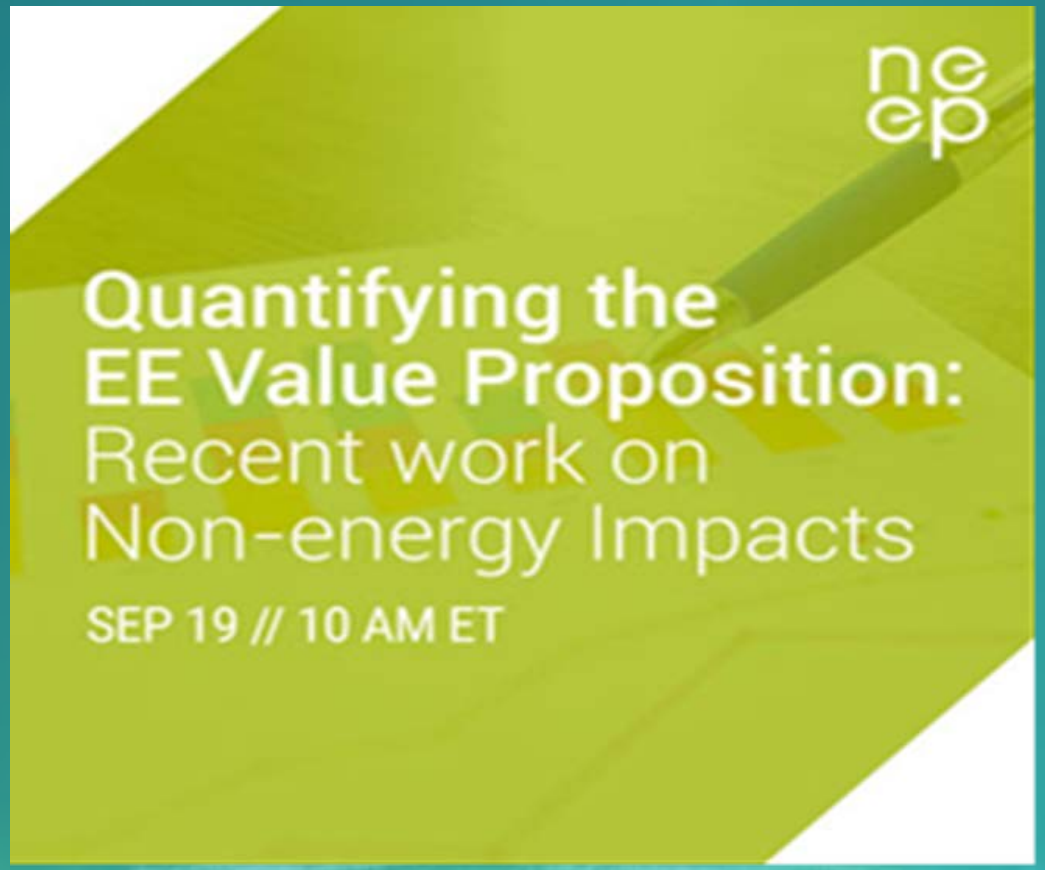

Quantifying the
EE Value Proposition:
Recent work on
Non-energy Impacts
SEP 19 // 10 AM ET

Welcome, Logistics & More

Please write in questions via chat or hand-raising function; we will field them at the end.

Please enter your PIN # so we can unmute you for Q&A.

Please note that the webinar is being recorded and we plan to post it to our website .

Mark Your Calendar !

For Coming NEEP Attractions

September 20 Webinar (Strategic Electrification Data and Resources)

October 1-3 NEEP Summit (Rhode Island)

October 12 Webinar (Pay 4 Performance)

November 7 M&V2.0 Workshop

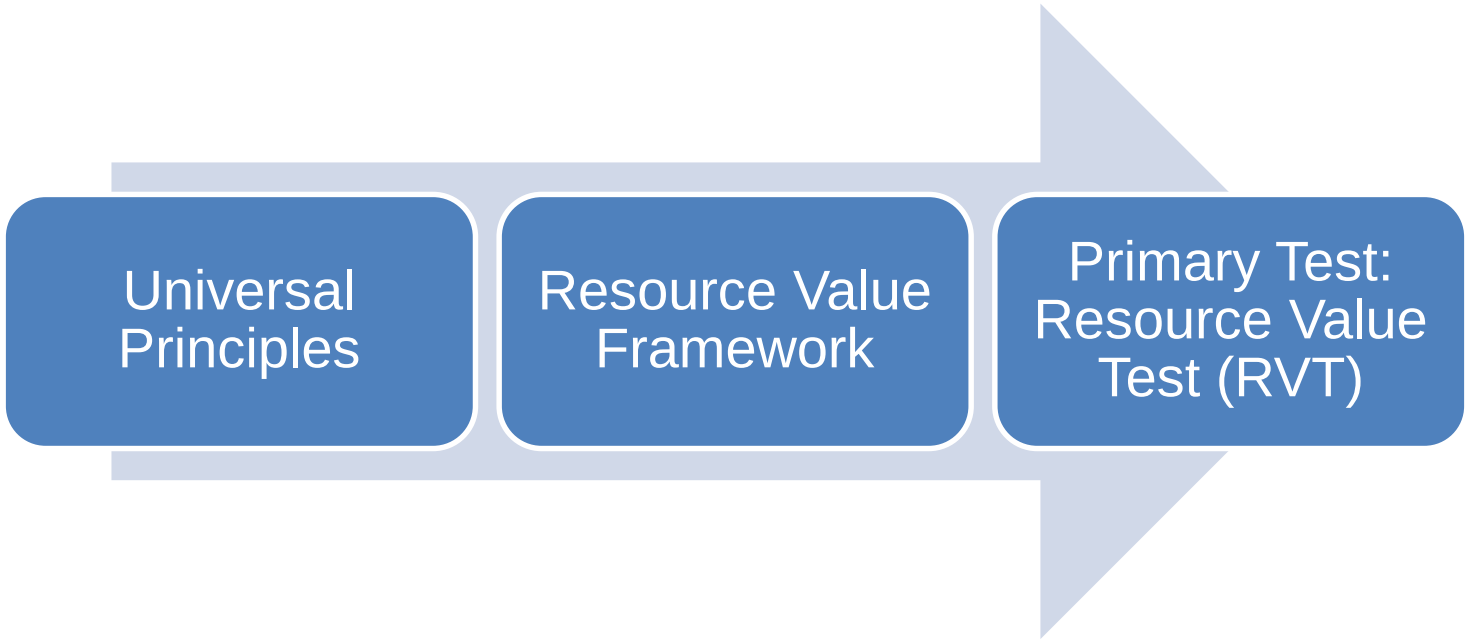
www.neep.org/events

The National Standard Practice Manual
What it says about NEIs and Supporting Resources

NEEP NEI Webinar
September 19, 2018

Julie Michals – E4TheFuture

Developing the Primary Cost-Effectiveness Test Using the Resource Value Framework

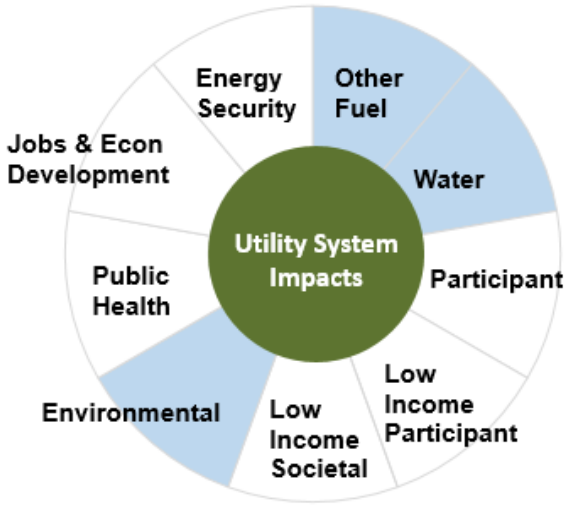


NSPM Principles

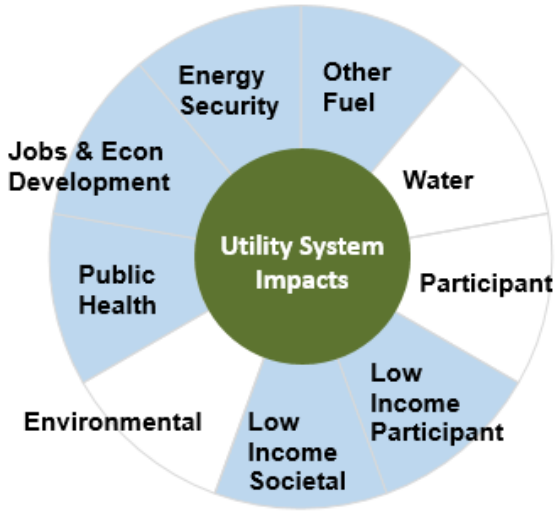
1. Recognize that energy efficiency is a resource.
2. Account for applicable policy goals.
3. Account for all relevant costs & benefits (based on applicable policies), even if hard to quantify impacts.
4. Ensure symmetry across all relevant costs and benefits.
5. Conduct a forward-looking, long-term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

Relationship of Resource Value Test (RVT) to Traditional Tests – Results May Align or Not

