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Additional Achievable Energy Efficiency (AAEE) & Additional Achievable Fuel Substitution (AAFS) for the Demand Scenarios Project & SB 100

August 7, 2024

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Acronyms & Initialisms

AAEE – Additional Achievable Energy Efficiency

AAFS – Additional Achievable Fuel Substitution

EE – Energy efficiency

FS – Fuel substitution

GHG – Greenhouse Gas

AB 3232 – Assembly Bill 3232

CEC – California Energy Commission

DER – Distributed Energy Resource

DF – Demand Flex/Flexibility

FSSAT – Fuel Substitution Scenario Analysis Tool

IEPR – Integrated Energy Policy Report

RASS – Residential Appliance Saturation Study

SB 350 – Senate Bill 350

ZEAS – Zero-Emission Appliance Standard



What are AAEE & AAFS?

- Focus on firm programs and projections
- Shows other possible outcomes given less (or more) effort and ability to realize the potential of existing or proposed EE and FS programs
- AAFS is conceptualized separately from AAEE



How do AAEE & AAFS work?

- Any overlap between these load modifiers as well as the baseline energy demand forecast are accounted for; only achievable EE savings or FS impacts above and beyond that which is already incorporated in the baseline energy consumption forecasts are retained.
- Both AAEE and AAFS reduce gas consumption.
- While AAEE also reduces electricity consumption, AAFS increases it.
 - Thus AAEE “savings” and AAFS “impacts”
 - Both load modifier increments and decrements are relative to baseline electricity and gas consumption on an annual basis
 - Electricity consumption is also modified by both AAEE & AAFS on an hourly basis
- AAFS may contain both programmatic inputs as well as technology-based FS modeled by the FSSAT, this will be described in the later part of this presentation.



2023 AAEE & AAFS Development

General approach to Scenarios

AAEE/AAFS
Scenario
Number

“programs that could exist in the future and would be required to meet some policy goals”
Includes all the below and expands speculative programs for mid-century GHG reduction goals

6

“more speculative programs, perhaps in early planning phases”
Adds more speculative programs that may help meet minimum AB 3232 goals or SB 350 doubling

5

“likely to occur but still in planning phases”
Ratchets the below elements up to compliance rates, participation, market adoption and funding.

4

“reasonable to occur with greater uncertainty about penetrations/volume of impact”
addition of newly developed and funded programs

3

“will occur but some uncertainty around impacts”
addition of newly existing programs

2

“Firm commitments”
existing programs and standards not incorporated in baseline forecast

1



AAEE & Programmatic AAFS in Demand Scenarios

“likely to occur but still in planning phases”

	AAEE 3	AAEE 4	AAFS 4
Policy Scenario	✓		✓
Policy Scenario (Augmented DER & DF)		✓	✓
Policy Scenario (High Hydrogen Use)	✓		✓

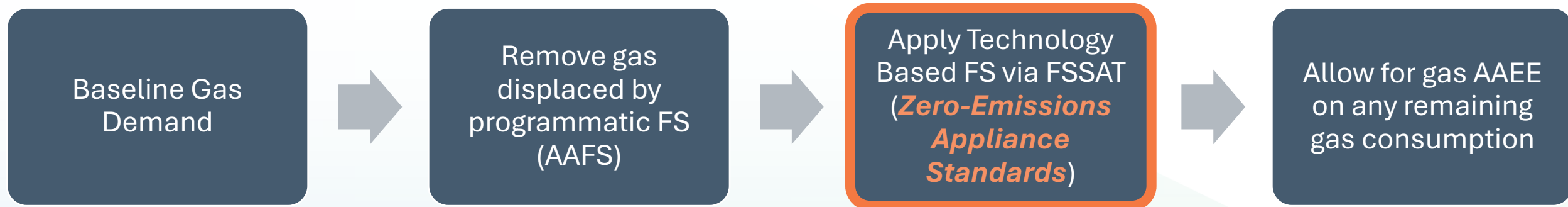
“reasonable to occur with greater uncertainty about penetrations/volume of impact”

*See <https://www.energy.ca.gov/event/2023-11/iepr-commissioner-workshop-load-modifier-scenario-results> for AAEE and programmatic AAFS scenarios developed as part of the 2023 IEPR Demand Forecast



Combining AAEE, Programmatic AAFS & FSSAT components in the Demand Scenarios

- AAEE electricity and gas may be separated.
- AAFS electricity and gas are joined.
- **FS is conducted before EE** because the GHG impacts are approximately four times greater for FS than for EE.





