December 12, 2024

**MEMORANDUM**

**TO:** Market Transformation Advisor Board (MTAB) Members

**FROM:** Karen Horkitz, Market Research and Evaluation Lead
Lynette Curthoys, VP Market Transformation

**SUBJECT:** Induction Cooking Updated Market Forecasting and Cost-Effectiveness Results

CalMTA made updates to the preliminary Induction Cooking Market Transformation Initiative (MTI) market adoption forecast and cost-effectiveness models in response to discussion and comments received during the November 21, 2024, MTAB meeting. This memo summarizes these updates as well as the rationale and impact for each.

Below is a list of updates to model inputs and assumptions in response to MTAB feedback and additional analysis:

1. Updated equipment price associated with battery-equipped induction stoves to align with the MTI program theory
2. Added electrical wiring costs associated with gas-to-electric conversions
3. Additional modeling corrections and refinements:
   - Corrected equipment price forecast methodology
   - Corrected modeling error to properly exclude non-ENERGY STAR radiant market adoption
   - Adjusted market assumptions regarding portion of radiant cooking products that are ENERGY STAR qualifying

A summary of MTAB feedback and model refinements pertaining to each of these updates is provided below followed by a summary of the impacts to TSB and cost-effectiveness for the Induction Cooking MTI.

## Updates identified at MTAB meeting

This section provides the details of each modeling change, including why the change was implemented and what impact it had on cost-effectiveness and benefit metrics.

## 1. Updated assumed equipment price associated with battery-equipped induction ranges

CalMTA reduced the projected price of battery-equipped, 120V induction range products to better align with the MTI program strategy and to reflect recently acquired market data related to equipment pricing.

### *What changed*

CalMTA changed model assumptions about the price trends for battery-equipped, 120V induction ranges. Table 1 summarizes the differences between the preliminary model and the updated model.

**Table 1. Updates to price forecasts for 120V induction range with battery**

| Assumption | Preliminary model | Updated model |
|---|---|---|
| 120V battery-equipped induction price – base year | $5,999<br>Based on current retail price of Copper's 30-inch range | Blended average of $3,000 for 24" range, and $5,999 for 30" product[1] |
| 120V battery-equipped induction price – 2027 | Determined by linear interpolation of base year and 2031 values | $3,500 for 30" product; blended average of 24" and 30" range |
| 120V battery-equipped induction price – 2031 | 2x the price of 240V induction products | Blended average price of $2,500 |
| 120V battery-equipped induction price – 2045 | 1.25x the price of 240V induction products | Unchanged |
| Price declines 2031-2045 | Linear interpolation | Unchanged |

### *MTAB feedback and rationale for the change*

CalMTA's preliminary model had erroneous assumptions about the pricing of battery-equipped, 120V equipment – for both current (base year) pricing and future pricing:

- The previous base year pricing did not reflect current market information from Copper, which recently quoted $3,000 for a 24" range in response to the New York City Housing Authority's Induction Stove Challenge.[2]

[1] Assumes adoption of 24" units by MF households and 30" units by SF households.

[2] As quoted by Copper to the NYC Housing Authority https://heatmap.news/sparks/nycha-induction-stoves-copper.

- The CalMTA induction cooking MTI program theory includes developing bulk purchase agreements with manufacturers by 2027 and influencing one or more major manufacturers to produce an affordable battery-equipped, 120V product at scale, by 2031. Based on conversations to date with product manufacturers, CalMTA projects availability of a 30" product priced at $3,500 by 2027 and expects the average price of battery-equipped, 120V units to be $2,500 by 2031.
- Achievement of the lower assumed negotiated price of battery-equipped, 120V product in the updated model is further substantiated by industry expectations regarding steep declines in battery prices over the next 20 years.[3]

### *Summary of changes and impact*

Table 2 summarizes the updated price inputs based on the changes described above.

