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IMPROVING ENERGY EFFICIENCY THROUGH TECHNOLOGY AND COMMUNICATIONS

HEARING

BEFORE THE

SUBCOMMITTEE ON COMMUNICATIONS, TECHNOLOGY, AND THE INTERNET

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

FEBRUARY 23, 2010

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ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

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CONTENTS

WITNESSES

IMPROVING ENERGY EFFICIENCY THROUGH TECHNOLOGY AND COMMUNICATIONS

TUESDAY, FEBRUARY 23, 2010

U.S. SENATE,
SUBCOMMITTEE ON COMMUNICATIONS, TECHNOLOGY, AND THE INTERNET,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Subcommittee met, pursuant to notice, at 9:59 a.m. in room SR–253, Russell Senate Office Building, Hon. John F. Kerry, Chairman of the Subcommittee, presiding.

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

The CHAIRMAN. Hearing will come to order.

Good morning, everybody. Thank you so much for being here and coming to order without anybody asking you to.

I appreciate the fact that our Chief Technology Officer, Aneesh Chopra, has agreed to join into one panel. Normally we don't do that, but we have a competing Finance Committee hearing. And I'm very, very appreciative to you for doing that. And I thank the members of the Committee for being willing to do that.

We're holding this hearing to—I just came, actually, from a session, hosted by the *New Republic,* where we were talking about energy policy and climate change and so forth. And I think the world is beginning to realize—if you look at what China, India, Germany, Brazil, South Korea, and other countries are doing, they are racing to the marketplace rapidly with new technologies, new approaches to energy savings, energy production, and economic growth, which comes out of it. And probably there has never been a more important time to do this, because energy independence has remained an elusive goal for the United States, as critical as it is, and as much as the American people want us to achieve it. And believe me, they do. It polls off the charts, in terms of a goal for Americans.

The companies represented here today are, each of them, companies with vision. They're making so-called "smart devices," which increase people's productivity. And they're making any number of different types of things—chips that allow machines to communicate with one another; they're involved in startups that are thinking about how you help homeowners to manage energy, save money as a result—and there are many ways to lower the household expenditure and retain money in the pockets of Americans.

We're also going to hear, as I mentioned, not just from the companies, but from Aneesh Chopra, who is our Nation's Chief Tech-

nology Officer. And he is going to share with us what the government is doing to help innovators bring new technologies to the marketplace. And so, again, I appreciate everybody, sort of, joining into the one panel.

We're also going to examine the innovation stemming from a hearing that the FCC held a few months ago at MIT on the relationship between broadband and smart grid technologies. Those who follow communications policy know that—as well as technology policy—know that the FCC is scheduled to release the national broadband plan next month. When I ran for President in 2004, I called for a universal, affordable, accessible broadband infrastructure. And I regret that it has taken us so long to, sort of—you know, it's now, what, 6 years later, and we're still, sort of, only talking about it.

I very much look forward to evaluating the roadmap that the FCC is going to produce toward that end. And early indications are that they're going to set bold goals for itself, for the industry, for Congress. And I encourage the FCC to do so.

Experts estimate that the information and communications technology industry is responsible for as much as 2.5 percent of the national carbon dioxide emissions in the United States, and that will grow as the ICT industry grows. But, the services that the industry provides, and the way that a lot of firms manage their own energy use, can help the other 98 percent of the economy dramatically reduce carbon emissions. And modernizing our infrastructure, getting broad operating standards, and establishing market incentives, are the keys to success for the country.

So, I appreciate the panel.

Mr. Chopra is the assistant to the President, the Chief Technology Officer in the White House, of Science and Technology Policy. He was named to the Government Technology Magazine's top 25 in their "Doers, Dreamers, and Drivers" issue in 2008. We like that. And doers are exactly what we need right now.

So, congratulations, and welcome.

I look forward, particularly, to hearing from him on how smart grid standards are going to accelerate the adoption of technologies that will allow us to maximize our efficient use of energy.

