Agriculture / Pumping Subcommittee Meeting #1

CALIFORNIA
TECHNICAL FORUM

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AUGUST 2017

Agenda

- Goals / Objectives
- Review Materials:
  - Ag Pumping, Sub Comm Mtg 2 – r1.ppt
  - Technology Summary - 3.0 Comm Refrig r2.1.xls
- Understand energy savings issues
  - Pump Overhaul
    - What has been done; What is being done; What needs to be done
  - VFD on Well Pumps
    - Need data to review the next step
  - Pump Motor Replacement – To-Code Measure
  - Irrigation – Disposition Understanding
    - Consensus
  - Dairy Measures Overview
  - Greenhouse Measure Overview – Planned to remove

Agricultural / 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
3.03	Farm Sprinkler to Micro Irrigation Conversion	2017
3.04	Low Pressure Sprinkler Nozzles	2017
3.02	Agricultural Ventilation Fans	2017
3.06	Milk Cooling Scroll Compressor	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

Pumping

Irrigation

Dairy

Greenhouse

3.01 Pump Overhaul - Memorandum

I. Basis of Claims
   A. Not just Pump Test, but also Overhaul is also required.
   B. Categorized as maintenance; Establish program influence.
   C. Pump Test viewed as necessary within the last 12 months.
   D. Savings estimates must be adjusted for pump wear.
   E. Cost basis calculated as a dual baseline project.

II. Ex-Ante Claims Issues
   A. Energy savings methodology adjusted if TDH varies by 10% (custom).
   B. Limit dataset by (deemed):
      A. Pumps with both pre- and post- test data
      B. Pumps with rated-hp that are covered by the workpaper
      C. Exclude Base and Post OPE with >10% of total pump head
      D. Higher post flow rates should not eliminate data
   C. Peak demand impacts must be documented via interval data analysis.
   D. Motor replacements must exceed standard.

3.01 Agricultural Pump System Overhaul

- What has been done?
  - SCE/Lincus Response
  - SCE - Discussions with Commission Staff to restart custom program as an Accelerated Replacement measure.
- What is being done?
  - PG&E/ITRC – Peak Demand study (Q4 2017)
  - PG&E/ITRC – Hours of Operation (Q1 2018) (*Is this correct?)*
- What needs to be done?
  - Align/clean datasets
  - Choose calculation methodology
  - Discuss whether this is a maintenance measure

3.01 Agricultural Pump System Overhaul

- Consolidation
  - 5 Pump Types; 1 or 2 rated-hp ranges (<=25 hp, ~~25-50 hp~~)
  - 16 Climate Zones
  - Based upon
    - SCE 3,000+ (<=25 hp) / 6,000+ (25-50hp) data points from pump test database
    - PG&E 1,400+ (<=25 hp) data points from pump test database
    - SDG&E 700+ (<=50 hp) data points from pump test database
  - Issues
    - Calculation methodology is slightly different - discuss
    - How to integrate / weight savings for overlapping Climate Zones?
    - Clarity on BRO – Additional requirements for deemed?
    - Phase 1 / Phase 2 approach
      - Clarity on EUL update
      - Improvement on savings accuracy

