Maryland Unified Benefit-Cost Analysis (UBCA) Framework for Distributed Energy Resources

Maryland PSC - Case No. 9674

Work Group Report

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Table of Contents

I. Summary

In May of 2022, the Maryland Public Service Commission ("PSC" or "The Commission") issued Order 90212 establishing that the State would develop a common framework for assessing the cost-effectiveness of all distributed energy resources (DERs)[1]. Among other actions, the order established a new Unified Benefit-Cost Analysis (UBCA) Work Group ("the Work Group")[2] to develop a primary Maryland-specific UBCA test ("MD-UBCA Test") based on the principles of the National Standard Practice Manual for Benefit Cost Analysis of Distributed Energy Resources (NSPM).

Per the PSC order, and through a competitive process, Exelon retained E4TheFuture and a subcontractor team (collectively referred to in this report as "the Consultant Team") as expert consultants to provide technical and facilitation support for the UBCA Work Group and to prepare this report. This report builds on extensive discussions with and feedback from Maryland stakeholders through a process consisting of eight meetings of the UBCA Work Group, several smaller single-issue meetings, several deliverables completed by Work Group members, and additional conversations in-between meetings with individual Work Group members and members of the Consultant team.

The recommendations in this report were developed through a process whereby the Consultant Team gathered information and presented options, and in some cases, initial recommendations regarding aspects of a MD-UBCA Test. Options and recommendations were based on NSPM guidance, Work Group input (including from PSC technical staff), existing Maryland BCA practices, Maryland policy direction and BCA practices of other states. Several iterations of the recommendations were addressed throughout the Work Group process, with the end result leading to a set of consensus recommendations, as presented in this report (with one exception noted in Chapter VII on the discount rate recommendation). The recommendations herein thus represent the positions of the Work Group as a whole, with the caveat that absent formal polling/votes across all the topics covered during the UBCA process, Work Group members may offer additional comments or positions during any formal comment period provided by the Commission on the final report.

The report includes recommendations for a primary MD-UBCA Test, as well as two secondary tests, and the categories and specific impacts – costs and benefits – to include in these tests. This report also provides recommendations from the Work Group on several important aspects of how the MD-UBCA Test should be applied, such as selection of discount rates, BCA assessment level, geographic coverage, and application in different regulatory contexts. A recommendation is also included regarding a next phase associated with implementing the MD-UBCA Test and conducting distributional equity analyses. These recommendations are summarized in the following sections of this Summary chapter, and fully described in subsequent chapters of this report.

[1] DERs addressed include energy efficiency (EE), demand response (DR), distributed generation (DG) and distributed storage (DS), as well as to electrification of transportation vehicles (EV) and buildings or industry (BE). See Section II.4 for a full discussion of DER definitions for electrification technologies.

[2] References to "the Work Group" in this report refer to the UBCA Work Group; other Maryland work groups, when discussed, are referenced by the full name of the work group.

1. Recommended Primary Maryland UBCA Test and Secondary Tests

The recommended primary MD-UBCA Test and the use of secondary tests are consistent with the fundamental economic principles articulated in the NSPM: to ensure inclusion of all utility system impacts (USIs) and to ensure that inclusion of non-utility system impacts (non-USIs) is based on state energy policy goals and objectives. Secondary tests are included for their ability to provide sensitivity analyses for informing regulatory decisions where primary BCA test results are inconclusive, informing program design, and prioritizing DER investments.

A. Primary MD-UBCA Test

The Work Group recommends the primary MD-UBCA Test presented in Table S-1, which provides a high-level summary of impacts to include in the test. Further details are provided in subsequent tables.

Table S-1: Primary Maryland UBCA Test - Summary

Impact Category	Impact Sub-Category	Specific Impacts	Included in Test
Utility System	Electric or Gas	All (see Tables S-2 and S-3)	✓
Non-Utility System	Other Fuels	Gas Utility Impacts from Electric DERs	✓
		Electric Utility Impacts from Gas DERs	
		Other Fuel Impacts (Propane, Gas, etc.)	
	Host Customer	All	✓
	Societal	Greenhouse Gas Emissions	✓
		Other Environmental	✓
		Public Health	✓
		Resilience	✓
		Energy Security	✓

Note that the inclusion of host customer impacts, though consistent with state policy, will be challenging because there has been little analysis conducted to date to identify and quantify non-energy impacts of DERs other than energy efficiency. Thus, Maryland will need to commit to investing in analyses of host customer impacts in order to apply the primary UBCA test in an appropriately balanced manner (i.e., giving equal consideration to host customer costs and benefits).

Note also that state policies suggest a strong interest in economic development and job creation as well as addressing the equity impacts of DER investments and strategies. Such impacts should not be mathematically included in a benefit-cost test, in part because – in the case of economic development – they are driven by (and therefore overlapping with) other impacts already included in the state's primary UBCA. In the case of addressing equity, in terms of the distribution of costs and benefits to priority populations (e.g., marginalized communities) relative to other customers, this requires a separate analysis - a Distributional Equity Analysis - as further described in Chapter V (Section E). In both cases, these impacts should be separately analyzed and considered in parallel with cost-effectiveness results.

The inclusion of a category of specific USIs and non-USIs, as shown in Table S-1, indicates that assessments of the cost-effectiveness of DERs need to consider those impacts, even though there may be cases (based on specific DER type or use case) where a particular impact may not be applicable or not material.

Table S-2 provides a more detailed breakdown of the electric USIs that are currently determined to be applicable and material for each type of DER; Table S-3 provides the same breakdown for gas USIs. Table S-4 provides a more detailed breakdown of the applicability and materiality of non-USIs to different DERs. In each of these tables, the DER acronyms are representative of the following DER types: energy efficiency (EE), demand response (DR), distributed generation (DG), distributed storage (DS), electric vehicles (EVs and EV infrastructure), and building electrification (BE).

Table S-2: Applicability and Materiality of Electric Utility System Impacts by DER[3]

Impact Type	Impact	EE	DR	DG	DS	EV	BE
Generation	Energy Generation	✓	✓	✓	✓	✓	✓
	Capacity	✓	✓	✓	✓	✓	✓
	Environmental Compliance	✓	✓	✓	✓	✓	✓
	RPS/CES Compliance	✓	NM	✓	NM	✓	✓
	Market Price Effects	✓	✓	✓	✓	✓	✓
	Ancillary Services	✓	✓	✓	✓	✓	✓
Transmission	Transmission Capacity	✓	✓	✓	✓	✓	✓
	Transmission System Losses	✓	✓	✓	✓	✓	✓
Distribution	Distribution Capacity	✓	✓	✓	✓	✓	✓
	Distribution System Losses	✓	✓	✓	✓	✓	✓
	Distribution O&M	✓	✓	✓	✓	✓	✓
	Distribution Voltage	NM	NM	✓	✓	NM	NM
General	Financial Incentives	✓	✓	✓	✓	✓	✓
	Utility Direct Investments in DERs	✓	✓	✓	✓	✓	✓
	Program Administration	✓	✓	✓	✓	✓	✓
	Utility Performance Incentives	✓	✓	✓	✓	✓	✓
	Credit and Collection	✓	NM	✓	NM	✓	✓
	Risk	✓	✓	✓	✓	✓	✓
	Reliability & Resilience	✓	✓	✓	✓	✓	✓

✓ Impacts that are both applicable and material

NM Not material, or not large enough to merit routine inclusion

[3] Note that these characterizations represent the current thinking of the Work Group. As deployment of DERs increases and new use cases are pursued, it is possible that some of these characterizations will merit revisiting.

Table S-3: Applicability and Materiality of Gas Utility System Impacts by DER

Impact Type	Impact	EE	DR
Energy	Fuel & Variable O&M	✓	✓
	Capacity and Storage	✓	✓
	Environmental Compliance	✓	NM
	Market Price Effects	✓	NM
Transmission	Pipeline Capacity	✓	✓
	Pipeline Losses	✓	✓
Distribution	Local Delivery Capacity	✓	✓
	Local Delivery Line Losses	✓	✓
General	Financial Incentives	✓	✓
	Utility Direct Investments in DERs	✓	✓
	Program Administration	✓	✓
	Utility Performance Incentives	✓	✓
	Credit and Collection	✓	NM
	Risk	✓	✓
	Reliability & Resilience	✓	✓

✓ Impacts that are both applicable and material

NM Not material, or not large enough to merit routine inclusion

Table S-4: Applicability and Materiality of Non-Utility System Impacts by DERs

Category		EE	DR	DG	DS	EV	BE
Other Fuels		✓	✓	✓	NA	✓	✓
Societal	Resilience	NA	NA	✓	✓	NA	NA
	GHGs	✓	*	✓	*	✓	✓
	Other Environmental	✓	✓	✓	*	✓	✓
	Public Health	✓	✓	✓	*	✓	✓
	Energy Security	✓	✓	✓	✓	✓	✓

✓ Impacts that are both applicable and material

NA Impacts that are not applicable to a given DER

* Not material in typical applications today, but could be material in the future as the grid evolves

B. Secondary Tests

The Work Group recommends two secondary tests to supplement the primary MD-UBCA Test, as described below.

1) Total Resource Cost Test (TRC)

This secondary test would include utility system impacts, other fuel impacts and host customer impacts.

The Commission might consider the results of this test when determining whether a DER program or initiative that is marginally cost-effective or not-cost-effective under the primary UBCA test should be

approved. The Commission might also use the results of this secondary test to inform decisions regarding the relative priority of different DER programs or initiatives that are all cost-effective under the primary UBCA test.

2) Utility Cost Test (UCT)

This secondary test includes only utility system impacts. It can be used to inform decisions on appropriate levels of ratepayer investment in some DERs. It can also provide valuable insights into the impacts of programs with high levels of free ridership.[4] Note that the value of the UCT only applies to DER investments that are expected to reduce utility system costs; the UCT has little value for consideration of electric ratepayer-funded electrification initiatives because it includes costs of such initiatives (increased electricity consumption) but none of the benefits (e.g., reduced use of other fuels and associated lower greenhouse gas emissions), since the UCT only accounts for the utility system impacts, and does not consider impacts related to other fuels, host customers or to society.

2. Discount Rates

Based on Maryland policies, the Work Group recommends using a 2.0% real societal discount rate for both the primary MD-UBCA Test and both secondary tests, as well as for the social cost of carbon. The PSC should consider using a higher real discount rate (e.g., a weighted average cost of capital) for a sensitivity analysis in only the UCT secondary test as it includes only utility system impacts. The recommendation to use a 2.0% discount rate for the UCT secondary test was not supported by one Work Group member (see Chapter VII).

3. Geographic Scope

Some categories of impacts recommended for inclusion in the primary UBCA test and secondary tests – as well as economic development and job impacts recommended for complementary analyses (i.e., outside of, but parallel to benefit-cost analyses) – raise questions regarding what is the "geographic boundary" [5] that should be used for estimating impacts. Based on Maryland policies, it is recommended that the boundaries in Table S-5 be applied to all tests, as further described in Chapter VII.

Table S-5: Geographic Scope of Impacts[6]

Impact Type	Recommended Boundary
Federal Financial Incentives	State Boundary
Market Price Effects	State Boundary
Greenhouse Gas Emissions (GHGs)	Global Boundary
Criteria Pollutant Emissions	Regional Boundary
Jobs and Economic Development	State Boundary

[4] Under the UCT, rebates or other financial incentives paid to free riders are treated as costs. In contrast, in tests that include host customer impacts, such as the other recommended secondary test, rebates to free riders are considered transfer payments (a cost to the utility system offset by a benefit to the customer) rather than costs.

[5] Geographic boundary refers to a physically defined area, such as the State of Maryland, the region (e.g., the mid-Atlantic region, the PJM region, the Eastern Interconnection grid), the country, or the world.

[6] As discussed above, jobs and economic development impacts should not be mathematically included in a benefit-cost test. Rather, they should be the subject of separate analyses considered in concert with BCA results. Inclusion in this table is simply to make the point that when such analyses are undertaken, they should focus on net job and economic development impacts within Maryland's state borders.

4. Assessment Levels

For the specific regulatory purpose of "screening out" DER investments as not cost-effective, the Work Group recommends the following general guidance regarding the level at which cost-effectiveness results should be applied:

- Do not apply cost-effectiveness screening at the measure level;
- Do not apply cost-effectiveness screening at the individual customer or project level; and
- Apply cost-effectiveness screening at the program level unless a different approach is merited given any of the following considerations: advancing equity (e.g., low-income programs), market transformation objectives, pilots, enabling of other cost-effective programs and other potential regulatory policy objectives.

5. Applicability of the MD-UBCA Test to Different Regulatory Contexts

The recommended MD-UBCA Test can be utilized in a wide variety of regulatory contexts, as summarized in Table S-6 below. While the application of this test will vary from one context to another, the critical goal for Maryland in applying the MD-UBCA Test is to ensure consistency in the impacts that are accounted for to achieve the state's policy goals and that underlying methodologies are consistently used (e.g., to calculate avoided costs, value streams). Chapter VIII provides additional examples and further recommendations.

Table S-6: BCA in Different Regulatory Contexts

Context	Application	Goal of BCA	Role of Costs & Benefits
Programs	EE, DR, DG, Storage, EV e.g., incentive or rebate programs	determine whether to implement the program	compare program benefits to costs
Procurement	DERs, NWAs, PPAs,	determine the ceiling price	ceiling price should equal the benefits of the procurement
Pricing	DER compensation	determine the value of service provided by the DER	value of DER is the sum of benefits
Planning	Optimize DERs	identify optimal DER portfolio	compare portfolio benefits to costs
	DP, IDP, IRP, IGP	identify preferred resource scenario	compare scenario benefits to costs
	GHG plans	achieve GHG goals at low cost	compare GHG plan benefits to costs
	State Energy Plans	identify resources to meet state goals	compare state plan benefits to costs
Infrastructure Investments	Grid Mod, AMI, EV infrastructure, etc.	determine whether to make the investment	compare investment benefits to investment costs
Prudence Reviews	Retrospective review	determine whether past utility decision was appropriate	compare benefits and costs using test in place at the time the decision was made
	Prospective review	determine whether proposed utility decision is appropriate	compare benefits and costs using test currently in place

6. Recommendation for a Phase II Process

This report focuses on *what* impacts should be included in the primary MD-UBCA Test and secondary tests but does not address *how* to determine the impacts e.g., how to monetize or otherwise quantify an

impact, or address the impact qualitatively. Further work will be required to develop the methodologies and assumptions to address those impacts. The Work Group recommends that the PSC consider initiating a Phase II process to address those methodological issues.

In addition, as noted above, BCAs do not address the distribution of costs and benefits to priority populations (e.g., underserved communities) relative to other customers. To appropriately address distributional equity – consistent with Maryland's comprehensive energy goals – the Work Group recommends that the Commission consider requiring that a Phase II process also develop recommendations for conducting distributional equity analyses (DEA) of DER investments, which can be considered alongside BCAs to fully understand the impact on priority populations.[7]

Conducting a rate and bill impact analyses is also important to conduct alongside a BCA to help address equity impacts across customer sectors.

Ideally, a Phase II process that addresses the above topics would be coordinated across Maryland's different Commission initiative work groups, including the UBCA Work Group, the Storage Energy Program Work Group, the DSP Work Group, the EmPOWER Maryland Evaluation Advisory Group, and any other relevant work groups.

[7] See further discussion in Chapter V, Section E and Chapter X. See US DOE publication Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources – A Practical Guide (May 2024).

II. Introduction

1. Public Service Commission (PSC) Direction

In December 2021, the Maryland Public Service Commission ("PSC") initiated Case No. 9674 to explore whether to develop a unified benefit cost analysis ("UBCA") framework for utility investments in or strategies to promote distributed energy resources ("DERs"). This effort was recommended by the PSC's Electric Vehicle Work Group to (1) ensure that all utility DER investment proposals will receive an adequate review; (2) ensure consistency in the valuation of relevant DER value streams; and (3) assist the Commission in evaluating utility investment strategies and distribution system planning practices.[8] The PSC held a hearing in February 2022 and released Order 90212 on May 13, 2022, establishing a new UBCA Work Group ("the Work Group")[9] to develop a Maryland-specific UBCA test ("MD-UBCA Test"). The PSC's order stated that "The primary purpose of a unified BCA framework is to ensure all DERs are assessed consistently against supply alternatives and each other to optimize the total investment in DERs relative to the level of investment in different DERs."

The Commission direction to the Work Group included the following:

- The Work Group should consider the principles and steps included in the *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources* ("NSPM for DERs").[10]
- The Work Group should consider the existing work of the Electric Vehicle Benefit Cost Work Group, the EmPOWER Maryland work groups, and the Energy Storage Work Group.[11]
- The UBCA should be flexible in accounting for the differences in DERs, including differences between costs and benefits applicable to each type of DER.
- The Commission does not intend to surrender its discretion by adopting an inflexible mathematical formula that would mandate approving or rejecting a proposed DER program or project.
- The UBCA shall not be designed to substitute for the utilities' independent, experienced judgement as to how maintain safe and reliable service on utility systems.
- The Work Group should also consider socioeconomic equity.

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[8] Per Code of Maryland Regulations (COMAR 20.50.09.02), DERs are defined as: *"Distributed energy resource" means any geographically dispersed energy resource located on an electric distribution system that produces electricity or offsets electrical demand including small generator facilities, energy storage devices, energy efficiency devices, and demand response devices."* This report builds on this specific definition, consistent with Order 90212, to also apply to the gas system and to vehicle and building electrification.

[9] References to "the Work Group" in this report refer to the UBCA Work Group; other work groups, when discussed, are referenced by the full name of the work group.

[10] National Energy Screening Project ("NESP"), (NSPM for DERs), National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources. August 2020

[11] Case No. 9478 Maryland EV-Jurisdiction-Specific Test ("JST") approved January 12, 2022, via letter order ML# 238013; Case No. 9648 Maryland-JST (EmPOWER) adopted June 15, 2022, via Order No. 90261; and Case No. 9619 Energy Storage Workgroup Report regarding reporting and metric requirements adopted December 27, 2022, in via Order No. 90454.

2. UBCA Work Group Consultant Team

PSC Order No. 90212 also directed Exelon to issue a competitive solicitation to hire expert consultants to provide technical support to and facilitate UBCA Work Group discussions. A team led by E4TheFuture (collectively referred to in this report as "the Consultant Team") was selected through this process. Among other things, the Consultant Team was charged with drafting this report on a proposed Maryland UBCA for DERs, informed by the NSPM and Work Group discussions. Key elements of NSPM guidance as well as Work Group discussions are described below, as well as in other chapters of this report.

3. Purpose and Limitations of a MD-UBCA Test

A MD-UBCA Test is intended to be a single, primary Maryland-specific test for assessing whether – given the state's policy goals – the benefits of any program or strategy for promoting investment in or acquiring a DER or combination of DERs exceed its costs. This is a critically important aspect of regulatory decisions regarding whether a DER investment/acquisition is merited.

It is important to recognize that there are other questions that regulators may want to consider that the MD-UBCA Test would not answer. For example, regulators may want to understand how equitably the benefits of DER investments would be distributed. They may also want to understand tradeoffs between rate impacts and the distribution of benefits of DER investments among different groups of utility customers. Thus, the PSC may consider additional supplemental analyses as part of a broader decision-making framework designed to address DER investment decisions. See Chapter X for the Work Group's recommendation on a Phase II process that can help to address these additional issues.

4. DERs Addressed

This report recommends that the Maryland UBCA Test be applied to the following utility DER investments:

- Energy efficiency (EE),
- Demand response (DR),
- Distributed generation (DG),
- Distributed storage (DS), and
- Electrification of vehicles and other forms of transportation (EV)
- Electrification of buildings, industry, agriculture, and other loads (BE).

At the start of the UBCA Work Group process, when the Consultant Team presented the above list of DERs, concern was raised by a Work Group member regarding whether building electrification (BE) and transportation electrification (EVs) should be defined as a DER on the basis that, by itself, BE does not provide grid services. Regardless of whether electrification investments are officially defined as DERs, the Work Group ultimately agreed that the same test used to assess cost-effectiveness of EE, DR, DG and DS resources should be used to assess cost-effectiveness of investments in electrification for the following reasons:

1. Electrification impacts on the grid are the mirror image of energy efficiency impacts; the first adds load while the second removes load – with the additions and subtractions often having essentially identical load shapes. It would not make sense to use one test to assess the cost-effectiveness of energy efficiency and a different test to assess the cost-effectiveness of investments that have identical kinds of impacts (just in different directions).

