MEMORANDUM

CALIFORNIA
TECHNICAL FORUM

Date: December 13, 2019

To: Cal TF Members

From: Ayad Al-Shaikh and Jennifer Holmes, Cal TF Staff

Subject: Statewide Measure Cost Methodology Overview

I. Overview and Objectives

Through the statewide measure consolidation process, Cal TF Staff reviewed and catalogued the cost estimation methodologies used for each deemed statewide measure (see related charts in Appendix). Cal TF Staff would next like to work with Cal TF to review trends in cost estimation methodologies across measures and end-uses, then develop a recommended framework for how cost for different measure types should be documented and calculated. Having a clear framework for developing cost methodology will help:

- Drive more consistency in the cost approach
- Reduce the maintenance cost of measures
- Establish a methodology for gauging the strength of this data
- Result in the appropriate level of accuracy that may differ by measure

II. Background

The participant cost parameter is among the largest contributors to cost-effectiveness, with only energy savings and measure life to provide equivalent impact[1]. The relative effect of cost, savings and measure life on TRC (Total Resource Cost) can be seen below in the analysis completed by the IOUs for the cost-effectiveness training. Therefore, careful attention to the correct approach for estimating costs is critical to accurately calculating measure performance. When looking at measures across the entire portfolio, it is easier to recognize trends that could lead to consistency and rigor.
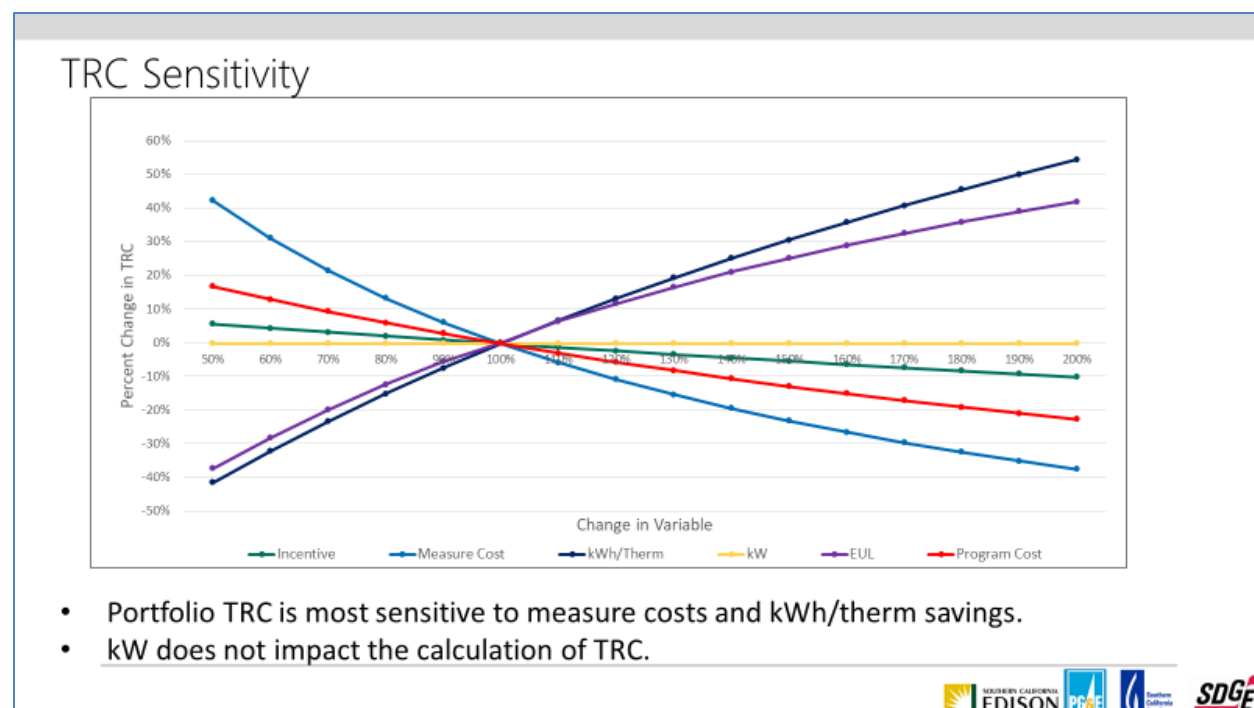
The original IOU measures were developed independently without a common framework and without guidance on appropriate approaches. These measures have been uploaded into the eTRM; through this consolidation and uploading process their cost methodologies have been

