

**PATHWAYS TO A “GREEN” GLOBAL
ECONOMIC RECOVERY**

HEARING

BEFORE THE

COMMITTEE ON FOREIGN RELATIONS

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PATHWAYS TO A “GREEN” GLOBAL ECONOMIC RECOVERY

TUESDAY, MAY 19, 2009

U.S. SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, DC.

The committee met, pursuant to notice, at 2:25 p.m., in room SD-419, Dirksen Senate Office Building, Hon. John F. Kerry (chairman of the committee) presiding.

Present: Senators Kerry and Lugar.

OPENING STATEMENT OF HON. JOHN F. KERRY, U.S. SENATOR FROM MASSACHUSETTS

The CHAIRMAN. This hearing will come to order. I apologize for the lateness of our starting, but it is genuinely for circumstances beyond both Senator Lugar’s and my control. The Senate chose to vote at 2:15, and the caucuses were both going on; both parties had their Tuesday caucus, and the result is that folks have been delayed there and we have come over from the vote. But, we’re really happy to welcome both of you here today.

It’s very special for us to have two of the world’s leading advocates for decisive action against climate change, Sir Nicholas Stern and Jim Rogers.

Lord Stern’s 2006 report, which is now known throughout the climate policy world simply as the Stern Report, remains the seminal document on the global economics of climate change. And Jim Rogers, the CEO of Duke Energy, has confounded many of the naysayers in the industry by continually remaining a very powerful and important, courageous advocate for aggressive action. I think “commonsense advocate” ought to be added to that too, because he believes it’s good for our economy and good for business. I might comment that he recently cut Duke Energy’s ties with the National Association of Manufacturers, citing, in part, his fundamental differences on climate change policy.

This hearing comes at a very timely moment in our national climate change debate. The House Energy and Commerce Committee is, right now, considering a comprehensive climate change energy bill that would reduce emissions by 83 percent by 2050, and it is a bill with a real chance of becoming law. We are focused, here in the Senate, as never before, on this issue, working continually, with weekly meetings, in an effort to advance this. And just earlier this afternoon, the President announced a plan to accelerate our fuel efficiency standards and goal in the country to 35.5 miles per gallon by 2016. I might comment parenthetically, China has actu-

ally set a more aggressive goal, and they have set the year of implementation for next year. So, it is not something where the United States is moving in a lonely way. The President also announced a tailpipe emissions plan that would, for the first time in the American economy, set a nationwide carbon dioxide emission standard.

Let me just say, personally, that this is a milestone in the fight against climate change. In 2002, Senator McCain and I introduced the first major fuel economy legislation, and I'm extremely pleased that the Nation is now adopting these aggressive measures, which will help ensure that the American automobile industry is viable for decades to come.

As our two witnesses will share, taking action to address climate change is not just an urgent scientific imperative, it is also a tremendous economic opportunity. Just this morning, we had several witnesses—Chad Holliday, of DuPont Company, and Mark Stiles and Liz Warner, of a startup company that is involved in algae production in New Mexico that is producing algae, which can create fuel for jet fuel, for diesel, and become a biocreated fuel that is economically viable in the commercial marketplace.

So, this is a chance to create millions of new jobs here at home. It's a chance to help spark a global recovery that brings clean growth to the developing world and lasting benefits to all of us.

We really have no choice but to undertake these policies at a difficult economic moment. Some people try to argue, "Well, we're in tough economic times. How do we afford this? We can't afford to do it." But, as we will hear from Sir Nicholas Stern and Jim Rogers, we really can't afford to delay. That's where the greater cost lies.

Both our Nation and other countries are, right now, making historic investments that are going to shape priorities and constrain spending for years to come. The reality is, though, there will never be a better moment than this one to transition the world's economies on to clean development pathways. As we act to address the financial crisis of this day, our challenge is also to use this opportunity to avert the financial crisis of tomorrow.

We're taking important steps. In addition to the President's announcement today, America's domestic recovery package invested, as we—a lot of Americans aren't aware of this, but in the package that we passed, the so-called American Recovery and Reinvestment Act of 2009, there's \$80 billion of direct green stimulus measures; that is second only to China's remarkable \$200 billion.

And anybody who wonders whether China is going to be part of this ought to just go back and read the New York Times of a couple of months ago, where a front-page story carried the news of how China is determined to quickly become the world's leading electric car manufacturer. Let me tell you, when the command-control economy such as theirs, as we've seen with China, decides to move in that direction, they will move in that direction. And many people who wonder what China is doing today are going to wake up in a couple of years and find that the United States is actually chasing China, trying to catch up to some of the things they're doing.

The fact is that, just last week, the Department of Energy announced a \$25 million stimulus fund to support a state-of-the-art

wind-turbine blade testing facility in Charlestown, MA. There is a competitive process for determining its location, but obviously I'm pleased it is there. It'll begin in construction this fall; it'll bring 250 new jobs to the greater Boston area. And local officials expect the facility to become a clean-energy hub that actually attracts new businesses and new jobs.

While the economic recovery package represents America's largest investment ever in clean energy, this is, frankly, just the first step. Congress needs to pass strong, comprehensive climate change and energy policy. And as Jim Rogers knows better than anybody, climate change is not just something you talk about in the abstract, all by itself. The only response to climate change is energy policy. Energy policy, whether it's new and alternative creative fuels or alternative renewable energy, or whether it's energy efficiency, those are the ways in which you affect emissions.

So, emissions are almost secondary, in a funny way, to the economic transformation that is staring us in the face through the clean energy jobs that we can win. Economists warn—and we'll hear this from Sir Nicholas Stern today—that to ward off catastrophic climate change—and I say this again and again to people who say, “Well, what about the cost? How much is this going to cost?” Folks, the costs are negligible. The McKinsey Company study shows that, in the first 20 years or so—20 to 30 years—it pays for itself through the energy efficiencies to actually make this transformation. So, it is not costs up front in that regard, although there's some capital outlay. But, the savings come back to pay for themselves.

But, the costs of not doing anything are going to be far greater. And the fact is that the Green Revolution needs to happen three times faster than the Industrial Revolution did in order for us to be able to meet this challenge.

The good news is that America has innovated on a massive scale before; and with the right incentives, we can do it again. America was the engine of the IT revolution. That revolutionized the way the world does business today. Today, the IT economy is estimated at \$1 trillion, without about 1.5 billion users worldwide. Obviously, we're trying to grow those users. But, energy is a \$6 trillion market, with 4 billion users worldwide. The opportunities for innovation and growth dwarf any other sector that we can imagine. Until now, we have ceded the initiative to other countries. We invented the solar photo voltaic cell at Bell Labs in 1954, but it was Germany that put in place strong policy mechanisms to drive investment in solar power and other renewable energy sources. As a result, renewable energy uses have tripled, to 16 percent, in Germany, creating 1.7 million jobs. By 2020, Germany's clean energy sector will be the biggest contributor to the nation's economy.

Last week, Tony Blair testified before this committee that the U.K. already employs far more people in green technologies than in traditional sectors, like coal, steel, and shipbuilding, industries which the British pioneered. These new jobs are the direct product of sustained policy incentives designed to spark private investment.

We know that with each dollar the government invests, we can create 3.5 times as many green jobs as old industry jobs, or as oil industry jobs. We also know that green jobs pay 17 percent more

than the median national income. As unemployment levels continue to rise, this is very simply one more reason why can't afford to wait until the economic downturn passes in order to try to implement strong energy policies. Strong energy policies are part of the economic recovery.

And, while the domestic imperative for acting to address climate change is huge, make no mistake, this is also a test of America's willingness to lead in meeting global challenges. Our domestic policy—I have heard this with Foreign Minister after Foreign Minister, Environment Minister after Environment Minister, country after country, preparing to go to Copenhagen—our domestic policy will motivate others to advance their own clean energy priorities, and that will, in turn, drive investment globally and open new and vibrant markets for the export of U.S. energy technologies. The question is not whether the 21st century economy will be the green economy; it has to become one. And I believe it will. The question is whether America will lead, and whether the world can change course fast enough to prevent a climate disaster.

Our two witnesses today have powerful insights into these economic opportunities and the challenge that is presented. I look forward to hearing their testimony.

Senator Lugar.

**OPENING STATEMENT OF HON. RICHARD G. LUGAR,
U.S. SENATOR FROM INDIANA**

Senator LUGAR. Well, I'm pleased to join you, Mr. Chairman, in welcoming our distinguished witnesses. They truly offer two unique perspectives on the economic consequences of climate change.

As an economist, Lord Nicholas Stern issued a far-reaching report, which you've mentioned, in 2006, including that the cost of addressing climate change will increase, the longer we delay taking action. As a businessman, Jim Rogers of Duke Energy knows firsthand the direct costs of dealing with climate change.

Steps to address climate change in the United States, as elsewhere, will occur in a political context that will be deeply affected by the current recession, by varying perceptions of risk, regional differences, and other factors. This would seem to be stating the obvious, but policymakers must continually remind ourselves that, even if some type of international agreement on climate change is possible, it won't mean much if the American public and publics around the world reject it as unfair or too burdensome.

American participation in any global agreement on climate change is likely to bring profound changes to the American economy and the culture that require achievements of much greater consensus than at least I perceive we now have.

By "consensus," I'm not speaking just of agreement, on the reality of climate change, or even the necessity of taking action. I believe we need much broader agreement on how we structure our response and what sacrifices will have to be made by the American people. Absent a reasonable consensus on these points, implementation of a climate change policy is far more likely to be ineffective, economically damaging, and divisive.

When I discuss, with Hoosiers in Indiana, the threats that the United States faces from our over-reliance on foreign oil, they

understand both the economic and national security risks of our situation. When Hoosiers open a new biofuels or geothermal plant, or unveil a new windmill, they are proud; but, their interests in these technologies is not always academic. They want to know how many jobs will be created, how many dollars will be returned by the investment in the long run, how the project fits into broader efforts to achieve energy independence for our country. Most Hoosiers are pleased that the project also reduces carbon emissions, but that is rarely their central motivation for embracing new technologies and conservation measures.

Now, I'm hopeful that the U.S. climate change response can be centered on steps that simultaneously reduce our reliance on foreign oil, promote soil and water conservation, contribute to rural development, leverage new energy technologies, and create jobs. Public support will be strongest for emissions-cutting measures that are seen as contributing to additional U.S. economic or national security priorities.

As I mentioned during the last hearing on climate change, the American political debate on this issue has not progressed on the same timetable as international negotiations. I've called on the Obama administration, both in private and in public, to vastly improve and broaden its education campaign on climate change. An essential step in this process must be to provide a much clearer picture of the overall elements of the problem and the administration's strategy in structuring a potential agreement. I understand that climate talks are fluid, but the American political debate must be sufficiently informed to reach some conclusions about what steps are economically and politically plausible.

If negotiations proceed without these public reference points, congressional approval of any climate change agreement will be exceedingly difficult, and we will fall far short of the type of consensus that is needed to sustain an effective program.

I look forward to the insights of our witnesses. As always, I appreciate your calling the hearing, Mr. Chairman.

The CHAIRMAN. Well, thank you, Senator Lugar. And let me just say, with respect to those comments, I appreciate them very much. You and I were at a conference in Spain together, on the subject of the Aspen Institute, and you've reflected some of your concerns here again today, which is the purpose of this hearing, obviously, and of further discussion. And I hope Mr. Rogers, who represents one of our largest energy-producing companies in the country, and, I think, has a strong voice in manufacturing, can help engage some of those people who are wondering about what the impact of this will be. So, we look forward to continuing that dialogue, and I intend to pass those words on to the administration, to make certain that they hear what you said today.

Sir Nicholas, would you begin?

Mr. Rogers, if you don't mind, I would like to sort of afford our guest the opportunity of sharing, sort of, the economic framework first, then I think that'll allow you to come in underneath it with a very much more specific piece. Thank you.

**STATEMENT OF LORD NICHOLAS STERN, CHAIR OF THE
GRANTHAM RESEARCH INSTITUTE ON CLIMATE CHANGE
AND THE ENVIRONMENT, LONDON SCHOOL OF ECONOMICS
AND POLITICAL SCIENCE, LONDON, UNITED KINGDOM**

Lord STERN. Thank you very much, Chairman Kerry, and thank you very much, Ranking Member Lugar, for inviting me to be with you here today. It's a great privilege to be back, testifying to the Senate. And it's also a pleasure to be on a panel again with such a distinguished industrialist as Jim Rogers.

I'm Nicholas Stern, professor at the London School of Economics. I'm a Member of the Upper House in the U.K. Parliament, a lot less influential than your distinguished body, Senators.

Let me start with why we're doing all this. What are the benefits of action? Well, the benefits of action are the other side of the costs of inaction. Given where we are, at around 435 parts per million of CO₂ equivalent concentrations in the atmosphere, and we're adding around 2½ parts per million a year, and that 2½ parts per million is rising, 100 years of that would put us at well over 750 parts per million, and that would give us at least a 50–50 chance as a world, sometime at the end of this century, beginning of next, being 5 degrees Centigrade above preindustrial times. That is truly enormous. The planet hasn't seen that for 30 million years. It hasn't even seen 3 degrees for 3 million years. And we humans have been around for about 100,000, maybe 200,000 if you relax your definition of sapiens in Homo sapiens. We simply don't know how we could cope with that, but what seems certain is that the changing pattern of coastlines, of where the deserts are, the absence of snow, essentially, in such a world, and ice, hundreds of millions of people would have to move, and we would see extended conflict over many decades.

That is the scale of the risks that we run. This isn't overdramatizing, it's just simply taking the simple science of where we're likely to get to if we don't act. If we're to bring those probabilities down to anything like acceptable levels, we as a world are going to have to peak in the next 5 or 10 years, which means the rich countries have to peak almost immediately, and the poorer countries have to peak by around 2020. Increasingly, you're seeing Mexico, Brazil, China come in with plans which look as if they could achieve peaking in 2020. We all hope they'll do more.

