Agriculture / Pumping Subcommittee Meeting #1

CALIFORNIA
TECHNICAL FORUM

AYAD AL-SHAIKH

AUGUST 2017

Agenda

- Goals / Objectives
- Review Materials:
  - Ag Pumping, Sub Comm Mtg 1 – r3.ppt
  - Technology Summary - 3.0 Comm Refrig r2.1.xls
- Energy Savings Perspective
- Understand energy savings issues
  - Pump Overhaul – Disposition and Response (Yeshpal)
  - VFD on Well Pumps – EUL
  - Pump Motor Replacement – To-Code Measure
  - Irrigation – Disposition Understanding

Measure Consolidation Flow Chart

Cal TF Staff

1. Identify Measures
3. Identify WP & POU TRM
4. Identify Sources

- Statewide Measure List

Cal TF Staff

8. Identify WP Differences & Issues
7. Complete Overlapping WP Template

- Workpapers
- CEDARS Data
- Ex Ante Tables

- Excel Summaries
- Pivot Tables
- Decks Summarizing Measures & Tables

IOU/POU Tech Staff

11. Identify Other Potential Issues
12. Challenges to Developing Statewide Measure

- IOU/POU Pre-Subcommittee Meeting

Back for additional consultation, if needed

Subcommittee

2. Subcommittee Formation
9. Address Issues Identified
6. Assess If Data is Sufficient
17. Subcommittee Measure Recommendations
16. Assess Measure Future

Full TF

19. CalTF Peer Review / Affirmation

Cal TF Staff

14,20. Populate Draft & Final eTRM Template and Upload into Repository

CPUC Staff

21. CPUC Approval of Measures and Repository

Cal TF Staff

5. Gather / Analyze Sources
10. Compare to Values in Other TRMs (if needed)

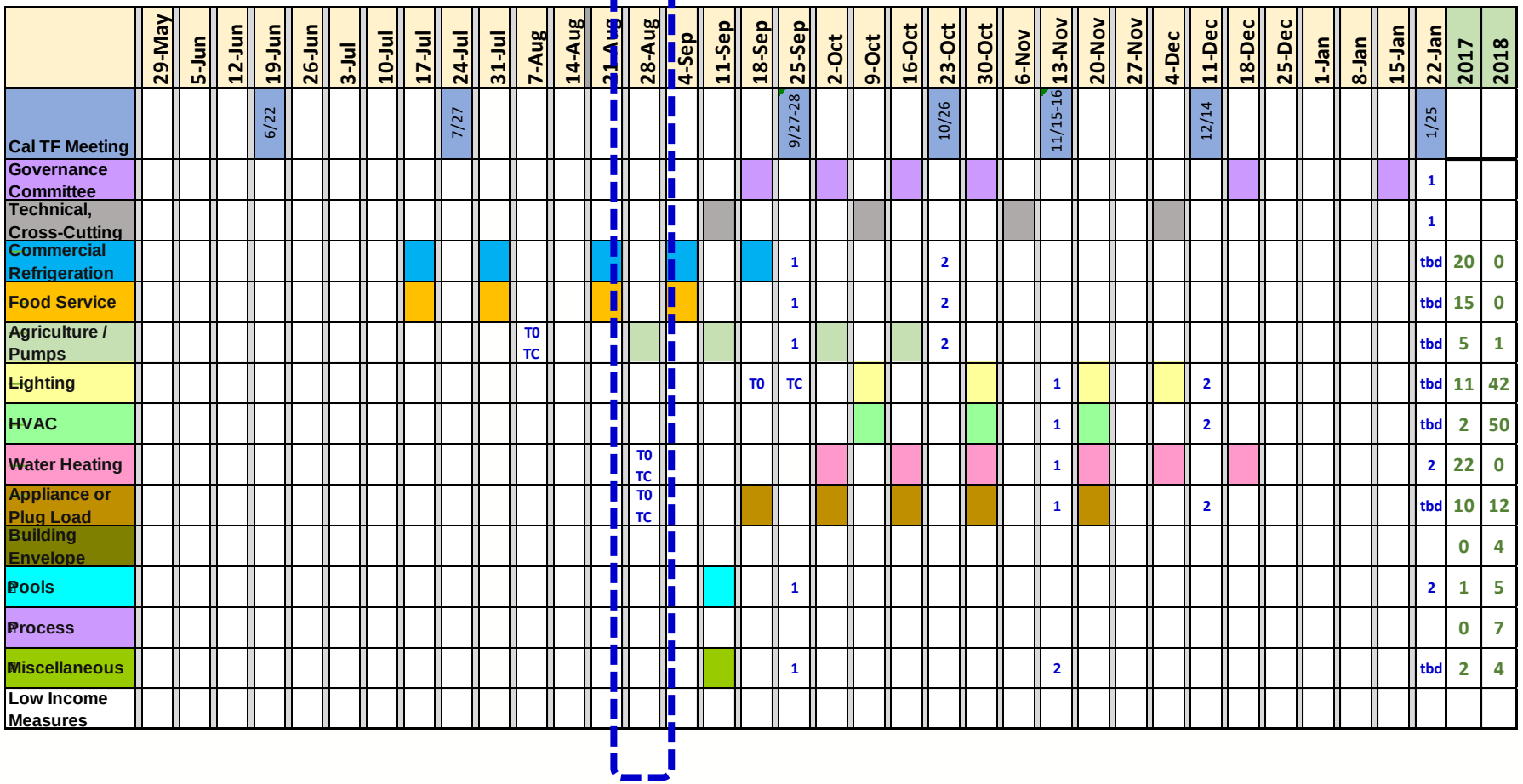
13. CPUC Consultation
18. Obtain CPUC Staff Feedback

*Note: Numbers refer to steps in TPP#6.

