

UNDERSTANDING PERCEPTIONS: A BEHAVIOURAL STUDY IN THE INDIAN COOLING SECTOR

October 2020



SHEETAL

Alliance for Sustainable Habitat, Energy Efficiency and Thermal Comfort for All

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Suggested format for citation

TERI. 2020
UNDERSTANDING PERCEPTIONS: A Behavioural Study in the Indian Cooling Sector
New Delhi: The Energy and Resources Institute. 70 pp.

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ABBREVIATIONS

AC	Air Conditioner
BEE	Bureau of Energy Efficiency
DISCOMS	Distribution Companies
ECBC-R	Energy Conservation Building Code – Residential
ESSCI	Electronics Sector Skills Council of India
GHG	Greenhouse gas
GWP	Global Warming Potential
HCFC	Hydro chlorofluorocarbons
HFC	Hydrofluorocarbons
ICAP	India Cooling Action Plan
IEA	International Energy Agency
IPCC	International Panel on Climate Change
ISHRAE	Indian Society of Heating, Refrigerating and Air Conditioning Engineers
MEPS	Minimum Energy Performance Standards
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoU	Memorandum of understanding
ODS	Ozone Depleting Substances
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
R&D	Research and Development
RAC	Refrigeration and Air Conditioning
S&L	Standards and Labelling programme
SDA	State Designated Agencies
TWh	Terawatt hours
UDD	Urban Development Departments
UNFCCC	United Nations Framework Convention on Climate Change

ACKNOWLEDGEMENTS

We would like to thank the Ministry of Environment, Forest and Climate Change (MoEF&CC) for their encouragement in carrying out this perception study. We are particularly thankful to Ms. Geeta Menon, Joint Secretary, MoEF&CC, Dr Amit Love, Additional Director, MoEF&CC and Mr. Arijit Sengupta, Director, Bureau of Energy Efficiency for their valuable interventions during the stakeholder consultation event at the World Sustainable Development Summit (WSDS) 2020. We are thankful to Ms. Dana Purcarescu, Chargée d'affaires, Embassy of France; Ms. Ulka Kelkar, World Resources Institute (WRI) India; Mr. Bimal Tandon, Refrigeration and Air-conditioning Manufacturing Association; Ms. Anjali Jaiswal, Natural Resource Defence Council (NRDC); and Ms. Aditi Shah, Aditi Air-conditioning Pvt. Ltd. For their expert interventions during the stakeholder consultation event at WSDS 2020. We thank all the participants who attended the thematic track event on 'SMART policy levers for achieving sustainable cooling' during the WSDS 2020 to share their valuable thoughts.

We would like to acknowledge the guidance and valuable feedback provided by the experts who participated in the interviews and Edelman India Pvt. Ltd for facilitating in conducting the surveys without whom our research findings would not be realised. The study was conducted with the financial support from Children Investment Fund Foundation (CIFF) and John D. and Catherine T. MacArthur Foundation and we are grateful to Dr Shirish Sinha, Director (Climate), CIFF and Ms. Moutushi Sengupta, Director, India Office, MacArthur Foundation for their continued support. The views expressed in the report are those of the authors and not of the Foundation

We are also grateful to our reviewers for their comments and feedback that helped improve this report, especially Mr. Amit Kumar, The Energy and Resources Institute and Dr Vaibhav Chaturvedi, Council on Energy, Environment and Water (CEEW). We are indebted to the entire TERI team for their constant support and encouragement, specially Mr. R.R. Rashmi, Distinguished Fellow, TERI for his guidance through the course of this research study.

SCOPE OF THE REPORT

Cooling is linked with economic growth and is recognized as the key to the health, wellbeing, and productivity of people in hot climates. India is a growing economy characterized by low penetration of air-conditioning, rising per capita income, rapid urbanization, and a largely tropical climate; all of which would lead to an increase in the requirement for cooling. Addressing the rising cooling requirement is a challenge as well as a unique opportunity, necessitating synergies in policies and actions to address the cooling requirement across sectors even while making cooling sustainable and accessible to all.

Increasingly, cooling is recognized as a developmental need that is linked with achieving many Sustainable Development Goals. A large part of the cooling demand is catered through refrigerant-based cooling globally across sectors such as buildings, cold-chain, refrigeration, and transport. Refrigerants used in cooling equipment are regulated under the Montreal Protocol regime.

Within this context, the development of the India Cooling Action Plan (ICAP) has been a multi-stakeholder, integrated and consultative process in order to synergize actions for addressing the cooling demand across all sectors. The ICAP provides a 20-year perspective (2017–18 to 2037–38) and recommendations to address the cooling requirements across sectors, and ways and means to provide access to sustainable cooling.

The ICAP underscores the importance of further development and the use of a robust mix of cooling technologies, including the use of energy-efficient appliances with appropriate environment-friendly refrigerants, for meeting the growing cooling requirement of the country.

As India's economy grows, cooling will take on a progressively more important role as a key driver and marker of development. With the need for cooling set to grow exponentially across residential, transport, industrial, and agricultural value chain applications, understanding the perceptions of key stakeholders can enable the creation of interventions, initiatives, and engagements to better support the sector's growth.

This research includes:

- ▶ Creating a benchmark of comparative stakeholder perceptions
- ▶ Gauging stakeholder group-specific perceptions to inform the creation of targeted interventions

The results will identify:

1. Key areas of opportunity for policy interventions in specific sectors
2. Key areas of concern – in perception and on-ground – that will need to be addressed

RESPONDENT SET

Consumers

SEC A/B, 26-55 years old

Policymakers

Senior government officials at the central and state level

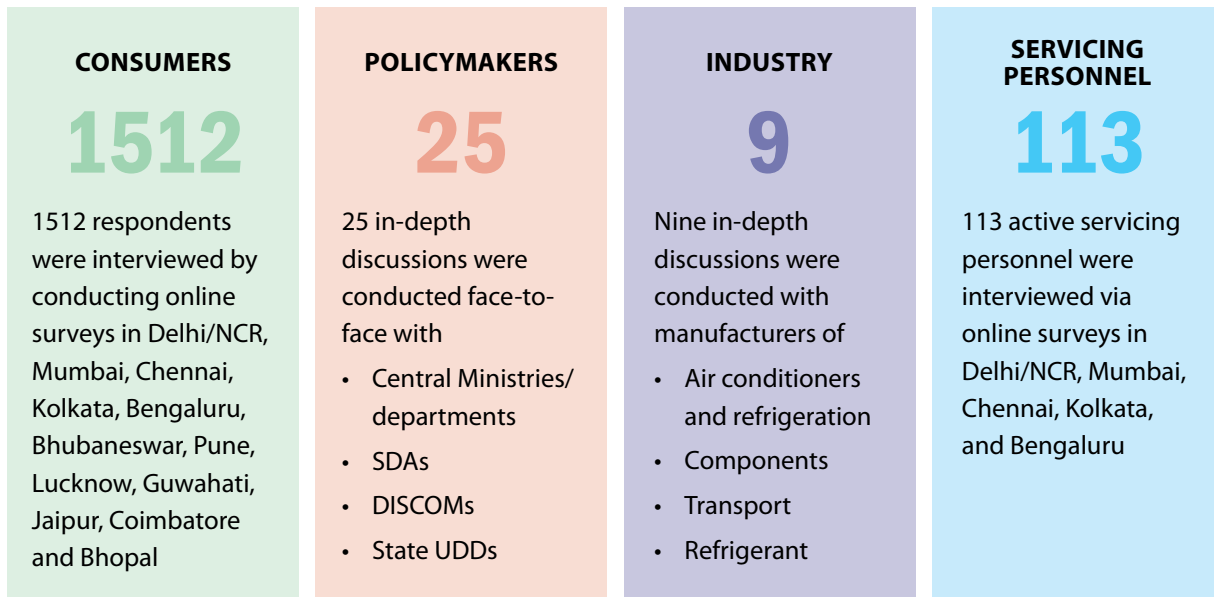
Manufacturers

Manufacturers of cooling equipment in India, i.e. manufacturers of cooling equipment components, air-conditioning, mobile air-conditioning, refrigeration, refrigerant

Servicing Personnel

Active servicing personnel in the RAC sector

Stakeholders were included from categories vital to the cooling ecosystem. These include the following:



To conduct the perception study, we have carried out the consumer and servicing technician survey. Perspectives were gauged through different approaches for different stakeholder groups. The analysis shown in the report is based on the data gathered during the perception survey and all the insights highlighted in this report are outcomes of the responses received from the stakeholders.

EXECUTIVE SUMMARY

Cooling requirement is a cross-sectoral and an essential part of economic growth. Cooling demand is set to rise in the future. The need for cooling is pervasive across different sectors of the economy, such as residential and commercial buildings, cold-chain, refrigeration, transport, and logistics.

Meeting this demand will result in increased use of refrigerants and energy use. The Kigali Amendment to the Montreal Protocol for the phase-down of Hydrofluorocarbons (HFC) was the first formal recognition of the linkages between refrigerant transition and energy efficiency of air-conditioning equipment. Integrated actions have a higher impact than any of the actions taken in isolation. It is therefore the need of the hour to have an integrated long-term vision on cooling encompassing, among other things, optimization of cooling demand, integration of energy efficiency and refrigerant transitioning efforts, and adoption of better technology options.

Within this context, the development of the India Cooling Action Plan (ICAP) has been a multi-stakeholder, integrated, and consultative process in order to synergize actions for addressing the cooling demand across all the sectors. The ICAP provides a 20-year perspective (2017–18 to 2037–38) and recommendations to address the cooling requirements across sectors and ways and means of providing access to sustainable cooling.

Given the cross-cutting requirement of cooling in multiple sectors, different government departments and ministries are linked with the subject of cooling. Therefore, the development and implementation of ICAP has been an inter-ministerial undertaking. Some actions emerging out of the ICAP also require involvement of state governments and urban local bodies for their implementation. These linkages have been captured in the ICAP implementation framework.



The ICAP has considered the interdependencies among policy interventions and strives to harmonize energy efficiency with the HCFC phase-out and high-GWP HFC phase-down schedules. It also re-emphasizes the principles enshrined in the Country Programme of India for phasing out of Ozone Depleting Substances (ODS) to minimize economic dislocation and obsolescence cost and maximize indigenous production for combined environmental and economic gains.

We have conducted this stakeholder perception study with the primary objective to gauge the perceptions of various stakeholders in the cooling sector. This study intends to identify the levers to policy intervention opportunities. To effectively implement SMART (Specific, Measurable, Achievable, Realistic and Timebound) levers to achieve sustainable cooling, it is imperative to understand the perceptions and attitudes of the key stakeholders.

Overview of chapters

The chapters are organized to separately cover the diverse perceptions of various stakeholder groups.

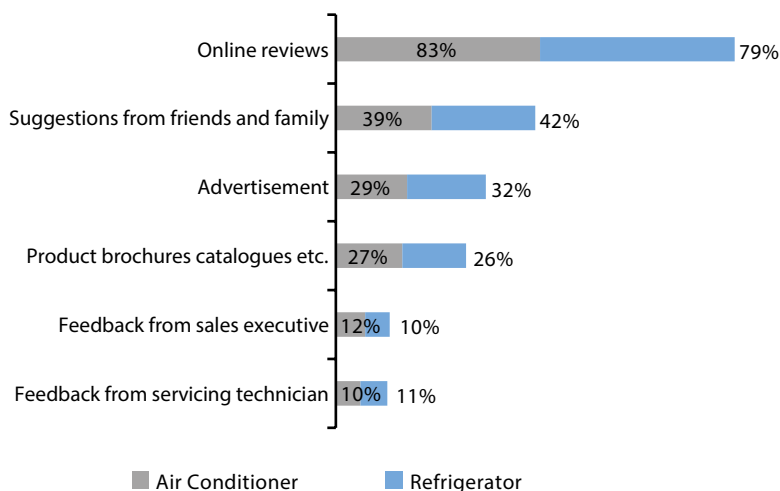
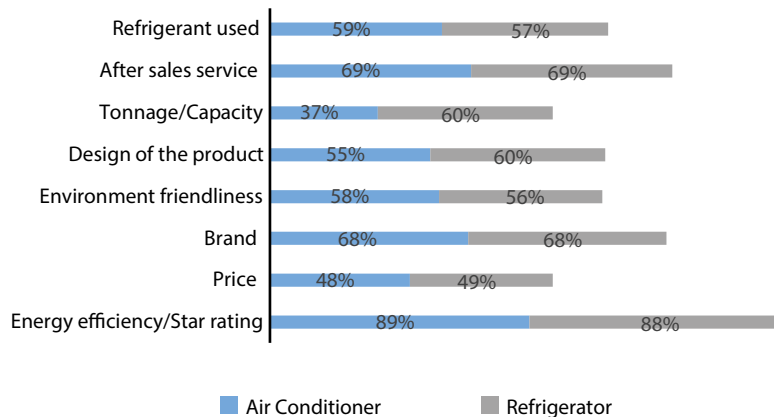
They have been summarized as follows:

Consumers tend to buy energy-efficient air conditioners

In the Asia-Pacific region, India is amongst the fastest growing room air conditioner and refrigerator markets. Rising per capita income, the presence of a large number of global and local players, the emergence of mega infrastructure, and surging investments have driven national demand for room air conditioners. Room air conditioners find predominant application in residential sector, and currently have a fairly low penetration in India. The residential sector plays a pivotal role in the growth of India's room air conditioner market.

Energy labelling and star ratings have led consumers to prefer a more efficient air conditioning equipment in their households. More preference for efficient cooling is due to the higher use of air conditioners and growing awareness of the associated emissions.

Online reviews have emerged as the most preferred platform to seek information while purchasing cooling appliances. Towards maximizing the product's lifespan and ensuring maximum energy efficiency, consumers also prefer to get their air conditioners serviced regularly. As consumers have become more familiar with the emissions caused by air conditioners and the international negotiations to address them, they are now looking forward to technological reforms in the sector.



Policymakers seek better awareness and cooperation across the value chain

The Government of India has many policies and programmes being implemented in the 'mission mode' in energy efficiency, urban development and housing, agriculture, transport, health, R&D, skill development and entrepreneurship (e.g. Housing for All, Smart Cities Mission, National Mission on Sustainable Habitat, Doubling Farmers' Income). While actions under these projects in various development sectors will proceed independently, it is imperative that synergies be forged, wherever possible, to leverage greater environmental and societal benefits.

Integrated actions have a higher impact than those taken in isolation. Therefore, an integrated long-term vision on cooling encompassing, among other things, optimization of cooling demand, integration of energy efficiency and refrigerant transitioning efforts, and adoption of better technology options, is the need of the hour.

Of the varied policymakers interviewed, there is an appreciation that there can be gaps between the policies created and awareness about them among key stakeholders, including manufacturers. Also, policymakers expect feedback, thus ensuring that policies are not made in a vacuum but are cognizant of ground realities. Key parties involved in policy implementation felt the requirement for more platforms for consultation and collaboration, especially in research.

The landmark policy document of ICAP demonstrates unprecedented inter-ministerial and cross-sectoral collaboration in laying out actionable pathways and has identified ambitious goals. ICAP underscores the environmental and socio-economic benefits of sustainable cooling through five ambitious goals, including the recognition of 'cooling and related areas' as a key area of research under the national science and technology programme to support the development of technological solutions and encourage innovation challenges.

Among policymakers, it is perceived that the training sector is expected to grow exponentially, due to the huge need for skilled personnel in the sector. Consequently, more capacity building is expected with a focus on training and skilling. Lastly, indirect fiscal incentives (instead of direct incentives) are expected for manufacturers to participate in a seamless transition to efficient air conditioners and refrigerants.

There is a need for an integrated long-term vision to address cooling requirement across sectors – a vision that encompasses reducing cooling demand; refrigerant transition; enhancing energy efficiency; advancing cooling technology options; and improving access to cooling in a more equitable manner.

Costs, policy direction and training are top concerns of manufacturers

Manufacturers believe that the cost impact of transitioning to environment friendly refrigerants must be understood better. At the same time, the cost of the transition should not leave the consumers unsatisfied.

The manufacturers have put forward their concerns about the inadequate clarity on the policies. There is a concern that the market risks associated with greener refrigerants may reduce industry motivation. They also shared recommendations for the training sector, significantly focusing on the need for safer installation and servicing practices to avoid accidents. There have been demands for a higher number of training facilities to support the need for a larger workforce. Financial aid to consumers should be provided as per the manufacturers.

The manufacturers are of the view that clarity on policies and implementation is required across the sector. In addition to providing financial aid to consumers, subsidizing the components and providing indirect incentives such as tax rebates and carbon credits to manufacturers can streamline the transition. The government should ensure that the necessary steps are being taken by the industry.

The servicing workforce is still driven significantly by informal training

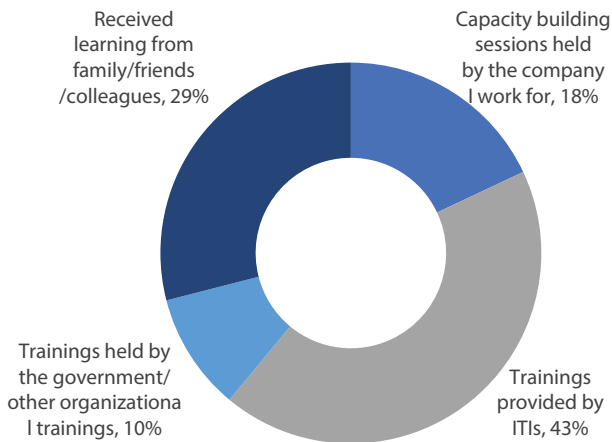
Cooling is one of the major sectors for employment, both in urban and in rural areas. Skilled personnel are needed for installation and servicing RAC equipment. With growing demand for cooling, there will be an increase in the number of manufacturing and assembling facilities and servicing activities. India has approximately 200,000 service technicians working in the RAC trade, in the formal and the informal sector¹. The number of

¹ Details available at <http://ozonecell.in/wp-content/uploads/2019/03/INDIA-COOLING-ACTION-PLAN-e-circulation-version080319.pdf>

technicians is expected to grow in line with the growth in penetration of RAC equipment in the country. With a large section of RAC service technicians working in the informal sector, there is potential to upskill service technicians through training and certification programmes.

