

Commercial Refrigeration Subcommittee Meeting #3



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AUGUST 2017

Agenda

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- Materials:
 - Com Refrig, Sub Comm Mtg 3 – r2.xls
 - Technology Summary - 1.0 Comm Refrig r3.2.xls
- Miscellaneous
 - Missing savings values
 - ✦ Email on Good / Mixed / Bad News
 - ✦ 1.04, Auto Door Closer – no modelled savings for CZ07
 - Averaged from other climate zones – Agreement (AS/SCE)
 - 1.07, Night Covers – DEER savings vary by:
 - ✦ Climate Zone
 - ✦ PA
- Refrigeration Controls Measure Structure
- EC Motor Retrofit Measure Structure
- Display Cases

Refrigeration Controls

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Refrigeration Controls

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- Looking for agreement on:
 - Process Controls
 - ✦ Recommendation: Remove process refrigeration controls measures and reconsider these for the Process Category.
 - Measure Break-Up
 - ✦ Recommendation: Create separate measures for FHP-Multiplex, Suction-Multiplex, FHP-Single Compressor.
 - Impact due to Climate Zone is significant.
 - ✦ Recommendation: Savings vary by 26-50% for kWh and 20-30% for therms. DEER presents these modeled values already, so Statewide implementation is straightforward.
 - Impact due to Building Vintage is significant.
 - ✦ Recommendation: To capture savings accurately, Vintage should be included if it is the best representation of the sensitive variables that are truly driving savings variation.
 - Control Strategy Averaging
 - ✦ Recommendation: Use the distinction of control strategy. Do not average savings from multiple types.

Refrigeration Controls

SCE17RN023.0

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- **Floating Head Pressure:**

- RF-31355: **Floating head pressure** control for comm. **air-cooled, multiplex** refrigeration systems.
 - ✦ DEER ID: D03-221: Fixed SCT = 70°F
 - ✦ DEER ID: **D03-223**: Control SCT to ambient + 12°F TD, 70°F min, backflood setpoint of 68°F
 - ✦ DEER ID: **D03-225**: Control SCT to ambient + 12°F TD, 70°F min, backflood setpoint of 68°F, variable-speed fan control
- RF-41488: **Floating head pressure** control for comm. **evap-cooled, multiplex** refrigeration systems.
 - ✦ DEER ID: D03-222: Fixed SCT = 70°F
 - ✦ DEER ID: **D03-224**: Control SCT to wetbulb + 17°F TD, 70°F min, backflood setpoint of 68°F
 - ✦ DEER ID: **D03-226**: Control SCT to wetbulb + 17°F TD, 70°F min, backflood setpoint of 68°F, variable-speed fan control
- RF-40395: **Floating head pressure** control for **process, evap-cooled** refrigeration systems.
 - ✦ DEER ID: D03-307: Fixed SCT = 70°F, backflood setpoint of 68°F
 - ✦ DEER ID: D03-308: Control SCT to wetbulb + 9°F TD, 70°F min, backflood setpoint of 68°F
 - ✦ DEER ID: D03-309: Control SCT to wetbulb + 9°F TD, 70°F min, backflood setpoint of 68°F, var-speed fan control

- **Suction Control**

- RF-51222: DEER ID: **D03-220**: **Multiplex system, air-cooled condenser, reset SST** based on worst-case demand
- RF-20965: DEER ID: D03-306: **Process, Reset SST** based on worst-case zone demand

Refrigeration Controls

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- Process Controls

- Recommendation: Remove process refrigeration controls measures and reconsider these for the Process Category.
- Concerns / Agreement:
 - ✦ May not get the same professional expertise reviewing measure if moved from this group.
 - ✦ Process refrigeration seems like custom rather than deemed realm.
 - ✦ Why separate? Does this mean that we want to separate refrigerated warehouse from retail stores?