eTRM Subcommittee Schedule

CALIFORNIA TECHNICAL FORUM

4

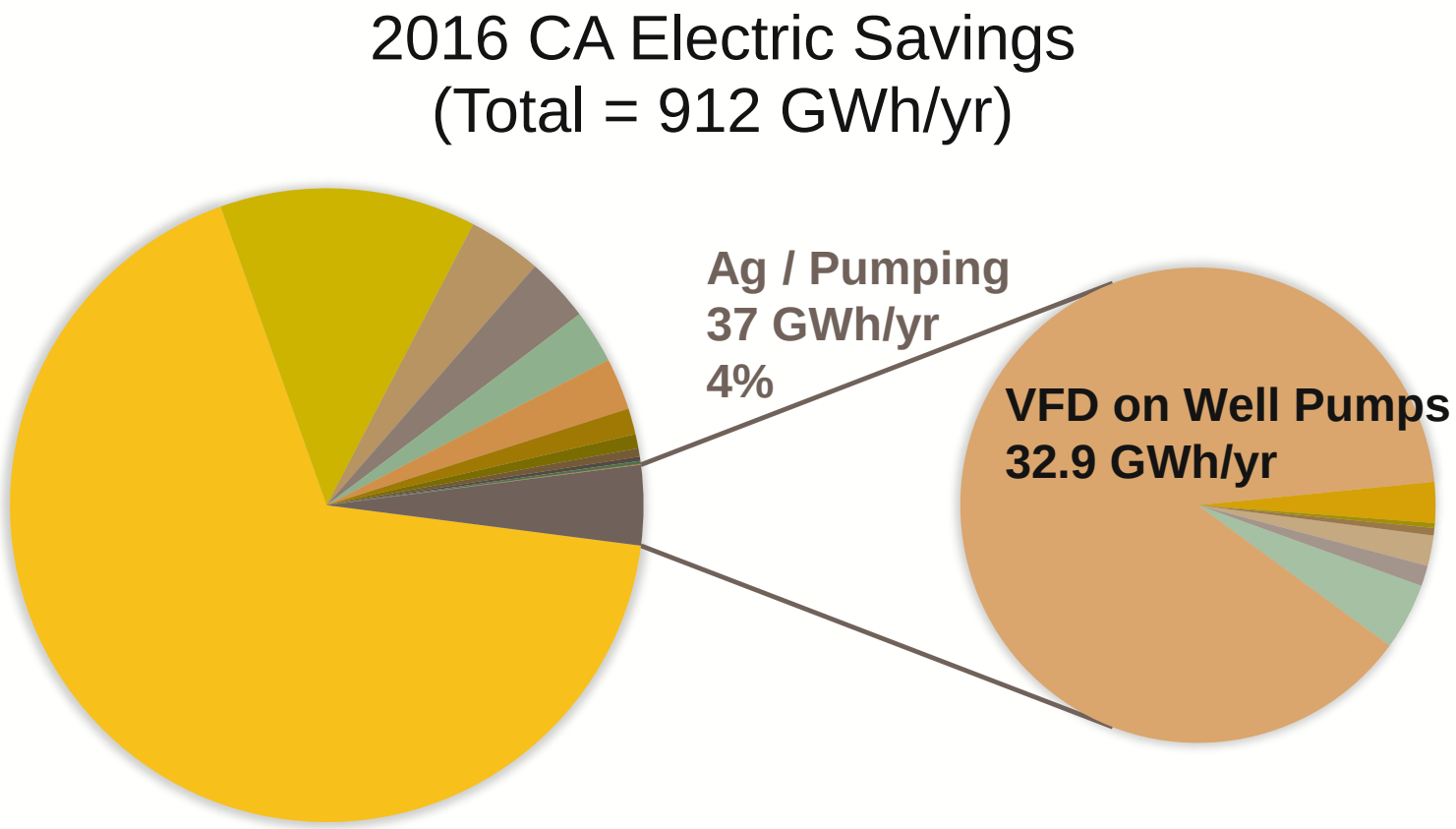


	29-May	5-Jun	12-Jun	19-Jun	26-Jun	3-Jul	10-Jul	17-Jul	24-Jul	31-Jul	7-Aug	14-Aug	21-Aug	28-Aug	4-Sep	11-Sep	18-Sep	25-Sep	2-Oct	9-Oct	16-Oct	23-Oct	30-Oct	6-Nov	13-Nov	20-Nov	27-Nov	4-Dec	11-Dec	18-Dec	25-Dec	1-Jan	8-Jan	15-Jan	22-Jan	2017	2018
Cal TF Meeting				6/22					7/27									9/27-28				10/26			11/15-16				12/14						1/25		
Governance Committee																																			1		
Technical, Cross-Cutting																																			1		
Commercial Refrigeration																		1				2													tbd	20	0
Food Service																		1				2													tbd	15	0
Agriculture / Pumps											T0 TC							1				2													tbd	5	1
Lighting																	T0	TC							1				2						tbd	11	42
HVAC																									1				2						tbd	2	50
Water Heating														T0 TC											1										2	22	0
Appliance or Plug Load														T0 TC											1				2						tbd	10	12
Building Envelope																																				0	4
Pools																		1																	2	1	5
Process																																				0	7
Miscellaneous																		1							2										tbd	2	4
Low Income Measures																																					

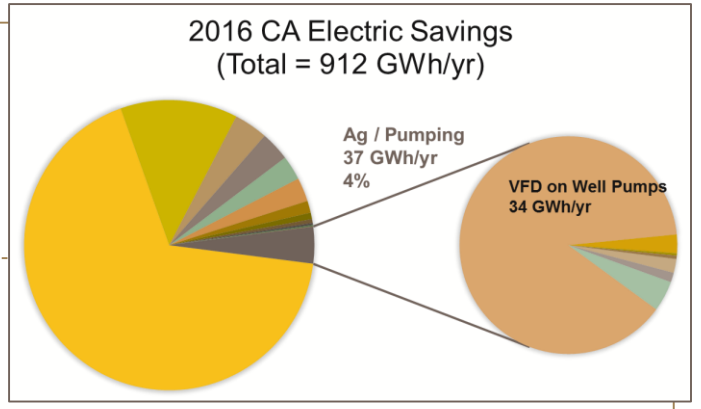
Green numbers = Number of Measures; **Blue** numbers: **1**=First Review / **2** = Affirmation.

Ag/Pumping Category Deemed Savings

- Savings Perspective



Ag/Pumping Category Deemed Savings



- Savings Perspective: 2016

Ref No	Name	Units Installed PGE	Units Installed SCE	Energy (kWh/yr) PGE	Energy (kWh/yr) SCE	Demand (kW) PGE	Demand (kW) SCE	Units Installed	Total Energy (kWh/yr)	Total Demand (kW)
3.01	**Agricultural Pump System Overhaul for Pumps Up To 25 HP**	**1,699**	**618**	**562,973**	**209,604**	**141**	**40**	**2,316**	**772,578**	**181**
3.02	**Agricultural Ventilation Fans**	**480**		**523,200**		**240**		**480**	**523,200**	**240**
3.03	**Farm Sprinkler to Micro Irrigation Conversion**	**3,565**		**1,693,437**		**1344**		**3,565**	**1,693,437**	**1,344**
3.05	**Variable Frequency Drive on Agricultural Well Pumps**	**130,195**		**32,921,200**		**15736**		**130,195**	**32,921,200**	**15,736**
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)		REA					43,460	11,200,000	5,246
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)		NC					70,480	18,100,000	8,507
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)		REA					8,320	1,900,000	1,015
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)		NC					4,595	1,000,000	561
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)		ROB					3,340	800,000	407
3.07	**Vertical Hollow and Solid Shaft Pump Motors**	**29,445**		**1,035,326**		**428**		**29,445**	**1,035,326**	**428**
3.11	**Chilled Glycol Pipe Insulation**	**6,736**		**121,713**		**26**		**6,736**	**121,713**	**26**
3.12	**Glycol tank Insulation**	**4,577**		**189,645**		**50**		**4,577**	**189,645**	**50**
3.13	**Tank Insulation**	**528**		**0**		**0**		**528**	**0**	**-**
Grand Total								**177,842**	**37,257,098**	**18,005**

- "VFD on Well and/or Booster Pumps" contributes the majority of the savings.

Measure Overview

Ref No	Name	Total Energy (kWh/yr)
★ 3.01	Agricultural Pump System Overhaul for Pumps Up To 25 HP	772,578
★ 3.02	Agricultural Ventilation Fans	523,200
★ 3.03	Farm Sprinkler to Micro Irrigation Conversion	1,693,437
★ 3.04	Low Pressure Sprinkler Nozzles	0
★ 3.05	Variable Frequency Drive on Agricultural Well Pumps	32,921,200
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	11,200,000
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	18,100,000
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	1,900,000
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	1,000,000
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	800,000
3.06	Milk Cooling Scroll Compressor	0
3.07	Vertical Hollow and Solid Shaft Pump Motors	1,033,376
3.08	CHR Unit - Electric and Gas	0
3.09	Milk Vacuum Pump VSD	0
3.10	Milk Transfer Pump VSD	0
3.11	Chilled Glycol Pipe Insulation	121,713
3.12	Glycol tank Insulation	189,645
		0
Grand Total		37,257,098

** Images used from workpapers and PG&E catalogs*

Measure Discussion

Agricultural / Pumping Measures

Measure No	Measure Name	eTRM Year
3.01	Agricultural Pump System Overhaul for Pumps	2017
3.02	Agricultural Ventilation Fans	2017
3.03	Farm Sprinkler to Micro Irrigation Conversion	2017
3.04	Low Pressure Sprinkler Nozzles	2017
3.05	VFD on Agricultural Well Pumps (<=300hp)	2017
3.06	Milk Cooling Scroll Compressor	2018
3.07	Vertical Hollow and Solid Shaft Pump Motors	2018
3.14	Greenhouse - Heat Curtain	2018
3.15	Greenhouse - Infrared Film	2018
3.08	CHR Unit - Electric and Gas	n/a
3.09	Milk Vacuum Pump VSD	n/a
3.10	Milk Transfer Pump VSD	n/a
3.11	Chilled Glycol Pipe Insulation	n/a
3.12	Glycol tank Insulation	n/a
3.13	Milk Pre Cooler	n/a

Agricultural / Pumping Measures

Measure No	Measure Name	eTRM Year	
3.01	Agricultural Pump System Overhaul for Pumps	2017	Pumping
3.05	VFD on Agricultural Well Pumps (<=300hp)	2017	
3.07	Vertical Hollow and Solid Shaft Pump Motors	2018	
3.03	Farm Sprinkler to Micro Irrigation Conversion	2017	Irrigation
3.04	Low Pressure Sprinkler Nozzles	2017	
3.02	Agricultural Ventilation Fans	2017	Dairy
3.06	Milk Cooling Scroll Compressor	2018	
3.14	Greenhouse - Heat Curtain	2018	Greenhouse
3.15	Greenhouse - Infrared Film	2018	
3.08	CHR Unit - Electric and Gas	n/a	
3.09	Milk Vacuum Pump VSD	n/a	
3.10	Milk Transfer Pump VSD	n/a	
3.11	Chilled Glycol Pipe Insulation	n/a	
3.12	Glycol tank Insulation	n/a	
3.13	Milk Pre Cooler	n/a	

Pumping Measures

Measure No	Measure Name	eTRM Year
3.01	Agricultural Pump System Overhaul for Pumps	2017
3.05	VFD on Agricultural Well Pumps (<=300hp)	2017
3.07	Vertical Hollow and Solid Shaft Pump Motors	2018

3.01 Agricultural Pump System Overhaul

- High Level Workpaper Overview
  - SCE / PG&E / SDG&E
- Memorandum, Dec 18, 2015
  - CPUC Staff review of Ag Pump Test / Refurbishment Activities
  - Lincus analysis of data
  - Does this change with AB802?
- EUL/RUL
  - BRO vs REA

3.01 Agricultural Pump System Overhaul

- Questions for this Team:
  - Do we have the data to address Commission Staff concerns in Memorandum of Dec 2015?
  - Which data set to use / can data be combined?
  - What is the correct Rated-HP range to include in deemed approach?
  - Other sensitive parameters? (irrigation vs public; crop type)
- If we can answer these questions…great
  - Mostly, I would like to hear from you:
    - What else has been done?
    - Ideas on what else could be done?
    - Next steps (before next meeting)

3.01 Agricultural Pump System Overhaul

- SCE
  - 5 Pump Types; 2 rated-hp ranges (<25 hp, 25-50 hp)
  - 8 Climate Zones (6, 8-10, 13-16)
  - Based upon 6000+ data points from pump test database
- PG&E
  - 5 Pump Types, 1 rated-hp ranges (<25 hp)
  - 9 Climate Zones (1-5, 11-13, 16)
  - Based upon 3000+ data points from pump test database
- SDG&E
  - 5 Pump Types, 1 rated-hp ranges (<50 hp)
  - 6 Climate Zones (6-8, 10, 14, 15)
  - Based upon SDG&E (supplemented by SCE) data points from pump test database
- EUL based upon pump type
- Savings vary by Pump Type, Rated-HP Range, CZ, PA

3.01 Agricultural Pump System Overhaul

- Memorandum – Basis of Claims
  A. Pump test alone is not sufficient to make claims.
  B. Measure activity (pump refurbishment) should be categorized as maintenance.
     - EE Programs need to produce savings above code (regulations, codes, and/or ISP)
     - Code baseline is the default baseline.
     - PA's asked to "demonstrate that their activities in this area accelerate maintenance and do so to an enhanced level."
     - "Commission staff does not accept PA claims that results of pump test are, by themselves, sufficient to establish program influence."

