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Industrious Labs, Earthjustice, Sierra Club, The 2035 Initiative at UCSB Comments on AAFS 6

Additional submitted attachment is included below.

September 15, 2026

Submitted Electronically

California Energy Commission
Docket Number 26-IEPR-03
715 P Street
Sacramento, CA 95814-5512

Re: Comments on Industrial Electrification Modeling in AAFS 6

Dear Chair Hochschild, Vice Chair Gunda, and Commissioners,

On behalf of the undersigned organizations, we appreciate the opportunity to comment on the industrial electrification modeling proposal presented at the August 31, 2026 workshop on load modifier inputs and assumptions. In our March 25, 2026 comments on the Draft Scoping Order, we recommended that the electricity demand forecast include an industrial electrification scenario that accounts for current and anticipated zero-emissions standards. We commend staff's responsiveness in developing the proposed Additional Achievable Fuel Substitution Scenario 6 ("AAFS 6").

AAFS 6 is significant progress from current scenarios that, as staff noted, model less than one percent industrial electrification, with the base forecast projecting little change in industrial gas use through 2045.[i] Connecting the FSSAT agricultural and industrial module to the IEPR demand forecast also establishes an important capability that will allow the Commission to forecast industrial electrification load and the gas consumption it displaces, which will inform infrastructure planning and procurement and sharpen assumptions underlying the electricity rate forecast. Our comments are offered to strengthen that work.

Below we recommend changes to the AAFS 6 scenario itself, as well as recommendations for future staff analysis.

I. Recommendations for the AAFS 6 Analysis

A. Extend electrification to process heat above 200°C and raise the projected adoption rates for electric heating in all temperature ranges.

AAFS 6 assumes that thermal energy at or above 200°C does not electrify, and applies electrification rates reaching only 22 percent for heat demand below 100°C and 8 percent for heat demand between 100°C and 200°C by 2050. Multiple considerations suggest these assumptions are more conservative than the evidence supports.

First, the aggregate share of high-temperature heat across all manufacturing overstates the share in the industries AAFS 6 is modeling. High-temperature process heat is a substantial share of California industrial thermal load overall, but that aggregate is heavily driven by petroleum refining. Excluding refining, approximately 70 percent of California industrial heat demand falls below 200°C.[ii] Fuel consumption shows the same pattern: food and beverage, pulp and paper, and chemicals account for roughly 69 percent of California manufacturing natural gas demand excluding refining, against 44 percent when refining is included.[iii] The fuel consumption figures derive from federal reporting data covering facilities above the 25,000 metric tons CO2e/year threshold and therefore exclude smaller manufacturers, whose processes are generally lower-temperature. The Demand Scenarios already treat refining separately, reducing its overall energy demand as petroleum product demand falls, so this sector follows a different trajectory than the industries AAFS 6 is modeling. A high-temperature share calculated across all industries including refining therefore overstates the constraint facing the industries this scenario is modeling.

