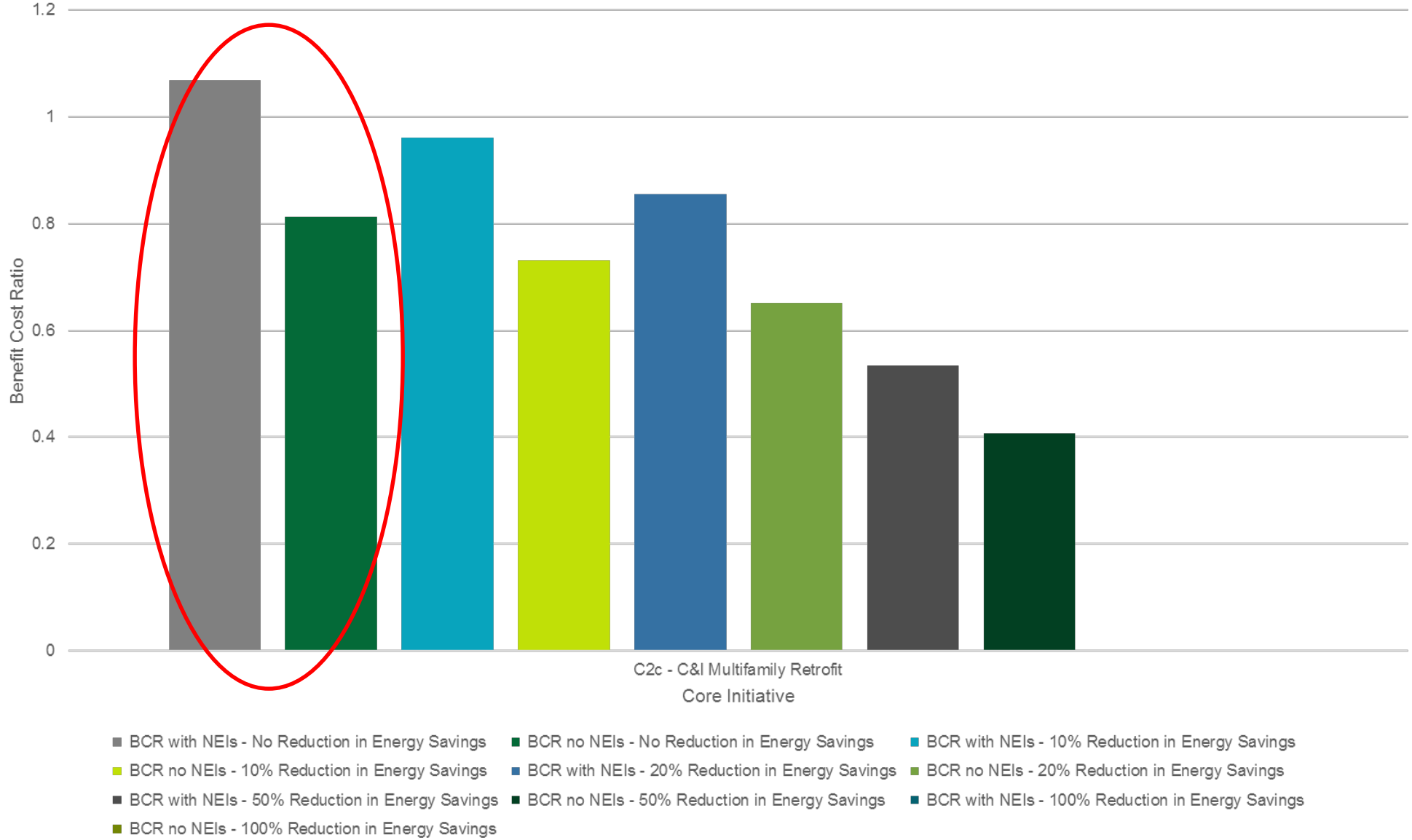
# MA Sensitivity Analysis – Electric - Residential