FSSAT Characterization in Demand Scenarios

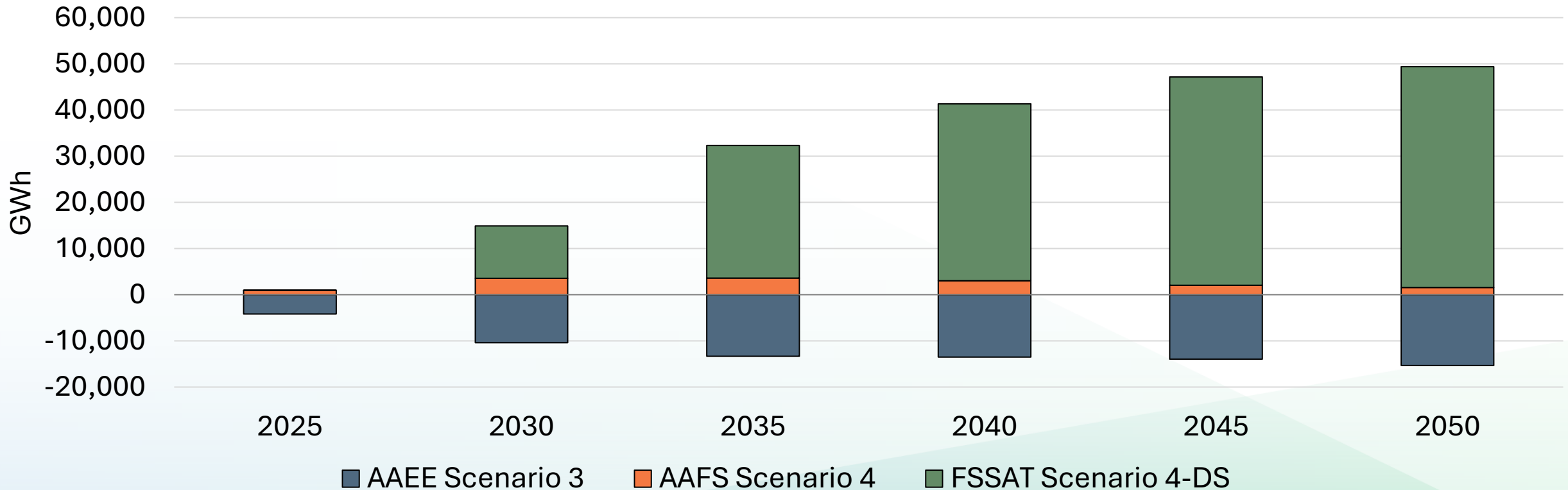
- FSSAT Scenario 4-DS is used in all SB 100 Demand Scenarios
 - Policy Scenario
 - Policy Scenario (Augmented DER & DF)
 - Policy Scenario (High Hydrogen Use)
- FSSAT Scenario 4-DS Scope
 - Models various ZEAS standards for the Residential and Commercial sectors
 - Models fuel switching (electricity and hydrogen) for the Industrial and Agricultural sectors
 - Hydrogen fuel switching is only considered in the Industrial sector
- FSSAT Scenario 4-DS has some minor updates compared to the 2023 IEPR FSSAT Scenario 4
 - Includes RASS 2019
 - Revised local Air Districts' ZEAS
 - Final 2023 IEPR Baseline Gas and Electric Forecast
 - Includes an Agricultural/Industrial fuel switching module



Electricity Impacts – Policy Scenario and Policy Scenario (High Hydrogen Use)

All load modifier results are the same for the **Policy Scenario** and the **Policy Scenario (High Hydrogen Use)**.