Refrigeration Controls

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- Measure Break-Up
 - Recommendation: Create separate Measures:
 - ✦ Floating Head Pressure Control, Multiplex Systems
 - ✦ Suction Control, Multiplex Systems
 - ✦ Floating Head Pressure Control, Single Compressor Systems
 - This is a structural question for the eTRM. Currently separated for PG&E, but combined for SCE.
 - Separation allows for a clearer description of the Measure.

Refrigeration Controls – Climate Zone

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- Impact due to Climate Zone is significant.
 - Recommendation: Savings vary by 26-50% for kWh and 20-30% for therms. DEER presents these modeled values already, so Statewide implementation is straightforward.

Std Dev Due to Climate Zone

		PGE		SCE		SCG		PGE-vfd	
Ref	BldgType	kWh	therms	kWh	therms	kWh	therms	kWh	therms
AC, Multiplex	Gro	404	0.16	151	0.07			310	0.15
EC, Multiplex	Gro	651	0.15	277	0.06			622	0.15
Floating SST	Gro	73	0.01	43	0.01				
Process, EC FHP	Gro			89	-				
Process, SST	Gro			92	-				
(blank)	Gro					-	0.11		

Percent Difference Due to Climate Zone

		PGE		SCE		SCG		PGE-vfd	
Ref	BldgType	kWh	therms	kWh	therms	kWh	therms	kWh	therms
AC, Multiplex	Gro	41%	29%	15%	29%			19%	29%
EC, Multiplex	Gro	50%	30%	20%	25%			44%	29%
Floating SST	Gro	26%	20%	12%	20%				
Process, EC FHP	Gro			6%					
Process, SST	Gro			16%					

Refrigeration Controls – Climate Zone

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Raw Values

BldgLoc	BldgType	BldgVint	kWh
CZ01	Gro	1975	1,818
		1985	1,836
		1996	1,502
		2003	1,039
		2007	557

BldgLoc	BldgType	kWh
CZ01	Gro	1,350

Average of Climate Zones

BldgLoc	BldgType	kWh
CZ01	Gro	1,350
CZ02	Gro	995
CZ03	Gro	1,026
CZ04	Gro	880
CZ05	Gro	1,095
CZ06	Gro	
CZ08	Gro	
CZ09	Gro	
CZ10	Gro	
CZ11	Gro	761
CZ12	Gro	852
CZ13	Gro	762
CZ14	Gro	
CZ15	Gro	
CZ16	Gro	1,054

- Average of CZ

- Standard Deviation of CZ

Ref	BldgType	kWh
AC, Multiplex	Gro	404

- % Difference Due to
Standard Deviation of CZ
= $404 / (\text{Average of CZs}) = 41\%$

Ref	BldgType	kWh
AC, Multiplex	Gro	41%

Refrigeration Controls - Vintage

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- Impact due to Building Vintage is significant.
 - Recommendation: To capture savings accurately, Vintage should be included if it is the best representation of the sensitive variables that are truly driving savings variation.
 - What does change between Vintage Prototype models?
 - Note: DEER does not represent values with vintages directly in READi; these would need to be re-run through MASControl to make the measure available statewide.

Average Difference Across Climate Zones

	PGE		PGE-vfd	
	kWh	therms	kWh	therms
AC, Multiplex	40%	21%	12%	20%
EC, Multiplex	54%	23%	47%	22%
Floating SST	28%	11%	#DIV/0!	#DIV/0!

Refrigeration Controls - Vintages

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Raw Values

BldgLoc	BldgType	BldgVint	kWh
CZ01	Gro	1975	1,818
		1985	1,836
		1996	1,502
		2003	1,039
		2007	557

Average of Vintages

BldgLoc	BldgType	kWh
CZ01	Gro	1,350

Standard Deviation of Vintages

BldgLoc	BldgType	kWh
CZ01	Gro	548

% Difference Due to Standard Deviation of Vintages

$$= 548 / 1,350 = 41\%$$

BldgLoc	BldgType	kWh
CZ01	Gro	41%

BldgLoc	BldgType	kWh
CZ01	Gro	41%
CZ02	Gro	40%
CZ03	Gro	45%
CZ04	Gro	41%
CZ05	Gro	43%
CZ06	Gro	
CZ08	Gro	
CZ09	Gro	
CZ10	Gro	
CZ11	Gro	36%
CZ12	Gro	40%
CZ13	Gro	36%
CZ14	Gro	
CZ15	Gro	
CZ16	Gro	37%

