TESTIMONY OF
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Introduction

Good morning, Chairman Bingaman, Ranking Member Domenici and Members of the Committee. My name is John Denniston and I am a Partner at the venture capital firm Kleiner Perkins Caufield & Byers. It's my privilege to be here today and to have the opportunity to share my views on moving advanced energy technologies to the marketplace.

Ensuring a sound energy future is one of the most urgent policy challenges facing our nation and indeed the global community, and I sincerely appreciate this Committee's leadership in this arena.

Along with the rest of America, venture capital and technology industry professionals – Republicans and Democrats alike -- are deeply concerned about the risks to our nation's welfare posed by our energy dilemma. Specifically, this includes the looming climate crisis, our oil addiction, and the very real danger of losing our global competitive edge. Yet our industry is also in a unique position to recognize that each challenge presents dramatic new opportunities to build our economy, creating jobs and prosperity.

Kleiner Perkins is a member of the National Venture Capital Association and a founding member of TechNet, a network of 200 CEOs of the nation's leading technology companies. I serve on TechNet's Green Technologies Task Force, which next week will release a detailed set of policy recommendations to drive the development and adoption of technologies we believe can help solve some of the world's most pressing energy and environmental problems. We refer to this emerging industry as "greentech," and for us, it includes clean power, transportation and water. We look forward to sharing that report with the Committee. My testimony today reflects my own views.

Based in California's Silicon Valley, and founded in 1972, Kleiner Perkins is one of America's oldest venture capital firms. We have funded more than 500 start-up companies over the years, backing entrepreneurs who have introduced innovative advances in such vital growth industries as information technology, medical products and services, and telecommunications. More than 170 of our companies have gone public, including Amazon.com, AOL, Compaq Computer, Electronic Arts, Genentech, Google, IDEC Pharmaceuticals, Intuit, Juniper Networks, Millenium Pharmaceuticals, Netscape, Sun Microsystems, Symantec, and VeriSign. Today, our portfolio companies collectively

employ more than 275,000 workers, generate $90 billion in annual revenue, and contribute more than $400 billion of market capitalization to our public equity markets.

Before joining Kleiner Perkins, I was a Managing Director at Salomon Smith Barney, where I served as the head of Technology Investment Banking for the Western United States. Prior to that, I was a Partner at the law firm Brobeck, Phleger & Harrison, where I was the head of its Venture Capital Practice Group.

In the 1990's, I served on the Board of Directors of a California-based fuel cell start-up firm. That experience opened my eyes to both the daunting energy challenges our country faces and the myriad opportunities we have to solve our problems through technology innovation.

You've asked me specifically to address the current market constraints to greater greentech investment, and what kinds of policies might accelerate market adoption of alternative energy solutions. Before I speak to that, I'd like to take just a few minutes to offer an overview of how I and many of my venture capital colleagues perceive the energy challenges and opportunities facing our country today.

The Challenges

I believe there is an unprecedented degree of consensus in America today as to our three main energy challenges: the climate crisis, our dependence on oil, and the risk of losing our global competitive edge by failing to champion new technologies that are becoming a huge new source of economic growth, jobs and prosperity.

The Climate Crisis

Just last month, the most recent report of the more than 2,000 scientist members of the Intergovernmental Panel on Climate Change warned us, once again, that the planet is warming, glaciers are melting and sea levels are rising. The panel concluded, with ninety percent certainty, that most of this warming is due to higher greenhouse gas concentrations in the atmosphere, most of which result from human fossil fuel emissions.

Many scientists predict we have only a short period of time to make dramatic cuts in our greenhouse gas emissions or risk irrevocably changing the climate. In fact, the IPCC report concludes temperatures and sea levels would continue to rise even if we were somehow able to immediately stabilize atmospheric concentrations. To date, we have failed to heed such warnings.

I want to note that in the venture-capital profession, we never make commitments without thorough research and consideration. Professionally and personally, I'm convinced, on the basis of exhaustive scientific evidence, we need to take bold action to solve our climate crisis. But wherever you stand on this issue, it's clear a lot of creative momentum is building in this country to seek solutions to global warming, including new collaboration between energy companies, civic groups and scientists, such as the United States Climate

Action Partnership (USCAP). This trend is promising not only for our environment, but for our national security and our economy.