3.01 Agricultural Pump System Overhaul

- Program Influence Issues:
  - Commission staff does not accept an assertion or implication that pump owners are unaware of changes in their pumping systems
  - Evidence such as when the pump customers contacted a PA requesting a pump test would not qualify as “program influence”.
  - The PA-sponsored testing program is now standard practice for at least some of these customers [municipal water].
  - PG&E’s APEP program documentation provides an example of an unacceptable demonstration of program influence (<25-hp).
- Program influence must at least be established in the workpaper as it is clear that no such influence can be claimed via program requirements.

3.01 Agricultural Pump System Overhaul

- Memorandum – Basis of Claims

C. Commission staff require that all eligible pump refurbishment projects have a pump test performed within the 12 months prior to the Program application signature date, and that the PA's influence be demonstrated by the PA having offered the pump test service to the customer.

  - Current workpapers provide no mechanism for establishing influence nor do they provide the preponderance of evidence needed to establish program influence on a global basis.

D. Since the RUL period has been defined as the period between pump overhauls, savings estimates must be adjusted to account for pump wear (and the associated degradation in pump performance) over the RUL period.

3.01 Agricultural Pump System Overhaul

- Memorandum – Ex-ante Claims Issues
  - A. Energy savings claims via Equation 1 are acceptable only for Base and Post Operating Pump Efficiency (OPE) values that remain within 10% of the total pump head.
    - $kWh_{saving} = kWh_{baseline}\ x \left(1 - \frac{OPE_{baseline}}{OPE_{post}}\right)$.
    - An example of an acceptable adjustment to savings values is to use the pump's performance curve to adjust base or post operating efficiencies to a common operating head.

3.01 Agricultural Pump System Overhaul

- Memorandum – Ex-ante Claims Issues
  - B. Current Base and Post OPE values in workpaper are not acceptable. (SCE example, CZ10)

Pump Type	Average Annual Hours of Operation (AOH)	Average Pump Size (Nominal Motor hp)	Average Baseline OPE (%)	Average Proposed OPE (%)	Average Motor Loading
Centrifugal Booster	3,205	13.6	41%	58%	85%
Submersible Booster	1,898	15.5	48%	57%	90%
Submersible Well	3,427	10.8	39%	54%	109%
Turbine Booster	2,365	14.3	53%	61%	90%
Turbine Well	3,751	11.8	43%	59%	71%

    - Limit estimates to pumps with both pre- and post-data
    - Database limited to those covered by workpaper (ie Post OPE from 55-69%)
    - Data to determine Base and Post OPE taken from similar total head (within 10%) values
    - Higher Post measured flow rates should not be taken as a reason to eliminate Base/Post pump test data

3.01 Agricultural Pump System Overhaul

- Memorandum – Ex-ante Claims Issues
  - C. Peak demand impacts are not accepted
    - Pump out test indicate increased flow rate with increased Post OPE, therefore, no significant reduction in demand.
    - Commission staff is amenable to reviewing the decision if specific evidence is provided.
    - "For workpaper claims, specific motor kW values used in determining Base and Post OPE data could be used to estimate potential demand impacts".
      - "Adequate interval billing data analyses will be needed to support claimable peak demand reduction during the DEER peak demand period."
  - D. Post OPE may claim motor replacement if efficiency exceeds EPACT minimum efficiency.

3.01 Agricultural Pump System Overhaul

- The degradation rates of OPE are defined in a matrix relating them to pump types and pump size ranges. (Table 2, pg 11) – about 2% / year
- The average baseline and post overall pump efficiency is defined for both pump types and pump size. (Table 5, pg 12, from custom projects)
- The pump test participation was found to be 48% if the pump test results in an OPE of 40% or less. The average increase in OPE was also found to be 20.3%.
- A custom analysis is also defined for measure savings when there is a large change in post overhaul operating parameters such as Total Dynamic Head (TDH).
- The customer survey indicates that both the pump test program and incentives greatly influence the customer to proceed with more frequent and comprehensive overhauls and better-quality materials. (pg 18-19, 24)
- A clear and defined difference between maintenance and overhaul tasks are distinguished along with their respective frequency. (Tasks, pg 29)
- The customer survey also indicates that the time between overhauls are typically over 5 years, giving a lower limit on the measure's EUL. A more accurate representation of the RUL is determined in regards to the pump size and type.

3.01 Agricultural Pump System Overhaul

- Savings comparison between workpapers
  - Based upon data, but large variation
  - Other sensitive parameters? (irrigation vs public; crop type)

3.05 VFD on Ag Well Pumps

- PG&E
  - Based upon 298 custom projects
  - Savings varies by
    - Well pumps (<=300 hp), Booster pumps (<=150 hp)
  - Delivery varies by
    - REA / NC;
    - PreRebDown / DI
- Life / REA
  - EUL = 10 yrs; RUL = 3.3 yrs

3.05 VFD on Ag Well Pumps

- Decisions:
  - Are there other sensitive variables:
    - Crop type, Climate Zone, Well depth, Subbasin (see example)
    - PG&E did an analysis of Crop Type already
  - Can additional data be added to the analysis?
    - How do we leverage the large dataset available from Pump Test Databases?
  - Can results be extended to other Climate Zones? (non-PG&E)
  - Peak period demand reduction methodology?
    - Dec 28, 2015 EAR Memo

3.05 VFD on Ag Well Pumps

- Savings supported by
  - ~200 well pump PG&E custom projects
  - ~100 booster PG&E pump custom projects
  - Include SCE data, if available
  - Because of impact of this measure, VFD on Ag Pumps could be a good candidate for a deeper sensitivity analysis

Ref No	Name	Total Energy (kWh/yr)
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3.04	Low Pressure Sprinkler Nozzles	0
3.05	Variable Frequency Drive on Agricultural Well Pumps	32,921,200
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	11,200,000
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	18,100,000
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	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	1,000,000
	Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	800,000
3.06	Milk Cooling Scroll Compressor	0
3.07	Vertical Hollow and Solid Shaft Pump Motors	1,035,326
3.08	CHR Unit - Electric and Gas	0
3.09	Milk Vacuum Pump VSD	0
3.10	Milk Transfer Pump VSD	0
3.11	Chilled Glycol Pipe Insulation	121,713
3.12	Glycol tank Insulation	189,645
3.13	Tank Insulation	0
Grand Total		37,257,098

Type	Pump HP	Count of # of Pumps
Booster	25	1
	30	4
	40	10
	50	10
	60	14
	75	28
	100	20
	125	9
	150	3
Well	25	2
	30	8
	40	2
	50	13
	60	5
	75	20
	100	24
	125	28
	150	28
	200	27
	250	17
	300	23

EUL of an REA Measure

NC **REA**

EUL ID	Description	Sector	UseCategory	EUL (Years)	RUL (Years)
Agr-VSDWellPmp	Well Pump Variable Speed Drive	Ag	Irrigate	10	3.3

Effective Useful Life (EUL) adjustments:

In their comments SDG&E requests that the Commission reject the Commission staff proposed adjustments measure EUL values in their claims.[72] Commission staff agrees with some of the SDG&E comments but disagrees with others. In general, Commission staff disagrees with SDG&E that there is a lack of clarity in the direction or timing relative to the EUL allowed to be claimed for REA measures. The guidance document covering REA measures was developed jointly by Commission staff and the IOUs and was first distributed in draft form to all IOUs in January of 2013 with the first final "living" document published for public distribution in July of 2014.[73] In that document the REA section provides that "The EUL of REA measures is capped at the RUL of the equipment being retrofitted. This means that REA measures utilize the RUL of the pre-existing equipment up to and not to exceed the EUL for the REA measure." From

