

HVAC Subcommittee Meeting #3



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MAY 2018**

Agenda for Mtg #3

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- Schedule for future HVAC Subcommittee meetings
- Parallel path approach for Consolidation
 - Near-term feedback needed from team
- Observation from the DEER Prototype translation process ([L.Brackney](#) and [A.Parker/NREL](#))
- 2018 Q1 Draft Measure list
 - Savings overview / perspective
 - Measure offering and savings methodology review
- Next meeting
 - Finalize Q2 Measure List
 - Review feedback on Measure Summaries
 - Explore Prototypes further

2018 Schedule

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2018

Month	1-Jan-18	8-Jan-18	15-Jan-18	22-Jan-18	29-Jan-18	5-Feb-18	12-Feb-18	19-Feb-18	26-Feb-18	5-Mar-18	12-Mar-18	19-Mar-18	26-Mar-18	2-Apr-18	9-Apr-18	16-Apr-18	23-Apr-18	30-Apr-18	7-May-18	14-May-18	21-May-18	28-May-18	4-Jun-18	11-Jun-18	18-Jun-18	25-Jun-18	2-Jul-18	9-Jul-18	16-Jul-18	23-Jul-18	30-Jul-18
Cal TF Meetings					1/29 (tc)			2/22 (SF)				3/22 (LA)					4/26 (LA)								6/28, SF					7/26, Sac	
Food Service																															
Dom								2																							
Appl /Plug Load								2																							
Lighting								2				1					2									2				2	
Agr / Pumps												2					2									2					
Water Heating												2					2														
Miscellaneous												2					2														
Pools																										2					
VAC																														2	
Building																										2					
Process																														2	

Parallel Path Approach – eTRM / HVAC

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Q2'18

Q3'18

Q4'18

Q1'19

Q2'19

Path 1: HVAC Measure Consolidation

- Create
structure

- Consolidate
50+ HVAC
Measures

- Affirmation
of 50+ HVAC
Measure for
eTRM

Path 2: HVAC Measure Analysis and Evolution

- Stakeholder
Feedback on
Measure
Summary
Template

- Complete
50+ Measures
Summaries
- HVAC
Modelling
Charette

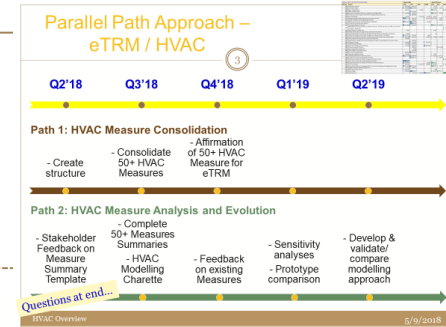
- Feedback
on existing
Measures

- Sensitivity
analyses
- Prototype
comparison

- Develop &
validate/
compare
modelling
approach

Process

5



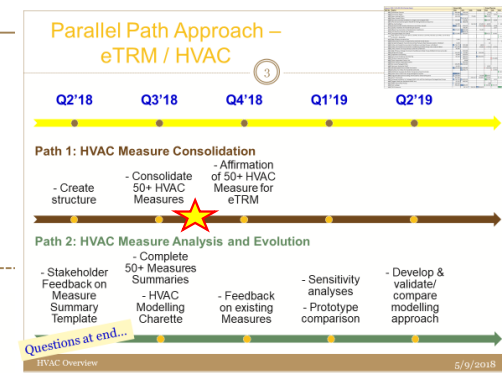
- Start: Approximately 55 HVAC measures to consolidate
 - ❑ *We will review the Draft list today, but feedback on alternatives is requested before next meeting (Thur, 5/31)*
- Review and group
 - ❑ Subcommittee reviews measure groupings
 - ❑ Break subcommittee into two (res and non-res; QI/QM; other(s))
 - ❑ *Thoughts?*
- Develop HVAC Measure Summary
 - ❑ Includes: Subcommittee feedback on standard results for each measure (end-use energy, hourly profiles, schedules, model metrics (kWh savings per square foot), Cooling and Heating load profiles, vintage profiles, etc.)
- Develop Prototype Summary
- *Comments on content for Summaries will be next meeting*

Questions that Subcommittee Members Will Be Asked

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- Are the prototype savings reasonably modeled
 - ❑ Do Cal TF Subcommittee Members agree with savings?
- Are the base case models reasonable at predicting actual load
 - ❑ Should schedules be different
 - ❑ Are internal loads what they think they would be for this building prototype
 - ❑ Are the measures being modeled correctly? (Different EER value or change run time variables)
 - ❑ Input on most sensitive parameters for measure (e.g. infiltration, hours of operation, LPD, etc.)
 - ❑ How are we documenting base and measure case for these measures (for example, why is base case efficiency whatever it is? Is saying it is T24 enough)?
- What other questions should we be asking or planning for?