Energy Security

As for our energy security dilemma, this Committee is well aware the U.S. imports about 30% of its overall energy needs, including approximately 60% of its oil. Rapid growth in worldwide energy demand has stretched supplies, tripling the price of both crude oil and natural gas. And there is a significant risk this trend will continue, as world population and energy demand increase.

Global Competitiveness

Finally, our future prosperity is at risk, and here I speak from very personal experience. Just in the past year, as I've traveled on business to China and Europe, I've witnessed how the rest of the world is striving, and often succeeding, to emulate the technology innovation that has been a hallmark of the U.S. economy and perhaps the single most important driver of our enviable standard of living. Increasingly, entrepreneurs overseas enjoy advantages in the form of determined government policies, including financial incentives and large investments in research and education.

Credible economic studies suggest our technology industries are responsible for roughly one-half of American GDP growth. Our country would look quite a bit different today had we not, several decades ago, become a global leader in biotechnology, computing, the Internet, medical devices, semiconductors, software and telecommunications.

Today, as our global energy challenges become ever more pressing, it's clear future economic growth throughout the world will depend to a great degree on new technologies to help us preserve our environment. Green energy technologies could very well become the economic engine of the 21st Century. Given its potentially massive market size, "greentech" could be the most powerful economic force of our lives. But will America again lead the way?

The Opportunities

Kleiner Perkins has been investing in the greentech field for the past seven years, backing more than 15 innovative companies in the fields of biofuels, coal gasification, energy efficiency, energy storage, fuel cells, solar energy, thermoelectrics and transportation. In the process, we've witnessed how technological progress is already revolutionizing our relationship with energy, solving problems that only recently seemed all but intractable. Solar manufacturers are innovating their way around silicon shortages, with next-generation materials including pioneering thin-film technologies. The agriculture industry is producing transportation fuels from plant matter – even from microscopic algae -- and is developing technologies so we can economically convert non-edible plants to biofuels. And nanotechnology breakthroughs are creating the promise of new ways to

store energy, which in turn could dramatically accelerate market adoption of solar and wind power.

At Kleiner Perkins, four accelerating trends have encouraged us to make greentech a core investment sector:

- The promise of exponential growth in the energy technology field. The rapid cost-reduction curve we are already witnessing will become ever steeper over time, making emerging sources of energy more and more competitive in the marketplace;

- Rising prices for fossil fuels – oil and natural gas – are making competing alternative energy sources more attractive;

- World class talent, with both missionary and monetary motives, is racing into the greentech sector;

- Americans are growing much more aware of and concerned by our energy crises, a development we believe will lend support to more sweeping policy solutions.

Moore's Law & The Pace of Technological Progress

In Silicon Valley, we often refer to a principle known as Moore's Law, which I'd like to explain briefly here, as it's fortunately quite relevant to what we see happening in the energy field. Intel co-founder Gordon Moore has been credited with predicting, back in the 1960s, that semiconductor performance would double every 24 months. That prediction was spot on, and helps explain the information technology revolution of the past three decades. Better, faster, and cheaper silicon chips led our transition from an era – remember, it was just 25 years ago! – of big, mainframe computers used principally by university researchers, to our capacity today to read the morning's headlines on our cell phones.

Today, we can already see a Moore's Law dynamic operating in the energy sector, giving us confidence the rate of greentech performance improvement and cost reduction will offer new energy solutions we can't even imagine right now. At Kleiner Perkins, we are excited by the technical breakthroughs we have seen in a host of scientific disciplines relating to the energy sectors, including material science, physics, electrical engineering, synthetic chemistry, and even biotechnology. We are particularly encouraged by innovations resulting from combining breakthroughs in several of these separate disciplines into single products.

