POLICY BRIEF
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Accelerating the Uptake of Energy-Efficient Air Conditioners in India

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The Energy and Resources Institute
Creating Innovative Solutions for a Sustainable Future

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ABBREVIATIONS

AC	Air Conditioner
AIACRA	All India Air conditioning & Refrigeration Association
BEE	Bureau of Energy Efficiency
Btu	British thermal unit
BU	Billion Units
CAGR	Compound Annual Growth Rate
CEA	Central Electricity Authority
DISCOM	Distribution Company
EC Act	Energy Conservation Act 2001
ECBC	Energy Conservation Building Code
EE	Energy Efficiency
EER	Energy Efficiency Ratio
EESL	Energy Efficiency Services Limited
EPI	Energy Performance Index
FEEED	Framework for Energy Efficient Economic Development
GDP	Gross Domestic Product
GoI	Government of India
GWh	Gigawatt hour
GWP	Global Warming Potential
HVAC	Heating, Ventilating, and Air Conditioning
IEA	International Energy Agency
ISEER	Indian Seasonal Energy Efficiency Ratio
ISO	International Organization for Standardization
LED	Light Emitting Diode
MEPS	Minimum Energy Performance Standards
MW	Mega Watt
NAPCC	National Action Plan on Climate Change
NDC	Nationally Determined Contributions
NECA	National Energy Conservation Awards
NMEEE	National Mission for Enhanced Energy Efficiency
ODP	Ozone Depleting Potential
PAT	Perform Achieve and Trade
PRGFEE	Partial Risk Guarantee Fund for Energy Efficiency
RAC	Room Air Conditioners
SEER	Seasonal Energy Efficiency Ratio
SME	Small and Medium-sized Enterprises
SDA	State Designated Agency
TR	Ton of Refrigeration
UJALA	Unnat Jeevan by Affordable LEDs and Appliances for All
UNFCCC	United Nations Framework Convention on Climate Change
VCFEE	Venture Capital Fund for Energy Efficiency
VRF	Variable Refrigerant Flow

1. INTRODUCTION

1.1 Background

Globalization has led to a rapid growth in the world's economy and subsequent movement of people, product, capital, etc., further leading to urbanization. Urbanization has facilitated the evolution of knowledge, and has been the incubator of civilization and the engine of growth. The urbanization process is also accompanied by a number of problems in urban areas, rooted in the unmanageable growth of populations in those areas, which are primarily related to the provision of basic facilities and services such as water supply, sanitation, housing, transport, etc. Developing countries are the most vulnerable as they are likelier to undergo massive urban population growth.

Urbanization leads to a change in people's lifestyles and their aspirations, thereby improving their purchase behaviour. As a result of this change in purchase behaviour, there are often non-linear shifts in demand. The growth of a young population that is enjoying rising incomes is creating a large emerging middle class in India, which is feeling informed and empowered to demand. With the rapidly increasing human aspirations, the spurt in energy demand has been tremendous. However, to ensure that the developing countries adhere to their development prerogatives, especially to eradicate poverty and improving the lifestyle of their citizens, access to electricity is paramount.

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[1]. 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 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 global demand up to 5.7% (in 2013), from 4.4% at the beginning of the century.

The estimated electricity consumption increased from 5,53,995 GWh during 2008–09 to 11, 30,244 GWh during 2017–18, showing a CAGR of 7.39%. The percentage increase in the electricity consumption from 2016–17 (10, 61,183 GWh) to 2017–18 (11, 30,244 GWh) has been

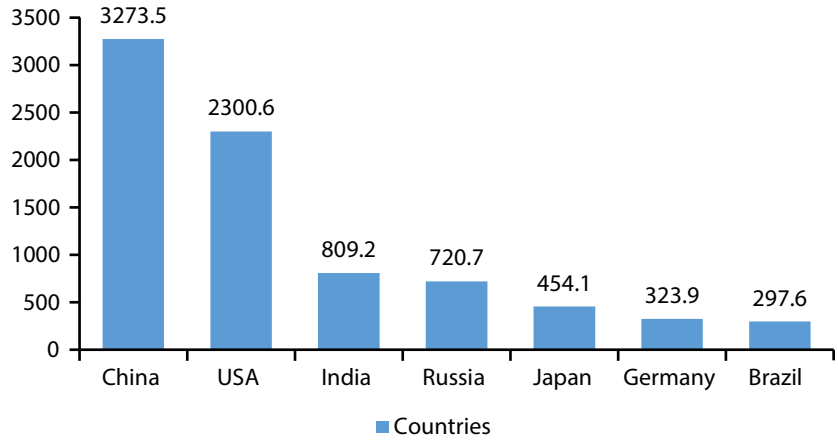

Figure 1.1 Energy consumption (Mtoe) in major economies in 2018[2]

(Source: BP)

[1] https://www.eia.gov/outlooks/ieo/pdf/0484(2017).pdf

[2] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf

6.51%. Of the total electricity consumption in 2017–18, the industry sector accounted for the largest share (41.48%), followed by domestic (24.20%), agriculture (18.08%), and commercial sectors (8.51%). The electricity consumption in the industry sector and domestic sector has increased at a much faster pace compared to other sectors from 2008–09 to 2017–18 with CAGRs of 8.39% and 7.58%, respectively, as shown in Figure 1.2[3].

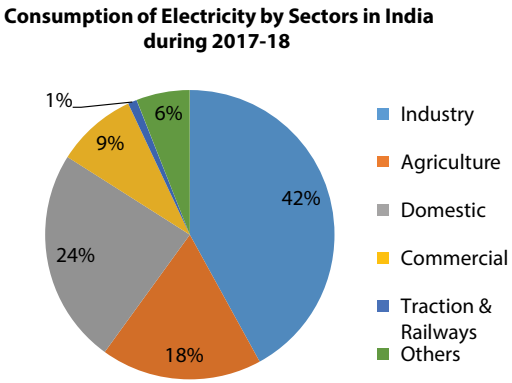

Figure 1.2 Consumption of Electricity by Sectors in India during 2017-18

(Source: MoSPI)

1.2 Energy demand in heating, ventilating, and air conditioning segment

Electricity demand in residential and commercial building sectors constitutes around 33% of total electricity demand in India. The residential share is approximately 24% of building sector demand. Lighting, heating, ventilation, and air conditioning are the key electricity demand drivers in the building sector. Figure 1.3 shows the electricity consumption pattern in residential buildings in which fan and lighting load are predominant factors. Though refrigeration and air conditioning are also major contributors, and their share in electricity consumption is deemed to rise and dominate with the rising economic growth and urbanization in India.

The HVAC equipment accounts for a major share of electricity bills for residential, commercial, and industrial applications, leading to tremendous pressure on energy sources. This ultimately impacts the environment, as shown in Figure 1.3.

