Agriculture / Pumping Subcommittee



AYAD AL-SHAIKH APRIL 2017

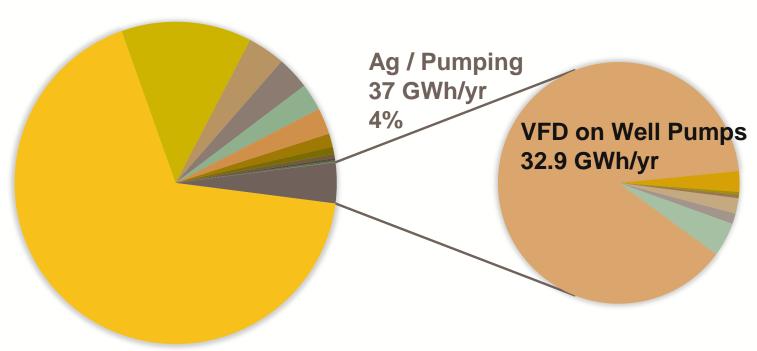
Ag/Pumping Category Deemed Savings CALIFOR



2

Savings Perspective

2016 CA Electric Savings (Total = 912 GWh/yr)



Agriculture / Pumping





	Total Energy
Ref No Name	(kWh/vr)
★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	1,035,326
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
	0
Grand Total	37,257,098

Before: Bearing & Elec Loss 9% Column & Shaft Loss 5% Pump Loss 31%

* Images used from workpapers and PG&E catalogs





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	0
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After:	TOTAL LOSSES = 27%
Motor, Bearing & Elec Loss 9%	73% OPE
Column & Shaft Loss 4%	
Pump Loss 10%	
0 0 100% in	

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Ref No N	lame	(kWh/yr)
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🜟 3.02 A	Agricultural Ventilation Fans	523,200
₹3.03 F	arm Sprinkler to Micro Irrigation Conversion	1,693,437
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3.10 N	Milk Transfer Pump VSD	0
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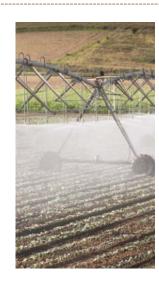


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3.06	Milk Cooling Scroll Compressor	0
3.07	Vertical Hollow and Solid Shaft Pump Motors	1,035,326
3.08	CHR Unit - Electric and Gas	0
3.09	Milk Vacuum Pump VSD	0
3.10	Milk Transfer Pump VSD	0
3.11	Chilled Glycol Pipe Insulation	121,713
3.12	Glycol tank Insulation	189,645
		0
Grand Tat		27 257 000



Grand Total 37,257,098

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Ref No	Name	(kWh/yr)
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2.03	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	<mark>32,9</mark> 21,200
	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
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L	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
		0
Grand Tot	al	37,257,098



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Ref No Name (kWh, 3.01 Agricultural Pump System Overhaul for Pumps Up To 25 HP 77	/yr) '2,578
2 01 Agricultural Pump System Overhaul for Pumps Up To 25 HP	2,578
3.01 Agricultural Fullip System Overhaul for Fullips Op 10 23 HF	
★ 3.02 Agricultural Ventilation Fans 52	23,200
★ 3.03 Farm Sprinkler to Micro Irrigation Conversion 1,69	3,437
★3.04 Low Pressure Sprinkler Nozzles	0
★ 3.05 Variable Frequency Drive on Agricultural Well Pumps 32,92	21,200
Variable Frequency Drive on Agricultural Well Pumps (<=300hp) 11,20	00,000
Variable Frequency Drive on Agricultural Well Pumps (<=300hp) 18,10	00,000
Variable Frequency Drive on Agricultural Booster Pumps (<=150hp) 1,90	00,000
Variable Frequency Drive on Agricultural Booster Pumps (<=150hp) 1,00	00,000
Variable Frequency Drive on Agricultural Booster Pumps (<=150hp) 80	0,000
3.06 Milk Cooling Scroll Compressor	0
3.07 Vertical Hollow and Soild Shart Pump Wotors 1,03	5,326
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 12	21,713
3.12 Glycol tank Insulation 18	9,645
	0



(typical baseline compressor)

Grand Total

37,257,098

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★3.01	Agricultural Pump System Overhaul for Pumps Up To 25 HP	772,578
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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_	Mille Cooling Scroll Compressor — — — — — — — — — — — — — — — — — — —	
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
		0
Grand Tot	al	37,257,098



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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
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3.11	Chilled Glycol Pipe Insulation	121,713
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	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	
3.09	Milk Vacuum Pump VSD	0
3.10	Milk Transfer Pump VSD	0
3.11	Chilled Glycol Pipe Insulation	121,713
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	Low Pressure Sprinkler Nozzles	0
	Variable Frequency Drive on Agricultural Well Pumps	32,921,200
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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	
3.10	Milk Transfer Pump VSD	0
3.11	Chilled Glycol Pipe Insulation	121,713
3.12	Glycol tank Insulation	189,645
		0
Grand Tot	al	37.257.098



