Creating a Transformational Path to the Future of Energy Efficiency, Together!

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Presented to MPSC EWR Collaborative

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(Adapted from Presentation given at 2021 ACEEE Energy Efficiency as a Resource Conference, October 21, 2021)

Agenda

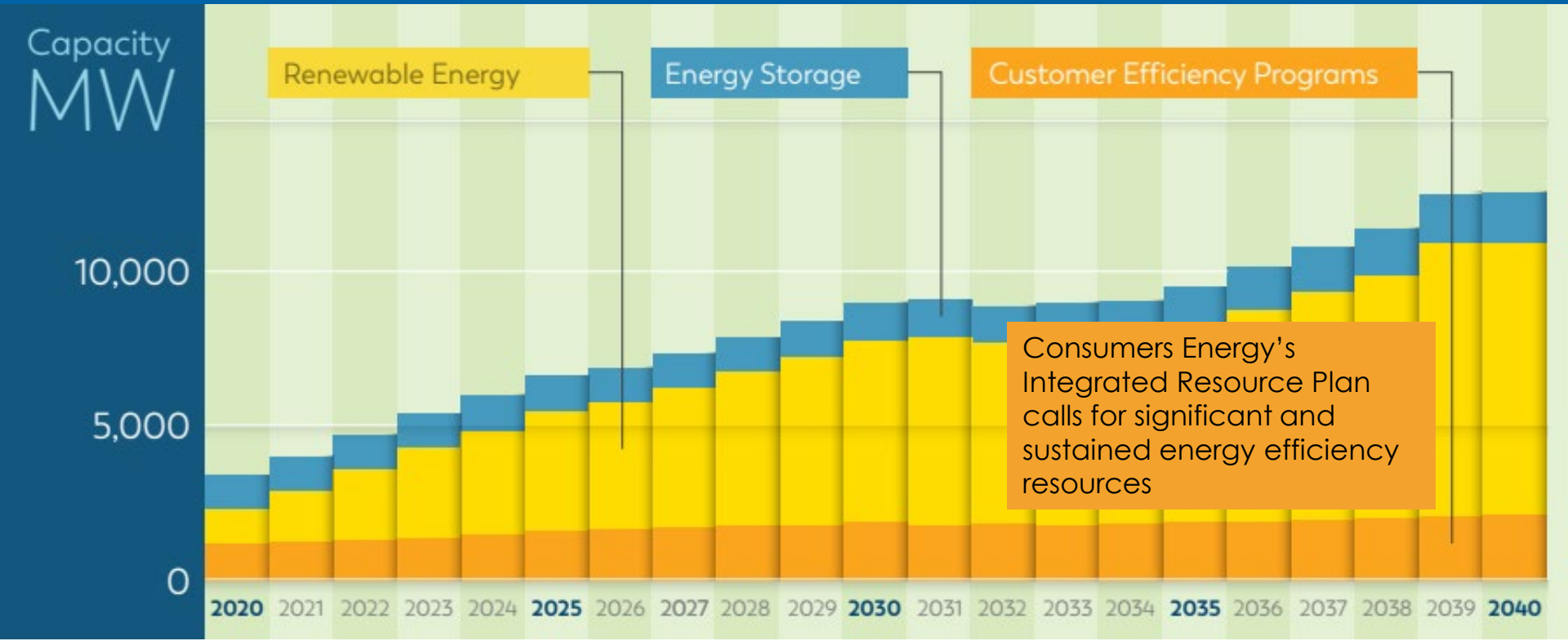
What are the future needs for utility-supported energy efficiency savings (EE)?

What do traditional electric EE potential study results say?

What insights do we have from our transformational technology scenario?

Can we develop a shared path forward?

