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Subject:	Docket 23-44-REG --- SEA Schedule 12 - Revised (April 8)
Date:	Monday, April 8, 2024 2:16:02 PM
Attachments:	SEA Schedule 12 - Update to Benefit-Cost Analysis for MW Allocation Plan and Adders Revised APR 8 2024.pdf

Good afternoon, Ms. Massaro:

Please find attached for filing in Docket 23-44-REG, a revised/updated SEA Schedule 12. Thank you.

Al

Albert J. Vitali III
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Sustainable Energy Advantage, LLC

SEA Schedule 12: Updated Docket 4600 Benefit-Cost Analysis of Megawatt Allocation Plan and Incentive-Payment Adders

In RE: The Rhode Island Distributed Generation Board's Recommendations for the 2024-2026 Program Years (Rhode Island Public Utilities Commission Docket 23-44-REG)

March 15, 2024

Sustainable Energy Advantage, LLC

Guide to New SEA Exhibits

- **SEA Schedule 12** (this document) is a Sustainable Energy Advantage, LLC ("SEA") PowerPoint on the updated benefit-cost analysis ("BCA") of the 2024-2026 REG Program Megawatt Allocation Plan and Proposed Adders.
  - Updates to the BCA reflect the recent 2024 Avoided Energy Supply Costs in New England (AESC) analysis, and other relevant items for consideration by the Commission and parties.
  - The scope of the updated BCA includes the Board's original program filing in December 2023, as modified by the withdrawal of the Landfill incentive-payment adder initially proposed by the Board to cover the full cost of capping the landfill following the Board's February 26, 2024 vote.
- **SEA Schedule 13** is an updated and modified version of the BCA methodology matrix (originally as SEA Schedule 10 filed in December 2023) to reflect the changes in the revised BCA.
- **SEA Schedule 14** is an updated and modified version of SEA Schedule 11, which contains the benefit results for the Megawatt Allocation Plan and proposed incentive-payment adders for eligible Landfill and Brownfield projects.

Table of Contents

Methodology for Revised Benefit-Cost Analysis

Avoided Energy Supply Costs in New England (AESC) Analysis

Introduction and Selection of Counterfactual

Sustainable Energy Advantage, LLC

Introduction to the Avoided Energy Supply Costs in New England (AESC) Analysis

- The Avoided Energy Supply Costs in New England (AESC) analysis is conducted once every three years by a team led by Synapse Energy Economics
- The AESC is used to calculate the avoided costs and other benefits provided by various energy efficiency and distributed energy resources (DER) programs in New England.
- To derive avoided costs, the analysis utilizes a series of techniques to model outcomes in both the electric and gas systems in New England via scenarios known as "Counterfactuals"
    - Counterfactuals in the AESC analysis are used to create different baselines for benefit-cost analysis of different program types (e.g., energy efficiency, demand response, transportation/buildings electrification, distributed generation, and behind-the-meter energy storage) to estimate the avoided cost per unit of energy and system capacity associated with a given program's impact
    - These Counterfactuals are designed to represent a range of base cases for outcomes associated with the electric and gas system that assume the absence of deployment of new resources of various kinds
- Synapse provides the results (i.e., the detailed values for avoided costs and/or benefits) via a series of User Interfaces associated with each Counterfactual

AESC 2021 Counterfactual Utilized in Initial BCA (1)

- For the initial benefit-cost analysis (BCA) filed by OER and the DG Board in Docket 23-44-REG, SEA utilized the version of AESC 2021 released in May 2021.
- The Counterfactuals associated with the AESC 2021 analysis are shown at right.
- The BCA initially filed in 23-44-REG utilized a sensitivity of Counterfactual #2 known as the "All-In Climate Policy" sensitivity
- Unlike Counterfactual #1, which assumes no further energy efficiency or active demand management programs, the All-in Climate Policy sensitivity to Counterfactual #2 assumes further deployment of such measures, along with load growth associated with the electrification of transportation and buildings
- The All-In Climate Policy sensitivity to Counterfactual #2 further assumes that the energy supply in the ISO-NE control area will be 90% emission-free by 2035

AESC 2021 Counterfactual Utilized in Initial BCA (2)

DSM component included?	**Counterfactual #1** *AESC for EE, ADM and building electrification*	**Counterfactual #2** *AESC for building electrification only*	**Counterfactual #3** *AESC for EE only*	**Counterfactual #4** *AESC for EE and ADM only*
Energy Efficiency (EE)	*No*	Yes	*No*	*No*
Active Demand Management (ADM)	*No*	Yes	Yes	*No*
Building electrification	*No*	*No*	Yes	Yes
Transportation electrification	Yes	Yes	Yes	Yes
Distributed generation	Yes	Yes	Yes	Yes

Source: AESC 2021

AESC 2024 Counterfactual Selection (1)

- On February 7, 2024, Synapse released the AESC 2024 report and User Interfaces
- In recognition of the fact that there are a wider array of DER programs and load drivers than in the past, there are now six, rather than four, main Counterfactuals, along with two sensitivities. These Counterfactuals and sensitivities are shown on the next slide
- Unlike AESC 2021, AESC 2024 includes Counterfactual #5 (“All-In DERs”), which not only assumes further deployment of energy efficiency, demand response, and further electrification of transportation and buildings, but also assumes further deployment of distributed generation (DG)
- Counterfactual #5, similar to AESC 2021, also includes an “Increased Clean Electricity” sensitivity, akin to the “All-In Climate Policy”, that assumes region-wide adoption of an Increased Regional Clean Energy Policy (IRCEP) that achieves an energy supply of 90% emission-free resources by 2035

AESC 2024 Counterfactual Selection (2)

	Counterfactual #1 "AESC Classic": Avoided costs for EE, ADM, and building electrification	**Counterfactual #2** Avoided costs for building electrification only	**Counterfactual #3** Avoided costs for EE only	**Counterfactual #4** Avoided costs for DR and BTM Storage only	**Counterfactual #5** All-in DERs	**Counterfactual #6** Avoided costs for BTM Storage only: Programmatic *and* non-programmatic measures	**Sensitivity #1** High Gas Price *(sensitivity on Counterfactual #1)*	**Sensitivity #2** Increased Clean Electricity *(sensitivity on Counterfactual #5)*
Energy efficiency	*No*	Yes	*No*	Yes	Yes	Yes	*No*	Yes
Building electrification	*No*	*No*	Yes	Yes	Yes	Yes	*No*	Yes
Demand response	*No*	Yes	Yes	*No*	Yes	Yes	*No*	Yes
BTM storage	*No*	Yes	Yes	*No*	Yes	*No (Programmatic and non-programmatic)*	*No*	Yes
Transportation electrification	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distributed generation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likely to transition to winter peaking in study period?	*No*	*No*	Yes (likely transition by 2035)	Yes (likely transition by 2035)	Yes (likely transition by 2035)	Yes (likely transition by 2035)	*No*	Yes (likely transition by 2035)
RPS and other renewable policies	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7, plus an IRCEP policy described in Chapter 12

Source: AESC 2024

AESC 2024 Counterfactual Selection (3)

- Since Counterfactual #5 is inclusive of the impacts of all potential base case DERs in the ISO-NE control area, while also meeting current statutory renewable energy standards region-wide, SEA believes that it should be used as the Counterfactual for the instant BCA
- Though SEA believes it was reasonable (though not ideal) to adopt a 90% clean electricity by 2035 sensitivity as a base case when using AESC 2021, we believe that it is not appropriate to do so for Counterfactual #5 ("Increased Clean Electricity") for three main reasons:
  - Since 2021, there have been substantial delays in the development, solicitation, selection, permitting, interconnection, construction and commercial operation of clean electricity resources of all sizes region-wide. **This renders achievement of a region-wide 90% minimum threshold by 2035 implausible under any reasonable base case assumptions, even if a region-wide minimum clean energy requirement of that level of stringency were to be adopted in the next several years**
  - Although Rhode Island has adopted a 100% renewable energy standard by 2033, no other state in the ISO-NE control area has yet adopted a comparable standard on a similar timescale, nor is it likely to assume the region will enact such requirements soon, considering the delays discussed above
  - There is a wide band of further policy, regulatory and permitting uncertainty emanating from the federal level regarding the partisan composition of the next Congress, as well as which party controls the executive branch, which is, at present, modestly slowing the pace of clean energy resource development
- Therefore, **SEA's revised BCA utilizes AESC 2024's "All-In DER" Counterfactual #5, but <u>without</u> the 90% by 2035 "Increased Clean Electricity" sensitivity**

Revised Per-Benefit Methodology Matrix

Sustainable Energy Advantage, LLC

Revised Per-Benefit Methodology Matrix Reflecting AESC 2024 (1)

Benefit Category	Description of Benefit	Previous Detailed Methodology	Revised Detailed Methodology	Revised Source of Value
Avoided Energy	The valued of energy generated by modeled DG (offsetting the need to purchase energy from other generators in ISO-NE wholesale energy markets)	AESC 2021 values for 8,760 hours/year (adjusted to account for changes in natural gas forwards since 2021) applied to solar production profiles*	AESC 2024 values for 8,760 hours/year (without modifications to account for changes in natural gas forwards) applied to solar production profiles*	Avoided Energy Supply Components in New England: 2024 Report (AESC 2024)
Energy Demand Reduction-Induced Price Effects (DRIPE) Benefits	The assumed change in the ISO-NE wholesale energy prices resulting from additional supply from modeled DG	AESC energy price effects values over 8,760 hours/year applied to solar production profiles, plus assumption of decay over time due to lower prices increasing usage	No change, only updated to AESC 2024 values	AESC 2024
Energy Cross-DRIPE	The assumed change in natural gas prices (and, in turn, ISO-NE wholesale energy prices) resulting from reduced wholesale energy requirements	Same approach as Energy DRIPE, but utilizing cross-DRIPE values from AESC	No change, only updated to AESC 2024 values	AESC 2024
Avoided Capacity	The value of capacity from modeled DG in the ISO-NE Forward Capacity Market (FCM)	AESC capacity prices multiplied by estimates of solar coincidence factor from ISO-NE 2023 Capacity, Energy, Loads, and Transmission (CELT) Report with annual system peak hour through 2031 (and assumed flat thereafter)	AESC estimates of current capacity market through 2027, and summer and winter capacity prices thereafter, multiplied by estimates of solar coincidence factor from Analysis Group report on Marginal Reliability Impact approach to future FCAs	AESC 2024 and Analysis Group report
Capacity DRIPE	The assumed change in the price paid to resources assuming a capacity supply obligation (CSO) in the FCM resulting from the additional capacity bid by modeled DG	Same approach as Avoided Capacity plus assumption of decay over time due to lower prices increasing usage	AESC estimates of capacity DRIPE associated with current capacity market design through 2027, and summer and winter capacity DRIPE thereafter	AESC 2024
Avoided Transmission**	The avoided cost of new transmission assets and facilities resulting from modeled DG	Pool Transmission Facility (PTF) value from AESC multiplied by the ISO-NE CELT coincidence value	Summer and Winter Pool Transmission Facility (PTF) value from AESC multiplied by the ISO-NE CELT coincidence value	AESC 2024
Reliability Benefits	The value of improved reliability of the electric system resulting from increased capacity procured through the FCM, due to increased low-cost supply (rather than reduced demand alone) reducing clearing price	Value of lost load (VoLL) multiplied by reduced outage estimates derived from AESC	No change, only updated to AESC 2024 values	AESC 2024

***Energy prices are assumed to include avoided embedded greenhouse gas emission standard compliance costs.**
****Though SEA is confident said values exist on certain feeders, there are no quantified avoided distribution savings, since such values cannot be generalized to all projects**

Revised Per-Benefit Methodology Matrix Reflecting AESC 2024 (2)

Benefit Category	Description of Benefit	Previous Detailed Methodology	Revised Detailed Methodology	Revised Source of Value
Renewable Energy Credit (REC) Benefits	The value of RECs titled to (and resold by) Rhode Island Energy (RIE) at forecasted commodity REC values	Product of total system production and SEA-forecasted Rhode Island REC price values through 2040, and increased thereafter at 2%/year (long-term inflation rate)*	No change to methodology, only updated to reflect new SEA REC price forecast analysis at end of 2023	Sustainable Energy Advantage's New England Renewable Energy Market Outlook (REMO) 2023-3 analysis
Non-Embedded Greenhouse Gas (GHG) Reduction Benefits	Value, based on a social cost of carbon methodology, of reduced GHG emissions not already captured in energy prices, adjusted to reduce overlap for benefits captured in REC value	Price/short ton New England electric-sector marginal abatement value in RIE energy efficiency filings from 2021 AESC Supplement (as used by RIE in its energy efficiency plans)	No change to methodology, only updated to AESC 2024 values	AESC 2024
Non-Embedded Nitrogen Oxide Reduction (NOx) Benefits	Value of reduced NOx emissions not already captured in energy prices	AESC cost/short ton methodology (similar in form to Non-Embedded GHG approach)	Not included in AESC 2024 and thus omitted from the revised BCA	N/A
Macroeconomic Benefits	Economic impacts (e.g., jobs, spending) resulting from construction and operation of modeled DG projects	Upfront and annual direct and induced spending/MW resulting from construction/operation of REG projects	No change, but results provided include those with said benefits, and without said benefits, **pursuant to PUC 2-8**	National Renewable Energy Laboratory's Jobs and Economic Development Impact (JEDI) model
Ecosystem Services Benefits	The non-carbon value of ecosystem services associated with improved water supply, water quality, flood and storm damage mitigation, wildlife habitat and air pollution removal provided by conserved open space	Value per acre of benefits described at left, multiplied by typical acres/MW of solar PV projects (3.8 acres/MW)	No change to values or methodology	Delaware Valley Regional Planning Commission study

***NOTE: No REG systems assumed to be behind the meter, therefore all production assumed granted to RIE for resale**

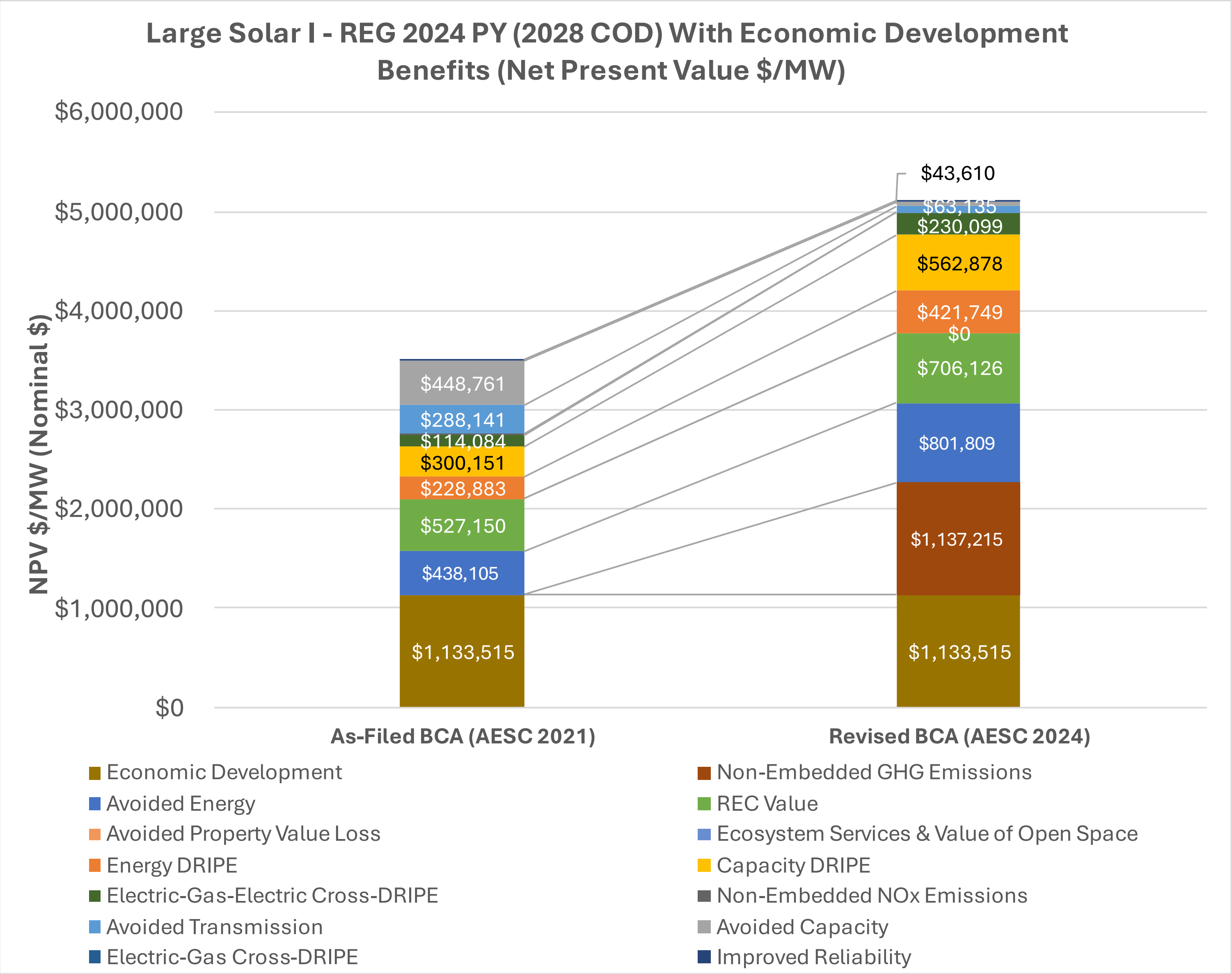
Sustainable Energy Advantage, LLC

Top Drivers of Revised BCA Results

Revised BCA Key Drivers (1)

- **Key Drivers of Decreases in Benefits for MW Allocation Plan Categories from Initial BCA**
  - As shown in an exemplar Large Solar I chart at right, and relative to AESC 2021, utilization of Counterfactual #5 from AESC 2024 results in substantially reduced avoided capacity and avoided transmission benefits
  - These changes stem from anticipated future changes to capacity markets, a shift to a winter-peaking system after 2035, and changes made by Synapse to their transmission cost estimation methodology
- **Key Drivers of Increases in Benefits from Initial BCA**
  - On the other hand, the same Large Solar I results show there were several other categories for which there were substantial increases in benefits, including Non-Embedded GHG Emission values, Avoided Energy, REC Value, Energy and Capacity DRIPE, and Energy Cross-DRIPE (both Electric-Gas and Electric-Gas-Electric)
  - The increases in these categories are driven by a wide array factors-that will be discussed in forthcoming slides in this section

Revised BCA Key Drivers (2)