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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	Giycoi tank insulation	189,645
		0
Grand Tot	al	37,257,098



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Ref No Name	(kWh/yr)				
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Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)	1,900,000				
Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)					
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				
	0				



37,257,098

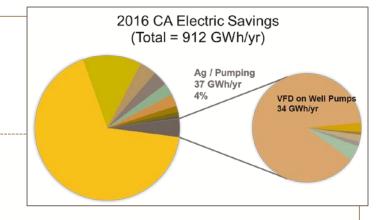
* Images used from workpapers and PG&E catalogs

Grand Total

Ag/Pumping Category Deemed Savings

17

Savings Perspective: 2016



Ref No	Name	Units Installed PGE	SCE	Energy (kWh/yr) PGE	SCE	Demand (kW) PGE		Units Installed	Total Energy (kWh/yr)	Total Demand (kW)
	Agricultural Pump System Overhaul for Pumps Up To 25 HP		618	562,973	209,604	141		2,316	772,578	181
	Agricultural Ventilation Fans	480		523,200		240	1	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	3.05 Variable Frequency Drive on Agricultural Well Pumps			32,921,200		15736	i	130,195	32,921,200	15,736
	Variable Frequency Drive on Agricultural Well Pumps (<=30		REA					43,460	11,200,000	5,246
	Variable Frequency Drive on Agricultural Well Pumps (<=30		NC					70,480	18,100,000	8,507
	Variable Frequency Drive on Agricultural Booster Pumps (<							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	3.07 Vertical Hollow and Solid Shaft Pump Motors			1,035,326		428	1	29,445	1,035,326	428
3.11	3.11 Chilled Glycol Pipe Insulation			121,713		26	i	6,736	121,713	26
3.12	3.12 Glycol tank Insulation			189,645		50)	4,577	189,645	50
3.13	3.13 Tank Insulation			0		0	1	528	0	-
Grand Tot	Grand Total 177,842 37,257,098 18,0							18,005		

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

Measure Specific Issue Sprinkler Disposition (2015)

- 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:
 - Discontinuing "Low Pressure Sprinkler" and "Micro Conversion"
 - Shifting "Drip Irrigation" to custom
 - These Measures should be re-evaluated

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Name	(kWh/yr)
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Low Pressure Sprinkler Nozzles	0
Variable Trequency Errye on Agriculturar Wen Pumps	52,921,200
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
Milk Cooling Scroll Compressor	0
Vertical Hollow and Solid Shaft Pump Motors	1,035,326
3 CHR Unit - Electric and Gas	0
Milk Vacuum Pump VSD	0
Milk Transfer Pump VSD	0
L Chilled Glycol Pipe Insulation	121,713
2 Glycol tank Insulation	189,645
3 Tank Insulation	0
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	1 Agricultural Pump System Overhaul for Pumps Up To 25 HP 2 Agricultural Ventilation Engs 3 Farm Sprinkler to Micro Irrigation Conversion 4 Low Pressure Sprinkler Nozzles Variable Trequency Drive on Agricultural Well Pumps (<=300hp) Variable Frequency Drive on Agricultural Well Pumps (<=300hp) Variable Frequency Drive on Agricultural Booster Pumps (<=150hp) Variable Frequency Drive on Agricultural Booster Pumps (<=150hp) Variable Frequency Drive on Agricultural Booster Pumps (<=150hp)

