If we switch to renewables, we won't need to worry about saving energy. Right?

Wrong! One reason to save energy is to limit carbon emissions from the energy we use. That's going to important until the energy system has been completely cleaned up. But energy conservation is important for reasons that go beyond the direct effect on emissions. Before I get to the reasons, I need to explain what I mean by energy conservation and why it's different than energy efficiency.

The idea of energy conservation is simple: reduce the total amount of energy you're using. That may sound like energy efficiency, but they're quite different. Energy efficiency means using less energy to produce the same goods or services (such as driving your car or heating your house). That can mean a decrease in your total energy use, but not necessarily. If cooling your house gets cheaper because you're more energy efficiency, you might decide you can afford to keep your house even cooler. In the end, you might use more electricity, not less.

First, a clean energy system is going to need a lot of solar panels, wind turbines, and batteries. Those, in turn will require a big expansion in the amount of minerals we need. According to a recent report of the International Energy Agency, we could see a near tripling in copper demand for solar panels, as well as big increases in demand for cadmium, tellurium, gallium, and lead, in different amounts and combinations depending on which technologies win out. Windmills require rare earths, plus more copper for cables connecting offshore wind. Batteries will probably cause a huge surge in demand for lithium and nickel. How all of this works out depends on which technologies end up in the lead, but every technology out there will require a lot of new mineral use.

Conserving energy will reduce demand for these minerals. That will help keep the price of power down, which is important for equity reason and also in order to speed the energy transition. Mining inevitably comes with environmental harms, as does process ore, and we'd like to keep those risks down as well. Finally, to the extent needed materials are in short demand, the complicates the logistics of getting things built and deployed quickly.

The other reason to keep energy use low is to reduce the amount of land needed to site renewables. The energy transition is going to require a huge increase in the number of solar farms and wind turbines. An article last year in the science journal *Nature* estimated that "with solar energy accounting for 25 to 80% of the electricity mix, land occupation [ranges] from 0.5 to 2.8% of total territory in the EU, 0.3 to 1.4% in India, and 1.2 to 5.2% in Japan and South-Korea." Much of this land is already in use for agriculture, so using up that land is likely to push production into less productive land. The indirect result can be to increase

emissions — for example, less land for soybean fields in Iowa can raise world prices, incentivizing deforestation in Brazil. Bottom line: if we use less energy, we use less land.

There are a lot of ways to reduce energy use. In terms of transportation, reducing vehicle weight will reduce the power draw for electric vehicles. So will congestion charges that discourage driving or encourage carpooling. Getting people to walk, bike, or use public transportation will also cut energy use, as would encouraging telecommuting. There are a variety of other techniques for cutting building and industrial use of energy.

My point is simple: Energy conservation isn't just a tool for cutting carbon. It's going to remain important even once we're well into the transition to a net-zero economy. Thus, it's going to be important in both the short run and the long term, but for different reasons.