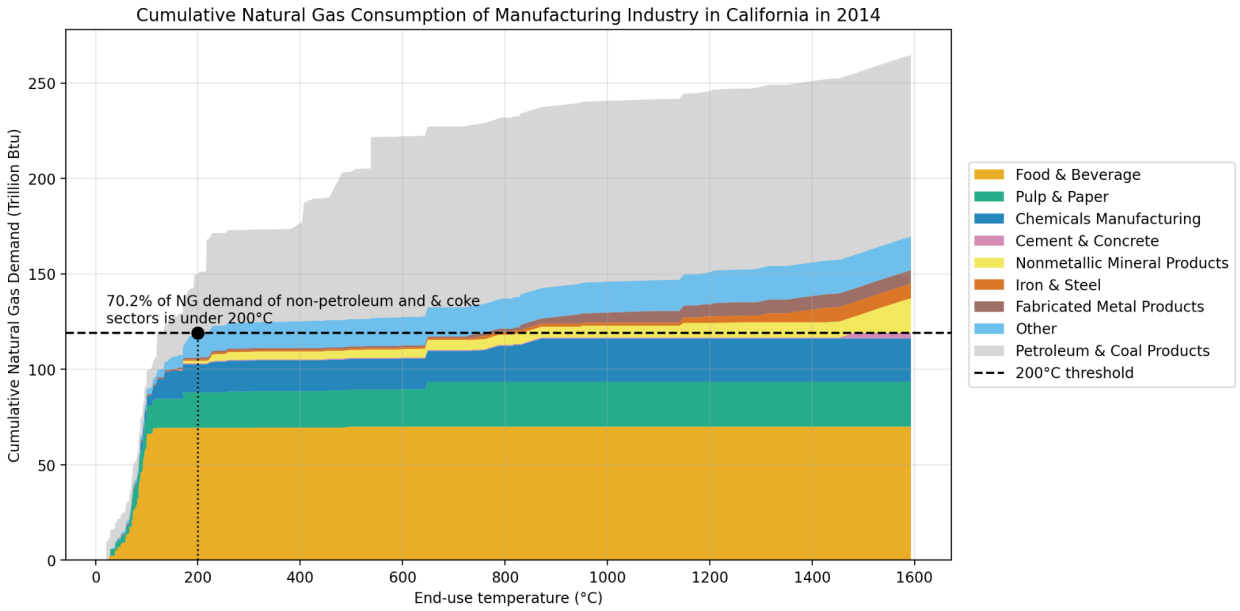

Figure 1. Cumulative natural gas consumption of California manufacturing by end-use temperature, 2014. Petroleum and coal products account for the large majority of consumption above 200°C.
Source: McMillan, 2019

While the 2023 Demand Scenarios assumed that high-temperature process heat would be decarbonized through hydrogen rather than direct electrification, these assumptions relied on a single source exclusively addressing heat pumps and did not consider industrial thermal batteries, electrode boilers, or resistance heating,[iv] which can reach temperatures above 200°C. More recent peer-reviewed analysis of California industrial facilities sets its temperature bands at the upper limits of what heat pumps and commercial resistance heaters can deliver and finds that over 88 percent of California's industrial heat demand falls below 1000°C and is amenable to electrification through those technologies. Only 11 percent, concentrated in cement, glass, lime, and metals, requires higher temperatures.[v] Commercially available technologies that can reach temperatures well above 200°C are already being deployed for industrial process heat,

including a 100 MWh thermal battery storing heat above 1,000°C in commercial operation in Kern County, delivering continuous steam and displacing gas-fired boiler use.[vi] Thermal battery models are also under development to support temperatures of up to 1,500°C.[vii] We were glad to see thermal batteries raised in the workshop discussion, including Commissioner McAllister's comments on their value as a grid flexible resource.

Thus, the proposed approach to AAFS 6 appears to markedly underestimate the available and achievable opportunities to decrease reliance on fossil fuels in industrial processes that require heat in each temperature range that CEC staff considered. If roughly 70 percent of non-refining industrial heat demand falls below 200°C, electrifying these industrial processes could be a major emissions reduction opportunity. Commercially available technologies can also serve a large majority of remaining industrial equipment.

B. Revise 50 percent federal policy discount.

AAFS 6 applies a 50 percent discount to the 2023 enhanced policy scenario "due to changes in federal policy since 2023."[viii] While we do not dispute that federal policy has changed, we question the magnitude and shape of the adjustment.

The discount accounts for losses in federal funding without accounting for major shifts in California policy to replace them. While staff's policy basis identifies $5.8 billion in rescinded funds from the Office of Clean Energy Demonstration's Advanced Industrial Facilities Deployment Program, approximately $845 million of that was awarded to California facilities, and of that, $75 million was for a single industrial electrification project.[ix] The adopted Manufacturing Decarbonization Incentive (MDI) allocation as part of the Cap & Invest Program changes creates approximately $4 billion in allowance value between 2028 and 2035 to help make up for the loss in federal incentives,[x] with process heat electrification among qualifying investments. The presentation's policy basis overrepresents the loss of federal funding and does not reflect state mechanisms established since then to incentivize industrial electrification, which now exceeds the federal funding withdrawn.