Disclaimer – CA Building Prototype models are likely to change through the DEER2020 Update



Questions for Cal TF

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- Feedback on general approach?
- What should go into “Measure Summary” template?
 - ❑ Total energy use
 - ❑ Energy use of HVAC
 - ❑ Load analysis – how much HVAC Load per square foot
 - ❑ Hours of operation
 - ❑ Infiltration
 - ❑ Lighting power density
 - ❑ Hourly profiles
 - ❑ What else?
- What should we be concerned about for HVAC measures?
 - ❑ Performance curves
 - ❑ Parametric values

DEER Prototype Translation Process

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- Observation from the DEER Prototype translation process ([L.Brackney](#) and [A.Parker/NREL](#))

HVAC Measure List – for Q2 Consolidation

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- Recommended HVAC Measure Characteristics (for Q2)
 - ❑ Some savings associated with them; planned for use in 2019
 - ❑ Looking for measures with a similar methodology (primarily modeled in DEER)
 - ❑ Want to include the first 2-3 measures that we will use to compare eQUEST/DOE2.2 and Energy Plus
- *Draft* HVAC Measure List for Q2
 - ❑ 5.03 Space Heating Boilers
 - ❑ 5.05 Water-Cooled Chillers
 - ❑ 5.09 Res DuctTestSeal
 - ❑ 5.17 Whole House Fan
 - ❑ 5.18 High Efficiency Furnaces - Residential
 - ❑ 5.22 Variable Refrigerant Flow - Commercial
 - ✦ Heat Pump & Heat Recovery Systems >65kBtu/h
 - ❑ 5.24 Unitary Air-Cooled - Commercial
 - ✦ Air Conditioners and Heat Pump >=65 kBtu/h
 - ❑ 5.25 Unitary Air Cooled - Commercial
 - ✦ Air Conditioners and Heat Pump Units Under 65 kBtuh
 - ❑ 5.27 High Efficiency Package Terminal AC and Heat Pump
 - ✦ 24kBtu/h (2 tons) and under
 - ❑ 5.39 Air-Cooled Packaged Chiller
 - ❑ 5.40 Upstream Residential HVAC
 - ❑ 5.51 Water Source Heat Pumps