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[1] Documented in IOU CET training presentation, called "Cost Effectiveness Training 010719.ppt". The graphic included in this Memo shows the effect that is described, where participant cost, energy savings and EUL have the largest impact on TRC. Outside of this analysis, Net-to-Gross Ratio does have a significant effect but was not included in this test.

reviewed in a much more systematic manner than possible before. However, the current data specification does not include some of the parameters that could help quantify the strength of that data that could include:

- Number of cost data points per measure or per offering
- Average and standard deviation for cost of the offering
- Claims data to show installation breakdowns
- Age of data and if scaled to current dollars
- Source: Primary / Secondary
- Source description
- Calculation methodology: Simple average, weighted average, regression / hedonic model

Inputs like these could provide guidelines on the methodology that should be used as well as document what was used so that it will be visible and transparent that higher impact measure are documented well and that lower impact measures can be correctly prioritized to improve documentation over time. This type of planning can only be done on a measure by measure basis today, but it is generally agreed that planning for updates would greatly improve value (though prioritization) and reduce the cost (by leveling workload). The graph below was taken from a "Cost-Effectiveness Training" (1/7/2019) that was provided by the IOUs and shows the relative importance of Measure Cost (the **blue** line).

TRC Sensitivity

- Portfolio TRC is most sensitive to measure costs and kWh/therm savings.
- kW does not impact the calculation of TRC.

III.   Approach

The following categories were used to define different data sources that were most common among the statewide measures. Often, there is not a clear line between categories, but the following description details how decisions were made so that measures could be categorized.

1. **Primary Data Sources[2] -** Primary research involves the researcher in first-hand collection or generation of new (primary) data (i.e., a source of origin where the data generate). It should be noted that primary data should be collected with its purpose in mind. Retroactively reviewing invoices can be difficult to interpret and access specific equipment and labor costs. Often times, contractors do not like to "unpack" different cost elements on their invoice. Typical sources include:

   a. Contractors
   b. Distributors
   c. Manufacturers
   d. Retailers
   e. Program Data / Invoices

   The procedure for primary data collection uses one of the following methodologies; in these cases, this procedure and the date of the data collection was included in the tabulated data:
   a. Phone
   b. Online
   c. Program Data

2. **Secondary Data Sources[3] -** Secondary data (sometimes referred to as unobtrusive data) is data not directly collected by the researcher but that has been initially collected or produced for another purpose. Secondary data tends to be indicative rather than precise. Typical sources include:

   a. **DOE** - The end-uses that corresponded to this reference type span Commercial Refrigeration, Water Heating, and Appliance or Plug Loads. A technical support document (TSD Report) which is a "stand-alone" report that provides technical analyses and results including engineering analyses, life-cycle costs (LCC), payback periods (PBP) and national impact analyses (NIA).
   b. **DEER**- Other than values that are prescribed through dispositions, the DEER values are limited to standard labor rates that are primarily seen in water heating measures.
   c. **RS Means** - The end-uses that corresponded to this North American, cost-estimating database include a wide variety: HVAC, Food Service, Water Pumping, Process, Commercial Refrigeration and Water Heating. This source is used more prevalently for labor cost, but also used for material costs across a wide group of end-uses.
   d. **Study** – This category specifically refers to Navigant cost studies that are referenced, but could refer to any national study that is collecting cost data.
   e. **AutoQuotes** – This category refers to an online catalog and quotation service focused on the foodservice equipment and supplies industry. Cost data in this

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[2] "Data which are gathered originally for a certain purpose are known as primary data." — Horace Secrist.
[3] "The data which are used in an investigation, but which have been gathered originally by someone else for some other purpose are known as secondary data." — Blair.