Dan Hesse, is the CEO of Sprint. It's rare that we have the CEO of a major corporation testify at a subcommittee hearing, and I'm very grateful to him for doing that. I think it speaks volumes about his commitment to this vision and the issue. The measurable goals for carbon reduction that he is setting for his firm is exactly the kind of leadership that we need across the board. And he's proving that you can be environmentally sound and also do good business as you do it.

In addition, we have Adrian Tuck, the CEO of a cutting-edge tech startup called Tendril; Kathrin Winkler, the CSO of EMC, a global information management business leader headquartered, I'm proud to say, in Massachusetts; and Lorie Wigle, the Director of Intel's Eco-Technology Program office.

So, thank you, all of you, for joining us today. We're very appreciative.

The Ranking Member is not here, I don't know if any of our other Senators have openings they wanted to make, or we just go right to the——

Senator Brownback?

STATEMENT OF HON. SAM BROWNBACK, U.S. SENATOR FROM KANSAS

Senator BROWNBACK. If I could, I'd like to welcome a Kansan, Mr. Hesse, the CEO of Sprint. I really appreciate him and the very dynamic, good, aggressive company, doing a great job and great leadership. I'm glad you're here, and I'm glad you're going to be participating. I look forward to what you have to say and what we can learn from the panel.

The CHAIRMAN. Thank you, Senator.

Senator BROWNBACK. Thank you, Chairman.

The CHAIRMAN. Mr. Chopra, if you'd begin. And we'll just run right across the panel.

Thank you, sir.

STATEMENT OF HON. ANEESH CHOPRA, CHIEF TECHNOLOGY OFFICER AND ASSOCIATE DIRECTOR FOR TECHNOLOGY, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES

Mr. CHOPRA. Thank you——

The CHAIRMAN. If you could all summarize, without objection, your full testimonies will be placed in the record as if read in full, and that will give us more time to have a discussion. Thanks.

Mr. CHOPRA. Thank you very much, Mr. Chairman, for the invitation—and Senators. It's an honor and a privilege to join you today to discuss the role of technology and energy efficiency.

Last September, the President unveiled his strategy for American innovation, which was focused on sustainable growth and quality jobs. He noted in that presentation that in no area will innovation be more important than in the development of new ways to produce, use, and save energy; that the Nation that leads the clean energy economy will be the Nation that leads the global economy. In my capacity, as Chief Technology Officer, I'm focused on the power and potential of technology, data, and innovation to transform the Nation's economy and to improve the lives of everyday Americans. That means, frankly, an economy where energy use is cleaner and more economical.

Today's hearing is focused on an important lever to modernize the electric grid, to make our homes and businesses more energy efficient. According to a recent report by the National Academies, aggressive efforts in the building, transportation, and industrial sectors could enable the United States, by the year 2030, to reduce energy use 30 percent below the level of the U.S. energy use in 1990 while saving consumers and businesses hard-earned money.

To realize these benefits, I am focused, and will share today, three opportunities to accelerate progress in energy efficiency. Those three areas are smart grid technologies, to your point; open data systems that benefit consumers; and the work we're doing in research and development for next-generation buildings.

So, a word on each:

First, on smart grid technologies. The Department of Energy Smart Grid Investment Grant Program funded by the Recovery Act is accelerating the deployment of smart meters and other components of an advanced electrical grid. NIST, the National Institute of Standards and Technology, is leading a public-private effort to develop a core set of smart grid standards. The National Science Foundation supports leading-edge research in smart grid technology, primarily through their Engineering Research Center programs. An important goal of this effort is the widespread availability of energy saving choices for consumers that will increase reliability, reduce environmental emissions, and foster the growth of renewable energy.

Related to that, today marks the opening of a new program to help us understand the role of standards in the topic of energy efficiency. On behalf of the President's Open Government Program, we are, today, launching a Smart Grid Forum, an online vehicle hosted at the National Institute of Standards and Technology website. The goal of the Smart Grid Forum is to engage all Americans in a conversation on how energy consumers can participate in the effort to spur innovation both in smart grid products and services.

