

# Commercial Refrigeration and HVAC Updates






**AYAD AL-SHAIKH**  
**APRIL 2019**

# Overview

## Final Measure List

2

No.	Measure Names	Plan	PG&E	SCE	SDG&E	SCG	POU	Owner	Month
1.01	Anti-Sweat Heater (ASH) Controls	2019						SCE	April
1.02a	Replace Anti-Sweat Heater Display Case	Dup	Overlap with 1.17a						
1.02b	Replace Anti-Sweat Heater Display Doors	2019						SCE	April
1.03a	Display Case EC Motor Retrofit	2019						SCE	April
1.03b	Walk-In EC Motor Retrofit	2019						SCE	April
1.04	Refrigerated Storage Auto Closer	2019						SCE	April
1.05	Walk-in Cooler/Freezer & Refrig Storage Evap Control	2019						POU	POU-only
1.06a	Floating Head Pressure Controls - Multiplex Systems	2019						SCE	April
1.06b	Suction Controls - Multiplex Systems	2019						SCE	April
1.07	Refrigeration Night Covers	2019						POU	POU-only
1.08	Bare Refrigeration Line Insulation	2019						SCE	Dec-2018
1.09	Add Doors to Walk-in Cooler	2019						POU	POU-only
1.10	Compressor Retrofit: Multiplex	2019						PG&E	May
1.11	Display Case ECM Motor Retrofit	Dup	Consolidate with 1.03a						
1.12	Efficient Condenser: Air-Cooled to Evap	Sunset	Hold - Sunset						
1.13	Efficient Condenser: Multiplex	Sunset	Hold - Sunset						
1.14	Floating Head Pressure Controls - Single Compressors	2019						POU	POU-only
1.15	Low Temp Coffin to Reach-In	2019	Hold - Baseline Change						PG&E May
1.16	Medium Temp Open Case Retrofit	2019	Overlap with 1.17a						PG&E May
1.17a	Display Case Replacement - Like for Like	2019						SCE	April
1.17b	Display Case Replacement - Open to Closed	2019	Hold - Baseline Change						PG&E May
1.18	Add Medium Temp Case Doors	2019						PG&E	May
1.19	Adaptive Refrigerator and Freezer Controls	2019						POU	POU-only
1.20	Strip curtain infiltration barrier for refrigerated space	Sunset	Hold - Sunset						
1.21	Ultra Low Temperature Freezer	2019	New Workpaper						PG&E April
1.22	Commercial Reach-In Refrigerators and Freezers	2019						PG&E	Nov-2019

	Lead Workpaper
	Support Workpaper
	Blue Text – Updated info

# Overview

## Final Measure List

No.	Measure Names	Plan	PG&E	SCE	SDG&E	SCG	POU	Owner	Month
1.01	Anti-Sweat Heater (ASH) Controls	2019						SCE	April
1.02a	Replace Anti-Sweat Heater Display Case	Dup	Overlap with 1.17a						
1.02b	Replace Anti-Sweat Heater Display Doors	2019						SCE	April
1.03a	Display Case EC Motor Retrofit	2019						SCE	Retire
1.03b	Walk-In EC Motor Retrofit	2019						SCE	Retire
1.04	Refrigerated Storage Auto Closer	2019						SCE	April
1.05	Walk-in Cooler/Freezer & Refrig Storage Evap Control	2019						POU	POU-only
1.06a	Floating Head Pressure Controls - Multiplex Systems	2019						SCE	April
1.06b	Suction Controls - Multiplex Systems	2019						SCE	April
1.07	Refrigeration Night Covers	2019						POU	POU-only
1.08	Bare Refrigeration Line Insulation	2019						SCE	Dec-2018
1.09	Add Doors to Walk-in Cooler	2019						POU	POU-only
1.10	Compressor Retrofit: Multiplex	2019						PG&E	May
1.11	Display Case ECM Motor Retrofit	Dup	Consolidate with 1.03a						
1.12	Efficient Condenser: Air-Cooled to Evap	Sunset	Hold - Sunset						
1.13	Efficient Condenser: Multiplex	Sunset	Hold - Sunset						
1.14	Floating Head Pressure Controls - Single Compressors	2019						POU	POU-only
1.15	Low Temp Coffin to Reach-In	2019	Hold - Baseline Change					PG&E	May
1.16	Medium Temp Open Case Retrofit	2019	Overlap with 1.17a					PG&E	May
1.17a	Display Case Replacement - Like for Like	2019						SCE	April
1.17b	Display Case Replacement - Open to Closed	2019	Hold - Baseline Change					PG&E	May
1.18	Add Medium Temp Case Doors	2019						PG&E	May
1.19	Adaptive Refrigerator and Freezer Controls	2019						POU	POU-only
1.20	Strip curtain infiltration barrier for refrigerated space	Sunset	Hold - Sunset						
1.21	Ultra Low Temperature Freezer	2019	New Workpaper					PG&E	April
1.22	Commercial Reach-In Refrigerators and Freezers	2019						PG&E	Nov-2019




