# Commercial Refrigeration Prototype Update Presentation


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# Overview (*from Feb 2018*)
# Final Measure List



| No. | Measure Names | Plan | PG&E | SCE | SDG&E | SCG | POU |
|---|---|---|---|---|---|---|---|
| 1.01 | Anti-Sweat Heater (ASH) Controls | 2017 | | | | | |
| 1.02a | Replace Anti-Sweat Heater Display Case | 2017 | Overlap with 1.17a | | | | |
| 1.02b | Replace Anti-Sweat Heater Display Doors | 2017 | | | | | |
| 1.03a | Display Case EC Motor Retrofit | 2017 | | | | | |
| 1.03b | Walk-In EC Motor Retrofit | 2017 | | | | | |
| 1.04 | Refrigerated Storage Auto Closer | 2017 | | | | | |
| 1.05 | Walk-in Cooler/Freezer & Refrig Storage Evap Control | 2017 | | | | | |
| 1.06a | Floating Head Pressure Controls - Multiplex Systems | 2017 | | | | | |
| 1.06b | Suction Controls - Multiplex Systems | 2017 | | | | | |
| 1.07 | Refrigeration Night Covers | 2017 | | | | | |
| 1.08 | Bare Refrigeration Line Insulation | 2017 | | | | | |
| 1.09 | Add Doors to Walk-in Cooler | 2017 | | | | | |
| 1.10 | Compressor Retrofit: Multiplex | 2017 | | | | | |
| 1.11 | Display Case ECM Motor Retrofit | n/a | Consolidate with 1.03a | | | | |
| 1.12 | Efficient Condenser: Air-Cooled to Evap | Hold | Hold - Sunset | | | | |
| 1.13 | Efficient Condenser: Multiplex | Hold | Hold - Sunset | | | | |
| 1.14 | Floating Head Pressure Controls - Single Compressors | 2017 | | | | | |
| 1.15 | Low Temp Coffin to Reach-In | Hold | Hold - Baseline Change | | | | |
| 1.16 | Medium Temp Open Case Retrofit | n/a | Overlap with 1.17a | | | | |
| 1.17a | Display Case Replacement - Like for Like | 2017 | | | | | |
| 1.17b | Display Case Replacement - Open to Closed | Hold | Hold - Baseline Change | | | | |
| 1.18 | Add Medium Temp Case Doors | 2017 | | | | | |
| 1.19 | Adaptive Refrigerator and Freezer Controls | 2017 | | | | | |
| 1.20 | Strip curtain infiltration barrier for refrigerated space | n/a | Hold - Sunset | | | | |
| 1.21 | Ultra Low Temperature Freezer | 2017 | | | | | |
| 1.22 | Commercial Reach-In Refrigerators and Freezers | Moved | | | | | |

Lead Workpaper
Support Workpaper
Blue Text – Updated info

# Overview (*Update*)
# Final Measure List

CALIFORNIA TECHNICAL FORUM



| 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 | April |
| 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 | | | | | | PG&E | April |
| 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 | April |
| 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 | April |
| 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

# Grocery Prototype Update



- Since 2005, refrigeration measures ex-ante savings claims and building prototypes for refrigeration end-use have not been updated in DEER
- Impacts several DEER measures and workpapers using DEER refrigeration prototypes

. Workpapers Affected

a. DEER Measures

| | | |
|---|---|---|
| SWCR001-01 | Anti-Sweat Heat (ASH) Controls | D03-230, D03-231 |
| SWCR007-01 | Floating Head Pressure Controls - Multiplex Systems | D03-223, D03-225, D03-224, D03-226 |
| SWCR008-01 | Floating Suction Pressure Controls - Multiplex Systems | D03-220 |
| SWCR010-01 | Compressor Retrofit, Multiplex | D03-214, D03-215 |
| SWCR016-01 | Adaptive Refrigerator and Freezer Controls | D03-210 |

b. Use eQuest DOE 2.2R Commercial Refrigeration Models

| | | |
|---|---|---|
| SWCR002-01 | Replace Anti-sweat Heater Display Doors | D03-228 |
| SWCR003-01 | Evaporator Fan Motor (Display Case) | D02-203 |
| SWCR004-01 | Evaporator Fan Motor (Walk In) | D02-203 |
| SWCR005-01 | Refrigerated Storage Auto Closer | D03-208, D03-209 |
| SWCR014-01 | Floating Head Pressure Controls - Single Compressor | |
| SWCR015-01 | Medium-temperature Display Case Doors Add-on | D03-206 |

# Grocery Prototype Update



- Task managed by SCE and performed by Solaris-Technical (Lincus subsidiary)
- Considered inputs from Statewide team
  - SCE / PG&E / SDG&E
  - Energy Smart Grocer Program – CLEAResult
- Task Objectives:
  - Since commercial refrigeration measures are applicable to Grocery (Gro) building type, update the DEER prototypes for Gro building type considering code and ISP evolution over the years.
  - Deliver Gro prototypes files in eQuest DOE2.2R with updated refrigeration end-use and DEER2020 updates for all CZs and building vintages.

