Responsible Refrigerant Planning for Retail Enterprises

State of the Industry

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25-26 June 2015 — Atlanta, Georgia

EMERSON Climate Technologies

Objective

To Show how a Retail Operation with 100 Stores

can Lower its Weighted GWP

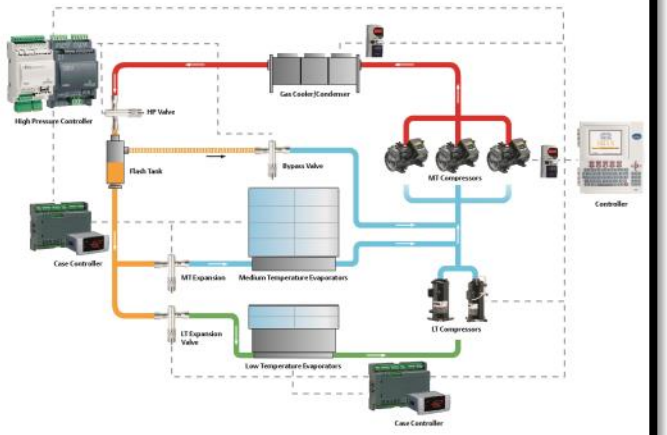
while Increasing

New Stores by 3% /yr Using;

1. ***Steady Approach***
2. ***Aggressive Approach***

Three System Architectures Offer Lowest LCCP* Choices in Supermarket Applications

Typical CO_2 Transcritical Booster System

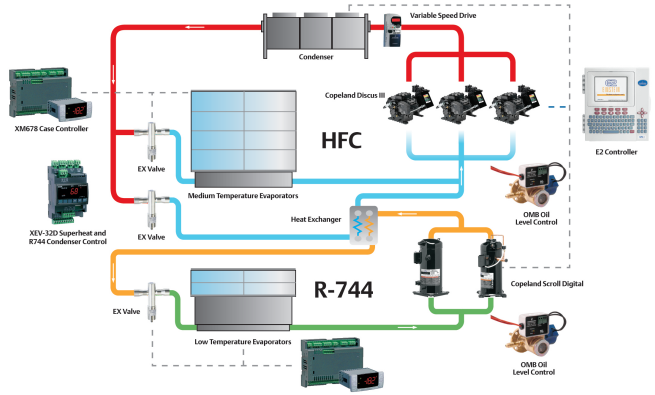


Direct Global Warming

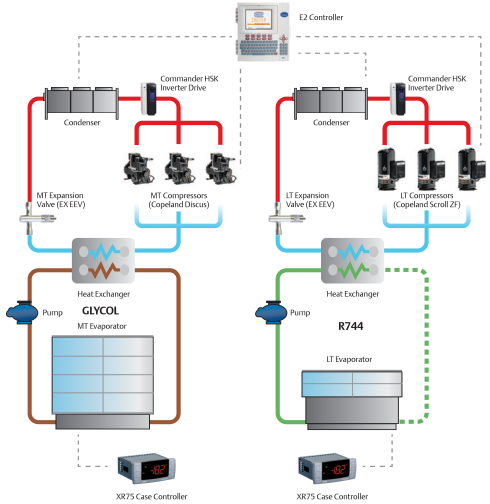
+

Indirect Global Warming

Typical CO_2 Hybrid Cascade System



Typical Secondary System: MT Glycol, LT CO_2



All Calculations were based On St Louis, MO location

Primary could use Lower GWP, A1 or A2L (HFO/HFC) Blends: Applicable to all Climates

LCCP* Life Cycle Climate Performance

https://apps.emersonclimate.com/LCCP/PerformEnergyCalc.htm

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Sample Refrigerant Phase-Down Analysis (Using Minimum LCCP Systems)