Recognizing this need, the MoEF&CC and the Ministry of Skill Development and Entrepreneurship of the Government of India entered into a Memorandum of Understanding (MoU) on 2 August 2018 for the upskilling and certification of 100,000 RAC service technicians under the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) – Skill India Mission².

While personnel seem to be aware of the technical aspects of servicing and best practices, the sector is majorly driven by informal training. Also, a significant number of respondents believed that trainings are necessary. They appreciate that training can lead to better socio-economic benefits, such as higher pay and better jobs, which can increase receptivity to training. This aspect can create the opportunity to bring a large percentage of the informal sector into the formal workforce.



Interlinkages identified that would support the sector development

Given the cross-cutting requirement of cooling in multiple sectors, different government departments and ministries are linked with the subject of cooling. Therefore, the development and implementation of ICAP has been an inter-ministerial undertaking. Some actions emerging out of the ICAP also require involvement of state governments and urban local bodies for their implementation. These linkages have been captured in the ICAP implementation framework.

The ICAP has considered the interdependencies among policy interventions and strives to harmonize energy efficiency with the HCFC phase-out and high-GWP HFC phase-down schedules. It also re-emphasizes the principles enshrined in the Country Programme of India for phasing out of Ozone Depleting Substances (ODS) - to minimize economic dislocation and obsolescence cost and maximize indigenous production for combined environmental and economic gains.

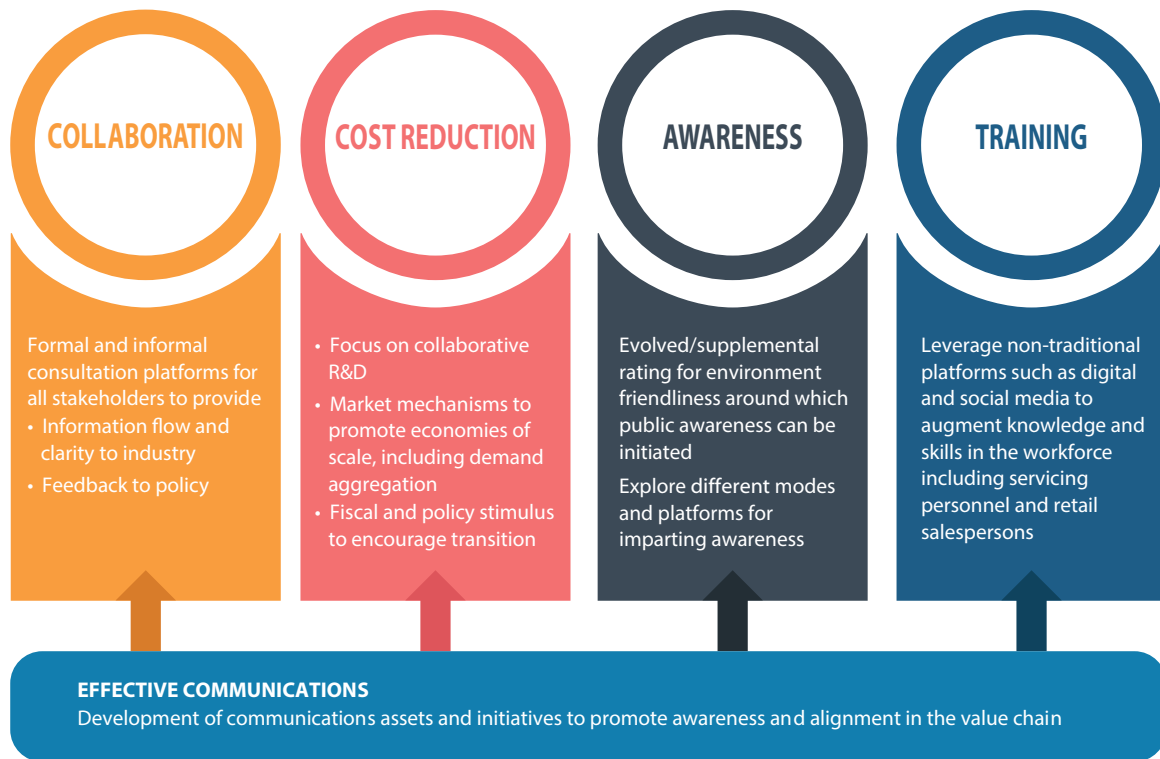
It is necessary to gauge priorities and challenges and identify opportunities such as effective implementation of SMART levers, so that any policy decision is effectively translated into desired outcomes.

Effective communication assets to develop the interlinkages among the stakeholders' vis-a-vis collaboration, cost reduction, training, and awareness are the way forward for the sector.

The analysis of various perceptions points to some clear pathways:

1. **Collaboration:** Formal and informal consultations and collaborations among key stakeholders
2. **Cost rationalization:** Cost is likely to always be an issue for both consumers and manufacturers. Collaborations, especially in R&D, may spread risk and reduce the cost of development.

² Details available at https://www.business-standard.com/article/pti-stories/1-lakh-technicians-to-be-trained-in-refrigeration-air-conditioning-service-118080201348_1.html



3. **Training:** There is a clear need for more training. Conventional training can perhaps be supplemented via digital and social platforms for micro-skilling and knowledge transfer.
4. **Awareness:** it is imperative to spread awareness among all stakeholder groups. Feedback loops to inform policy, awareness about policy among manufacturers and technology and the benefits of ratings among consumers can drive a holistic intervention to achieve a faster transition to efficient cooling.
5. **Effective Communications:** This underpins all above-mentioned activities. Only when stakeholders know that can participate effectively can decisions be better informed. Only then will consumers also buy into the transformative process. Effective communications at all levels will be vital to the success of any sectoral initiative



CONSUMER BEHAVIOR PLAYS A KEY ROLE IN RESIDENTIAL SECTOR COOLING ECOSYSTEM

In the Asia-Pacific region, India is amongst the fastest growing room air conditioner and refrigerator market. Rising per capita income, the presence of a large number of global and local players, the emergence of mega infrastructure, and surging investments have driven the national demand for room air conditioners. On account of the recent COVID-19 outbreak, the room air conditioner market in India is expected to face challenges in 2020.

The world energy consumption is expected to increase from 575 quadrillion British thermal units (Btu) (in 2015) to 663 quadrillion Btu by 2030, and further to 736 quadrillion Btu by 2040. Most of this increase in energy demand is expected to come from developing countries, where strong economic growth, increased access to marketed energy, and growing populations lead to a rise in the demand for energy. India has been responsible for almost 10% of the increase in global energy demand since 2000. India's energy demand in this period has almost doubled, pushing the country's share in the global demand up to 5.7% (in 2013), from 4.4% at the beginning of the century.³

Room air conditioners find predominant application in residential sector, and currently have a fairly low penetration in India at around 7–9%. The residential sector will play a pivotal role in the growth of India's room air conditioner market. Rising population, increasing urbanization and per capita income, the availability of financing options, and the increasing housing construction across the country are anticipated to drive the room air conditioner market in the residential sector. Moreover, to fulfil housing demand, the government is planning to construct over 2 crore new housing units in urban areas and about 4 crore houses in rural areas by 2022⁴. This will further accelerate the residential demand for air conditioners.

Consumers are the most important stakeholders in the cooling sector as they are the final end user of the equipment. Consumers hold a strategic viewpoint towards the overall sector and their level of awareness and behaviour affects the key aspects of cooling. The requirements and aspirations of the consumers for their cooling equipment in terms of preferences need to be understood.

An online survey of 1512 consumers, spread across 12 key cities, was conducted to assess the awareness and behaviours of consumers on some of the key aspects of cooling. The respondents were between the ages of 26 and 55. Around 84% had at least one air-conditioner installed in their households. The remaining (16%) said they would buy an air conditioner in the next six months. All respondents were using a refrigerator in their respective households.

³ Details available at <https://www.teriin.org/sites/default/files/2020-01/modified-accelerating-the-uptake.pdf>

⁴ Details available at <https://theprint.in/india/governance/modi-govts-1000-day-rural-target-2-crore-houses-roads-to-all-villages-toilets-in-homes/245556/>

Consumers now prefer to purchase energy-efficient cooling equipment

Bureau of Energy Efficiency (BEE) instituted the Standards and Labelling (S&L) programme in 2006 to set minimum energy performance standards (MEPS) for room air conditioners, along with other consumer appliances. The S&L programme has multiple benefits. At the national level, it is tremendously successful in addressing issues such as peak load, accelerated electricity demand and ensuring awareness generation among consumers regarding the household monetary saving benefits of energy-efficient equipment to the consumers.

Being more informed about the effects of emissions and high energy use of their appliances, consumers have started considering energy efficiency and environment friendliness as the key attributes while buying air conditioners or refrigerators. Energy efficiency, brand, and after-sales services are the leading attributes considered as 'important' while making a purchasing decision. Figure 1.1 shows the variances in preferences of different attributes. The energy-efficiency ratings, after sales services, brand and the refrigerant used are the most prominent factors that influence the purchasing decision of the consumers across all age categories. It is optimistic to note here that consumers have become aware about energy efficiency, environmental friendliness and choice of refrigerant used in the equipment and consider these factors when buying a refrigerator. Interestingly, consumers are less concerned about the cooling capacity or tonnage of the air conditioners. One of the inferences that could be drawn here is that the consumers relies more on the retailer suggestion. This may also be the reason for the installation of oversized cooling equipment in the country.

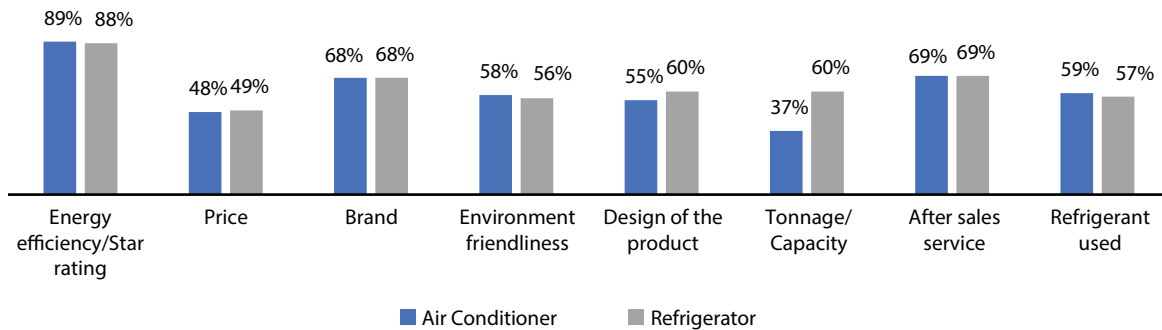


Figure 1.1 Respondents' preferences on key attributes while purchasing air conditioner/ refrigerator

Note: Total sample size, $n = 1512$

An analysis of the behaviour across different age groups shows that the younger generations are more aware about environment- and refrigerant-related attributes. Figure 1.2 showcases the preferences of different generations while purchasing an air conditioner.

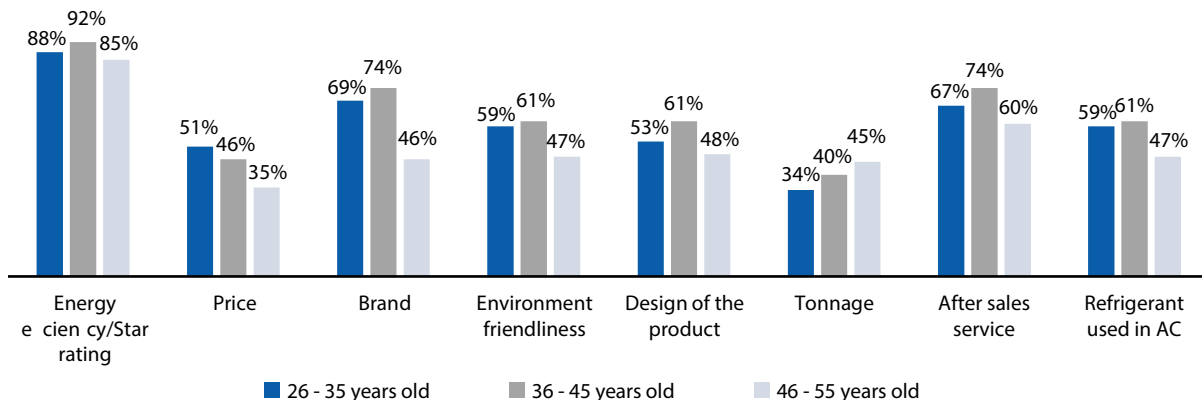


Figure 1.2 Respondents' preferences on key attributes while purchasing air conditioner (age data)

Note: Total sample size, $n = 1512$; 26–35 years old $n = 796$; 36–45 years old $n = 551$; 46–55 years old $n = 165$

When it comes to buying such equipment, consumers have lately been showing an inclination towards online platforms. The surge in preference for online platforms can be attributed to cheap data access by telecom service providers in India and higher penetration of e-commerce companies.

Higher penetration of mobile phones and e-commerce platform coupled with lower Internet rates have paved the way for increased use of online purchase in India. The cooling equipment market is also witnessing the same trend. A large number of consumers have responded that they prefer online review platforms for making purchasing decisions. The change has been seen recently in India and can be one of the effective tool to leverage for consumer awareness campaigns to promote low-GWP-based climate friendly cooling products. Respondents rely on their respective friends and family members for positive feedback on the appliances before they finalize the purchase.

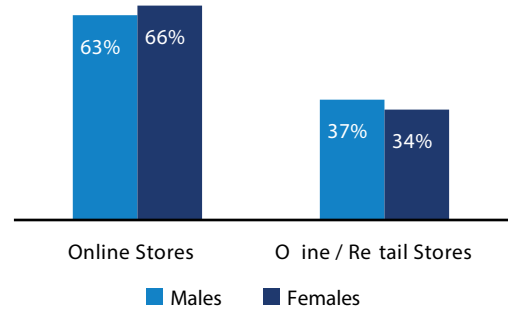


Figure 1.3: Consumer preferences on platforms to buy air conditioner
 Note: Total Sample Size, n = 1512; Males n = 1052; Females n = 460

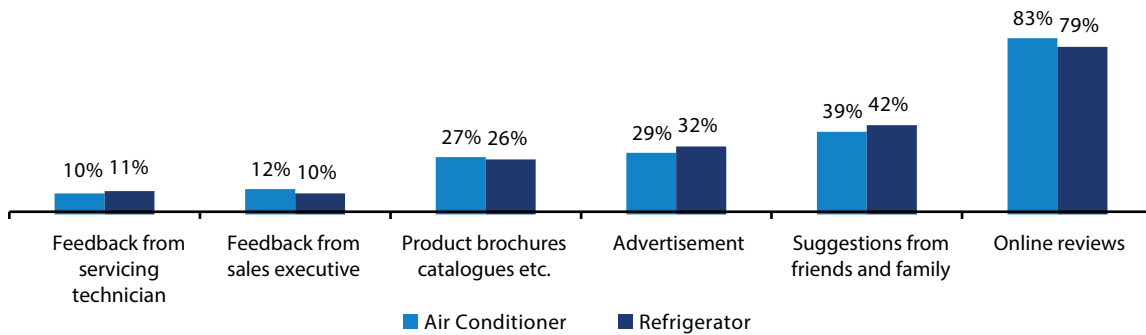


Figure 1.4 Sources of information sought in case of air-conditioners
 Note: Total sample size, n = 1512

FURTHER, THE CONSUMERS HAVE NOW BEEN LOOKING FORWARD TO ONLINE REVIEWS MORE FOR INFORMATION ON THE AIR CONDITIONER AND THE REFRIGERATORS. THIS IS WIDELY SEEN DUE TO HIGHER PENETRATION OF SMARTPHONES AND CHEAPER DATA ACCESS.

Increased usage of cooling equipment shows how it is now recognized as a necessity

Split air conditioners continue to capture the highest share in the room air conditioner market owing to their reduced price gap in comparison to the window air conditioners.

Adoption of air conditioners in residential segment has fuelled the demand in the split air conditioner market. Introduction of smart and inverter split air conditioners with advanced featured systems would further propel the market demand, especially in the premium segment. Market trends in the room air conditioner segment has been reflecting the same and according to BEE data around 85% of the air conditioners sold in 2018 in India were split units.

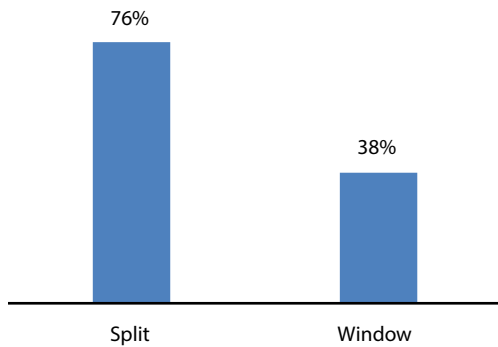


Figure 1.5: Type of air conditioner preferred

Note: Total sample size, $n = 1265$

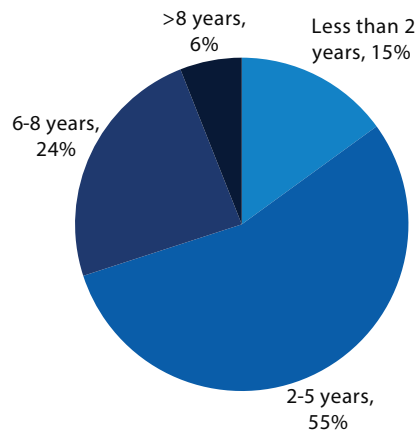


Figure 1.6: Tendency to replace air conditioners in households

Total Sample Size, $n=1265$

Respondents have shown different behaviours when it comes to replacing their air conditioners. While 55% of the respondents opt for a replacement within 2–5 years of purchasing an air conditioner, one-fourth of them replace it between 6 and 8 years. The large second-hand inefficient air conditioner market available in urban areas can be attributed to the old air conditioners being sold by consumer to the local vendors. The replacement tendency of the air conditioner in households is an interesting insight and the possible attributes to such behaviour can be high income levels, the usage, longevity, preference on technology, and the star ratings or relocation.