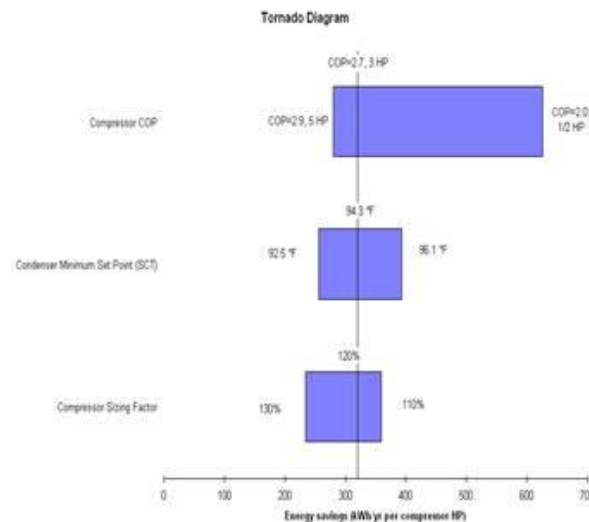
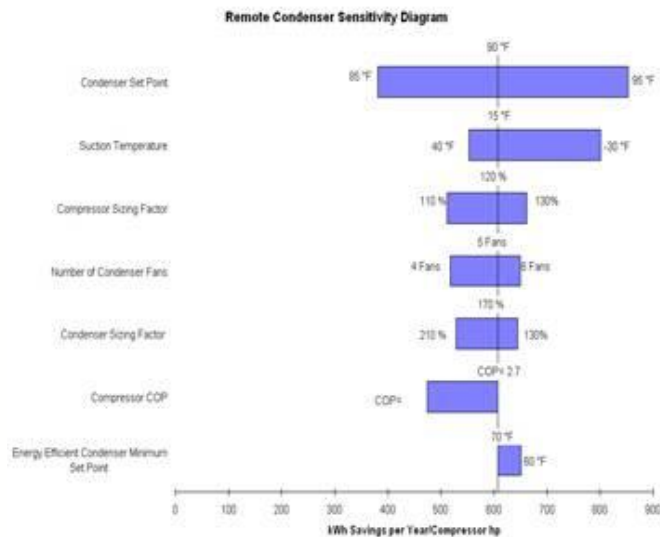
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	PGE		PGE-vfd	
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Refrigeration Controls - Vintage

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- Impact due to Building Vintage is significant.
 - Recommendation: To capture savings accurately, Vintage should be included if it is the best representation of the sensitive variables that are truly driving savings variation.
 - What are those variables?



