

Briefing to Governor Deval Patrick: January 18th, 2007

by

Raymond S. Bradley

Governor Patrick, Secretary Bowles, President Wilson, Chancellor Collins, Distinguished Guests...

We are living in unusual times. The climate of the last century was dominated by universal warming. Almost all parts of the earth had temperatures at the end of the century that were higher than when it began. Indeed, our work shows that northern hemisphere temperatures in the last few decades of the 20th century were the warmest for over 1000 years. These trends have continued and record-breaking global temperatures have been recorded year after year since 2000. 2006 was the warmest year ever recorded across the United States.

At the same time, the concentration of greenhouse gases in the atmosphere has increased to a level that is higher than at any time in *at least* the last 650,000 years. Greenhouse gas concentrations (such as carbon dioxide) are now 35-40% higher than they were in the middle of the 19th century. These changes are largely the result of fossil fuel combustion, driven by population growth and the increasing demand for energy. We are putting back into the atmosphere, carbon dioxide that was removed by plants hundreds of millions of years ago, and stored away in coal and oil deposits. And we are now reversing this process at a very rapid rate. We have no evidence that such a rapid rise in greenhouse gases has taken place since our species, *homo sapiens*, evolved and it is this rate of change, and the increase

to levels not experienced in recent geologic time that is the cause for concern. We have imposed on the earth unprecedented changes in atmospheric composition, and now we are reaping the consequences of those actions in terms of changes in the climate. And changing the concentration of greenhouse gases *does* affect global climate. We know this from the physics of the system, and we can simulate the changes with computer models. These models point to characteristic fingerprints of human-induced climate change—warming across the earth’s surface, enhanced warming in the Arctic, more extreme weather conditions, melting glaciers and ice sheets, and a rise in sea-level—all of which we see happening today.

I noted that the rise in greenhouse gases is fundamentally driven by population growth and the relentless demand for energy. Given that world population will probably double within the lifetime of those currently in kindergarten, unless something is done to curb the use of fossil fuel consumption, it seems very likely that very significant changes in climate will occur in the near future. Although we tend to focus on temperature change, there will inevitably be changes in the atmospheric circulation, which is after all driven by differences in temperature across the globe. And it is the circulation of the atmosphere that brings rainfall, snowfall, extreme events like hurricanes and tornadoes and severe electrical storms. It may be that changes in *these* factors—which are much harder to predict—will have especially significant consequences for many people across this nation and across the world. Climate is essentially the weather we expect to get. Life on earth relies on certain patterns of climate; we have adapted our agriculture

and our infrastructure—buildings, reservoirs, roads, coastal defences etc--to meet those expectations. As greenhouse gas levels continue to rise at an accelerating rate, we can no longer rely on past expectations; some areas will be subject to more frequent droughts, other regions will suffer from heavier precipitation; rainfall patterns will change in almost all parts of the world and this will be especially disruptive to those societies that rely on year-to year agricultural output.

Here in New England, we can expect higher temperatures and associated impacts on weather-sensitive sectors of the economy. The Union of Concerned Scientists recently reported on model simulations showing that the climate in Massachusetts may be more like South Carolina by the end of this century, than what we are used to. Changes in rainfall & snow amounts are much harder to predict and we have much work to do to refine our models to the point where we can give you reliable forecasts of how rain and snow amounts, and their seasonal patterns, will change across the region. Sea-level will rise, but again it is hard to be certain about the rate of change, which is very dependent on how major ice sheets in Greenland and Antarctica respond to global warming. These are research frontiers and I don't want to give you the impression that we have all the answers—we don't...but we are working on it...at the Climate System Research Center at UMass, Amherst and at other Universities in the region. Nevertheless, I can assure you that our present understanding of the climate system is quite sufficient to say that *human activity is affecting climate on a global scale*, and that without a reduction in greenhouse gas emissions climate will change

even more in the decades ahead, leading to a large-scale disruption of the global climate system. Indeed, there may be consequences that we have not yet fully grasped.

Therefore, we must act swiftly to reduce emissions of greenhouse gases from fossil fuels. Of course, this requires a global effort to be ultimately successful. But we can begin locally, regionally....and make a difference. We need a massive effort in energy conservation, to reduce the waste of energy -- in energy production and distribution, the transportation sector and in residential and commercial buildings. We have the technology, and Massachusetts can take the lead in developing and deploying these products. We should encourage the use of non-fossil fuel sources of energy wherever feasible, and we must launch a powerful education campaign to make sure all of our citizens understand what steps they can take, and the consequences of inaction.

I am delighted to see your interest in this important topic, and I welcome your leadership on this issue.