NSPE-MD™ MARYLAND SOCIETY OF PROFESSIONAL ENGINEERS

BUILDING PERFORMANCE STANDARDS (*BEPS*) PANEL

DR. ZACH BERZOLLA | MARYLAND DEPARTMENT OF THE ENVIRONMENT
MAXWELL COOKE | GORDON FEINBLATT LLC
BEN ROUSH, PE | FSI ENGINEERS

Maryland's Building Energy Performance Standards (BEPS)

BEPS Overview

Visit Our Website

mde.maryland.gov

Zach Berzolla, Ph.D.

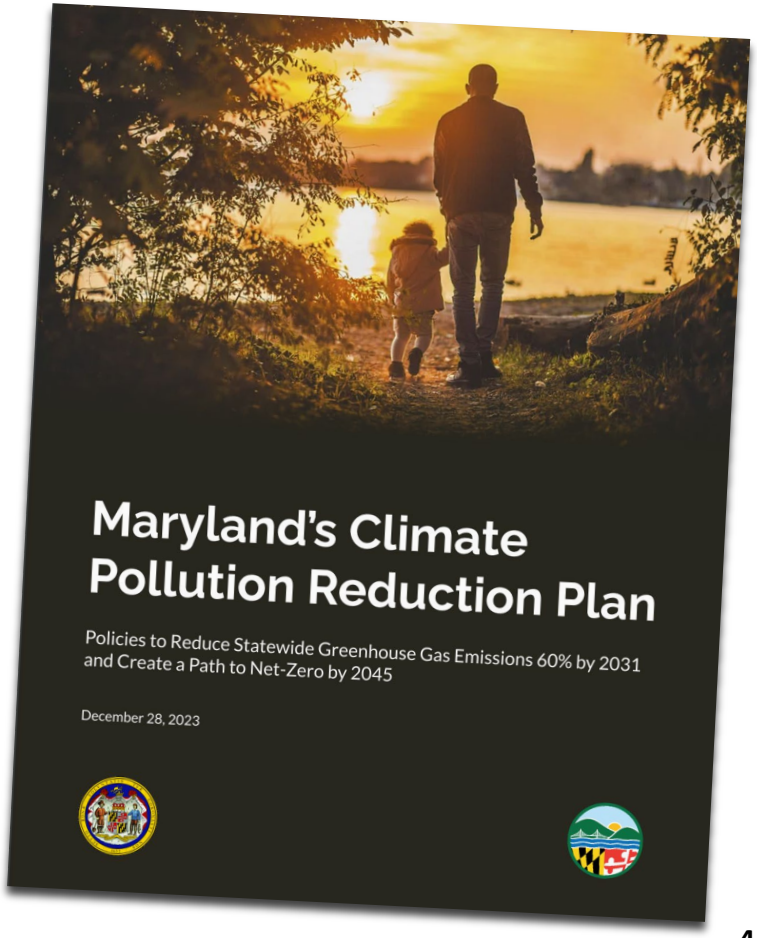
MDE Building Decarbonization Section Head

Agenda

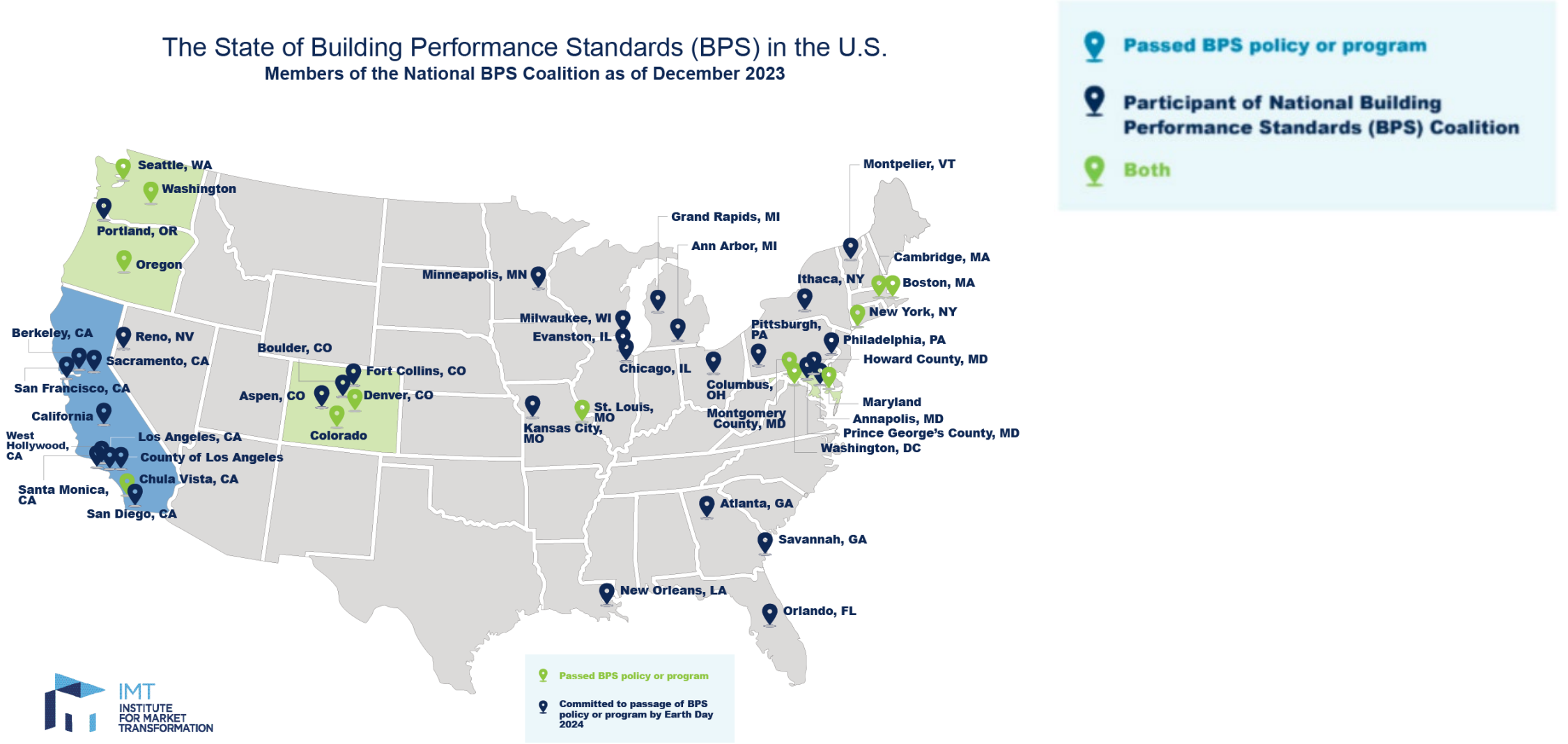
- MD BEPS background
- What's a "covered" building
- What building owners need to know
- Performance standards
- Alternative compliance

Climate Plan Objectives

- Reduce statewide greenhouse gas emissions (compared to 2006 levels)
    1. Achieve 60% reduction by 2031
    2. Achieve net-zero emissions by 2045
- Implement BEPS to help meet these reductions
- Create net benefits and green jobs
- Read the plan today @ mde.maryland.gov



BEPS is Emerging Nationwide



Overview of BEPS Regulation

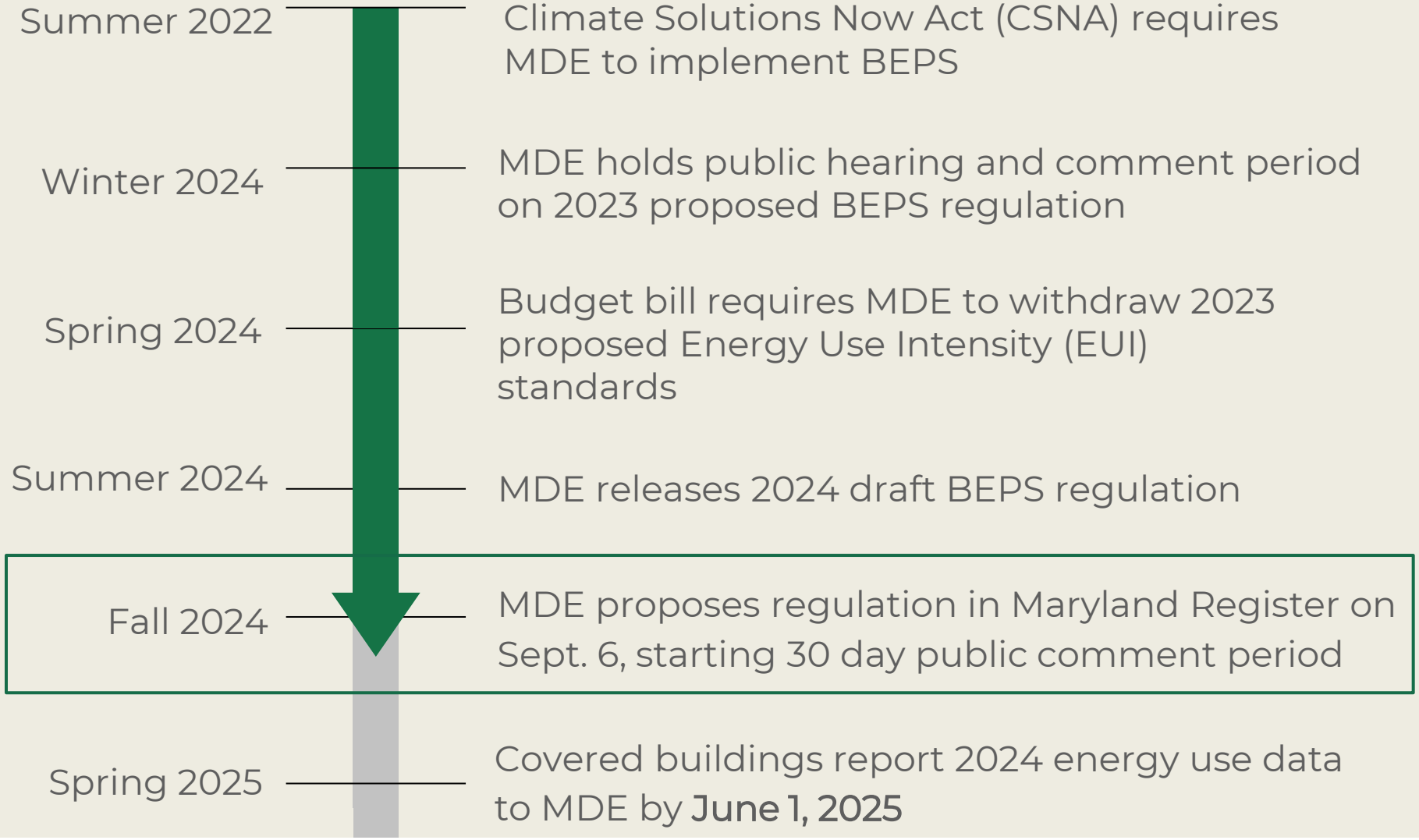

Emissions


Energy Costs

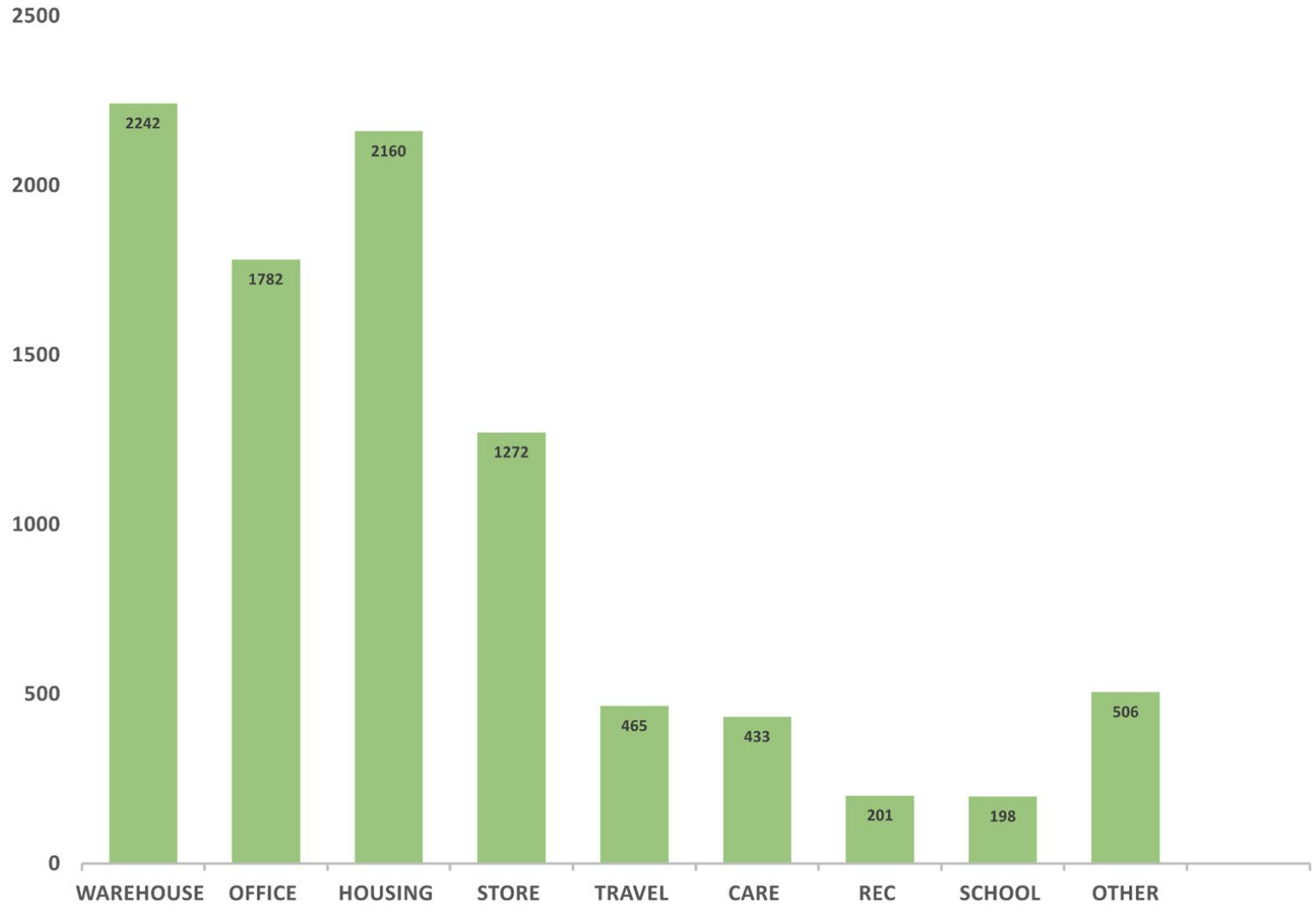

Air Quality

- Most buildings 35,000 square feet or larger are “covered”
- Covered buildings must annually report energy consumption beginning next year
- First reports are due June 1, 2025
- Start meeting phased emissions standards in 2030
- Building owners can choose to pay an alternative compliance fee for a building's excess emissions over the standards

Regulation Timeline

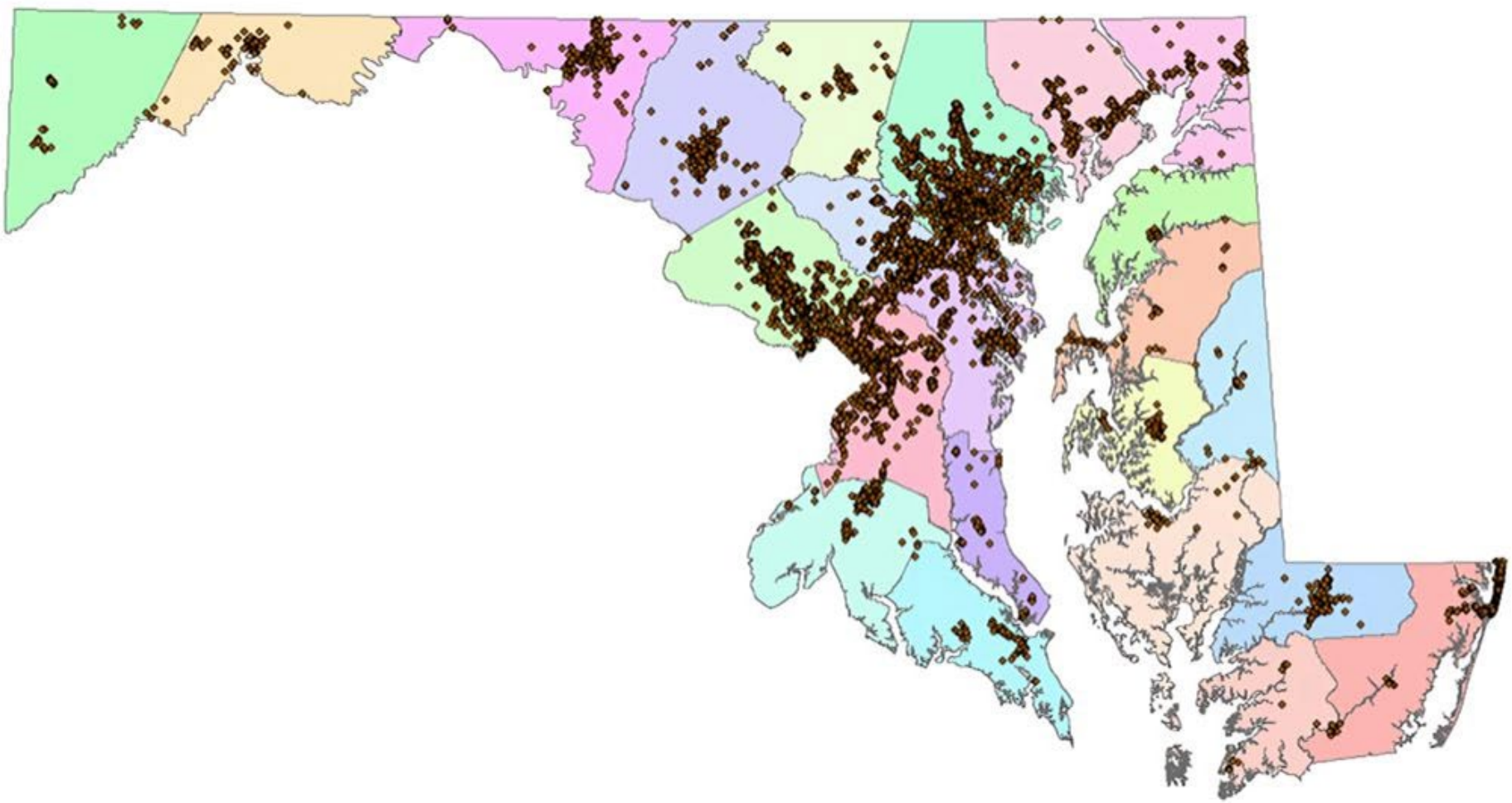


Covered Buildings: Property Types



Preliminary analysis

Covered Buildings: Locations



Preliminary analysis

Exemptions

Buildings

Designated Historic

Elementary & Secondary Schools

Manufacturing

Agricultural

Federally Owned

Energy Use

Food Service Facilities

EV Charging

Required Combustion Generators

What Does a Building Owner Need to Do?