# MA Sensitivity Analysis – Electric – Low Income



# MA Sensitivity Analysis – Electric – C&I

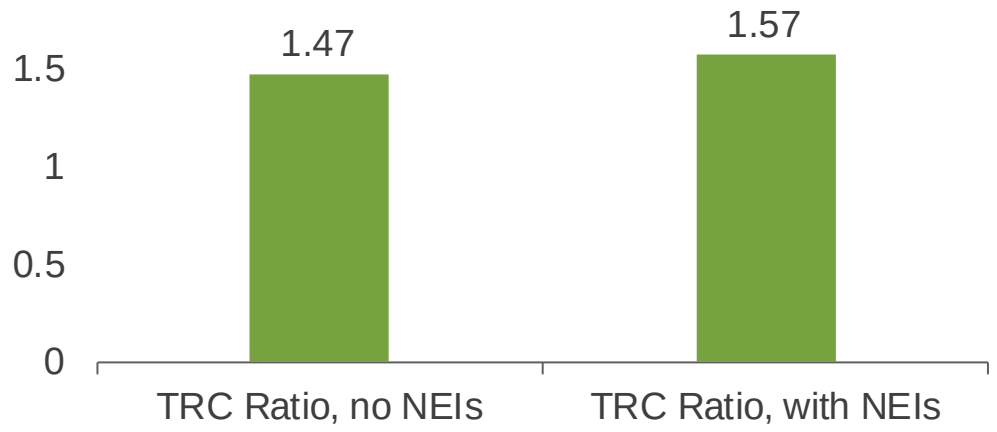


# Pennsylvania: Background

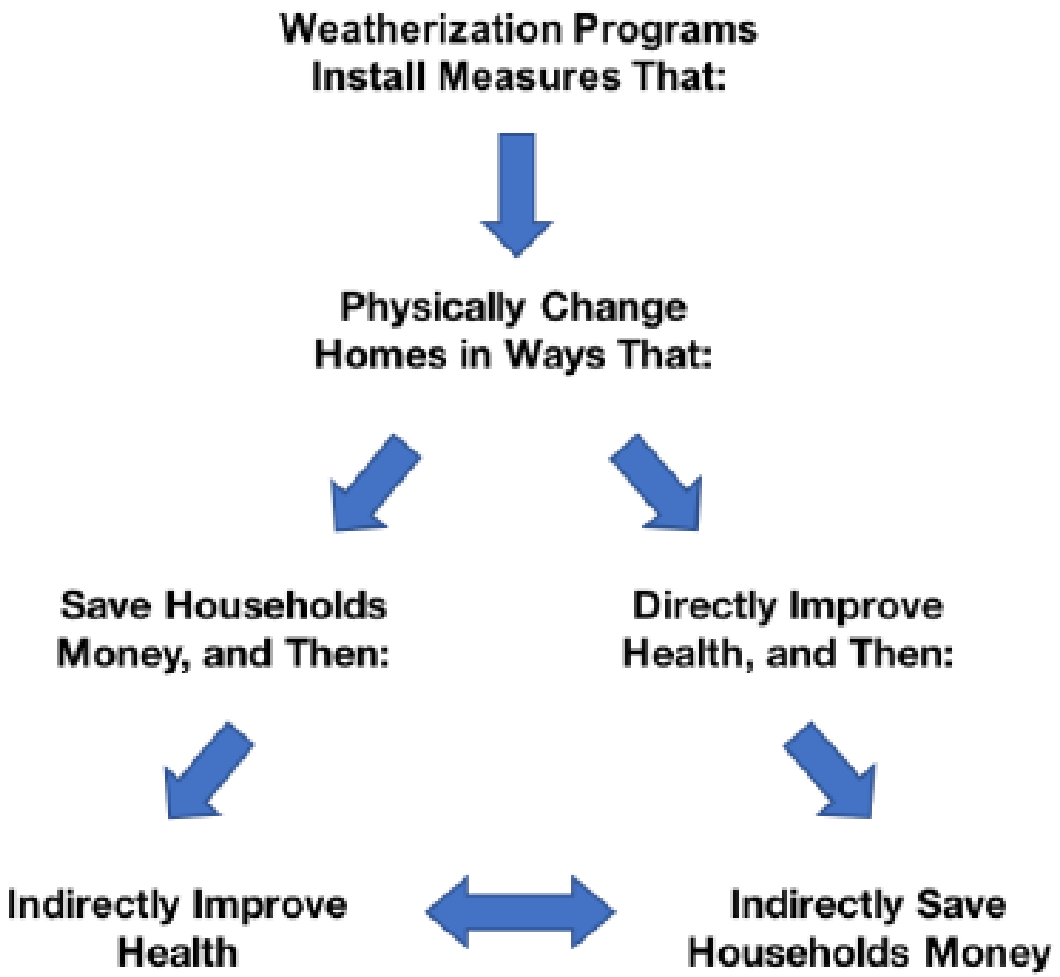
- Act 129: Governs electric energy efficiency programs in Pennsylvania
  - Applies to 7 largest electric distribution companies (EDCs)
  - Directs the Public Utility Commission (PUC) to use a TRC Test to analyze the benefits and costs
  - PUC TRC Order:
    - Provides guidance, methodology, and formulas for properly evaluating cost effectiveness
- 2016 TRC Order:
  - Directed EDCs to include fossil fuel and water impacts in Phase III TRC Test
  - First time inclusion of NEIs