What would it cost us to do this as a world? Well, I've said 1 or 2 percent of GDP to cut emissions by—as a world, by 50 percent by 2050, which would be what would be necessary to hold emissions concentration—to hold concentrations in the atmosphere below 500 parts per million of CO₂ equivalent, and then start the process of bringing it on down from there.

Many estimates—Mr. Chairman, you quoted that from McKinsey's, which is a very good one—are much, much lower than those numbers. Those numbers leave a lot of scope for good policy to bring those costs down, and they don't assume much learning. We can do much, much better than that, in my view.

But, there's actually a rather deeper point, which is that this simple calculation of costs in the way that most economists do it—you know, What slice of GDP do you have to make out to make these changes?—usually the number is small, as I argued, but I

think that's the wrong way to look at it. We have to look at it in a much more dynamic way. If you just look at this next year or two, we can, through a green recovery, have a very powerful force for coming out of recession. Roughly speaking, for \$10 billion, you create 100,000 jobs in weatherproofing. That's—and the tremendous returns to that, in terms of energy saving. You probably save \$2 or \$3 billion a year simply on energy from that whilst creating those jobs. The Peterson Institute's come up with those numbers; they're quite similar to what we've done in the Grantham Institute at London School of Economics. So, great returns in the short run.

We would embark, second, on two or three decades of very powerful growth driven by investment in low carbon technology. We'd have a true Schumpeterian story of innovation and investment driving growth would be similar—indeed, probably bigger than the railways, electricity, the motor car, or IT. There's a very dynamic story of growth there.

Third, if you run that forward 40 or 50 years, we'll have low carbon growth. That will be much more attractive than the alternative. It will be cleaner, in the normal sense of less polluting locally. It will be much more energy secure. It will be quieter, it will be safer, it will be more biodiverse. And further, in a still longer period, it'll dramatically reduce the long-term risks.

This is an investment program, with returns in years and months, and with returns in a few decades, a return in several decades, returns over the century. It is enormously attractive, and a narrow view of short-run costs doesn't pick up that dynamic story.

And, above all, it's a growth story. High carbon growth kills itself—first, on very high prices of hydrocarbon, and second, on the very hostile physical environment it creates. Low carbon growth is the only growth story, and the United States is in a tremendous position to lead. The constant innovations and new ideas that you see, in large measure, come from this country.

We are, of course, in an economic crisis. That just strengthens the arguments still further. The argument of the economic crisis for delay is simply confused and wrong. We should surely have learned that risks ignored are risks magnified. That must be a lesson from this economic crisis. We should surely have learned that you don't come out of one crisis and sow the seeds of the next crisis. I would suggest that's, in part, what we, as a world, did when the dot-com bubble burst around the turn of the century; we sowed the seeds of the next one. What we must surely do is lay the foundation for the real growth story of these next few decades.

If you just take a narrow view, over this next decade, of the new jobs in renewables, it's probably a few million in the United States and a few million in Europe. That's a very narrow view of renewables. We have to see energy efficiency as pervading the whole construction industry, as pervading the whole of public transport and of private transport. If you take that view, I believe you're going to talk about a big slice of our workforce in the new technologies, the new construction, the new transport, and so on, that's coming forward.

So, the challenge, then, is to manage the transition, and to do it well. We know the kind of policies that are necessary—prices for carbon and regulation, investing in new technologies, public and

private, promoting energy efficiency, avoiding deforestation, and adapting to the carbon—adapting to the changes which will take place. We know what we have to look out for—problems of competitiveness and leakage. We can analyze how big they are.

Joe Aldy and Betty Pizer, a recent paper, have showed that, actually, the problem is very small, and, for a reasonable estimate, the carbon price in the United States, the change in employment in manufacturing would be negligible.

There'll be a few areas where it is most important, and we have to focus our policy on working out how to manage those. But, I believe, again, there's a great deal we can do in, for example, adjusting the speed of auctioning permits, which could be different in industries with different challenges. That would be one way of doing it. But, of course, much the best way is to work together as a world to get everybody along this path, and that's the opportunity we have in Copenhagen.

I've tried, in the book "Global Deal," which was published here in the United States last month, to set out what such a global deal would look like. I believe that the United States, China, and the European Union will lead that global lead. They're responsible for about half of global emissions. The big story is the relationship between the United States, China, and the European Union. That will shape where this global deal goes.

We have to recognize what other people are doing. And you, in your introduction, sir, you described very clearly that China is moving quickly. The European Union is moving very quickly. I spend a lot of time in discussions with European Union leaders and with Chinese leaders, and I always try to explain to them what United States is doing. But, what I'm saying here is that United States position is critical. The technologies that you set as standards will change the world. In the United States, you went from leaded to unleaded petrol; everybody else had to follow. And they did. At the same time, the action which people will take, themselves, will depend very much on what United States does. So, you have a tremendous leadership role, which I believe you are starting to take, and you have the ability to have a tremendous multiplier effect, not only through your ideas and technologies, which will be fundamental, but also in the policies and actions which you make, going forward. And I think you're already seeing the world starting to follow where the world thinks United States is likely to go, and I think that's a tremendous move forward. I'm not an American, as you can tell from my accent, but looking at United States from outside, I think the leadership that's emerging is tremendously important. And, of course, if it doesn't emerge, it would be very damaging for a global agreement. But, I'm much more optimistic now than I was before.

So, thank you very much for the opportunity to be here.

[The prepared statement of Lord Stern follows:]

PREPARED STATEMENT OF LORD NICHOLAS STERN, CHAIR OF THE GRANTHAM RESEARCH INSTITUTE ON CLIMATE CHANGE AND THE ENVIRONMENT AND IG PATEL PROFESSOR OF ECONOMICS AND GOVERNMENT AT LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE, LONDON, UNITED KINGDOM

OVERVIEW

The world currently faces both an economic crisis and an even deeper climate crisis. This global economic recession, triggered by a major financial crisis, draws into sharp focus the economic and social impact of not taking into account the risks of our actions. The climate crisis is altogether of a different scale and magnitude. Continuing with current practice will, by the end of the century, take the world to a point where eventual global warming of more than 5 °C is more likely than not. Temperature increases on this scale would disrupt the climate and the environment so severely that there would be enormous consequences for where and how people lived their lives. Large scale migration, possible of hundreds of millions of people, would probably result in extended conflict. In other words, the current path of high carbon growth cannot sustain itself over the long term. Low carbon growth is the only sustainable growth path for the future. Moreover, the transition to a low carbon global economy offers substantial opportunities for a surge in economic growth led by innovation, investment and job opportunities, whilst supporting energy security and a cleaner, safer, quieter and more biodiverse environment. Many of the necessary technologies are already understood, but new ones will be created along the way offering substantial opportunity for investment. Those countries which act early are likely to reap significant economic rewards and ensure their growth will be resilient to climate change in future. Those countries who fail to anticipate change will be left behind. The United States has a historic opportunity to lead the transition to a global low carbon economy, demonstrating that low carbon growth is feasible and affordable. Moreover, the United States has a critical role to play if the world is to achieve a global deal on climate in Copenhagen in December 2009.

THE CASE FOR ACTION

The basic science is well understood. The rising concentration of greenhouse gases in the atmosphere, due to emissions from a wide range of human activities, is increasing average global temperatures. This process affects the timing, distribution, averages and extremes of temperatures as well as the intensity of rainfall, likelihood of extreme weather events and pace of sea level rise. Without strong action the world will, in the next decade, commit future generations to a temperature rise of at least 2 °C relative to preindustrial levels—a level which many scientists already deem too dangerous. A temperature rise of at least 5 °C is unknown territory for humans and greater than the difference between now and the last ice age. There would undoubtedly be catastrophic consequences for the planet.

Climate change is already having an impact in the United States. Increases in weather extremes such as storms, floods, droughts, and heat waves have already led to significant economic damages in both rural and urban areas and further impacts and increasing damages are forecast. Globally, it is the poorest countries and poorest within those countries that will be hit earliest and hardest but these impacts will be felt worldwide. The risks of severe hardship and dislocation, water stress, mass migration and rising conflict will pose a severe foreign policy challenge for the United States in the future. The need to manage risks to United States economic, national, and energy security therefore dictates early and strong action on climate change.

Climate change policy is not only sensible risk management. It is also the means for boosting growth today whilst laying the foundations of stable and sustainable growth for future generations. It is vital that all countries act together in order to achieve emissions cuts on the scale required. The United States has an important leadership role to play and can lead the world in the transformation to a low carbon global economy, generating new investment and employment opportunities and positioning itself as a global leader in new innovative technologies. Policies for a “green recovery” will create a pathway for more sustainable growth whilst also sharply reducing climate change risks. This is the only growth strategy for the future.

FUTURE GROWTH MUST BE LOW CARBON GROWTH

1. Economic opportunities in early and strong action on climate change

The question of what economic opportunities strong action on climate change could bring should start with an overview of what the policy framework should look like. The following key components make up the essential elements:

- Placing a price on carbon to correct market failures by making it possible for markets to reflect the right signals;
- Policies to stimulate the development and deployment of low carbon technologies through addressing market failures and bottle necks;
- Encouraging behavioural change, particularly energy efficiency;
- Promoting adaptation to climate change that is already unavoidable;
- Globally, bringing an end to deforestation.

If applied in the right way, policies to tackle climate change present both short-term benefits during the current global recession and underpin large and growing investment opportunities for decades to come. For example, pathways for green global recovery include short-term policies that can stimulate employment creation and investment, all of which can play a vital role in supporting aggregate demand and growing out of recession. In the medium to long term there are clear win-wins from a strong policy framework to tackle climate change, including the stimulus to innovation from structural change, addressing longstanding market failures and barriers preventing behavioural change and uptake of new technologies, and important co-benefits such as a cleaner environment and greater energy security. The era of low carbon growth promises to be exciting, creative, and transformational.

For these reasons, the debate around climate change action should not be seen purely through the lens of containing and managing economic costs. There will indeed be costs of transition, but these can be managed through carefully targeted policies and programs. More importantly, there will be investments with very high returns. Moreover, taking action today is crucial to avoid the high costs of delay. Continuing business as usual emissions will build stocks of CO₂ in the atmosphere, resulting in higher concentrations and making the starting point for reductions both more challenging and more expensive. Slow initial action not only increases the chances of going above 2 °C, but also means that low-cost mitigation options are missed and high carbon technologies and infrastructure are locked in. It is therefore vital to strengthen the understanding among governments, businesses and consumers of how key policies to tackle climate change, both domestically and at a global level, can promote and sustain economic recovery and growth in the future.

The economic arguments that climate change policies can be growth enhancing have most recently been debated in the context of the economic stimulus and recovery packages implemented in many of the world's major economies. At time when declining demand in the world economy is driving economic downturn, causing a sharp deterioration in the economic outlook, the case for a fiscal stimulus becomes clear cut—helping to sustain demand, use otherwise idle resources, save money through improved energy efficiency and create jobs. To be effective, however, fiscal policies need to be timely (with a significant proportion of expenditures being carried out within the next year), well targeted (with long-term social returns, positive lock-in effects and use of underutilized resources) and time-limited without bringing into question the long term credibility of the fiscal framework.

In several recent papers¹ on this issue, public spending aimed at stimulating private investment to reduce green house gas emissions was seen to perform very well against these criteria for an effective stimulus, whilst increasing energy efficiency and security. Through addressing market failures and stimulating private investment, these measures generally avoid crowding out private sector activity. Such policies not only make sense in the current economic context, but also more generally as the drivers of future innovation, job opportunities and to lay the foundations for growth in the future that is far more sustainable than the path the world is currently on. Crucially, these policies avoid the risk of locking in high carbon infrastructure for the coming decades.

2. Key areas for investment and action

A key example of this is in spending to improve energy efficiency. All major economies have the potential for substantial energy efficiency improvements, which in total could make up a significant proportion of the emissions reductions required to meet global stabilisation targets. Energy efficiency measures have a high multiplier effect (raising aggregate demand through fiscal spending) being concentrated in sectors strongly affected by the decline in global demand, such as construction. Furthermore, lower spending on energy costs frees up income that can be spent on the products from other sectors of the economy. Energy efficiency measures also lay the foundation for a more sustainable future, simultaneously reducing emissions and energy costs, cushioning against future resurgent oil prices. In all countries, sub-

¹“Towards A Green Global Recovery—Recommendations for Immediate G20 Action,” O. Edenhofer and N. Stern, April 2009. And, “An Outline of the Case for a Green Stimulus,” A. Bowen, N. Stern, S. Fankhauser, and D. Zenghelis, February 2009.

stantial potential for energy efficiency improvements remain. The IEA² has identified 25 energy efficiency policies, including in buildings, transport, appliances and industrial sectors that can be implemented at low or negative cost impacting economic activity in the short term and reducing consumer energy bills in the future.

Policies to upgrade physical infrastructure are another good example of measures to create short-run benefits whilst laying the foundations for future sustainable growth. Investment in infrastructure can have a high multiplier effect in times of economic recession. If well targeted, it can also have strong implications for the profile of emissions in the future. This is nowhere truer than in the power sector. Ageing capital stock in industrialized countries presents an excellent investment opportunity, for example in the transmission and distribution grid, storage of electricity and other elements of the network to absorb innovative low carbon technologies and avoiding lock-in of high carbon systems. Investing in networked technologies to ensure energy is produced, distributed and consumed more efficiently through integrated “smart” systems which monitor and reduce waste also have great potential to save money and reduce emissions. Investment in public transport is another strong example, contributing to the decarbonisation of infrastructure, for example through setting emissions standards for CO₂ and local air pollutants and supporting the switch from petroleum to electricity.

Policies to support clean energy technology are a further crucial part of the mix, contributing directly to job growth and fostering innovation, creativity and comparative advantage in a key future growth sector. If the world is to put itself on a path to achieve the necessary cuts in emissions, a fundamental transformation is required in the way energy is produced and consumed. Key technologies including renewable energy (solar, wind, hydro, tidal, wave, biomass, and geothermal), nuclear and carbon capture and storage for coal will require significant investment for demonstration and deployment if growing world energy demand is to be met. The IEA estimates \$1 trillion a year in energy supply investment between now and 2030 is needed. The difficulties caused by current credit market constraints and other bottlenecks make this challenge even more daunting. Nonetheless, there could be significant economic opportunity for early movers who strive to get ahead of the curve. As we learn more about technologies from research and experience and exploit economies of scale, costs fall over time. Moreover, the job growth potential in the clean energy industry is increasingly clear, with countries such as Denmark and Germany amongst many others already reaping rewards. Early investment in low carbon technologies also makes clear sense from a cost perspective, reducing a key source of uncertainty about the scale of future mitigation costs. Furthermore, it can promote energy security through securing against future supply disruptions and support resistance to future price shocks.