Major Drivers of Increases in Benefits from Initial to Revised BCA

Sustainable Energy Advantage, LLC

Net Non-Embedded GHGs – Impact on Eligible Projects

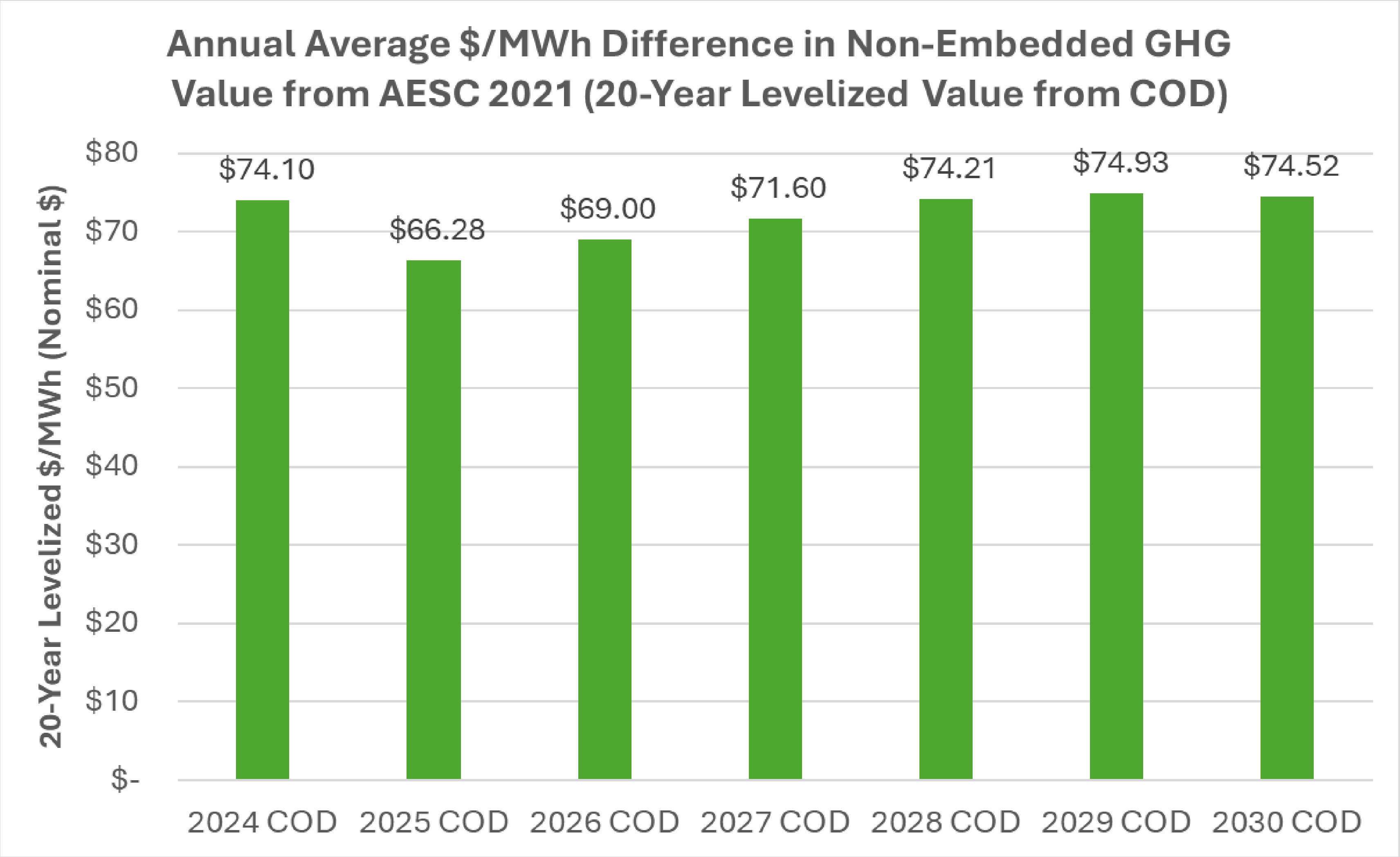
- **Impact on 2024 PY Projects:**
  - Relative to the initial BCA, the Non-Embedded GHG values resulted in an increase of **$0.96-1.14 million/MW** on an NPV basis (depending on the resource in question).
    - This increase was net of an increase in the REC value, which is deducted from the gross Non-Embedded GHG values found in AESC 2024
    - Given this netting, the initial BCA resulted in Non-Embedded GHG values at or close to zero in most cases
- **Impact on 2025 PY Projects:**
  - For 2025 PY projects, relative to the initial BCA, the Non-Embedded GHG values resulted in an increase of **$0.91-1.1 million/MW** on an NPV basis (depending on the resource in question).
- **Impact on 2026 PY Projects:**
  - For 2025 PY projects, relative to the initial BCA, the Non-Embedded GHG values resulted in an increase of **$0.86-1.1 million/MW** on an NPV basis (depending on the resource in question).

NOTE: SEA has not included percentage change impacts for this category for the revised BCA relative to the initial BCA, owing to the value in the initial BCA being at or near zero. As such, the percentage change metric (which results in an Excel "divide by zero" error) provides no value in understanding the magnitude or direction of the increase.

Non-Embedded GHGs – Key Drivers of Difference from Initial BCA (1)

- **Differences Between AESC 2021 and 2024 Results:**
  - Synapse ascribes most of the difference in non-embedded GHG values to an update to the EPA's estimate of the Social Cost of Carbon, as well as an increase in the cost of offshore wind, the main "marginal abatement" resource in New England.
- **Differences Between Renewable Energy Classes:**
  - As a benefit that varies based on production from a renewable energy system, GHG emission values are higher for higher-output projects such as Large Solar projects, and lower for lower output projects such as Small Solar.
  - However, the differences are relatively small on an NPV $/MW basis, given relatively small differences in assumed production as a proportion of their system size.
- **Relative Differences Over Time:**
  - AESC 2024 finds that grid emissions in ISO-NE are likely to drop substantially, even relative to AESC 2021, in part because in AESC 2024, these values are measured over a longer duration than in previous analyses.
  - However, the level of societal damage from each ton of GHG emissions still rises over time, resulting in a slight upward trend based on COD.

Non-Embedded GHGs – Key Drivers of Difference from Initial BCA (2)



REC Value – Impact on Eligible Projects/Drivers of Difference

- **Impact on 2024 PY Projects:**
  - Relative to the initial BCA, REC value increased between **8%-34% ($3k-$198k/MW)** on an NPV basis (depending on the resource in question).
- **Impact on 2025 PY Projects:**
  - For 2025 PY projects, relative to the initial BCA, REC value increases **12%-36%** (**$52k-$184k/MW)** on an NPV basis (depending on the resource in question).
- **Impact on 2026 PY Projects:**
  - For 2025 PY projects, relative to the initial BCA, the Non-Embedded GHG values resulted in an increase of **25%-36% ($99k-$178k/MW)** on an NPV basis (depending on the resource in question).
- **Differences Between Initial and Revised Results**
  - The difference in value is produced by an update to SEA's Renewable Energy Market Outlook (REMO) assumptions
  - A rise in prices has been driven by a variety of factors, which are detailed in SEA's 2023-3 REMO briefing.
  - Further details can be provided upon request, but under seal, given the competitively sensitive nature of the information

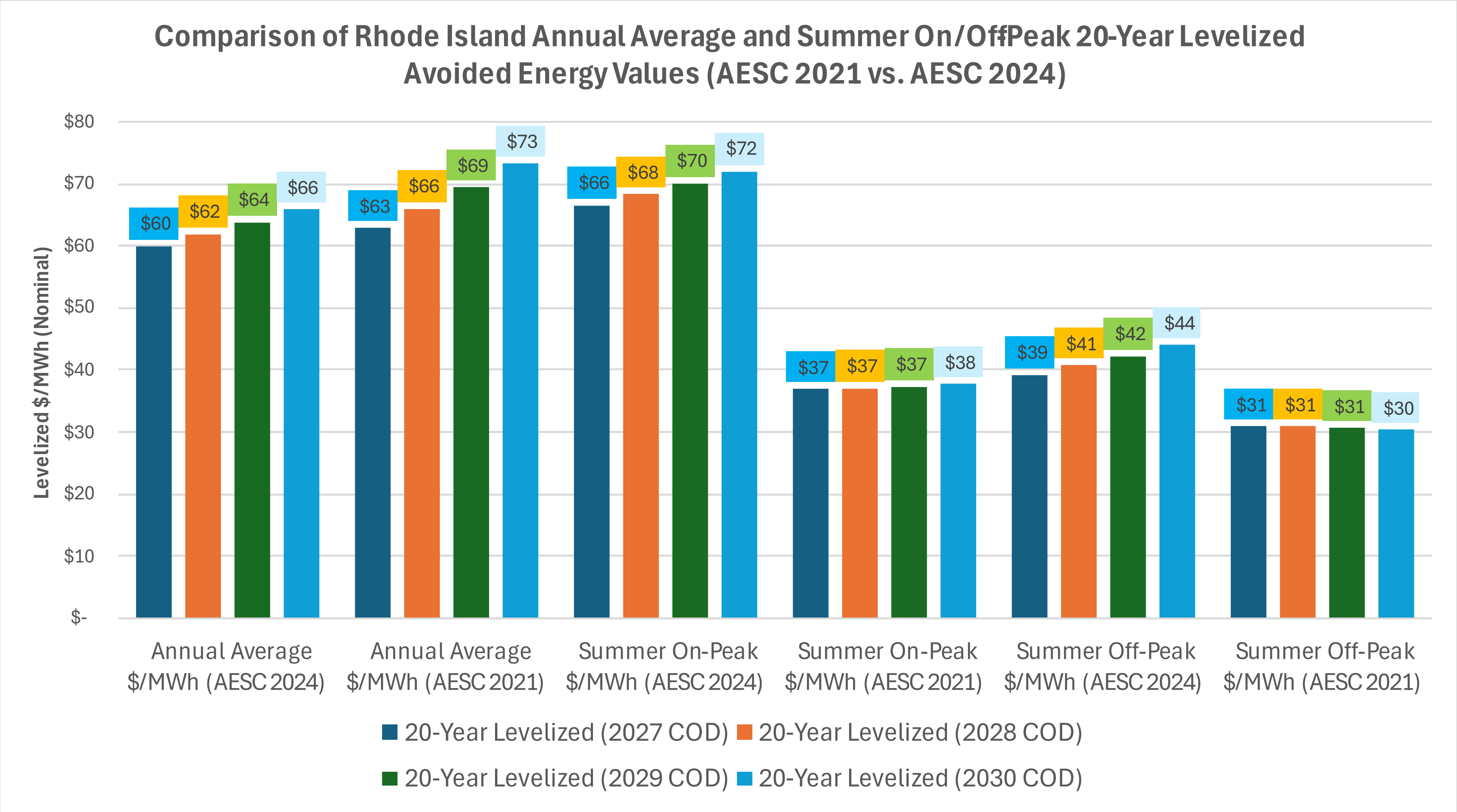
Avoided Energy – Impact on Eligible Projects

- **Impact on 2024 PY Projects:**
  - Relative to the initial BCA, the AESC 2024 avoided energy values results in a **53%-83% increase** in avoided energy benefits per MW (depending on the resource in question, equivalent to an increase of between **~$203k-$364k/MW** on an NPV basis.
- **Impact on 2025 PY Projects:**
  - The AESC 2024 values found, depending on the resource in question, a **62%-88% increase** relative to the same values for AESC 2021 in avoided energy benefits per MW, equivalent to an increase of **between ~$207k-$374k/MW** on an NPV basis.
- **Impact on 2026 PY Projects:**
  - For 2026 PY eligible projects, avoided energy benefits increase between **66%-92%** relative to AESC 2021 values, which results in a **~$198k-$381k/MW** increase on an NPV basis.
- ***NOTE:*** *The apparent discrepancy between a 66% relative increase and a smaller ~$198k absolute increase (both of which are the outcomes specific to Small Solar I projects) can be attributed to lower absolute energy values from AESC 2021 for projects reaching commercial operation in 2026, for which a smaller absolute increase has a larger relative impact, as compared to other resources.*

Avoided Energy – Key Drivers of Difference from Initial BCA (1)

- **Differences Between AESC 2021 and 2024 Results**
  - Relative to the AESC 2021 All-In Climate Policy sensitivity, Summer On- and Off-Peak energy values increased disproportionately relative to the revised annual average values for AESC 2024 Counterfactual #5.
  - This is the result of higher near and medium-term projections of natural gas prices and delayed CODs for clean energy projects.
- **Differences Between Renewable Energy Classes**
  - Absolute and relative increases in avoided energy values vary on a mainly linear basis with overall system production.
  - Therefore, smaller projects with lower assumed production (e.g. Small Solar projects) register a much smaller increase in avoided energy benefits than larger projects, which have substantially higher assumed output.
- **Relative Differences Over Time**
  - As shown in the charts on the following pages, levelized values for 2024-2030 COD projects vary only somewhat, in part because AESC 2024's short- to medium-term energy price outlook is higher (as a result of higher natural gas prices in the near term) relative to AESC 2021
  - These short-/medium-term rises have more contribution to the levelized values as a result of the time value of money.

Avoided Energy – Key Drivers of Difference from Initial BCA (2)



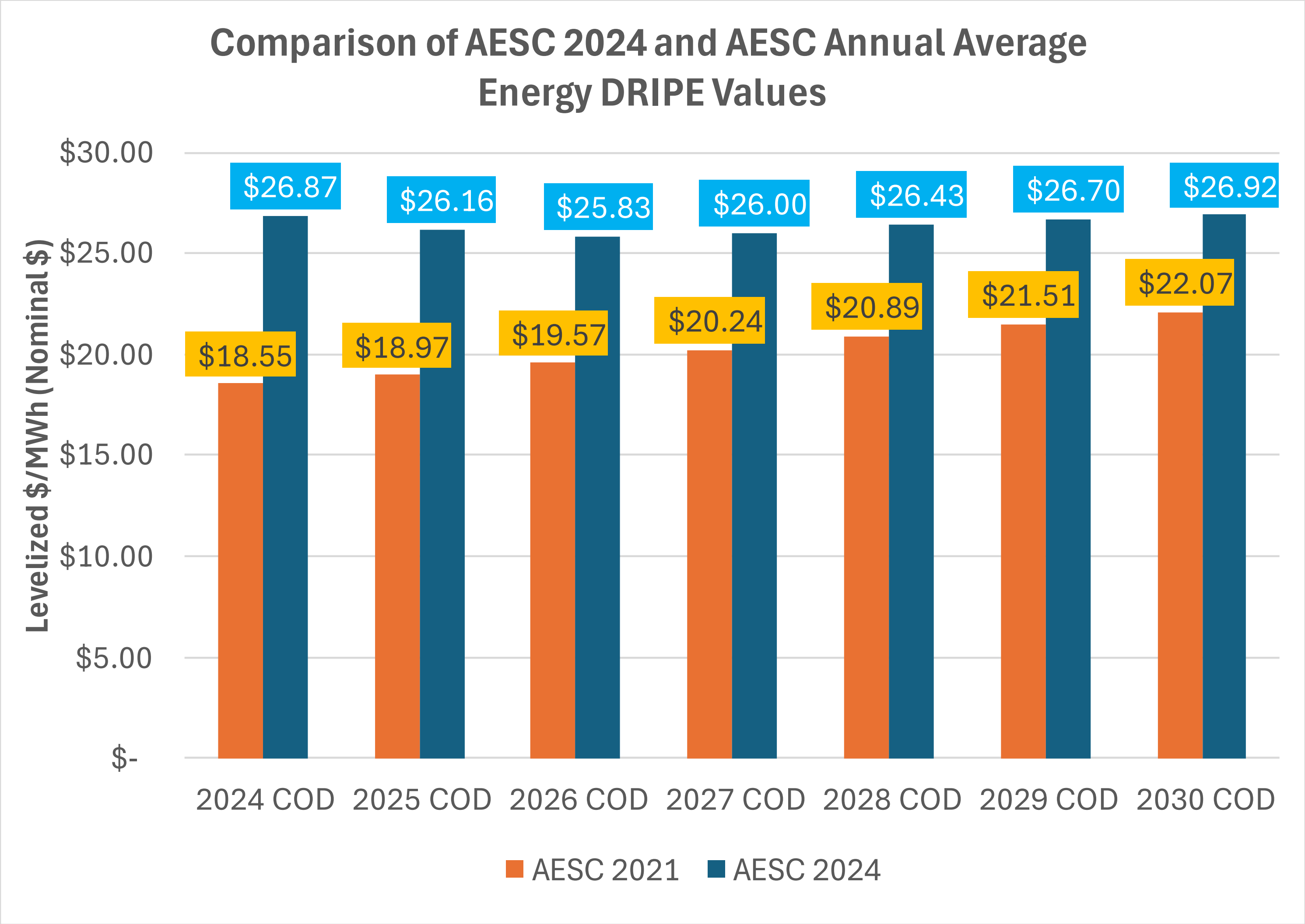
Energy DRIPE – Impact on Eligible Projects

- **Impact on 2024 PY Projects:**
  - Relative to the initial BCA, using AESC 2024 energy DRIPE values results in a **53%-83% increase** in intrastate and **74%-86% increase** in rest-of-pool benefits per MW (depending on the resource in question), equivalent to an increase of between **~$149k-$193k/MW** on an NPV basis.
- **Impact on 2025 PY Projects:**
  - Using AESC 2024 energy DRIPE values results in a **63%-80% increase** in intrastate and **81%-86% increase** in rest-of-pool benefits per MW (depending on the resource in question), equivalent to an increase of between **~$157k-$186k/MW** on an NPV basis.
- **Impact on 2026 PY Projects:**
  - Using AESC 2024 energy DRIPE values results in a **70%-83% increase** in intrastate and **72%-86% increase** in rest-of-pool benefits per MW (depending on the resource in question), equivalent to an increase of between **~$151k-$180k/MW** on an NPV basis.

Energy DRIPE – Key Drivers of Difference from Initial BCA (1)

- **Differences Between AESC 2021 and 2024 Results:**
  - According to Synapse, the differences in generic energy DRIPE values from the last analysis is minimal.
  - However, solar PV's greater coincidence with seasonal peak periods (for which energy prices rose substantially since the 2021 analysis) results in a more substantial move upwards in estimated value
- **Differences Between Renewable Energy Classes:**
  - Like non-embedded GHG value and avoided energy value, energy DRIPE value is closely tied to system production
  - Larger projects have a larger absolute $/MW values on an NPV basis, while smaller projects have smaller absolute $/MW values
- **Relative Differences Over Time:**
  - In its report, Synapse suggests that energy-related AESC 2024 values do not differ substantially over time because of the relative increase in energy prices in the near-/medium-term results in an expected relative decline over the longer term

Energy DRIPE – Key Drivers of Difference from Initial BCA (2)



Energy Cross DRIPE (Electric-Gas & Electric-Gas-Electric) – Impact on Eligible Projects

- **Electric-Gas Cross DRIPE**
  - For resources in the **2024 and 2025 program year** Electric-Gas Cross DRIPE benefits **decreased by roughly 25%** per MWh (for both intrastate and rest-of-pool benefits), equivalent to a decrease of ~$1k-$1.6k/MW on an NPV basis.
  - For resources in the **2026 program** year, the Electric-Gas Cross DRIPE **benefits decreased by 24%-28%** per MWh (for both intrastate and rest-of-pool benefits, depending on the resource in question)**,** equivalent to an increase of between ~$1k-$1.8k/MW on an NPV basis.
- **Electric-Gas-Electric Cross DRIPE**
  - For resources in the **2024 program year** Electric-Gas Cross DRIPE benefits **decreased by roughly 23%** per MWh for intrastate benefits and **increased by roughly 78%-85%** per MWh for rest-of-pool benefits (depending on the resource in question), equivalent to an increase of ~$92k-$116k/MW on an NPV basis.
  - For resources in the **2025 program year** Electric-Gas Cross DRIPE benefits **decreased by roughly 23%** per MWh for intrastate benefits and **increased by roughly 78%-90%** per MWh for rest-of-pool benefits (depending on the resource in question), equivalent to an increase of ~$92k-$120k/MW on an NPV basis.
  - For resources in the **2026 program year** Electric-Gas Cross DRIPE benefits **decreased by roughly 22%-25%** per MWh for intrastate benefits and **increased by roughly 78%-89%** per MWh for rest-of-pool benefits (depending on the resource in question), equivalent to an increase of ~$96k-$124k/MW on an NPV basis.