Long Term Needs: Our Clean Energy Plan



EWR Potential Study

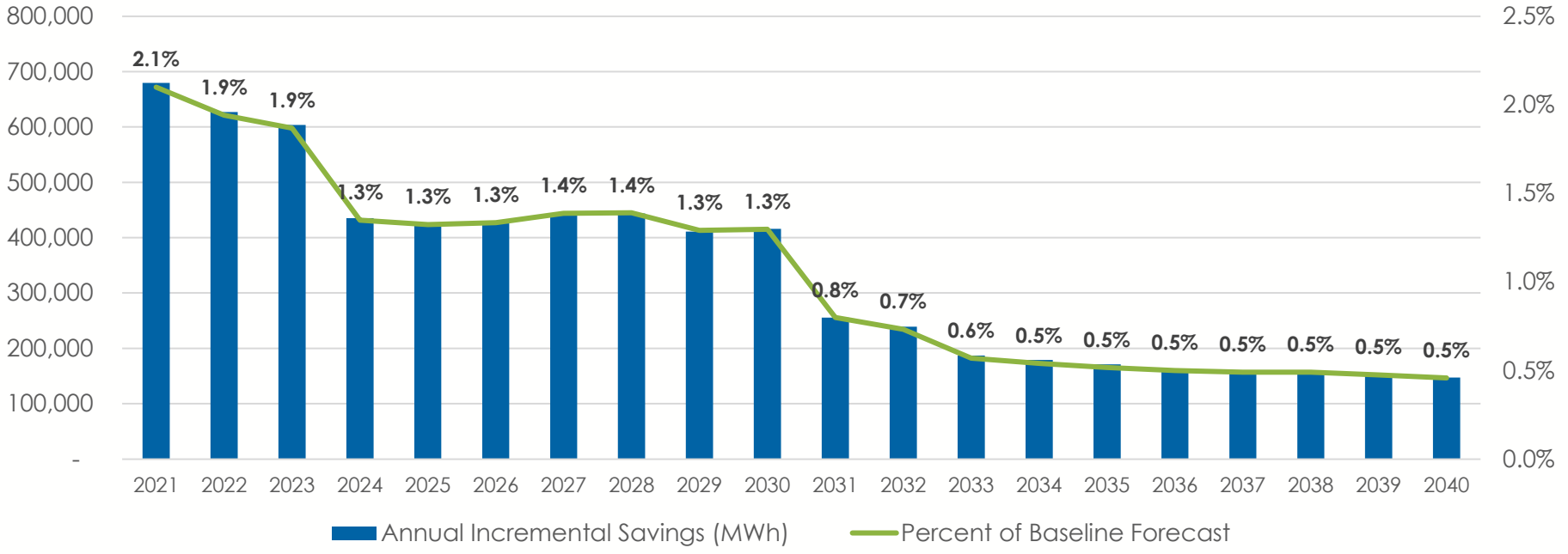
Consumers Energy initiated a traditional electric energy efficiency potential study in late 2019 to inform its 2021 integrated resource plan and EWR program plan.

Incorporated commercially available measures and most recent market and technology data.

Reflected new equipment standards and market trends, including regulatory guidance around LED savings.

Cumulative potential assumes **"replacement savings"** but excludes them from cumulative savings increases.

Decline Predicted by Traditional EE Forecast



Transformational Technology Scenario

- Investigated savings from emerging technologies that may become commercially available over next 20 years.

- Instead of just measuring what technologies **are** available?
- What is under development & **could be** available?

Creating a Transformational Technology Scenario

Engaged our evaluation teams **Cadmus** and **TRC** and the utility benchmarking firm **E Source** to identify and characterize emerging technologies.

Consulted recognized experts from national laboratories, regional market transformation organizations, and industry research institutes as well as intervenors for ideas and to estimate the applicability, development timeline, cost trajectory, and potential energy and demand savings.

Electric Power Research Institute	American Council for an Energy-Efficient Economy	Midwest Energy Efficiency Alliance	Oak Ridge National Laboratory
Edison Electric Institute	Consortium for Energy Efficiency	Energy Futures Grp &Five Lakes Energy	Pacific Northwest National Laboratory

