Time to Reassess the Economics of Climate Change

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The year 2005 may be regarded as the year in which scientific discoveries and new research confirmed the serious concerns in the science community about the emerging threat from global climate change. The findings reported last year in the many peer-reviewed journals all point to an unavoidable conclusion: The physical consequences of climate change are no longer theoretical; they are real, they are here, and they can be quantified (Levin and Pershing 2006). The growing evidence has prompted both scientists and policymakers to rethink the link between global warming and hurricane activity, for example, and to reconsider the impact of climate change on both ecosystems and the economy. In a similar way, perhaps it is time to reexamine the costs and benefits of reducing greenhouse gas emissions that are thought to contribute to global warming and associated climate change.

Despite the growing evidence on the science of climate change, there is an unfortunate but widespread belief within the policy community that any steps taken to reduce such greenhouse gas emissions will impose significant costs on the economy. However, this belief is primarily the result of reports generated by highly stylized economic models which capture few of the real world opportunities to reduce emissions in ways that can actually increase the productivity of our economy (Laitner, et al. 2003). Indeed, the evidence suggests that over the next several decades the United States could reduce greenhouse gas emissions by perhaps 30-40 percent at a net benefit to the economy – if consumers and businesses were willing to make such decisions (Hanson and Laitner 2003). What is this evidence?

First, the majority of greenhouse emissions are in the form of energy-related carbon dioxide gases. These gases are emitted when we use fossil fuel resources including coal for electricity generation, natural gas for heating our homes and schools, and gasoline for powering our cars and trucks. Unfortunately, much of this energy is used in highly inefficient ways. The good news, however, is that there are a large number of studies which document significant opportunities to improve overall energy efficiency. The American Council for an Energy-Efficient Economy, for example, routinely evaluates a large number of efficiency improvements that can save money while effectively reducing energy-related carbon dioxide emissions (see, for example, Martin et al. 2000, Sachs et al. 2004, and Nadel et al. 2004). Many of these technologies pay for themselves in 3-5 years. Since these technologies have lifetimes of 10-15 years or more, this would be good for the economy.

Second, the measure of economic activity, what we call Gross Domestic Product, or GDP, is nothing more than adding up how much we invest in our economy, how much we spend as households, how much we import and export from foreign countries, and how much we spend on our various governmental programs. So if we choose to invest in more productive technologies that pay for themselves within a few short years, in effect, we may be generating higher economic returns as we actually use less energy. Or, as it might be better said, we may be generating higher economic returns by using energy more efficiently (Hanson and Laitner 2004).

Unfortunately, many of my colleagues in the economics profession begin almost any analysis of climate policies with the key assumption that all investment, all labor, and all energy resources are already fully employed and efficiently allocated. By definition, this starting assumption implies an inevitable trade-off between economic growth and reduced energy use. If we are, indeed, already producing the needed goods and services in a very efficient way, then any change in the economic recipe would automatically imply an economic penalty. But is this right?

When we dig a little deeper into the assumptions, this apparently negative result seems more an artifact of modeling convenience than a reflection of the technologies now available within the marketplace. As I have already suggested, the real world evidence points to the existence of many little inefficiencies that can add up to a big opportunity for protecting the climate and enhancing economic activity. Let’s review just a few of those opportunities from the U.S. perspective.