1. Determine if a building is covered by calculating its square footage and/or evaluating exemption status
2. **Start benchmarking**
3. Assess whether the building is already achieving the proposed standards
4. If not meeting the standards, plan to make improvements and determine when it's preferable to pay for the building's excess emissions

How to Get Started

Benchmarking

Annually,
starting in 2025
Use ENERGY STAR Portfolio Manager to track annual energy use and greenhouse gas emissions

How to Get Started

Benchmarking	Assessment
Annually, starting in 2025 Use ENERGY STAR Portfolio Manager to track annual energy use and greenhouse gas emissions	**Annually, starting in 2025** Determine if changes are needed to achieve the standards

How to Get Started

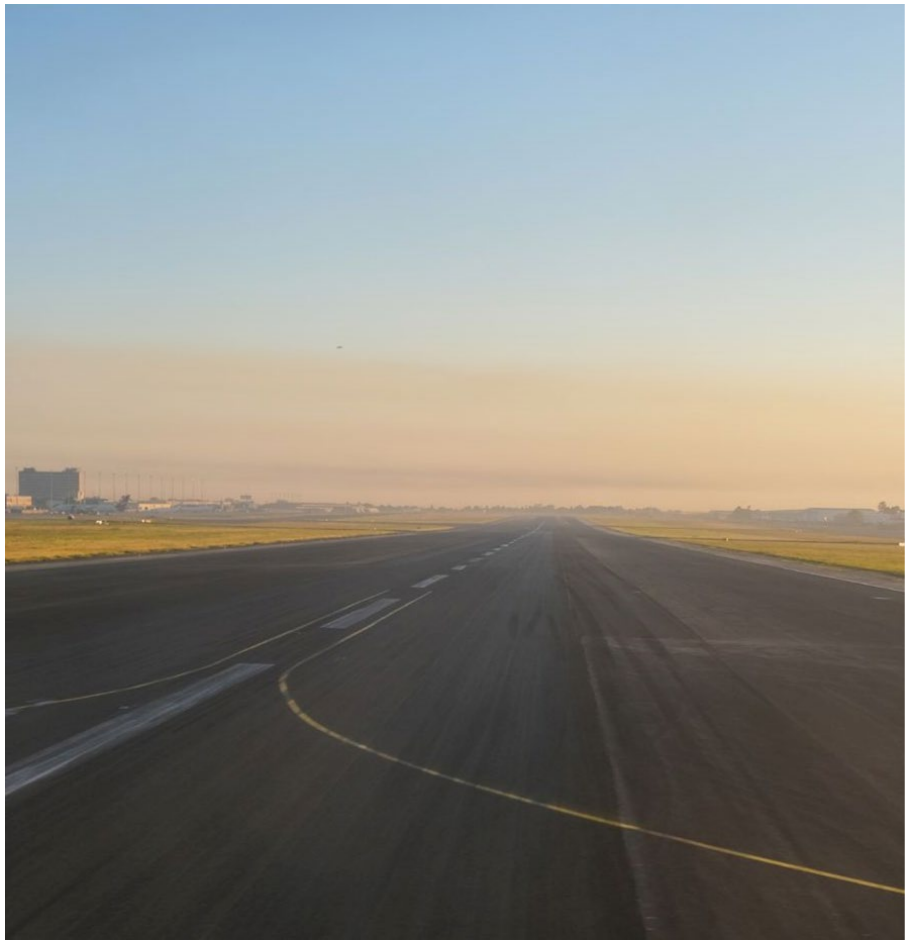
Alternative Compliance Payment

Benchmarking	Assessment	Achieve Standards
Annually, starting in 2025 Use ENERGY STAR Portfolio Manager to track annual energy use and greenhouse gas emissions	**Annually, starting in 2025** Determine if changes are needed to achieve the standards	**Annually, starting in 2030** Achieve standards OR Achieve partial compliance and make alternative compliance payment

Performance Standards

- Phased reduction of on-site “direct” emissions by type of building
  1. Interim Standard 1 (2030 - 2034) ⬇
  2. Interim Standard 2 (2035 - 2039) ⬇⬇
  3. Final Standard Net-Zero (2040 +) ⬇⬇⬇

- MDE intends to adopt an energy efficiency standard, called site energy use intensity (EUI) in 2027 – and recommends not installing inefficient electric equipment

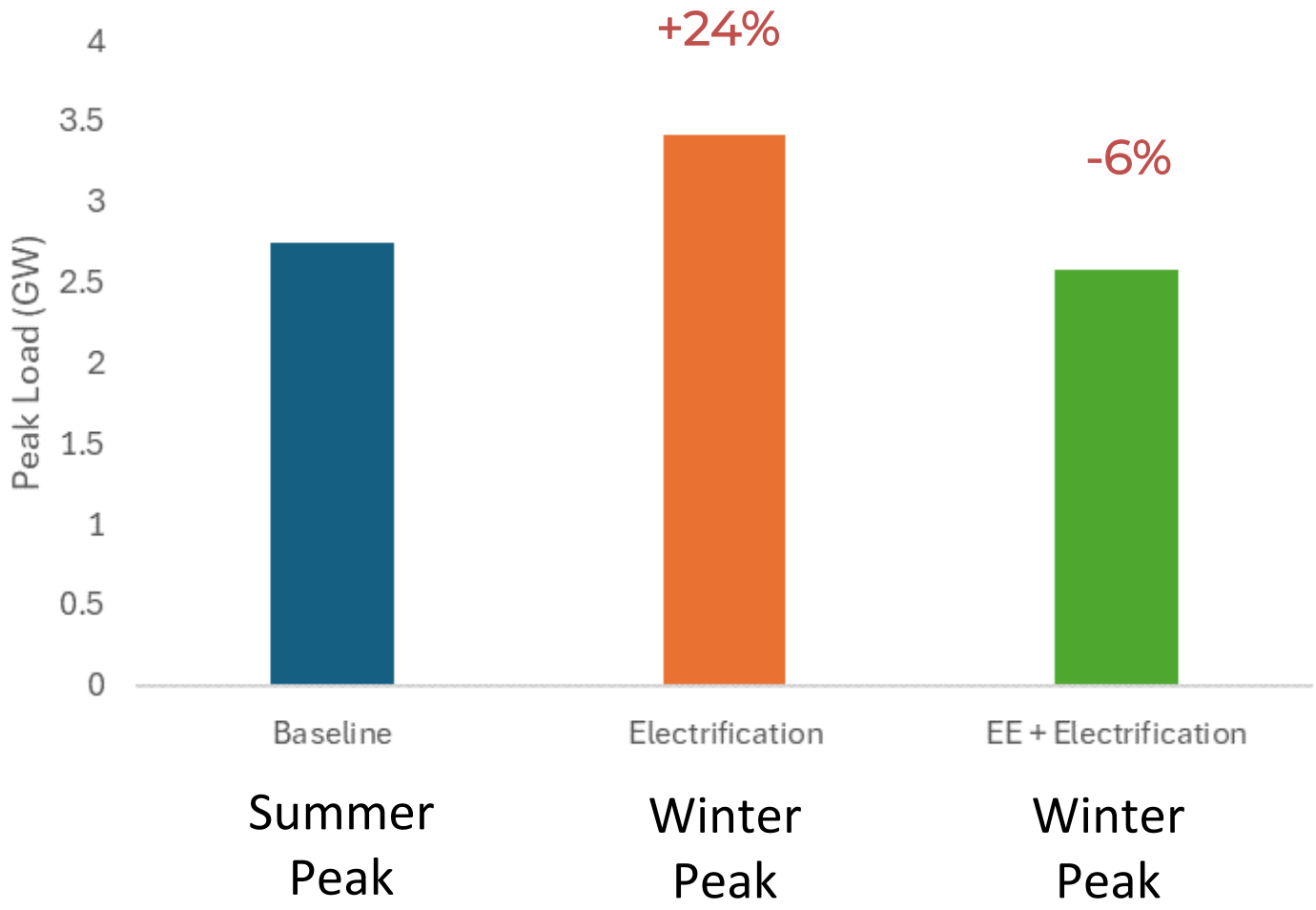


Building owners have a long runway!

Peak Electricity Demand Analysis

Peak electricity demand from covered buildings:

- *Increases 24%* when emissions targets are <u>not</u> combined with efficiency targets, but it
- *Decreases 6%* when emissions and efficiency targets are combined, as required by the CSNA and recommended by the US EPA



Source: Lawrence Berkeley National Laboratory (Available:https://mde.maryland.gov/programs/air/ClimateChange/SiteAssets/Maryland%20Peak%20Load%20Results_12.12.2023%20%281%29%20%282%29%20%281%29.pdf)

Alternative Compliance

Alternative compliance is available for the proposed net direct emissions standard in the form of payments set at the US Environmental Protection Agency's (EPA) social cost of greenhouse gas. These rates are the lowest permitted by law.

Year	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040+
Annual Payment per metric ton of CO2E	$230	$234	$238	$242	$246	$250	$254	$258	$262	$266	$270	$4+

All figures are in 2020 dollars and will be adjusted for inflation to that year

Compliance Spectrum

Undesirable

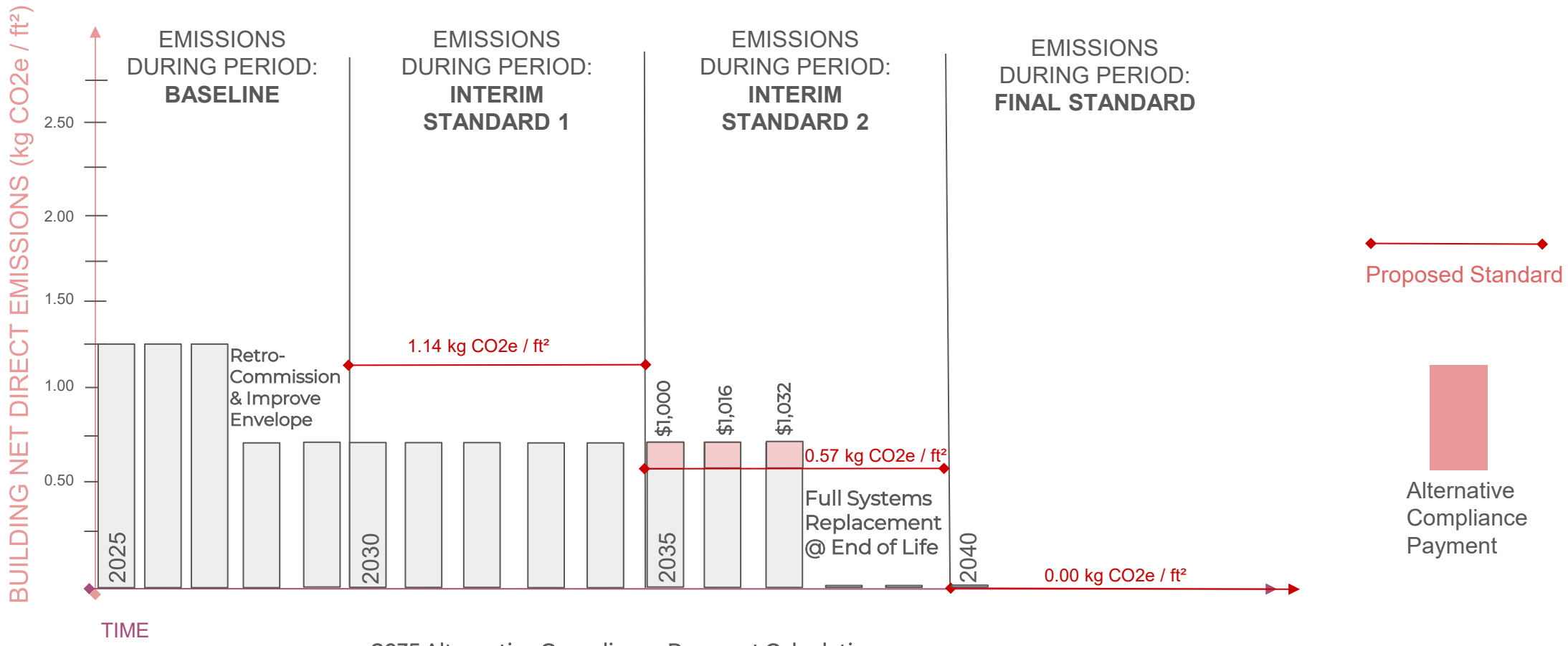
Ideal

Building owner is not currently meeting the standard and makes no improvements to their property. They opt to meet compliance by making an Alternative Compliance Payment for the difference between the standard and their total emissions.

Building owner is already nearly in compliance and/or opts to make improvements to their property until they deem it is more cost-effective to make an Alternative Compliance Payment on remaining emissions over the proposed standard.

Building owner is already meeting or making improvements to meet the standard.

Example: Alternative Compliance



2035 Alternative Compliance Payment Calculation
Emissions over standard: 0.67 - 0.57 kg CO2e/ft² = 0.1 kg CO2e/ft²
0.1kg CO2e/ft²*40,000 ft² / 1000 kg/ton = 4 CO2e
4 tons CO2e * $250/ton CO2e in 2035 = **$1,000/year**
$1000/12 = ~ $83/mth

Economic Impacts

- On average, over the 2025-2050 time horizon, covered buildings *spend* $0.65 per square foot
- Under a future regulation that includes emissions and site EUI standards, over the 2025-2050 time horizon, on average covered buildings *save* $4.47 per square foot
- Significant funding from the federal Bipartisan Infrastructure Law and Inflation Reduction Act are expected to reduce costs of compliance with BEPS and speed their return on investments
- The Building Energy Transition Implementation Task Force recommended programs, policies, and incentives aimed at reducing GHG emissions from the buildings sector and development of a plan for funding the retrofit of covered buildings to comply with BEPS

Resources and Financial Support

EmPOWER MARYLAND

Utility incentives for training, building tuneups, equipment

MARYLAND CLEAN ENERGY CENTER

Financing and technical assistance

Maryland DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

Grants and loans for energy efficiency

Federal Incentives, tax credits and deductions

MD PACE Property Assessed Clean Energy Loans

Turn-key, low cost, standardized services to make buildings energy efficient

Maryland Energy Administration

Clean Buildings Hub, grants, loans, rebates

Clean Buildings Hub

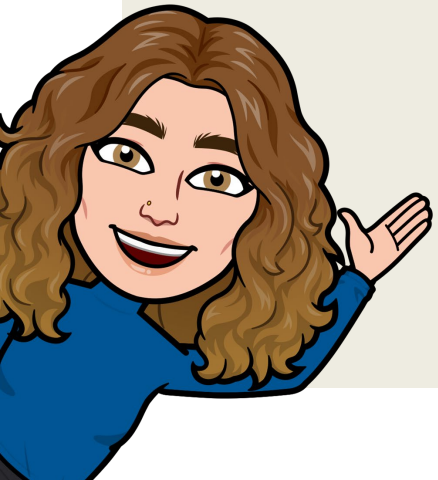
Upcoming Outreach Sessions

Oct. 22 - Campus Compliance Working Group Session 1

Oct. 24 - Affordable Housing Provider Working Group Session 1

TBD - Exemption Process Informational Session

Signup today on the MDE BEPS Website



BEPS CONTACT INFORMATION

Building Decarbonization Team

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BEPS Website

BEPS Email List

MDE

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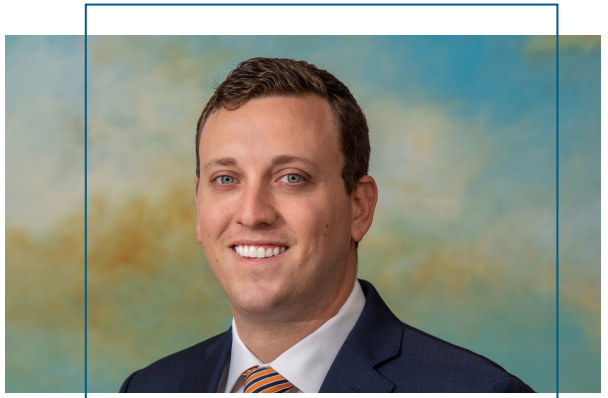
GORDON·FEINBLATT LLC
ATTORNEYS AT LAW

Maxwell Cooke



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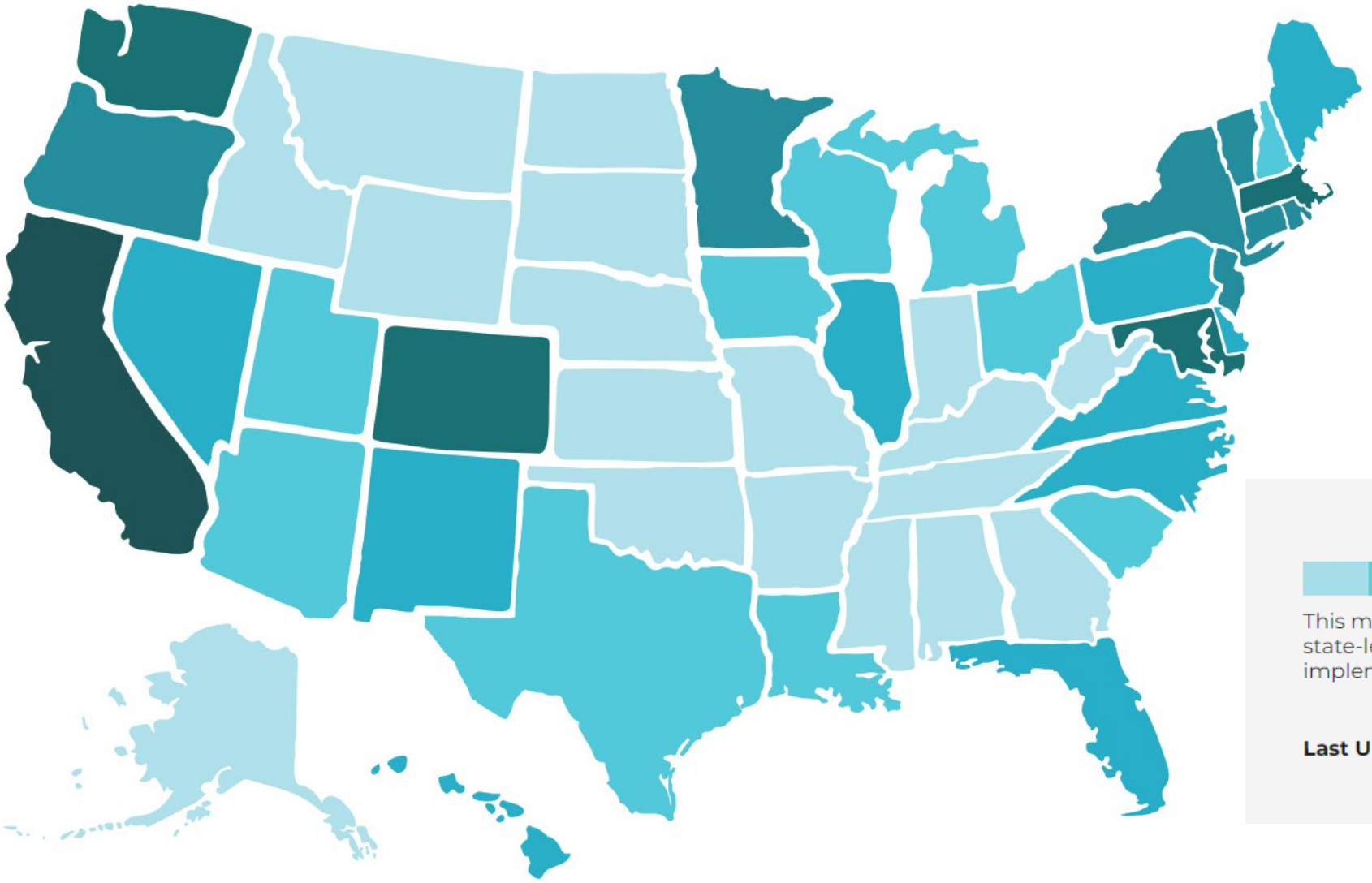
UNDERSTANDING THE ACRONYMS

BEPS	*Building Energy Performance Standards*
CSNA	*Climate Solutions Now Act of 2022*
EUI	*Site Energy Use Intensity*
GHG	*Greenhouse Gas*
MDE	*Maryland Department of the Environment*

STATE CLIMATE POLICY TRACKER



THIS POLICY MAP TRACKS THE PASSAGE AND IMPLEMENTATION OF 66 CLIMATE POLICIES ACROSS ALL 50 STATES.

This map shows the occurrence of climate policies passed at the state-level. Higher numbers represent more climate policies implemented.

Last Updated July 2023

Source: Climate Xchange www.climate-xhange.org

MARYLAND'S MANDATE

IS THE MOST AGGRESSIVE IN THE UNITED STATES

Maryland	**60% reduction by 2031; Net zero emission by 2045**
California	40% reduction by 2030; Carbon neutral by 2045
New York	40% by 2030; 85% by 2050
Massachusetts	50% by 2030; 75% by 2040; Net zero by 2050
Colorado	50% by 2030; 75% by 2040; Net Zero by 2050
Virginia	No 2030 target; Net Zero by 2045
Pennsylvania	26% by 2025; 80% by 2050
West Virginia	No Targets
Paris Agreement	45% by 2030 and net zero by 2050

Source: Climate Xchange www.climate-xhange.org

CLIMATE SOLUTIONS NOW ACT OF 2022

60% REDUCTION BY 2031, NET ZERO BY 2045

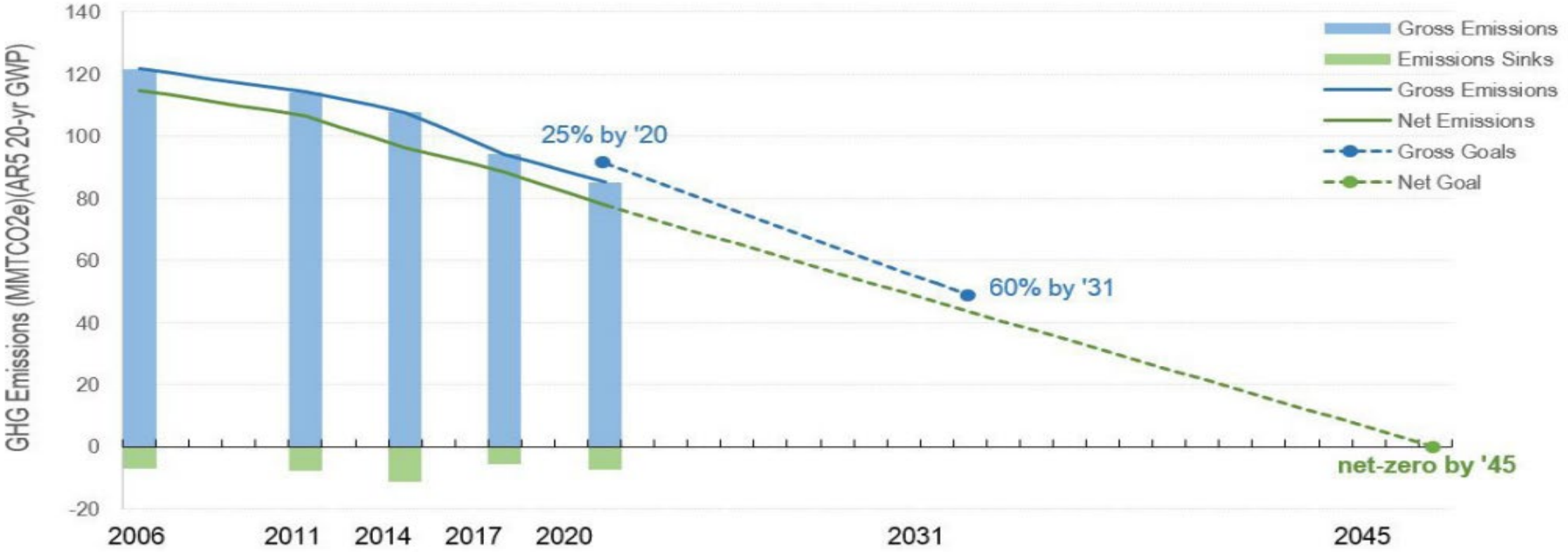
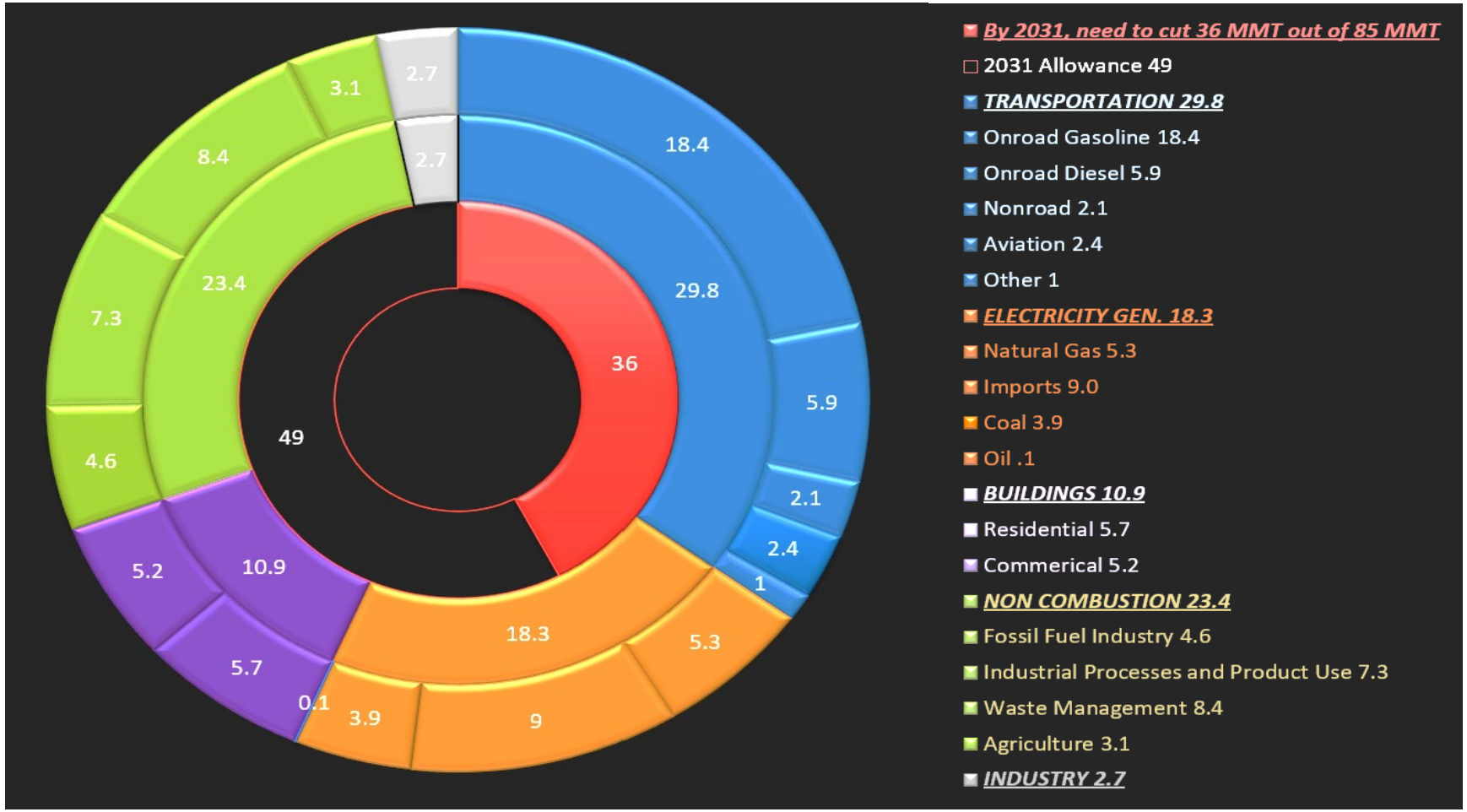