EUL of an REA Measure

NC REA

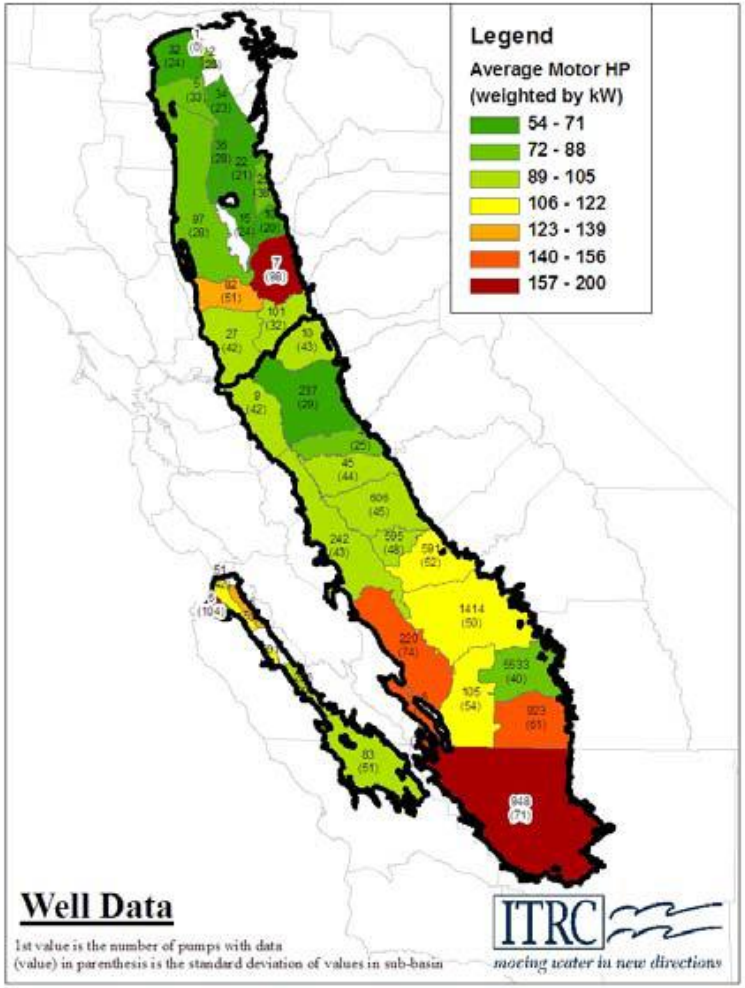
EUL ID	Description	Sector	UseCategory	EUL (Years)	RUL (Years)
Agr-VSDWellPmp	Well Pump Variable Speed Drive	Ag	Irrigate	10	3.3

- Is this better data for pump life? (ie, by pump type from DEER)

EUL ID	Measure	EUL (Years)	RUL (Years)
PumpCentBstr	Ag Pump – Centrifugal Booster	12.7	4.33
PumpSubBstr	Ag Pump – Submersible Booster	8.3	2.77
PumpSubWell	Ag Pump – Submersible Well	6.5	2.23
PumpTurbBstr	Ag Pump – Turbine Booster	9.3	3.1
PumpTurbWell	Ag Pump – Turbine Well	6.8	2.27

- We saw that Overhauls extend life by 5 yrs, and average number of overhauls per pump in SCE database was >4.5 (from 1995-2015).

Ex: Region Comparison by Subbasin



Source:
Irrigation Training and Research Center
CEC-50002001-049, pg.124

3.07, Vertical Hollow & Solid Shaft Pump Motors

- Final DOE rulemaking with new standards effective June 1st, 2016
  - 2014-05-29 Energy Conservation Program: Energy Conservation Standards for Commercial and Industrial Electric Motors; Final Rule
- Is there an opportunity to use existing conditions baseline (Accelerated Replacement)?
  - Can installed measure exceed code?
  - (Policy issue) Can savings be exclusively to-code?

Irrigation Measures

Measure Specific Issue
Sprinkler Impact Eval (2015)

Ref No	Name	Total Energy (kWh/yr)
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- Issues related to:
  - 4 of 25 ineligible measures (added load)
  - Hours of Use lower (-25%)
  - Baseline irrigation method assumption (-33%)
  - Pumping equipment operation assumptions (-25%)
- 10% Realization Rate (Net Lifetime kWh)
- 7% Realization Rate (Net Lifetime kW)
- Recommendation from Impact Evaluation:
  - Discontinuing “Low Pressure Sprinkler” and “Micro Conversion”
  - Shifting “Drip Irrigation” to custom
  - *These Measures should be re-evaluated*

Sprinkler Measures

TABLE 4-1: DISPOSITION OF ESPI MICRO-NOZZLE AND DRIP IRRIGATION VERIFICATION

Measure	Sites	Received Rate	Failure Rate	Storage Rate	Removal Rate	Installation Rate
Micro-nozzle and Drip Irrigation	25	100%	0.0%	0.4%	0.0%	99.6%

- 4 of 25 ineligible measures
  - Two projects involved the installation of micro-nozzles on a field which featured no electrically-powered irrigation previously (ie, diesel).
  - Two projects involved a field that was not irrigated previously (ie, gravity fed system).
- Proposed Solution:
  - Ideas to solve the issue of rebating only valid sites.

Sprinkler Measures

- Hours of Use lower (-25%)
  - 6 of 25 sample projects involved a switch of crop type
  - 3 of the 6 featured conversions almonds/walnuts which are more water intensive
- Proposed Solution:
  - Ideas for creating an offering that has more reliability in terms of hours of use.

TABLE 4-2: COMPARISON OF EX ANTE AND EX POST OPERATING HOURS BY MEASURE

Measure	Sites[7]	Ex Ante Operating Hours	Mean Ex Post Operating Hours
Micro-nozzle and Drip Irrigation: Field/veg	9	1,260	656
Micro-nozzle and Drip Irrigation: Deciduous	12	2,222	2,253

[7] The evaluators determined that four sampled projects were ineligible because they were using diesel fuel. These four ineligible projects have been excluded from the parameter-level analysis.

Sprinkler Measures

- Baseline irrigation method assumption (-33%)
- Pumping equipment operation assumptions (-25%)
  - 8 of 25 sampled projects involved a pre-project irrigation system that was different than assumed.
- Proposed Solution:
  - Ideas for documenting pumping baseline more accurately.

TABLE 4-4: DISCHARGE PRESSURE REDUCTION BY PRE-PROJECT IRRIGATION METHOD

Pre-Project Irrigation Method	Sites[1]	Ex Ante Discharge Pressure Reduction	Mean Ex Post Discharge Pressure Reduction
High-pressure sprinkler nozzles	13	20.0 psi	11.2 psi
Flood/furrow[2]	3	20.0 psi	-19.2 psi
Drip tape[3]	5	20.0 psi	-4.3 psi

[1] The four ineligible projects have been excluded from this parameter-level analysis.

[2] While past program applications could not be found online, an example catalog of program offerings indicates that flood irrigation was an acceptable baseline for low-pressure nozzle eligibility (page 2): http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/agriculture/AgFood-EM_Agriculture_Irrigation_Fact_Sheet.pdf

[3] Some farmers indicated that they regularly replace their old drip irrigation systems with new drip irrigation systems.

Sprinkler Measures

Discrepancy Category	Explanation of Discrepancy	Overall	
		# Instances	Impact on GRR
Difference in affected field acreage	The evaluators found that the impacted field acreage was different than the value obtained from the CATI survey.	1	-0.3%
Difference in crop age	The evaluators found that the crop's age (i.e. water requirement) was different than the program's deemed value.	7	-5.0%
Difference in irrigation hours of operation	The evaluators found that the pump hours of operation were different than the program's deemed values.	13	-16.5%
Difference in pump discharge pressure reduction	The evaluators found the the reduction in pump discharge pressure was different than the program's deemed value.	12	-10.0%
Incorrect post-project irrigation method	The evaluators found that the post-project irrigation method was mischaracterized by the program.	3	-6.4%
Incorrect pre-project irrigation method	The evaluators found that the pre-project irrigation method was mischaracterized by the program.	8	-34.2%
No electric use	The evaluators found that the pre-project irrigation method did not use an electric powered pump.	4	-12.5%
Switch in crop type	The evaluators found that a crop switch had occurred in conjunction with the project installation.	3	-1.9%
Reported savings greater than annual billed usage	The evaluators found that the savings claimed by the program exceeded the facility's annual energy usage.	1	-0.2%
	Total	**52**	**-87.0%**

iTron - Recommended Methodology

- Initial Application
  - Pre-project crop type, crop age and irrigation method
  - Prior year's electric billing data
  - Photographs of affected irrigation pump
- Document pre- and post-water requirements
  - Note changing requirements
- Document pre-pumping system
- Document operating pumping efficiency (OPE)

Current Workpapers
Sprinkler to Drip Irrigation

- PG&E, PGECOAGR111

$$Electrical\ Savings\left(\frac{kWh}{Acre}\right) = Electrical\ Savings_{Well}\left(\frac{kWh}{Acre}\right)\times 0.85 + Electrical\ Savings_{non-Well}\left(\frac{kWh}{Acre}\right)\times 0.15$$