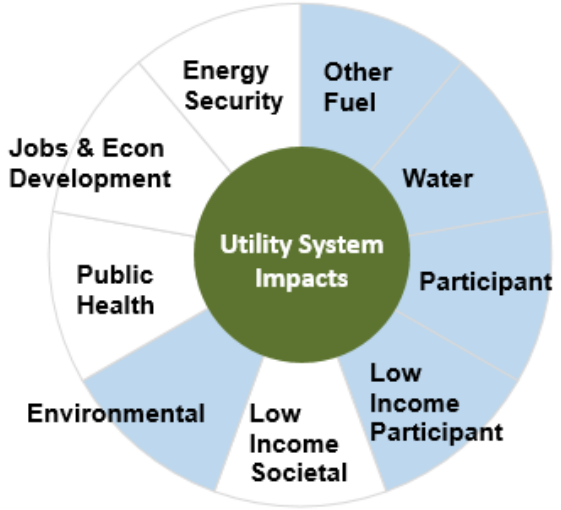
JURISDICTION 1: RVT



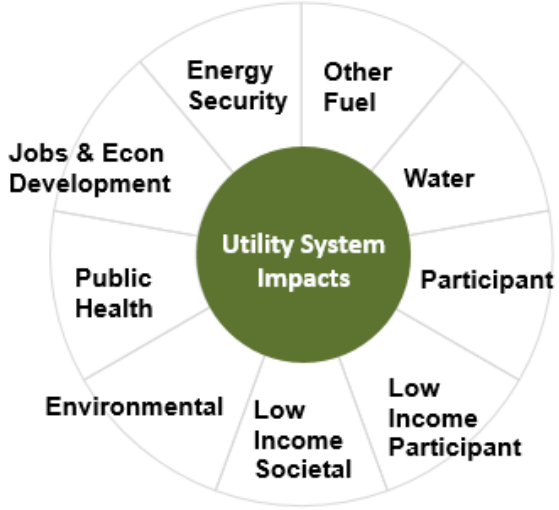
JURISDICTION 2: RVT



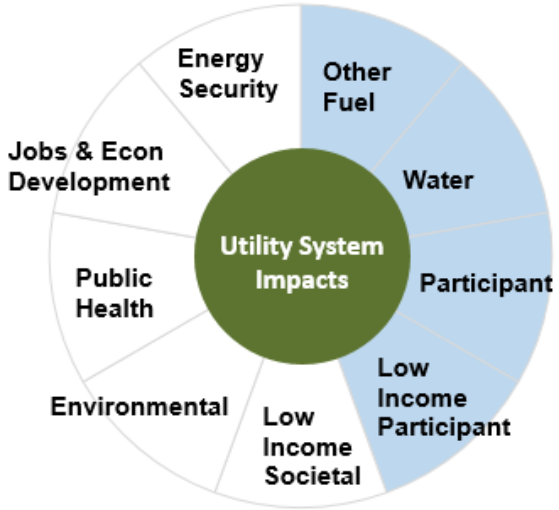
JURISDICTION 3: RVT



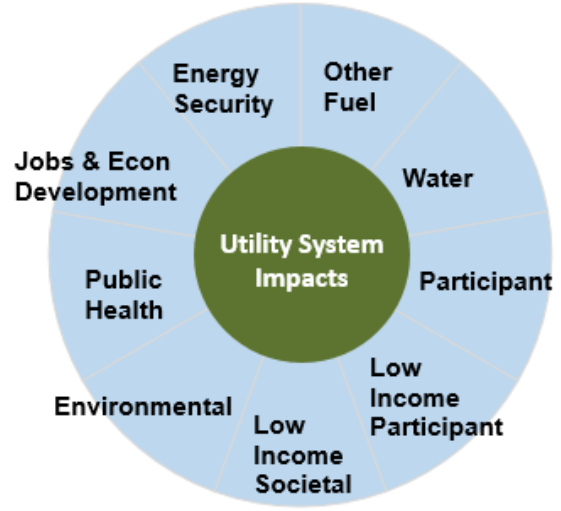
JURISDICTION 4: RVT = UCT



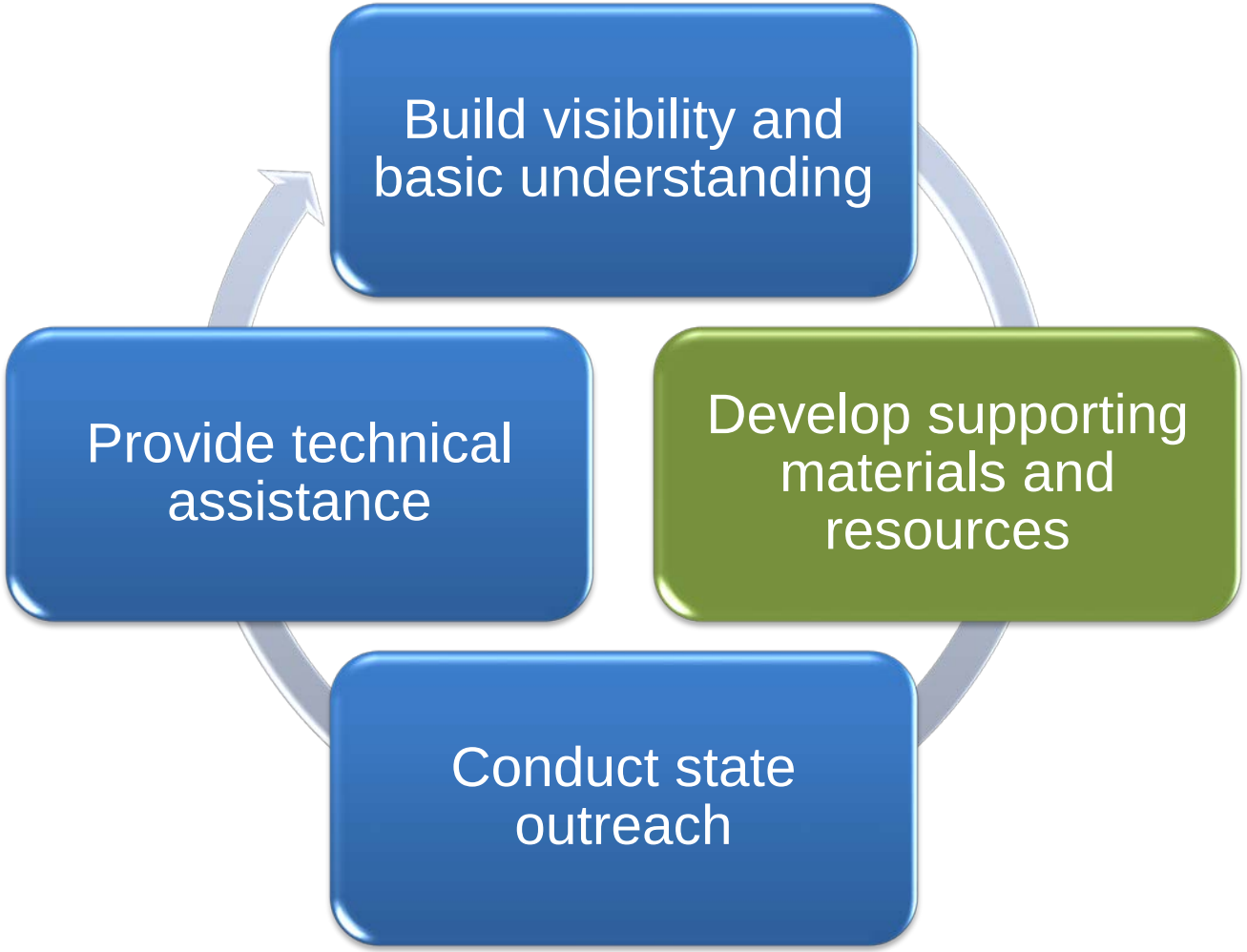
JURISDICTION 5: RVT = TRC



JURISDICTION 6: RVT = SCT

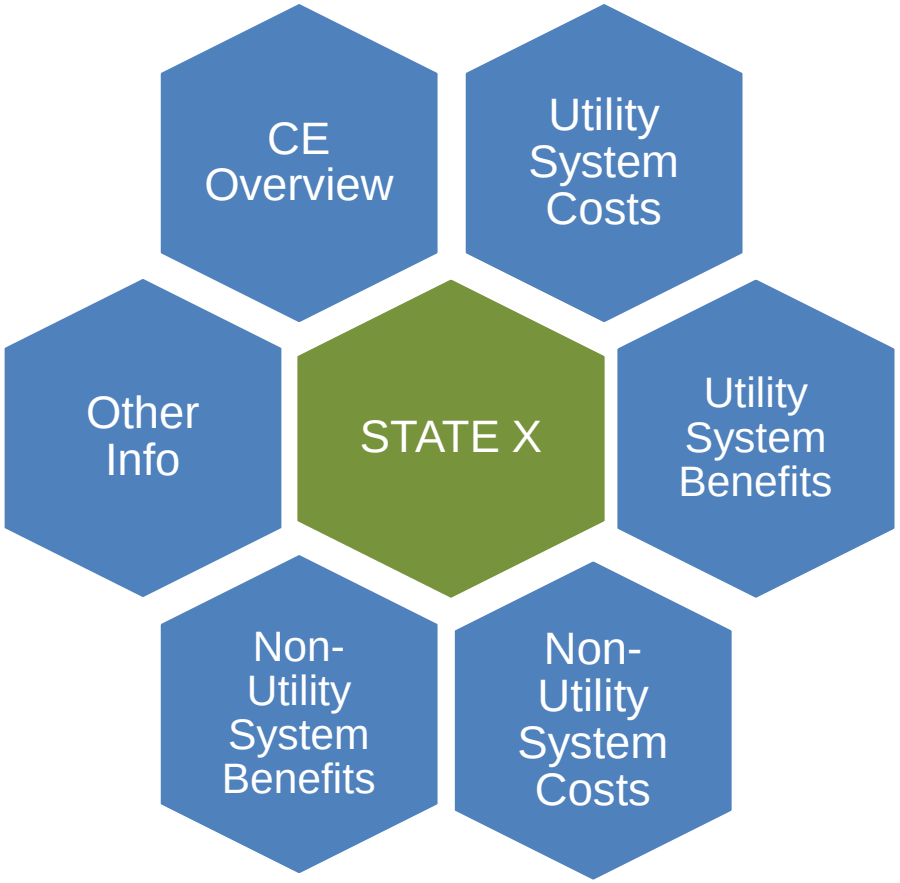


NSPM Outreach & Support Strategy



NSPM Cost-Effectiveness Testing Repository (CETR) Comparison of State Practices and Supporting Sources