Figure 1.7 shows the varied behaviours of populations from different cities. In spite of diverse climatic conditions, most people tend to replace their household air conditioners between 2 and 5 years as observed throughout the country.

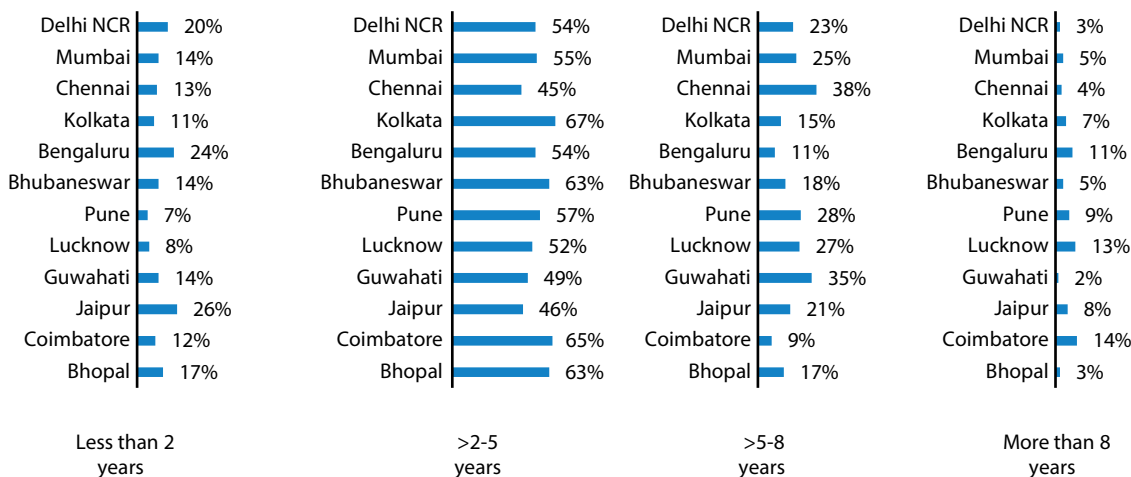


Figure 1.7 : Tendency to replace air conditioners in households (city data)

Note: Total sample size, $n = 1265$; Delhi NCR $n = 168$; Mumbai $n = 174$; Chennai $n = 182$; Kolkata $n = 182$; Bengaluru $n = 99$; Bhubaneswar $n = 65$; Pune $n = 69$; Lucknow $n = 62$; Guwahati $n = 49$; Jaipur $n = 90$; Coimbatore $n = 65$; Bhopal $n = 60$

In cities with less variation in temperature, respondents do not regulate the temperature settings of their refrigerators. Figure 1.8 shows the usage pattern of refrigerators in detail. Cities such as Guwahati, Chennai, Kolkata, and Pune which do not see much variation in temperature tend to operate the refrigerator at a constant temperature. In contrast, Delhi and Lucknow, as they experience extreme weathers, tend to adjust the temperature as per the conditions.

WHEN IT COMES TO OPERATING THE REFRIGERATOR AS PER REQUIREMENT, MOST RESPONDENTS TEND TO USE IT AT A CONSTANT TEMPERATURE THROUGHOUT THE YEAR.

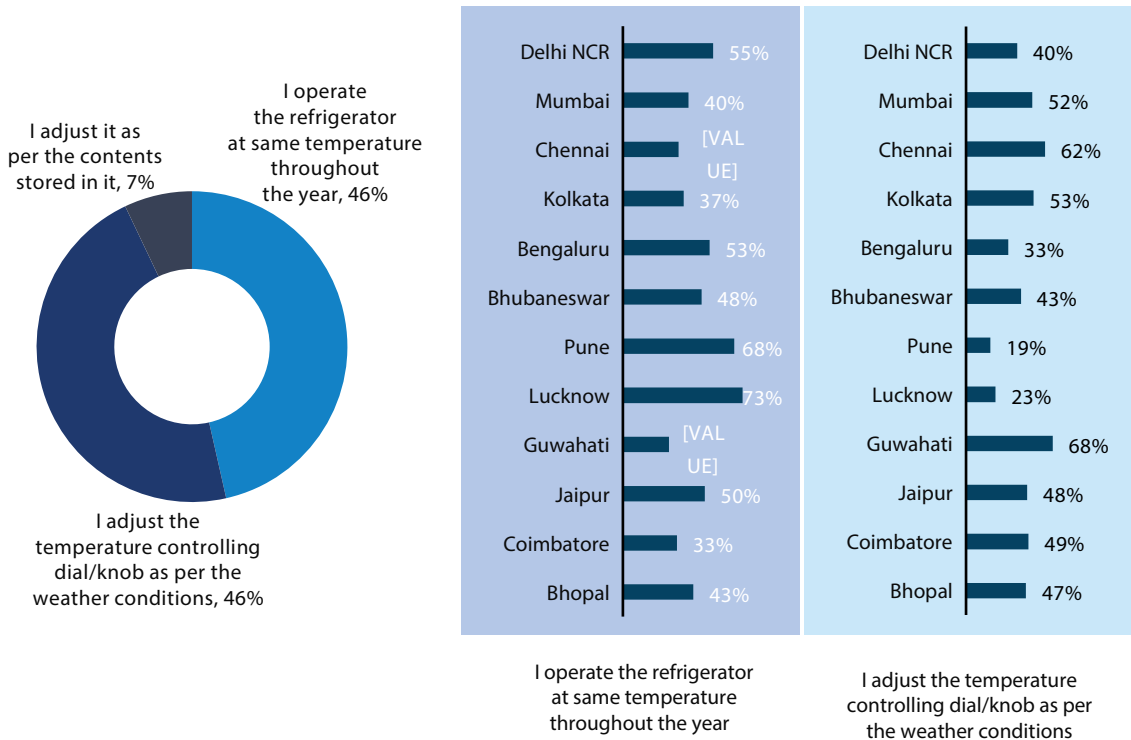


Figure 1.8 : Usage pattern in case of refrigerator
Note: Total Sample Size, n = 1512

Air coolers are popular and have a very high degree of penetration throughout India as majorly the country experiences hot climate. About 7 in 10 respondents use an air-cooler in addition to an air conditioner. One of the primary reasons why consumers prefer air coolers to an air conditioner is its lower cost.

Figure 1.9 shows that the lower purchasing costs and the environment friendliness of an air cooler are the reasons why respondents prefer to buy it. Better air quality is the most motivating factor why people use air coolers.

Figure 1.10 shows the triggers of preference for the use of air conditioners over air coolers. People preferring air-conditioners over air coolers cite better cooling as the reason.

Also, as air conditioners are deemed to be more effective in areas with higher humidity levels, consumers prefer them over cheaper and energy-efficient cooling equipment such as an air cooler.

The rising living standards and higher disposable incomes have led people to use more than one air conditioner in their homes. Of the respondents, about three-fourth have more than one air conditioner in their homes. A typical respondent household has on average two air conditioners installed.

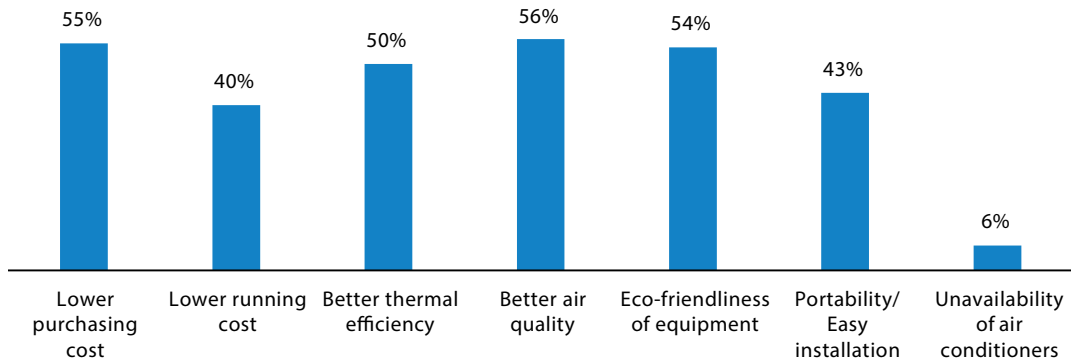


Figure 1.9 : Motivating factors to use an air-cooler

Note: Total sample size, $n = 1063$

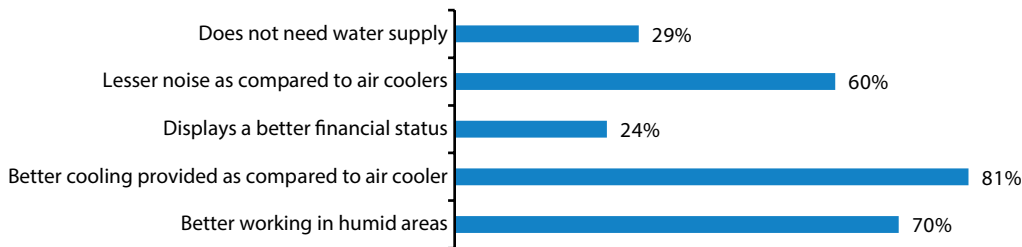


Figure 1.10: Triggers to prefer air conditioner over air cooler **Note:** Total sample size, $n = 353$

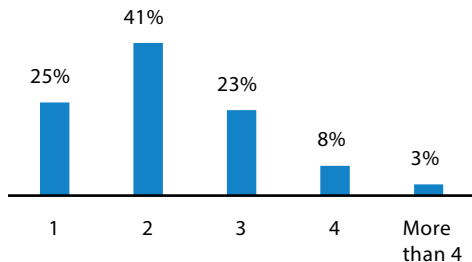


Figure 1.11: Number of air conditioners in use

Note: Total Sample Size, $n = 1265$

Consumers typically are not technically aware about refrigerants

The domain knowledge of refrigerant specifications is considered to be specifically technical but with rising penetration levels of air conditioners, this knowledge gap is disappearing among people. Figure 1.12 depicts the perception of people on the properties of refrigerants. With time, respondents are now getting acquainted with the key properties possessed by refrigerants. However, they seem to be not technically aware about specific refrigerants.

Consumers seemingly exhibit a recommended behaviour while getting ACs serviced

Servicing of air conditioners is very important for maintaining the operational efficiency of the equipment and avoiding failures. Respondents saw the benefits of getting air conditioners serviced at periodic intervals in households.

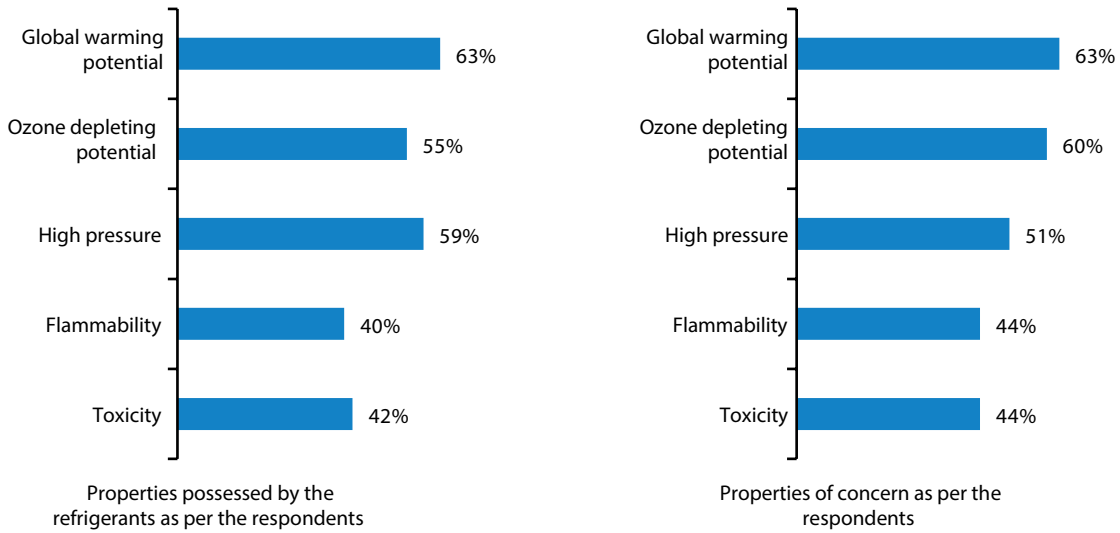


Figure 1.12: Respondents perception on the properties possessed by the refrigerants, **Note:** Total sample size, $n = 1512$

Figure 1.13 shows the service frequency of air conditioners as per the responses received during the survey. More than 9 in 10 respondents preferred getting their air conditioners serviced at least once a year. Apart from disposable income, the reason for getting periodic servicing can also be that there is a gap in the understanding of the respondents about preventive and breakdown maintenance.

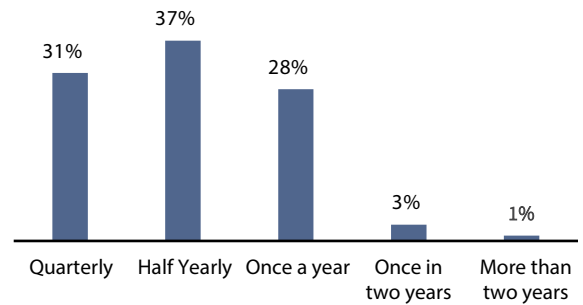


Figure 1.13: Frequency in which air conditioner is serviced **Note:** Total sample size, $n = 1265$

Figure 1.14 shows that respondents in cities with less yearly fluctuation in temperature have a higher frequency of servicing. The respondents positively acknowledge

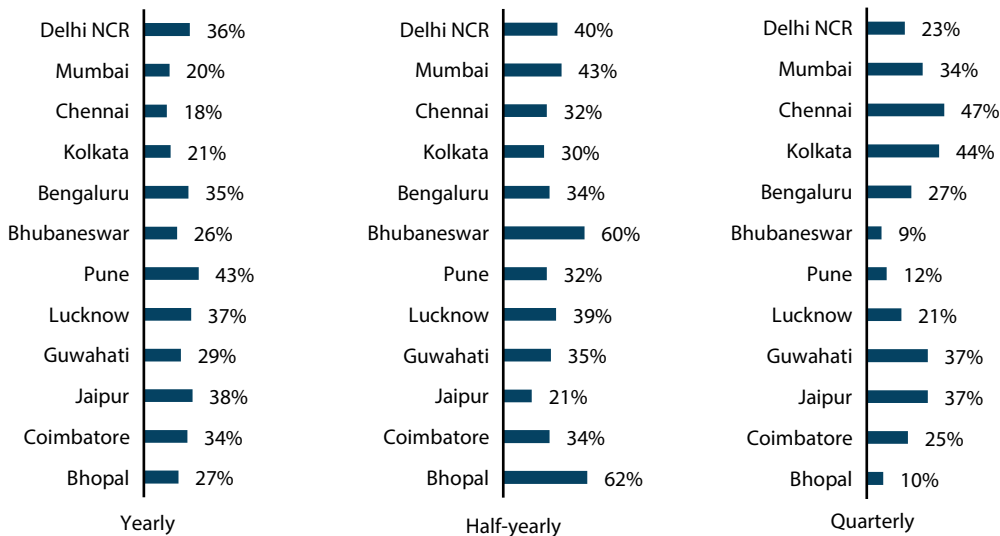


Figure 1.14: Frequency in which air conditioner is serviced (city data) **Note:** Total sample size, $n = 1265$; Delhi NCR, $n = 168$; Mumbai, $n = 174$; Chennai, $n = 182$; Kolkata, $n = 182$; Bengaluru, $n = 99$; Bhubaneswar, $n = 65$; Pune, $n = 69$; Lucknow, $n = 62$; Guwahati, $n = 49$; Jaipur, $n = 90$; Coimbatore, $n = 65$; Bhopal, $n = 60$

the role of servicing for their equipment across the country. Chennai, Kolkata, Guwahati, and Mumbai tend to get their air conditioners serviced quarterly as compared to other regions. These cities face lesser fluctuation in temperatures throughout the year as compared to Delhi NCR. The reasons for this behaviour can be attributed to the usage patterns and average temperatures throughout the year in these cities.

Since the level of awareness regarding servicing is quite high, people choose the servicing personnel very carefully. At the time of getting the cooling equipment serviced, the company technician is perceived to be more technically sound. This perception may depend on the background of technicians. People in metropolitans tend to rely on the air conditioner retail outlets for technicians who are often perceived as company authorized.

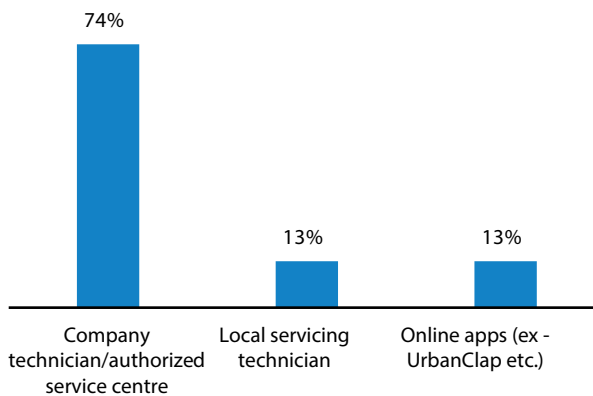


Figure 1.15: Choosing a servicing technician
Note: Total Sample Size, n = 1265

Figure 1.16 shows the reasons for choosing a certain servicing technician for the job. The technical qualification is the key reason why a company servicing personnel is preferred more. Apart from qualifications, aspects such as cost of servicing, warranty, and convenience are other major factors that control the selection of technician for the job. However, further investigation at much larger consumer base including Tier 3 cities, small towns, etc. is needed regarding the preference for technicians to conclude the statement with robustness.

Consumers, in most cases, trust the technician to do the right thing while they are in the midst of the servicing procedure.