2. Electrification programs are frequently implemented and deployed in concert with energy efficiency programs.
3. In initiating the UBCA Work Group process, the PSC made specific reference to consideration of several recent efforts to develop benefit-cost tests for the state, including the EV Work Group recommendations.
4. The Commission also required the UBCA Work Group to consider the guidance of the NSPM for DERs, which treats electrification of transportation and buildings as a form of DER.

5. NSPM Overview

The NSPM for DERs provides guidance for valuing DER opportunities to inform policies, strategies and programs that support state goals/objections. DER investments can be evaluated in the context of program plans, procurement solicitations, pricing strategies/mechanisms, distribution system planning, and/or other regulated processes to achieve a range of policy goals. Policy goals can cover a broad range of objectives, from providing reliable and low-cost energy service, to meeting statutory electrification objectives (e.g., through the promotion of electric vehicles), or meeting greenhouse gas emission reduction objectives.

The NSPM identifies eight core principles that should be followed in developing and applying cost-effectiveness tests to DERs. Those principles are presented in

Figure 1 below.

Figure 1: Fundamental NSPM Benefit-Cost Analysis Principles[12]

Principle 1	**Treat DERs as a Utility System Resource** DERs are one of many energy resources that can be deployed to meet utility/power system needs. DERs should therefore be compared with other energy resources, including other DERs, using consistent methods and assumptions to avoid bias across resource investment decisions.
Principle 2	**Align with Policy Goals** Jurisdictions invest in or support energy resources to meet a variety of goals and objectives. The primary cost-effectiveness test should therefore reflect this intent by accounting for the jurisdiction's applicable policy goals and objectives.
Principle 3	**Ensure Symmetry** Asymmetrical treatment of benefits and costs associated with a resource can lead to a biased assessment of the resource. To avoid such bias, benefits and costs should be treated symmetrically for any given type of impact.
Principle 4	**Account for Relevant, Material Impacts** Cost-effectiveness tests should include all relevant (according to applicable policy goals), material impacts including those that are difficult to quantify or monetize.
Principle 5	**Conduct Forward-Looking, Long-term, Incremental Analyses** Cost-effectiveness analyses should be forward-looking, long-term, and incremental to what would have occurred absent the DER. This helps ensure that the resource in question is properly compared with alternatives.
Principle 6	**Avoid Double-Counting Impacts** Cost-effectiveness analyses present a risk of double-counting of benefits and/or costs. All impacts should therefore be clearly defined and valued to avoid double-counting.
Principle 7	**Ensure Transparency** Transparency helps to ensure engagement and trust in the BCA process and decisions. BCA practices should therefore be transparent, where all relevant assumptions, methodologies, and results are clearly documented and available for stakeholder review and input.
Principle 8	**Conduct BCAs Separately from Rate Impact Analyses** Cost-effectiveness analyses answer fundamentally different questions than rate impact analyses. Cost-effectiveness analyses should therefore be conducted separately from rate impact analyses.

The NSPM also recommends a five-step process for states to develop a primary, jurisdiction-specific benefit-cost test for DERs. These steps are summarized in

Figure 2. The recommended primary MD-UBCA Test in this report was developed in a process that followed the first three of these five steps; Steps 4 and 5 of the NSPM process focus on the proper application of the jurisdiction-specific test that is developed through Steps 1, 2 and 3.

Documentation of Maryland's applicable policy goals (consistent with Step 1 of the NSPM process) is addressed in Chapter III of this report. Discussion of the USIs that are applicable and material to each type of DER (consistent with Step 2 of the NSPM process) is provided in Chapter IV of this report. The process and results of determining what Maryland's applicable policies suggest about categories of non-USIs to include in the MD-UBCA Test is discussed in Chapter V of this report (consistent with Step 3 of

[12] NSPM for DERs, pg. iv.

the NSPM process). The Work Group's recommendations for a primary MD-UBCA Test, as well as secondary tests, are presented in Chapter VI. Key aspects of how the UBCA tests should be applied are addressed in Chapters VII and VIII.

Figure 2: NSPM Process to Defining a Jurisdiction's Primary Cost-Effectiveness Test

STEP 1	**Articulate Applicable Policy Goals** Articulate the jurisdiction's applicable policy goals related to DERs.
STEP 2	**Include All Utility System Impacts** Identify and include the full range of utility system impacts in the primary test, and all BCA tests.
STEP 3	**Decide Which Non-Utility System Impacts to Include** Identify those non-utility system impacts to include in the primary test *based on applicable policy goals identified in Step 1* (i.e., determine whether to include host customer impacts (non-low income, low-income impacts), other fuel impacts, and/or societal impacts.
STEP 4	**Ensure that Benefits and Costs are Properly Addressed** Ensure that the impacts identified in Steps 2 and 3 are properly addressed, where: • Benefits and costs are treated symmetrically; • Relevant and material impacts are included, even if hard to quantify; • Benefits and costs are not double-counted; and • Benefits and costs are treated consistently across DER types
STEP 5	**Establish Comprehensive, Transparent Documentation** Establish comprehensive, transparent documentation and reporting of process used to determine the primary test, BCA input assumptions and results.

6. Maryland UBCA Work Group and Process

On July 19, 2023, Maryland UBCA Work Group held its first meeting. Seven additional meetings were held by the end of April 2024. The Work Group participants included organizational representation from:

- MD PSC Technical Staff,
- Maryland Office of People's Counsel (OPC) (represented by both OPC staff and its consultants from Synapse Energy Economics),
- Maryland Energy Administration,
- Department of Housing and Community Development (represented by Cadmus),
- Maryland electric and gas utilities
    - Columbia Gas
    - Exelon Utilities
        - Baltimore Gas and Electric
        - Pepco
        - Delmarva
    - Potomac Edison
    - Southern Maryland Electric Cooperative
    - Washington Gas
- American Council for an Energy Efficient Economy
- Northeast Energy Efficiency Partnerships

- Several consulting firms:
    - Clean Grid Advisors
    - Demand Side Analytics
    - Energy Policy Design Institute
    - Guidehouse
    - Hungeling Analytics
    - KBH Energy Consulting
    - Loper Energy

During the first Work Group meeting, the Consultant Team provided background on Case No. 9674 (including the scope and definitions for the Work Group), an overview of the NSPM for DERs, and a review of existing DER benefit-cost analysis (BCA) practices in Maryland.

In meetings #2 through #4, the Consultant Team presented and facilitated Work Group input on applying the NSPM process for establishing a single, primary, Maryland-specific benefit-cost test for all DERs. Work Group members were asked to complete assignments on behalf of their company/organization to inform the meeting discussions. Assignments included providing input/feedback on:

- Which USIs are currently included in Maryland BCAs for different DER types;
- Which USIs are conceptually applicable and material to different DERs (whether or not part of current Maryland practice);
- An initial applicable policy inventory to determine if any policies should be added or excluded as a relevant state energy policy, as well as which policies should receive a priority focus; and
- Categories of non-USIs that priority policies suggest are related to state goals, based on a set of criteria developed by the Consultant Team.

Work Group meetings #2, #3 and #4 included virtual "polling" on questions, such as preferred criteria for determining when a state policy suggests impacts on a state objective are significant enough to include in the MD-UBCA Test and which non-USIs should be included in the MD-UBCA Test given those criteria.

After Work Group meeting #4, in late November 2023, the Consultant Team produced and distributed a draft version of the first five chapters of this report, including a recommendation for the categories of impacts that should be included in a primary Maryland UBCA test. Written comments on the draft report were provided by PSC Technical Staff, Exelon, Potomac Edison, Washington Gas, Office of People's Counsel, and Joe Loper. The Consultant Team recommendations and Work Group feedback was discussed in Work Group meeting #5 and was further discussed in a couple of smaller subgroup meetings devoted to specific topics (host customer impacts and the applicability of utility system impacts to different DERs) in early January 2024. Using Work Group feedback on the draft report, the Consultant Team presented a revised recommendation for a primary MD-UBCA Test, as well as recommendations for secondary tests in Work Group meeting #6 in late January 2024.

Work Group meeting #7 was devoted to discussion of several other considerations, including the geographic boundary for estimating values for several important categories of impacts, discount rates, and the level of aggregation of DER investments to which the Maryland UBCA should be applied to determine whether a DER initiative merits investment. A smaller subgroup meeting on geographic boundaries helped inform the discussion of that topic in meeting #7.

Following Work Group meeting #7, in mid-March 2024, the Consultant Team produced a revised report that reflected Work Group input up to that point in time. Written feedback on that draft report was provided by PSC Technical Staff, Exelon, Washington Gas, Office of People's Counsel, Joe Loper, and Energy Policy Design Institute in early April 2024. Work Group meeting #8, held in mid-April, was devoted entirely to discussion of the revised draft report. Through those discussions, the Work Group came to consensus on the categories of impacts that should be recommended for inclusion in primary Maryland UCBCA test, as well as on recommendations for secondary tests. Those consensus recommendations are reflected in this final report.

Note that in addition to written feedback on two report drafts, Work group members also provided verbal feedback during Work Group meetings and subgroup meetings, responses to non-binding "polls" held during Work Group meetings, and input in the "chat box" during the Work Group meetings. The Consultant Team also held follow-up discussions with several Work Group members between meetings to clarify homework assignments and to talk through perspectives of members' responses.

III. Maryland Applicable Energy Policies

1. Introduction

The first step in developing a primary BCA test, per the NSPM, is to identify applicable energy policies from which state's key goals and objectives can be determined, since state energy policy goals should be used to determine which categories of non-utility system impacts to include in the state's primary UBCA. This chapter discusses the UBCA Work Group's consideration and prioritization of state energy policies.

2. Maryland Public Utilities Article

The Maryland Public Utilities Article (PUA) provides foundational guidance to the PSC regarding its powers and objectives. Of particular relevance to the establishment of the MD-UBCA Test are the policy goals that the PSC is directed to consider in Maryland Statutes - Public Utilities Section 2-113(a):[13]

(1) The Commission shall:
- *i. supervise and regulate the public service companies subject to the jurisdiction of the Commission to:*
  - *1. ensure their operation in the interest of the public; and*
  - *2. promote adequate, economical, and efficient delivery of utility services in the State without unjust discrimination; and*
- *ii. enforce compliance with the requirements of law by public service companies, including requirements with respect to financial condition, capitalization, franchises, plant, manner of operation, rates, and service.*

(2) In supervising and regulating public service companies, the Commission shall consider:
- *i. the public safety;*
- *ii. the economy of the State;*
- *iii. the maintenance of fair and stable labor standards for affected workers;*
- *iv. the conservation of natural resources;*
- *v. the preservation of environmental quality, including protection of the global climate from continued short–term and long–term warming based on the best available scientific information recognized by the Intergovernmental Panel on Climate Change;*
- vi. *the achievement of the State's climate commitments for reducing statewide greenhouse gas emissions, including those specified in Title 2, Subtitle 12 of the Environment Article; and*
- *vii. the protection of a public service company's infrastructure against cybersecurity threats.*

Note that the UBCA Work Group did not discuss Public Utilities Section 2-113 in Work Group meetings #1 through #4 but is included in this report as it serves to reinforce (rather than change) conclusions regarding the recommended MD-UBCA Test.

3. Other Important Maryland Energy Policies

The Maryland UBCA Work Group collectively identified more than 20 other Maryland energy policies that could potentially provide insight into the state's energy policy goals and objectives. These policies

[13] See https://mgaleg.maryland.gov/mgawebsite/Laws/StatuteText?article=gpu&section=2-113&enactments=False&archived=False. Note that 2-113(b) makes clear that "the powers and duties listed in this title do not limit the scope of the general powers and duties of the Commission provided for by this division."

were generally either in the form of statutes, state energy plans or Maryland PSC orders. A full list of these policies is provided as Appendix A to this report.

The UBCA Work Group decided to initially focus on a set of "priority policies," as a careful review of each of these policies would be a significant undertaking and because a subset of applicable state energy policies is more recent, more comprehensive in potential application to DERs, and/or potentially sufficient in aggregate to inform the UBCA process. Work Group members were asked to identify what they consider to be the priority policies. Seven such policies were identified by at least two or more working group members as priorities. These priority policies are summarized in Table 1 below.

Table 1: Maryland Energy Policies Prioritized for Review

Name and Source	Type	DER Applicability
Climate Solutions Now Act of 2022 (Chapter 38 / SB 528)	Statute	All DERs
EmPOWER Maryland Energy Efficiency Act of 2008 (Public Utilities §7-211)	Statute	principally EE and DR (also EV pilot)
***NEW* Maryland's Climate Pollution Reduction Plan,** Maryland Department of Environment, Dec. 2023	State Plan	All DERs
Transforming Maryland's Electric Grid, Maryland Public Service Commission Public Conference 44 (PC44)	MD PSC Order	All DERs except EE
Energy Storage - Targets and Maryland Energy Storage Program - Establishment 2023 (Chapter 570 / HB 910; Public Utilities §7-216, §7-216.1)	Statute	DS
Energy Storage Pilot Project Act of 2019 (Chapter 427 / SB 573; Public Utilities §7-216)	Statute	
Building Energy Transition Plan, Maryland Commission on Climate Change, Nov. 2021	State Plan	EE,DR,BE

Note that the Work Group initially recommended inclusion of the Maryland Department of Environment's 2030 Greenhouse Gas Reduction Act (GGRA) Plan, which was published in February 2021. However, after the Department published the Maryland Climate Pollution Reduction Plan in December 2023, the Work Group agreed that should replace the GGRA Plan in the list of priority policies. That change is reflected in the table above.

Subsequent to the Work Group's review of priority policies, on April 4, 2024, the General Assembly passed House Bill (HB) 1256, the Distributed Renewable Integration and Vehicle Electrification (DRIVE) Act. The Consultant Team reviewed the DRIVE Act and presented it to the Work group during meeting #8, as further described below in Chapter V.

In addition, on April 8, 2024, the Maryland General Assembly passed HB 864 and sent the legislation to Governor Moore for consideration. The Governor signed the bill into law on May 9, 2024. HB 864 updates the statutory goals of the EmPOWER energy efficiency program to focus on greenhouse gas emissions reductions, in accordance with the goals established by the Climate Solutions Now Act (CSNA). While the Work Group had included both the CSNA and the EmPOWER statutes in the review of applicable policies, HB 864 sets forth that the Commission shall consider participant, utility, and societal non-energy benefits in the primary cost test for the EmPOWER program. HB 864 also sets forth that the Commission shall consider use of a total resource cost test including participant and utility non-energy

benefits. The Work group considered the impacts of HB 864 during meeting #8, which contributed to the final recommendations for non-utility system impacts as detailed below in Chapter V.

In addition to statutes and state-level policy planning documents, the Work Group identified various proceedings where the PSC has provided direction regarding inclusion of specific impacts (utility and non-utility system) in BCA practices for specific DER types. The Work Group identified four regulatory guidance documents that provide important policy direction, as presented in Table 2.

Table 2: MPSC Policy Implementation Frameworks Prioritized for Review

Name	MPSC Order	DER Applicability
EV BCA Framework	#238013 (1/12/22)	EV
Benefits and Costs of Utility Scale and Behind the Meter Solar Resources in Maryland	ML#222756 (11/02/2018)	PV
Energy Storage Working Group Metrics	#90454 (12/27/22)	DS
EmPOWER Future Program Working Group Report	#90261 (6/15/22)	EE, DR

Taking inventory of Maryland energy policies, their applicability to DER types, and prioritizing the policies is a key first step to help inform the development of a UBCA for Maryland. Further review of these policies is addressed in Chapter V where criteria are used to identify relevant non-USIs to include in a UBCA (Step 3 of the NSPM process).

IV. Utility System Impacts

1. Introduction

This chapter addresses utility system impacts (USIs) that should be included in the MD-UBCA Test. It begins with an identification and description of several different categories and sub-categories of USIs. It then discusses current Maryland practice regarding which USIs are included in BCAs for different DERs and briefly discusses NSPM guidance on the issue. Because a foundational element of these benefit-cost tests (as defined in the NSPM and agreed to by the Work Group) is that all utility system impacts that are applicable and material should be included in any DER cost-effectiveness test, a key question for the MD-UBCA Test is which utility system impacts are applicable to each DER and which, even if conceptually applicable, are material enough to routinely include in a test. The last part of the chapter is focused on those questions.

2. Categories of Utility System Impacts

Utility system impacts (USIs) are defined as the elements of the electricity or gas system required to deliver service to utility customers. Utility system impacts include generation, transmission, distribution, and other potential system impacts. Table 3 and Table 4 define electric and gas USIs, respectively. The definitions provided below are consistent with the NPSM. Each impact was discussed in the Work Group to develop consistency and to clarify the application for specific DERs.

Table 3: Electric Utility System Impact Definitions

Impact Type	Utility System Impact	Description and Examples
Generation	Energy Generation	The production or procurement of energy (kWh) from generation resources on behalf of customers
	Capacity	The generation capacity (kW) required to meet the forecasted system peak load
	Environmental Compliance	Actions to comply with environmental regulations
	Renewable Portfolio Standards/Clean Energy	Actions to comply with renewable portfolio standards or clean energy standards
	Market Price Effects	The decrease (or increase) in wholesale market prices as a result of reduced (or increased) customer consumption
	Ancillary Services	Services required to maintain electric grid stability and power quality
Transmission	Transmission Capacity	Maintaining the availability of the transmission system to transport electricity safely and reliably
	Transmission System Losses	Electricity lost through the transmission system
Distribution	Distribution Capacity	Maintaining the availability of the distribution system to transport electricity safely and reliably
	Distribution System Losses	Electricity lost through the distribution system
	Distribution O&M	Operating and maintaining the distribution system
	Distribution Voltage	Maintaining voltage levels within an acceptable range to ensure both real and reactive power production are matched with demand
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Utility Direct Investment in DERs	Direct costs for development and deployment of DERs by the utility, typically on the utility side of the meter
	Program Administration	Utility outreach to trade allies, technical training, marketing, administration/management, & evaluation of effort to promote DERs
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs
	Credit and Collection	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining generation, transmission, and distribution system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions
Other	Compliance with Regulatory Requirements	Actions to comply with federal, state, and regional policies. Example would be FERC Order 2222

Table 4: Gas Utility System Impact Definitions

Impact Type	Utility System Impact	Description and Examples
Energy	Fuel / Commodity	The fuel and O&M costs associated with gas commodity
	Capacity and storage	The gas capacity required to meet forecasted peak load
	Environmental Compliance	Actions required to comply with environmental regulations
	Market Price Effects	The decrease (or increase) in wholesale prices as a result of reduced (or increased) customer consumption
Transmission	Pipeline Capacity	Cost to maintaining the availability of the transmission system to transport gas safely and reliably
	Pipeline Losses	Gas lost through the transmission system
Distribution	Local Delivery Capacity	Cost to maintain the availability of the distribution system to transport gas safely and reliably
	Local Delivery Line Losses	Gas lost through the distribution system
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Utility Direct Investment in DERs	Direct costs for development and deployment of DERs by the utility, typically on the utility side of the meter
	Program Administration	Utility outreach to trade allies, technical training, marketing, administration/management, & evaluation of effort to promote DERs
	Utility Performance Incentives	Incentives offered to utility shareholders to encourage successful, effective implementation of DER programs
	Credit and Collection	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining the gas system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, response to, and recover rapidly from disruptions
Other	Compliance with Regulatory Requirements	Actions to comply with federal, state, and regional policies

3. Current Maryland Practices

Table 5 and Table 6 summarize which USIs are currently included in Maryland cost-effectiveness analyses of energy efficiency (EE), electric vehicles (EV) and distributed storage (DS) pilot. These current DER-specific BCA practices reflect separate processes and regulatory decisions unique to each DER. A checkmark indicates that the impact is currently monetized and included as part of the subject BCA test. Note that for some impacts, the absence of a checkmark (shaded blank cell) indicates that a category of impacts is not currently applicable in Maryland (e.g., utility shareholder incentives for EV program performance) rather than a conceptual determination that should not be included. For other impacts, such as Electric Distribution O&M and Distribution voltage under EE, it was determined in the respective DER work group processes that these impacts would not be material enough to quantify and include in the BCA.