Energy Cross DRIPE (Electric-Gas & Electric-Gas-Electric) – Key Drivers of Difference from Initial BCA

- **Differences Between AESC 2021 and 2024 Results**
  - It not immediately unclear from Synapse's analysis why the values for electric-gas-electric DRIPE declined on a zonal basis for Rhode Island, but increased for the rest of ISO-NE
  - However, it is likely that a contributor to this difference is the result of differing marginal heat rates over time for in-zone resources relative to the rest of ISO-NE, as well as differing wholesale gas market conditions within the zone
- **Differences Between Renewable Energy Classes**
  - The values are, like the other energy-based values, directly related to system production
  - As a result, larger-scale resources with higher assumed production levels are expected to have higher benefits than those for smaller-scale resources
- **Relative Differences Over Time**
  - As stated above, it is not immediately clear why intra-zonal benefits have fallen relative to ISO-wide benefits, or why those persist over longer periods of time
  - However, we suspect that the stability of these benefits are linked to the fact that gas remains on the margin in ISO-NE for at least the remainder of the 2020s and 2030s, and because of the relative stabilization of energy values given a near-/medium-term rise and a long-term drop relative to AESC 2021

Major Drivers of Decreases in Benefits from Initial to Revised BCA

Sustainable Energy Advantage, LLC

Avoided Transmission – Impact on Eligible Projects

- Relative to the 2021 AESC study inputs, avoided transmission benefits decreased for all Program Years
- Specifics are as follows (with ranges provided depending on the specific resource in question):
  - **PY 2024:** Avoided transmission benefits **decreased by 52%-78%** per MWh, equivalent to a decrease of ~$127k-$225k/MW on an NPV basis.
  - **PY 2025:** Avoided transmission benefits **decreased by 56%-81%,** equivalent to a decrease of ~$133k-$230k/MW on an NPV basis.
  - **PY 2026:** Avoided transmission benefits **decreased by 61%-85%,** equivalent to a decrease of ~$140k-$235k/MW on an NPV basis.

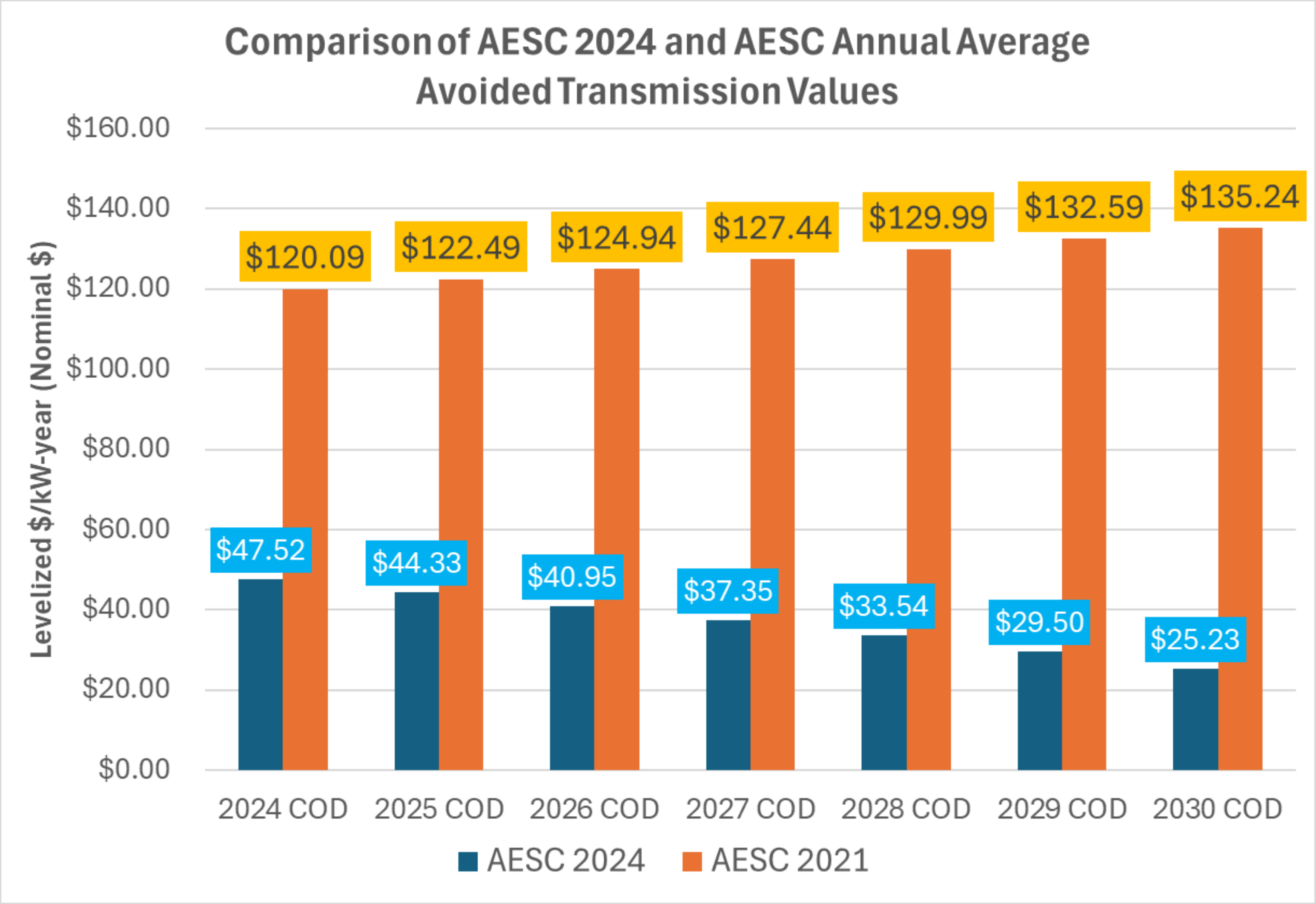
Avoided Transmission – Key Drivers of Difference from Initial BCA

- **Differences Between AESC 2021 and 2024 Results**
  - Overall, Synapse states that its estimate shifted downward because of a shift from a backward-looking to a forward-looking methodology
  - In the specific context of REG, this renders as a significant reduction for solar PV projects, since there is a 0% coincidence for solar PV not paired with energy storage during winter peak periods
- **Differences Between Renewable Energy Classes**
  - These values do not differ quite as substantially between renewable energy classes as energy-based benefits do
  - This is because REG projects are assumed to not serve behind the meter load, have more limited variation in their peak coincidence relative to variation in their production
- **Relative Differences Over Time**
  - With a shift to a winter-peaking system in the middle of the 2030s, projects reaching commercial operation closer to that time have more substantial avoided transmission value

Avoided Transmission – Key Drivers of Difference from Initial BCA (1)

- **Differences Between AESC 2021 and 2024 Results**
  - Overall, Synapse states that its estimate shifted downward because of a shift from a backward-looking to a forward-looking methodology
  - In the specific context of REG, this renders as a significant reduction for solar PV projects, since there is a 0% coincidence for solar PV not paired with energy storage during winter peak periods
- **Differences Between Renewable Energy Classes**
  - These values do not differ quite as substantially between renewable energy classes as energy-based benefits do
  - This is because REG projects are assumed to not serve behind the meter load, have more limited variation in their peak coincidence relative to variation in their production
- **Relative Differences Over Time**
  - With a shift to a winter-peaking system in the middle of the 2030s, projects reaching commercial operation closer to that time have more substantial avoided transmission value

Avoided Transmission – Key Drivers of Difference from Initial BCA (2)



Avoided Capacity – Impact on Eligible Projects

- Relative to the 2021 AESC study inputs, avoided capacity benefits decreased for all Program Years
- Specifics are as follows (with ranges provided depending on the specific resource in question):
  - **PY 2024:** Avoided capacity benefits **decreased by 66%-92%,** equivalent to a decrease of ~$149k-$372k/MW on an NPV basis.
  - **PY 2025:** Avoided capacity benefits **decreased by 79%-94%,** equivalent to a decrease of ~$223k-$369k/MW on an NPV basis.
  - **PY 2026:** Avoided capacity benefits **decreased by 82%-92%,** equivalent to a decrease of ~$232k-$400k/MW on an NPV basis.

Avoided Capacity – Drivers of Difference from Initial BCA

- **Differences Between AESC 2021 and 2024 Results**
  - In general, Synapse found increases in capacity prices relative to AESC 2021, resulting from a greater number of fossil plant retirements, higher load growth and the delay in construction and operation of new clean energy projects relative to expectations in 2020-2021.
  - However, in the context of REG, values are (as with avoided transmission) down for solar PV not paired with energy storage, given the likely shift towards a marginal reliability impact (MRI)-based capacity market, an increased emphasis on seasonal values, and a shift to a winter-peaking system in the mid-2030s.
- **Differences Between Renewable Energy Classes**
  - As with transmission, these values differ by only a relatively small amount across resource classes, rather than over time
  - This is a result of these values being based on peak coincidence, rather than production
- **Relative Differences Over Time**
  - Similar to transmission, these values differ substantially over time as the date by which ISO-NE shifts to being a winter-peaking system
  - Thus, the projects' capacity value is reduced over time with successive CODs for projects not paired with energy storage as the coincidence value in a winter peaking system is expected to approach zero

Categories With Major (But Mixed) Impacts Upon Revised BCA Benefits

Sustainable Energy Advantage, LLC

Capacity DRIPE – Impact on Eligible Projects

- Relative to the 2021 AESC study inputs, capacity DRIPE benefits decreased in some cases and increased in others
- Specifics are as follows (with ranges provided depending on the specific resource in question):
  - **PY 2024:** Capacity DRIPE benefits **increased by 123%-255%** for intrastate benefits and **changed by -19% to 75%** for rest-of-pool benefits**,** equivalent to a net increase of ~$3k-$264k/MW on an NPV basis.
  - **PY 2025:** Capacity DRIPE benefits **increased by 51%-420%** for intrastate benefits and **both increased and decreased by a range of -24% to 172%** for rest-of-pool benefits**,** equivalent to a net change of ~$-32k to $366k/MW on an NPV basis.
  - **PY 2026:** Capacity DRIPE benefits **increased by 26%-256%** for intrastate benefits and **both increased and decreased by a range of -44% to 75%** for rest-of-pool benefits**,** equivalent to a net increase of ~$-411k to $261k/MW on an NPV basis.

Capacity DRIPE – Key Drivers of Difference from Initial BCA

- **Differences Between AESC 2021 and 2024 Results**
  - Overall, the increases in capacity DRIPE (when there are increases) relative to AESC 2021 appear (according to Synapse) to largely stem from higher avoided capacity values stemming from higher capacity costs (the reasons for which are described above)
  - These values appear to be increased in most cases (though not all) for most resources, given increased capacity prices, even as avoided capacity value for non-storage-paired solar PV is likely to decline as the switch to a winter-peaking system approaches
- **Differences Between Renewable Energy Classes**
  - Though there appears to be relatively little relationship or linkage between system scale and level of capacity DRIPE benefits once a system is larger than 25 kW, capacity DRIPE values appear to be somewhat lower for Small Solar projects
  - SEA suspects this is related to the differing peak coincidence for smaller resources
- **Relative Differences Over Time**
  - Capacity DRIPE values can shift very rapidly from lower to higher values (often from the hundreds of dollars per kW to thousands from one year to the next), which leads to different resources getting very different values over time.
  - Thus (and despite the fact our team was unable to share a levelization chart as for other resources) there appears from our BCA model to be limited patterns in terms of changes in benefits consistently over time, with projects with CODs in certain years having lower or higher benefits than others that came either before or after them

Sustainable Energy Advantage, LLC

Results of Revised BCA for Recommended 2024–2026 REG Program Plan

Revised BCA Results

Recommended REG 2024-2026 PY Megawatt Allocation Plan (With and Without Economic Development Benefits)

Sustainable Energy Advantage, LLC

Comparison of Initial and Revised Megawatt Allocation Plan BCA Results

With Docket 4600 Economic Development (Econ. Dev.) Benefits

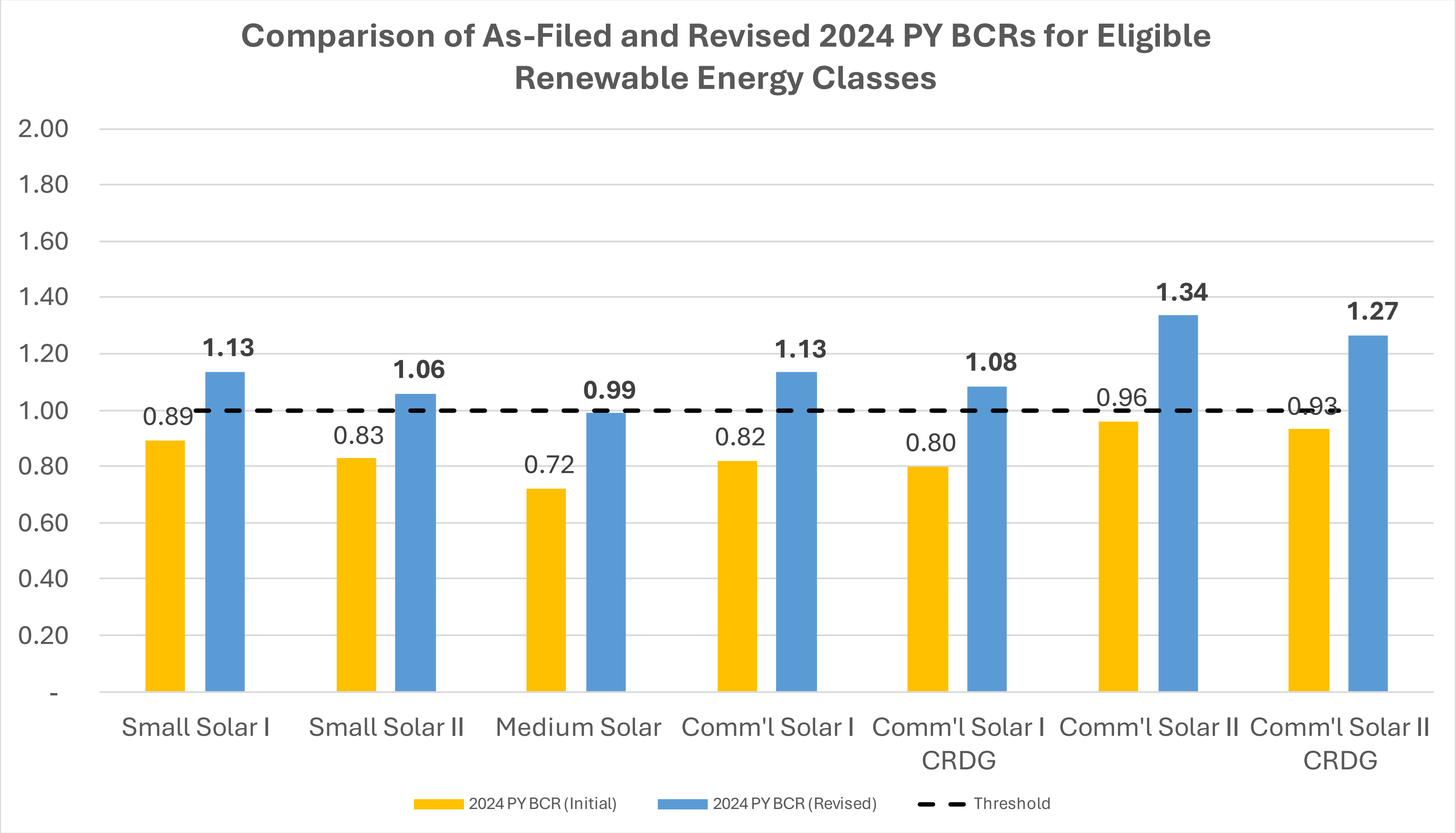
Program Year	2024		2025		2026		2024-2026 Total	
BCA	*Initial*	*Revised*	*Initial*	*Revised*	*Initial*	*Revised*	*Initial*	*Revised*
Capacity-Weighted BCR per MW Allocated REG Capacity (≤=1 MW)	0.88	**1.17~~1.18~~**	0.91	**1.23~~1.25~~**	0.94	**1.28~~1.30~~**	0.91	**1.23~~1.25~~**
Capacity-Weighted BCR per MW Allocated REG Capacity (>1 MW)	1.23	**1.82~~1.81~~**	1.40	**1.96**	1.64	**1.96**	1.47	**1.92**
Capacity-Weighted BCR per MW Allocated REG Capacity (All)	1.11	**1.61**	1.11	**1.74**	1.13	**1.78~~1.79~~**	1.31	**1.72~~1.73~~**

Without Docket 4600 Econ. Dev. Benefits

Program Year	2024		2025		2026		2024-2026 Total	
BCA	*Initial*	*Revised*	*Initial*	*Revised*	*Initial*	*Revised*	*Initial*	*Revised*
Capacity-Weighted BCR per MW Allocated REG Capacity (≤=1 MW)	0.49	**0.79~~0.80~~**	0.51	**0.84~~0.85~~**	0.55	**0.900.91**	0.52	**0.86~~0.85~~**
Capacity-Weighted BCR per MW Allocated REG Capacity (>1 MW)	0.87	**1.46**	1.04	**1.60**	1.28	**1.60**	1.11	**1.57**
Capacity-Weighted BCR per MW Allocated REG Capacity (All)	0.75	**1.24~~1.25~~**	0.88	**1.37**	1.09	**1.42**	0.94	**1.36**

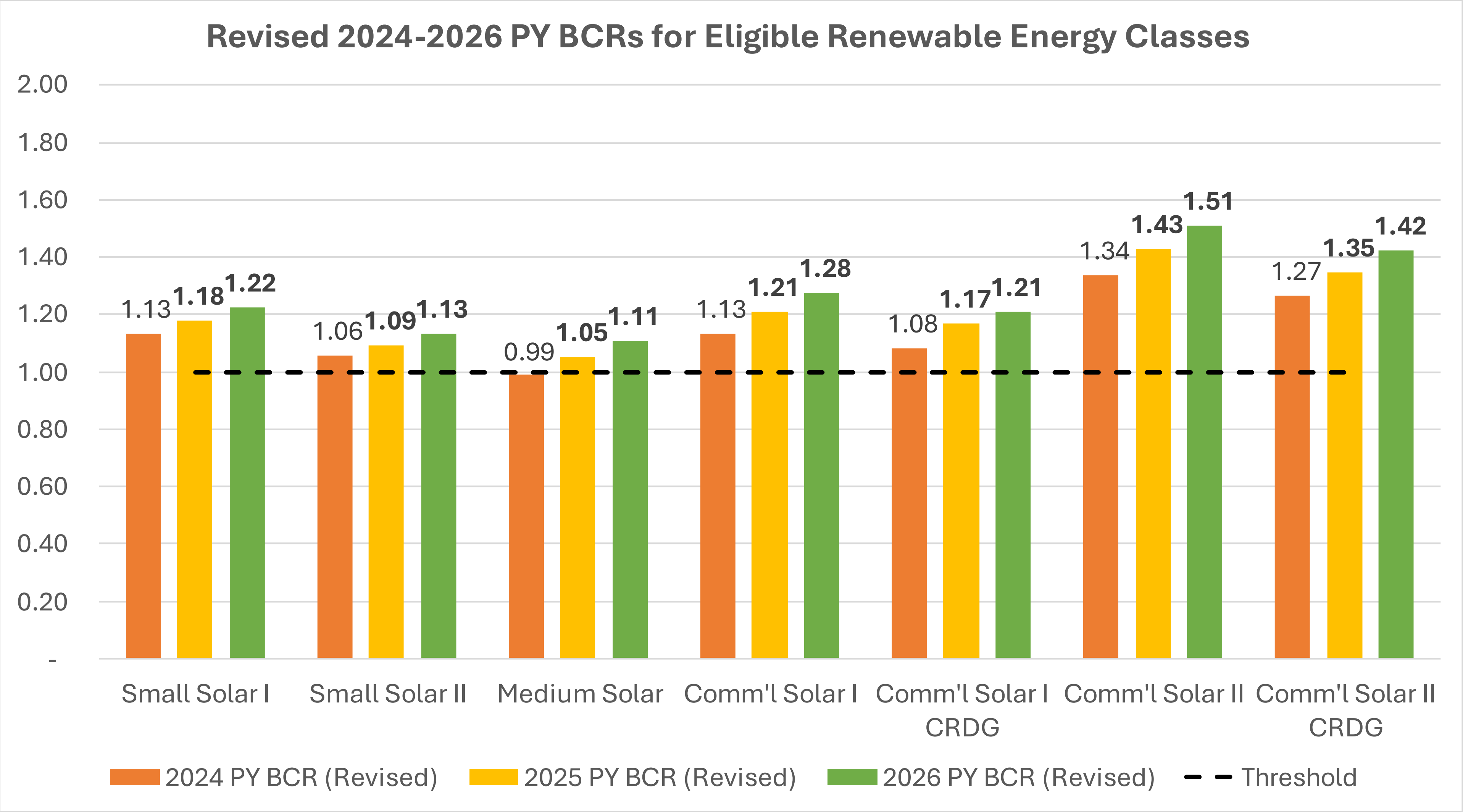
NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

