Maryland
Department of the Environment

Building Energy Performance Standards

May 2023
Development of Maryland's Standards

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Objective

This webinar will provide more information relating to the Maryland BEPS:

- Maryland building stock analysis
- Estimated energy and emissions reductions
- Methodology for setting Maryland's standards

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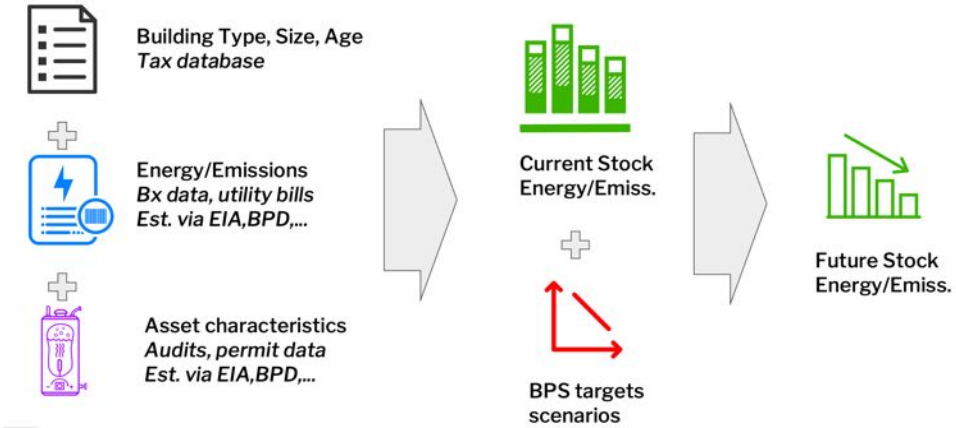
Maryland BPS Policy Design: Stock Analysis + Target Setting Methodology

Overview of Building Stock Analysis

- Characterize the building stock (size, type, and energy use for each bldg)
- Scenarios for potential BPS policies (metrics, targets, timing)
- Predict energy reductions under each scenario



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Data Sources and Modeling Methodology

- Data Sources
  - Building types and sizes from Maryland Covered Building List (CBL) (~9300 bldgs >35k sqft)
  - Site EUI and electric/site ratio from EPA dataset
  - Ratio of fuel used for space and water heating from CBECS/RECS
  - Projected grid emissions factors from Maryland analysis

- Impact Model: Reduce energy use to meet targets
  - 3 cycles of 5 years (ending in 2030, 2035, 2040) – actual compliance cycle TBD by MDE
  - First: Try to meet direct emissions target with efficiency
  - Next: Electrify space heating, water heating, other uses, until direct emissions target met
  - Last: Reduce electric use until site energy use intensity (EUI) target met