Table 5: Electric Utility System Impacts in Current MD BCA Tests[14]

Impact Type	Impact	EE	EV	DS-Pilot
Generation	Energy Generation	✓	✓	
	Capacity	✓	✓	✓
	Environmental Compliance	✓		
	RPS/CES Compliance	✓	✓	
	Market Price Effects	✓	✓	
	Ancillary Services	✓		
Transmission	Transmission Capacity	✓	✓	✓
	Transmission System Losses	✓	✓	
Distribution	Distribution Capacity	✓	✓	✓
	Distribution System Losses	✓	✓	
	Distribution O&M			
	Distribution Voltage			✓
General	Financial Incentives	✓	✓	✓
	Utility Direct Investments in DERs	✓	✓	✓
	Program Administration	✓	✓	✓
	Utility Performance Incentives			
	Credit and Collection	✓		
	Risk	✓		
	Reliability & Reslience			✓

Table 6: Gas Utility System Impacts in Current MD BCA Tests[15]

Impact Type	Impact	EE
Energy	Fuel & Variable O&M	✓
	Capacity and Storage	✓
	Environmental Compliance	✓
	Market Price Effcts	✓
Transmission	Pipeline Capacity	✓
	Pipeline Losses	✓
Distribution	Local Delivery Capacity	✓
	Local Delivery Line Losses	✓
General	Financial Incentives	✓
	Program Administration	✓
	Utility Performance Incentives	
	Credit and Collection	✓
	Risk	✓
	Reliability & Resilience	
Other	Compliance with Regulatory Requirements	

[14] A check means that the category of impacts is included in a current test, a blank means it is not included. Impacts that are excluded is either because they were not considered, considered but determined to be not applicable or considered but determined to be applicable but not material. The Work Group did not endeavor to identify and document the reasons for why some impacts are not currently included. Note that a single check is provided for the combination of risk, reliability, and resilience for EE, as a current "risk adder" was intended to cover all of these potential impacts (personal communication with Joe Loper, February 19, 2024).

[15] Note that there is disagreement over inclusion of gas transmission and distribution (T&D) avoided costs. Washington Gas included such values the filing of its 2024-2026 EE plan. However, the EmPOWER Advisory Group guidance has been to not include gas T&D impacts on the presumption that they would be negligible (not material) in a future in which gas demand is falling due to electrification promoted to reduce GHG emissions.

As Tables 5 and 6 show, not all USIs are currently monetized in Maryland benefit cost analyses for EE, EVs, and DS. In addition, while there is a fair degree of consistency in the range of utility impacts considered for each of these DERs, there are also some inconsistencies across the DERs. Some of the inconsistencies are likely related to implicit determinations in previous regulatory proceedings that some sub-categories of USIs are not applicable or not material for some DERs (particularly for DS), as discussed in the next sub-section. However, there are other inconsistencies that are likely substantive.

4. NSPM Guidance

A core principle of the NSPM for DERs is that all USIs should be included in cost-effectiveness tests to enable comparison of the economic merits of DERs, both relative to supply-side alternatives and to each other. Inclusion of all elements of the USIs ensures that, at a minimum, the cost-effectiveness test assesses whether total utility system costs are reduced or increased by the investment. As discussed further below, including all USI impacts does not mean that there will be a non-zero value included for every benefit-cost analysis of every DER. Additionally, some of the categories of USI impacts are not applicable to some DERs, and even when categories of USI impacts are conceptually applicable to a DER, they may not be material enough to routinely include in a test.

5. Applicability and Materiality of USIs to Different DERs

All USIs that are applicable to a given DER and of sufficient magnitude to materially affect BCA results should be included in Maryland's UBCA. Table 7 and Table 8 provide summaries of the electric and gas USIs, respectively, that are both applicable and material to each type of DER.[16] Note that the conclusions regarding applicability and materiality of the electric utility system impacts in Table 7 were discussed in the third Work Group meeting in early October. The applicability and materiality of gas utility system impacts were further discussed in an informal meeting between the Consultant team and Washington Gas, also in October to clarify outstanding concerns. Conclusions regarding the applicability and materiality of both electric and gas utility system impacts were presented in the Consultant Team's first draft report in December 2023. Modifications to those draft conclusions were subsequently discussed in a small subgroup meeting in early January 2024 as well as in Work Group meeting 6 in late January and Work Group meeting 8 in April. As a result of those discussions, Tables 7 and 8 reflect a consensus of the Work Group.

Whether the applicable impacts in Tables 7 and 8 are considered either a cost or a benefit was not discussed during the Work Group meetings, as this determination can depend on a number of factors beyond the DER type e.g., technology characteristics, use case, resource ownership/control (see NSPM Chapters 6-10). As BCAs are conducted going forward using a UBCA, determinations of whether the impacts are a cost or benefit will be determined on a case-by-case basis of the resource and the use-case being analyzed.

[16] Applicability was considered for a range of potential applications or use cases that could be developed in the near-term, rather than just the way DERs may be currently promoted or deployed in Maryland. For example, while there are no performance incentives currently provided for delivery of energy efficiency programs in Maryland, so that type of utility system impact is not applicable today, that could change very quickly if a new policy direction was adopted. With respect to materiality, the Work Group did not endeavor to establish a numeric threshold. Rather, materiality was based on qualitative assessments of whether the impact would likely be large enough to significantly affect benefit-cost ratios.

Table 7: Applicability and Materiality of Electric Utility System Impacts

Impact Type	Impact	EE	DR	DG	DS	EV	BE
Generation	Energy Generation	✓	✓	✓	✓	✓	✓
	Capacity	✓	✓	✓	✓	✓	✓
	Environmental Compliance	✓	✓	✓	✓	✓	✓
	RPS/CES Compliance	✓	NM	✓	NM	✓	✓
	Market Price Effects	✓	✓	✓	✓	✓	✓
	Ancillary Services	✓	✓	✓	✓	✓	✓
Transmission	Transmission Capacity	✓	✓	✓	✓	✓	✓
	Transmission System Losses	✓	✓	✓	✓	✓	✓
Distribution	Distribution Capacity	✓	✓	✓	✓	✓	✓
	Distribution System Losses	✓	✓	✓	✓	✓	✓
	Distribution O&M	✓	✓	✓	✓	✓	✓
	Distribution Voltage	NM	NM	✓	✓	NM	NM
General	Financial Incentives	✓	✓	✓	✓	✓	✓
	Utility Direct Investments in DERs	✓	✓	✓	✓	✓	✓
	Program Administration	✓	✓	✓	✓	✓	✓
	Utility Performance Incentives	✓	✓	✓	✓	✓	✓
	Credit and Collection	✓	NM	✓	NM	✓	✓
	Risk	✓	✓	✓	✓	✓	✓
	Reliability & Resilience	✓	✓	✓	✓	✓	✓

✓ Impacts that are both applicable and material

NM Not material, or not large enough to merit routine inclusion

Table 8: Applicability and Materiality of Gas Utility System Impacts

Impact Type	Impact	EE	DR
Energy	Fuel & Variable O&M	✓	✓
	Capacity and Storage	✓	✓
	Environmental Compliance	✓	NM
	Market Price Effects	✓	NM
Transmission	Pipeline Capacity	✓	✓
	Pipeline Losses	✓	✓
Distribution	Local Delivery Capacity	✓	✓
	Local Delivery Line Losses	✓	✓
General	Financial Incentives	✓	✓
	Utility Direct Investments in DERs	✓	✓
	Program Administration	✓	✓
	Utility Performance Incentives	✓	✓
	Credit and Collection	✓	NM
	Risk	✓	✓
	Reliability & Resilience	✓	✓

✓ Impacts that are both applicable and material

NM Not material, or not large enough to merit routine inclusion

6. Additional Guidance on Utility System Impacts

Further discussion of some of the recommendations in Tables 7 and 8 above may be helpful to the PSC's consideration of how certain USIs are captured or reflected in the MD-UBCA Test:

- **Environmental Compliance Costs and RPS/CES Compliance Costs**. Environmental compliance costs, as well as RPS/CES compliance costs, may be embedded in values estimated for avoided generation capacity costs and/or avoided energy costs. It is not important that they be separately estimated, but rather that there is clear demonstration and explanation (NSPM "transparency" principle) of how they are embedded in avoided costs.
- **Utility Performance Incentives.** While Maryland currently does not offer utility performance incentives, if this were to change, the cost of those incentives should be included in quantification of utility system impacts. The UBCA framework is designed to address such potential changes. For now, a MD-UBCA Test would simply use a $0 value for utility performance incentives if such incentives are not available.
- **Utility Direct Investment in DERs.** This category of impacts addresses situations in which the DER is purchased or owned by the utility, typically because it is deployed on the utility-side of the meter. One example would be a utility-owned battery storage device deployed to address distribution system (e.g., as part of non-wires solutions) needs rather than solely to address generation needs.
- **Reliability and Resilience.** Most DERs enhance the ability of the electric grid and gas system to remain up and running when facing severe weather and other challenges – defined as 'reliability' benefits. While DERs may not typically provide significant benefits in helping the system as a whole or even significant portions of the system to recover from unexpected disruptions, such as those caused by hurricane, terrorist attack or other factors – referred to as 'resilience' benefits – that could change in the future. For example, microgrids that can be islanded and served by distribution generation and storage could enhance resilience to all customers served by such microgrids. In addition, many DERs improve the resilience of individual customers – e.g., by enabling them to more easily withstand the effects of a downed electric or gas system. Such customer-specific resilience benefits are included as a non-utility system impacts (discussed in Chapter V) because they accrue only to the "host customers" who invest in EE, DG, DS, and EVs that can also function as storage, or to society as a result of some individual host customers being able to provide important societal services (e.g., hospitals, police stations, fire stations), rather a benefit of energy access that accrues to all customers on the utility system. The key points here are that there are different kinds of reliability and resilience benefits, that these benefits should be categorized according to who benefits, and that it is important that the benefits not be double-counted.
- **Treatment of Federal Policies.** Federal policies (e.g., U.S. Environmental Protection Agency (EPA) regulations or Federal Energy Regulatory Commission (FERC) orders) as well as regional market rules (e.g., PJM rules) can affect the impact that DERs would have on utility system costs. The effects of such federal or regional policies and rules should be captured in the way that specific USIs from DERs are quantified.
- **Credit and Collection Costs.** Even for the DERs for which credit and collection costs could be significant, materiality will ultimately be a function of the extent to which DER initiatives are targeted to payment troubled customers.

V. Non-Utility System Impacts

1. Introduction

This chapter describes several different categories and sub-categories of non-utility system impacts (non-USIs). It then discusses current Maryland practice regarding which non-USIs are included in BCAs for different DERs and summarizes NSPM guidance on the role of applicable energy policies in determining which non-USIs to include in a primary BCA. The chapter then presents Work Group recommendations regarding what impacts Maryland policy goals suggest should be included in the MD-UBCA. The order and presentation of topics below generally follows the Work Group process for considering and deciding on which non-USIs to include in the MD-UBCA.

2. Categories of Non-Utility System Impacts

There is a range of non-USIs that can potentially be included in a state's primary benefit-cost test for DERs. The non-USIs include benefits and costs from utility DER investments associated with the consumption of other fuels, impacts on the utility customers ("host customers") participating in the DER initiative, and a range of societal impacts. Each of these major categories of non-USIs impacts is described in greater detail below.

Note that there may be overlaps between USIs and some non-USIs. For example, greenhouse gas emission (GHG) reduction compliance costs associated with the Northeastern states' Regional Greenhouse Gas Initiative (RGGI), which are a utility system impact, are a portion of the societal cost of GHG emissions. Care must be taken to recognize such overlaps to ensure there is no double-counting of impacts. Sometimes, there can also be confusion between certain USIs and similarly named or types of non-USIs, such as those associated with risk, reliability, and resilience. NSPM guidance sets forth that inclusion of any non-USIs should be truly incremental to utility system impacts. As such, the non-USIs addressed below do not overlap with the USIs presented in the prior chapter.

A. Other Fuel Impacts

An electric or gas utility investment in DERs can often have impacts on the magnitude and/or costs of consumption of "other fuels" (i.e., other than those that are the primary focus of a utility program). For example, a gas utility funded efficiency program that helps residential customers insulate their attic can provide both gas heating savings and electric cooling savings. For the gas utility running such a program, the electric cooling savings are the "other fuel" impact. If an electric utility was running such a program to produce summer cooling savings, the gas heating savings would be the "other fuel" impact. In some cases, a DER that reduces consumption of one fuel results in an increase (rather than a reduction) of another fuel. This is the case with electrification measures, such as heat pumps, where electricity consumption is increased while fossil fuel consumption is reduced.

Note that other fuel impacts are not limited to other PSC-regulated utility supplied fuels. For example, electrification of vehicles reduces gasoline and/or diesel fuel consumption. Similarly, while heat pumps can displace natural gas, they can also displace propane or fuel oil consumption. In addition, an industrial demand response program participant that uses diesel generators to meet its internal electricity needs, when called upon by its electric utility during a peak demand event to reduce consumption from the grid, will experience an increase in diesel fuel costs. Subcategories of other fuel impacts are summarized in Table 9 below.

Table 9: Other Fuel Impacts

Impact	Description and Examples
Commodity	Fuel and related O&M costs of other fuels
Environmental Compliance	Cost of actions to comply with environmental regulations of other fuels
Market Price Effects	Change in prices for other fuels resulting from changes in levels of consumption
Other Utility System Impacts	If gas DER, impacts on electric system (e.g., gen. capacity, T&D, reliability , etc.)
	If electric DER, impact on gas system (e.g., T&D, storage, reliability, etc.)

B. Host Customer Impacts

DER investments can impact host customers in a variety of ways. As Table 10 shows, for example, host customers often bear a portion of the cost of the DER investment – e.g., where utility rebates for a measure cover only a portion of the installed cost. Host customers can also experience changes in risk and/or resiliency due to a DER investment. For example, improvements to the insulation levels of a home reduce the homeowner's risk of exposure to future fuel price volatility.[17] Insulation upgrades, customer-sited battery storage, and distributed generation can all enable customers to withstand the adverse effects of loss of power – a resilience benefit.

Table 10: Host Customer Impacts

Impact	Description and Examples
Energy Impacts	
DER Measure Costs	The portion of DER measure costs born by the host customer (e.g., cost net of utility incentives)
Transaction Costs	Non-financial costs to install DERs (e.g., application fees, time spend facilitating installation, paperwork)
Interconnection Fees	Costs paid by customers to interconnect DERs to the electric grid
Risk	Uncertainty regarding price volatility, power quality and performance of DER equipment
Resilience	Ability to adapt to changing conditions and withstand, respond or recover from disruptions
Tax Incentives	Government tax incentives (or other incentives) that defray the cost of DERs
Non-Energy Impacts	
Asset Value	Changes in the value of a home or business as a result of the DER (e.g., increased building value)
Water cost impacts	Costs or cost savings from increased or decreased water consumption resulting from DER installation
O&M costs	Changes in operation and maintenance costs
Productivity	Other changes in productivity (e.g., reduced business waste streams, increased worker productivity)
Economic well-being	Economic impacts beyond bill savings (e.g., reduced service terminations, reduced foreclosures)
Comfort	Changes in comfort (e.g., thermal, noise and lighting quality)
Amenity	Changes in other values (e.g., less refrigeration capacity, more "free time", performance uncertainty)
Health & Safety	Changes in air quality or other factors affecting medical costs, availability for work/school, deaths, etc.
Empowerment	Satisfaction from ability to control energy consumption and bills
Pride	Satisfaction from contributing to social good (e.g., from reduced environmental footprint)

Non-energy impacts can be particularly important to host customers, and utilities often recognize that importance by marketing DER programs based in-part on key non-energy benefits.[18] These benefits

[17] Customers with improved insulation are better off if energy prices increase because they consume less energy. Of course, they also experience less of the benefit of potential energy price decreases. However, there is typically more room for prices to increase than to decrease, in part because there is no upper limit to prices whereas they can never get to zero on an average annual basis. Even if that is not the case, and both the magnitude and probability of potential price increases and potential price decreases are the same, many customers are risk averse and would welcome a narrowing of the range of total energy costs that they may incur in the future.

[18] For example, PEPCO's marketing of its Home Performance with Energy Star Program starts by identifying the potential comfort concern of uneven temperatures within a home. See Home Performance with Energy Star.

include changes in improvements to comfort, health and safety, operation and maintenance costs, business productivity, aesthetics, and other amenities.

Non-energy benefits are often particularly large for low-income customers. This is both because the quality of low-income housing stock is often worse and the energy burdens (as a percentage of income) for low-income households are typically higher than those of other customers, meaning energy efficiency and some other DER investments often improve both living conditions and the ability of households to afford to live comfortably. On the other hand, there can also be host customer non-energy costs. For example, the Safety and Environmental subgroup of the Maryland Energy Storage Program Work Group has identified a potential concern regarding the risk of fire incidents that, if confirmed, could represent a significant host customer cost. Some DER measures can also increase operation and maintenance costs or reduce a customer's amenities (e.g., higher indoor temperatures because of air condition load control programs).

C. Societal Impacts

There is a range of impacts that apply to society at large, rather than just to customers who participate in DER initiatives (i.e., host customers). Examples of these impacts, as shown in Table 11, address concerns that can go well beyond the direct benefits and costs of energy consumption, such as environmental impacts, economic development and jobs, resilience of public or social institutions that serve key social needs (e.g., hospitals) and energy independence or security.

Table 11: Societal Impacts

Impact	Description and Examples
Resilience	The societal impact of critical customers' (e.g., hospitals, fire stations, police, water treatment facilities, etc.) ability to maintain operations during utility
Greenhouse Gas Emissions	Impact of changes in GHG emissions on society and the environment
Other Environmental	Impact of changes in other emissions or land use
Public Health	Changes in medical outcomes and costs
Energy Security	Changes in energy independence

Public health impacts and environmental impacts, while sometimes identified by jurisdictions as discrete policy goals, are often interlinked (e.g., reductions in criteria air pollutants can lead to better air quality and improvements in public health, such as lower asthma rates). As such, there can be significant overlap between the two impacts, and BCAs need to avoid double-counting such impacts – a key NSPM principle. Similarly, there is a potential for overlap between the concepts of resilience and reliability to the utility system, host customers and society. Thus, there is a need to ensure that there is no double-counting in the methodologies used to estimate these impacts.

D. Addressing Economic Development and Job Impacts

Note that economic development and job impacts are often driven, in significant part, by the utility system cost reductions that DERs can provide (and that will already be included in any benefit-cost analysis). Thus, while there can be value in quantifying net changes in economic development and jobs to inform regulatory decisions on DER investments – when state energy policies suggest such that economic growth and job creation are important objectives – such quantification should be separate from benefit-cost calculations of DER net benefits or benefit-cost ratios rather than mathematically added to BCA impacts.

E. Addressing Energy Equity

There is also often a societal interest in addressing energy inequities, especially where efforts are underway to move to a fully decarbonized energy industry. Though critically important to state policy goals, such equity objectives – in particular those pertinent to assessing the *distribution* of benefits and costs of a DER investment across customer groups – do not lend themselves well for inclusion in benefit-cost analyses. Instead, a companion *distributional equity analysis* (DEA) is warranted to determine how proposed DER investments will impact priority populations (e.g., underserved, or overburdened customers) relative to other populations.

A BCA is an essential tool used by regulators, utilities, and other decision-makers when considering utility investments in DERs, and whether the DER will provide net benefits for all customers. BCAs determine the impact ***across customers on average*** (where costs are typically recovered across all customers or all customers within a customer class, and benefits are typically a blend of avoided costs experienced by all customers). A BCA does not assess the *distribution of costs and benefits* across customers with different characteristics.

A comparison of a BCA and a DEA is provided in Table 12 below, including the types of metrics that are commonly used. Importantly, BCA metrics or impacts are most often monetized, while DEA metrics typically are not monetized, but often quantified.

Table 12: Differences Between Benefit-Cost and Distribution Equity Analyses

	Benefit-Cost Analyses	Distributional Equity Analyses
Purpose	To identify in which DER programs utilities should invest	To identify how DER programs impact priority populations relative to other populations
Costs and Benefits	Costs and benefits across all customers on average	Costs and benefits for priority populations compared to costs and benefits for other customers
Impacts Analyzed	• Utility system impacts • Participant impacts • Societal impacts	Depends on choice of DEA metrics
Metrics	• Costs (PV$) • Benefits (PV$) • Net present value (NPV) • Benefit-cost ratio (BCR)	Examples: • Rates ($/kWh) • Bills ($/month) • Participation rates (% of eligible customers) • Energy burden (% of income spent on energy bills) • Reliability impacts (% change in CEMI*) • Service shutoffs (% change) • Health impacts (ER visits for asthma) • Environmental impacts (PM 2.5 emissions)

In response to state interest in understanding how to address distributional equity implications of DER investments, the U.S. Department of Energy (US DOE) and E4TheFuture have co-funded a guidance document titled *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources – A Practical Guide* (May 2024)[19]. Managed by Lawrence Berkeley National Laboratory (LBNL), the primary purpose of this 'DEA Guide' is to provide a framework that can be used to supplement BCA results, and to inform equitable utility DER investment decisions.

