



Global Refrigeration Technology Transition:

Progress and Issues identified during HPMPs Implementation

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The Montreal Protocol on Substances that Deplete the Ozone Layer

- Its objective is to phase-out the ozone depleting substances (ODSs);
- Focus on the elimination of the sources of the ODS: their production and consumption;
- Was agreed upon on 16 September 1987 - entered into force on 1 January 1989;
- Most of the ODS covered are very potent greenhouse gases (GHG);
- The ODS phase-out activities have provided considerable co-benefits to the climate change mitigation;
- The total avoided net annual ODS emissions by 2010 is estimated to be equivalent to about 10 Gt CO₂/year. (*Velders et. al, 2007*)

Air Conditioning and Refrigeration: Manufacturing & Assembling Sectors

Country*	Application	Major Technology Trend** & Pilots Implemented
Bangladesh	Room AC	R-290
	Domestic Refrigeration	R-600a
	Commercial AC	HFC-32
India	Room AC	HFC-32
Indonesia	Room AC	HFC-32
	Commercial AC	HFC-32
	Commercial Refrigeration	HFC-32
Iran	Room AC	R-410A
Chile	Commercial Refrigeration	Super-critical CO2
Colombia	Commercial AC	R-290
Costa Rica	Industrial Refrigeration	NH3 (reduced charge)
Mexico	Domestic Refrigeration	R-600a

*Article 5 Countries assisted by UNDP

**Support by the Multilateral Fund. Does not include ineligible companies assessment.

Air Conditioning and Refrigeration: Servicing & Installation Sectors



*Empowered lives.
Resilient nations.*

- Only sector for majority of countries (trend to be confirmed under Kigali Amendment);
- Management of HCFCs (mostly HCFC-22):
 - Reduce demand (Recovery, Recycle/Reclaim, Re-use);
 - Containment (better practices, training);
 - Retrofit, early retirement and replacement incentives.
- Growing share of (high-GWP) HFCs (R-410A, R-407C and R-404a);
- HPMPs are promoting diverse experiences to uptake low (or lower) GWP refrigerants;
- No “one fits all” solution anymore: need to be prepared!

Challenges and Barriers to the Technology Transition

- Adequate Regulatory Framework;
 - Sector or substance control, limits and bans;
 - Technical Standards (Safety Standards);
 - Labelling Systems
- Cost and Availability of Alternatives:
- Supply Chain of Parts and Components:
- Product Design (issue);
- End of the Chain:
 - Standards for Transport, Installation and Use;
 - Training (A2L, A3 and B3 refrigerants) and Certification (Skills)
 - Going “beyond” the Mechanics (new Technologies, “IOT”).

Energy Efficiency Linkages

- **Kigali Amendment:** Parties recognised *“that a phase-down of hydrofluorocarbons under the Montreal Protocol would present additional opportunities to catalyse and secure improvements in the energy efficiency of appliances and equipment.”*
- TEAP (2016): approx 10% of gains in EE is due refrigerante, while 30% can be additionally achieved by design and components improvement.

Global Warming Impact of HVAC-R Sector (as per TEAP 2016)

- ~80% indirect: electricity use
- ~20% direct: release of refrigerants (especially with old equipment with high GWP refrigerants)

Opportunity to achieve larger EE gains by:

- ✓ Transition to low GWP Refrigerants (direct impact)
- ✓ Reduce energy consumption (indirect impact)
 - ✓ Increase Energy Efficiency
 - ✓ Reduce cooling load
 - ✓ Improve maintenance

Case Study 1: AC and Ref. Manufacturing Sector of Indonesia

- HPMP Stage I of Indonesia: convert AC-R companies to HFC-32
- **Challenges faced:**
 - Supply Chain barrier: lack of HFC-32 components for larger sized equipment;
 - Regulatory barrier: HFC-32 recognized and treated as A3 substance: control and use restricted.
 - Cost issues: HFC alternatives (R-410^a and R-407C are consolidated in the market, A1 refrigerants, and have lower costs).
 - Technical barriers: variable speed units able to deliver higher COP than initial prototyped HFC-32 units.
 - Aftermarket: lack of knowledge of vendor, technicians and clients of HFC-32 based units and its peculiarities.

Case Study 2: Assembling/Installation Sector of Chile

- Demonstration of Super-critical CO₂ in “warmer climates” allowed the first transcritical CO₂ system to be installed in a chielan supermarket in the coastal city of Valparaíso (warmer climate). After succesful technology transfer, local chains committed to open 8 new supermarkets in 2019 using trans-critical CO₂.
- Need to change mentalities from supply and demand sides.
- **Challenges faced:**
 - Well established HCFC-22 based supply chain for supermarkets;
 - New stores flagging with the possibilitiy of “easy” transition to R-404a;
 - Lack of knowledge of CO₂-based system in the country;
 - Inexistent supply chain of components, installers and maintainers;
 - Higher “phase-in” cost of CO₂-based systems (30% above HCFC-22);

Case Study 3: Preparing the Servicing Sector In Trinidad and Tobado.

- TTO is an Caribbean Island that do not manufacture AC-R equipment.
- Country is “technology taker”;
- Economy based on oil extraction. 100% of energy is from oil, so energy efficiency is a latent need as AC-R is responsible by larger share of energy consumption.
- **Challenges faced:**
 - “Dumping” of high-GWP and low cost based-equipment;
 - Lack of knowledge of natural refrigerants in the country;
 - Exporters unable to export A2L and A3 due to lack of standards;
 - Higher “phase-in” costs of natural refrigerants and natural refrigerants-based equipment;

Thank you!

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