Steady Approach

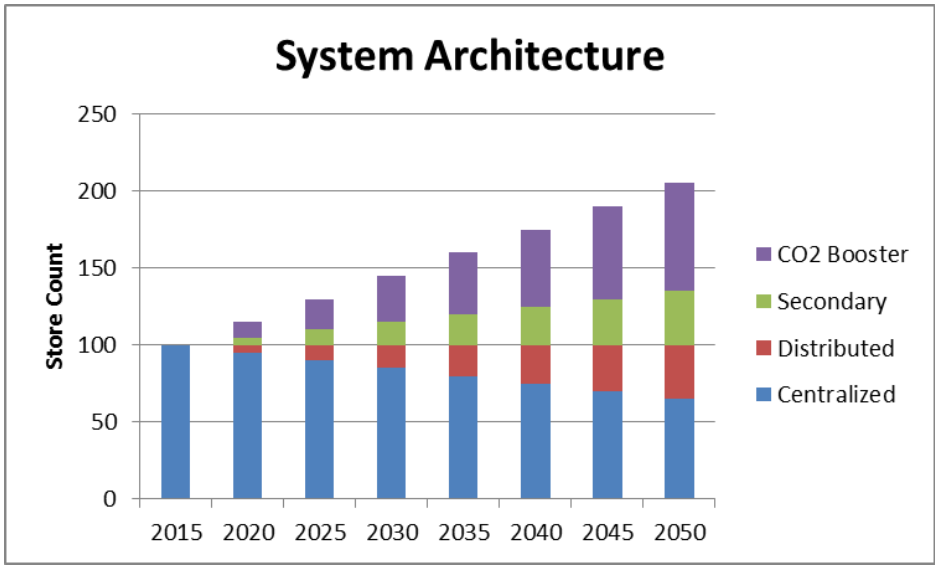
100-Store Chain

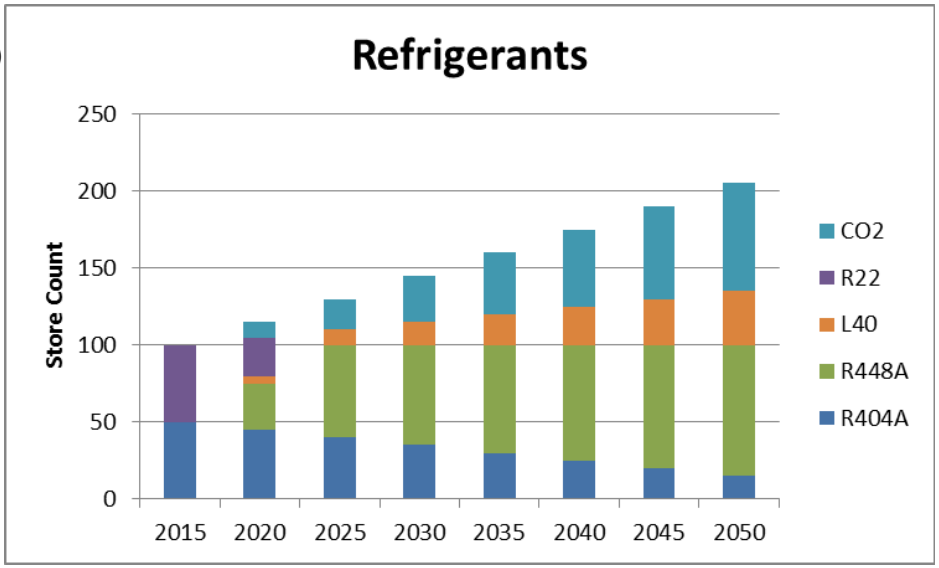
Builds: Three New Stores/Year (3%)

Baseline: 50% R404A and 50% R22 Centralized

System Architectures & Refrigerants Changes

1. **Retrofits:**
   - 5 Refrigerant Retrofits/yr to R448A or R449A for 10yrs to Eliminate R22
   - 3 Retrofits/yr to R448A or 449A/Year for 15 year Periods to nearly eliminate R404A
2. **Remodels:**
   - 1 Remodels/ year to either Hybrid CO_2 Cascade or CO_2 Secondary with R448A or R449A on Primary
   - Starting 2025 1 Remodel /yr (HFO-Blend <300GWP) Distributed
3. **New Construction:**
   - 2 Stores/yr to CO_2 Booster
   - 1 store per year, either Hybrid CO_2 Cascade or Secondary with R448A or R449A on high stage or Distributed.