Very specifically, our goal is to encourage smart grid solutions that provide all consumers with the information and services they need to efficiently manage their energy consumption, that integrate well with existing or new information and entertainment systems, and that can be widely deployed at low cost. A robust, secure, and flexible architecture based on open standards is needed for information exchange between the home and the smart grid. These systems need to ensure cybersecurity while enabling broad participation among diverse consumers.

Mr. Chairman, this smart grid forum, we believe, will help invite the American people to decide how and in what manner they can balance all of these goals. Our obvious intention is for everyone to participate.

In addition, we are focused on next-generation research and development programs. In my capacity as the Chair of the National Science and Technology Council's Committee on Technology, I'm working very closely with about 16 Federal agencies to design the future, today. What does a "net-zero" building look like, and how might we learn from those research activities to commercialize them in real estate throughout the United States?

And in that regard, I'm pleased to announce that, just a week ago, the Federal agencies associated with energy usage—not just the Department of Energy, but the National Science Foundation and others—have joined forces in the first regional innovation cluster grant program—we call it E–RIC, the Energy Regional Innovation Cluster—of—making available over $130 million over the next 5 years to create a regional research center of excellence that focuses on buildings' efficiencies, but looks at startup opportunities and areas in which we can unleash the value and the power of this information into the hands of the American consumer.

In closing, Mr. Chairman, I'm pleased to report that the President has called on us to take action and leadership. While a number of these initiatives will take time to deliver the results, in signing the Executive Order 13514 on Federal sustainability, he's di-

rected each Federal agency to achieve—to present their plans and goals and milestones for a detailed implementation plan on driving energy efficiency. I'm pleased that a good component of that will be areas like telework, where people can use technology today to reduce their reliance on carbon emissions, with respect to car travel, and so forth. And we'll see more of that in the years to come.

Again, thank you, Mr. Chairman, for the opportunity. I look forward to your questions.

[The prepared statement of Mr. Chopra follows:]

PREPARED STATEMENT OF HON. ANEESH CHOPRA, CHIEF TECHNOLOGY OFFICER AND ASSOCIATE DIRECTOR FOR TECHNOLOGY, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES

Chairman Kerry, Senator Ensign, and Members of the Committee, it is an honor to appear before you today to discuss the role of technology in advancing energy efficiency.

In my capacity as Assistant to the President, Chief Technology Officer, and Associate Director for Technology in the Office of Science and Technology Policy, my mission is to harness the power and potential of technology, data, and innovation to transform the Nation's economy and to improve the lives of everyday Americans. The Administration envisions an economy in which jobs are more plentiful, American firms are more competitive, Americans are more safe and secure, and energy use is cleaner and more economical.

In order to achieve our energy and environmental goals, we must fully leverage the commercially attractive energy efficiency opportunities that already exist while accelerating development and deployment of next-generation technologies. While the Nation's energy use per dollar of gross domestic product has been cut in half since 1973—and about 70 percent of that improvement has come from gains in energy efficiency—much more progress is needed.

Energy supplies are limited, energy demands continue to grow, and global emissions from fossil fuel combustion imperil the planet that we will leave to future generations. That's why the Recovery Act that we passed 1 year ago commits about $90 billion to clean energy. A large portion of this funding is being used to modernize the electric grid, to make our homes and businesses more energy efficient, and to double our capacity to generate renewable electricity. These investments not only contribute to economic recovery; they also lay a new foundation for lasting prosperity.

Broad-based deployment of energy efficiency practices and technologies will yield great benefits to the Nation. According to a recent National Academies report, aggressive efforts in the buildings, transportation, and industrial sectors could enable the United States by 2030 to reduce its energy use by 30 percent—below the level of U.S. energy use in 1990—while saving money.

To help realize these benefits, the Administration has stepped up its leadership on energy efficiency through high-level policy actions, public-private partnerships, and research initiatives to develop next-generation efficiency technologies. In this context, I am focused on three opportunities to accelerate progress in energy efficiency: smart grid technologies, open data systems that benefit consumers, and research on next-generation buildings.