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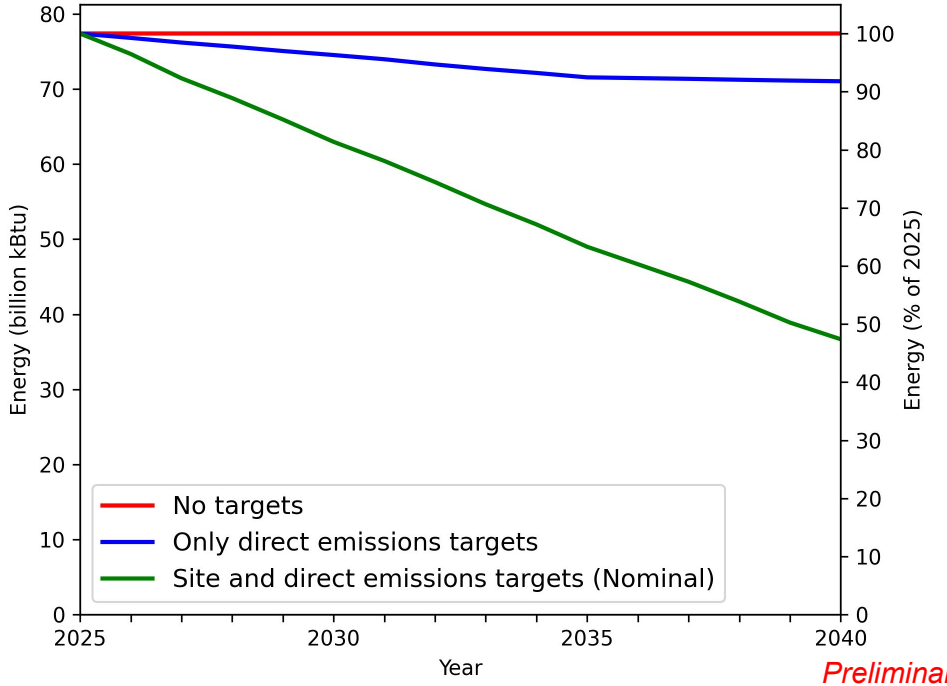
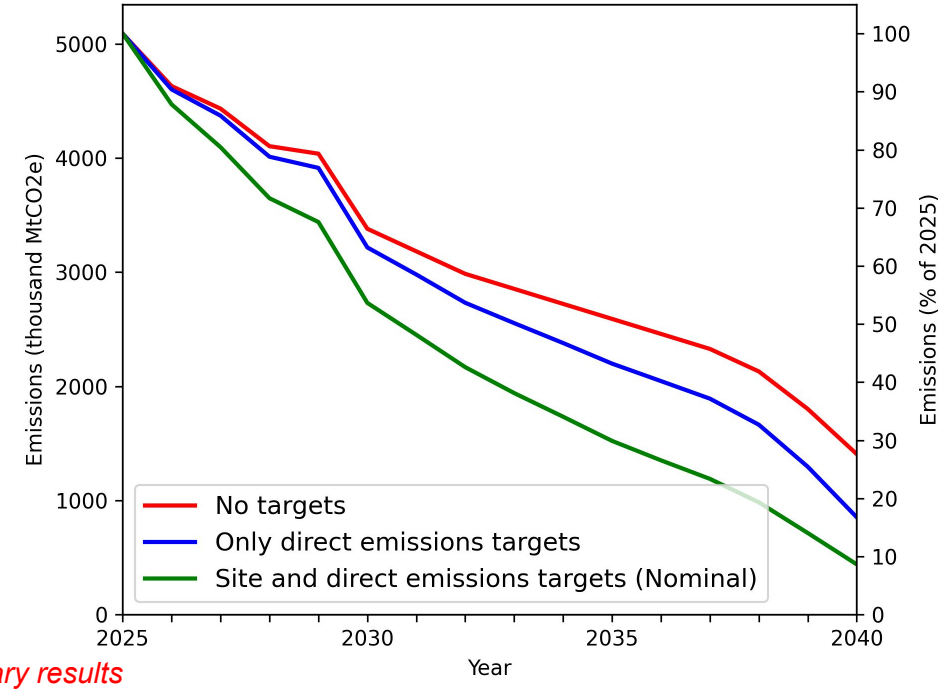
Energy and Emissions Reductions

- Emissions savings aggregate of cleaner projected grid, electrification, and efficiency
- Site vs. direct emissions targets: more electric energy savings than emissions

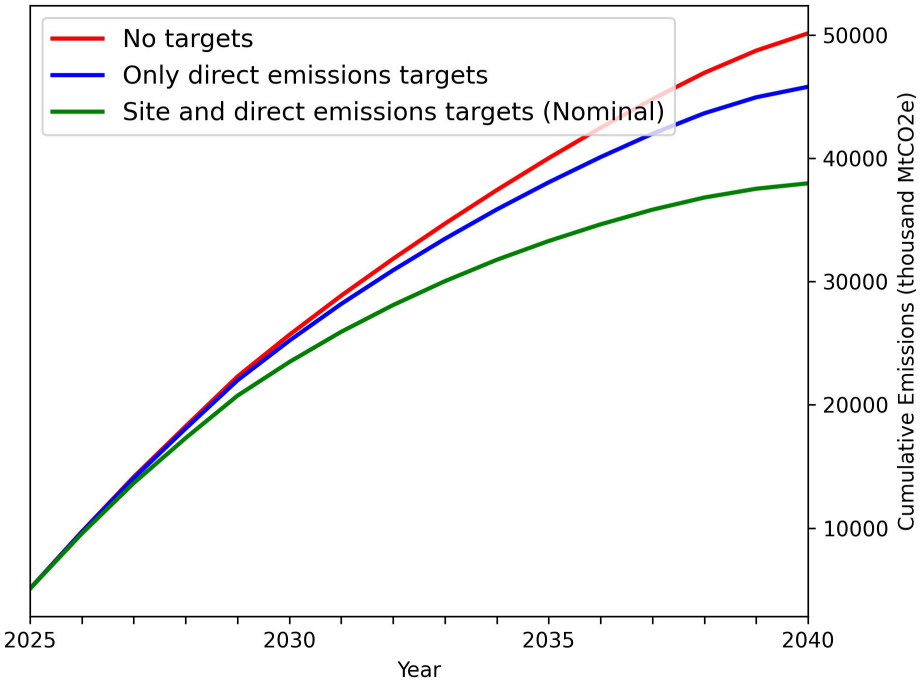




Preliminary results

Cumulative Emissions

- Only direct emissions targets vs. no targets: 8.7% decrease
- Site and direct emissions targets vs. no targets: 24% decrease