[19] US DOE, 2024. See project website at: https://emp.lbl.gov/publications/distributional-equity-analysis

While there are many key dimensions to addressing energy equity, including recognition, procedural, distributional and restorative, the DEA Guide focuses on addressing distributional equity issues that might be caused by future utility investments, and on how to use DEA results alongside BCA results to the answer the key question: *Which new DERs should utilities invest in, given their impacts on equity?* The DEA framework can also help to answer questions regarding:

- Whether to pursue or invest in a proposed DER program or continue to support an existing one;
- Whether to modify or redesign a proposed or existing DER program; and
- How to prioritize investments across multiple DER programs.

The Consultant Team presented briefly on the topic of DEA to the Work Group, with the understanding that the topic of equity – and conducting a DEA – will be addressed in subsequent efforts. This could include a presentation on the DEA Guide for the Maryland commission staff and DER/DSP work group stakeholders and/or, as recommended in Chapter X, the topic could also be part of a Phase II process.

3. Current Maryland Practice – Accounting for Non-USIs

Table 13 below provides an overview of which non-USIs are included in benefit-cost tests currently used in Maryland for energy efficiency programs (EmPOWER), programs that promote and/or support electrification of vehicles, and the Commission's distributed storage pilot program. These benefit-cost tests were developed separately for each type of DER, at somewhat different points in time and often with different organizations or different individuals from the same organizations involved. Thus, while there is some commonality in terms of non-USIs included in current BCAs for these three different DERs, there are also inconsistencies.

Table 13: Non-Utility System Impacts Currently Applied in Maryland BCA Tests[20]

Non-Utility System Impacts	EE	EV	DS (Pilot)
Other Fuels			
Fuel and O&M	✓	✓	✓
Delivery Costs (incl. other fuel T&D)	✓	Embedded	
Environmental Compliance	Embedded	Embedded	
Market Price Effects	✓		
Host Customer			
Measure Costs	✓	✓	N/A
Transaction Costs			N/A
Interconnection Fees	N/A	N/A	✓
Risk			
Reliability			
Resilience			✓
Tax Incentive	✓	✓	
Non-Energy Impacts (Non-Low-Income)	partially	partially	
Non-Energy Impacts (Low-Income)	partially	partially	
Societal			
Greenhouse Gas Emissions	✓	✓	✓
Other Environmental Impacts	✓	Embedded	✓
Public Health	Embedded	✓	✓
Water Use	✓		
Energy Security			
Resilience			✓

4. NSPM Guidance

The NSPM for DERs provides guidance on how a jurisdiction can determine which categories of non-USIs to include in its primary test for assessing the cost-effectiveness of all DERs. The NSPM sets forth a key principle which is that a state's energy policy goals and objectives should dictate which categories of non-USIs to include in a jurisdiction's primary test.

State energy policy goals and objectives can be documented in various ways, from statutory language to state plans and regulatory orders. The NSPM recommends that the first step in establishing a jurisdiction's primary cost-effectiveness test for DERs is to inventory its applicable energy policy goals and objectives.[21] That inventory of policies should then determine which categories of non-USIs – from other fuel impacts to host customer impacts to a range of other societal impacts – are of policy interest and concern to the state. That will often require some interpretation of language and intent. Thus, it can also be helpful to establish a set of criteria about whether language in state energy policy documents is clear enough to draw conclusions about the importance of potential state goals and objectives. Finally,

[20] Blank cells indicate that no impact is currently used in the BCA, not necessarily that it was not considered. For example, the EmPOWER Work Group concluded that host customer transaction costs (unclear if they increase or decrease) and resilience, as well as societal resilience and energy security, would not be material. Second, economic development and job impacts are considered "not applicable" by EmPOWER because they should not be mathematically added to costs and benefits in a BCA test. Third, there is currently an EmPOWER "risk adder" applied to avoided costs that is intended to account for not just utility system reductions in risk resulting from efficiency programs, but a range of other host customer and societal impacts for which specific values (or proxy adders) have not been estimated (personal communication with Joe Loper, March 5, 2024).

[21] "Policy goals can be articulated in many different ways, including but not limited to legislation; executive orders; regulations; commission or board guidelines, standards, or orders; a utility's resource planning principles and policies; and requirements of other governing agencies within a jurisdiction." (from NSPM for DERs)

having "scored" individual state policy documents in terms of the direction that they provide on the importance of different potential energy policy goals and objectives, a UBCA framework development process must address whether the direction – in aggregate across all state policies – is sufficient to warrant inclusion of different categories of non-USIs in the state's primary DER benefit-cost test.

5. Conclusions on Maryland Energy Policy Goals

In Chapter III above, a set of priority Maryland energy policies are presented based on collective input from Work Group members that those policies should be relied upon to identify the state's energy policy goals and objectives. This, in turn, can inform decisions on the categories of non-USIs that should be included in the MD-UBCA Test.

Language in statutes, state plans, regulatory decisions and other policy documents can have varying levels of clarity regarding state policy goals and objectives. To facilitate interpretation of language in the Maryland priority policies identified in Chapter III, and relevant non-USIs, the Consultant team presented three criteria to the Work Group to use to determine the relevance of a non-USI to the specific priority policies:

A. The policy requires an action or desired outcome related to a non-utility system impact.
B. The policy document explicitly states that a non-utility system impact is an objective.
C. The policy makes reference to a non-utility system impact but does not explicitly state that the impact is an objective.

The UBCA Work Group members were polled on the question of which of these levels of reference to state policy goals and objectives should be sufficient to consider a non-USI "relevant" to a given policy and thus appropriate to include in the MD-UBCA Test. Of the ten individual work group members who answered the question,[22] nine selected criterion A, eight selected criterion B, and five selected criterion C as sufficient to consider a non-utility system impact as relevant to a policy (more than one criterion could be selected).[23] The ultimate outcome of this exercise -- which is documented in full detail in Appendix B – is provided in Figure 3 below, where green cells suggest general Work Group agreement that a policy supports inclusion of an impact in a Maryland UBCA, blue cells indicate agreement that a policy could be argued to support inclusion of an impact in the UBCA (just that it is less compelling support than green cell references) and peach-colored cells suggest some disagreement among Work Group members.

[22] This included representatives from PSC Technical Staff, OPC, two electric utilities, two gas utilities, Exelon utilities (the state's only dual-fuel utility), and a PSC consultant on energy efficiency programs.

[23] The only respondent who did not select criterion A, selected both criteria B and C.

Figure 3: Reference to Non-Utility System Impact Goals by Policy

Maryland Priority Policies	Non-Utility System Impact Categories Relevant to Policy								
	Other Fuels	Societal Impacts						Host Customer	
		Resilience	GHG Emissions	Other Environ-mental	Public Health	Economic Developmt & Jobs	Energy Security	Host Customer (non-LMI)	Host Customer (LMI)
Climate Solutions Now Act of 2022 (Chapter 38/SB 528)									
MD Code, Public Utilities §7–211 EmPOWER Act									
Maryland's Climate Pollution Reduction Plan (December 2023)									
PC44 Transforming Maryland's Electric Grid									
Combined: MD Energy Storage Program - 2023 (Chapter 570/HB 910)									
Combined: Energy Storage Pilot Project Act of 2019 (Chapter 427/SB 573)									
MCCC Building Energy Transition Plan (November 2021)									
Maryland Regulatory Implementation Frameworks									
EV BCA Framework								*partially*	*partially*
Benefits and Costs of Utility Scale and BTM Solar Resources in MD									
Energy Storage Working Group Metrics									
EmPOWER Future Program Working Group Report								*partially*	*partially*
Overall Policy Support for Including non-USI in UBCA									

- General agreement policy does not address non-USI per criteria
- General agreement that policy/framework supports inclusion in UBCA
- Policy/framework mentions non-USI, may support inclusion in UBCA
- Potential disagreement on relevance or appropriate criteria

As discussed in Chapter III, subsequent to the Work Group's consideration of priority policies, the General Assembly passed HB 1256 and HB 864. The Consultant Team assessed these bills and presented them to the Work Group during Meeting #8. HB 1256 ("the DRIVE Act") identifies specific desired policy outcomes, including greenhouse gas emissions reductions, on-site resilience for customers, health benefits in overburdened communities, and unspecified host customer "benefits." The Consultant Team reviewed the DRIVE Act and assessed that it (1) reinforced the policy goals regarding non-utility system impacts identified in Figure 3, and (2) did not introduce any significant changes to the policy landscape regarding prioritization of non-utility system impacts.

HB 864 updates the EmPOWER statutes by amending the Public Utilities law §7-211 through §7-228. Regarding non-utility system impacts, HB 864 requires that the Commission shall consider:

- The "*primary state jurisdiction–specific test, as developed, updated, or approved by the commission, to determine the cost–effectiveness of a program or service prospectively, including consideration of: a) participant nonenergy benefits; b) utility non-energy benefits; and c) societal non-energy benefits.*"
- "A *total resource cost test to compare the electricity savings and demand reduction targets of the program or service with the results of similar programs or services implemented in other jurisdictions, including: a) participant non-energy benefits; and b) utility non-energy benefits.*"

While a couple of other priority policies had identified host customer impacts as of some interest, as shown in Figure 3, none had previously required consideration for the inclusion of host-customer impacts in a primary test to the same extent as HB 864. The consideration for a total resource cost test identified in HB 864 also exceeded any previously identified policy regarding use of secondary tests.

6. Applicability and Materiality of Non-USIs to Different DERs

Inclusion of a category of specific USIs and non-utility system impacts (non-USIs) in the primary MD-UBCA Test simply means that assessments of cost-effectiveness of DERs need to consider those specific impacts. In some cases, certain impacts will not be applicable to all DER types or use cases. In other cases, certain impacts, while conceptually applicable, may not be large enough to be material. Tables 14 and 15 summarize the applicability and materiality of different non-USIs to different DERs. Cases in which a non-USI is both applicable and material to a type of DER are represented by check marks. An asterisk is used for categories of impacts that are not likely to be material in typical near-term applications or use cases of DERs but could become material in the medium- to longer-term, particularly if there are efforts to decarbonize the grid through deployment of increasing volumes of non-dispatchable renewables. In such a future, DR and DS could become critically important resources for constantly balancing the system (rather than just for peak shaving).

Table 14: Applicability and Materiality of Other Fuels and Societal Impacts to Different DERs

Category		EE	DR	DG	DS	EV	BE
Other Fuels		✓	✓	✓	NA	✓	✓
Societal	Resilience	NA	NA	✓	✓	NA	NA
	GHGs	✓	*	✓	*	✓	✓
	Other Environmental	✓	✓	✓	*	✓	✓
	Public Health	✓	✓	✓	*	✓	✓
	Energy Security	✓	✓	✓	✓	✓	✓

✓ Impacts that are both applicable and material

NA Impacts that are not applicable to a given DER

* Not material in typical applications today, but could be material in the future as the grid evolves

Note that some of the categories of non-USIs have a range of impacts that would need to be captured if included in the MD-UBCA. This is particularly true of host customer impacts. One of the challenges with considering host customer impacts is that there are many of them; they also vary considerably for different types of customers and for different DERs. Further, while there has been a fair amount of work done, both nationally and in Maryland, to quantify various types of host customer impacts associated with energy efficiency investments, there has been very little focus on this issue for other DERs. For example, the Maryland EV work group included the host customer benefit of reductions in vehicle maintenance costs in the MD-EV JST proposed to the commission, but it did not consider or monetize other host customer impacts such as range limitations (sometimes called "range anxiety") and changes in host customer transaction costs from not having to refuel at gas stations.

Thus, it may be challenging to comprehensively include host customer impacts in benefit-cost analyses for all DERs without investment in new research and analysis. Table 15 summarizes the key host customer impacts that are both applicable and material to different DERs.

Table 15: Host Customer Impacts Applicable and Material to Different DERs

Impact	EE	DR	DG	DS	BE	EV
Energy Impacts						
DER Measure Costs	✓	✓	✓	✓	✓	✓
Transaction Costs	✓	✓	✓	✓	✓	✓
Interconnection Fees	NA	NA	✓	NA	NA	NA
Risk	✓	NA	✓	✓	✓	✓
Reliability	NA	NA	NA	NA	NA	NA
Resilience	✓	NA	✓	✓	NA	✓
Tax Incentives	✓	NA	✓	✓	✓	✓
Non-Energy Impacts						
Asset Value	✓	NA	✓	✓	✓	NA
Water cost impacts	✓	NA	NA	NA	NA	NA
O&M costs	✓	NA	✓	✓	✓	✓
Productivity	✓	NA	NA	NA	NA	NA
Economic well-being	✓	NM	✓	✓	✓	✓
Comfort	✓	NA	NA	NA	✓	NA
Amenity	✓	✓	NA	NA	✓	✓
Health & Safety	✓	NA	NA	NA	✓	NA
Empowerment	✓	NA	✓	✓	✓	✓
Pride	✓	NM	✓	NM	✓	✓

✓ Impacts that are both applicable and material

NA Impacts that are not applicable to a given DER

NM Impacts that are conceptually applicable but "not material" or large enough to merit routine inclusion in the MD UBCA test

7. Additional Guidance on Non-Utility System Impacts

Further discussion of the following non-USIs proposed for inclusion in the MD-UBCA Test may be helpful to address in the future (possibly as part of the Phase 2 process recommended in Chapter X):

- **Difference between utility system, host customer and societal "resilience" impacts**. DERs can potentially affect the resilience of the electric grid or gas distribution system, and the resilience of individual customers at the homes or businesses of which the DERs are installed and/or the resilience of society more broadly. Understanding these differences is critical to ensuring that resilience impacts are captured in BCAs, but that there is no double-counting in doing so. For example, there are societal resilience benefits associated with EE, DG, and DS investments that allow hospitals, fire stations, police stations and other public service institutions to continue to operate when power is lost. It is important that there is transparency in how and where those benefits are captured to avoid double counted of societal impacts and host customer impacts.[24]
- **Importance of symmetry in addressing host customer impacts**. As Table 15 illustrates, there are a large number of potential host customer impacts associated with investments in DERs. NSPM guidance states that these impacts need to be considered in their totality, rather than selecting

[24] Enhanced resilience of customers that provide important community services is an economic benefit to be considered in a UBCA, rather than an equity benefit, because those public institutions serve all customers rather than just low income or other targeted groups. However, a separate assessment of distributional equity – conducted in parallel with benefit-cost analysis – could assess the extent to which deployment of DERs that enhance resilience is targeted to hospitals, fire stations, police stations located in economically disadvantaged areas or other areas of concern.

and including only a portion of them in a BCA. That guidance is rooted in the fundamental economic principle that treatment of costs and benefits in BCAs needs to be symmetrical. That is, if a category of costs is included, all of the related benefits also need to be included (and vice versa) in order to produce an analysis that is not biased. In particular, it is highly problematic to include all host customer costs (just because they may be easy to estimate) and not include all host customer benefits (because some or many of them may be difficult to estimate).[25]

- **Federal tax incentives**. The NSPM suggests that decisions on whether to treat federal tax incentives and/or rebates as host customer benefits, rather than as transfer payments, is a regulatory decision that should be based on state policy interests. Note that if federal incentives for DERs are to be treated as transfer payments rather than as host customer benefits, then that approach must also be used throughout the BCA. That could become very challenging because the energy sector is rife with examples of federal incentives (e.g., oil and gas production incentives; tax credits for wind, solar and other forms of generation; federal subsidization of insurance for nuclear power plants, etc.) whose effects would have to be removed when estimating avoided energy costs and other utility system impacts. Chapter VII addresses this question in more detail.
- **Economic development and job impacts will need to be addressed outside of benefit-cost calculations of net present value and benefit-cost ratios**. The impacts that DER investments have on the economy and jobs are largely a function of both DER installation costs and the benefits that those installed DERs can provide in reducing utility system costs. Thus, it is difficult if not impossible to monetarily disentangle economic development and job impacts from impacts that are already captured for the utility system and host customers. Put another way, economic development impacts (e.g., changes in gross domestic product) and job impacts are really a different form of "currency" than what is used in a BCA. Therefore, while there can be great value in quantifying such impacts for a state like Maryland for which economic development and job growth are important energy policy objectives, such analyses should be considered as separate form and complementary to the results from a benefit-cost test rather than included in such a test.
- **Effort should be made to monetize all relevant impacts, even those for which that is difficult; however, quantification without monetization or even qualitative summaries of impacts can used instead when monetization is not possible**. Monetization may not be possible for some impacts – or at least not initially possible because of the effort required to develop monetized assumptions or estimates. In such cases, impacts should at least be qualitatively documented and included along with the monetized results of other impacts when they are filed with regulators. Further discussion on methodologies for accounting for impacts can be addressed in

[25] If host customer impacts are to be included in a UBCA test, the full range of host customer costs and benefits would need to be addressed. This includes the full range of benefits that reflect the reasons why customers invest in specific DERs (whether EE, DR, DG, DS, EVs and/or BE). In the case of EE, the Maryland FPWG discussed and agreed to capture some key host customer benefits such as comfort via a proxy adder. A similar process will be needed to identify non-energy benefits and costs for other DERs, which will involve identifying the various possible, and often subjective, amenities that are important to host customers (e.g., increased resilience from DS and some EVs, both the benefit of avoiding visits to gas stations and the cost of "range anxiety" associated with EVs, pride in environmental contributions associated with owning a PV system, etc.)

future conversations in a potential Phase II process – as recommended in Chapter X, contingent upon the Commission's determination for such a process.

- **The impacts included in benefit-cost analyses should be "net impacts."** As discussed in Chapter II, one of the core economic principles of benefit-cost analyses (NSPM principle #5) is that analyses should be forward-looking, long-term and incremental to what would have occurred absent the DER. "Incremental to what would have occurred" means that the impacts included in benefit-cost analyses should be impacts that are net of impacts that would be (or would have been, for retrospective assessments of cost-effectiveness) experienced if a DER investment is not made. For example, if an electrification investment decreases GHG emissions from direct combustion of fossil fuels but increases GHG emissions from the electric grid, benefit-cost analyses should be based on the net effect of those two changes in emissions.

VI. Recommended Maryland UBCA Tests

1. Introduction

This report presents the UBCA Work Group recommendations for both a primary Maryland Uniform Benefit-Cost Analysis (UBCA) test for all DERs, and two secondary tests.[26] It also discusses the purpose of the primary test and the role each recommended secondary test could play in regulatory decision-making on DER investments.

2. Recommended Primary UBCA Test

As described in the NSPM, the purpose of a primary BCA test is to answer the question:

> *Does a DER investment reduce or increase costs, given a jurisdiction's policy objectives, and therefore does it merit utility investment?*

Table 16 summarizes the categories of impacts that the Work Group recommends be included in Maryland's UBCA to answer this question.

Table 16: Recommended Primary Maryland UBCA Test

Impact Category	Impact Sub-Category	Specific Impacts	Included in Test
Utility System	Electric or Gas	All	✓
Non-Utility System	Other Fuels	Gas Utility Impacts from Electric DERs	✓
		Electric Utility Impacts from Gas DERs	
		Other Fuel Impacts (Propane, Gas, etc.)	
	Host Customer	All	✓
	Societal	Greenhouse Gas Emissions	✓
		Other Environmental	✓
		Public Health	✓
		Resilience	✓
		Energy Security	✓

As discussed in Chapter V, Maryland's policy goals suggest that the primary MD-UBCA Test should include not only utility system impacts but also other fuel impacts, host customer impacts, as well as impacts associated with greenhouse gas emissions, other environmental emissions, public health, and resilience. There is also a case that can be made for including energy security. The recommended primary UBCA test includes all of these categories of impacts.

3. Recommended Secondary Tests

The Work Group recommends two secondary tests:

1. **Total Resource Cost (TRC) Test**. Consideration of the TRC is effectively mandated as a secondary test for efficiency programs by HB 864. Including it in the UBCA framework enables comparisons

[26] There were two Work Group members that disagreed with the Work Group's recommendation on the basis that the current BCA practice for EmPOWER programs includes host customer impacts.

across DERs. This secondary test would help the Commission understand the sensitivity of DER cost-effectiveness to the inclusion or exclusion of societal impacts.

2. **Utility Cost Test (UCT)**. This test includes only utility system impacts, providing a narrow perspective of the direct financial impacts of DER investments on utility system costs.

Table 17 summarizes the categories of impacts that would be included in each of the recommended secondary tests.