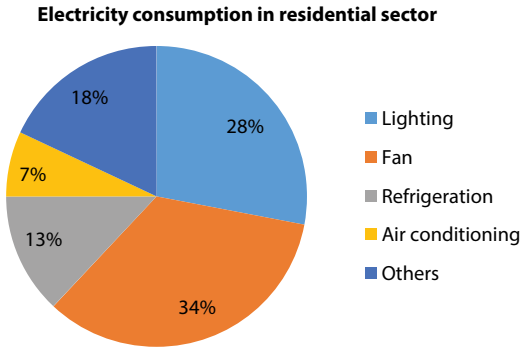

Figure 1.3 Electricity consumption in residential sector

(Source: Planning Commission, 2011)[4]

As per a report by the World Bank[5], the total electricity consumption by air conditioning will increase to 50,000 GWh per year in 2031. Room air conditioners constitute around 50% of total energy consumption in urban homes in India. Within the next two decades, the electricity demand for cooling could increase by 25 times in India.

Currently, the space cooling requirement in India is predominantly met by fans and RACs in residential complexes and by RAC, chillers and variable refrigerant flow (VRF) in commercial buildings. However, still, a very low percentage of Indians (around 7–9%[6]) use air conditioners for cooling comfort.

The equipment wise cooling demand according to ICAP data is given in Figure 1.4.

Even with low penetration of air conditioners in the country, the electricity demand to run the AC equipment covers a fair share, as shown in Figure 1.3. The growing demand for cooling systems in India has an implicit challenge of meeting this demand through affordable means. As India is a developing country and has a considerable large middle class population, affordability becomes the paramount factor for meeting the energy demand. Expensive energy-efficient cooling products provide the way for proliferation of low-efficiency

[3] http://mospi.nic.in/sites/default/files/publication_reports/Energy%20Statistics%202019-finall.pdf?download=1

[4] http://www.gbpn.org/sites/default/files/08.%20INDIA%20Baseline_TR_low.pdf

[5] http://siteresources.worldbank.org/INDIAEXTN/Resources/295583-1238410833992/5967776-1238410858783/Residentialpowerconsumption.pdf

[6] http://ozonecell.in/wp-content/uploads/2019/03/INDIA-COOLING-ACTION-PLAN-e-circulation-version080319.pdf

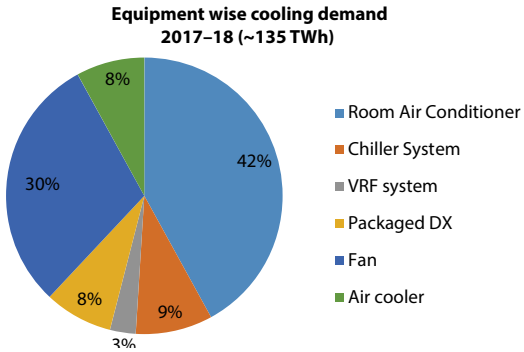

Figure 1.4 Equipment wise cooling demand 2017–18

(Source: ICAP)

air conditioners with high-GWP refrigerants, thereby increasing the stress on power grids by contributing to peak loads, thus aggravating brownouts and blackouts, and generating substantial greenhouse gas emissions that contribute to global warming.

The exponential electricity demand can be eliminated by the deployment of energy efficient measures, resulting energy savings and its associated abatement in energy bills. HVAC systems comprise 40% of the energy consumed by buildings in India[7]; hence, HVAC remains the primary focus area for energy saving through system upgradation and optimization.

The chiller (medium and large capacities) and VRF (small and medium capacities) market in India is growing exponentially in terms of volume and quality with the use of latest and innovative technology. The total size of chiller and VRF market in India is around 1.1 million ton of refrigeration (TR). The market is growing with an annual growth of 40% in VRF and 10% in chillers segments, respectively according to All India Air conditioning & Refrigeration Association (AIACRA).

The RAC market has been growing at a compound annual growth rate (CAGR) of 12% over the last five years. The market for RAC was 7.6 million units (approximately) in 2018 (as per BEE). Comparatively, the Indian market size is minimal compared to other developing countries such as China, where the RAC demand was more than 44 million units in 2018[8].

1.3 Energy efficiency in RAC segment

The United Nations is leading a 'Sustainable Energy for All' initiative to ensure universal access to modern energy services, improve efficiency, and promise an increased use of renewable sources. To meet the sustainable development goals, energy efficiency is considered the most cost-effective resource. This has been strengthening energy security, reducing energy expenditure, and helping the environment. Notably, improved energy intensity has been the biggest factor behind the recent flattening of global greenhouse gas emissions.

Therefore, improving the energy efficiency meets the dual objectives of promoting sustainable development and making the economy competitive. Recognizing the tough challenges of meeting the energy needs and providing adequate and diverse energy of desired quality in a sustainable manner and at reasonable costs, and improved efficiency have become important components of energy policy.

Globally, between 2000 and 2016, energy efficiency improved by 13%. Without this improvement, global final energy uses in 2016 would have been 12% higher – equivalent to adding the annual final energy use of the European Union to the global energy market (IEA). In developing countries, there are issues/challenges that come in the way of accelerated growth of an energy-efficient market. Financing, awareness, diversification of policies, etc., are the major factors that need to be worked on.

The RAC segment is and will continue to be the major sector in Indian residential sector to meet the cooling demand. Still, the penetration of room ACs in Indian households is 7–9% (*source:* ICAP), which is going to accelerate in the next couple of decades. Energy efficiency in this segment is the only resource that can address the side effects of the increasing RAC market, such as increasing peak load, etc.

[7] https://eta.lbl.gov/sites/all/files/publications/lbnl-6230e.pdf

[8] https://www.jraia.or.jp/english/World_AC_Demand.pdf

1.4 Policy framework for enabling energy efficiency in RAC

The cooling requirement is cross-sectoral and an essential part for economic growth. Most importantly, synergistic actions with respect to cooling across sectors will have a higher impact than any other action taken in isolation. This was the core idea of the Government of India to develop a comprehensive cooling strategy for the country through the India Cooling Action Plan (ICAP). The overarching goal of ICAP is to provide sustainable cooling and thermal comfort for all while securing environmental and socio-economic benefits for society.

Various governmental and non-governmental initiatives are being undertaken to address the efficiency and environment-friendly refrigerant issues in the cooling sector. Referring to the earlier discussion on various cooling technologies in use to provide thermal comfort, RAC has been the most prominent technology and covers the major market share. This rationalizes the need for further discussion regarding the improvement of energy efficiency and adoption of climate-friendly refrigerant in the RAC segment.

Under the provisions of Energy Conservation Act 2001, Government of India has initiated many activities for improving energy efficiency in different sectors. The Bureau of Energy Efficiency (BEE), a statutory body under GoI established in 2002, has been given the mandate to formulate policies that can transform the market towards energy efficiency. BEE initiated flagship schemes such as Standards and Labelling, Energy Conservation Building Code (ECBC), and Perform Achieve and Trade (PAT) scheme to improve the efficiency in appliances, buildings, and industry with the prime objective to reduce the burden created on the Indian economy due to a rise in energy demand and contribute significantly to meet the global obligation on climate change.