Preliminary results

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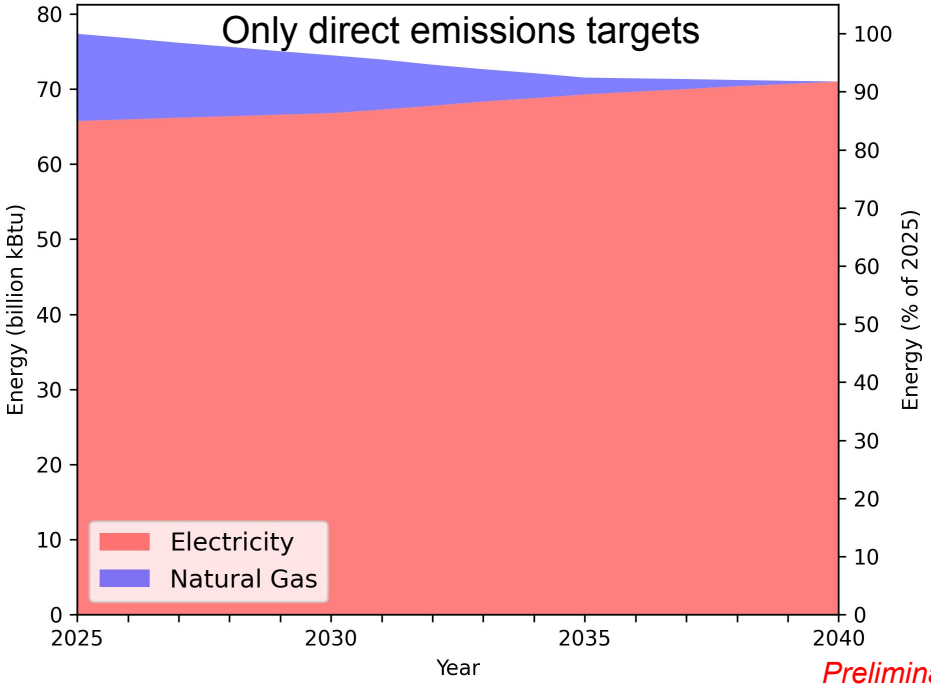
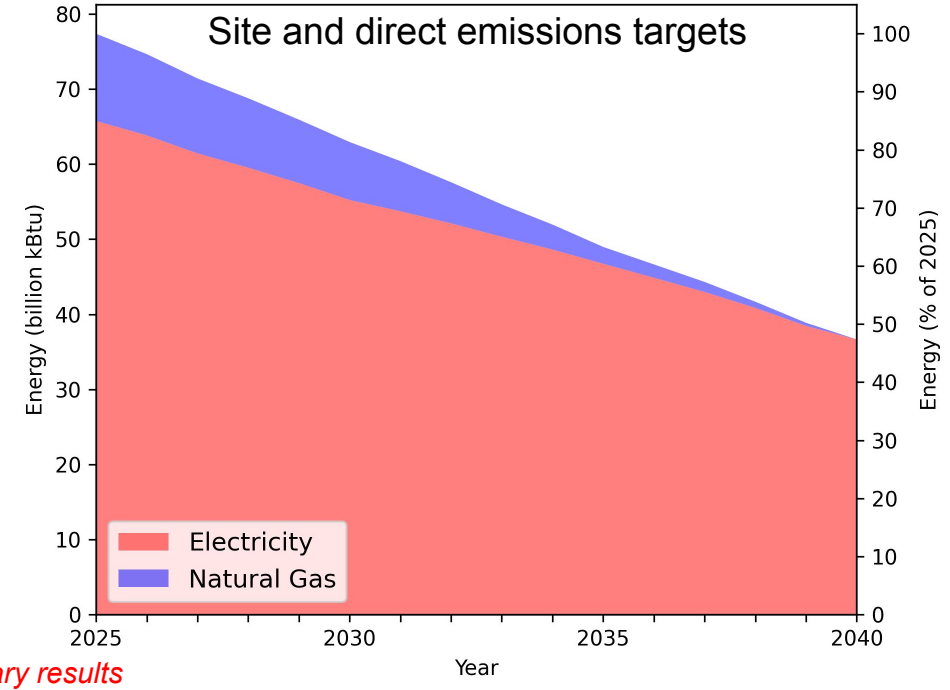
Electricity and Gas Energy Reductions

