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Document Title:	Presentation - Additional Achievable Energy Efficiency & Fuel Substitution
Description:	By: Ingrid Neumann, Ph.D.CEC -EAD
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Additional Achievable Energy Efficiency & Fuel Substitution

IEPR Commissioner Workshop

December 2, 2021

Electricity & Natural Gas Demand Forecast: Results

Ingrid Neumann, Ph.D.
CEC - EAD

Additional Achievable Energy Efficiency (AAEE)

Single Managed Forecast Set

- *"Energy Commission, in consultation with the CPUC and the CAISO, considered public input in selecting a single or managed demand forecast from the adopted forecast report for use in transmission planning and procurement. This set of forecast numbers is a combination of two forecast components: a base case with weather variants and an additional achievable energy efficiency (AAEE) scenario. Combined together, these create the single or managed forecast."*

- **Three baseline cases and five scenarios of AAEE**
- The mid-mid AAEE forecast scenario will be used for system-wide and flexibility studies relied upon for procurement and transmission planning purposes.
- Because of the local nature of reliability needs and the difficulty of forecasting locally disaggregated AAEE, the mid-low AAEE scenario will be used for local studies.

Development of 2021 AAEE

- ***For 2021 we utilized the same saving accounting, aggregation, and extrapolation methodology & tools as were developed for 2019***

- Historical data and potential savings projections were updated in all existing workbooks and some new workbooks were added based on recent programmatic activities

2021 Additions and Enhancements

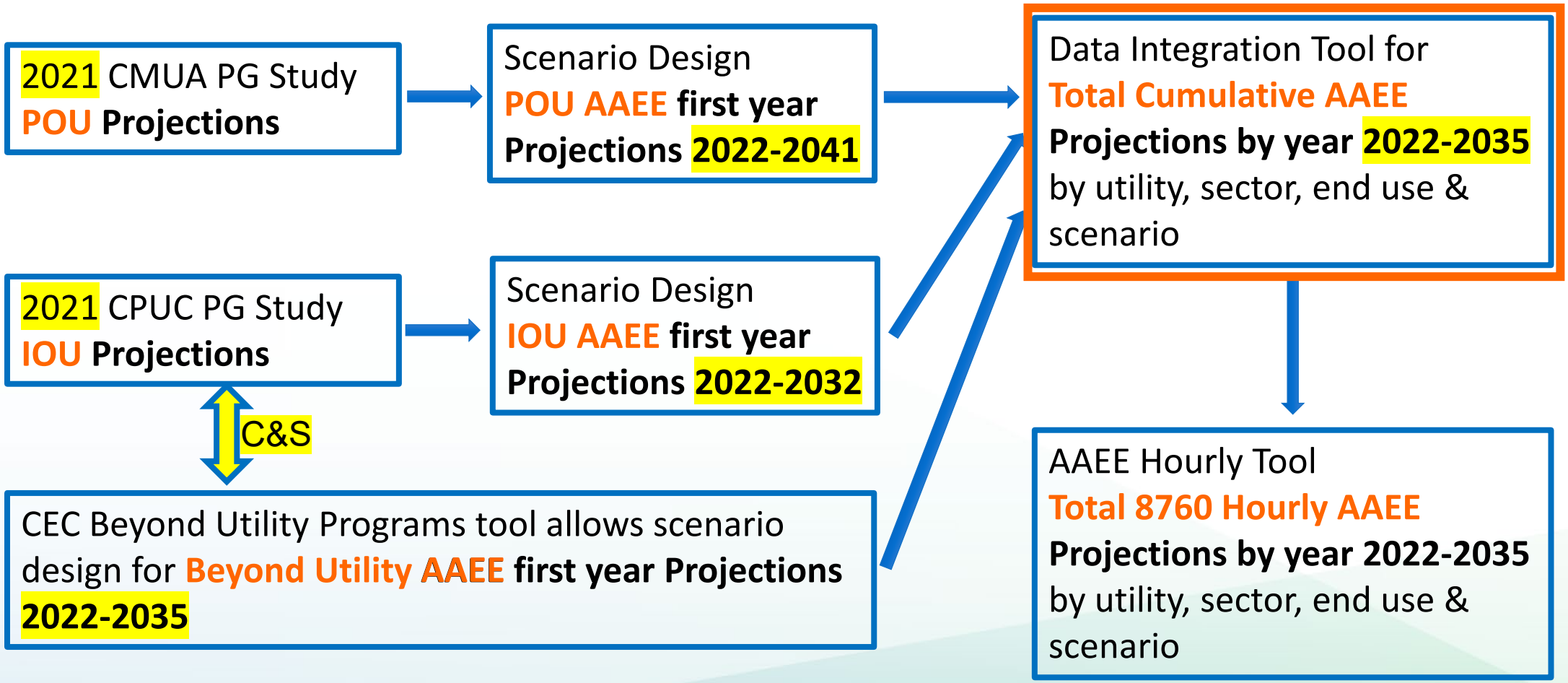
Removed Fuel Substitution

- Supplanted by Additional Achievable Fuel Substitution (AAFS)

ADDED new workbooks

- CCA and REN Program Savings (not yet modeled in PG Study)
- T24 Res & Com New Construction Fuel Sub
- Clean Energy Optimization Program (CEOP)
- IOU Low Income Fuel Sub
- POU Fuel Sub
- SGIP HPWH Incentives
- TECH-BUILD
  (SB 1477 Low Emissions Buildings and Sources of Heat Energy))
- Food Processing Investment Program (FPIP)

Additional Achievable Energy Efficiency (AAEE)
2021 Process Flow Overview



Scenario Development for 2021 AAEE

Lever	Mid - Very Low (Scenario 1)	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - High (Scenario 4)	Mid - Very High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case					
Retail Prices						

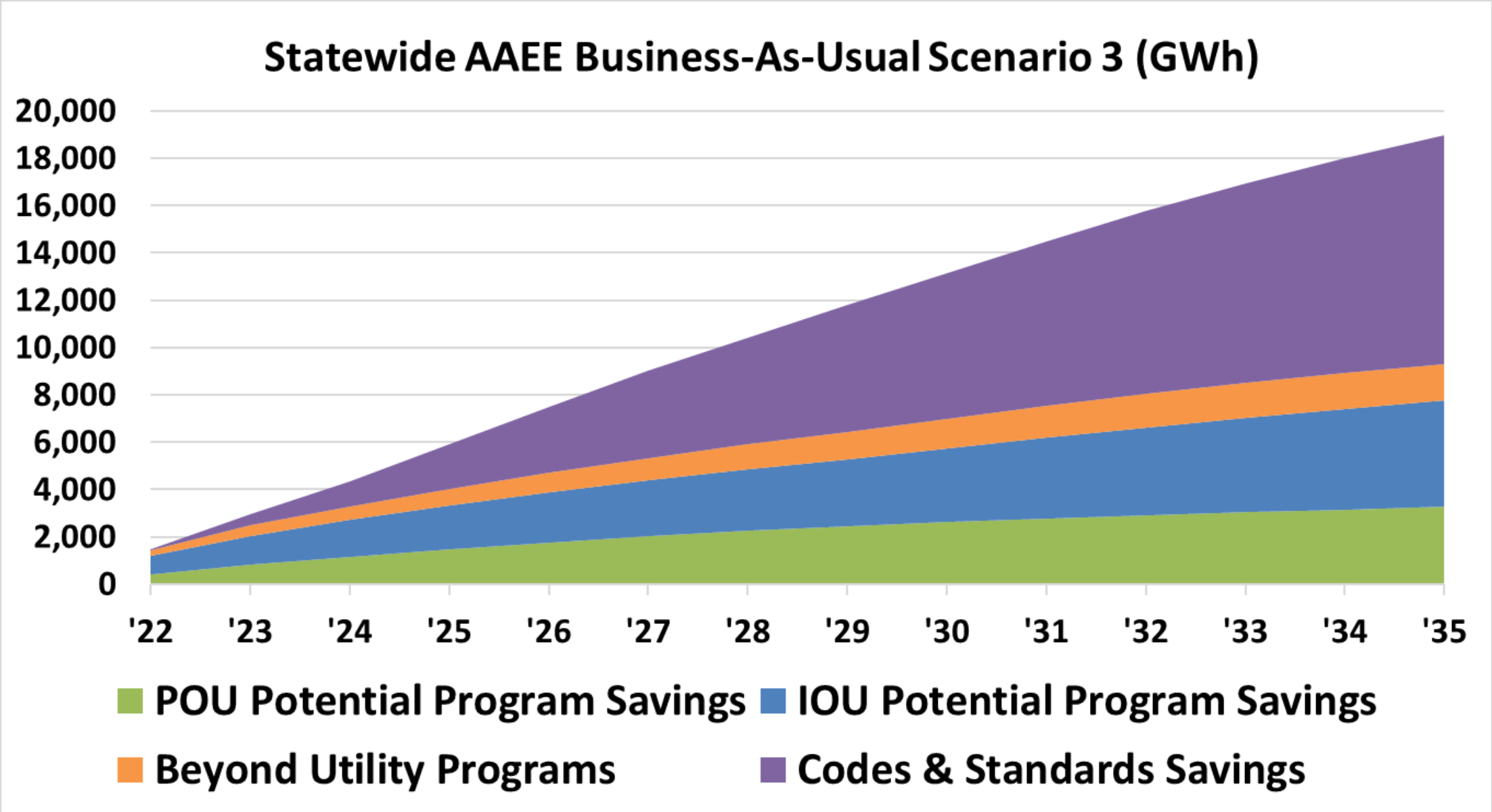
IOU Potential Program Savings

POU Potential Program Savings

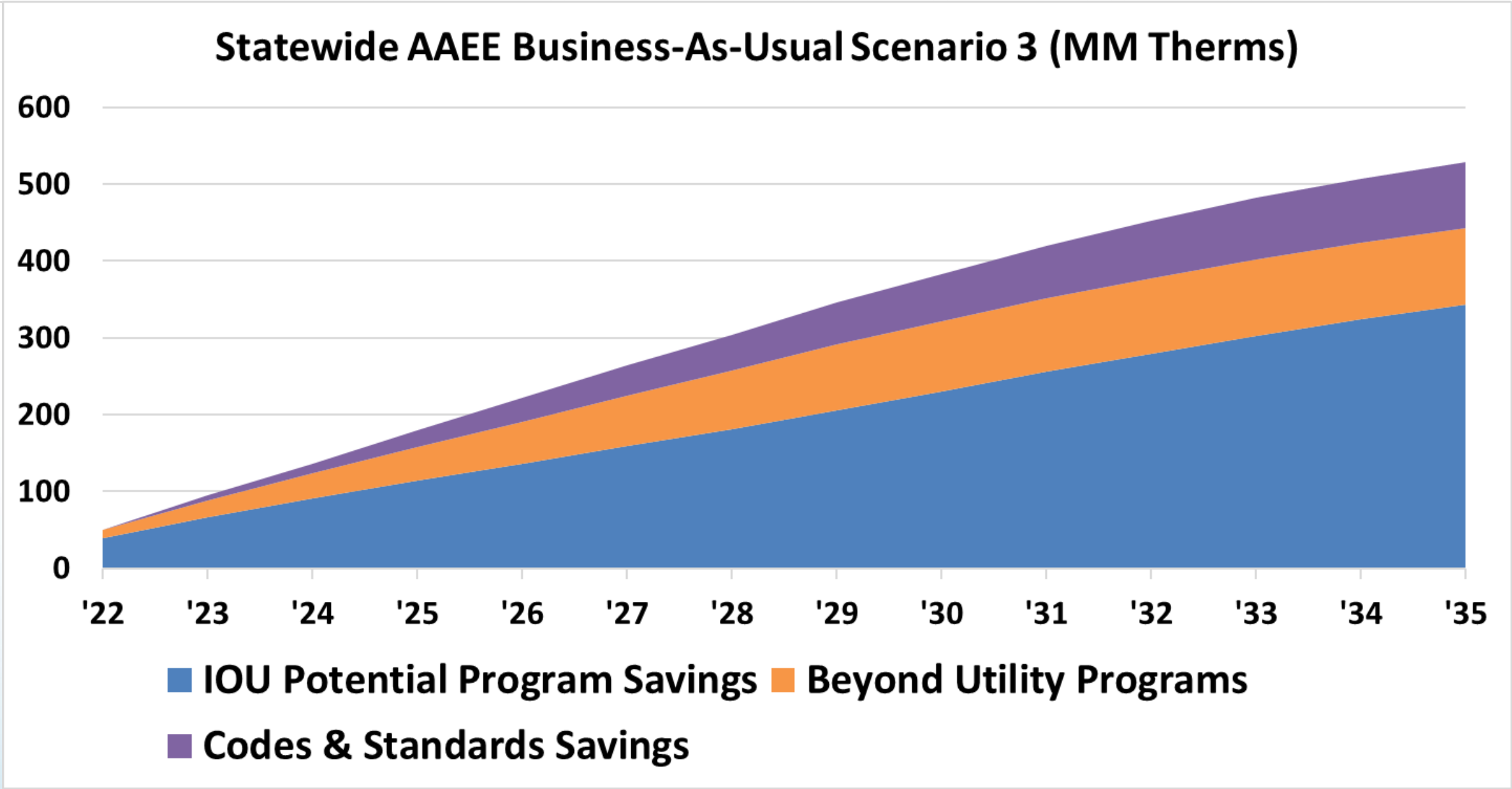
Codes and Standards Savings

Beyond Utility Program Savings

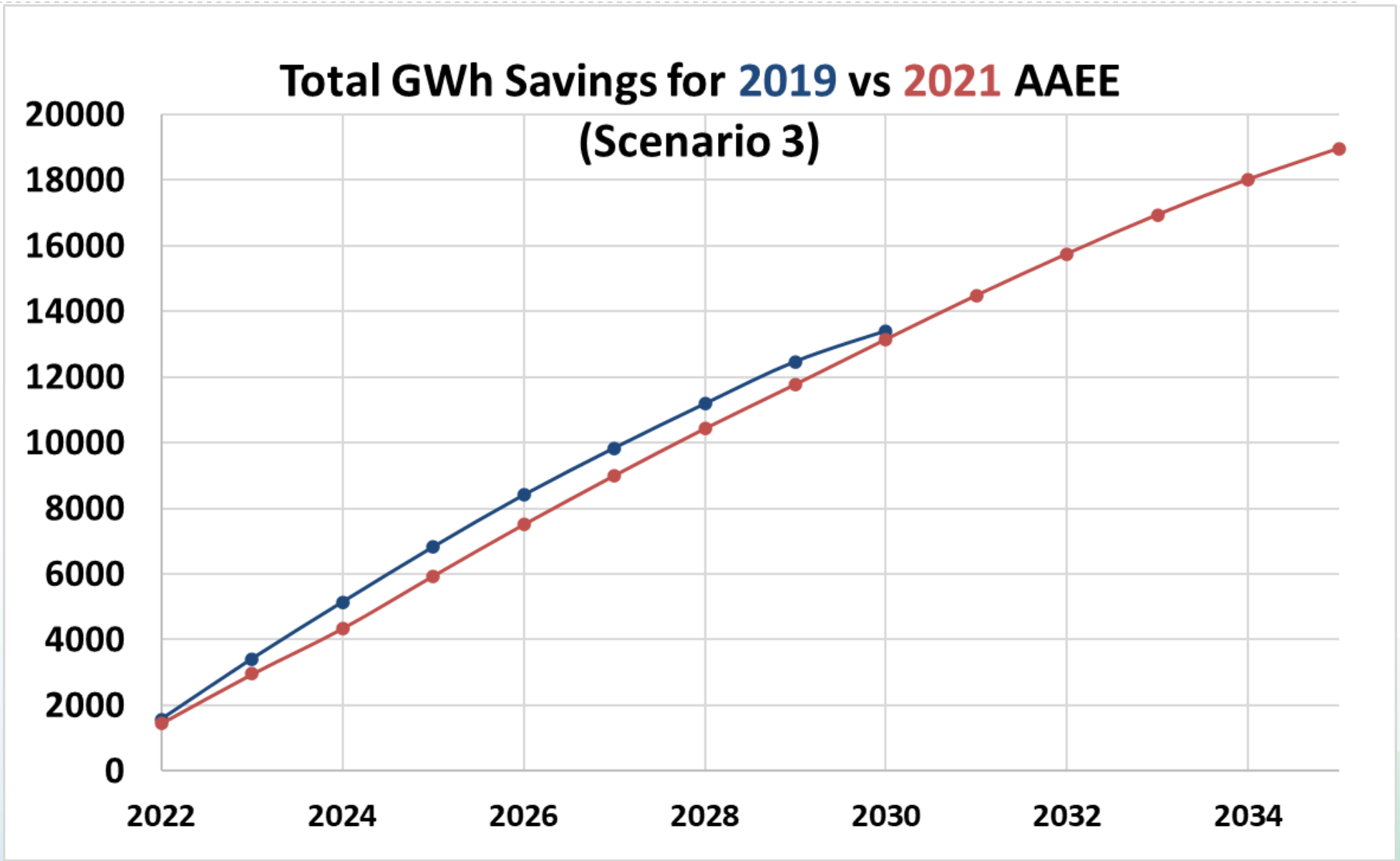
2021 AAEE Annual Savings Scenario 3 - Statewide Electricity



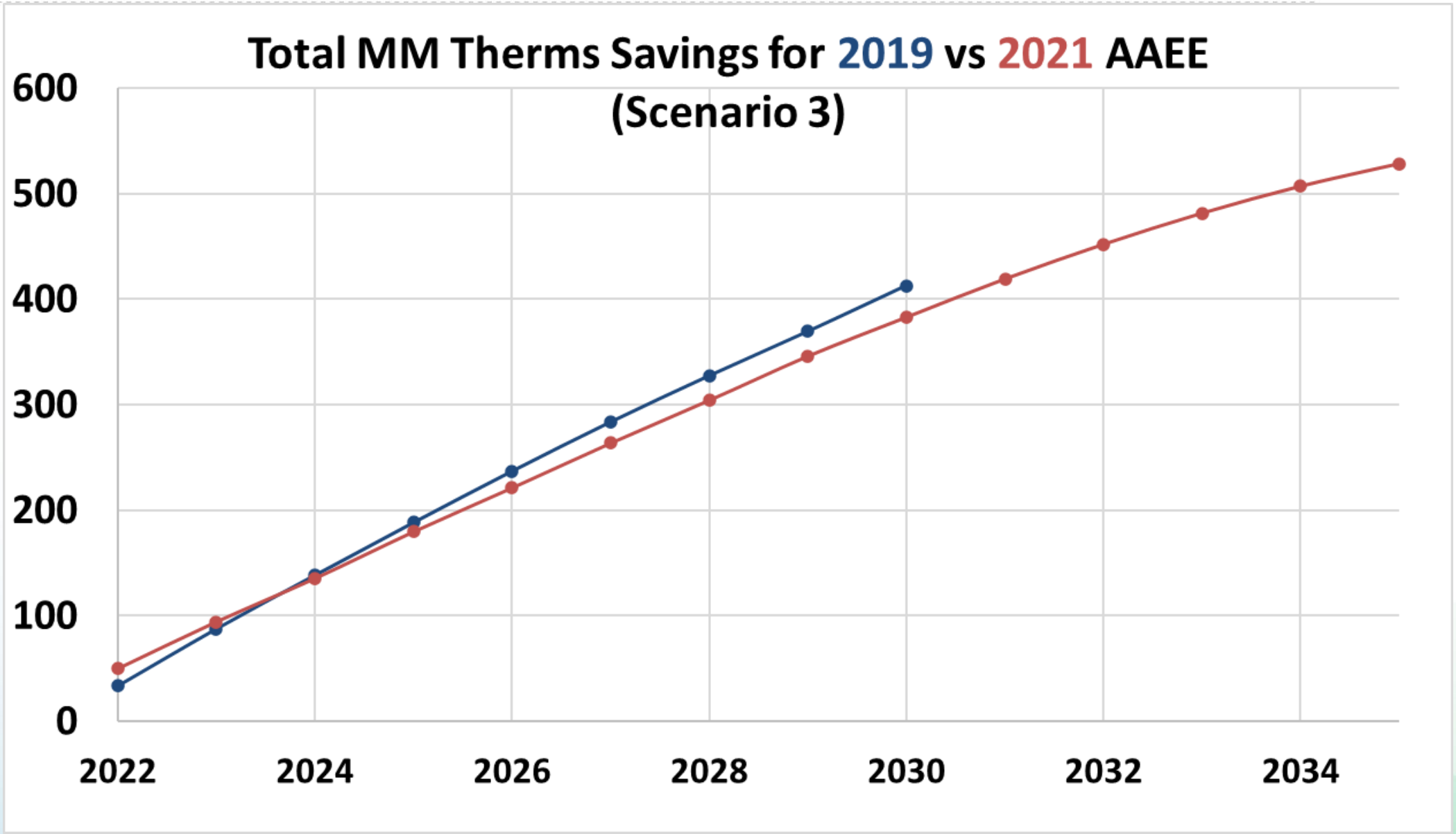
2021 AAEE Annual Savings Scenario 3 - Statewide Gas