  - DEER values used for well and non-well energy
  - DEER values available for citrus trees, deciduous trees, field and vegetable crops, and vineyards – but only field/veg used

Region	Climate Zones	Field/Vegs (kWh/Acre-yr)		Field/Vegs (kWh/Acre-yr)
		Non Well	Well	Blended Savings
Central Valley	11,12,13	422	484	475
Coastal	1,2,3,4,5	277	324	317

- SDG&E, WPSDGENRAG0001
  - Same approach
  - Except averaged all crop types before using the weighted approach

Current Workpapers
Sprinkler to Drip Irrigation

- SCE, SCE13WP003
  - Major Climate Regions
    - Central Valleys (zones 11, 12, and 13); Coastal (zones 1, 2, 3, 4, 5, 6, 7, and 8)
  - Crop Types
    - Field/Vegetables, Deciduous Trees, Citrus Trees, Grapes (vineyards)
  - Note that Well, Non-Well (irrigation district ditch water) are averaged

DEER.MeasureName	kWh/Acre per Year	CZ Zone IDs
Coastal		
Sprinkler to Micro irrigation - Field/Vegs	300.5	1,2,3,4,5,6,7,8
Sprinkler to Micro irrigation - Decid Trees	474.5	1,2,3,4,5,6,7,8
Sprinkler to Micro irrigation - Citrus Trees	498.5	1,2,3,4,5,6,7,8
Sprinkler to Micro irrigation - Grapes	328.0	1,2,3,4,5,6,7,8
Central Valleys		
Sprinkler to Micro irrigation - Field/Vegs	453.0	11,12,13
Sprinkler to Micro irrigation - Decid Trees	694.5	11,12,13
Sprinkler to Micro irrigation - Citrus Trees	651.5	11,12,13
Sprinkler to Micro irrigation - Grapes	564.0	11,12,13

3.03 – Micro Irrigation - Cost

SDG&E

MeasureID	Name	Description	Abbrev	BaseDescription	Eimpact	Gimpact	Pimpact	Life	IncEquipCost	InstalledCost
D03-972	Sprinkler to Micro irrigation - Field/Vegs - non well	Micro irrigation in fields without a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	277	0	286	20	$0.00	$1,000.00
D03-973	Sprinkler to Micro irrigation - Field/Vegs - well	Micro irrigation in fields with a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	324	0	286	20	$0.00	$1,000.00
D03-974	Sprinkler to Micro irrigation - Decid Trees - non well	Micro irrigation of deciduous trees without a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	434	0	249	20	$0.00	$1,000.00
D03-975	Sprinkler to Micro irrigation - Decid Trees - well	Micro irrigation of deciduous trees with a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	515	0	249	20	$0.00	$1,000.00
D03-976	Sprinkler to Micro irrigation - Citrus Trees - non well	Micro irrigation of citrus trees without a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	456	0	136	20	$0.00	$1,000.00
D03-977	Sprinkler to Micro irrigation - Citrus Trees - well	Micro irrigation of citrus trees with a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	541	0	136	20	$0.00	$1,000.00
D03-978	Sprinkler to Micro irrigation - grapes - non well	Micro irrigation of grapes without a well	Micro	Stadard 50+ PSI impact-driven sprinkler heads	300	0	172	20	$0.00	$1,000.00

Offerings based upon crop type.

Variation cost.

EUL.

PG&E

Measure Code	LIFE CYCLE (RUL if ER RET, REA	Base Case Cost ($/unit)	MatlCost ($/unit)	LaborCost ($/unit)	Incremental/ Full Measure Cost ($/unit)	NTG	DelivType
A266	20	168	448	0.00	280	0.60	PreRebDown
A266	20	0.00	285	163	448	0.60	DirInstall

Support to Understand Materials

Subcommittee Overview

- Goals
  - Address Measures at a higher level (by category) to:
    - Identify and address all **cross-cutting category issues** that are technical or policy related.
    - React to **Measure specific issues** that arise during the consolidation process.
    - Separate issues into 2017 / 2018 **issue solution path** to set expectations correctly
  - Create a **communication channel** for category stakeholders to stay informed or participate in a more focused manner.

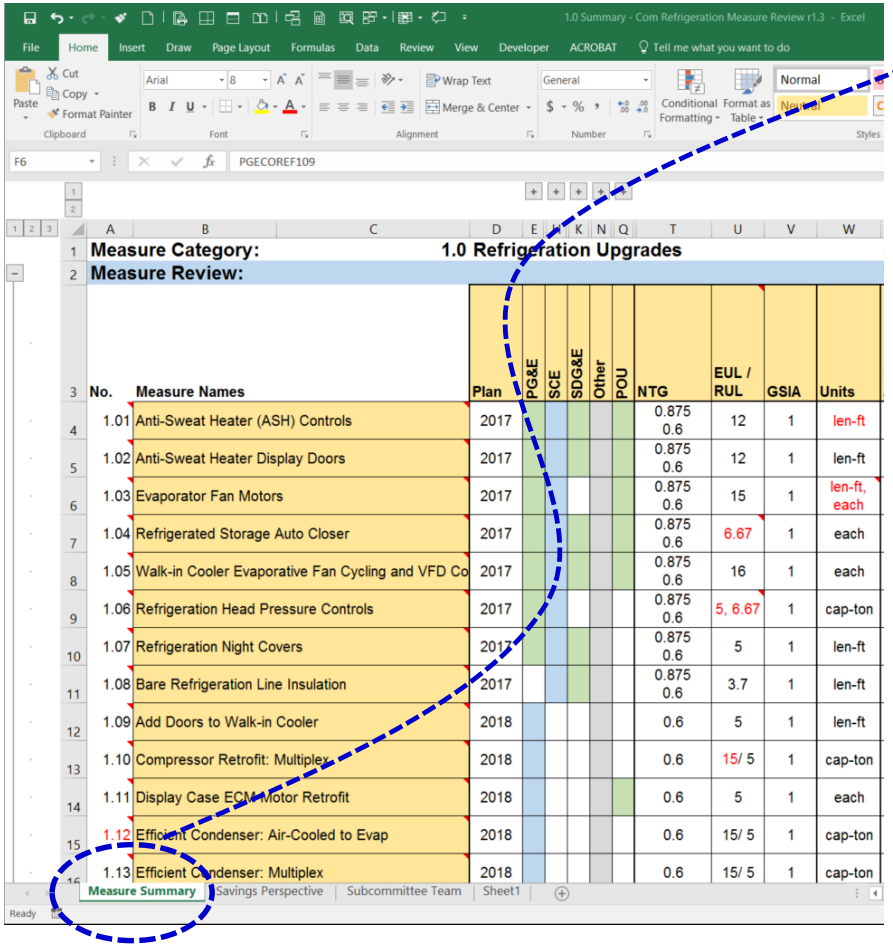
Subcommittee Overview

- Initial Expectations
  - Cal TF Staff:
    - Creates **summary documentation** one week prior to meeting.
    - Provide **access to detailed documentation** if desired (through a DropBox link).
    - Share **common results** between Subcommittees.
  - Subcommittee Members:
    - Read through **summary documentation** prior to meeting.
    - Formulate **opinions on issues** identified.
    - Raise **other concerns** that should be looked at in further detail (offline).

Subcommittee Materials

- Category Summary File
  - Measure Review
  - Cross-Cutting Issues
  - Measure-Specific Issues
- Category Savings Perspective
- Subcommittee Team List
- Library of Workpapers

Category Summary File



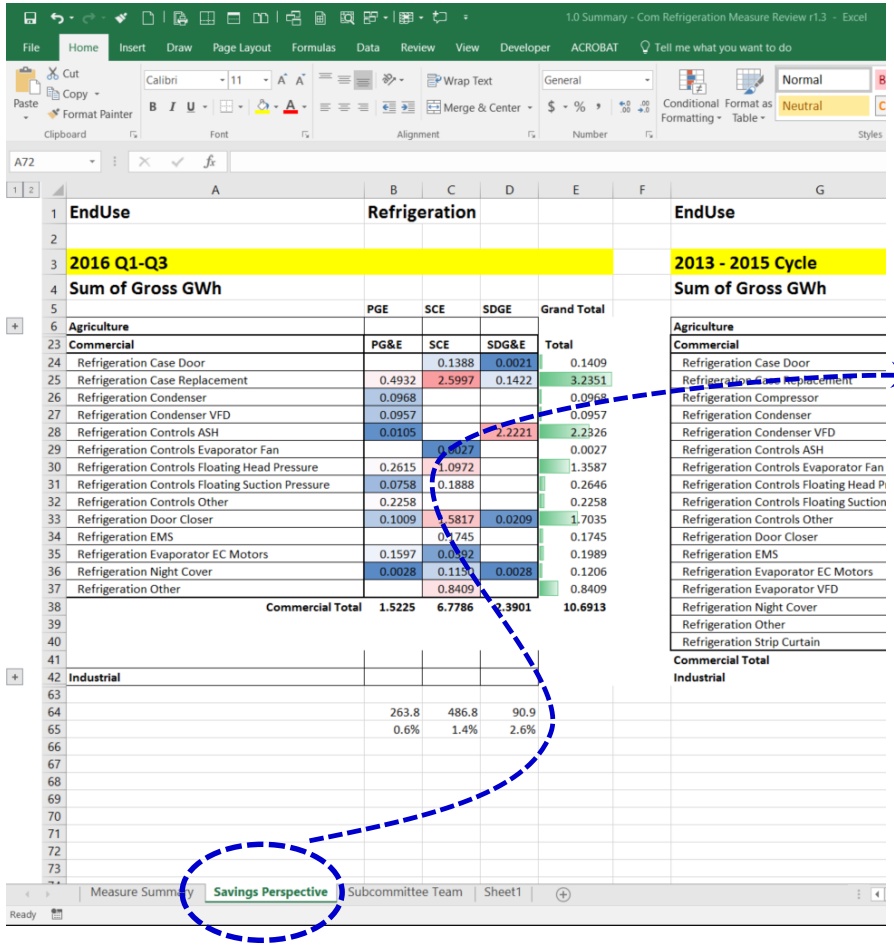
Measure Category: 1.0 Refrigeration Upgrades