Figure 1. Maryland's Historic GHG and sink (bars), and CSNA goals (lines)

Source: Matt Stewart at MDE

2022 INVENTORY AND REDUCTIONS NEEDED BY 2031

APPROXIMATE MILLION METRIC TONS

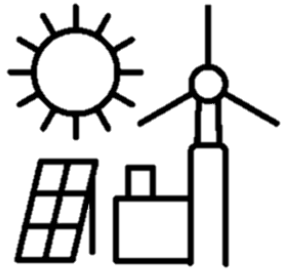


CLIMATE SOLUTIONS NOW ACT OF 2022

ELECTRIFY EVERYTHING

The bill sets out an overall plan that can be summarized simply:

Substitute electricity for fossil fuel consumption.



Replace fossil fuel electric generation with “clean” energy (solar, wind, nuclear, hydro).

Meet a very difficult transition milestone in seven years (by 2031).

Eliminate/Offset all fossil fuel and transition to 100% renewable electricity by 2045

BUILDINGS

Retrofitting Covered Buildings

LEGAL IMPLICATIONS

Penalties:

- GHG and EUI

Leases:

- How will landlords get this information from tenants?

Due Diligence:

- Buyers & Sellers

BEPS COST IMPACTS

MARYLAND REGISTER – 2024 STUDY FINDINGS

Current Regulations (2025-2040):

- Total spending on efficiency: $205M
- Total spending on electrification: $5.53B
- Total energy cost savings: $1.2B

Future Regulations with EUI Standards:

- Total spending on efficiency: $8.8B
- Total spending on electrification: $6.4B
- Total energy cost savings: $8.96B (2025-2040)

Long-term Savings (2025-2050):

- Projected energy cost savings without EUI: $4.6B
- Projected energy cost savings for EUI: $22.3B

Variability in Savings (without EUI):

- 25% of buildings: savings > $0.06/sq ft
- 25% of buildings: spending > $2.65/sq ft

DELAYED EUI REQUIREMENTS

DESIGNED TO FORCE BUILDINGS TO USE LESS ENERGY

- **EUI Delay:** Pending benchmarking and cost studies
- **Impact:** EUI targets may double the number of covered buildings
- **EUI vs. Direct GHG Emissions**:
  - **Direct GHG:** Only on-site fossil fuels
  - **EUI:** Includes off-site energy
- **Penalties:**
  - **Direct GHG:** Compliance fee ($230 - $270/ton CO2e)
  - **EUI:** Penalties up to $25,000/day
- **Next Steps:** MDE to publish standards in 2027 but expected to simply republish the draft standards

Examples of Draft EUI Standards	
Property Type	Final Site EUI & BTU / sq ft*
Office	55
Multifamily	30
Strip Mall	58
Retail Store	48
Senior Living	50
Hospital	144
Hotel	60
Warehouse	55
Conv. Ctr	40
Stadium (open)	21
Zoo	41

"Interim site EUI standards are calculated using a straight-line trajectory from a covered building's baseline performance to the final performance standards in 2040 …"

WHAT WILL THIS DO TO NATURAL GAS PRICES?

- **Gas prices ⇧ in**:
  - high electrification scenario (limited customers)
  - decarbonized methane scenario (production cost increases)
  - Electrification with fuel backup (limited customers and increased production cost)
- **Delivery costs ⇧:**
  - Limiting customers while maintaining distribution systems
- **Possible surcharges for climate revenue needs**
  - Transportation surcharge
  - Cap and invest carbon tax
  - Clean Heat Standards

RESIDENTIAL NATURAL GAS RATES (IN 2021 EQUIVALENT DOLLARS PER MMBTU) FOR COMMISSION RECOMMENDATIONS

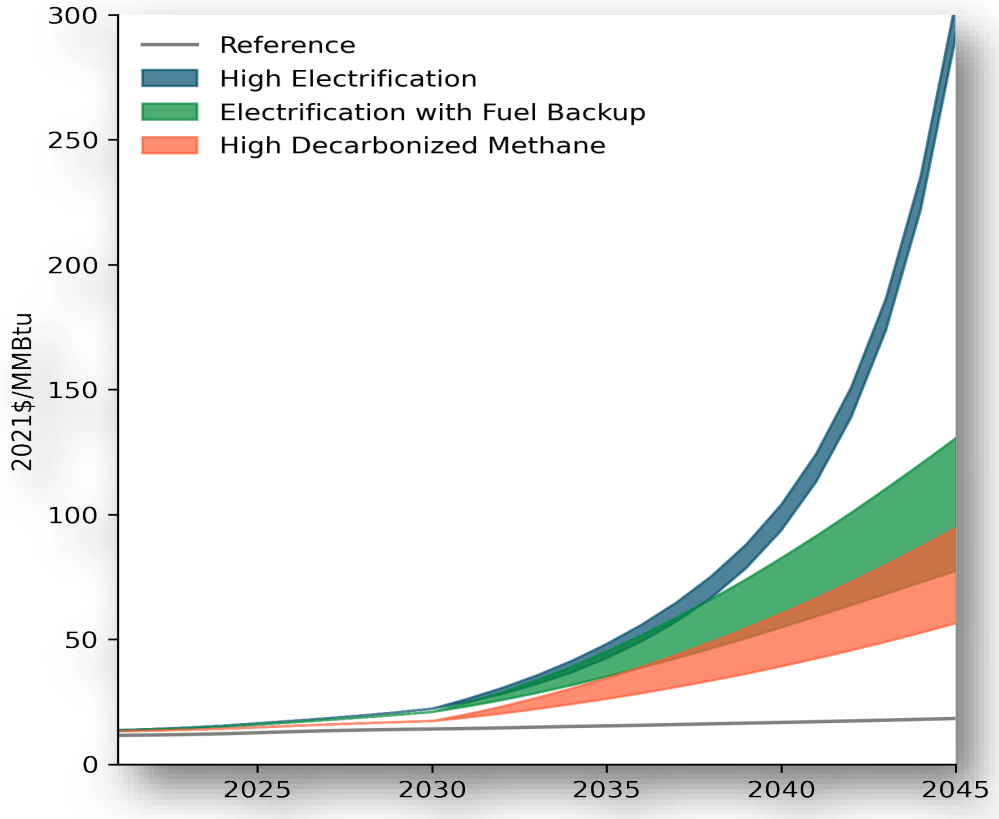
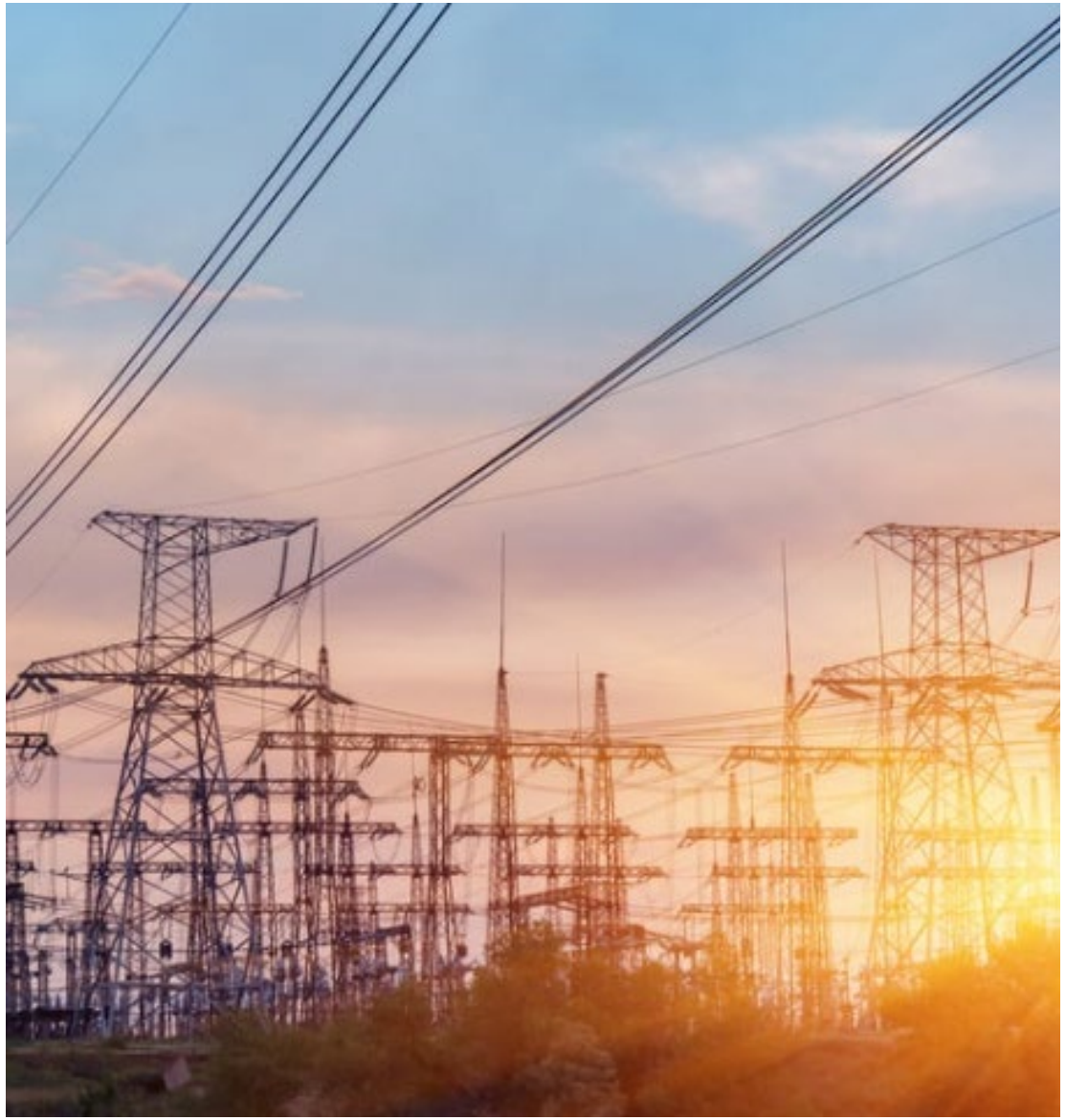


Chart from E3 presentation to Mitigation Working Group

WHAT WILL THIS DO TO ELECTRIC RATES?

PRICES LIKELY TO INCREASE DRAMATICALLY

- **Price Surge:**
  - Capacity: from $28.92 to $466.35/MW day (BGE)
  - Estimated 24% increase in residential rates in 2025
- **Brandon Shores Coal Plant:**
  - Operate until 2028 at high RMR cost
  - New transmission line: ~$800 million
- **Electrification:**
  - 200 new/upgraded substations needed
  - New HVAC and vehicle charging equipment
- **Offshore Wind:** Expensive and slow to develop



CAN THE GRID HANDLE THE LOAD?

Current: Maryland is a “summer peak” state (high summer day AC use)

Future: Transition to electric heating will shift to “winter peak” (high winter night demand)

Increased Load:

- Fossil fuel elimination
- Electric vehicles
- Low solar production in winter

PSC Study (Jan 16, 2024):

- Demand can be met with aggressive management
- Costs not included

PJM Warning: Risk of rolling blackouts in Baltimore (2025-2028) if Brandon Shores closes before transmission line built

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Ben Roush

Principal, PE (Mech & FP), LEED AP BD+C ASHRAE BEMP & BEAP, CCP, CEPE

Mechanical & FP Engineer

Board Chair Emeritus, USGBC-MD

AIA Baltimore COTE chair

USGBC E&A Committee Vice Chair

Sustainable Mechanical Engineering

Energy Modeling and Auditing

140+ LEED Projects

3 Certified Living Buildings

9 Current Projects Targeting Net Zero

Code Nerd

I want to read the code myself!

MEA Draft Regulation for BEPS:

https://mde.maryland.gov/programs/air/ClimateChange/Pages/BEPS.aspx

SB0528 (CSNA):

https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/sb0528?ys=2022RS

DC Building Energy Performance Standards (BEPS):

https://doee.dc.gov/service/building-energy-performance-standards-beps

Montgomery County BEPS:

https://www.montgomerycountymd.gov/green/energy/beps.html

DC Green Code:

https://codes.iccsafe.org/content/DCGCC2017P1/preface

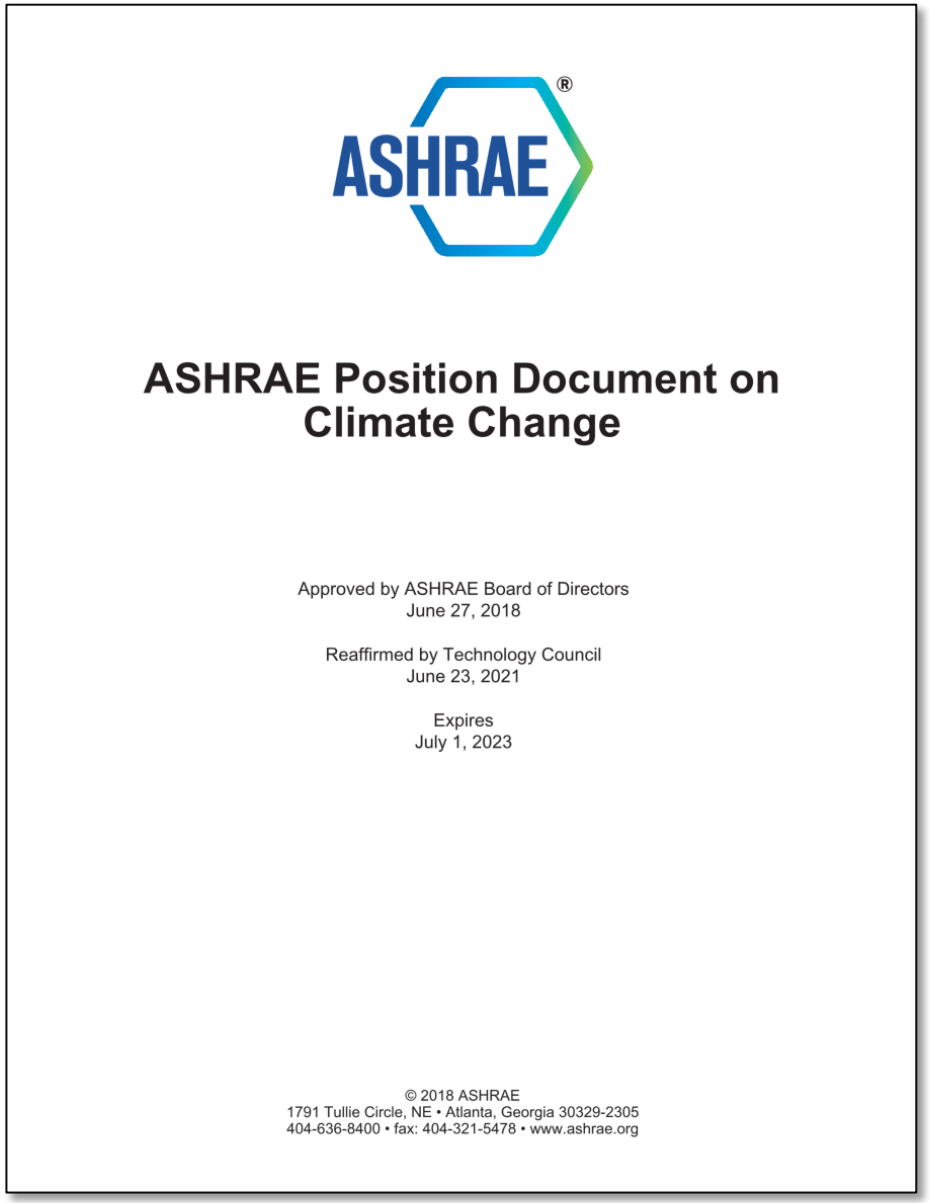
Maryland Commission on Climate Change (MCCC) annual report (see archive for E3 report):

https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/index.aspx

ASHRAE Position Paper on Climate Change:

https://www.ashrae.org/file%20library/about/position%20documents/ashrae-position-document-on-climate-change---2023.pdf

ASHRAE Position on Climate Change



ASHRAE®

ASHRAE Position Document on Climate Change

Approved by ASHRAE Board of Directors
June 27, 2018

Reaffirmed by Technology Council
June 23, 2021

Expires
July 1, 2023

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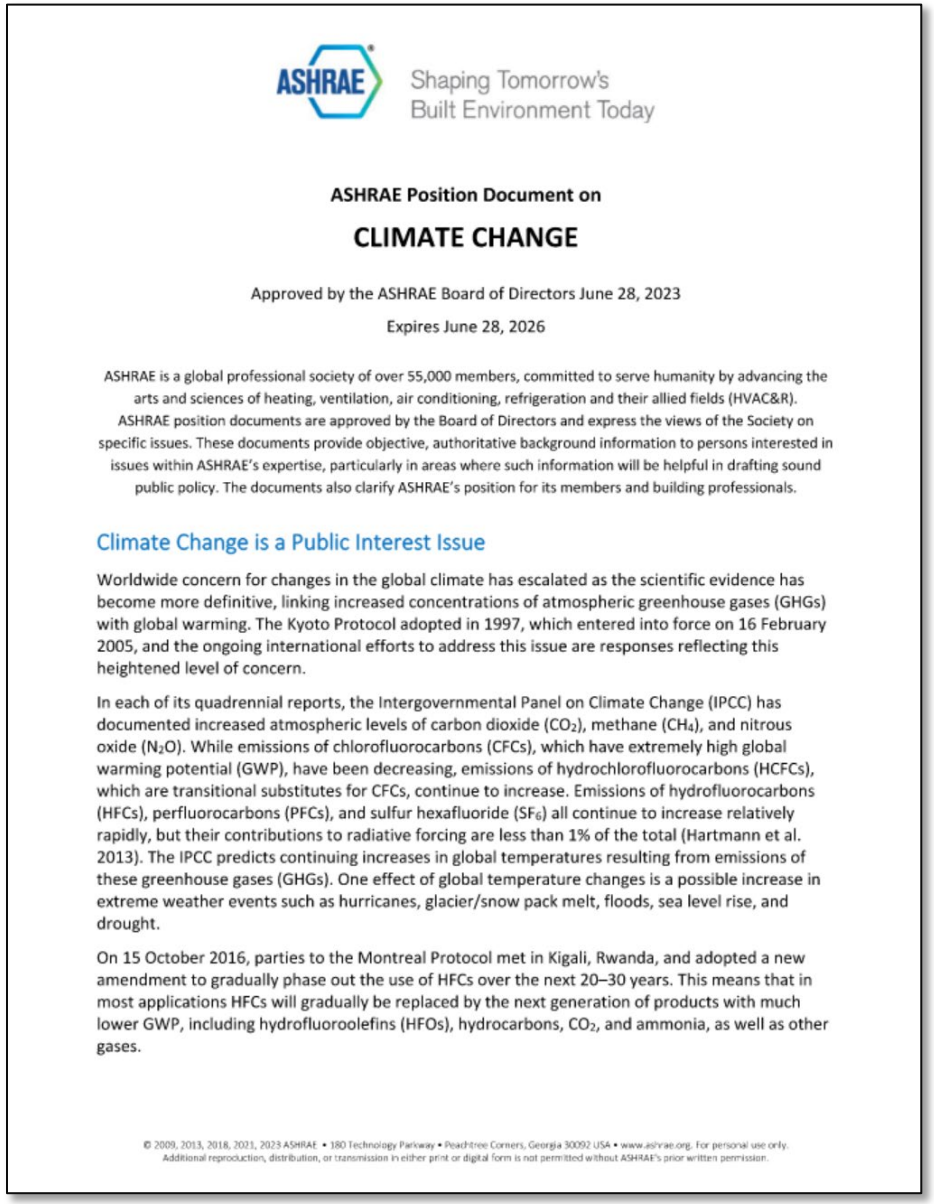


ASHRAE Shaping Tomorrow's Built Environment Today

ASHRAE Position Document on

CLIMATE CHANGE

Approved by the ASHRAE Board of Directors June 28, 2023

Expires June 28, 2026

ASHRAE is a global professional society of over 55,000 members, committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields (HVAC&R). ASHRAE position documents are approved by the Board of Directors and express the views of the Society on specific issues. These documents provide objective, authoritative background information to persons interested in issues within ASHRAE's expertise, particularly in areas where such information will be helpful in drafting sound public policy. The documents also clarify ASHRAE's position for its members and building professionals.