- With only direct emissions targets: electricity use increases 8.0%
- With site and direct emissions EUI targets: electricity use decreases 44%

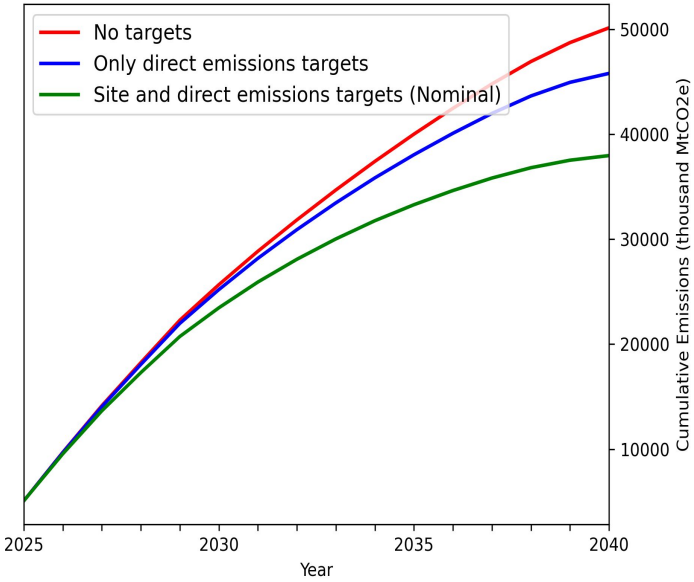




Preliminary results

Target Setting Process

- **Two-metric approach to target-setting**
  - Direct GHG Emissions (i.e. – on-site fuel use)
    - Explicit targets established in regulation
    - Modeled directly into impact analysis
  - Site EUI
    - Critical for major GHG reductions, peak load impact mitigation, and cost savings to building owners.
    - Focus on leveraging empirical data + existing regional studies to set realistic, data-driven targets.



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Target Setting Process - Direct GHG Emissions

- **Direct GHG Emissions**
  - What are direct GHG emissions?
    - Greenhouse gas emissions produced on-site by covered buildings
  - Targets as established by Climate Solutions Now Act
    - 20% reduction in net direct Greenhouse Gas (GHG) emissions by January 1, 2030, as compared with 2025 levels for average buildings of similar construction and;
    - Net-zero direct GHG emissions by January 1, 2040.

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Target Setting Process - Site EUI

- **Site EUI**
  - BEPS Technical Report - Steven Winter Associates (SWA) and Montgomery County
    - A review of the building stock and energy benchmarking information of Montgomery County and development of an approximate list of buildings projected to be subject to a BEPS policy. This building stock was separated into building types to set technically feasible site EUI targets.

#	Typology Sub-type	Floor Area [SF]	Baseline Site EUI	ZNC Target EUI	ZNC Interim Target 1 EUI	ZNC Interim Target 2 EUI	EE Target EUI	EE Interim Target 1 EUI	EE Interim Target 2 EUI	ZNC Target Package EUI	EE Target Package EUI	Less-than-Five Year Payback Package EUI
1	**Office** (p 79) Class A	200,000 – 225,000	70 – 80	53.4	63 – 72	57 – 64	53.4	49 – 53	67 – 75	49 – 53	49 – 53	67 – 75
2	**Office** (p 89) Mixed-fuel HVAC	250,000 – 275,000	80 – 90	57.8	71 – 80	62 – 70	57.9	52 – 57	67 – 75	52 – 57	52 – 57	67 – 75
3	**Office** (p 95) Older All-Electric	225,000 – 250,000	80 – 90	53.4	71 – 80	62 – 70	53.4	47 – 53	57 – 64	47 – 53	47 – 53	57 – 64
4	**Multifamily** (p 109) New – Tall	125,000 – 150,000	50 – 60	38.7	46 – 53	42 – 47	59.1	35 – 38	50 – 60	35 – 38	N/A	50 – 60
5	**Multifamily** (p 119) Old – Tall	125,000 – 150,000	70 – 80	35.4	58 – 65	45 – 50	55.1	65 – 72	60 – 65	32 – 35	50 – 57	64 – 73
6	**Multifamily** (p 131) Short / Garden	50,000 – 75,000	115 – 125	35.4	90 – 95	60 – 65	55.1	95 – 102	75 – 80	31 – 34	51 – 55	107 – 116
7	**Lodging** (p 143) Full-service hotel	150,000 – 175,000	115 – 125	57.8	95 – 105	75 – 85	75.7	102 – 110	88 – 95	53 – 57	72 – 76	94 – 102
8	**Lodging** (p 156) Partial-service hotel	200,000 – 225,000	125 – 135	57.8	101 -110	77 – 85	75.7	108 – 115	90 – 96	53 – 57	72 – 76	99 – 107
9	**Worship** (p 168)	75,000 – 100,000	80 – 90	36.4	65 – 72	50 – 56	47.9	70 – 77	59 – 64	33 – 36	45 – 48	72 – 81

