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on Energy Independence and Global Warming
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Thank you, Chairman Markey, Congressman Sensenbrenner and Members of the Committee. On behalf of the Massachusetts Institute of Technology, I am grateful for this chance to highlight the overwhelming importance of funding basic energy research.

As you know, since before World War II, MIT has served the nation as an honest broker on complex technical issues, and as a source of breakthrough research. In the past few years, as part of a major MIT initiative on energy, we have delivered landmark reports on coal, nuclear and geothermal energy, which have helped inform recent Congressional action. Our faculty is now preparing similar reports on cap-and-trade policy, solar energy, nuclear infrastructure and waste disposal, and overall energy technology policy, as well as pioneering the technologies that will help make these options real.

Today, however, I am here to talk about the research funding required to achieve an energy revolution.

We all know the United States is tangled in a triple knot of difficult problems. First, a shaky economy, battered by volatile energy prices, a loss of good jobs and threats to our global technology leadership. Second, a geopolitical situation weighed down by issues of energy consumption and security. And third, mounting evidence that global climate change is upon us.

Each knot is daunting on its own, and the three are profoundly tied together. Fortunately, we have the power to loosen all those knots at once, with a dramatic new level of federal investment in energy R&D. If one advance could transform America's prospects, it would be having a range of clean, renewable, low-carbon energy technologies, ready to power our cars, our buildings and our industries, at scale, while creating jobs and protecting the planet.

If we want to own those future technologies, there is only one path: research.

Yet in the last several decades, federal funding for energy research has dwindled to the point of irrelevance. In 1980, 10 percent of federal research dollars went to energy. Today, when we really need energy answers, it is an embarrassing two percent. From 1980 to 2005, the major OECD countries also reduced energy R&D

an average of 39 percent, but our cuts were more drastic, a funding drop of 58 percent.

Nor can we count on private industry to do the job. Since 1980, research investment by US energy companies paralleled the drop in public research. By 2004, corporate energy R&D stood at just $1.2 billion in today's dollars. This level might suit a cost-efficient and technologically mature fossil-fuel-based energy sector. However, it is wildly out of step with any industry that depends on innovation. Pharmaceutical companies invest 18 percent of their revenues in R&D. Semiconductor firms invest 16 percent. Even the auto industry invests 3.3 percent. But US energy companies invest less than one quarter of one percent of revenues in R&D. With that level of investment, we cannot expect an energy revolution. Moreover, while we should welcome a recent surge in venture funding for "green" technologies, the fact is that venture money flows not to revolutionary research, but to near-market-ready ideas — the very last phase of the "D" in R&D.

The lesson here is that while industry must support development and commercialization, only government can prime the pump of research. Congress funded the basic research that spawned the information technology revolution and the biotechnology revolution. Today, to spark an energy revolution, Congress must lead again.

Why should you or the taxpayers believe this investment will work? Because the same kind of research investment has paid off so spectacularly before. Let me give just one example: Over the past 30 years, Congress gave the National Institutes of Health the money to invest $4 per American per year on cardiac research. That investment has cut deaths from strokes and heart attacks by 63 percent. Imagine the same payoff measured in electric cars, safe nuclear technology or a smart new grid.

The potential here, from the economy to global security to the climate, is boundless. Yet we are not the only ones who have noticed. If we fail to make major strategic investments in energy research now, we will swiftly forfeit the advantage to our competitors, from China and India to Germany and Japan. Other countries have the money and motivation, and they are chasing the technology almost as fast as we are. We must make sure that in the energy technology markets of the future, we have the power to invent, produce and sell, not the obligation to buy.

How much should we invest in energy R&D? Let's start with how much – or, frankly, how little – the federal government spends today. The total depends on which programs one counts, but recognized authorities put the number for 2006

at between $2.4 and 3.4 billion. For comparison, that is less than half of what our largest pharmaceutical company alone spends on R&D every year. In today's dollars, it is about two percent of the total price of the Apollo program.

A range of experts, including the business-led Council on Competitiveness, reports that federal energy research must climb to twice or even ten times the current level.

In my view, the nation needs to increase energy R&D sharply, moving promptly to triple current rates, and then increasing further as the Department of Energy builds its capacity to translate basic research to the marketplace. To establish firm funding guidelines, industry, government and universities must come together to create a detailed energy R&D roadmap. Speaking for MIT, and I know for other research universities, we would be honored to help design such a strategic plan.

Let me close with a brief vignette.

In 1940, when Germany invaded France, President Roosevelt received an urgent visit from a man named Vannevar Bush, then chair of the National Advisory Committee on Aeronautics, and formerly Vice President and Dean of Engineering at MIT. His message to the President was simple: For America to win the war, it had no choice but to make aggressive, focused investments in basic science. The case was so compelling, President Roosevelt approved it — in ten minutes. From radar to the Manhattan Project, the investments and innovations that that decision unleashed were the military tools that won the war.

What's more, that same presidential decision launched the enduring partnership between the federal government and the nation's research universities, a partnership that has vastly enhanced America's military capabilities and national security, launched many of our most important industries, produced countless medical advances and spawned virtually all of the technologies that define our modern quality of life.

Vannevar Bush's essential insight was his appreciation for the value of basic research in powering innovation. I believe that we stand on the verge of a global energy technology revolution. The question is: will America lead it and reap the rewards? Or will we surrender that advantage to other countries with clearer vision?

Today, as we face the deeply linked challenges of economic insecurity, energy insecurity and global climate change, we should see in this historic story a

profoundly hopeful, practical path to America's future — through rapid, sustained, broad-based and intensive investment in basic energy research.