

From CFCs To HFCs And Kigali Amendment 41 Years In The Making;

<https://www.universityofcalifornia.edu/news/how-uc-research-led-global-deal-against-super-pollutants>

<http://www.cop22.ma/en/landmark-agreement-reached-kigali-fight-global-warming>

In 1975 Ramanathan discovered the super greenhouse effect of the halocarbons, CFC-11 and CFC-12. (Chlorofluorocarbons, belonging to the family of halocarbons). Ram's work showed that one molecule of CFC-11 or CFC-12 had the same greenhouse effect as 14000 molecules of CO₂. It was called a trace gas because it exists in minute amounts in the atmosphere. Common uses for CFCs and other halocarbons have been as solvents, pesticides, refrigerants, fire-resistant oils, ingredients of elastomers, adhesives and sealants, electrically insulating coatings, plasticizers and plastics.

In 1987 CFC-11 and CFC-12 used as refrigerants and propellants were targeted for phase-out under the Montreal protocol because of their effects on depleting the stratospheric ozone layer and causing deleterious health effects on humans. Although, from Ram's 1975 study, it was known at that time that CFCs was a more potent greenhouse gas than CO₂, this finding did not influence the Montreal negotiations in 1987, which is understandable since climate change was still in its infancy.

Dupont came up with a new class of halocarbons called hydrofluorocarbons (HFCs), belonging to the same family of halocarbons as CFCs. HFCs do not harm the ozone layer, but, as halocarbons, have a high global warming potential (GWP). HFC's warming effect on a molecular basis is as much as 1000 to 4000 times that of CO₂.

Beginning 2008, Ramanathan started looking into warming effect of HFCs since they were among the fastest growing greenhouse gases. In a study published with his student Xu in 2010, he showed that phasing out HFCs under the Montreal protocol, would mitigate 0.1°C warming by 2050. He followed this up with another study with Xu and others in 2013, in which he showed phasing out HFCs under the Montreal protocol would mitigate as much as 0.5°C warming by 2100. This 0.5°C mitigation of warming by 2100 became the rallying cry (even used by Secy John Kerry at Kigali) for phasing out HFCs under an amendment to Montreal Protocol for the negotiations that just concluded (Oct 15th, 2016) in Kigali. The Kigali amendment to Montreal protocol that calls for phasing out HFCs, was signed by over 197 nations.

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Going Beyond Carbon Dioxide

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http://www.nytimes.com/2012/12/07/opinion/going-beyond-carbon-dioxide.html?_r=0

To Fight Climate Change, Clear the Air

Veerabhadran Ramanathan And David G. Victor NOV. 27, 2010

<http://www.nytimes.com/2010/11/28/opinion/28victor.html>