Table 17: Recommended Secondary Tests

Impact Category	Impact Sub-Category	Specific Impacts	Included in Test	
			Total Resource Cost Test	Utility Cost Test
Utility System	Electric or Gas	All	✓	✓
Non-Utility System	Other Fuels	Gas Utility Impacts from Electric DERs	✓	-
		Electric Utility Impacts from Gas DERs		-
		Other Fuel Impacts (Propane, Gas, etc.)		-
	Host Customer	All	✓	-
	Societal	Greenhouse Gas Emissions	-	-
		Other Environmental	-	-
		Public Health	-	-
		Resilience	-	-
		Energy Security	-	-

As discussed in the NSPM, there can sometimes be value in also considering the results of one or more secondary BCA tests, which can be used to:

- **Inform decisions regarding DER investments that marginally pass or fail the primary test**. Secondary tests can be a form of sensitivity analysis. This can be particularly important when there is less than 100% clarity regarding which categories of non-utility system impacts to include in the primary test. For example, if a DER investment failed Maryland's primary UBCA test with a benefit-cost ratio of 0.95 but passed the secondary TRC and/or UCT tests with a benefit-cost ratio of 1.5, the Commission could decide to support the investment and/or place more weight on factors other than cost-effectiveness (e.g., equity, jobs created, etc.) when deciding whether to approve the investment. The opposite might apply if the DER initiative passed Maryland's primary test with a benefit-cost ratio of 1.05 but failed the secondary TRC and/or UCT tests with a benefit-cost ratio of 0.5.
- **Informing decisions on how much utility support to provide to a DER program or initiative**. While the primary test should play a critically important role in determining *whether a DER program or initiative merits ratepayer investment*, other perspectives are often just as valuable to address the question of *how much ratepayer investment is appropriate*. For example, if there are over-riding equity concerns about using utility funds to address policy goals that extend well beyond the utility system, regulators could reject incentives for DERs that do not pass both the

primary UBCA test and achieve a specific UCT benefit-cost ratio.[27] Note that this potential value of the UCT only applies to DER investments that are designed to reduce utility system costs. The UCT has little value in considering electric utility investments in electrification because it only captures costs (increased electricity consumption) and does not include any benefits (reductions in consumption of other fuels and reductions in emissions). The UCT could also provide useful insights into the impacts of programs with high levels of free ridership.[28]

- **Informing prioritization of DER investments**. If Maryland is ever in a position where it cannot invest in all cost-effective DERs – whether due to funding limits, rate impact concerns, equity concerns, or other reasons – the Commission may need to make choices about which cost-effective DER programs or initiatives to support. Their relative cost-effectiveness under the primary UBCA test would be one factor in making such decisions, but not necessarily the only factor. Relative rankings under secondary tests could also be useful input into such decisions.

It should be noted that there are two other traditional "tests" sometimes referenced in other jurisdictions – the Ratepayer Impact Measure (RIM) test and Participant Test. Neither of these tests are recommended as secondary tests for Maryland's UBCA framework.

First, the RIM test is a test of rate impacts rather than of cost-effectiveness. Cost-effectiveness tests assess changes in costs. A core component of the RIM test is changes in revenue. Changes in revenue are different than changes in cost because rates (which drive revenue) are designed to recover past "sunk costs" and/or fixed costs as well as variable new costs. A core principle of cost-effectiveness analyses is that they should only be forward-looking, measuring changes in future costs. Sunk costs – or ways of recovering sunk costs – should never be included. They can obviously be part of rate impact assessments, but not cost-effectiveness analyses. Note that even as a test of rate impacts, the RIM test has serious limitations.

Second, while the Participant Test can provide information that is useful for designing DER programs (e.g., how large a rebate might be needed to attract a large number of participants), it is not a good tool for informing regulators as to whether a DER program or initiative merits investment. First, it values changes in energy costs based on retail rates rather than avoided costs. Because retail rates are designed to not only recover new variable costs but to recover past sunk costs and fixed costs, the Participant Test does not answer the question the key regulatory question of whether total costs are increasing or decreasing. Moreover, the Participant Test only tells us whether *the average participant* would see their costs increase or decrease. It does not make sense for regulators to reject a program that may be very attractive to a minority of customers, as long as it is not harming customers as a whole. Ultimately, if a customer decides to participate in a DER program, that customer views the program as cost-effective.[29]

[27] This could be a UCT ratio of 1.0 – meaning that utility system benefits exceed utility system costs. However, it could also be a lower ratio reflecting a willingness to spend have utility system costs exceed utility system benefits – e.g., in order to realize other non-utility system benefits such as substantial greenhouse gas emission reductions – but only to a certain point (e.g., given the magnitude of other benefits, a Commission might be willing to accept a UCT of 0.7 but not 0.1)

[28] Under the UCT, rebates or other financial incentives paid to free riders are treated as costs. In contrast, in tests that include host customer impacts, such as the other recommended secondary test, rebates to free riders are considered transfer payments (a cost to the utility system offset by a benefit to the customer) rather than costs.

[29] At least as long as the customer is not misled or misinformed when making the investment.

Thus, while the Participant Test can provide some insight into how many customers are likely to participate,[30] it does not provide information on whether the program has inherent economic merit.

More information on these other traditional tests can be found in Appendix A and Appendix E of the NSPM for DERs and Appendix A of the NSPM for EE.

4. Periodic Reconsideration of UBCA Tests

As discussed in the UBCA Work Group meetings and throughout this report, the categories of non-utility system impacts that should be included in a state's primary UBCA test should be a function of the state's energy policy goals. Energy policy goals can change over time. Indeed, as the discussion in chapters III and V of this report documents, they changed even during the course of this Work Group's 9-month engagement. Thus, there is value in periodically revisiting – perhaps every four or five years (or more often when necessitated by any major changes in policy) – the UBCA tests that the PSC adopts.

[30] This insight is imperfect, both because of the range of conditions of different individual customers and because it is very challenging to quantify non-energy benefits that often influence customer decisions to invest in DERs.

VII. Other Important Issues for a UBCA for All DERs

1. Introduction

The previous chapter summarizes recommendations regarding the categories of impacts that should be included in the Maryland UBCA. This chapter addresses three key additional questions regarding how the UBCA should be applied which should also be consistent across different types of DERs and the different approaches to promoting DER deployment:

- Discount rate;
- Geographic boundaries used to estimate magnitude of key impacts; and
- Level of aggregation of DER investments at which cost-effectiveness should be assessed – often referred to as "assessment level."

These additional topics were addressed by the UBCA Work Group both because they were identified by some Work Group members as important and because they were discrete enough to enable thorough discussion in the time available for the current Work Group process. Note that other topics also identified as important by both Work Group members and the Consultant Team – including methodologies for quantifying key impacts and approaches to addressing distributional equity – would require considerable time to address and were therefore deferred to a potential future Phase II of the Work Group process (see Chapter X on Next Steps).

2. Discount Rates

DER investments will typically affect costs over many years, often for decades. Thus, when assessing the cost-effectiveness of such investments, it is necessary to account for the time value of money. Generally speaking, a dollar of benefit in the future is considered less valuable than a dollar today. And the further one goes into the future, the less valuable the dollar becomes relative to a dollar today. This is not just because inflation erodes what a dollar can buy. Importantly, even if after inflationary effects are removed, individuals and society typically prefer benefits in the near term over benefits in the long-term. Discount rates are used to account for this reality, by discounting future streams of costs and benefits when computing the economic impact of an investment over the life of that investment.

The selection of the discount rate to be used in cost-effectiveness analyses is extremely important. As Figure 4 shows, the longer-lived the expected impacts of an investment are expected to be, the more important the choice of discount rate becomes.

Figure 4: Present Value (PV) of $10 of Benefits by Year

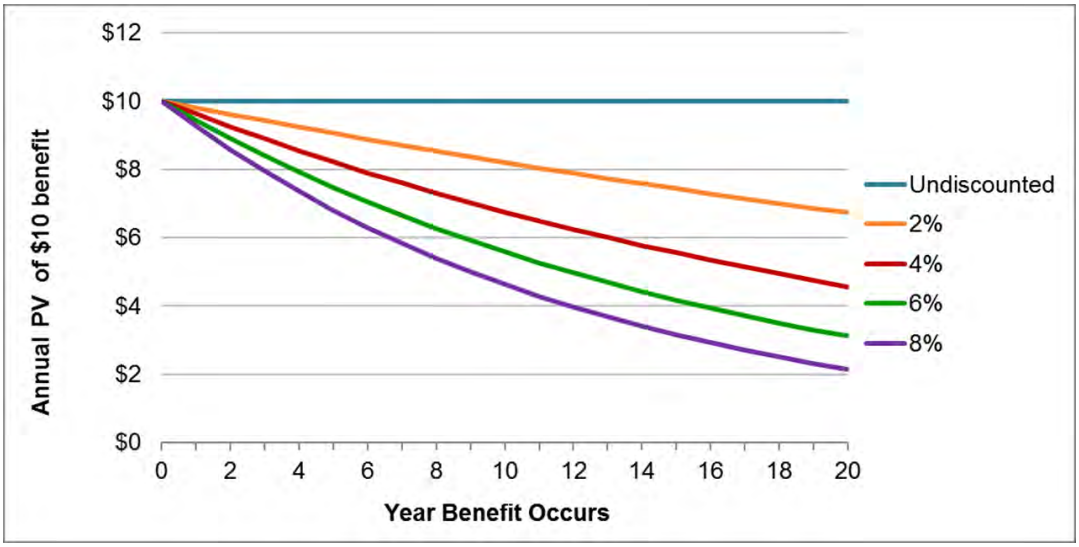

Table 18 presents a wide range of potential discount rates that can potentially be considered for cost-effectiveness analyses of utility ratepayer-funded DER investments. The variation is primarily a function of perspective. For example, societal perspectives reflect greater concern for inter-generational equity and are therefore lower than utility shareholder perspectives that underpin a utility's weighted average cost of capital.

A. Recommended Discount Rate for Maryland's Primary UBCA Test

The selection of a real discount rate for use in cost-effectiveness analyses should be a function of a jurisdiction's policies, or the regulator's perspective. The more those policies reflect a broader range of societal concerns, the stronger the argument for using a societal discount rate or something close to a societal discount rate. The more that the policies focus on primarily or exclusively utility system impacts, the stronger the case for a higher discount rate.

- **The Work Group recommends using a societal discount rate in the primary MD-UBCA test.**

As discussed in Chapter V of this report, Maryland's energy policy goals are very broad in terms of addressing societal goals, including a particularly strong concern with regards to addressing climate change – an inherent societal concern.

Table 18 below shows that real societal discount rates typically range from 0% (i.e., no discounting of future impacts) to 3%. Based on this information:

- **The Work Group recommends that Maryland use 2.0% as its real societal discount rate.** This is approximately equal to the current, long-term average real rate of return on 10-year U.S. Treasury bond yields.[31] It is also the rate currently being used in Maryland to assess cost-effectiveness of the EmPOWER programs.

[31] https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_real_yield_curve&field_tdr_date_value=2024.

Table 18: Examples of Real Discount Rates[32]

Type of Discount Rate	Potential Indicator of Time Preference	Typical Values	Notes and Sources
Societal	Societal cost of capital, adjusted to consider intergenerational equity or other societal values	<0% to 3%	In addition to low-risk financing, government agencies have a responsibility to consider intergenerational equity, which suggests a lower discount rate (US OMB 2023). Society's values regarding environmental impacts might warrant the use of a negative discount rate (Dasgupta, Maler, and Barrett 2000).
Low-Risk	Interest rate on 10-year U.S. Treasury Bonds	-1.0% to 3%	Over the past 20 years the real interest rate on 10-year U.S. Treasury Bonds ranged between roughly -1.0% and 3.0% percent (multpl.com).
Utility Customers on Average	Customers' opportunity cost of money	varies	Customers' opportunity costs can be represented by either the cost of borrowing or the opportunity costs of alternative investments (Pindyck and Rubinfeld 2001, 550). The real rate on long-term government debt may provide a fair approximation of a discount rates for private consumption (US OMB 2003).
Publicly Owned Utility	Publicly owned utility's cost of borrowing	3% to 5%	Publicly owned utility costs of capital are available from the Federal Energy Regulatory Commission Form 1, Securities Exchange Commission 10k reports, and utility annual reports.
Investor-Owned Utility	Investor-owned utility's weighted average cost of capital	3% to 7%	Investor-owned utility costs of capital are available from the Federal Energy Regulatory Commission Form 1, Securities Exchange Commission 10k reports, and utility Annual Reports.

Note that the social cost of carbon that is typically used to assign value to reductions in GHG emissions varies depending on how future climate change damages are discounted. For internal analytical consistency, this report recommends that the 2% real discount rate used in Maryland's primary UBCA test also be used generate values for the social cost of carbon used in the test. This is consistent with how the state's current utility-run efficiency programs and how their EV programs value reductions in GHG emissions.

B. Recommended Discount Rate for Maryland's Secondary BCA Tests

With respect to the secondary cost-effectiveness tests' discount rate, the Work Group recommends the following:

- **Secondary test #1 – Total Resource Cost (TRC) Test –** Use a 2% real societal discount rate. Using the same discount rate as in the primary UBCA test will allow for an "apples-to-apples" comparison that enables an understanding of the implications of removing societal impacts from cost-effectiveness assessments.
- **Secondary test #2 – Utility Cost Test –** Conduct sensitivity analyses using both a 2% real discount rate and a higher discount rate. Analysis using the same real discount rate as used in

[32] A "real" discount rate is used to represent the time value of money with inflationary impacts removed. It should only be applied to projected streams of future costs or benefits that also have inflationary impacts removed. A "nominal" discount rate adjusts for both the time value of money and inflationary impacts. It should be applied only to projected streams of future costs or benefits that have inflationary impacts included. A real discount rate can be converted to a nominal discount rate through use of the following formula: [(1 + Real Discount Rate) * (1 + Inflation Rate)] – 1. For example, if both the real discount rate and the expected inflation rate are 2.0%, the nominal discount rate would be (1.02 * 1.02) – 1.00 = 4.04%.

the primary UBCA test enables understanding of the portion of net benefits under the primary test that are coming from the utility system. This also enables consideration of equity issues in program design (e.g., if there is an interest in limiting the level of program support based on the magnitude of utility system benefits) while still applying a more societal perspective to what is cost-effective. Analyses using a higher real discount rate (e.g., a utility's weighted average cost of capital) provide a different perspective with respect to the time value of money.

C. Work Group Comments on the Recommended Discount Rates

There was a majority consensus from the Work Group on the discount rate recommendations above.[33] One member of the Work Group raised questions as to whether the UCT (a secondary test) should only be analyzed using the utilities' weighted average cost of capital (WACC), rather than both a 2% real rate and a higher rate like WACC as this report recommends. This participant argued that WACC is the discount rate traditionally used for the UCT, that because the UCT includes only utility system impacts it should be assessed with a utility discount rate, and that using anything other than WACC under the UCT would be problematic because WACC is the basis for how utilities amortize and recover costs from ratepayers.

While it is true that WACC has traditionally been used in the UCT, there is no compelling economic reason to do so. The point of a discount rate is to help regulators make decisions on what utility initiatives reduce costs and therefore (all other things being equal) merit investment. As such, *the discount rate should reflect regulators' time preference for money – or the value that regulators place on reducing costs for future ratepayers relative to reductions in costs for current ratepayers*. WACC is what it costs utilities to raise money given investors' perceptions of the riskiness of financing and expectations on profitability. This should not dictate how regulators decide to value future utility system costs and benefits – or to make tradeoffs between costs on future ratepayers and costs on current ratepayers. Consider the fact that different utilities have different WACCs. Regulators' level of concern about costs to ratepayers a decade from now should not be greater for one utility's customers (the one with lower WACC) than another utility's customers (the one with the higher WACC).

As explained in the NSPM, discount rates used to assess cost-effectiveness of DERs should be based on a jurisdiction's energy policies. The more those policies suggest a jurisdiction is interested in broad societal goals (e.g., addressing climate change), the more compelling the case for a societal discount rate. Once a policy-driven discount rate is established, there is no reason to use something higher just because a secondary test is focused on a small range of impacts (e.g., the UCT's focus on just utility system impacts) than the primary cost-effectiveness test addresses. Indeed, one could argue that it is economically irrational to use a societal discount rate for analyzing utility system impacts when they are part of a broad set of impacts assessed under the state's primary test but a different rate when utility

[33] In its comments on the draft report (March), one utility suggested that the commission should weigh in on the appropriate discount rate variations for DERs with different risk factors and programs operated by different entities. However, this was discussed in Work Group meeting #8 (April), with the Consultant Team (A) suggesting there is not a good economic rationale for changing discount rates based on which entity is running a program, (B) noting that differences in risk can be accounted for in the UBCA test itself, and (C) recommending not changing the draft report recommendation to use a 2% real discount rate for assessing all DER initiatives. That recommendation was not contested in the meeting. Nor did the utility or any other party raise any disagreement in feedback on the meeting notes which documented the Work Group discussion of the issue in meeting #8.

system impacts are assessed in isolation. It can be reasonable to test how sensitive some impacts may be to different discount rates, as this report recommends for the UCT, but there is no economic rationale for always using the WACC when analyzing utility system impacts in isolation.

Finally, it is important to emphasize that the regulatory choice of a discount rate is different than the rate that is used to turn utility investments into revenue requirements for cost recovery. There is no reason that the two need to be the same because they are used for fundamentally different purposes.

3. Geographic Boundaries for Estimating Impacts

Some categories of impacts recommended for inclusion in Maryland's primary UBCA test and secondary tests – as well as economic development and job impacts recommended for complementary analyses (i.e., outside of, but parallel to benefit-cost analyses) – raise questions regarding what is the applicable "geographic boundary"[34] that should be used for estimating impacts. Five such categories were discussed by the Work Group:

- **Federal Tax Incentives or Rebates**. If a "state boundary" is used, then federal financial incentives are a benefit – because the benefit is realized by a utility or host customers within the state, whereas the cost is incurred by taxpayers who are almost entirely out of state. If a "global boundary" is used, federal incentives are a transfer payment and have no impact on cost-effectiveness – because the reduction in cost for a DER experienced by a utility or a host customer as a result of the federal incentive is offset by the cost incurred by taxpayers across the country. Note that this definitional issue is primarily a concern only for the proposed Maryland secondary test that includes host customer impacts, because most federal incentives for DERs are targeted to homes or businesses. However, they can potentially also apply to purchases made by utilities, including for DERs installed on the utility side of the meter (e.g., distributed solar generation).
- **Market Price Effects**. DER investments that increase or decrease electricity and/or natural gas consumption can have, albeit usually small, effects on wholesale market clearing prices for electric energy, electric generating capacity and/or gas commodity. Because Maryland is part of a multi-state regional electricity market (PJM) and because gas commodity markets are not state-specific, the impact of lowering or increasing market clearing prices will be larger if impacts on an entire multi-state region are considered than if the impacts on just Maryland are considered.
- **Greenhouse Gas Emissions (GHGs)**. Emissions of GHGs affect the global climate with resulting climate changes causing damage across the globe. Because Maryland is only a very small part of the world, the value of reducing (or increasing) GHG emissions through investment in DERs in Maryland will be much greater if the global damages are considered than if just damages in Maryland are considered.
- **Criteria Pollutant Emissions**. Because Maryland is part of a regional electric power pool, reductions or increases in electricity consumption in the state can affect the operation of electric generation both within and outside the state. Further, because of prevailing winds, even changes in the operation of electric generation within Maryland will affect the extent to which residents

[34] Geographic boundary refers to a physically defined area. For this application, geographic boundaries could include the State of Maryland, the mid-Atlantic region, the PJM region, the Eastern Interconnection grid, the country, or the world.

in other states are exposed to criteria pollutants such as particulates, nitrogen oxides (NOx) and sulfur dioxide. The burning of methane gas for home or business space heating, water heating and other end uses also results in emissions of criteria pollutants that can be blown into neighboring states. Thus, the magnitude of the estimated benefit of reductions (or cost of increases) in criteria pollutants as a result of DER investments in Maryland will be much smaller if only the effects on Maryland residents are considered than if broader regional effects are considered.

- **Job and Economic Development Impacts**. DER investments can increase jobs and economic activity associated with producing, delivering, and installing DER measures. Of course, such investments also reduce jobs and economic activity that are associated with alternative investments in energy supply that the DERs displace. If DER investments lower energy and other consumer costs, they can also indirectly create jobs by increasing customers' disposable income which is spent in restaurants, in local retail stores, etc.; the obverse is also true. The net effects of such changes in jobs and economic development will be different if the focus is just on impacts within the state, region, country, or the globe. The differences will be a function of a where DER products are produced, where alternative energy supply products are produced, where or by whom such products are sold, differences in labor- and capital-intensity of DERs and their traditional supply alternatives and a variety of other factors.