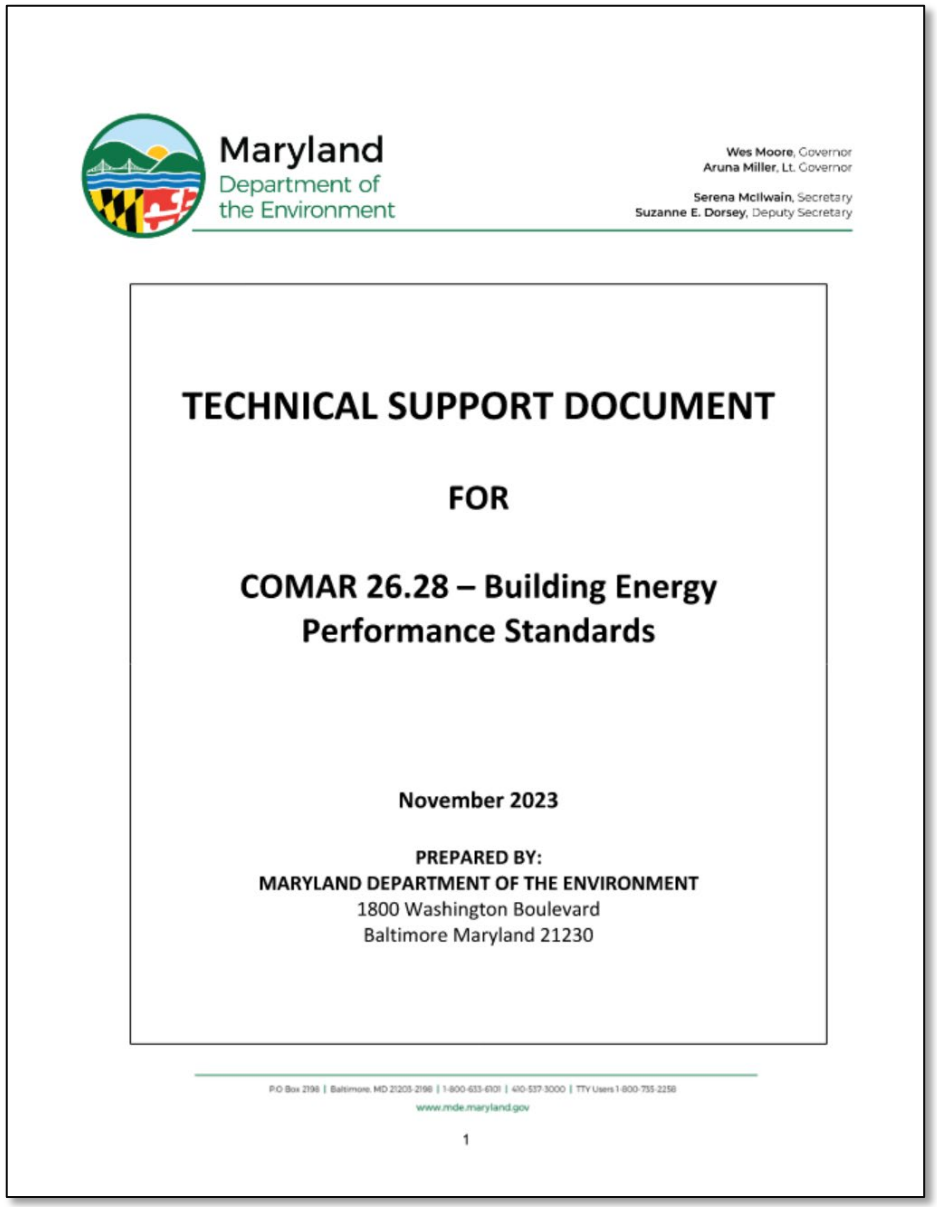
Climate Change is a Public Interest Issue

Worldwide concern for changes in the global climate has escalated as the scientific evidence has become more definitive, linking increased concentrations of atmospheric greenhouse gases (GHGs) with global warming. The Kyoto Protocol adopted in 1997, which entered into force on 16 February 2005, and the ongoing international efforts to address this issue are responses reflecting this heightened level of concern.

In each of its quadrennial reports, the Intergovernmental Panel on Climate Change (IPCC) has documented increased atmospheric levels of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). While emissions of chlorofluorocarbons (CFCs), which have extremely high global warming potential (GWP), have been decreasing, emissions of hydrochlorofluorocarbons (HCFCs), which are transitional substitutes for CFCs, continue to increase. Emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) all continue to increase relatively rapidly, but their contributions to radiative forcing are less than 1% of the total (Hartmann et al. 2013). The IPCC predicts continuing increases in global temperatures resulting from emissions of these greenhouse gases (GHGs). One effect of global temperature changes is a possible increase in extreme weather events such as hurricanes, glacier/snow pack melt, floods, sea level rise, and drought.

On 15 October 2016, parties to the Montreal Protocol met in Kigali, Rwanda, and adopted a new amendment to gradually phase out the use of HFCs over the next 20–30 years. This means that in most applications HFCs will gradually be replaced by the next generation of products with much lower GWP, including hydrofluoroolefins (HFOs), hydrocarbons, CO_2, and ammonia, as well as other gases.

Building Energy Performance Standards, MD



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

TECHNICAL SUPPORT DOCUMENT

FOR

COMAR 26.28 – Building Energy Performance Standards

November 2023

PREPARED BY:
MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Baltimore Maryland 21230

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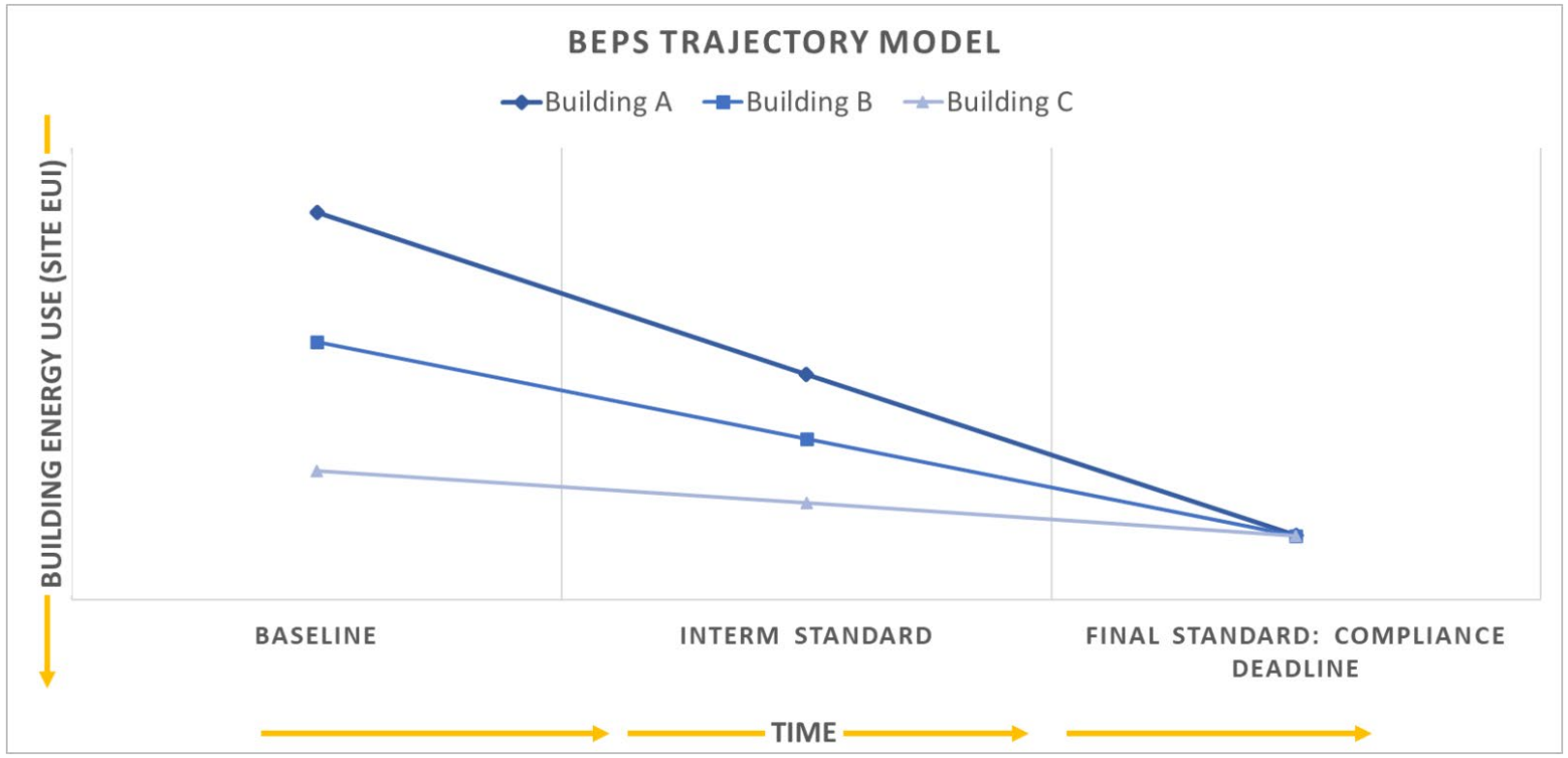
1

Building Energy Performance Standards, DC

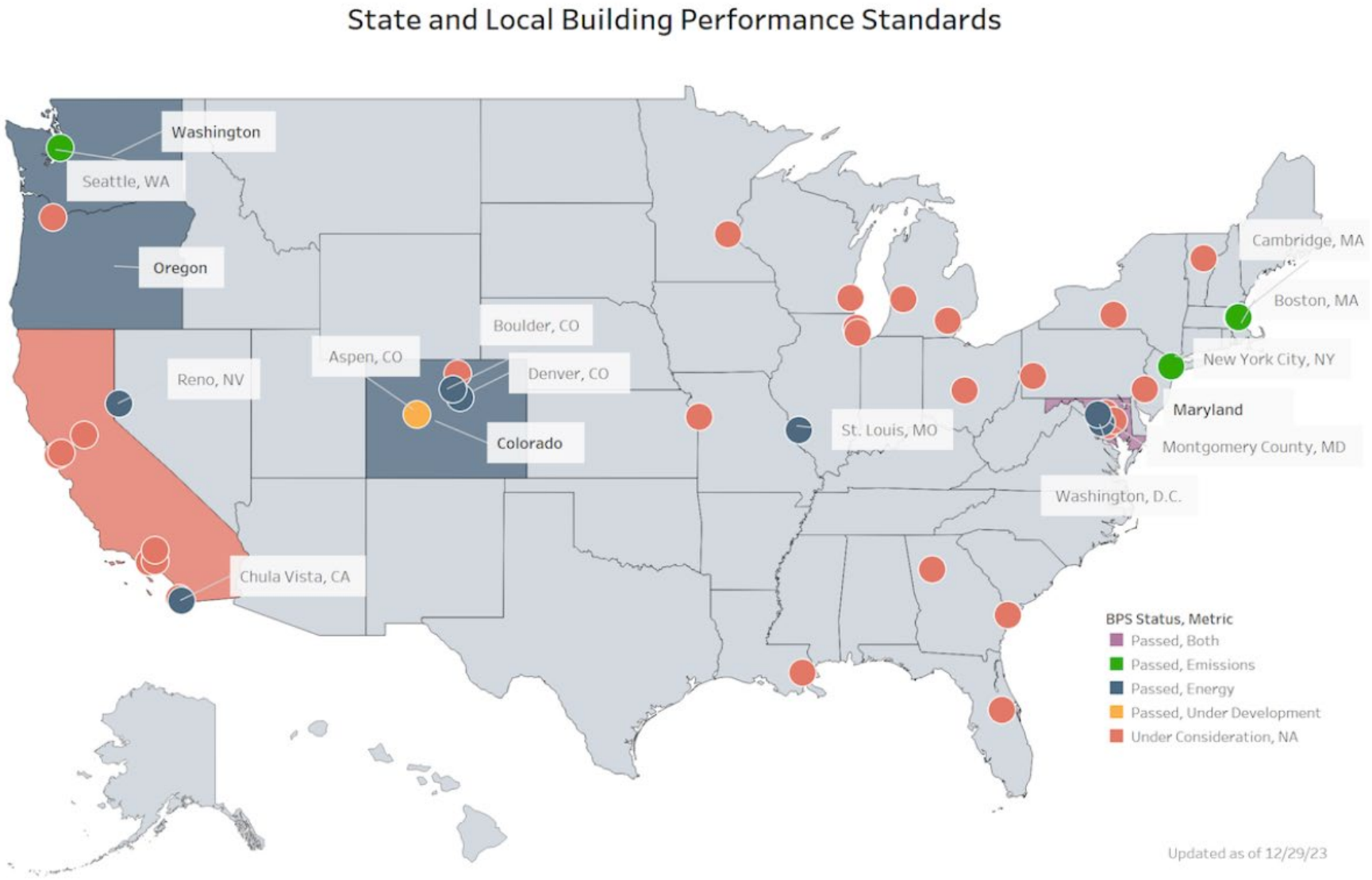
- 50% reduction in greenhouse gases by 2032
- Carbon neutrality by 2050
- 50% reduction in District-wide energy use by 2032
- 100% renewable electricity in the District by 2032

Property Type	2021 Building Energy Performance Standard	
	ENERGY STAR Score	Source EUI
Adult Education		110.4
Ambulatory Surgical Center		426.9
Aquarium		240.2
Automobile Dealership		124.1
Bank Branch	71	153.7
Bar/Nightclub		297
Barracks	56	141.4
Bowling Alley		206.6
Casino		240.2
College/University		180.6
Convenience Store with Gas Station		592.6
Convenience Store without Gas Station		592.6
Convention Center		192
Courthouse	71	153.7
Data Center	50	1.8 Total Energy kBtu/IT Energy kBtu
Distribution Center	19	103.7
Drinking Water Treatment & Distribution		5.9 kBtu/gallons per day
Enclosed Mall		170.7
Energy/Power Station		229.4
Fast Food Restaurant		886.4
Financial Office	71	153.7
Fire Station		185.5
Fitness Center/Health Club/Gym		206.6
Food Sales		592.6
Food Service		527.7
Hospital (General Medical & Surgical)	50	426.9
Hotel	54	183.9
Ice/Curling Rink		206.6
Indoor Arena		240.2
K-12 School	36	139
Laboratory		318.2
Library		206.4
Lifestyle Center		228.8
Mailing Center/Post Office		242.6
Medical Office	62	172
Mixed Use Property		229.4
Movie Theater		240.2
Multifamily Housing	66	110.7
Museum		240.2
Non-Refrigerated Warehouse	19	103.7
Office	71	153.7

Building Energy Performance Standards, MOCO



Building Energy Performance Standards



Gas Bans, Bans on Gas Bans

State legislation prohibiting local governments from restricting natural gas utility service:

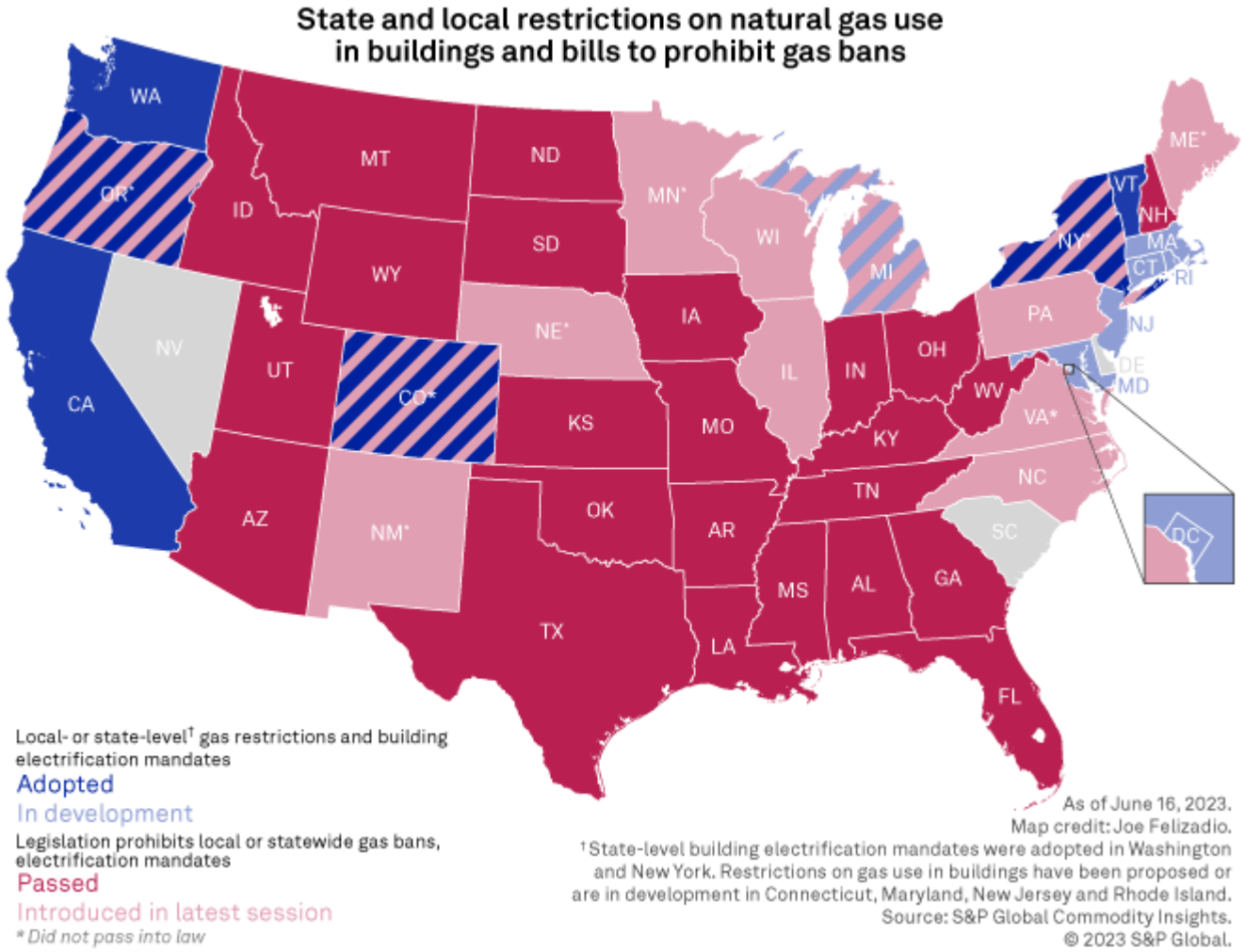
Passed

Introduced in legislative session

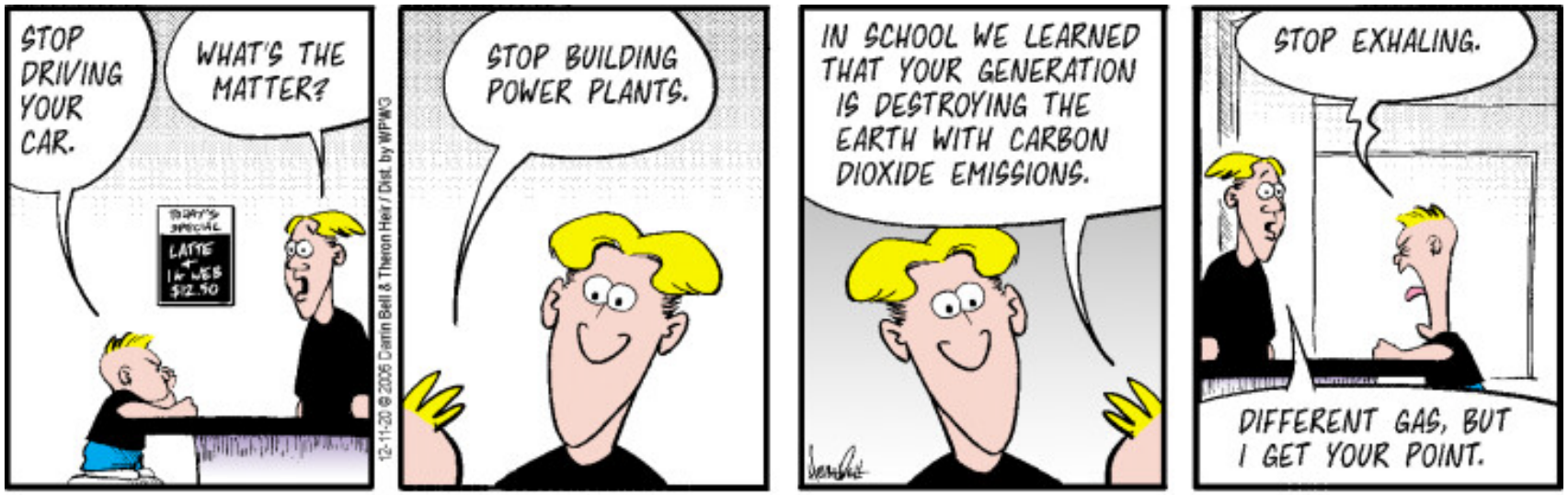
Local gas bans & electrification codes for new buildings:

Passed

In development



Let’s talk about Carbon (emissions)



C407, Welcome to ASHRAE 90.1, DC

Table C407.3(1)
Carbon Emissions Factors

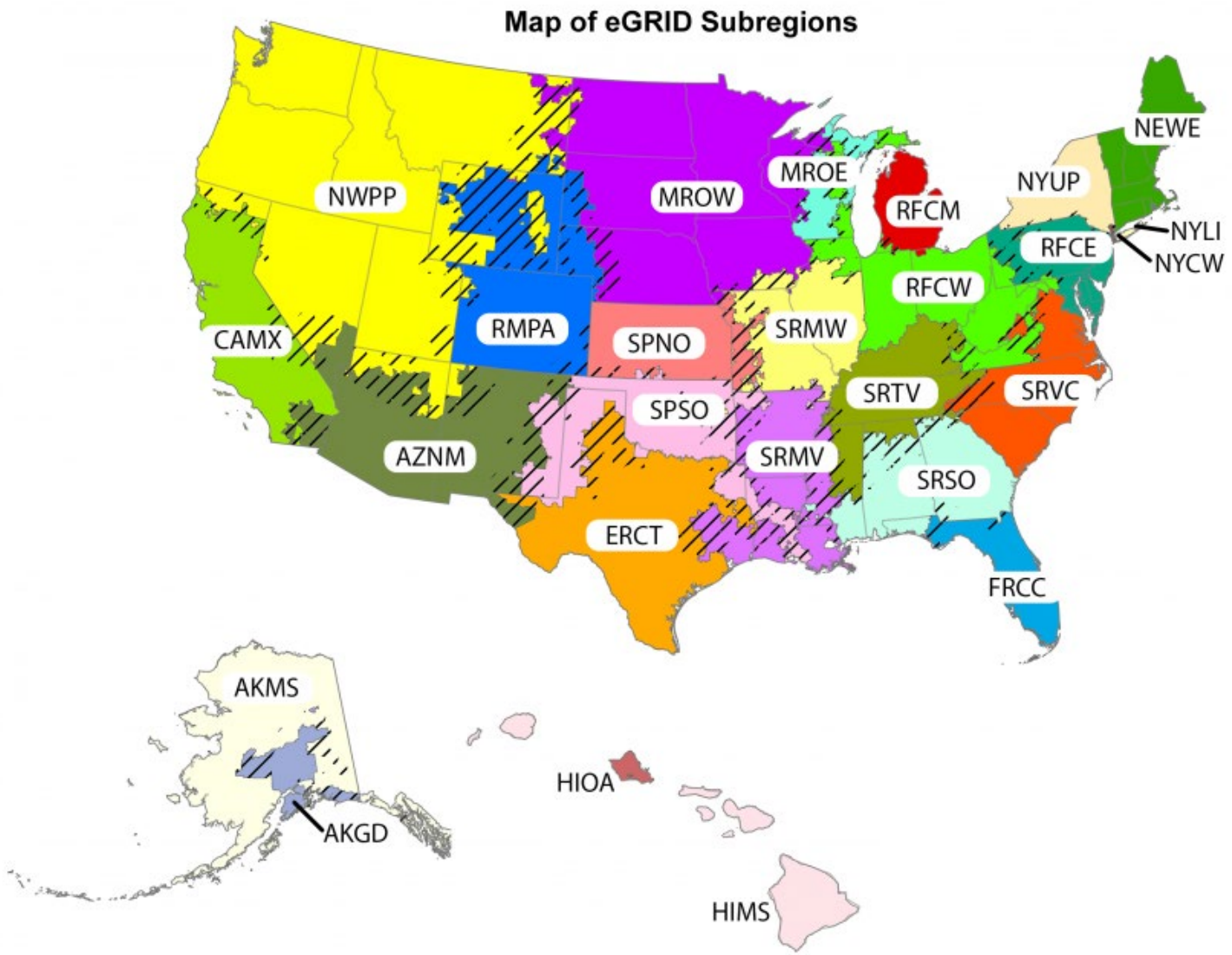
Type	CO2e (lb/unit)	Unit
Electricity	0.70	kWh
Natural Gas	11.7	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other[a]	195.00	mmBtu
On-site renewable energy	0.00	

[a] District energy systems may use alternative emissions factors supported by calculations approved by the *code official*.

IgCC

Carbon multiplier	Co2e
Electricity	716 lb/mWh
Natural gas	509 lb/mWh
Coal	820 lb/mWh
Gasoline	681 lb/mWh
District steam	855 lb/mWh
District chilled water	323 lb/mWh
District hot water	807 lb/mWh

Power Grids

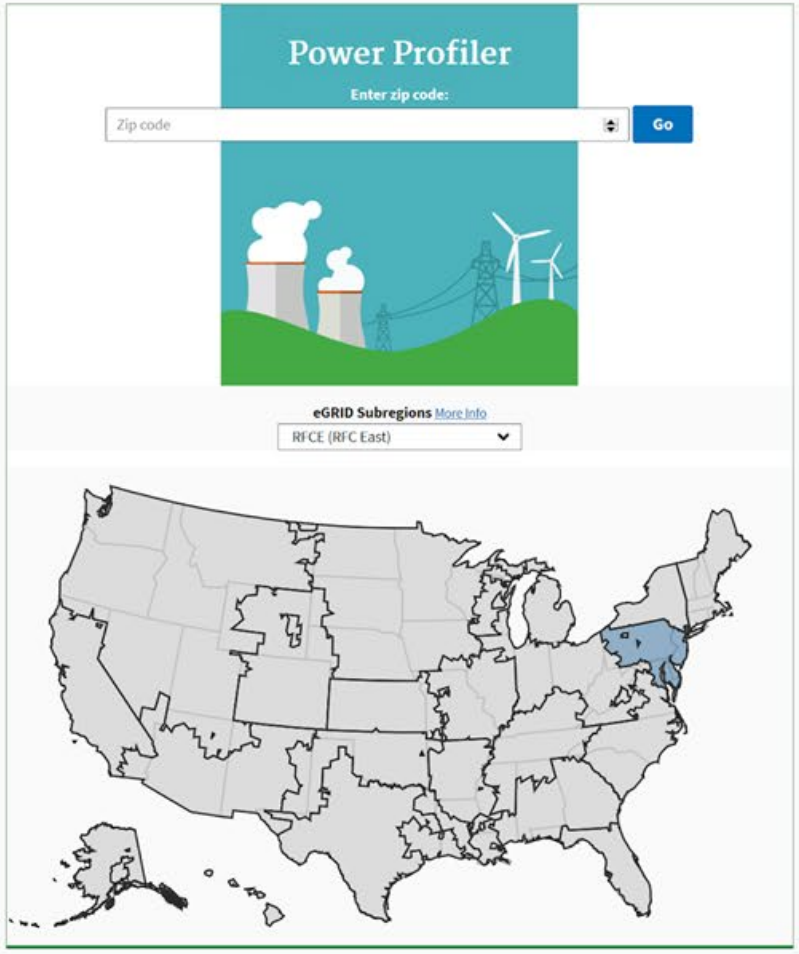

Map of eGRID Subregions
NWPP
MROW
MROE
NEWE
NYUP
RFCM
NYLI
NYCW
RFCE
RFCW
CAMX
RMPA
SPNO
SRMW
SRTV
SRVC
SPSO
AZNM
SRMV
SRSO
ERCT
FRCC
AKMS
AKGD
HIOA
HIMS

Power Profiler

Power Profiler

How clean is the electricity you use?

Electricity is produced by many different sources of energy, including, but not limited to, wind, solar, nuclear, and fossil fuels. The type and amount of emissions produced depend on how electricity is generated in your region. Type in your zip code (or select a region) to view your power profile. More Info



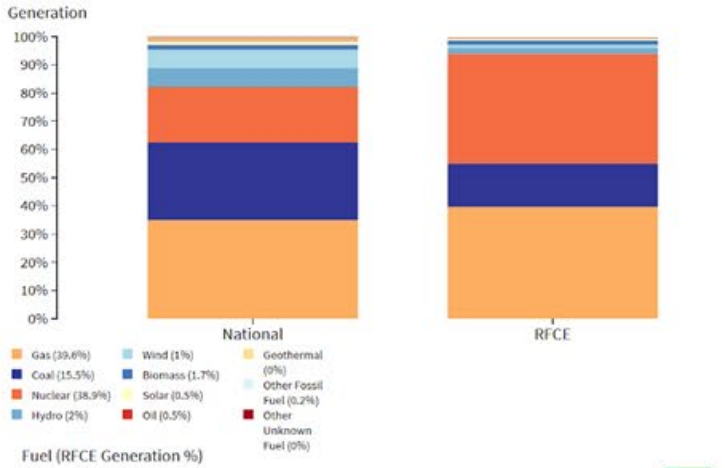
RFCE Emission Rates

CO_2	SO_2	NO_X
716.0 (lbs/MWh)	0.5 (lbs/MWh)	0.3 (lbs/MWh)

« Back to All Subregions

Fuel Mix

This chart compares fuel mix (%) of sources used to generate electricity in the selected eGRID subregion to the national fuel mix (%).



Emission Rates

This chart compares the average emission rates (lbs/MWh) in the selected eGRID subregion to the national average emission rates (lbs/MWh) for carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen oxide (NO_X).

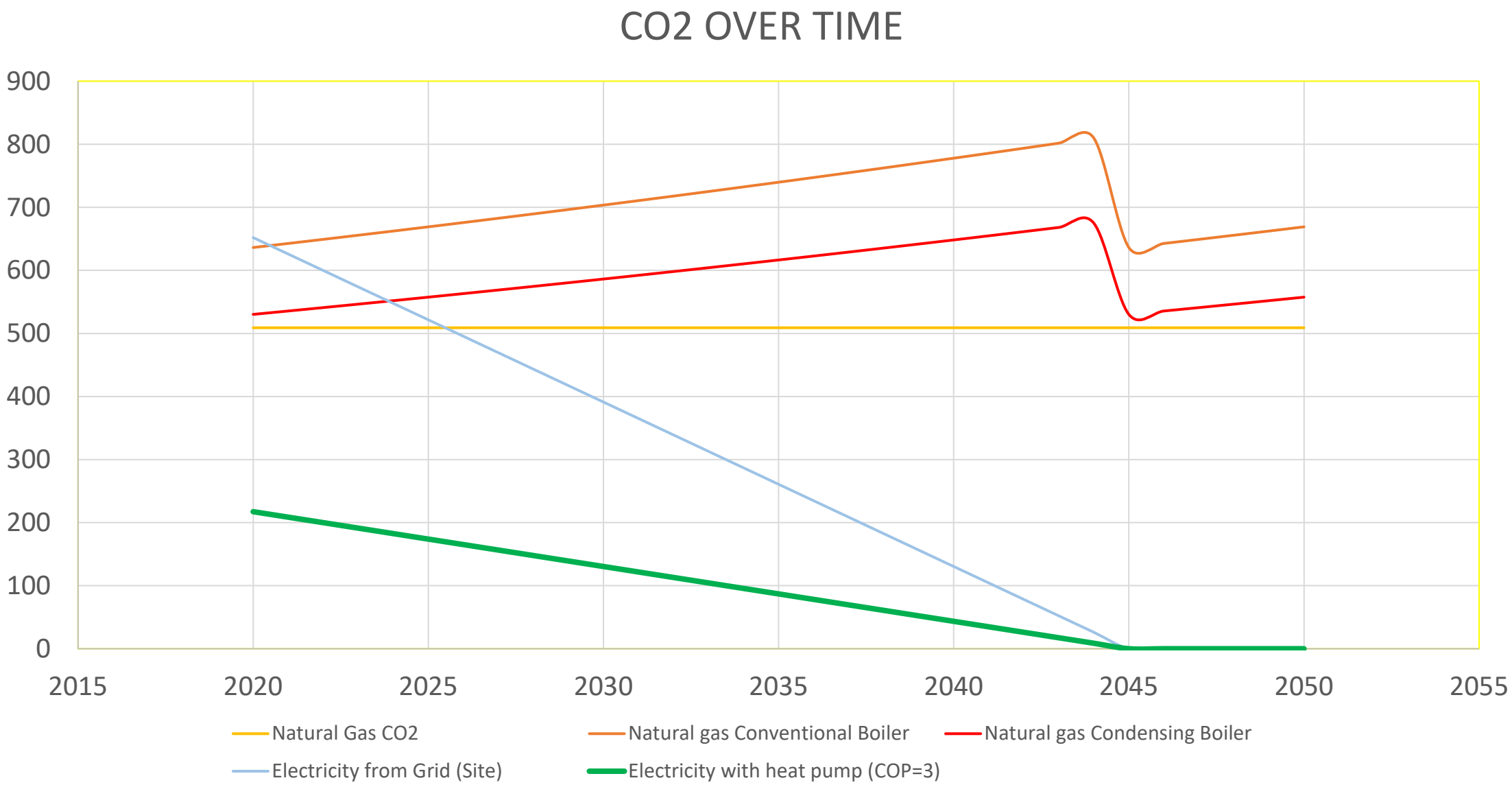
Power Profiler, 2023

RFCE Emission Rates

CO_2	SO_2	NO_X
672.8	0.337	0.296
(lbs/MWh)	(lbs/MWh)	(lbs/MWh)

« Back to all subregions

Carbon Over Time, MD



Climate Solutions Now Act (CSNA)

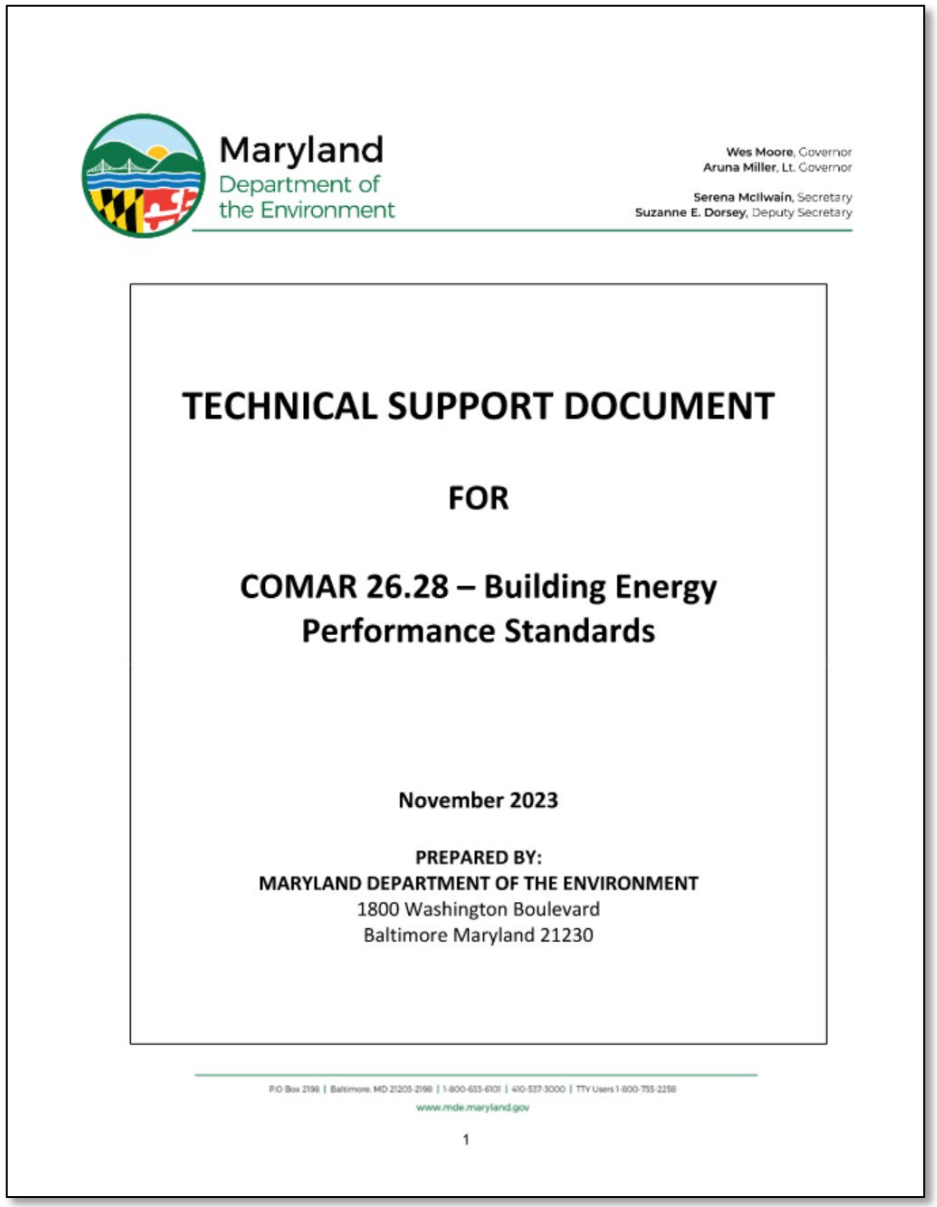
Title	Climate Solutions Now Act of 2022
Sponsored by	Senators Pinsky, Ferguson, Kelley, Guzzone, Smith, Kagan, Waldstreicher, Lam, Washington, Patterson, Hester, Ellis, Zucker, Kramer, Hettleman, Young, Sydnor, Hayes, Watson, Beidle, Carter, Augustine, Elfreth, Feldman, Jackson, King, and Lee
Status	Enacted under Article II, Section 17(b) of the Maryland Constitution - Chapter 38
Analysis	Fiscal and Policy Note (Revised)
Synopsis	Requiring the State to reduce statewide greenhouse gas emissions by altering statewide greenhouse gas emissions goals, establishing of a net-zero statewide greenhouse gas emissions goal, developing certain energy efficiency and emissions reduction requirements for certain buildings, requiring electric companies to increase their annual incremental gross energy savings, establishing certain zero-emission vehicle requirements for the State fleet, and establishing an electric school bus pilot program; etc.
Committees	Original: Education, Health, and Environmental Affairs Budget and Taxation Opposite: Environment and Transportation Economic Matters
Committee Testimony	Witness List
Details	Bill File Type: Regular Effective Date(s): June 1, 2022 Bill imposes a mandated appropriation in the annual State Budget Bill Creates a Task Force or Commission
History	⌄
File Code	⌄
Subjects	⌄
Statutes	⌄

Climate Solutions Now Act (CSNA)

What Passed, partial list:

- Electric school bus funding
- Carbon neutral power grid by 2045 (60% by 2031)
- +5% funding for net zero schools
- Incentivize community scale solar
- Adoption of most current IgCC
- Funding for low income projects and households
- BEPS for MD, for fossil fuel, 35,000 SF and larger

Building Energy Performance Standards, MD (DRAFT)



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

TECHNICAL SUPPORT DOCUMENT

FOR

COMAR 26.28 – Building Energy Performance Standards

November 2023

PREPARED BY:
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard
Baltimore Maryland 21230

P.O Box 2398 | Baltimore, MD 21203-2398 | 1-800-633-6101 | 410-537-3000 | TTY Users 1-800-735-2258
www.mde.maryland.gov

1

Building Energy Performance Standards, MD (DRAFT)

Building Energy Performance Standards, MD

Exceptions for:

- “Is a food service facility as defined by COMAR 10.15.03.02”
- Engages in commercial cooking and water heating
- Excludes parking garage
- Historic properties
- Elementary or secondary school buildings
- Manufacturing process energy use
- Agricultural buildings

Building Energy Performance Standards, MD (DRAFT)

	Net Direct Emissions Standards Kg CO2e per square foot			**Site EUI Standards** kBTU per square foot
Property Type	**Interim Standard for 2030-2034**	**Interim Standard for 2035-2039**	**Final Standard for 2040 and beyond**	**Final Standard for 2040 and beyond**
Adult Education	2.34	1.17	0	46
Ambulatory Surgical Center	1.76	0.88	0	46
Aquarium	1.99	1.00	0	145
Bank Branch	1.01	0.50	0	85
Bar/Nightclub	1.70	0.85	0	220
Barracks	0.57	0.29	0	38
Bowling Alley	2.07	1.03	0	84
Casino	1.03	0.52	0	41
College/University	2.43	1.21	0	57
Convenience Store with Gas Station	2.25	1.13	0	137
Convenience Store without Gas Station	2.25	1.13	0	137
Convention Center	0.39	0.19	0	40
Courthouse	1.14	0.57	0	47
Data Center	1.26	0.63	0	145
Distribution Center	0.58	0.29	0	19
Enclosed Mall	0.24	0.12	0	44
Fast Food Restaurant	exempt	exempt	exempt	exempt
Financial Office	0.32	0.16	0	58
Fire Station	1.70	0.85	0	47
Fitness Center/Health Club/Gym	2.87	1.43	0	59
Food Sales	2.25	1.13	0	137
Food Service	exempt	exempt	exempt	exempt

Building Energy Performance Standards, MD (DRAFT)