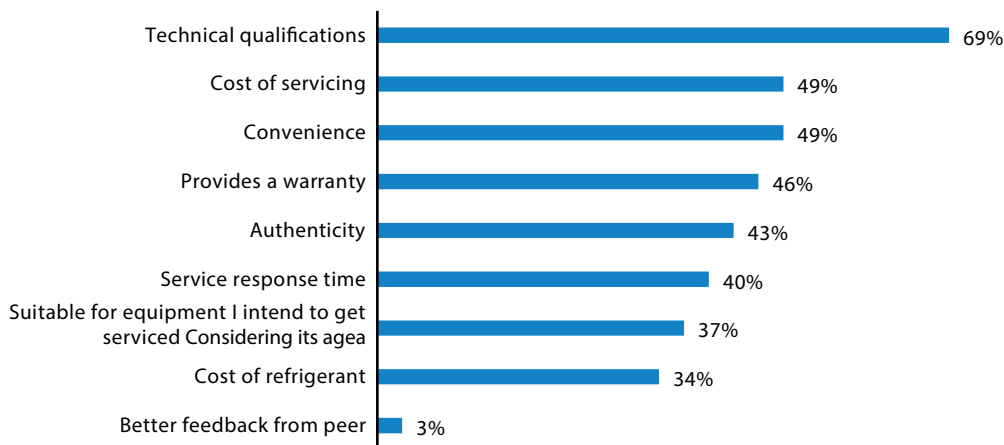


Figure 1.16: Reasons behind choosing a certain servicing technician
Note: Total sample size, n = 1265

Consumer perceptions on developments and innovations in the RAC sector

Consumers have various perceptions on the innovations being brought in the RAC sector. They believe that more is being done on the energy consumption front and prefer appliances that more efficient when it comes to consuming energy. Consumers are also concerned with the ill-effects of global warming and consider developments that are being made towards these aspects in the RAC sector as well.

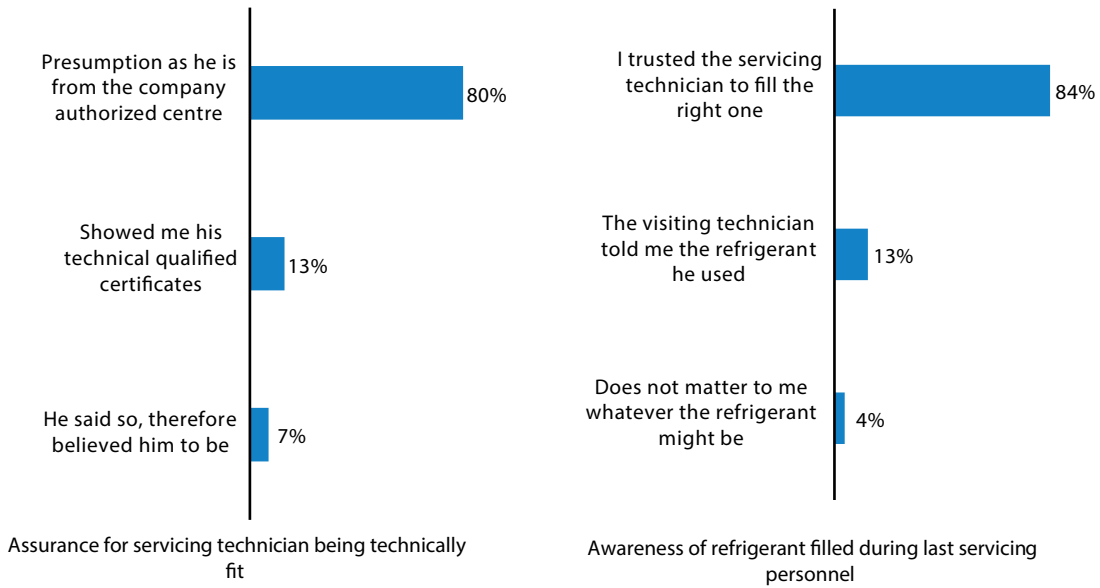


Figure 1.17: Respondents' view of servicing technician
Note: Total sample size, $n = 1265$

From the government front, respondents expect them to facilitate and promote technology innovation and also increase awareness about the new cooling technologies among the masses. Figure 1.19 shows the expectations that the consumers have from the government. A large fraction of the respondents expects the government to align the domestic environmental policies with the international treaties and agencies.

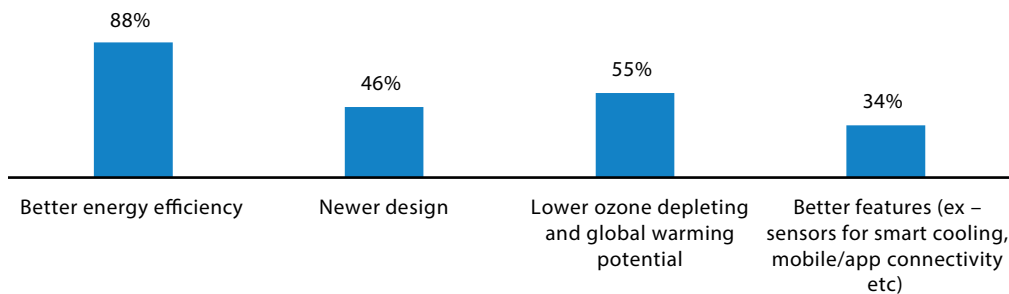


Figure 1.18: Innovations as per the respondents being introduced in the RAC sector
Note: Total sample size, $n = 1512$

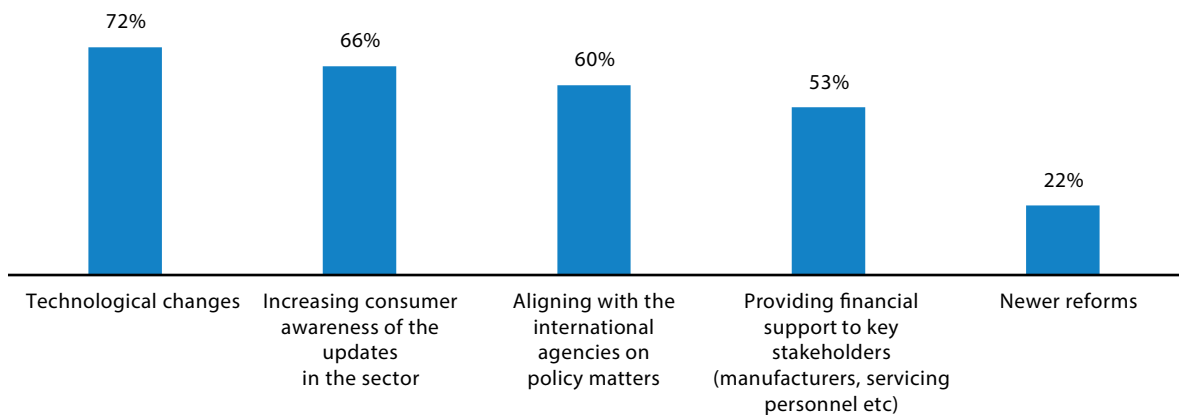


Figure 1.19: Consumers' expectations from the government
Note: Total sample size, $n = 1512$

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POLICYMAKERS SEEK BETTER AWARENESS AND CO-OPERATION ACROSS THE VALUE CHAIN

Given the increasing requirement of cooling in multiple sectors, the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, has developed the 'India Cooling Action Plan' (ICAP). The ICAP presents a 20-year outlook on how the demand for cooling in the country will evolve across priority demand sectors, and outlines strategies and actions to promote sustainable and smart cooling practices across the nation while mitigating adverse impacts.

The government is implementing schemes such as the Pradhan Mantri Awas Yojana with the objective of providing affordable housing for all. These schemes are for the economically weaker sections and low-income group segments and would benefit by using climate appropriate and energy-efficient building design for construction of houses. This would, inter alia, provide thermal comfort for all, reduce cooling load, and provide gains in terms of energy efficiency. In this regard, the energy-efficient building envelope guidelines of ECBC-R could be enforced. In addition, funding and support, where required, for initiatives providing thermal comfort such as cool-roof programmes, off-grid micro-systems for cooling, and localized heat-action plans could be provided.

The Government of India has many policies and programmes that are being implemented in the 'mission mode' in energy efficiency, urban development and housing, agriculture, transport, health, R&D, skill development and entrepreneurship (e.g. Housing for All, Smart Cities Mission, National Mission on Sustainable Habitat, Doubling Farmers' Income). While actions under these projects in various development sectors will proceed independently, it is imperative that synergies be forged, wherever possible, to leverage greater environmental and societal benefits.

Integrated actions have a higher impact than those taken in isolation. Therefore, an integrated long-term vision on cooling, encompassing, among other things, optimization of cooling demand, integration of energy efficiency and refrigerant transitioning efforts, and adoption of better technology options, is the need of the hour.

In light of this, understanding the viewpoint of policymakers spread across various departments and ministries, is imperative for the overall and streamlined growth of the (Refrigeration and Air conditioning) RAC sector. A total of 25 respondents were interviewed as a part of this exercise, spread across various departments and ministries (10), distribution companies (DISCOMs) (5), state designated agencies (SDA) (6), and state urban development departments (UDD) (4). The SDAs, UDDs, and the distribution companies belonged to the key states of Rajasthan, Telangana, Uttar Pradesh, New Delhi, Punjab, and Karnataka. The policymakers zeroed in for this exercise have experts in their respective capacities.

Views on international negotiations – Montreal Protocol and Kigali Amendment

Policymakers have been optimistic about the refrigerant and technology transition negotiations held at the international level. However, there is an increasing concern regarding some key aspects, with inappropriate implementation of programmes and ICAP. Policymakers have pointed out that key stakeholders lack awareness towards international agreements and the requirement to achieve the targets of these agreements is cost intensive for the industry.

A major gap exists between policies framed and awareness amongst manufacturers and other stakeholders. Policymakers, manufacturers, and consumers are not fully aware about these negotiations. On the other hand, policymakers have listed out various challenges that they are facing during the implementation of various plans.

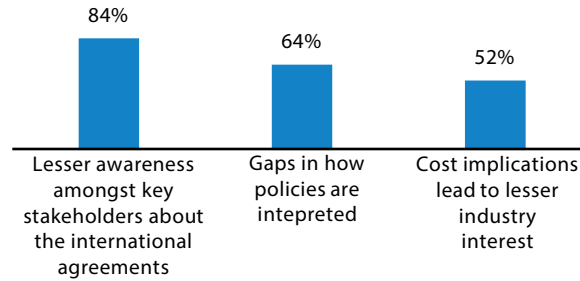


Figure 2.1: Views on Montreal Protocol and Kigali Amendment
Note: $n = 25$

Challenges

The landmark policy document of ICAP demonstrates unprecedented inter-ministerial and cross-sectoral collaboration in laying out actionable pathways. It has identified five ambitious goals and underscores the environmental and socio-economic benefits of sustainable cooling through the recognition of ‘cooling and related areas’ as a key area of research under the national science and technology programme to support the development of technological solutions and encourage innovation challenges.

Implementation of ICAP thus becomes a challenging task for the government as well as industry players, with the cross-sectoral nature of cooling raising important issues that need to be addressed, including the alignment of priorities and regulatory and institutional contradictions.

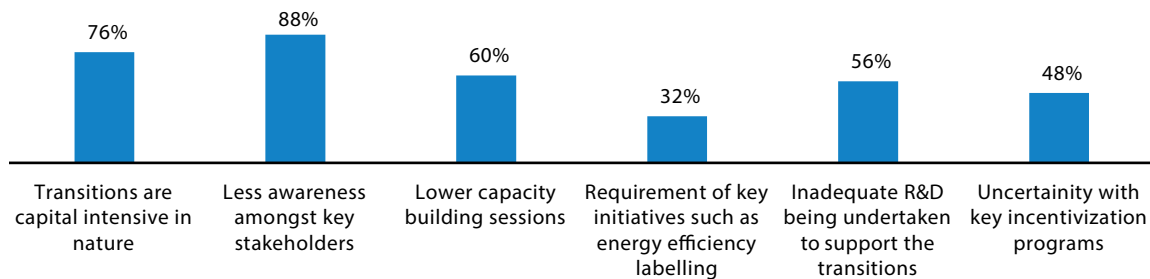


Figure 2.2: Key challenges faced in the RAC sector
Note: $n = 25$

THE KEY CHALLENGE THAT POLICYMAKERS LIST OUT IS LOW AWARENESS AMONGST KEY STAKEHOLDERS. OFFICIALS HAVE BEEN OF THE VIEW THAT THERE ARE GAPS ON HOW THE POLICIES REALLY ARE AND HOW THEY ARE UNDERSTOOD BY THE MANUFACTURERS, CONSUMERS, AND OTHERS. AS PER THE POLICYMAKERS, THE POLICIES THAT ARE FRAMED ARE ASPIRATIONAL IN NATURE AND DO NOT TAKE GROUND-LEVEL REALITIES INTO CONSIDERATION.

Cost, being one of the key attributes of the overall transition, needs to be looked at. Cooling is a vast topic encompassing multiple aspects, including, inter alia, technological aspects such as cooling technologies, refrigerants, and associated R&D; and socio-economic aspects such as access to cooling and linkage with productivity.

State Designated Agencies recommend a robust approach

SDAs have been very vocal about the positive aspects of renewable energy and have been making consumer aware about this. SDAs, apart from driving awareness, are also replacing appliances in key establishments such as schools and government offices with energy-efficient ones. SDAs have also recommended that the government should drive multiple initiatives.

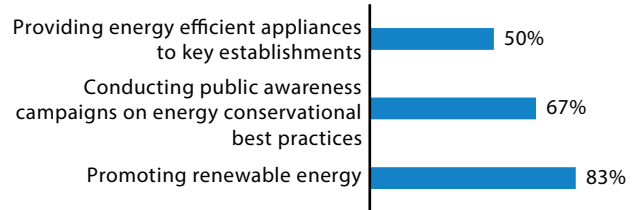


Figure 2.3: Key objectives of SDAs
Note: n = 6

Figure 2.4 shows the expectations of the SDAs towards the government and policymakers for the cooling sector. Clearly, the government needs to drive more initiatives in promoting sustainable cooling with major focus on research and development. SDAs feel that the data-driven proof-based initiatives can benefit consumer’s awareness towards sustainable cooling.

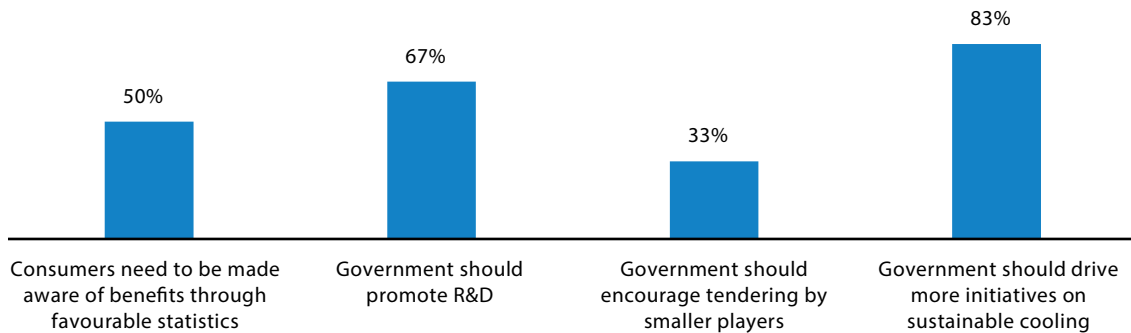


Figure 2.4: Key initiatives expected from the government by SDAs
Note: n = 6

DISCOMS have been running several programmes that complement energy efficiency

The power distribution companies are the backbone of energy security in the country and a step towards energy efficiency will go a long mile in the progress of the country towards energy conservation. Distribution companies have been running key initiatives that support the energy-efficient ecosystem.

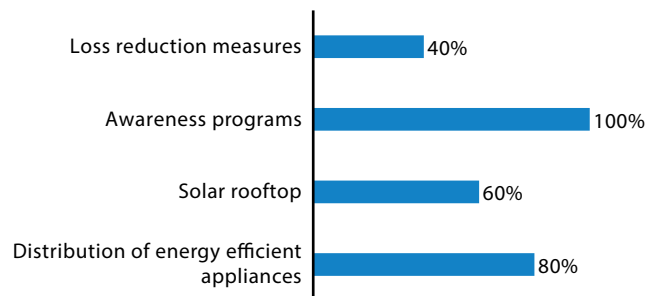


Figure 2.5: Key programmes undertaken by DISCOMS
Note: n = 5

The promotion and awareness generation of energy-efficient equipment and the use of renewable energy are important aspects of the programmes undertaken by the DISCOMS. A few DISCOMS have been also implementing demand reduction measures to promote energy efficiency in various segments of their consumer base.

Urbanization is the key to increasing demand and, subsequently, an opportunity for growth

UDDs have been involved in some key programmes and initiatives that support and provide guidance on energy efficiency. These departments have been implementing the Energy Conservation Building Code (ECBC). The Code has been an important tool in increasing energy efficiency of the infrastructure and leads to reduction in energy consumption.

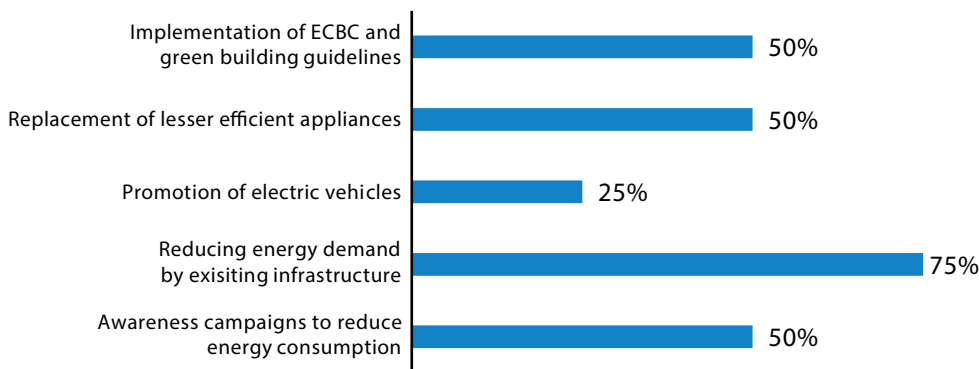


Figure 2.6: Key programmes undertaken by UDD

Note: $n = 4$

UDDs have certain expectations about the facilitative policy framework, which they believe can lead to the overall growth in urbanization. The need of capacity building exercises across the levels of UDD on the front of energy efficiency and the awareness campaigns for the implementation of ECBCs are the most critical expectations from UDDs towards the policy framework.