Synapse and ACEEE research



Non-Utility System Impact Categories in CETR

Impact	Description
Participant impacts	Impacts on program participants, includes participant portion of measure cost, other fuel savings, water savings, and participant non-energy impacts
Impacts on low-income customers	Impacts on low-income program participants that are different from or incremental to non-low-income participant impacts. Includes reduced foreclosures, reduced mobility, and poverty alleviation
Other fuel impacts	Impacts on fuels that are not provided by the funding utility, for example, electricity (for a gas utility), gas (for an electric utility), oil, propane, and wood
Water impacts	Impacts on water consumption and related wastewater treatment
Environmental impacts	Impacts associated with CO2 emissions, criteria pollutant emissions, land use, etc. Includes only those impacts that are not included in the utility cost of compliance with environmental regulations
Public health impacts	Impacts on public health; includes health impacts that are not included in participant impacts or environmental impacts, and includes benefits in terms of reduced healthcare costs
Economic development and jobs	Impacts on economic development and jobs
Energy security	Reduced reliance on fuel imports from outside the jurisdiction, state, region, or country

For more information, visit
www.nationalefficiencyscreening.org
to download the full NSPM and supporting documents

For additional questions contact:
Julie Michals – jmichals@e4thefuture.org

NEEP

Non-energy impacts: New evidence and how they help bring efficiency to market

Noel Stevens
19 September 2018

Agenda

Non—Energy Impacts: Changing the evaluation paradigm – Total benefit assessment

National Grid MA Use of NEIs in cost effectiveness testing

AEP Ohio Use of NEIs in program outreach and marketing

NEIs to transition EE from a cost to a Benefit through Smart Lighting

Conclusion / Q&A

Non—Energy Impacts: Changing the evaluation paradigm:
What are NEIs?

What are Non-Energy Impacts (NEIs)?

- *NEIs* include positive or negative effects attributable to energy efficiency programs apart from energy savings.
- *Participant Impacts* are NEIs that directly benefit a program partner, stakeholder, trade ally, participant, or the participant's household.
- Examples:

Lower maintenance

Reduced waste disposal costs

Fewer parts and supplies

Increased comfort / wellbeing

Increased health

Changing the evaluation paradigm – Total benefit assessment

Why estimate NEIs?

Program cost-effectiveness: Massachusetts

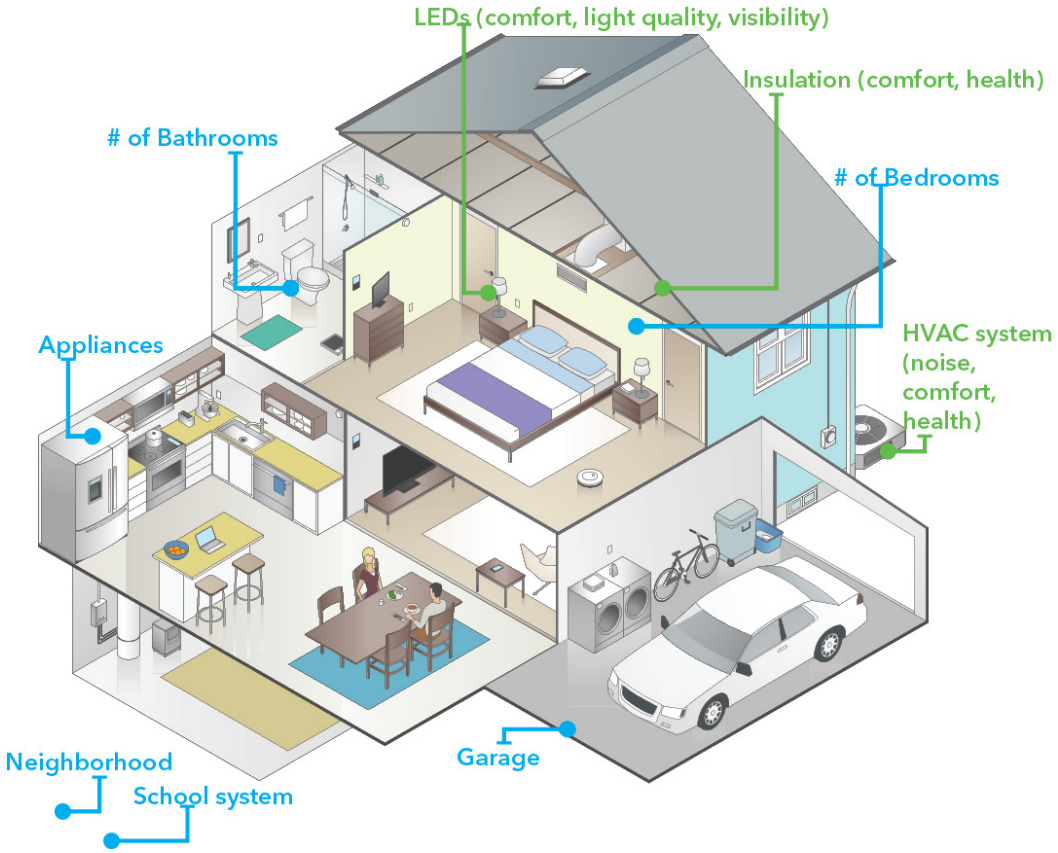
- *Regulatory cost-effectiveness testing* – Positive NEIs demonstrate effective use of resources in regulatory filings.

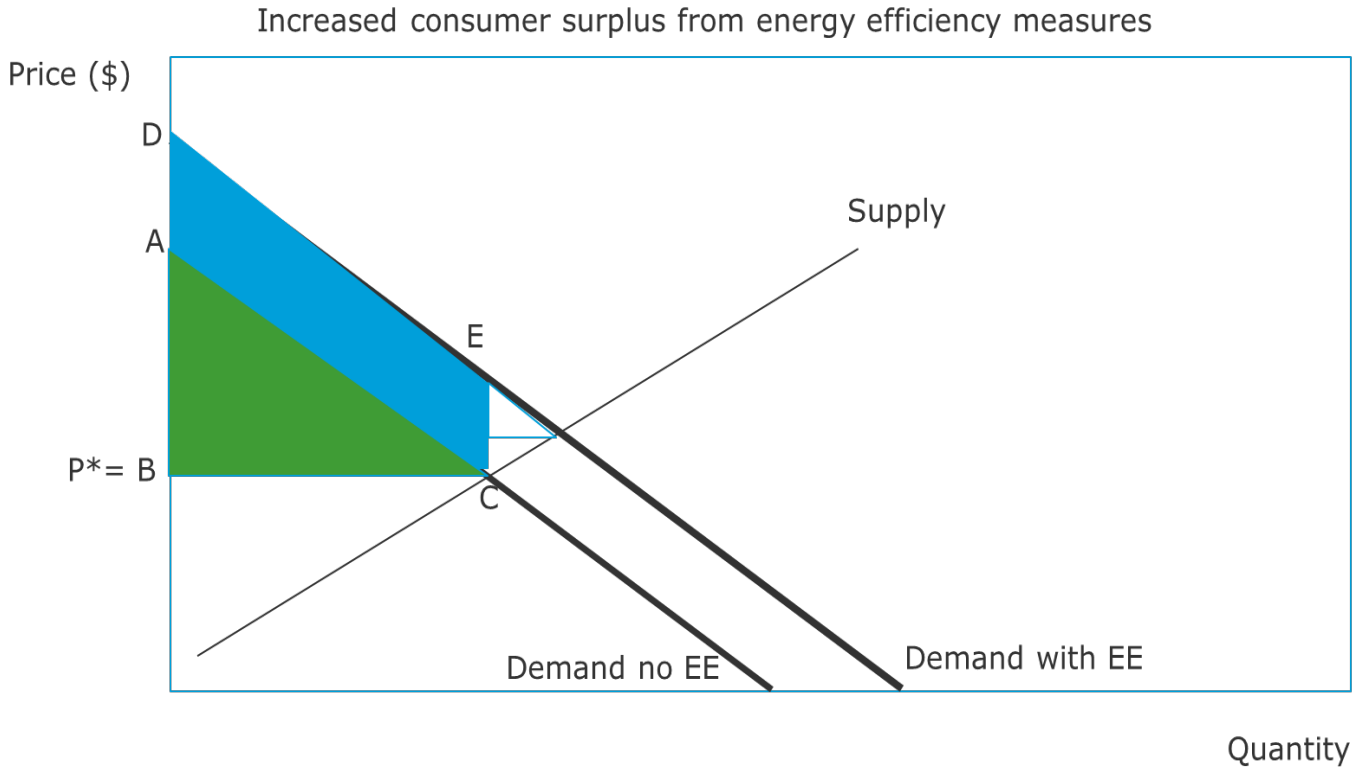
Sales and marketing to end users: AEP Ohio, Consumers Energy

- *Program marketing/targeting* – Demonstrate full value of programs to customers