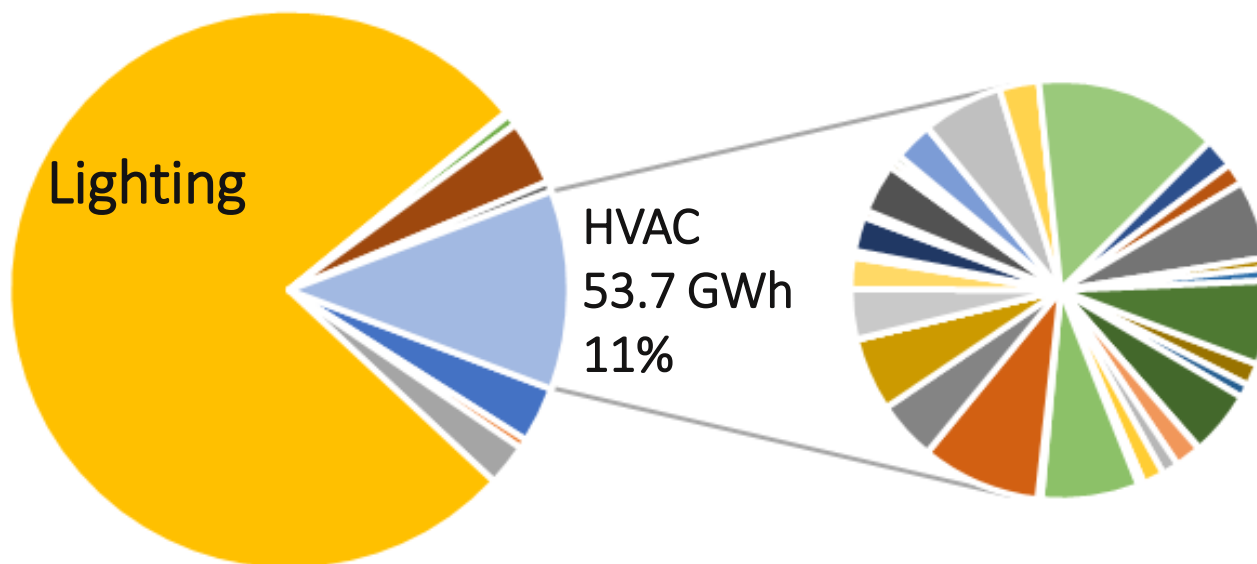
HVAC Electric Savings

(Source – 2017 Q1-Q3, IOU Claims Data)

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HVAC - Electric Savings by Measure

(Source - 2017 Q1-Q3 IOU Deemed Claims)



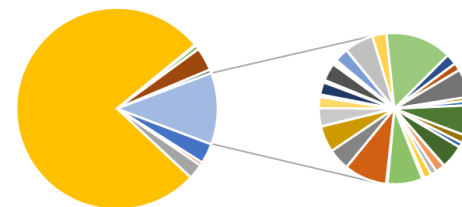
HVAC Electric Savings

(Source – 2017 Q1-Q3, IOU Claims Data)

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HVAC - Electric Savings by Measure

(Source - 2017 Q1-Q3 IOU Deemed Claims)



Ref No	Name	Gross kWh	PGE	SCE	SDGE
5.45	Guest Room PTAC/PTHP Energy Management System	7,626,835	7,599,985		
5.13	Efficient Fan Controller for Residential Air Conditioners	4,940,741	2,474,047	2,394,509	72,185
5.10	Residential HVAC Quality Maintenance and Motor Retrofit	4,044,713	3,661,735	204,453	178,525
5.52	Whole House - Residential	3,460,215	290,621	3,169,595	
5.41	Variable Speed Drive on HVAC Fan Control	3,332,090	2,223,110	1,108,980	
5.49	Enhanced Ventilation for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps	3,232,393	1,740,763	1,422,159	
5.15	Unoccupied Supply Fan Control	3,038,106	2,113,409	924,697	
5.02	Economizer Repair	2,704,019	679,997	2,024,022	
5.14	VFD Retrofit to Central Plant Systems	2,484,678		2,484,678	
5.24	Unitary Air-Cooled Commercial Air Conditioners and Heat Pumps >=65 kBtu/h	2,060,795	1,736,774	322,188	1,833
5.32	Commercial Condenser Coil Cleaning	2,039,439	66,164	490,331	1,482,943
5.42	Brushless Fan Motor for Residential Central AC	1,638,174		1,638,174	
5.39	Air-Cooled Packaged Chiller	1,616,700	100,295	1,516,405	
5.30	Refrigerant Charge	1,433,067	164,420	732,081	536,566
5.25	Unitary Air Cooled Commercial Air Conditioning and Heat Pump Units Under 65 kBtu/h	1,306,765	856,208	395,891	54,665
5.46	Programmable Communicating Thermostat for Demand Response	1,233,427	1,218,918		14,508
5.05	Water-Cooled Chillers	1,071,870		1,071,870	

Includes measures with at least 1M kWh; 18 more measures with savings not shown.