About +7 / +10% kWh

About -10% kWh

No savings

About +87% kWh

Likely down since eligible up to 2011

 Lead Workpaper  
 Support Workpaper  
 Blue Text – Updated info

# HVAC Measure Planning

4

- See Excel Sheet...
  - Commercial / Residential
  - Trends in savings from 2016 through 2018
  - Which measures may be going away because:
    - ✦ Out-dated measure, but low/no savings
    - ✦ Code / ISP concern

# Likely to Sunset

5

## Low / No Savings, but Significant Effort to Update

- 5.28, Ductless AC, < 24 kBTU/h, Comm
- 5.53, Ductless Air Conditioner, Under 60 kBTU/hr
- 5.51, Water Source Heat Pumps (D03)
- 5.44, Adaptive Climate Controller for Guest Room PTAC or PTHP (relies upon D03 code for savings)
- 5.23/5.26 – Evaporative Condenser – (D03)
- 5.34 – Window Evaporative Coolers – (D03)
- 5.35 – Direct Evaporative Coolers, Res (D03)
- 5.36 – Direct-Indirect Evap Coolers, Res (D03)
- 5.11 – Quality Install for Res Split Systems & Package Systems (low savings but requires remodeling)
- 5.27 – High Efficiency PTAC & HP (<2 tons) (D03)
- 5.29 – Air Filter Replace w/ Alarm (low savings but require analysis)
- 5.55 – HP Elect Resistance Heater Cntrls, Res

## Code / ISP -> Low savings

### HVAC

- 5.45, Energy Management System for Guest Room PTAC or PTHP
- 5.46, Programmable Communicating Thermostat for Demand Response, Commercial
- 5.14, [VFD Retrofit to Central Plant System \(Cooling Tower offering\)](#)
- 5.07, VFD Demand Control System Retrofit to Parking Structure Exhaust Fan

