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Staff Workshop on 2023 Demand Scenarios Project

Building Scenarios – Inputs and Assumptions

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Acronyms and Initialisms

AAEE – Additional Achievable Energy Efficiency
AAFS – Additional Achievable Fuel Substitution
AC – Air Conditioner
AQMD – Air Quality Management District
Btu – British Thermal Unit
BUILD - The Building Initiative for Low-Emissions Development
CARB – California Air Resources Board
CEC – California Energy Commission
CED/CEDF – California Energy Demand Forecast
Comm. – Commercial Sector
EBD – Equitable Building Decarbonization Program
EE – Energy Efficiency
FS – Fuel Substitution
FSSAT – Fuel Substitution Scenario Analysis Tool
FSSAT-ZEAS AAFS – FSSAT-ZEAS modeling
GWh – Gigawatt-hour
HEEHRA - Home Electrification and Appliance Rebates
HOMES - Home Efficiency Rebates (HOMES)
IEPR – Integrated Energy Policy Report
LI – Low Income
MF - Multifamily
MM – Million
NC – New Construction
NOx – Nitrogen Oxides
Prog. AAEE – Programmatic AAEE
Prog. AAFS – Programmatic AAFS
Regs – Regulation(s)
Res. – Residential Sector
RASS – Residential Appliance Saturation Study
ROB – Replace on Burnout
SF – Single Family
TECH – Technology and Equipment for Clean Heating
ZEAS – Zero-Emission Appliance Standards

Building Scenarios

General Characterizations

Input Assumptions – Residential and Commercial Sectors

- Invariant Inputs Across All Scenarios:
  - ➢ Baseline Forecast: Electricity & Pipeline Gas
    - 2023 IEPR Baseline Consumption Forecast Extended to 2050 and Redistributed to end use (March 2024)
- Variant Inputs Across Scenarios:
  - ➢ AAEE Scenarios (Programmatic Contributions)
  - ➢ AAFS Scenarios
    - Programmatic Contributions
    - ZEAS Modeling (using FSSAT) of Combustion Control Measures

Variant building scenarios input assumptions

Demand Scenario	AAEE Gas (Programmatic Contributions)	AAEE Electric (Programmatic Contributions)	AAFS (Programmatic Contributions)	AAFS FSSAT Modeling of Combustion Control Measures (FSSAT-ZEAS AAFS)
Reference	Scenario 3	Scenario 3	Scenario 3	Scenario 3 (Space and water heating ZEAS compliance in 2030 with slower ramp rate)
Policy Scenario (+ sensitivities)	Scenario 3	Scenario 3 Scenario 4 (High DER/DF)	Scenario 4	Scenario 4 (Space and water heating ZEAS compliance in 2030)
Enhanced Policy Scenario (+ sensitivities)	Scenario 3	Scenario 6	Scenario 5	Scenario 5 (Includes propane and all-end uses)

Elements of the Programmatic AAEE and Programmatic AAFS Scenarios

AAEE 3 and AAFS 3 (Reference or Business-as-Usual scenarios used for Statewide Planning Purposes

- **IOU Programs**
  - EE plus LI & FS
- **POU Programs** EE and FS
- **Codes and Standards**
  - Title 24 Building Standards
    - 2022 Reference
    - 2025 Conservative
  - Title 20 CA & Federal Appliance Standards
    - Near-term new measures conservative
- **BU Programs**
  - Established (e.g., TECH and BUILD reference)
  - Pending (e.g., HEEHRA, HOMES, and EBD conservative)

Added or enhanced for AAEE 4 and AAFS 4

- Change modeling from moderate or reference to aggressive view
- Add more programs in early planning stages with more uncertainty around impacts or design

+ AAEE 5/6 & AAFS 5/6

Addition of more speculative programs that could be developed

**for additional details see presentations here*
https://www.energy.ca.gov/event/2023-11/iepr-commissioner-workshop-load-modifier-scenario-results

Building Scenarios

Detailed Characterizations

ZEAS Modeling Input Assumptions

Detailed ZEAS modeling AAFS Input Assumptions: Invariant across scenarios

Scenario(s)	Jurisdiction/ Regulation Amendment	Replacement Type	Sector	Fuel Type	End Uses	2024-2025	2026	2027	2028	2029	2030-2050
All	Statewide	NC	Res	Gas	Space and Water Heating	0%	**100%**	**100%**	**100%**	**100%**	**100%**
All	Statewide	NC	Comm	Gas	Space and Water Heating	0%	0%	0%	0%	**100%**	**100%**
All	BAAQMD 9-4	ROB	Res/ Comm	Gas	Space Heating	0%	25%	50%	75%	**100%**	**100%**
All	BAAQMD 9-6	ROB	Res	Gas	Water Heating	0%	50%	**100%**	**100%**	**100%**	**100%**
All	South Coast AQMD (1146.2)*	ROB	Comm	Gas	Water Heating	0%	25%	50%	75%	**100%**	**100%**