Changing the evaluation paradigm – Total benefit assessment

NEIs in Cost-effectiveness testing: Theory and practice - Residential

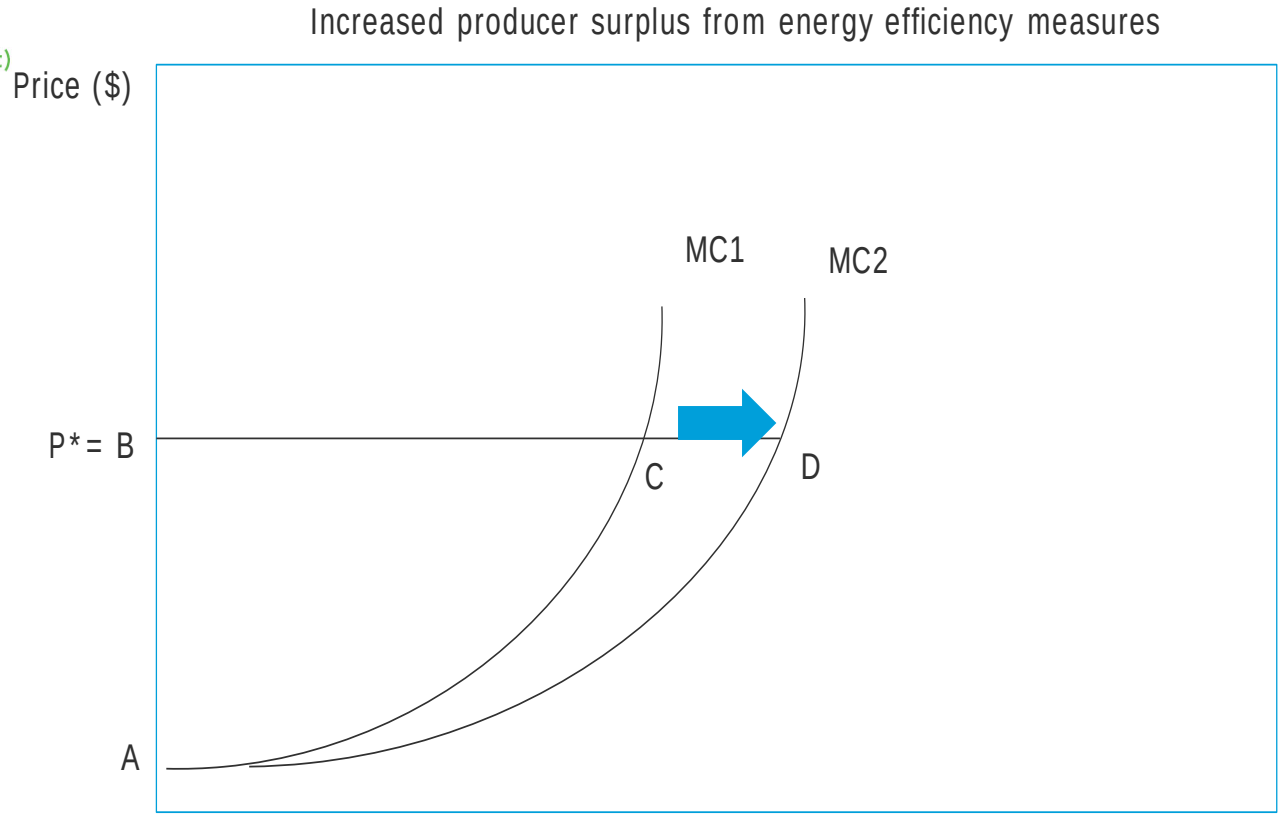




"**Hedonic price theory**" of property values states that "housing prices reflect differences in the quantities of various characteristics of housing and that these differences have significance for applied welfare analysis."*

Changing the evaluation paradigm – Total benefit assessment

NEIs in cost-effectiveness testing: Theory and practice - C&I



NEIs reflect changes to firm profits (or producer surplus)

Profit = Revenue(increased sales, output, productivity) – Costs (reduced O&M, downtime, errors, materials, increased safety

Changing the evaluation paradigm – Total benefit assessment

Be sure to get the story straight: Double counting property values

Double counting

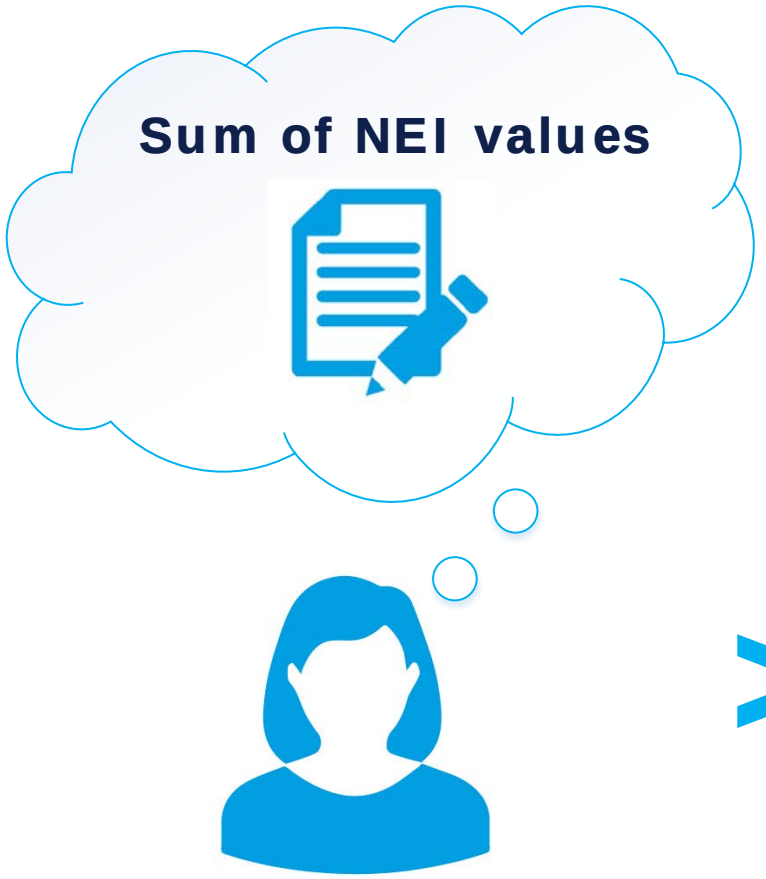
- If counting the annual stream of benefits that lead to property value change, we cannot also count the property value change

Exception

- If we can show an increase in occupancy rate, the NEI should be included (difficult in saturated urban markets)

Changing the evaluation paradigm – Total benefit assessment

Be sure to get the story straight:: Non-additive NEIs



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Total value of NEIs

Additive assumption

- Individual impacts are additive
- Total programmatic impact = Sum (Comfort, health, noise, etc.)

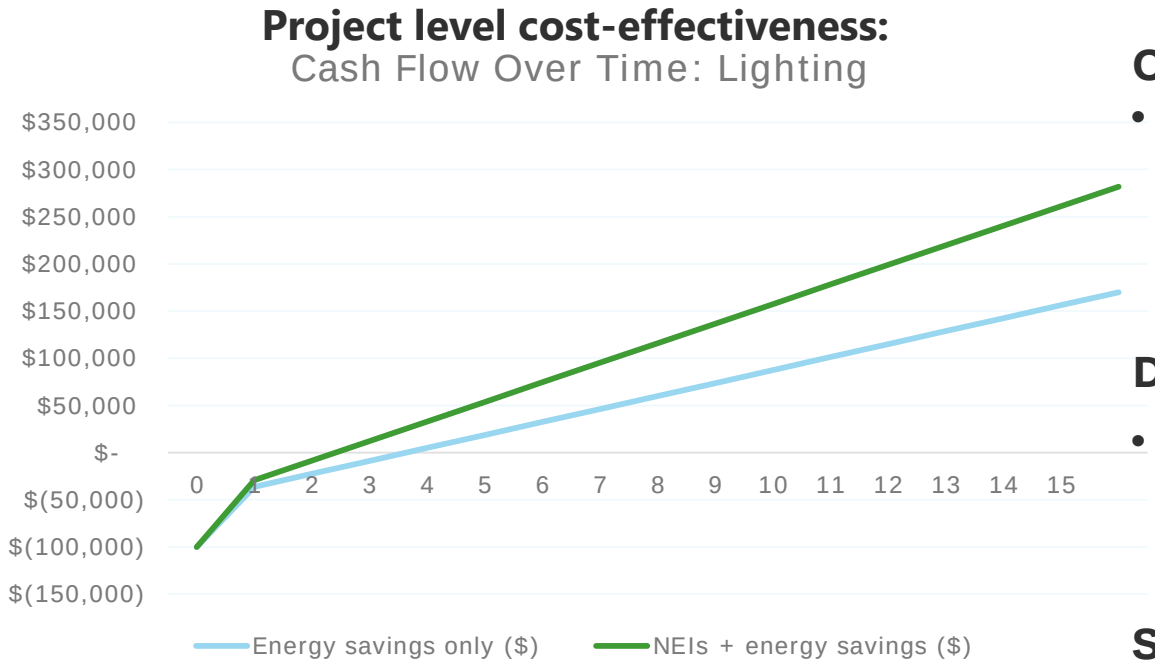
Violation of additive assumption

- If impacts not mutually exclusive (i.e., not additive)
- Sum of the individual NEIs can exceed the value of the “total NEIs.”
- Why: Respondents have difficulty separating values

DNV·GL

NEIs in program implementation & outreach

Demonstrate true value to participants: Decrease project payback period



Results for Lighting	
Payback Period (with NEI):	2.41 years
Payback Period (without NEI):	3.64 years
Years to positive ROI:	1.32 years
Energy Savings/year:	13,750 $/year
NEI/year	7,000 $/year

O&M Cost savings

- Example (HVAC):
  - External: Fewer service calls from temp/humidity issues.
  - HVAC: Internal service calls decreased roughly $25,000/year

Downtime / revenue increase

- Operating room - VFD / New chiller online - 1 hour downtime / month = $100,000 happened 12 times per year = $1,200,000 improvement in revenue per year.

Safety

- Prior system getting so many complaints and out of compliance.
- Operating rooms - surgeons more productive, able to control temp and humidity better. improvement in performance.