**Table 2. Updates to price assumptions of 120V induction range with battery**

| Year | Pricing assumption: preliminary model | Pricing assumption: updated model | Notes |
|---|---|---|---|
| 2024 | $5,999 | $4,611 | Current assumption based on adoption weighted average of 24″ and 30″ products. |
| 2027 | $4,657 | $3,284 | Prior assumption based on linear interpolation between 2024 price and 2031 price. Current assumption based on expected price trends for 24″ and 30″ products and linear interpolation. |
| 2031 | $3,234 | $2,500 | |
| 2045 | $1,782 | $1,782 | Unchanged |

The resulting reduction in incremental measure cost for those use cases led to significant increases in TRC and SCT ratios.

## 2. Added electrical upgrade costs associated with gas-to-electric conversions

### *What changed*

**Preliminary model:** Did not include incremental cost associated with wiring upgrades required for use cases that involved changing from gas to electric.

**Updated model:** Added the estimated cost of upgrading a kitchen outlet to support a 240V ENERGY STAR radiant or induction cooktop or range for use cases that involved changing from gas to electric. Per eTRM, this is assumed to be $131 per installation.[4]

[3] Source: Mauler, L., Duffner, F., Zeier, W. G., & Leker, J. (2021). Battery Cost Forecasting: A Review of Methods and Results with an Outlook to 2050. *Energy & Environmental Science*, *14*(9), 4712-4739. Per meta-analysis by the study, battery cost is expected to decline from 234 $/kWh in 2020 to 132 $/kWh in 2030 and 71 $/kWh in 2050.

[4] https://www.caetrm.com/measure/SWAP013/03/.

### *MTAB feedback and rationale for the change*

MTAB members asked for clarification as to whether these incremental costs had been included for fuel substitution use cases, and CalMTA clarified that they were omitted. The general consensus was that while it would be inappropriate to assume that panel upgrades would be required or driven by changing cooking fuel, it makes sense to include the cost of required wiring upgrades and associated labor.

### *Summary of changes and impact*

CalMTA added $131 in wiring costs and labor associated with gas-to-electric installations. This had a small negative effect on TRC and SCT for fuel substitution cases.

## Additional modeling corrections and refinements

CalMTA made three additional corrections and refinements to the market adoption and cost-effectiveness models, each of which is described below.

### 3a. Corrected equipment price forecast methodology

While addressing the changes to equipment costs described above, CalMTA identified and corrected an error in the equipment price calculations.

### *What changed*

**Preliminary model:** Used median price of all induction and ENERGY STAR radiant models (combined technologies) compiled based on retail research.

**Updated model:** Identified median equipment prices for each technology type (induction, ENERGY STAR radiant, non-ENERGY STAR radiant, coil), and weighted prices according to forecasted annual market shares.

### *Rationale for the change*

During its review of assumed product prices, CalMTA discovered that it had inadvertently overweighted induction cooking product prices versus ENERGY STAR radiant products prices in the base year. CalMTA previously used the median price based on retail research. However, the team discovered that the median price was skewed toward induction products because there were a larger proportion of induction products in CalMTA's database than the assumed market share. For that reason, CalMTA revised its approach to identify a median price for each technology and weighted those prices to match the forecast share of each adopted in each year. CalMTA used the same approach to appropriately weight the base year prices of baseline technologies.

### *Summary of Changes and Impact*

Revising the product cost calculation approach from a simple median among all reviewed ranges to a technology-specific price median, weighted by the shares of ENERGY STAR radiant and induction, had the overall impact of reducing IMCs for most range products because ENERGY STAR radiant ranges tend to have lower prices than induction – as opposed to cooktops which are

more similar in price. Table 3 below shows the previous and updated median prices. The updates resulted in higher incremental costs for cooktops and lower incremental costs for ranges.