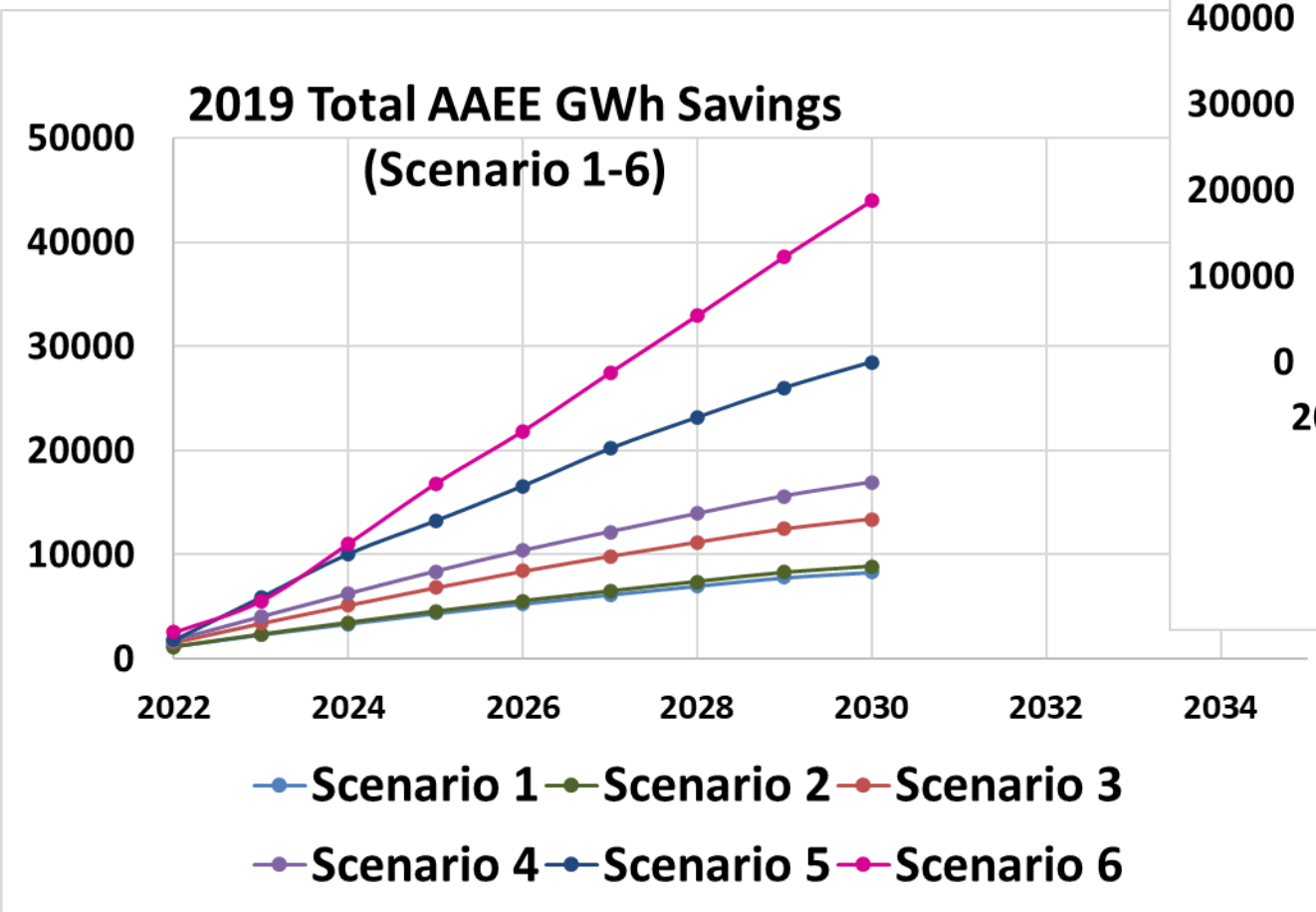
Comparing Total Statewide 2021 AAEE BAU Forecast to 2019 AAEE BAU Forecast - Electricity

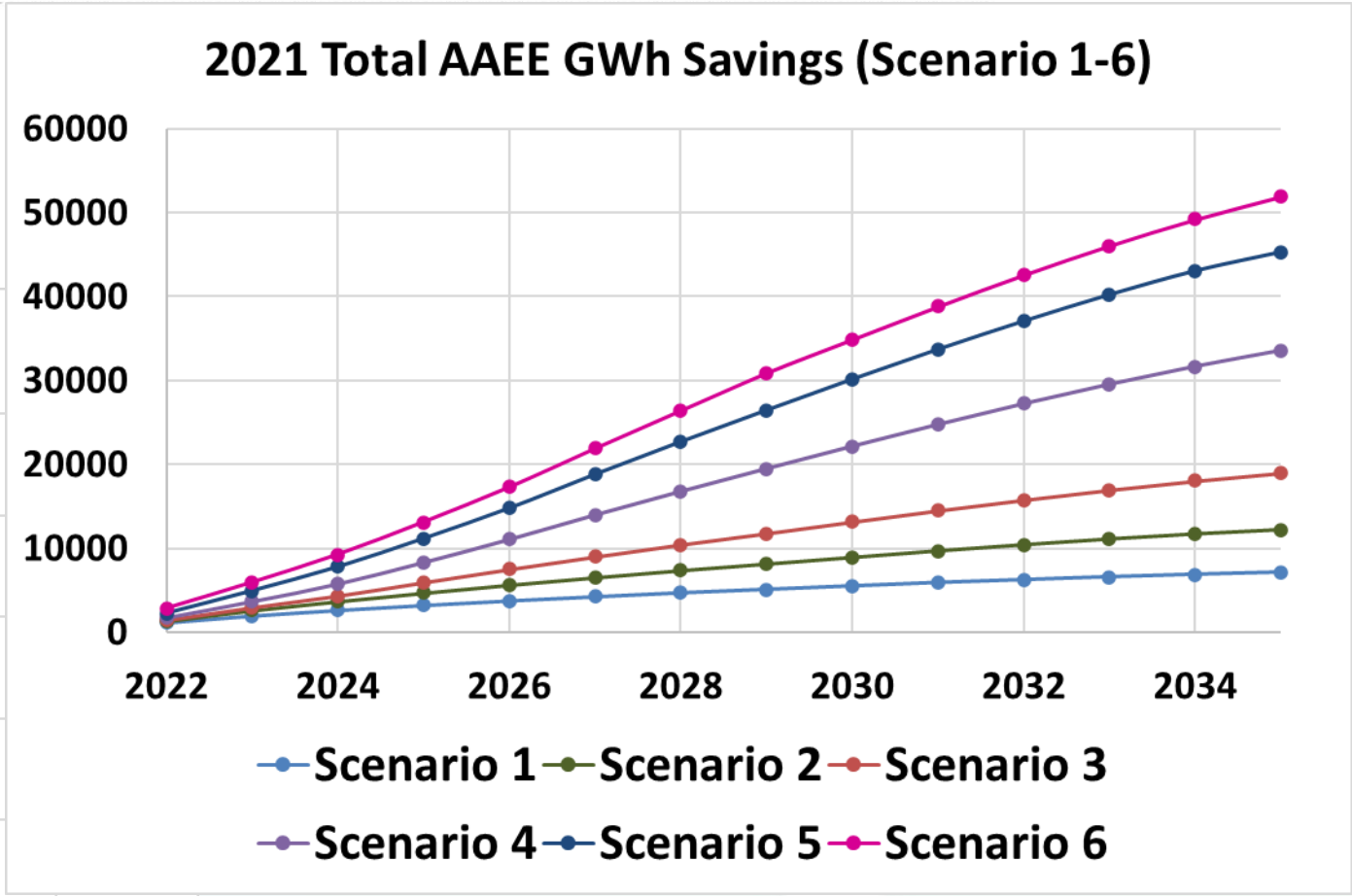


Comparing Total Statewide 2021 AAEE BAU Forecast to 2019 AAEE BAU Forecast – Gas

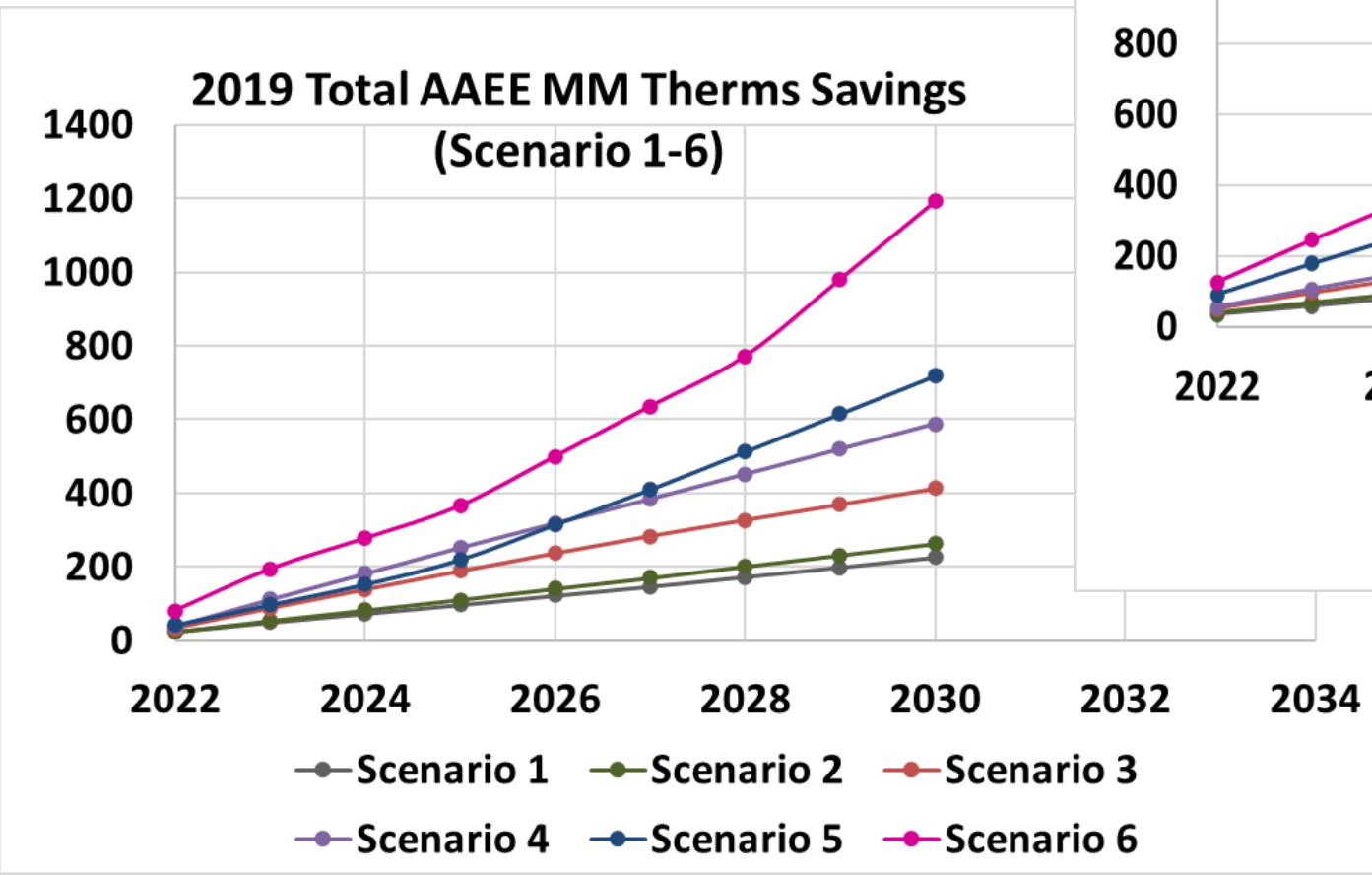


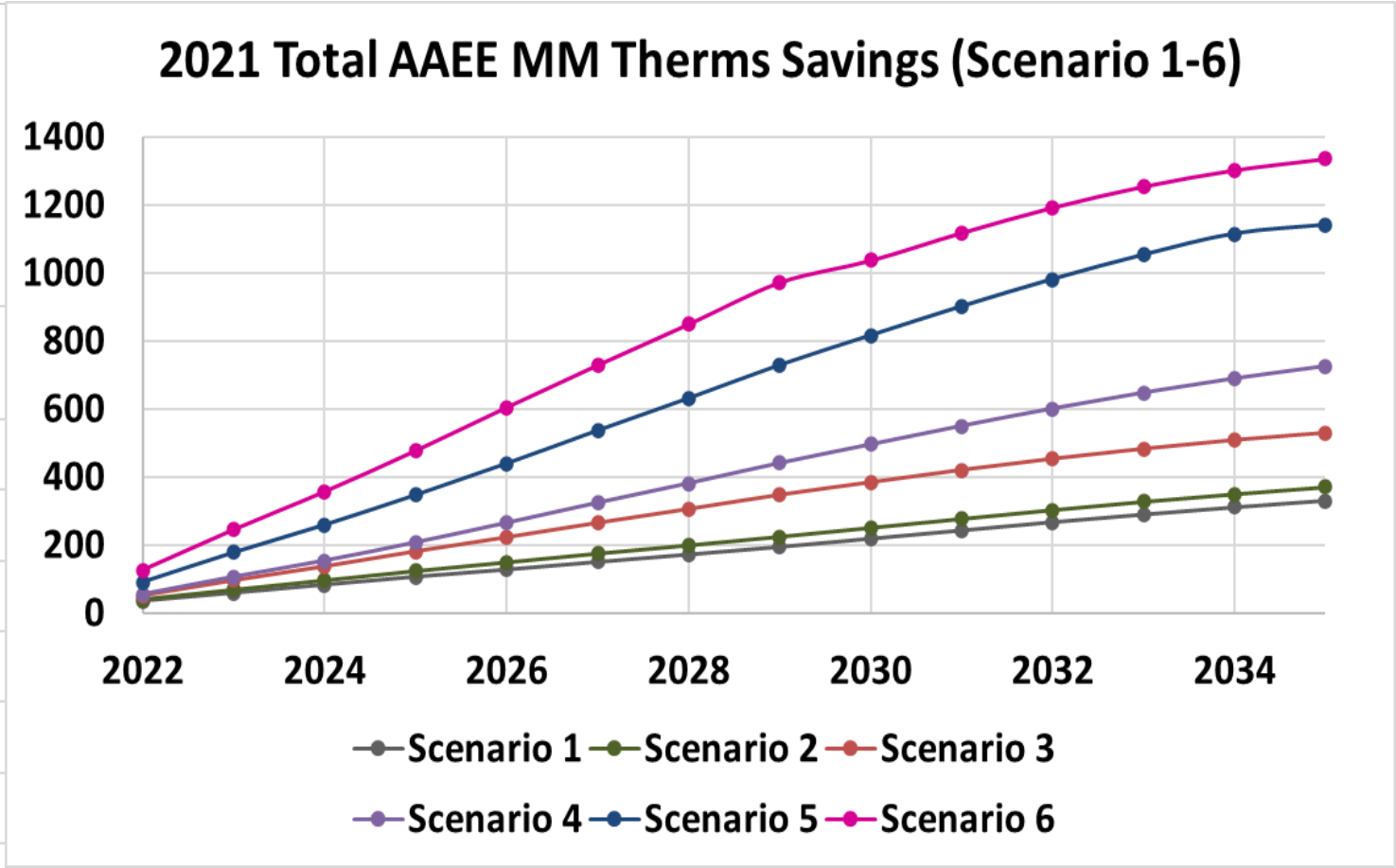
Comparing Total Statewide Spectrum of 2021 AAEE Scenarios to 2019 AAEE Scenarios - Electricity





Comparing Total Statewide Spectrum of 2021 AAEE Scenarios to 2019 AAEE Scenarios – Gas

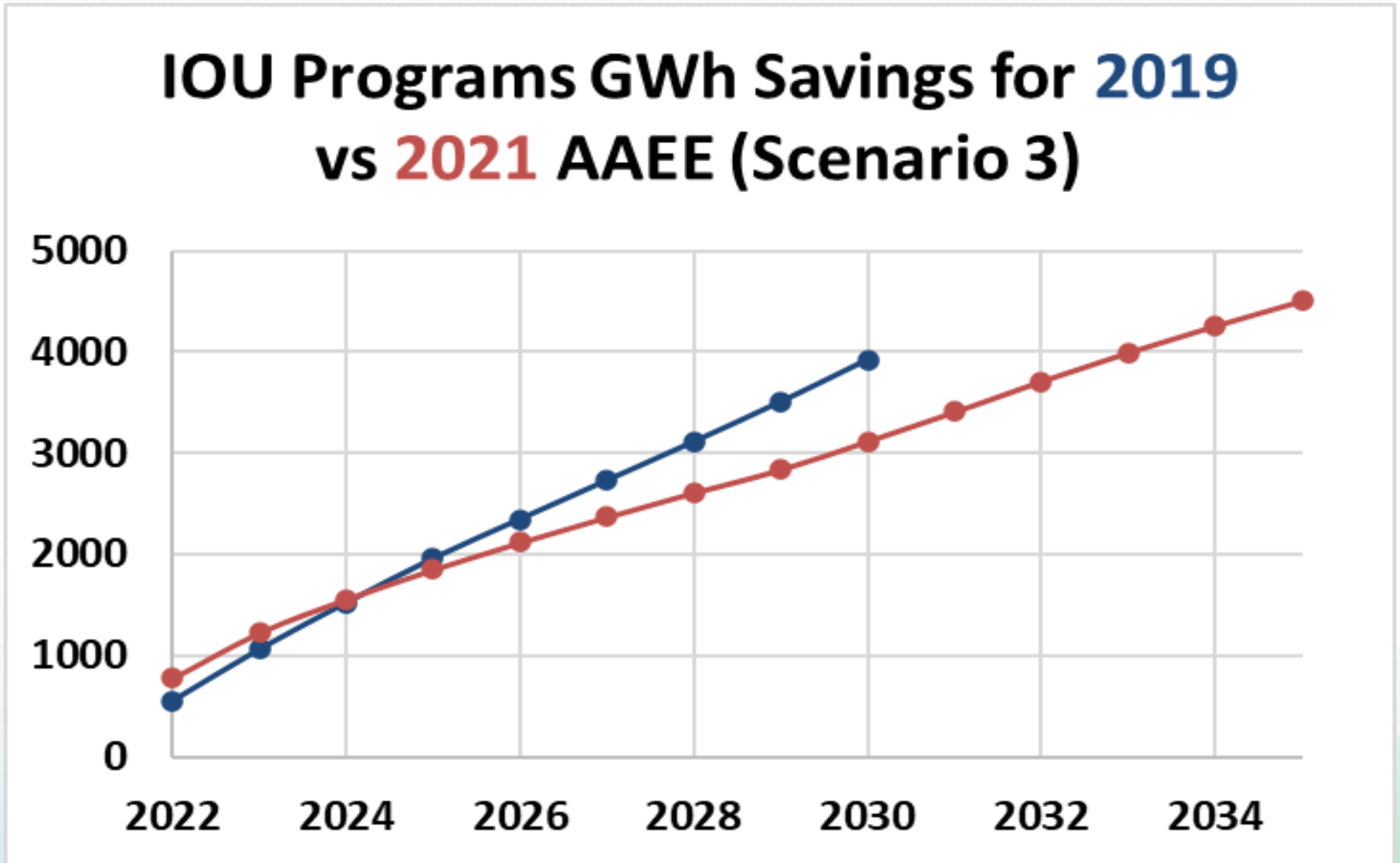




2021 IOU AAEE Scenario Design

Lever	Mid - Very Low (Scenario 1)	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - High (Scenario 4)	Mid - Very High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	**2019 IEPR Mid-Case**					
Retail Prices						
AIMS ETs	Reference		**Reference**	Average of Reference & Aggressive		Aggressive
Incentive Levels	capped at 25% of incremental cost	capped at 50% of incremental cost	**capped at 50% of incremental cost**	capped at 50% of incremental cost		capped at 75% of incremental cost
C-E Measure Screening Threshold (TRC using 2020 ACC for 2022-2023; 2021 ACC for 2024-2032)	1.25	1	**0.85**	0.85		0.75
Marketing & Outreach = Rebate Program Engagement Assumptions	Default calibrated value		**Default calibrated value = Reference**	Increased marketing strength		
Financing Programs	No modeled impacts		**No modeled impacts**	IOU financing programs broadly available to Res and Com customers		
BROs Program Engagement Assumptions	Conservative	Reference	**Reference**	Average of Reference & Aggressive		Aggressive
EE program cost adjustments	10% more than existing levels for ET	no change			10% less than existing levels for ET	
DR co-benefits: on vs. off	off				on	
COVID adjustment: on vs. off	on	off; default assumptions				
Low Income	ESA Decision Goals 2022-2026; PG Study Sc 1 Base 2027-2032		**ESA Decision Goals 2022-2026; PG Study Sc1 Base 2027-2032**	ESA Decision Goals 2022-2026; PG Study Sc2 High 2027-2032	ESA Decision Goals 2022-2026; PG Study Sc3 Double 2027-2032	PG Study Sc3 Double 2022-2032