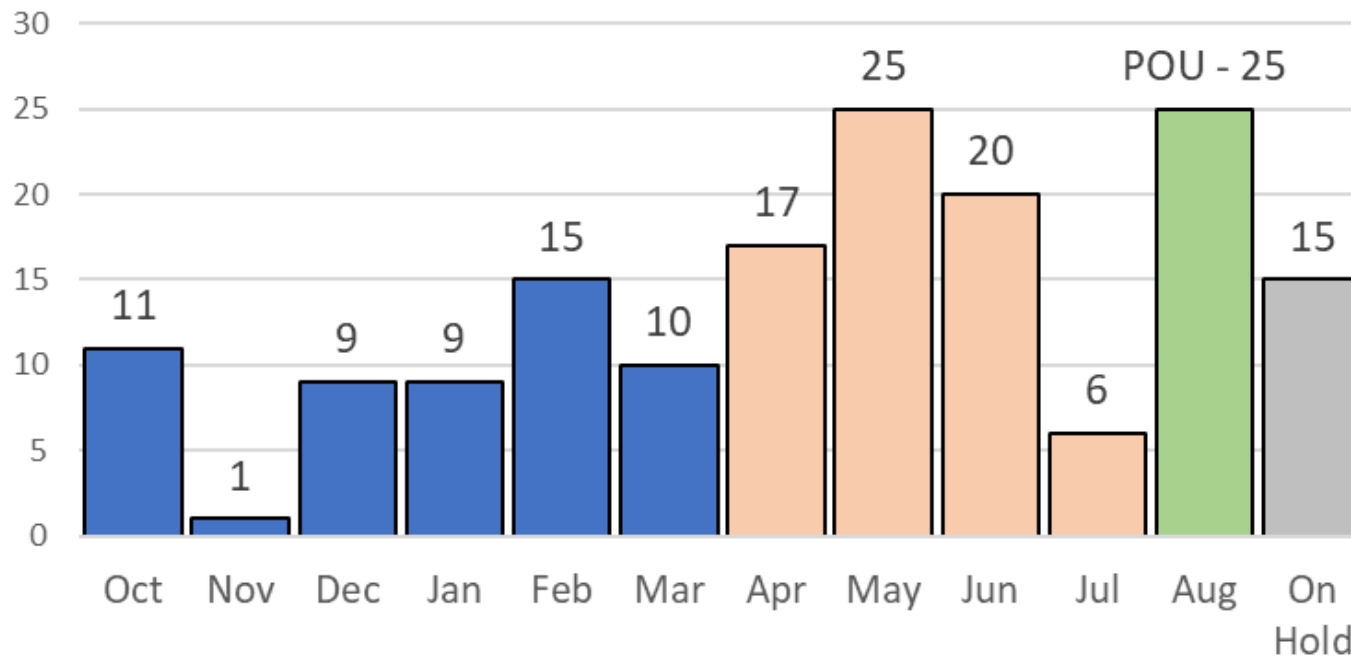
### Commercial Refrigeration

- 1.05 - [Walk-in Cooler Evaporative Fan Cycling and VFD Control](#)
- 1.03a and 1.03b - Evaporator Fan Motors

