

Sustainable cooling & global warming: stakeholder voices from India

Talanoa Dialogue Questions

The following inputs are provided specifically for the Talanoa Dialogue. Nine interviews were carried out (see list below of stakeholders) along with desk research by first year MBA students of Xavier Institute of Management (XIMB), at Xavier University, India. The class was led by Prof. Subhasis Ray in collaboration with Dr Jenny Lieu within the framework of the TRANSrisk project which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642260.

Stakeholders list contacted:

End-users: 3 university students, 1 physics teacher, 1 security guard

Electronic retailer: 1 sales person, 1 owner

AC technology provider: 1

International organisation expert: 1

Secondary/desk research: Aditi Sharma

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Question 1- Where are we? (student research- select industry/sector)

- a) The commitment (planned and/or announced) as well as the actions taken so far that are in line with aims of Paris Agreement, the 1.5/2 degrees' goal and the transition towards a net-zero emission society by this mid-century

The context

The rise of temperature globally, growth of population, rapid urbanization and economic growth are driving up the cooling demand more than ever, particularly in lower income countries and emerging economies. Along with this, living standards are rising with electricity access, which is leading to increases in sales of room air conditioners (ACs). The demand for air conditioning is likely to increase by 9% annually until the year 2050 in developing countries. The AC sector is responsible for around 7% of global greenhouse emissions¹. Part of the emissions are a result of low efficiencies in ACs along with a high release rate of refrigerants which has a high GWP (Global Warming Potential). Greenhouse gas (GHGs) emissions are likely to increase to 8.1 GT CO₂eq per year by 2030 from 3.7 GT CO₂eq in 2014².

¹ GIZ, Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety- Federal Republic of Germany (2014) "Green cooling initiatives- Green Cooling technologies, Market trends in selected refrigeration and air conditioning subsectors by GIZ". *Updated February 2015*.

² Abhyankar N, Shah N, Park W Y, and Phadke A. (2017) "Accelerating Energy Efficiency Improvements in Room Air Conditioners in India: Potential, Costs-Benefits, and Policies". Lawrence Berkeley National Laboratory (LBNL). Available at: <https://eta.lbl.gov/sites/default/files/publications/lbnl-1005798.pdf>

India has the highest unmet cooling demand in the world³ due to its large population, hot climate and growing energy demand. In order to meet these need, the AC stock has expanded from 2 million in 2006 to an estimated 30 million in 2017. Expected sales of room ACs are projected to be between 55 - 124 million by 2030. In the Fiscal year 2017, about 5 million ACs were sold across the country⁴. In order for the air conditioning market to grow sustainably, climate friendly room with ACs need to be energy efficient and also use climate safe refrigerant gases.

The phasing down of HCFC has already begun and ACs are being replaced by HFC-410A and HFC -32 which have comparatively lower GWP and are set to completely replace HCFC as a refrigerant in the AC market primarily due to international policies.

Policies

Policies at the international level have pushed for the phasing out of HFCs. Since the late 1980s policies, the Montreal Protocol on Substances that Deplete the Ozone Layer, was established to protect the ozone layer by promoting the phasing out of Ozone Depleting Substances (ODS). The protocol entered into force in 1989 and was ratified in 2015 by all countries in the United Nations. A year later in 2016, the Kigali Amendment to the agenda of the Montreal Protocol was initiated specially to phase³.down the production and use of HFCs. Fulfilling the Kigali Agreement in India could avoid the use of HFCs equivalent to around 2 to 6 Billion tons of CO₂ through 2050. 20- 25% this reduction would come from HFCs used in ACs. India also has the opportunity to save an additional 950 million tons of HFC if we choose to phase down more rapidly compared to the majority of lower income countries under the Kigali Agreement.

Policies at the national level are also supporting decarbonization in the AC sector. The Ministry of Environment, Forest and Climate change (MoEFCC), and the Government of India developed India Cooling Action Plan (ICAP) provided a 20 Year Outlook on how cooling demand in India would grow and evolve. The Development of the India Cooling Action Plan (ICAP) has been a multi-stakeholder integrated and consultative process that encourages synergies across various sectors to support actions for meeting cooling demand needs.