3.03 – Micro Irrigation



SDG&E

										<i>/</i>
MeasureID	Name	Description	Abbrev	BaseDescription	Eimpact	Gimpact	Pimpact	Life	IncEquipCost	InstalledCost
l í	Sprinkler to		 						I	
l i	_	Micro irrigation in		Stadard 50+ PSI			l i			
l i	Field/Vegs - non	fields without a		impact-driven					!	
D03-972	well	well	Micro	sprinkler heads	277	0	28	20	\$0.00	\$1,000.00
			li 💮				\ \ \			
	Sprinkler to		1	Stadard 50+ PSI						
		Micro irrigation in	1	impact-driven						
D03-973	, ,	fields with a well	Nicro	sprinkler heads	324	0	286	20	\$0.00	\$1,000.00
i	Sprinkler to									
į i		Micro irrigation of		Stadard 50+ PSI						
L	Decid Trees - non		li.	impact-driven		_				
D03-974	well	without a well	Micro	sprinkler heads	434	0	249	20	\$0.00	\$1,000.00
	Sprinkler to		i i							
	Micro irrigation -	Micro irrigation of	1	Stadard 50+ PSI						
	Decid Trees -	deciduous trees	ļ <u>.</u>	impact-driven					40.00	4
D03-975	well	with a well	Nicro	sprinkler heads	515	0	249	20	\$0.00	\$1,000.00
l i	Sprinkler to			S. I. 150. DS.						
I .	Micro irrigation - Citrus Trees -	Micro irrigation of citrus trees		Stadard 50+ PSI						
D03-976		without a well	Micro	impact-driven	456	0	136	20	\$0.00	¢4 000 00
D03-976	non well	without a well	IVIICIO	sprinkler heads	456	U	136	20	\$0.00	\$1,000.00
	Sprinkler to Micro irrigation -	Micro irrigation of		Stadard 50+ PSI						
	Citrus Trees -	citrus trees with a		impact-driven						
D03-977	well	well	Nicro	sprinkler heads	541	0	136	20	\$0.00	\$1,000.00
DU3-9//	weii	weii	NIC O	sprinkier neads	541	U	136	20	\$0.00	\$1,000.00
į i	Sprinkler to	Micro irrigation of		Stadard 50+ PSI						
	Micro irrigation -	grapes without a	li 💮	impact-driven						
D03-978	grapes - non well	0 '	Nicro	sprinkler heads	300	0	172	20	\$0.00	\$1,000.00
1503 370	IBIODES HOH WEIL	wen -	1 1010	Sprinker nedds	300	O ₁	1/2	20	Ç0.00	71,000.00

Offerings based upon crop type.

Variation cost.

EUL.

PG&E

Measure Code	LIFE CYCLE (RUL if ER RET, REA	(' /	MatlCost (\$/unit)	LaborCost (\$/unit)	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

Measure Specific Issue EUL Methodology Should be Examined

20

 DEER EUL-ID (10 yrs) references an original PG&E workpaper, but 15 yrs is more typical in TRMs.

Ref No	Name	Total Energy (kWh/yr)
	Agricultural Pump System Overhaul for Pumps Up To 25 HP	772,578
	• • • • • • • • • • • • • • • • • • • •	h
	Agricultural Ventilation Fans	523,200
	Farm Sprinkler to Micro Irrigation Conversion	1,693,437
3_04	Lew Brossure Sprinkler Mezzles	
3.05	Variable Frequency Drive on Agricultural Well Pumps	32,921,200
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	11,200,000
1	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
3.00	fyrink cooling Scroil compressor	
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 Tot	al	37,257,098

Measure Summary Information							
Measure description	Retrofit of a pump or fan system by installing a variable frequency drive (VFD) for variable load or fixed constant load control.						
End use	HVAC, process						
Project eligibility	 Constant-flow pump or fan serving a variable load. Oversized constant volume pump or fan serving a constant load. Variable flow pump or fan controlled inefficiently, such as a poorly functioning inlet guide vane or a throttling devise (discharge damper, balancing valve). Not applicable for cooling tower fan control. Not applicable for systems with high static head. For example: Open-system irrigation water pumps. Water pump lift stations. Poorly designed VAV supply air fan systems with incorrectly positioned static pressure control sensor. Poorly designed water or air distribution systems with undersized branches or circuits. These types of systems are often operated with a high static pressure setting to overcome design deficiencies. 						
Savings type	Semi-custom						
Unit energy savings	Project-specific savings can be calculated using either the TRM401, TRM405, TRM406, or TRM407 energy savings calculators.						
Measure-sost	Preject-epesificacests are used to determine cost-effectiveness.						
EUL	15 years ¹						

- □ REA Measure will use 1/3 of EUL of pump
- SCE requesting pump life data from their 3rd party contactor

Measure Specific Issue Savings Methodology



- 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)					
3.01	Agricultural Pump System Overhaul for Pumps Up To 25 HP	772,578					
3.02	3.02 Agricultural Ventilation Fans						
3.03	3.03 Farm Sprinkler to Micro Irrigation Conversion						
3_04	Low Brossure Sprinkler Nozales						
3.05	Variable Frequency Drive on Agricultural Well Pumps	32,921,200					
	Variable Frequency Drive on Agricultural Well Pumps (<=300hp)	11,200,000					
ī	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					
3.00	lvink cooling Scroll compressor	o					
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 Tot	al	37,257,098					

Туре	*	Pump HP	*	Count of # of Pumps
■ Booster			25	1
			30	4
			40	10
			50	10
			60	14
			7 5	28
		1	.00	20
		1	25	9
		1	50	3
■Well			25	2
			30	8
			40	2
			50	13
			60	5
			75	20
		1	.00	24
		1	25	28
		1	50	28
		2	00	27
		2	50	17
		3	00	23

Questions