AAEE, Programmatic AAFS, and FSSAT Electricity Impacts - Policy Scenario and Policy Scenario (High Hydrogen Use)

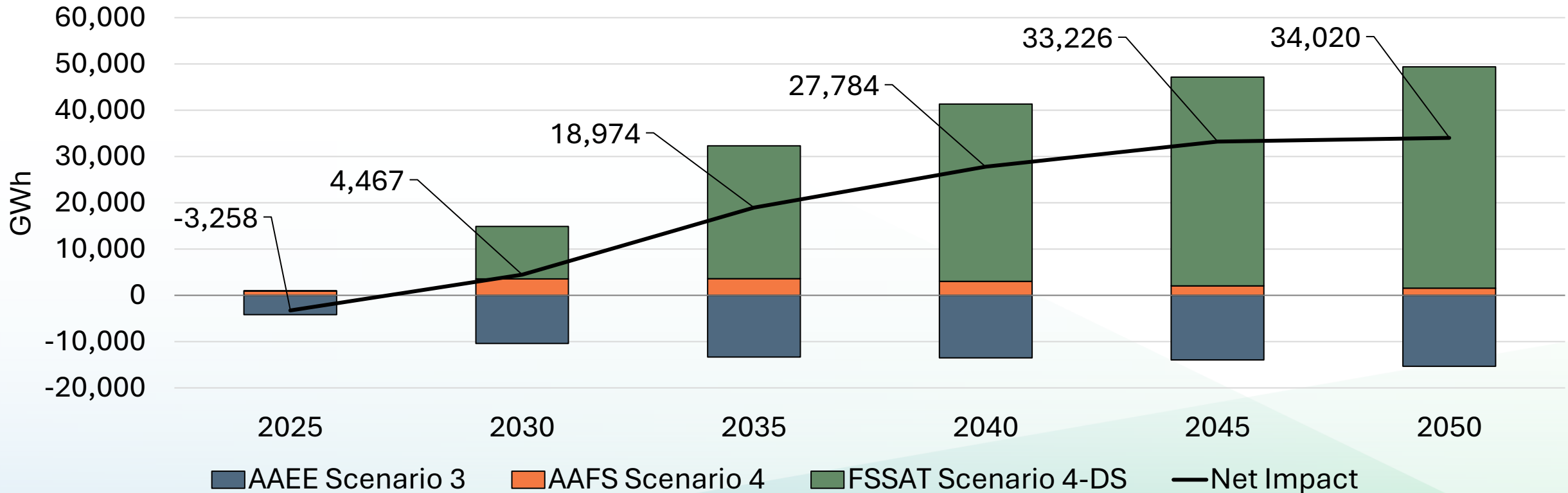




Electricity Impacts – Policy Scenario and Policy Scenario (High Hydrogen Use) [+ Net Impact]

All load modifier results are the same for the **Policy Scenario** and the **Policy Scenario (High Hydrogen Use)**.

AAEE, Programmatic AAFS, and FSSAT Electricity Impacts - Policy Scenario and Policy Scenario (High Hydrogen Use)