The Standards and Labelling (S&L) scheme has been initiated with the objective to provide the consumer an informed choice about the energy performance of the product. This has been the government's flagship programme to improve the energy efficiency in the appliances segment including RACs, refrigerators, colour televisions, water heaters, etc.

Standards provide a policy push at the supply end by promoting design and technology developments, alignment with international trends, handholding of some segments of manufacturers, along with a pull at the demand side by creating a demand for energy-efficient products through awareness and knowledge dissemination with the help of labelled information about the energy performance of the product, encapsulated in its Standards and Labelling programme, policies, and regulatory framework. The following sections will give a detailed analysis of the scheme for RACs.

Apart from regulatory approach, the government has also initiated market interventions through business models to deploy super-efficient products. India is the first country to use government procurement processes through the initiative of Energy Efficiency Services Limited (EESL) to buy super-efficient air conditioners, showcasing a leadership role in the transition towards super efficiency and low-GWP refrigerants. A strategy borne out of India's imperative to reduce consumer-energy bills and meet climate mitigation commitments, needs to leapfrog and accelerate the introduction of super-efficient air conditioners. Such an initiative will help meet the challenges of the increasing electricity demand from ACs, sustainably, thereby reducing GHG emissions.

2. Approach and Methodology

The policy analysis as presented here is initiated with the collected information pertaining to the role of electricity demand due to cooling sector and energy efficiency levels of the air-conditioners produced under BEE Standards and Labelling scheme. The relevant information is analysed as to assess the impact of Standards and Labelling scheme for air-conditioners, and the trend of increasing energy efficiency for RACs in the country.

The approach for the study involved review of policy documents, action plans, research articles and websites, collection of data available in the public domain, such as reports and industry websites. Stakeholder engagement in the form of one-to-one meetings & expert interviews has been conducted. The issues and challenges in the current state of the scheme are then identified and options to tackle the same are suggested.

Methodology

1. Based on the research and reviews of the Standards and Labelling scheme, the challenge associated with relatively low share of 5-star rated AC in total production is identified.

2. Envisioned the various options to address the challenge associated with relatively low share of 5-star rated AC in total production.
3. Laid down a criterion for the feasibility assessment of the options.
4. Carried out a comparative analysis of the options based on the defined criteria.

3. Standards and Labelling Programme for RAC

In 2006, BEE launched Standards and Labelling programme for Room Air-conditioners. Initially, the programme began in a voluntary phase for the vapour compression type room air conditioner and split air conditioner up to a rated cooling capacity of 10,465 Watt (9,000 kcal/h). Subsequently, the star rating for room air conditioners was made mandatory in 2010. The scope expanded in 2015 to include cassette ACs, floor-mounted and ceiling-mounted ACs, and in 2018, it proposed to include variable speed ACs in a mandatory regime. The star rating awarded was based on the energy efficiency ratio (EER) value calculated as per IS 1391 (Part 1 and Part 2)[9,10,11]

It is imperative to understand that as the efficiency parameter value is one of the indicators to evaluate the improvement potential for air conditioners, it is essential to understand the local market and weather conditions, and other preferences to take the most appropriate policy actions. The government policy should reflect on the local conditions, such as the required cooling comfort for testing standards, temperature profile of the country, etc.

To obviate this problem, in 2015, Indian Seasonal Energy Efficiency Ratio (ISEER) was created to provide an energy efficiency measure that is closer to the actual performance of AC units in situ over the cooling season in India. ISEER includes the impact of variations in the outdoor air temperature and the effect of the cooling load, which is also sensitive to building and user behavioural norms. These metrics typically require many test points to compute a seasonally weighted average efficiency and are intended to give results that are representative of how the AC would perform over a typical cooling season within a representative building type having typical operating characteristics. Initially, the methodology was introduced for variable speed ACs and calculated as per ISO 16358[12].

Subsequently, BEE launched the voluntary star labelling programme for such inverter air conditioners on 29 June 2015. The performance of such air conditioners evaluated was used as per Indian climatic conditions and the star rating was called Indian Seasonal Energy Efficiency Ratio (ISEER), as shown in Table 3.1.

Table 3.1 Star Rating Plan (Valid from 1st January, 2018 to 31st December, 2019) (source: BEE)

Star level	Minimum (ISEER)	Maximum (ISEER)
1 Star	3.1	3.29
2 Star	3.3	3.49
3 Star	3.5	3.99
4 Star	4.0	4.49
5 Star	4.5	

Subsequently, BEE notified on 8 August 2017 to merge the star rating of variable speed with fixed speed air conditioners in the mandatory regime from 1 January 2018. With this change, the variation in performance with temperature was addressed. Additionally, Minimum Energy Performance Standards (MEPS) for fixed speed split ACs was upgraded to ISEER – 3.1.

[9] https://archive.org/details/gov.in.is.1391.1.1992/page/n3

[10] https://consumerhelpline.gov.in/bis/1391%20Part%202.pdf

[11] https://beeindia.gov.in/sites/default/files/RAC%20-%20Page%2049-74.pdf

[12] https://www.iso.org/standard/56467.html

4. Impact of Standards and Labelling Programme

The scheme to improve energy efficiency in the appliance sector has been in existence for over a decade, an adequate amount of time after which any policy could be reviewed in order to assess whether it has achieved its intended outcome. As per the available data and market trends, the scheme has made inroads to transform the market towards energy efficiency. The design of the programme is such that both the components (standards and label) complement each other in market transformation. Minimum energy performance standards make a highly cost-effective policy option to establish an 'efficiency floor' for products sold within India. The standards push the market towards energy efficiency. Labelling of products is one of the most effective methods for communicating energy efficiency and product performance to consumers, which support to pull the market towards a higher demand for more energy-efficient products.

Over the last decade, corporate initiatives for air conditioner efficiency have gotten more streamlined. Producers encouraged by governmental initiatives and consumers' positive responses are now giving significant weightage to the production of energy-efficient products. This is reflected in the growing sales and popularization of energy-efficient products in India.

The Standards and Labelling programme has multiple benefits. At the national level, it is tremendously successful to address issues such as peak load, accelerated electricity demand etc. and ensuring monetary saving for the consumers.

The star rating programme for air conditioners has resulted in significant energy savings and a reduction in peak demand over the years. The market has also moved towards sale of higher efficiency appliances. According to the available BEE data, electricity savings of approximately 6.09 BU was achieved through sale of star rated air-conditioners in 2016–17. Cooling electricity demand in the urban areas has bearing on the overall peak demand, star rating program for RACs proved to be one of the major factor to compliment in managing the peak demand.