Furthermore, the CEC's own documentation for the 2023 Demand Scenarios Project states that federal tax incentives and grants were the rationale for adoption assumptions up to the early 2030s, but that under the enhanced policy scenario, adoption rates continue to increase after the early 2030s. This is due to decarbonization technologies becoming more common and part of the conventional set of choices for industrial facilities, with potential growing as manufacturing capacity for these products expands.[xi] Because the federal support was intended to impact the adoption forecast only for a particular period, the discount should reflect that period rather than the full horizon, and also take into account CARB's adoption of the MDI.

II. Recommendations for Future Analysis

A. We support modeling current and anticipated regulatory drivers.

Staff have identified South Coast AQMD's recent and proposed regulations for industrial boilers and heaters as a subject for future modeling. We strongly support this. Nonattainment obligations are driving air districts toward zero-emissions pathways, and the resulting equipment transitions are among the most predictable sources of industrial electrification load in California. Indeed, widespread electrification of all industrial heating needs may be the only feasible route to attainment in California's most polluted regions, which are home to California's manufacturing base. Regulators have recognized that a transition to zero-emissions for stationary sources of all sizes is necessary to meet these health-based air quality standards in the South Coast AQMD.[xii]

The District took a first step toward transitioning the industrial sector in 2023 by adopting Proposed Amended Rule 1153.1, a zero-emissions standard for large commercial ovens and the nation's first such standard for stationary sources of pollution.[xiii] Its recent technology review found the zero-emissions requirements feasible and established them as Best Available Retrofit Control Technology.[xiv] The rule is already delivering measurable results; for example, 66 percent of covered smokehouses are now zero-emissions. PAR 1146 and 1146.1 are now in development and would cover approximately 1,900 boilers, steam generators, and process heaters.

Compliance schedules for these rules can translate directly into adoption curves, and they operate independently of the federal policy uncertainty that motivated the 50 percent discount.

B. We support an interagency effort to acquire and share improved data, and recommend a dedicated technoeconomic assessment in the 2027 IEPR.

Staff have identified three priorities for continued research: characterizing the share of gas used by temperature range, industrial heat pump readiness at different temperatures, and the economics of electrification across subsectors and facilities.[xv] We support all and recommend they be pursued together, as a dedicated chapter in the 2027 IEPR presenting an independent technoeconomic assessment of industrial decarbonization options by equipment type and temperature range. Such an assessment would serve the demand forecast directly, and it could also supply quantitative support for the industrial sector pathways in CARB's next Scoping Plan update.

On data, we commend staff's use of interval meter data to develop more accurate load profiles for industrial process heat users. We further recommend that staff coordinate with air districts on data sharing. District permit records provide equipment population and rated heat input at the facility level for regulated units. When combined with temperature characteristics by process and equipment type based on literature, these records could further support California-specific temperature characterization.

C. Policy impacts on electrification economics should be modeled.

Staff have also identified the economics of electrification as an area for further work. We support this, and would emphasize an assessment of retail electric and gas rate structures in particular. California's spark gap - the multiplier between electric and gas rates - is nearly five, meaning a facility switching from gas to electricity faces an operating cost penalty regardless of the efficiency of the equipment it installs.[xvi]

The CPUC currently has an open rulemaking on Advanced Electric Rate Design (R.26-04-009) that will examine, among other issues, how investor-owned utility retail rates should be updated to better support industrial electrification and beneficial load growth.[xvii] Because current rate design is under active reconsideration, the CEC should not hold tariff structures fixed through 2050. Instead, we recommend a cost of substitution analysis including sensitivities to alternative retail rate structures designed to support industrial electrification, and to behind-the-meter resource availability, rather than relying solely on current sector-average retail electricity rates.