Witness some of these examples of the greentech equivalent of Moore's Law:

- The price of wind power has plummeted by an order of magnitude since 1980, to the point where, in some regions, it is now very close to being able to compete with coal and gas power;

- Solar power costs have fallen by more than 60% over the past fifteen years;

- Ethanol production efficiencies per gallon have improved by more than 45% since 1982. Back then, state-of-the-art technologies produced a gallon of ethanol using 55,000 Btus with a capital cost of $2.25 per gallon of annual production capacity. Today, we can produce that same gallon of ethanol with nearly half the energy previously required, and at nearly half the cost.

These and other improvements have occurred over a period of time in which there was relatively little government policy or entrepreneurial focus on these sectors. Imagine what American ingenuity could accomplish in the future as more and more of our best and brightest devote their efforts to the greentech field.

But now I'll move on to speak specifically about my perspective on how government policy might encourage this emerging industry.

Barriers To Greater Investment and Market Adoption: The Five Faces of the Energy Market

The energy market is not monolithic. In fact, it comprises several distinct markets, each massive in scale and each with its own unique challenges and opportunities. These include energy generation, energy storage, transportation fuels, transportation, and energy efficiency.

Energy Generation

For the energy generation market, the high cost of new energy sources, relative to the incumbent competition, is the most serious barrier to greater capital investment and more rapid adoption of clean power. Why does green power cost more? Primarily because it's so new. Being new, it is still at the very early stages of its cost-reduction curve, and is presently being produced in such low volumes that the industry has yet to benefit from economies of scale. We can be certain American scientists and engineers will continually innovate to improve the performance and reduce the costs of these technologies going forward. But the speed at which they do so will depend to a large degree on government policy that is as bold and innovative as they are.

There's another way older power sources benefit from their longevity. Most coal-fired and natural-gas plants were constructed many years ago, and are now fully amortized. That means those facilities' owners no longer need to charge rate-payers for initial construction costs. Clean-power companies, in contrast, still need to include construction financing costs in their customer pricing, putting them at a major disadvantage.

On top of this, government policy to date has provided powerful advantages to fossil fuels and nuclear energy. In some cases, the federal government itself has paid directly for electrical generation facilities and transmission and distribution infrastructure. This

pattern of favorable public policy goes back many years, and it made sense in its time. But times, as we all know, have changed.

Beyond government subsidies, the fossil fuel industry has long benefited by escaping responsibility for the costs of the environmental consequences of its emissions – instead, society has paid the price. Clearly, traditional power sources would become much more expensive, and alternative sources of energy more cost-competitive, if plant owners had to take on the true costs of these emissions.

In the special case of nuclear power, the federal government has for many decades assumed enormous research and development, operating, waste disposal and containment costs, which if borne by nuclear plant operators would dramatically change the industry economics. As an example, private insurance companies are unwilling to insure nuclear power plants, which leaves the federal government as the insurer by default. The federal government has gone one step further with laws to specifically relieve nuclear plant operators of liability in case of accident. Further, the federal government has spent billions of dollars on nuclear waste disposal, and will need to continue to do so far into the future.

In view of the urgent threats we face to our environment and national security, public policy could, and should, level the playing field between old and emerging energy generation sources, and go further by driving the adoption of green technologies. There are indeed already several federal programs in place intended to encourage the adoption of renewable energy. Yet the incentives and benefits they provide pale in comparison to the advantages enjoyed by traditional energy sources, and have been inadequate in scope to meaningfully address the problems. In many cases, they are also of short duration, leading to a lack of predictability.

Energy Storage

Technical difficulty and the relative scarcity of investment opportunity are the two leading barriers to higher capital investment in the energy- storage sector. Energy storage has historically been a challenging technical field: essentially, scientists have to operate within the performance limitations provided by the periodic table of elements. Lead-acid batteries were first developed more than 150 years ago, and are still widely used.

Lithium-ion batteries alone have offered a significant jump in the amount of energy stored, yet still have safety and durability limitations. Until recently, we have seen only modest improvement in the performance characteristics of lithium-ion technology. It is important to note lithium-ion research and development has been dominated by Asian producers, leveraging off of their development of cells for consumer electronic applications. The number of U.S.-based electrochemistry experts is relatively small in comparison to U.S.-based expertise in other greentech fields, as a result of which there are not as many investment opportunities. Some of the investment opportunities in the field today involve basic research, whose particularly high risk makes it unattractive to most private investors.