4.1 Impact on energy efficiency

To leverage the advancement in technology and progressively improve the efficiency of RACs, BEE continuously ratcheted up the energy efficiency standards. Ratcheting up of the standards has led the way towards energy efficiency. The government too is shifting the goalpost and tightening the norms in response to market transformation. The demand for 3-star labelled products has always been higher, and continues to be till date. Figure 4.1 tells the story of energy performance norms for the air conditioner star rating programme over the mandatory phase of the scheme. Here, it is visibly evident that BEE has progressed, though gradually, and sustainably to improve the air conditioning system efficiency in India.

The minimum energy efficiency standards for air conditioners in India have been upgraded by approximately 34% in the last 8 years. Figure 4.2 shows the upgradation in MEPS as well as ratcheting up of the threshold for a 5-star rating.

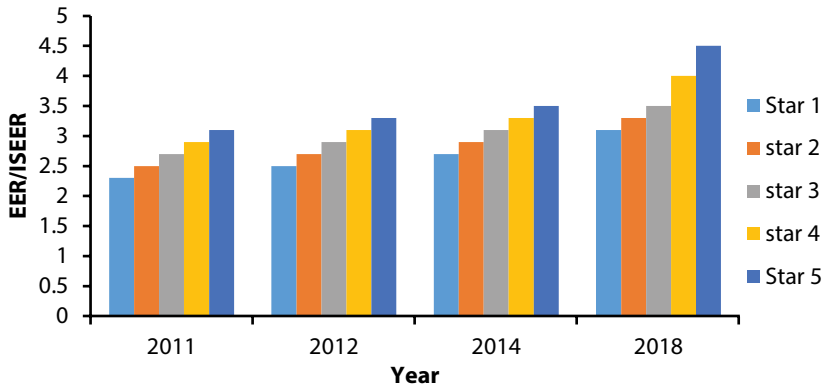

Figure 4.1 Status of the efficiency norms

(Source: BEE)

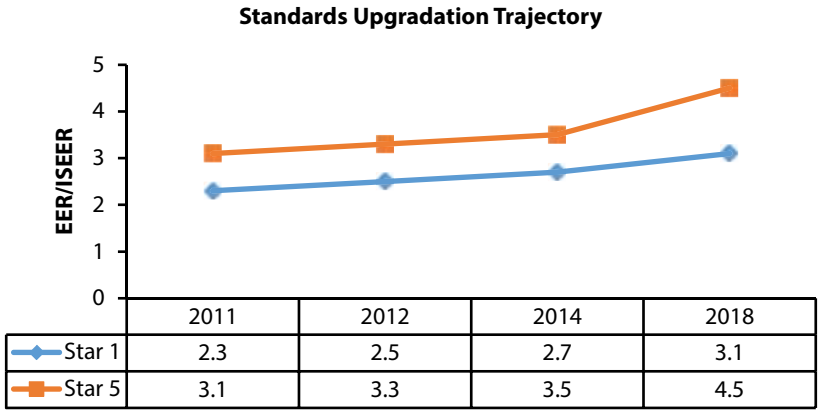

Figure 4.2 Standards upgradation trajectory in India

(Source: BEE)

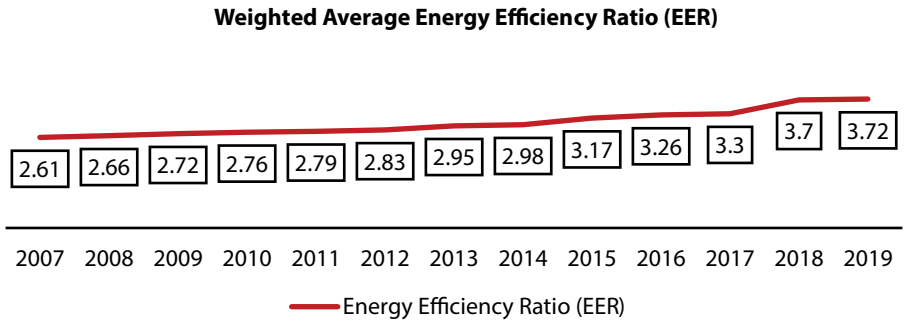

Figure 4.3 Improvement in average EER

(Source: BEE & CLASP)

It should be noted that the weighted average EER of ACs (refer to Figure 4.3) increased from 2.6 in 2007 to 3.72 in 2019, which is an increase of 43% in average efficiency of RACs sold in the market during the year.

HVACs are the prime contributors to peak load power in India, the shortage of which leads to load-shedding, blackouts and brownouts, further causing significant social and economic losses. The star rating program has helped tremendously in minimizing this contribution by saving an adequate amount of electricity. As per TERI analysis, Figure 4.4 maps the capacity avoided due to the Standards and Labelling programme for air-conditioners. The programme offset a change in consumer behaviour, enabling the consumers to make informed decisions on their purchases of appliances, keeping in mind their energy consumption and electricity bills.

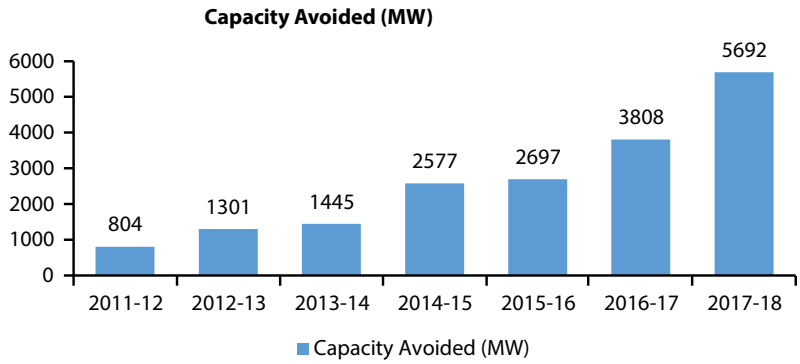

Figure 4.4 Avoided capacity generation (MW) due to star rating over the years (TERI analysis)

The estimated capacity avoided in Figure 4.4 has been calculated by considering the baseline efficiency as 2.3 EER and the average cooling load per unit as 1.35 TR.

5. Issues and Challenges

The market shares for different star products have been varying since the inception of the star rating programme for RACs. The market shares for different star-rated ACs are shown in Figure 5.1. The 1-star and 4-star air conditioners' shares have always been low whereas the 2-star air-conditioners' share has shown a decreasing trend. The share for the 5-star air conditioners has been varying around 20% whereas the share for 3-star air conditioners has soared in recent years.