Comparison of As-Filed and Revised 2024 PY BCRs (<=1 MW, With Economic Development Benefits)

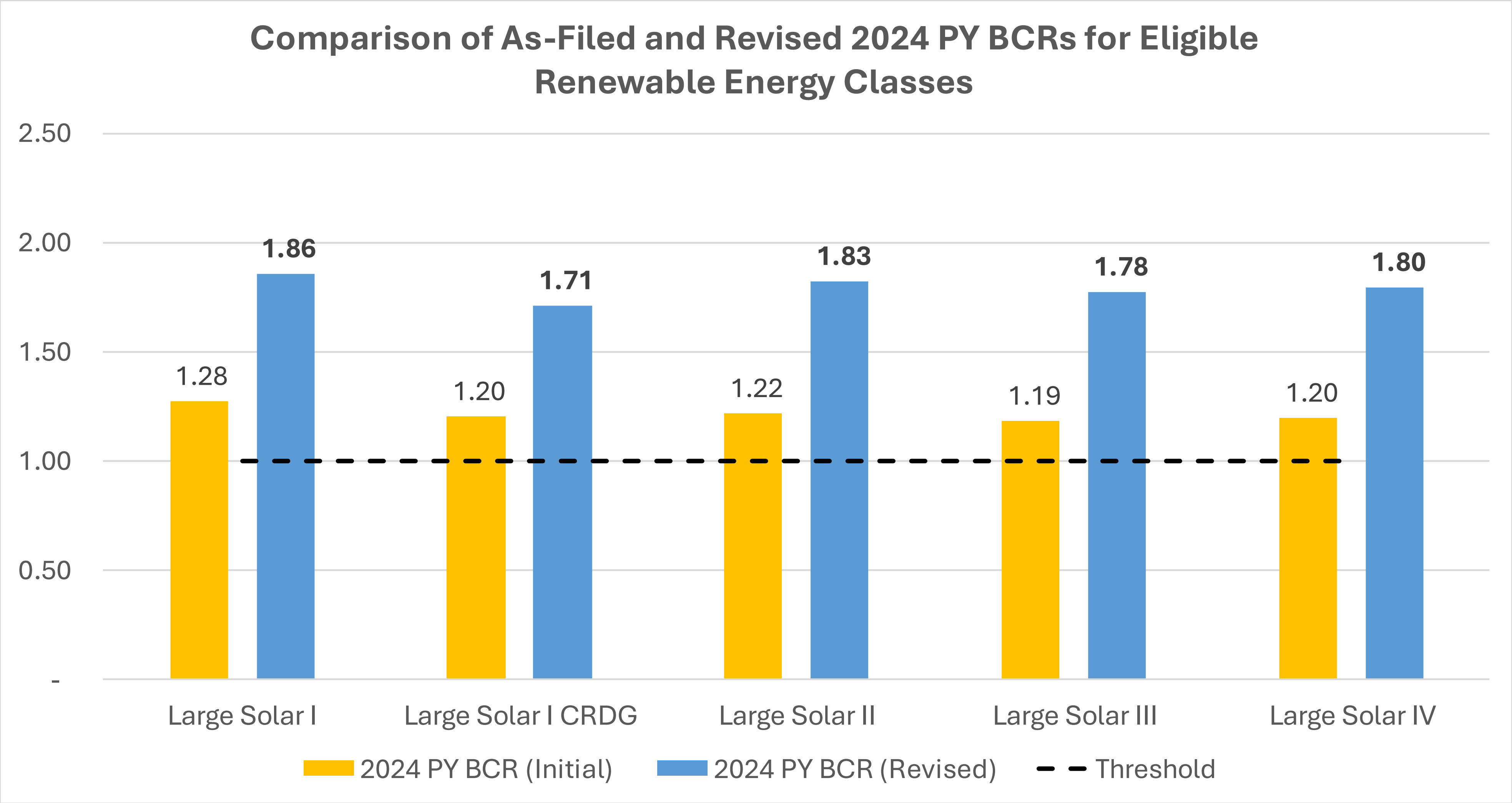


NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

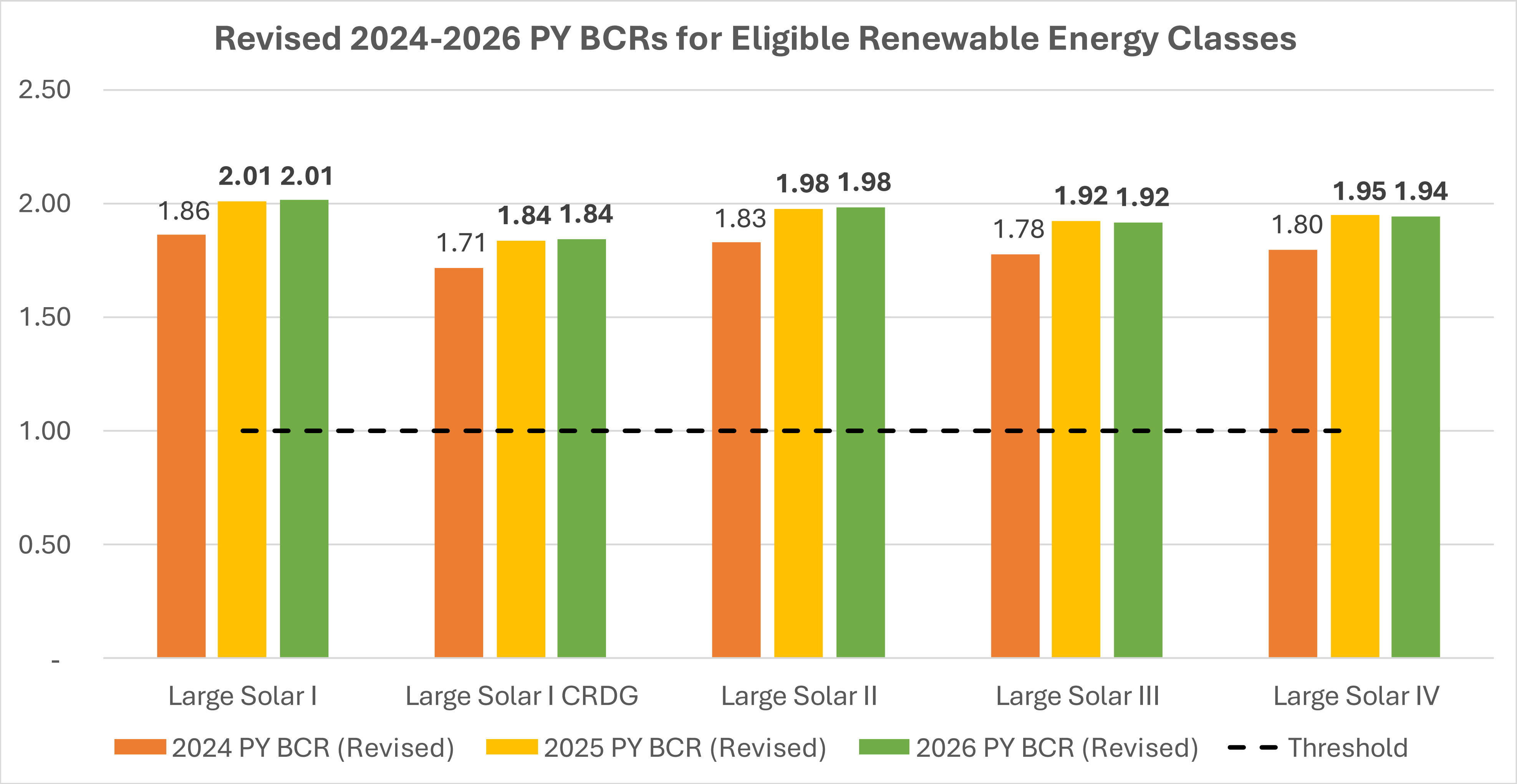
Revised 2024-26 PY BCRs (<= 1 MW, With Economic Development Benefits)



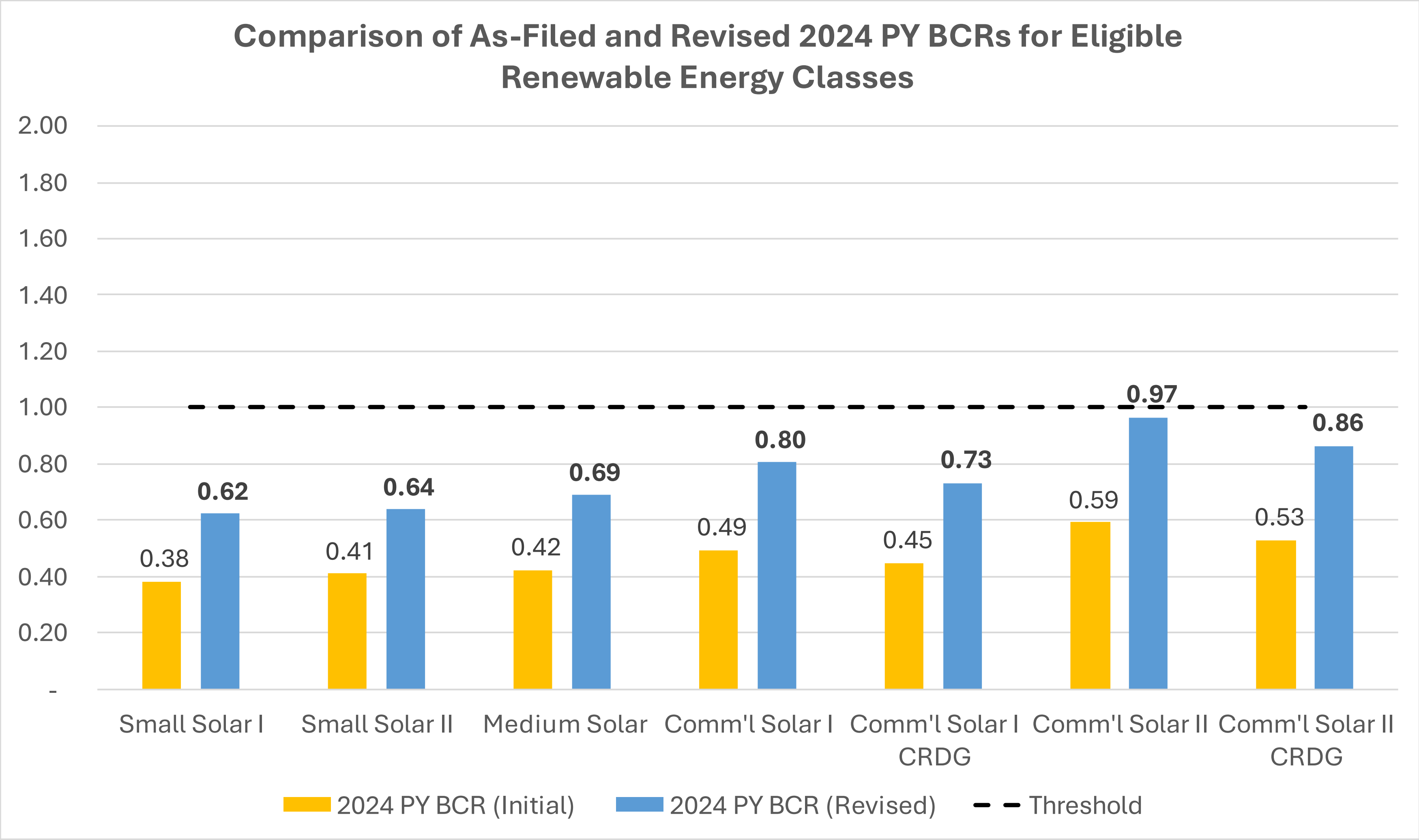
Comparison of As-Filed and Revised 2024 PY BCRs (>1 MW, With Economic Development Benefits)



Revised 2024–26 PY BCRs (>1 MW, With Economic Development Benefits)

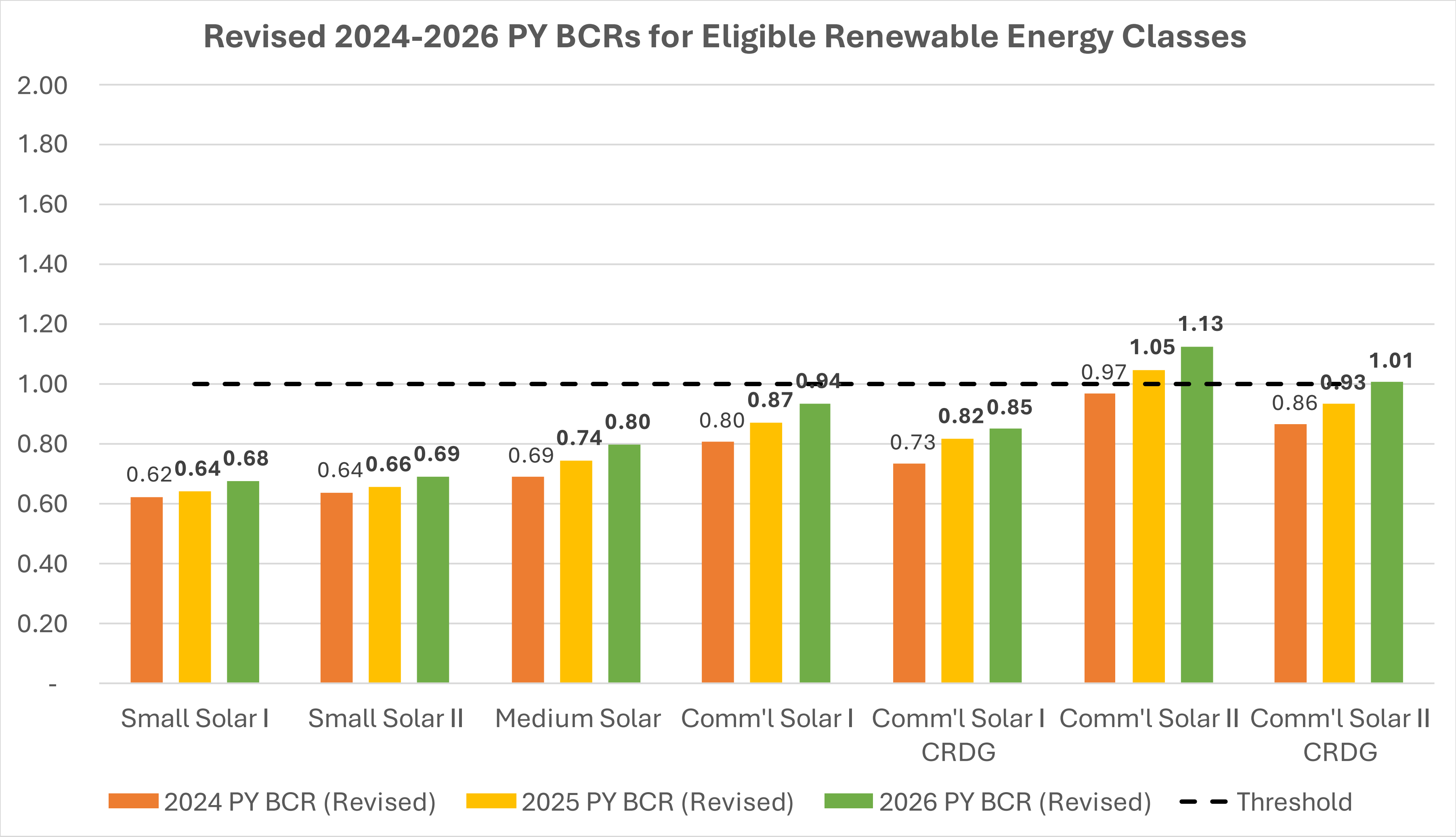


Comparison of As-Filed and Revised 2024 PY BCRs (<=1 MW, Without Economic Development Benefits)



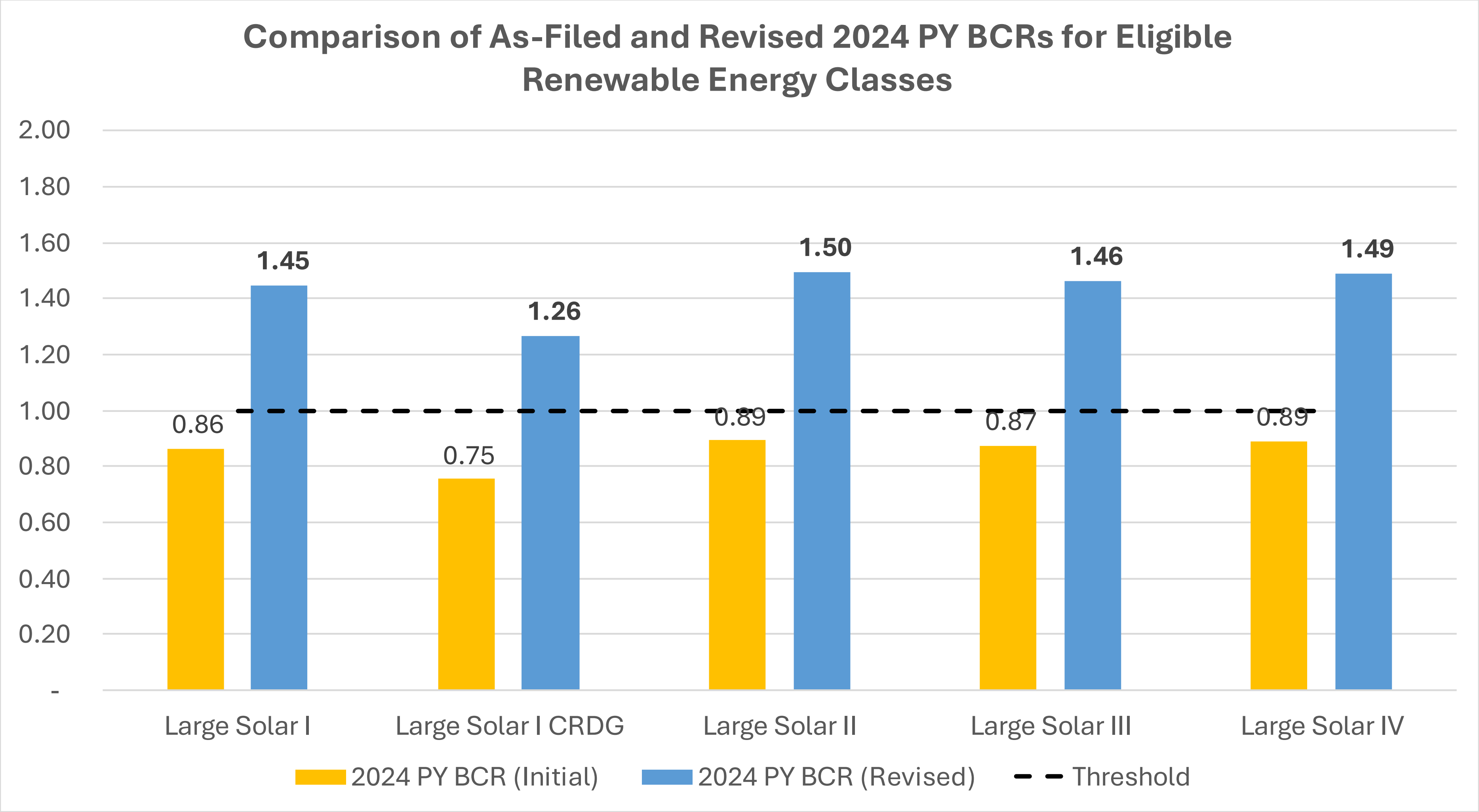
NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