# Pennsylvania: TRC Sensitivity Analysis

- EDC evaluations excluded fossil fuel or water savings from TRC benefits
- Statewide Evaluator (SWE) calculated the water and fossil fuel savings for 2 measures offered in 2016-17 program year:
  - 66,000 faucet aerators
  - 39,000 low-flow showerheads
- An additional $30 million in TRC benefits
- Increased the statewide gross TRC by 7.3% – from 1.47 to 1.57



# Current Research: Health and Safety Impacts Low-income Multifamily Weatherization




**Common physical changes include:**
1- reduced allergens and pests;
2- improved thermal performance;
3- reduced mold and mildew; and
4- increased noise insulation.

**Common health improvements include:**
1- reduced asthma symptoms;
2- reduced thermal stress;
3- fewer colds and flu;
4- reduced poor mental health days; and,
5- reduced # days of poor rest/sleep.

**Common ways that health improvements indirectly save money include:**
1- reduced missed days of work from being sick or having a household member being sick (results in less lost income); and,
2- reduced out-of-pocket expenses incurred from illnesses.

Source: *Impacts of Weatherizing Low-income Multifamily Buildings, by Three[3]*

# Low-income Multifamily Weatherization (LIMF)

- Previous research on SFH and mobile homes (MH):
  - Monetized improved health outcomes: $937 / year ($220 w/out avoided death)
    - Reduced asthma, thermal stress, missed days at work, CO poisoning, fires & increased home productivity
- Does comprehensive MF weatherization produce similar benefits?
  - If so, what is the magnitude of the benefits?
- WAP studies:
  - Demographics of MF building residents suggest they are a more vulnerable population on average than the occupants of SF or MH
    - Socioeconomic status and physical health
- Examine additional potential health impacts:
  - Trips and falls
  - COPD / other respiratory illnesses
  - Arthritis
  - Diabetes

# Current Study: MA LIMF Weatherization

## Comparison with Treatment (CwT)

buildings weatherized one to two years previously

## Treatment (T)

buildings scheduled to be weatherized

## Control

buildings that have not been weatherized and not scheduled to be weatherized

# The Impacts of Energy Efficiency in Schools

### Improve Environment

A failure or malfunction of any component of the HVAC system may subject student or faculty to discomfort and exposure to airborne contaminants. Relative humidity levels greater than 60 percent promote fungal growth. Reducing the risk of fungal grow to improve student and faculty health and decreasing absences by 15 percent.