Smart Grid Technologies

Modernization of the Nation's electric grid is a vital component of the President's comprehensive energy plan. The "smart grid" will help provide consumers with the information, automation, and tools they need to control and optimize energy use. The tools and services enabled by the smart grid will improve the reliability, security, and efficiency of the electric grid. Smart grid technologies can facilitate energy generation from clean energy supplies and enable more effective integration with the electricity delivery system of renewable energy sources, demand response resources, and plug-in electric vehicles.

The Department of Energy (DOE) Smart Grid Investment Grant program, funded by the Recovery Act, is accelerating deployment of smart meters and other components of an advanced electric grid. The National Institute of Standards and Technology (NIST) is leading a public-private effort to develop a core set of smart grid standards. The National Science Foundation supports leading edge research in smart grid technology primarily through their Engineering Research Centers Program. An important goal of our efforts on the smart grid is the widespread avail-

ability of energy-saving choices for consumers that will increase reliability, reduce environmental emissions, and foster the growth of renewable energy.

Open Government

In December, OMB Director Peter Orszag published the President's Open Government Directive to hardwire accountability, access, and public participation into government operations, reflecting a set of recommendations that my office culled directly from the American people during the summer of 2009. We are working with the DOE, NIST, and other Federal agencies to apply these principles of openness and incentives for innovation to the arena of the smart grid.

As one step in our efforts to increase the government's participation and collaboration with the public, *today we are launching the Smart Grid Forum*, a public online forum on the future of the smart grid and what it will mean for consumers, including how to encourage innovation in smart grid products and services.

We seek to encourage smart grid solutions that provide all consumers with the information and services they need to efficiently manage their energy consumption, that integrate well with existing or new information and entertainment systems, and that can be widely deployed at low cost. A robust, secure, and flexible architecture based on open standards is needed for information exchange between the home and the smart grid. These systems need to ensure cyber security while enabling broad participation among diverse consumers. Through the Smart Grid Forum, we are inviting the public to provide input on how to achieve these goals most effectively. I encourage everyone to participate.

Buildings Energy Efficiency

In the United States, buildings consume 40 percent of end-use energy and over 70 percent of electricity, while contributing nearly 40 percent of carbon emissions. Energy consumption in the commercial buildings sector alone rose by 70 percent over the 25 year period ending in 2005 (largely because of the increase in commercial building stock over that time period). U.S. buildings contribute more than 9 percent of world CO_2 emissions, more than the total emissions of the United Kingdom, France, and Japan combined. Clearly, buildings are essential to achieving our national energy and environmental goals.

One of our efforts to accelerate technology's role in promoting energy efficiency is to develop net-zero energy buildings, which consume no more energy than they use from renewable sources. We also focus on building designs and technologies that can meet other sustainability objectives, such as using recycled building materials, implementing smart data center designs, reducing water use, or ensuring indoor occupant health and safety.

I currently serve as the Co-Chair of the National Science and Technology Council (NSTC) Committee on Technology, which includes a Buildings Technology R&D Subcommittee. With sixteen Federal agencies represented, this group promotes the development and deployment of cost-effective net-zero energy building technologies, including sensors, software tools, and advanced heating, ventilation, and air conditioning technologies. The group collaborates with two major DOE initiatives—the Building Systems Innovation Hub and ARPA–E—on these and other research priorities. We are working with public and private stakeholders to integrate these technologies and principles into future building designs, investments, and codes and standards.

We are committed to partnering with local and regional stakeholders to develop and deploy these technologies. On Feb. 12, seven Federal agencies issued a combined Funding Opportunity Announcement of up to $129.7 million over 5 years to create a regional research center. This Energy Regional Innovation Cluster (E–RIC), which includes the DOE Building Systems Innovation Hub as an integral component, will develop new building efficiency technologies, work with local partners to implement advanced technologies in area buildings, and promote regional growth. This is our first demonstration of collaboration to pursue economic growth through clusters. By bringing together synergistic Federal programs, we are proactively encouraging collaboration amongst stakeholders at the regional level to bring the benefits of these technologies to spur new business and job creation, and to align education and workforce training with new business opportunities that may spin out of the E–RIC.