Revised 2024-26 PY BCRs (<=1 MW, Without Economic Development Benefits)



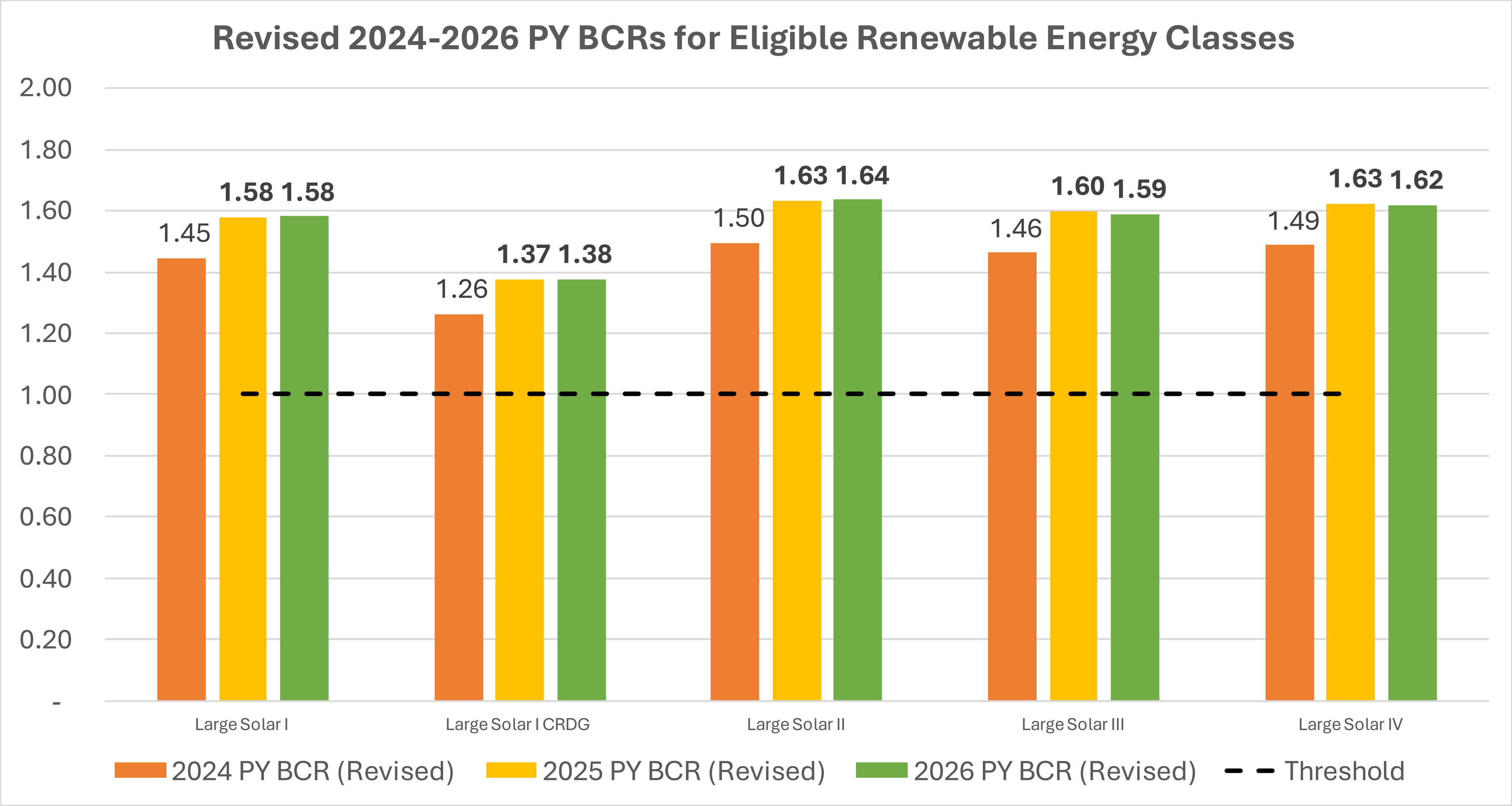
NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

Comparison of As-Filed and Revised 2024 PY BCRs (>1 MW, Without Econ. Dev. Benefits)



NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

Revised 2024–26 PY BCRs (>1 MW, Without Economic Development Benefits)



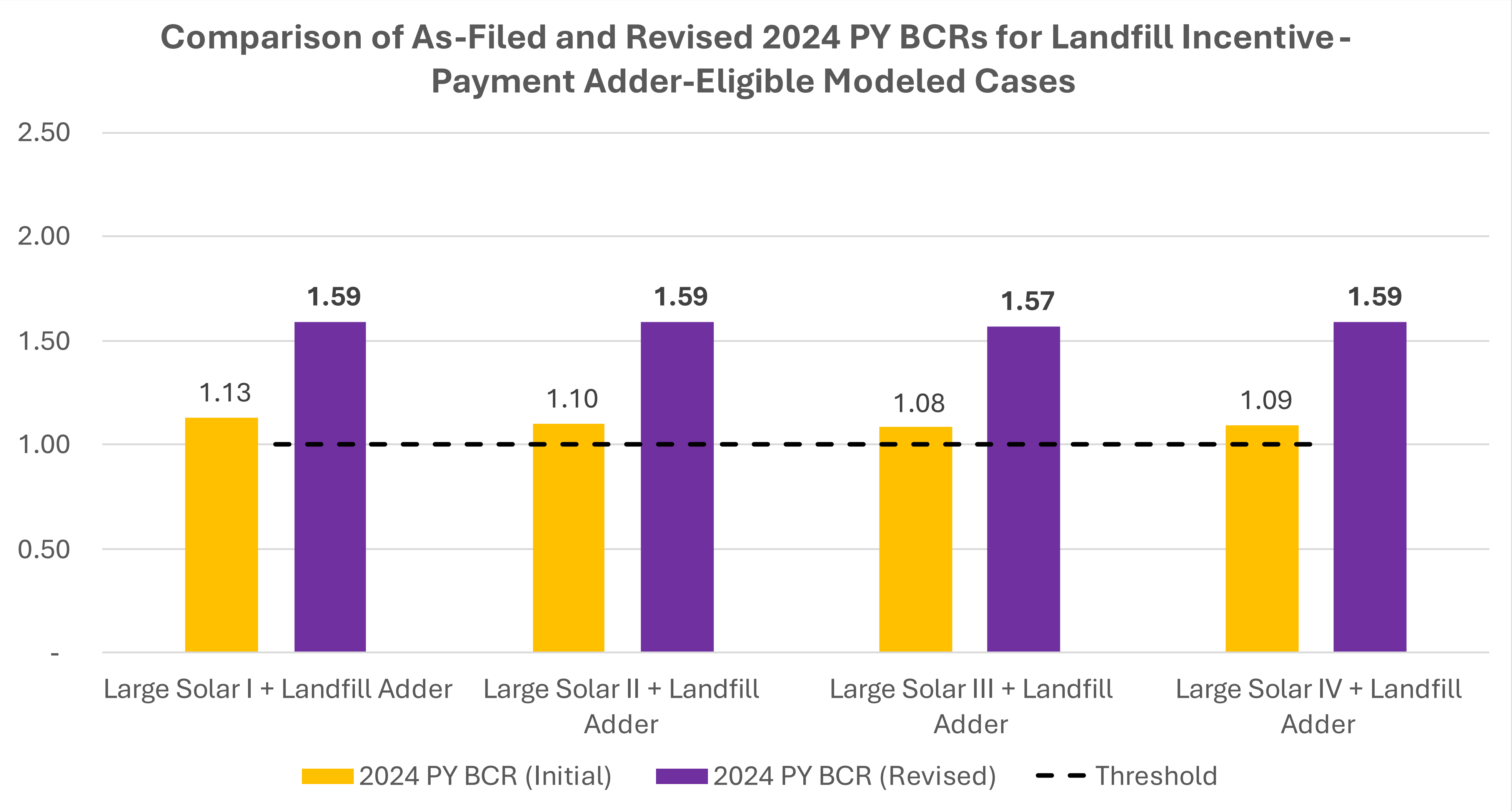
NOTE: The above values are intended to replace the MW Allocation Plan tables requested in PUC 2-8.

Revised BCA Results

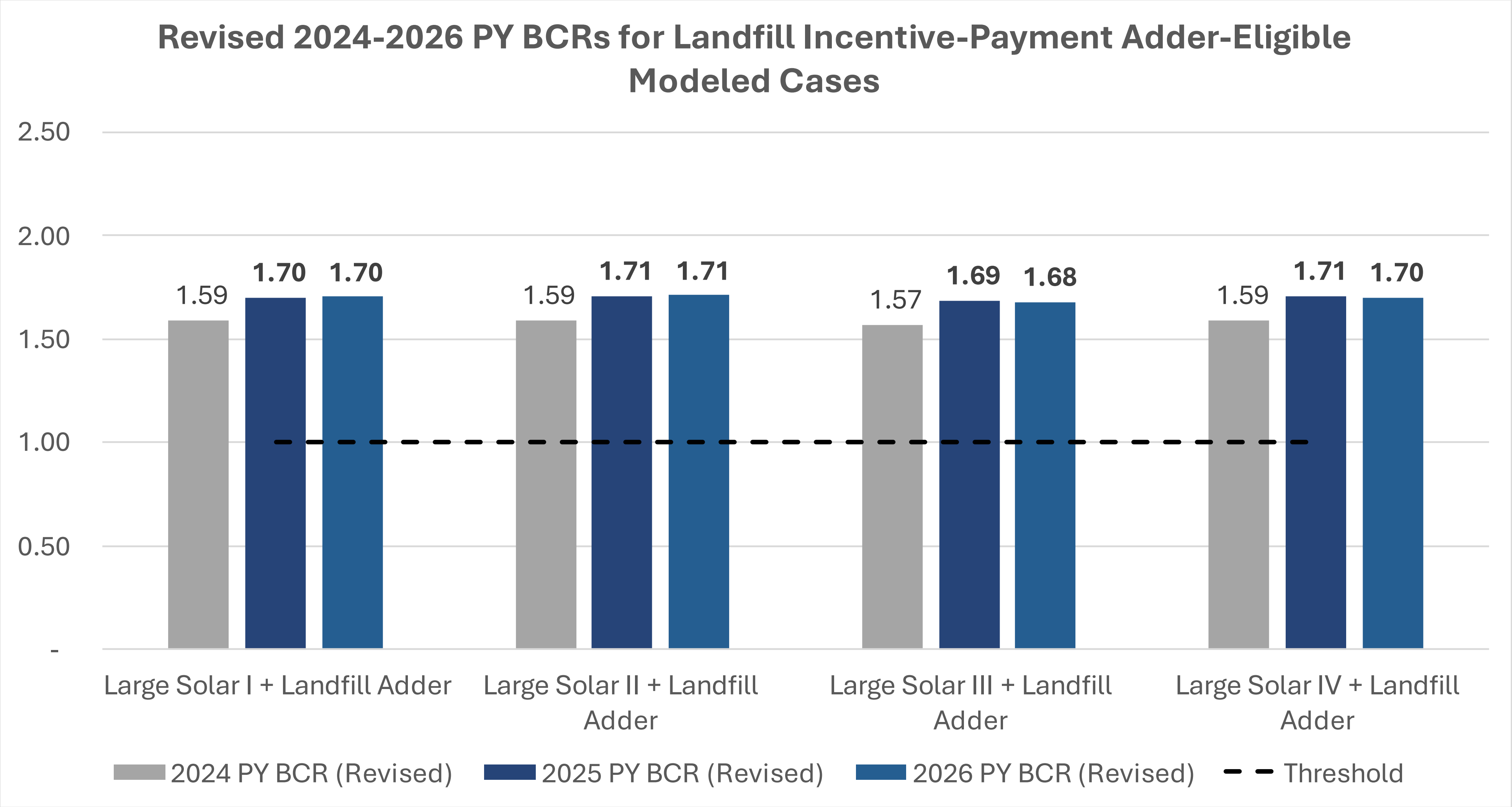
Recommended REG 2024-2026 PY Landfill and Brownfield/Superfund Incentive-Payment Adders (With and Without Economic Development Benefits)

Sustainable Energy Advantage, LLC

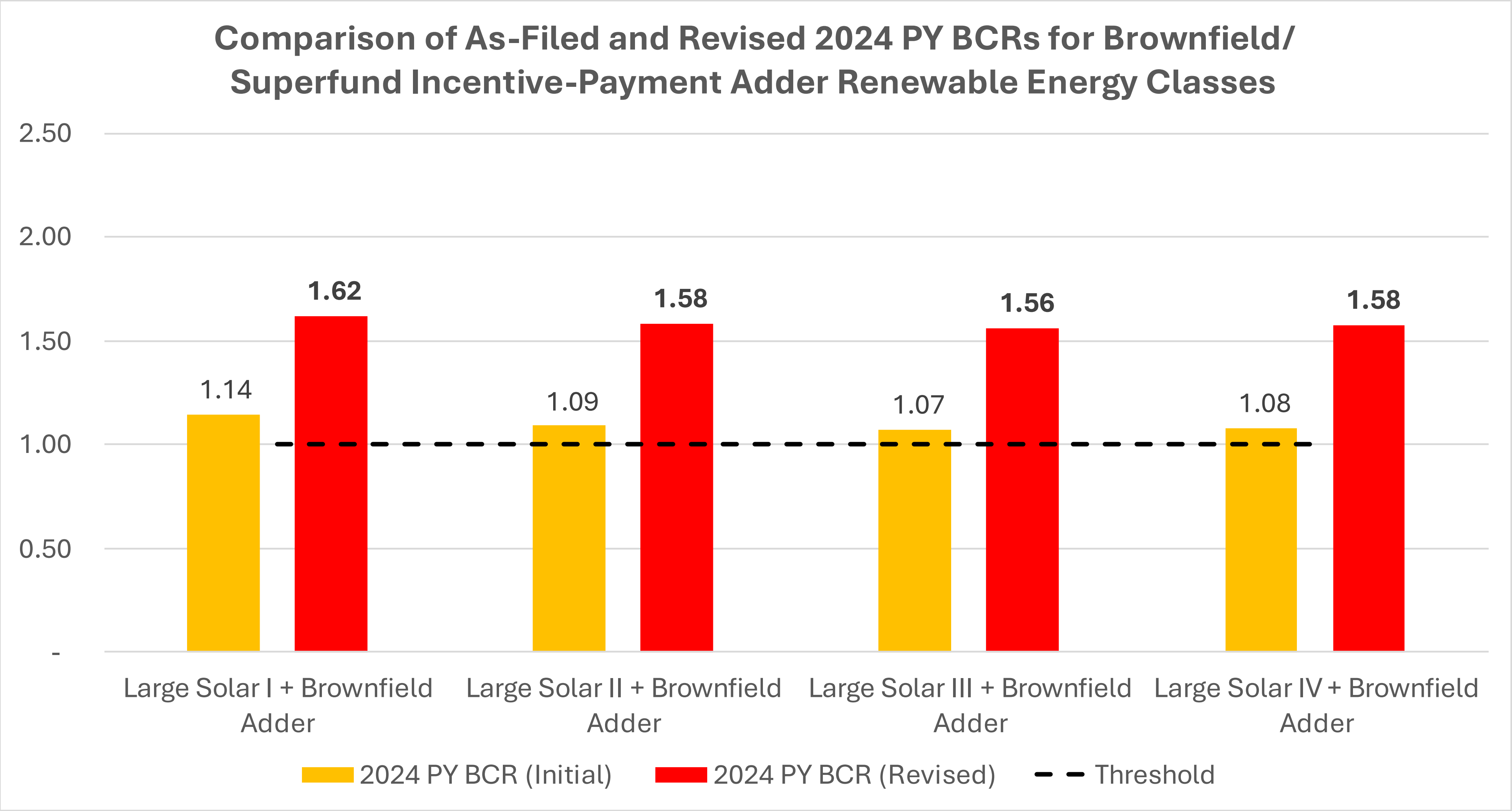
Comparison of As-Filed/Revised 2024 PY BCRs (Landfill Adder, With Econ. Dev. Benefits)



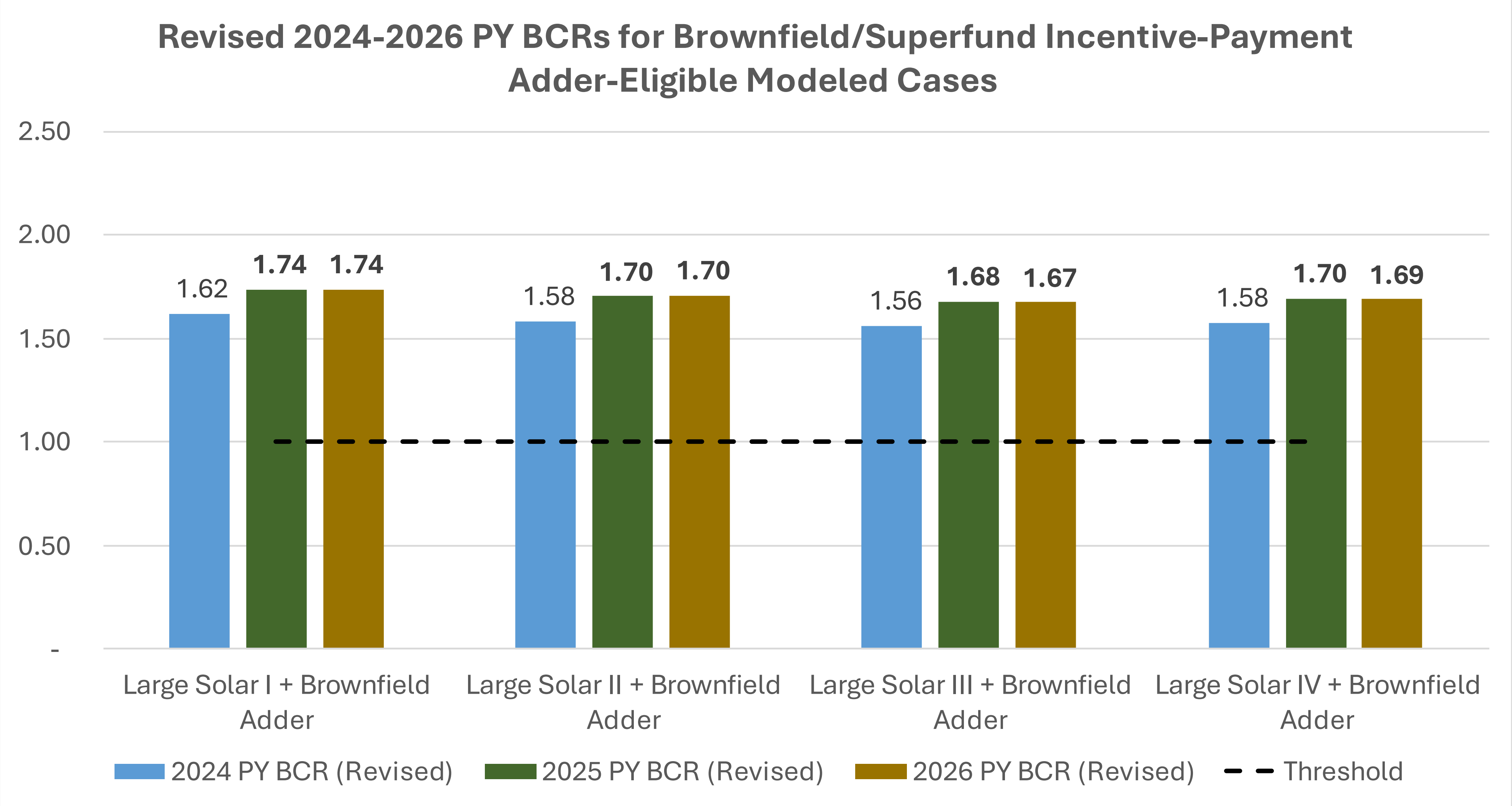
Revised 2024–2026 PY BCRs (Landfill Adder, With Econ. Dev. Benefits)