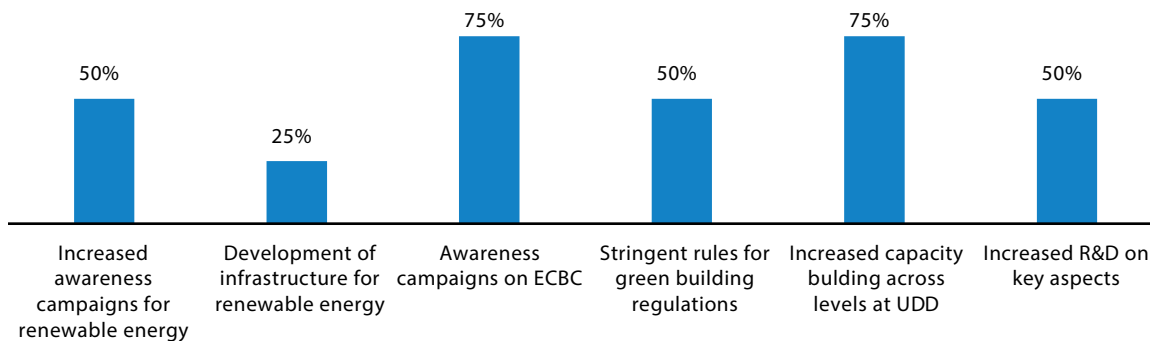


Figure 2.7: Expectations from policy framework

THE NEED OF TAILORED AWARENESS CAMPAIGNS

HIGHLIGHTING ENERGY EFFICIENCY IS THE INITIATIVE

THAT MOST POLICYMAKERS BELIEVE IS REQUIRED.

Key Takeaways

Wider stakeholder segment from policymakers have been approached and most of them acknowledged about the need for facilitative policy framework to achieve sustainable and energy efficient future in the cooling sector. Key aspects that respondents have pointed out include the need for an integrated long-term vision to address cooling requirement across sectors – a vision that encompasses reducing cooling demand; refrigerant

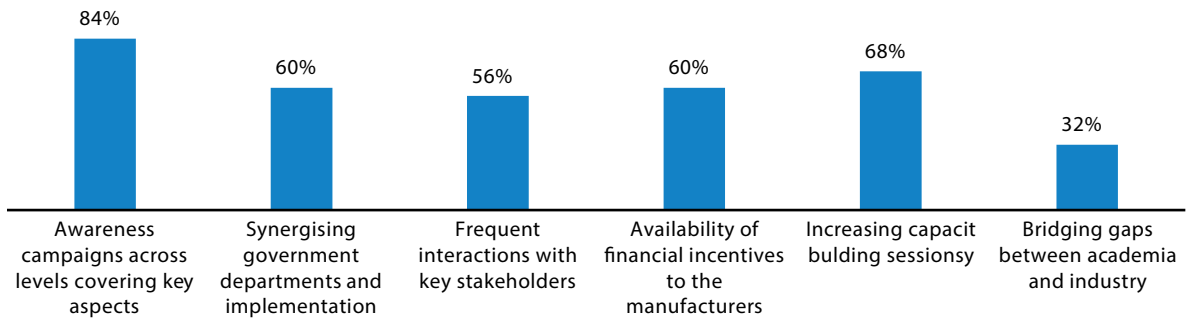


Figure 2.8: Imperatives for growth
 Note: n = 25

transition; enhancing energy efficiency; advancing cooling technology options; and improving access to cooling in a more equitable manner. Key stakeholders need to come together to amplify the growth in the sector and develop a synergized action plan.

Awareness among consumers and other key stakeholders need to be enhanced significantly to overcome major growth barriers. Frequent interactions amongst stakeholders and a concerted effort from all stakeholders will help the country meet its energy efficiency goals. Furthermore, bridging the industry–academia gap could lead to consolidation of viewpoints and enable a seamless transition. The policymakers seek better awareness and co-operation across the value chain.

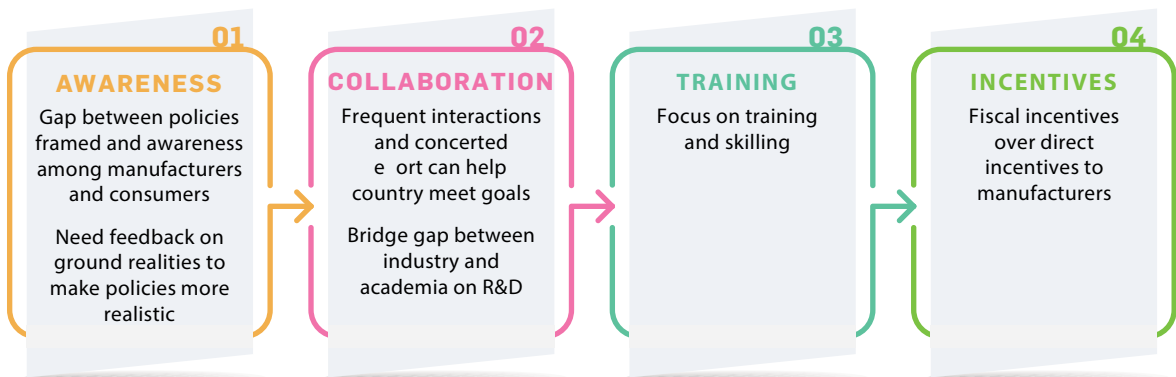


Figure 2.9: Key takeaways for the policymakers



COSTS, POLICY DIRECTION, AND TRAINING ARE TOP CONCERNS OF MANUFACTURERS

Nine respondents were surveyed in this category. The respondents were from companies manufacturing air conditioners, components, refrigerants, transport, and cold chain equipment.

Perspectives on Montreal Protocol and Kigali Amendment

The industry has an optimistic view about government commitments towards international negotiations. Manufacturers believe that India is one of the few countries that has met the expectations of these international agreements and developed a cooling action plan. They believe that the impact of cost needs to be understood better from a consumer angle. At the same time, the transition should not leave consumers unsatisfied in terms of costs.

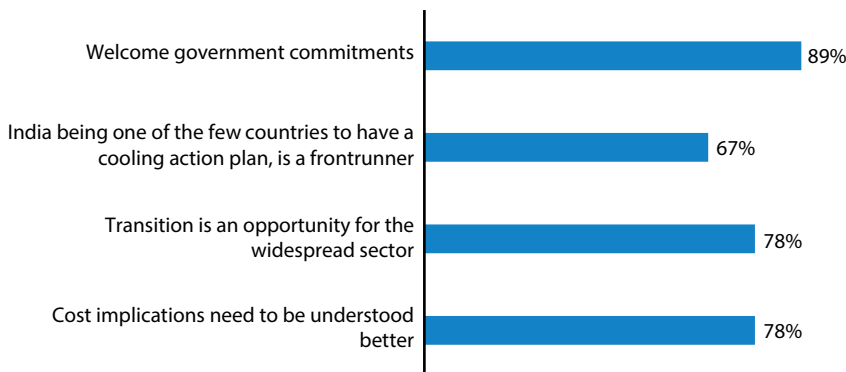


Figure 3.1: Perceptions on key government commitments

Views on servicing industry and the technicians engaged in the sector

Safety is crucial as the service technicians' work in a dangerous environment because of the presence of high pressure equipment and the risk of exposure to chemicals. Manufacturers believe that safe installation practices should be introduced, as most of the casualties occur due to lack of proper gear. Further, unsafe practices leave workers exposed to chemicals. The servicing technicians are employed seasonally and the servicing industry faces annual fluctuations in their business. Manufacturers believe that personnel working in the sector should be provided with job security. Upskilling of the work force is critical in keeping the servicing industry competent in terms of application of new technologies. Manufacturers have also put forward their concerns about the low number of training centres.

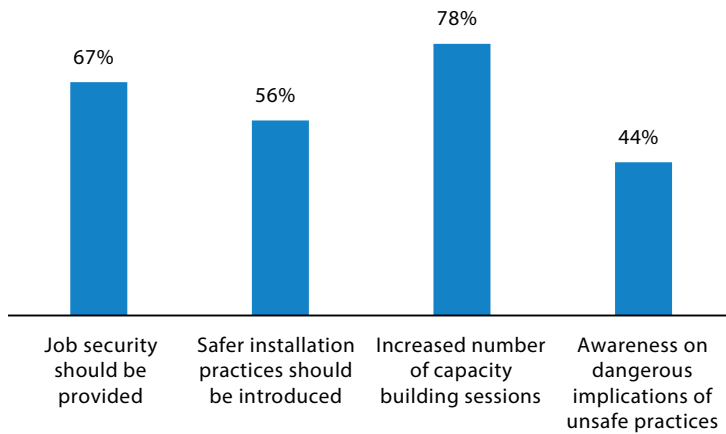


Figure 3.2: Views on servicing industry

Priority mechanisms to streamline transition

Manufacturers are of the view that if proper steps are followed, the sector could witness growth and overall development.

There are certain aspects that the manufacturers have put forward, which should be weighed in while coming up with action plans related to the sector. One of the major suggestions from the equipment manufacturing industry to reduce the cooling demand is to cater large potential available through reducing cooling demand through passive means such as better building design. Also, build consumer trust towards international obligations without leaving them unsatisfied with cooling services. Figure 3.3 shows these in more detail.

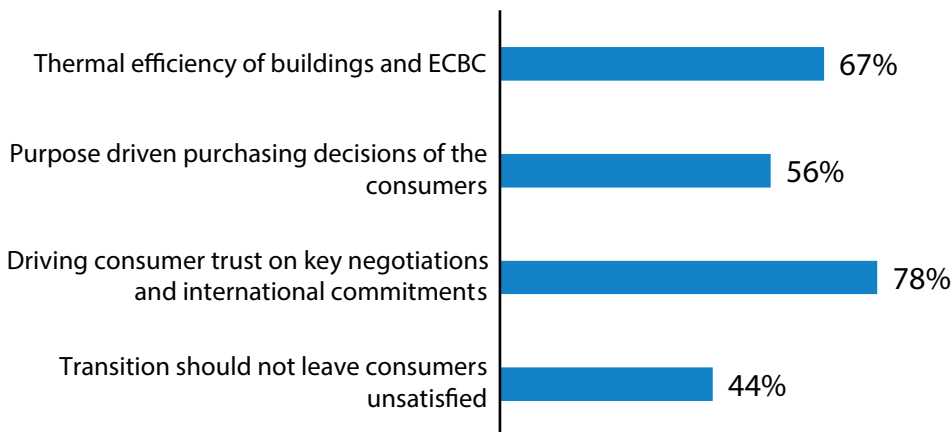


Figure 3.3: Mechanisms streamlining transition and increasing uptake

THERE IS POSITIVITY IN THE INDUSTRY ABOUT THE GROWTH POTENTIAL OF THE COOLING SECTOR IN THE COUNTRY IN TERMS OF JOB CREATION AND ACCESS TO COOLING.

Challenges

Figure 3.4 shows the challenges perceived by the manufactures for the uptake of energy-efficient equipment.

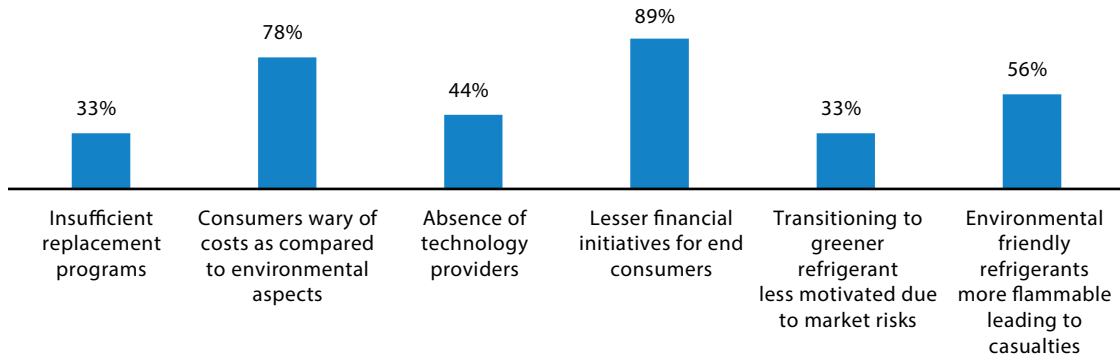


Figure 3.4: Perceived challenges to increase uptake

The following are the challenges in increasing the uptake of more efficient air conditioners:

- ▶ Non-availability of replacement programmes
- ▶ Consumers more concerned about costs as compared to environment effects
- ▶ Absence of technology provider
- ▶ Lesser financial initiatives by the government for consumers

Challenges in moving to greener refrigerant are as follows:

- ▶ Industry stakeholders less motivated due to market risks
- ▶ Environment-friendly refrigerants are more flammable and can lead to casualties
- ▶ As consumers are wary of costs, it leads to slower phase-out of such existing refrigerants

Key Takeaways

During the interaction with industry, policy certainty has been the key factor, which could impact the sector growth to a large extent. The costs to consumer, policy direction, and training are among top concerns of the industry. One of the major perception shifts, as observed in Chapter 1 is that the consumer is increasingly becoming aware about energy efficiency while making purchase decision for cooling equipment, contrary to industry perception. However, cost has been undeniably a predominant factor for consumer purchase decision.

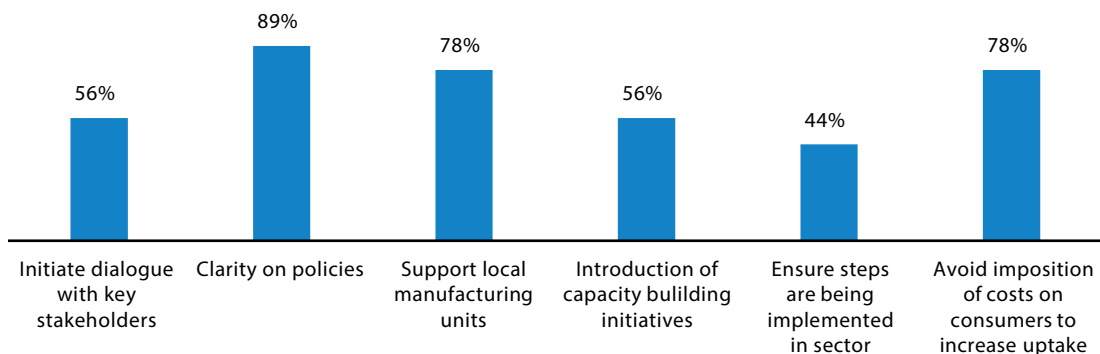


Figure 3.5: Steps expected to be taken by the government

Expectations from the government

India's cooling sector is growing rapidly and has a great potential for making India self-reliant in this sector.

THE MANUFACTURERS ARE OF THE VIEW THAT CLARITY ON POLICIES AND IMPLEMENTATION IS REQUIRED ACROSS THE SECTOR. ONE OF THE MOST IMPORTANT EXPECTATIONS OF THE MANUFACTURERS FROM THE GOVERNMENT IS TO PROVIDE ALL NECESSARY SUPPORT TO THE DOMESTIC MANUFACTURING OF THE EQUIPMENT

In addition to providing financial aid to consumers, subsidizing the components and providing indirect incentives such as tax rebates and carbon credits to manufacturers can streamline the transition. The government should ensure that the necessary steps are being taken by the industry.

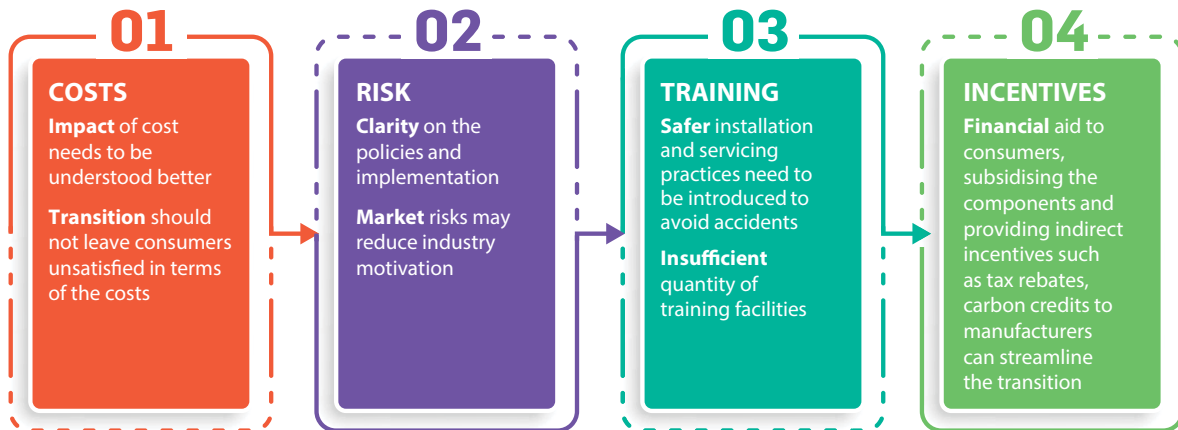


Figure 3.6: Key takeaways for the industry

SERVICING WORKFORCE STILL DRIVEN SIGNIFICANTLY BY INFORMAL TRAINING

Organizations have been helping developing countries for long to meet and sustain their compliance with the commitments under the Montreal Protocol on substances that deplete the ozone layer. A major area in this respect is the capacity building of servicing technicians in the Refrigeration and Air-conditioning (RAC) sector to help them service equipment in a better way by applying good practice principles and techniques. RAC products tend to use refrigerant gases that deplete the protective ozone layer and contribute to global warming. The role of servicing technicians is critical not only in ensuring the longevity, efficiency, and safety of these products but also in minimizing their impact on the environment during their use.

As the phase-out of HCFCs progresses, it is expected that there will be considerably higher uptake of alternatives such as HFCs, hydrocarbons, ammonia, carbon dioxide, and others in developing countries. Many of these refrigerants have different characteristics from previously used substances in terms of toxicity, flammability, and high pressure. When RAC equipment is installed, serviced, repaired and dismantled, safety issues need to be carefully evaluated and considered, particularly when the servicing technicians have to deal with refrigerants that have properties which they are not familiar with. It is, therefore, important that the RAC industry adds to the technical and safety issues concerning these refrigerants.