category are expected to be the list price rather than the negotiated price typically paid.

    f. **WO017** - The end-uses that corresponded to this reference type included HVAC, Water Heating, Commercial Refrigeration, Building Envelope and Service. When analyzing the individual sources used for each measure, all costs were derived from the 2010-2012 WO017 Ex Ante Measure Cost Study Final Report. Depending on the measure, further investigation can document the methodology used for each data point.

    g. **Webscraping / Web Harvesting** – This process is used primarily for Retail Product Platform (RPP) measures, which is where this description has been taken from. "The web harvester collects data from retailer websites using one of two methods: 1) Through a retailer Application Program Interface (API), which provides all the information presented on the retailer website in table format, or 2) using screen scraping methods, in which an automated script is run to collect product attribute data page-by-page.[4] Through these methods, the web harvester collects product data including retailer, brand, model number, price, and relevant product specification data (both related and unrelated to product energy consumption). The web harvester can collect hundreds or thousands of data points for a specific product at a single point in time to develop a large sample size. Minimal additional effort is needed to replicate the process so that data are collected on an ongoing basis, which can help identify changes in product price over time."[5]

The methodologies for calculating the final value for material or labor cost ranged to include:

1. Simple Average – This methodology is currently most prevalent in which data is collected for equipment models that would qualify for the proposed measure. Cost data is then combined using a simple average. Cost is then normalized.

2. Weighted Average – This methodology is less common but appears in two forms. More frequently, program data is used to represent the measure cost, which is inherently based upon what is installed. A few measures use data claims or market data to weight cost data when it is combined. Cost is then normalized.

3. Regression Analysis – A few measures take a cost data set and evaluate a relationship between cost and the normalizing unit. In this way, cost can be calculated for each unit savings.

4. Hedonic Models – This type of regression analysis methodology was used for Retail Product Platform (RPP) measures, which attempts to separate the influences of energy versus non-energy features on the cost of the product.

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[4] This web harvesting approach was initially utilized by the Statewide IOU Codes and Standards team to identify key drivers of product costs for LED lamps from 2012-2014, and was presented at the ACEEE Summer Study Conference in 2014.

[5] Workpaper, Retail Products Platform, PGECOAPP128 R6, 4/3/2018.

V. Questions

We are asking for Cal TF Members to provide feedback to help develop guidelines for:
- Cost valuation methodologies that include Baseline and Measures cost, as well as, Material and Labor cost.
  - What are the pros and cons of each approach?
  - When are certain cost approaches preferred (or could reasonably be used) for certain measure types?

	Approach	Pro	Con
Primary Source	**Contractors**		
	Distributors		
	Manufacturers		
	Retailers		
	Program Data / Invoices		
Secondary Source	**DOE**		
	DEER		
	RS Means		
	Study		
	AutoQuotes		
	WO017		
	Webscraping / Web Harvesting		

- Specifically for labor cost, should labor cost vary by location (ie, climate zone)? Currently, statewide measures have removed this parameter because the variation resulting from this factor is assumed to be much smaller than the error band of the reported labor cost value.
  - Are there specific measures or end uses where this justification does not hold true?