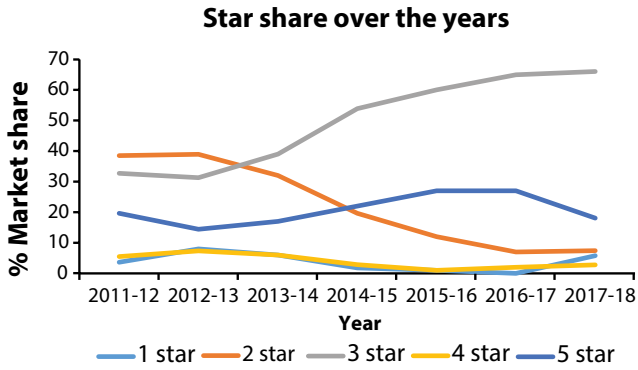

Figure 5.1 Star share variations over the years

(Source: BEE)

5.1 Barrier analysis

BEE has been regularly ratcheting up the standards and the average efficiency of the market is improving gradually and shows positive results. In this policy brief, the aim is to address the behavioural aspect of the consumer and examine the consumer's preference for a 3-star product over a 5-star one, even though it leads to operational monetary saving. This brief attempts to analyse the barriers, opportunities, and feasible options to increase the uptake of 5-star products in the total production in coming years.

The rationale in the low market share for 5-star efficient ACs can be attributed to the affordability issues associated with highly efficient ACs. As per the data collected from various e-commerce and manufacturers' websites, the initial upfront cost for a similarly configured 5-star AC is way more in comparison to a 3-star AC, as explained in Figure 5.2.

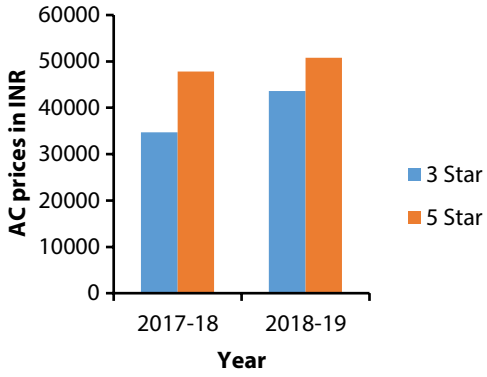

Figure 5.2 Price variation for 3-star and 5-star 1TR ACs

(Source: e-commerce websites)

The market penetration for RAC in India is fairly very low at around 7-9%, reported in accordance with the India Cooling Action Plan. Therefore, the market increase in the ACs would be through new consumer ownership in India, where the first-time buyers could have a negative bias towards buying a 5-star rated AC product due to higher upfront costs and lack of awareness of the operational costs for running inefficient ACs. The affordability issues associated with the adoption of new higher technology is a major barrier in the uptake. The primary challenge to the introduction of highly energy efficient, low GWP refrigerant RAC technologies is an initial price hump, which makes them less competitive as compared to more prevalent (lower efficiency, higher GWP refrigerant) technologies. The 'price hump' signifies the relationship between price increase for energy efficiency improvement and appropriate timelines to implement the enhanced energy efficiency measures[13]. The continuous low market share of 5-star rated air-conditioners demotivates manufacturers to provide energy-efficient products at an affordable cost due to lack of appropriate business opportunities. For a first-time consumer, there is lack of awareness in the energy efficiency benefits that a 5-star rated product possesses, such as lower monthly

[13] https://ipeec.org/bulletin/113-taking-the-heat-off-sustainably.html

contribution in electricity bills, in comparison to a 1-star rated product. Innovative business models could play important role in addressing affordability concern and boost the uptake of new and super energy efficient products among the consumers. The contribution of highly efficient 5-star rated ACs should rise sufficiently in order to have a lasting impact on the peak load demand of power due to cooling on the grid as well as for the efficient thermal comfort.

Table 5.1 shows the comparison between different star-labelled 1.5 TR split ACs in terms of electricity units and annual monetary savings as compared to 1-star ACs.

Such a sensitivity analysis is helpful in generating awareness about energy efficiency through comparison among various options available in the market. There is a huge potential of power saving with the use of 5-star ACs instead of 1-star ones; and monetary saving could payback the initial upfront cost within short period of time.

Figure 5.3 shows the potential of more electricity saving and avoided emission in the intended scenario (60% share of 5 star products instead 18% in total annual production) for the year 2017-18.

Table 5.1: Star-wise comparison of 1.5 TR split AC

Star	ISEER (Threshold value)	Electricity consumption (Watt)	Power units saved annually (kWh) as compared to 1-star	Annual monetary savings (INR) as compared to 1-star
1	3.1	1702	0	0
2	3.3	1599	165	990
3	3.5	1507	311	1867
4	4.0	1319	613	3676
5	4.5	1172	847	5083

Note: These calculations are done with the assumption of 1600 hours of AC usage annually and rate of electricity at INR 6/kWh

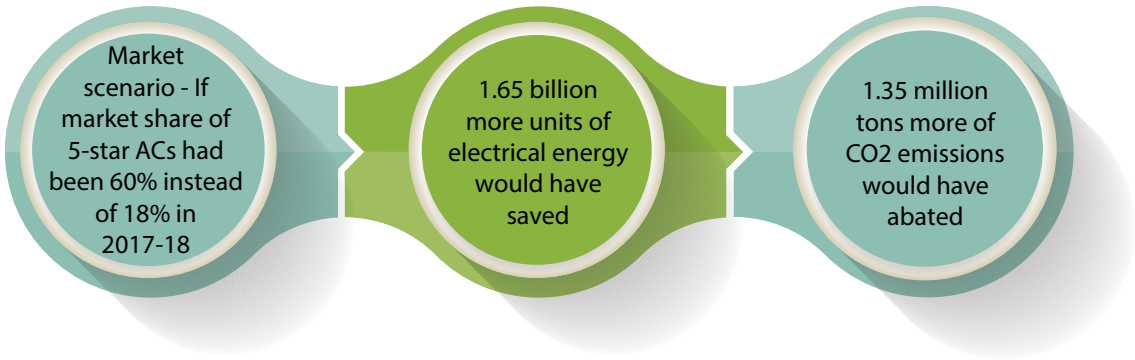

Figure 5.3 Market share scenario comparison of ACs in 2017-18

Note: These calculations are done with the assumption of 1600 hours of AC usage annually and weighted average emission factor = 0.82 tCO2/MWh[14] for India.

[14] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

The above figure compares the Actual market share scenario with a hypothetically intended market scenario in which the market share for 5-star AC is 60% for the year 2017-18. The above analysis shows that 1032 MW of capacity and 1.65 BU of more electricity could have possibly saved with 60% market share of 5-star ACs. The intended market share scenario could have reduced CO2 emission by 1.35 million ton Analysis such as above provides a strong case for increasing the uptake of energy efficient 5-star ACs to help combat climate change by showcasing the relationship between CO2 emissions and AC market share.