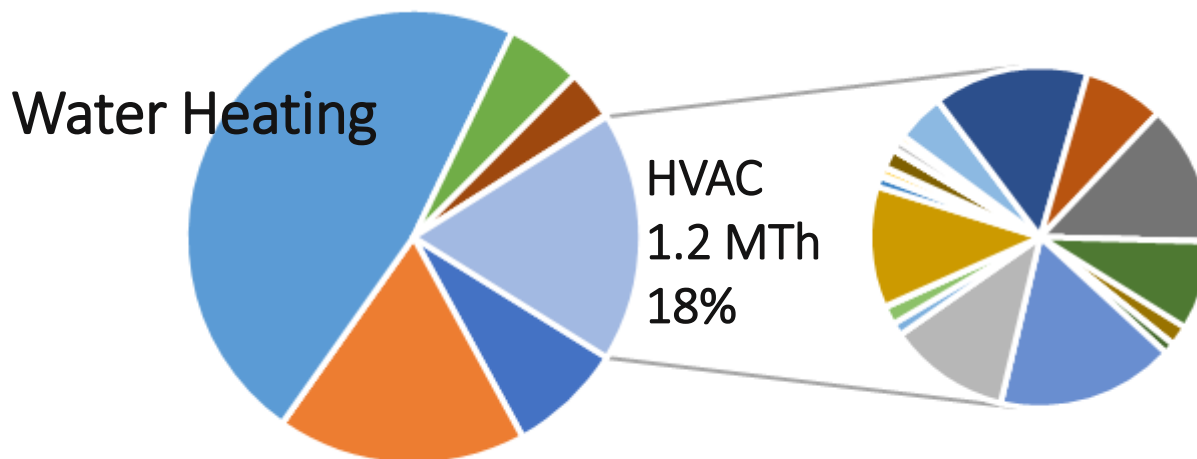
HVAC Gas Savings

(Source – 2017 Q1-Q3, IOU Claims Data)

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HVAC - Gas Savings by Measure

(Source - 2017 Q1-Q3 IOU Deemed Claims)
(negative gas from lighting removed, -4.2MTh)



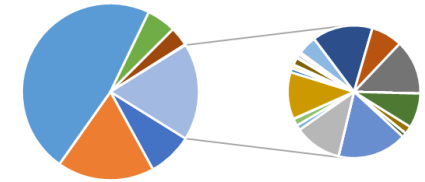
Note: “DEER Measures”, which includes some HVAC measures, was removed since it is only a small part (SDG&E – Refrig Charge Adjustment, VAV Box).

HVAC Gas Savings

(Source – 2017 Q1-Q3, IOU Claims Data)

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HVAC - Gas Savings by Measure
(Source - 2017 Q1-Q3 IOU Deemed Claims)
(negative gas from lighting removed, -4.2MTh)



Ref No	Name	Gross Therms	PGE	SCE	SCG	SDGE
5.03	Space Heating Boilers	203,869	131,218		72,651	
5.46	Programmable Communicating Thermostat for Demand Response	177,985	174,913			3,072
5.49	Enhanced Ventilation for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps	161,068	156,723	1,311		
5.06	Demand Controlled Ventilation for Single Zone Packaged HVAC	139,559	130,290	9,269		
5.15	Unoccupied Supply Fan Control	138,272	124,211	14,061		
5.52	Whole House - Residential	101,711	34,536	67,175		
5.47	Smart Thermostat	91,797	63,393		17,719	10,685
5.43	Multifamily Domestic Hot Water Temperature Reset Controller	55,749			55,749	
5.09	Res DuctTestSeal	14,603	6,052		4,321	4,230
5.02	Economizer Repair	12,644	9,122	3,522		
5.18	High Efficiency Furnaces - Residential	11,737			11,196	542
5.40	Upstream Residential HVAC	1,587	1,587			
5.19	High Efficiency Furnaces-Com	1,583	1,583			
5.11	Quality Installation for Residential Split Systems	1,027		1,027		
5.20	Gravity Wall Furnaces in Single-Family and Multi-Family Homes	252			252	
5.22	Variable Refrigerant Flow Commercial Heat Pumps & Heat Recovery Systems >65kBtu/h	14	14			

Note: “DEER Measures”, which includes some HVAC measures, was removed since it is only a small part (SDG&E – Refrig Charge Adjustment, VAV Box).

Eight (8) measures with negative gas savings, not shown.

Measure Consensus -

5.05 – Water Cooled Chillers

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● Offering

□ SCE workpaper (SCE13HC043.2, updated to SCE17HC043.x)

- ✦ Constant speed centrifugal chiller
 - 3 capacity sizes: ≥150 to <300 tons, ≥300 to <600 tons, ≥600 tons
 - 1 efficiency tier
- ✦ Variable speed centrifugal chiller
 - 3 capacity sizes: ≥150 to <300 tons, ≥300 to <600 tons, ≥600 tons
 - 2 efficiency tiers
- ✦ Screw / Scroll chillers
 - 3 capacity sizes: ≥75 to <150 tons, ≥150 to <300 tons, ≥300 tons
 - 2 efficiency tiers

□ Building Types

- ✦ Education - Community College
- ✦ Education - Secondary School
- ✦ Education - University
- ✦ Health/Medical - Hospital
- ✦ Health/Medical - Nursing Home
- ✦ Lodging - Hotel
- ✦ Manufacturing - Bio/Tech
- ✦ Office - Large
- ✦ Office - Small
- ✦ Retail - Multistory Large