Comparing IOU Programs in the BAU 2021 AAEE Scenario to the BAU 2019 AAEE Scenario - Electricity



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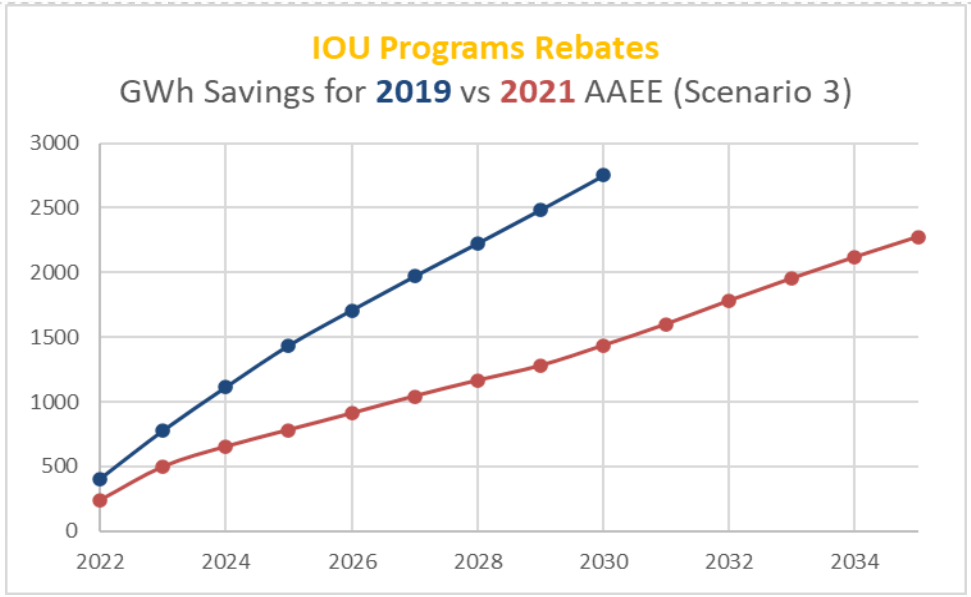
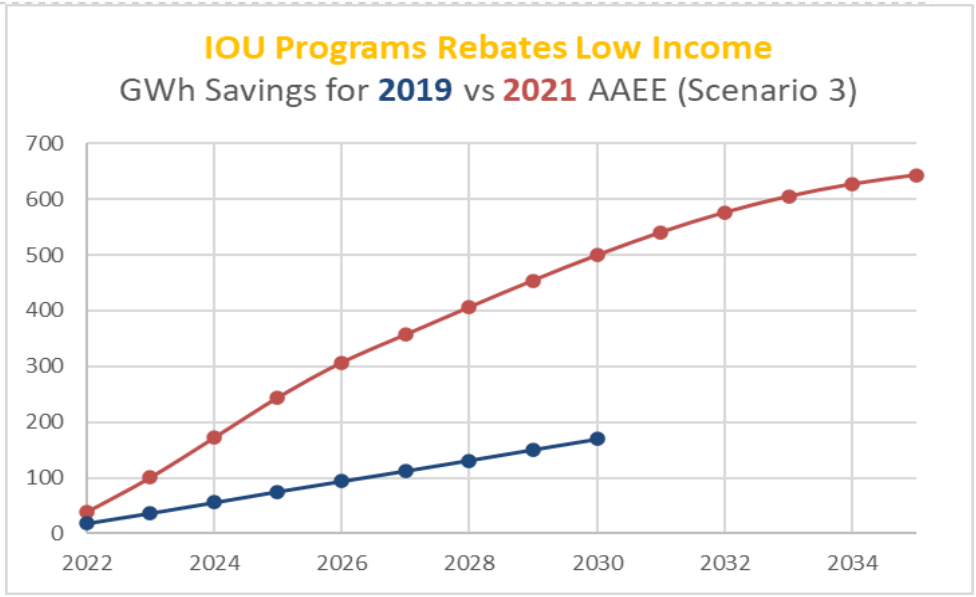
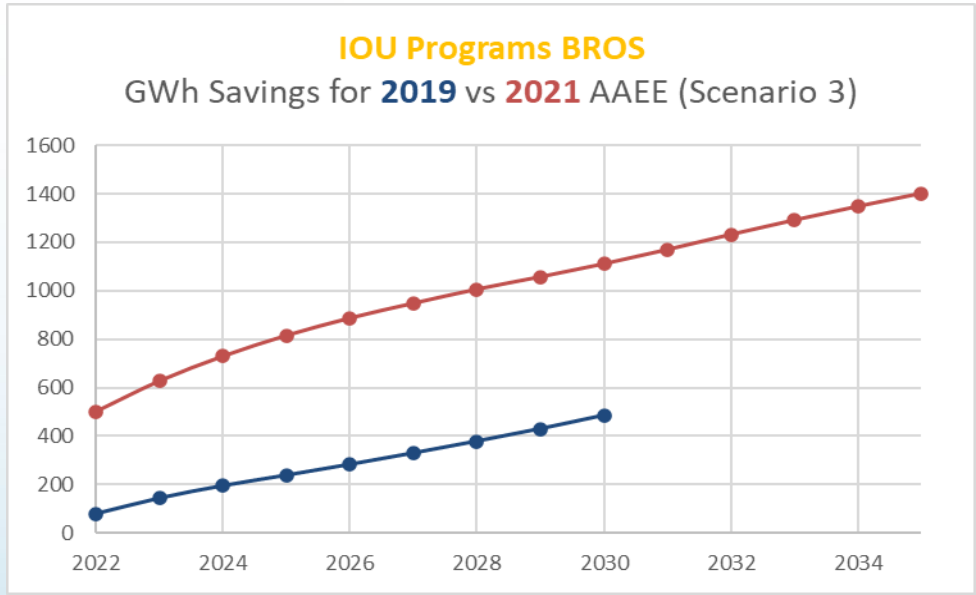
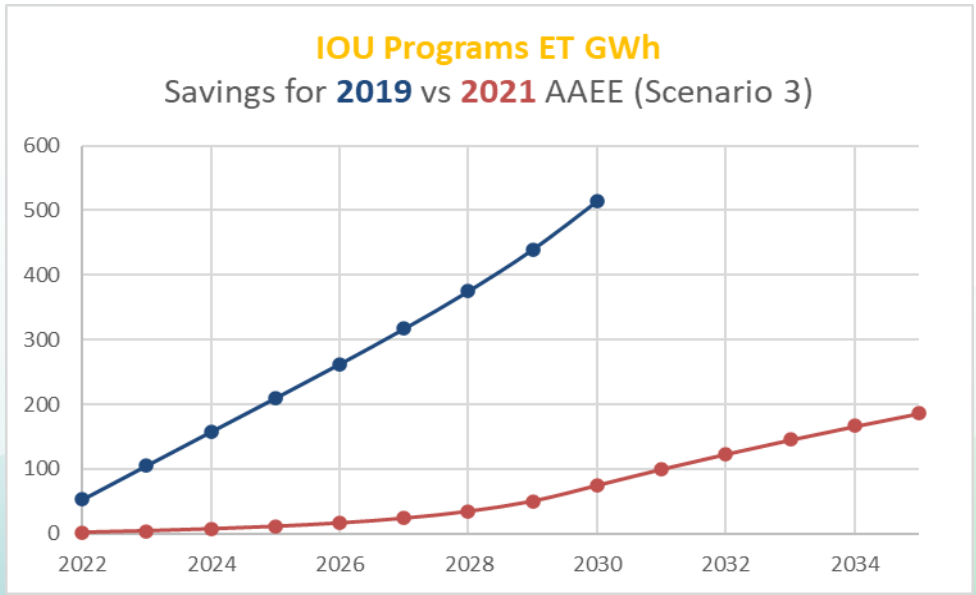
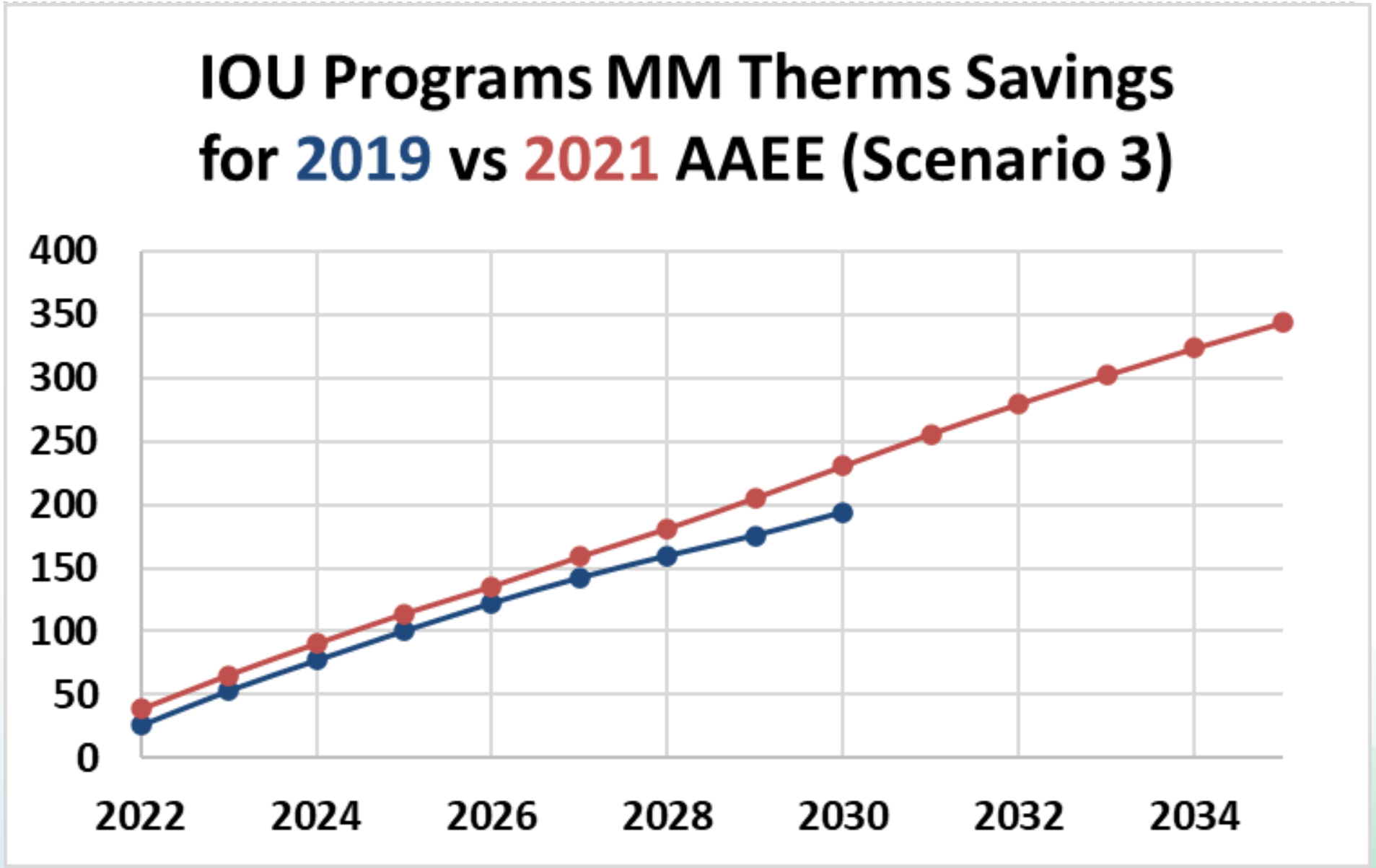








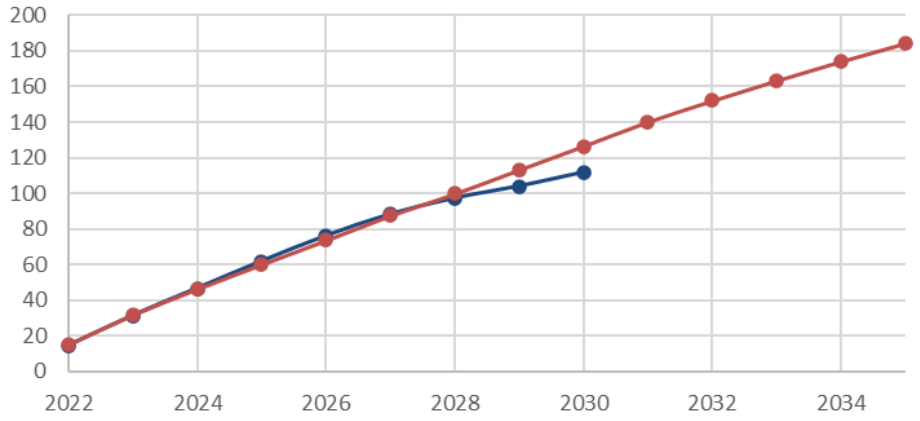
Comparing IOU Programs in the BAU 2021 AAEE Scenario to the BAU 2019 AAEE Scenario – Gas



Comparing IOU Programs in the BAU 2021 AAEE Scenario to the BAU 2019 AAEE Scenario – Gas

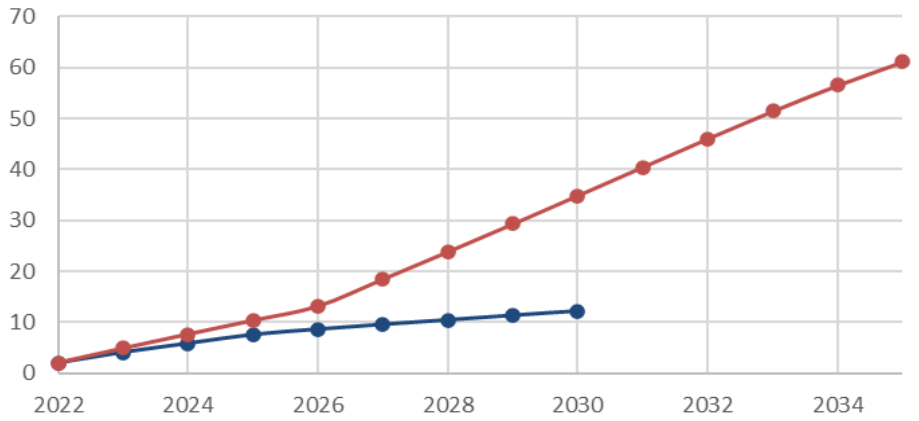
IOU Programs Rebates

MM Therms Savings for **2019** vs **2021** AAEE
(Scenario 3)



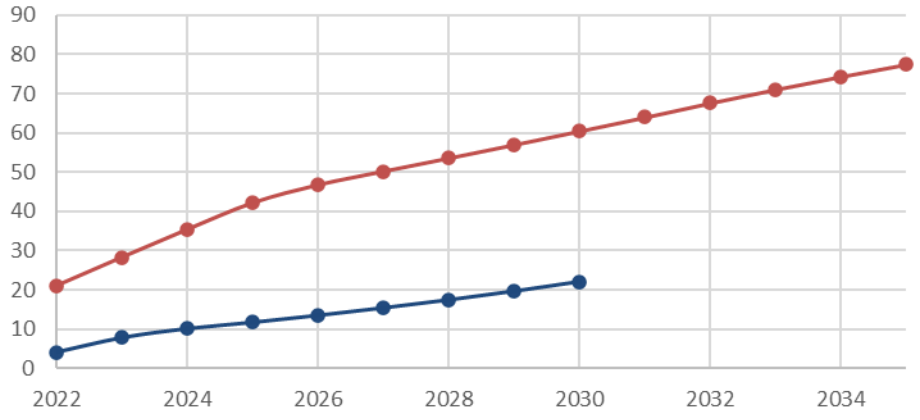
IOU Programs Rebates Low Income

MM Therms Savings for **2019** vs **2021** AAEE
(Scenario 3)



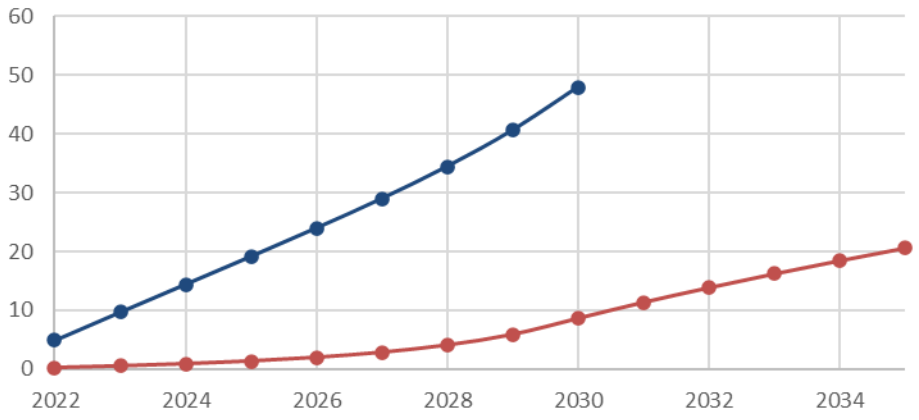
IOU Programs BROS

MM Therms Savings for **2019** vs **2021** AAEE
(Scenario 3)