VI. Appendix: Graphs and Attachments

Cost Methodology Data Spreadsheet
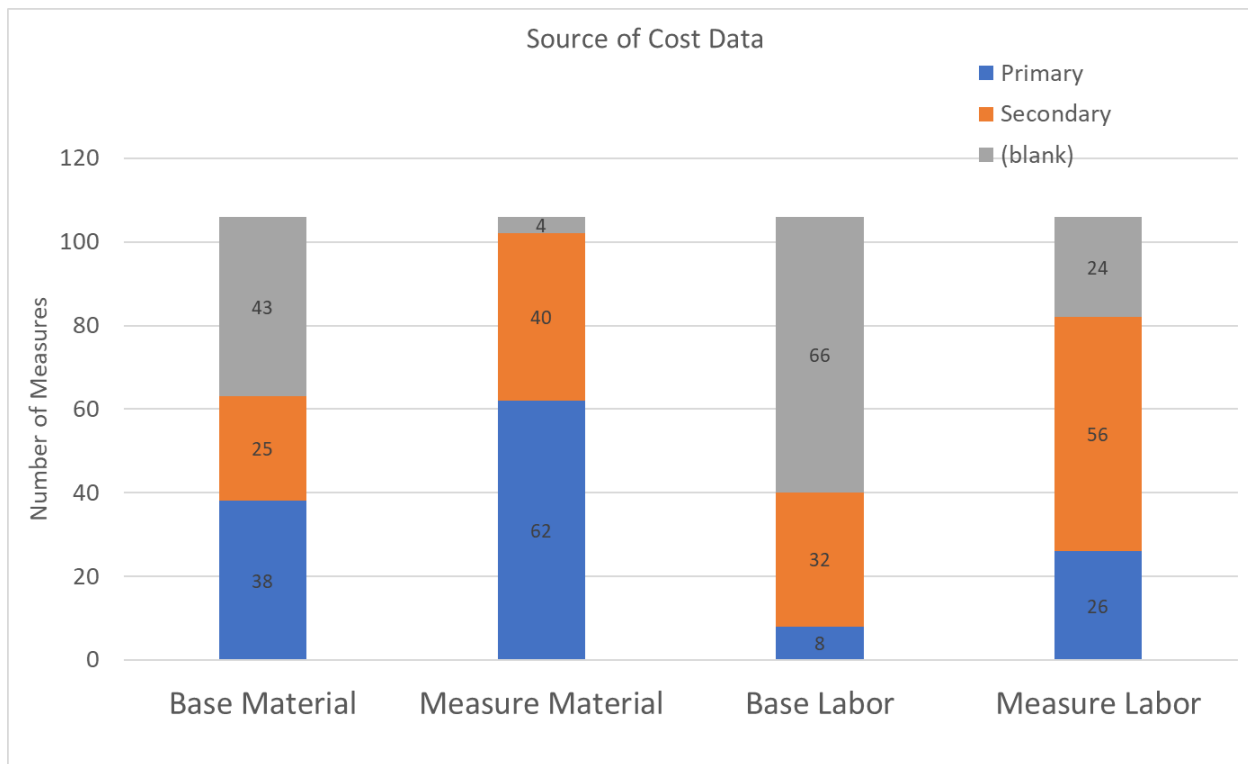
Observations / Notes:
- Blanks in Material Cost occur mostly from measures that do not require base material cost because they rely on a full measure cost for their analysis. This is true for measures that fall into certain measure application types:
  - Add-On Equipment
  - BRO-RCx
- Blanks in Labor Cost are more common and typically result for two reasons. If an incremental cost analysis is *only* required (such as for Normal Replacement or New Construction) and it can be reasoned that the labor cost is the same for both base and measures cases, then the value is not reported. Other time, the labor cost may be baked into the general measure cost, so that it is more difficult to separate the material and labor components.
- Use of Primary Data seem more prevalent with Material Cost as compared to Labor Cost.