□ HVAC Types: cWtd

□ Delivery: Upstream; ROB

□ Climate Zones: ~~6, 8, 9, 10, 13 – 16~~ (SCE); Includes all climate zones

Blue text = Changing and first time that item is mentioned
Italics text = Item that has not been completed

Measure Consensus -

5.05 – Water Cooled Chillers

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- Stage 1 Issues

- Offering:

- ✦ Climate zones seem to be limited to SCE territory

- Savings Methodology

- IPLV-Based eQUEST Methodology

- ✦ Cases in which the improved IPLV efficiencies, based on calculations using the standard eQUEST performance curves, translated to a FLE that did not meet Title 24 minimum FLE requirements

- Modified DEER approach

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Measure Consensus -

5.09 – Duct Test & Seal, Residential

● Offering

- ❑ Workpaper (PGE3PHVC159, R4)
- ❑ High Duct Leakage:
 - ✦ Base case description for High Duct Leakage:
 - 40% (20% Supply/20% Return) Leakage (single- and multi-family)
 - 35% Supply Leakage (mobile home)
 - ✦ Measure case description for High Duct Leakage Reduction:
 - Residential: Duct Sealing (Total Leakage Reduced from High (35/40%) to Low (15/12%)
 - (35% to 15% for mobile home and 40% to 12% for single- and multi- family)
- ❑ Medium Duct Leakage:
 - ✦ Base case description for Medium Duct Leakage:
 - 24% (12% Supply/12% Return) Leakage (single- and multi-family)
 - 25% Supply Leakage (mobile home)
 - ✦ Measure case description for Medium Duct Leakage Reduction:
 - Residential: Duct Sealing (Total Leakage Reduced from High (25/24%) to Low (15/12%)
 - (25% to 15% for mobile home and 24% to 12% for single- and multi- family)
- ❑ Building Types
 - ✦ Res: MFm, DMO, SFm
- ❑ HVAC Types
 - ✦ rDXGF
- ❑ Delivery: Upstream; RC (Retro-commissioning)
- ❑ Climate Zones: 1-5, 11-13, 16 (PG&E)

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Measure Consensus -

5.09 – Duct Test & Seal, Residential

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- Stage 1 Issues

- Offering:

- ✦ Climate zones seem to be limited to PG&E territory

- Savings Methodology

- DEER values

Measure Name	Impact ID
Residential: Duct Sealing (Total Leakage Reduced from (40/35%) to (12/15%))	Res-DuctSeal-HighToLow-wtd
Residential: Duct Sealing (Total Leakage Reduced from (25/24%) to (15/12%))	Res-DuctSeal-MedToLow-wtd

- Normalized units

- ✦ Translated from “Cap-Tons” to “per Household”
 - ✦ “Capacity values per Household” comes from EnergyImpacts_RB-HV-MHDuctSeal-25pct-15pct; EnergyImpacts_RB-HV-MFDuctSeal-40pct-12pct
 - Varies by BT and CZ (except DMO)

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Measure Consensus -

5.17 – Whole House Fan (WHF), Residential

● Offering

- ❑ Workpaper (SCE13HC005.2, PGECO HVC134 R2)
- ❑ Base case
 - ✦ Includes an HVAC system; however, does not include air-economizing
- ❑ Measure case
 - ✦ Requires that WHF be sized at least 2 cfm/sqft. of conditioned floor area
 - ✦ Have at least 1 sqft. of attic vent free area for each 375 cfm of rated WHF air flow
 - ✦ May include a control timer (e.g., 30 min. WHF operation) and/or a two speed controller (e.g., low fan speed and high fan speed).
- ❑ Building Types
 - ✦ Res: MFm, DMO, SFm
- ❑ HVAC Types
 - ✦ rDXGF
- ❑ Delivery: DI and Downstream; REA (Retrofit Add-On)
- ❑ Climate Zones: 6, 8, 9, 10, 13 – 16 (SCE)

Measure Consensus -

5.17 – Whole House Fan (WHF), Residential

- Stage 1 Issues

- Offering:

- ✦ Climate zones seem to be limited to SCE territory
 - ✦ Older version of PG&E workpaper can extend climate zones

- Savings Methodology

Measure Name	Impact ID
Whole house fan	D03-441

- Normalized units

- ✦ Translated from “1000 sqft” (measure area) to “per Household”

Climate Zone	Bldg. Type	Bldg. Vintage	Bldg. HVAC	Square Feet/Home	Num. Unit
6	DMo	Ex	rWtd	1,220	1.22
6	MFm	Ex	rWtd	1,000	1.00
6	SFm	Ex	rWtd	1,710	1.71