*SCAQMD (Rule 1146.2): Modeled for compliance to begin in 2029 for the Demand Scenarios project. Assumption revised to 2031 for the 2024 IEPR Update to be consistent with current CARB and BAAQMD compliance and equipment size compliance schedules.

Detailed ZEAS modeling AAFS Input Assumptions: Scenario variants (1 of 2)

Scenario(s)	Jurisdiction/ Regulation	Replacement Type	Sector	Fuel Type	End Uses	2024-2025	2026	2027	2028	2029	2030-2050
Reference (AAFS 3)	Statewide (Original proposed CARB SIP)	ROB	Res/ Comm	Gas	Space and Water Heating	0%	10%	30%	50%	70%	**100%**
Policy & Enhanced Policy (AAFS 4 & 5)	Statewide (Original proposed CARB SIP)	ROB	Res/ Comm	Gas	Space and Water Heating	0%	20%	40%	60%	80%	**100%**
Enhanced Policy (AAFS 5)	Statewide	NC	Res	Gas	Cooking, Clothes Drying	0%	0%	0%	0%	**100%**	**100%**
Enhanced Policy (AAFS 5)	Statewide	NC	Comm	Gas	Cooking	0%	0%	0%	0%	**100%**	**100%**

Detailed ZEAS modeling AAFS Input Assumptions: Scenario variants (2 of 2)

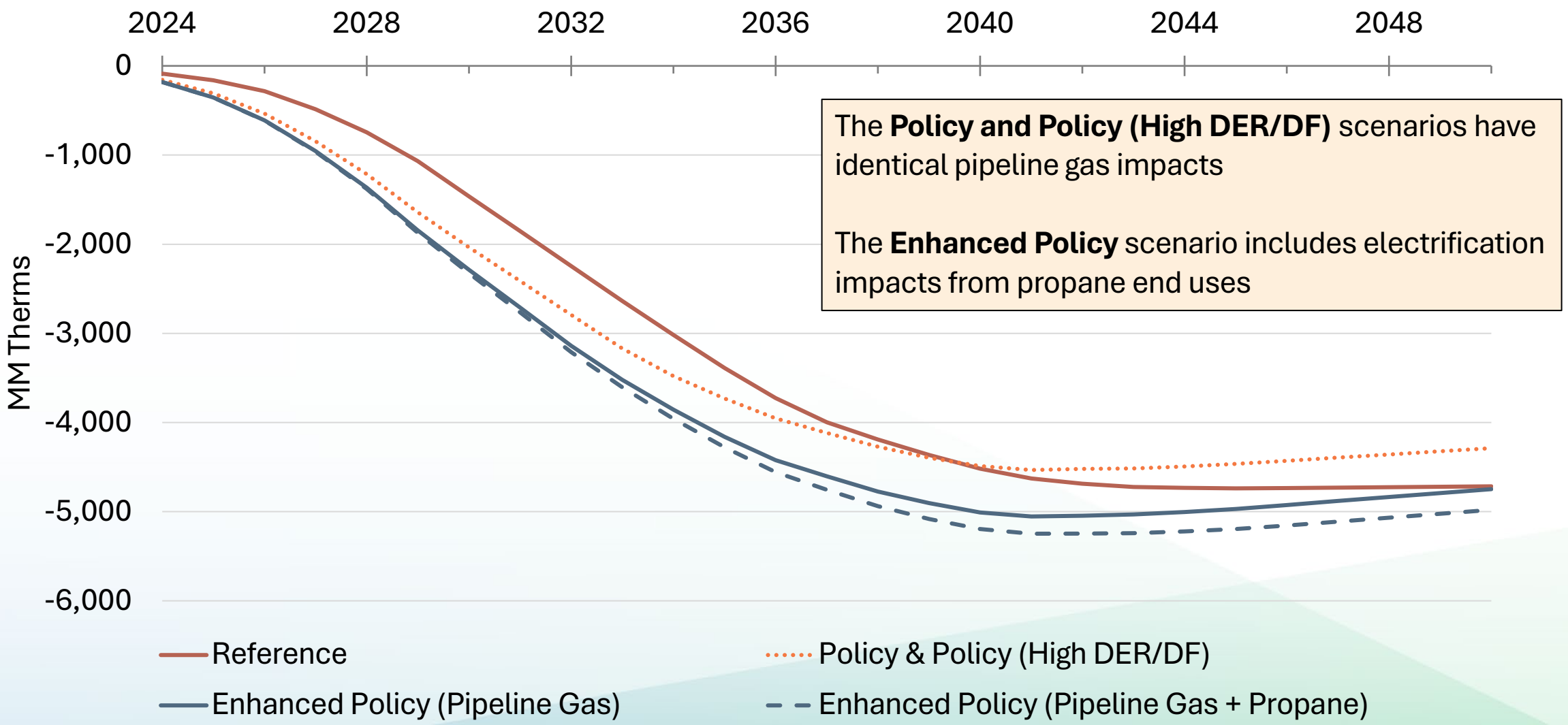
Scenario(s)	Jurisdiction/ Regulation	Replacement Type	Sector	Fuel Type	End Uses	2024-2025	2026	2027	2028	2029	2030-2050
Enhanced Policy (AAFS 5)	Statewide	ROB	Res	Gas	Cooking, Clothes Drying	0%	16%	32%	48%	64%	80% in 2030; **100% in 2035**
Enhanced Policy (AAFS 5)	Statewide	ROB	Comm	Gas	Cooking	0%	16%	32%	48%	64%	80% in 2030; **100% in 2045**
Enhanced Policy (AAFS 5)	Statewide	NC	Res	Propane*	Space Heating, Water Heating, Cooking	0%	0%	0%	0%	**100%**	**100%**
Enhanced Policy (AAFS 5)	Statewide	ROB	Res	Propane	Space Heating, Water Heating, Cooking	0%	16%	32%	48%	64%	80% in 2030; **100% in 2035**