Source of Labor Cost Data

Source of Material Cost Data
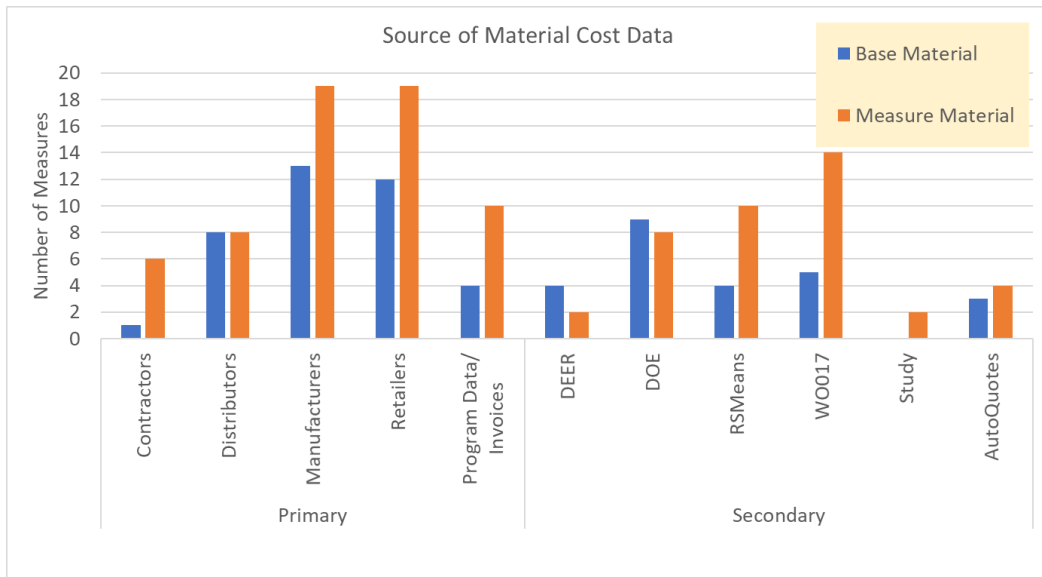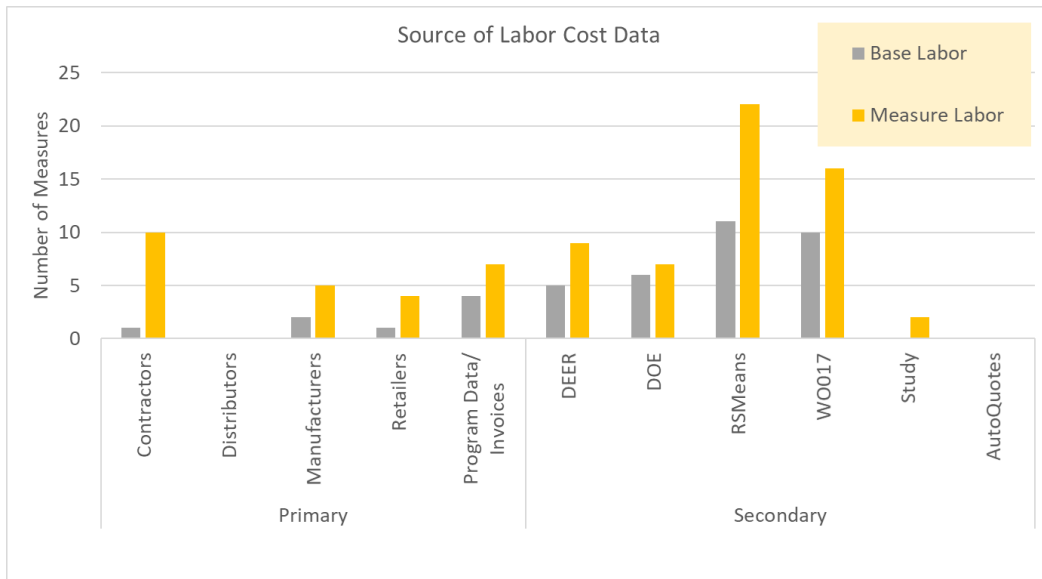
Observations / Notes:
- Labor cost is more represented through secondary sources; Material cost is more represented through primary sources.
- DEER still exists as a source for labor because they are calculated from labor rates, which are taken from a list on DEER.