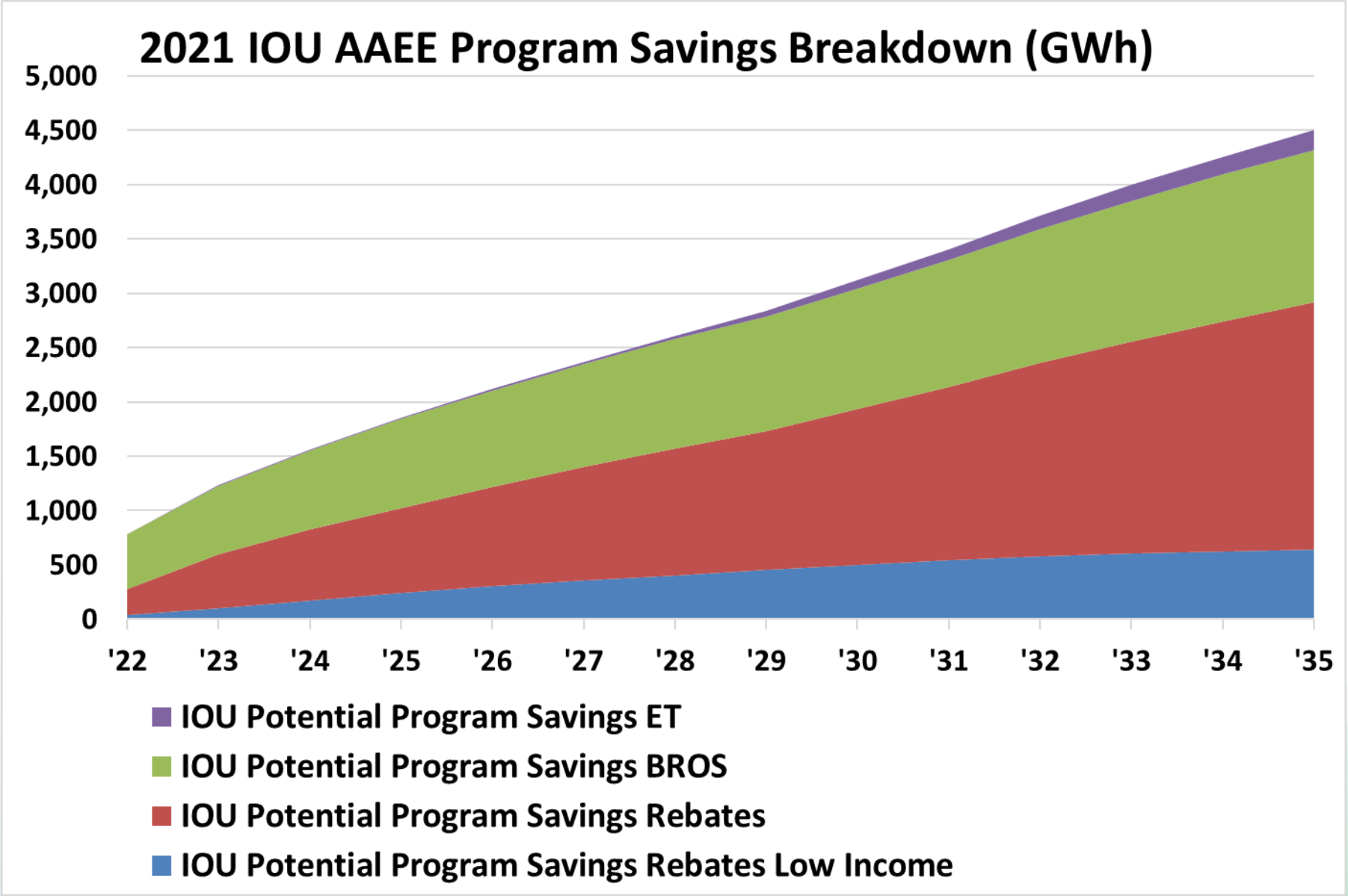


IOU Programs ET

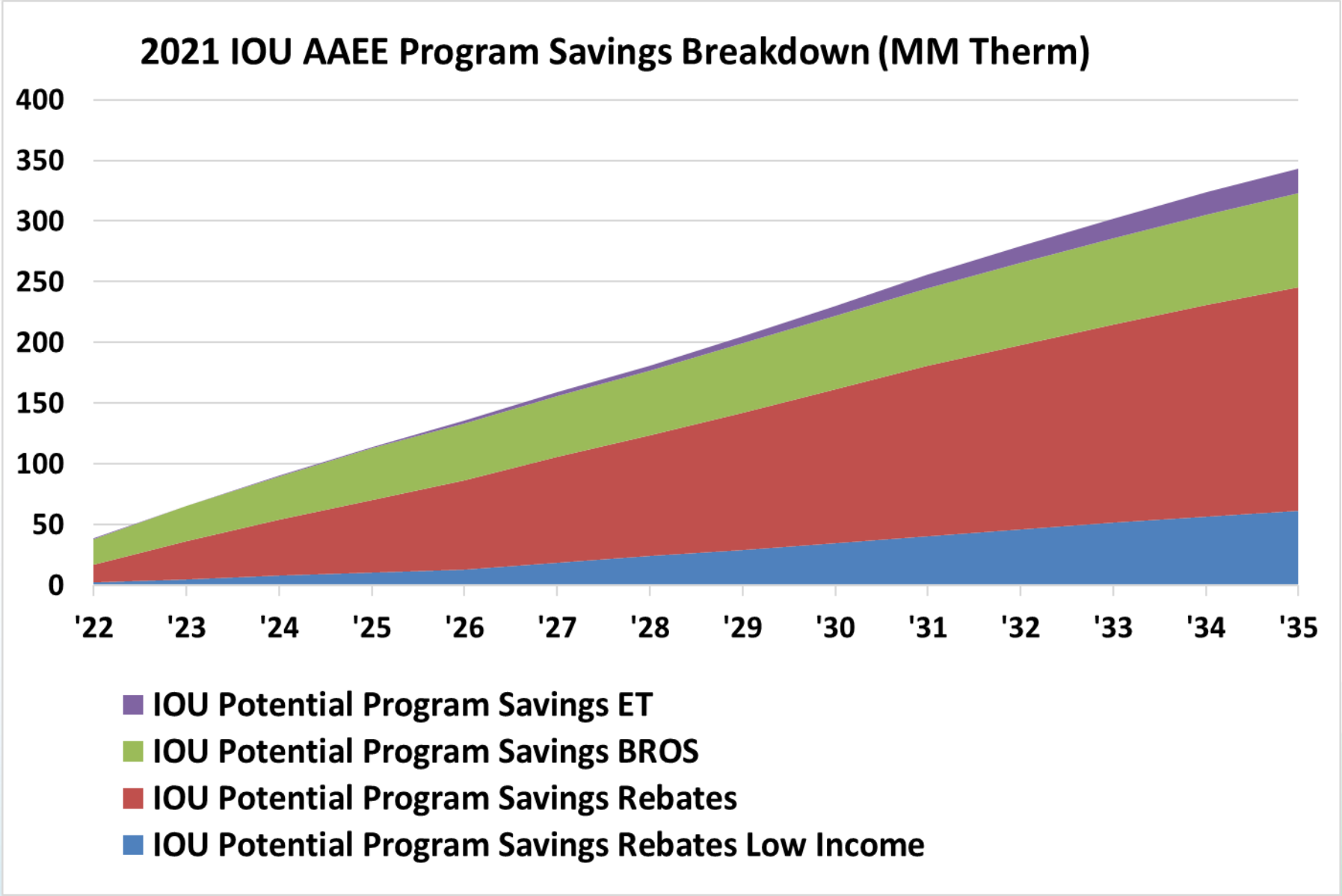
MM Therms Savings for **2019** vs **2021** AAEE
(Scenario 3)



Comparing IOU Programs in the BAU 2021 AAEE Scenario - Electricity



Comparing IOU Programs in the BAU 2021 AAEE Scenario – Gas

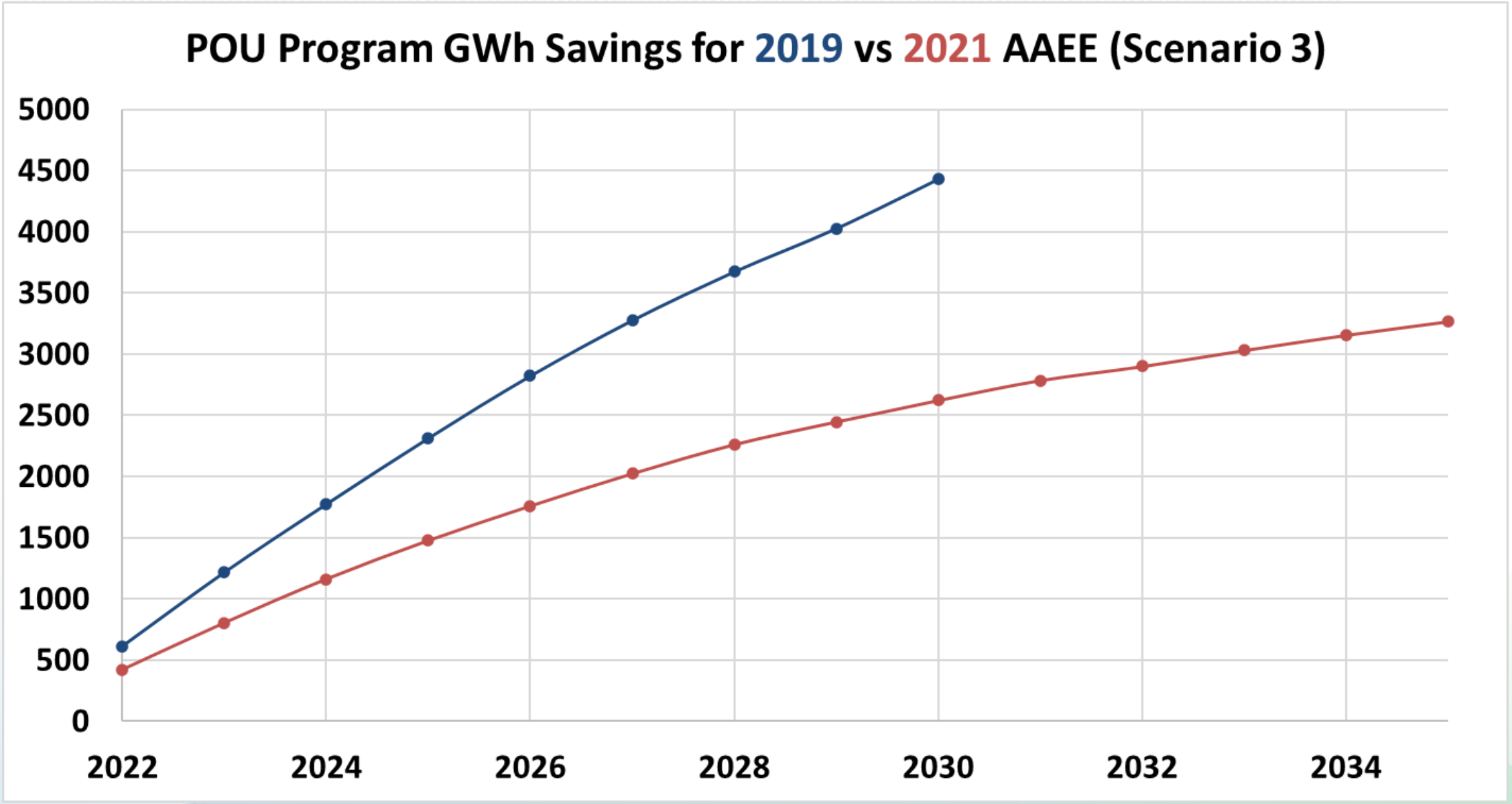


2021 POU AAEE Scenario Design

Lever	Mid - Very Low (Scenario 1)	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - High (Scenario 4)	Mid - Very High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case					
Retail Prices						
POU Program Contributions	conservative EE savings		reference EE savings		aggressive EE savings	

- For each of the 38 California POUs, energy efficiency savings projections were defined for the years 2022 to 2041 by GDS Associates on behalf of the CMUA
- Savings were characterized by sector, by end use, and by program name
  - Behavioral Programs were named
  - Fuel Substitution impacts were not included
- first-year Cumulative Market Potential was used as the reference level
- to create POU potential scenarios, the team calculated sector-by-sector (Residential, Commercial, Industrial, and Agricultural) ratios from the 2021 PG study IOU data

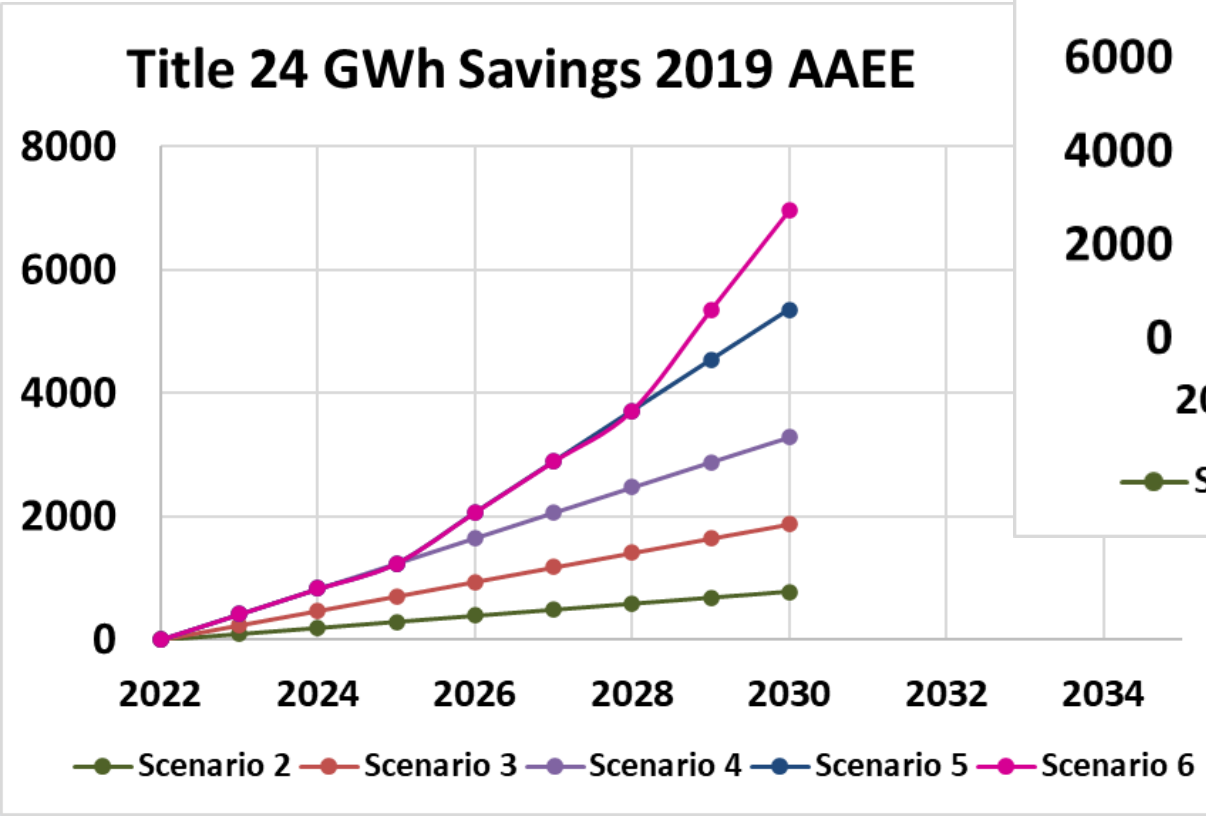
Comparing POU Programs in the BAU 2021 AAEE Scenario to the BAU 2019 AAEE Scenario - Electricity

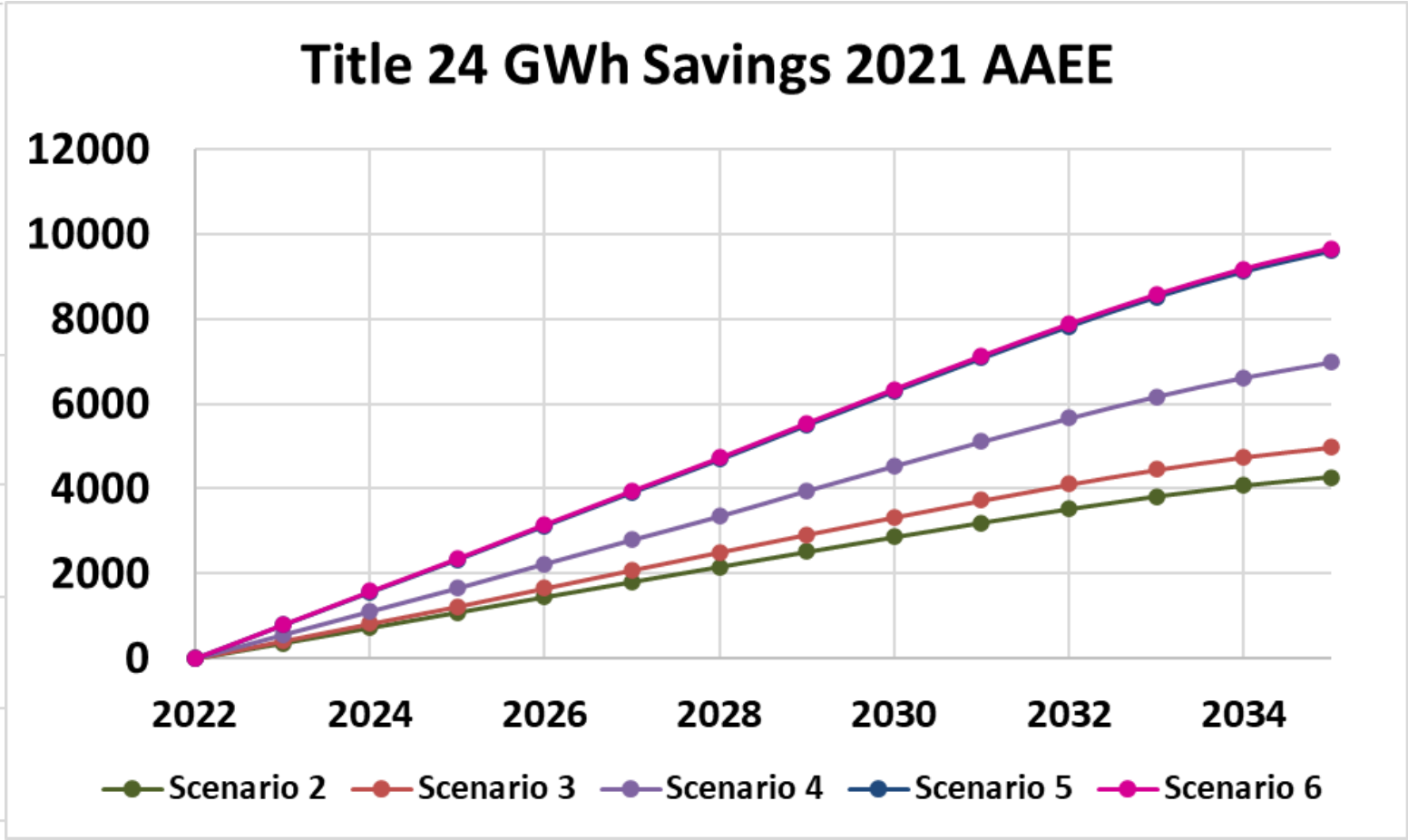


2021 C&S AAEE Scenario Design

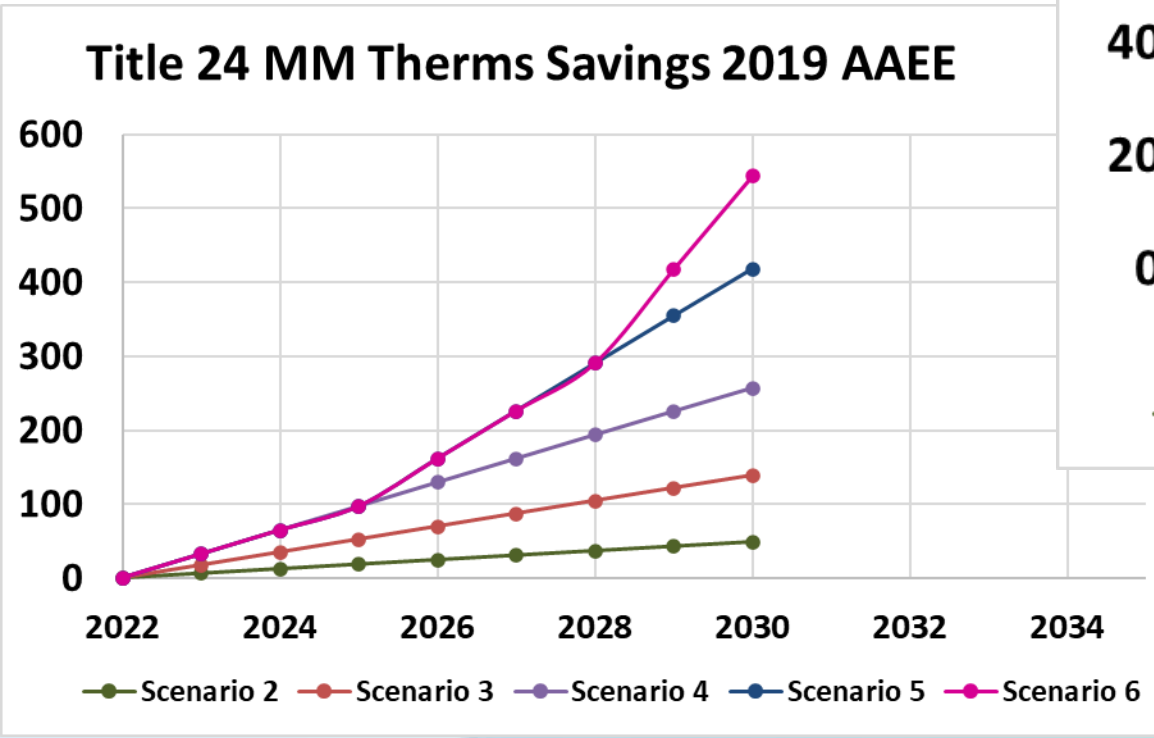
Lever	Mid - Very Low (Scenario 1)	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - High (Scenario 4)	Mid - Very High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case					
Retail Prices						
Title 24	none added above the baseline of the **2019** Standards	adding the **2022** Standards at a 20% compliance rate reduction	adding the **2025** Standards at a 20% compliance rate reduction	adding the **2028** Standards at a 20% compliance rate reduction	adding the **2025** Standards at a 20% compliance rate reduction	adding the **2028** Standards at the reference compliance rate
			adding the **2022** Standards at the reference compliance rate	adding the **2025** Standards at a 20% compliance rate reduction	adding the **2025** Standards at the reference compliance rate	adding the **2025** Standards at a 20% compliance rate enhancement
				adding the **2022** Standards at a 20% compliance rate enhancement		adding the **2022** Standards at a 20% compliance rate enhancement
Title 20	none added above the baseline of standards **"on the books" in 2021**	none added above the baseline of standards "on the books" in 2021	adding possible new **measures starting 2022- 2024** at a 20% compliance rate reduction	adding additional possible new **measures starting 2025-2030** at a 20% compliance rate reduction	adding additional possible new measures starting 2025-2030 at the reference compliance rate	adding additional possible new measures starting 2025-2030 at a 20% compliance rate enhancement
				adding possible new measures starting 2022-2024 at the reference compliance rate		adding possible new measures starting 2022-2024 at a 20% compliance rate enhancement
Federal Appliance Standards	none added above the baseline of standards **"on the books" in 2021**	none added above the baseline of standards "on the books" in 2021	adding possible new **measures starting 2023- 2026** at a 20% compliance rate reduction	adding additional possible new **measures starting 2027-2031** at a 20% compliance rate reduction	adding additional possible new measures starting 2027-2031 at the reference compliance rate	adding additional possible new measures starting 2027-2031 at a 20% compliance rate enhancement
				adding possible new measures starting 2023-2026 at the reference compliance rate		adding possible new measures starting 2023-2026 at a 20% compliance rate enhancement