These are only three examples of policy areas that can secure the immediate benefits of stimulus and employment creation, whilst laying the foundations for a low carbon world. Governments around the world are already taking strong action in this direction, evidenced by the \$430 billion fiscal resources dedicated to climate change investment themes as part of recent stimulus packages. This includes the \$65 billion committed by the U.S. administration to green energy, through spending and tax incentives. In the U.K. 2009 budget, £1.4 billion new spending was announced to support the low carbon sector. China and South Korea are also major economies with policies for low carbon growth making up an important part of their fiscal stimulus packages and approaches to future wealth creation and sustainability. There are many more positive examples at the firm level, where globally competitive companies are embedding energy savings and low carbon policies at the centre of their business planning. Recent research shows that better managed firms generally tend to be more energy efficient, reducing energy usage without hurting their employment and output. In the United States, companies such as Cisco, IBM, DuPont, Dow Chemical, General Electric, and Duke Energy are at the forefront of the climate change debate, recognising that strategic global importance of low carbon growth and energy savings to their business models.

The current global financial crisis has clearly brought into sharper focus the need for an economic recovery which leads to a more sustainable global economy. Action currently being taken around the world is only the beginning of the pathway that is necessary to achieve a low carbon global economy, consistent with the international targets necessary to avoid dangerous climate change. In future, there is both a need and an opportunity to deepen these policies at the national level and make them even more impactful through globally coordinated action. Without this, it will not be possible to stimulate the global flows of trade and investment that

²“A Clean Energy New Deal: Ensuring Green Growth in a Time of Economic Crisis,” December 2008.

is vital to support deep emissions cuts on the scale required, whilst sustaining economic growth and supporting the international development and diffusion of critical low carbon technologies. The United States has a historic opportunity to lead the world in the era of low carbon growth, acting early to create new forms of comparative advantage and foster a sustainable growth path for itself and others in the future. Leadership has already been shown in some United States States, such as California, to introduce regulation, cut emissions and support low carbon industry. Furthermore, there is enormous scope for developing the renewable industry in the United States, given its natural resource endowments.

3. *Fostering the transition and managing the costs of adjustment*

Like any adjustment process, there will be costs of transition inherent in transforming the economy to a low carbon growth path. Placing a price on carbon, whether through cap and trade or a carbon tax, requires the market to readjust. There will clearly be winners and losers from this process, as with any adjustment process. However, with the right policy framework these costs should be manageable and are not a reason to delay strong action. Complementary policies to support adjustment at the firm level, innovation and uptake of new technologies, to encourage behavioural change and to enable trading will help support least cost abatement potential and keep costs at a manageable level.

Concerns about competitiveness and carbon leakage are often heard and are important considerations for any government. It is important to understand and quantify these impacts as closely as possible, to ensure they are not overstated and that any compensation program can be well targeted. Existing research shows that these concerns are mainly relevant to a small number of specific industries and sectors rather than the wider economy. In the United States, only 1.6 percent of GDP and 1.7 percent of employment are generated from carbon intensive sectors. Moreover, the influence of small carbon costs on location decisions is dwarfed by commercially more important factors such as access to markets, raw materials, skills, technologies and infrastructure. Recent research by the Pew Centre³ confirms that the competitiveness impacts from a unilateral United States climate policy on domestic manufactures as a whole are small (approximately 0.7 percent) for a \$15 per tonne CO₂ price. This implies policies are most efficiently targeted at supporting the transition in specific industries. Protectionist trade measures should be avoided. They are blunt measures and risk affecting unrelated industries if trade dispute results.

Equally important are the concerns around costs to consumers and households through energy price rises, brought about by placing a price on carbon. Whilst cost passthrough of the carbon price from industry to the consumer does occur as part of the clear price signal that is necessary to incentivise behavioral change, the average cost to household budgets can be contained through careful measures, including through compensating low-income households. Moreover, encouraging companies to improve their efficiency and allowing companies access to cheaper abatement opportunities abroad would reduce the price of emission permits, leading to lower cost being passed through to the consumers. Household energy consumption can also be reduced through behavioral change, awareness, low-cost actions, and investment decisions. Capturing such opportunities would mean less income spent on energy, and hence help keep cost down for vulnerable families. In other words with the right flanking measures, a carbon price should not necessarily entail excessively higher cost to consumers.

ACHIEVING A GLOBAL DEAL ON CLIMATE CHANGE—A LEADERSHIP ROLE FOR THE UNITED STATES

A global deal on climate change is necessary if the world is to achieve the necessary global targets. The timing is urgent, with the negotiations for a post-Kyoto framework shortly to get underway in the buildup to Copenhagen 2009. Both developed and developing countries have a role to play in building positive momentum for a global deal. This must be global collaboration on a scale never witnessed before in our lifetimes. The United States has a historic opportunity to play a crucial international leadership role to achieve this. The world will look to U.S. leadership in setting clear and strong mid-term targets for 2020, on a credible pathway to achieve its goals by 2050. The rest of the world will watch the domestic debate on U.S. climate legislation more closely than ever before, and if the United States demonstrates strong ambition for its own emissions reductions the rest of the world will follow. Moreover, the support which developing countries require to achieve low car-

³“The Competitiveness Impacts of Climate Change Mitigation Policies,” J. Aldy and W. Pizer, Resources for the Future, May 2009.

bon growth, including vital flows of finance and technology, can only be successfully designed and implemented with strong U.S. backing. The chances of achieving a credible and enduring global deal on climate change depend on the United States playing a central role.

CONCLUSION

Strong action on climate change is feasible and affordable and creates substantial economic opportunity. The economic and climate arguments for the green fiscal stimulus have enabled governments around the world to better understand the framework for supporting opportunities, whilst managing the economic costs. Fiscal stimulus measures for example in energy efficiency, investment in alternative power infrastructure, low carbon RDD&D, infrastructure and transport will both enable a green recovery and lay the foundations for the future more sustainable growth. This is only the beginning of what needs to be done to set the world on a pathway for avoiding dangerous climate change. The scale of the challenge is daunting, but full of opportunities. The task now rests with Governments to put in place as quickly as possible a clear, consistent and credible set of policies and measures to support the transition to a global low carbon economy, bound into an international framework.

The CHAIRMAN. Well, thank you, Sir Nicholas. And we do look forward to being able to ask you a few questions. But, your opening statement sets a good stage, and we appreciate it very much.

Mr. Rogers.

STATEMENT OF JAMES E. ROGERS, PRESIDENT AND CHIEF EXECUTIVE OFFICER, DUKE ENERGY, CHARLOTTE, NC

Mr. ROGERS. Mr. Chairman, Ranking Member Senator Lugar, I am delighted to be here today to share with you my thoughts on how we can work together to drive a green global economic recovery.

My name is Jim Rogers. I'm the CEO of Duke Energy. We provide electric power to more than 11 million people in five States, and, as Senator Lugar knows, we're the largest utility in Indiana. We're also the third-largest electric power generator, based on kilowatt-hour sales, in the Americas, both North and South America. We produce electricity from renewables, solar, wind, and biomass, coal, nuclear, natural gas, and hydropower.

As I sit before this committee, I recognize, as you all do, that we face two simultaneous and urgent crises: Global climate change and a deep financial downturn. There are great similarities between them. No one nation or entity can solve either problem. It will take policy leaders and businesses from around the world to solve both.

There's a great opportunity for us in both crises. If we structure our approach to climate change effectively, we can address the global climate crisis, which will provide a pathway to help address the global financial crisis.

Climate legislation in the United States is not going to be free, it's not going to be easy or quick, but it must be fair, and it must be now, to drive a green global economic recovery.

There are several reasons why action, now, is important. By putting a cap on emissions and a price on carbon, it will allow our country to get the best bang for the buck from the green portions of the stimulus. This linkage will create a roadmap that will allow capital-intensive industries, like my own, to start planning for future investments and the creation of 21st century high-tech jobs, because the building of new transmission, renewables, nuclear,

cannot be done overnight; it can be completed over the next 3 to 10 years. Most importantly—and I want to underscore this—it is confidence in this roadmap that will help us all rebound from this recession that we find ourselves in today.

I'd further note that, as I look at our own company, as one of the largest generators in the country, by 2050 virtually every power-plant we own today will be retired or replaced. And that's an "aha" for me, in the sense that it says that, if we want a low carbon generation fleet in this country, getting about the business now will allow us to make this transition in a way that creates jobs and generates advanced technologies.

The second reason is—action now is important—is because the United States, in my judgment, lags behind its global competitors in the race to fuel the clean energy future. According to research firm New Energy Finance, the value of low carbon energy market worldwide is expected to reach \$450 billion annually by 2012, rising to \$600 billion annually in 2020. Without a U.S. carbon program, we will not be participating in these lucrative markets.

If you look today at China, you will find that they are investing roughly \$221 billion over the next 2 years in clean energy. That's double the U.S. investment in everything from wind to solar to advanced batteries. I understand very well the arguments against action on energy and climate, with concerns focused on our economy today; but, the reality is, we can't afford not to act if we hope to compete and lead.

The right—underscore "right"—comprehensive carbon legislation can provide, not only the certainty and rules of the road by which we can plan, build, and compete, they can also protect consumers during the transition to this low carbon world. The sooner Congress provides a clear set of rules, the sooner investments will be made.

I strongly believe that one of the most effective approaches to solving the climate issue would be to develop a series of public and private partnerships with countries and businesses around the globe. Through domestic action and international leadership and cooperation, we can drive a green economic recovery worldwide.

For instance, we have an opportunity to establish a new spirit of cooperation between China and the United States. The most important long-term issue that both countries face is the same: The challenge of responding to climate change while providing for economic growth. It is an issue for which progress would be mutually beneficial. Think about it. Both countries rely heavily on coal. Both rely on oil, a national security issue for both. Both are at risk, due to climate change. Because of these shared concerns, this area is ripe for collaborative endeavors that would build additional trust between China and the United States.

It is my judgment, and the recommendation that I would make is, that the United States should appoint a senior climate negotiator to work directly with China to build what I would characterize as a ladder of cooperation which engages both the public and private sectors. I believe China would respond in kind. And I think that's an important point. This cooperative effort, I believe, would be like a living laboratory to further action on electric cars, the identification of new energy efficiency capabilities, research and deployment of carbon capture and sequestration, which is so key to

our continued use of coal. I believe that we will be able to scale carbon capture and sequestration faster in China, with their buildout of plants, than we can in the United States; and by working together, we can do it even faster. It will also lead to work on Smart Grid technologies, and are involved, as a company, in some of those efforts, and advanced technologies for the monitoring of greenhouse gases. These are just some of the areas that we could work together with the Chinese on that would advance for both of us.

Cooperation and progress in the development and deployment of clean energy technologies are not just important in their own right, they also encourage a new spirit of Chinese leadership in United Nations climate negotiations.

It's my belief that China is better equipped than any other developing country to help the world define pathways for all nations to follow toward emission reductions. First, by taking cost-effective steps to cut energy waste, and second, by graduating to real and enforceable emission limits. Working together on clean energy, the United States and China may also be able to show the way to a new global agreement on climate change.

And this idea is not original with me; this idea actually comes from former Prime Minister Tony Blair, who talks about the significance of the G2, not just the G8 or the G20, but if the G2 can come together, not in a way that—to the exclusion of the rest of the world, but because we have these common interests and these common issues, that we could help mold a post-Kyoto agreement. Our company stands ready to work both with the administration and Congress to get this done.

Thank you very much.

[The prepared statement of Mr. Rogers follows:]

PREPARED STATEMENT OF JAMES E. ROGERS, CHAIRMAN, CEO, AND PRESIDENT,
DUKE ENERGY CORPORATION, CHARLOTTE, NC

Mr. Chairman and members of the committee, I am delighted to be here today to share with you my thoughts on how we can work together to drive a green global economic recovery. My name is Jim Rogers and I am chairman, CEO, and president of Duke Energy Corporation.

Duke Energy provides electric power to more than 11 million people in five States: North Carolina, South Carolina, Ohio, Indiana, and Kentucky. We are the third-largest electric power holding company in the United States based on kilowatt-hour sales. Our diversified generation portfolio of 37,000 megawatts mirrors the mixture of supply in the United States as a whole with a blend of coal, nuclear, natural gas, and hydropower.

We have also made sizeable investments in renewables, notably wind where we have more than 500 megawatts in operation and another 5,000 megawatts under development, and in biomass where we have formed a joint venture that has targeted the construction of at least ten 50-megawatt biopower facilities in the United States over the next 5 years. Finally, Duke Energy owns and operates approximately 4,000 megawatts of electric generation facilities in Central and South America. About 75 percent of this capacity is hydroelectric.

My views on these international challenges are not just shaped by my responsibilities running a large U.S. energy company with significant international operations. My perspective has also been formed from my membership and participation in the World Economic Forum's Task Force on Low-Carbon Economic Prosperity, the Club of Madrid and U.N. Foundation "Global Leadership for Climate Action," Globe International, the World Business Council for Sustainable Development, and the Copenhagen Climate Council. We are a founding member of the Joint U.S.-China Cooperation on Clean Energy where we are focused on sharing information, experience, and expertise. And we are the only U.S. utility that is a founding member of the China Greentech Initiative. Some of the other U.S. members are Dell, Cisco, and GE.

TWO CRISES, TWO OPPORTUNITIES

Here and around the world we are facing two simultaneous and urgent crises: Global climate change and a deep financial downturn. There are great similarities between them. No one nation alone can solve either problem. With both, government, NGOs, and business must work together to find the right way forward.