ICAP encompasses the follow aspect to promote technological innovation within the AC sector which includes:

- a) Passively-cooled building design that deploys natural and mechanical ventilation;
- b) Adoption of adaptive thermal comfort standards to specify pre-setting of temperatures of air conditioning equipment for commercial built spaces;
- c) Promoting the use of energy-efficient refrigerant;
- d) Policy interventions for market transformation, including public procurement of energy efficient RAC appliances and equipment;
- e) Development of energy efficient and renewable energy base cold chain for perishable foods, national skill development program for training and certification for RAC service technicians to complement transition to energy efficient, low-GWP refrigerants; and

³ The Energy Resources Institute (2018), "Improving Air conditioners in India". Natural Resources Defense Council, Institute for Governance & Sustainable Development.

⁴ IEA, (2018) "The Future of Cooling: Opportunities for energy efficient air conditioning". Available at: https://www.iea.org/publications/freepublications/publication/The_Future_of_Cooling.pdf

- f) Focused R&D efforts to foster an innovative ecosystem to support development and deployment of low-GWP refrigerant alternatives.

There are other important industry indicators established to measure energy including SEER (seasonal Energy efficiency Ratio). Due to the seasonal variation in temperatures, there is variation in the amount of cooling required. For instance, the amount of energy required to cool a room from 30 degrees to 25 degrees is different from energy required to cool a room from 40 degrees. The usage hours also differ across seasons. The Indian Seasonal Energy Efficiency Ratio (ISEER) is the ratio of the total annual amount of heat that the equipment can remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period.

The Minimum Energy Performance Standards (MEP) is specifically established for energy efficiency and labelling in India. MEPS are procedures and regulations that prescribe the energy performance of manufactured products and prohibit the sale of products that do not meet these standards. AC MEPS consist of a broader labelling system which is a 5- Star rating program, Star rating is grade of energy efficiency displayed on the label of the room AC based on the energy consumption standard. The available stars are between a minimum of 1 to maximum of 5. The star rating is calculated by star rating band. 1 star has minimum energy efficiency. Table 1 indicates the Star rating standards set by the Bureau of Energy Efficiency corresponding to Maximum and minimum ISEE

Table 1: Mandatory 5-Star rating Scale 208-2019

Star Rating	Minimum ISEER	Maximum ISEER
1 Star	3.1	3.29
2 Star	3.3	3.49
3 Star	3.5	3.99
4 Star	4	4.49
5 Star	4.5	-

Source: BEE, 2017⁵

- b) Progress made so far against the above commitments, including success stories, case studies and gaps

The schedule under the Kigali Amendment does not yet call for controlling HFCs (for India, a cap on HFCs will begin in 2028). However, half a dozen room AC manufacturers in the Indian market are already planning to leapfrog away from HFC-410A with high GWP to other refrigerants with lower GWP (see table 2) as a part of HCFC Phase out Management Plan process (HPMP). Companies will receive funding from Multilateral Funds (MLF) to transition away from HCFC-22 over the next 7 years. The Montreal Protocol funds the manufacturing units to convert factories

⁵ BEE, Bureau of Energy Efficiency. Ministry of Power, New Delhi (8 August 2017). Available at https://www.beestarlabel.com/Content/Files/AC_Notification.pdf

from using ozone depleting chemicals and high GWP refrigerants to safer alternatives. This is done by redesigning products, retooling factories.

Table 2: Comparison of room AC refrigerant GWP characteristics

Refrigerant	Chemical Type	GWP	Indian Market Status
HCFC-22	HCFC	1760	India is phasing out HCFC-22 under the Montreal Protocol because of its ozone depletion impact. HCFC-22 is used in older, lower efficiency room ACs and has a high GWP
HFC-410A	HFC	1924	HFC-410A has been commercialized in India, including in higher energy efficiency room ACs, but it has a high GWP and will be phased down under the Kigali Amendment.
HFC-32	HFC	677	HFC-32 is replacing HCFC-22 in the market. Over 1 million ACs with HFC-32 have been sold in India, including the highest efficiency room ACs, but it has a moderate GWP and will be subject to the Kigali Amendment.
Blends	HFC/HFO	<700	Room ACs using blended refrigerants are currently in the pre-commercial stage.
HC-290	Hydrocarbon	3	HC-290 is replacing HCFC-22 in the market. Hundreds of thousands of room ACs using HC-290 have been sold in India, including the highest efficiency room ACs, and it has low GWP