*Commercial propane end uses currently are not modeled in FSSAT.

Building Scenarios

Gas and Electric Results:
Combined AAEE and AAFS Impacts

Buildings: Combined Pipeline Gas and Propane Impacts – MM Therms



The **Policy and Policy (High DER/DF)** scenarios have identical pipeline gas impacts

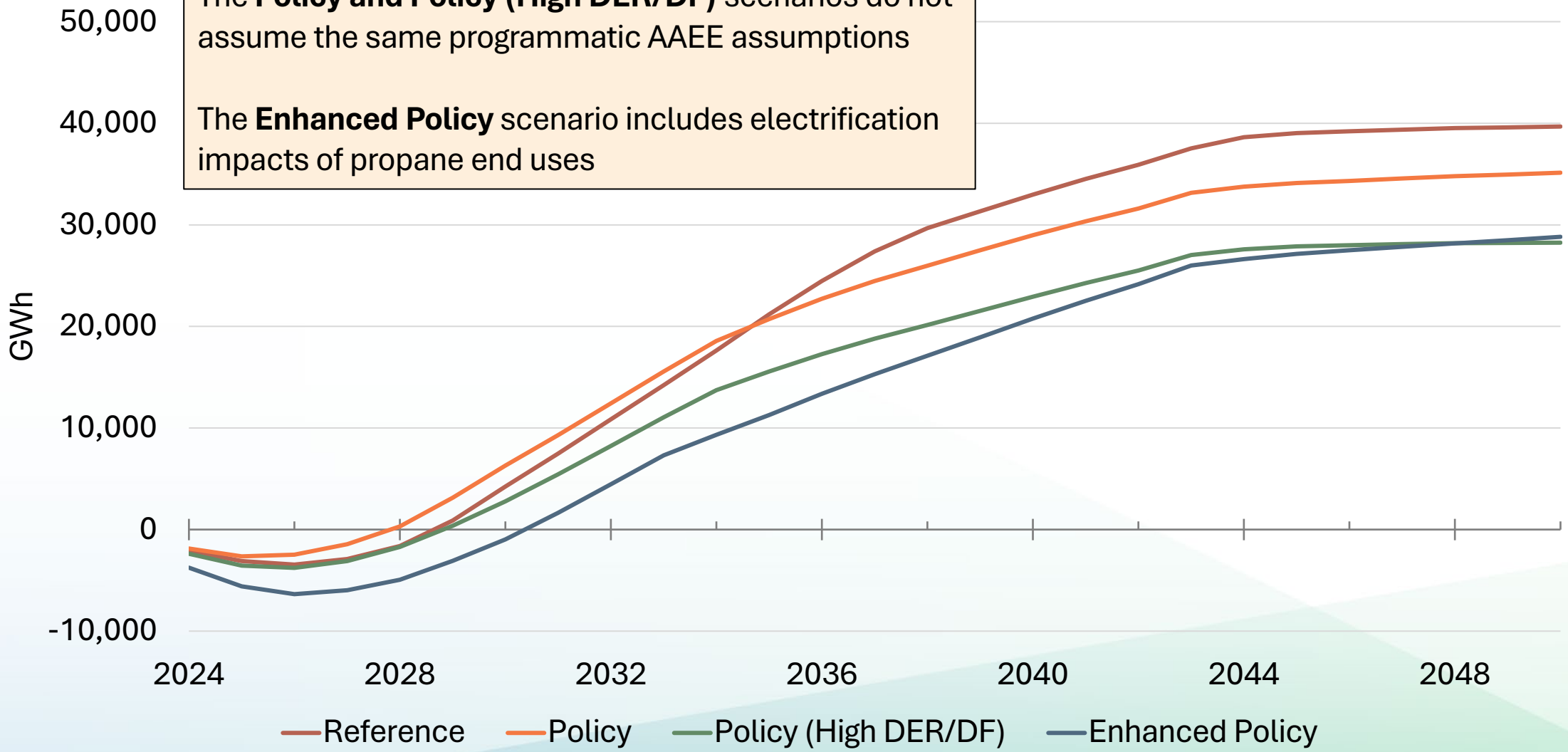
The **Enhanced Policy** scenario includes electrification impacts from propane end uses