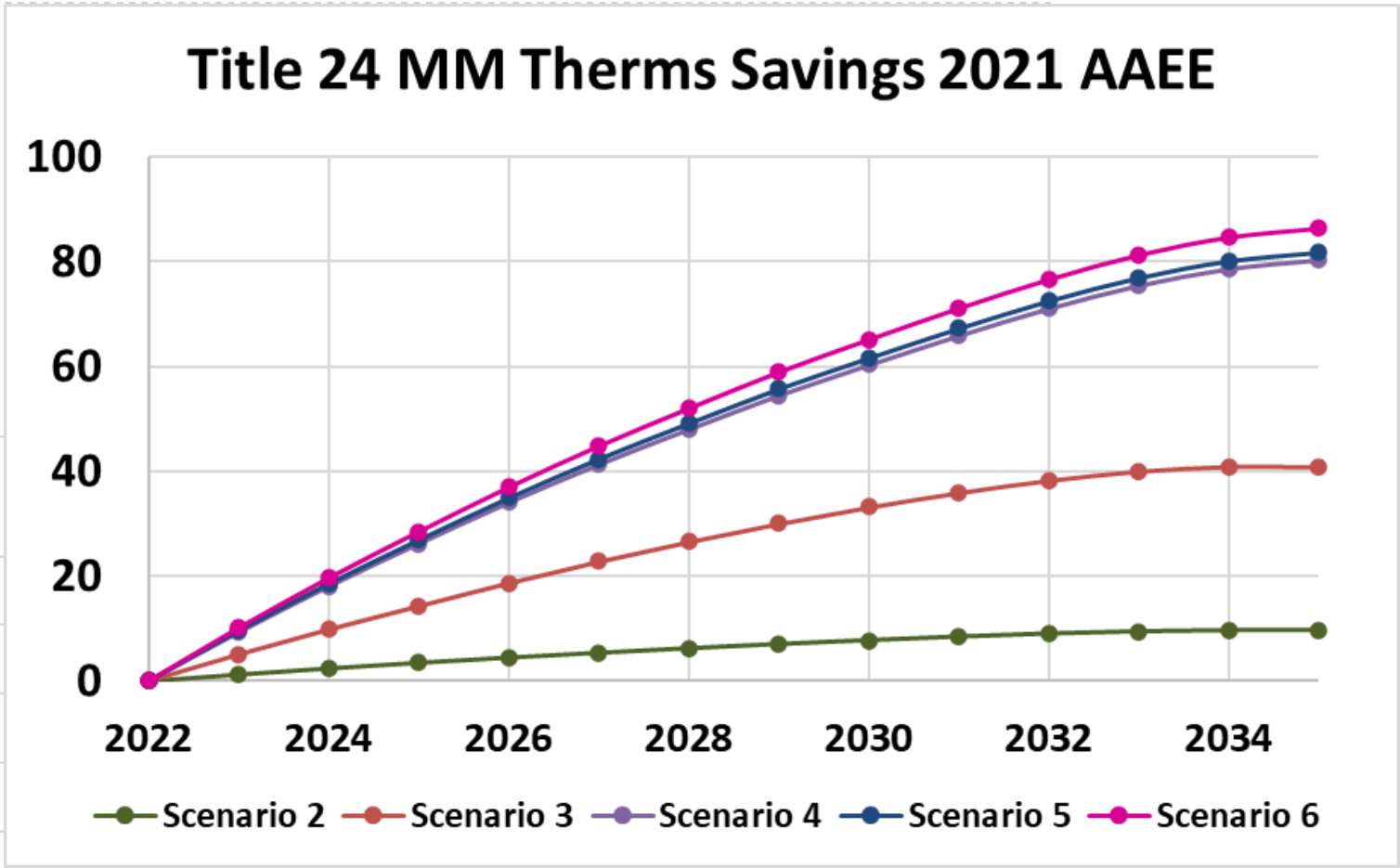
Comparing Title 24 Building Standards Savings 2021 AAEE Scenarios to 2019 AAEE Scenarios - Electricity



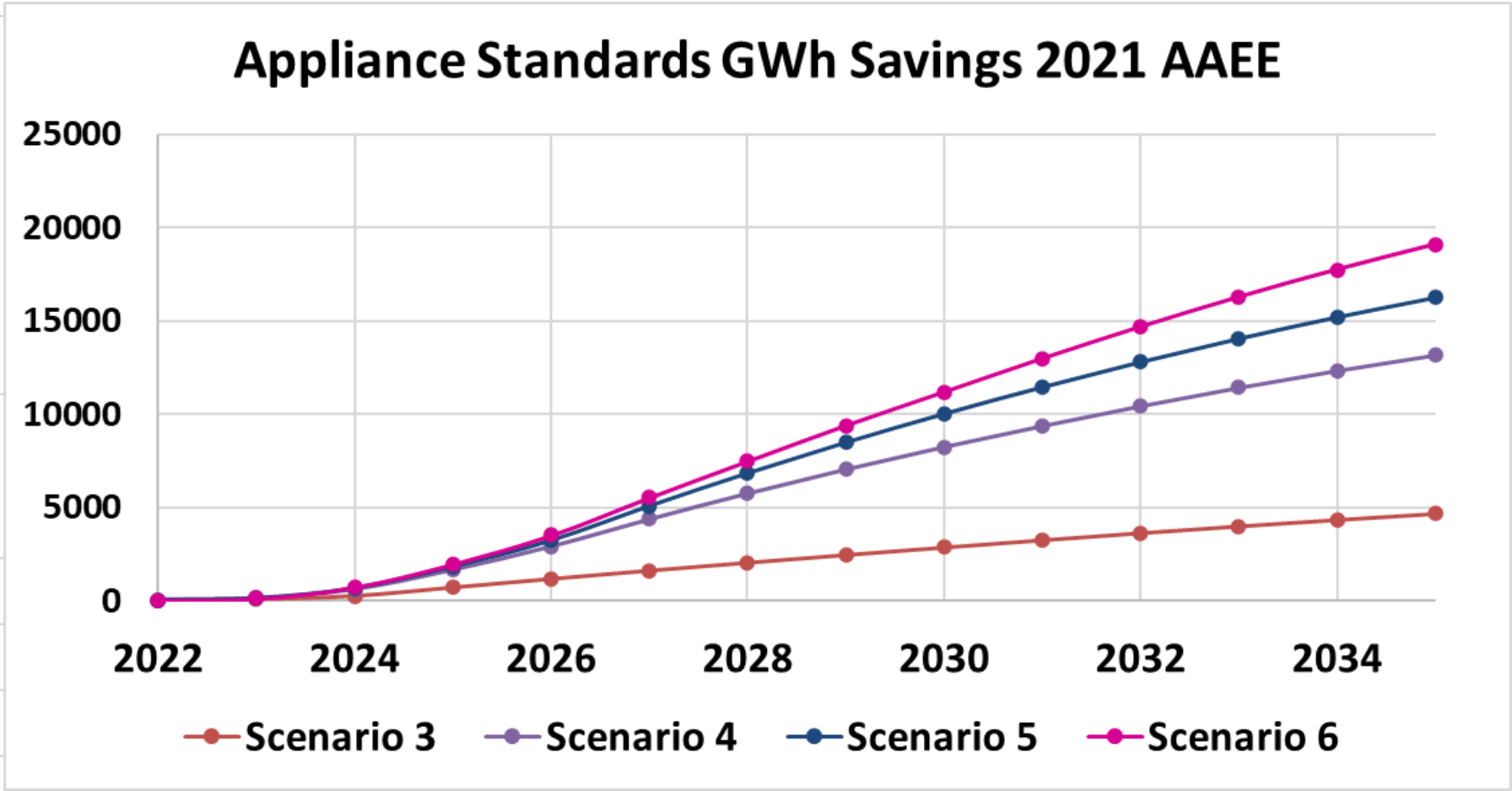


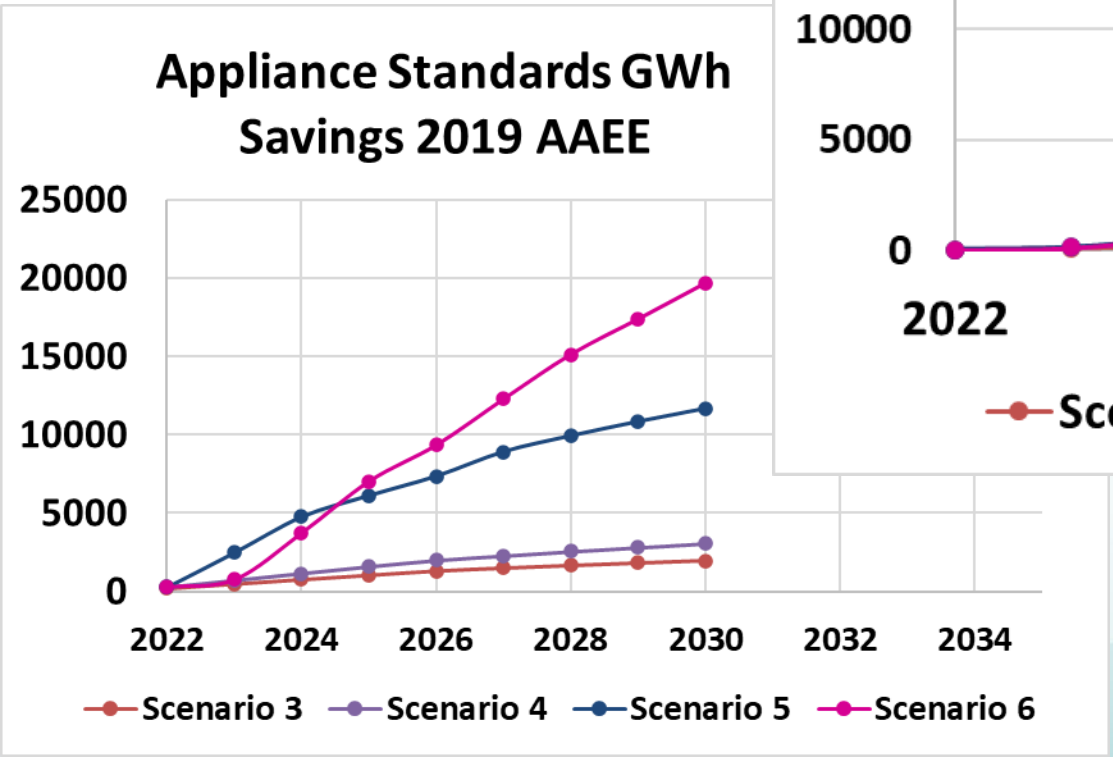
Comparing Title 24 Building Standards Savings 2021 AAEE Scenarios to 2019 AAEE Scenarios – Gas



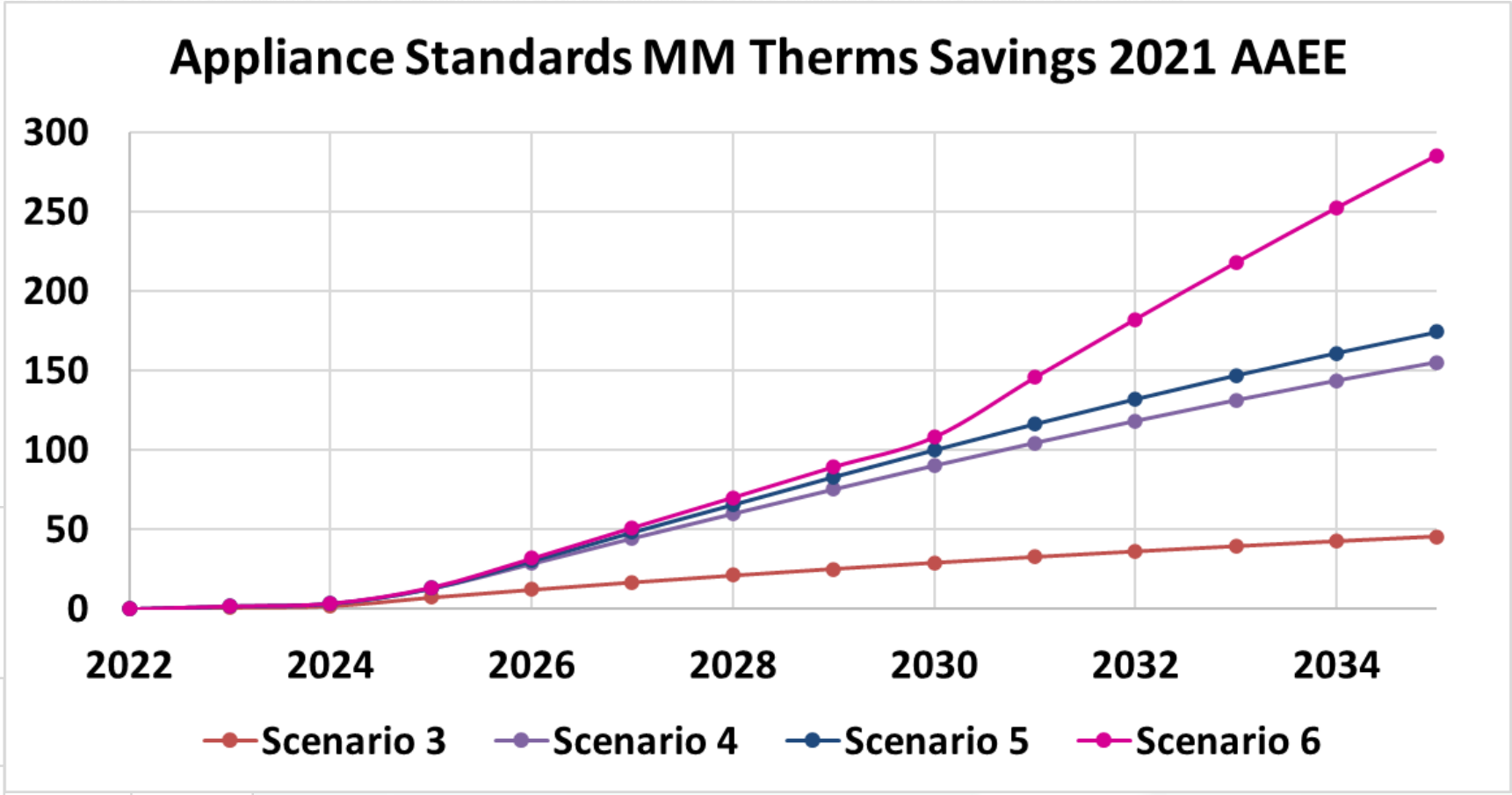


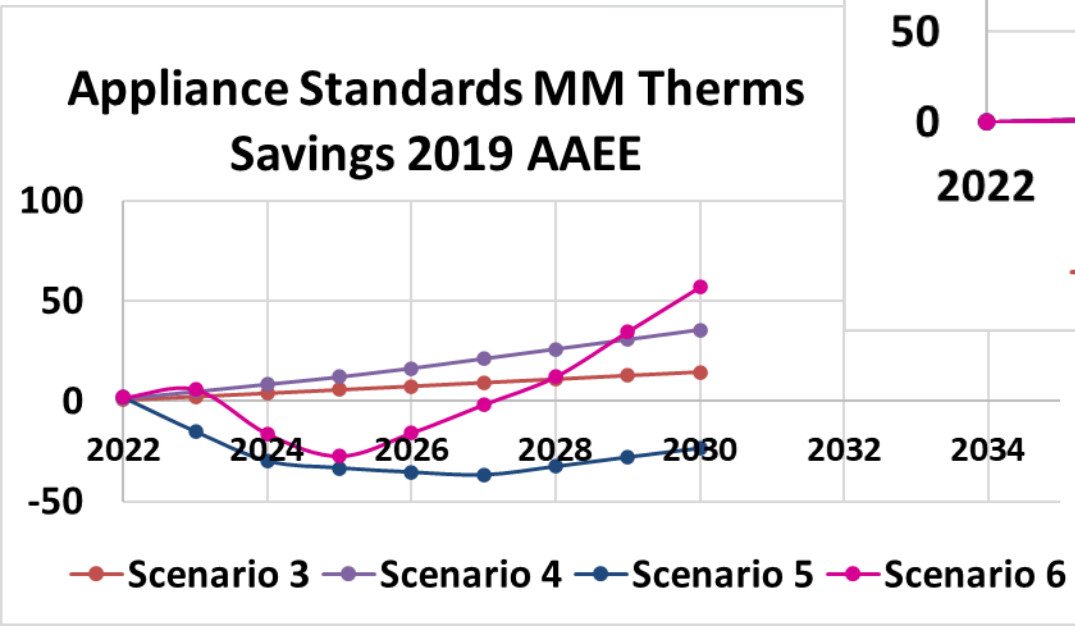
Comparing Title 20 & Federal Appliance Standards Savings in 2021 AAEE Scenarios to 2019 AAEE Scenarios - Electricity





Comparing Title 20 & Federal Appliance Standards Savings in 2021 AAEE Scenarios to 2019 AAEE Scenarios – Gas