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Measure Consensus -

5.18 – High Efficiency Furnaces

● Offering

- ❑ Workpaper (PGECO HVC145 R3, PGECO HVC147 R3, WPSCGREHC130115A-Rev04)
- ❑ Common Offerings
 - ✦ Res-GasFurnace-AFUE95 (AFUE $\geq 95\%$ & $< 96\%$)
 - ✦ Res-GasFurnace-AFUE97 (AFUE $\geq 97\%$)
- ❑ PG&E Specific Offerings
 - ✦ Furnace with variable speed motor (VFD or ECM), only CZ11, 12, 13
- ❑ SCG Specific Offerings
 - ✦ Res-GasFurnace-AFUE92 (AFUE $\geq 92\%$ & $< 95\%$)
 - ✦ Res-GasFurnace-AFUE96 (AFUE $\geq 96\%$ & $< 97\%$)
- ❑ Building Types
 - ✦ Res: MFm, DMO, SFm
- ❑ HVAC Types
 - ✦ rWtd
- ❑ Delivery: DI and Downstream; ROB (PG&E) / ROBNC (SCG)
- ❑ Climate Zones: 1-16, IOU

Measure Consensus -

5.18 – High Efficiency Furnaces

- Stage 1 Issues

- Offering:

- ✦ SCG uses additional tiers
 - ✦ PG&E offers variable speed fan addition

- Savings Methodology

Measure Name	Impact ID
High efficiency furnace	Res-Furnace-dHIR

- Normalized units

- ✦ Translated from “cap-kBTUh” to “per Household”

- Motor calculations

- ✦ Based upon scaled values from a disposition from a high efficiency blower motor workpaper (PGECHVC139)
 - ✦ Calculates kWh, kW, and negative gas impact

Measure Consensus -

5.18 – High Efficiency Furnaces

● Stage 1 Issues

□ Offering:

- ✦ SCG uses additional tiers

SCG	PG&E	Measure Description	Number of Units	Gross Therms
540357		Central Gas Furnace 92% AFUE	7	169
540358	x	Central Gas Furnace 95% AFUE	237	6,338
530641		Central Gas Furnace 96% AFUE	85	2,805
530642	x	Central Gas Furnace 97% AFUE	54	1,885

□ Notes

- ✦ Not a large savings measures
- ✦ More savings could be claimed with additional offerings (like SCG), but equivalent of about 6% increase.

Measure Consensus -

5.24 – Unitary Air-Cooled A/C ≥ 65 kBTU/hr

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● Offering

- ❑ Workpaper (PGECOHC128 R9, SCE17HC035.0)
- ❑ Base case = Code
 - ✦ Standard Efficient EER/IEER Rated Packaged/Split Air Conditioner, 65kBtu/h or larger
- ❑ Measure case
 - ✦ High Efficient EER/IEER Rated Packaged/Split Air Conditioner, 65kBtu/h or larger
 - ✦ Split-package or Single-package units
 - ✦ Like for like; within 5% of existing capacity
- ❑ Capacity Ranges / Efficiency Tiers
 - ✦ ≥ 5.4 to < 11.3 tons; 4 tiers plus to-code offering
 - ✦ ≥ 11.3 to < 20 tons; 3 tiers plus to-code offering
 - ✦ ≥ 20 to < 63.3 tons; 3 tiers plus to-code offering
 - ✦ ≥ 63.3 tons; 3 tiers plus to-code offering
- ❑ Building Types
 - ✦ Com (weighted average commercial building type)
- ❑ HVAC Types
 - ✦ cDXGF
- ❑ Delivery: Upstream / Midstream; ROB and NC (PG&E)
- ❑ Climate Zones: 1-16, IOU