Yet there are key differences: The economy has sustained a cycle of boom and bust for generations, whereas the environment is close to “bust,” and it is not cyclical. We are fast approaching thresholds of irreversible damage to our global climate. But the government has the chance to address this great market failure to still minimize its worst impacts. And there is a great opportunity for us in both crises: If we structure our approach to climate change effectively, addressing the global climate crisis can also be one of the keys to addressing our global financial crisis.

I agree with a key point Sir Nicholas Stern has made: We must act now because if we don’t, the economic costs, including the cost of our security here at home, will be much greater. Moreover, the costs and harm to those who are least able to adapt to the impacts of global climate change will rise significantly absent action now—and the unjust irony is they have contributed least to the problem.

CONSUMERS ARE AT RISK: WE MUST GET THIS RIGHT

I might add that my company and my customers are at ground zero for both the environmental and economic storms we face. Duke Energy is the third-largest consumer of coal in the United States and we emit around 100 million tons of carbon dioxide annually. And as Senator Lugar knows, the Midwest has been particularly hard hit by this recession. With so much of this region dependent upon traditional coal-fired powerplants, we have to be very careful about how we make the transition to a “decarbonized” economy. Yet we also know that new clean technology manufacturing can help restart closed factories as the Gamesa wind turbine facility has in Pennsylvania.

So how do we move forward to capture this economic opportunity here at home and globally? We need government leadership to partner with industry to transition our economy to be cleaner, more efficient, and more competitive. The Waxman-Markey bill currently being marked up goes a long way toward providing a solid foundation upon which we can build a green global economic recovery. It creates a 40-year roadmap for U.S. carbon reductions; in our sector, it seeks to minimize consumer impacts and regional disparities by effectively distributing allowances directly to consumers of electric power; it creates enormous incentives for renewable energy; and it focuses needed resources on the development of the next generation of coal powerplants that will include carbon capture and sequestration.

AMERICAN ECONOMIC OPPORTUNITY

By putting a cap on emissions, encouraging energy efficiency and deployment of clean energy technologies, and providing a transition to allow carbon economy, the right climate legislation will not only increase our competitiveness by reducing energy consumption and reliance on foreign oil, but will also create clean energy jobs here at home in engineering, manufacturing, and construction.

The carbon intensity of the United States has begun to show steady declines on a normalized basis—that is greenhouse gas emissions per unit of GDP. Since 1950 U.S. energy use—measured per dollar of GDP—has declined more than 75 percent, from 9.4 British Thermal Units per dollar of GDP to just 2.5 BTUs.¹ Yet we have much more work to do.

According to the McKinsey Global Institute, “each person in the United States today consumes the equivalent of almost seven gallons of oil—80 percent more energy than Northwestern Europe, 94 percent more than Japan, and seven times the level of China.” This waste harms our competitiveness. Yet, according to this same analysis, by deploying existing technologies that have an investment return of 10 percent or more, the United States can increase its energy productivity to cap our energy demand at today’s levels.²

Of course one key aspect of this is in the utility industry is the disincentives to saving energy. Working as cochair of the National Action Plan on Energy Efficiency, which has developed Vision 2025, a plan to increase dramatically energy efficiency by 2025, we encouraged States to examine the disincentives to utility energy effi-

¹Joel Makower, “Strategies for the Green Economy.”

²“Wasted Energy: How the U.S. Can Reach Its Energy Productivity Potential,” McKinsey Global Institute, July 2007, available at: http://www.mckinsey.com/mgi/publications/wasted_energy/index.asp.

ciency and identified the barriers that consumers have to meeting that energy efficiency goal.

The United States also lags behind its global competitors in the race to fuel the clean energy future. According to the research firm New Energy Finance, the value of low carbon energy market is expected to reach \$450 billion annually by 2012, rising to \$600 billion annually in 2020. In 2007, global investment in sustainable energy broke all previous records, with \$148.4 billion of new money raised in 2007, an increase of 60 percent over 2006. Total financial transactions in sustainable energy, including acquisition activity, was \$204.9 billion.³

China is Investing in Greentech

While I recognize that the Chinese market differs substantially than the United States, it is still worth noting that China has committed \$221 billion over the next 2 years toward their clean energy economy. That's double the U.S. investment in everything from wind to solar to advanced batteries. China now has renewable energy, energy efficiency, and fuel economy standards that are all more aggressive than our own. I also realize that China is developing more coal plants than the United States, but the point that should be emphasized is they are also preparing to meet new energy challenges.

According to the Chinese Sustainable Energy Programs: "By 2008, average Chinese passenger cars had to meet a 36-miles-per-gallon (mpg) fuel efficiency standard. In late 2007, the U.S. standard for passenger vehicles was raised to 35 mpg, but not until 2020. China is also in the process of setting fuel economy standards for trucks and agricultural vehicles. These policies together are going to reduce China's GHG emissions by 488 million tons of CO₂ by 2030."⁴ In comparison, the EU commitment under Kyoto is about 300 million tons of CO₂ between 1997 and 2012.

Perhaps most striking, China has established the world's most aggressive energy efficiency target, which calls for a 20-percent reduction in energy intensity between 2005 and 2010 (which is a nation's energy consumption per unit of GDP). If fully implemented, this target would translate to a reduction of over 1.5 billion tons of CO₂ in just 5 years. Although China is not yet on track to fully reach this goal, they are working toward it and are already taxing the least efficient performers in major emitting industries to increase productivity.⁵

China's Renewable Energy Law, which came into force in 2005, has set the world's most aggressive renewable energy target. By 2020, 15 percent of all energy is to come from wind, biomass, solar and hydropower energy, compared to its current 7 percent. China projects that it will have 137 gigawatts of renewable power generation by then, plus vehicle fuels with at least 15 percent renewable energy content. In August 2007, China's National Development and Reform Commission launched its Medium to Long-term Renewable Energy Development Plan. By 2020, installed capacity for small hydro, wind, biomass, and solar will reach 75 GW, 30GW, 30 GW and 1.8 GW, respectively. Estimated total investment needs for realizing these target amounts to nearly US\$270 billion. As you know, the United States has yet to establish a national renewable energy platform.⁶

These investments and policies are paying off. This year, China is expected to become the world's largest wind turbine manufacturer. Until the late 1990s, the United States dominated the global solar energy market. Now Japan, China, and Germany are the leaders. These other countries have policies that have created better markets for clean technologies, so the business opportunities have moved overseas. According to recent research by Lazard, of the world's top 10 solar, 10 wind, and 10 advanced battery manufacturing companies, only five of the 30 are American companies.⁷

Arguments against action on energy and climate suggest we can't afford to take action; yet the reality is we can't afford not to act if we hope to compete and lead. We need comprehensive energy and carbon legislation to provide the certainty and rules of the road by which we can plan, build, and compete. The sooner Congress provides a clear set of rules, the sooner investments will be made. We must unleash the spirit of economic entrepreneurship to tackle this challenge.

³"Global Trends in Sustainable Energy Investment," 2008, New Energy Finance and United Nations Environment Program.

⁴The China Sustainable Energy Program is a joint project of the Packard Foundation and the Energy Foundation.

⁵Ibid.

⁶Ibid.

⁷Lazard research for Kleiner Perkins Caufield and Byers.

A GLOBAL DEAL TO DRIVE A GREEN ECONOMIC RECOVERY

Internationally, I have been working to develop recommendations and help shape the structure of a global agreement through the World Economic Forum's Gleneagles Dialogue, through Global Leaders for Climate Action (under the auspices of the Club of Madrid and the U.N. Foundation), and as a member of the executive committee of the World Business Council on Sustainable Development.

It is clear to me that just as effective comprehensive carbon legislation in the United States is what we need to drive our economic recovery, so too can a smart global agreement on climate change support global economic prosperity. And there are other benefits to agreement: First, the sooner we act, the lower the costs of impacts we will face in the future; second, the opportunities to cooperate on policy and technology strategies can improve our relationships; and by reducing global impacts from climate change, we will increase stability and improve national security.

To reach a deal that includes developing countries the United States must demonstrate leadership and reengage in international negotiations. Seventy to eighty percent of the existing greenhouse gas concentrations in the atmosphere are from developed countries, and the United States continues to emit one-quarter of the world's emissions with only 5 percent of the world's population. There is a short window of opportunity for the United States to show its commitment to resolving the climate change challenge through strong action.

Without a mandatory cap on greenhouse gas emissions here, it is highly unlikely that key developing countries like China will make their own commitments. And without a new agreement we won't have the market signals to drive financial flows to more efficient, cleaner energy, and greater global productivity. A global deal will also expand opportunities to find the lowest cost emission reductions; a global approach to emissions reductions allows each dollar to be spent where it can go the farthest.

So to facilitate a truly global deal, we need a strong legislative package of medium- and long-term domestic targets, along with a suite of commitments and mechanisms to engage internationally. These include:

- Mandatory domestic reductions of greenhouse gas emissions;
- Provisions for valuing standing forests and other types of international offsets;
- Bilateral and multilateral mechanisms to accelerate clean technology deployment overseas;
- Financing for investments in these clean technologies (clean energy and carbon mitigation technologies) in developing countries; and
- Assistance to the most vulnerable populations for adaptation to climate change, to reduce climate change's greatest impacts such as drought, flooding, and sea level rise. Oxfam estimates that developing country costs of adaptation will be some \$50 billion.

BENEFITS OF A GLOBAL DEAL WITH DEVELOPING COUNTRIES

These provisions also serve America's interests. Mandatory reductions here drive domestic competitiveness and the development of vital new technologies. Carbon reductions from protecting international forests are low cost and have great co-benefits from poverty alleviation, to protection of biodiversity and will bring nations like Brazil and Indonesia to the table for the global agreement. Support for clean technology deployment and financing in developing economies benefits American innovators because it is these developing economies that can be the greatest market opportunities.

According to New Energy Finance, in 2004–05, developing countries accounted for 10 percent of global asset finance, which doubled to 20 percent in 2006–07, reflecting a surge in sustainable energy capacity in these countries. In addition, investment in shipping, airline, and auto efficiency and cleaner technologies and fuels also reduces our dependence on oil. Finally, adaptation assistance serves America's national security interests as well: As the Center for Naval Analysis has found, climate change is a great potential threat to our national security, undermining our stability and efforts to alleviate poverty which also exacerbates global instability. To ensure U.S. leadership, I understand that Senator Kerry has informed the Senate Budget Committee of his support for a \$5 billion reserve fund to assist with the implementation of agreements reached at the 15th Conference of the Parties in Copenhagen this December.

Competition and Cooperation With China

Some have argued that to ensure China and other rapidly industrializing countries make their own commitments, the United States needs to put in place border tax adjustments for carbon-intensive imports. However, China and India, the pri-

mary targets of U.S. trade measures in domestic legislation, are not leading suppliers of carbon-intensive exports to the United States. Therefore, U.S. trade measures may not create substantial leverage to shape climate change policies of other countries—particularly China and India—even though they could provoke retaliation that hits U.S. exports.

The United States should consider leading with cooperation, engaging China and India in the climate negotiations so as to reach global agreement and contribute to cooperative financing and technology arrangements that move all of us to reduce carbon emissions. Secretary Clinton has called for the United States and China and Japan to collaborate on clean cars and building efficiency. In fact investments in efficiency are the cheapest carbon reduction investments we can make. The electrification of transportation will reduce emissions and oil consumption, both leading to reduced carbon emissions and better U.S. security as we wean ourselves off massive infusions of foreign oil.

I strongly believe that one of the most effective approaches to solving the climate issue will be to develop a series of public and private partnerships with China. Thus we are currently working with several Chinese organizations (and seeking other Chinese partnerships) to speed the development of smart grid and carbon capture and sequestration technologies. I have also been involved in efforts to have the three largest consumers of coal, the United States, China, and Australia, combine their efforts to quickly test and deploy advanced coal technologies including facilities with carbon capture and sequestration.

I am proud that Duke is currently building the first “next generation” coal gasification plant at our Edwardsport station in Indiana. We are also working to add carbon capture and sequestration to this project. But with China opening new coal-fired powerplants on a monthly basis we have to accelerate our work on not just carbon capture from new plants but create retrofit options as well. This is a formidable technological and financial challenge. I think it behooves the United States to work with the other two “coal powers,” China and Australia, to pool our resources, to share data and to develop standard approaches that can quickly move this key solution from conception to commercial installation.

CONCLUSION: WE MUST LEAD

Through domestic action and international leadership and cooperation, we can drive a green economic recovery worldwide. The energy provisions in the stimulus package were a downpayment on the transformation of our economy. But we need Congress to pass comprehensive climate legislation to build off of the stimulus investments, to continue the transition to a cleaner, more prosperous future for this country, and to regain our technological and moral leadership on this challenge globally.

We stand ready to work with both the administration and Congress to get it done. We can lead. And we must lead.

The CHAIRMAN. Well, thank you very much, Mr. Rogers. We, as I said earlier, greatly appreciate the leadership.

Lets dig in. I know, Sir Nicholas, you have a plane that you need to catch, and we’re sort of dealing with about a 45-minute period, here, but I’m confident that Senator Lugar and I will have you out of here on time.

Mr. Rogers, speak to the concerns that, as Senator Lugar has pointed out, and some other folks have in their States, about the transitional impact, here. What is it that you see, in terms of the imperative to move now, and the feasibility of doing so, that some other CEOs don’t share with you? And you’ve had a lot of these discussions.

Mr. ROGERS. I’ve had the good fortune to spend the last several years working with USCAP. It’s a group of 25 companies and four NGOs who have worked to mold what we call a blueprint—

The CHAIRMAN. Just for the record’s sake—I know who they are, but lay out the companies that are involved in that.

Mr. ROGERS. Well, I probably can’t name them all, but GE, DuPont, some of the major auto industries, ConocoPhillips, Rio Tinto, which is the coal business; on the NGO side—

The CHAIRMAN. Dow Chemical—I think, Florida Power & Light. Mr. ROGERS [continuing]. Florida Power & Light, Public Service of New Mexico, PNM, Pacific Gas & Electric, also——

The CHAIRMAN. Almost all of them, Fortune 500 companies.