Measure Review:

No.	Measure Names	Plan	PG&E	SCE	SDG&E	Other	POU	NTG	EUL / RUL	GSIA	Units
1.01	Anti-Sweat Heater (ASH) Controls	2017						0.875 0.6	12	1	len-ft
1.02	Anti-Sweat Heater Display Doors	2017						0.875 0.6	12	1	len-ft
1.03	Evaporator Fan Motors	2017						0.875 0.6	15	1	len-ft, each
1.04	Refrigerated Storage Auto Closer	2017						0.875 0.6	6.67	1	each
1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co	2017						0.875 0.6	16	1	each
1.06	Refrigeration Head Pressure Controls	2017						0.875 0.6	5, 6.67	1	cap-ton
1.07	Refrigeration Night Covers	2017						0.875 0.6	5	1	len-ft
1.08	Bare Refrigeration Line Insulation	2017						0.875 0.6	3.7	1	len-ft
1.09	Add Doors to Walk-in Cooler	2018						0.6	5	1	len-ft
1.10	Compressor Retrofit: Multiplex	2018						0.6	15/ 5	1	cap-ton
1.11	Display Case ECM Motor Retrofit	2018						0.6	5	1	each
1.12	Efficient Condenser: Air-Cooled to Evap	2018						0.6	15/ 5	1	cap-ton
1.13	Efficient Condenser: Multiplex	2018						0.6	15/ 5	1	cap-ton

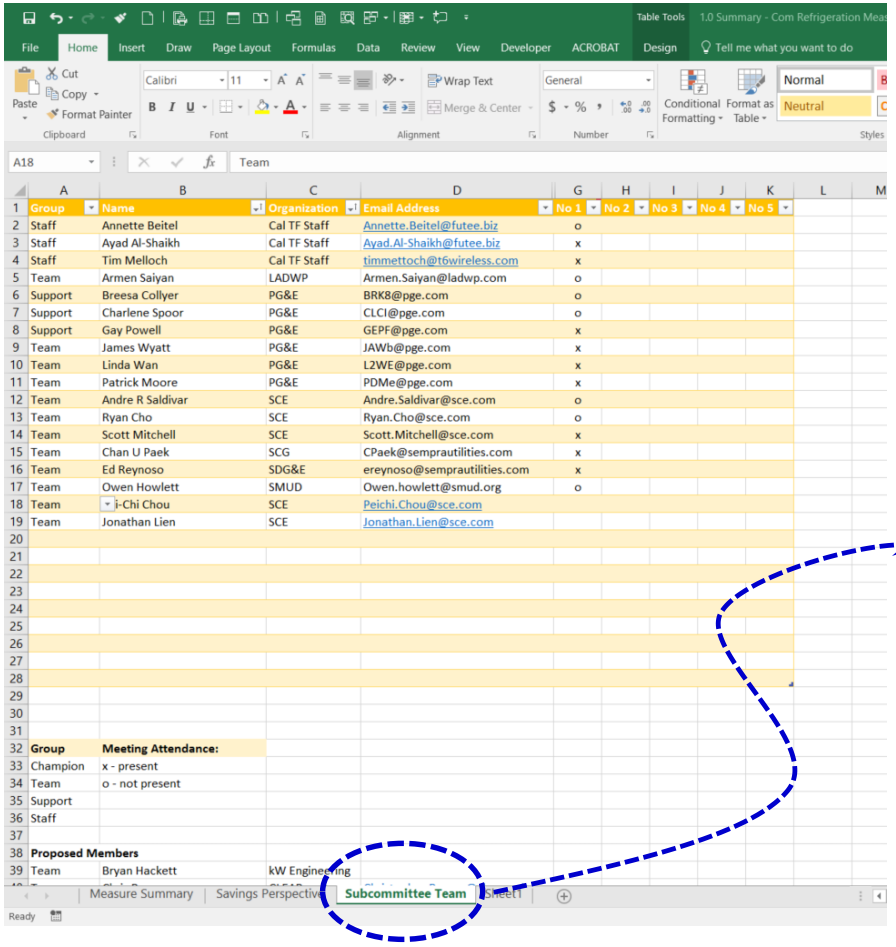
- Category Summary File
  - Measure Review
  - Cross-Cutting Issues
  - Measure-Specific Issues
- Category Savings Perspective
- Subcommittee Team List

Category Summary File



- Category Summary File
  - Measure Review
  - Cross-Cutting Issues
  - Measure-Specific Issues
- Category Savings Perspective
- Subcommittee Team List

Category Summary File



Group	Name	Organization	Email Address	No 1	No 2	No 3	No 4	No 5
Staff	Annette Beitel	Cal TF Staff	Annette.Beitel@futee.biz	o				
Staff	Ayad Al-Shaikh	Cal TF Staff	Ayad.Al-Shaikh@futee.biz	x				
Staff	Tim Melloch	Cal TF Staff	timmettoch@t6wireless.com	x				
Team	Armen Saiyan	LADWP	Armen.Saiyan@ladwp.com	o				
Support	Breesa Collyer	PG&E	BRK8@pge.com	o				
Support	Charlene Spoor	PG&E	CLCI@pge.com	o				
Support	Gay Powell	PG&E	GEPF@pge.com	x				
Team	James Wyatt	PG&E	JAWb@pge.com	x				
Team	Linda Wan	PG&E	L2WE@pge.com	x				
Team	Patrick Moore	PG&E	PDMe@pge.com	x				
Team	Andre R Saldivar	SCE	Andre.Saldivar@sce.com	o				
Team	Ryan Cho	SCE	Ryan.Cho@sce.com	o				
Team	Scott Mitchell	SCE	Scott.Mitchell@sce.com	x				
Team	Chan U Paek	SCG	CPaek@semprautilities.com	x				
Team	Ed Reynoso	SDG&E	ereynoso@semprautilities.com	x				
Team	Owen Howlett	SMUD	Owen.howlett@smud.org	o				
Team	Ji-Chi Chou	SCE	Peichi.Chou@sce.com					
Team	Jonathan Lien	SCE	Jonathan.Lien@sce.com					

Group	Meeting Attendance:
Champion	x - present
Team	o - not present
Support	
Staff	