### Increased Productivity

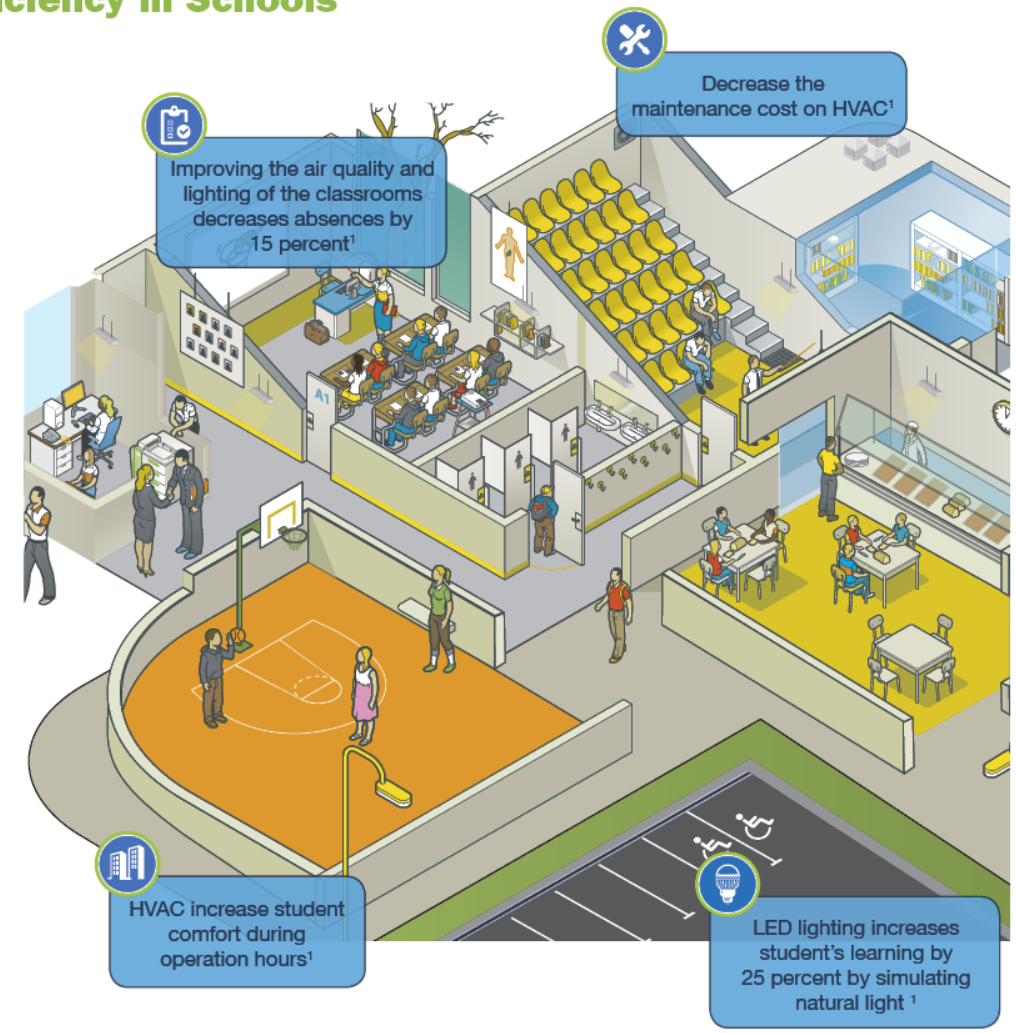
LEDs can simulate daylight that increases student productivity by 20 percent and learning by 25 percent. LED can also improve student's mood and attention in the classroom.

### Increased Comfort

HVAC systems in school districts are designed to maintain the indoor air temperature and humidity at comfortable levels for students and faculties. HVAC systems provide a cleaner, quieter, healthier and more comfortable learning and working environment for students, teachers, and staff. Improved HVAC upgrades run quieter, reducing distractions stemming from noise.

### O&M Cost Savings:

Energy management system (EMS) and HVAC controls lead to lower maintenance requirements, reduced costs for maintenance, and maintenance materials. Equipment life for the updated energy efficiency products also increased for school districts.




**Operations & Maintenance Cost Savings**

| Equipment | Energy Savings | Non - Energy Savings | Total Energy Savings | Energy Payback | Non - Energy Payback |
|---|---|---|---|---|---|
| Lighting | $2,961 | $7,670 | $10,632 | 3.10 yrs. | 0.86 yrs. |
| VFD | $906 | $0 | $906 | 2.11 yrs. | 2.11 yrs. |

1. LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES: Energy Efficiency Programs in K-12 Schools: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs. U.S. ENVIRONMENTAL PROTECTION AGENCY. 2011

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