The future is NOW! The next frontier for efficiency

Advanced lighting and controls technologies and NEIs

Lighting optimization

- Circadian lighting – worker/student performance, worker, student, patient health
- Lumen optimization -

Air quality monitoring

- Hospitals – Patient health, code compliance
- Schools – Student / teacher health, mold

Asset tracking

- Manufacturing – Shop floor
- Retail – Theft detection

Productivity / downtime studies

- Predictive maintenance – manufacturing
- Reduced changeovers
- Lower fatigue

Energy Efficiency can move energy from a cost center to a revenue generator

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NEI Development in Massachusetts



Beth Delahaij, National Grid

September 19, 2018

EE in Massachusetts: Context

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- Green Communities Act directs all electric and gas program administrators (PAs) to seek out and implement all EE and demand reduction that is “cost effective or less expensive than supply”
- Aggressive growth in EE since 2008, hitting savings rates of ~3% of sales (electric) and ~1.2% of sales (gas) statewide
- Currently facing challenges in understanding how EE will evolve

Mature programs

After decades of implementation, saturation becomes an issue

Declining avoided costs

Increase in gas supply has decreased gas supply costs and generation costs

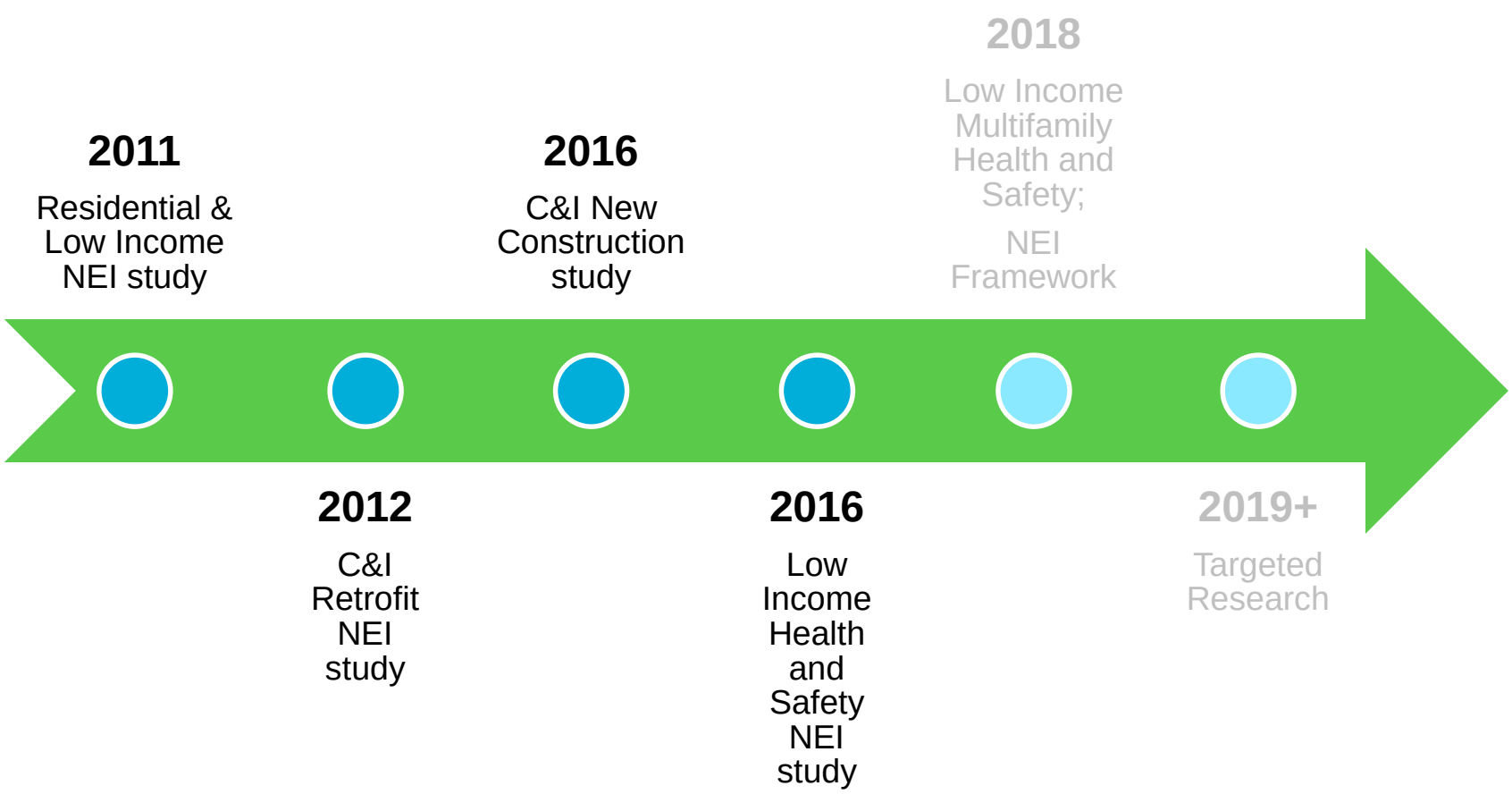
Higher baselines, declining savings

Federal codes & standards

Industry Standard Practice (ISP)

Application of NEIs

History of NEI Research in MA



The Impact of NEIs on Benefit-Cost Ratios: Example

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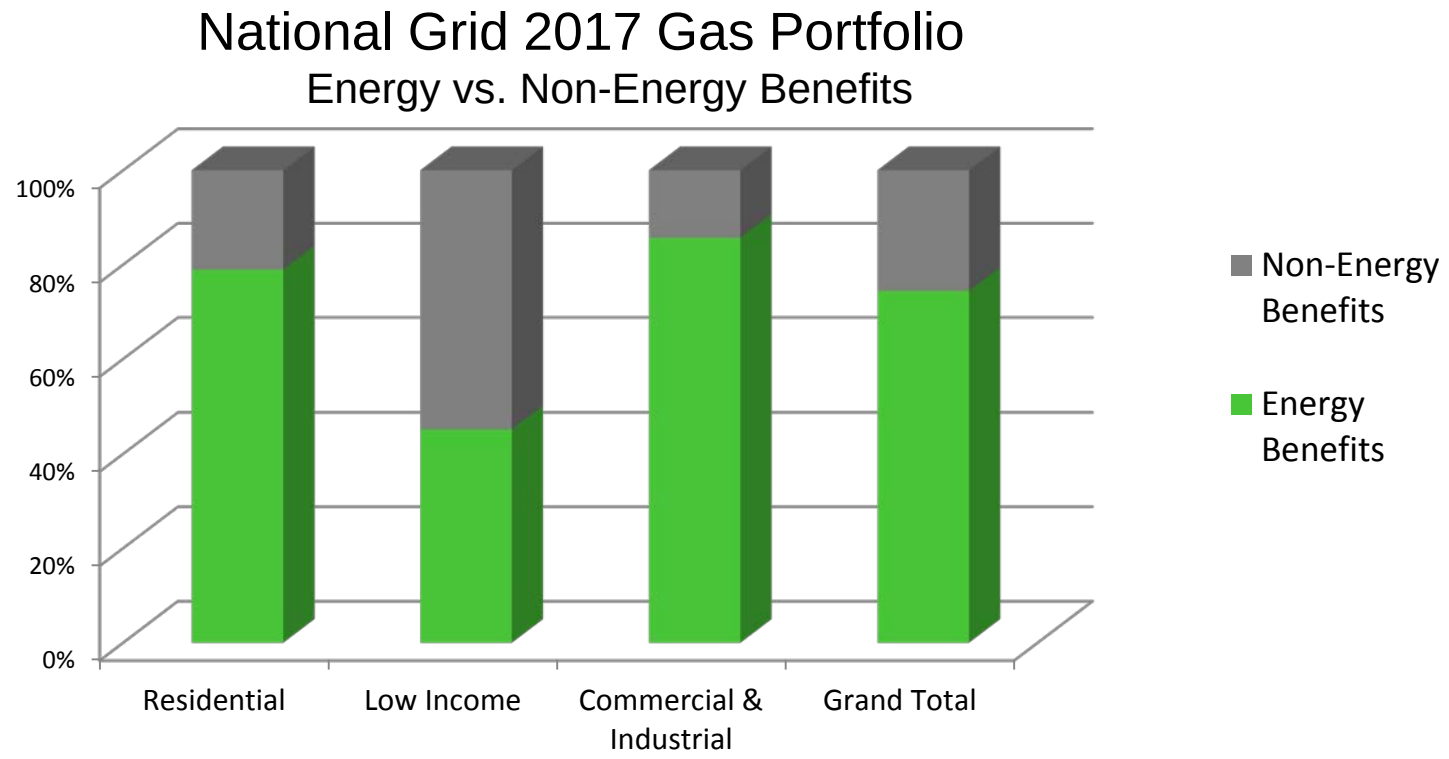

BCR	1.63	2.04	2.69	1.92

NEI Research in MA: Looking Ahead

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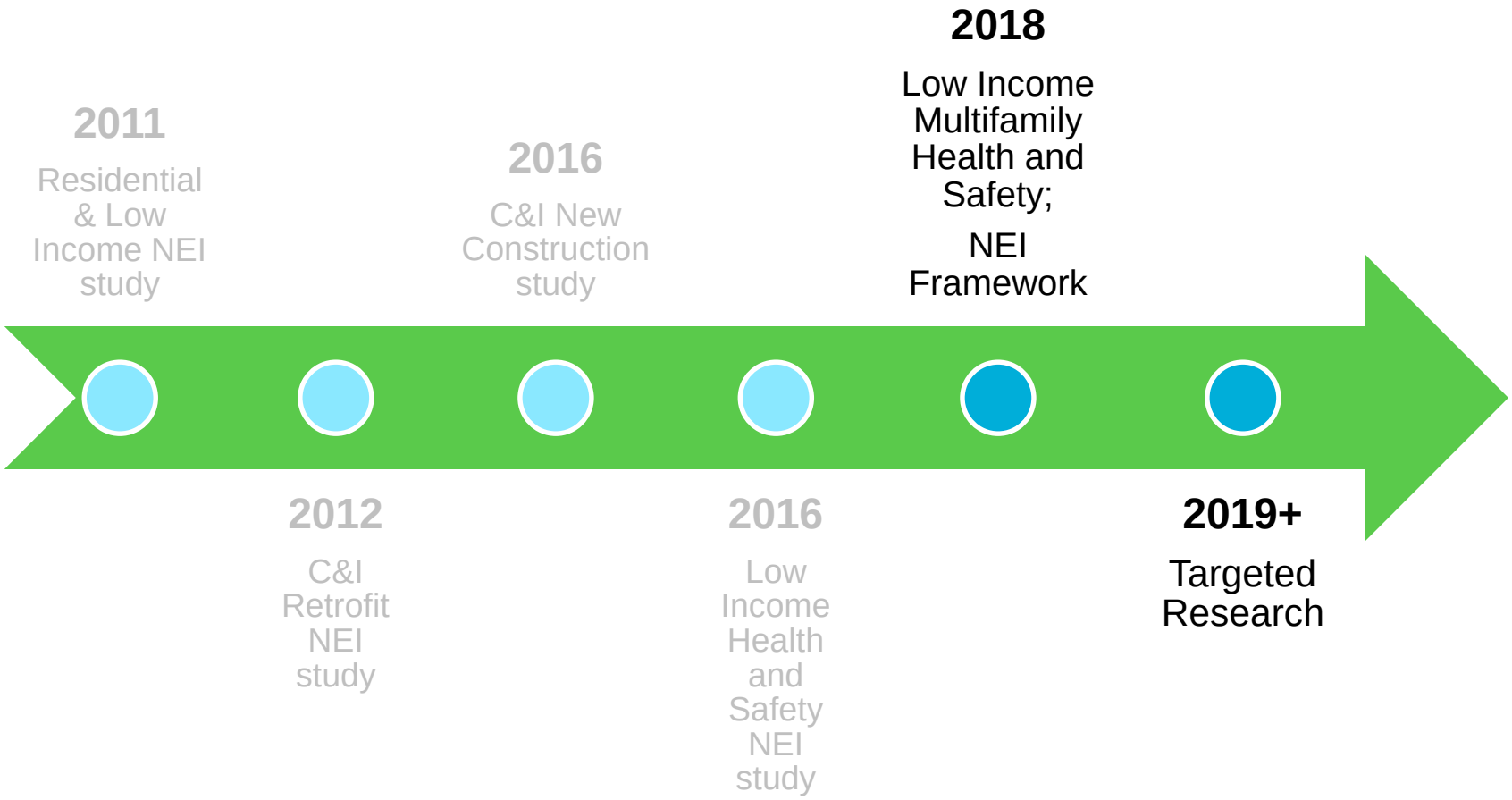