6. Increasing the Uptake of Energy-Efficient Air Conditioners

This section presents the possible options for increasing the contribution of 5-star rated products in RAC total production in India. Implementation of any measure including regulatory, financial and outreach strategy to increase the uptake of 5 star rated products depends on several factors. Analysing the factors such as cost, implementation ease etc. could be important to choose specific option to achieve the intended objective. The various options are evaluated based on the following parameters:

1. Net benefits
2. Cost: The cost associated with the implementation of the program.
3. Political acceptability
4. Efficiency
5. Administrative ease
6. Extent of uncertainty

Option 1: Bulk procurement model

Bulk procurement programmes are the tools to use economy of scale and buy large quantities of products at lower prices, often replacing older and lesser efficient technologies with newer, energy-efficient, and higher quality equipment. Bulk procurement programmes help next-generation technologies to penetrate the market. They do this by aggregating the demand for technology and establishing a demand market for participating manufacturers, thereby, leading to rapid reduction in prices.

Under the National Mission for Enhanced Energy Efficiency (NMEEE), in association with BEE–Unnat Jyoti through the 'Affordable LEDs for All' (UJALA) scheme[15], EESL has utilized the bulk procurement programme to procure a substantial number of 7 lakh energy-efficient LED bulbs and achieved the dual aim of increasing the market size of this product and lowering the cost of energy-efficient LED lighting. The success of this initiative is evident in the price drop for an LED from INR 310 in 2014 to INR 38 in 2016. Until now, the UJALA scheme has distributed over 358 million LED bulbs and avoided 9325 MW of peak power demand[16].

EESL's Super-Efficient Air Conditioning Programme (ESEAP) – which is enabling the roll-out of 40% more energy-efficient ACs at prices comparable to the available variants in the market – is creating the market scale for sustainable cooling while also showcasing one of the ways through which to reduce the price hump. By leveraging economies of scale through demand aggregation, the costs of these ACs will come down significantly, making them accessible to the consumer[17]. With the success of its unique procurement programme, EESL has now partnered with DISCOMS such as BSES and Tata Power DDL to distribute 50,000 units of super-efficient and environment-friendly ACs through their e-commerce platform EESL mart to consumers in Delhi on a first-cum-first-serve basis under the first phase of the current programme. This promises to achieve 40% savings in cooling energy cost and longevity of the product with use of 100% copper coils with anti-rust coating. EESL is also offering a hassle-free service experience, comprising complaint-redressal support during the life of the programme, in addition to EMI options through selective banks, and a buy-back option for customers looking to upgrade their ACs.

[15] https://www.teriin.org/policy-brief/bulk-procurement-room-air-conditioning-critical-analysis-eesl-programme

[16] http://www.ujala.gov.in/

[17] https://wec-policies.enerdata.net/Documents/cases-studies/Measures_to_promote_efficient_air_conditioning.pdf

Approach and key features

The bulk procurement programme for air conditioners is very different from the one designed for the LEDs and therefore, a direct comparison between the two should not be drawn. Some approaches for the bulk procurement programme for ACs along with their features to boost the market share of energy-efficient 5-star ACs are discussed below:

- The super-efficient AC bulk procurement programme cannot match the volumes of units of similar LED programme under the UJALA scheme. The AC bulk procurement suffers from many constraints such as affordability for the end user, size of the product and its procurement, initial investment required from the consumer as well as government, and the equipment operation, maintenance, and service associated costs.
- For a successful bulk procurement programme, the cost of the product should be competitive and the quality should not be compromised. The product should have all the relevant features in addition to being energy efficient and thus, low in operational costs. The products should encourage trust and confidence in the end consumer to buy the product from the programme.
- The objectives of the bulk procurement programme should be defined precisely and correctly. The size of the procurement, technical specification of the product including the type of refrigerant, price of the product, after sales service and warranty plans, installation process and timelines of the product to end consumer are some features that should be clearly demarcated in the tenders of the bulk procurement.
- Keeping in line with the prime objective to improve the market share of 5-star ACs for better average efficiency of the market, the bulk procurement should not target the highest ISEER value available in the market to support the super-efficiency aspect of the programme. The programme should gradually increase the ISEER values of the product by initially keeping the value in the range of 4.5–4.8 and then move to higher values above 5 or 5.5 in the subsequent phases of the programme with new procurement tenders. Leapfrogging to highest possible energy-efficiency in the market can hamper the affordability and quality of the ACs, whereas a gradual increase in the efficiency of the product can address the affordability constraints efficiently.
- The AC replacement scheme can be a feature of the bulk procurement programme and it can be implemented through different means for the public and the government. The older air conditioners that are consuming more energy to operate and are in a bad condition should be replaced with new higher efficient units, which utilize less electricity and have more eco-friendly refrigerants with low GWP and ODP. The older AC units, which would otherwise land up in waste and further create hazards and threats to the environment due to refrigerant leakages, should be recycled through material recovery facilities.
- The government, through a policy framework, can make the recycling of the older ACs mandatory. The bulk procurement programme offers an opportunity for the replacement of older units of ACs from the government establishments and institutions with new eco-friendly and efficient products. The public procurement of ACs for the government can be made through the bulk procurement programme for the replacement of older units. The general public can also benefit by availing discounts in the bulk procurement product prices through buy-back schemes for the older ACs depending on the condition of the units.

Feasibility analysis

The decision of buying air conditioners is based on a number of factors such as affordability, tonnage, energy efficiency, etc. Since the product itself is cost intensive at the consumer's end, designing a bulk procurement programme for ACs also requires huge capital investment for the government. The cost of carrying out the bulk procurement model is very high because of the direct administrative involvement and such a policy action is monetary in nature as well. Given the huge economy scale of India, the bulk procurement models can bring net benefits for all stakeholders. Consumers could be benefited as they can opt for the highly efficient 5-star products at a cost comparable to 3-star products because bulk procurement is known to have cleared the price hump and the model could beneficial for industry through creating market for efficient products.

The energy efficiency of ACs helps in reducing the power consumption of the equipment and can lead to

the reduction in percentage of load on the grid due to cooling energy demand. Therefore, it is highly acceptable politically too because it benefits the government by sparing it from setting up more auxiliary power plants to cater to the needs of balancing the power supply with increasing demand for generation, transmission, and distribution of electricity. Since all the aspects and variables for the bulk procurement model are in direct control of the government, therefore, the programme can be handled efficiently and with political acceptability due to greater visibility for the government to ensure a higher uptake of efficient equipment at affordable prices to the people.

The size or volume of units of the procurement is a critical factor for the success of such a programme. The bulk procurement model may not be favourable if the uncertainty in the demand aggregation is not accounted for the demand and supply gap. The extent of uncertainty associated with this option of bulk procurement programme seems to be medium because it has already been successfully applied to LED lamps through the UJALA scheme.

Option 2: Consumer awareness campaigns

The objective of consumer awareness campaigns is to create awareness among people on the efficacy and virtue of adopting a habit for energy conservation. As the Standards and Labelling work on the 'push and pull mechanism', creating a demand for energy-efficient products through various awareness measures is an essential part of the scheme.