**the blue page numbers are links to the case studies in this report*

Figure 2 on the following page contains a subset of the information contained in Table 6 arranged in graphical format. An asterisk is noted to call out the all-electric building in the case studies.

Source: Building Energy Performance Standards Development – Technical Analysis
Steven Winters Associates, 02/2022

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Target Setting Process - Site EUI

- **Site EUI - *continued***
  - A recommended method for setting building performance standards, what the targets can be, and the estimated impacts of meeting those targets.
  - Case studies detailing how different energy performance standards can be achieved for a representative sample of buildings.
  - An estimate of the total capital investment to reach the standards, which would inform both the cost to building owners and the level of economic impact of the recommended standards.

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Target Setting Process - Site EUI

- **Site EUI – Final Targets**
  - Generalizing approach for the State
    - Develop comprehensive **property type mapping** between Montgomery County, ESPM, and state-wide tax assessor data
    - Utilize all available **statewide building energy data** to establish baseline site EUI's by property type.
    - Utilize climactically-appropriate CBECS/RECS end-use breakdowns to develop standard estimated proportions
    - Apply SWA ZNC methodology to newly established baselines + end-uses

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Target Setting Process - Site EUI

How Targets are Calculated

All units **Site EUI** [kBTU/SF]

The 2019 median is split into energy end uses, and each is reduced according to the efficiency and electrification potential associated with that end use, using market ready technology.

Electricity Use | "Gas" (Gas, Oil, District Steam) Use

Baseline assumes gas heating and gas hot water

Due to rounding, components may not add up to 100% of total

Example Calculation	Total Site EUI – All Fuels	Total Site Electricity	Total Site Gas	Space Cooling Elec	Other Elec	Space Heating	Water Heating	Cooking	Other
Food service 2019 Median	138	61	77	5	56	12	16	49	0
			EE Reduction Potential	*15%*	*15%*	*20%*	*10%*	*0%*	*0%*
			Resulting end use EUI	4.25	47.6	9.6	14.4	49	0
Food service EE Target	**125** *(=52+73)*			**52**			**73**		
			Electrification Reduction Potential	*0%*	*0%*	*68%*	*59%*	*39%*	*11%*
			Resulting end use EUI	4.25	47.6	3.1	4.1	29.9	0
Food service ZNC Target	**89** *(=52 + 37)*			**52**			**37**		

Figure 7. Target calculation, from baseline data through splitting up energy end uses and applying reductions to each end use to arrive at the Energy Efficiency (EE) and Zero Net Carbon-Compatible (ZNC) targets.

End Use	Percent reduction from the median for EE target	Percent reduction starting from the EE target for ZNC target
Electricity	15%	0% (no further change)
Gas Space Heating	20%	68%, all electric (COP* 0.80 → 2.50)
Gas Water Heating	10%	59%, all electric (COP 0.90 → 2.20)
Gas Cooking	0%	39%, all electric (COP 0.45 → 0.74)
Gas Laundry/Other	0%	11%, all electric (COP 0.90 → 1.00)

**COP is the Coefficient of Performance of the equipment, defined as energy output (heat) divided by purchased energy input (gas or electricity). A COP of 0.8 is an annual efficiency of 80%. A heat pump can operate at average efficiencies of 250% (COP of 2.50) by extracting heat from the outside air. Efficiency assumptions came from the 'Electrification of Gas End Uses' tab of the CNCA EBPS tool.*