Mr. ROGERS. All Fortune 500 companies.

The CHAIRMAN. Right.

Mr. ROGERS. NRDC, EDF, WRI, the Pew Institute—so, we have a—that process, Mr. Chairman, has given me 2 years to work the issue and to think through the issue. And we were able to come together with a blueprint that I think points the way forward.

And let me characterize it in my words, because, in Indiana, as Senator Lugar knows, 96 percent of our electricity comes from coal, and we need to make the transition to the low carbon world without having to pay twice for the transition. So, through USCAP, what we've found is that we can have aggressive timelines and targets and protect the environmental quality of the legislation. That, you put over here on one side. We can achieve that. It's 80 percent type reductions by 2050, it's milestones in 2030 and 2020. So, we have very aggressive targets there.

But, the other thing that's recognized is the importance of making the transition. When I said, a few moments ago, it wouldn't be free or easy or quick, but it had to be fair, what I really meant is, yes, it's going to cost more money. There's no question about that. And some regions of the country more than others. Second, and it's not going to be easy, because virtually every way we generate electricity needs advances in technology. Wind needs it, solar needs it, coal needs it, with CCS, natural gas needs it, with a way to capture carbon, nuclear, with spent fuel. Virtually every way we generate electricity, we need advances in technologies. It won't be quick, because, either with CCS, unless we can scale up faster by working with the Chinese, could be a decade to 15 years off.

One of the things that we all came together around is, How do you make the transition? And the key to that is really the same way we did it under the Clean Air Act amendments in 1990, as you may remember, where we adopted cap and trade and we used an allowance system to allow companies like ours to continue to generate power from our plants until we could either retire or replace or retrofit. That system, I would suggest to you, worked well for SO₂, will work well for CO₂ in this country, and mitigate—and I'm looking directly at Senator Lugar when I say this—mitigate the cost impact on the consumers in his State, but allow us to make that transition to a low carbon world.

My last point in this. In Indiana, we're building what will be the world's largest coal gasification plant. We're building it because it will be, from a SO_x/NO_x, mercury, fine-particulate standpoint, the least emissions of any coal plant in the world. Part of that is a result of participating in a demonstration project in the early 1990s, where we got comfortable with the technology. This is a private funding, with some public health. But, here's the important point. We had the capability in Indiana, with that plant, to develop, and we are now investing over \$18 million for carbon capture and sequestration, which will become the largest sequestration project in the world, done here in the United States. And I think

it shows leadership on our part, as we move forward, that we can deliver electricity and reduce carbon from coal.

The CHAIRMAN. That's very helpful.

Sir Nicholas, what about from your point of view? What do you say to the manufacturers or others in coal-burning States where they face the potential of an increased cost of the coal itself, or the production, because they've got to capitalize to put out their new technologies or the conversions? What's the response to that?

Lord STERN. I think that we have to look to manage that transition process, as Jim Rogers has described. One way in which we handled that in European Union when we have different countries differentially dependent on coal—and Poland, for example, is very dependent on coal—is that you can allow for the process of auctioning to be adjusted over time so that those kinds of areas or industries go more slowly toward the fuller auctioning than elsewhere. So, that's one mechanism of adjustment.

A second is that any revenues you get from different kinds of auctioning systems can be used to protect those people who are hit earliest or hit hardest by this story. The MIT work from the Global Action Labs described that it should be possible in United States to carry out these adjustments, these increases in prices, because some electricity must be more expensive. But, it's possible to carry that out in a way where these revenues can be used to protect low- and middle-income households.

So, part of it is through the way in which you cooperate with the companies themselves—for example, through the auction process that I described—and second is through the consumers, and—compensate those consumers who might be hardest hit.

The CHAIRMAN. Then the—

Lord STERN. But, at the same time, recognizing that the sums involved there, the impact on consumers, are not huge in this story.

The CHAIRMAN. The plan, as we currently contemplate it, does look at a major rebate to taxpayers out of the revenues off the auction, to whatever degree you decide to auction. I personally am in favor of as much of it being as close to 100 percent as you can get. Now, we're not going to get 100 percent, we're going to have allowances in there, and we all understand that. But, if you put those revenues back into primarily cushioning any impact on consumers, second, into R&D, and third, into some of the things we need to do to help less-developed countries do it, you can, I think, patch together a pretty good equation here.

The question that some folks have is, Will this disadvantage them in the global marketplace? Will this somehow make them noncompetitive? What do you say to that, both of you?

Mr. ROGERS. First, I would start and, in a very respectful way, suggest to you that USCAP said we would evolve to a full auction, but that we had to allocate 40 percent of the allowances to the electric sector and start with a high allowance level going directly to the LDCs, and then being phased out over time, because that proves to be the most cost-effective way—because, take a State like Indiana, which is the largest coal-producing State in the country; that will keep the rates down. In fact, the steel industry in our country is one of the least carbon-intensive steel industries in the world. So, keeping the power costs down for these capital-intensive

or energy-intensive industries is one key way to do it. So, I would suggest to you, as you think your way through this, mirroring more the approach of the CO₂ program will produce better results without administrative costs and without the diversion of money with the auctions.

As a for-instance, there has been great debate, as you know, with the notion of 100 percent auction, which has been proposed, which is nothing more than a carbon tax; and that money would be diverted from the 25 States where more than 50 percent of the electricity comes from coal to the coast. And, interestingly enough, in Indiana, specifically, the GDP per capita is lower than the States on the coast. And this redistribution of wealth would be for tax reductions, so maybe specific payments, but the reality is, it wouldn't be to solve this ecological crisis that we face. And I think that's one of the reasons a full auction is flawed from the get-go.

The other point I would make is—and I say this very respectfully—is that we really pushed hard, in the Kyoto negotiations, Mr. Chairman, as you know, for cap and trade. The reason that it didn't work in Europe is because they didn't really have a baseline with respect to that, so it was difficult to make allocations. And second, they had a fundamentally different power sector. It had been liberalized. As a consequence of it, there were windfalls. Given the way our country structures our utility industry, there is no potential for windfall, and we have clear baselines. So, whatever failures or shortcomings happened there won't happen here.

The CHAIRMAN. Well, I happen to completely agree with that. I was at—as you know, was part of the negotiations in Kyoto, and I remember distinctly—first of all, the Europeans didn't want to do it, because they didn't believe in it. So, there was an inherent resistance to the idea. And I think the early implementation began with some of that, with great skepticism about its ability to work.

Second, there was, as we know, a sort of negative impact on selected sectors—cement, a few others—giveaways that took place in—without sufficient understanding.

Europe has now understood that very well, and has moved to correct it. And, in fact, it serves as a terrific baseline of understanding what not to do as we approach it, and how to do it right. But, I helped write the original bill. As a Lieutenant Governor back in 1983, I chaired a Governor's Task Force, and we devised the whole concept of trading emissions, and put it in place for CO₂. And I might comment that the CO₂ experience is one which showed that all the predictions came in way below the original—everybody's fears—and it happened a lot faster than everybody predicted, and with much greater ease. And I am absolutely confident the same thing is going to happen here, because technology and the marketplace are just going to take over, and this is going to be a lot easier than people think. That would be my judgment.

Do you want to comment, Sir Nicholas?

Lord STERN. Yes, Mr. Chairman. On the first question of the competitiveness and costs, there's a tremendous amount that can be done on energy efficiency, which actually brings costs down. Help firms to focus on that, giving incentives to firms to focus on that, setting the right kinds of standards, can actually bring costs down. And we see a lot of examples—I'm sure Jim has seen far

more than I have directly—is that if you help a strong focus in this area, it’s really remarkable the kind of results that you can get.

Second, there will only be a few industries for which the cost increases are of any great substance. And I think it’s very important to be analytical and work through and focus where those problems are.

And, basically, we know what the energy-intensive industries are. It’s not a secret. I mean, it’s aluminum and steel and, you know, paper and cement. It’s a few; it’s not more than half a dozen or so. And there, I think the first challenge would be to try to get global agreements on standards in those sectors. And there, I think that we’re beginning to see some movement forward on industries like steel, which are measuring, in a comparable way now, their emissions right across through their international industry associations.

So, I think the first step is energy efficiency. The second step is global agreement, but all on the back of a careful analysis of where the problems really are, and how big they are.

Now, commenting on the question of the European experience in cap and trade, actually phase 1, 2005 to 2007, of the European Union emissions trading scheme was very much about the kind of learning that Jim Rogers has just described. When we came out of phase 1—and I think probably the most important thing was the—by then, after those 2 or 3 years, we had managed to be able to measure much more carefully what was going on, industry by industry. And I think the United States is probably already there, so that particular learning phase of understanding what the baseline was and, therefore, what the emissions allocations and the permits should be, has probably already been done in this country.

You were also pioneers of the SO_x trading scheme. So there’s direct experience of that. And probably in Europe we didn’t learn enough from the United States, but the mistakes that we did make in the early stages, I think, are worth remembering, although they are pretty obvious that, if you give out too many permits, you’ll crash the price, and you don’t need a degree at London School of Economics to work that out. I do not think that there’s any danger, really, of your making that mistake in this country.

I do think that it’s starting to work and showing real results. I think, by the end of phase 2, 2012, that emissions will be 9 percent lower than they were in 2005, when the trading scheme started. So, we’re already starting to see those results on prices which have varied between 10 euros and 30 euros per ton of CO₂. The exchange rate between the dollar and the euro has moved around during that time, all over the place, and I tend to think of one-for-one, although I know it’s not exactly one-for-one right now. But, you can see though, roughly speaking, what those prices have been.

I think, as we get a bit more ambitious in Europe, those prices will go up, and that will be part of the process of cutting back. But, we’ll be getting much more carbon-efficient along the way. And so, whilst the price of carbon will go up, its effect on prices and goods which are produced will not be anywhere near that much because of the learning about how to be much more efficient, relative to energy and to carbon.

So, I think the cap-and-trade scheme is going well now. You'd expect the price to fall a bit during a recession, because demands for energy will be less. Probably no bad thing that that happens. It's one of the countercyclical aspects of the price mechanism. But, we don't want too heavy fluctuations. I think strong ambition will mean that the price stays steady, and I think it's important that it doesn't fluctuate too much, although some fluctuation is inevitable and, I believe, acceptable.

So, I think that your cap-and-trade scheme here, along the lines I've been reading it as proposed, I think has excellent prospects for having the effects that you expect it to have.

The CHAIRMAN. Thank you very much, sir.

Senator Lugar.

Mr. ROGERS. Mr. Chairman, if I may—

The CHAIRMAN. Yes.

Mr. ROGERS [continuing]. Echo Sir Nicholas' comments in a couple of ways. One, with respect to energy-intensive industry, I think what we have learned, there is not that much worldwide trade with respect to steel and cement, aluminum, and those areas. There's actually an excellent study, by the World Resources Institute and the Peterson Institute, where they get into great detail, in terms of how to address these issues, that I would recommend to you.

Second, with respect to energy efficiency, I have the good fortune of having cochaired the National Action Plan on Energy Efficiency, and now also cochair the Alliance to Save Energy, here in Washington. And there's been a tremendous effort made to change the regulatory models at every State level to incent utilities to invest in residential consumers, in businesses, in industry, to help stimulate productivity gains in the use of electricity. I think we've just begun with respect to those kind of investments. And I believe if we're able to continue to make it and we're incented to make it, I believe it will happen, and it will play the kind of role that was just suggested in dealing with these issues.

The CHAIRMAN. Very helpful, thank you, sir.

Senator Lugar.

Senator LUGAR. Mr. Chairman, let me just begin by saying that I come back to the thought that many people who are my constituents in Indiana really are sold on the idea of conserving energy. They see the cost savings for their businesses, for themselves. And so, that's important, that there are a great number of public efforts.

At Ball State University, a week ago, I was the commencement speaker, but after we finished, we went out to drill the first hole of 3,700 that will make Ball State University campus, several hundred acres, a thermal energy situation, the largest one in the United States. And it's likely to take 4 or 5 years, and probably \$41 to \$70 million to do this. But, nevertheless, we described this to the graduates, to the 15,000 people that were there. People were very proud of the fact that that's going to occur there in Muncie, Indiana.

Likewise, they're proud of the fact that their architectural school is involved in renovating huge office buildings in New York, in addition to small houses in Indiana. There is excitement about this.

This has been true, although controversies abound, over ethanol. Nevertheless, many people have been thoughtful about how we

replace oil, and there are some savings, when it comes to conservation. They're interested in what happens in biofuels and hybrid cars, and we have hybrid engines being produced.

Now, this is tremendously important regarding the issue we're talking about today. We have sort of a threshold in which the broad use of climate change, as a term, or cap and trade, as a mechanism have not caught on. I've been looking, maybe in vain, for what would be almost a small picturebook of what happens in the world as things change due to excessive CO₂ in the atmosphere or other emissions. Al Gore, when he appeared in this room before this committee, had some excellent illustrations in which we saw, not only ice melting, but progressive changes of temperatures, year by year, at least in the schematics that he had, that would make a change, not only in Iceland or up in Greenland, but across various areas of Africa or of the United States.

Even here, skeptics, say, in Indiana, find this ambiguous. Some say, "Perhaps our growing season would be longer. In fact, corn yields might be better." Now, granted that in Sri Lanka things may be going very badly, and we're sorry about that; but, nevertheless, we have a major case that this is the catastrophic situation that is being portrayed for everybody, maybe for somebody. Now, you're not making that case, either, but you're saying the dislocations, the conflicts that might occur, the suffering in humanity would be large, that all of us, as human beings, have some common stake in mankind.

I just come back to the fact that it has been very difficult for me to find, just physically, the materials, pieces of paper, small books, pictures, schematics. I think you may have had the same problem, but if you haven't, let me say, just as a working politician, this is where rubber hits the road right now with regard to all of this.