Heated Swimming Pool	2.07	1.03	0	84
Hospital (General Medical & Surgical)	6.10	3.05	0	144
Hotel	1.47	0.74	0	60
Ice/Curling Rink	2.07	1.03	0	84
Indoor Arena	1.03	0.52	0	41
K-12 School	exempt	exempt	exempt	exempt
Laboratory	5.35	2.68	0	144
Library	1.92	0.96	0	55
Lifestyle Center	0.91	0.46	0	58
Mailing Center/Post Office	0.92	0.46	0	48
Medical Office	0.18	0.09	0	70
Movie Theater	0.78	0.39	0	57
Multifamily Housing	0.82	0.41	0	29
Museum	0.75	0.38	0	29
Non-Refrigerated Warehouse	0.09	0.05	0	30
Office	0.22	0.11	0	55
Other – Education	1.59	0.80	0	45
Other - Entertainment/Public Assembly	0.54	0.27	0	48
Other - Lodging/Residential	0.002	0.001	0	37
Other – Mall	1.40	0.70	0	81
Other – Other	1.60	0.80	0	54
Other - Public Services	2.12	1.06	0	61
Other – Recreation	0.70	0.35	0	78
Other - Restaurant/Bar	exempt	exempt	exempt	exempt
Other – Services	2.63	1.31	0	51
Other - Specialty Hospital	6.10	3.05	0	144
Other – Stadium	0.31	0.16	0	23
Other - Technology/Science	0.001	0.001	0	183
Outpatient Rehabilitation/Physical Therapy	1.76	0.88	0	46
Parking	exempt	exempt	exempt	exempt
Performing Arts	2.38	1.19	0	57
Personal Services (Health/Beauty, Dry Cleaning, etc)	2.17	1.09	0	47
Police Station	1.52	0.76	0	54
Pre-school/Daycare	2.45	1.23	0	48
Prison/Incarceration	0.57	0.29	0	38
Race Track	1.03	0.52	0	41
Refrigerated Warehouse	1.37	0.69	0	38
Repair Services (Vehicle, Shoe, Locksmith, etc)	2.16	1.08	0	52
Residence Hall/Dormitory	0.70	0.35	0	38
Residential Care Facility	1.43	0.72	0	50
Restaurant	exempt	exempt	exempt	exempt
Retail Store	0.60	0.30	0	48
Roller Rink	2.07	1.03	0	84
Self-Storage Facility	0.19	0.10	0	7
Senior Living Community	1.43	0.72	0	50
Social/Meeting Hall	1.53	0.76	0	39
Stadium (Closed)	0.31	0.16	0	23
Stadium (Open)	0.32	0.16	0	21
Strip Mall	1.90	0.95	0	58
Supermarket/Grocery Store	2.25	1.13	0	137
Transportation Terminal/Station	2.22	1.11	0	56
Urgent Care/Clinic/Other Outpatient	1.76	0.88	0	46
Vehicle Dealership	2.23	1.12	0	61
Veterinary Office	1.76	0.88	0	46
Vocational School	2.34	1.17	0	46
Wholesale Club/Supercenter	0.60	0.30	0	48
Worship Facility	0.87	0.44	0	32
Zoo	1.03	0.52	0	41

Building Energy Performance Standards, MD (DRAFT)

	Net Direct Emissions Standards Kg CO2e per square foot			Site EUI Standards kBTU per square foot
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Food Sales	2.25	1.13	0	137
Food Service	exempt	exempt	exempt	exempt

Building Energy Performance Standards, MD (DRAFT)

Multifamily Housing	0.82	0.41	0	29
Self-Storage Facility	0.19	0.10	0	7
Senior Living Community	1.43	0.72	0	50

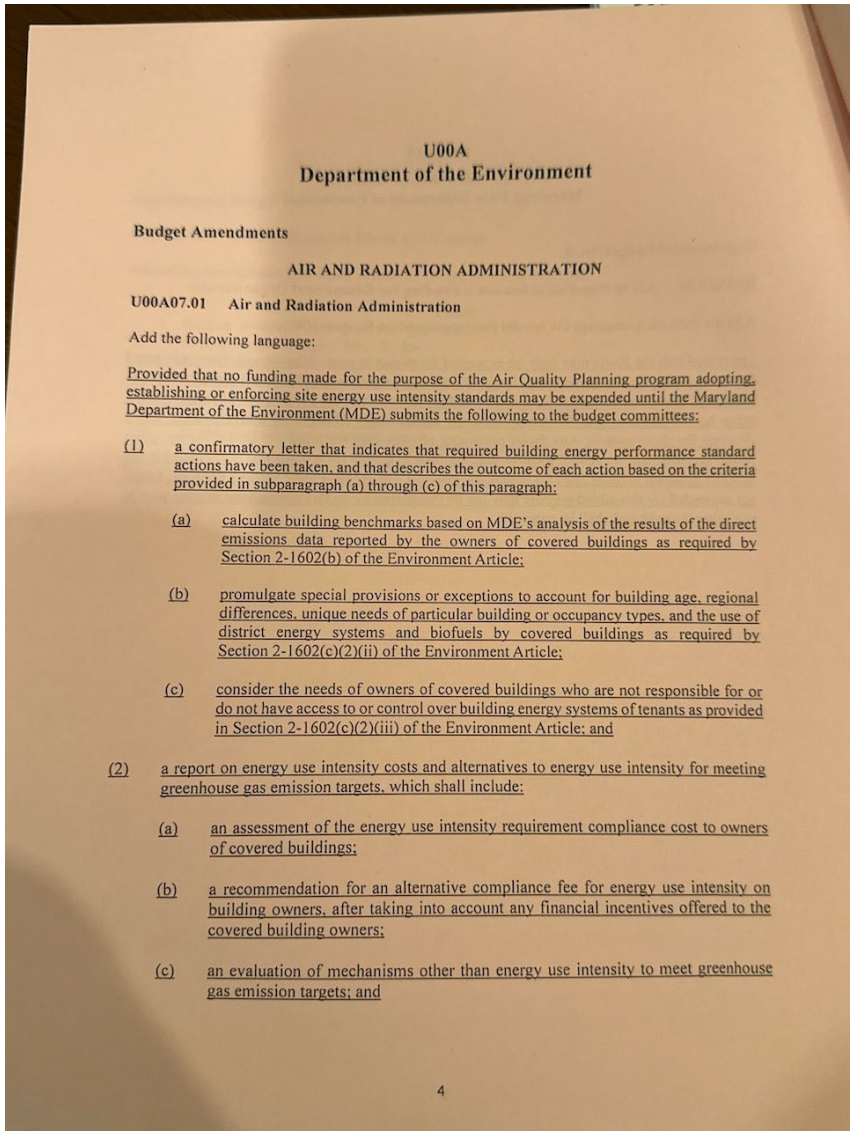
Building Energy Performance Standards, MD (DRAFT)

(2) An alternative compliance fee shall be paid for every metric ton of net direct emissions in excess of the net direct emissions standard in a given calendar year. The fee shall be:

(a) $230 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2030;
(b) $234 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2031;
(c) $238 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2032;
(d) $242 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2033;
(e) $246 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2034;
(f) $250 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2035;
(g) $254 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2036;
(h) $258 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2037;
(i) $262 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2038;
(j) $266 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2039;
(k) $270 per metric ton of excess CO2e in 2020 dollars, adjusted for inflation, for 2040; and
(l) The fee rate increases by $4 per metric ton of CO2e per calendar year in 2020 dollars, adjusted for inflation, in each calendar year following 2040.

Building Energy Performance Standards, MD

Building Energy Performance Standards, MD



U00A
Department of the Environment

Budget Amendments

AIR AND RADIATION ADMINISTRATION

U00A07.01 Air and Radiation Administration

Add the following language:

Provided that no funding made for the purpose of the Air Quality Planning program adopting, establishing or enforcing site energy use intensity standards may be expended until the Maryland Department of the Environment (MDE) submits the following to the budget committees:

(1) a confirmatory letter that indicates that required building energy performance standard actions have been taken, and that describes the outcome of each action based on the criteria provided in subparagraph (a) through (c) of this paragraph:

(a) calculate building benchmarks based on MDE's analysis of the results of the direct emissions data reported by the owners of covered buildings as required by Section 2-1602(b) of the Environment Article;

(b) promulgate special provisions or exceptions to account for building age, regional differences, unique needs of particular building or occupancy types, and the use of district energy systems and biofuels by covered buildings as required by Section 2-1602(c)(2)(ii) of the Environment Article;

(c) consider the needs of owners of covered buildings who are not responsible for or do not have access to or control over building energy systems of tenants as provided in Section 2-1602(c)(2)(iii) of the Environment Article; and

(2) a report on energy use intensity costs and alternatives to energy use intensity for meeting greenhouse gas emission targets, which shall include:

(a) an assessment of the energy use intensity requirement compliance cost to owners of covered buildings;

(b) a recommendation for an alternative compliance fee for energy use intensity on building owners, after taking into account any financial incentives offered to the covered building owners;

(c) an evaluation of mechanisms other than energy use intensity to meet greenhouse gas emission targets; and

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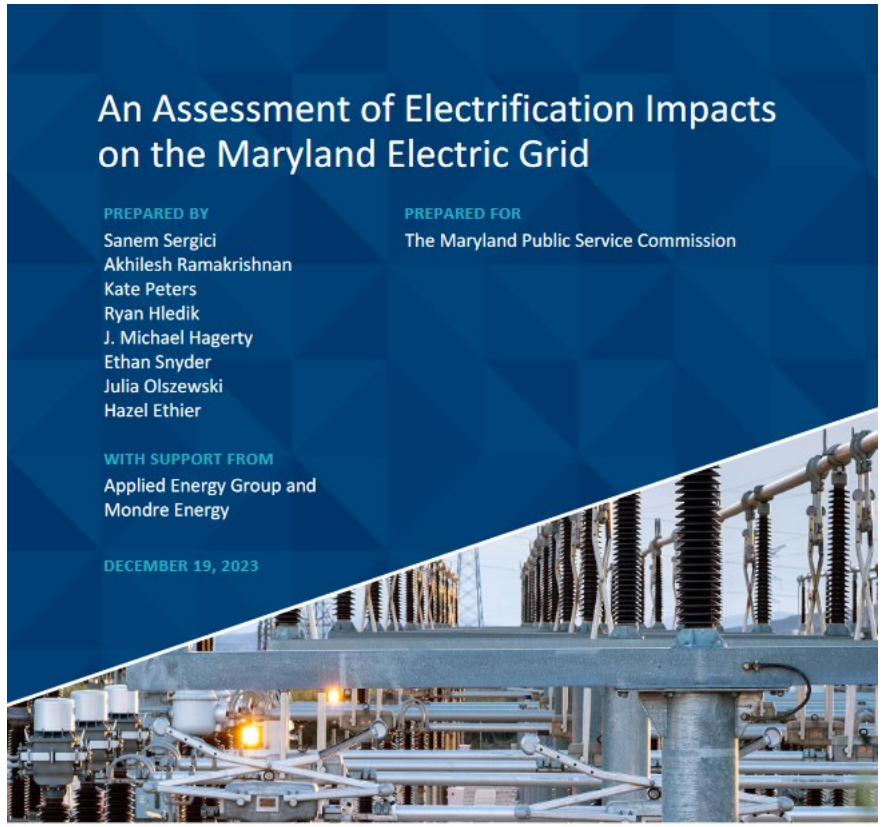
Building Energy Performance Standards, MD

Building Energy Performance Standards, MD

Building Energy Performance Standards, MD

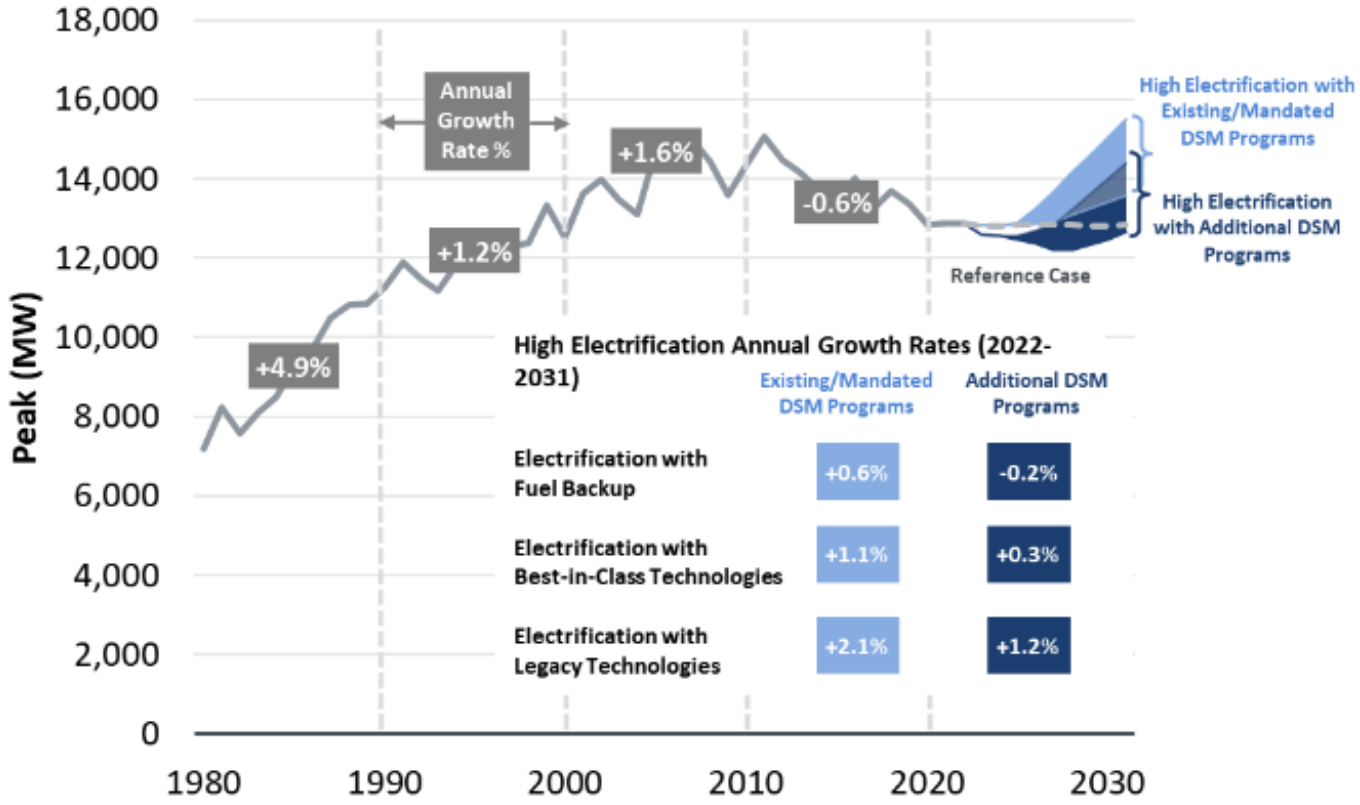
Building Energy Performance Standards, MD



Brattle

Building Energy Performance Standards, MD

FIGURE 1: HISTORICAL AND PROJECTED MARYLAND ANNUAL LOAD GROWTH



Sources and Notes: Maryland system peak loads are based on the total coincident peak of the six in-scope utilities. Historical load is backcasted using the 2022 peak load and the weighted average historical annual load growth of each utility. Historical growth rates are sourced from utility data if available or PJM zonal data for the corresponding zone. Projected load growth rates are based on utility load forecasts submitted for the 2022–2031 Ten Year Plan and Brattle modeling of the impacts of energy efficiency, behind-the-meter solar, load flexibility, transportation electrification, and building electrification.

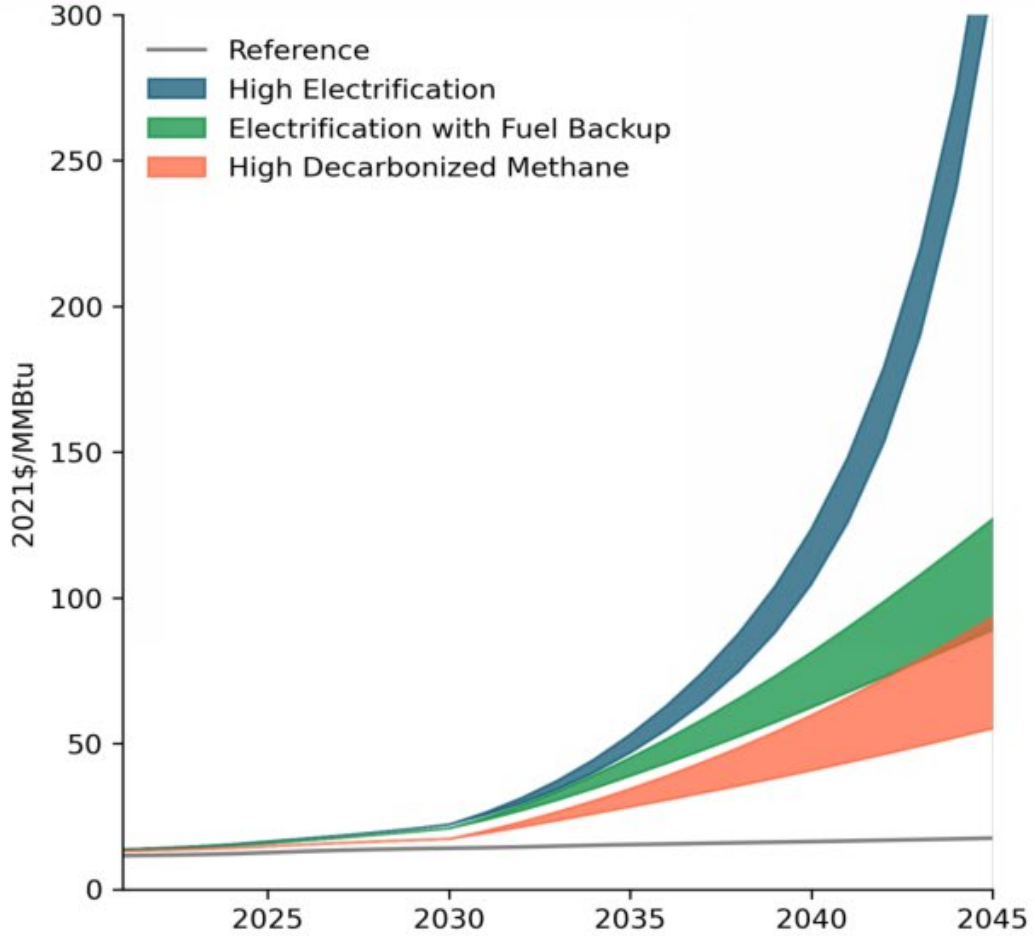
Building Energy Performance Standards, MD

"We only have a few rules around here,
but we really enforce them."

MCCC, E3 Report

MCCC, E3 Report

Residential gas rates (2021$/MMBtu)

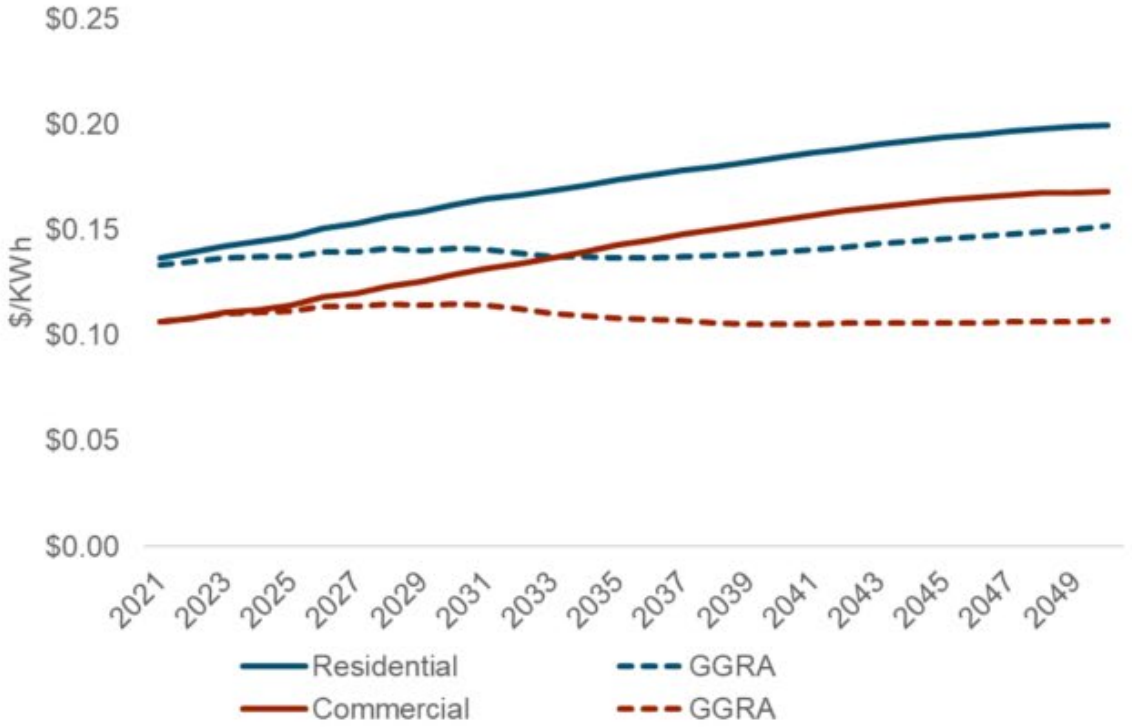


- **High Electrification scenario** experiences a rapid rate increase driven by declining throughput despite lower total delivery and commodity costs
- Rate increases in the **High Decarbonized Methane scenario** are driven primarily by the commodity cost for zero carbon fuel
- **Electrification with Fuel Backup scenario** has higher gas rates than the High Decarbonized Methane scenario, due to its lower throughput and the resulting higher per MMBtu delivery cost

