

## Concept Note on Sustainable Cooling and Devices

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It was in 2015 when the world leaders signed the landmark Paris Agreement so as to limit the rise in global temperature up to 2 degrees by the end of this century. Thereafter each signatory endeavoured to limit its domestic emissions through a series of actions. The thrust of their efforts had been in limiting the release of carbon dioxide and evaluating alternative sources of energy. However, the recent developments indicate the need of equivalent attention towards those emissions which are released from cooling equipment such as air conditioners and refrigerators. It is to be now seen that whether the cooling emissions are indeed a threat to the global climate change or is it just a hoax call?

*Keywords:* Cooling Emissions, Paris Agreement, UNEP, International Energy Agency

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### INTRODUCTION

The attention towards emissions from cooling equipment (cooling emissions) actively began after the signing of the historic Montreal Protocol which is related to limit the substances depleting the Ozone Layer (Connolly et al., 2013). It advocated the need to phase out the use of Chlorofluorocarbons (CFCs) which are a severe threat to the ozone layer (Durkin, 2019). It was based on the research that these long-life compounds react with the atmospheric gases and break the ozone molecules thereby weakening the ozone layer (Abel et al., 2018). Since stratospheric ozone is of paramount importance, it was decided to replace CFCs

with Hydrochlorofluorocarbons (HCFCs) and thereafter with Hydrofluorocarbons (HFCs). The cooling industry which is the major emitter of these compounds was therefore required to shift from CFCs to HFCs (Hayes, 2019). However, it was observed that although HFC compounds are not damaging the ozone layer, but they have massive greenhouse gas potential and negatively impact the environment much more than carbon dioxide (Chaney et al., 2007). Considering these factors, the Kigali Amendment to the Montreal Protocol was finalized which aimed to control the emissions of HFCs. The amendment was made legally binding upon the parties so as to strongly

emphasise the need to control and limit HFCs (Games, 2019). In order to control HFCs, it is imperative to identify their major sources which are the cooling equipment and the cooling industry.

### **RESEARCH OBJECTIVES**

The present study has the objective of identifying how much potential does the cooling industry has in affecting the environment negatively. Secondly, what steps are required to be taken up to deal with the cooling emissions so as to lead up to a regime of sustainable cooling.

### **RESEARCH ANALYSIS**

The world is warming and the world is warming at a rapid rate (IEA WEO, 2018). Global warming i.e. the increase in global temperature is real and is affecting the humanity severely (Hawkins, 2019). As the world gets hotter, there is a heightened demand of cooling systems such as air conditioners, refrigerators, cold chains, storage warehouses etc. In fact, the total energy demand for air conditioning has more than tripled, from 1990 to 2016, rising from 600 Terawatt Hours to 2,000 Terawatt Hours (IEA, 2018). The energy consumed by cooling devices equals to around 17% of the total electricity consumed in the world (Dreyfus et al., 2020). Amongst the cooling devices, air conditioners account for the largest share in

electricity consumption (Molina et al, 2019). The demand for air conditioners is needed for the purposes of space cooling i.e. lowering the temperature within enclosed environment. The skewedly rising demand for a particular luxury good indicates the case of rising inequalities, income disparities and cases of urbanization (O'Neill et al., 2005). The unsustainable use of air conditioning is aggravating the phenomenon known as the Urban Heat Island Effect, wherein the cities are becoming hotter vis a vis the surrounding areas (Taylor, 2008). This happens due to reduced albedo levels and increased levels of greenhouse gases etc. The concept of sustainable cooling is of particular relevance here. This concept states that the demand for cooling must not be met from environmentally unsustainable sources. The discussion on Kigali Amendment is of paramount importance here. The said agreement seeks to limit the rise of global temperature from HFCs emissions. It was projected that the world was on the path of becoming warmer by about  $0.3^0 - 0.4^0$  C by the end of the century from HFC emissions (Montzka et al., 2015). Kigali Amendment seeks to draw the attention of the world towards HFC emissions and therefore restrict the temperature rise due to HFC emissions, thereby saving a rise of about  $0.4^0$  C. (Teng'o, 2017) supporting the negotiations at Paris Agreement (Smith et al., 2015). Possible solutions to

control the solution include reduce the demand for refrigeration, manufacturing efficient cooling equipment, reducing HFC leakages, training workers about modern developments, replacing older equipment, promoting star rating scheme etc. The space cooling purposes can be made efficient by using the best technology available and installing state of the art equipment (Pal & Eltahir, 2016). Adoption of community cooling and district cooling equipment can be suggested wherein instead of every household having a separate air conditioner, an entire district can have one mega air conditioner with its ducts reaching different households (Gang et al., 2016). Such a methodology can monitor the type of refrigerants used, timely maintenances, use of locally produced renewable energy (such as waste heat), ensuring proper waste disposal, carbon capture, utilization and storage, controlling the outflux of HFCs and drawing power from ultra-mega cooling plants etc. This can improve the overall efficiency as state-of-the-art technology can be utilized for the overall purposes (Deason et al., 2016).

