HVAC Overview Plan

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Parallel Path Approach – eTRM / HVAC

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(source 2017, Q1-Q3 IOU Claims Data)		Gross kWh				Gross Therms			
Ref No	Name	PGE	SCE	SCG	SDGE	PGE	SCE	SCG	SDGE
5.01	Economizer Controls	406,088	150,130			(135)	2		
5.02	Economizer Repair	679,997	2,024,022			9,122	3,522		
5.03	Space Heating Boilers	(46,133)		75,066		131,218		72,651	
5.05	Water-Cooled Chillers		1,071,870				-		
5.06	Demand Controlled Ventilation for Single Zone Packaged HVAC	210,666	478,081			130,290	9,269		
5.07	VFD Demand Control System Retrofit to Parking Structure Exhaust Fan		886,648				-		
5.09	Res DuctTestSeal	56,299		84,744	87,493	6,052		4,321	4,230
5.10	Residential HVAC Quality Maintenance and Motor Retrofit	3,661,735	204,453		178,525	(22,649)	3,208		(1,347)
5.11	Quality Installation for Residential Split Systems		148,387				1,027		
5.13	Efficient Fan Controller for Residential Air Conditioners	2,474,047	2,394,509		72,185	-	-		-
5.14	VFD Retrofit to Central Plant Systems		2,484,678				-		
5.16	Unoccupied Supply Fan Control	2,113,409	924,697			124,211	14,061		
5.18	High Efficiency Furnaces 92 AFUE (1.08 HIR), 95 AFUE (1.05 HIR), 96 AFUE (1.04 HIR), and 97 AFUE (1.03 HIR) - Residential			-	-			11,196	542
5.19	High Efficiency Furnaces-Com	2,064				1,583			
5.20	Gravity Wall Furnaces in Single-Family and Multi-Family Homes			-				252	
5.22	Variable Refrigerant Flow Commercial Heat Pumps & Heat Recovery Systems >65kBtu/h	6,462				14			
5.24	Unitary Air-Cooled Commercial Air Conditioners and Heat Pumps >=65 kBtu/h	1,736,774	322,188		1,833	-	-		-
5.25	Unitary Air Cooled Commercial Air Conditioning and Heat Pump Units Under 65 kBtuh	856,208	395,891		54,665	(7,441)	(2,243)		(222)
5.26	Unitary Water and Evaporatively Cooled Air Conditioners	36,400				-			
5.27	High Efficiency Package Terminal Air Conditioners & Heat Pumps 24kBtu/h (2 tons) and under		232,306				-		
5.30	Refrigerant Charge	164,420	732,081		536,566	-	-		(292)
5.31	Evaporator Coil Cleaning	33,246	243,625			-	-		
5.32	Commercial Condenser Coil Cleaning	66,164	490,331		1,482,943	-	-		-
5.34	Window Evaporative Coolers		282,331				(21,489)		
5.35	Direct Evaporative Coolers, Res		8,868				-		
5.36	Direct-Indirect Evaporative Coolers		281,595				-		
5.39	Air-Cooled Packaged Chiller	100,295	1,516,405			-	-		
5.40	Upstream Residential HVAC	16,565				1,587			
5.41	Variable Speed Drive on HVAC Fan Control	2,223,110	1,308,980			(6,512)	(3,717)		
5.42	Brushless Fan Motor for Residential Central AC		1,638,174				(7,343)		
5.43	MultiFamily Domestic Hot Water Temperature Reset Controller			-				55,749	
5.45	Guest Room PTAC/PTHP Energy Management System	7,599,985				-			
5.46	Programmable Communicating Thermostat for Demand Response	1,218,918			14,508	174,913			3,072
5.47	Smart Thermostat	487,369		230,512	166,891	63,393		17,719	10,685
5.49	Enhanced Ventilation for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps	1,740,763	1,422,159			156,723	1,311		
5.50	Cogged V-Belt Non-Residential HVAC Fans	42,531	400,301			-	-		
5.51	Water Source Heat Pumps	529,534				(90)			
5.52	Duct Leakage	290,621	3,169,595			34,536	67,175		
5.54	DEER Measures		26,741	268,956	2,308,803		-	426,770	131,081

Q2'18 | **Q3'18** | **Q4'18** | **Q1'19** | **Q2'19**

Path 1: HVAC Measure Consolidation

- Q2'18: - Create structure
- Q3'18: - Consolidate 50+ HVAC Measures
- Q4'18: - Affirmation of 50+ HVAC Measure for eTRM

Path 2: HVAC Measure Analysis and Evolution

- Q2'18: - Stakeholder Feedback on Measure Summary Template
- Q3'18: - Complete 50+ Measures Summaries; - HVAC Modelling Charette
- Q4'18: - Feedback on existing Measures
- Q1'19: - Sensitivity analyses; - Prototype comparison
- Q2'19: - Develop & validate/ compare modelling approach

Questions at end...

Process

- Start: Approximately 55 HVAC measures
- Review and group
  - Subcommittee reviews measure groupings
  - Break subcommittee into two (res and non-res; QI/QM; other(s))
- Develop HVAC Measure Summary
  - Include:
  - 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.)

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

- 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

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

Questions for Cal TF

- 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 . . .?

Questions that Cal TF will be asked

- Are the prototype savings reasonably modeled, do they 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?

Other tasks

- Subcommittee feedback
  - Cost documentation
  - Implementation Support Tables
  - Review savings/TRC comparison (current vs. 2017 claims data)
  - Preponderance of evidence

Initial HVAC Structure

CALIFORNIA TECHNICAL FORUM

(source 2017, Q1-Q3 IOU Claims Data)		Gross kWh				Gross Therms			
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