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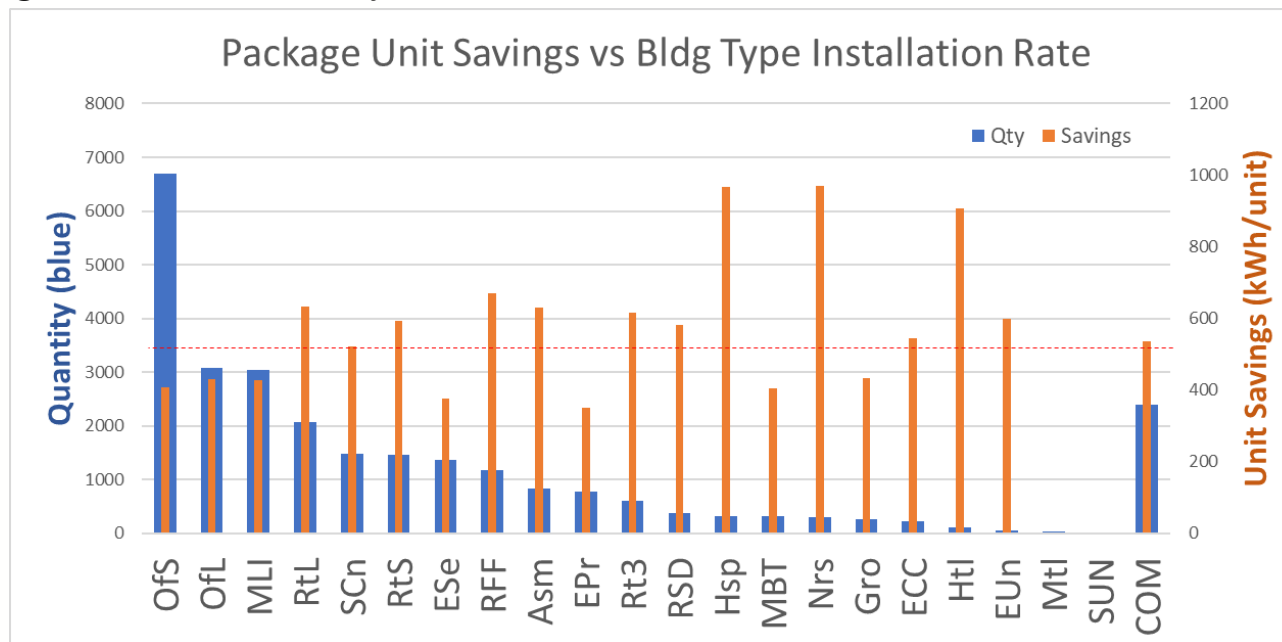
Measure Consensus -

5.24 – Unitary Air-Cooled A/C ≥65 kBTU/hr

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● Savings Methodology

- ❑ DEER savings are used directly
- ❑ Why is the weighted average building type savings used? Claims data still reports BT, so difference can be calculated.
- ❑ Simplified approach (only using one package unit savings / one CZ to get profile)
- ❑ Weighted value is very similar to COM value



Measure Consensus -

5.25 – Unitary Air-Cooled A/C <65 kBTU/hr

25

• Offering

- ❑ Workpaper (PGECOHC126 R7, SCE17HC012.0, WPSDGENRHC0023 R1)
- ❑ Base case = Code
 - ✦ Air cooled air conditioning or heat pump units with cooling capacities less than 65 kBTuh, for use in non-residential buildings, meeting the federal minimum efficiency standard of 14 SEER.
- ❑ Measure case
 - ✦ Air cooled air conditioning or heat pump units with cooling capacities less than 65 kBTuh, for use in non-residential buildings, meeting the minimum efficiency requirements
 - ✦ Packaged A/C, Split System A/C, Packaged HP, Split System HP
 - ✦ Like for like; within 5% of existing capacity
- ❑ Capacity Ranges / Efficiency Tiers
 - ✦ Packaged Air Conditioner
 - <55 kBTUh; 4 tiers plus to-code offering
 - 55 to <65 kBTUh; 4 tiers plus to-code offering
 - ✦ Split System Air Conditioner
 - <45 kBTUh; 4 tiers plus to-code offering
 - 45 to <55 kBTUh; 4 tiers plus to-code offering
 - 55 to <65 kBTUh; 4 tiers plus to-code offering
 - ✦ Packaged Heat Pump
 - <55 kBTUh; 4 tiers plus to-code offering
 - 55 to <65 kBTUh; 4 tiers plus to-code offering
 - ✦ Split System Heat Pump
 - <55 kBTUh; 4 tiers plus to-code offering
 - 55 to <65 kBTUh; 4 tiers plus to-code offering
- ❑ Building Types
 - ✦ Com (weighted average commercial building type)
- ❑ HVAC Types
 - ✦ cDXGF
- ❑ Delivery: Upstream / Midstream; ROB and NC (PG&E)
- ❑ Climate Zones: 1-16, IOU

