

In the comments to [Ann's earlier post](#), the question was raised as to why global temperatures haven't declined in response to the decline in carbon dioxide emissions from Europe in the past year. I made a quick response to this question in the comments, but I wanted to elaborate on that response here. What follows is a brief summary of a recent article I wrote on the issue, which you can find [here](#).

The basic problem is a common one in environmental law – there can be a substantial time lag between a human activity and the environmental harm from that human activity. In the context of climate change, this means that carbon dioxide emissions today don't necessarily result in increased temperature on a global scale tomorrow – their full impact in fact won't be felt for decades from now. The primary reason for this is the high heat capacity of water – as anyone who has tried to watch a pot of water boil knows, it takes a long time to heat up water (or reciprocally, cool it down). (This is also why oceans and lakes tend to moderate temperature swings in the areas around them.) In the context of climate change, this means that even as CO<sub>2</sub> increases the atmospheric temperature, there will be a time delay (measured in decades) between when the rises in atmospheric temperatures connect to changes in the temperatures of the oceans. And because oceans are an important driver of the global climate system, this means that the full effects of CO<sub>2</sub> emissions on the global climate won't be manifested for decades as well. (We'll also see extended delays in terms of when the full effects of CO<sub>2</sub> emissions today will be felt in terms of sea level rise and ice sheet changes for similar reasons.)

This delay in harm from CO<sub>2</sub> emissions has an important implication for any regulatory system for carbon emissions (whether it is a carbon tax, a cap-and-trade system, or a command-and-control system). Even if we terminated all CO<sub>2</sub> emissions tomorrow (perhaps with a global “hold your breath week”), there would still be increases in global temperatures over a time frame of decades as a result of what scientists call “warming commitment” or “climate change commitment” – the changes in global climate that are already going to occur because of CO<sub>2</sub> emissions in the past.

The [comment to Ann's post](#) encapsulates perfectly the political problem that this is likely to create for any future carbon regulatory system. Whatever system we install to restrict carbon emissions, it will have no impact on the changes in global climate that are already destined to occur because of the emissions that have already happened. Those who are skeptical of anthropogenic climate change (such as the commenter) will undoubtedly seize on the continued change in global climate despite carbon regulation as “proof” that there is no connection between carbon emissions and global climate change. (They will be wrong, for the reasons given above.) Even those who are not skeptics might wonder if our regulatory efforts are really worth the trouble, if we're still moving into unprecedented (in

terms of human experience) changes in the environment regardless of our regulatory efforts, maybe we should emphasize adaptation much more than mitigation. Why spend a whole lot of time and energy to “save the planet” when it is changing anyway? In any case, one might expect a significant backlash against any carbon regulatory system in response to this delayed harm phenomenon.

One possible solution to this dilemma is to try and “undo” the harm that past carbon emissions have created. We can’t just wait for the CO<sub>2</sub> in the atmosphere to disperse, even if we stop all emissions, because the residence time in the atmosphere is so long (1000+ years in the latest estimates). So we might be forced – for political reasons if nothing else – to consider various “geoengineering” schemes either to reduce the levels of CO<sub>2</sub> in the atmosphere through active efforts to extract the CO<sub>2</sub>, or to offset the impacts of CO<sub>2</sub> on the global climate system (one fashionable proposal is to use sulfur in the upper atmosphere to reduce the amount of sunlight that warms the planet, offsetting the impact of higher CO<sub>2</sub> levels). Of course, these “geoengineering” strategies carry their own risks of side-effects, unexpected consequences, and tremendous ethical problems. But given the political problems that we might be facing, we might not have much of a choice.