The National Science Foundation (NSF), with support from DOE and EPA, is investing as much as $20 million in an Fiscal Year Emerging Frontier and Research Innovation program to understand the fundamental science and engineering needed for next-generation energy and materials technologies for future building systems.

Private-sector innovation, often spurred by public policy and incentives such as the cost-shared R&D grants provided by the DOE's Energy Efficiency and Renew-

able Energy programs, has led to major strides in energy-efficient and cost-effective technologies for lighting, heating, cooling, refrigeration, computing, and other basic services that drive energy demand in residential buildings and commercial facilities. Hundreds of commercially feasible and demonstrated technologies, some already available and others just beginning to enter the market, could, in total, lead to huge improvements in energy efficiency.

As just one example, public and private collaborations have identified numerous cost-effective opportunities to improve the efficiency of IT data centers, which represent a small but rapidly growing portion of U.S. energy consumption. The Save Energy Now program at the DOE's Office of Energy Efficiency and Renewable Energy is one example of this collaboration, aiming to reduce energy use in U.S. data centers by 10 percent by 2011.

Federal Leadership

The Administration has taken strong action to spur efficiency gains within Federal agencies. The Federal Government is the single largest user of energy in the Nation, representing 1.6 percent of U.S. total consumption and costing taxpayers about $25 billion in Fiscal Year 7. Of this amount, over $7 billion was spent on energy to operate the 500,000 buildings that the Federal Government currently owns, operates, and leases in the United States.

To ensure that the government leads by example and makes the best use of taxpayer dollars, last October President Obama issued Executive Order 13514 on Federal Sustainability, requiring each agency to establish goals, milestones, and a detailed implementation plan across a range of sustainability metrics. Subsequently, in January, the President announced that the Federal Government will reduce its greenhouse gas pollution from non-National security mission critical activities by 28 percent by 2020, yielding a projected $8 to $11 billion in cumulative avoided energy costs through 2020. A significant portion of these reductions will be obtained through Federal building efficiency measures and on-site renewable energy. As part of the Executive Order implementation, each agency will be graded on how well it is meeting its performance targets. These annual "scorecards" will be publicly posted online.

Data centers represent an area where there is significant opportunity to achieve energy savings. Over the past decade, we have seen a large increase in the number of Federal data centers. In 1998, there were 432 Federal data centers; today, there are 1,101. This growth has driven increases in the total power requirements and consumption of these facilities. According to DOE, in 2006, data centers accounted for 1.5 percent of all electricity use in the United States, double the corresponding amount in 2000. If current trends continue, future data center energy consumption will grow exponentially, increasing both the costs to the Federal Government and challenges to the reliability of electrical supplies.

We have the opportunity to do better with existing technologies. As one example, the U.S. Postal Service eliminated over 88 percent of its physical servers—from 895 to 104—and reduced power consumption by 3.5 million kilowatt hours. When I served as Virginia's Secretary of Technology, we undertook a similar effort—generating $12 million annually in savings as the result of a 35-percent reduction in energy use. To ensure that these savings can be achieved across the entire government, the Federal Chief Information Officer, Vivek Kundra, has undertaken a significant data center consolidation effort. Adoption of a cloud computing model—by which I mean, for purposes of today's discussion, providing useful online services through efficient, shared, and consolidated infrastructure—is a major part of this strategy.

Another area where the Administration is looking to lead by example is in promoting telework. As the recent snow storms in Washington, DC demonstrated, the ability to telework can help keep the government functioning when Federal workers are unable to get to work. Telework is not only important during emergencies but also as a way to reduce energy consumption as employees depend less on modes of transportation powered by fossil fuels. Last year, the White House held an online forum seeking ways for the Federal Government to be more energy efficient; telework filled the online suggestion box. Under the leadership of Director John Berry, the Office of Personnel Management will be hosting a forum next month to examine ways for the government to incorporate telework more and to address technology and other challenges to telework.