University of California economist, Stephen DeCanio, reviewed about two dozen studies different studies about economic efficiency. He found a typical 14 percent gap in the economic efficiency of all businesses based on today’s technologies and management practices. An annotated database contains references to some 1500 studies which all show overall economic savings that range from 10 to 40 percent compared to existing use of capital and labor, and in some cases energy. University of Michigan professor Marc Ross and his colleagues have developed an economic model to evaluate the impact of energy efficiency improvements within industry. They generally found cost-effective opportunities to reduce energy use by 10 to 20 percent with a concomitant reduction in pollution levels that are normally associated with energy use. According to the U.S. Department of Energy (DOE), improved maintenance can lead to potential gains of 10 percent or more in industrial boiler efficiency. Many manufacturing facilities can recapture lost energy through the installation of more efficient steam equipment and processes. A typical industrial facility can realize steam savings of 20 percent by improving their steam system. According to the DOE, if steam system improvements were adopted industry-wide the benefits would be $4.0 billion in fuel cost reductions and equally large reductions in carbon dioxide emissions. In the U.S., compressed air systems account for $1.5 billion per year in energy costs. Many industries use compressed air systems as power sources for tools and equipment used for pressurizing, atomizing, agitating, and mixing applications. Optimization of these systems can provide energy efficiency improvements of 20 to 50 percent. At the same time, motor-driven equipment accounts for almost two-thirds of the electricity consumed in the U.S.

industrial sector. By installing energy efficient motors and applying sound motor management techniques, a company can reduce its motor systems energy costs by as much as 18 percent. Process heating is vital to nearly all manufacturing processes, supplying the heat needed to produce basic materials and commodities. This single use of energy accounts for nearly 17 percent of all industrial energy use. Advanced technologies and operating practices offer significant opportunities to reduce energy consumption in process heating by an additional 5 to 25 percent over the next decade (with all examples in the above paragraph updated from Laitner 2002).

There are also large possible savings in our fleet of cars and trucks. If we take steps to increase the overall fuel economy of our nation’s cars and trucks by just 5 miles per gallon over the next 10 years, gasoline and petroleum demand would be decreased by almost 20 percent compared to standard forecasts. Carbon dioxide emissions from petroleum usage would also be reduced by about 20 percent. Perhaps as important as the climate benefits, consumers and businesses would save between 50 and 70 billion dollars in lower fuel bills. Oil imports would be similarly reduced by an amount that is more than twice the expected production of the controversial Alaska National Wildlife Reserve (author calculations). Studies by Barrett and Hoerner (2005) and Bezdek and Wendling (2005) suggest that even greater levels of fuel economy would be cost-effective and generate net positive benefits for the economy. Moreover, these improvements in fuel economy would likely ensure a greater energy security with less volatility in world oil prices. Indeed, it is likely that more efficient use of our petroleum resources would lower the world oil price compared to standard forecasts.

Finally, what we waste in the production of electricity throughout the United States is more than Japan uses to power its entire economy. The reason? The nation’s electricity system is, at best, 33 percent efficient. This is a level of inefficiency that has been unchanged since the 1960s. This means that for every kilowatt-hour (kWh) of electricity that we deliver to homes and businesses, we waste the equivalent of about 2 kWh in the generation and transmission of that electricity. If we do the math, it turns about that we lose about one-fourth of the total US consumption in the form of waste heat from electricity generation. Technologies such a combined heat and power, with efficiencies typically exceeding 70-80 percent, can substantially reduce both emissions and wasted energy dollars (Casten and Downes 2005, Bailey and Worrell 2005, and Hanson and Laitner 2005).

All of these and many other examples underscore the very large opportunity for additional energy efficiency gains that are cost-effective. In the case of the United States (and indeed, for most regions of the world), adding up and evaluating all of the many different opportunities for efficiency improvements suggests that the economy will likely expand at about the same three percent annual rate of growth that is projected by standard economic forecasts. The good news is that these efficiency improvements can support the same level of economic activity while using no more energy over the next 15 years than now used today. Carbon dioxide emissions might be expected to stay at roughly comparable levels as well. Even better, such improvements can pay for themselves through lower energy costs. The bad news is that even maintaining greenhouse gas emissions at today's level will provide only a down payment on what will have to be an even larger and more expensive reduction in those emissions. But the added flexibility of taking steps today can become a critical first step toward a more effective deployment of even more productive energy technologies in the future. That's the opportunity. The challenge is to encourage an immediate and more productive investment pattern in the first place.

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