Now, fortunately, in our State, Jim Rogers is involved. I pay tribute to him, because, pragmatically, Duke is a large producer of power in Indiana. And a year ago or so, when Jim and I had a conversation about the so-called Lieberman-Warner bill, he was already informed by USCAP and by conversations as to why he felt this was probably not the best piece of legislation to cosponsor and to move on, at that point. I'll not try to reiterate all that conversation, but essentially it came back to considerations that we have in our State; namely, a fear that the price of electricity for ordinary consumers, a few months after cap and trade is adopted, might go up 40 percent. Now, that may have been an exaggeration, but that was commonly the figure that was cast about in the press and in arguments. And some would say, "Well, tough luck. You folks are using coal. This is dirty. You're putting the CO₂ in the atmosphere. You ought to pay for it." If, in fact, you live in New England or California, why, that's their problem. Nevertheless, people come back and say, "But, listen, historically we have 96 percent of our electricity from coal. Even if we started changing immediately, who all is going to change that immediately? Will Duke Power begin tearing down all the installations, and thus, there is no electricity available at all to us, or precisely how does the world work in my generation or for my grandchildren, what—really, where is the scheme?"

The lack of sensitivity toward these arguments led to crash-and-burning of Lieberman-Warner, very fast, sort of 1 week of cap and trade, and that was it for the year.

Now, this year it has an expected better run ahead of it. I don't know all the details of the House committee's deliberations, nor all the amendments that may be offered during the markup which will be transpiring shortly, but essentially it appears that some Members have tried to meet some of the things you've talked about today; namely, how rapidly to progress in this. What is the transition period? How can consumers, ordinary people, be compensated for what is occurring in industry or the government, in the meanwhile, so that there are not egregious differences between 25 States of the Union and the other 25?

Furthermore, the moneys that are engendered if we were to have an auction of any sort, where does it go? Originally, in some budget schemes that were proposed, it might have gone to pay for almost anything in the world. This has been more narrowed, in terms of its focus, as we've come on. But, that will be a very critical element. So will be the thoughts that Mr. Rogers presented about the carbon sequestration experiment. None of us know how well that works, how efficiently, how well it will be adopted by others. But, it's an important step forward; critical, really, if coal is to be utilized, and will probably be utilized for a while in our world.

I like the idea that has been presented today of international cooperation. This will have to be very sophisticated, because at least we are routinely told that the Chinese open up a coal-fired powerplant every week somewhere in China, even while they're giving plans and ideas that are of worldwide significance. Why? Because, in a practical way, they would say, a lot of very poor people are moving from the farm to the city, heating their houses for the first time in life, using cars for the first time. We've got to understand that, and we try to. But, this is going to require very sophisticated international diplomacy.

Let me just ask this question. What are the metrics that are available for any of us to try to gauge, first of all, where we stand and where we're headed? Now, there are, I appreciate, many scientific studies that have made estimates of what type of carbon is in the atmosphere presently. That has to be sort of the threshold from which we gauge that we've made headway. Can this be done by nation, by sector? How often is it published?

In the financial press, why, people who are interested can find the Dow Jones Average every day. Now, it may be impractical to get a CO₂ fix each day, in terms of our understanding, but for most of us it's pretty hard to find it at all, except in journals or abstruse documents. And it appears to me, for instance, from the standpoint of my constituents, they would say, "Are we making headway? Are the things that we are doing making any difference in all of this, given what we feel is the sacrifice and the inconvenience, dislocation of our lives?"

I think the metrics of this will be extremely important, as well as a check-and-balance with everybody else in the world as to how well all of us are coming along with this thing, how much of the sharing and cooperation may be available.

Do either one of you have any comments about that? That is, the measurements currently, the information available, information that could be available, and then, finally, this very broadcast situation for rudimentary illustrations so that there is a gut feeling on the part of even a majority of people in my State that this is worth tackling, quite apart from the personal enthusiasm I would have or others, such as yourselves, who wander through our State.

Lord STERN. If I may go first, as I will have to leave fairly shortly.

I think the communications side of this is absolutely vital, and the media, the politicians, the academics, the industrialists, just to take categories of people in this room, I think all have a major responsibility here.

I think the way I like to understand it is the risks of the kind of transformation that I described. I mean, 5 degrees Centigrade is enormous. It's way outside human experience. It rewrites the physical geography of the world. In Europe, we would have to see much of southern France, Italy, Spain, Portugal start to look like the Sahara Desert—

Senator LUGAR. Do you have—

Lord STERN [continuing]. By the end of this.

Senator LUGAR [continuing]. Confidence the 5 degree Centigrade is right? In other words, that that's in the ballpark?

Lord STERN. I am a consumer of the science of—the great science that comes out of the center in the United Kingdom, at Princeton, et cetera, just to name two of the major centers. And the numbers I'm giving, about business as usual for much of this century, taking us to a 50–50 chance of being either side of 5 degrees Centigrade by the end of this century, early next, comes directly from them. And it's now pretty balanced view across the scientists of the world, that you'll find those kinds of numbers.

So, people who say we've been up and down—we've been down quite recently; last ice age, 10 or 12,000 years ago. We have never, as humans, been anywhere near the kind of range we're describing, and it would transform United States just as much as other countries. But, of course United States, like many of the countries of the rich world, would have to deal with massive movements of people. I mean, it would just be a long period, a period that we couldn't see the end of, actually, of movement and conflict. We just have to understand the scale.

But, it's not just that kind of image. I think it's also the image that the alternative story is actually very attractive. It's a different kind of growth. It drives growth for the next few decades, when we get to low carbon growth; it allows growth to continue, and so on. And, you know, it's cleaner, it's more energy-secure, it's quieter, it's safer, it's more biodiverse.

So, the worrying side is very, very worried, but the different way of organizing ourselves, continuing to grow, continuing to move around, continuing to heat and cool our homes, all those things we can do, but we can do it in a low carbon way, and it will be actually attractive, for all sorts of reasons.

So, I think those arguments have to be made powerfully; as I said, by academics, industrialists, politicians, media. There's very good film coming out, being issued round the world, called "Home,"

made by Yann Arthus-Bertrand, is a very famous sort of French photographer and ecologist—that's coming out next month—which has a lot of visual things it can show. But, we need many more things like that for the communication.

On the price side, I mean, I think 40 percent extra for electricity consumer is way over the odds of estimates of these kinds of things. The extra price for generation, of course, is very different from the extra price for delivery, because the price for generation is only—it would be generally less than—again, I—some trepidation, with Jim Rogers, on my right—the price for generation would generally be less than half of the price actually delivered to the consumer. So, you know, you've got to make sure that when people are talking about prices here, they're talking about delivered prices to the consumers.

On the—

The CHAIRMAN. Yes, also, that—can I just ask you before you—

Lord STERN. Yes.

The CHAIRMAN [continuing]. Run? In answer to that question of Senator Lugar, while prices may go up for the unit of energy itself—

Lord STERN. Yes.

The CHAIRMAN [continuing]. The Union of Concerned Scientists come out with a report showing that all across the country, sector for sector, the consumer gains, because of all the other efficiencies that you can actually—

Lord STERN. Yes.

The CHAIRMAN [continuing]. Measure and factor coming into the system. So, out-of-pocket family expenses, budget, are, in fact, going to see savings, not expense.

Lord STERN. We are actually in the middle of—well, perhaps not the middle of—at the beginning of a revolution in energy efficiency, just the kind of light bulbs being developed, they're changing—they're cutting the usage of electricity by factors of 5 or 10 or 15—not percentage—by factors like that. So, the kinds of efficiency standards that were being discussed today, if I understand correctly, by President Obama, you're seeing very big increases in efficiency there. So, one has to set, as it were, the price of the energy in the context of the world, through these kinds of pressures and schemes and regulations and incentives, are actually driving a whole energy-efficiency revolution. I think you described it, yourself, Senator, how excited people get when, in their communities and in their institutions and their universities or wherever they work, they see those opportunities.

On CCS, I think we have—because there are so many types of geology and so many types of coal, I think what we would like to see is, in Europe, some kinds of experiments; United States, some kinds of experiments—and we mean, here, commercial-scale plants, because we have to find out how they're going to function and what it's going to cost—and Australia. We have to communicate with each other as to which ones we're doing so that if we have 30 or 40 round in the world—in the world, in the next 10 years, there is sufficient variation that we do enough learning to cover these different types of coal, different kinds of technology, different kinds of methods of when you capture it in the process. So, I think we

have to share what we're doing as a world, and not all do the same, because otherwise we're not going to learn. And that kind of co-operation doesn't need a worldwide CCS energy council; that's another layer of bureaucracy. It actual needs communication, country by country, and asking, "What are you doing? OK, we'll do something—we'll do something different."

Last, on the counting, Deutsches Bank, in Times Square in New York, in about 3 weeks time—I hope I'm not jumping the gun here—is going to launch a carbon counter. I just recorded something for that occasion. And it's going to be running up. And so, at any point in time, you go to Times Square—and obviously you get there online, as well—and you can watch the carbon concentrations—

Senator LUGAR. The concentrations—

Lord STERN [continuing]. In the atmosphere—

Senator LUGAR [continuing]. Counter up there.

Lord STERN [continuing]. Going up. So, these are the kinds of communications stories—

The CHAIRMAN. Great.

Lord STERN [continuing]. That I think that we're going to need, and we're all going to have to be involved, in our own ways.

The CHAIRMAN. They ought to work—

Mr. ROGERS. Senator Lugar—

The CHAIRMAN [continuing]. Having a carbon counter on every face page of every search engine so that it goes up; we should really do that, I'm serious. That would save everybody spending more time driving it up by going to Times Square to see it. [Laughter.]

We could do it virtually, I think.

Sir Nicholas, we need to excuse you. I know you've got to be in a car within 5 minutes to get where you're going and do what you're doing. So, before Jim answers, if I can just thank you, on behalf of the committee, we're extraordinarily appreciative of the contribution you've made to this. It is no small feat that your report is sort of the gospel, or whatever other denomination you want to attach to it, of guidance in this effort, globally, and I've enjoyed working with you, as have others, and we look forward to staying in touch with you.

I would like to ask you—we're going to get a meeting, probably in a few weeks, once the House has done something, we're going to sit down with our colleagues on the other side of the aisle and really begin the hard-nosed effort, here. It would be wonderful if, on your next scheduled visit through here, you'd let us know so we could schedule you to come in there. I think it would be really great to have you and USCAP members come in, in that context, and I want to try to schedule that.

Lord STERN. Thank you so much.

Senator LUGAR. Thank you very much, sir.

The CHAIRMAN. Thank you so much. We appreciate it and wish you well in your travels.

Lord STERN. Thank you very much for having me.

The CHAIRMAN. We're delighted. We're honored. We really are. Thank you.

Mr. ROGERS. Safe travels. We've had an opportunity to work together a lot, and it's been a great inspirational for me, and been very informative. And thank you so much.

The CHAIRMAN. Thank you.

So, if you could answer Senator Lugar, would that great.

Mr. ROGERS. I would. And, Senator Lugar, I'm going to start by saying I come from a perspective—as a guy who started his career as a consumer advocate fighting rate increases at utility companies in the 1970s. And I've spent the last 20 years as a CEO, starting in Indiana, as you know well. So, first of all, when I approached this, I approached this with—really wearing both hats.

What I've done is really depend on the work of the scientists. And the scientists of IPCC really say that the 450 to 550 parts per million is where we need to be by 2050, and that means an 80-percent reduction in this country, and that we need to be on that road. Now, there's been additional scientific work done that suggests different numbers, but, quite frankly, those are the numbers that I'm comfortable with, mainly because it represents kind of a worldwide consensus with respect to this very technical issue.

I would say that when you—when we look at national averages in terms of impact, the fact of the matter is, this falls unevenly across our country. The same is true when you look at climate change and adaptation. Some parts of the world benefit, other parts are hurt, so there's uneven impact, and even the scientists are not clear how that plays out.

They are clear that the Earth is warming. They're clear that manmade emissions are contributing. There is—not perfect clarity around the timeline and the impacts, but more work is being done. But, I think there's enough science that says we need to act.

The second point I would make—and this really gets to why we're where we are and why we need a fair transition, an equitable transition. I happen to remember back, new to Washington after being a consumer advocate, working for the Federal Energy Regulatory Commission, and later for a law firm here, that—the passage in 1978 of the National Energy Act. And the important thing I remember is that, at that point, 18 percent of the electricity of this country came from oil, and we said we must wean ourself from oil in energy independence in 1970 standards. We did do several things. First, we encouraged the building of coal plants in this country, and we encouraged the building of nuclear plants. The second thing we did is, we passed a law that prohibited the burning of natural gas. Few people remember that law being passed in 1978, but it was later repealed, as you know, in 1985, to allow us to use natural gas to generate electricity. But, the reality became—our mission in the 20th century was to provide universal access, affordable, and then, when Three Mile Island happened and we had Marble Hill in Indiana, we basically only had one way to provide generation 24-by-7, and that was coal. And so, many States, who had to meet the demand in the most affordable way, built coal plants, and that was just the reality of national policy. And I've taken the position, in many forums, that it would be unfair to punish that region of the country for carrying out the national policy of the 1970s, in terms of building coal plants, that we need a fair transition.

Now, let me make another point that really answers your question that I think is very important. Even—and this is the motivating point for all Hoosiers—first of all, we’re going to have to retire and replace all of our plants anyway. And so, we need to do that in a smart way with advanced technologies. That is just going to happen. And there’s a certain reality, even without carbon legislation, that process will drive prices up. And so, that is a certain inevitability that I’m unafraid to talk about, because we need to talk about it to be straight with the American people and with Hoosiers.

But, the second thing that I think is really important—and this is why I’m such an advocate for energy efficiency—between now and 2050, the world’s going to go from 6½ billion people to 9 billion people. There’s going to be a tremendous battle for scarce resources. I believe that the State or the country that’s the most energy efficient in the world are going to be the ones that have the highest probability of raising GDP per capita. And even without carbon concerns, I think we ought to be on that road, because of this battle over scarce resources.

So, when I add the retirement-and-replacement point and the need to—the battle over scarce resources, I combine those two facts, and then I look at the need to reduce our carbon footprint—all of that comes together, that says we need to act urgently, because we’re already in a period, I believe, where we’re beyond mitigation, we’re in a period of adaptation, and the only issue is what adaptation will occur and what the cost will be. The sooner we act, it reduces the probability that we have adaptation costs and issues in the future. And I know that if Sir Nicholas was here, he would—he has made that argument very persuasively, because the sooner that we act, it minimizes the adaptation, going forward.

