The Future of Commercial Refrigeration
Opteon™ XP & Opteon™ XL

www.opteon.com
Agenda

- Regulations
- Opteon™ Solutions
- Opteon™ XL Study
Regulations are Driving Change

US Regulatory Activity requiring refrigerants with low Global Warming Potential (GWP)

American Innovation and Manufacturing (AIM) Act

- HFC Phase-down

California Air Resource Board (CARB)

- Reliable
- Cost Effective
- Field Tested and Proven
- Sustainable

* GWP Limits for specific applications are also present in the rulemaking
## Next Generation Solutions – Opteon™ Refrigerants

<table>
<thead>
<tr>
<th>Applications</th>
<th>Temperature Profile</th>
<th>Installed Base</th>
<th>Immediate Replacement Options</th>
<th>Next Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium Temp</td>
<td>R-134a (GWP:1430)</td>
<td>Opteon™ XP10 (R-513A) (GWP:631)</td>
<td>Opteon™ XL10 (R-1234yf) (GWP: 4)</td>
</tr>
<tr>
<td></td>
<td>Low Temp</td>
<td>R-22 (GWP: 1760)</td>
<td>Opteon™ XP40 (R-449A) (GWP: 1397)</td>
<td>Opteon™ XL20 / XL40 (R-454C / R-454A) (GWP: 148 / 239)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-404A/ R-507A (GWP: 3943/3985)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-407A (GWP: 1923)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-407F (GWP: 1596)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-422D (GWP: 2473)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium Temp &amp; Low Temp</td>
<td>R-404A (GWP: 3922)</td>
<td>Opteon™ XP44 (R-452A) (GWP: 2141)</td>
<td>Opteon™ XL20 / XL40 (R-454C / R-454A) (GWP: 148 / 239)</td>
</tr>
</tbody>
</table>

**Notes:**
- Opteon™ XP20 and Opteon™ XL blends are not yet fully commercial in all regions.
- GWP values noted are based on IPCC 4th Assessment Report.
Benefits of Retrofit & Next Gen Solutions

- 67% reduction GWP vs R-404A / R-507
- 5%-12% energy savings vs. R-404A / R-507
- Readily available and OEM approved

- 56% reduction GWP vs R-134a
- Azeotrope with zero glide
- Readily available and OEM approved

- Low and Ultra low GWP
- Successfully adopted in the EU in the EU
- The preferred choice of major retail brands in the EU
Wave Refrigeration Case Study:

Compared seven alternative refrigeration technologies in two different store architectures at two different European locations with moderate (UK) and high (Spain) ambient conditions.

*Opteon™ refrigeration systems had lower 10-yr Life Cycle Costs than R-290 and CO₂ technologies
Think Beyond GWP!

Energy consumption dominates total emissions. Opteon™ systems had lower total emissions than R-290 and CO₂ refrigeration systems.
Conclusion

• The price and availability of higher GWP products could change as we progress through the phase down.

• Opteon™ XP40 and Opteon™ XP10 are viable lower GWP refrigerants for existing and new commercial refrigeration systems.

• Opteon™ XL refrigerants are available today for OEM sampling and will be commercially available in the US in the next couple of years.

• It is important to take a holistic view when considering the various commercial refrigeration systems available.
For more information, go to

**OPTEON™ - COMMERCIAL REFRIGERATION**