A. Recommended Geographic Boundaries

As with decisions on which categories of impacts to include in a state's primary cost-effectiveness test, decisions on what geographical boundary to use for estimate impacts should be a function of state policy objectives and priorities. With that in mind, the Work Group recommends the following with respect to the four categories of impacts discussed above:

- **Federal Tax/Rebate Incentives – Use a State Boundary.** There are three reasons for this recommendation. First, there is no state policy that mandates the use of a purely societal perspective on cost-effectiveness. Second, several Commission and other Maryland government statements make clear that there is a state policy interest in leveraging federal funds. This suggests the state is not indifferent between DER programs that cost less to ratepayers because of federal funds versus those that cost more to ratepayers because of the absence of federal funds. Third, if federal incentives for DERs are to be treated as transfer payments rather than benefits, that decision would need to be applied to all categories of impacts in the UBCA. It is important to recognize that the avoided electric energy, avoided electric capacity and avoided gas commodity costs typically used to value DERs are all affected by a wide range of federal incentives for oil and gas exploration; wind, solar and other generating capacity investments; insurance for nuclear facilities; etc. Such avoided costs would be higher if the effects of those federal policies are removed. Accounting for such effects is unlikely to be practical (in terms of application) and may not be desirable.
- **Market Price Effects – Use State Boundary.** There are two reasons for this recommendation. First, as noted above, there is no state policy that mandates the use of a purely societal perspective on cost-effectiveness. Second, it is assumed that when it comes to impacts that are purely about prices, the Commission is likely to care principally, if not solely about impacts to the residents and businesses within its jurisdiction.

- **Greenhouse Gas Emissions** – **Use Global Boundary.** There are two related reasons for this recommendation. First, it is unlikely that Maryland would have adopted GHG emission reduction requirements based solely on the benefits such reductions would have just within state borders. Second, it is recognized that the state has adopted GHG emission reduction requirements under a presumption (or at least hope) of reciprocity. That is, the state anticipates that all jurisdictions across the globe will or should work together to reduce global emissions and that its efforts to address its contribution to the "tragedy of the commons" problem will help leverage, encourage, or support the adoption of similar commitments in other places.
- **Criteria Pollutant Emissions – Use Regional Boundary.** There are three reasons for this recommendation. First, most, if not all, criteria pollutants spread across regions, unconcerned with state borders. Second, unlike pure financial impacts, a policy interest in reducing environmental pollutants is often inherently more of an expression of "societal" concern than just a parochial "state" concern. Third, though perhaps less compelling than for GHGs, there is a potential argument that there is some expectation of reciprocity in addressing emissions of criteria pollutants through DER investments, at least within the PJM power pool with Maryland shares with other states.
- **Jobs and Economic Development** – Use State Boundary. State policies that express interest in jobs and economic development are almost always focused solely on impacts within state borders. That is clearly the case with references in the priority policies considered by the Work Group. For example, the Climate Solutions Now Act references achieving greenhouse gas emissions reductions "…in a manner that promotes new 'green' jobs and protects existing jobs and the State's economic well-being." (emphasis added). Similarly, PC44 Transforming Maryland's Electric Grid states that "…electric service should be reliable, cost-effective and environmentally sustainable for numerous reasons, including the growth of Maryland's economy…" (emphasis added)

Table 19 summarizes these geographic boundary recommendations.

Table 19: Recommendations on Geographic Boundaries for Quantifying Key UBCA Impacts

Impact Type	Recommended Boundary
Federal Financial Incentives	State Boundary
Market Price Effects	State Boundary
Greenhouse Gas Emissions (GHGs)	Global Boundary
Criteria Pollutant Emissions	Regional Boundary
Jobs and Economic Development	State Boundary

4. Level of DER Aggregation to Use UBCA Tests for Regulatory Decisions

The cost-effectiveness of DERs can be measured at a variety of different levels of aggregation – what is sometimes called "assessment level". They include:

- **Measure-level**. This is the application of cost-effectiveness analysis to the average cost and savings across all utility customers for a particular technology or action that utility programs may promote. Examples could include the cost-effectiveness of utility rebates for residential Energy Star refrigerators, the cost-effectiveness of business rooftop PV rebates, and the cost-effectiveness of a free EV charging device offered in exchange for a commitment to allow managed charging.

- **Customer-level**. Also sometimes called "project-level," this is the application of cost-effectiveness analysis to a package of DERs that are offered to an individual customer. Examples might include the offer of financial incentives for the installation of a several different efficiency measures, the offer of rebates for the installation of rooftop PV panels, the offer of incentives for the installation of a battery for storage, or incentives offered for purchase or installation of a combination of these and/or other DERs. Note that this level of analysis is typically only possible for large business customers for whom the transaction costs of one-on-one interaction can be justified.
- **Program-level**.[35] This is the application of cost-effectiveness analysis to an entire program or initiative. This would include not only the cost of an individual measure, but also all non-measure costs such as marketing costs to promote the measure, costs of training trade allies, costs of administering the program or initiative, etc. Note that this covers programs that promote multiple different measures – e.g., rebates for Energy Star refrigerators, clothes washers, dryers, and other appliances – as well as single-measure programs such as incentives for a certain kind of battery or for participation in a residential air conditioner demand response offering. It can also include initiatives that do not involve customers at all because the DER investment is on the utility side of the meter, such as the purchase of portable batteries to deal with localized distribution system constraints.
- **Sector-level**. This is the application of cost-effectiveness analysis to a combination of programs that are targeted to a particular sector. An example would be a range of energy efficiency or demand response programs targeting businesses.
- **Portfolio-level**. This is the application of cost-effectiveness analysis to a combination of programs targeted to a range of different kinds of customers (e.g., residential and business). It might most commonly be applied today to a mix of programs promoting one particular type of DER – e.g., a portfolio of energy efficiency programs, a portfolio of demand response programs, a portfolio of storage programs, a portfolio of electric vehicle programs, etc. However, it can also mean portfolios of programs promoting multiple DERs. That might become increasingly common as the advantages of considering interactions between DERs becomes more apparent. Portfolio analyses would include not just the sum of all costs of all programs in the portfolio, but also any costs that are incurred at the portfolio level – e.g., for management of all DER initiatives, development of data tracking systems that used for multiple programs, general marketing for multiple DER programs, etc. – and therefore not allocated to any individual program.

The question of which level of aggregation of DER impacts should regulators use to determine if ratepayer investments are not cost-effective – i.e., the default level of aggregation that should be used to "screen out" investments (all other things being equal)[36] – is not straightforward.

On the one hand, the higher the level of aggregation, the greater the potential for supporting investments that do not make economic sense. For example, a portfolio benefit-cost ratio of 2.0 –

[35] As used here, the term "program" means an initiative (also a mechanism or an offering) that does not rely in a material way on synergies with other initiatives to effectively engage with the market and/or to drive investment in one or more DERs. While multiple initiatives can be combined and assessed together, there are merits to separately assessing cost-effectiveness of individual initiatives that do not rely on others to drive DER investment.

[36] As discussed above, cost-effectiveness under the state's primary UBCA should be a critically important criterion for regulatory approval of DER investments. However, it should not be the only criterion. Equity concerns, rate impact concerns and/or other cost-effectiveness perspectives can also be important to consider in regulatory decisions.

suggesting the benefits are twice as large as the costs – could mask the fact that there are measures, projects or programs in the portfolio that are not cost-effective. Absent any potentially important interactions between such non-cost-effective investments and those that are very cost effective, the portfolio benefit-cost ratio and (more importantly) the portfolio's net economic benefits would be greater if the elements of the portfolio that are not cost-effective are removed from the portfolio. Screening at just the portfolio-level would not allow for that kind of improvement.

On the other hand, there can be important reasons for including some non-cost-effective DER investments in programs or portfolios of programs such as:

- There can be important interactions between different DER measures and/or programs. For example, a program that is promoting super-efficient residential new construction practices may include requirements for mechanical ventilation that go beyond state code requirements. As an individual measure, mechanical ventilation will generally not pass a benefit-cost test because it increases energy consumption. However, that increase may be necessary to maintain indoor air quality in a building made much tighter through potentially very cost-effective insulation and air leakage reduction measures. In other words, it is sometimes important to consider the combined effects of a package of DER measures.
- Another reason to support some investments in non-cost effective DERs is the potential role they can plan in helping utilities to develop relationships with customers that could enable the installation of many very cost-effective DER measures in the future. In other words, some non-cost-effective DERs in which some customers may be interested can be used as "loss-leaders." Regulators could require demonstration that every measure and every customer project is cost-effective, while allowing for exceptions if the reasons for the exceptions are carefully documented. However, in practice that very strict approach – because of both the transaction costs it imposes on utilities and the fact that utilities are typically very risk averse – could cause more harm (in constraining innovation in approaches to promoting DERs, and therefore reducing overall DER portfolio cost-effectiveness) than good (in precluding some investment in non-cost-effective DERs).

With the above considerations, the Work Group recommends the following regarding the level of aggregation at which the Maryland Commission should apply the UBCA to inform its decisions regarding which DER investments merit regulatory support:[37]

- **Do not apply cost-effectiveness screening at the measure level**. It would be appropriate to consider exceptions to this general rule when individual non-cost-effective measures constitute a substantial portion of the utility system cost of a DER program or initiative.
- **Do not apply cost-effectiveness screening at the individual customer or project level**. It would be appropriate to consider exceptions to this general rule for very large individual customer projects.
- **Apply cost-effectiveness screening at the program level**. This should be the default level for informing determinations of whether a proposed DER investment merits regulatory support

[37] Consistent with the discussion above, we use the term "inform regulatory decisions" because cost-effectiveness is typically only one of several factors that may be important for regulators to consider.

based solely on cost-effectiveness.[38] This default could be modified based on any of the following considerations:

- Equity**.** It may be appropriate to include programs that are not cost-effective to ensure that a wider range of customers can potentially benefit from DER investments. Programs targeted to low-income customers are an example of this. Many jurisdictions either do not require low-income programs to be cost-effective or apply a lower benefit-cost ratio requirement to them (e.g., 0.7 instead of 1.0).
- Market transformation[39]**.** For programs that are specifically focused on transforming DER markets, the Commission should retain some flexibility in how UBCA tests are applied. This flexibility recommendation is because market transformation programs tend to be designed for long-term, future benefits; benefits which can be difficult, at least during the early program stages, to quantify. For example, market transformation programs can be designed to grow demand for technologies that are currently expensive, perhaps because they are in very early stages of market availability, in order to accelerate development of economies of scale to drive down costs. Examples include some programs in the U.S. that promoted LED lighting and rooftop photovoltaics when they were first introduced and very expensive, with both technologies ultimately becoming much more cost-effective over time. It should be noted, though, that many DER programs can have some market-transforming effects. Thus, the target of this flexibility recommendation are those programs that are designed with market transformation as an objective.
- Enabling other cost-effective programs. Some programs that may not be cost-effective when considered on their own may be integral to the ability of one or more additional programs to engage with the market and cost-effectively drive investment in DERs. It can be problematic to judge the economic merits of such "enabling" programs in isolation. For example, if a program promoting smart thermostats was not cost-effective based solely on the energy savings that it provides, but it enables future enrollment by customers in a demand response program which is very cost-effective, it may be appropriate to support the smart-thermostat program as part of a portfolio of efficiency programs. A different example is the inclusion of a DER program that may not be cost-effective in isolation but may be necessary as part of a non-wires solution – in combination with other cost-effective DERs targeted to the same geographic area – to generate enough peak demand reduction to cost-effectively defer an electric substation upgrade. Yet another example would be a distributed storage incentive that would not be sufficient, by itself, to drive participation, but is designed to work in concert with other sources of potential revenue from other storage initiatives. In such cases, the enabling programs might need to be bundled together with the programs that they enable when conducting cost-effectiveness analyses for regulatory decision-making (and/or to assess cost-effectiveness at a higher level of aggregation, such as the sector or portfolio levels, rather than the program level).

[38] As previously noted, factors other than cost-effectiveness, including equity and rate impacts, can also inform regulatory decisions.

[39] Market Transformation in this context is defined as strategic interventions that attempt to cause lasting changes in the structure or function of a market, or the behavior of market participants, resulting in an increase in the adoption of DER products, services, or practices.

- Pilot programs. The principal purpose of pilot programs is often to learn something about a technology or an approach to a market. In that context, it is typically not important whether they are cost-effective or not. They are sometimes designed in a way that is intentionally less cost-effective than they actually are in order to learn more.
- Other policy objectives and/or statutory requirements. There may be other reasons the Commission may choose to approve a non-cost-effective program (or reject a cost-effective one). This report cannot anticipate all such reasons, so it is simply acknowledging that other reasons may arise.

The suggestion that regulators do not use the MD-UBCA Test to screen out individual DER measures or individual customer projects does not mean that cost-effectiveness analysis should not be conducted at those levels by program designers as there can be value in analyzing cost-effectiveness at those levels, both to inform the design of DER programs or initiatives and their implementation.

VIII. Applicability of MD-UBCA Test to Different Regulatory Contexts

In Case No. 9478, the PC44 Electric Vehicle Work Group Leader recommended the opening of a proceeding to develop a unified BCA across DERs, building on BCA practice. The PC44 EV WG Leader stated that: "The new BCA proceeding could also examine ways to utilize a broader BCA framework to address different questions before the Commission related to utility investment in or strategies for DER programs and distribution system planning." The Commission's notice to initiate Case No. 9674 to develop a proposed unified BCA framework for DERs in Maryland set forth a scope that includes "the role of a unified BCA in Commission proceedings."

This chapter addresses how the recommended primary MD-UBCA Test, and secondary tests, can be used or applied to different regulatory contexts, including DER programs, procurement, pricing strategies, planning, grid infrastructure investments, and prudency reviews. The NSPM guidance – particularly its core principles – can help to guide decisions in how BCA is applied to different contexts.

In its most common regulatory application, a BCA can be used to determine whether a particular DER program, project or portfolio is cost-effective. Under this 'traditional' application, the ultimate determination is a function of the cumulation of benefits and costs (i.e., impacts) where the benefit-cost ratio informs decisions on where a program/project is cost-effective or non-cost-effective.

BCA also applies to a range of other regulatory contexts. Table 20 summarizes this range – including the goal of the BCA, application examples, and the role of costs and benefits in the BCA for each context. These are each further described below.

1. Examples of BCA in Different Regulatory Contexts

Importantly, in all these different contexts, the application of the primary MD-UBCA Test is a way to assess cost-effectiveness that accounts for the utility system impacts but also considers the extent to which the investments help to meet Maryland's policy goals (e.g., GHG emission reductions, public health impacts). Use of secondary tests, such as the Utility Cost Test, informs different questions, such as whether a price paid for a resource is too high from the perspective of the utility. The Commission will need to determine how best to balance key objectives of meeting state policy goals (using the MD-UBCA), while also considering the cost to the utility, and the associated potential rate and bill impacts for customers, as well as other equity considerations.

Further, the applicability of the benefits and costs for any particular DER type and use-case within the regulatory context is going to vary, as there will be cases where certain MD-UBCA impacts don't apply or are not sufficiently material to include (see Chapters IV and V).

Table 20. BCA Application in Different Regulatory Contexts

Context	Application	Goal of BCA	Role of Costs & Benefits
Programs	EE, DR, DG, Storage, EV e.g., incentive or rebate programs	determine whether to implement the program	compare program benefits to costs
Procurement	DERs, NWAs, PPAs,	determine the ceiling price	ceiling price should equal the benefits of the procurement
Pricing	DER compensation	determine the value of service provided by the DER	value of DER is the sum of benefits
Planning	Optimize DERs	identify optimal DER portfolio	compare portfolio benefits to costs
	DP, IDP, IRP, IGP	identify preferred resource scenario	compare scenario benefits to costs
	GHG plans	achieve GHG goals at low cost	compare GHG plan benefits to costs
	State Energy Plans	identify resources to meet state goals	compare state plan benefits to costs
Infrastructure Investments	Grid Mod, AMI, EV infrastructure, etc.	determine whether to make the investment	compare investment benefits to investment costs
Prudence Reviews	Retrospective review	determine whether past utility decision was appropriate	compare benefits and costs using test in place at the time the decision was made
	Prospective review	determine whether proposed utility decision is appropriate	compare benefits and costs using test currently in place

Procurement

The MD-UBCA can be applied to set the ceiling price above which the procurement would not be cost-effective. One example might be the procurement of grid services through the control of aggregated smart inverters, or the competitive procurement of capacity value through demand response programs. All other things being equal, the ceiling price is like the maximum rebate level in the case of a DER program. That is, it marks the maximum outlay that the utility or program administrator can make and still realize net statewide benefits. As pointed out above, the use of the secondary utility cost test informs whether that ceiling price level is cost-effective from the utility perspective. Ideally, the solicitation will result in multiple competitive bids that are below the ceiling price; the lower the bid is, the more cost-effective the procurement will be.

Pricing

Applying the MD-UBCA to the pricing of DER services, such as DG compensation, is very similar to a value-stack analysis, where cumulating the sum of the benefits—or avoided costs—of a particular DER or combination of DERs informs the exercise of pricing the DER(s). The avoided costs are those identified in the MD-UBCA primary test.

Planning

The MD-UBCA framework can be used to add analytical rigor to planning exercises (e.g., distribution system planning), and to improve development and evaluation of alternative plan portfolios. The costs and benefits that are used to optimize portfolios of investments should be the same costs and benefits that are used in the primary test. Table 20 above provides four application examples: (1) Optimization of DERs within a plan, (2) Identification of a preferred resource scenario, (3) Maximization of GHG goals (or other benefit goals) at the lowest cost, and (4) Portfolio design to develop state energy plans in a cost-

effective manner that also meets state policy goals. In such applications, the MD-UBCA can help in evaluating scenario portfolios and prioritizing investments from within such portfolios.

Infrastructure Investments

As Maryland evaluates investments in grid modernization, vehicle charging, and other infrastructure opportunities, the MD-UBCA can be used not only to ensure that specific infrastructure investment plans are cost-effective and align with state policy goals, but also to inform prioritization of investments. As with traditional financial investment approaches, the BCA levelizes the streams of benefits and costs expected from the infrastructure investment and returns a cumulative net present value that informs the decision of whether to move ahead with the investment.

Prudency Reviews

The MD-UBCA framework can also be used to evaluate the performance of DER programs, portfolios, or applications *after they have been installed* and have realized a record of performance (i.e., a retrospective analysis). A BCA can also enable mid-course evaluations and course corrections. For example, if deployment incentives are securing program participation, but actual operations are not yielding planned outcomes, the BCA work done in the planning and program design stage can inform pursuit of alternative use cases for the DER. The results can not only inform whether to continue or modify a program or investment, but also provide insights on improving the BCA framework and its methodologies for future use. The costs and benefits that are used to evaluate infrastructure investments should be the same costs and benefits that are used in the primary test.

2. Applying the UBCA to Storage – Example using MESPWG Programs

Applying the MD-UBCA framework to the full range of regulatory contexts addressed herein involves two basic steps.

> **Step 1 – Confirm Purpose and Goal.** First, as suggested above, the evaluator should be careful to define why the program or effort is being evaluated and what questions the MD-UBCA Test is being used to inform. For example, an effort focused on setting a fair compensation rate for DG exports will focus on the benefits, net of costs, of the energy generated. Some impacts assessed under the MD-UBCA framework that don't relate to DG will not be applicable or material to the evaluation efforts. However, if the goal is to identify the optimal level of DG deployment in a distribution system plan, evaluation of other DERs as alternatives would be appropriate. This implies the second step—the identification of relevant impacts.
>
> **Step 2 – Identify Relevant Impacts.** Once the purpose and goal of the BCA exercise is clearly confirmed, the evaluator should reference the MD-UBCA tables of applicable impacts and determine the applicability of the benefits and costs for any particular DER type and use case within the context that is being evaluated, recognizing that certain MD-UBCA impacts will not apply or will not be sufficiently material to include in the analysis. See Tables 7-8 and Tables 14-15 in Chapters IV and V, respectively.

Example: The Maryland Energy Storage Program Workgroup (MESPWG) – As part of its ongoing engagement with other Commission-sponsored work groups, the MD-UBCA consulting team met with the MESPWG and the Maryland Distribution System Planning Work Group. The consulting team

explained the UBCA process and approach, and shared presentations on how a UBCA could be applied to the efforts of those working groups.

The UBCA Consulting Team used the MESPWG as an example in undertaking the first step in the process described above—the identification of purpose and goals for analysis of benefits and costs within the specific contexts that the MESPWG has developed.

As shown in Table 21, below, the UBCA Consultant Team provides the Storage Deployment & Operation Mechanisms and the Market Segments identified by the MESPWG in a simple matrix. The table was populated by the UBCA Consultant Team with possible purposes for which the MD-UBCA Test could be applied by the MESPWG, and where it might not.