*Assumes 15% leakage rates on centralized and distributed

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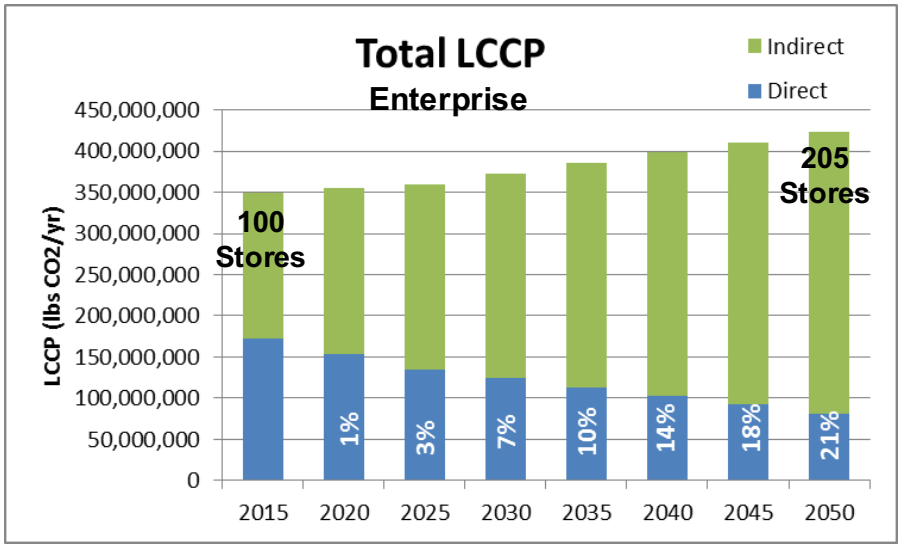