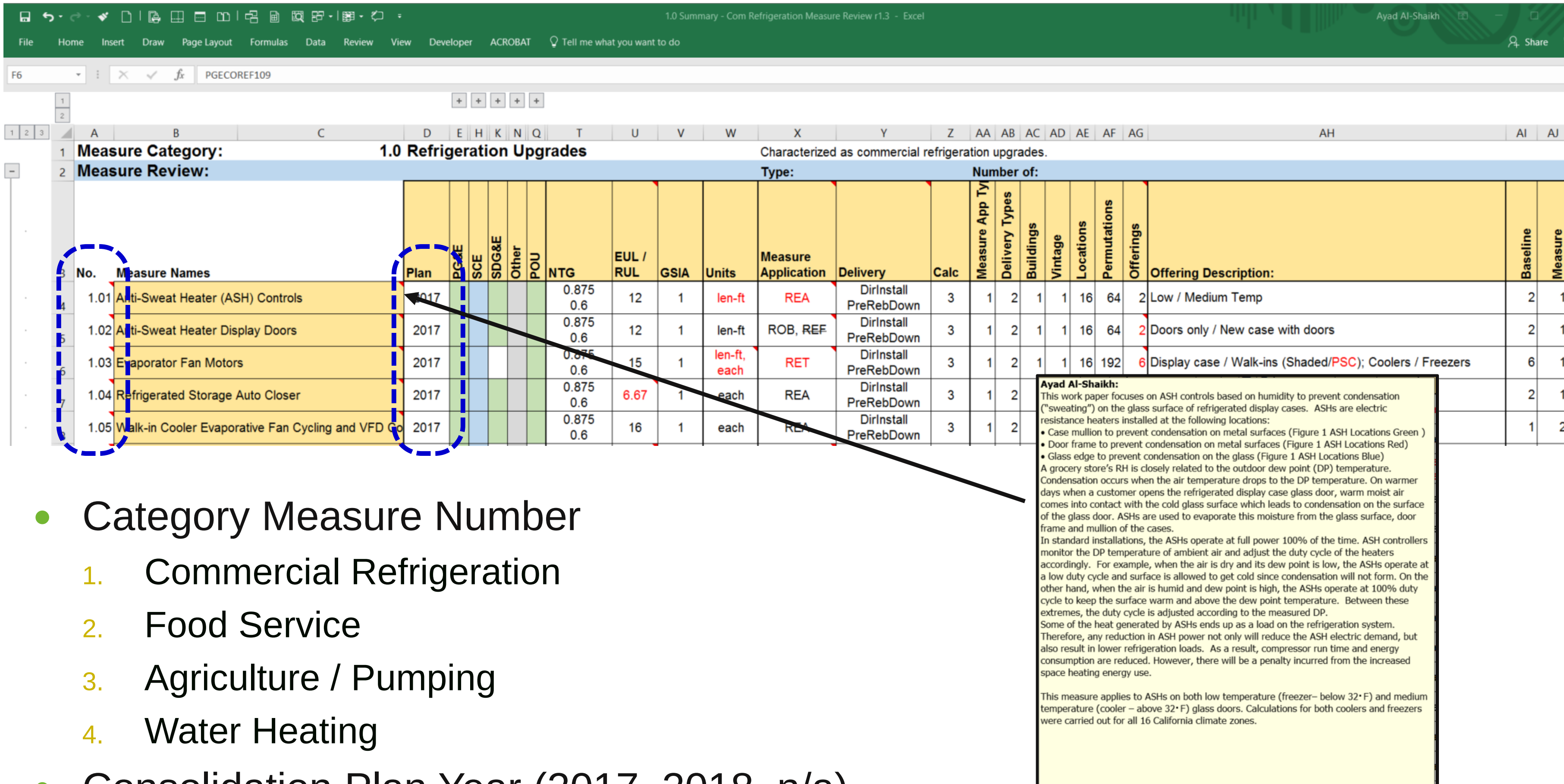
Proposed Members

Team	Bryan Hackett	kW Engineering

Measure Summary | Savings Perspective | **Subcommittee Team** | Sheet1

- Category Summary File
  - Measure Review
  - Cross-Cutting Issues
  - Measure-Specific Issues
- Category Savings Perspective
- Subcommittee Team List

Category Summary File



Measure Category: **1.0 Refrigeration Upgrades** Characterized as commercial refrigeration upgrades.

Measure Review: **Type:** **Number of:**

No.	Measure Names	Plan	PG&E	SCE	SDG&E	Other	POU	NTG	EUL / RUL	GSIA	Units	Measure Application	Delivery	Calc	Measure App Ty	Delivery Types	Buildings	Vintage	Locations	Permutations	Offerings	Offering Description:	Baseline	Measure
1.01	Anti-Sweat Heater (ASH) Controls	2017						0.875 0.6	12	1	len-ft	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Low / Medium Temp	2	1
1.02	Anti-Sweat Heater Display Doors	2017						0.875 0.6	12	1	len-ft	ROB, ~~REF~~	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Doors only / New case with doors	2	1
1.03	Evaporator Fan Motors	2017						0.875 0.6	15	1	len-ft, each	RET	DirInstall PreRebDown	3	1	2	1	1	16	192	6	Display case / Walk-ins (Shaded/PSC); Coolers / Freezers	6	1
1.04	Refrigerated Storage Auto Closer	2017						0.875 0.6	6.67	1	each	REA	DirInstall PreRebDown	3	1	2							2	1
1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co	2017						0.875 0.6	16	1	each	REA	DirInstall PreRebDown	3	1	2							1	2

Ayad Al-Shaikh:
This work paper focuses on ASH controls based on humidity to prevent condensation ("sweating") on the glass surface of refrigerated display cases. ASHs are electric resistance heaters installed at the following locations:
- Case mullion to prevent condensation on metal surfaces (Figure 1 ASH Locations Green)
- Door frame to prevent condensation on metal surfaces (Figure 1 ASH Locations Red)
- Glass edge to prevent condensation on the glass (Figure 1 ASH Locations Blue)

A grocery store's RH is closely related to the outdoor dew point (DP) temperature. Condensation occurs when the air temperature drops to the DP temperature. On warmer days when a customer opens the refrigerated display case glass door, warm moist air comes into contact with the cold glass surface which leads to condensation on the surface of the glass door. ASHs are used to evaporate this moisture from the glass surface, door frame and mullion of the cases.
In standard installations, the ASHs operate at full power 100% of the time. ASH controllers monitor the DP temperature of ambient air and adjust the duty cycle of the heaters accordingly. For example, when the air is dry and its dew point is low, the ASHs operate at a low duty cycle and surface is allowed to get cold since condensation will not form. On the other hand, when the air is humid and dew point is high, the ASHs operate at 100% duty cycle to keep the surface warm and above the dew point temperature. Between these extremes, the duty cycle is adjusted according to the measured DP.
Some of the heat generated by ASHs ends up as a load on the refrigeration system. Therefore, any reduction in ASH power not only will reduce the ASH electric demand, but also result in lower refrigeration loads. As a result, compressor run time and energy consumption are reduced. However, there will be a penalty incurred from the increased space heating energy use.

This measure applies to ASHs on both low temperature (freezer– below 32•F) and medium temperature (cooler – above 32•F) glass doors. Calculations for both coolers and freezers were carried out for all 16 California climate zones.

- Category Measure Number
  1. Commercial Refrigeration
  2. Food Service
  3. Agriculture / Pumping
  4. Water Heating
- Consolidation Plan Year (2017, 2018, n/a)
- Note: Comments available to give workpaper "Technical Description"

Category Summary File

CALIFORNIA
TECHNICAL FORUM

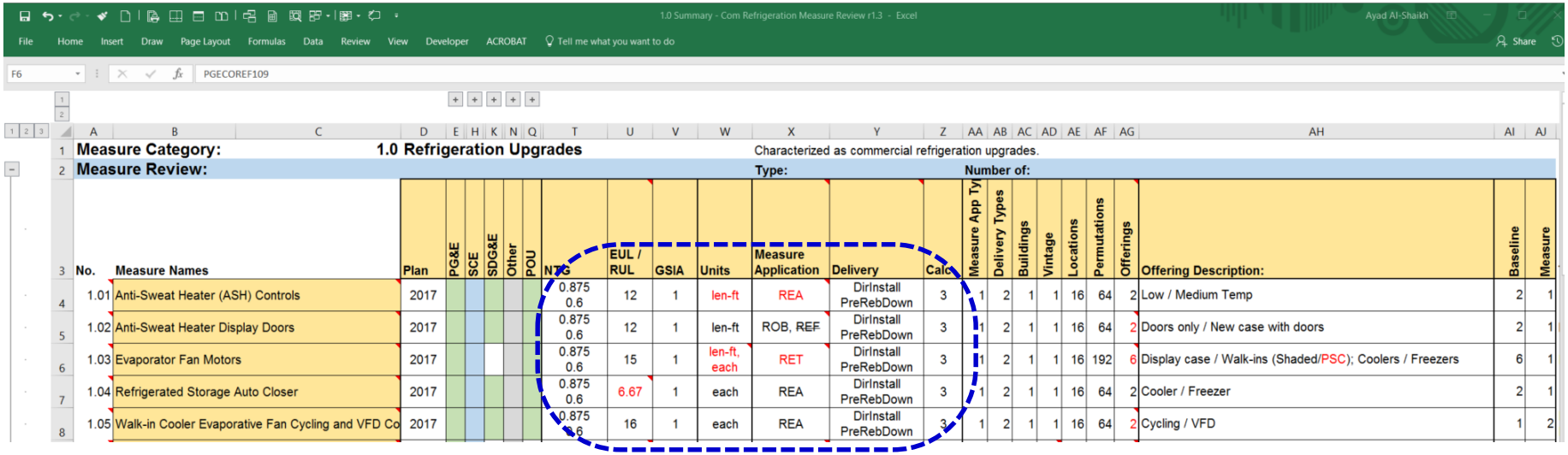
Measure Category: **1.0 Refrigeration Upgrades** — Characterized as commercial refrigeration upgrades.

Measure Review:

No.	Measure Names	Pla	PG&E	Measure No	Rev	SCE	Measure No	Rev	SDG&E	Other	POU	NTG	EUL / RUL	GSIA	Units	Measure Application (Type:)	Delivery	Calc	Measure App Ty (Number of:)	Delivery Types	Buildings	Vintage	Locations	Permutations	Offerings	Offering Description:
1.01	Anti-Sweat Heater (ASH) Controls	2017		PGECOREF108	R7		SCE13RN009 SCE17RN009	2 0				0.875 0.6	12	1	len-ft	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Low / Medium Temp
1.02	Anti-Sweat Heater Display Doors	2017		PGECOREF123	R3		SCE13RN018	2				0.875 0.6	12	1	len-ft	ROB, ~~REF~~	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Doors only / New case with doors
1.03	Evaporator Fan Motors	2017		PGECOREF109	R6		SCE13RN011	2				0.875 0.6	15	1	len-ft, each	RET	DirInstall PreRebDown	3	1	2	1	1	16	192	6	Display case / Walk-ins (Shaded/PSC);
1.04	Refrigerated Storage Auto Closer	2017		PGECOREF110	R6		SCE17RN024	0				0.875 0.6	6.67	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cooler / Freezer
1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co	2017		PGECOREF106	R6		SCE13RN025	2				0.875 0.6	16	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cycling / VFD

- Workpaper Details
  - **Green** Shading designates the lead workpaper that is referenced
  - **Blue** Shading designates that a workpaper exists in the library
  - **Red** Shading designates that the workpaper exists, but we don't have a copy (yet)
  - Groups can be opened to show workpaper number and current revision
    - For POUs, this shows the reference within the CA TRM, if applicable.