# Statewide Measures

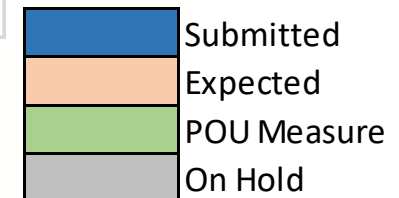
6

## Statewide Measure Submittal



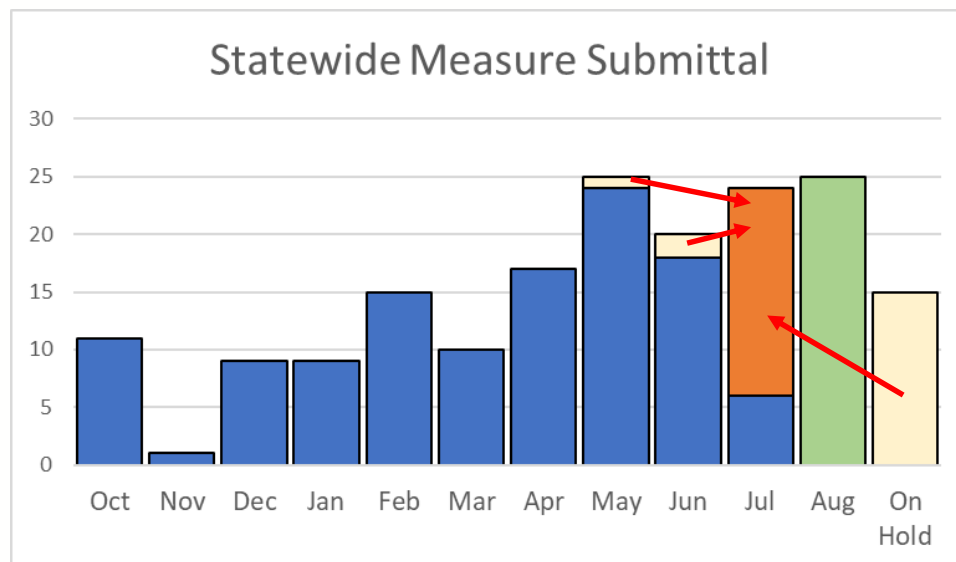
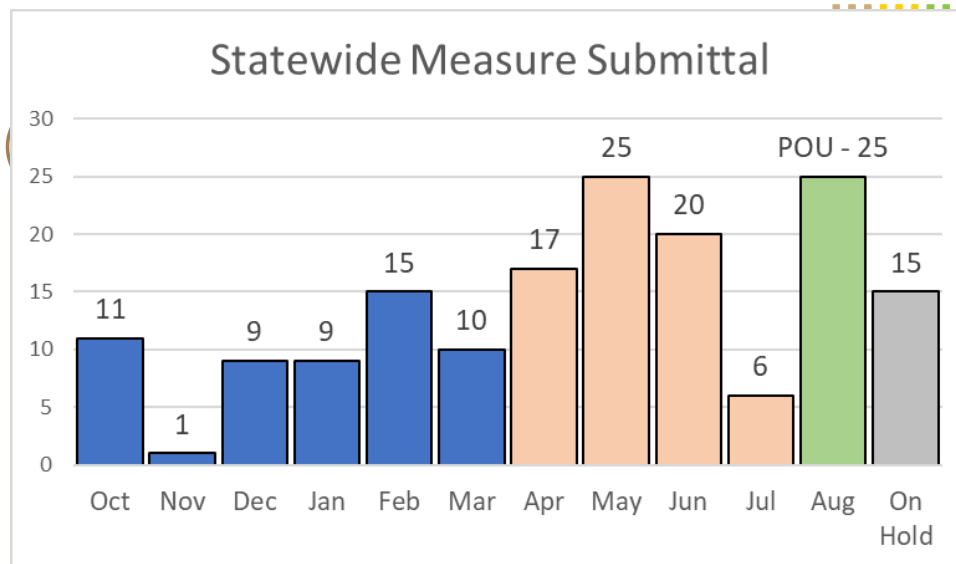
# = number of measure submitted

Note that values change regularly so the provides a rough schedule



# Statewide Measures

- Tried to flatten out Apr/May/June by pushing some low-savings / low-risk measures into July
- Some measures naturally moving getting pushed out to July
- Exploring an option to streamline the measures that are on hold (ie, low/no claims but significant work to update)
- Upload POU measures to eTRM in August



# Back-up Slides

8



# Measure Consensus

## SWCR001 (1.01) – Add Anti-Sweat Heater (ASH) Controls

### • Offerings

- ❑ AOE; DnDeemed, DnDeemDI
- ❑ Building Type: Com
- ❑ Low Temp (Freezer) and Medium Temp (Cooler)
- ❑ Permutations vary by Climate Zone



### • Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Multiple cost methodologies; SCE/NEEP approach uses the best available data
- ❑ Measure Application Type change for PG&E (ROB to REA)

### • Stage 2 Issues Activities

- ❑ None

Blue text = Item not discussed in last meeting  
*Italics text* = Item that has not been completed

# Measure Consensus

## SWCR002 (1.02b) – Replace Anti-Sweat Heater Display Doors

10

### ● Offerings

- ❑ AOE; DnDeemed, DnDeemDI, UpDeemed
- ❑ Building Type: Any
- ❑ Low Temp (Freezer) only
- ❑ Permutations vary by Climate Zone



### ● Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Removed overlapping measure to replace Display Case (1.02a)
- ❑ Harmonized to Early Retirement (ER) measure application type because savings are with respect to existing conditions

### ● Stage 2 Issues Activities

- ❑ *Update cost documentation*

Blue text = Item not discussed in last meeting  
*Italics* text = Item that has not been completed