Transportation Fuels

Private capital investment in the alternative fuels market increased significantly through the first three quarters of 2006, driven by excitement over ethanol's potential to address our oil dependence. However, these capital flows declined drastically in the fall of 2006, when in short order, crude oil prices plummeted from $78 per barrel to $49 per barrel, and corn prices skyrocketed from $2.50 per bushel to over $4 per bushel. The combination of higher feedstock costs and lower ethanol costs squeezed the profitability of the ethanol industry. As a result, the market capitalizations of public ethanol companies dropped dramatically, and these events had a similar ripple effect on private biofuels companies. I expect some of the publicly announced biofuels plants will not be completed on schedule, and others will not be completed at all.

In addition, gasoline has benefited from favorable public policy, including direct and indirect subsidies going back many decades, as well as from a free externality in the form of costly environmental emissions which are not reflected in the price of gasoline at the pump. The retail price of gasoline would increase meaningfully, and cleaner alternative fuels would become much more competitive, if the United States required gasoline to reflect the societal costs stemming from emissions.

Transportation

The market success of hybrid electric vehicles has produced heightened interest in high efficiency, low-cost vehicles. Most of the development work is taking place within the labs of major automobile companies. However, I expect several start-up automobile companies to introduce innovative vehicles in the coming years. Many hope the industry will be able eventually to produce commercially attractive plug-in electric vehicles in large volumes, although battery technology will need to improve considerably for that to become a reality, in my view. A relatively small percentage of automobiles sold in the United States today are flex fuel vehicles capable of being powered by gasoline or high blend ethanol ("E85"), in part because very few gas stations sell E85.

Energy Efficiency

In the case of buildings, we have today a range of available technologies for building systems and equipment, including improved lighting, windows, heating and cooling, and appliances. Collectively, these hold the promise of significantly improving building energy efficiency. Still other building-related innovations remain under development, including solid-state lighting, electrochromic windows, and solid-state refrigeration systems. However, the construction and building industries are among the most fragmented in the United States – no single company has the ability to drive efficiency into a meaningful portion of the market. In addition, many owners of existing buildings do not have the capital budgets to retrofit them to increase energy efficiency, even if the investment to do so is quickly recouped in the form of energy savings.

Key Policies To Drive Deployment

Federal policy can do a great deal to help advance clean technology in all five of the energy markets. These are some of the policy initiatives I urge Congress to implement:

1. **A Market-Based National Carbon Cap and Trade System**. A well-designed national cap-and-trade system could simultaneously address all three of America's energy-related crises: climate change, national security threats stemming from energy dependence, and the danger of losing American competitiveness. America had great success with such a system in the 1990s, when it was used to curb sulfur-dioxide emissions causing acid rain. The system would place a price on carbon, today a costly externality of our energy production and use, and reward companies for progress in adopting clean power. I urge Congress, in planning such a system, to assure that all credible green technology solutions have a shot at the market. It is impossible at this moment to predict which clean energy sources will have the most impressive Moore's Law-like properties in the future, and ultimately the lowest production costs. In addition, the cap and trade system should also include transportation fuels, as roughly 25% of U.S.-generated greenhouse gas emissions emanate from our transportation system.

2. **Renewable Portfolio Standard**. A cap-and-trade system is no guarantee, by itself, of solving our carbon problem. Even if adopted and signed into law, it may not require deep enough reductions in carbon emissions to solve the problem, or it may well encounter other problems in its implementation. A national renewable portfolio standard would insure against such problems by establishing minimum adoption levels of clean and renewable energy sources.