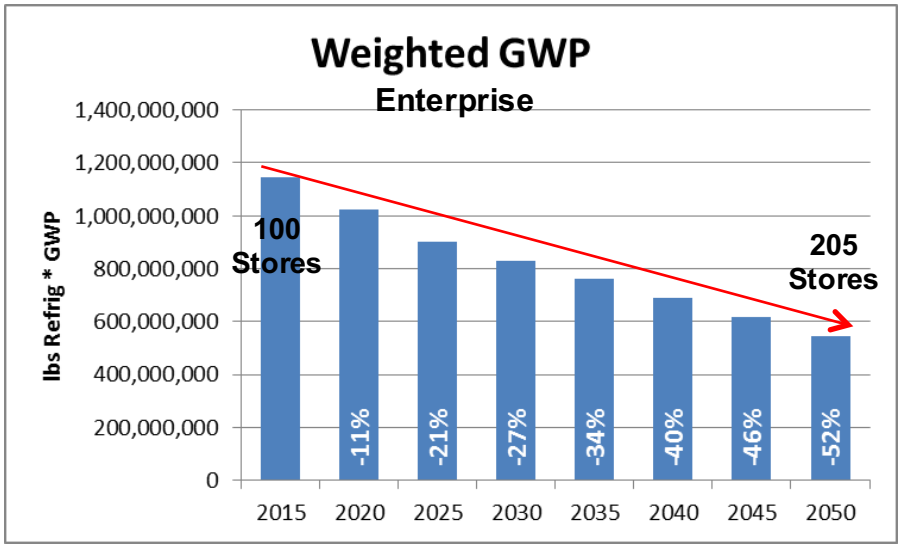
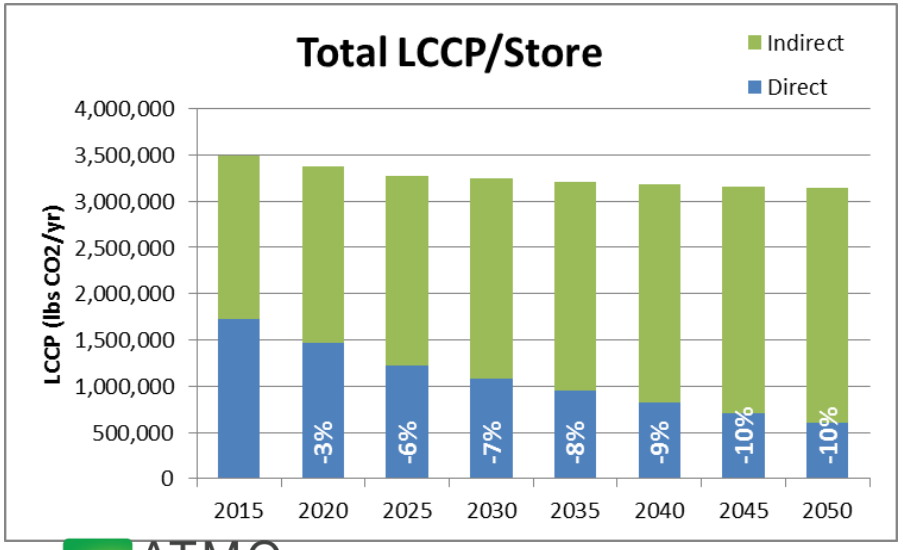
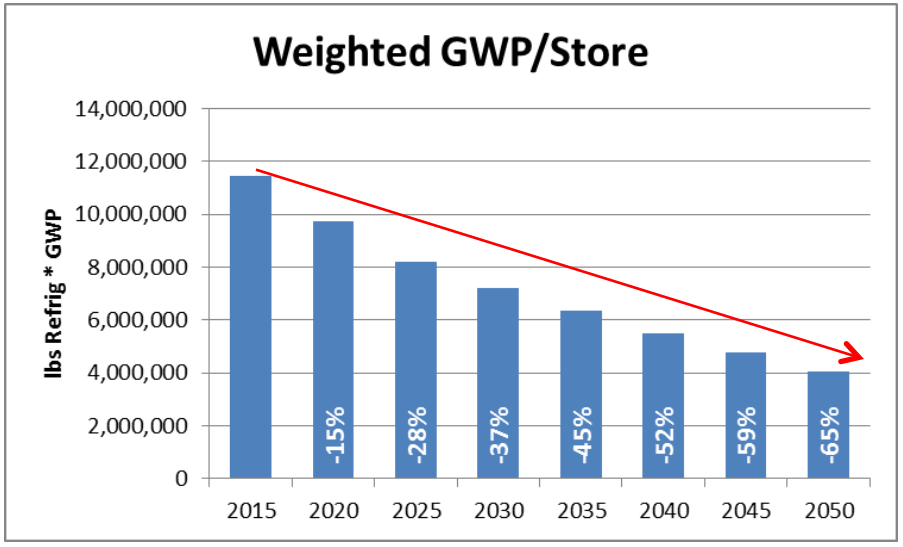
LCCP and Weighted GWP