BEE has been pushing hard to create a demand for highly energy-efficient products through aggressive advertisements in print and electronic media. One strategic shift could be make in consumer awareness strategy is to focus on showcasing about the benefits of energy efficient 5-star rated ACs instead focussing on mere star rated products. The consumer awareness campaigns about the ACs have been encouraging the consumers to buy energy-labelled products, but now, after the market has evolved, all the ACs present in the market are already star-labelled as BEE has made star labelling for ACs mandatory[18] it becomes important to pull the market towards 5 star rated products. Some of the major actions taken by the government include:

1. National Retailer Training Programme (NRTP): Under S&L scheme, various workshops are conducted to educate retailers on the provisions of Standards and Labelling. These workshops intend to cover retailers across Tier 1, Tier 2, and Tier 3 cities[19].
2. The National Energy Conservation Awards are presented to industry and other establishments. On National Energy Conservation Day (14 December), the 'Appliance of the Year' award is given to the appliance, which has achieved major energy savings the previous year, by the Ministry of Power with the objective of promoting energy conservation among all sectors of economy[20].
3. The government through BEE is regularly promoting awareness and extending its outreach about energy efficiency and conservation through various platforms and sources in the electronic and print media[21].

Approach and key features

Now there is a shift required to make the consumer aware of the 5-star ACs and the campaigns should focus on promoting the high efficiency 5-star ACs with low GWP refrigerants.

- The communication strategy and effective outreach of the awareness programmes should include city-specific surveys based on the mapping of climatic conditions to assess the usage pattern of the ACs in order to identify the priority areas and to better steer the awareness programme.
- The government through the Ministry of Consumer Affairs, Food and Public Distribution, can run consumer awareness campaigns. These campaigns can be televised or aired on the radio informing the people about the benefits of choosing energy-efficient 5-star rated ACs over lower star-labelled products and the positive impacts of using low GWP refrigerants on our

[18] http://www.beestarlabel.com

[19] https://beeindia.gov.in/content/awareness-outreach

[20] https://beeindia.gov.in/content/national-energy-conservation-awards

[21] https://beeindia.gov.in/content/awareness-and-outreach

environment. Such advertisements can be promoted through billboards, electricity bills, etc.

- TERI has been conducting a perception survey for various stakeholders in the cooling sector and from the preliminary review of this perception study has found out that substantial percentage of consumer preferred online reviews to seek information while purchasing ACs. This analysis shows that there is a need for online consumer awareness campaigns that could target the energy efficient and low GWP refrigerant ACs.
- The government can lead by example by informing the public about the benefits of installing low GWP refrigerant based 5-star rated ACs in their new buildings. In order to support their claims, the government can present analysis similar to the above mentioned table 5.1.

Feasibility analysis

Most consumers prefer to seek information through online platforms. Therefore, the consumer awareness programmes should target these platforms to promote energy efficiency. The cost involved for such online consumer awareness campaigns is moderate as the administrative action required for such campaigns is of only supervision role. Consumer awareness can trigger an accelerated adoption of 5-star rated ACs and can help in improving the understanding of the government schemes for the people. The beneficiaries of this option are consumers as they would become more aware of the benefits of efficient equipment and can form an informed decision while buying an air conditioner. It would be beneficial for government as well as industry as it would be the least cost option to address peak demand issue and would create market for next generation technologies respectively.

The efficiency of consumer awareness depends on the effectiveness of the outreach of such campaigns. Since the consumer awareness campaigns are indirectly targeting the higher uptake of 5-star rated ACs, therefore, the implementation efficiency for this option can be considered moderate as these campaigns can only promote awareness of energy efficiency and major aspect of the programs depends on the consumer willingness. Any awareness campaign would be beneficial for government and have political acceptability, as these programs have higher impact with less cost in implementation.

The extent of uncertainty for such consumer awareness programmes is moderate as the impact of this strategy is not quantitatively predictable and any concrete target cannot be planned based on the awareness level of the consumers.

Option 3: Financial & fiscal incentives

The government has launched the National Mission for Enhanced Energy Efficiency (NMEEE), which is one of the eight missions under the National Action Plan on Climate Change (NAPCC). NMEEE aims to strengthen the market for energy efficiency by creating conducive regulatory and policy regimes, and it has envisaged fostering innovative and sustainable business models in the energy efficiency sector. This mission has spelt out a Framework for Energy Efficient Economic Development (FEEED), for development of fiscal instruments to promote energy efficiency. Under this initiative, two funds have been created – Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE). The government can also focus on other financial incentives to overcome the price difference associated with 5-star rated ACs that can be of various types, such as decreasing the GST slab, tax cuts for those manufacturers who produce and sale highly energy-efficient ACs, subsidies for energy-efficient ACs procurement, rebates in taxes for consumers, etc.

Approach and key features

- A monetary policy such as easy discharge of loan scheme through favourable terms and conditions such as easy EMIs and low rates of interests for the procurement of energy-efficient 5-star ACs can provide an essential platform for the people. The terms & conditions should specify the applicability of this monetary policy only for the 5-star rated ACs using low-GWP refrigerant.
- A uniform policy on tax rebates for the procurement of energy-efficient products such as 5-star ACs can positively impact the sale of energy-efficient ACs. Such fiscal initiatives can boost the market share of 5-star rated ACs by enabling people to opt for energy-efficient products in a way to support climate change mitigation and to better channelize their tax savings. Recent corporate tax reduction can also help in this direction for the manufacturers to cut down prices for the energy-efficient products.

- The current tax slab for the ACs in the GST is the highest, which is 28%, and still, ACs are considered luxury items in this increasingly warm planet. One way to increase the market share of energy-efficient ACs is to give a relaxation for the 5-star rated ACs in the taxation system by moving the energy-efficient 5-star ACs from the highest to the moderate tax bracket.

Feasibility analysis

The financial and fiscal incentives policy action requires only a regulatory order and therefore the cost for carrying out this action is low. There is an existing larger taxation framework in place and the implantation for a change in GST slab is easy administratively. Provided the intervention would be implemented by the government existing tax system, implementation efficiency of the program would be high.

The net beneficiaries for this policy action are the consumers as they can afford energy-efficient 5-star ACs due to subsidy or tax benefit from the government. Financial incentive programmes such as tax cuts from the government also motivate manufacturers to produce energy-efficient equipment and thus manufacturers can also be a beneficiary due to larger market for energy-efficient products.

The air conditioners are being considered as luxury item and out of reach for the poor. Also, there are pocket-friendly technologies available in the market for the thermal comfort such as fans and evaporative coolers. This policy action becomes very difficult politically to be implemented. Even though there seems to be a revenue loss for the government in a short-term period, this could be considered as an investment opportunity to promote energy efficiency and thereby, contribute in the fight against the negative impacts of climate change. The extent of uncertainty for financial and fiscal incentives is low because it directly impacts the issue of affordability of energy-efficient products.