3.01 Agricultural Pump System Overhaul

Measured/Observed value
Lookup value
Estimated value
Calculated value

- Calculation Methodology
  - Basic equation electric savings (per hp)
    - PG&E: kWh Savings = Avg. Pump Size (hp) x $0.746 \frac{kW}{hp}$ x Avg. Motor Loading / η_{motor} x Avg. AOH x $\left(1 - \frac{OPE_{Base}}{OPE_{Post}}\right)$
      - Avg Pump Size (rated hp) – recorded during pump test
      - Avg Motor Loading (%) - Calculated from: kW-draw, rated hp, motor eff
        - kW-draw (kW) - Calculated from OPE, gpm, total lift, motor eff
      - Avg AOH (hrs/yr) – Documented at Pump Test
      - OPE_{Base} (%) - Documented at Pump Test
      - OPE_{Post} (%) – Not clear
    - SCE: kWh Savings = Avg. Pump Size (hp) x $0.746 \frac{kW}{hp}$ x Avg. Motor Loading x Avg. AOH x $\left(1 - \frac{OPE_{Base}}{OPE_{Post}}\right)$ / η_{motor}
      - Avg Pump Size (rated hp) – recorded during pump test
      - Avg Motor Loading (%) - Calculated from: kW-input, rated hp, motor eff
      - Avg AOH (hrs/yr) – Calculated from: kW-input, OPE_{Base}, OPE_{Post}, GRS_kWh_Sav
      - OPE_{Base} (%) - Documented at Pump Test
      - OPE_{Post} (%) – Not clear
      - GRS_kW_Sav – Not clear

3.01 Agricultural Pump System Overhaul

- Phase 1 / Phase 2 Approach
  - Phase 1
    - Offerings consistent
    - Data consolidated to a statewide methodology
      - NOTE – Savings would change because of issues with data set
    - Discuss how to include degradation
    - Measure application type: BRO (3 yr EUL)
  - Phase 2
    - EUL update
    - Improvement on savings accuracy – other sensitive parameters
      - Include results of Hours of Operation Study
      - Using Hydrological Zones and Geological Zones
    - Include results of Demand Study
    - Pump Redesign Option

3.05 VFD on Ag Well Pumps

- Phase 1 / Phase 2 Approach
  - Phase 1 – PG&E approved workpaper
    - Based upon 298 custom projects
    - Savings varies by
      - Well pumps (<=600 hp), Booster pumps (<=150 hp)
    - Delivery varies by
      - REA / NC;
      - PreRebDown / DI
    - Can this Measure be applied statewide?
  - Phase 2
    - Document longer pump EUL
      - Currently, REA measure → EUL = 10 yrs; RUL = 3.3 yrs
    - Consider more sensitive parameters than pump type
      - Operating hours (Muni vs Ag)
    - Opportunity to pump to open vessel – would need more info

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

3.07, Vertical Hollow 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)
3.01	Agricultural Pump System Overhaul for Pumps Up To 25 HP	772,578
3.02	Agricultural Ventilation Fans	523,200
3.03	[illegible]	[illegible]
3.04	Low Pressure Sprinkler Nozzles	0
3.05	Variable Frequency Drive on Agricultural Well Pumps	32,921,200
	[illegible]	[illegible]
	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	1,035,326
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

- Consensus:
  - Do not pursue Low Pressure Sprinkler Measure
  - Revive the Micro Conversion Measure by redefining it

- Micro/Drip-Conversion Measure
  - Address impact evaluation concerns
  - Include new requirements to make savings reliable

Measure Specific Issue
Sprinkler Impact Eval (2015) - Micro/Drip-Conversion

- Impact Evaluation Concerns
  - 4 of 25 ineligible measures (added load)
  - Hours of Use lower (-25%)
  - Baseline irrigation method assumption (-33%)
  - Pumping equipment operation assumptions (-25%)
- Questions
  - Solve the issue of rebating only valid sites.
  - Create an offering that has more reliability in terms of hours of use.
  - Document pumping baseline more accurately.
  - Use in connection with existing Pump VFD Measure.
  - Evaluate if DEER savings are still valid after impact evaluation.
- Itron had a recommendation

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.

iTron - Recommended Methodology

- Initial Application → Potentially Ineligable
  - 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

Dairy Measures

3.06 Milk Cooling Scroll Compressor

- Only one workpaper
- Low Measure usage – no claims in 2016
  - More applicable to smaller Dairies
  - Valuable measure to support that Hard-to-Reach market
- Savings based upon average values from an EM&V study (2007)
  - Normalized Unit = kWh / scroll compressor