Creating a Transformational Technology Scenario

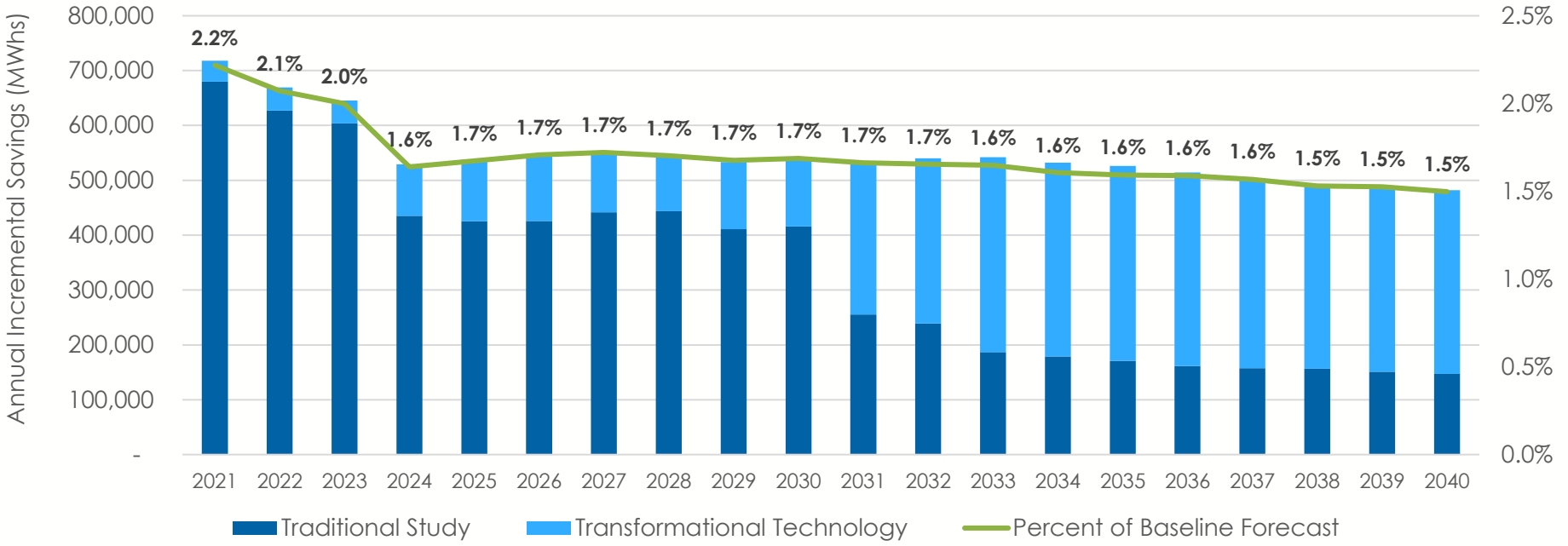
Identified promising technologies based on applicability, development timeline, cost trajectory, & potential savings.

Is an optimistic scenario that is going to require many things to go right.

What role can we each play in improving those odds?

- Electric Power Research Institute
- American Council for an Energy-Efficient Economy
- Midwest Energy Efficiency Alliance
- Oak Ridge National Laboratory
- Edison Electric Institute
- Consortium for Energy Efficiency
- Energy Futures Grp &Five Lakes Energy
- Pacific Northwest National Laboratory

More Optimistic EE TransTech Scenario



TransTech Detail Available-Residential

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Residential Emerging Technology: HVAC Heating

The emerging technology HVAC heating measures makes up 15% of the 20-year residential portfolio achievable potential for emerging technology measures. The HVAC heating measures are a subset of the HVAC measures bundle, which makes up 46% of the 20-year residential portfolio achievable potential for emerging technology measures.

Bundle Measure Names and Residential Sector Applicability

Table C-9 shows the eight measures in the HVAC heating measures bundle, as well as the residential sectors in which the measures can be installed.

Table C-9. HVAC Heating Measure Names and Applicable Segments

Measure Name	Single Family	Single Family Low Income	Multifamily	Multifamily Low Income	Manufactured	Manufactured Low Income
Emerging Technology - Advanced Air-Source Heat Pump	X	X	X	X	X	X
Emerging Technology - Advanced Furnace Fan	**X**	**X**	**X**	**X**	**X**	**X**
Emerging Technology - Advanced Wall Heater	X	X	X	X	X	X
Emerging Technology - Electro Caloric Heat Pump	X	X	X	X	X	X
Emerging Technology - Heat Pump with Integrated Desuperheater	X	X	X	X	X	X
Emerging Technology - Horizontal Drainpipe Heat Exchanger	X	X	X	X	X	X
Emerging Technology - Radiant Panels	X	X	X	X	X	X
Emerging Technology - Well-Connected Geothermal Heat Pump	X	X				

Measure Characteristics Energy Savings, Demand Reduction, and Incremental Cost

Table C-10 shows several characteristics for each measure: the annual percentage of energy savings over the baseline technology, annual energy savings and demand reduction, incremental cost, measure life, and commercial availability start year. The team assumed the same measure cost and incremental cost over the 20-year planning horizon.