Steady Approach









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Steady Approach

Sample Refrigerant Phase-Down Analysis (Using Minimum LCCP Systems)

Aggressive Approach

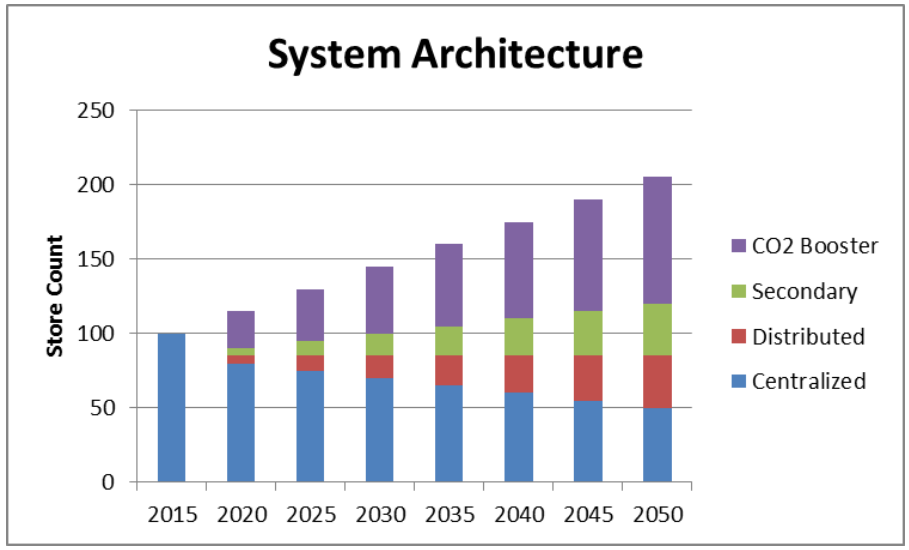
100-Store Chain

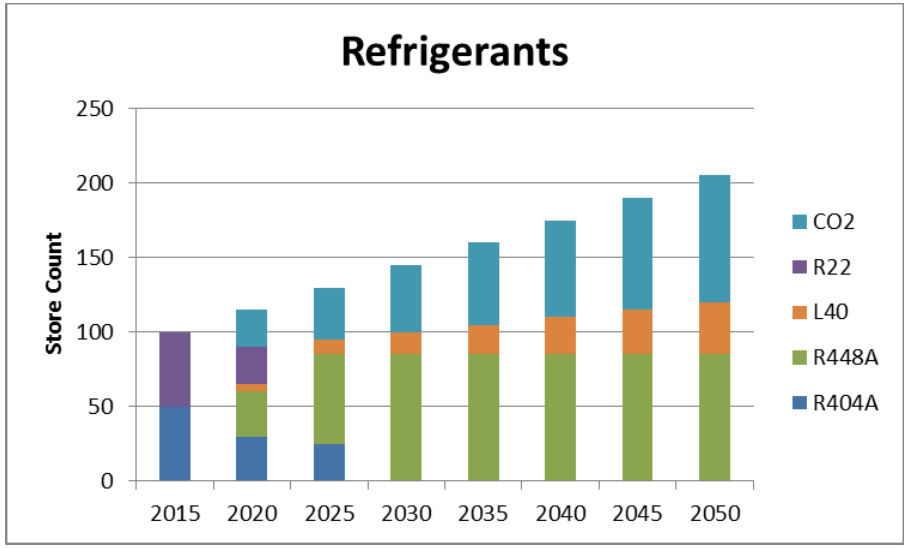
Builds: 3 New Stores/Year (3%)

Baseline: 50% R404A and 50% R22 in Centralized Systems

System Architectures & Refrigerants Changes

1. **Retrofits:**
   - 5 Refrigerant Retrofits /yr. to R448A or R449A for 10 yrs to Eliminate R22
   - 5 Retrofits /yr. to R448A or 449A/Year for 10 year to Eliminate R404A
2. **Remodels:**
   - 3 CO_2 Booster Remodels/ year (Replace R22 Fleet)
   - 2 Hybrid CO_2 Cascade, or CO_2 Secondary with R448A or R449A high stage (Replace R22 Fleet)
3. **New Construction**
   - 2 CO_2 Boosters /yr.
   - 1 store per year, either Hybrid CO_2 Cascade or CO_2 Secondary with R448A or R449A on high stage





