The Tough Realities of the Paris Climate Talks

By Steven E. Koonin

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IN less than a month, delegates from more than 190 countries will convene in Paris to finalize a sweeping agreement intended to constrain human influence on the climate. But any post-meeting celebration will be tempered by two sobering scientific realities that will weaken the effectiveness of even the most ambitious emissions reduction plans that are being discussed.

The first reality is that emissions of carbon dioxide, the greenhouse gas of greatest concern, accumulate in the atmosphere and remain there for centuries as they are slowly absorbed by plants and the oceans. This means modest reductions in emissions will only delay the rise in atmospheric concentration but will not prevent it. Thus, even if global emissions could be reduced by a heroic average 20 percent from their "business as usual" course over the next 50 years, we would be delaying the projected doubling of the concentration by only 10 years, from 2065 to 2075.

Unconditional national commitments made by countries for the Paris meeting are projected to reduce total greenhouse gas emissions through 2030 by an average of only 3 percent below the business-as-usual average rise of 8 percent.

This is why drastic reductions would be needed to stabilize human influences on the climate at supposed "safe" levels. According to scenarios used by the United Nations Intergovernmental Panel on Climate Change, global annual per capita emissions would need to fall from today's five metric tons to less than one ton by 2075, a level well below what any major country emits today and comparable to the emissions from such countries as Haiti, Yemen and Malawi. For comparison, current annual per capita emissions from the United States, Europe and China are, respectively, about 17, 7 and 6 tons.

The second scientific reality, arising from peculiarities of the carbon dioxide molecule, is that the warming influence of the gas in the atmosphere changes less than proportionately as the concentration changes. As a result, small reductions will have progressively less influence on the climate as the atmospheric concentration increases. The practical implication of this slow logarithmic dependence is that eliminating a ton of emissions in the middle of the 21st century will exert only half of the cooling influence that it would have had in the middle of the 20th century.

These two scientific realities make emissions reductions a sluggish lever for constraining human influences on the climate. At the same time, societal realities conspire to make emissions reductions themselves difficult. Energy demand, which is strongly correlated with rising incomes and living standards, is expected to grow by some 50 percent by midcentury, driven by economic progress in developing countries and by population growth to about 9.7 billion people from the current 7.3 billion.

Fossil fuels, which are not running out anytime soon, supply over 80 percent of the world's energy today and are usually the least expensive and most convenient means of meeting growing energy demand. They continue to be widely adopted as the developing world builds its energy-supply infrastructure, because whatever the emissions benefits of technologies such as nuclear fission, carbon sequestration, wind and solar, all currently have drawbacks (including cost, land use and intermittence) that hamper their deployment at scale.

And in the developed world, the energy-supply infrastructure of electric generating plants, transmission lines, refineries and pipelines changes slowly because of the large capital costs and long facility lifetimes, and because different parts of the energy system must work together (for example, cars, their fuel and the fueling infrastructure must all be compatible).

Improvements in energy efficiency can help, but even if today's annual per capita emissions of three tons in the developing world grew by midcentury to only five tons (about 70 percent of Europe's per capita emissions today), annual global emissions would increase by 60 percent.

And, overarching all this, the tension between emissions reductions and development is complicated by uncertainties in how the climate will change under human and natural influences and how those changes will impact natural and human systems.

These scientific and societal realities compound to make stabilization of the atmospheric concentration of carbon dioxide, let alone its reduction, a distant prospect. As a result, even as the world struggles to reduce emissions, human influences on the climate will not be decreasing for many decades. Thus, adaptation measures such as raising the height of sea walls or shifting to drought-resistant crops become very important. Fortunately, adaptation is on the table in Paris to complement emissions reductions.

Adaptation can be effective. Humans today live in climates ranging from the tropics to the Arctic and have adapted through many climate changes, including the Little Ice Age about 400 years ago.

Adaptation is also indifferent to whether the climate change is natural or human-induced; it can be proportional, depending upon how much or how quickly the climate changes; and it can be politically easier to accomplish because it does not require a global consensus and has demonstrable local and immediate effects. Adaptation will no doubt be more difficult if the climate changes rapidly (as it has done naturally in the past), and, like emissions reductions, it will induce inequalities, as the rich can adapt more easily than the poor. Adapting ecosystems to a changing climate will require a more careful monitoring and deeper understanding of the natural world than we have today.

The critical role of adaptation in responding to the realities of climate change demands a deeper analysis and more prominent discussion of the nature, effectiveness, timing and costs of various adaptation strategies. But whatever the outcome in Paris, or of future discussions of emissions and the climate, the reality is that humans must continue to adapt, as they always have.

Steven E. Koonin, director of the Center for Urban Science and Progress at New York University, was under secretary for science in the Energy Department from 2009 to 2011. Previously, he was chief scientist for BP, where he worked on renewable and low-carbon technologies.