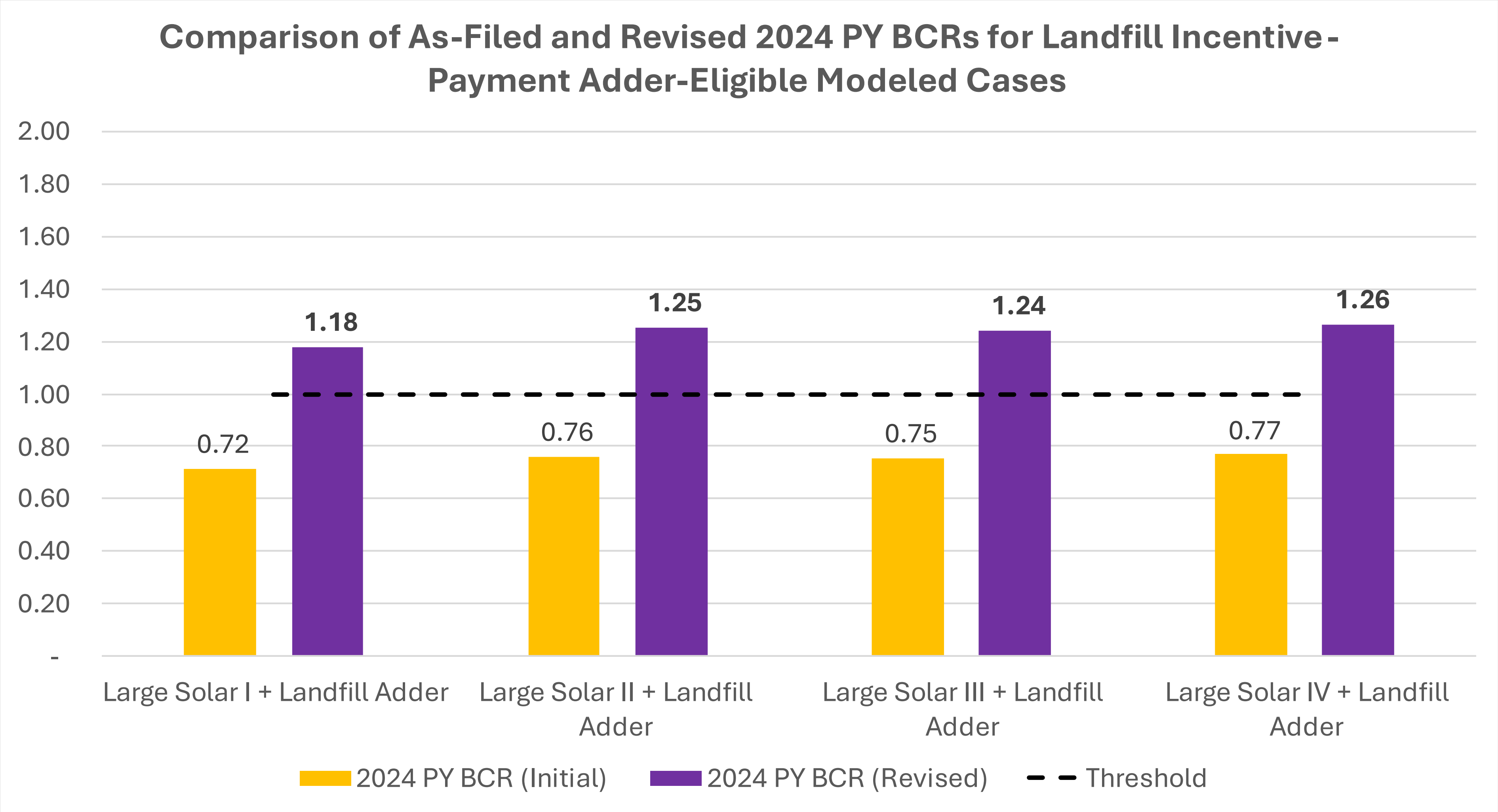
Comparison of As-Filed/Revised 2024 PY BCRs (Brownfield/Superfund Adder, With Econ. Dev. Benefits)



Revised 2024–2026 PY BCRs (Brownfield/Superfund Adder, With Econ. Dev. Benefits)

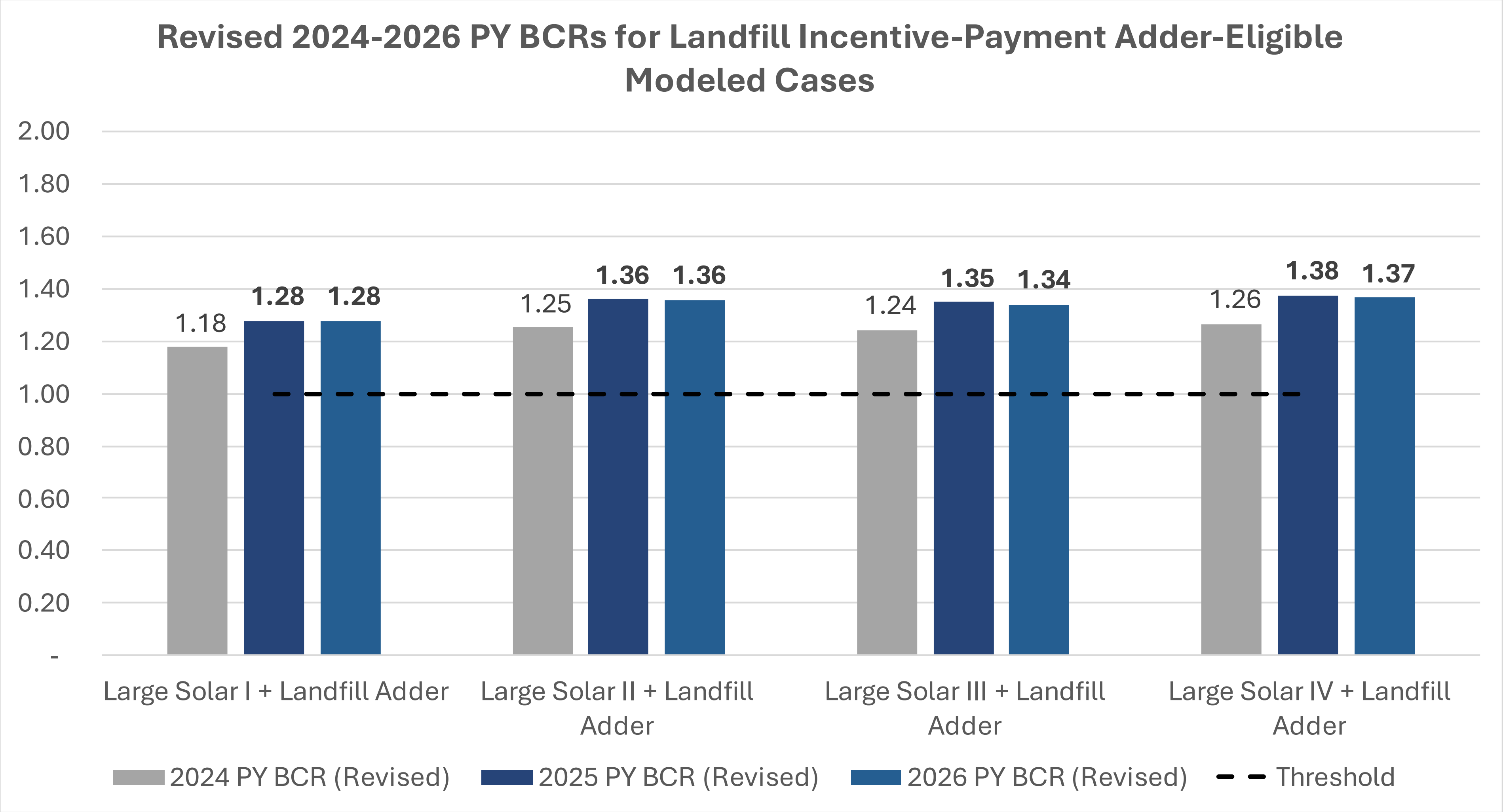


Comparison of As-Filed/Revised 2024 PY BCRs (Landfill Adder, Without Econ. Dev. Benefits)



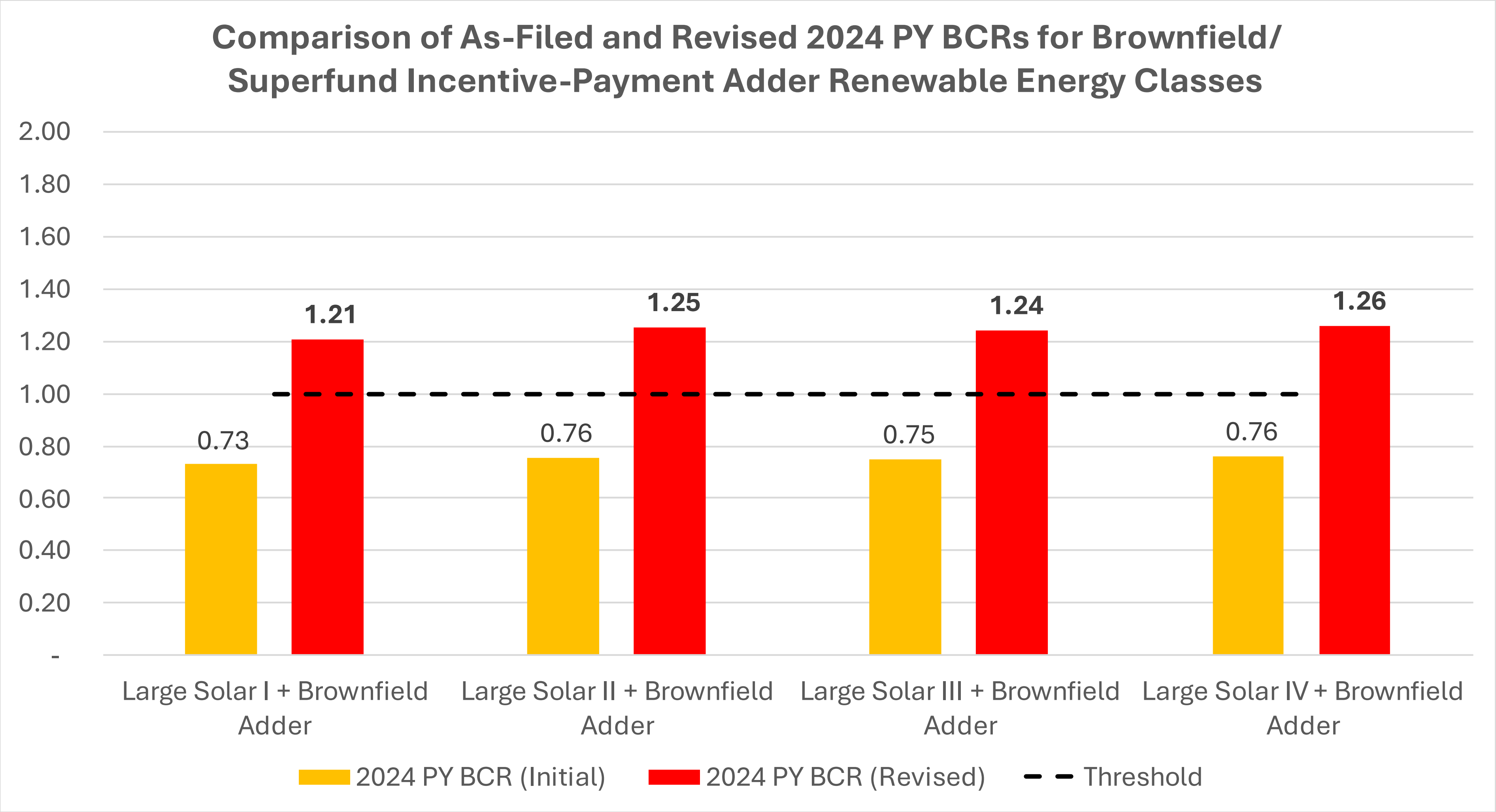
NOTE: The above values are intended to replace the Landfill incentive-payment adder tables requested in PUC 2-8, with the exception of the Landfill adder that included the cost of capping that has been withdrawn by the DG Board.

Revised 2024-2026 PY BCRs (Landfill Adder-Eligible, <u>Without</u> Econ. Dev. Benefits)



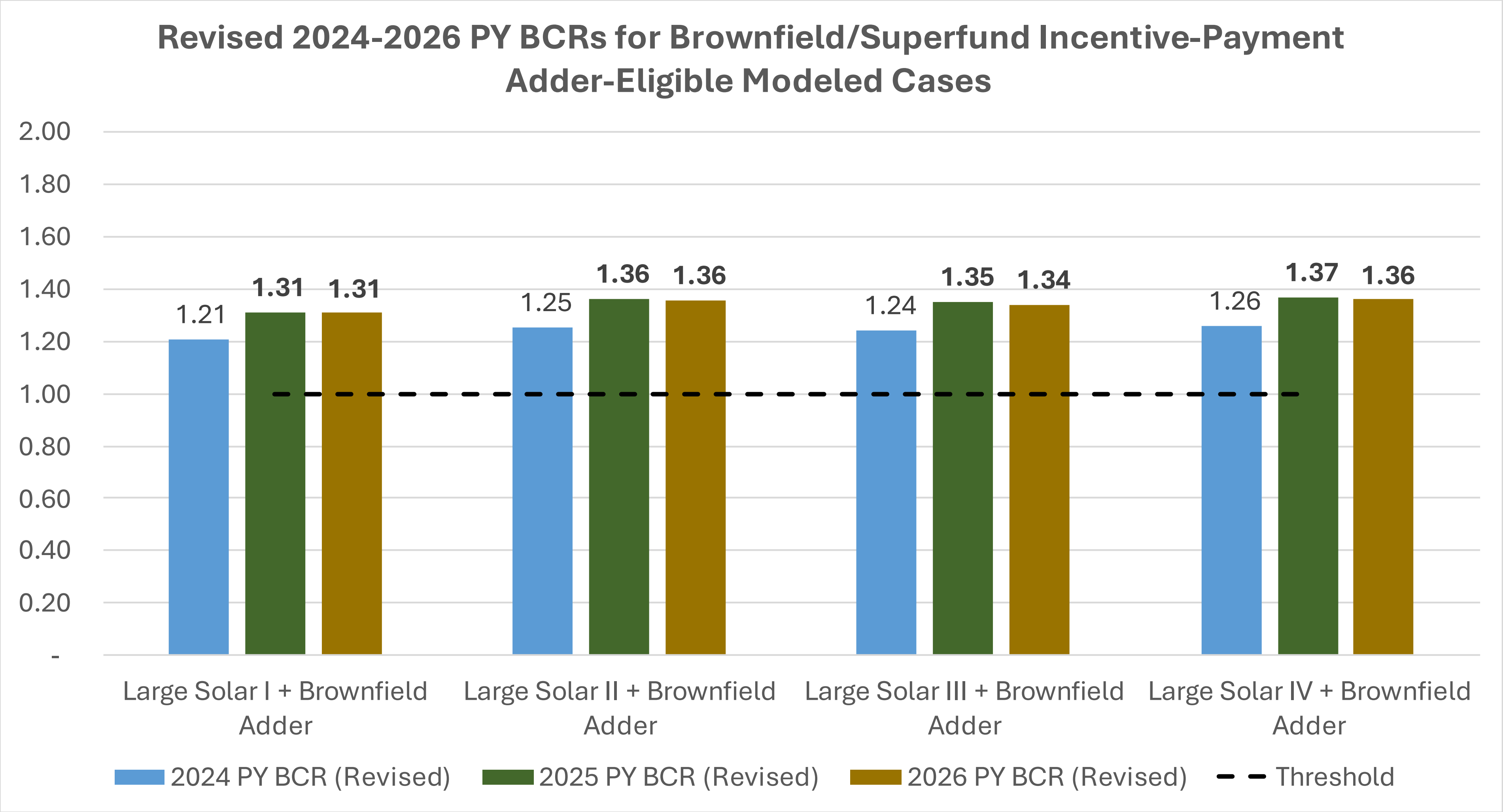
NOTE: The above values are intended to replace the Landfill incentive-payment adder tables requested in PUC 2-8, with the exception of the Landfill adder that included the cost of capping that has been withdrawn by the DG Board.

Comparison of As-Filed/Revised 2024 PY BCRs (Brownfield/Superfund, Without Econ. Dev. Benefits)



NOTE: The above values are intended to replace the Brownfield/Superfund incentive-payment adder tables requested in PUC 2-8.

Revised 2024-2026 PY BCRs (Brownfield/Superfund, <u>Without</u> Econ. Dev. Benefits)



NOTE: The above values are intended to replace the Brownfield/Superfund incentive-payment adder tables requested in PUC 2-8.