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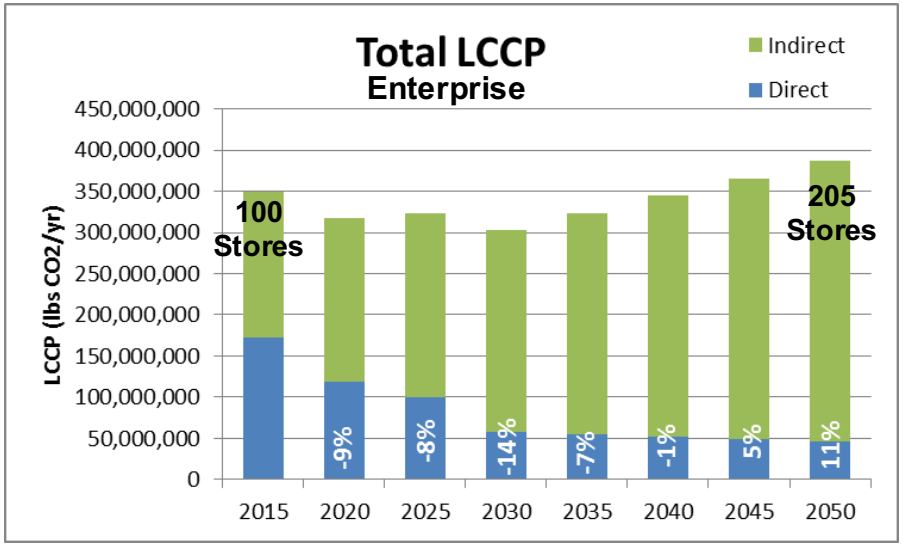
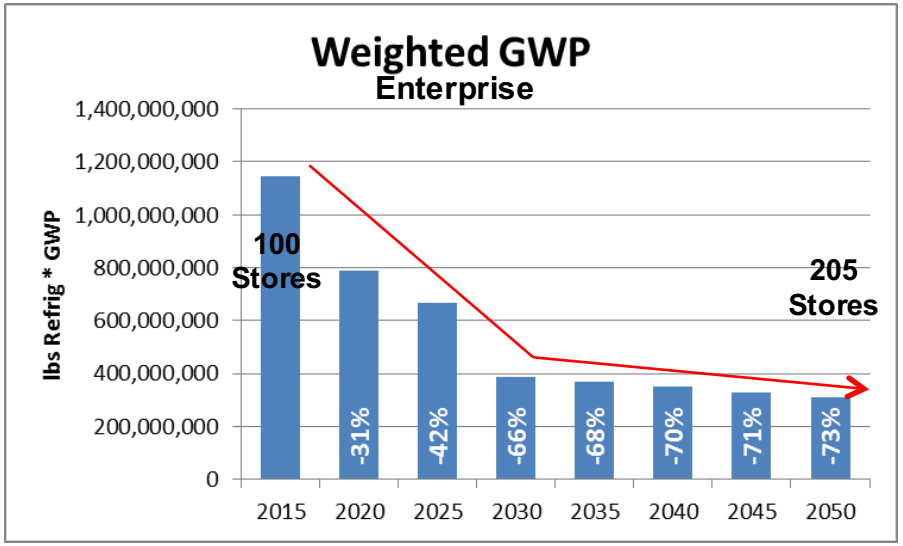
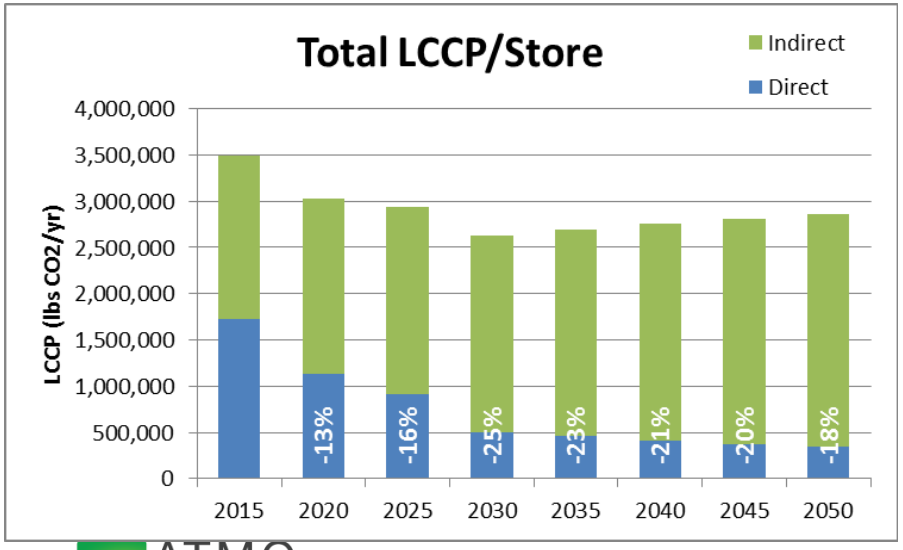
*Assumes 15% leakage rates on centralized and distributed