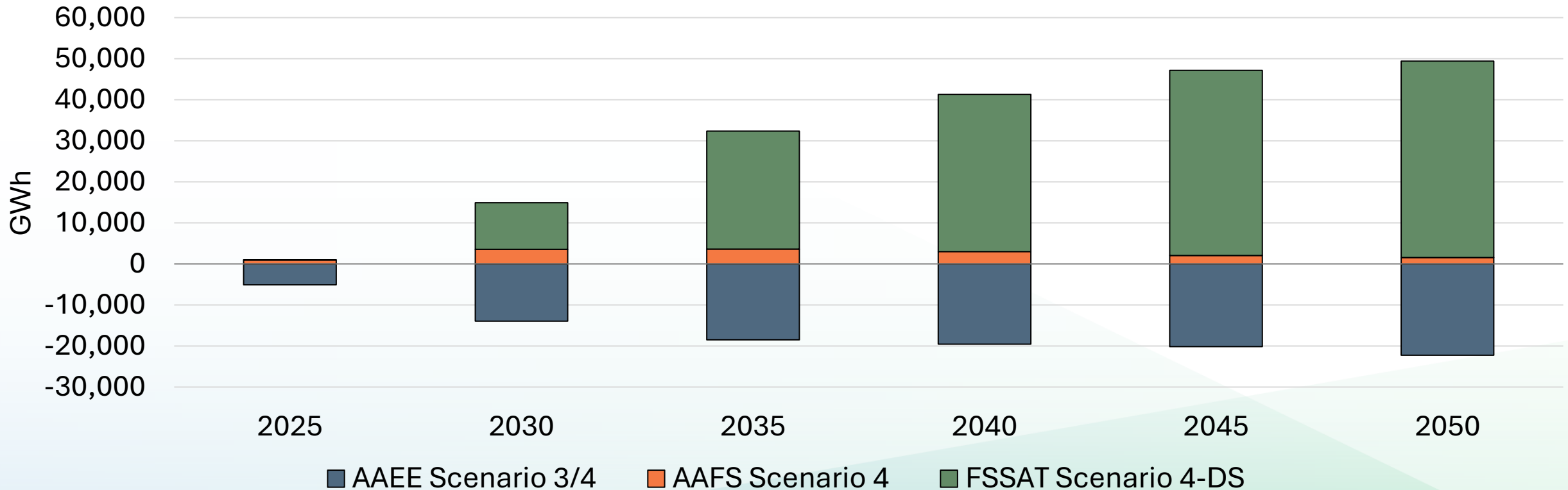




Electricity Impacts – Policy Scenario (Augmented DER & DF)

Uses AAE Scenario 4 for the Residential and Commercial sectors (“AAEE Scenario 3/4”).

AAEE, Programmatic AAFS, and FSSAT Electricity Impacts - Policy Scenario (Augmented DER & DF)

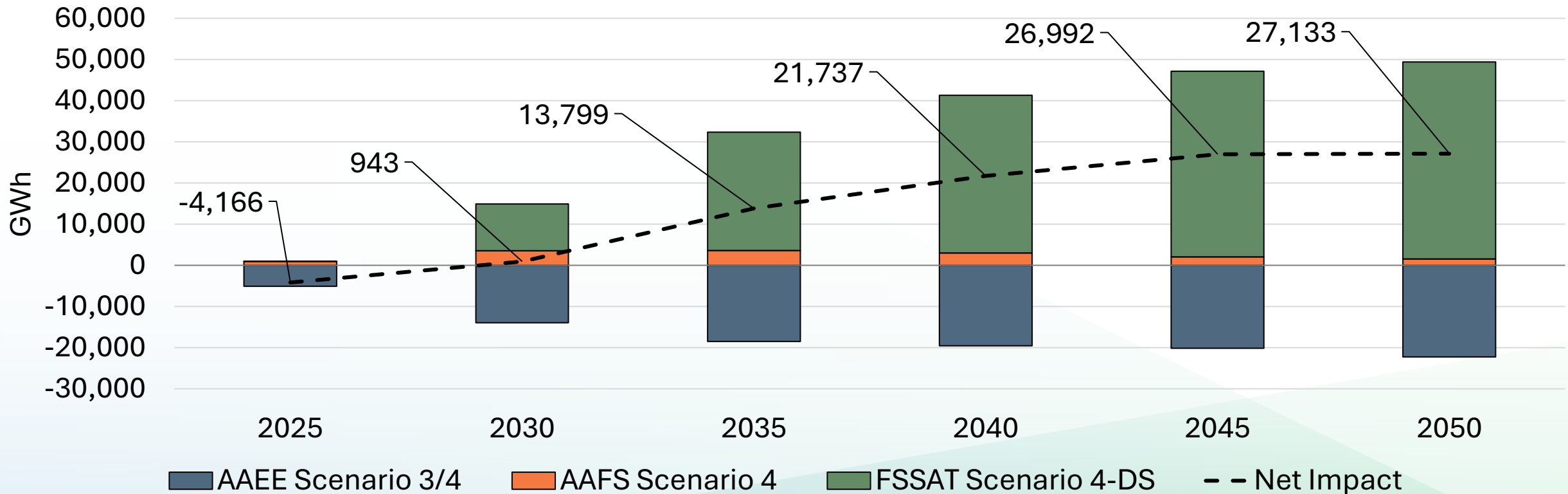




Electricity Impacts – Policy Scenario (Augmented DER & DF) [+ Net Impact]