Option 4: Mandatory public procurement for 5-star ACs

According to the World Bank, the Government of India spends 20% of its GDP on public procurement[22]. Considering the size of the Indian economy, the public procurement's share in the GDP is an enormous figure and has a huge potential to affect the course of any action in the country on a large-scale. The government can make the public procurement mandatory for ACs to opt for only low GWP refrigerant-based 5-star rated ACs. Such a policy action is easy to implement as it requires a regulatory notification and this policy push also resonates with fulfilling India's NDC to the Paris Agreement and is in line with ICAP's recommendations.

Approach and key features

Some approaches for the mandatory public procurement option to increase the uptake of 5-star rated ACs in order to boost the average EER of the country are discussed below:

- Public procurement policy can make it mandatory for the public institutions and bodies to procure only low-GWP refrigerant based 5-star rated ACs. There should be specific mentions of low-GWP refrigerant and energy efficiency along with other technical details of the product in the tenders for the bid. This action can surely increase the market share for 5-star ACs considering the huge expenditures in the public procurement, and it also reflects the intentions and will of the government towards energy efficiency.
- The older inefficient equipment in public institutions should be replaced with the new energy-efficient 5-star products. For such an action too, there should be a mandatory requirement for energy efficiency in the bids for the procurement.

Feasibility analysis

The cost for carrying out this policy action of mandatory public procurement of 5-star rated ACs is lower because the administrative involvement is minimal and can be implemented through a regulatory notification. This option can be achieved by direct governmental control and therefore, its efficiency is also higher.

The beneficiary of this option is the government as it saves on the reduction in peak load demand, thus ensuring access to electricity for more people and it helps in the fulfilment of India's commitment to mitigate climate

[22] https://blogs.worldbank.org/governance/public-procurement-rich-country-s-policy

change. The governmental institutions and bodies at all levels can face some initial difficulties due to increased costs for procurement of highly efficient 5-star ACs but in the longer run, they can benefit from lower operational costs.

The political acceptability for mandatory public procurement action is moderate as on the one hand, the government benefits on reducing the peak load demand due to the presence of energy-efficient ACs, but on the other hand, it also puts an initial burden on public institutions in terms of capital. The extent of uncertainty in carrying out this action is low as the power to make the decision lies in direct control of the government.

7. The Way Forward

To boost the reduction in energy demand for cooling and promote energy efficiency benefits among consumers, this policy analysis gives a detailed outline of various options to increase the market share for the energy-efficient 5-star rated room ACs.

The analysis reveals that the energy demand for HVAC has been increasing continuously over the years. This daunting increase anticipated in the cooling equipment as per the ICAP due to more penetration of ACs in the country would lead to a subsequent rise in peak demand. The government of India, through BEE, has been providing a policy push at the supply end by promoting design and technology developments, alignment with international trends, along with a pull at the demand side by creating a demand for energy-efficient products through awareness and knowledge dissemination with the help of its flagship Standards and Labelling programme.

The Standards and Labelling programme was launched in the voluntary phase for the RAC segment and was eventually made mandatory to push energy efficiency. The MEPS for room ACs has been updated at regular intervals to keep up with technological advancements and its impact shows a gradual increase in the average ISEER of the ACs. The energy performance labels are promoted as a brand that not only ensures trust but also disseminates information among the consumers about the performance levels of the product and helps them in making an informed decision about their purchase.

The options to increase the market share and ensure a higher uptake of highly efficient 5-star rated ACs, as discussed in the earlier sections, should provide synergistic actions with respect to the implementation in order to have a higher impact than any other action taken in isolation. The combination of options should be selected in such a way that it can enhance the benefits for all stakeholders. Table 7.1 shows a comparison among various options.

Table 7.1: Comparison of options for intervention based on various parameters

Factors	Bulk procurement	Consumer awareness campaigns	Financial & fiscal incentives	Mandatory public procurement for 5-star ACs
Cost	Very high	Moderate	Low	Low
Net benefit	Consumer & Government	Consumer & Government & Manufactures	Consumer & Manufacturers	Government & Manufactures
Efficiency	High	Moderate	High	High
Political acceptability	High	High	Low	Moderate
Extent of uncertainty	Moderate	High	Low	Low

The table highlights the key imperatives among various options by taking into account the different perspectives for above mentioned intervention options analysis. The bulk procurement model showcases the optimistic approach to achieve the goal of increasing the uptake of highly efficient low GWP refrigerant ACs with high efficiency and political acceptability. It also provides the net benefit to consumers and the government. The bulk procurement model is cost intensive and the extent of uncertainty in achieving the goal is moderate due to monetary and direct policy action. The consumer awareness campaigns present an indirect and monetary policy action, and therefore, the efficiency and political acceptability are moderate with consumers as the net beneficiaries. The cost in carrying out such campaigns is moderate but the extent of uncertainty associated with this option is high because of unpredictability of achieving the goal. The policy action for financial and fiscal incentives is similar to the bulk procurement model but the political acceptability is low due to a possible loss of revenue for the government in short term and the fact that ACs are still considered luxury item and out of reach for the poor. The extent of uncertainty for financial and fiscal incentives is low because of the affordability issues associated with the energy efficient products, and the consumers and manufacturers are the net beneficiaries of this action. The mandatory public procurement for 5-star ACs directly and efficiently eliminates the inefficient ACs from the public institutions and bodies, and it has a low extent of uncertainty associated in achieving the goal of increasing the share of 5-star efficient ACs. This policy action is non-monetary as the cost incurred is low, and it has a high political acceptability as the government is the net beneficiary.

Based on government's role in any public policy action, it could be classified based on two parameters. Figure 7.1 elucidate the nature of implementation and government role for the policy options discussed in this policy brief based on following factors.

1. Monetary or Non-monetary
2. Direct or Indirect

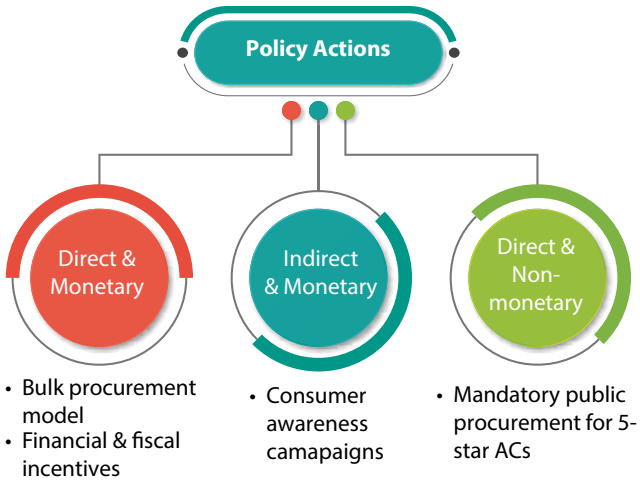

Figure 7.1 Classification of policy actions

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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 Poicy Brief has been brought out by the Earth Sciences and Climate Change Division as a part of TERI's work on refrigerant transition and cooling sector.

For more information, please visit: **http://www.teriin.org/**

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