# Measure Consensus

## SWCR003 (1.03a) – Display Case EC Motor Retrofit

11

### ● Offerings

- ❑ NR; DnDeemed, DnDeemed
- ❑ Building Type: Com
- ❑ Display Case only
- ❑ Permutations vary by Cooler / Freezer

### ● Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Do not collapse Cooler / Freezer permutations for ROB measures
- ❑ Collapse Vintage permutations for ER measure to make consistent (<1%)
- ❑ Collapse Climate Zone permutations for all measures (<3%)
- ❑ POU/TRM savings reflected in ER measure

### ● Stage 2 Issues

- ❑ None

*Hold due to  
Cost-Effectiveness*



# Measure Consensus

## SWCR004 (1.03b) – Walk-Ins EC Motor Retrofit

12

### • Offerings

- ❑ AR; DnDeemed, DnDeemDL
- ❑ Building Type: Com
- ❑ Walk-Ins only; Permutations vary by Cooler / Freezer

### • Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Do not collapse Cooler / Freezer permutations
- ❑ Collapse Climate Zone permutations
- ❑ Measure application type changed from NR to AR due to code baseline

### • Stage 2 Issues

- ❑ Change Normal Unit to “Rated-HP” from “Each”
  - ✦ IOUs move to POU methodology
  - ✦ Preserve POU/TRM methodology



*Hold due to  
Cost-Effectiveness*

# Measure Consensus

## SWCR005 (1.04) – Refrigerated Storage Auto Closer

13



### ● Offerings

- ❑ AOE; DnDeemed, DnDeemDI, UpDeemed
- ❑ Building Type: Any
- ❑ Permutations vary by Cooler / Freezer
- ❑ Permutations vary by Climate Zone

### ● Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ *Cost aligned to WO017 value (3x greater than DEER value)*
  - ✦ Dependent upon door typical size

Measure Description	Cost Unit	N	Cost Estimate	DEER 2008	DEER 2005	DEER 2001
Auto-closers on main cooler/freezer doors, <42" wide	Per cooler door	1	\$155.67	\$120.00	\$322.59	N/A
Auto-closers on main cooler/freezer doors, >42" wide	Per cooler door	1	\$917.19	\$120.00	\$322.59	N/A

- ❑ Increase POU/TRM savings / decreases EUL
  - ✦ Currently using older savings methodology
- ❑ Measure Application Type change for PG&E (NR to AOE)

### ● Stage 2 Issues

- ❑ *Align Offerings with cost and savings so that an average TRC does not hurt good permutations*

Blue text = Item not discussed in last meeting  
*Italics text* = Item that has not been completed

# Measure Consensus: 1.05 – Walk-in Cooler/Freezer & Refrigerated Storage Evaporative Control

## ● Offerings

- ❑ Permutations vary by Control (Fan Cycling / VFD)
- ❑ Permutations vary by Climate Zone



## ● Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Cost aligned to WO017 value (3x greater than DEER value – for VFD offering)
  - ✦ Increased costs for SCE and SDG&E; (PG&E is currently using this)
  - ✦ Cost decrease for SCE since primarily implements Cycling offering
- ❑ Measure Application Type change for PG&E (NR to AOE)

## ● Stage 2 Issues

- ❑ *Change Norm-Unit to “Rated-HP” from “Each”*
  - ✦ *Preserve POU/TRM methodology*

Blue text = Item not discussed in last meeting  
*Italics text* = Item that has not been completed



# Measure Consensus

## SWCR007 (1.06a) – FHP Controls - Multiplex Systems

15

### • Offerings

- ❑ AOE; DnDeemed, DnDeemDI
- ❑ Building Type: **Com**
- ❑ Permutations vary by Climate Zone (16 CZ)
- ❑ ~~Permutations vary by Vintage (5 Vintages)~~
- ❑ Permutations vary by Condenser (Air/Evap) / Control (Fan Cycle/VFD)

### • Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Moved Process FHP to Process Category for review
- ❑ Vintage permutations run through MASControl, available for all Climate Zones Vintage governed by sensitive parameters:
  - ✦ Saturated Condensing Temperature SP (SCT) & Condenser Efficiency
- ❑ Cost updated to WO017 value (greater than DEER value)
  - ✦ Dependent upon “\$ per discharge group” but convert to “\$ per ton”
  - ✦ Changing to weighted average of ton / discharge group

### • Measure Extension

- ❑ Added measure for POU's

### • Stage 2 Issues

- ❑ *Improve cost analysis with better data to support tons/group*



# Measure Consensus

## SWCR008 (1.06b) – Suction Controls - Multiplex Systems

### • Offerings

- ❑ AOE; DnDeemed, DnDeemDI
- ❑ Building Type: **Com**
- ❑ Permutations vary by Climate Zone (16 CZ)
- ❑ ~~Permutations vary by Vintage (5 Vintages)~~

### • Stage 1 Issues

- ❑ Updated Grocery prototype and remodeled savings
- ❑ DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift
- ❑ Moved Process Suction Control to Process Category for review
- ❑ Vintage permutations run through MASControl for all Climate Zones
- ❑ Vintage governed by sensitive parameters:
  - ✦ Saturated Suction Temperature SP (SST)
- ❑ Cost updated to WO017 value (greater than DEER value)
  - ✦ Dependent upon “\$ per suction group” but convert to “\$ per ton”
  - ✦ Changed to weighted average of ton / suction group
  - ✦ Revising WO017 methodology that assumed labor but no material cost

### • Measure Extension

- ❑ Added measure for POU's

### • Stage 2 Issues

- ❑ *Improve cost analysis with better data to support tons/group*





# Measure Consensus

## 1.14 – FHP Controls - Single Compressors

**POU Only Measure**

- Offerings
  - ❑ Permutations vary by Climate Zone (16 CZ)
  - ❑ Offerings by LT/MT and One Condenser / Multiple Condensing Unit
- Stage 1 Issues
  - ❑ Documenting cost methodology
  - ❑ Added permutations for all climate zones (ran DOE2.2r models)
- Measure Extension
  - ❑ Added measure for POUs (16 CZ available)
- Stage 2 Issues
  - ❑ None



# Measure Consensus

## SWCR014 (1.17a) – Display Case Replacement - Like for Like

18

### ● Offerings

- ❑ NR, NC; DnDeemed, DnDeemDI, UpDeemed
- ❑ Building Type: Asm, Gro, RFF, RSD, Rt3, RtL, RtS
- ❑ 30 Offerings vary by Equipment Class

### ● Stage 1 Issues

- ❑ **DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift**
- ❑ Measures 1.02b and 1.16 removed because overlapping
  - ✦ New DOE rulemaking changing baseline conditions takes effect Jan 1, 2018
  - ✦ When replacing a display case, the baseline must be updated to this new standard
- ❑ (No claims in 2016 or 2017)

### ● Measure Extension

- ❑ Added measure for POUs

### ● Stage 2 Issues

- ❑ *Adding interactive effects*
- ❑ *Resolve 1.17b Measures – Open to Closed / ROB*
- ❑ *Consider Accelerated Replacement (AR) offerings*



# Measure Consensus

## SWCR017 (1.21) - Ultra Low Temperature Freezer

### • Offerings

- ❑ NR, NC; DnDeemed, DnDeemDI, UpDeemed
- ❑ Building Type: EUn, Hsp, IPH, MBT
- ❑ Offerings vary by Freezer size
- ❑ 4 building types
  - ✦ Education – University
  - ✦ Hospital
  - ✦ Manufacturing Pharmaceutical
  - ✦ Manufacturing Biotech

### • Stage 1 Issues

- ❑ **DEER 2020 updates: Measure Application Type, Delivery Type, Measure Calculation Type, Peak Demand Reduction shift**
- ❑ Measure specific interactive effects included