Appendix

Study Name	Study
Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation (TetraTech/NMR)	 Adobe Acrobat Document
Commercial and Industrial Retrofit Non-Energy Impacts Study (DNV GL)	 Adobe Acrobat Document
Commercial and Industrial New Construction Non-Energy Impacts Study (DNV GL)	 Adobe Acrobat Document
Low Income Single Family Health and Safety NEI Study (Three^3/NMR)	 Adobe Acrobat Document
Non-Energy Impact Framework Study Report (TetraTech/NMR/DNV GL)	 Adobe Acrobat Document

NEI study drivers

- Tell a more complete, more compelling story. It doesn't end with incentives and energy cost savings.
- Use NEI benefits to help prevent opt-outs by large C&I customers
- Consider NEIs in EE program cost-effectiveness tests

Telling a more complete story

- Introduced the concept of NEIs in AEP Ohio's annual C&I magazine "Efficiency Today"
- Revised previous case studies to include NEIs and highlight hard-to-measure NEIs that help drive business segments
- Helped clarify value propositions in project proposals by incorporating NEIs

https://aepohio.com/save/business/EfficiencyTodayMagazine.aspx

Case studies: HVAC benefits

Efficient HVAC systems do a better job of regulating temperature and humidity.

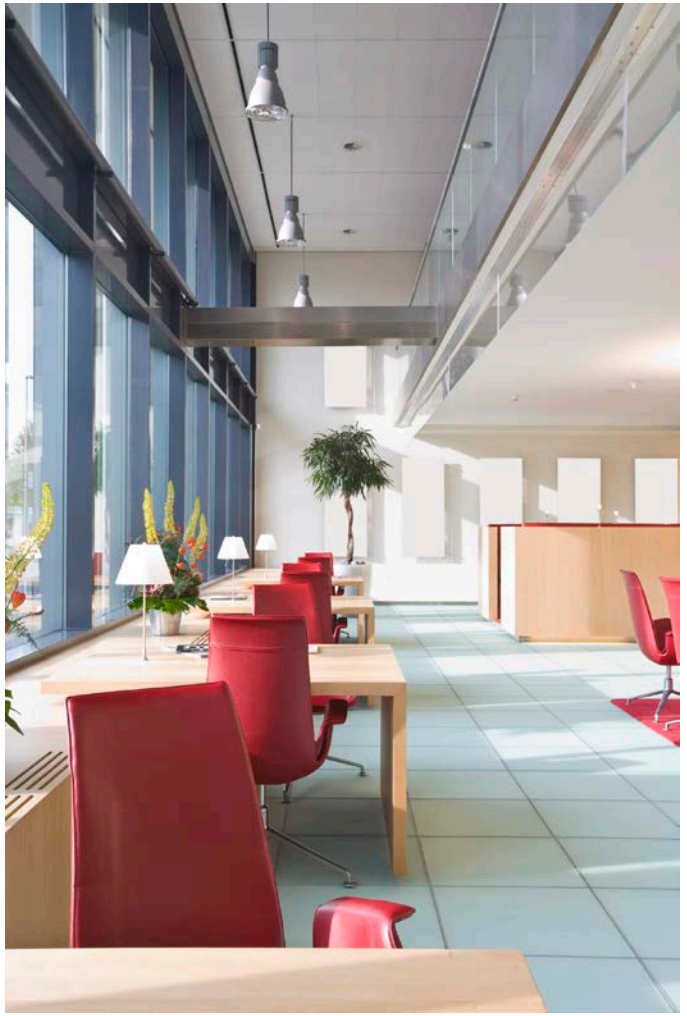
In manufacturing, this often results in improved product quality and less product loss. The more pleasant work environment improves employee productivity and retention.

In retail, HVAC improvements help maintain product quality and increase customer comfort. This translates to a longer browse through the store, and more opportunity for increased revenue.

Case studies: Retail improvements

Abercrombie & Fitch Co. distribution centers and IT/data center

- LED-lit office spaces decrease eye strain for operations and design associates
- LEDs increase safety for distribution center exteriors, illuminating the parking lot for employees
- New cooling equipment for IT data center: air exchanging economizers maintain ideal server temperature while using significantly less energy.



Case studies: LEDs and health

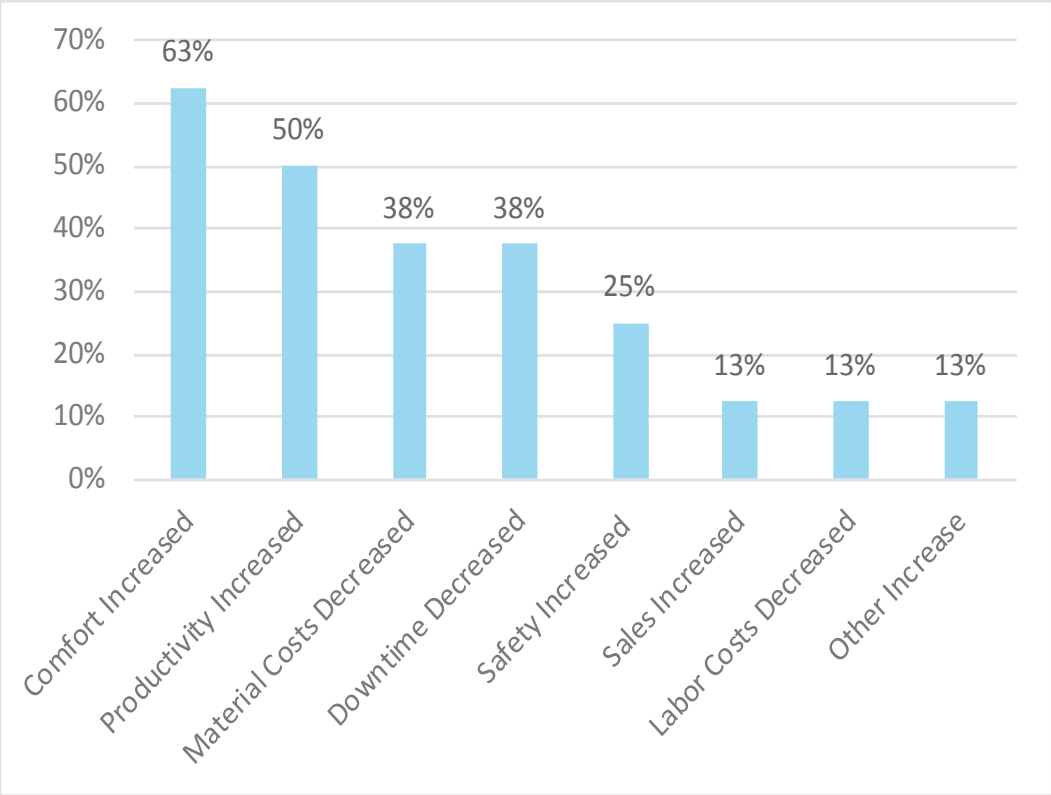
Patients and providers want to come to a place where all the equipment is up and running, and that's well lit. It's all about feeling better—and this building feels healthy. –Craig Sherman, Director of Outpatient and Support Services, **Wooster Community Hospital**

- Evidence that natural light improves learning, mood, and attention dates back over 100 years.
- Recent studies have shown that LEDs can mimic natural morning light, resulting in increased attention, performance and mood.
- In contrast, fluorescent lighting can suppress melatonin release toward the end of the worker's shift, which can result in sleep disorders such as insomnia—a common problem for second and third-shift work
- LEDs can increase surgical and nursing staff performance by enhancing mood and alertness, particularly during night shifts.