Uses AAEE Scenario 4 for the Residential and Commercial sectors (“AAEE Scenario 3/4”).

AAEE, Programmatic AAFS, and FSSAT Electricity Impacts - Policy Scenario (Augmented DER & DF)





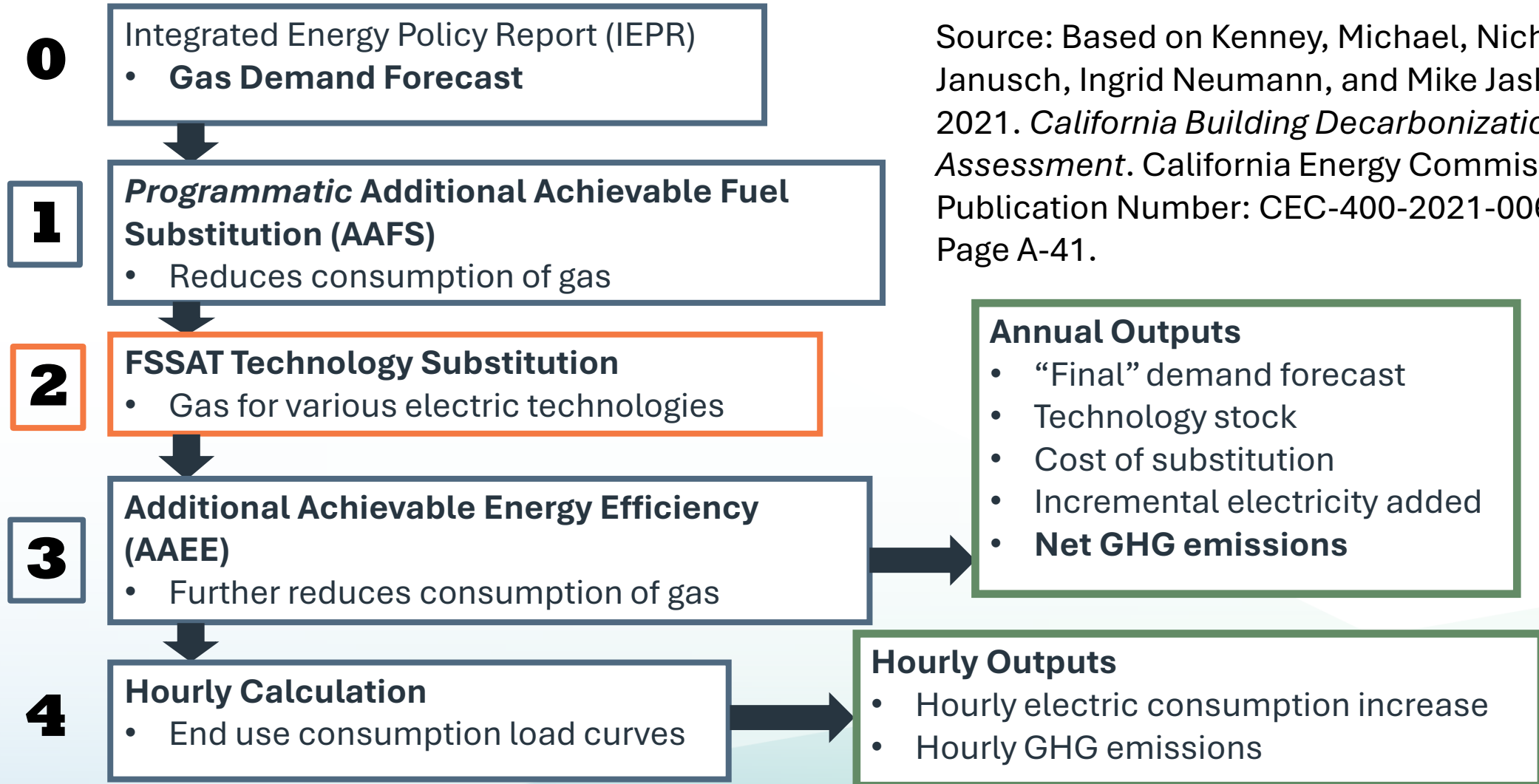
Thank you



Appendix



Modeling Electrification: FSSAT Main Processes Flow Chart



Source: Based on Kenney, Michael, Nicholas Janusch, Ingrid Neumann, and Mike Jaske. 2021. *California Building Decarbonization Assessment*. California Energy Commission. Publication Number: CEC-400-2021-006-CMF. Page A-41.



ZEAS Characterization – FSSAT Scenario 4-DS

Agency	Board Hearing Date	Zero Emission Appliance Standard	Characterization in FSSAT
Bay Area AQMD ¹	March 16, 2023	Amendments to Rule 9-4 and Rule 9-6: Space Heaters	ZEAS for replace on burnout (ROB) beginning in 2029 for residential & commercial space heaters
Bay Area AQMD ¹	March 16, 2023	Amendments to Rule 9-4 and Rule 9-6: Water Heaters	Revised - ZEAS beginning in 2027 for ROB for residential water heaters
South Coast AQMD ²	June 7, 2024	Rule 1146.2 – Large Water Heaters and Small Boilers and Process Heaters	Added - ZEAS beginning in 2029 for ROB for commercial water heaters
Statewide		New Construction	100% adoption of electric space and water heaters for residential in 2026, and 2029 for commercial
CARB ³	2025	Existing Buildings	Statewide ZEAS for ROB beginning in 2030 for residential & commercial space and water heaters

¹Bay Area Air Quality Management District - [BAAQMD's Building Appliance Rules 9-4 and 9-6 webpage](#)