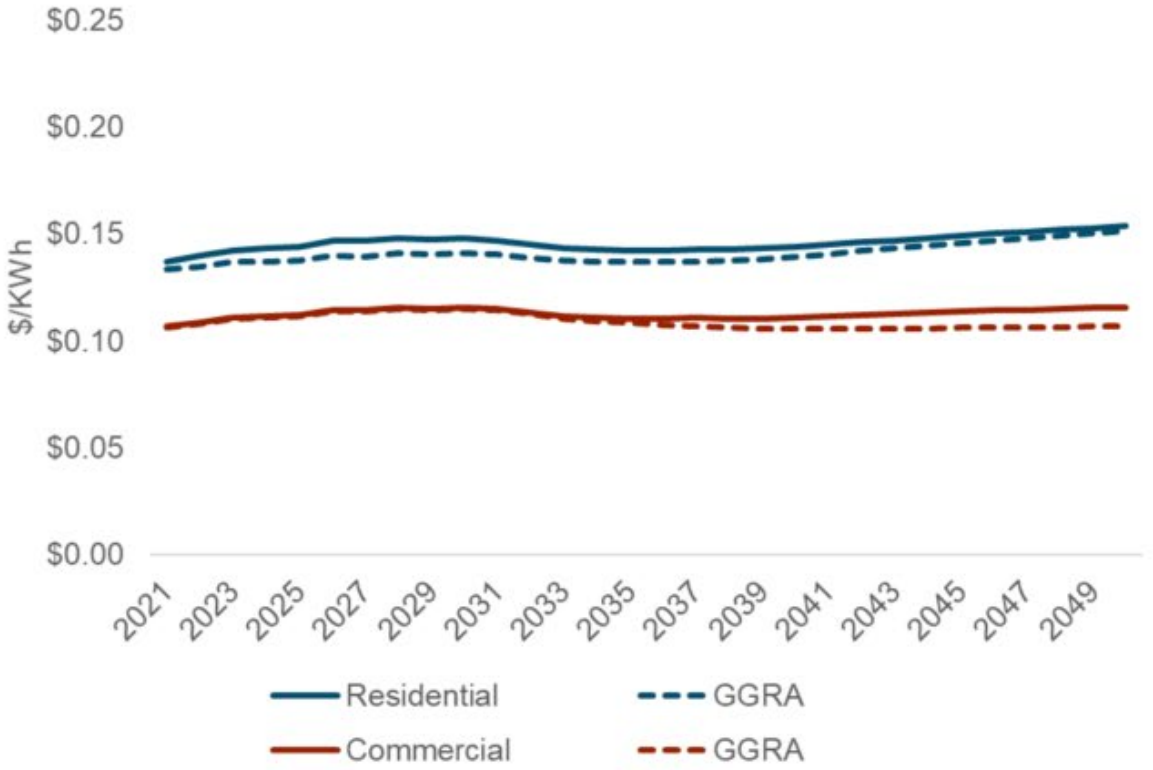
*Range shown in figure reflects the commodity cost forecast uncertainty

MCCC, E3 Report

Electric rates in the High Electrification Scenario (2021$/kWh)



Electric rates in the Electrification + Gas Back-up Scenario (2021$/kWh)



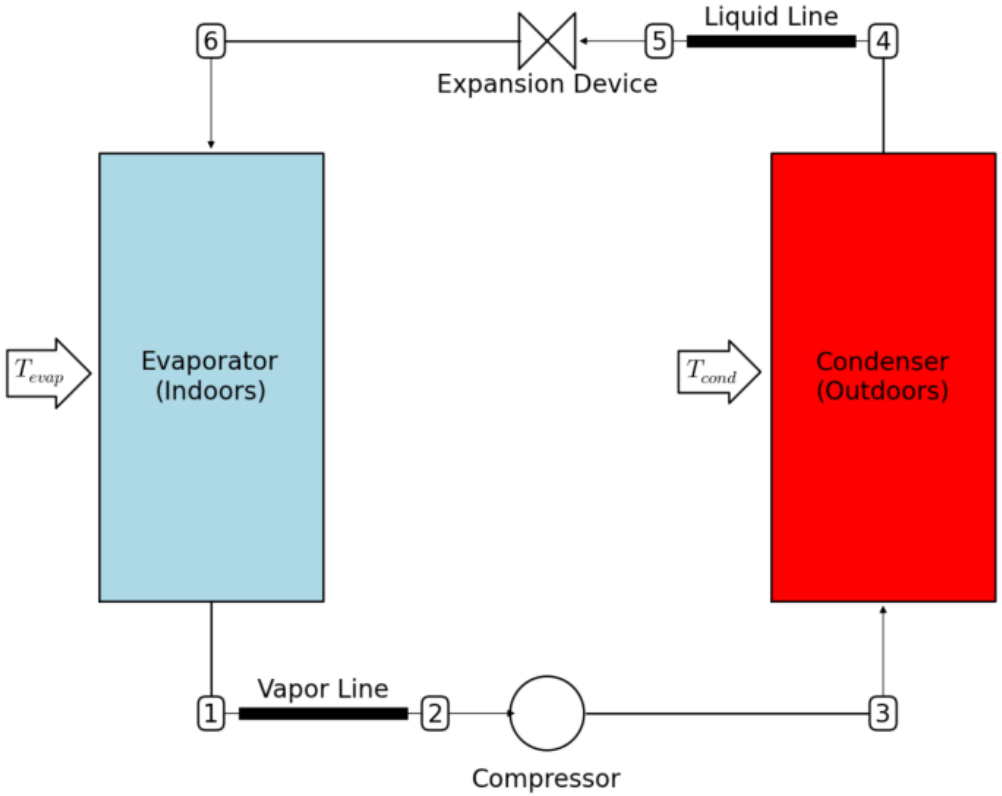
Engineering Terms

Heat Pump

Performance

Coefficient of Performance (COP)

Resistance:
1kW in=1kW Work Out

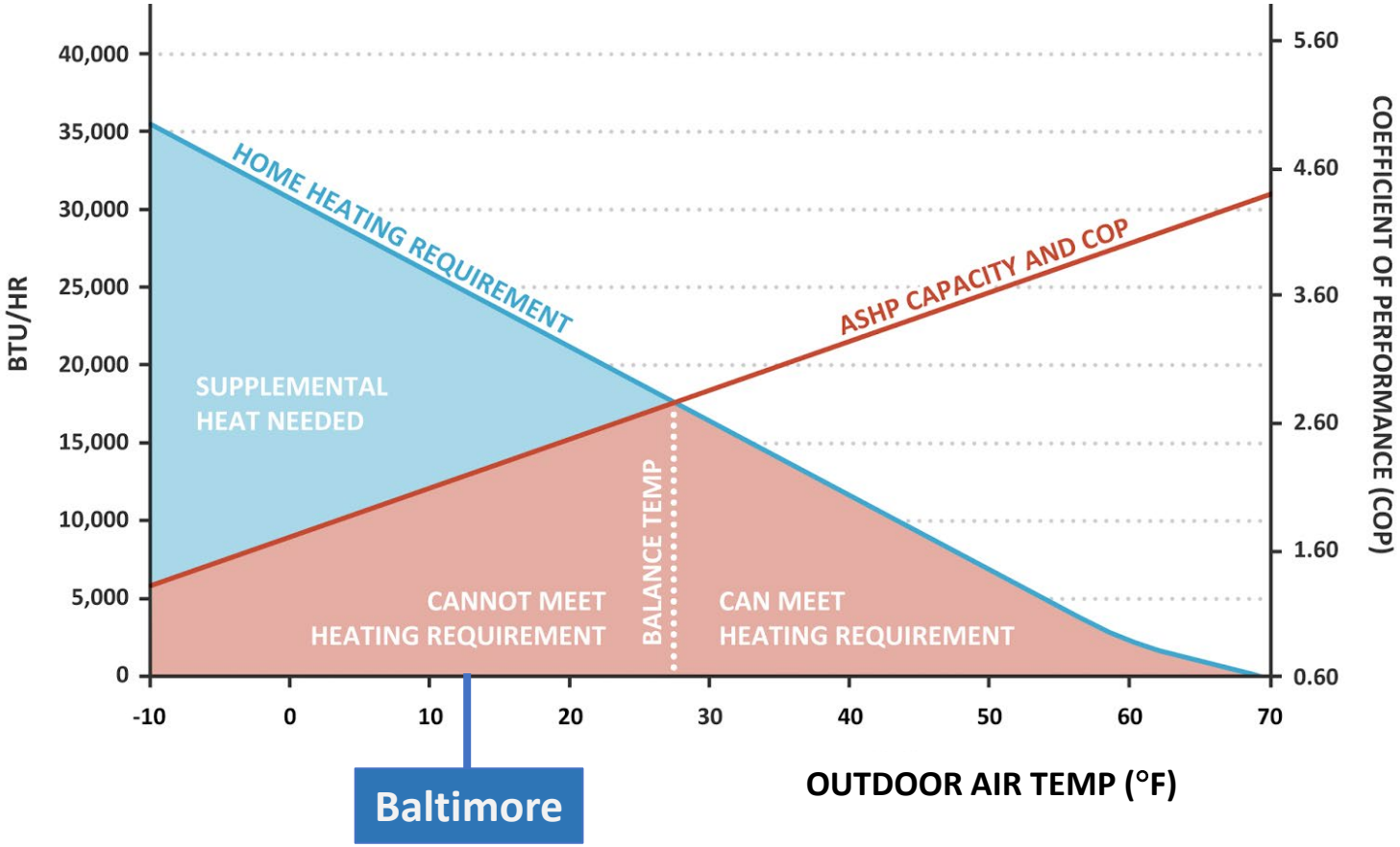


Refrigeration cycle:
1kW in=3kW Work Out

Engineering View, Limitations

Heat Pump Performance, Cold Temp Impacts (cheap version)

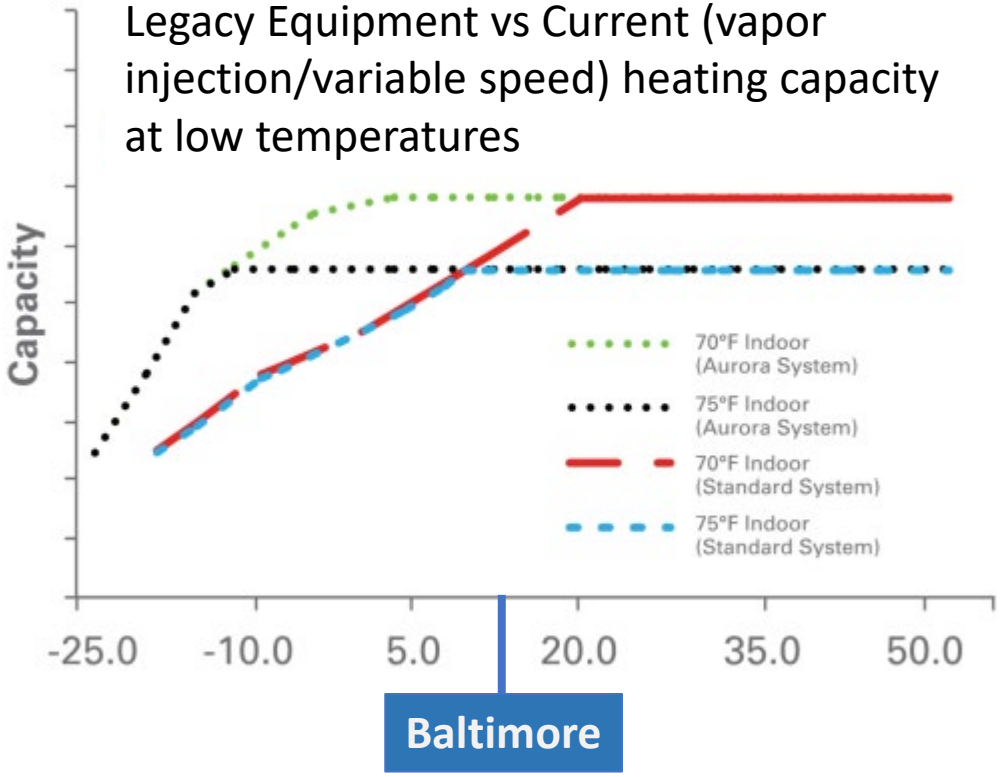
Performance of typical 2-ton air-source heat pump



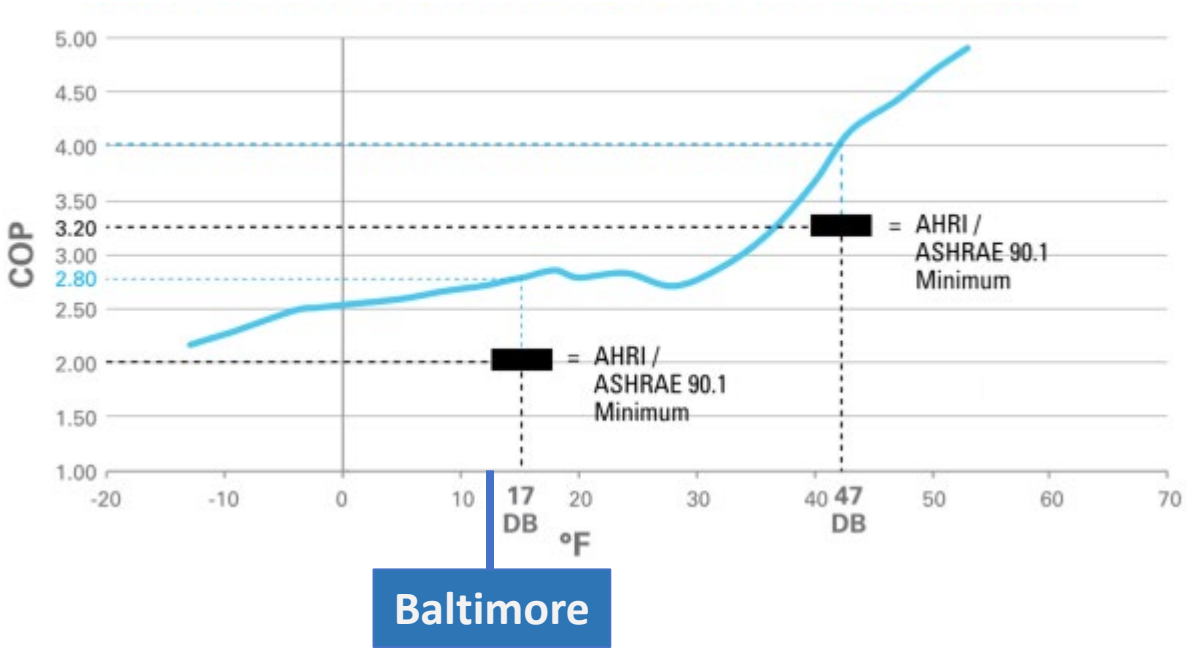
Engineering View, Fewer Limitations

Variable Speed Version

Legacy Equipment vs Current (vapor injection/variable speed) heating capacity at low temperatures



COP for 16 ton VRV system vs temperature



Engineering View, Future

Engineering View, Future

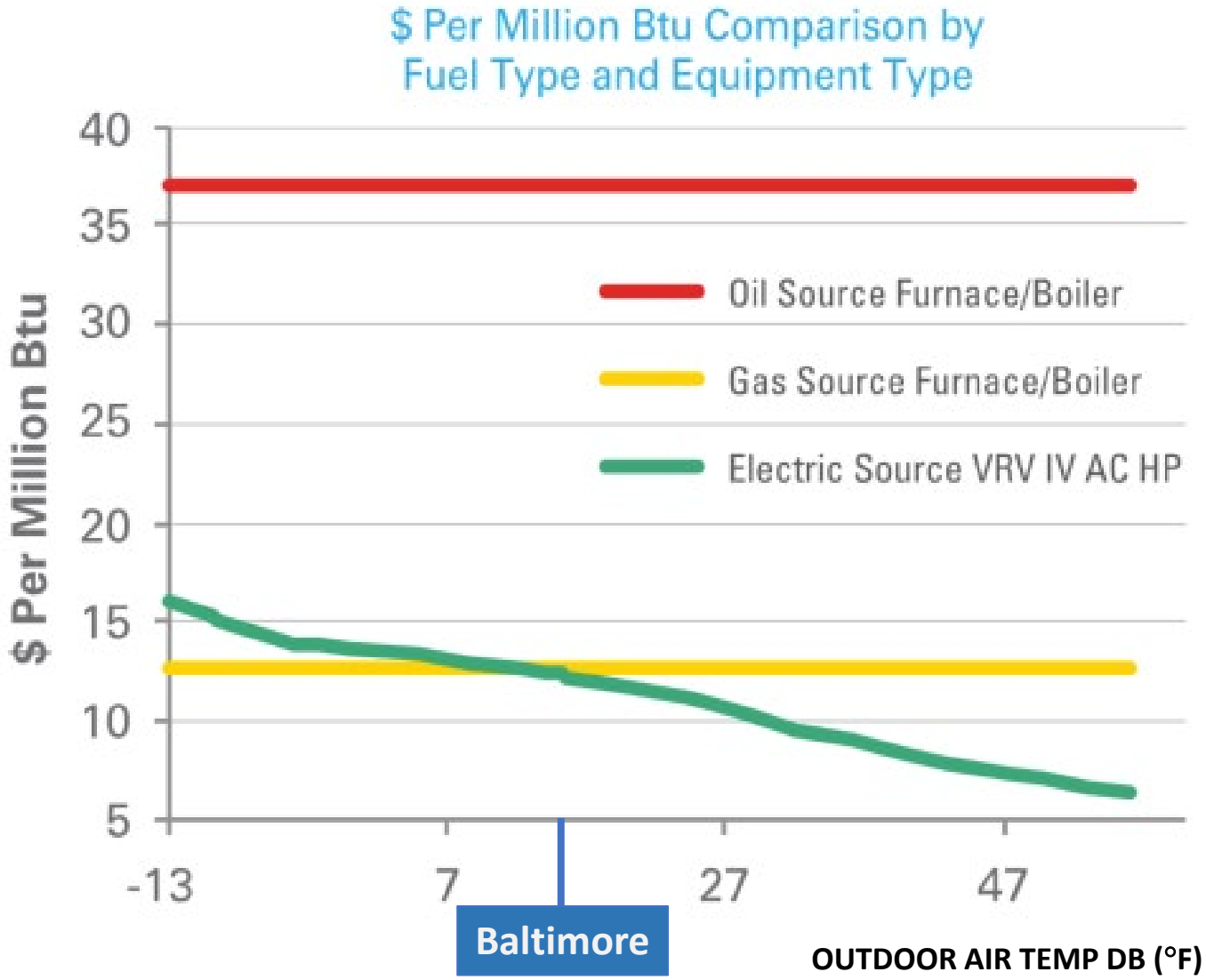
Table II-2: Performance Requirements at 5°F (-15°C)[2]

HP nominal capacity[1] (Btu/h)	COP at 5°F (-15°C)	Capacity Ratio	Low-temperature compressor cut-out	Low-temperature compressor cut-in
≥24,000 and ≤ 36,000	2.4	100%	≤ -10°F (-23°C)	≤ -5°F (-21°C)
>36,000 and ≤ 48,000	2.4	100%		
>48,000	2.1	100%		

[1] Capacity for the A2 test of Appendix M1 for a heating/cooling heat pump. Capacity of the $H1_N$ test of Appendix M1 for a heating-only heat pump.

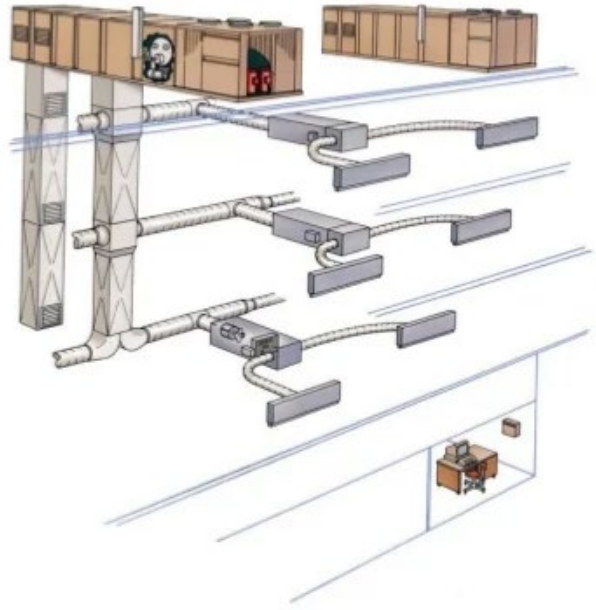
[2] All of the requirements in the second through fifth columns are mandatory as indicated for the specified ranges of HP nominal capacity.