Cooling is one of the major sectors for employment, both in urban and in rural areas. Skilled personnel are needed for installation and servicing RAC equipment. With growing demand for cooling, there will be an increase in the number of manufacturing and assembling facilities and servicing activities. India has approximately 200,000 service technicians working in the RAC trade, both in the formal and in the informal sector. The number of technicians is expected to grow in line with the growth in penetration of RAC equipment in the country. With a large section of RAC service technicians working in the informal sector, there is potential to upskill service technicians through training and certification programmes.

Recognizing this need, the MoEF&CC and the Ministry of Skill Development and Entrepreneurship of the Government of India entered into a Memorandum of Understanding (MoU) on 2 August 2018 for the upskilling and certification of 1,00,000 RAC service technicians under the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) – Skill India Mission.

Face-to-face interviews with 113 servicing technicians, who had at least 2 years of experience in the RAC sector, were conducted across Delhi, Mumbai, Kolkata, Chennai, and Bengaluru.

Respondents were interviewed and key areas such as technical awareness, perception on the opportunities in the RAC sector, and views on training programmes were gauged.

⁵ Details available at <http://ozonecell.in/wp-content/uploads/2019/03/INDIA-COOLING-ACTION-PLAN-e-circulation-version080319.pdf>

⁶ Details available at https://www.business-standard.com/article/pti-stories/1-lakh-technicians-to-be-trained-in-refrigeration-air-conditioning-service-118080201348_1.html

Technicians seem to be aware of the technical aspects

Figure 4.1 shows the basic technical awareness among the service technicians. Almost 2 in 3 servicing personnel believe that releasing refrigerants into open can be harmful.

Technicians are now seemingly aware about the global warming potential of the refrigerants and believe that safe handling of the refrigerants should be seen as a mandatory step in order to avoid casualties.

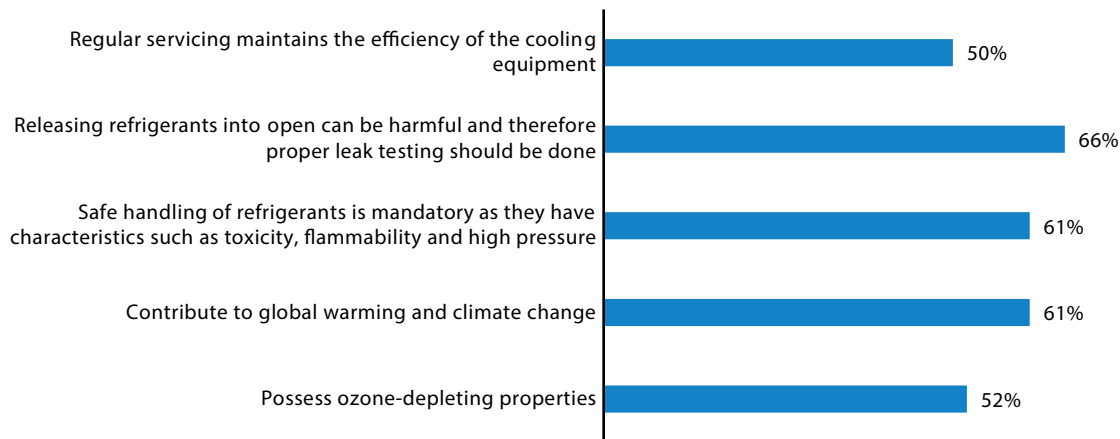


Figure 4.1 Basic technical awareness

Note: $n = 113$

As mentioned in the consumer survey findings in Chapter 1, consumers depend on the technicians for refrigerant gas selection. It becomes important to investigate about the factors that influence technicians to select certain gas during servicing. Our findings suggest that while three-fourth of the servicing technicians interviewed consider brand as a key aspect, one-third of the respondents rely on the availability of the refrigerant. Figure 4.2 shows how the servicing personnel determine which refrigerant to use while in field. Further investigation at the Tier-2 and Tier-3 cities could be important in this case to get more robust insights at the pan-India level.

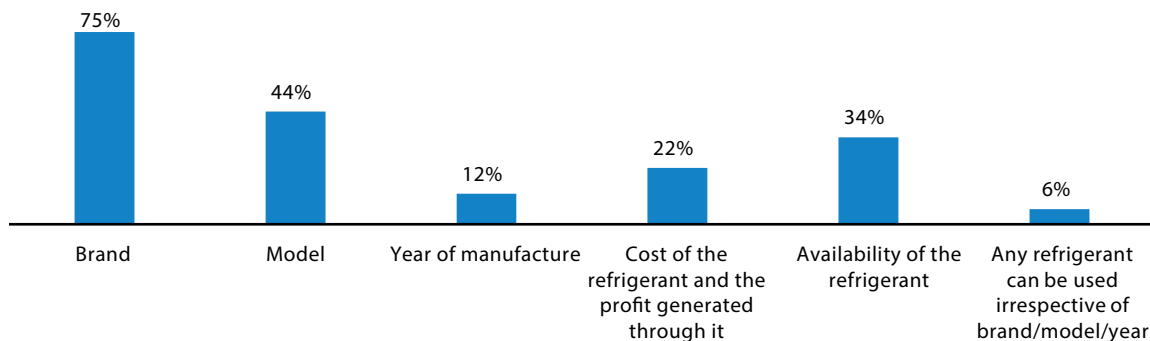


Figure 4.2 Key aspects, as per the personnel, used to determine the appropriate refrigerant

Note: $n = 113$

Safety while transporting the refrigerants does not seem to be a priority, as many servicing personnel carry refrigerants on two-wheelers. While only about 3 out of 10 servicing personnel carry it on a vehicle equipped with all the requisite safety features, around 65% of respondents do not use the equipped vehicle.

Perceptions on the trainings being provided in the RAC sector

While speaking about the refresher training being imparted, it was found that informal knowledge still drives a significant part of the servicing sector. Many servicing personnel operating in the sector do not have any formal training or certification

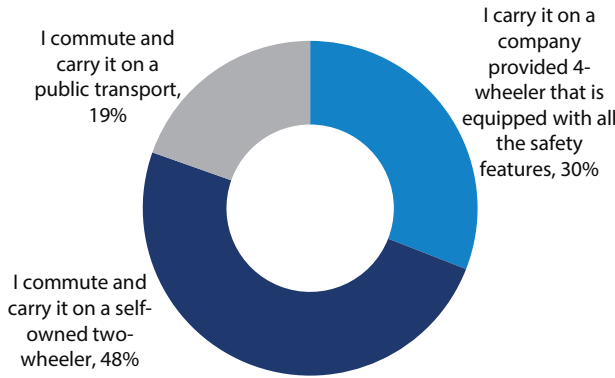


Figure 4.3 Mode used to carry the refrigerant while in field
Note: n = 113

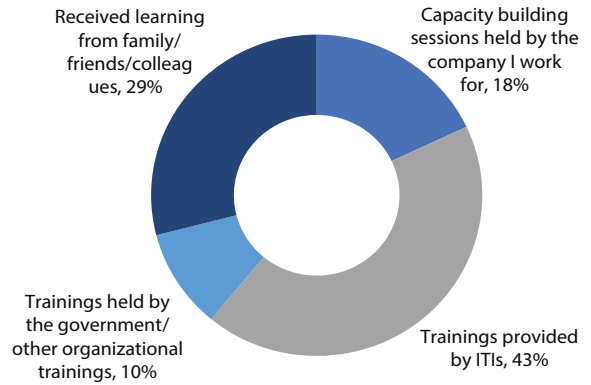


Figure 4.4 Source of refresher training provided in the RAC sector (n=113)

Refresher trainings, as per the respondents, built capacity and lead to better economic opportunities.

As per the servicing technicians, trainings are necessary to get familiar with the updates in the cooling sector and get accustomed to the newer and modern refrigerants at the same time.

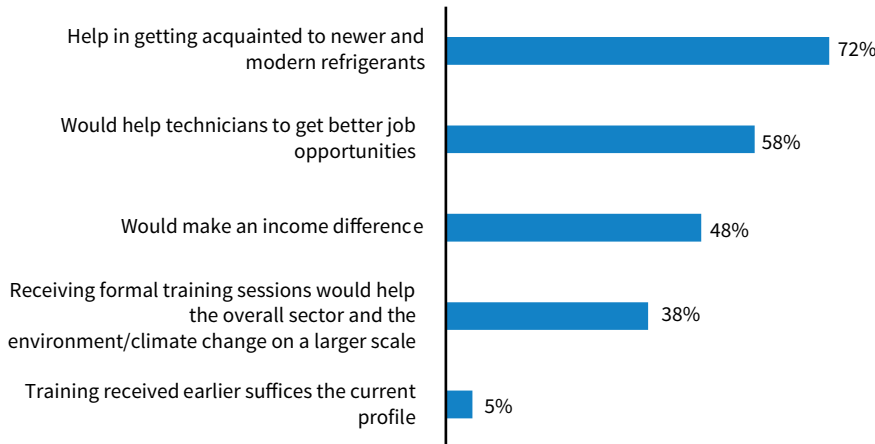


Figure 4.5 Reasons why refresher training is preferred sector
Note: n = 113

THE SERVICING PERSONNEL PERCEIVES THE REFRESHER TRAININGS TO BE EFFECTIVE AND REGARDS THEM REWARDING FOR THEIR WORK.

More than two-third of the servicing technicians rely completely on the training provided to them, while they are in the field servicing RAC equipment. Figure 4.6 elucidate the usefulness of fixed course trainings.

Figure 4.7 shows the various government trainings that the servicing personnel have participated in to get acquainted with the latest updates in the sector. The most popular skill development programmes among the servicing personnel are by the ESSCI and ISHRAE. But still almost half of the personnel are unaware of the skill development programmes and there is a need to boost the awareness initiatives.

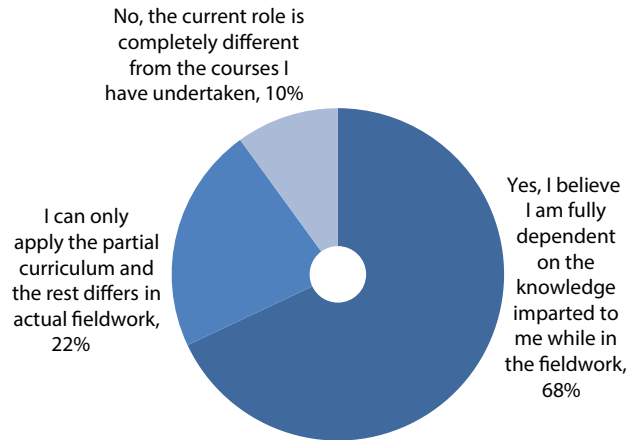


Figure 4.6: Resonance between the courses and job
Note: $n = 113$

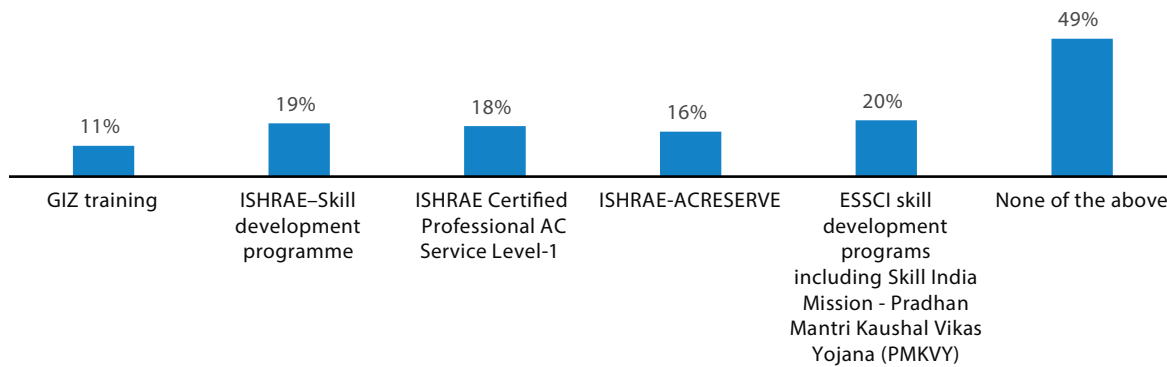


Figure 4.7: Trainings preferred by the servicing personnel
Note: $n = 113$

INTERLINKAGES IDENTIFIED THAT WOULD SUPPORT THE SECTOR DEVELOPMENT

Given the cross-cutting requirement of cooling in multiple sectors, different government departments, ministries, and industry are linked with the subject of cooling. As a result, the development and implementation ICAP has been an inter-ministerial undertaking. Many of the actions emerging out of the ICAP also require involvement of state governments and urban local bodies for their implementation. These linkages have been captured in the ICAP implementation framework.

The ICAP has considered the interdependencies among policy interventions and strives to harmonize energy efficiency with the HCFC phase-out and high-GWP HFC phase-down schedules. It also re-emphasizes the principles enshrined in the Country Programme of India for phase-out of ozone depleting substances (ODS) in order to minimize economic dislocation and obsolescence cost and maximize indigenous production for combined environmental and economic gains.

The ICAP takes a holistic and balanced approach by encompassing both passive and active cooling strategies as well as by optimization of cooling loads. The ICAP, inter alia, encompasses: (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-based appliances as well as not-in-kind technologies; (d) policy interventions for market transformation, including public procurement of energy-efficient RAC appliances and equipment; (e) development of energy-efficient and renewable energy-based cold chain; (f) national skill development programme for training and certification for RAC service technicians to complement transition to energy efficient, low-GWP refrigerants, and (g) focused R&D efforts to foster an innovative ecosystem to support development and deployment of low-GWP refrigerant alternatives.

Synergistic actions taking a holistic view of the cooling requirement across sectors will have a higher impact than actions taken in isolation. This will help in securing both environmental and socio-economic benefits. Different government developmental programmes are already under implementation such as standards and labelling programme, building codes, Pradhan Mantri Awas Yojana, Smart Cities, Doubling Farmers Income, Skill India Mission and Mission Innovation where the activities for addressing cooling requirement could be synergized to leverage both environment and societal benefits.

Such synergies could also be looked at for international commitments. Sustainable cooling is at the intersection of three international commitments, namely Kigali Amendment to the Montreal Protocol, Paris Agreement under United Nations Framework Convention on Climate Change (UNFCCC), and Sustainable Development Goals of 2030.

The impact of climate change is manifesting itself in increasingly erratic weather patterns that are increasing in frequency and severity. Heat waves in the summer months across the hemispheres are becoming more of a

norm rather than the exception. The 2019 report by the International Panel on Climate Change (IPCC) estimated that around 2.3 billion people could be both exposed and vulnerable to heatwave events due to 1.5°C increase in temperature and global warming. Human hardship, the report also pointed out, would get compounded because of the impact of food production, with food loss and waste likely to contribute around 10% to the annual GHG emissions. Ensuring food security, particularly fruits, vegetables and other fresh produce, is likely to become more challenging due to the impact of climate change.

Unsurprisingly then, in 2018 and 2019 the issue of cooling and promoting sustainable cooling at affordable cost has emerged as a focus of governments, health care companies, food manufacturers, real estate firms, air-conditioning and refrigeration equipment manufacturers, refrigerant producers, as well as financial institutions. Rather than viewing access to cooling as a luxury, there is a growing recognition that in a warming world access to sustainable cooling is a necessity.

Global warming is creating increased demand for cooling

Global energy demand for air conditioning in buildings more than tripled between 1990 and 2016, from about 600 Terawatt hours (TWh) to 2000 TWh (OECD/IEA, 2018). As per IEA, the projected growth in residential and commercial space cooling capacity will rise from 11,670 GW in 2016 to over 36,500 GW in 2050, which will leave substantial cooling needs unmet. Air conditioner ownership, in particular, rises very rapidly with the rise in income, in countries with hot and humid climates, where cooling is essential for people to live and work in comfort (OECD/IEA, 2018). Statistically, cooling demand globally is being met through refrigerant-based cooling across sectors such as buildings, cold-chain, refrigeration, and transport.

As far as India's air-conditioning scenario is concerned, production of room air conditioners has been growing at 13% per year since 2010 and the demand for air conditioners is expected to grow by 11–15% per year over 2017–2027 period (ICAP, 2019). Consequently, India's aggregate cooling-related energy demand is expected to soar from 90 TWh (billion units of kWh) in 2015 to 1350 TWh by 2050, signifying a 15-fold increase. India, along with China and Indonesia, is expected to extract a lion's share in energy for space cooling by 2050 and contribute half of the global cooling energy demand growth. Also, the country's peak electricity load for space cooling is projected to jump from 10% now to 45% in 2050. This poses the risk of adverse environmental and societal impact, including the need for significant additional power generation capacity, peak load impact, and an enormous GHG footprint.

Cross sectoral alignment in the sector necessitates effective communications

Cooling is essentially cross-sectorial in nature, ranging from residential and commercial buildings to transport, cold storage and industries; each with differing demands and priorities. Implementation of the India Cooling Action Plan (ICAP, 2019) thus becomes a challenging task for the government as well as industry players, with the cross-sectoral nature of cooling raising key aspects that need to be addressed, including aligning priorities, and solving regulatory and institutional contradictions.

The behaviour of different stakeholder groups and their perception towards issues and challenges in the sector becomes very critical to design policies, communication strategies, and assessing capacity building needs. Activities can be complementary, thus reinforcing each other and achieving better results with optimal efforts. To bring about a desired result through behavioral change, some elements that are required to be kept in mind include time taken to devise action plans, seeking strategies through collaborations between various stakeholders, identifying effective previous work done in comparable fields, involving appropriate expertise, and highlighting the importance of specific behavioural targets and timeframes. Figure 5.1 concludes the key aspects

TO EFFECTIVELY IMPLEMENT SMART (SPECIFIC, MEASURABLE, ACHIEVABLE, REALISTIC AND TIMEBOUND) LEVERS TO ACHIEVE SUSTAINABLE COOLING, IT IS IMPERATIVE TO UNDERSTAND PERCEPTIONS AND ATTITUDES OF KEY STAKEHOLDERS. IT IS NECESSARY TO GAUGE PRIORITIES AND CHALLENGES AND IDENTIFY OPPORTUNITIES SO THAT ANY POLICY DECISION IS EFFECTIVELY TRANSLATED INTO DESIRED OUTCOMES.