Sustainable Energy Advantage, LLC

Quantification of Additional Docket 4600 Benefit Categories

Methodology for Avoided Property Loss Quantification

Sustainable Energy Advantage, LLC

Avoided Property Value Loss Benefit Methodology (1)

- In OER and the Board's initial filing, SEA's testimony referenced additional quantifiable benefits associated with avoided property value loss
- These benefits were initially identified and explored in a follow-up BCA of the Carport adder pilot program filed in Docket 5202
- Given R.I.G.L. § 39-26.6-22 appears to only require the finding of any "identifiable system benefit, reliability benefit, or cost savings to the distribution system in that geographical area, or conservation benefit, or climate resilience benefit", SEA declined to quantify these benefits as part of initial BCA in Docket 23-44-REG
- However, SEA has, for the avoidance of doubt in interpretation, quantified these values in the revised BCA described herein

Avoided Property Value Loss Benefit Methodology (2)

- In the Benefit-Cost Framework developed in Docket 4600, the category of Conservation and Community Benefits includes land use impacts that could include “loss of sink, habitat, historical value, [or] sense of place”
- A component of these “loss[es]” is the quantified loss of property value associated with siting of solar PV projects
- The counterfactual assumption for this analysis is that Landfill and Brownfield projects “requiring remediation” would either:
  - Not be located near residential properties whose value can be reduced; or
  - The placement of a solar PV project on said preferred sites would not further reduce the value of said properties (given the fact they are already near parcels that confer such significant dis-amenities)
- These losses were identified and analyzed in detail by Gaur and Lang in Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island (2020)
  - The analysis found a statistically significant average property value loss of 1.7% ($5,751) for households within 1.0 miles of a solar PV installation, relative to households between 1.0 and 3.0 miles from an installation
  - The analysis also found that there were an average of 317 households within 1.0 miles of an installation

Avoided Property Value Loss Benefit Methodology (3)

- Similar impacts have been found in a six-state group (which also included CT and MA) by Elmallah, et al. (2023), a group of researchers at the Lawrence Berkeley National Laboratory (LBNL)
  - The analysis found statistically significant average property value losses of 2.3% for households within 0.25 miles, 1.3% for households within 0.25 and 0.5 miles, and 0.82% for households within 0.5 and 1.0 miles
- SEA further adjusted the average $5,751 loss per household value observed in 2019 to reflect current (and expected future) sale prices for homes by (i) utilizing (for 2020-2023 CODs) historical Case-Shiller home price index values for the Boston area~~,~~ and (ii) increasing prices for 2024-2030 CODs at the long-term (1987-2023) compound annual growth rate (CAGR).
- These values per household, which are then multiplied by the Gaur and Lang average of 317 households within one mile and divided by the proxy size of Large Solar I, II, III and IV projects, are shown at right
- These values are applied based on the COD Year of the project
  - 2028 COD for 2024 PY projects, 2029 COD for 2025 PY projects, and 2030 COD for 2026 PY projects

Avoided Property Value Loss Benefit Methodology (3)

- Similar impacts have been found in a six-state group (which also included CT and MA) by Elmallah, et al. (2023), a group of researchers at the Lawrence Berkeley National Laboratory (LBNL)
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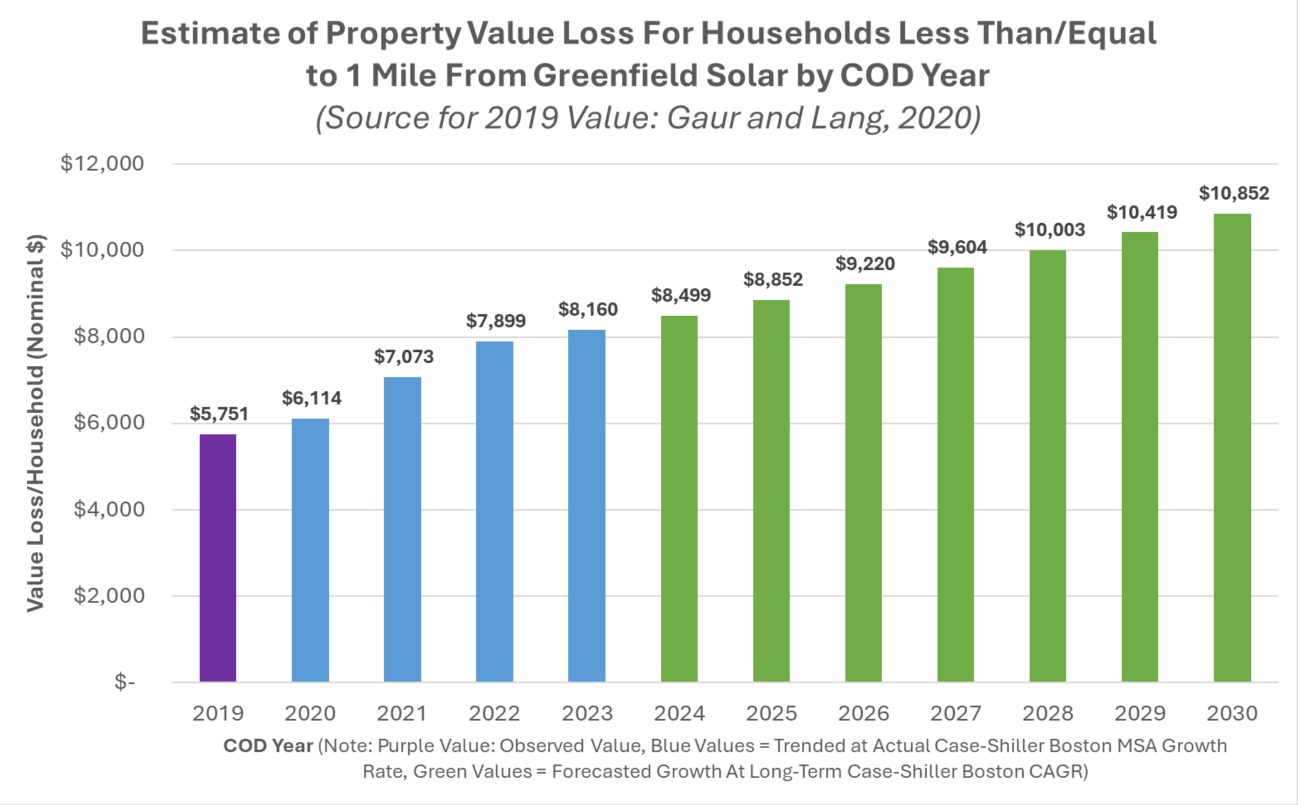
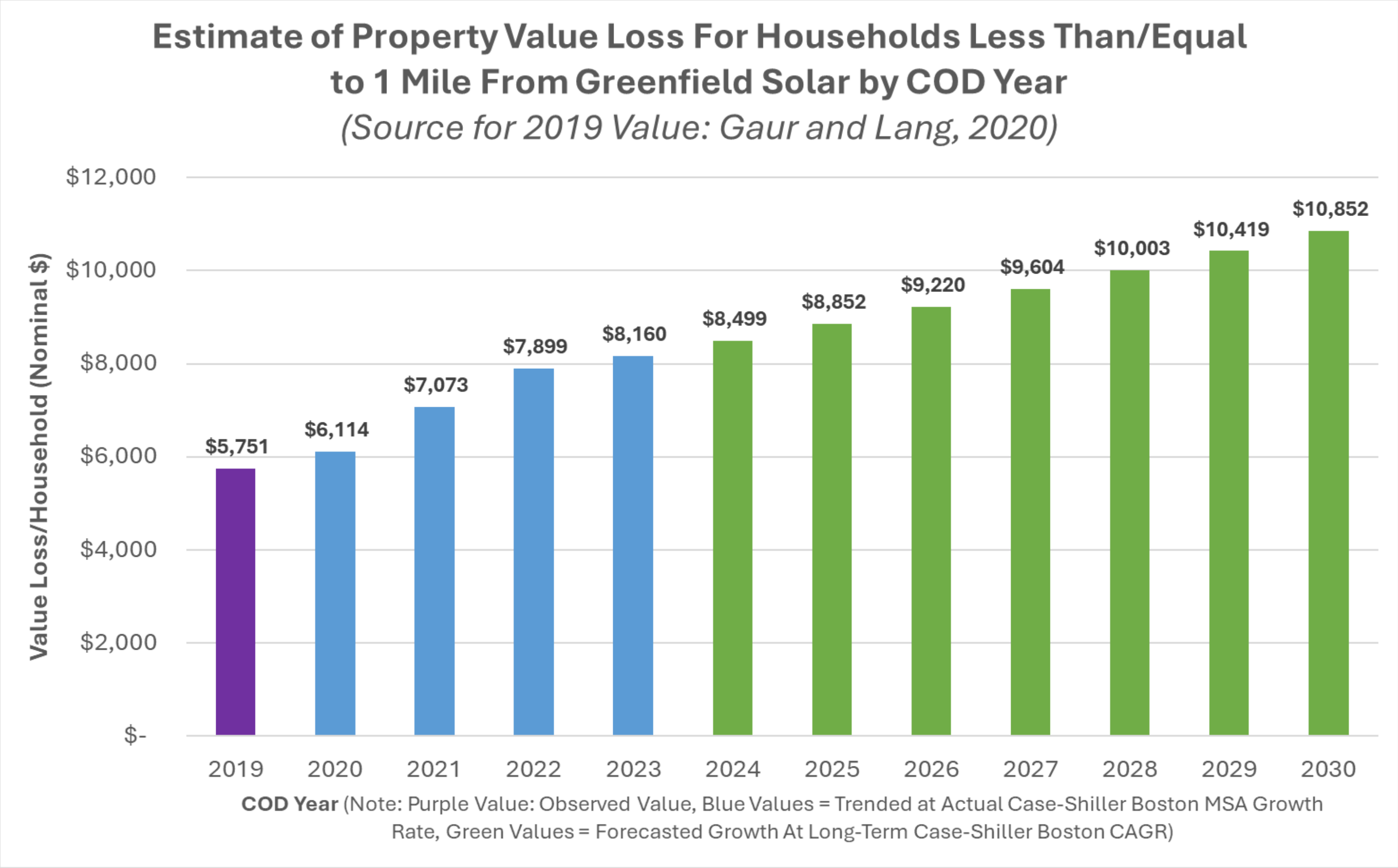


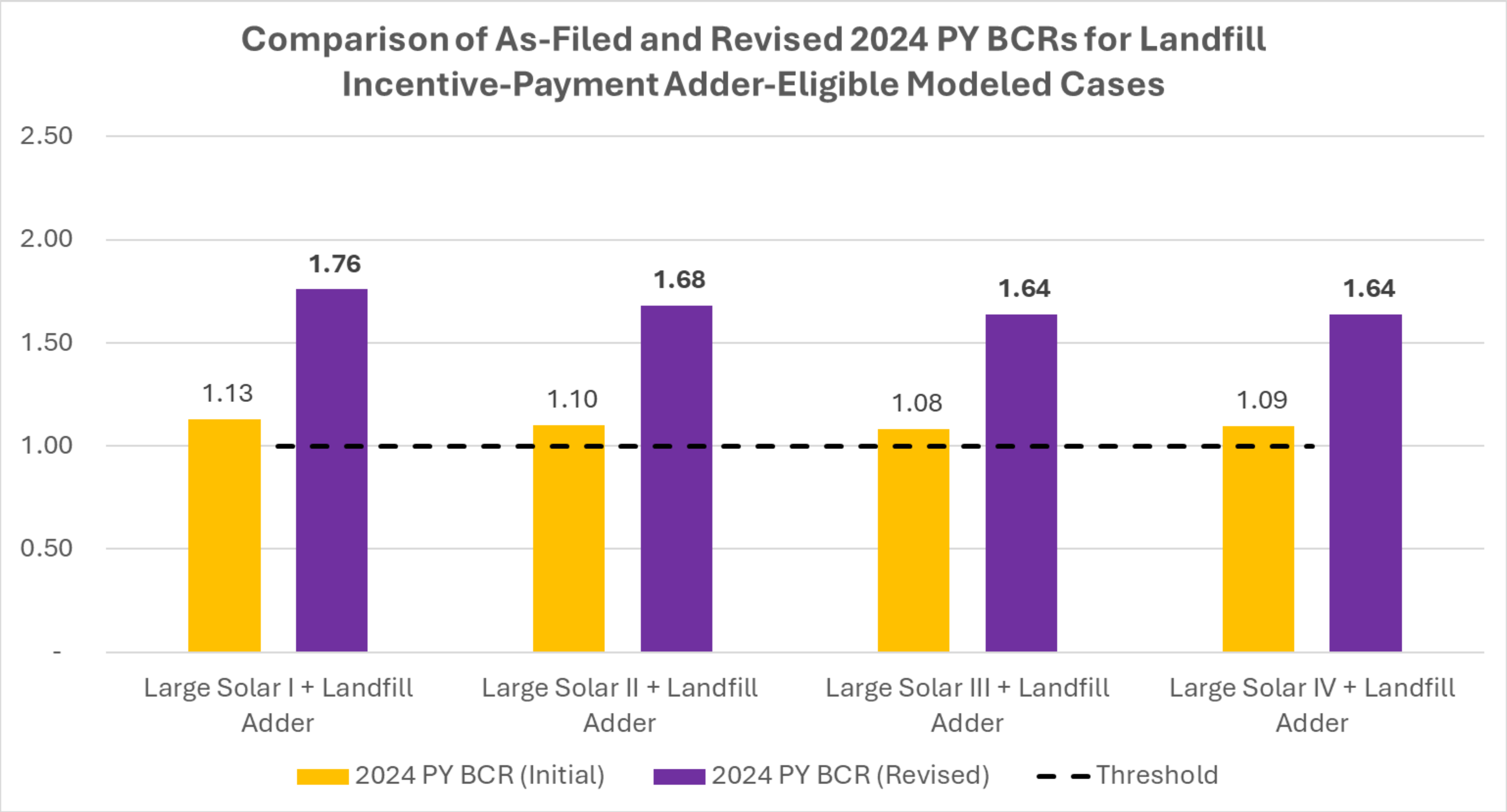
Avoided Property Value Loss Benefit Methodology (3)



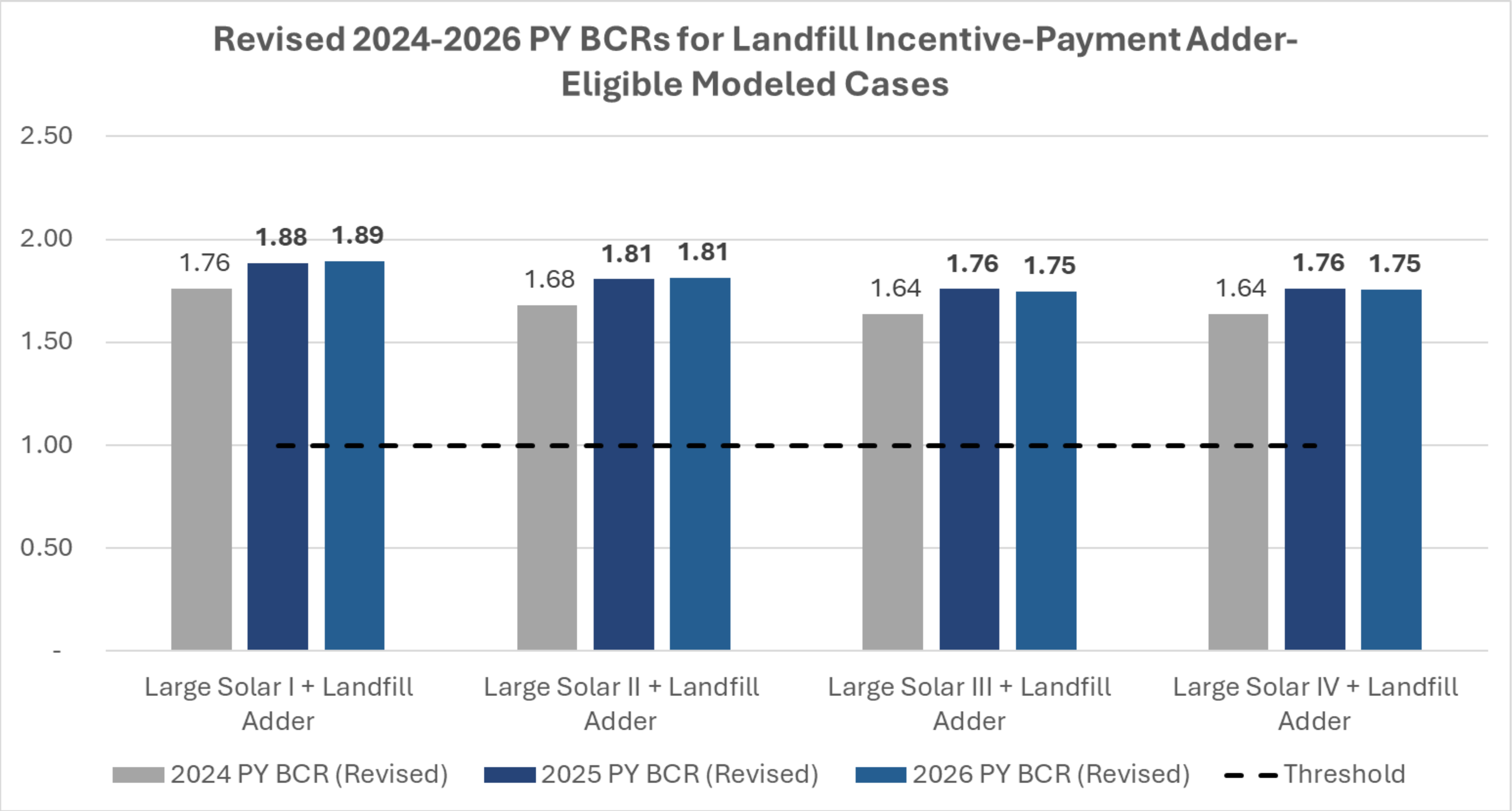
Revised BCA Results Inclusive of Avoided Property Loss Quantification

Sustainable Energy Advantage, LLC

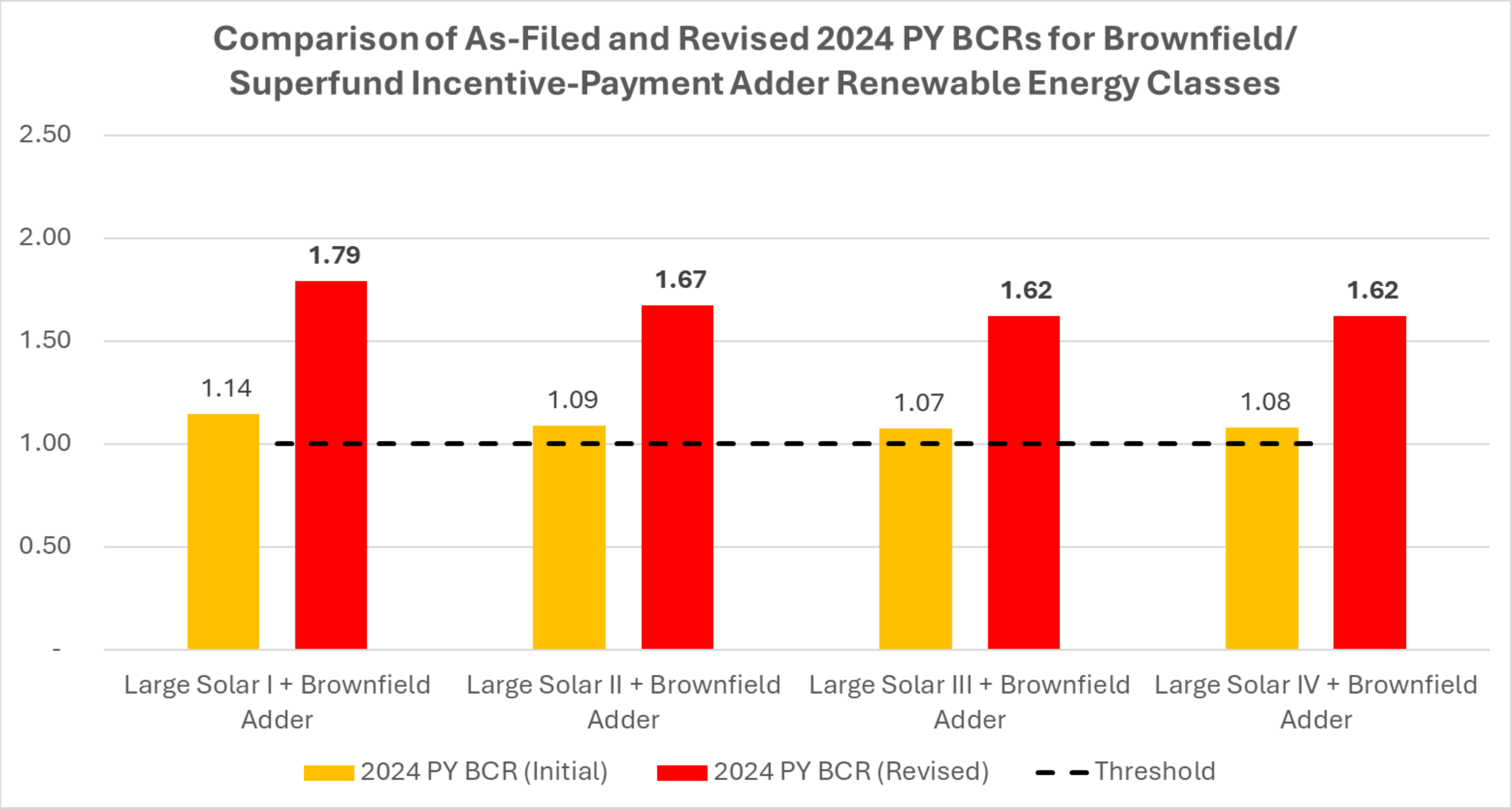
Comparison of As-Filed/Revised 2024 PY BCRs (Landfill Adder, With Econ. Dev. Benefits and Avoided Property Value Loss Benefits)



