Global climate deal to phase out fast-growing pollutant. What happens next?

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More than 170 countries reached a landmark climate deal last weekend to limit the use of a chemical used in air conditioners and refrigerators that's been called the world's fastest-growing climate pollutant. Credit: www.cwcs.co.uk via Flickr

In a climate deal years in the making, more than 170 countries reached an agreement last weekend in Kigali, Rwanda, to limit the use of hydrofluorocarbons, a chemical used in air conditioners and refrigerators that's been called the world's fastest-growing climate pollutant.

The Kigali agreement comes after last year's historic, but voluntary, climate agreement in Paris to cut carbon emissions. This new agreement is legally binding and caps and gradually reduces the use of HFCs beginning in 2019 first in developed countries and then later in developing countries. It's been estimated that the reduction in HFCs could prevent nearly 1 degree Fahrenheit of global warming by the end of the century. As the New York Times notes, this would be critical toward averting an atmospheric temperature increase of 3.6 degrees Fahrenheit, "the point at which many experts think the world will be locked into a future of rising sea levels, severe droughts and flooding, widespread food and water shortages, and more powerful hurricanes."

Matthew Eckelman, assistant professor in the Department of Civil and Environmental Engineering, studies sustainability from the perspective of analyzing the lifecycle of chemicals' production and use. Here, he weighs in on the significance of the Kigali agreement and the environmental trade offs that come with replacing one technology—in this case, refrigerants—with another.

What is the significance of this deal as it relates to climate change?

It adds momentum to the international progress on climate change negotiations, and it's a really nice companion to the deal reached in Paris last year. Unlike that agreement, which was voluntary based on targets each country set for itself, the Kigali agreement is binding and very specific on the different countries' schedules for phasing out hydrofluorocarbons. We can incorporate these future greenhouse gas reductions into climate models so that we can update our scenarios of how emissions might change in the future. So I view this as a more certain mark of progress than the Paris agreement.

Matthew Eckelman, assistant professor in the Department of Civil and Environmental Engineering. Credit: Adam Glanzman/Northeastern University

How do you view this agreement in the context of your research?

My research primarily looks at the lifecycle of chemicals production and use, with a general focus on industrial activities. The overall theme is that you have to consider the whole system of a technology—how it's made, how it's used, what emissions take place in the supply chain and during its use and disposal—in order to make well-informed engineering and design decisions. The overall intention of this agreement is to reduce emissions. But what it doesn't do explicitly is look at the performance of alternatives, which affects their electricity use and therefore greenhouse gas emissions from electricity generation such as carbon dioxide. There could be a trade-off here between direct emissions of HFCs and indirect emissions of CO2; this is a typical trade off that we explore in my research group. The converse situation is also common—you might have a new technology that performs better, but it also might be more harmful to manufacture or there might be some disposal issues like toxicity. Our group looks at these kinds of trade offs and tries to find design options with the lowest emissions or environmental impacts overall.

Where do alternatives to HRCs currently stand?

There has been a good amount of field research. This is an area where there has been a lot of testing beforehand, because it's an obvious point that came up during the Kigali negotiations—which have been ongoing for several years. Researchers have been smart about the way they've approached this. They've looked at the performance of alternatives in some hot climates—places where there is both greater projected population growth than the rest of the world and also places where you need A/C units to live comfortably. And there have been some encouraging results that show that some of the alternatives perform better than what we currently have now in terms of energy use. It's really a win-win: We reduce electricity use and associated upstream emissions for A/C units and refrigerators, and we reduce direct emissions due to the refrigerants themselves. When you reduce greenhouse gases on both sides, it's a good story.

Many of the alternatives have been under development for a long time. Honeywell has been very active as have some of the other large chemical companies in the U.S. and elsewhere. Some of these chemical companies see this as a way to make money, and that's one reason why they've been supportive of the deal. It helps the negotiations, of course, to have industry calling for a switch-out.

How have these kinds of refrigerants evolved over the years?

It's interesting to look at the history of refrigerants. It's been one of unintended consequences. Ammonia was a popular refrigerant in the early part of 20th century. It's both a toxic and corrosive chemical, and researchers started looking for alternatives. They settled on chlorofluorocarbons, or CFCs and hydro-chlorofluorocarbons, or HCFCs. These were used for decades until people figured out they were depleting the ozone layer. Then they were phased out in favor of HFCs. And now we're realizing that HFCs are potent greenhouse gases, so we're trying to phase them out. Now we're at the next transition, and it's important to choose the next generation of refrigerants wisely so that we avoid unintended consequences as much as possible.

Provided by Northeastern University