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Table C-10. Percentage Energy Savings over the Baseline Technology

Measure Name	Energy Savings (%)	Energy Savings (kWh)	Demand Reduction (kW)	Incremental Cost Per Home	Incremental Cost (Per Unit)	Units Per Home	Measure Life
Emerging Technology - Advanced Air-Source Heat Pump	6% - 7%	358 - 680	0.07 - 0.1	$758 - $1,199	$381/heat pump ton	1.9 - 3.1	15
Emerging Technology - Advanced Furnace Fan	**17% - 27%**	**188**	**0.02**	**$302**	**$302/ furnace fan**	**1**	**10**
Emerging Technology - Advanced Wall Heater	30% - 31%	1,807 - 4,505	-	$78 - $139	$71.50/ 12,000 Btuh electric room heat	1.1 - 2.0	20
Emerging Technology - Electro Caloric Heat Pump	33%	1,791 - 3,657	0.8 - 1.6	$1,997 - $3,156	$1,003/heat pump ton	1.9 - 3.2	15
Emerging Technology - Heat Pump with Integrated Desuperheater	10% - 24%	170 - 318	0.02 - 0.04	1257.65	$1,258/ water heater	1	15
Emerging Technology - Horizontal Drainpipe Heat Exchanger	3% - 10%	50 - 170	0.008 - 0.03	$1,366	$1,366/ drainpipe heat exchanger	1	20
Emerging Technology - Radiant Panels (cool central)	30%	145 - 537	0.2 - 0.8	$28,180-50,018	$27/sq ft	1,271 - 1,352	20
Emerging Technology - Radiant Panels (heat pump, heat central)	30%	1,611 - 6,966	0.7 - 1.5	$28,180-50,019	$27/sq ft	1,271-1,352	20
Emerging Technology - Well Connected Geothermal Heat Pump	26% - 48%	1,961 - 3,524	0.4 - 0.6	$12,654 - $17,337	$12,654 - $17,337/ home	1	15

Path to Commercialization

The commercialization dates for the residential emerging HVAC heating measures range from 2021 to 2026; however, they face barriers to adoption that are common to many new energy-efficient technologies:

- Lack of customer and contractor awareness of the technology
- Incremental cost

Table C-11 shows the path to commercialization for each measure.

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Table C-11. Path to Commercialization

Measure Name	Development Timeline	Development Path			
		Technology Development and Demonstration	Delivery Strategy Optimization	Customer and Trade Ally Outreach	Regulatory Review and Acceptance
Emerging Technology - Advanced Air-Source Heat Pump	Mid-Term 2026-2030	X		X	X
Emerging Technology - Advanced Furnace Fan	**Short-Term 2021-2035**			**X**	**X**
Emerging Technology - Advanced Wall Heater	Short-Term 2021-2035			X	X
Emerging Technology - Electro Caloric Heat Pump	Long-Term 2036-2040	X	X	X	X
Emerging Technology - Heat Pump with Integrated Desuperheater	Short-Term 2021-2035			X	X
Emerging Technology - Horizontal Drainpipe Heat Exchanger	Short-Term 2021-2035		X	X	X
Emerging Technology - Radiant Panels	Short-Term 2021-2035			X	X
Emerging Technology - Well-Connected Geothermal Heat Pump	Short-Term 2021-2035			X	X

Bibliography

U.S. Department of Energy. August 30, 2016. "Federal Technical Supporting Document for Residential Furnaces."

Consortium for Energy Efficiency. 2020. "Catalog of Emerging Opportunities Assessments 2020."

doityourself. December 20, 2009. "Typical Hydronic Radiant Heat Life Span." https://www.doityourself.com/stry/typical-hydronic-radiant-heat-life-span

Emerging Technologies Coordinating Council. March 20, 2018. *Development of a Laboratory Data-Based Algorithm for Horizontal Drain Water Heat Recovery Devices, and Predictions of In-Field Performance*.

Franklin Energy Services. Accessed 2020. *2020 Michigan Energy Measures Database*. "Residential GFX." White Paper Supporting Document FES-C17.

Iowa Utilities Board. January 1, 2019. *2018 Iowa TRM V3.0*. https://iub.iowa.gov/regulated-industries/energy-efficiency-plans-and-programs-iowa