Source: CEC Staff

Buildings: Combined Electric Impacts – GWh

The **Policy and Policy (High DER/DF)** scenarios do not assume the same programmatic AAEE assumptions

The **Enhanced Policy** scenario includes electrification impacts of propane end uses



Source: CEC Staff

Other Notable Input Assumptions

- Modeled ZEAS technology characterizations
  - Scenarios used updated technology characterizations in FSSAT compared to 2023 IEPR
  - Modeled ZEAS impacts assume an evenly mix of efficiency levels for replacement technologies
- IEPR Baseline forecast
  - Scenarios use the final version of 2023 IEPR baseline forecast
    - Draft version was used for AAFS scenarios developed in 2023 IEPR

Thank you

Please send any written comments or questions to:
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Appendix

Background: AAEE & AAFS Load Modifiers

AAEE & AAFS – Load Modifiers

Additional Achievable Energy Efficiency (AAEE)

Refers to the incremental energy efficiency savings from market potential that is not included in the baseline demand forecast but is reasonably expected to occur. These savings include future updates of building standards, appliance regulations, and new or expanded energy efficiency programs.

Additional Achievable Fuel Substitution (AAFS)

Fuel substitution refers to substitution of one end use fuel type for another such as changing out gas appliances in buildings for cleaner, more efficient electric appliances.

Analogous to AAEE, gas savings and incremental added electricity impacts are accounted for in AAFS. These impacts are modeled based on programmatic impacts and technology-based impacts (i.e., zero-emission appliance standards).

AA Framework & Scenarios

- **Additional Achievable framework:** is applied to energy efficiency, fuel substitution, and transportation electrification for the 2023 IEPR forecast.
- The **additional achievable** scenarios capture a range of incremental market potential impacts, beyond what are included in the baseline demand forecast, but are within the range of what is reasonably expected to occur.

Additional Achievable Scenarios

AAEE 1, AAEE 2, AAEE 3, AAEE 4, AAEE 5, AAEE 6

AAFS 1, AAFS 2, AAFS 3, AAFS 4, AAFS 5, AAFS 6

← Conservative Optimistic →

CEC's AAEE AAFS Nomenclature

- The Fuel Substitution Scenario Analysis Tool (FSSAT) creates IEPR AAFS Load Modifier Scenarios using different input scenarios beginning with the Baseline Gas Demand Forecast:
  1. Programmatic AAFS
  2. **Zero-emission appliance standards (ZEAS) modeled using FSSAT**
  3. Programmatic gas AAEE
- Because of interdependencies, the 1-2-3 order is required
- ZEAS modeling can also include propane end-uses
- The inclusion of programmatic AAFS **does not** imply "efficient electrification"
  - AAFS combines electricity and gas from both programmatic and FSSAT modeling and has interplay with gas AAEE
  - **IEPR Electric AAEE** is independent of AAFS process and is only programmatic