Industrial Electrification Modeling in AAFS 6

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Acronyms, Initialisms, and Abbreviations

- **AAFS** – Additional Achievable Fuel Substitution
- **AAFS 6** – Scenario 6: the most aggressive AAFS scenario

- **Ag** – Agricultural Sector
- **AQMD** – Air Quality Management District
- **CEC** – California Energy Commission
- **DS** – Demand Scenarios
- **FS** – Fuel Substitution
- **FSSAT –** Fuel Substitution Scenario Analysis Tool
- **GHG** – Greenhouse Gas
- **IEPR** – Integrated Energy Policy Report
- **IMD** – Interval Meter Data
- **Ind** – Industrial Sector
- **IRA** – 2022 Inflation Reduction Act
- **PiCS** – Programs and incremental Codes and Standards

Overview

- Background
  - Rationale
  - Our proposal's relationship to existing forecast components
- Industrial AAFS 6
  - Using a modified version of the 2023 Demand Scenarios Project's industrial electrification modeling
  - Modeled policies
  - From policies to modeling
- Plans for future forecast cycles

Background

Rationale

Stakeholder Comments

- Growing demand for industrial electrification
- Need for AAFS scenarios to consider a broader range of plausible market and policy outcomes

The Need for Including More Industrial Electrification in AAFS 6

- 2025's base forecast (State Form 1.1) suggests little change in industrial gas use through 2045
- Existing AAFS scenarios model very little (<1%) industrial electrification
- Growing policy interest and technological development

Fitting the FSSAT Ag & Industrial Module into the IEPR Forecast

IEPR Ag & Ind Gas Baseline Demand Forecast

PiCS Additional Achievable Fuel Substitution Scenario
Reduces consumption of Ag & Ind gas

FSSAT Ag & Ind Fuel Substitution Module (Electricity or Hydrogen)
- Characterize and Split Ind thermal end uses
  - Process Heat-Low (electricity)
  - Process Heat-High (H_2)
  - Water Heating (electricity)
- Apply estimates from H_2 production & transport
- Calculate fuel substitution potential

PiCS Additional Achievable Energy Efficiency Scenario
Further reduces consumption of Ag & Ind gas

Hourly Outputs
Load profiles based on NAICS codes (now based on IMD)

Annual Outputs
- Final demand forecasts
- Incremental electricity added from FS and onsite H_2 production
- Hydrogen demand
- Avoided gas consumption
- Net GHG emissions
- *Cost of substitution*

2026 IEPR: AAFS Scenario 6 Proposal

Revisiting 2023's Demand Scenarios

2023 Demand Scenarios Project

- Industrial electrification framework and scenarios
- Modeling module in FSSAT

Policy Basis

Key Legislation	IRA Incentive Names and Descriptions
The 2020 Infrastructure Investment and Jobs Act	48C Manufacturing Tax Credit: $1.2 billion for industrial decarb (largely remains)
The 2022 Inflation Reduction Act (IRA)	Advanced Industrial Facilities Deployment Program: $5.8 billion (now rescinded)

2026 Forecast: AAFS 6 industrial to incorporate 2023 Demand Scenarios modeling

2027 Forecast: Additional updates and improvements

Industrial AAFS 6 Scenario

- AAFS 6 will emulate the 2023 Demand Scenarios Project's enhanced policy scenario using
  - Only the industrial sector
  - Only the electrification portion (no hydrogen fuel substitution)
  - With a 50% discount due to changes in federal policy since 2023

Industrial AAFS 6 Step 1

Split industry into 46 subsectors. For each subsector:

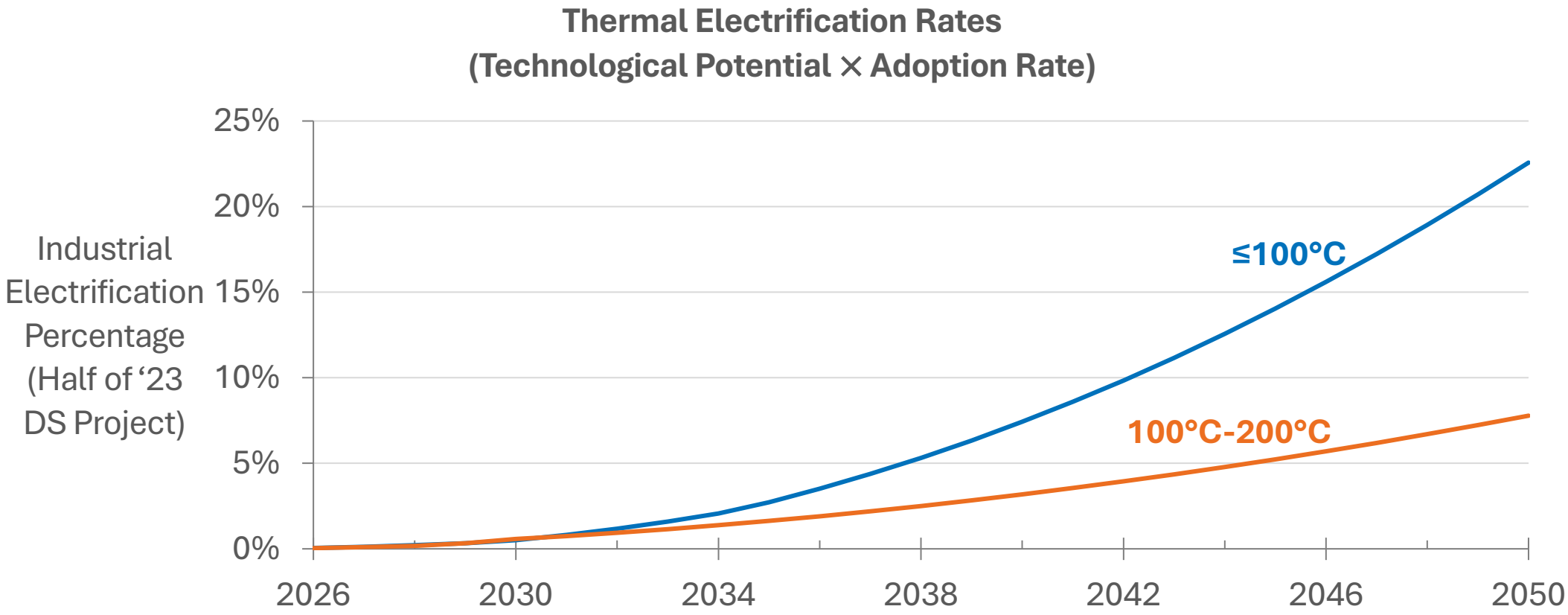
- Characterize % of gas used for thermal end uses[1]
- Split thermal gas usage by temperature[2]
- Assume a conversion factor for each temperature range

Temperature Range	≤100°C	100-200°C	≥200°C
Name in the report	Water heating	Process Heat-Low	Process Heat-High
Conversion Factor (kWh/therm)	12.02	6.23	N/A
Electric coefficient of performance ÷ gas efficiency	2.44	4.70	N/A

1. 2023 Demand Scenarios Table B-1 (page B-3)
2. 2023 Demand Scenarios Table B-4 (page B-8)

Industrial AAFS 6 Step 2

- Staff judgement of electrification rates for each temperature range
- Same rate across subsectors
- Assumptions are conservative
- Assume thermal energy ≥200°C does not electrify



Industrial AAFS 6 Details: Conclusion

For each subsector and temperature range:

- thermal range gas usage × thermal range electrification rate
  × thermal range conversion factor = realized electrification

Plans for Future Forecast Cycles

Future steps

Further research into:

- Industrial heat pump readiness assumptions for different temperatures
- The economics of electrification for different subsectors and/or facilities
- Agricultural fuel substitution

Better data for:

- Characterizing, per subsector, % gas used for thermal end use temperature ranges
- Tracking electrification that has already occurred

Modeling impacts of current industrial electrification trends, including:

- South Coast AQMD – proposed and recent regulations for boilers/heaters
- Concentrated solar thermal for medium+ temperature heating in Searles Valley
- Existing CEC-sponsored industrial electrification projects

Potentially expanding modeling to additional AAFS scenarios

Feedback Request

If you have insights or data that can help our industrial electrification modeling, please share!

Thank You!
Questions?

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