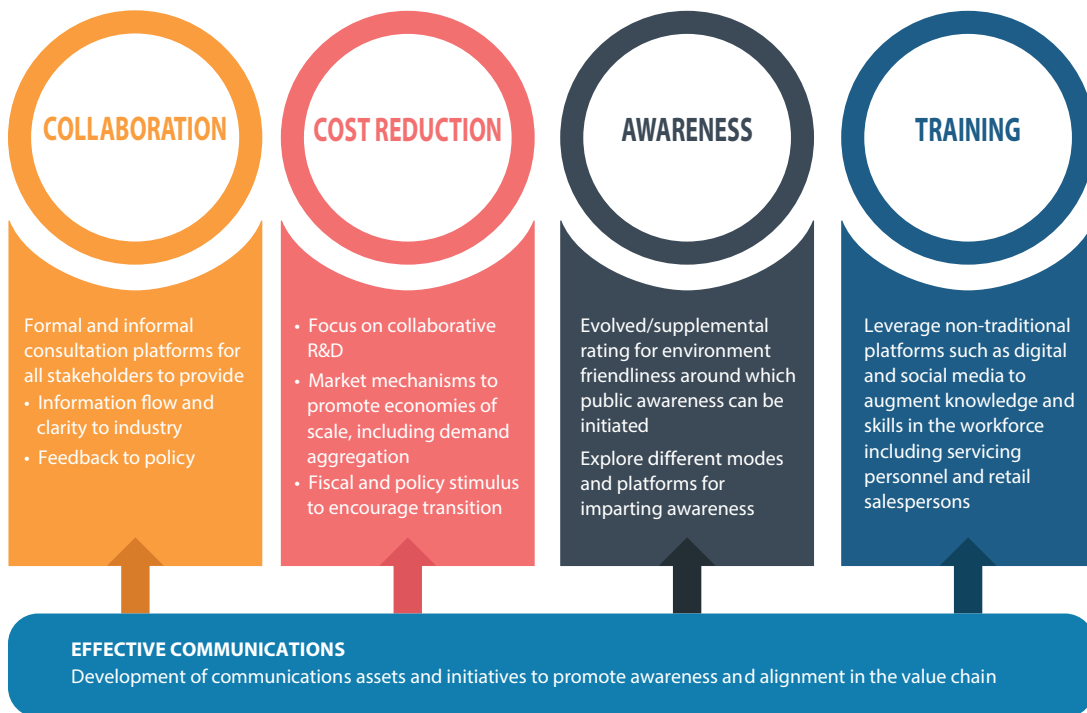


Figure 5.1: Perception study imperatives and way forward

about the policy, institutional, financial and capacity building levers to facilitate the ICAP implementation. The multi-sectoral perception survey has been helpful in understanding the contrary perception among different groups on certain issues. Still we feel, there is a need for further investigation through a much wider survey. The study raises many questions and brings light upon some of the key concerns which need to be addressed to achieve sustainable cooling targets in India.

An analysis of these perceptions, points to some clear pathways:

- 1. Collaboration** – Formal and informal consultations and collaborations between industry, and between industry and government, perhaps also between different ministries and departments of the government so that there is alignment at all levels. Collaboration would pave the way for policy certainty.
- 2. Cost rationalization** – Cost is likely to always be an issue, for both consumer and manufacturers. Collaborations, especially on R&D, may spread risk and reduce the cost of development. Innovative market models, such as demand aggregation, may also be explored to bring scale and further reduce cost to consumers

- 3. Training** – There is a clear need for more training. Conventional training can perhaps be supplemented by leveraging digital and social platforms for micro-skilling and knowledge transfer
- 4. Awareness** – It is imperative to spread awareness among all stakeholder groups. Feedback loops to raise awareness about policy among manufacturers, as well as about technology and the benefits of ratings among consumers can drive a holistic intervention to achieve a faster transition to efficient cooling.
- 5. Effective communication** – This underlies all the above activities. Only when stakeholders are aware, can they participate effectively. Only then can decisions be better informed, and only then will consumers also buy into this transformative process. Effective communications at all levels will be vital to the success of any initiative in the sector.

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OECD/IEA. (2018). *The Future of Cooling Opportunities for Energy-Efficient Air Conditioning Together Secure Sustainable*. 92. Details available at www.iea.org/t&c/

Details available at https://www.business-standard.com/article/pti-stories/1-lakh-technicians-to-be-trained-in-refrigeration-air-conditioning-service-118080201348_1.html

Details available at <https://www.teriin.org/sites/default/files/2020-01/modified-accelerating-the-uptake.pdf>

Details available at <https://theprint.in/india/governance/modi-govts-1000-day-rural-target-2-crore-houses-roads-to-all-villages-toilets-in-homes/245556/>

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Details available at https://www.business-standard.com/article/pti-stories/1-lakh-technicians-to-be-trained-in-refrigeration-air-conditioning-service-118080201348_1.html



ANNEXURES

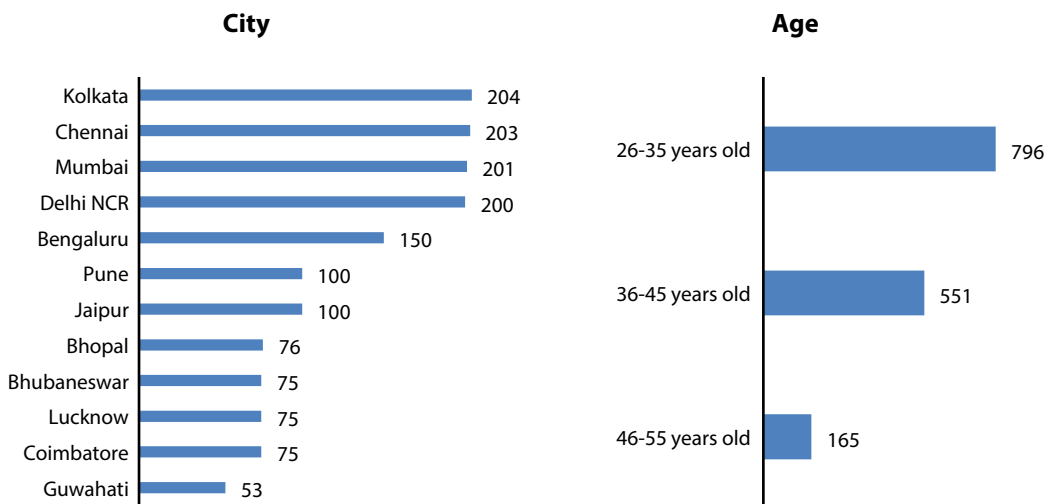
Methodology - Approach and Questionnaires

Consumers

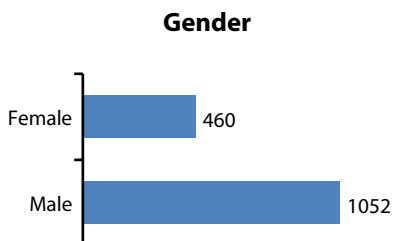
The respondents for this study is all the adults aged between 26 years and 55 years living in households that either own an air-conditioner and refrigerator presently or intend to buy one in the next six months. These individuals are classified under SEC A1/A2 of the NCCS.

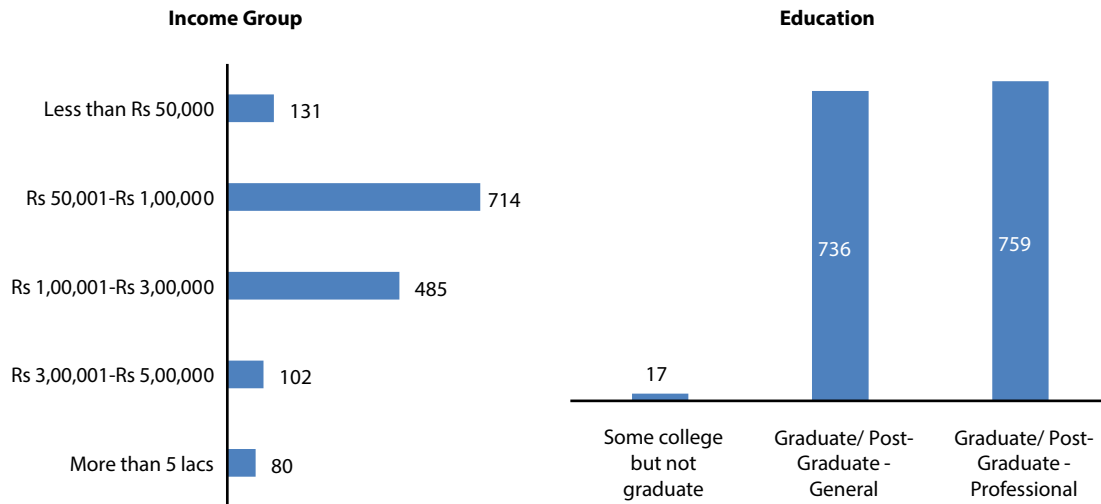
The survey consists of a total of 1512 completed online interviews. All sample surveys are subject to possible sampling error; that is, the results may differ from those which would be obtained if the entire population under study were interviewed.

The completed respondents in the study belonged to different demographic groups.



Refer below for more details.





<https://www.barcindia.co.in/resources/pdf/NCCS%20is%20the%20New%20SEC-Sept%2015.pdf>

Survey Questionnaire

-SCREENER-

Section 1: Demographics

1. What is your age (in years)?-----Years SINGLE CODE

Less than 26 Years	1	Terminate
26–35 years old	2	Continue
36–45 years old	3	Continue
46–55 years old	4	Continue
More than 55 Years	5	Terminate

2. What is your gender? **SINGLE CODE.**

Male	1	Continue
Female	2	Continue

3. Which of the following cities do you live in currently? **SINGLE CODE.**

City	Code	City	Code
Delhi NCR	1	Pune	7
Mumbai	2	Lucknow	8
Chennai	3	Guwahati	9
Kolkata	4	Jaipur	10
Bengaluru	5	Coimbatore	11
Bhubaneswar	6	Bhopal	12

4. What is your monthly household income? **SINGLE CODE.**

Income	Code
Less than Rs 50,000	1
Rs 50,001–Rs 100,000	2
Rs 100,001–Rs 300,000	3
Rs 300,001–Rs 500,000	4
More than 5 lakh	5

5. Which of the following best describes your highest educational qualification? **SINGLE CODE.**

Education Qualification	Code
No Formal Education	1
Primary Education (Upto 5th Class)	2
6th – 9th Class	3
Secondary Education (Class 10th)	4
Higher Secondary Education (Class 12th)	5
Diploma (2-year course)	6
Bachelor's degree (College / University)/Graduate	7
Beyond bachelor's degree (e.g. Masters, PhD) / Post Graduate	8

6. What is your occupation? **SINGLE CODE.**

Shop owner	1
Business	2
Self employed	3
Clerical	4
Supervisor	5
Jr. Executive	6
Mid-Sr. Executive	7

Programmer: use the below grid for coding purpose only. Do not show to the respondent.

Education →	Illiterate	School upto 4 Years	School 5-9 years	SSC/ HSC	Some college but not graduate	Graduate/ Post-Graduate-General	Graduate/ Post-Graduate-Professional
Occupation	1	2	3	4	5	6	7
1. Unskilled workers	E2	E2	E1	D	D	D	D
2. Skilled workers	E2	E1	D	C	C	B2	B2
3. Petty Traders	E2	D	D	C	C	B2	B2
4. Shop owners	D	D	C	B2	B1	A2	A2
5. Businessmen/ Industrialist: No employees	D	C	B2	B1	A2	A2	A1
6. Businessmen / Industrialist with 1-9 employees	C	B2	B2	B1	A2	A1	A1
7. Businessmen / Industrialist with 10+ employees	B1	B1	A2	A2	A1	A1	A1
8. Self-employed professionals	D	D	D	B2	B1	A2	A1
9. Clerical/Salesmen	D	D	D	C	B2	B1	B1
10. Supervisory level	D	D	C	C	B2	B1	A2
11. Officers/ Executives- Junior	C	C	C	B2	B1	A2	A2
12. Officer/ Executives- Middle/Senior	B1	B1	B1	B1	A2	A1	A1

6.a.

SEC A1	01	Continue
SEC A2	02	Continue
SEC B1	03	Terminate
SEC B2	04	Terminate
SEC C	05	Terminate
SEC D	06	Terminate
SEC E1	07	Terminate
SEC E2	08	Terminate

7. Do you own an air conditioner / intend to buy one in the next six months? **SINGLE CODE.**

Yes	1	Continue
No	2	Terminate

8. Please look at this card and let me know your role in the decision-making about purchase of air conditioner that you bought or are planning to buy in the next six months? **SINGLE CODE**

I am the main decision maker	1	CONTINUE
I jointly make the decision along with the other family member	2	
I have no role in the decision making	3	TERMINATE

9. Do you own a refrigerator currently? **SINGLE CODE.**

Yes	1	Continue
No	2	Terminate

10. Please look at this card and let me know your role in the decision making about purchase of refrigerator that you bought? **SINGLE CODE**

I am the main decision maker	1	CONTINUE
I jointly make the decision along with the other family member	2	
I have no role in the decision making	3	TERMINATE

11. What is the size of your household? Please state this in terms of all your family members living with you.

12. Which of the following architectural design describes your house the best? **SINGLE CODE.**

Bungalow	1
Studio apartment	2
1-bedroom apartment/flat	3
2-bedroom apartment/flat	4
3-bedroom apartment/flat	5
More than 3-bedroom apartment/flat	6
Villa	7

Section 2: Purchasing decision

13. While purchasing, what attributes in an air-conditioner would be important to you? Please rate it on scale of 1–5 as depicted below.

	Very important	Slightly important	Neither important nor unimportant	Slightly unimportant	Not at all important
Energy efficiency/Star rating	5	4	3	2	1
Price	5	4	3	2	1
Brand	5	4	3	2	1
Environment friendliness	5	4	3	2	1
Design of the product	5	4	3	2	1
Tonnage	5	4	3	2	1
After sales service	5	4	3	2	1
Refrigerant/coolant used in air conditioner	5	4	3	2	1

14. While purchasing, what attributes in a refrigerator would be important to you? Please rate it on scale of 1–5 as depicted below.

	Very important	Slightly important	Neither important nor unimportant	Slightly unimportant	Not at all important
Energy efficiency/Star rating	5	4	3	2	1
Price	5	4	3	2	1
Brand	5	4	3	2	1
Environment friendliness	5	4	3	2	1
Design of the product	5	4	3	2	1
Capacity	5	4	3	2	1
After sales service	5	4	3	2	1
Refrigerant/coolant used in refrigerator	5	4	3	2	1
Energy efficiency/Star rating	5	4	3	2	1
Price	5	4	3	2	1
Brand	5	4	3	2	1
Environment friendliness	5	4	3	2	1
Design of the product	5	4	3	2	1
Capacity	5	4	3	2	1
After sales service	5	4	3	2	1
Refrigerant/coolant used in refrigerator	5	4	3	2	1

15. What platform do you prefer buying an air conditioner or a refrigerator? **SINGLE CODE** option for each.

	Online stores	Retail stores
Air conditioner	1	1
Refrigerator	2	2

16. What sources do you seek information from when purchasing an air conditioner? Rank the following sources from 1 to 6 where 1 is for the most preferred source and 6 is least preferred information source.

Online reviews	1
Advertisements	2
Suggestions from friends and family	3
Product brochures catalogues etc.	4
Feedback from sales executives	5
Feedback from servicing technicians	6

17. What sources do you seek information from when purchasing a refrigerator? Rank the following sources from 1 to 6 where 1 is for the most preferred source and 6 is least preferred information source.