Source: NDRC, 2017 cited in TERI, 2018⁶

In India, HFC-32 emerged as predominant alternative with a GWP of 677, which are improvement compared to most HFC refrigerants that currently have GWP between 2,000 and 4,000⁷. HFC-32 is considered market ready by nearly all manufacturers and provides about two third reduction in direct climate impact of the refrigerant as compared to HFC-410A. The first HPMP to use HFC-32 will save over 1.2 million CO₂e tonnes of refrigerant annually. HC-290 (Propane), which has a GWP of 3, and is already being used in India but its market share would increase when HFC is fully phase down under the Kigali Agreement.

c) Quantitative impact so far with respect to mitigation, adaptation, resilience and/or finance

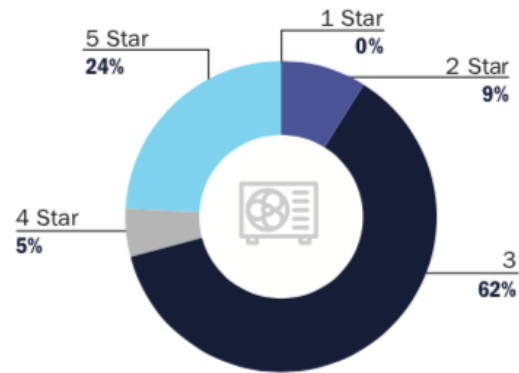
The rising demand for cooling appliances is a positive sign of growth for business in the cooling sector. The evolution of the energy efficient products in market and the inverter technology available now in the market has led to energy saving of around 60% electricity. R22 gas, a refringent in ACs also known as Freon, currently makes up the majority of the market share of refrigerants (70%). However, R22 is now being replaced by R410, which is eco-friendly and has better cooling efficiency. The anticipated share of R410 was at 11% in 2017 and is expected to continue to increase.

⁶ TERI (2018). “Industry Information and Estimate, 2018 –Report: Improving Air conditioners in India”. Available at: <http://www.teriin.org/policy-brief/improving-air-conditioners-india>

⁷ Goetzler W, Sutherland T, Rassi M, Burgos J. (2014) “Research & Development Roadmap for Next-Generation Low Global Warming Potential Refrigerants”. U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Building Technologies Office. Available at: <https://www.energy.gov/sites/prod/files/2014/12/f19/Refrigerants%20Roadmap%20Final%20Report%202014.pdf>

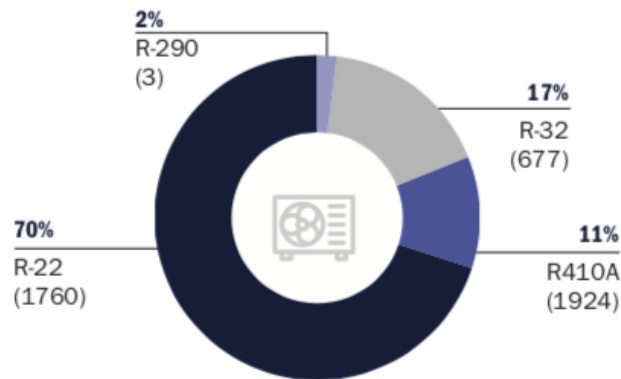
The share for more energy efficient AC is improving in India. Figure 1, which provides the share AC sales by star rating while Figure 2 provides a breakdown of refrigerant type for AC sales in India.

Figure 1: Room AC sales in India by Star Rating (2017-18)



Source: TERI, 2018⁶

Figure 2: Estimated AC sales in India by refrigerant (2017)



*GWP value in parenthesis

Source: TERI, 2018⁶