Engineering View, Cost

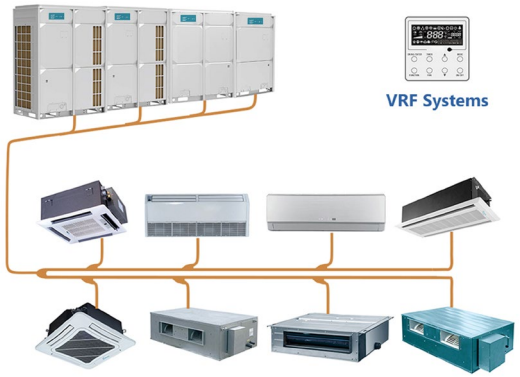


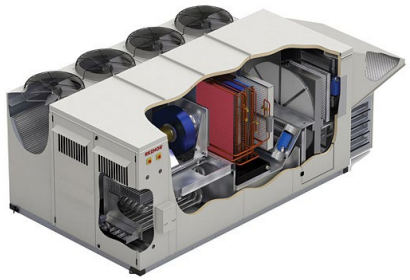
Engineering View, Impacts

VAV RTU
w/Gas Heat
Electric Reheat

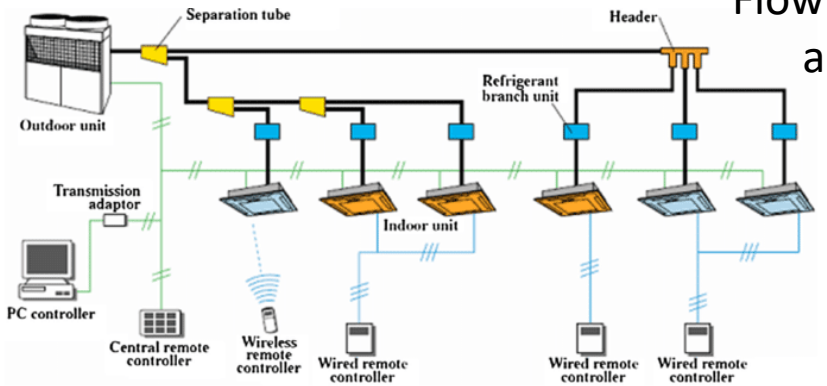


Systems and equipment will be different than what we've been used to designing and building for the last 30-40 years





DOAS AHU
w/Energy Recovery



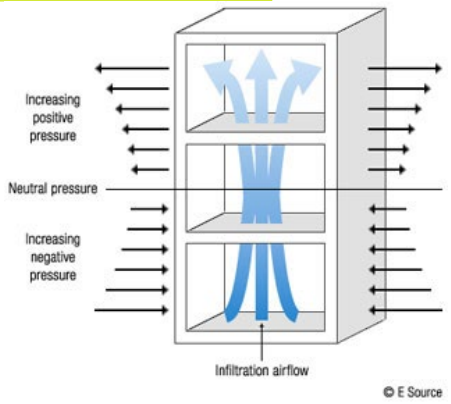
Variable Refrigerant Flow (VRF) heating and cooling

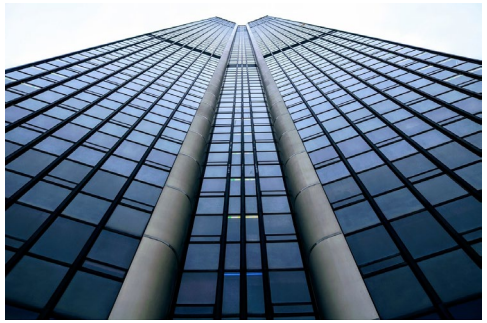
Engineering View, Impacts

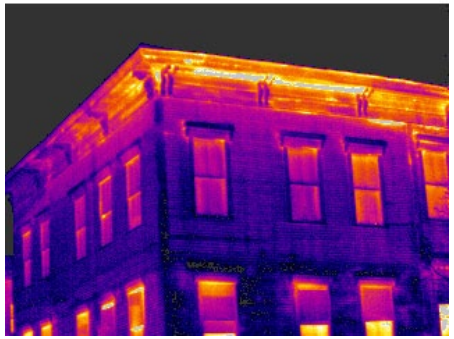
Engineering View, Impacts

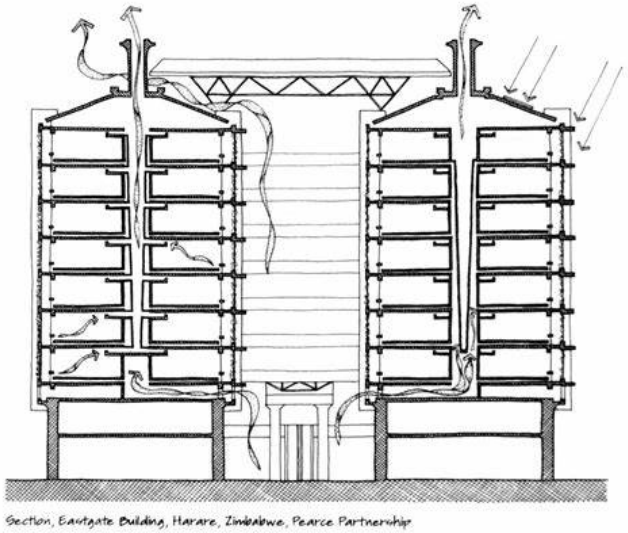
Architectural – Reduce the Load

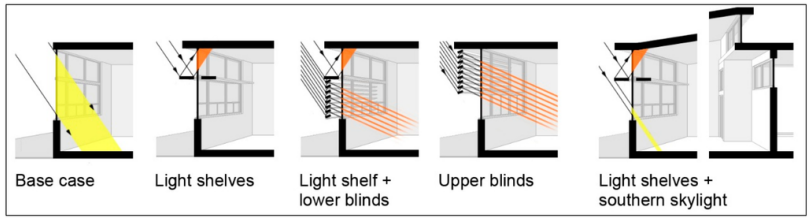
- Limits to glazing area (30%-40%)
- High performance glazing systems - Low U-values and Solar Heat Gain Factors (SHGF)
- Architectural daylighting strategies (light shelves, 50% area within daylight zones)
- Improved building thermal performance (Insulation)
- Reduce infiltration – building air barrier pressure testing
- Promote passive cooling (natural ventilation, stack ventilation)





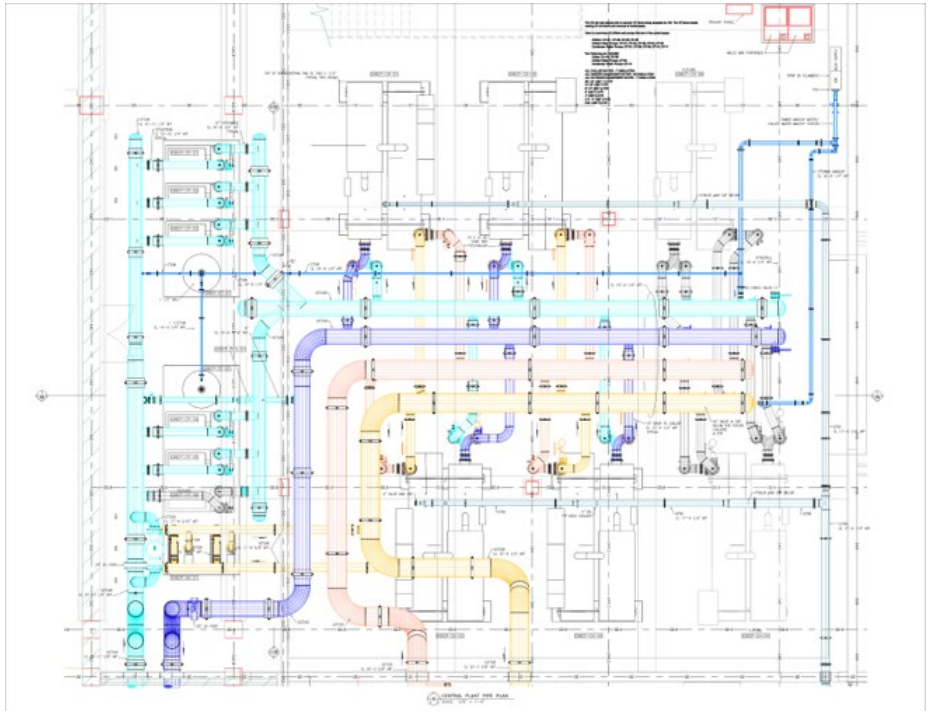


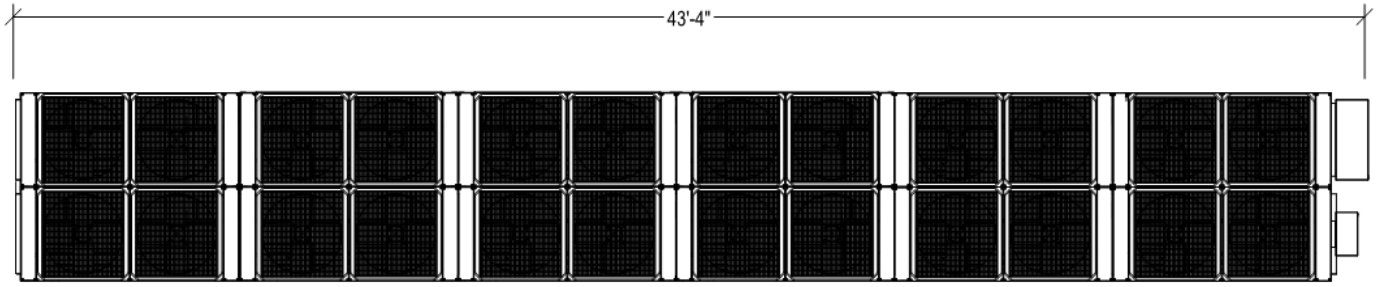




Engineering View, Impacts

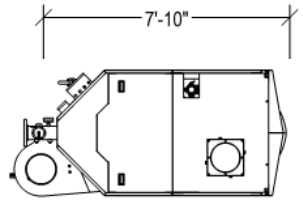
Architectural – Yes, HVAC really does need all that space





17,500 lbs

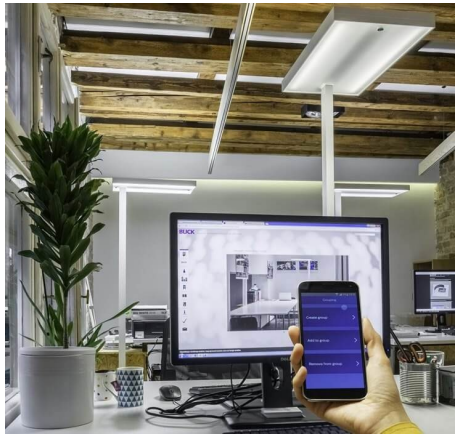
3200 MBH Gas Boiler
-vs-
Same capacity AWHP



4,000 lbs

Engineering View, Impacts

Electrical - Strategies



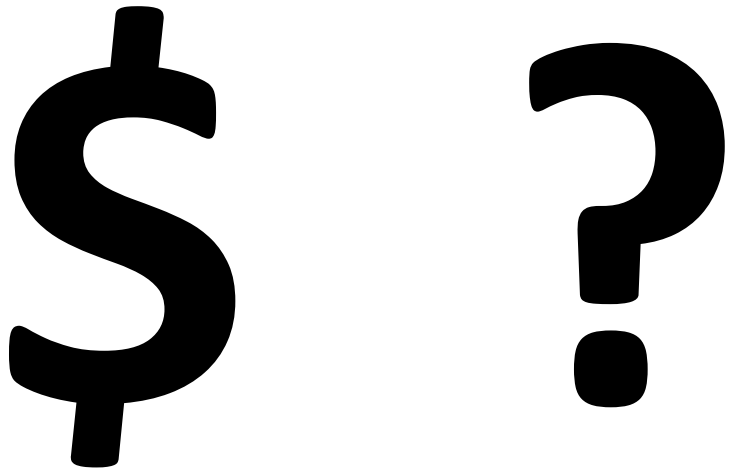
- Reduced Lighting Power Density (LPD)
  - LED Lights
  - Human centric lighting
- Advanced Lighting Controls:
  - Daylighting controls
  - Addressable zones/fixtures
- Controlled Receptacles (50% of installed receptacles to be controlled by timers)
- Energy Metering:
  - Source Energy Metering
  - End Use Metering
    - Requires additional circuiting
- Solar (PV)

Engineering View, Impacts

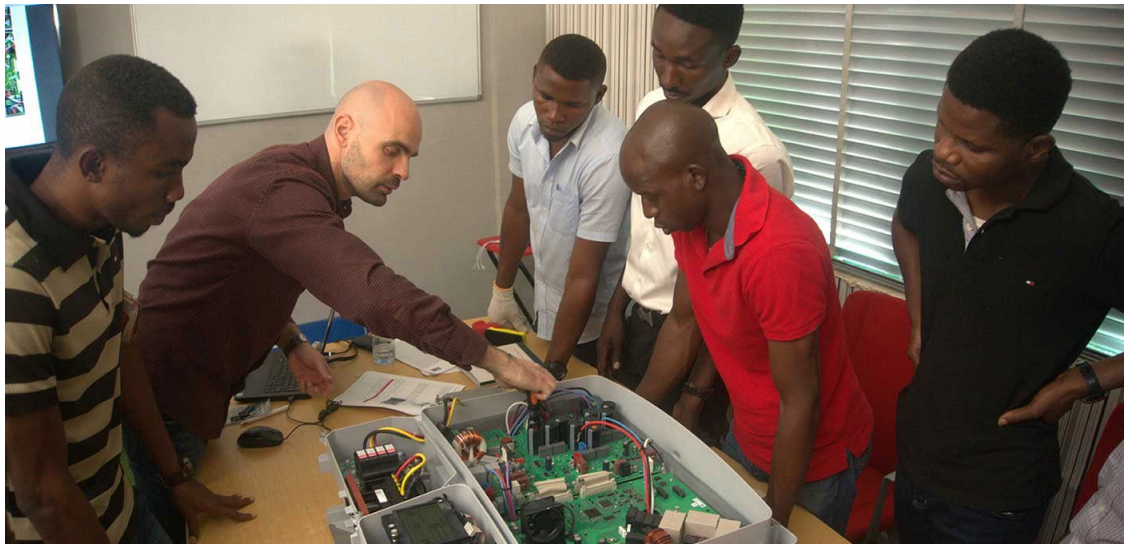
Electrical - Impacts

- Decarbonization:
  - Use of fossil fuels prohibited or significantly limited use (e.g., backup source only)
  - Increase in electrical service size (depending on occupancy and use)
    - 25% increase for current Life Science project
    - Up to 200% for commercial cooking facility (restaurants)
  - Smaller projects may require transformer vault – depends on local provider limits

Engineering View, Cost and Schedule



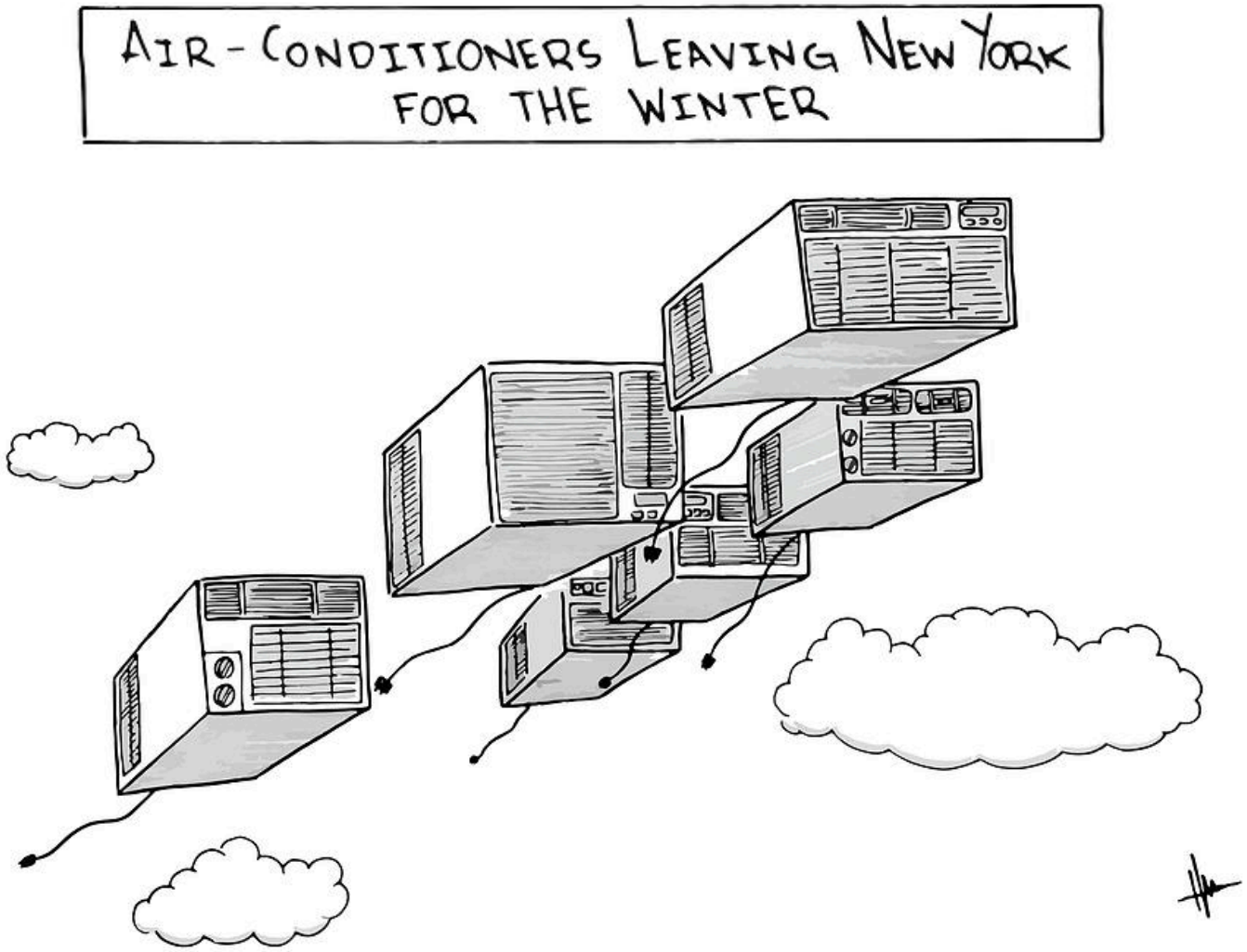
Engineering View, Training and Operations



Empower Changes

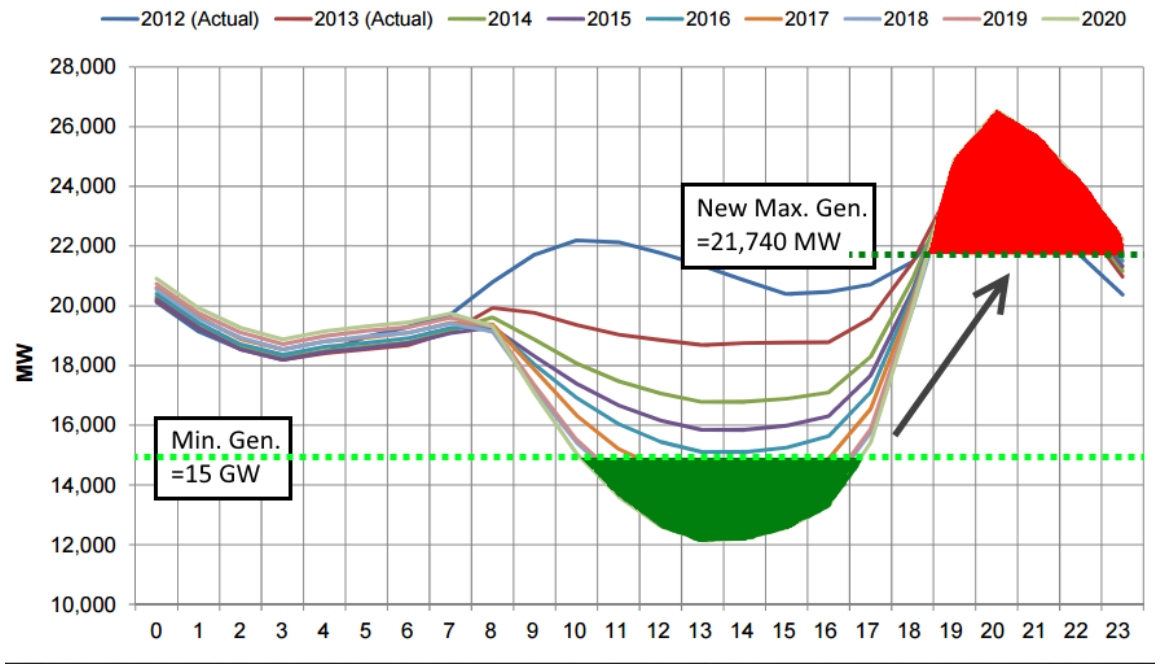
The Big Picture

Heat pumps are coming….for your children!

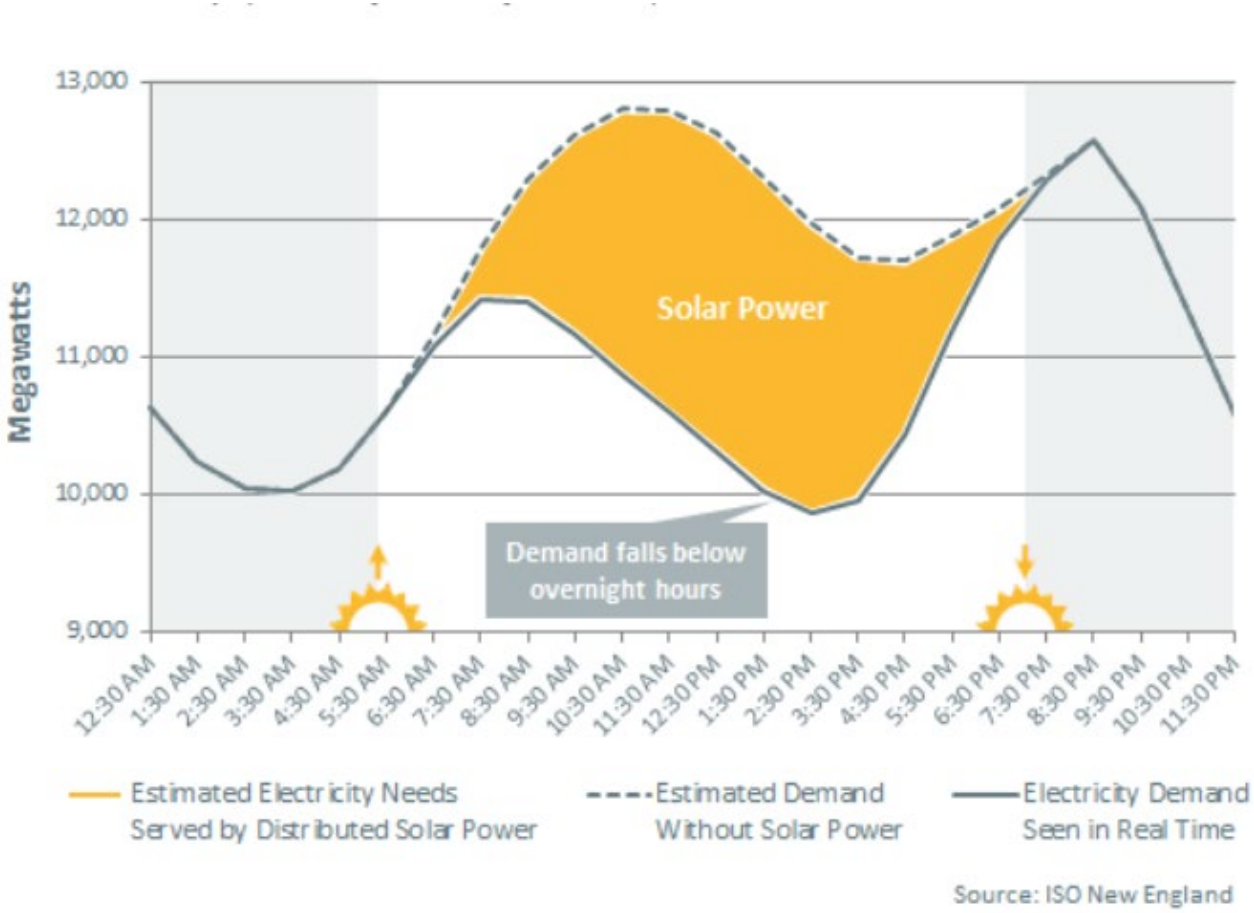


Econ 101, life, death and taxes?

Energy Use in Buildings: Solar deep dive



California Independent System Operator “duck curve”



Today’s breakthroughs are tomorrows breakdowns –Larry Ransom

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Q&A