Innovation Strategy

The Federal Government also leads by investing in the building blocks that only the government can provide, setting an open and competitive environment for businesses and individuals to experiment and grow, and by providing extra catalysts to

jumpstart innovation in sectors of national importance. In this way, we can harness the inherent ingenuity of the American people and a dynamic private sector to generate innovations.

In September 2009, as part of his Strategy for American Innovation, the President called for a set of "grand challenges" to improve our quality of life and serve as the foundation for the jobs of future. Such challenges could include net-zero energy homes and solar cells as cheap as paint. We intend to fully harness the power and potential of technology and innovation to advance a set of challenges.

Another critical component of innovation in energy efficiency is workforce development. Thus the Fiscal Year DOE budget includes $55 million for the RE–ENERGYSE program—or REgaining our ENERGY Science and Engineering Edge—a partnership with the NSF for clean energy education and training. These opportunities include undergraduate and graduate scholarships and fellowships, internships, and post-doctoral opportunities as well as technical training at community colleges, and new K–12 education and outreach efforts.

In conclusion, under President Obama's leadership in calling for a government that works, we are focused on the transformative power of technology and innovation to deliver economic and environmental benefits through improved energy efficiency in buildings and by enabling smarter use of energy by consumers.

I welcome any questions that the Committee may have.

The CHAIRMAN. Thank you, Mr. Chopra, appreciate it.

Mr. Hesse.

STATEMENT OF DANIEL R. HESSE, CHIEF EXECUTIVE OFFICER, SPRINT NEXTEL CORPORATION

Mr. HESSE. Good morning, Chairman Kerry and Members of the Subcommittee.

I'm Dan Hesse, the CEO of Sprint Nextel Corporation. Thanks for the opportunity to testify about how the progressive environmental path Sprint is forging is challenging the technology industry to create a greener, more sustainable future.

Our country has been transformed by numerous periods of historic and evolutionary change, from the Industrial Revolution to the dot-com bubble in the age of the Internet. Today, we are in the midst of a new green era. Today's U.S. consumer and members of this legislative body are sending a call to action to corporations to act in the best interests of our people and our planet. Sprint is proud to embrace this opportunity as we make environmental responsibility a cornerstone of our company.

In my capacity as the Sprint CEO, let me take this opportunity to highlight just how seriously Sprint is heeding the call. In 2008 Sprint established, and publicly announced, a set of 10-year environmental goals, including securing 10 percent of Sprint's commercial energy use from use from renewable sources by 2017; reducing greenhouse gas emission by 15 percent; achieving a wireless device collection rate of 90 percent, as compared to device sales; ensuring that at least 90 percent, based upon spend, of all Sprint suppliers comply with environmental standards; reusing or recycling 95 percent of Sprint's network NIT waste.

We are making significant progress toward achieving our goals. Sprint achieved a 6.8-percent greenhouse gas reduction in 2008, and we expect a further improvement when we see our results this year, for 2009.

Sprint was awarded a $7.3-million grant from the U.S. Department of Energy as part of the American Recovery and Reinvestment Act funding for fuel cell technology. This grant will allow Sprint to extend the unassisted runtime from 15 hours currently,

in deployed fuel cells at cell sites, to 72 hours. Sprint possesses, or has filed, 47 patents in green technology areas, and we have 15 issued patents for hydrogen fuel cell technologies which emit no greenhouse gases.

Sprint expanded its commitment to green power use, announcing an agreement, with Kansas City Power and Light, that facilitated the building of a local Kansas-based wind farm. As part of this agreement, Sprint agreed to purchase, from Kansas City Power and Light, 87 million kilowatt hours per year, providing 80 percent of the power needed to run our 200-acre Overland Park, Kansas, headquarters. Sprint recently partnered with Samsung to launch the Reclaim, which you have here, an eco-friendly, full-featured wireless device that is 80-percent recyclable, with components made partly from biodegradable plastic sourced from corn. The Reclaim has been a market success and is the most technologically advanced eco-friendly device currently available in the U.S.