Refrigeration Controls - Vintage

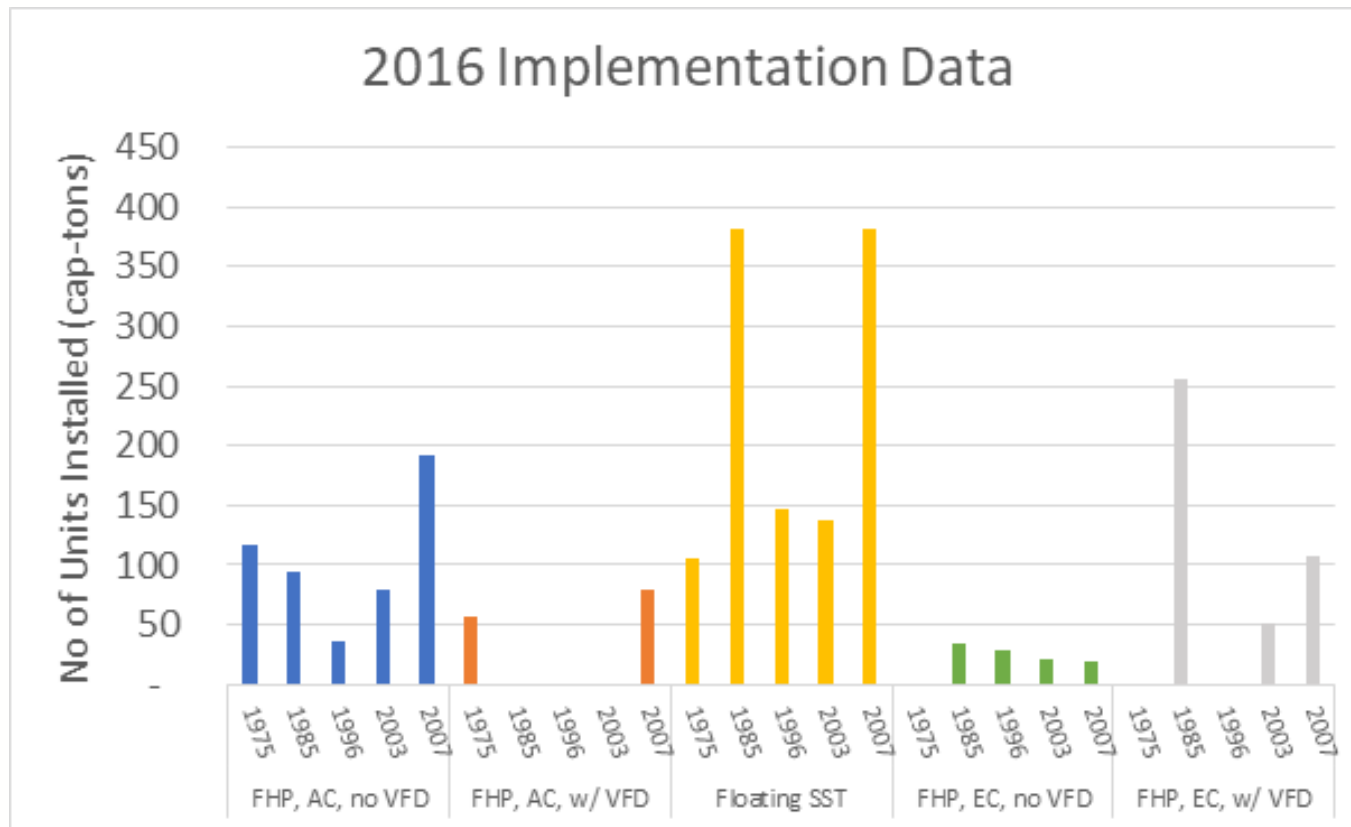
13

- Impact due to Building Vintage is significant.
 - Recommendation: To capture savings accurately, Vintage should be included if it is the best representation of the sensitive variables that are truly driving savings variation.
 - What are those variables?
 - What are the differences between vintage prototype models?
 - Can information be collected effectively?
 - Any vintages preferentially used for these measure
 - ✦ See bar graph

Refrigeration Controls - Vintage

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- Impact due to Building Vintage is significant.
 - Any vintages preferentially used for these measure



Refrigeration Controls

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- Control Strategy Averaging
 - Recommendation: Use the distinction of control strategy. Do not average savings from multiple types.

Average Savings

	w/o VFD		w/ VFD		<u>% kWh</u>	<u>% thm</u>
	kWh	therms	kWh	therms	<u>Diff</u>	<u>Diff</u>
AC, Multiplex	975	0.53	1,672	0.54	-71%	-2%
EC, Multiplex	1,305	0.49	1,419	0.25	-9%	49%
Floating SST	283	0.06				