# Grocery Prototype Update



- Methodology
  - Review the evolution of code for commercial refrigeration since the last update in 2005.
  - Review the evolution of ISP over the years. Particularly, the program data from PG&E's EnergySmart Grocer program was reviewed to determine ISP.
  - Review previous impact evaluation studies.
  - Review the CA state regulations impacting refrigerants.
  - Determine the parameter that needs to be updated and applicable vintages.
  - Update protypes to include refrigeration end-use and relevant parameters.

# Grocery Prototype Update



- Title 24 Code - started including commercial refrigeration and refrigerated warehouses from 2013 standards; No major changes since 2013.
  - Condenser fans shall be continuously variable speed
  - Condensers shall use variable setpoint control logic to reset the condensing temperature setpoint
  - Evap cooled condenser minimum specific efficiency 160 Btuh/W; Air cooled condenser minimum specific efficiency 65 Btuh/W

# Grocery Prototype Update



- ISP Review - CLEAResult, implementer of PG&E's EnergySmart Grocer program, shared results from 1,802 uniqu
progr
categ
ges.

| Refrigeration Parameter | Results based on n=1802 store audits | ISP determination |
|---|---|---|
| Compressor Type | 81% reciprocating | The existing prototypes already uses non-centrifugal compressor. |
| Average Saturating Condensing Temperature (SCT) Setpoint | 82 °F | The existing prototypes use 80 °F which is more stringent. Hence no updates. |
| Floating Head Pressure (FHP) controls | 25%. Very few CZs have >50% FHP and that too only for certain vintages | Measures is not likely to be an ISP |
| Floating Suction Pressure (FSP) controls | 31%. Very few CZs have >50% FSP for certain vintages | Measure is not likely to be an ISP |
| Air Cooled | 71% | Prototypes for both air cooled and evap cooled condensors are generated |
| Evap Cooled | 29% | |
| Existing VFD Control-Air Cooled Condenser | 9% have VFDs with no instances of >50% | Measure is not likely to be an ISP |
| Existing VFD Control-Evaporative Cooled Condenser | 33% have VFDs with a few instances of >50% | No specific saturation pattern is identified to determine that this measure is an ISP for a specific grocery store population. It is also not likely to be an ISP for the entire population. |

# Grocery Prototype Update



- Impact Evaluation Studies- Studies available for 2002-2003, 2004-2005 and 2006-2008 program years. Latest studies not available.
  - No information which requires updates to prototypes
  - From 2004-2005 evaluation study

*Exhibit ES-5 -- Contractor Estimates of Technology Penetration*

| Among the food stores that you service, approximately what percentage have each of the following technologies in place: | Percent of Stores |
|---|---|
| Energy Management Systems | 55% |
| Floating head pressure controls | 37% |
| Multiplexed compressors | 44% |
| Night covers for refrigerated cases (for stores not open 24/7) | 24% |
| Cycling of anti-sweat heaters/ controls for anti-sweat heaters | 41% |
| Permanent Split Capacitor (PSC) evaporator fan motors | 32% |
| Electronically commutated (ECM) evaporator fan motors | 20% |
| What percent of freezer (low temperature) cases have doors? | 70% |
| What percent of (MT) refrigerated cases have doors? | 28% |
| What percent of case doors are low/no heat? | 32% |

# Grocery Prototype Update



- Refrigeration Laws
  - Existing DEER prototypes use R-507.
  - SNAP20 - R-507 in new supermarket systems (not stand-alone units) is unacceptable after January 1,2017. This will impact vintages 2017, 2020 and NEW.
  - From web scraping the common alternatives for R-507 that will be acceptable after January 1, 2017 are R-407A and R-407F. This is confirmed by CLEAResult's program data where R-407A's market share is increasing.
  - DOE 2.2R has R-407A properties. Hence, used as alternative for R-507.

# Grocery Prototype Update



- Required Updates

| eQuest Parameter | DEER2005 prototype input value | Proposed Updates |
|---|---|---|
| Refrigeration System – Refrigerant | R-507 | R-507 for vintages until 2015[1].<br>R-407A for vintages 2017, 2020 and NEW |
| SCT Control | FIXED | FIXED for vintages until 2011<br>DRYBULD-RESET for Air cooled for vintages 2015 and after<br>WETBULB-RESET for Evaporator cooled for vintages 2015 and after |
| SCT Setpoint (°F) | 80 °F | 80 °F for vintages until 2011<br>70 °F for vintages 2015 and after |
| Condenser - Fan Power (EIR*TD) for Air cooled Fan Power (EIR) for Evaporator cooled | 0.644 | 0.644 for vintages until 2011<br>0.525 for vintages 2015 and after Air cooled; code requirement of 65 Btuh/W @105 °F SCT and 95 °F EDB (Note EIR*TD=10°F *(3.412[btuh/W])/65 btuh)<br><br>0.021325 for vintages 2015 and after for Evaporator cooled; code required 160 Btuh/W which is equal to (EIR=3.412/160 ) |
| Condenser-Capacity Controls | CYCLE-FAN | CYCLE-FAN for vintages until 2011<br>VAR-SPEED-FAN for vintages 2015 and after |
| Compressor-Capacity Control | None | EXTERNAL-SIGNAL |

# Back-up Slides