3. **Federal Incentives To Drive Clean Energy Development.** In my view, the federal government should dramatically expand financial incentives to drive the market adoption of green energy sources, with mechanisms including tax credits, subsidies, loan guarantees and other programs. Leading scientists tell us we need to have a national program of the urgency and scope of the Manhattan Project to stabilize our climate. Considering the added motivations of our national security threats and the U.S. competitiveness crisis, I believe such urgency and ambition is more than warranted. In addition, Congress should consider creating incentives for U.S. greentech companies to manufacture their products in this country. European and Asian countries offer incentives for U.S.-based companies to establish manufacturing operations overseas, in some cases including government payment of 40% of upfront capital costs and 15 year tax holidays. Loan guarantees may be an important part of this set of incentives, as long as they are structured to be attractive to lenders and to be available to both large and small projects.

4. **Federal Research Funding.** Our urgent need to ramp up government assistance to clean energy sources certainly also applies to research and development monies. Total federal research funding for renewable energy (excluding nuclear power) and energy efficiency amounts to less than $2 billion per year. Energy consumption and transportation account for roughly 15% of U.S. gross domestic product, which is approximately the size of the U.S. health care system. But research and development funding for new and necessary technologies is not by any means commensurate. By comparison, the NIH budget this year is around $28 billion. To oversee our federal energy research funding, I suggest Congress consider creating a new agency– you might call it the National Institute of Energy – to consolidate and rationalize federal energy research funding.

5. **Energy Efficiency.** The United States can make a significant dent in our energy challenges simply by making our energy system more efficient. Congress should strengthen CAFÉ standards, require energy efficiency standards for electronic equipment and appliances, and work with states to create energy efficiency standards for buildings. Congress should also evaluate how to work with utilities so their profit potential is driven as much by introducing energy efficiency as it is by selling power.

6. **Federal Procurement.** The Federal government is the single largest U.S. energy consumer. As such, it can lead our energy transition by becoming the single largest green-technology user. Congress could establish a deadline for federal agencies to meet minimum clean energy use requirements. In addition, Congress could require all new federal vehicles to be hybrid electric, electric or flex fuel vehicles.

7. **Biofuels.** Congress could take several steps to strengthen the rapidly emerging biofuels market. I recommend an increase in the Renewable Fuels Standard, consistent with President Bush's call to reduce gasoline consumption by 20 per cent over the next ten years. Another contribution would be to restructure the existing blender's credit so it is paid to ethanol producers rather than gasoline distributors, provides a credit level that is inversely related to the price of gasoline so as to create a safety net for ethanol producers in the case of a sudden drop in gasoline prices, and is made available to all alternative fuels, not just ethanol and specific molecular formulations of butanol. Finally, Congress should provide an additional subsidy for producers of biofuels from non-edible, and thus more sustainable, feedstocks; mandate flex fuel vehicles and E85 pumps; and create a fast-track approval process for energy crops.

8. **Batteries.** Congress should define a program for the objective analysis of rechargeable batteries, possibly using one of the U.S. national labs. The battery industry has been plagued by wild claims, most of which are compilations of one-off "best-of" single values. The industry would benefit from a standardized, scientific-based testing program.

Government Program Structures

To my mind, two main structural issues significantly impede the effectiveness of existing federal policies and programs in driving new technologies.

First, to drive the necessary level of private sector investment in new energy technologies, we need stable, long term and predictable incentives. I believe these incentives should be in place for a minimum of five years, and, ideally, longer. Existing tax credits, including the Production Tax Credit and Investment Tax Credit, have experienced lapses and short-term extensions. For example, the Investment Tax Credit, created by the 2005 Energy Policy Act, was scheduled to expire at the end of 2007 and was only recently extended through the end of 2008. Such uncertainty limits the capacity of incentives to support projects with long lead times.

Second, federal policy should not attempt to pick winners and losers. Federal tax incentive programs today frequently deter innovation by specifying a limited set of eligible technologies. For example, the Investment Tax Credit sets a cap on fuel cells that limits the credit's value in driving fuel cell development. None of us can predict which of these various technologies will have the lowest production costs in the future. We need to open up incentive programs to a wide range of promising technologies.

Once again, I want to thank the Committee for inviting me here today. I believe we all have an opportunity to be part of the solution to our country's energy crises. I look forward to today's hearing and to learning about how we can work together to build a more secure future.