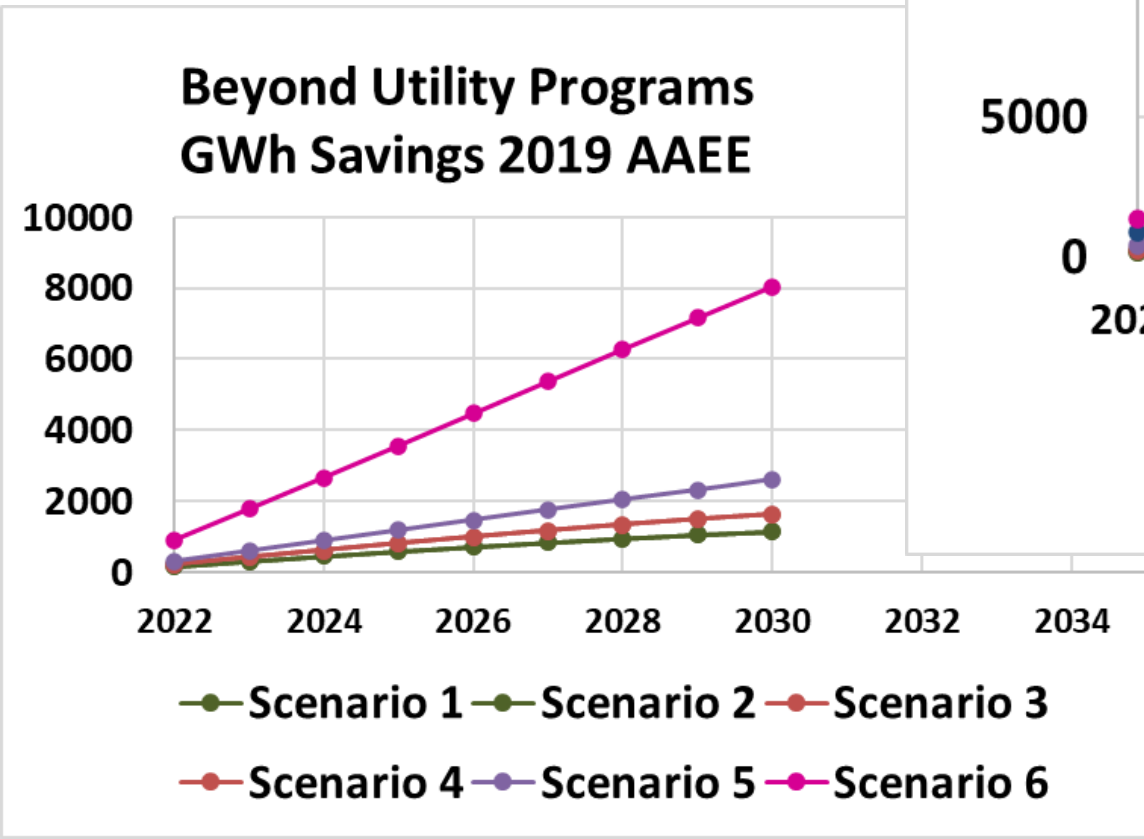


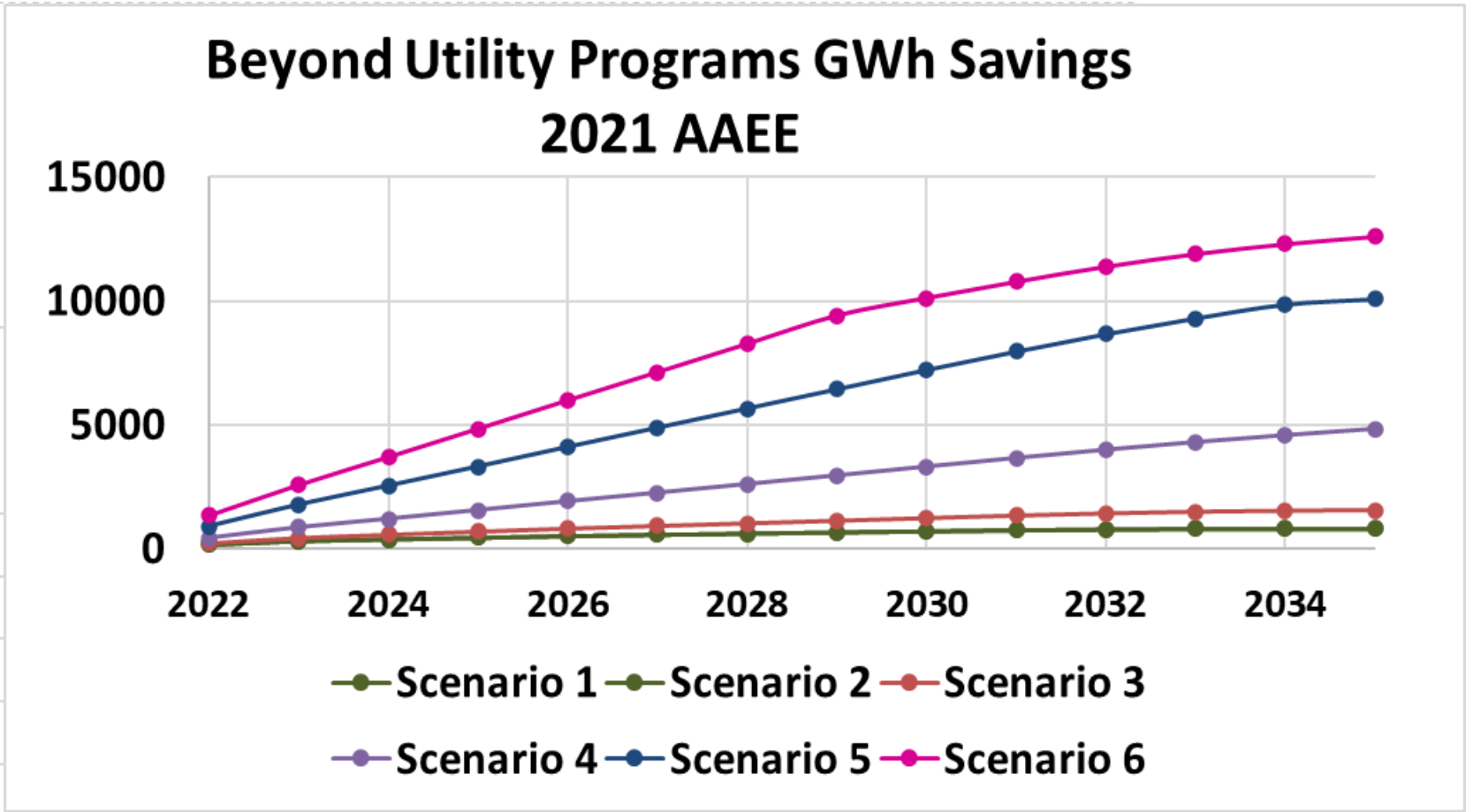


2021 Beyond Utility AAEE Scenario Design

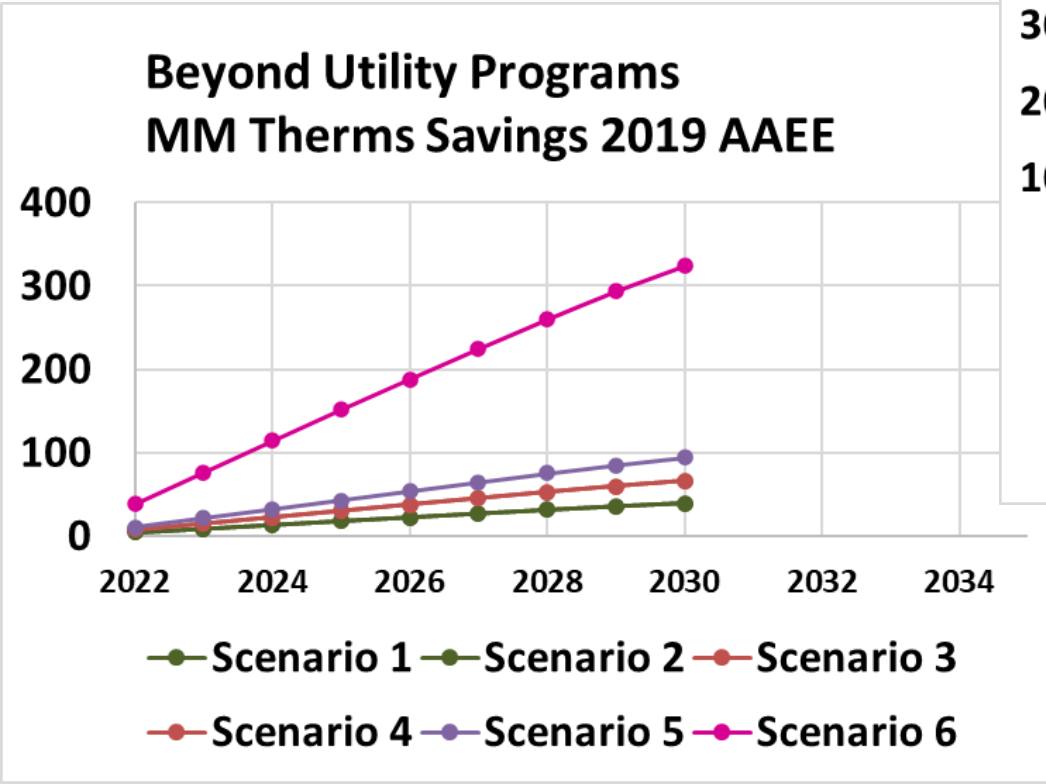
Lever	Mid - Very Low (Scenario 1)	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - High (Scenario 4)	Mid - Very High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	**2019 IEPR Mid-Case**					
Retail Prices						
Prop 39 2021	reference EE savings				aggressive EE savings	
DGS 2021						
ECAA 2021						
CCA RENs 2021 New	conservative EE savings		reference EE savings		aggressive EE savings	
GGRF_WEG 2021						
GGRF_LIWP 2021						
LGO 2021						
PACE 2021						
POU BROS 2021	not included		conservative EE savings		reference EE savings	aggressive EE savings
LGC 2021						
AssetRating 2021						
SmartMeter 2021						
SGIP HPWH 2021 New						
CEOP 2021 New						
FPIP 2021 New						
AQMD 2021	not included			conservative EE savings	reference EE savings	aggressive EE savings
CVR 2021						
Industrial 2021						
Ag 2021						

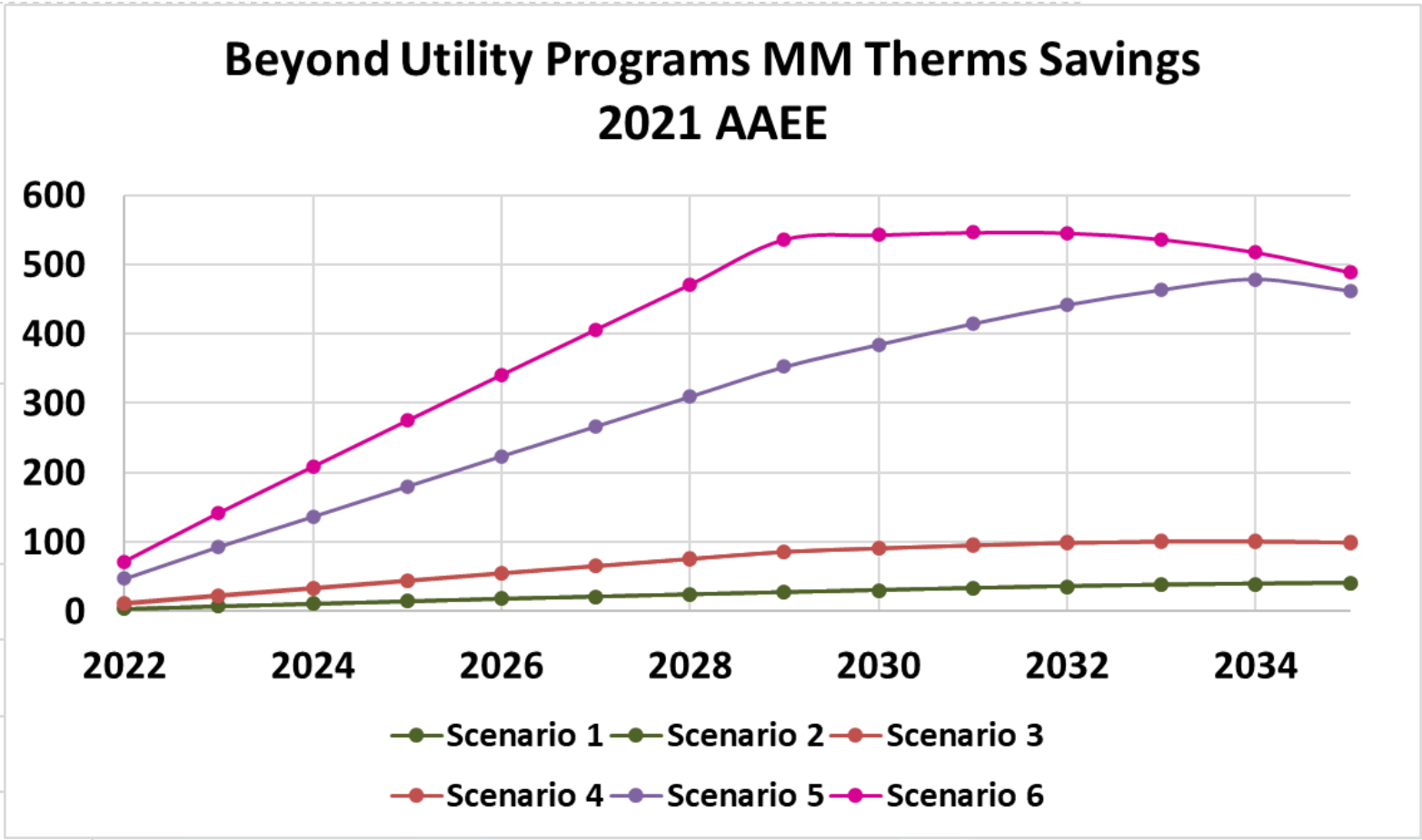
Comparing Beyond Utility Program Savings in 2021 AAEE Scenarios to 2019 AAEE Scenarios - Electricity





Comparing Beyond Utility Program Savings in 2021 AAEE Scenarios to 2019 AAEE Scenarios – Gas





Additional Achievable Fuel Substitution (AAFS)

Used AAEE as a template for AAFS

- ***For 2021 we developed Additional Achievable Fuel Substitution (AAFS) as an hourly load modifier to the baseline demand forecast.***

- We used a manner similar to the one which was developed for AAEE for AAFS; ie. a “template”

- **AAFS was conceptualized as separate from AAEE**

Development of 2021 AAFS

- **DAWG stakeholder workshops June 23 & September 9**
- **IEPR Commissioner Workshop August 5**
  Electricity & Natural Gas Demand Forecast: Inputs and Assumptions

- As in the 2019 AAEE forecast, and before, the objective is to continue to focus on firm programs and projections since the core scenarios will be used for planning and procurement purposes
- As in previous iterations, develop variations around these most probable futures to show other possible outcomes given less or more effort input to realize the potential of existing or proposed EE and FS programs

Scenario Development for 2021 AAFS

				actually more conservative planing scenarios >		
		less FS penetration	*reference BAU*	*more FS penetration*	*meet AB 3232 goals ?*	*meet mid-century goals ?*
Lever		**Mid - Low (Scenario 2)**	**Mid - Mid (Scenario 3)**	**Mid - Mid Plus (Scenario 4)**	**Mid - High (Scenario 5)**	**Mid - High Plus (Scenario 6)**
Building Stock	**2019 IEPR Mid-Case**					
Retail Prices						

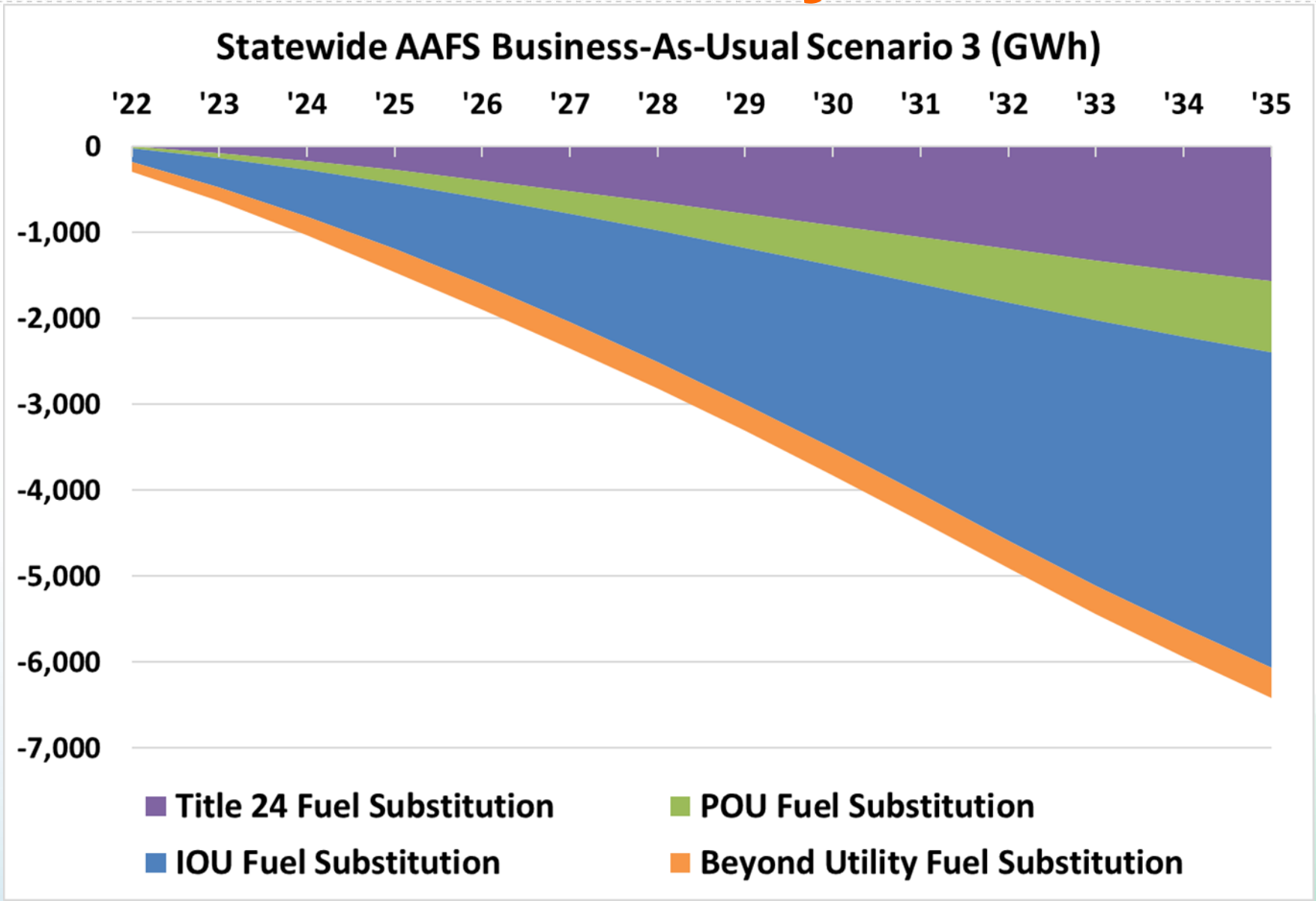
IOU Potential Program Impacts

POU Potential Program Impacts

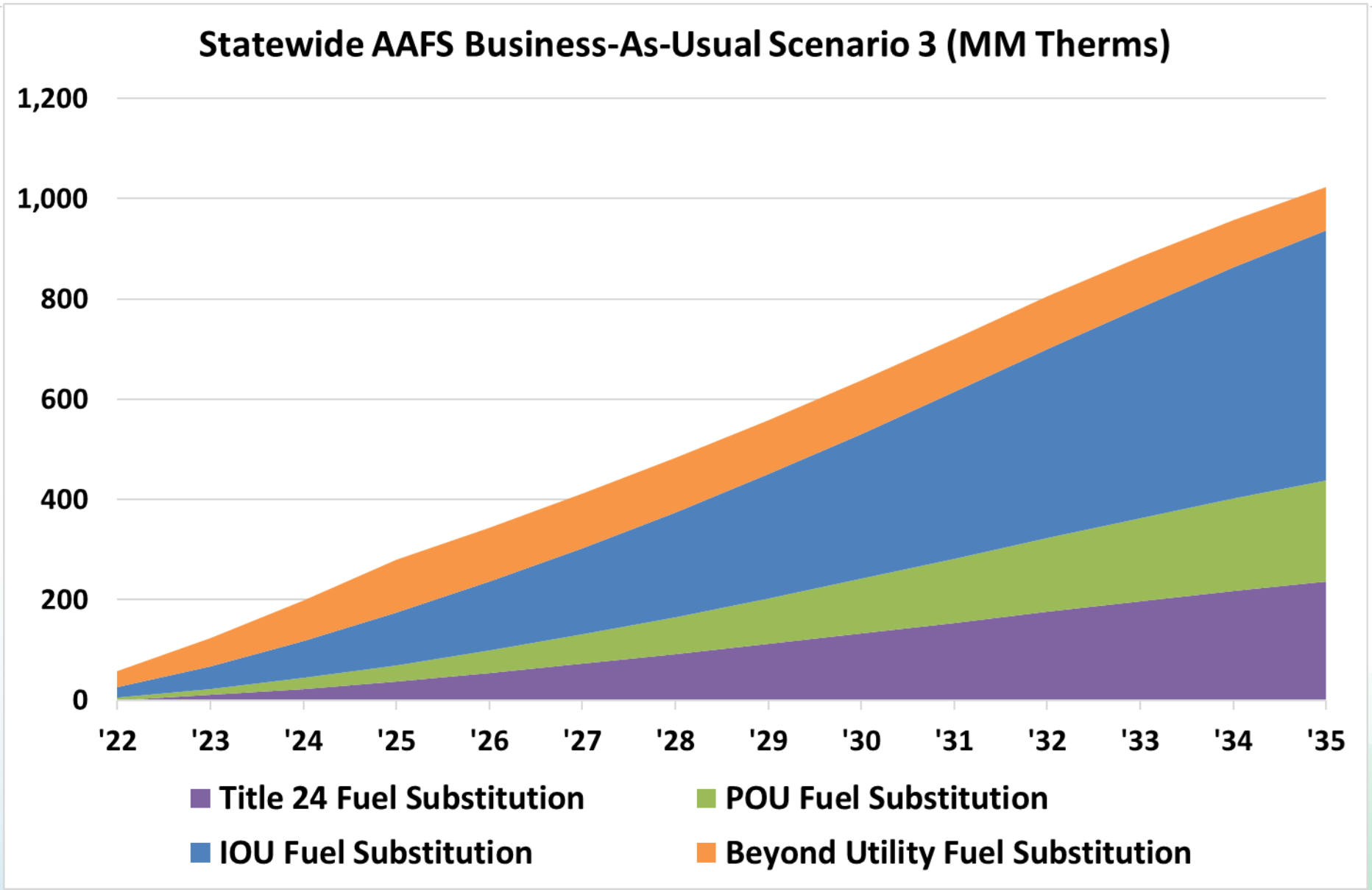
Codes and Standards Impacts

Beyond Utility Program Impacts

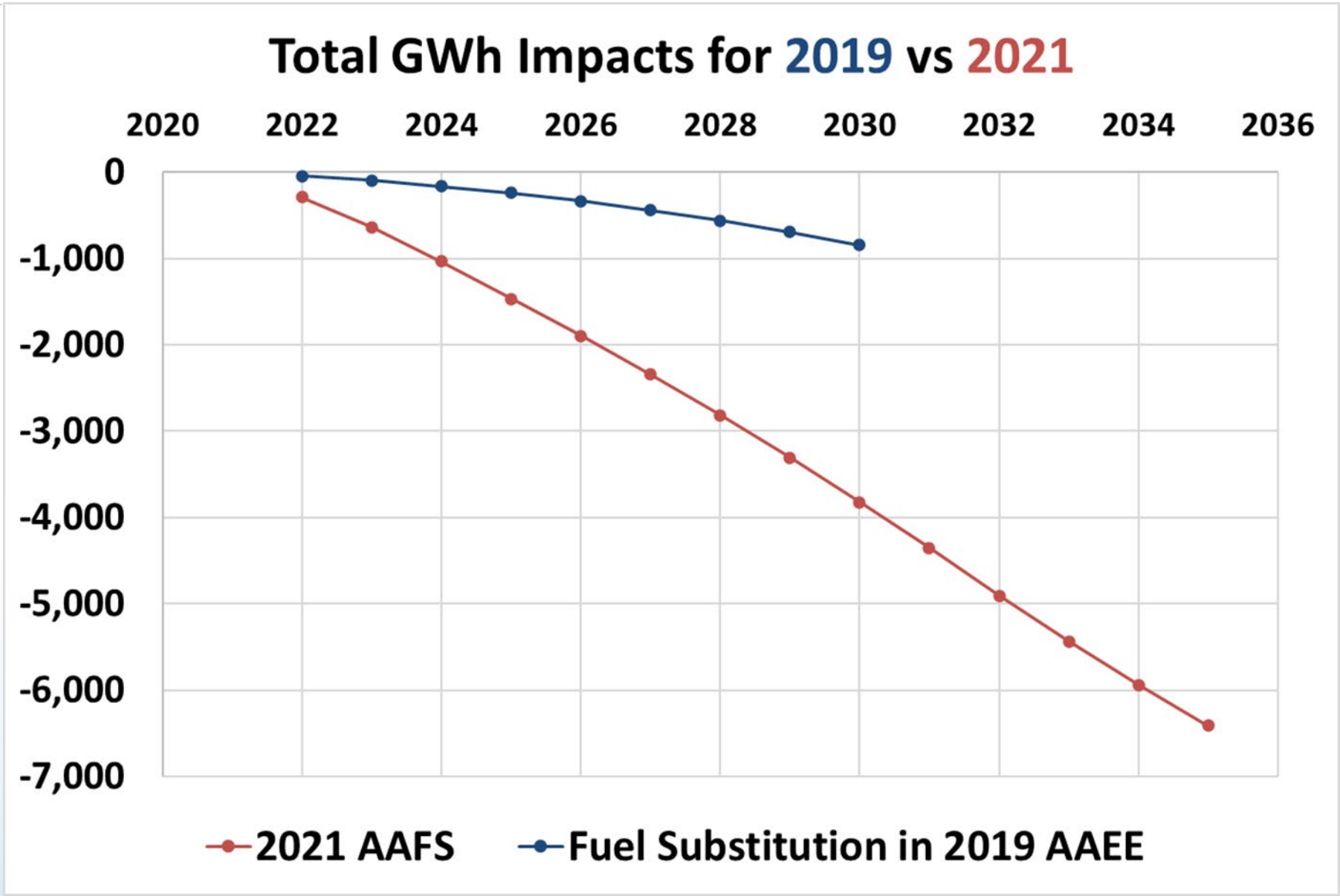
2021 AAFS Annual Impacts Scenario 3 - Statewide Electricity