### • Measure Extension

- ❑ Added measure for POU's
- ❑ Added measure for SCE and SDG&E

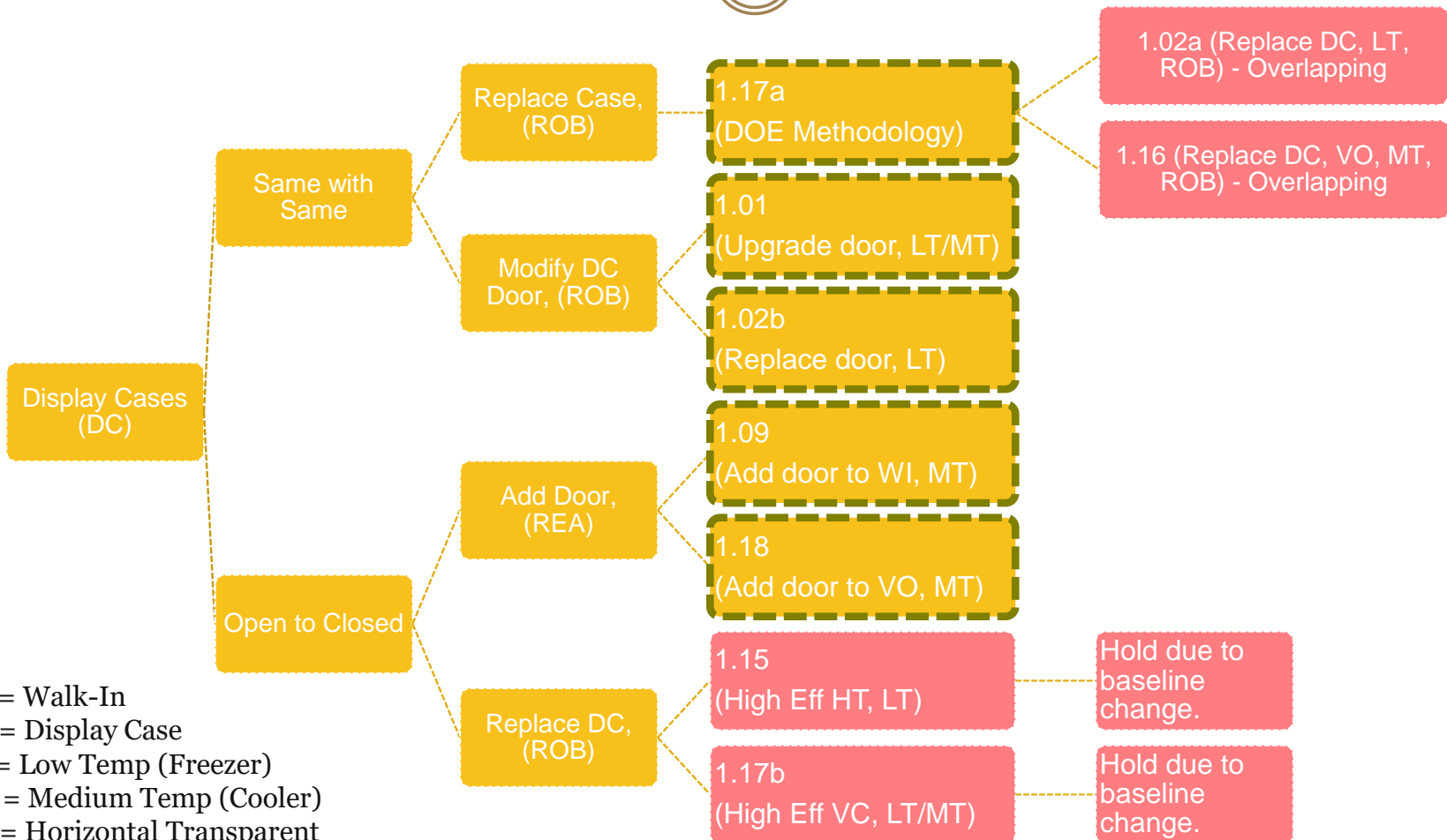
### • Stage 2 Issues

- ❑ None



# Display Case Tree

20



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

Consolidate in 2017