Average O&M cost savings per project from EE measures

	NEI $/kWh savings	Average of kWh savings	# of projects	Average Incentives	Average energy cost savings	NEI $/yr	Average measure cost	Average # of payback years
Commercial	$0.0188	19,345	4365	$1,548.92	$2,321.42	$296.96	$ 10,097	2.07
Manufacturing and Industrial	$0.0168	86,690	806	$5,456.68	$10,389.95	$987.02	$ 25,249	1.54
Public	$0.0204	27,322	1238	$1,983.33	$3,278.67	$327.36	$ 11,208	2.82
Grand Total	$0.0189	29,346	6409	$2,124.36	$3,521.03	$389.62	$ 12,217	2.02

Multi-faceted approach



Percentage of measures with reported NEIs

- Combined interview-based modeling approach: O&M, revenue …
- Literature review-Hard-to-measure NEIs: Circadian rhythm (productivity, health impacts, reduced downtime

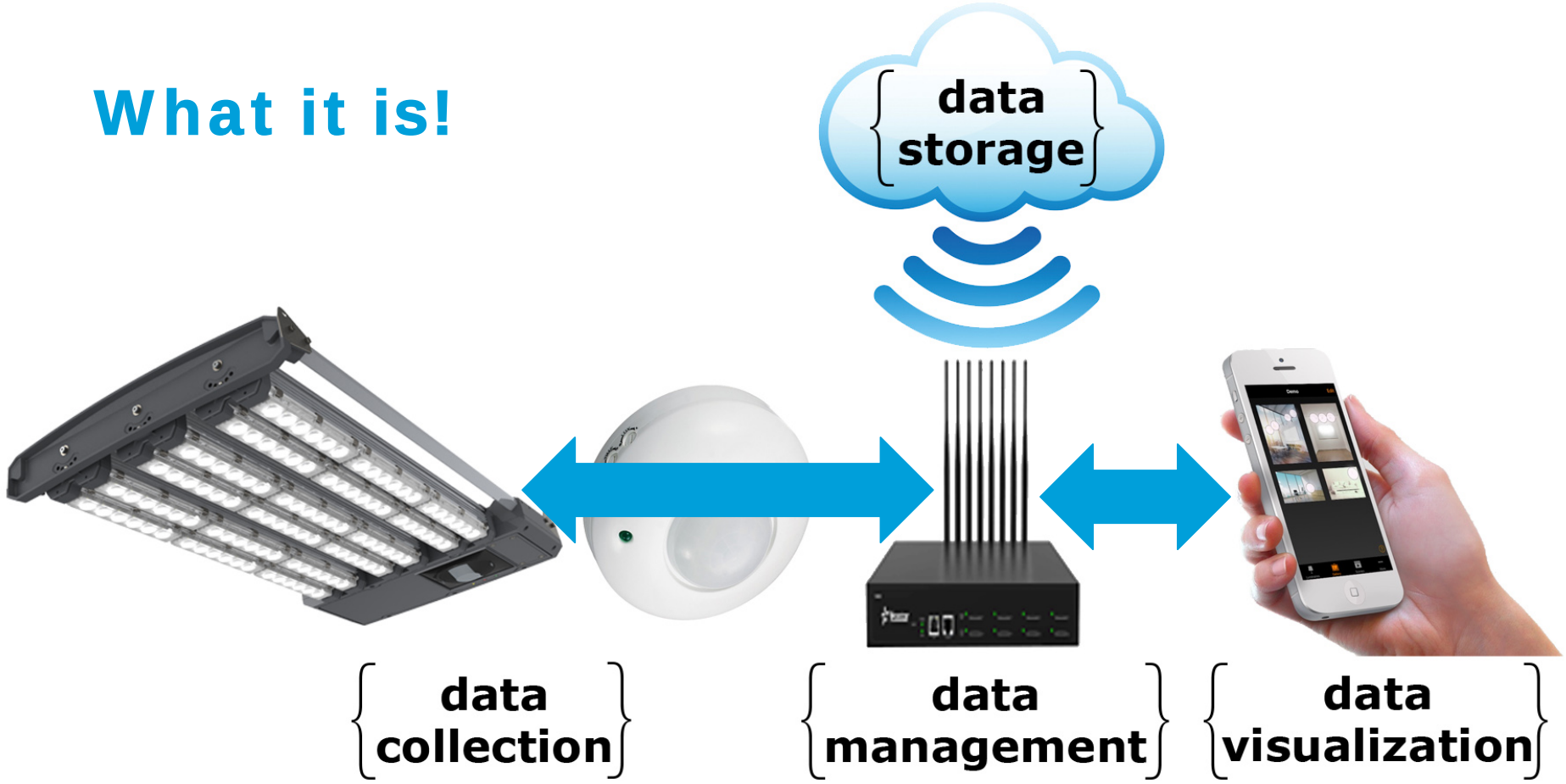
Next steps

- Develop well-documented estimates of NEIs to demonstrate the full range of measure benefits
- Expand the dialogue into regulatory environments

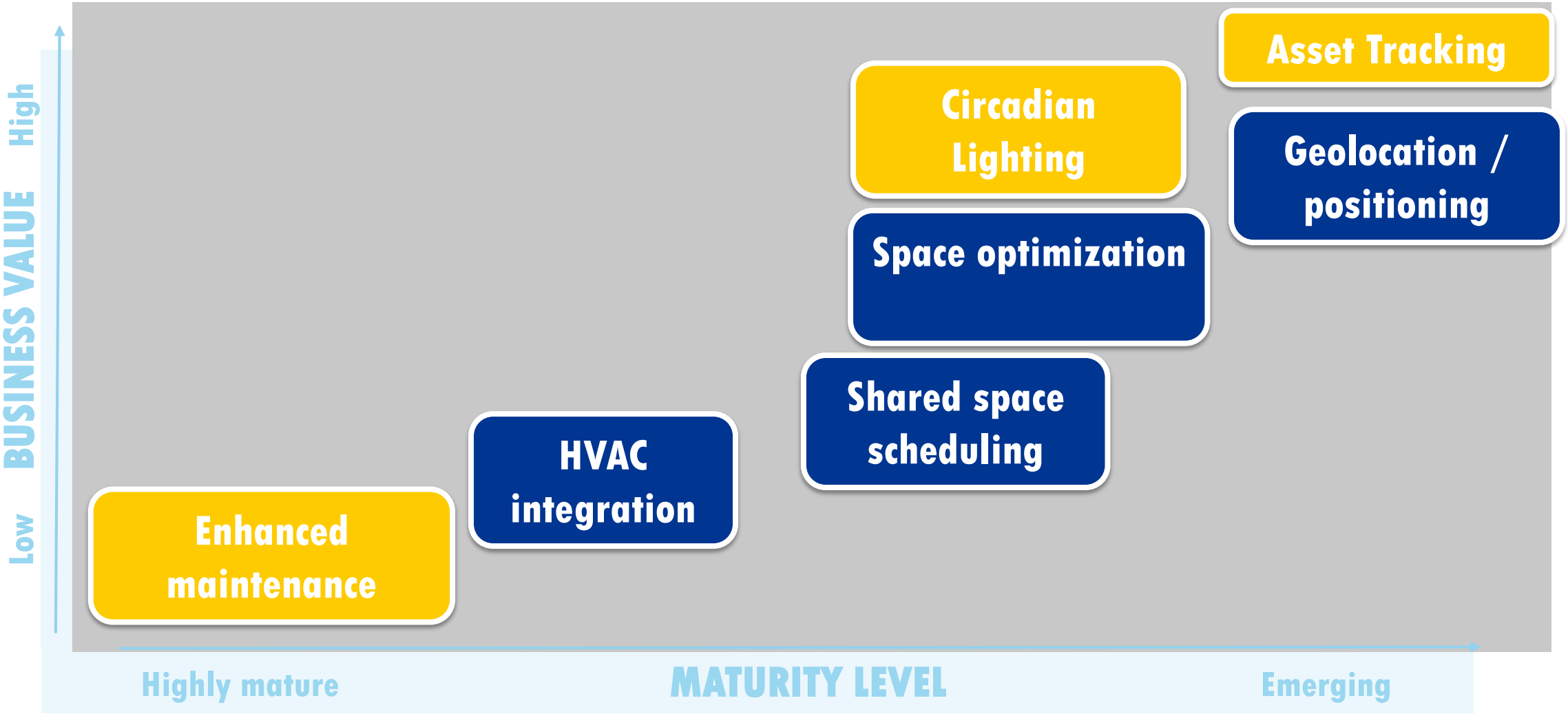
What is Smart Lighting?

What it is not!

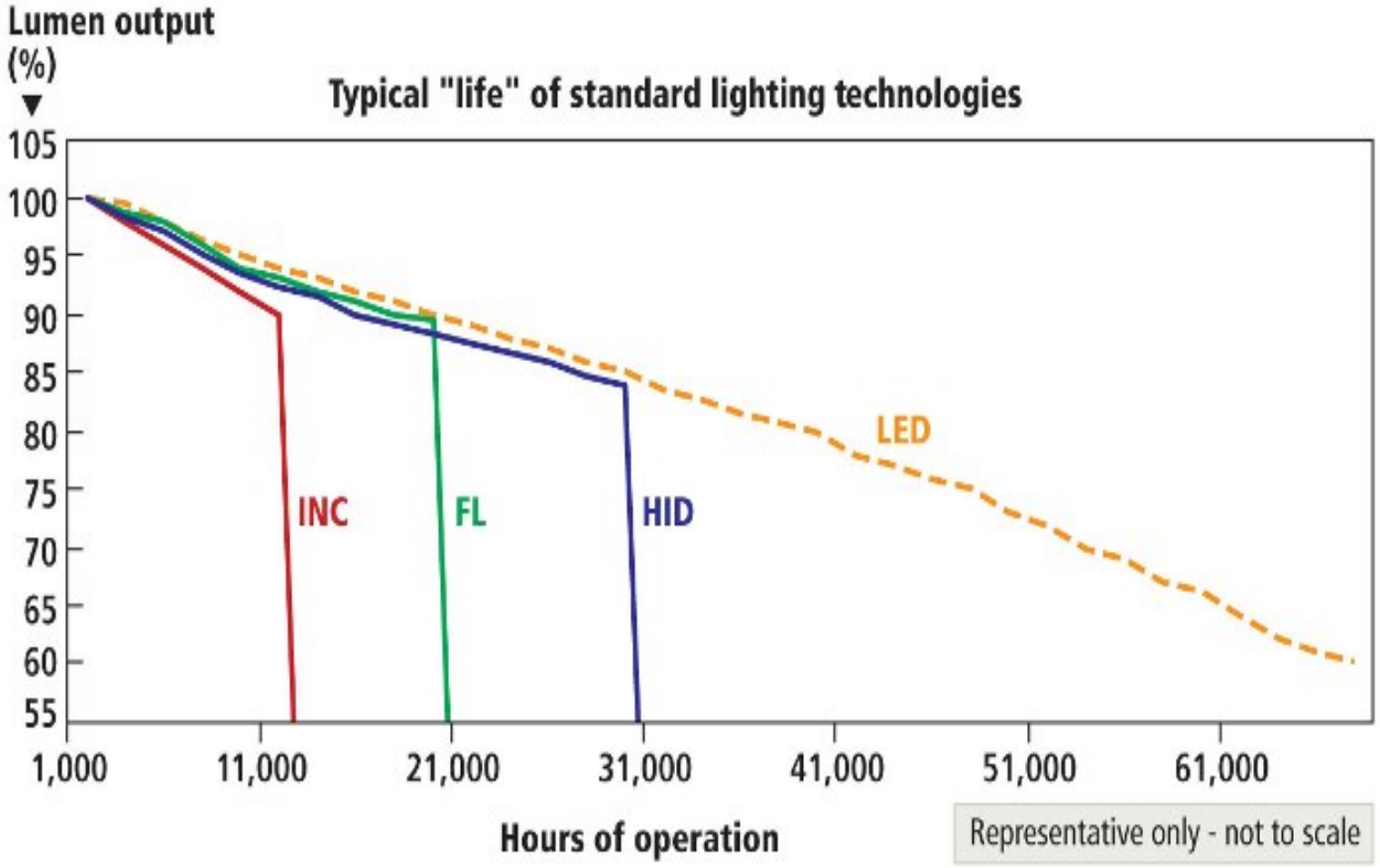
What it is!