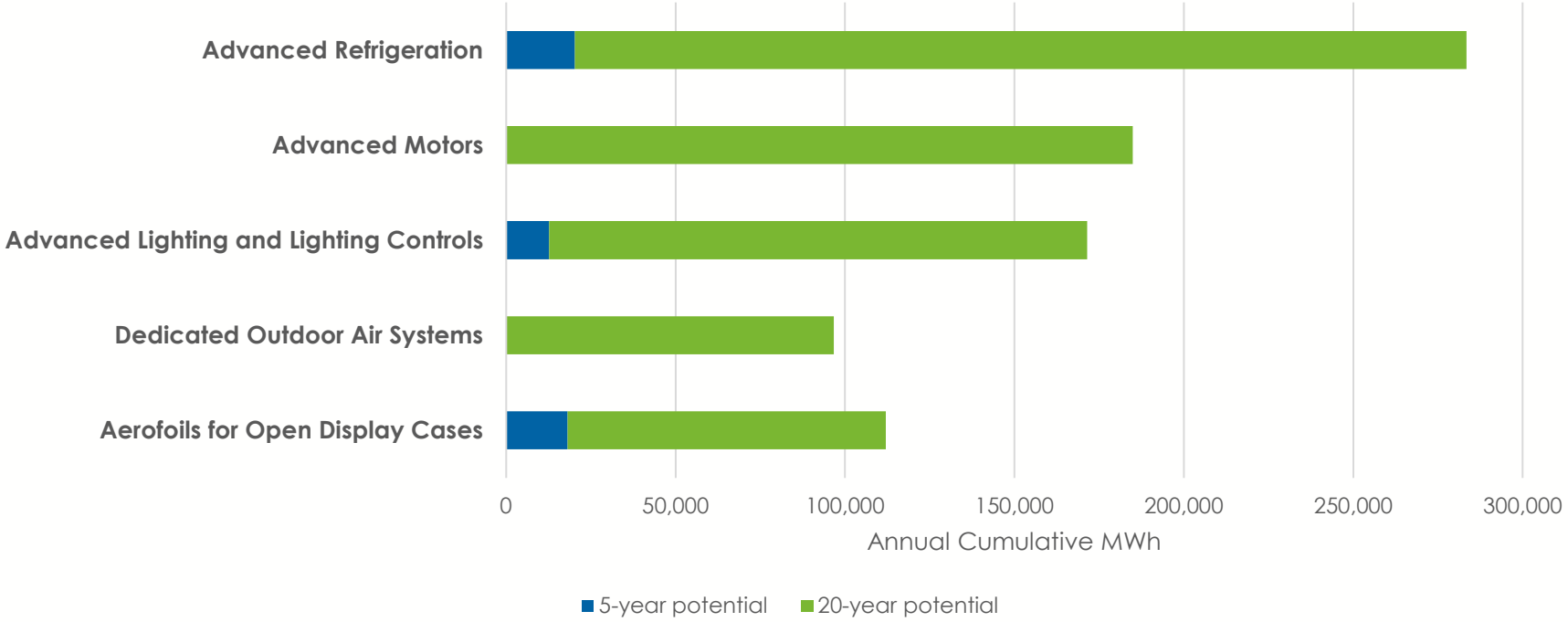
Messana. Accessed July 2020. "Is Radiant Cooling Expensive? How Much Would it Cost for my House?" https://radiantcooling.com/kb/is-radiant-cooling-expensive-how-much-would-it-cost-for-my-house/#:~:text=Typical%20cost%20for%20just%20the,60%25%20of%20the%20ceiling%20

Messana. Accessed July 2020. "Is Radiant Cooling and Heating More Energy Efficient than a Traditional Forced Air System?" Accessed July 2020. https://radiantcooling.com/kb/is-radiant-cooling-and-heating-more-energy-efficient-than-a-traditional-forced-air-system/

Michigan Public Service Commission. 2020.

Regional Technical Forum. Accessed July 2020. "UES Measures." https://rtf.nwcouncil.org/measures

Some C&I TransTech Opportunities



C&I TransTech Detail Available

CADMUS

Commercial Emerging Technology: Lighting

Emerging lighting technologies make up 9% of the 20-year commercial portfolio achievable potential.

Bundle Measure Names and Commercial Sector Applicability

Table C-33 shows the two measures within the commercial emerging lighting bundle, as well as the commercial sectors in which the measures can be installed.

Table C-33. Commercial Emerging Lighting Measure Names and Applicable Segments

Measure Name	Education	Grocery	Health	Lodging	Office	Other	Restaurant	Retail	Warehouse
Emerging Technology - Advanced Daylighting Controls	X	X	X	X	X	X	X	X	X
Emerging Technology - Future Lighting - Perovskite LEDs	X	X	X	X	X	X	X	X	X

Measure Characteristics Energy Savings, Demand Reduction, and Incremental Cost

Table C-34 shows several measure characteristics for each measure: the percentage of energy savings over the baseline technology, annual energy savings and demand reduction, incremental cost, and measure life. The team assumed the same measure cost and incremental cost over the 20-year planning horizon.