For the upper left and lower right use cases (Behind the Meter (BTM) Procurement, and Front of the Meter (FTM) Transmission Deployment Incentives), the UBCA consultants characterized these use cases as 'unlikely' that a BCA (and the MD-UBCA specifically) would generally apply. That is, the Consultant Team found it unlikely that utilities would use traditional procurement processes to secure the deployment of behind the meter storage systems, though perhaps this could arise in the future through aggregation strategies. Likewise, the UBCA consultants thought it would be unlikely that utilities would use traditional incentives or rebates without operational conditions (except interconnection) to secure deployment of front-of-meter storage deployed at the transmission level of the grid.

Table 21. Applicability of BCA to Different Storage Mechanisms and Market Segments[40]

Market Segment	Storage Deployment & Operation Mechanisms		
	Procurement (Competitive Acquisition of Assets or Resources – Build or Buy)	**Grid Services Programs** (Pay for Performance to Compensate ES for Specific Grid Services – like Ancillary Services markets)	**Deployment Incentives** (Incentives or Rebates without Operational Conditions, except interconnection)
Behind the Meter (BTM)	Not likely utility does direct procurement, but possibly through aggregators (VPPs). • Set procurement requirements • Evaluate bids • Evaluate performance	• Set optimal pricing levels • Set quantity targets & performance criteria • Evaluate program effectiveness	• Set incentive/rebate levels • Set enrollment criteria • Evaluate performance and cost effectiveness
Front of the Meter (FTM) Distribution	Possibly as part of NWS initiatives, or identified in DSP • Set procurement requirements • Evaluate bids • Evaluate performance		• Set incentive/rebate levels • Set enrollment criteria • Evaluate performance and cost effectiveness
Front of the Meter (FTM) Transmission	Identified in IRP or DSP • Set procurement requirements • Evaluate bids • Evaluate performance		Not likely that utilities will use this mechanism in this market segment

[40] The term "program" is used in different ways in the DER industry and in this report. In Table 21, "program" is a label used by the MESPWG to describe the grid service offerings in the second column. The MESPWG and the Commission have referenced all the offerings listed in this table as the state's energy storage "program." In contrast, in Table 20, which describes different regulatory contexts in which DER investments could be considered, the term "program" refers to the kind of initiative that has been funded by utilities for decades to encourage customers to invest in energy efficiency or rooftop photovoltaics, typically in the form of rebates for the purchase of equipment. In contrast, what is called a "grid services program" in Table 21 is similar to the

The next step would be for that work group to transfer and cross-reference the MD-UBCA Test impacts to its identified Mechanisms and Markets categories. In taking this step, the impacts will need to be identified as either "applicable," "not material," or "not applicable" for each use case. This step allows for the tailoring of the MD-UBCA Test to the MESPWG program design and evaluation efforts.

"pricing" context described in Table 20. Finally, for the purpose of determining the level of aggregation at which regulators should consider cost-effectiveness results when making decisions on proposed DER investments (see Chapter VII, Section 4), each of the cells in Table 21 could be considered a "program" with the combination of these "programs" (i.e., the collection of initiatives or mechanisms or offerings) being a "portfolio" of programs.

IX. Summary Recommendations on BCA Tests and Application

The Work Group recommendations are summarized below, representing a large majority consensus of the Work Group members. Where applicable, non-consensus positions are described.

1. Primary Test (see Chapter VI): Use the primary **MD-UBCA Test**, which includes the full range of Utility System Impacts, Other Fuels, Host Customer and Societal Impacts that align with Maryland priority policies identified by the Work Group (GHG Emissions, Other Environmental, Public Health, Resilience and Energy Security impacts). This test helps to inform the Commission of the extent to which the state's priority policy goals can be met. Note that though economic development and job growth are important state policy goals, such impacts should not be mathematically included in a benefit-cost test, in part because they are driven by other impacts already included in the state's primary UBCA. Instead, they should be separately analyzed and considered in parallel with cost-effectiveness results (see also Chapter V. Section D).
2. Secondary Tests (see Chapter IV): Use two secondary tests:
    a. **Total Resource Cost Test (TRC):** This test includes utility system, other fuel, and host customer impacts.
    b. **Utility Cost Test (UCT):** This test includes only utility system impacts. It can be used to inform decisions on appropriate levels of ratepayer investment in some DERs and can provide valuable insight into the impacts of DER programs with high levels of free ridership. Note that the value of the UCT only applies to DER investments that are expected to *reduce* utility system costs; the UCT has little value for consideration of electrification initiatives because it includes costs of such initiatives (increased electricity consumption) but does not include any of the benefits from reducing *other* fuels and associated lower greenhouse gas emissions.
3. Applicability and Materiality of Impacts (see Chapter VI). For both the primary and secondary tests, the applicability and materiality of the impacts will depend upon the DER type and specific use cases. The guidance in this report can inform such considerations.
4. Discount Rates (see Chapter VII):
    a. The Work Group recommends using a 2.0% real societal discount rate for the primary MD-UBCA Test, both secondary tests, and for the social cost of carbon.
    b. For the Utility Cost Test (secondary test), in addition to using a 2% discount rate, a higher real discount rate should also be used for a sensitivity analysis.
5. Geographic Scope (see Chapter VII): the appropriate scope or boundaries for the BCA for certain key impacts is as follows:
    a. Federal financial incentives: State boundary
    b. Market Price Effects: State boundary
    c. Economic development and jobs: State boundary
    d. Criteria Air Pollutants: Regional boundary
    e. GHG Emissions: Global boundary
6. DER Aggregation Level in BCA (see Chapter VII): Conduct BCA at all levels to inform the design and implementation of DER initiatives. For the specific regulatory purpose of "screening out" DER investments as not cost-effective, apply the following guidance:

a. Apply screening at program level, subject to several considerations including equity, market transformation objectives, pilots, enabling of other cost-effective programs and other potential regulatory policy objectives.
b. Do not apply screening at the measure level.
c. Do not apply screening at the individual customer or project level.

7. Applicability of MD-UBCA Test to Different Regulatory Contexts (see Chapter VIII). The MD-UBCA Test can apply to a range of contexts, including incentive/rebate type programs, procurement, pricing, planning, infrastructure investments and prudence reviews. The benefits (value streams) and costs, and underlying methodologies used to estimate the impacts in these different regulatory contexts should be consistent to the extent applicable. The Commission will need to determine how best to balance key objectives of meeting state policy goals (using the MD-UBCA Test), while also considering the cost to the utility, and the associated potential rate and bill impacts for customers, as well as other equity considerations.

X. Next Steps and Phase II Recommendation

This report documents significant progress made by the Maryland UBCA Work Group between July of 2023 and April of 2024. It documents a set of recommendations for a primary Maryland UBCA test, two secondary tests, the applicability and materiality of a wide range of utility system and non-utility system impacts to different DERs, and several other important aspects of how to uniformly apply the Maryland UBCA framework to all DERs and across different regulatory contexts.

However, to ensure consistent and sufficiently accurate approaches to assessing cost-effectiveness of all DERs, the full range of utility system and non-utility system impacts to be included in the Maryland UBCA test need to be quantified. That additional work could be conducted through a future second phase of the UBCA Work Group process.

In addition, as discussed throughout the UBCA Work Group process, factors other than cost-effectiveness can be considered by regulators when making decisions on whether to approve investment of utility funds in a DER program or initiative. Other factors can include assessing rate impacts alongside cost-effectiveness, as well as conducting a distribution equity analyses to determine how DER impacts will accrue to underserved customers and communities. A second phase of the UBCA Work Group process could also explore how to develop and integrate such additional analyses with benefit-cost analyses to inform regulatory decisions on DER investments.

In summary, the Work Group recommends a Phase II process to support the implementation of primary and secondary tests recommended in this report, as well as to ensure the Commission's decision on the framework for utility investments in DERs can consider not only BCA results, but also rate and bill impacts, and economic development and equity impacts. Phase II topics could include:

1. Identifying appropriate **methodologies** for accounting for DER impacts (monetized or quantified assessments) to include in the UBCA[41];
2. Providing guidance on conducting **distributional equity analysis** alongside BCAs to inform how DER investments will impact priority populations/communities (e.g., underserved populations) relative to other customers[42];
3. Providing guidance on conducting a Maryland **economic development** (e.g., job) analysis that accounts for net job creation, including direct and potentially indirect jobs[43]; and
4. Providing guidance on conducting **rate and bill impact analyses** alongside BCAs to understand equity impacts across customer classes/sectors, including assessing not only the monetary impacts for the rate classes as a whole, but also how various rate designs impact customers with varying consumption rates and patterns.[44]

[41] Using resources such as Methods, Tools & Resources for Quantifying DER Impacts (NESP, 2022) – MTR Handbook, a companion document to the NSPM.

[42] The Commission could explore potential technical assistance resources from LBNL to assist the state in conducting a DEA using Distributional Equity Analysis for Energy Efficiency and Other DERs (US DOE, 2024).

[43] See MTR Handbook (NESP, 2022), Chapter 7.4 Macroeconomic Impacts.

[44] Methodologies can include building from experience gained in the EmPOWER Maryland program, the Electric Vehicle Benefit/Cost Analysis Methodology (PC44 EV-BCA Work Group in Case 9478) section on rate assessments, utility cost of service studies, and other resources.

For topic #1 (Methodologies for Quantifying Impacts), this could involve establishing a work group[45] with stakeholder representation across all DER types, whereby the work group could provide recommendations to the Commission in the following areas:

- Prioritization of which specific impacts to quantify in the near-term (because values already exist or can be relatively quickly assessed and quantified) or the long-term (because primary research or studies will be required), and
- Review and comment on the general scope of work, schedule, and process for quantifying the material and relevant priority UBCA impacts.
- Review and comment on the work products developed to quantify the DER BCA impacts.

For topics #2-4 above, prioritization of these analyses will likely require further consideration in terms of the scope and timeframe for each analysis, and the immediate and long-term needs for developing a robust decision-making framework for the Commission in its review and decisions on DER investments and strategies to meet Maryland's energy policy goals.

In closing, this Work Group report and its recommendations culminates over ten months of work involving eight UBCA Work Group meetings where input was gathered from many stakeholders and commission staff in the form of meeting discussions and polls, written comments on draft and final draft reports, and email exchanges. The Work Group, Consultant Team and Work Group leadership appreciates this opportunity to provide the recommendations herein for the Commission's consideration on a UBCA framework for Maryland and steps going forward to support its implementation.

[45] This work group could be coordinated across Maryland's different Commission initiative work groups, including the UBCA Work Group, the Storage Energy Program Work Group, the DSP Work Group, the EmPOWER Maryland Evaluation Advisory Group, and any other relevant work groups.

Appendix A: Full List of Applicable Maryland Energy Policies

MARYLAND PRIORITY POLICIES [Submitted as a priority by 2 or more parties]			
Policy	**Type**	**Parties Indicating Policy is a *Priority***	**Relevance to DER type**
Climate Solutions Now Act of 2022 (Chapter 38 / SB 528)	Statute	PSC Technical Staff, OPC, Exelon Utilities, Columbia Gas	All DERs
EmPOWER Maryland Energy Efficiency Act of 2008 (Public Utilities §7-211)	Statute	PSC Technical Staff, Exelon Utilities, Columbia Gas, WGL	principally EE and DR (also EV pilot)
Maryland's Climate Pollution Reduction Plan, Maryland Department of Environment, Dec. 2023	State Plan	General Work group agreement to include at Meeting #6; replaces GGRA Plan	All DERs
***2030 Greenhouse Gas Reduction Act (GGRA) Plan**, Maryland Department of Environment, Feb. 2021 [Superceded by Climate Pollution Reduction Plan, December 2023]*	*State Plan*	*PSC Technical Staff, OPC*	*All DERs*
Transforming Maryland's Electric Grid, Maryland Public Service Commission Public Conference 44 (PC44)	MD PSC Order	PSC Technical Staff, OPC, Exelon Utilities, WGL	All DERs except EE
Energy Storage - Targets and Maryland Energy Storage Program - Establishment 2023 (Chapter 570 / HB 910; Public Utilities §7-216, §7-216.1)	Statute	PSC Technical Staff	DS
Energy Storage Pilot Project Act of 2019 (Chapter 427 / SB 573; Public Utilities §7-216)	Statute	WGL	
Building Energy Transition Plan, Maryland Commission on Climate Change, Nov. 2021	State Plan	Exelon Utilities, Potomac Edison, OPC	EE,DR,BE

REGULATORY IMPLEMENTATION OF POLICY			
Policy	**Order # (Date)**	**Parties Indicating Regulation is Applicable**	**Relevance to DER type**
EV BCA Framework	#238013 (1/12/22)	Exelon Utilities, Columbia Gas	EV
Benefits and Costs of Utility Scale and Behind the Meter Solar Resources in Maryland			PV
Energy Storage Working Group Metrics	#90454 (12/27/22)	OPC	DS
EmPOWER Future Program Working Group Report	#90261 (6/15/22)	PSC Technical Staff, OPC	EE, DR

ADDITIONAL PRIORITY MARYLAND POLICIES		
Policy	**Parties Indicating Policy is a *Priority***	**Relevance to DER type**
Energy Savings Goals for State Government – 2020 (Chapter 289 / HB 662)	Columbia Gas	EE, BE
MD Code, Public Utilities § 7-213	PSC Technical Staff	All DERs
GHG Emissions Reduction Act (GGRA) of 2016 (Chapter 11 / Senate Bill 323)	Columbia Gas	All DERs
MD PSC Order No. 87082 from 2015	Columbia Gas	EE, DR
Maryland Sustainable Buildings Act of 2023 (Chapter 586 / HB 6)	Exelon Utilities	EE, BE
MD Code, Environment § 1-701	Columbia Gas	All DERs
The Shirley Nathan-Pulliam Health Equity Act of 2021 (Chapter 750 / SB 52)	Columbia Gas	All DERs
2020 Annual Report of the Commission on Environmental Justice and Sustainable Communities (CEJSC)	WGL	All DERs

ADDITIONAL APPLICABLE MARYLAND POLICIES		
Policy	**Parties Indicating Policy is *Applicable* only**	**Relevance to DER type**
Electricity - Community Solar Energy Generating Syste	PSC Technical Staff, OPC	DG
Clean Energy Jobs Act of 2019 (Chapter 757 / SB 516)	PSC Technical Staff, Exelon Utilities, OPC	All DERs
Clean Transportation and Energy Act of 2023 (Chapte	PSC Technical Staff, OPC, Exelon Utilities (Maybe)	EV
Utility Regulation - Consideration of Climate and Labor (Chapter 614 / House Bill 298 of 2021)	PSC Technical Staff, OPC, WGL, Exelon U. (Maybe)	DG, All DERs
Task Force to Study Solar Incentives (CH545/SB469 20	OPC	DG
FERC Order No. 2222	PSC Technical Staff	All DERs

Appendix B: Maryland Policy Language Supporting Inclusion of Non-USIs

Policy	Other Fuels	Societal Impacts: Resilience	Societal Impacts: GhG Emissions	Societal Impacts: Other Environmental	Societal Impacts: Public Health	Societal Impacts: Economic Development/ Jobs	Societal Impacts: Energy Security	Host Customer Impacts: Host Customer (non-LMI)	Host Customer Impacts: Host Customer (LMI)
Foundational Guidance - Maryland Statute Public Utilities §2–113(a)		"(1) The Commission shall: (i) supervise and regulate the public service companies subject to the jurisdiction of the Commission to: ... 2. promote **adequate**, economical, and efficient **delivery of utility services...** (2) In supervising and regulating public service companies, the Commission shall consider: (i) **public safety**; ... (vii) the **protection of a public service company's infrastructure against cybersecurity threats.**	"(2) In supervising and regulating public service companies, the Commission shall consider: ... v. the preservation of environmental quality, including **protection of the global climate from continued short–term and long–term warming** based on the best available scientific information recognized by the Intergovernmental Panel on Climate Change; and vi. the achievement of the State's climate **commitments for reducing statewide greenhouse gas emissions...**"	"(2) In supervising and regulating public service companies, the Commission shall consider: ... iv. the **conservation of natural resources**; v. the **preservation of environmental quality**..."	"(2) In supervising and regulating public service companies, the Commission shall consider: (i) the **public safety;**"	"(2) In supervising and regulating public service companies, the Commission shall consider: ... (ii) the **economy of the State**; (iii) the **maintenance of fair and stable labor standards for affected workers;**"			
Section 1: MARYLAND'S PRIORITY POLICIES [Submitted as a priority by at least 2 parties]									
Climate Solutions Now Act of 2022 (Chapter 38 / SB 528)	***A, B, C*** *A: gec §10–855(e)(iii) (CSNA p. 10) "The Fund may not be used for a project to install equipment that uses fossil fuels or improve the efficiency of existing equipment that uses fossil fuels"* *B: gen §2–1206(5) (CSNA p. 31) "**Ensure that the plans do not decrease the likelihood of reliable and affordable electrical service and statewide fuel supplies;** "*	***B, C*** *B: gen §2–1206(5) (CSNA p. 31) **"Ensure that the plans do not decrease the likelihood of reliable and affordable electrical service and statewide fuel supplies;"*** *B: gpu §7–801 **"It is the goal of the State that the electric distribution system support, in a cost–effective manner, the State's policy goals with regard to: ... (4) achieving energy distribution resiliency, efficiency, and reliability.** "* *C: gen §2–1303.3 (CSNA p. 40) "[The Energy Resilience and Efficiency Working Group shall] Conduct a study of: ... supporting distributed renewable energy projects and energy storage with the **potential to supply electric energy to critical facilities during a widespread power outage;** "*	***A, B, C*** *A: gen §2–1204.1. (CSNA p. 28) **"The State shall reduce statewide greenhouse gas emissions by 60% from 2006 levels by 2031."*** *A: gen §2–1204.2 (CSNA p. 6-7) **"The State shall achieve net–zero statewide greenhouse gas emissions by 2045."*** *B: gpu §7–801 "It is the goal of the State that **the electric distribution system support, in a cost–effective manner, the State's policy goals with regard to: (1) greenhouse gas reduction;...** "* *B: gpu §7–802 (CSNA p. 77) "...that promote, **as specific goals, the following: (1) measures to decrease greenhouse gas emissions..."***	***B, C*** *B: ged §10–855 (CSNA p. 7-8) "There is a Climate Catalytic Capital Fund... [to leverage capital to] (6) optimize the economic, health, social, and **environmental value of community–scale infrastructure** for resilience and energy equity;"* *C(PV): gen §2–1303.4 (CSNA p. 44) " [The Solar Photovoltaic Systems Recovery, Reuse, and Recycling Working Group shall] (6) Perform an impact assessment to examine the environmental impacts of various solar photovoltaic systems..."* *C(EV): gpu §7–217 (CSNA p. 76) "[For the electric school bus pilot, the IOU shall report on] (I)(2)(i) an evaluation of the environmental and health benefits of the pilot program;"*	***A, B, C*** *A: gen §2–1201. **"(8) It is necessary to protect the public health, economic well–being, and natural treasures of the State by reducing harmful air pollutants** such as greenhouse gas emissions by using practical solutions that are already at the State's disposal;"* *B: ged §10–855 (CSNA p. 7-8) "There is a Climate Catalytic Capital Fund... [to leverage capital to] (6) optimize the economic, **health,** social, and environmental value of community–scale infrastructure for resilience and energy equity;"* *C(EV): gpu §7–217 (CSNA p. 76) "[For the electric school bus pilot, the IOU shall report on] (I)(2)(i) an evaluation of the environmental and **health benefits** of the pilot program;"*	***A, B, C*** *A: gen §2–1201. (CSNA p. 28) **"(4)...achieving net–zero statewide greenhouse gas emissions by 2045 in a manner that promotes new "green" jobs, and protects existing jobs and the State's economic well–being;"*** *C: Lists jobs/econ throughout*	***A, C*** ***A:** gpu §7–801. "It is the goal of the State that the electric distribution system support, in a cost–effective manner, the State's policy goals with regard to: ... **(3) decreasing dependence on electricity imported from other states..."*** ***C: pg. 40 - (G)(2)(II)** Methods of **increasing the security of the electricity grid** by supporting distrubted renewable energy projects*	***C*** *C(EV): gpu §7–217 (CSNA p. 76) "[For the electric school bus pilot, the IOU shall report on] (I)(2)(ii) the financial costs and **benefits of implementing the pilot program to the participating school system** and the investor–owned utility,"*	*C* *[Same as non-LMI]*
MD Code, Public Utilities §7–211 EmPOWER Act			***A*** *A: gpu §7–211 (g)(2)(v) "For 2025 and thereafter, the core objective of the targeted reductions under this section shall include development and implementation of a portfolio of mutually reinforcing goals, including **greenhouse gas emissions reduction**, energy savings, net customer benefits, and reaching underserved customers."*	***A*** *A: gpu §7–211 (i)(1)(iv) "In determining whether a program or service encourages and promotes the efficient use and conservation of energy, **the Commission shall consider the: ... impact on the environment"***	***A*** *A: gpu 7-211 (i)(1)(i)(2C) includes societal nonenergy benefits, which is broad and could contain public health*	***A*** *A: gpu §7–211 (i)(1)(iii) "In determining whether a program or service encourages and promotes the efficient use and conservation of energy, **the Commission shall consider the: ... impact on jobs"***		***A*** *A: gpu §7–211 (g)(2)(v) **"... the core objective of the targeted reductions under this section shall include development and implementation of a portfolio of mutually reinforcing goals, including ...net customer benefits..."*** *A: gpu 7-211 (i)(1)"the Commission shall consider the: ...the total resource cost test... **including: ... participant nonenergy benefits"***	***A*** *[Same as non-LMI]*

Appendix B cont.