EC Motor Retrofits

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EC Motor Retrofits

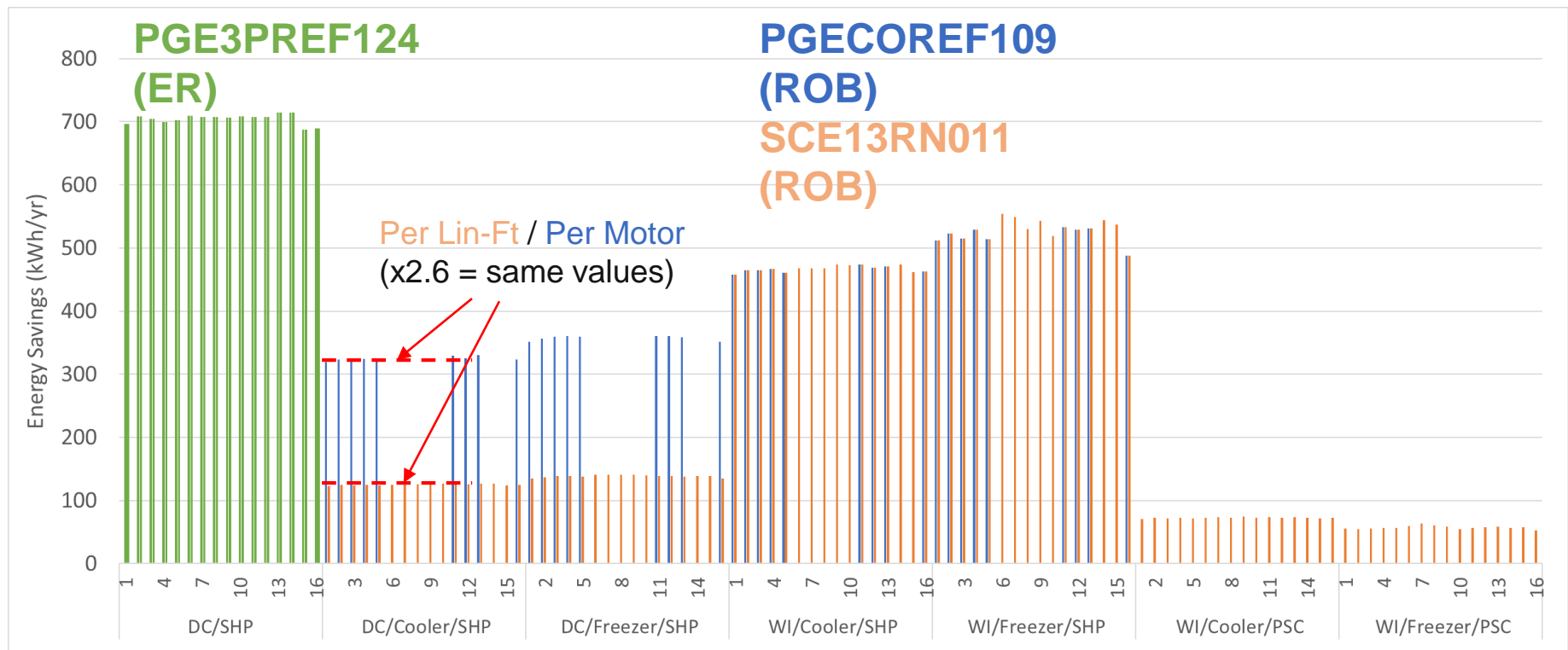
17

- Permutation Collapse due to Climate Zone
 - 1-3% for SHP baseline motors
 - Note that PSC motor baseline is not be used currently.
 - ✦ Agreed to remove?
- Permutation Collapse due to Offering
 - 7-9% for Display Cases and Walk-Ins
- Best Available Market Data for Display Case motor sizes
- Consensus on:
 - Phase 1 - now
 - Phase 2 - future

EC Motor Retrofit Options

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- 3 Workpapers to consolidate
 - Display Case (DC) / Walk-In (WI)
 - Freezer / Cooler
 - Shaded Pole (SHP) / Permanent Split Capacitor (PSC)



EC Motor Retrofit Options

- Notes:

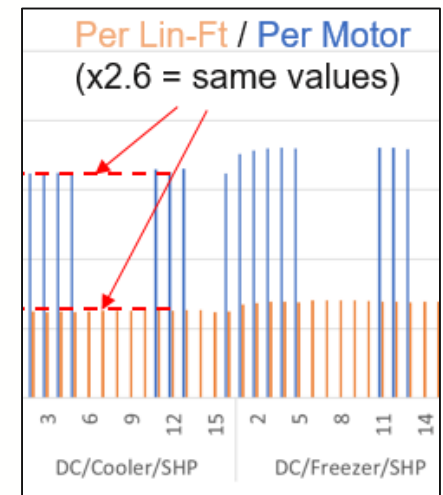
- Variation due to Climate Zone is minimal