Value beyond illumination – future use cases



Cutting Cost through Enhanced Maintenance

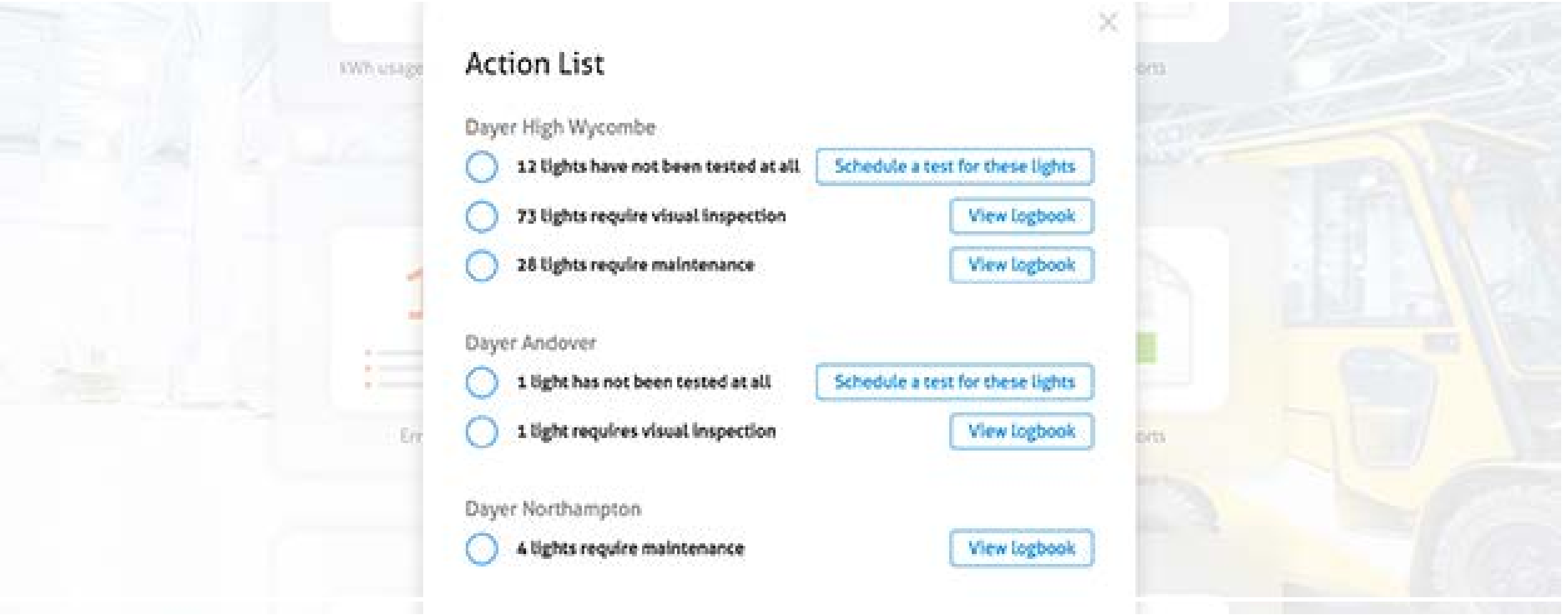


Predictive Maintenance –

Using data to quantify the probability of failure before preventative maintenance is identified or scheduled

- Decreases equipment downtime
- Improved worker & environmental safety
- Lower labor and material costs
- Improved aesthetics

Preventative Maintenance example



Source: NEDAP Luxon

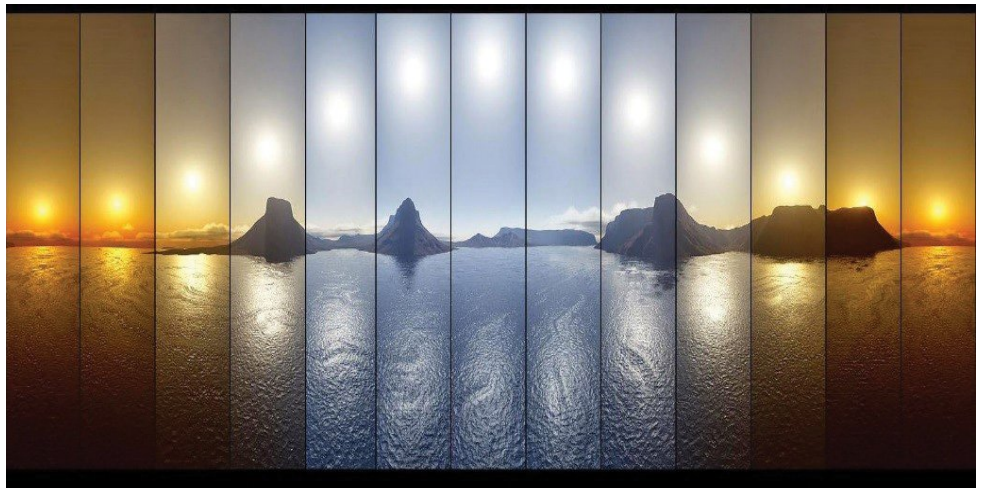
What is circadian lighting?

Source: Glumac

- Circadian lighting is: ‘Spectrally weighted retinal irradiance that stimulates the human circadian system’ (LRC)
- Utilizes LED lighting and advanced controls to mix at least red, green, and blue channels to deliver the entire range of the color spectrum
- Emerging technology that is being commercialized

Enhancing occupant comfort through circadian lighting

90 % **of our time is spent in enclosed spaces!**



Sources: Glumac, CBRE

71 % of participants felt more energized

76 % of participants felt happier

50 % of participants felt healthier

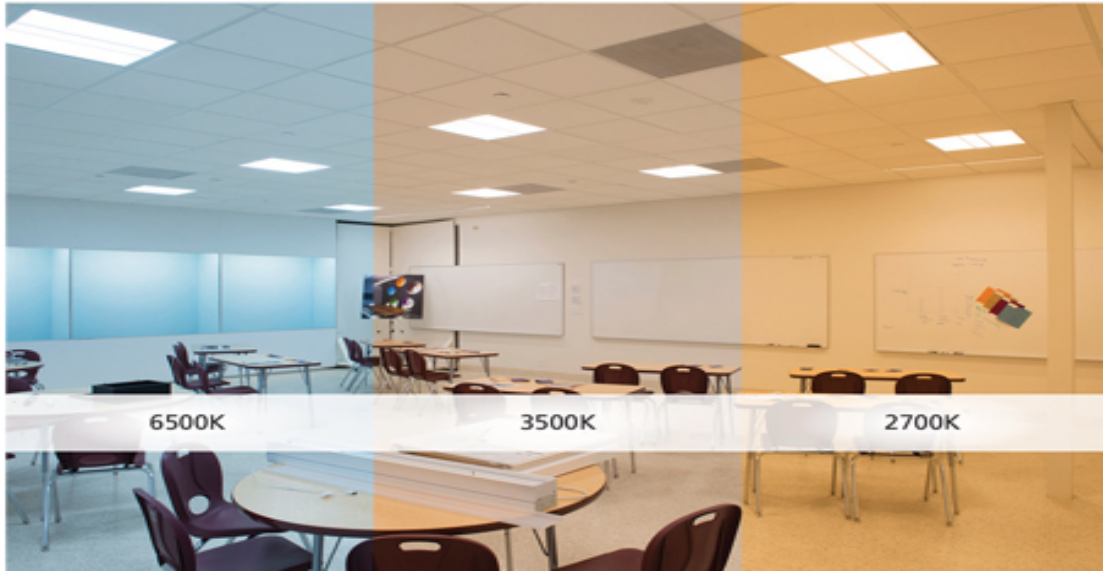
Improving outcomes through circadian lighting

Healthcare – the case against blue light

- Nightshift nurses report better sleep
- Patients maintaining regular sleep/wake cycles
- Reduced administration of medication for dementia patients

Education – the case for blue light

- Teacher control over mood
- Enhanced reading speeds
- Improved concentration / test scores



Sources: CLTC UC Davis, Lightnow blog

Asset Tracking – Optimizing people & asset productivity

- A hospital of 1,000 nurses would expect to see 6,000 hours wasted per month on looking for misplaced equipment (nursing times)
- Many hospitals report equipment utilization rates under 50% (GE Healthcare)
- Advanced technology can help organizations raise worker productivity and optimization asset utilization

Source: Osram

Contacts

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Q&A!