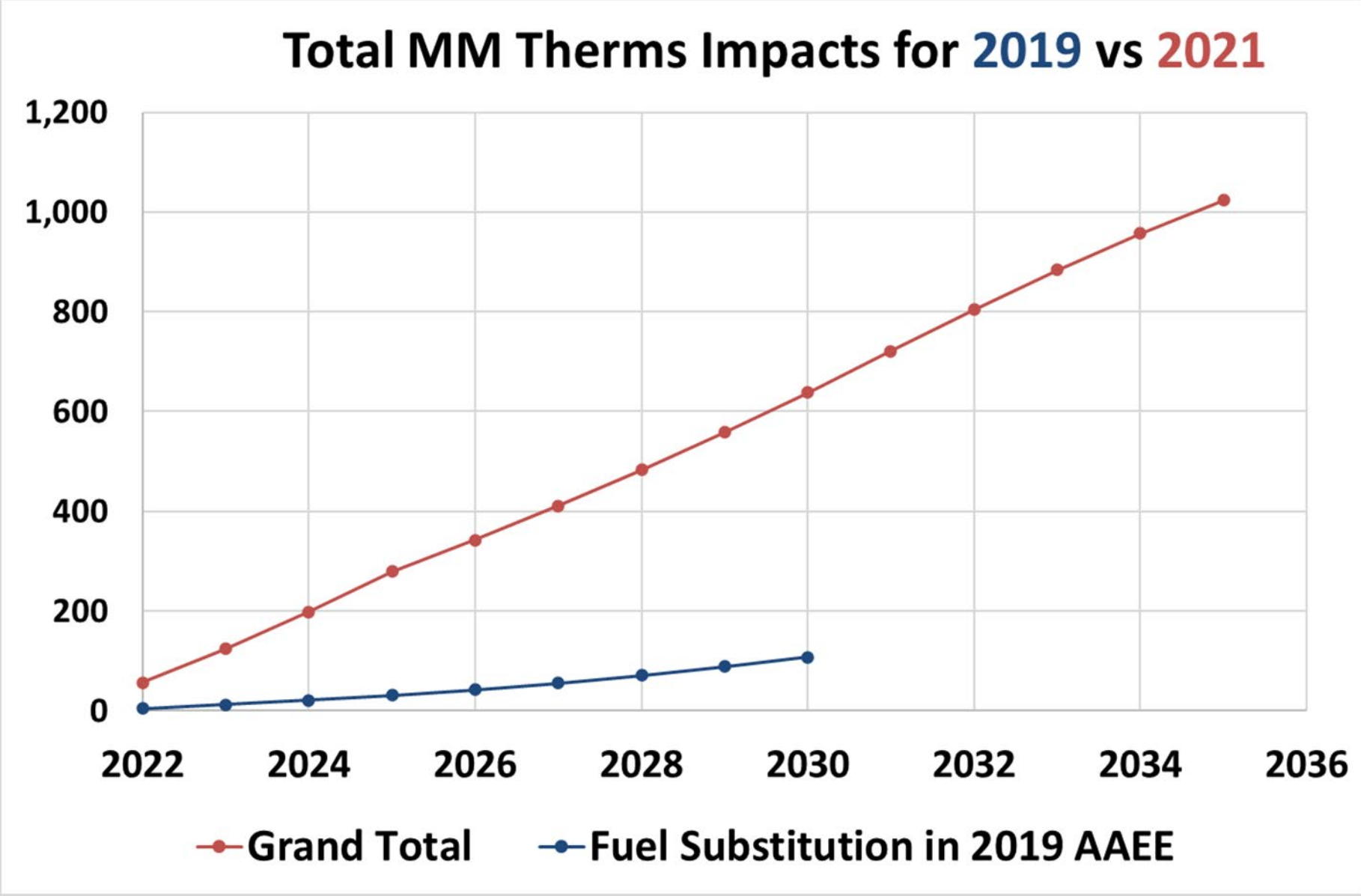
2021 AAFS Annual Impacts Scenario 3 - Statewide Gas



Comparing Total Statewide 2021 AAFS BAU Forecast to 2019 AAFS BAU Forecast - Electricity



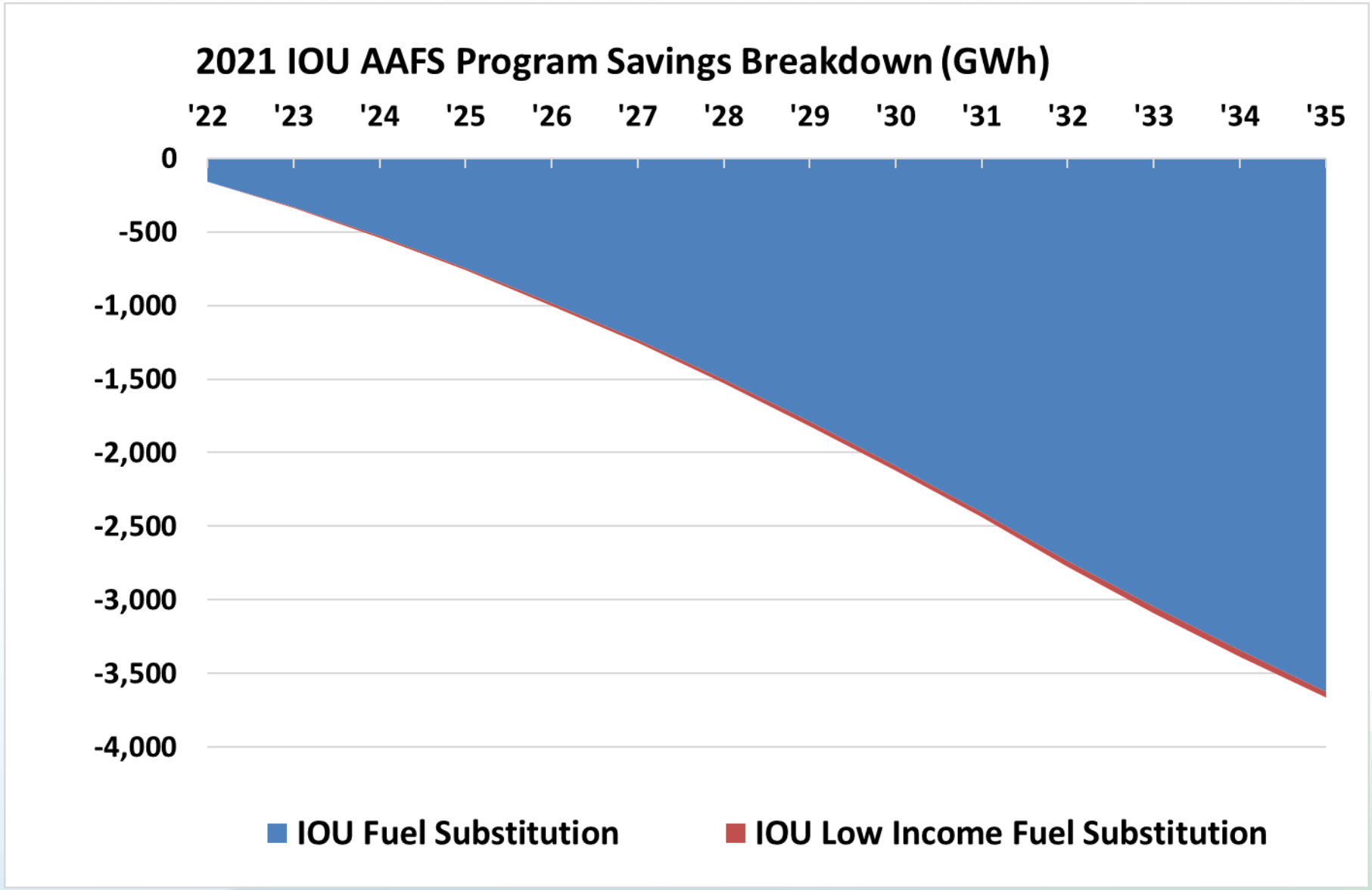
Comparing Total Statewide 2021 AAFS BAU Forecast to 2019 AAFS BAU Forecast – Gas



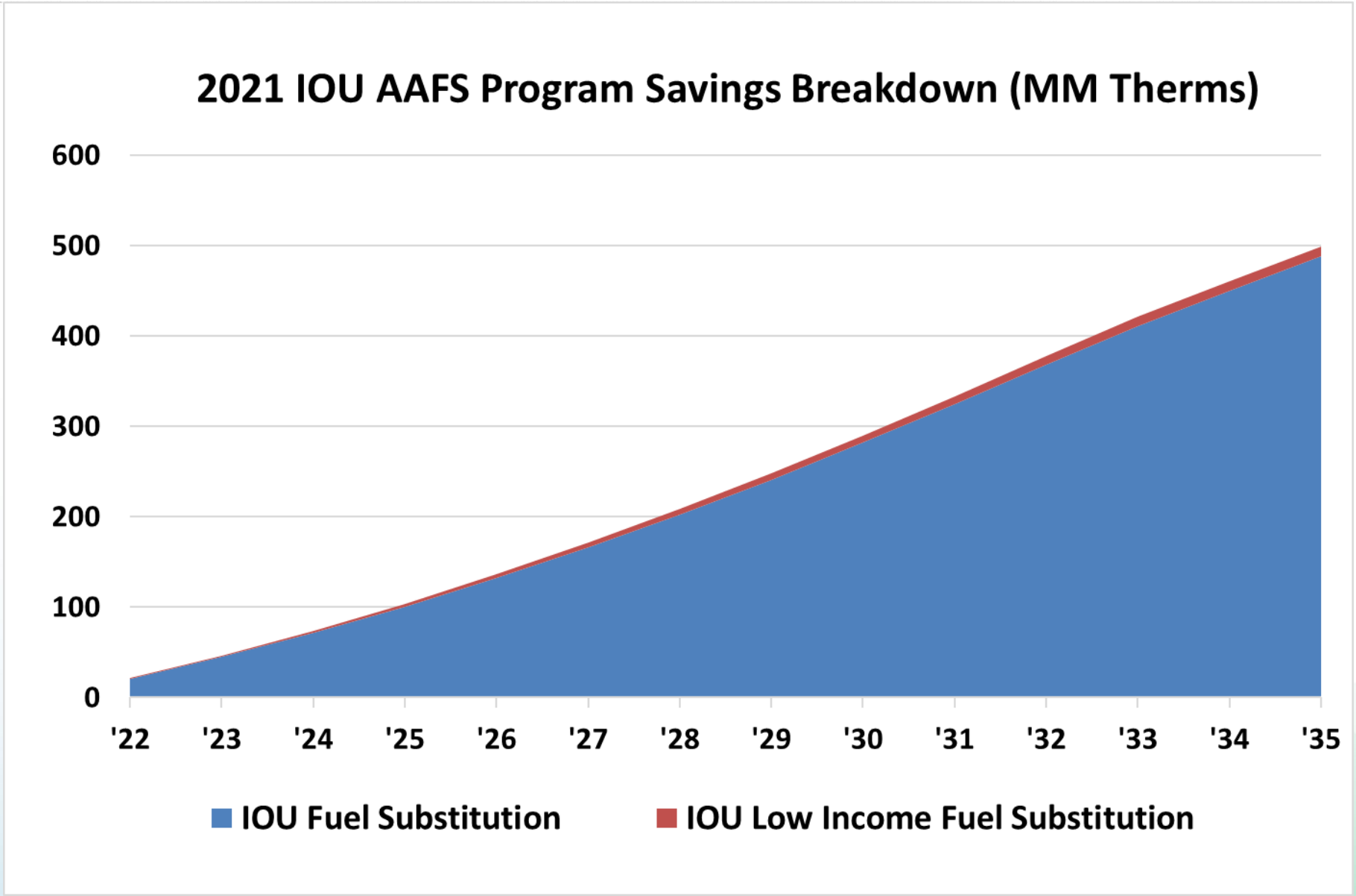
2021 IOU AAFS Scenario Design

Lever		Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - Mid Plus (Scenario 4)	Mid - High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case					
Retail Prices						
AIMS		Reference	**Reference**	Average of Reference & Aggressive		Aggressive
Incentive Levels		capped at 25% of incremental cost	**capped at 50% of incremental cost**	capped at 50% of incremental cost		capped at 75% of incremental cost
C-E Measure Screening Threshold (TRC using 2020 ACC for 2022-2023; 2021 ACC for 2024-2032)		1	**0.85**	0.85		0.75
Marketing & Outreach = Rebate Program Engagement Assumptions		Default calibrated value	**Default calibrated value = Reference**	Increased marketing strength		
Financing Programs		No modeled impacts	**No modeled impacts**	IOU financing programs broadly available to Res and Com customers		
FS program cost adjustments		20% more than existing levels	no change		20% less than existing levels	
FS equipment cost adjustments		20% more than existing levels	no change		20% less than existing levels	
DR co-benefits: on vs. off		off			on	
IOU Low Income Fuel Subsitution Program Contributions		low FS impacts	reference FS impacts		aggressive FS impacts	

IOU Program Impacts in the BAU 2021 AAFS Scenario - Electricity



IOU Program Impacts in the BAU 2021 AAFS Scenario – Gas

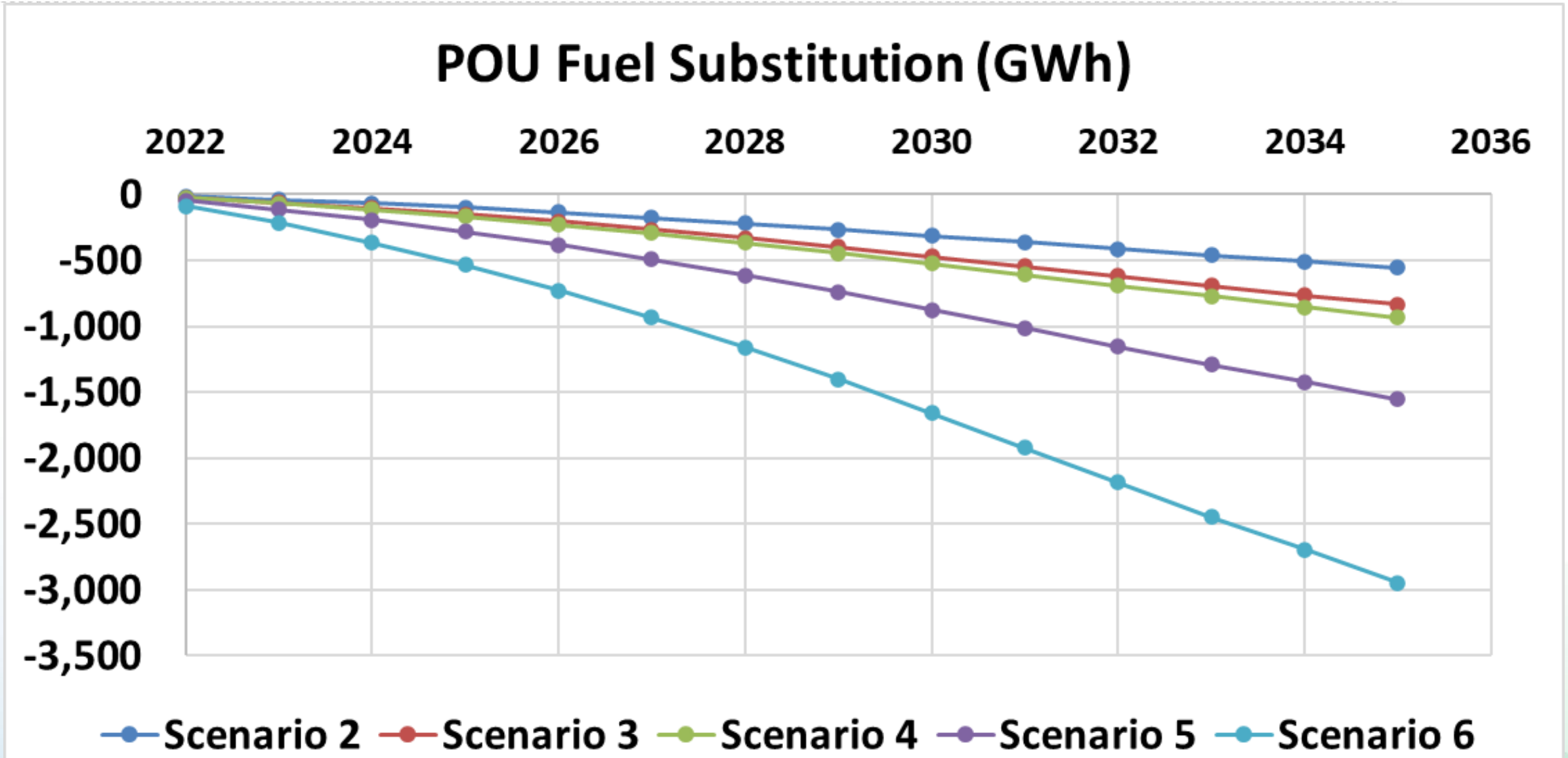


2021 POU AAFS Scenario Design

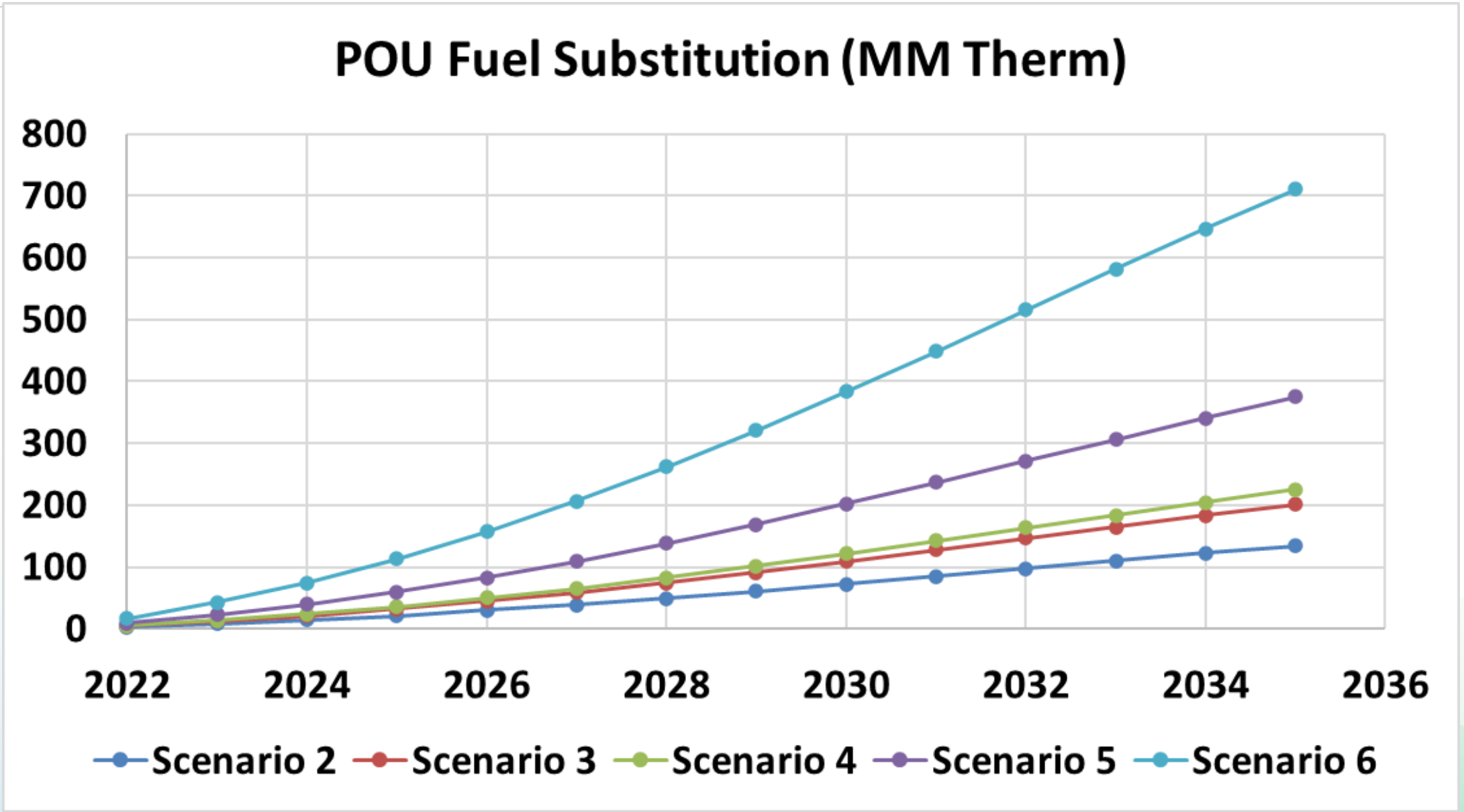
Lever		Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - Mid Plus (Scenario 4)	Mid - High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case					
Retail Prices						
POU Fuel Subsitution Program Contributions		low uptake of low FS impacts	moderate uptake of low FS impacts	moderate uptake of reference FS impacts	high uptake of reference FS impacts	high uptake of aggressive FS impacts