**Table 3. Updates to base year (2024) equipment cost**

| Case | Technology | Range/ Cooktop | Median equipment price (previous) | Weighted average or median equipment price (updated) | Difference | % Difference |
|---|---|---|---|---|---|---|
| Baseline | Coil or Radiant | Cooktop | $999 | $747 | $(252) | (25)% |
| Proposed | ES Radiant or Induction | Cooktop | $1,199 | $1,251 | $52 | 4% |
| Baseline | Coil or Radiant | Range | $874 | $981 | $107 | 12% |
| Proposed | ES Radiant or Induction | Range | $1,550 | $1,368 | $(181) | (12)% |

Table 4 provides context for which use cases contributed the most to total IMC and shows that ranges represent 87% of incremental adoption units. Due to the high proportion of households with ranges (versus standalone cooktops), the overall impact of the median price updates was a reduction in IMCs and as a result, significantly higher TRC and SCT ratios.

**Table 4. Revised Incremental Measure Cost by case**

| Case # | Baseline equipment | Proposed equipment | Base year IMC (previous) | Base year IMC (updated)[a] | 2024–2045 Incremental adoption (Units) | Proportion (units) |
|---|---|---|---|---|---|---|
| 1 | Coil or radiant cooktop | ES radiant or induction cooktop | $200 | $503 | 23,931 | 1% |
| 2 | Gas cooktop | ES radiant or induction cooktop | $1 | $53 | 331,002 | 12% |
| 3 | Coil or radiant range | ES radiant or induction range | $676 | $388 | 142,347 | 5% |
| **4** | **Gas range** | **ES radiant or induction range** | **$632** | **$450** | **1,567,423** | **59%** |
| 5 | Coil or radiant range | Induction with battery range | $5,125 | $3,631 | 130,261 | 5% |
| **6** | **Gas range** | **Induction with battery range** | **$4,950** | **$3,563** | **468,069** | **18%** |
| **Total Units** | | | | | **2,663,033** | **100%** |

[a] Includes additional $131 per unit electrical wiring costs (change #2) and lower assumed price for battery-equipped, 120V products (change #1).

## 3b. Corrected modeling error to properly exclude non-ENERGY STAR radiant market adoption

### *What changed*

**Preliminary model:** Incorrectly included non-ENERGY STAR radiant units in the MTI market adoption and cost-effectiveness analyses.

**Updated model:** Corrected this error; removed non-ENERGY STAR units from the incremental market adoption and cost-effectiveness analyses.

### *MTAB feedback and rationale for the change*

MTAB members requested clarification about the surprisingly high proportion (47%) of reported market adoption that was identified as "radiant." The discussion revealed that the radiant proportion of market adoption included both ENERGY STAR and non-ENERGY STAR models, and that both types had been included in the incremental impact and cost-effectiveness calculations.

### *Summary of changes and impact*

As noted above, all non-ENERGY STAR units were removed from the analysis. This change resulted in a decrease in net incremental adoption from 3.3 million units to 2.9 million units, which resulted in modest decreases to TSB and all three benefit-cost ratios.

## 3c. Adjusted market assumptions regarding portion of radiant cooking products that are ENERGY STAR

After reviewing ENERGY STAR versus non-ENERGY STAR radiant cooking units, CalMTA revised the assumed ENERGY STAR share.

### *What changed*

**Preliminary model:** Assumed that ENERGY STAR-qualified products would comprise 50% of all radiant products sold for both BMA and TMA, based on reported shares of various residential appliances including dryers (48% in 2022), washers (61%), refrigerators (66%), and LCD monitors (65%).[5]

**Updated model:** Assumed ENERGY STAR-qualified product market share would reach 75% by 2035, based on experience with a broader set of appliance categories, including dishwashers (96%), room air cleaners (86%), and dehumidifiers (90%), and considering the increasing stringency of the ENERGY STAR standards for these appliances.[6]

### *Rationale for the change*

The CalMTA team was concerned that 50% was an overly conservative estimate for the 2035 market share of ENERGY STAR radiant cooktops and ranges, based on experience with other

[5] https://www.energystar.gov/sites/default/files/2022%20Unit%20Shipment%20Data%20Summary%20Report.pdf.
[6] In both the previous and current case, the indicated proportion is expected to be reached by 2035, with a linear interpolation between 2024 and 2035. The proportion is assumed to remain constant beyond 2035.

kitchen appliances such as dishwashers and refrigerators. After reviewing prior experience with residential appliances, CalMTA changed the 2035 market share assumption to 75%.