So, from my standpoint, we do need to educate consumers. We feel like that’s an important role that we have. But, we also need to educate them to the—what the worldwide scientists are saying—to the inevitability of retirement and replacement, and to the need to be energy efficient, because that, over time, not just for us, but for our children and grandchildren, will assure that the—increase the probability that the GDP per capita for our consumers will grow if we’re the most efficient in the world.

Thank you very much.

Senator LUGAR. Thank you, sir.

The CHAIRMAN. Let me follow up on that, if I can. And thank you for your terrific answer.

I want to ask you a couple of toughies that get thrown at us by some folks around here as we struggle through this. Some people say, “Well, you know, the utility guys, yeah, they’re—they can be for it, because they’re going to get these big allowances, and it’s going to help them do exactly what you just described, and they’ll get a bunch of money in the pocket, but the other guys are going to get hit a little harder, because they don’t have the same capacity to grab the allowance, et cetera.” What do you say to that? I’m sure you’ve heard it.

Mr. ROGERS [laughing]. Yes, sir. Mr. Chairman, based on the way we’re regulated in the five seats we operate—Indiana, Ohio, Kentucky, and North and South Carolina—that these allowances,

they're the same way the CO₂ allowances—go directly to our customers. Directly. And I'm a CEO that would sign in blood that these go directly to our customers. And actually, I had a wonderful conversation with Larry Summers the other day, talking through this and the recognition that—of how regulated utilities work. It goes directly to the customers, particularly if you send it directly to the local distribution companies, because there are some States that have been deregulated, and in those States it still needs to go to the LDC, which is regulated by the State Commission.

So, I think the short answer is, no windfalls. And I think you can write that into the legislation. I'd be delighted to sign it, because I think that is one reality. So, in a sense of the word, I sit here today, not because this is going to affect my investors; I sit here today because it's going to have an adverse impact on my customers, which goes back to the very beginning of my career as an assistant attorney general fighting rate increases.

Because I see prices going up anyway, because our company spent \$5 billion retrofitting our plants for SO_x and NO_x coming out of the 1990 amendments, and we've been able to do that over time at a lower cost, as you suggested, can smooth out the impact on consumers, because of the way the allowance system worked.

The second thing is, is that we're building out Smart Grid. Smart Grid, we have in our budget, about \$1 billion over the next 5 years. That will drive prices up. But, the important thing about Smart Grid is, that will fundamentally transform several things. It will improve our reliability. It will improve our ability to do restoration after storms. It will reduce line loss. And probably, Mr. Chairman, most importantly, it will enable the next several generations of energy efficiency that many of us today can't imagine. My prediction is, we'll look back, 5 years from now or 10 years from now, and what we're doing for energy efficiency today will look very primitive with respect to what we will do then. And the Smart Grid is really the key to being able to enable that.

The CHAIRMAN. Good answer. And a direct answer. And I appreciate it.

Let me ask you another sort of question you hear and get asked. I think the record's important to build out, here. If coal-fired powerplants are such a danger—and I believe they are—any pulverized coal-fired powerplant that can't capture and sequester, today, is a problem—why are we not creating a greater crash project to build nuclear or some other—i.e., solar thermal, concentrated solar thermal or something else in Arizona, et cetera? I know you said you're doing solar, you're looking at wind, you're doing these other things so are you investigating how to scale this up? I would assume you're balancing that kind of thing as mightily as anybody in the business can.

Mr. ROGERS. Yes, sir. We're in a unique place. We're the third-largest generator of electricity from coal, but we're also the third-largest generator from nuclear. And we have proposed building a 2,200-megawatt nuclear plant in Cherokee County, SC, and we're actually exploring the possibility of a nuclear plant in the Midwest.

The reason that we are looking at nuclear, because we believe there will be a need for baseload generation—and, as I sit here today, the only technology that exists that provides power 24-by-

7 with zero greenhouse gas is nuclear—it will allow me to retire some of my coal plants. We have not retrofitted every one of our coal plants. Some are 40, 50, 60 years old. It didn't make economic sense to retrofit them for SO_x and NO_x. And, as I look at mountaintop mining, I look at ash ponds, I look at stricter—and I had an opportunity yesterday to meet with Administrator Lisa Jackson—

The CHAIRMAN. Yes.

Mr. ROGERS [continuing]. To talk about this.

The CHAIRMAN. Absolutely.

Mr. ROGERS. As I see this coming, I believe I need a program to retire, as soon as possible, without making incremental investments in, these old plants. So, from my standpoint, I believe that the only 24-by-7 product that I can build is nuclear, but I also believe—because we have 500 megawatts that we operate today, and 5,000 under development—wind will play a role. But, I'm actually coming to the belief—and I'm going to share this in a very careful way—that I think that solar will end up playing a much bigger role, because—for a variety of different reasons, and one reason is I'm on the Board of Advanced Materials in Santa Clara, which is really developing the manufacturing capability to really accelerate, in the same way they did for semiconductors, to reduce the cost. I believe solar will end up playing a much bigger role, at the end of the day, than wind.

And then when you start to—because it also provides a distributed generation option that wind doesn't, because wind—the transmission issues are immense, in terms of getting it from where the wind is to where the load is, and that's a long conversation in itself—but, the important point is, I think nuclear and wind and much cleaner coal—but, I think it's an open question.

And the last point I'll make—and I say this very carefully, and I present it to you as a work in process—but, I have come to believe addressing the spent-fuel issue for nuclear, with the cask system that we have today and with the process—the possibility of recycling, might prove to be easier to do and cheaper to do than sequestration of carbon, because of the—huge infrastructure will have to be built. And a Princeton scientist said it to me in a very direct way. He said, “If you look at all the spent fuel in America, you could put it on one football field, 7 feet high.” If—contrast that geography to the geography of hundreds and hundreds and hundreds of thousands of acres of storing carbon underground. As a guy who used to run natural gas storage fields with migration of gas and the other issues, I have some sense of some of the technical challenges associated with sequestration.

But, from a time standpoint, there's another dimension. As I talked to the scientists at MIT, they truly believe that we can advance the recycling technology that's been used in France successfully, where 75 percent of the electricity comes from nuclear, that we can do that in the next 25 to 50 years. And the current storage that we have in the cask system works. What we really need to do is pour money into the recycling. And, quite obviously, the proliferation issue is not the same today, when you recognize that over 30 nuclear plants are being built around the world, and not in the United States.

The CHAIRMAN. Well, that really sets the stage. I couldn't agree with you more. And I know it's a little heresy in some quarters to say it, but I wrote a book, a year and a half ago, with my wife, in which we dedicated a small amount of it to this issue, because it wasn't really about that, alone. But, I allowed—I mean, as a strong environmentalist and one who opposed nuclear, you know, 15, 20 years ago, when I thought we were going to come online faster with bigger alternatives. But I look at the predicament we're in today, and, if you accept the science that drives the notion that you have to do something about this—and I've said, many times, you can't be half pregnant on this—if you accept the science of global climate change, and accept the greenhouse, and accept that we're causing it, then you also have to listen very carefully to the scientists who tell you, "This is what's going to happen, X, Y, and Z," particularly when you measure all the science that's coming in today, all of which is coming in at a much faster rate and to a much higher quantity, telling us all the things they said were going to happen are happening. So, as a public policy, sort of, precautionary point of view, I think we have to respond to that. And I would far rather, particularly, as you've said—I mean, there are going to be nuclear plants built all around the world; none are safer than here, and none of the waste is safer than here. I would far rather do that than build a coal-fired powerplant right now. I don't think we ought to build another one until we know how to capture and sequester.

When people talk about "clean coal," I accept that. It's great. We can have clean coal, and we can burn it clear, terrific, because we have huge supplies, it's cheap. All of those arguments are real. But, I have to tell you, I don't know quite yet how we're going to do that.

Vinod Khosla, whom you know and I know, is pursuing an interesting new venture-capital effort that may be a game changer; it may show us how we can actually burn coal, take the CO₂, turn it into a product that you can then sell, and you win on both sides of the equation. More power to it. But, until we know we can do that and cleanly, we shouldn't be building more of them. And it seems to me that nuclear is an enormously obvious alternative, in the near term. Long term, I agree with you 100 percent. Solar, if I were in the private sector today, and I was doing this, I'd be racing down that solar road, because there's just no question in my mind of the numbers of places in the world where this is—I just came back from Jordan over the weekend. King Abdullah is exploring solar. I was interested to hear that—he's exploring it with several countries, and I asked him, "Is the U.S. in this game?" He said, "No." And he was a little surprised. And I'm surprised. We're not in the hunt for their solar project. We ought to be. We ought to be in the hunt for these projects all over the world.

So, the sooner we can do this, the better. You know, there are more places with more sun that have more ability to translate it into electricity in places that don't have it, where there's a huge market. That's what I meant by the \$6 trillion market. That's for today's users. There are a bunch of people out there who aren't today's users, but who want to be. And if you're talking about an electric-car market, you've got to find a way to supply electricity

that is going to power those cars and charge those batteries at night, and so forth.

Another point I'd make is, on the issue of the transmission, that's the second biggest piece of this. And we ought to be doing—and I think this is a debate we've got to get into quickly—it's absurd that, in the United States of America in 2009, you can produce electricity out in California, but you can't get it to other parts of the country. For instance, Texas has its own grid but it won't connect to New England. If you're going to produce solar or produce wind in these places, it's not 24–7. Therefore, No. 1 is that you've got to have some feed into that grid to make up for it; but, two, you've got to get it from here to there. I am told that the minute we deal with that issue, there's anywhere from \$150 to \$200 billion in the private sector waiting to rush in, that will engage in construction of facilities, because they now know they can get a return on the investment by appealing to a larger market.

So, my hope is that this will be the front—I mean, this ought to be the major debate, here. We ought to be grabbing this stuff and getting it done. And I do think the experience of Franklin Roosevelt and electricity is relevant, because—you know, they put it out there for about \$5 billion of cost in the 1930s. He made a fundamental policy decision: All of America has got to be connected. And within about 4 or 5 years, all of America was connected, and look at the difference that it made. This is not unlike the Internet or some other thing in the way. We've got to get it out there. And we're falling behind on that, too, because we haven't made the commitment to get broadband to all the parts of our country, so other countries are far more wired than we are, and their productivity goes up faster.

So, I think that this is all linked in a funny way, and your leadership, Mr. Rogers, is really critical, you and the rest of the USCAP folks, because you can validate this in ways that we elected officials just can't. You know, anybody who employs thousands of people, and pays the levels of taxes you do, and has the kind of annual revenues you do, has more ability, I think, to move minds here in these next months. So, we're going to call on you to do that, and I would hope we can rely on you to have Washington on your travel schedule, you know, a little bit over these next 5, 6 months, because you're going to be a key part of this.

Mr. ROGERS. Mr. Chairman, I appreciate that, and I will do that. But, may I drop a footnote to your last comment?

The CHAIRMAN. Of course.

Mr. ROGERS. Because I think it will add to the conversation.

First, in North Carolina we just got approval for us to invest to put solar on the rooftop, so when we look out, we see the rooftop of our customers as future plant sites. And so, we're going to be installing, operating, and dispatching, and learning to operate our grid reliably with solar on the rooftop. It's one of the first programs approved in the United States.

The CHAIRMAN. That's great.

Mr. ROGERS. The second thing that I would say, with transmission—and that's why I believe, at the end of the day, solar wins, versus wind—is because the only way you get transmission built in this country, to be—use a technical term, as a former law-

yer—you have to eminent domain, because—and, quite frankly, most people that want transmission built—I mean, want renewables, don't want eminent domain, because of the local pushback. So, I think we need to have a honest conversation about eminent domain, but also to look at what the ultimate cost is of moving power across the country.

And my last point—and I think this is one of the reasons that I'm here today, and it's in my testimony, but I want to underscore it, because I think this should be the clarion call to Congress, to the American people, to the future of our economy, and there's recent research that's done by Lazare, that says, of the world's top 10 solar, top 10 wind, and top 10 advanced battery manufacturing companies, only 5 of the 30 are American companies. We're losing out on an opportunity. And I think good, sound policy, that I know you all are working toward, is going to give us a running shot, because it isn't a question of leading, it's a question of catching up so that we can lead someday.

The CHAIRMAN. Boy, do I agree with that, and I quote, often, in some speeches lately, that, having founded the solar cell, as I mentioned earlier, of the top 10 solar companies in the world, we don't have one of them. And out of the top 30 alternative renewable, I think we only have 6. We only have 6 out of the 30. I mean, this is our economic future.

And I couldn't agree with you more, I testified, a year ago—I have legislation on the question of how you're going to put some of these pipes in, and so forth, for sequestration. It works, as you know, pretty well if you're in North Dakota or South Dakota or somewhere and you're near a particular plant. They're doing some enhanced oil recovery with natural carbon dioxide now. And you can do it. But, the fact is, boy, did I learn, in that hearing, as you listened to the various Senators and the questions that were asked, the morass of liability issues and of passage, rights-of-way, and easements and the—just the cost of the infrastructure—I have grown very, very skeptical and leery of joining in this grand chorus about geologic sequestration in far-off places. I think you can find some plants and put them right beside a place, and you may get some of it, but that is not going to be the silver bullet to this issue, because the cost of those pipelines and of those pipes and of that maintenance, as you just said, compared to that football field, it just—it's not going to take you where you need to go.

So, these are good things to be putting out on the table now, and I thank you for helping to do that today. We all need to do it. But, I hope—some of Senator Lugar's questions, I hope, have been answered, and we look forward to continuing this dialogue in a very constructive way over the course of the next months.

Thank you very much for being here.

Senator Lugar, do you have any more questions or any comments?