- ✦ Savings = per motor
 - ✦ % Std Dev = Std Dev / Ave kWh
 - ✦ Therefore, consider collapsing values

Description	Avg kWh	Std Dev	% Std Dev
DC/Cooler/SHP	325	3.0	1%
DC/Freezer/SHP	360	4.3	1%
WI/Cooler/SHP	467	4.7	1%
WI/Freezer/SHP	528	16.2	3%
WI/Cooler/PSC	73	0.9	1%
WI/Freezer/PSC	57	2.6	5%
DC/SHP	704	7.8	1%

- Difference in Unit of Measure shows an inconsistency for:

- ✦ DC/Freezer/SHP and DC/Cooler/SHP
 - ✦ However, 2.6 ft/DC * SCE Value = PG&E Value
 - ✦ Therefore, no actual difference in savings



EC Motor Retrofit Recommendation

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- Phase 1: No savings values would change
 - The basis for savings already exists in all cases
 - Create 2 Measures for:
 - ✦ Display Case EC Motor Retrofit
 - ✦ Walk-In EC Motor Retrofit
 - Use ROB methodology from **PGECOREF109 & SCE13RN011**
 - ✦ Norm Unit = per motor
 - ✦ *For **both** Display Cases and Walk-Ins*
 - Add ER/(Accelerated Replacement) methodology from **PGE3PREF124**
 - ✦ Norm Unit = per motor
 - ✦ *For Display Cases only*

EC Motor Retrofit Recommendation

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- Phase 2 (future):
 - Display Case and Walk-In
 - ✦ Collapse savings values
 - ✦ Still maintain all savings values for climate zone, but average results (weighted average is preferable – **how?**)
 - Walk-In Only
 - ✦ Methodology changed to follow PGE3PREF126
 - ✦ Norm Unit = Rated-HP (**instead of “per motor”**)