### *Summary of changes and impact*

CalMTA increased the assumed 2035 proportion of radiant cooktops or ranges that are ENERGY STAR versus non-ENERGY STAR radiant cooktops or ranges from 50% to 75%. This update, combined with the exclusion of non-ENERGY STAR certified products (update 3, above), led to a reduction in net incremental adoption from 2.9 million units to 2.7 million units and a modest reduction in TSB and all three benefit-cost ratios.[7]

Tables 5 and 6 show the previous and updated market adoption estimates, by household segment.

**Table 5. Previous market adoption estimates by household type, 2024-2045, thousands of units: presented at the November 21, 2024, MTAB meeting**

| | TMA ($Y^{TMA}$) | BMA ($Y^{BMA}$) | PA-verified units ($Y^{RA}$) | Net Incremental ($Y^{N.Incremental}$) | Adoption attributed to non-IOU territory | Adoption for TSB and CE estimation |
|---|---|---|---|---|---|---|
| **Single-family households** | 3,883 | 1,357 | 191 | 2,335 | 597 | 1,738 |
| **Multifamily households** | 1,621 | 766 | 54 | 802 | 205 | 597 |
| **New construction** | 421 | 255 | - | 166 | 42 | 124 |
| **Total** | **5,926** | **2,378** | **245** | **3,303** | **844** | **2,459** |

[7] The increase in the share of ENERGY STAR-certified products among radiant cooktops and ranges was applied to both BMA and TMA. Because the adoption of radiant products is higher in BMA than in TMA, the total number of ES radiant units in BMA increased more than it did in TMA, resulting in reduced incremental adoption.

**Table 6. Revised market adoption estimates by household type[8]**

| | TMA ($Y^{TMA}$) | BMA ($Y^{BMA}$) | PA-verified units ($Y^{RA}$) | Net Incremental ($Y^{N.Incremental}$) | Adoption attributed to non-IOU territory | Adoption for TSB and CE estimation |
|---|---|---|---|---|---|---|
| **Single-family households** | 3,559 | 1,511 | 124 | 1,924 | 492 | 1,433 |
| **Multifamily households** | 1,610 | 958 | 35 | 617 | 158 | 460 |
| **New construction** | 459 | 338 | - | 121 | 31 | 90 |
| **Total** | **5,629** | **2,808** | **158** | **2,663** | **681** | **1,982** |

## Summary of impacts

Table 7 provides a comparison of TSB and cost-effectiveness results presented to the MTAB and the results of CalMTA's revised analysis. The updates resulted in these notable changes:

- TSB decreased by approximately 4%. The decrease was driven by removing non-ENERGY STAR qualified cooking equipment, as described in update 3b, above.
- TRC increased from 0.9 to 1.12. The increase in TRC was driven by the lower assumed prices of battery-equipped induction equipment (update 1) and 240V induction ranges (update 4a), both of which reduced overall incremental costs.

**Table 7. Summary of changes in cost-effectiveness results**

| Metric | Draft MTAB presentation results | Final results |
|---|---|---|
| TSB | $ 561M | $ 537M |
| TRC Ratio | 0.90 | 1.12 |
| PAC Ratio | 14.99 | 14.36 |
| Base SCT TSB | $2.5B | $ 2.3B |
| Base SCT Ratio | 2.58 | 3.04 |
| High SCT TSB | NA | $ 2.3B |
| High SCT Ratio | NA | 3.04 |
| Statewide TSB | NA | $ 722M |
| Statewide TRC Ratio | NA | 1.14 |
| Statewide PAC Ratio | NA | 19.29 |

[8] Includes impacts from removing non-ENERGY STAR qualified units and from changing assumed ENERGY STAR proportion of radiant products from 50% to 75%.