- Interviewed all willing POU's…
- Relied on preliminary pilot program data from LADWP projected for 2021-2052 and data from SMUD, Pasadena, Palo Alto on reasoned cost projections, number of participant projections, or estimated future GHG reductions
- assigned a fuel substitution delay or 'head start' to each POU, relative to the LADWP fuel substitution timeline. SMUD, for example, was judged to be two years ahead of LADWP in fuel substitution implementation, while most other POUs were judged to be two years behind LADWP

POU Program Impacts in the BAU 2021 AAFS Scenario - Electricity



POU Program Impacts in the BAU 2021 AAFS Scenario - Gas

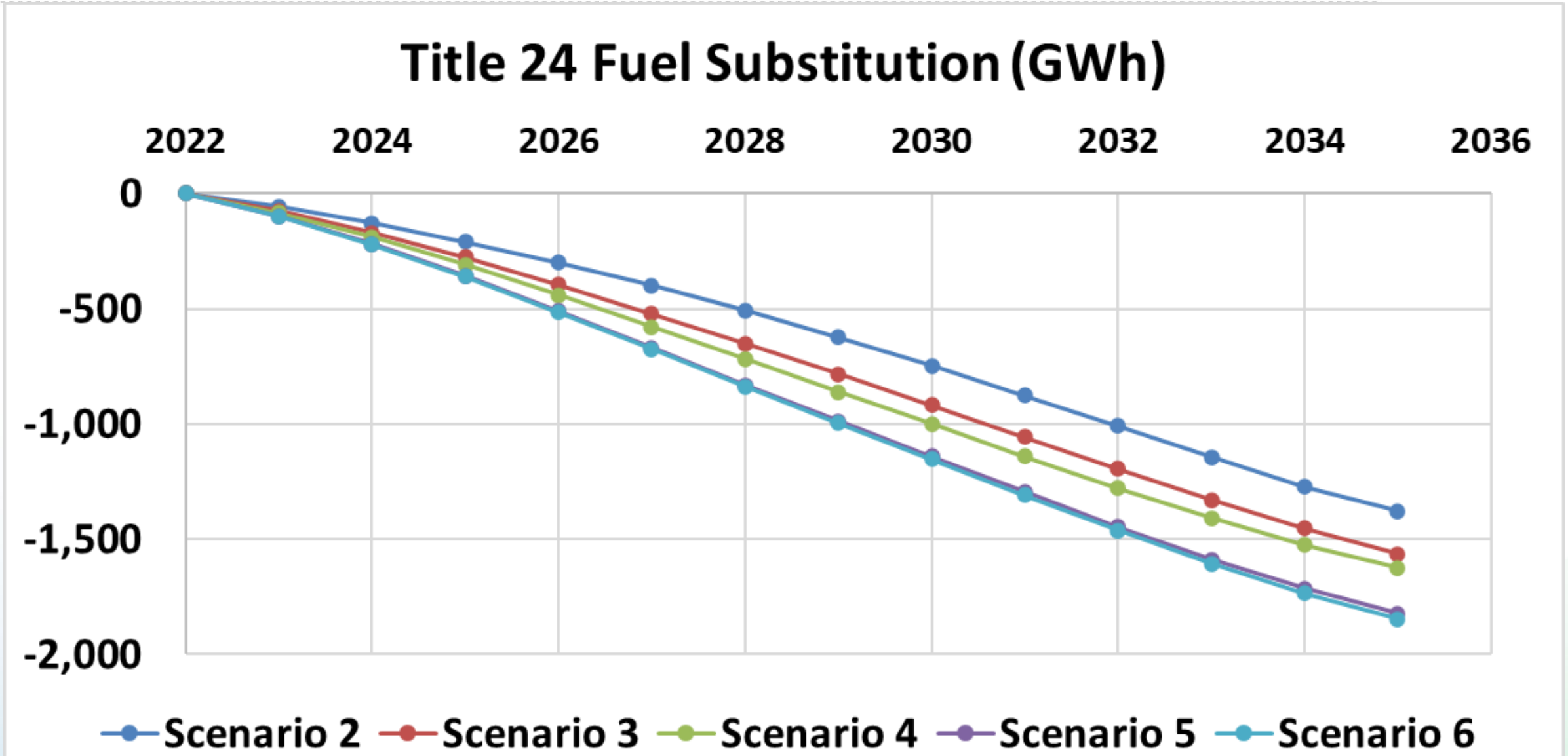


2021 C&S AAFS Scenario Design

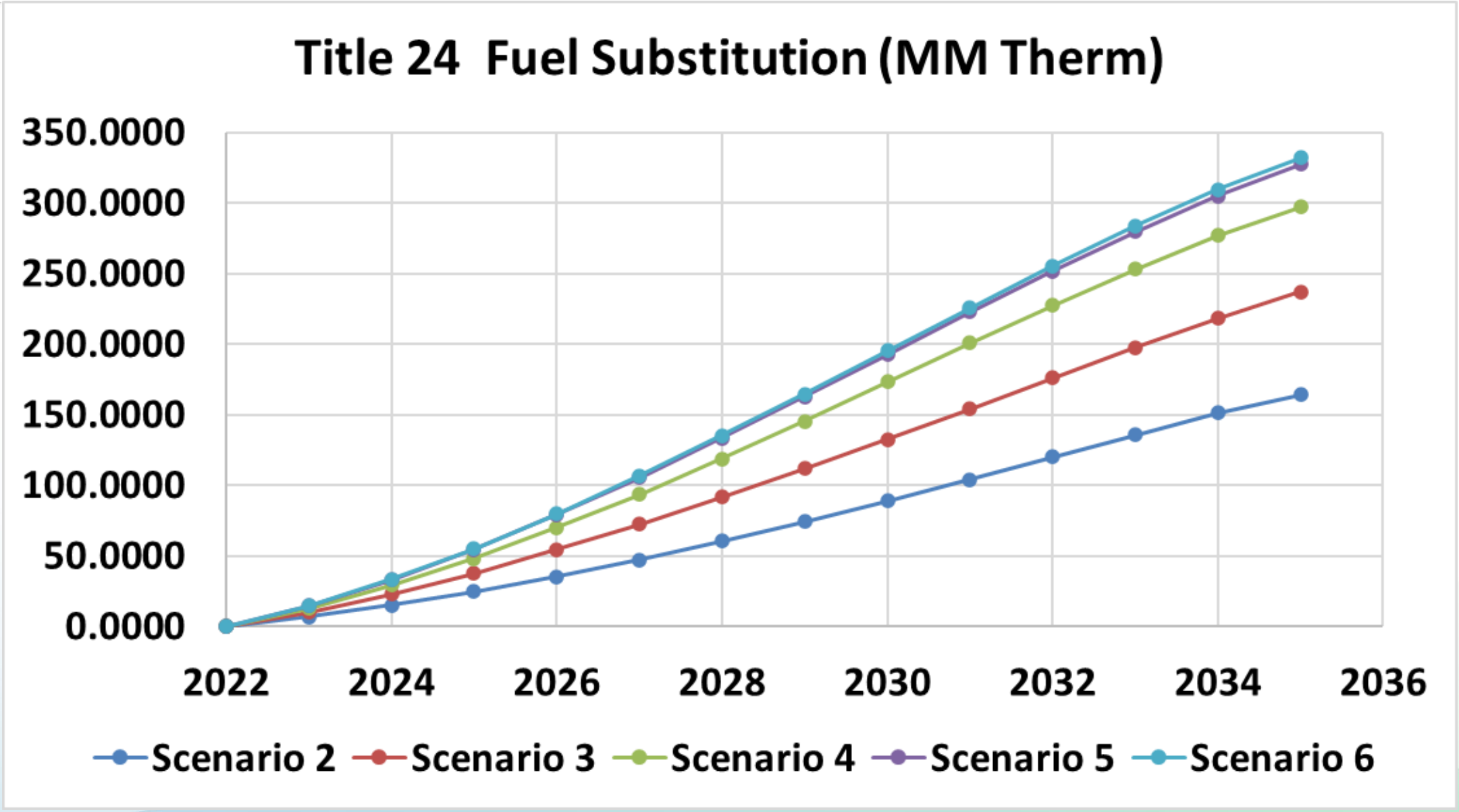
Lever	Mid - Low (Scenario 2)	Mid - Mid (Scenario 3)	Mid - Mid Plus (Scenario 4)	Mid - High (Scenario 5)	Mid - High Plus (Scenario 6)
Building Stock	2019 IEPR Mid-Case				
Retail Prices					
Title 24			adding potential updates in the **2028** Standards at a compliance rate reduction and low uptake rate	adding potential updates in the **2028** Standards at the reference compliance rate and high uptake rate	
		adding potential updates in the **2025** Standards at a compliance rate reduction and low uptake rate	adding potential updates in the **2025** Standards at a compliance rate reduction and low uptake rate	adding potential updates in the **2025** Standards at the reference compliance rate and high uptake rate	
	adding the building electrification encouraged by the **2022** Standards at a 20% compliance rate reduction and low uptake rate	adding the building electrification encouraged by the **2022** Standards at the reference compliance rate and reference uptake rate	adding the building electrification encouraged by the **2022** Standards at at a 20% compliance rate enhancement and high uptake rate		

- In accordance with the CPUC's 2020 and 2030 zero-net-energy goals, we originally considered the zero-net-energy requirements for residential and nonresidential buildings for the 2019 and 2028 standards, respectively.
- Since then, the state began focusing on decarbonization, the CEC implemented changes for the 2022 Title 24 standards to include a GHG metric. To this end two new workbooks were created: Nonres/Com New Construction Fuel Sub and Residential Fuel Sub, Residential A&A was modified to have an EE path and a FS path with an uptake percentage for each adding to 100%

Title 24 Building Standards Impacts in 2021 AAFS Scenarios - Electricity



Title 24 Building Standards Impacts in 2021 AAFS Scenarios – Gas



2021 Beyond Utility AAFS Scenario Design

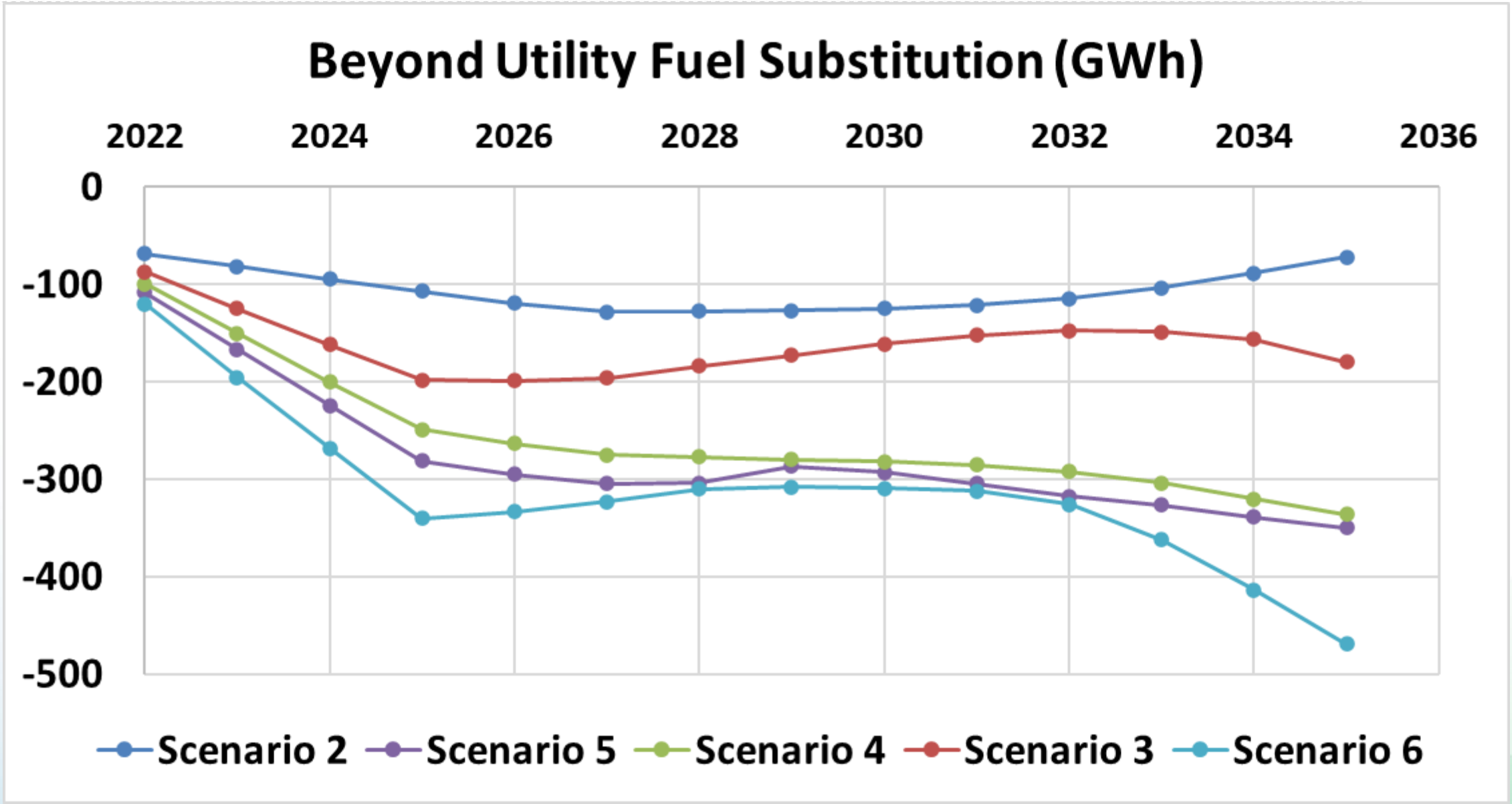
<table>
<tr><th>Lever</th><th></th><th>Mid - Low (Scenario 2)</th><th>Mid - Mid (Scenario 3)</th><th>Mid - Mid Plus (Scenario 4)</th><th>Mid - High (Scenario 5)</th><th>Mid - High Plus (Scenario 6)</th></tr>
<tr><td>Building Stock</td><td colspan="6" rowspan="2">2019 IEPR Mid-Case</td></tr>
<tr><td>Retail Prices</td></tr>
<tr><td>CCA RENs 2021 New</td><td rowspan="8"></td><td rowspan="2">low FS impacts</td><td colspan="2">reference FS impacts</td><td colspan="2">aggressive FS impacts</td></tr>
<tr><td>LGO 2021</td></tr>
<tr><td>CEOP 2021 New</td><td rowspan="6">none</td><td rowspan="2">low FS impacts</td><td colspan="2" rowspan="2">reference FS impacts</td><td rowspan="2">aggressive FS impacts</td></tr>
<tr><td>TECH-BUILD 2021 New</td></tr>
<tr><td>SGIP HPWH 2021 New</td><td colspan="3">reference FS impacts</td><td rowspan="2">aggressive FS impacts</td></tr>
<tr><td>FPIP 2021 New</td><td rowspan="2">none</td><td>conservative FS impacts</td><td>reference FS impacts</td></tr>
<tr><td>Industrial 2021</td></tr>
<tr><td>Ag 2021</td></tr>
</table>

- Programmatic FS may not be of the magnitude needed to meet various policy goals
- Programmatic FS can be input to the FSSAT to determine what remaining gas displacement remains

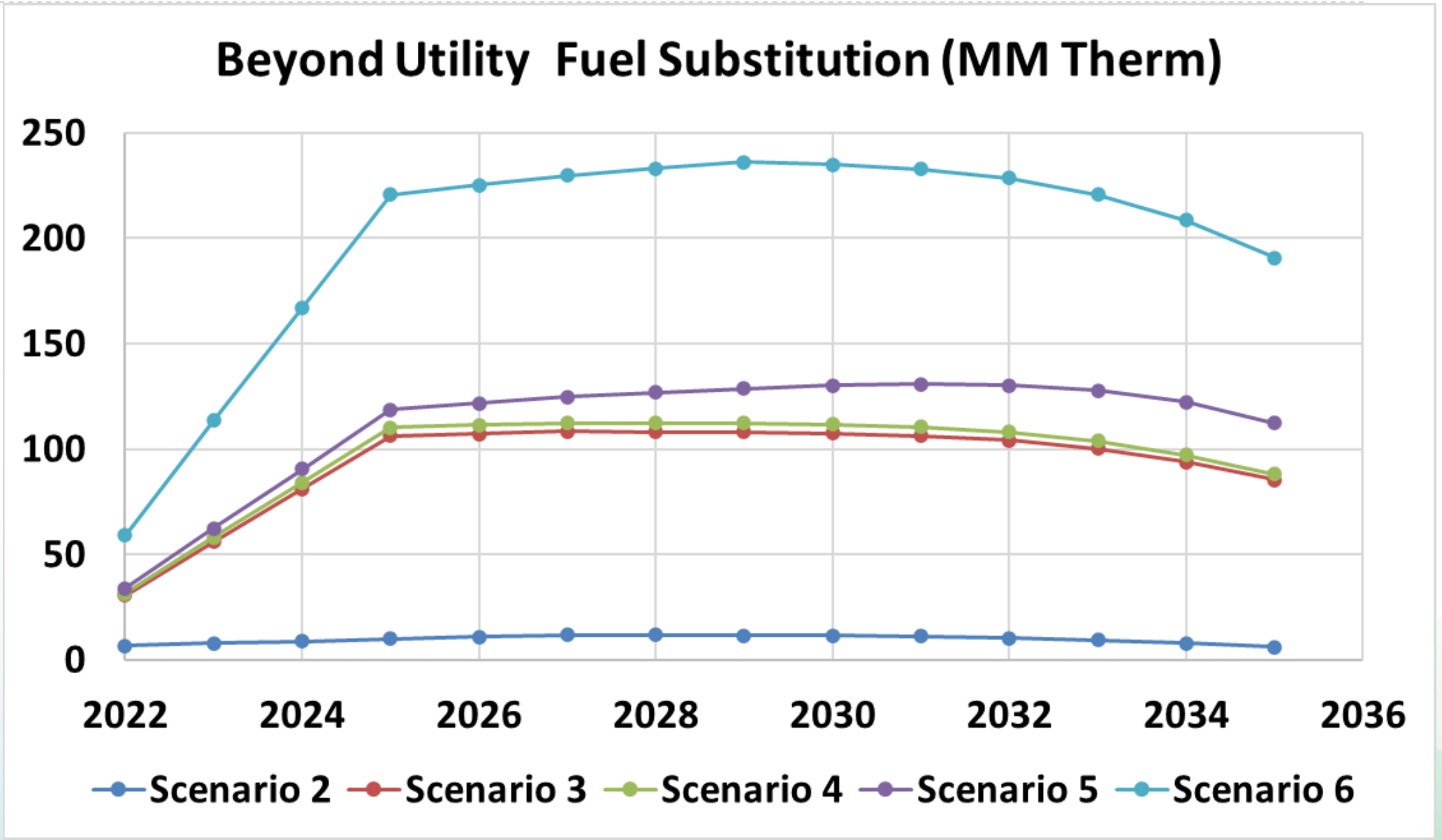
<table>
<tr><td rowspan="3">Speculative FSSAT Contribution</td><td>% NC</td><td rowspan="3"></td><td rowspan="3">none</td><td rowspan="3">additional "what if" subsitution added to meet minimum AB 3232 goals</td><td rowspan="3">additional "what if" subsitution added to meet mid-century GHG goals</td></tr>
<tr><td>% ROB</td></tr>
<tr><td>% RET</td></tr>
</table>

- we can add speculative “what if” technology-based FS to show what additional types of programmatic efforts may be necessary to reach these goals

Beyond Utility Program Impacts in 2021 AAFS Scenarios - Electricity



Beyond Utility Program Impacts in 2021 AAFS Scenarios – Gas



Consideration of who will use 2021 AAFS and for what purpose…

- By adding AAFS, we will need to revisit our common set forecasting agreement language after it has been determined what agencies and their stakeholders will desire and for what purpose.
- Need to consider which combinations of AAEE/AAFS scenarios are compatible with each other given total gas displacement potential and program funding sources.

Thank you!

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