Category Summary File



	A	B	C	D	E	H	K	N	Q	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1	**Measure Category:**			**1.0 Refrigeration Upgrades**										Characterized as commercial refrigeration upgrades.												
2	**Measure Review:**													**Type:**			**Number of:**									
3	**No.**	**Measure Names**		**Plan**	**PG&E**	**SCE**	**SDG&E**	**Other**	**POU**	**NTG**	**EUL / RUL**	**GSIA**	**Units**	**Measure Application**	**Delivery**	**Calc**	**Measure App Ty**	**Delivery Types**	**Buildings**	**Vintage**	**Locations**	**Permutations**	**Offerings**	**Offering Description:**	**Baseline**	**Measure**
4	1.01	Anti-Sweat Heater (ASH) Controls		2017						0.875 0.6	12	1	len-ft	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Low / Medium Temp	2	1
5	1.02	Anti-Sweat Heater Display Doors		2017						0.875 0.6	12	1	len-ft	ROB, REF	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Doors only / New case with doors	2	1
6	1.03	Evaporator Fan Motors		2017						0.875 0.6	15	1	len-ft, each	RET	DirInstall PreRebDown	3	1	2	1	1	16	192	6	Display case / Walk-ins (Shaded/PSC); Coolers / Freezers	6	1
7	1.04	Refrigerated Storage Auto Closer		2017						0.875 0.6	6.67	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cooler / Freezer	2	1
8	1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co		2017						0.875 0.6	16	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cycling / VFD	1	2

- Measure Characteristics Comparison
  - Net to Gross (NTG)
  - Effective Useful Life / Remaining Useful Life (EUL/RUL)
  - Gross Savings and Installation Adjustment (GSIA…similar to IR)
  - Units
  - Measure Application Type (ER, NC, RC, REA, RET, ROB, or ROBNC)
  - Delivery Type
  - Calculation Type (1=simple calculation; 2=complex calculation; 3=modeled result)
- Note: Red values indicate some type of discrepancy between workpapers

Category Summary File

Measure Category: **1.0 Refrigeration Upgrades** — Characterized as commercial refrigeration upgrades

Measure Review:

No.	Measure Names	Plan	PG&E	SCE	SDG&E	Other	POU	NTG	EUL / RUL	GSIA	Units	Measure Application	Delivery Type:	Calc	Number of: Measure App Ty	Delivery Types	Buildings	Vintage	Locations	Permutations	Offerings	Offering Description:	Baseline	Measure
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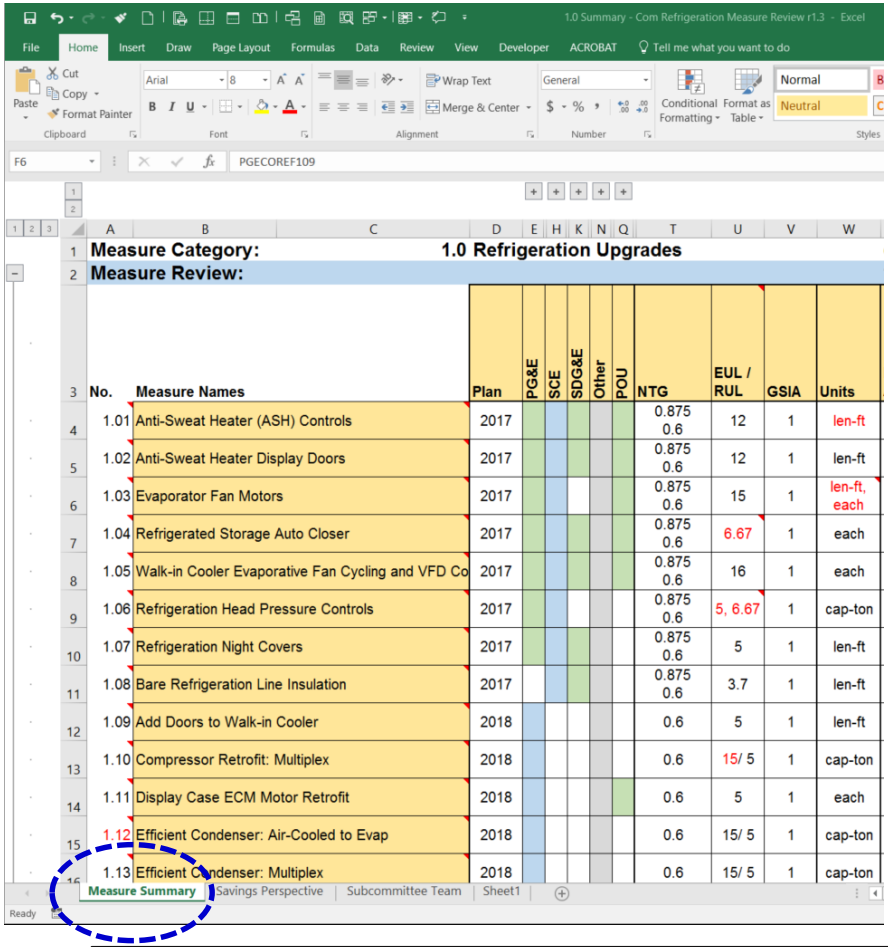
1.03	Evaporator Fan Motors	2017						0.875 0.6	15	1	len-ft, each	RET	DirInstall PreRebDown	3	1	2	1	1	16	192	6	Display case / Walk-ins (Shaded/PSC); Coolers / Freezers	6	1
1.04	Refrigerated Storage Auto Closer	2017						0.875 0.6	6.67	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cooler / Freezer	2	1
1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co	2017						0.875 0.6	16	1	each	REA	DirInstall PreRebDown	3	1	2	1	1	16	64	2	Cycling / VFD	1	2

- Permutations
  - Building Type (26 types, Res, Com, Any)
  - Vintage
  - Location (16 Climate Zones or IOU)
- Offerings

Category Summary File



Measure Category: 1.0 Refrigeration Upgrades

Measure Review:

No.	Measure Names	Plan	PG&E	SCE	SDG&E	Other	POU	NTG	EUL / RUL	GSIA	Units
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1.02	Anti-Sweat Heater Display Doors	2017						0.875 0.6	12	1	len-ft
1.03	Evaporator Fan Motors	2017						0.875 0.6	15	1	len-ft, each
1.04	Refrigerated Storage Auto Closer	2017						0.875 0.6	6.67	1	each
1.05	Walk-in Cooler Evaporative Fan Cycling and VFD Co	2017						0.875 0.6	16	1	each
1.06	Refrigeration Head Pressure Controls	2017						0.875 0.6	5, 6.67	1	cap-ton
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1.08	Bare Refrigeration Line Insulation	2017						0.875 0.6	3.7	1	len-ft
1.09	Add Doors to Walk-in Cooler	2018						0.6	5	1	len-ft
1.10	Compressor Retrofit: Multiplex	2018						0.6	15/ 5	1	cap-ton
1.11	Display Case ECM Motor Retrofit	2018						0.6	5	1	each
1.12	Efficient Condenser: Air-Cooled to Evap	2018						0.6	15/ 5	1	cap-ton
1.13	Efficient Condenser: Multiplex	2018						0.6	15/ 5	1	cap-ton

- Category Summary File
  - Measure Review
  - Cross-Cutting Issues
    - **Intent**: Higher level concern that effects multiple Measures
      - Policy Issues
      - Technical Issues
      - Technical Questions
      - Etc…
  - Measure-Specific Issues
    - **Intent**: Detailed issue that needs resolution before consolidation.

Note: Some Cross-Cutting issues are turning out to be Global Issues.

"Generic" Measure *Development* in eTRM Ecosystem

Measure Request

- IOU
- POU
- Implementer
- Product Mfg'er
- Etc…

WP Developer Approved Pool

- "Best Available Data"
- Measure input tables
- Sources
- Narrative

eTRM

Reduction to about 63 fields from current 140+ fields.

eTRM Replaces:
- Workpaper databases
- READi
- PEAR
- DEER
- CA TRM
- Others…

"In Process" → *Internal & Cal TF Staff QC* → "Pending" → *Cal TF Review & Affirmation* → "Submitted" → *CPUC Review (EM&V Contractor)* → "Approved"

IOU Use

POU Use

Note: Can begin throughout the year as needed.