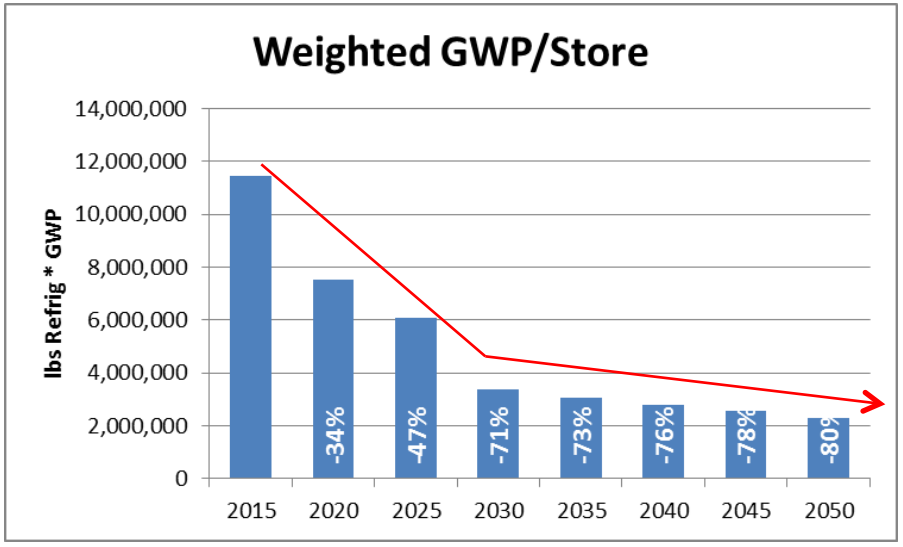
LCCP and Weighted GWP

Aggressive Approach









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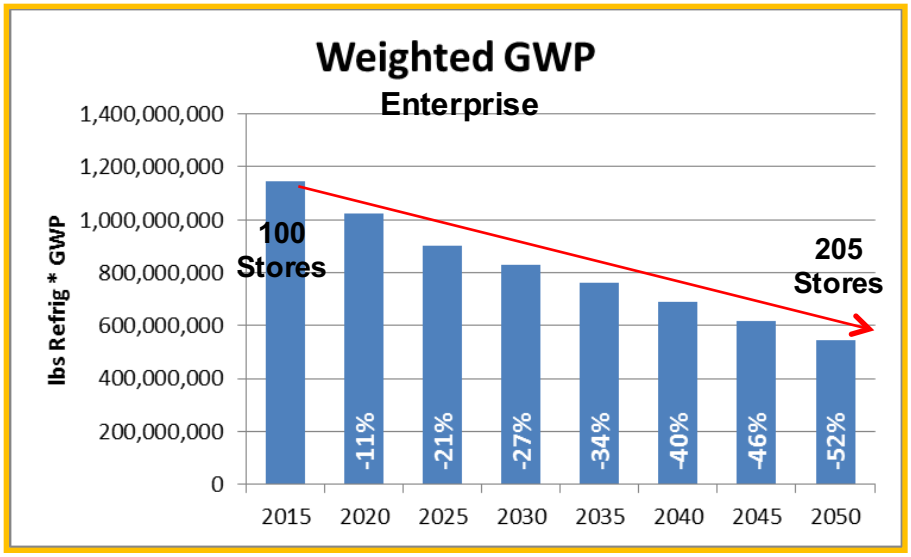
Summary of Both Approaches

Retrofits: 8/yr to eliminate R22 & R404A

Remodels: 1/yr Cascade or Secondary,
in 2025 1/yr w/ <300GWP Refrigerant

New Const: 3 Stores/yr : 2 CO_2 Booster, 1 Cascade

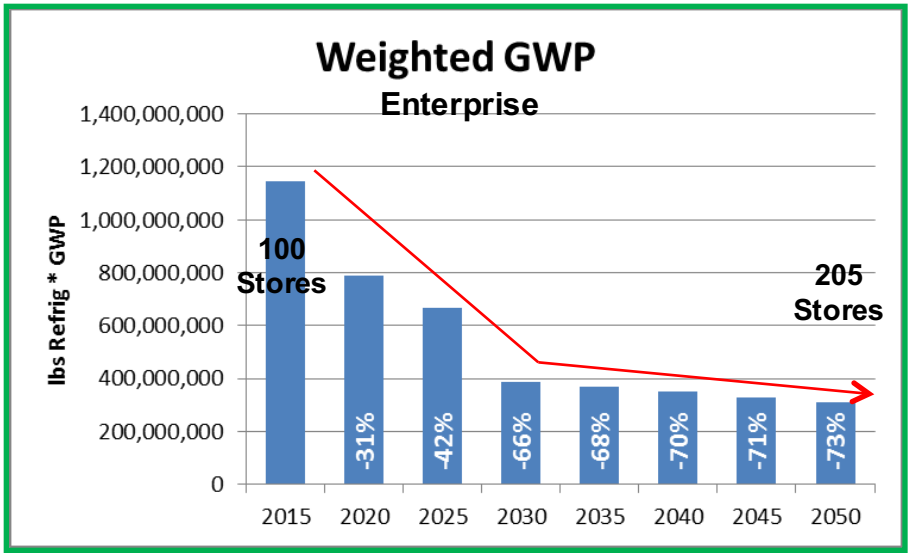


Steady Approach

Retrofits: 10/yr to eliminate R22 & R404A

Remodels: 5/yr: 3/yr CO_2 Booster, 2/yr Cascade

New Const: 3 Stores/yr : 2 CO2 Booster, 1 Cascade



Aggressive Approach

Takeaways

Responsible Refrigerant Planning for Retail Enterprises

1. **Reduction in CO_2e is Possible While Adding New Stores**
2. **Remodelled & New Store with CO_2 Booster, Dramatically Reduces Weighted GWP of Your Enterprise Quickly**
3. **By Factoring Warm Ambient Strategies into CO_2 Booster Architecture, Results Would Significantly Improve**

Thank You

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