3.02 Agricultural Ventilation Fans

- Only one workpaper
- Offerings based upon fan size
  - 24-26”, 36”, 48”, ~~50-52”~~
  - Savings documented per fan
  - Fans qualify based upon a Qualified Products List (BESS lab tested)
- Phase 2 – custom / not deemed
  - Add a 72” option - Larger fans are more efficient
  - Include a VFD option – Control based upon temperature
  - Include new construction/added load – Farms that do not have cow cooling yet
  - Consider other sensitive variables (Climate Zone, Setpoint)

Greenhouse Measures

- Industry Standard Practice (ISP)
  - Green Building Studio ISP study (2005)
    - Confirms the infrared film technology considered ISP. Nearly 80% of locations studied used IR film
    - While not conclusive for heat curtains, majority of the locations studied had heat curtains on some portion of their properties. Cost to maintain product a factor for considering removal from deemed product inventory
  - Navigant Study (2015)
    - Confirms the infrared film technology considered ISP.
    - Confirmed that majority of locations studied had heat curtains, despite statements by customers stating that heat curtains may not be ISP
    - Utility incentives were instrumental in purchase
  - Removed from 2005 DEER catalog as industry standard practice. 2013-14 DEER shows zero claimable energy savings for both measures.

Backup

3.01 Agricultural Pump System Overhaul

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

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

- 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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3.11	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

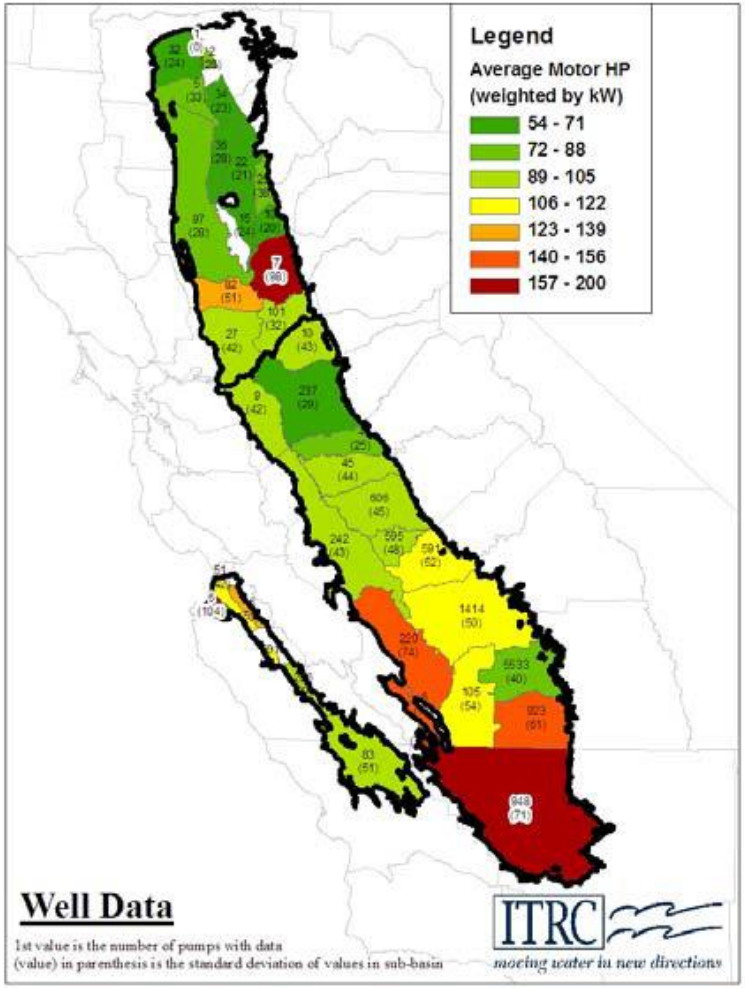
EUL ID	Description	Sector	UseCategory	EUL (Years)	RUL (Years)
Agr-VSDWellPmp	Well Pump Variable Speed Drive	Ag	Irrigate	10	3.3

- 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?

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%**

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

"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.