Secondly, the overall household cooling demand needs to be reduced through new models of construction and modern building designs such as strategic placement of windows, appropriate positioning of walls, roofs, and apposite colour paints on the outer wall of the

residential building (UNEP & IEA, 2020). Terrace farming and Vertical farming can also be evaluated while constructing newer units. Active user awareness in the form of educating the residents about the level of their energy consumption and its harmful environmental impacts can also be looked upon. Herein the use of metering devices can be evaluated which can provide the exact numbers of energy consumption a by particular electronic device. The per unit consumption can be translated into level of HFC emission using the online calculators (Carvalho et al., 2014). Another innovative idea for the modern houses is to discard the central air conditioning system and to opt for individual air conditioning units. The centralized model draws up massive amount of energy involving high levels of energy wastages (UNEP CC, 2019). While individual units can be placed as per the ventilation scenario of the room and will consume energy only on need basis. Thereafter, the surroundings of the residential unit need to be made sustainable. This involves increasing the greenery levels, vegetation cover and to make the pavements surfaces more reflective. Another ideology of promoting sustainable cooling is the revamping of the refrigeration system in the economy (Akbari et al., 2001). The faulty appliances as well as the older models drive a poor energy input to output ratio involving high electricity

consumption for the same level of cooling output which could have been provided with a lower energy input (Abel et al., 2019). The increased energy input translates into higher amounts of HFC emissions. Refrigeration facilities of the food stores and super markets needs to be improved considerably. In fact, they possess a scope of improving their cooling efficiencies by 15% – 77% (Deason et al., 2016). Another segment of air conditioning is the mobile air conditioning systems which are the portable forms of cooling devices. They possess a potential of improving up to 63% efficiency levels (Gang et al., 2016). Modern technologies such as SL-MAC (Secondary Loop Mobile Air Conditioning) can be evaluated for better efficiency levels. While smaller innovations can indeed be beneficial in sustainable cooling however national and international linked efforts can yield marvellous results. International cooperation's involve sharing of past experiences, expertise and new innovations. There have been some recent international initiatives (Abhyankar et al., 2017), exclusively to promote sustainable cooling such as Cool Coalition, Kigali Coaling Efficiency Program (K-CEP), Biarritz Pledge for Fast Action on Efficient Cooling, World Bank Sustainable Cooling Initiative, Sustainable Cooling Innovation Program by International Finance Cooperation etc. (UNEP

CC, 2019). A country wide National Cooling Action Plan has the potential of documenting in clear terms the path of making cooling sustainable (Solomon et al., 2016). Furthermore, countries can declare minimum energy performance standards in the form of star ratings to every equipment denoting what should be the minimum efficiency levels for an electronic product to be allowed to be released in the commercial market. Energy Efficiency Building Codes may be introduced at the global level to mandate inclusion of certain innovative environmentally friendly practices in the construction field (BPIE, 2018). Further, bulk public procurement of efficient electronic products is being evaluated at present by India, Morocco and Brazil and this has yielded positive results (UNEP & IEA, 2020). Herein, a public private partnership model is followed under which the regulator may acquire modern and efficient electronic products at bulk from the private players and thereafter disburses it to the community at reduced prices so as to increase the accessibility to efficient equipment. Such a strategy has yielded positive results in the form of reduced HFC emissions and promoting energy efficiency (E3G-K-CEP, 2020). Further apposite skilling of professionals may be proposed for creating a workforce of well-educated and well-trained personnel in the field of energy efficiency. Unregulated

dumping of obsolete products must be stringently controlled. It results in piling up of E-Waste and creation of a circular chain of environmental problems (such as pollution, ozone depletion, health issues etc.) (Molina & Rowland, 1974).

## CONCLUSION

Sustainable cooling is the need of the hour. It ensures a better and healthier planet and also complements the binding obligation of limiting the overall rise of global temperature. It further promotes development of the society and the achievement of the Sustainable Development Goals. Sustainable cooling involves restricting the rise of HFC emissions through upgrading air conditioning equipment, refrigeration methodology, creating sustainable cold chains etc. Detailed solutions mentioned in this study promote sustainable cooling, however, they require mobilization of adequate levels of finance which can be arranged through international collaborations. The ability of the climate financing bodies such as Green Climate Fund and Green Environment Facility can be leveraged to utilize their resources for the purposes of sustainable cooling (GCF, 2019).

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