Challenges in HVAC Industry to Phase-Out the use of HCFC

Presentation by:
Shailesh Nigam
DGM – Applied Business
Indian Market

- Indian Industry is addressing energy efficiency requirements specific to Indian Climatic conditions and path is laid down for future.

- The industry is getting inverterised with higher energy efficiency equipment. New development of RAC, VRV/VRF and chillers are with inverters.

- Growing awareness among users for energy efficient equipment.

- RAC efficiencies are up by 30% from 2010 and will further go up by 20% in 3 to 4 years.

- The efficiencies of Chillers are at par with global players and expected to improve further with new regulations in place.

- Product like VRV / VRF which have high efficiency is the fastest growing segment. Ducted systems are stagnant.
Life Cycle Climate Performance (LCCP) - To Measure Environment Impact

LCCP

Direct Global Warming + Indirect Global Warming

Holistic Approach:
- Safety
- Performance
- Environment
- Economics

1. Leak Rate
2. Charge Amount
3. Refrigerant GWP

Energy Consumption has 95 to 98% impact on Environment

Source: Emerson Climate Technologies, Inc.
Regulations

Product

- Refrigerants
- Energy Labeling
- E-Waste Rules

- The standard is mandatory and State Government agencies are to implement it.
- Latest ECBC 2017 is technology agnostic and is more focused on the energy efficiency.

The energy performance requirement as per the new standard is as under:

| Common table for both Fixed Speed & VFD units. |
| To show compliance to ECBC, minimum requirement of both COP and IPLV requirement of ECBC Building shall be met. |
| To show compliance with ECBC+ Building and SuperECBC Building, minimum requirement of either COP or IPLV of respective efficiency level shall be met. |

<table>
<thead>
<tr>
<th>Chiller Capacity (kW)</th>
<th>ECBC Building</th>
<th></th>
<th></th>
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<th></th>
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<tbody>
<tr>
<td></td>
<td>COP</td>
<td>IPLV</td>
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<td>IPLV</td>
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<tr>
<td>&lt;260</td>
<td>4.7</td>
<td>5.8</td>
<td>5.2</td>
<td>6.9</td>
<td>5.8</td>
<td>7.1</td>
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<tr>
<td>≥260 &amp; &lt;530</td>
<td>4.9</td>
<td>5.9</td>
<td>5.8</td>
<td>7.1</td>
<td>6.0</td>
<td>7.9</td>
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<tr>
<td>≥530 &amp; &lt;1,050</td>
<td>5.4</td>
<td>6.5</td>
<td>5.8</td>
<td>7.5</td>
<td>6.3</td>
<td>8.4</td>
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<tr>
<td>≥1,050 &amp; &lt;1,580</td>
<td>5.8</td>
<td>6.8</td>
<td>6.2</td>
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<td>≥1,580</td>
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Industry shall need to develop all future models based on ECBC criteria only.
HCFC Refrigerants in phase-out list

• **Air-conditioning and Refrigeration**
  – HCFC-22
  – HCFC-123

• **Foam Sector**
  – HCFC-141b

• **HCFC-22 is the major consumption in**
  – Refrigeration & Air-conditioning products
  – HCFC-123 is used by few manufacturers in Chillers

• **Consumption frozen from 1\textsuperscript{st} Jan 2013**

• **Phase-out started from 1\textsuperscript{st} Jan 2015**
### Status of HCFC Phase out & Refrigerants used

<table>
<thead>
<tr>
<th></th>
<th>HCFC</th>
<th>HFC</th>
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<tbody>
<tr>
<td>Room AC Fix Speed</td>
<td>R22</td>
<td>R410A, R32</td>
</tr>
<tr>
<td>Room AC Inverter</td>
<td></td>
<td>R410A</td>
</tr>
<tr>
<td>Chillers Large</td>
<td></td>
<td>R134a</td>
</tr>
<tr>
<td>Chillers small</td>
<td>R22</td>
<td>R407c, R410A</td>
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<tr>
<td>VRF</td>
<td></td>
<td>R410A</td>
</tr>
<tr>
<td>Ducted</td>
<td>R22</td>
<td>R407c, R410A</td>
</tr>
<tr>
<td>Refrigeration</td>
<td>R22</td>
<td>R404A</td>
</tr>
</tbody>
</table>

**Chillers, VRV / VRF, Inverter Room AC**
- MNCs introduced global designs
- HFC 134a, HFC 410A, R32 adopted

**Foam**
- HCFC 141b phase-out taken on priority
- C5 technology adopted

**Imports**
- Import of units with HCFC banned from July 2015
Low GWP alternatives emerging

- HFC 32 (Moderate GWP): Better efficiency & environmental properties than R22 & R410A. Commercially launched & adopted for last three years by one Japanese company. Being adopted other industry players in RAC segment.

- HC 290 (Low GWP): In use for last four years adopted by one company in India estimated 250,000 units in four years. Not being adopted by other manufacturers due to flammability issues.

- HFC 446A/ 447A : Can replace R410A and are rated A2L category. At development stage

- HFO : Launched by some chiller manufacturers. Performance being observed by industry.

No clear solution for Ducted, PAC, Chillers with Low GWP
Natural Refrigerants

- Available Natural refrigerants are ammonia, carbon dioxide, propane, iso butane etc.
- Natural refrigerants have low GWP and Zero ODP
- They have major challenges of safety as most of these refrigerants are highly flammable / toxic and have limitation of usage
- Ammonia is still used to great extent in industrial & low temperature application but the use is restricted to commercial segment due to its toxicity, flammability etc.
- Carbon dioxide has limitation due to bad thermodynamic properties & safety concern as can cause suffocation if in large quantity.
- Propane, A3 category refrigerant has good thermodynamic property but is highly flammable.
Business process end to end & Challenges

- With no clarity on refrigerants alternatives, equipment manufacturers cannot have a long term plan as only interim solutions are available.
- Energy Efficiency Regulations and Refrigerant change have to be addressed in tandem.
Role of Industry

- ECBC Labeling Program
- New technologies
- Montreal protocol, Kigali Amendment
- Market dynamics

External Factors
Role of Industry

Integrated approach on Regulation

Skill development

Absorb new Technologies

Invest in R & D

Help in Developing India specific Policies

Initiatives
Present Status

- Energy regulation policies in place with clarity. This helps in planning.
- Industry is closely working with various stakeholders in developing India specific standards.
- Implementation of Montreal protocol is ahead of curve.
- HFCs are the potent Green House Gases (GHG) and emissions of these gases are controlled under Kyoto Protocol.
- Non availability of proven refrigerants technology to adopt low GWP refrigerants specifically in large systems.
- Industry has adopted low GWP technologies wherever technology is available such as C5 in foam sector.
Challenges

- Shorter product life cycles driven by regulation
- Technical options are still emerging, Industry to look for low GWP long term solutions
- HFCs are the main options to HCFC for most of the applications in refrigeration and air-conditioning
- Natural refrigerants have challenges of flammability and toxicity.
- Proven and matured technologies are not available
- Integration of regulations
- Integration of technologies
- Skill of service technicians is below the minimum acceptable level, hinders introduction of new technologies
Parties to the Montreal Protocol announced a draft agreement outlining a global phase down of HFCs.

HFC are intermediate solutions as they have low ODP but contribute to global warming.

Technologies as alternative to HFC are under development and not yet matured.

Industry will have to wait to understand if they have any harmful effects.
In long term, we will have to look beyond conventional cooling solutions to reduce the impact on environment due to Energy consumption & Refrigerants

THANK YOU . . .