Table C-34. Percentage Energy Savings over the Baseline Technology

Measure Name	Unit	Energy Savings	Annual Energy Savings (kWh)	Annual Demand Reduction (kW)	Incremental Cost	Measure Life
Emerging Technology - Advanced Daylighting Controls	Per building sq ft	2% - 6%	0.15 - 1.05	0 - 0.0004	$3.04	30 Years
Emerging Technology - Future Lighting - Perovskite LEDs	Per building sq ft	14%	1.0	0.00018	$0.41	15 Years

Path to Commercialization

Both measures are expected to be commercially available by 2036; however, they face barriers to adoption that are common to many new energy-efficient technologies:

- Lack of customer awareness of the technology and understanding of the required integration of advanced lighting controls with other building systems
- Incremental cost and coordination required to maximize the benefits of advanced lighting controls

Table C-35 shows the path to commercialization for both commercial lighting measures.

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Table C-35. Development Path to Commercialization

Measure Name	Development Timeline	Development Path			
		Technology Development and Demonstration	Delivery Strategy Optimization	Customer and Trade Ally Outreach	Regulatory Review and Acceptance
Emerging Technology - Advanced Daylighting Controls	Mid-Term (2026-2030)		X	X	
Emerging Technology - Future Lighting - Perovskite LEDs	Long-Term (2036-2040)	X		X	

Bibliography

Michigan Energy Measure Database. 2020.

City of Seattle. Department of Planning & Development. *Integrated Lighting for Fire Stations: Daylighting and electric Lighting Strategies.* http://www.seattle.gov/Documents/Departments/FireLevy/Consultants/Sustainability_TBDaylight.pdf

LightLouver Daylighting system. Accessed September 4, 2020. "Comparative Normalized Costs." http://lightlouver.com/performance-information/comparative-normalized-costs/

American Institute of Physics. July 30, 2019. "Improving efficiency, brightness of perovskite LEDs." *ScienceDaily.* https://www.sciencedaily.com/releases/2019/07/190730120322.htm

Lessons & Opportunities

Like forecasts elsewhere, our traditional forecast of electric energy efficiency potential **predicts a gap versus goals we need to solve.**

The industry has closed similar gaps in past with multi-stakeholder work to develop & scale EE technologies such as **CFLs, LEDs,** etc.

Past successful collaborations have included non-profits, utilities, state regulators, federal agencies, manufacturers and industry associations.

We have **identified** some paths to closing the current approaching gap, but some major differences exist this time.

No clear major innovation is on the horizon for lighting, so a broader set of product innovations will be needed.

Commercial & Industrial segment technology innovation will likely need to play an even larger role in savings.

Key Path to Future Savings

Identification of new savings opportunities

This process can take years

Shortening this timeline is key to ensuring sustained savings opportunities

Establishment of deemed savings and incorporation in full scale programs

- **Technology demonstration**
- **Pilot offerings**
- Savings verification/ development of evaluation protocols

- Depending on the technology or measure, some or all of these may be applicable
- Need to maintain a customer focus; **what problem are you helping to solve?**
- **Expediting evaluation protocols** is critical to gaining regulatory approvals (example, advanced thermostats)

How Could We Make This Happen?

Align on the urgency of the challenge.

Increase focus on collaboration within & across industries, stakeholder & regulators to increase effectiveness and reduce duplication of efforts.

Share customer insights & utility needs more broadly to accelerate development & adoption.

Increase focus on trade ally outreach, education & workforce development.

Next Steps

Consider the Transformational Technologies appendix as a resource

Let's redouble our efforts to focus on achieving this transformation!

Expand our collaborations on best practices & opportunities to increase engagement with manufacturers to accelerate effective innovation?

How can we innovate in our regulatory focus here in Michigan to get effective technology into deemed databases faster, while ensuring savings are real and accurate?

How can we get stronger & faster EM&V on new technologies and avoid unnecessary duplication across utilities and states?

How can we make EE results sustainable as technologies scale more broadly to less EE-focused customers?

Need to take our collaboration to the next level - What are your ideas, questions, resources?

One Resource

Consumers Energy Electric EWR Potential Study was filed with its Integrated Resource Plan*

A summary of the transformational technology scenario is included in the report; **Appendix C includes transformational technology:**

- Measure descriptions
- Sector and segment applicability
- Costs and impacts
- References

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*Filing number U-21090-005, pp. 638-817; available at https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t000000NibWaAAJ

Thank You!