Display Case Measures

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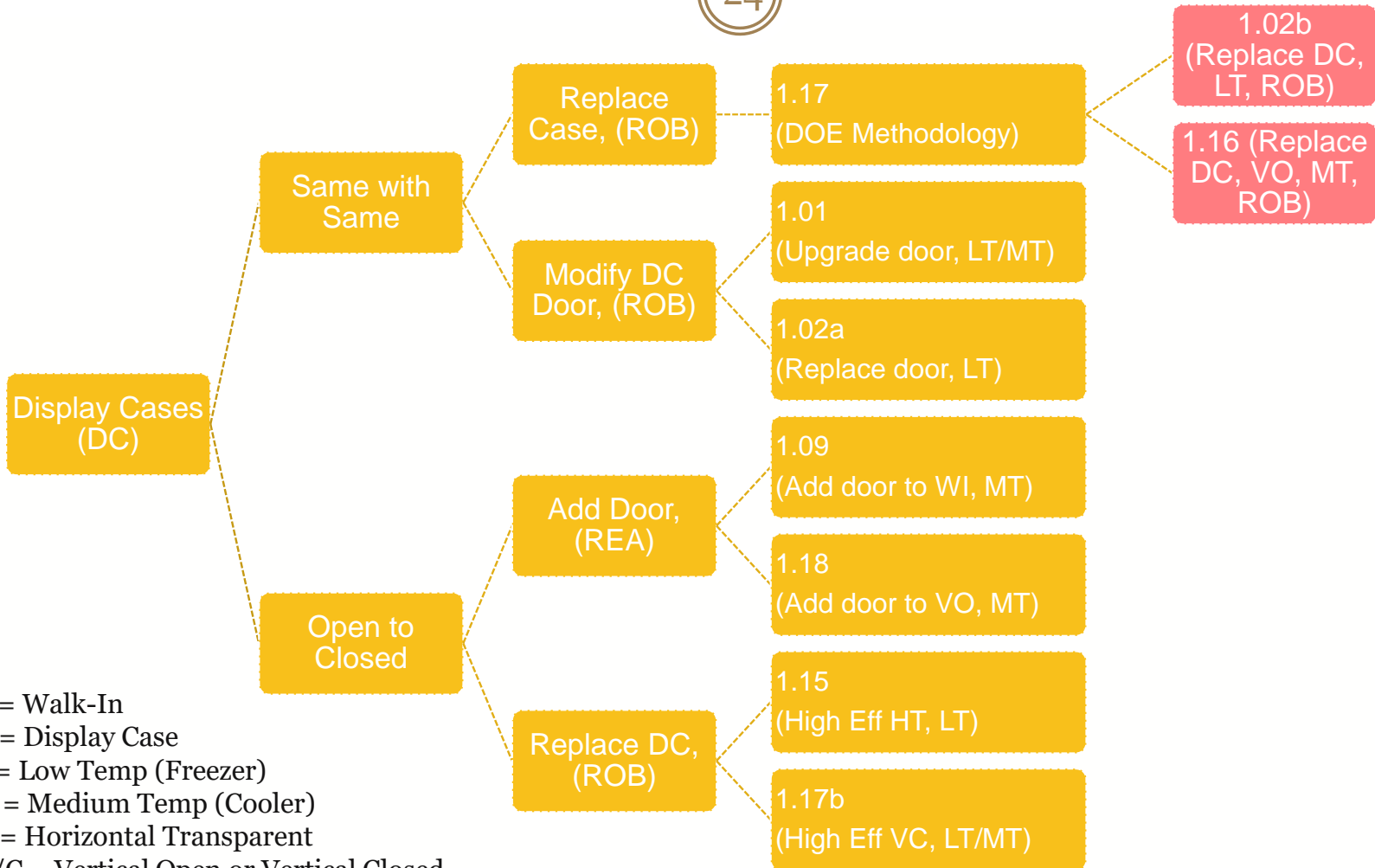
Display Case Measures

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- Measures recommended as overlapping:
 - 1.02b, Anti-Sweat Heater Display Doors
 - ✦ Review PG&E comment
 - 1.16, Medium Temp Open Case Retrofit
 - ✦ Agreement to remove
- Display case options not captured in the tree?
- Is 1.17a (SCE workpaper SCE17RN028.0) the correct methodology to use for like-for-like display case replacements?

Display Case Tree

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WI = Walk-In
 DC = Display Case
 LT = Low Temp (Freezer)
 MT = Medium Temp (Cooler)
 HT = Horizontal Transparent
 VO/C = Vertical Open or Vertical Closed
 Red Boxes = Overlapping measures to be removed

1.17 Display Cases w/ Doors (SCE approach)

Source: DOE rule
making [A], Table 3.2.5
Commercial
Refrigeration Equipment
Classes

Commercial Refrigeration

Equipment Family	Equipment Family Designation	Sample Equipment Family Image	Operating Mode Designation	Temperature Designation	Operating Temp.	Equipment Class Designation	
Vertical Open	VOP		Remote Condensing (RC)	M (38 °F)	≥32 °F	VOP.RC.M	
Semi vertical Open	SVO			M (38 °F)	≥32 °F	SVO.RC.M	
Horizontal Open	HZO			L (0 °F)	<32 °F	HZO.RC.L	
Vertical Closed Transparent	VCT			M (38 °F)	≥32 °F	VCT.RC.M	
				L (0 °F)	<32 °F	VCT.RC.L	
Horizontal Closed Transparent	HCT		Self-Contained (SC)	L (0 °F)	<32 °F	HCT.SC.L	
				I (-15 °F)	≤-5 °F	HCT.SC.I	
Horizontal Closed Solid	HCS			M (38 °F)	≥32 °F	HCS.SC.M	
Pull-Down	PD			M (38 °F)	≥32 °F	PD.SC.M	