Table 2: Minimum Efficiency Requirements

	Program Tier	Minimum SEER	Minimum EER
Packaged Air Conditioner	Code	14.0	11.6
	Tier 1	15.0	12.0
	Tier 2	16.0	12.4
	Tier 3	17.0	13.0
	Tier 4	18.0	14.0
Split System Air Conditioner	Code	14.0	12.0
	Tier 1	15.0	12.5
	Tier 2	16.0	13.0
	Tier 3	17.0	13.5
	Tier 4	18.0	14.0
Packaged Air Cooled Heat Pump	Code	14.0	11.6
	Tier 1	15.0	12.0
	Tier 2	16.0	12.4
	Tier 3	17.0	13.0
	Tier 4	18.0	14.0
Split System Air Cooled Heat Pump	Code	14.0	12.0
	Tier 1	15.0	12.5
	Tier 2	16.0	13.0
	Tier 3	17.0	13.5
	Tier 4	18.0	14.0

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Measure Consensus -

5.25 – Unitary Air-Cooled A/C <65 kBTU/hr

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● Savings Methodology

- ❑ DEER savings are used directly
- ❑ “To-Code” savings are calculated as follows:

To Code Savings Portion Measures

The To Code Savings Portion measures in this work paper are the savings from retrofitting customer existing equipment (various SEER values) to 14 SEER code-compliant equipment. The savings were determined by subtracting the “AStdWB” savings from the “APreWB” savings for 15 SEER ACs and HPs. The result was the difference between customer existing equipment and 14 SEER equipment. Measures savings (ROB, NEW) are attributed to the Upstream and Midstream HVAC programs.

Example: <55kBtuh To Code Savings Portion Packaged Air Conditioner, SCE, Assembly, CZ 06

DEER savings:

EnergyImpactID	APreWBkWh	APreWBkW	APreWBtherm	AStdWBkWh	AStdWBkW	AStdWBtherm
NE-HVAC-airAC-Pkg-lt55kBtuh-15p0seer	560	0.293	-3.12	129	0.0454	-1.2

kWh Savings = 560 - 129 = **431 kWh**

kW Reduction = 0.293 - 0.0454 = **0.2476 kW**

therm Savings = -3.12 - (-1.2) = **-1.92 therms**

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Questions...

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- Plans for next meeting

Back-up...

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HVAC “Types”: DEER Measure

- Step 1: From READi, download a Measure ID and savings
- Step 2: Reproduce savings for a few test cases (if you have correct version of MASControl, possible to reproduce)
- Step 3: Using MASControl, generate base case and measure case for all applicable permutations (Building Type, Climate zone)
 - Vintage and HVAC Type may be required
 - Save as documentation in eTRM
- Step 4: Identify key differences between base and measure case (HVAC measure and other parameters)
- Step 5: Prepare “Measure Summary” template
- Step 6: Seek subcommittee feedback (for Stage II) on Measure Summary template
 - “Correctness” of base and measure case
 - Identified sensitive parameters (perhaps this is area for more EM&V)
- Step 7: Review OpenStudio measures to see if measure could be re-run in EnergyPlus to compare with DOE 2.2/eQUEST results.

HVAC “Types”: “Roots” Within DEER Measure

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- Step 1: From READi, download a Measure ID and savings
- Step 2: Locate building simulation models (from all utilities with WP) and results
 - Probably with utility WP developer consultant
- Step 3: Compare base case and measure case for all applicable permutations (Building, Climate zone)
 - Save as documentation in eTRM
 - Likely many fewer permutations because “typical” vintage and “typical” HVAC type used
- Step 4: Identify key differences between base and measure case for an individual utility (HVAC measure and other parameters) for each utility model.
- Step 5: Compare utility modeling approaches across utilities: 1. base case models and 2. measure case models
 - Identify key differences between utility base cases and utility measure cases
- Step 6: Complete “Measure Summary” template
- Step 7: Seek subcommittee feedback (for Stage II) on
 - “Correctness” of base and measure case
 - Different approaches taken by each utility
 - Which utility approach is best and run preferred models to fill in gaps throughout state
 - Identified sensitive parameters (perhaps this is area for more EM&V)
- Step 6: Review OpenStudio measures to see if measure could be re-run in EnergyPlus to compare with DOE 2.2/eQUEST results.

HVAC Types: Non-DEER HVAC Measure

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- Same approach as used for other non-HVAC measures, examples
 - Review RCT
 - Review savings calculation
 - Etc.