D. Mapping industrial electrification potential against grid capacity would support better policy.

We also support Commissioner McAllister's suggestion at the workshop that industrial electrification potential be mapped against grid capacity and interconnection constraints. Industrial thermal load is geographically concentrated and substantially flexible. Lawrence Berkeley National Laboratory has found that industrial processes have the lowest median cost to install and implement shift-enabling technologies, which places industrial loads amongst the most accessible shift resources available.[xviii]

Various electrified clean heat technologies offer demand flexibility. Thermal batteries store energy as heat and discharge it on demand, allowing facilities to charge during hours of high renewable penetration, which is particularly valuable in California, where curtailment is rising faster than utility-scale demand.[xix] Industrial heat pumps paired with storage can also achieve the same result. Analysis of a California food processing facility found that operating a heat pump around time-varying rates – charging thermal storage during off-peak hours and drawing on it during peak periods – substantially reduced the facility's on-peak power consumption without compromising its process heat supply.[xx]

Industrial electrification shifted toward off-peak hours does not add demand at system peak but instead spreads electric system costs over more hours, putting downward pressure on rates and reducing the ramping costs of starting and stopping peaker plants. Mapping electrification potential against available capacity would show where electrification can proceed without major upgrades and where targeted investment is warranted, giving grid planners a clearer basis for the infrastructure decisions that industrial electrification will require.

III. Summary of Recommendations

In sum, we urge the CEC to incorporate the following into the AAFS 6 Scenario and Future Analysis:

In AAFS 6 as proposed:

1. Raise the projected electrification adoption rates and assign an electrification pathway above 200°C reflecting commercially available high-temperature electric technologies.
2. Apply the federal policy discount only to the years federal incentives were expected to drive adoption, and account for the new MDI. Otherwise, present the undiscounted case.

In future analysis;

3. Model current and anticipated regulatory drivers.
4. Include a dedicated chapter presenting an independent technoeconomic assessment of industrial decarbonization options by equipment type and temperature range.
5. Build a cost of substitution analysis with explicit sensitivity to alternative retail rate structures and behind-the-meter resources, rather than sector-average rates alone.
6. Map industrial electrification potential against grid capacity and interconnection constraints.

IV. Conclusion

Industrial electrification serves multiple state objectives at once. It advances California's climate commitments and is necessary for many regions facing federal air quality deadlines. It keeps the state's manufacturing base competitive as global markets move toward lower-carbon production, preserving existing jobs and supporting new ones in equipment manufacturing, installation, and maintenance trades that modernizing these facilities requires. Recent analysis from the Renewable Thermal Collaborative and the Industrial Heat Pump Alliance estimates that accelerated industrial electrification would support approximately 73,700 jobs and $31 billion in economic activity in California, and it ranks the state amongst the highest-potential states for both deployment and domestic manufacturing of electrified industrial technologies.[xxi] Furthermore, because industrial thermal load is highly flexible, it can support rate affordability for all customers by spreading fixed system costs across a larger base, a point reflected in staff's own observation that slower load growth increases the rate impact of capital investment.[xxii]

As was noted at the workshop, California's leadership carries weight well beyond its borders, and the state's approach to industrial decarbonization can help move solutions forward across the sector globally. An AAFS 6 forecast grounded in the technologies available today and the policies now in place strengthens that role.

For these reasons, we urge the Commission to project more robust adoption rates across all temperature ranges. We recognize that AAFS 6 is an initial step and that staff have identified improvements for subsequent cycles. Because this scenario arrives as CARB prepares its next Scoping Plan Update and as the CPUC revisits non-residential rate design, strengthening it now could help impact multiple regulatory processes. We welcome the opportunity to support staff with additional data and analysis.

Sincerely,

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[viii] Jonathan Margoliash, CEC, "Industrial Electrification Modeling in AAFS 6," Docket 26-IEPR-03, TN 272221, August 28, 2026, slide 9.
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[xii] South Coast Air Quality Management District, 2022 Air Quality Management Plan, at ES-5 (Dec. 2022).
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