Age of Cost Data
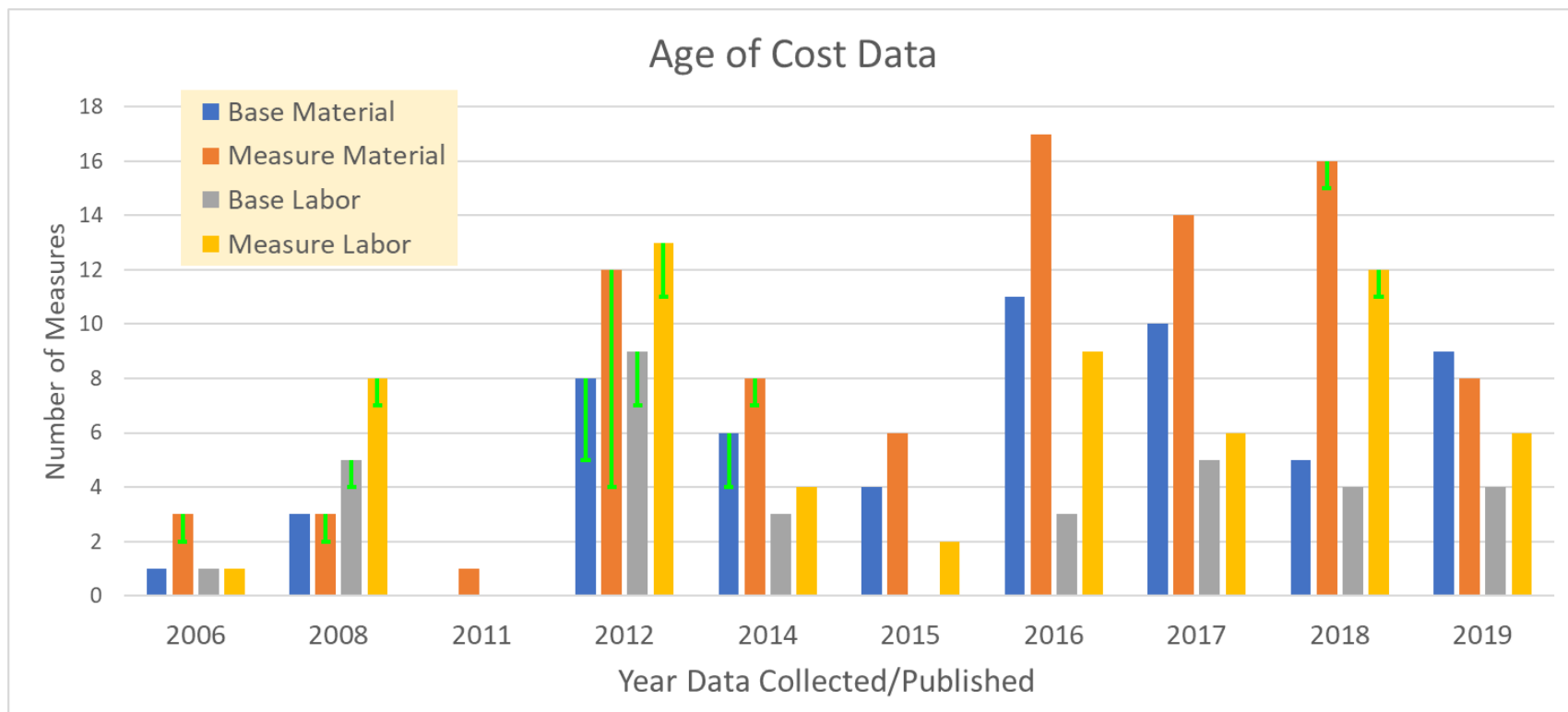
Observations / Notes:
- Over half (58%) of the measures have cost data that comes from the last 4 years.
- If weighting is applied to measures based upon 2018 savings claims (IOU Deemed claims from CEDARS), then this percentage increases from 58% to 64% in the last 4 years and over 92% in the last 6 years. This means that a minimal number of measures using data from 2012 and before play a large role in portfolio savings.
    - Claims data were only included in a very simple way. ¼ of the kWh claims values were summed for each instance that either the base material, measure material, base labor, or measure labor cost were collected/published in a certain year.
    - Because of this methodology, measures that do not require baseline costs (like AOE measures) are under-represented.
    - Total claims were then summed per year and divided by the entire total.
- Using the same analysis with gas data shows that 73% of the savings correlates to measures with data collected in the last 4 years, which increases to 80% of the savings within the last 6 years.
    - The gas portfolio is different in that it does not have as many very large measures that can greatly drive the result.
- The **green** error bars show values that were scaled to 2018/2019 dollars using inflations factors from RS Means.