²South Coast Air Quality Management District - [SCAQMD's Proposed Amended Rule 1146.2 webpage](#)

³California Air Resources Board - [CARB's Zero-Emission Appliance Standards proceeding webpage](#)



ZEAS Characterization – FSSAT Scenario 4-DS

Agency	Board Hearing Date	Zero Emission Appliance Standard	Characterization in FSSAT
Bay Area AQMD ¹	March 16, 2023	Amendments to Rule 9-4 and Rule 9-6: Space Heaters	<p>Disclaimer: 2023 IEPR CARB ZEAS characterization is outdated. CARB presented their updated proposal at a May 29th, 2024 public workshop (Source: https://ww2.arb.ca.gov/our-work/programs/building-decarbonization/zero-emission-space-and-water-heater-standards/meetings-workshops).</p>
Bay Area AQMD ¹	March 16, 2023	Amendments to Rule 9-4 and Rule 9-6: Water Heaters	
South Coast AQMD ²	June 7, 2024	Rule 1146.2 – Large Water Heaters and Small Boilers and Process Heaters	
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ZEAS Replacement Assumptions – FSSAT Scenario 4-DS

Territory	Replacement Type	FSSAT Scenario	2020-25	2026	2027	2028	2029	2030-50
Statewide	Comm. New Construction	Scenario 4-DS	0%	0%	0%	0%	100%	100%
Statewide	Res. New Construction	Scenario 4-DS	0%	100%	100%	100%	100%	100%
BAAQMD	Replace on Burnout: Space Heating	Scenario 4-DS	0%	25%	50%	75%	100%	100%
BAAQMD	Replace on Burnout: Res. Water Heating	Scenario 4-DS	0%	50%	100%	100%	100%	100%
SCAQMD	Replace on Burnout: Comm. Water Heating	Scenario 4-DS	0%	25%	50%	75%	100%	100%
Rest of State	Replace on Burnout	Scenario 4-DS	0%	20%	40%	60%	80%	100%