Online reviews	1
Advertisements	2
Suggestions from friends and family	3
Product brochures catalogues etc.	4
Feedback from sales executives	5
Feedback from servicing technicians	6

18. What type of air conditioner do you use? **SINGLE CODE**

Split air conditioner	1
Window air conditioner	2
Non-inverter air conditioner	3
Inverter air conditioner	4

19. Often do you replace an air-conditioner? **SINGLE CODE**

Total Time of Replacement	Code
Less than 2 years	1
>2–5 years	2
> 5–8 years	3
>8 years	4

Section 3: Usage of cooling equipment

20. In addition to using an air conditioner, do you use an air cooler in household? **SINGLE CODE.**

Usage	Code
Yes	1
No	2

Ask If Coded 1 in Q18

21. Why do you prefer using an air cooler? **MULTIPLE CODING**

Preference	Code
Lower purchasing cost	1
Lower running cost	2
It offers better thermal efficiency basis the room size	3
It provides better quality of air (air circulated from an air cooler is preferable for people with asthma or dust allergy)	4
It is eco-friendly in nature	5
It is portable and has an easy installation	6
Due to unavailability of air conditioners	7

Ask If Coded 1 in Q18

22. In which all rooms do you use an air cooler? **MULTIPLE CODING**

Total Rooms	Code
Master bedroom	1
Secondary bedroom	2
Living room/hall	3
Other rooms (reading room, dressing room)	4

Ask If Coded 2 in Q18

23. Why do you prefer using an air conditioner? **MULTIPLE CODING**

Preference	Code
It works well in humid areas	1
It provides better cooling as compared to air cooler	2
I feel using air conditioner displays better financial status	3
It produces lesser noise as compared to air coolers	4
Does not need water supply	5

Ask If Coded 2 in Q18

24. In which all rooms do you use an air conditioner? **MULTIPLE CODING**

Total Bedroom Count	Code
Master bedroom	1
Secondary bedroom	2
Living room/hall	3
Other rooms (reading room, dressing room)	4

25. How many air conditioners do you have in your household? **SINGLE CODE**

Count	Code
1	1
2	2
3	3
4	4
More than 4	5

26. On a particular day, for how many hours do you use the air conditioner(s)? Please add the number of hours in case of multiple air conditioners. For example consider the running time to be 6 hours if 2 air conditioners are used for 3 hours each. **SINGLE CODE**

Hours	Code
Less than 2 hours	1
>2–5 hours	2
>5–10 hours	3
>10 hours	4

27. What is the usual temperature on which you operate an air conditioner? **SINGLE CODE**

Temperature	Code
<19°C	1
19°C–21°C	2
22°C–25°C	3
>25°C	4

28. In the case of refrigerator, which of the following best describes your usage? **SINGLE CODE**

Usage of Refrigerator	Code
I operate the refrigerator at same temperature throughout the year	1
I adjust the temperature controlling dial/knob as per the weather conditions	2
I adjust it as per the contents stored in it	3
I only adjust the dial when the refrigerator is not in use	4

Section 4: Refrigerant awareness

1. Do you know the following refrigerants? **MULTIPLE CODE.**

	Code
R-22	1
R410-A	2
R-32	3
R290	4
R-600A	5
I am not aware of any of the above refrigerants. (Mutually exclusive)	6

29. What all properties according to you are possessed by the refrigerants? **MULTIPLE CODE.**

	Code
Toxicity	1
Flammability	2
High pressure	3
Ozone depleting potential	4
Global warming potential	5
Thermal efficiency	6
Other (Please specify)	99

30. What all properties would be of concern to you that are possessed by the refrigerants? **MULTIPLE CODE.**

	Code
Toxicity	1
Flammability	2
High pressure	3
Ozone depleting potential	4
Global warming potential	5
Thermal efficiency	6
Other (Please specify)	99

Section 5: Service

31. How often do you get your air conditioner serviced? **SINGLE CODE.**

	Code
Quarterly	1
Half Yearly	2
Once a year	3
Once in two years	4
More than two years	5
Never	6

32. How do you choose your service technician? **SINGLE CODE.**

	Code
Company technician/authorized service centre	1
Local servicing technician	2
Online apps (-example UrbanClap)	3
Other (Please specify)	99

33. Why do you prefer choosing the servicing technician that is <Enter response from Q30>? What are your main reasons? **MULTIPLE CODE.**

	Code
Technical qualifications	1
Provides a warranty	2
Convenience	3
Cost of servicing	4
Cost of refrigerant	5
Authenticity	6
Suitable for equipment I intend to get serviced considering its age	7
Service response time	8
Better feedback from peer	9
Other (Please specify)	99

34. What is your assurance of him being technically fit for servicing? **SINGLE CODE**

	Code
Presumption as he is from the company authorized centre	1
Showed me his technical qualified certificates	2
He said so, therefore believed him to be	3

INSTRUCTIONS: Ask if coded 2,3, 99 in Q30

35. (Would you be willing to pay more for servicing of cooling equipment following the best practices recommended? **SINGLE CODE.**

	Code
Yes	1
No	2

36. Do you know the refrigerant the technician filled last time? **SINGLE CODE.**

	Code
I trusted the servicing technician to fill the right one	1
The visiting technician told me the refrigerant he used	2
Does not matter to me whatever the refrigerant might be	3

37. If you had an option to trade in your existing AC to buy a new super-efficient air conditioner that has climate friendly refrigerants, what would make you go for one? **SINGLE CODE.**

	Code
Same upfront cost, lower running cost	1
Higher upfront cost, recovered in 3 years	2
Higher upfront cost, recovered in 5 years	3
Would have opted for it irrespective of the cost	4

38. What are the innovations, according to you, that are being introduced in the RAC sector? **MULTIPLE CODE**

The innovations	Code
Better energy efficiency	1
Better thermal efficiency	2
Newer design	3
Lower ozone depleting and global warming potential	4
Inverter technology	5
Better features (ex – sensors for smart cooling, mobile/app connectivity etc)	6

39. What are your expectations from the government agencies in this sector? Select all that apply

	Code
Technological changes	1
Increasing consumer awareness of the updates in the sector	2
Aligning with the international agencies on policy matters	3
Providing financial support to key stakeholders (manufacturers, servicing personnel etc)	4
Newer reforms	5
Other (Please specify)	99

Policymakers

In-depth face-to-face discussions were held with key policymakers in the cooling ecosystem. This included several ministries, PSUs, urban development departments, electricity distribution companies, development authorities of key Indian states.

A total of 25 respondent in this group were interviewed. Of these, eight were from central ministries, two from PSUs, five DISCOMs, six from SDAs, and four from UDDs.

Discussion guide/questionnaire

Section 1

In this section, we seek to understand the awareness of the multiple stakeholders regarding the negotiations held at international level compliant to Kigali Amendment to the Montreal Protocol, Paris Agreement under United Nations Framework Convention on Climate Change (UNFCCC) and Sustainable Development Goals of 2030.

- ▶ What, according to you is the current understanding of the following stakeholders regarding the international negotiations?
 - Manufacturers
 - Consumers
 - Servicing personnel/technicians
- ▶ What do you think are the major barriers/challenges faced by the following in the transition to move to super-efficient cooling and increasing the uptake of environment friendly refrigerants?
 - Consumers
 - Manufacturers
 - Servicing personnel
- ▶ Where do you think these categories lack in awareness?
- ▶ What are the possible steps that can be taken to increase the awareness of each category depending on their involvement in the industry?
- ▶ How is the industry overall taking this transition? What is the adoption rate?

Section 2

Here, please inform the necessary steps that should be adopted by the agencies

- ▶ What are the steps that should be taken by the nodal government agencies, in terms of:
 - Policy framework
 - Incentives
 - Consumer awareness and outreach
- ▶ How does existing policies support the sector overall? Do you think these suffice? Or should there be any other modifications?

Section 3: View on current policies and support

- ▶ What is your view on government schemes/policies such as Pradhan Mantri Awas Yojana, Smart Cities, Doubling Farmers Income, Skill India Mission and Mission Innovation and how can these be synergized in the cooling and energy efficiency area?
- ▶ Since the critical aspect for sustainable cooling is the availability of cost-effective low GWP and non-ODS refrigerants, what is being done from R&D point of view to develop cost-effective solutions to meet the cooling demand of the country?

Manufacturers

In-depth face-to-face discussions were held with OEMs and manufacturers in the cooling sector. This involved interviews with 9 such stakeholders including representatives of OEMs, cold storage, transport industry, and the manufacturers of air conditioners.

Discussion guide/questionnaire

Section 1: General Information

I would like to start off by knowing a little bit about you and your company. Please tell me in as much detail as you can:

- ▶ What is the annual production of the unit?
- ▶ How many employees are working in the unit?
- ▶ How has automation helped the AC manufacturing unit?
- ▶ What are the challenges faced by the industry?

Section 2

In this section, we seek to understand the awareness of manufacturers regarding the negotiations held at international level compliant to Kigali Amendment to the Montreal Protocol, Paris Agreement under United Nations Framework Convention on Climate Change (UNFCCC), and Sustainable Development Goals of 2030.

- ▶ Are you aware of the recent BEE reforms for energy efficiency? Can you share your thoughts on the recent changes?
- ▶ What is the cost implication in the change of award of star ratings basis ISEER ratios?
- ▶ What are your views on Montreal Protocol and the Kigali Amendment?
- ▶ What Sustainable Development Goals are linked to cooling and how will it impact the RAC business?
- ▶ Do you see the transition of moving to super-efficient air conditioners as an opportunity for the overall sector?
 - What impact do you think it would create on the industry overall?

Section 3: Refrigerants and cost implications

The HCFC Phase-out Management Plans (HPMPs) is under implementation. India is completely phasing-out production and consumption of HCFCs per the Montreal Protocol by 2040. However, we are expected to reach 67.5% by 2025. Do you think as a country we can achieve it?

- ▶ What is the cost implication for change of refrigerants from R-22 to R-290/R-600a?
- ▶ In what all areas would there be a cost implication for this transition?
 - Manufacturing
 - Upskilling the current workforce
 - Increasing awareness in the consumers

- ▶ What proportion of your current revenue is directed towards in the development of technology for the efficient RAC equipment?
 - Are there any technological/financial challenges being faced?
- ▶ In your view, is the industry being supported adequately by the government?
 - What are the areas in which the manufactures require more support?
 - Please inform how do you plan to incorporate this support in the current manufacturing scenario?

Section 4: Government’s initiatives in this area

- ▶ Pradhan Mantri Kaushal Vikas Yojana (PMKVY) the government of India wants to upskill and certify 1,00,000 RAC service technicians? What are your views on it?
- ▶ How do you think it would impact the current line of servicing?

Section 5: Marketing and PR

- ▶ Have your company as a manufacturer, undertaken any branding step as an environment friendly manufacturer?
- ▶ How do you assume this would help in increasing the awareness of the general population?
- ▶ Which of your competitors excel in this kind of campaigning?

Servicing Personnel

Computer-assisted personal interviews were conducted with 113 servicing personnel in the air conditioning and refrigerators sector across five cities: Delhi/NCR, Mumbai, Kolkata, Chennai, and Bengaluru.

Survey Questionnaire

Section 1: Demographics

1. What is your age (in years)?

Less Than 26 Years	1
26–35 years old	2
36–45 years old	3
46–55 years old	4
More than 55 years	5

2. What is your gender? **SINGLE CODE**

Male	1	Continue
Female	2	Continue

3. Which of the following cities do you live currently in? **SINGLE CODE**

City	Code
Delhi NCR	1
Mumbai	2
Chennai	3
Kolkata	4
Bengaluru	5

4. Which of the following best describes your highest educational qualification? **SINGLE CODE.**

Education Qualification	Code
No Formal Education	1
Primary Education (Upto 5th Class)	2
6th – 9th Class	3
Secondary Education (Class 10th)	4
Higher Secondary Education (Class 12th)	5
Diploma (2 year course)	6
Bachelor's degree (College / University) / Graduate	7
Beyond bachelor's degree (e.g. Masters, Ph.D.) / Post Graduate	8

5. Which of the following cooling equipment do you service currently? Select one. **SINGLE CODE**

Air Conditioner	1	Continue
Refrigerator	2	Continue
Both AC and Refrigerator	3	Continue
None	4	Terminate

6. How many years of experience do you have in the servicing profession for the RAC sector? Select one

Less than 1 year	1	Terminate
1–2 Years	2	Continue
2–5 years	3	Continue
More than 5 years	4	Continue

7. Could you please tell which of the following statements best describe about your current profession?
SINGLE CODE

I work alone independently	1	Go to Q. 9
I have team of people who support me in my work	2	continue

8. How many people work in your company?

Total no. of employees work: _____

Post code:

No of Employees	Code
Less than 5	1
6–10	2
10–20	3
21–50	4
More than 50	5

Section 2: Technical Awareness

9. Which of the following statements do you agree with? Select all that apply. **MULTIPLE CODING**

Refrigerants used in cooling equipment have ozone-depleting properties	Code
Refrigerants used in cooling equipment contribute to global warming and climate change	1
Refrigerants have characteristics such as toxicity, flammability, and high pressure therefore these need to be handled carefully using best practices	2
Releasing refrigerants into open can be harmful and therefore proper leak testing should be done	3
Regular servicing maintains the efficiency of the cooling equipment	4
None of the above statements are true. (<i>Mutually exclusive</i>)	5

10. What are the aspects that you consider determining the appropriate refrigerant that is to be used? Select one.

Aspects for appropriate refrigerant	Code
Brand	1
Model	2
Year of manufacture	3
Cost of the refrigerant and the profit generated through it	4
Availability of the refrigerant	5
All of the above	6
Any refrigerant can be used irrespective of brand/model/year	7

11. Which of the following refrigerants do you use while servicing the RAC equipment? Select all that apply. **MULTIPLE CODE**

	Code
R-22	1
R-410A	2
R-32	3
R-134A	4
R-290	5
R-600A	6
None of the above (<i>Mutually exclusive</i>)	7

12. How do you carry the refrigerant on a usual basis? Please check the list below and select best suitable option.
SINGLE CODE

	Code
I carry it on a company provided 4-wheeler that is equipped with all the safety features	1
I commute and carry it on a self-owned two-wheeler	2
I commute and carry it on a public transport	3
Other (Please specify) _____	4

13. Basis of your awareness of the refrigerants, which of the following do you think have the ODP and GWP properties?

(Scripter instruction: Show responses selected in Q11)

Refrigerant	Ozone Depleting Potential	Global Warming Potential
R-22	1	2
R-410A	1	2
R-32	1	2
R-134A	1	2
R-290	1	2
R-600A	1	2

14. What, according to you, are the properties are possessed by the modern refrigerants that make them a better substitute for existing HCFC based refrigerants? Select all that apply. **MULTIPLE CODE**

	Code
Lower toxicity	1
Lower flammability	2
Lower ozone depleting potential	3
Lower global warming potential	4
Safer to use/carry	5
Better thermal efficiency	6
Newer refrigerants have no difference as compared to existing ones (<i>Mutually exclusive</i>)	7

15. While visiting for servicing, what all does the consumer enquire from you? Select all that apply **MULTIPLE CODE**

	Code
Consumer enquires for my qualifications	1
Consumer enquires regarding my experience in the industry	2
Consumer asks about the refrigerant that would be filled in the equipment	3
Other (Please specify)	

16. Which of the following information do you provide the customer pro-actively? Select all that apply

	Code
Servicing procedure	1
Refrigerant to be used	2
Cost of the refrigerant	3
Other (Please specify)	4

17. Which of the following best describes the nature of your job? **SINGLE CODE**

	Code
Full-time employee	1
Part time employee	2
Self employed	3
Employed by an organization for some time of the year considering the seasonal requirement	4

18. Below are the few statements regarding the best practices? Rate the following statements on a scale of 1 to 5 where 1 means “Not at all agree” and 5 means “Strongly agree”.

Not at all agree	Somewhat agree	Neither Agree nor Disagree	Somewhat disagree	Strongly Agree
1	2	3	4	5

Statements	Not at all agree	Somewhat agree	Neither Agree nor Disagree	Somewhat disagree	Strongly Agree
The refrigerant should never be released in the atmosphere, while repairing, decommissioning, or at the end of the life of the AC.	1	2	3	4	5
Proper leak testing should be ensured.	1	2	3	4	5
Nitrogen should only be used for pressure testing to ensure personal safety.	1	2	3	4	5
Right quality of the goggles should be used.	1	2	3	4	5
The electrical wiring should be done with proper termination, and no loose connections or improper joints should be made.	1	2	3	4	5
During servicing, it should be ensured that the coils and filters are properly cleaned so that the air-conditioners operate efficiently.	1	2	3	4	5
Due to the properties such as flammability, toxicity and high pressure that the refrigerant possesses, it should be transported with care in a vehicle that is equipped with all the safety features.	1	2	3	4	5

Section 3: Perception about training programmes

19. What is the source of the training/refresher training provided to you in the RAC sector? Select one **SINGLE CODE**

	Code
Capacity building sessions held by the company I work for	1
Trainings provided by ITIs	2
Trainings held by the government/other organizational trainings	3
Received learning from family/friends/colleagues	4
Other (Please specify)	5

20. Which of the following statements do you agree with in choosing this profession? Select all that apply. **MULTIPLE CODE**

	Code
The role I perform gives me a sense of satisfaction and I get a sense of achievement in repairing/service a machine.	1
The profession has better job security and I have work throughout year.	2
My organization supports me well by bringing in other benefits such as better pay, incentives etc.	3
The job gives a boost to income at certain times of the year due to nature of work.	4
The profession has better training courses to enhance technical skill.	5
Pursuing a career in this field leads to significant improvement in the living standards of my family.	6

21. Why do you think refresher training in this field is necessary for you and your peers? Select all that apply. **MULTIPLE CODE**

	Code
It would help me getting acquainted to newer and modern refrigerants	1
Updated training would help technicians to get better job opportunities	2
A refresher course would make an income difference	3
Receiving formal training sessions would help the overall sector and the environment/climate change on a larger scale	4
I believe the training received earlier suffices my current profile (Mutually exclusive)	5

22. Do you think that you are able to apply the knowledge gained through courses you have undertaken in this sector to your current job? Select one. **SINGLE CODE**

	Code
Yes, I believe I am fully dependent on the knowledge imparted to me while in the fieldwork	1
I can only apply the partial curriculum and the rest differs in actual fieldwork	2
No, the current role is completely different from the courses I have undertaken	3

23. Which of the following government training programmes are you aware of? Select all that apply. **MULTIPLE CODE**

	Code
GIZ training (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	1
Indian Society of Heating, Refrigerating and Air Conditioning Engineers (ISHRAE) – Skill development programme	2
ISHRAE Certified Professional AC Service Level – 1	3
ISHRAE – ACRESERVE	4
ESSCI skill development programmes including Skill India Mission - Pradhan Mantri Kaushal Vikas Yojana (PMKVY)	5
None of the above (Mutually exclusive)	6

24. Have you ever participated in any such training programme? If yes, please state the name of the programme.

SINGLE CODE

Yes	1	Name of programme: _____
No	2	

ABOUT TERI

The Energy and Resources Institute (TERI) is an independent, non-profit organization, with capabilities in research, policy, consultancy and implementation. TERI has multi-disciplinary expertise in the areas of energy, environment, climate change, resources, and sustainability.

With the vision of creating innovative solutions for a sustainable future, TERI's mission is to usher in transitions to a cleaner and more sustainable future through the conservation and efficient use of the Earth's resources and develop innovative ways of minimizing waste and reusing resources.

TERI's work across sectors is focused on:

- Promoting efficient use of resources across sectors
- Increasing access and uptake of sustainable practices
- Reducing the adverse impact on environment and climate

TERI works with a diverse range of stakeholders across governments, both at the national and state levels, international agencies, and civil society organizations to help deliver research-

based transformative solutions. Headquartered in New Delhi, TERI has regional centres and campuses in Bengaluru, Gurugram, Guwahati, Mumbai, Nainital, and Panaji.

Currently, TERI's work is structured around seven sectors:

- Agriculture
- Climate
- Energy
- Environment
- Habitat
- Health and Nutrition
- Resources

TERI brings out Discussion Papers on key contemporary issues in sectors such as energy, agriculture, water and environment with multi-disciplinary and multi-sectoral implications for use by policy makers, legislators, researchers and practitioners. This Report has been brought out by the Earth Sciences and Climate Change Division as a part of TERI's work in the cooling sector.