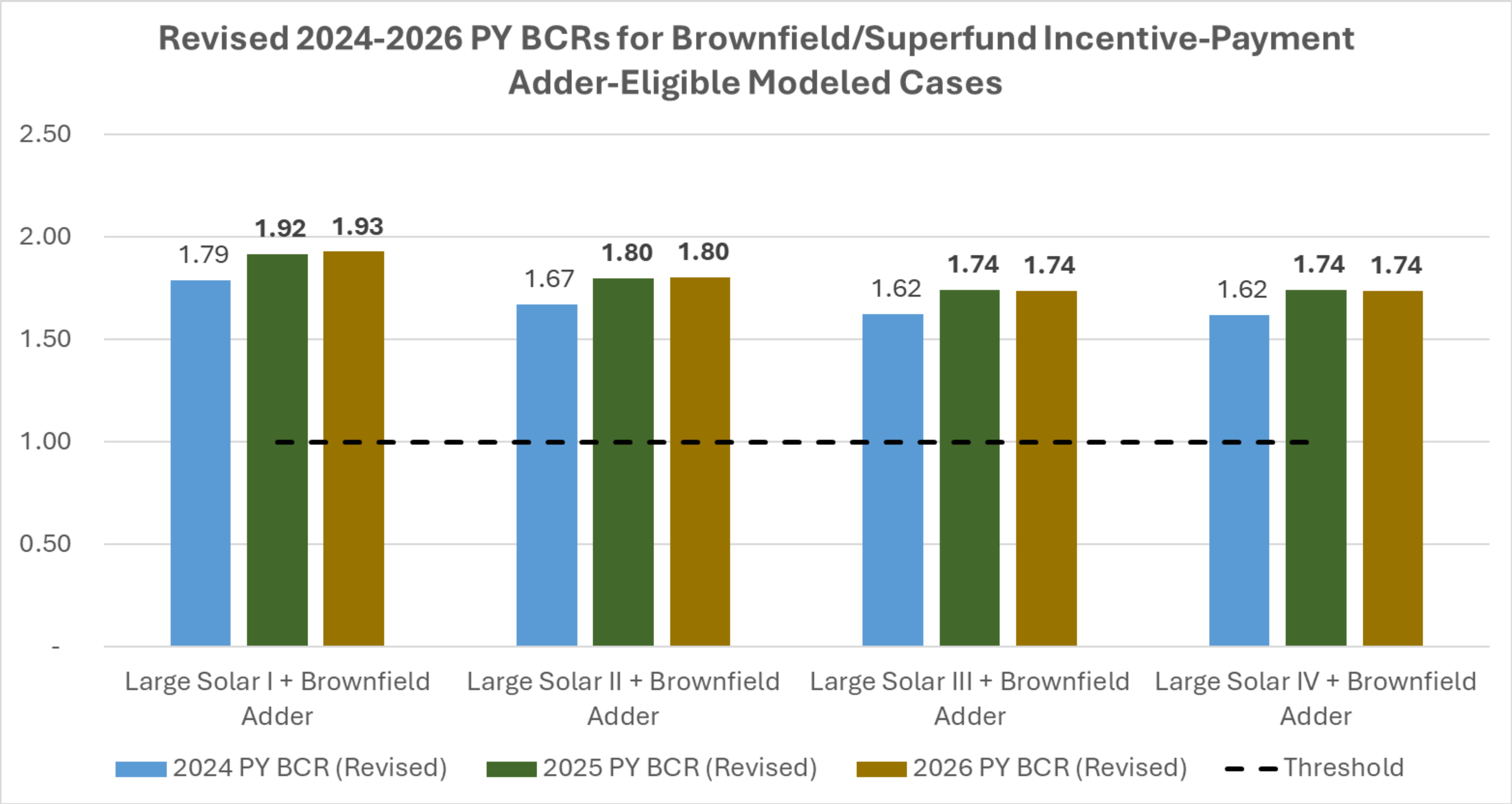
Revised 2024–2026 PY BCRs (Landfill Adder, With Econ. Dev. Benefits and Property Value Loss Benefits and Property Value Loss Benefits)



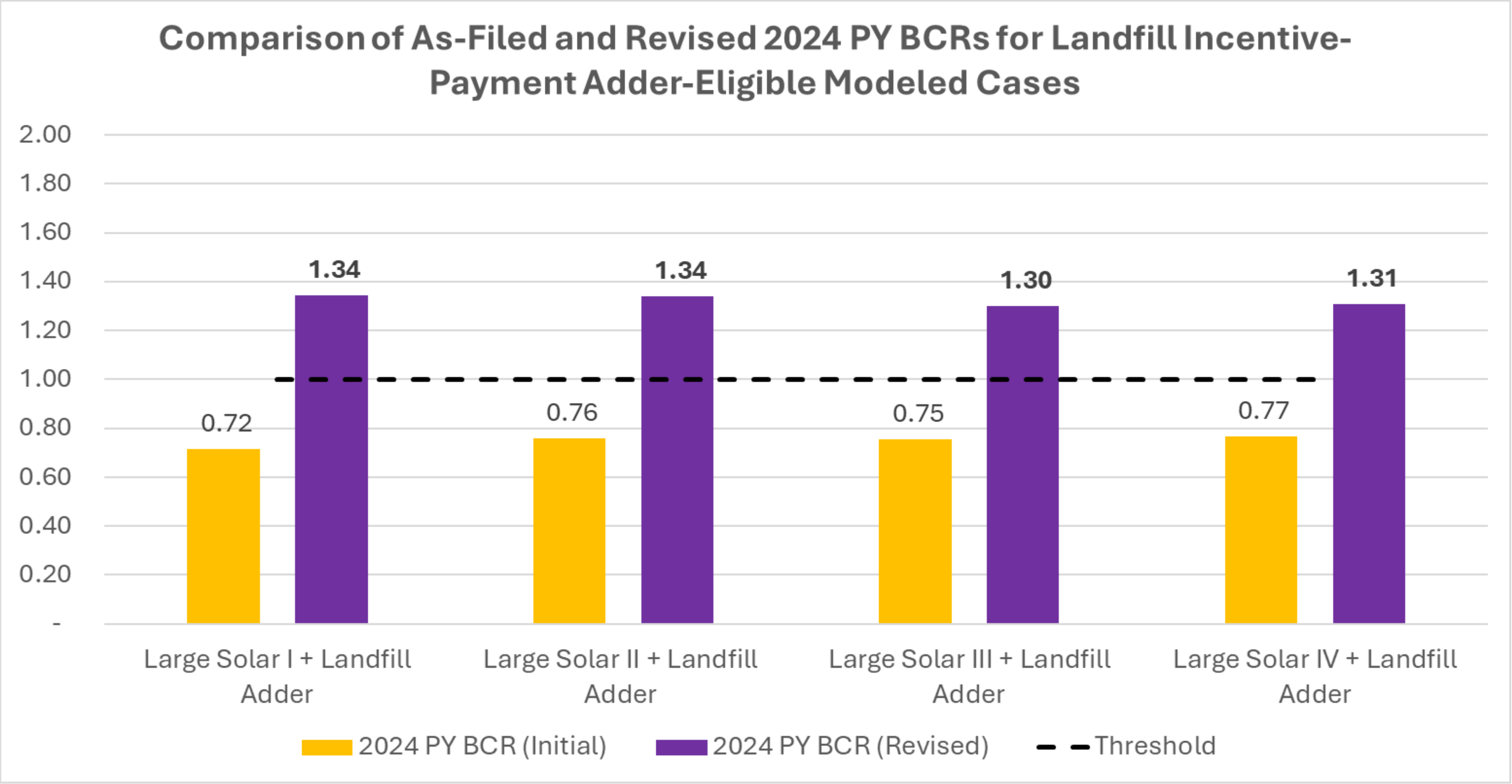
Comparison of As-Filed/Revised 2024 PY BCRs (Brownfield/Superfund Adder, With Econ. Dev. Benefits and Avoided Property Value Loss Benefits)



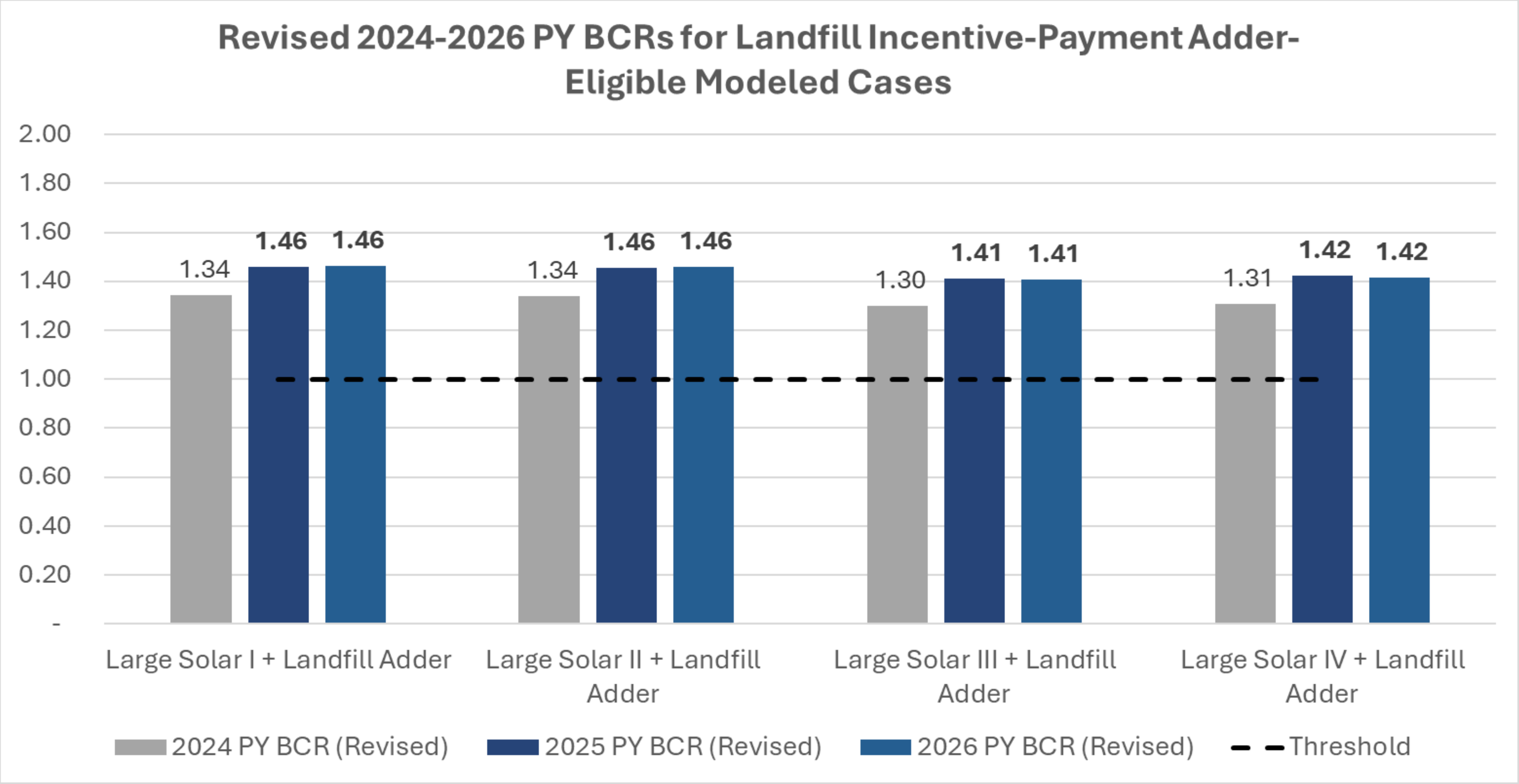
Revised 2024-2026 PY BCRs (Brownfield/Superfund Adder, With Econ. Dev. Benefits and Avoided Property Value Loss Benefits)



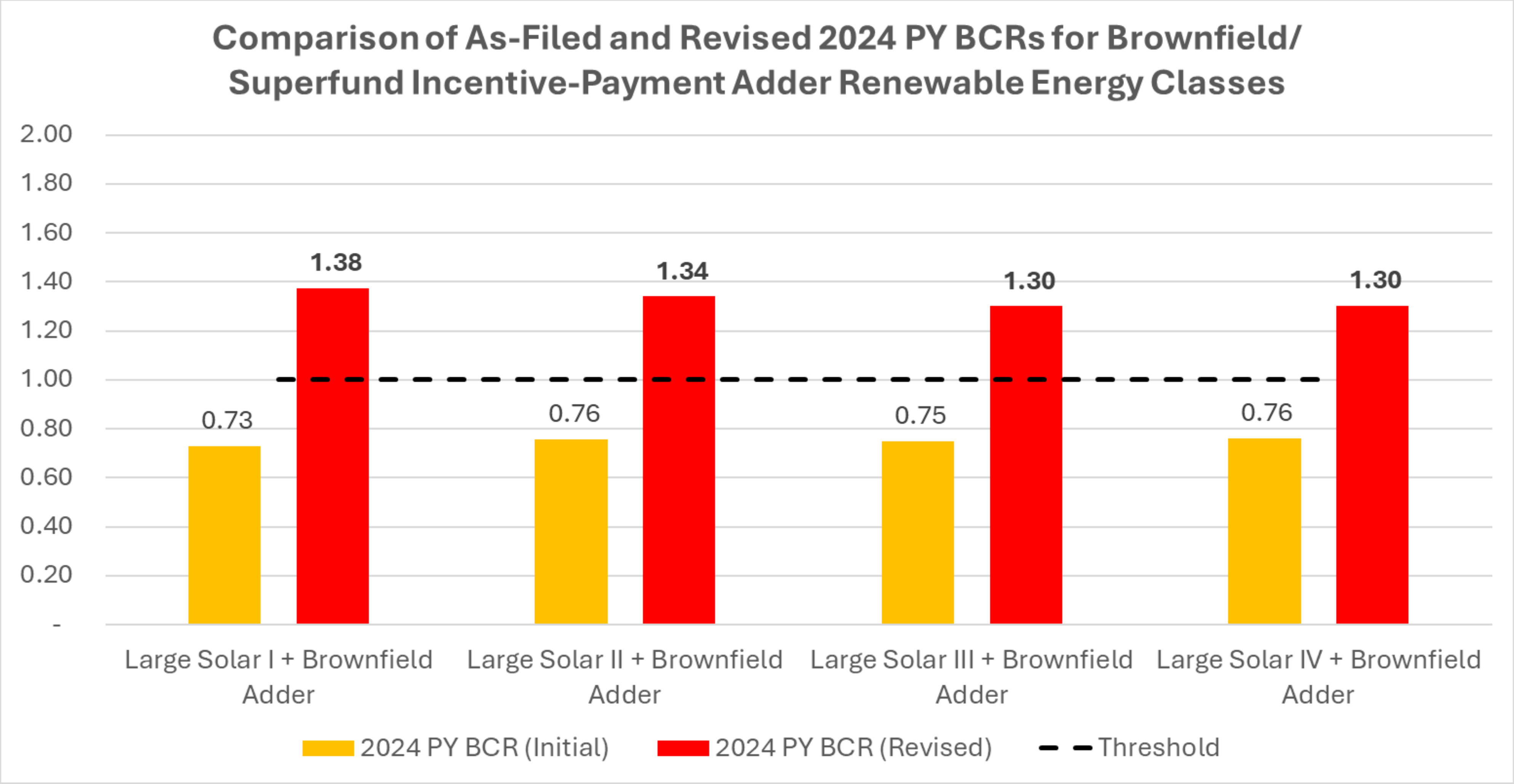
Comparison of As-Filed/Revised 2024 PY BCRs (Landfill Adder, Without Econ. Dev. Benefits and With Avoided Property Value Loss Benefits)



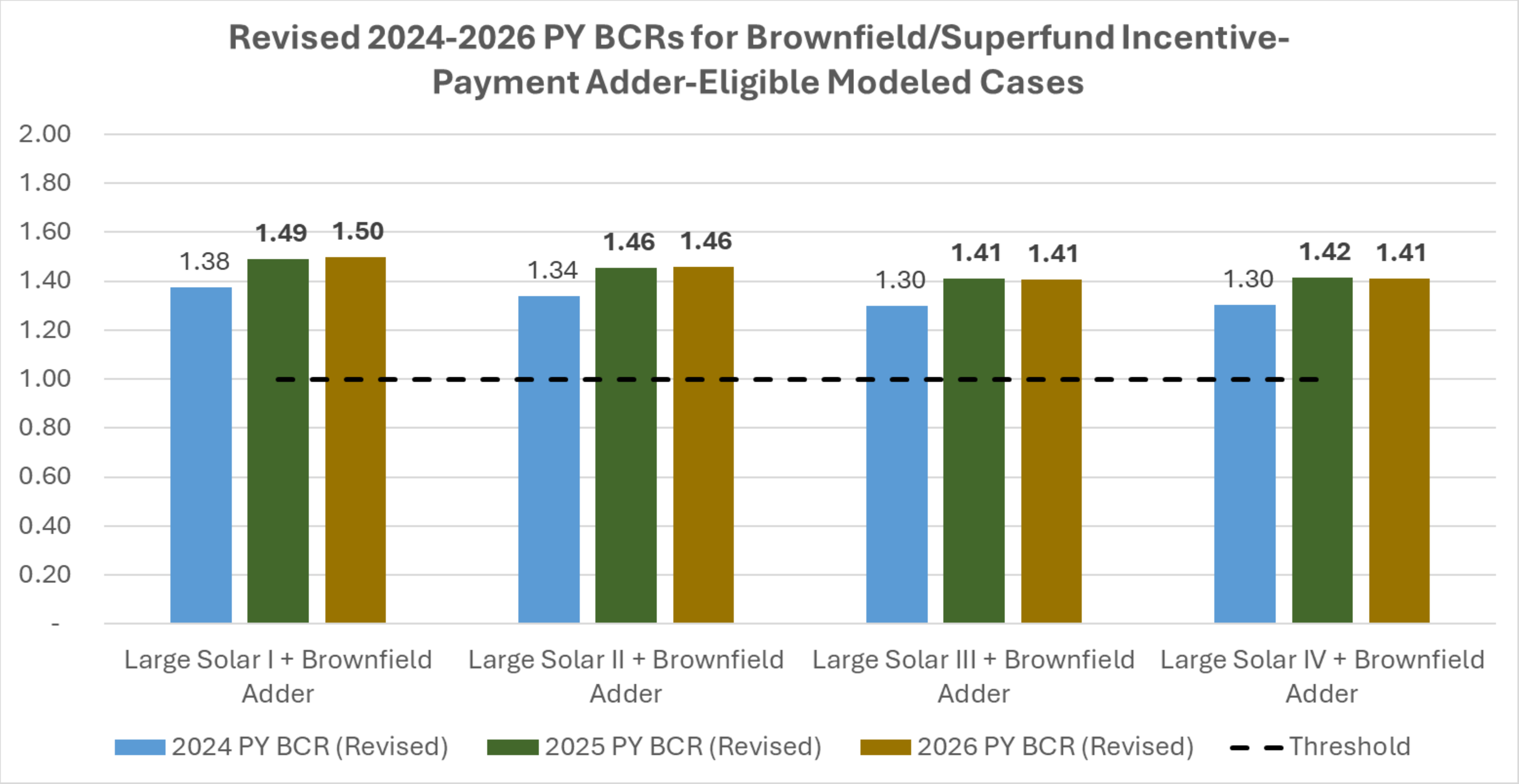
Revised 2024-2026 PY BCRs (Landfill Adder-Eligible, Without Econ. Dev. Benefits and With Property Value Loss Benefits)



Comparison of As-Filed/Revised 2024 PY BCRs (Brownfield/Superfund, Without Econ. Dev. Benefits and With Property Value Loss Benefits)



Revised 2024-2026 PY BCRs (Brownfield/Superfund, Without Econ. Dev. Benefits and With Property Value Loss Benefits)



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