Senator LUGAR. I just would add to your compliment of our witness, Jim Rogers. He is uniquely in a position of being executive of a large power company and providing services to five States, as you pointed out, but, likewise, experienced enough with legislators here in Washington, as well as the rest of the other interest groups, to pragmatically try to weave together some source of for-

mula. So, by the time these formulas are woven together, the purists, idealists, whatever, find all of this to be one compromise that is just simply unconscionable after another. But, it's this kind of individual that conceivably can bring together a piece of work that, in our democracy, with all the complexities, and 50 States, and so forth, might happen.

So, I appreciate your enormous patience, as well as the intellectual grasp you have of all this; likewise, your understanding of working politicians who are dealing with constituents, as you are. Yours is customers, ours is voters, and so forth.

But, thanks so much for coming.

Mr. ROGERS. Thank you.

The CHAIRMAN. Sometimes they're the same. [Laughter]

Thanks so much. Appreciate it.

We stand adjourned.

[Whereupon, at 4:10 p.m., the hearing was adjourned.]

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

PREPARED STATEMENT SUBMITTED BY THE STAFF OF FRIENDS OF THE EARTH,
WASHINGTON, DC

INTRODUCTION

Chairman Kerry, Ranking Member Lugar, we ask that this written testimony be submitted into the record for the above-referenced hearing. Our comments concern reducing black carbon emissions from ships transiting Arctic waters.

BLACK CARBON EMISSIONS ARE EXACERBATING ARCTIC WARMING

Climate, change impacts are apparent in many areas around the globe but nowhere more so than in the Arctic, ground zero for warming, where winter temperatures have climbed 3–4 degrees Celsius over the past 50 years, and may rise another 4–7 degrees Celsius over the next century.¹ In addition to having well-documented public health effects² and accelerating the melting of Himalayan glaciers to the detriment of billions in South Asia,³ black carbon, the light-absorbing carbonaceous element of soot, can have profound effects on Arctic warming, and, in turn, global ramifications. Suspended black carbon particles not only heat the atmosphere by absorbing direct and reflected sunlight,⁴ but they also reduce the reflectivity of ice and snow, thereby increasing melting rates.⁵ As lighter colored snow and ice recede and are replaced by darker, more light-absorbing matter such as water and land, warming is accelerated in a dangerous feedback mechanism. Recent studies find that black carbon is responsible for almost half of Arctic warm-

¹ Arctic Climate Impact Assessment, "Impacts of a Warming Arctic," 10, 12 (2004), available at <http://amap.no/acia/>.

² J. Schwartz, Testimony to the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007.

³ Elisabeth Rosenthal, "Third-World Stove Soot is Target in Climate Fight," N.Y. Times, April 15, 2009, available at <http://www.nytimes.com/2009/04/16/science/earth/16degrees.html?scp=1&sq=Ramanathan%20black%20carbon&st=cse>.

⁴ The current estimate for black carbon forcing at the "top of the atmosphere" is as much as 60% of the current radiative forcing due to carbon dioxide's greenhouse gas effect. V. Ramanathan, "Role of Black Carbon on Global and Regional Climate Change," Testimony to the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007.

⁵ C. Zender, "Arctic Climate Effects of Black Carbon," Testimony to the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007.

ing,⁶ and that incomplete fossil fuel combustion, such as from marine vessel engines, constitutes a significant source of black carbon in this region.⁷

Many scientific experts assert that near-term black carbon mitigation efforts can limit warming and forestall cataclysmic “tipping point” events, such as permafrost melt and loss of the Greenland ice sheet and associated sea level rises.⁸ Additional derivative problems from Arctic-related warming that can be forestalled include prolonged droughts, altered weather patterns in the northern hemisphere,⁹ desertification, increased boreal wildfires,¹⁰ coastal erosion, and reduced glacial-fed freshwater resources in other parts of the world.¹¹ These issues threaten the environmental, economic, and national security interests of the United States and the international community. Secretary of State Clinton,¹² Nobel Prize Laureate Al Gore,¹³ and the Arctic Council¹⁴ have all recently noted how addressing short-lived¹⁵ climate forcers such as black carbon can slow Arctic warming. More specifically, one scientific expert even remarked during a 2007 congressional hearing that “[r]educing intra-Arctic [black carbon] emissions from generators and *marine vessels* will become increasingly important as industry and transport seek new opportunities in the thawing Arctic.”¹⁶

BLACK CARBON EMISSIONS FROM SHIPS: A GROWING PROBLEM

Ships accounted for 3.6 percent of black carbon emissions in the United States¹⁷ in 2002 and 1.7 percent of black carbon emissions in the world in 2000,¹⁸ and in 2004 released 1,180 tons of black carbon in or near the Arctic.¹⁹ Moreover, since 2004, shipping and attendant black carbon emissions have increased substantially.²⁰ With the Arctic continuing to warm at twice the rate of the rest of the world,²¹ and

⁶D. Shindell & G. Faluvegi, “Climate Response to Regional Radiative Forcing During the Twentieth Century,” 2 *Nature Geoscience* 294, 2009.

⁷D. Koch et al., “Global Impacts of Aerosols from Particular Source Regions and Sectors,” 112 *Journal of Geophysical Research* D02205, 2007; see M. Flanner et al., “Present-Day Climate Forcing and Response from Black Carbon in Snow,” 112 *Journal of Geophysical Research* D11202, 2007 (finding that over 80 percent of the forcing caused by black carbon on snow comes from black carbon from fossil fuels).

⁸E.g., Ramanathan, *supra* note 4.

⁹M.C. Serreze et al., “Perspectives on the Arctic’s Shrinking Sea-ice Cover,” 315 *Science* 1533, 1536 (2007).

¹⁰Arctic Climate Impact Assessment, “Arctic Climate Impact Assessment,” 840 (2005).

¹¹Rosenthal, *supra* note 3.

¹²Secretary of State Hilary Clinton, Remarks at The Joint Session of the Antarctic Treaty Consultative Meeting and the Arctic Council, 50th Anniversary of the Antarctic Treaty, Washington D.C., April 6, 2009, available at <http://www.state.gov/secretary/rm/2009a/04/121314.htm>.

¹³Arctic Council Conference on Melting Ice, Co-Chair’s Summary—“Melting Ice: Regional Dramas, Global Wake-Up Call,” Tromsø, Norway, April 28, 2009, available at <http://arctic-council.org/filearchive/summary.pdf>.

¹⁴Tromsø Declaration, 6th Ministerial Meeting of the Arctic Council, April 29, 2009, Tromsø, Norway, at <http://arcticcouncil.org/filearchive/FINAL%20DRAFT%20DECLARATION%2028%20APR%2009%20A4.pdf>.

¹⁵Generally black carbon aerosols stay aloft for less than one week. Reddy, M.S. and O. Boucher, “Climate Impact of Black Carbon Emitted from Energy Consumption in the World’s Regions,” 34 *Geophysical Research Letters* L11802, 2007.

¹⁶Zender, *supra* note 5, at 6 (emphasis added).

¹⁷W. Battye et al., “Methods for Improving Global Inventories of Black Carbon and Organic Carbon Particulates,” Report No. 68-D-98-046, Prepared for U.S. EPA by EC/R Inc., 2002, available at <http://www.epa.gov/ttn/chieff/conference/ei11/ghg/battye.pdf>.

¹⁸D. Lack et al., “Light Absorbing Carbon Emissions from Commercial Shipping,” 35 *Geophysical Research Letters* L13815, 2008.

¹⁹Arctic Council, “Arctic Marine Shipping Assessment 2009 Report,” 141 (2009), available at <http://arcticportal.org/en/pame/amsa-2009report> [hereinafter AMSA].

²⁰Dr. Lawson Brigham presentation at 8th Conference of Arctic Parliamentarians, Fairbanks, Alaska, August 12, 2008, cited by Treadwell M. & Wiepking T., “Why the Arctic Matters . . . America’s Responsibilities as an Arctic Nation,” Commonwealth North Study Report, at 22, April 2009, available at http://www.commonwealthnorth.org/index.cfm?fa=documents_overview&doctype=54.

²¹IPCC 2007, Observations: Surface and Atmospheric Climate Change, In: “Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report,” [Trenberth, K. et al, (eds.)], 237, available at: <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter3.pdf>.

the region's sea ice extent²² and thickness²³ decreasing dramatically, the fabled Northwest Passage and Northern Sea Route opened to traffic in the summer of 2008.²⁴ In the near term, shipping involving oil and gas in the Arctic, where nearly one quarter of the world's untapped hydrocarbon resources reside,²⁵ as well as shipping of minerals and timber, is likely to increase.²⁶ In the not-so-distant future, as sea ice melting accelerates, trans-Arctic shipping along the above-mentioned passages—as well as over the North Pole²⁷—will present attractive options for shippers as it could save many thousands of kilometers, and substantial fuel costs, on voyages between Asia and Europe.²⁸ In addition, destination cruise ship travel to the Arctic is exploding, and pushing further north.²⁹ In sum, approximately 3,000 marine vessels operated in the Arctic in 2004 alone,³⁰ and that number has likely increased in the following five years time as summer sea ice has continued to wane and the Northwest Passage and Northern Sea Route have opened up. These vessels present a significant, continuing, and growing black carbon threat to an already warming Arctic.

HOW THE UNITED STATES SHOULD PROCEED ON THIS ISSUE

Presently there are no national or International Maritime Organization (IMO) measures regulating black carbon emissions from ships in the Arctic. For instance, while the United States and Canada's recently submitted Emission Control Area (ECA) application to the IMO is a necessary and laudable action directed at lessening the public health and environmental impacts from ships in both countries, the ECA does not extend into the U.S. or Canadian Arctic, nor do its proposed measures target black carbon emissions.³¹

The IMO has the ability to create stringent particulate matter standards that decrease black carbon emissions as well as adopt ECAs which focus on black carbon particle reductions, similar to what has been done with respect to sulfur in Baltic and North Sea SECAs. Further, there are available ways to reduce black carbon emissions immediately that are cost-effective and practicable, through in-engine modifications (e.g., slide valves) and operations (e.g., reduced speeds). Moreover, the use of distillate fuel in ship engines, rather than heavy fuel oil, would facilitate the use of engine exhaust technologies such as particulate filters that decrease black carbon emissions.

We request that this Committee urge the U.S. IMO delegation, and in particular the U.S. EPA, to collaborate with IMO member nations, especially countries with territory in the Arctic, to (1) develop particulate matter/black carbon-specific ECA emission standards and adopt a black carbon (and also nitrogen oxide) Arctic ECA in the near term; (2) institute interim voluntary black carbon measures for ships operating in the Arctic immediately; and (3) support the development and enhance-

²²R.W. Lindsay & J. Zhang, "The Thinning of Arctic Sea Ice, 1988-2003: Have We Passed a Tipping Point?" 18 *Journal of Climate* 4879 (2005); J. Stroeve et al., "Arctic Sea Ice Extent Plummeted in 2007," 89 *Eos Trans. Amer. Geophys. Union* 13 (2008), available at <http://www.agu.org/pubs/crossref/2008/2008EO020001.shtml>; J. Richter-Menge et al., "Sea Ice Cover," in *Arctic Report Card 2008*, available at <http://www.arctic.noaa.gov/reportcard/seai.html> (in 2007, sea ice extent was thirty-nine percent lower than the long-term average from 1979 to 2000).

²³"Arctic is Seeing Thinner Sea Ice, Experts Warn," Associated Press, April 6, 2009, available at <http://www.msnbc.msn.com/id/30074699/>.

²⁴Andrew Revkin, "Arctic Ice Hints at Warming, Specialists Say," *N.Y. Times*, September 6, 2008, available at http://www.nytimes.com/2008/09/07/science/earth/07arctic.html?_r=4&scp=2&sq=northwest%20passage&st=cse&oref=slogin.

²⁵USGS Newsroom, "90 Billion Barrels of Oil and 1,670 Trillion Cubic Feet of Natural Gas Assessed in the Arctic," USGS, July 23, 2008, available at <http://www.usgs.gov/newsroom/article.asp?ID=1980>.

²⁶AMSA, *supra* note 19, at 76-77.

²⁷Scott Borgerson, "Sea Change: The Transformation of the Arctic," *The Atlantic*, 88-89, November 2008 (indicating that a voyage between Yokohama, Japan, and Rotterdam, Netherlands, over the North Pole, rather than through the Panama Canal, would reduce trip length by over 12,000 kilometers).

²⁸K. Wilson et al., "Shipping in the Canadian Arctic: Other Possible Climate Change Scenarios," *Geoscience and Remote Sensing Symposium, IGARSS '04 Proceedings*, September 2004, available at http://www.arctic.noaa.gov/detect/KW_IGARSS04_NWP.pdf.

²⁹Approximately 250 passenger ships operated in the Arctic in 2004. AMSA, *supra* note 19, at 71; see also M. Treadwell & T. Wiekping, *supra* note 20, at 22 (noting that, in 2008, 45 cruise ships, carrying 55,000 passengers, visited Greenland, up from 30 ships in 2007; and three different cruise ships voyaged through the Northwest Passage in the summer of 2007, while seven cruise ships with over 3,000 passengers visited the northern Bering Sea and Arctic Alaska waters in 2008).

³⁰AMSA, *supra* note 19, at 72.

³¹See U.S. EPA Web site, at <http://www.epa.gov/otaq/oceanvessels.htm>.

ment of technical and operational measures to control and reduce black carbon emissions from ships.

It is imperative that strong and effective measures to reduce black carbon be initiated now as shipping emissions are currently contributing to melting Arctic sea ice and snow, Arctic shipping is growing considerably, and adequate mitigation measures may take several years to implement. Neglecting the issue of black carbon emissions from Arctic shipping at this stage would risk exacerbating the speed and degree of climate change. We believe that the U.S. delegation should take a leading role at the IMO to immediately address Arctic black carbon emissions from ships.

We further request the Committee urge the U.S. IMO delegation to provide technical expertise and guidance in helping to strengthen and harmonize any black carbon-related efforts at the IMO with pending federal legislation (e.g., H.R. 1760) addressing black carbon emissions.

Thank you for the opportunity to provide these comments.

Sincerely,

JOHN KALTENSTEIN,
Clean Vessels Program Manager,
Friends of the Earth.