Source: Building Energy Performance Standards Development – Technical Analysis
Steven Winters Associates, 02/2022

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Target Setting Process - Site EUI

- **Site EUI – Interim Targets**
  - Application of the ‘Trajectory Model’ for Site EUIs
    - Alternative to requiring all buildings of a given property type to achieve the exact same target in the earliest compliance period.
    - Reduces short-term burden on lower-performing buildings
    - Achieves same long-term targets as traditional target-setting

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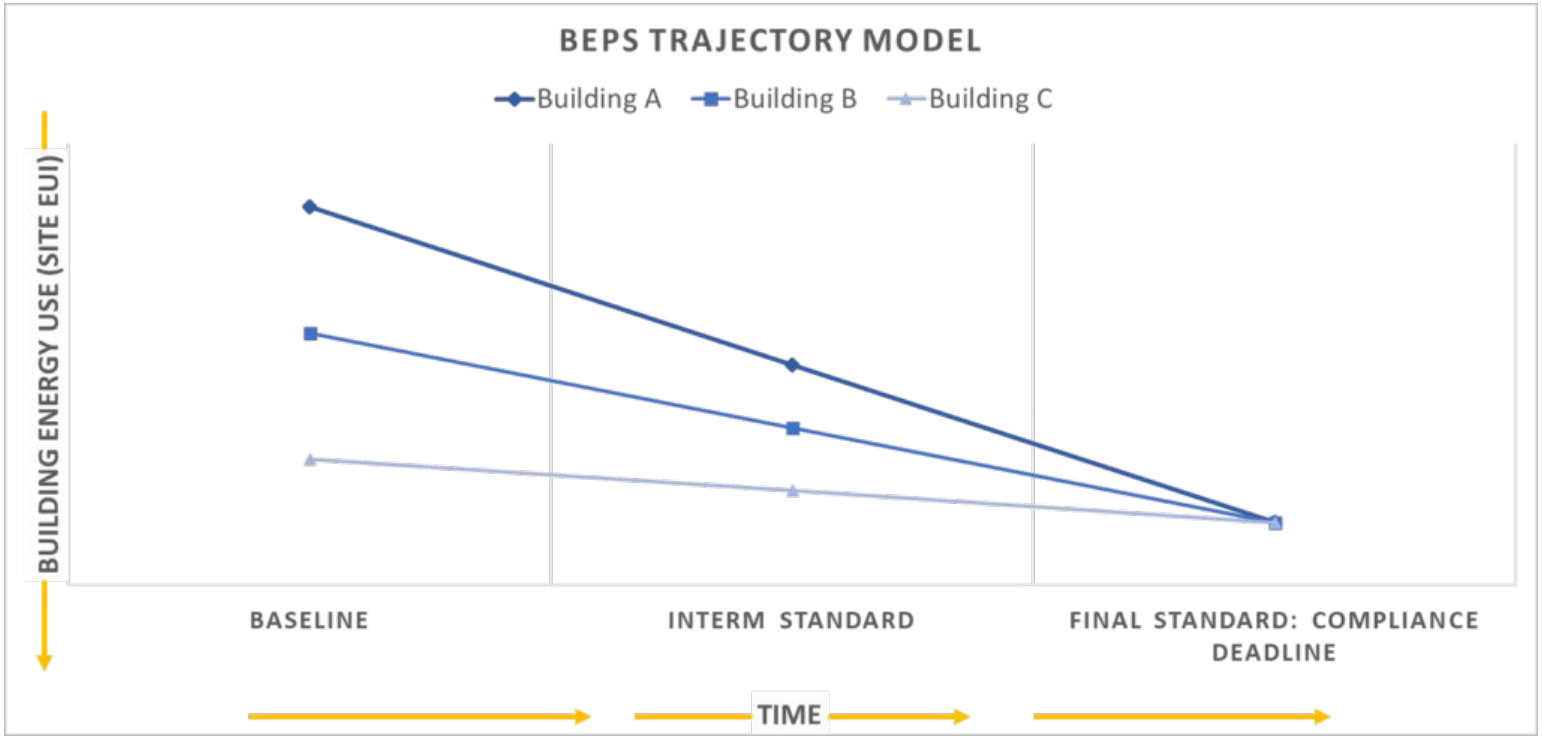
Target Setting Process - Site EUI



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