Policy	Other Fuels	Societal Impacts						Host Customer Impacts	
		Resilience	GHG Emissions	Other Environmental	Public Health	Economic Development/ Jobs	Energy Security	Host Customer (non-LMI)	Host Customer (LMI)
Maryland's Climate Pollution Reduction Plan (December 2023)	**A, C** *A: Recommends a Clean Heat Standard, which requires "helping [gas/oil] customers install heat pumps, and **replacing fossil fuels with lower-impact fuels**." p. 40* *C: "The majority of these savings are due to the **lower fueling costs of an EV as compared to a gasoline-powered vehicle.**" p. 71*	**C** *"While some of these same actions can support climate change adaptation and resilience, **this plan is not offered as a comprehensive strategy to make Maryland more resilient** to climate change impacts." p. 15* *C: "MEA deploys SEIF funds to... promote affordable, reliable, and clean energy...[while] increasing resiliency..." p. 23* *C: "enabling millions of low-income households to access affordable, resilient, and clean solar energy." p. 86*	**A, B, C** *A: "The Maryland Department of the Environment (MDE) is responsible for producing the plan to **achieve the state's GHG reduction goals** but achieving the goals will require a whole-of-government approach." p. 4 ... "This plan focuses on **how to reduce emissions**." p. 15* *B: "The new policies in this plan are modeled to **reduce statewide GHG emissions by 646 million metric tons** of carbon dioxide equivalent (MMTCO2e) between now and 2050. **The societal benefit of this level of emissions reduction** is estimated to be $135 billion based on estimates for the social cost of GHG emissions." p. 9* *C: Discussion of meeting CSNA GHG reduction goals through the report.*	**C** *C: "To achieve multiple benefits that advance equity, economic growth **and environmental regeneration.**" p. 61*	**B, C** *B: "This plan also **yields significant benefits for air quality and public health** through emissions reductions of co-pollutants. Overall, this plan delivers additional health benefits of $142 million to $321 million in 2031 compared to current policies." p. 66* *B, C: Section on State Public Health p. 66-70*	**A, C** *A: "Commerce has two primary areas of focus for **growing the energy industry sector and supporting the creation of jobs**" p. 75* *C: "New policies will generate up to... **a net gain of 27,400 jobs** between now and 2031 as compared with current policies." p. 4* *C: "MEA deploys SEIF funds... **creating jobs in growing industries**..." p. 23*	**C** *C: "MEA deploys SEIF funds... **promoting energy independence**." p. 23*	**C** *C: "Building energy codes have supported a wide array of environmental, energy, and health policy goals such as improvements in **indoor air quality**..." p. 35 [Indoor air quality being primarily a host-customer benefit]* *C: "This can translate to **economic benefits for the landowner** and the forest products industry in Maryland." p. 62* *C: Reference to Federal tax credits throughout, which are a form of host customer benefit.*	**B** *"MDE will schedule and conduct listening sessions with citizens in the community ... to address inequities and ensure **direct benefits to communities.** Direct citizen feedback from these sessions will help to identify priorities for Maryland's PCAP and inform methods for **how to assess community benefits.**" p. 94* *[Plus non-LMI benefits cited]*
2030 GGRA Plan (February 2021) [Superceded by Climate Pollution Reduction Plan of December 2023]	**A, B, C** *A: pgs. 45-46: "saves fuel...use electricity instead of gasoline or diesel.."* *B, C: p. 47 "[heat pumps] are **much more efficient than furnaces or boilers that burn natural gas, heating oil, or propane for heat**, and electricity is a lower carbon source for energy than those other fuels. The result is that homes heated by heat pumps are responsible for fewer GHG Emissions than those heated by fossil systems."*	**B, C** *B, C: **Chapter 7: Adaptation and Resiliency (p. 236-248)*** *B: p. 268: "adaptation in Maryland aims to enhance the resilience of natural and human-based systems"* *C: p. 60: "overarching equity components of adaptation include ... adapting in this sector to increase resilience."*	**A, B, C** *A: p. 260: **"the GGRA of 2016 requires that the state reduce emissions by 42.89 million metric tons of carbon dioxide equivalent (MMtCO2e) (40% of the state's gross GHG emissions in 2006) to achieve the 2030 goal."*** *B: p. 16: "the combined emissions reductions of all the programs in the 2030 GGRA plan will yield a total of 52.7 MMtCO2 in emissions reductions in 2030, compared to 2006."*	**A, B** *A: p. 153: "by 2030, t**he implementation goal of this program is to achieve the afforestation and/or reforestation of 68,530 acres in Maryland.**"* *B: p. 145: "once completed, the [Forestry Economic Strategy] plan will provide a roadmap for capitalizing on new opportunities in the forest industry, which will lead to environmental benefits as well as the creation of jobs and businesses in designated Opportunity Zones."*	**B** *B: p. 70: "MD has identified EJ as an ethical mandate and **seeks equal protection from environmental and public health hazards for all residents regardless of race, income, culture, and social class...** the State will utilize the CEJSC to identify additional opportunities to better incorporate those consideration into all state programs in this and future climate plans."*	**A** *A: p. 11: "the plan must...ensure a net increase in jobs and economic benefit, opportunities for new green jobs..."* *A: p. 212: "whereas, MDOT MPA, MEA, and MDE will collaborate on efforts to identify EE, alternative fuels, clean energy, and resiliency opportunities that benefit the state's clean energy, climate, and **economic development; and workforce goals.**"*	**C** *C: p. 54 (renewables): "recognizing the economic, environmental, fuel diversity, and **security benefits of renewable energy resources,** MD became one of the first states to adopt a RPS"* *C: p. 238 (EVs only): "when these [CAFÉ standards] are raised, automakers respond by creating a more fuel-efficient fleet, which improves our nation's energy security."*	**C** *C: p. 83: "those [initial steps to support heat pumps] include reforming the EmPOWER program to pursue... GHG reductions, energy savings, **net customer benefits,** and reaching underserved customers."*	**C** *[+ non-LMI policies]*

Appendix B cont.

Policy	Other Fuels	Societal Impacts						Host Customer Impacts	
		Resilience	GHG Emissions	Other Environmental	Public Health	Economic Development/ Jobs	Energy Security	Host Customer (non-LMI)	Host Customer (LMI)
PC44 Transforming Maryland's Electric Grid		***C*** *C: Order No. 90777 p. 8 "For each of the §7-802 policy goals, the Work Group should also provide an assessment of how well current utility DSP practices promote those policy goals ..." [These goals include **"(5) incorporation of energy storage technology as appropriate and prudent to: (i) support efficiency and reliability of the electric distribution system;... (7) electric distribution system resiliency and reliability,"]***	***C*** *C: Order No. 90777 p. 8 "For each of the §7-802 policy goals, the Work Group should also provide an assessment of how well current utility DSP practices promote those policy goals ..." [These goals include "**(1) measures to decrease greenhouse gas emissions incident to electric distribution**, including high levels of distributed energy resources and electric vehicles"]*	***B, C*** *B: PC 44 Notice 1/31/2017 p. 3: "Electric service should be reliable, cost-effective, **and environmentally sustainable** for numerous reasons, including the growth of Maryland's economy, and there should be a balance among these three objectives;"* *C (PV): PC 44 Notice 1/31/2017 p. 5 "[T]he study should include a Maryland-specific analysis of distributed solar's health and **environmental benefits**... (i.e. valuing the cost of lost open space, agricultural and ecological services,..)"* *C (EV): PC 44 Notice 1/31/2017 p. 7 "Widespread adoption of electric vehicles would reduce harmful health and **environmental effects**"*	***C*** *C (PV): PC 44 Notice 1/31/2017 p. 5 "[T]he study should include a Maryland-specific analysis of distributed solar's **health** and environmental benefits... (i.e. valuing the cost of lost open space, agricultural and ecological services,..)"* *C (EV): PC 44 Notice 1/31/2017 p. 7 "Widespread adoption of electric vehicles would **reduce harmful health** and environmental effects"*	***B*** *B: PC 44 Notice 1/31/2017 p. 3: "Electric service should be reliable, cost-effective, and environmentally sustainable for numerous reasons, **including the growth of Maryland's economy,** and there should be a balance among these three objectives;"*			
Energy Storage - Targets and Maryland Energy Storage Program - Establishment 2023 (Chapter 570 / HB 910) Energy Storage Pilot Project Act of 2019 (Chapter 427 / SB 573)		***A, B, C*** *B: HB 910 Preamble: "WHEREAS, Energy storage systems provide benefits... **bolstering grid reliability and resilience..."*** *A, C: gpu §7–216 "(e)(1)(v) **estimates of other societal benefits achieved by the project, such as incremental reliability and resiliency,** greenhouse gas emission reductions, and learning benefits;"*	***A, C*** *A, C: gpu §7–216 "(e)(1)(v) **estimates of other societal benefits achieved by the project, such as** incremental reliability and resiliency, **greenhouse gas emission reductions,** and learning benefits;"*	***C*** *C: Order No. 89240 8/23/2019 p. 5 "the Commission also directs that **project applications shall address the impact of each project on other State policy goals, including** environmental **and clean energy objectives** ...the Energy Storage Working Group is directed to develop and propose... metrics on **environmental** and clean energy objectives and impacts on the retail energy market for use in evaluating any project proposal."*		*B* *B: HB 910 Preamble: "WHEREAS, Energy storage systems provide benefits... **promoting economic development and job creation in Maryland communities..."***			
MCCC Building Energy Transition Plan (November 2021)	***A*** *A: "Direct the PSC to require the electric utilities to proactively encourage customers with gas, oil, or propane heating systems to replace or supplement those systems with electric heat pumps, especially for low-income households and consumers." p. 14*	***C*** *C: "The Roadmap is intended to: ... raise awareness of the benefits to deep decarbonization, such as: Resilience;" p. 32*	***A, B, C*** *A: "Require that the core objective of EmPOWER change from electricity reduction to a portfolio of mutually reinforcing goals, including GHG emissions reduction...Encourage beneficial electrification, which are strategies that provide ...societal benefits [including] reduced GHG emissions." p. 20* *A: "The General Assembly should require the Maryland Department of the Environment to develop a Building Emissions Standard that would guide commercial and multifamily residential buildings to net-zero emissions by 2040." p. 5* *B: "develop this Building Energy Transition Plan to serve as a roadmap for reaching net-zero emissions from residential and commercial buildings by 2045" p. 6* *C: GHG referenced throughout the document.*			***B*** *B: "The Roadmap is intended to:... Spur economic development and the creation of quality clean energy jobs;" p. 32*		***B, C*** *B: "Require that the core objective of EmPOWER change from electricity reduction to a portfolio of mutually reinforcing goals, including...net customer benefits, and reaching underserved customers." p. 20* *C: "The Roadmap is intended to: ... raise awareness of the benefits to deep decarbonization, such as: Energy savings; Health & safety, comfort, and productivity; Resilience;" p. 32*	***A, C*** *A: "Provide funding to enable ...comprehensive retrofits to 100 percent of low-income households by 2030. Holistic retrofits would...improve the health and safety of homes statewide." p. 20* *[+non-LMI policies]*

Appendix B cont.

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Section 2: Regulatory Implementation of Policy [These impacts and metrics were developed through bottom-up workgroup processes, in contrast to top-down policy direction; Comission decisions/direction approving the benefits analysis/frameworks are noted above].									
EV BCA Framework (Adopted via Letter order ML# 238013, 1/12/2022)	*p. 5 "EV drivers realize significant reductions in vehicle operating costs, both due to **the displacement of fuel-purchases"***		*p. 15 "21. Benefits From Reduced GHG Emissions: **The economic value of reduced net GHG emissions** , based on estimates for the **"societal cost of carbon"** , represented as a societal benefit. The changes in emissions should reflect both absolute changes in emissions intensity (mobile sources vs generation sources), but also changes in emissions associated with differences in asset dispatch."*	*p. 9 "3. ANRI (all): aggregate non-participating-ratepayer impact (ANRI) as induced by the utility program, including both monetized impacts (on utility bills) and important externalities (such as **avoided environmental harm** and improved public health). This assessment is provided for both each utility EV-program individually, and for the entire portfolio of programs in combination."*	*p. 15 "22. Public Health Value Of Reduced/Shifted Emissions: **The economic value of improved public health** associated with reduced net emission of criteria pollutants, combined with a shift inwhere those emissions take place (from the roadway to the power plant), represented as asocietal benefit. The changes in emissions should reflect both absolute changes in emissionsintensity (mobile sources vs generation sources), but also changes in emissions associatedwith differences in asset dispatch."* *p. 9 "3. ANRI (all): aggregate non-participating-ratepayer impact (ANRI) as induced by the utility program, including both monetized impacts (on utility bills) and important externalities (such as avoided environmental harm and **improved public health**). This assessment is provided for both each utility EV-program individually, and for the entire portfolio of programs in combination."*		*[Not included] p. 16 "Changes in Security: No quantifiable metrics for this objective in Maryland, and/or no established impact computation methods"*	*p. 15 "15. **Participant Impacts:*** *16. Incremental EV Purchase Cost: The difference in price between an EV and a non-EV that would have otherwise been purchased by the vehicle owner.* *17. EV Charger Costs: The full costs of buying, installing, and operating (i.e. data and network charges, maintenance) EV charging infrastructure. Any applicable utility charger incentives are not reflected in this factor (since that is a transfer). This factor is a cost under the MD EVIST and MW tests, and is not applicable under the ANRI assessments.* *18. Avoided Vehicle Fuel Costs: Savings that result from eliminating gasoline, diesel and/or other liquid fossil fuel purchases that are avoided by "fueling" an EV with electricity instead. This calculation is adjusted to reflect EV-owners paying "their fair share" toward Maryland state costs for infrastructure investment (i.e. Maryland fuel taxes).* *19. Savings From Decreased Vehicle Maintenance: The value of reduced maintenance costs, which is recognized by the EV owner as a benefit.* *20. Federal Tax Incentive (EV purchase): The value of any federal tax credit (or similar) incentive that may be due in support of an EV purchase, which is recognized by the EV owner as a benefit."*	*[Same as non-LMI]*
BENEFITS AND COSTS OF UTILITY SCALE AND BEHIND THE METER SOLAR RESOURCES IN MARYLAND			*p. 164 "The modeling quantified the potential **emission reductions of NOx, SO2 and CO2** throughout the PJM service area associated with solar development in the State of Maryland over the studyperiod (2019-2028)."*	*p. 163 **"Environmental Benefits: Value of reductions in air pollutant emissions; Water Benefits: Value of reduction in water use; Loss of Open Space and Agricultural Use: Impact of solar on agricultural, forested and vegetated lands"***	*p. 163 **"Health Benefits: Health and mortality benefits of reduced emissions"***	*p. 163 **"Macroeconomic Benefits: Benefits to Maryland's economy** from solar development"*			

Appendix B cont.

Policy	Other Fuels	Societal Impacts						Host Customer Impacts	
		Resilience	GhG Emissions	Other Environmental	Public Health	Economic Development/ Jobs	Energy Security	Host Customer (non-LMI)	Host Customer (LMI)
Energy Storage Working Group Metrics (adopted via Order No. 90454, 12/27/2022)	*[Missing citation]*	*PC 44 ENERGY STORAGE WORKING GROUP 12/31/2019 (Case No. 9619) p. 19 "8.* ***Resilience (Higher Value for Select Locations)*** *Energy storage can* ***support energy resilience*** *by reducing the recovery time frommajor outage events. There are a number of proposed methodologies for* ***quantifying resilience*** *value but there is not yet a single commonly accepted methodology given the* ***difficult nature of quantifying the specific value of improved resilience.*** *Nonetheless, this macroeconomic value is substantial to Maryland businesses and residents."*	*PC 44 ENERGY STORAGE WORKING GROUP 3/31/2021 (Case No. 9619) p. 4 "a.* ***Emissions Reductions Based on Marginal Unit Hourly Emissions*** *...This new marginal unit emissions data will providemuch more granular hourly CO2, NOx, and SO2 emissions rates by load node."* *PC 44 ENERGY STORAGE WORKING GROUP 12/31/2019 (Case No. 9619) p. 4"The Working Group recommends incorporating the* ***dollar value of the net tons of greenhouse gas emissions reductions*** *based on an assumption of 84 pounds per megawatthour (MWh) of load shifted from an on-peak hour to an off-peak hour."*	*PC 44 ENERGY STORAGE WORKING GROUP 3/31/2021 (Case No. 9619) p. 16 "the Working Group recommends that ...* ***land use impacts*** *will be quantified by demonstrating any avoided land use from the distribution deferral of the energy storage projects such as new right-of-way ("ROW") for distribution plant..."* *PC 44 ENERGY STORAGE WORKING GROUP 12/31/2019 (Case No. 9619) p. 13 "By increasing the efficiency of the electric system through the creation of stored inventory, energy storage can reduce the impact the State's electricity needs might otherwise have on* ***natural resources*** *, i.e., utilities might be able to avoid acquiring land, currently used for other purposes."*	*PC 44 ENERGY STORAGE WORKING GROUP 3/31/2021 (Case No. 9619) p. 9 "the EPA tool is currently being revised to be directly applicable to battery storage (the existing tool is built to* ***analyze public health benefits*** *of energy efficiency)."* *PC 44 ENERGY STORAGE WORKING GROUP 12/31/2019 (Case No. 9619) p. 5 "The Working Group* ***recommends measuring these public health benefits*** *using the* ***U.S. Environmental Protection Agency's (EPA) new public health quantification tool*** *...Public Health Benefits, at $1.30 for each MWh of load shifted from an on-peak hour to an off-peak hour in Maryland..."* *PC 44 ENERGY STORAGE WORKING GROUP 3/31/2021 (Case No. 9619) "...* ***quantifying the dollar value of the reduction in NOx emissions.*** *The Working Group recognizes that currently, EmPOWER uses a composite value for NOx combined with SO2 and particulate matter (PM) that could be used to approximate the change in NOx marginal emissions."*	*PC 44 ENERGY STORAGE WORKING GROUP 12/31/2019 (Case No. 9619) p. 17 "Energy storage carries the potential for* ***increasing economic productivity in Maryland.*** *The more stored inventory of electricity is available to the system, the more economic productivity is enabled by reducing shocks to the economy that result fromemergency events. Moreover, the energy storage industry provides an economic growthopportunity through increased demand for direct and indirect jobs in Maryland"*			
EmPOWER Future Program Working Group Report MJST (adopted via Order No. 90261, 6/15/2022)	*p. 52 "Work Group reached an agreement and recommends the Commission include* ***an adder of 10% of avoided energy to account for a range of costs and risks not otherwise included in the MJST."***	*[No citation provided by Work Group]*	*p. 49 "With respect to an* ***air emissions benefit*** *, the Work Group recommends using a benefit that corresponds to Mr. Loper's "option 17" (row 20) framework, including a 2% discount rate for the SCC..."*	*[No citation provided by Work Group]*	*p. 49 "With respect to an air emissions benefit, the Work Group recommends using a benefit that corresponds to Mr. Loper's "option 17" (row 20) framework, including a 2% discount rate for the SCC..." [Social cost of carbon (SCC) includes public health benefits per EPA COBRA inclusion of PM2.5, see https://www.epa.gov/cobra] [Includes health in the benefit]*	*[No citation provided by Work Group]*		*p. 51 "The Work Group recommends the Commission include a 10% health and safety adder be applied to the MJST as referenced above."* *Appendix D, #6 "An adder of 10% of avoided energy to account for a range of costs and risk" [includes host cost/risk]* *p. 52 "Other recommendations that were part of the agreement: to include federal tax credits as benefits in the primary MJST"*	*p. 52 "The joint recommendations also included a LI benefit of 20% of avoided energy for LI programs to account for non-comfort health and safety benefits as well as a general basket of non-specific economic benefits."*