As a result, over the last year, Sprint has earned numerous industry awards and accolades for our leadership in the green space. Sprint ranked 15th overall, and was the only telecom company listed in a top 100 in *Newsweek's* green rankings. Sprint also scored highest among U.S.-based wireless companies on the Carbon Disclosure Project's 2009 Global 500 Report on Carbon Disclosure.

At Sprint, the innovations we pursue and the new environmental programs in which we engage are both transparent and accountable. Experience has taught us that collective action, working cooperatively with handset manufacturers, nongovernmental organizations, and government agencies, helps to quickly and broadly establish common standards for better environmental performance. Today, I'm proud to announce that Sprint is the first U.S. wireless carrier to establish a set of green design criteria for consumer devices.

Moving forward, every handset vendor who manufactures handsets to operate on Sprint's networks must produce handsets that meet or exceed Sprint's new design—green design criteria and specs. The green design criteria and specifications supports Sprint's product development vision, which is to provide devices and accessories for our customers that are made of sustainable materials; manufactured and packaged sustainably; free of potentially hazardous materials; highly energy efficient, or even self-charging; compatible with interoperable accessories; and fully and easily recyclable.

Working in partnership with our handset manufacturers, Sprint has developed an industry-first environmental scorecard to bolster progress toward Sprint's green design specifications. The criteria in the scorecard better enables Sprint and our vendors to gauge the degree to which each handset manufacturer complies with our environmental standards. These handset manufacturers include Samsung, HTC, LG, Motorola, Palm, RIM, and Sanyo. Handsets will be measured according to the following scorecard categories: environmentally sensitive materials, end-of-life management, sustainable packaging, energy efficiency, and innovation.

We hope that by collaborating proactively with our handset vendors, we will encourage the entire wireless industry to develop new, innovative, greener handsets for consumers. Designing greener

handsets is crucial for our industry and is also part of our larger goal to ensure that wireless devices do not end up in landfills. According to recent statistics from the EPA, only 10 percent of cell phones are recycled each year in the U.S. Americans annually dispose of 140 million old or unused cell phones and send 65,000 tons of e-waste to landfills. While 40 to 50 percent of Americans recycle common materials, the truth about e-cycling, or the reuse of—or recycling of electronic goods is that many consumers just don't.

The implication of low e-cycling rates is significant. Many of these electronics contain valuable metals, such as gold and silver, that could be recycled into jewelry, electronics, lawn furniture, car parts, plastic containers, and more. A great example of an innovative use of these reclaimed materials from electronics can be seen in Vancouver, where this year's athletes are receiving gold, silver, and bronze Olympic medals that contain materials reclaimed from end-of-life electronics.

A recent ABI research report found that, of 1,000 people surveyed, 98 percent were prepared to return handsets to an operator store, to a charity, to a refurbishing company, or to the manufacturer, but only in return for some compensation—either cash, store credit, or a tax deduction.

Sprint has been at the forefront of recycling efforts in the wireless industry. In 2008, we made a public commitment to achieve a wireless reuse and recycling rate of 90 percent, as compared to our device sales. Our current wireless rate, at the end of 2009, was just over 40 percent, well ahead of the industry average. We accept all phones for recycling or reuse, regardless of which wireless carrier or who the customer may have bought the phone from. Since 2001, Sprint has collected more than 19 million devices for wireless reuse and recycling.

Today, we are announcing the launch of a new vastly expanded wireless handset buyback program that offers a financial incentive in the form of an instant account credit to current and new Sprint customers, who can turn in up to three eligible wireless devices. Sprint's new expanded buyback program accepts all eligible wireless devices, regardless of the manufacturer or the carrier. Through this new buyback program, currently—current or new Sprint customers can go to one of more than 1,000 Sprint-owned retail stores nationwide, or go online, to convert any eligible old Sprint, Verizon, AT&T, or T-Mobil network phone into an instant account credit.

Thank you for holding this hearing today to highlight how the U.S. wireless industry can take our environmental responsibilities even more seriously. And I'm happy to answer any questions you may have later.

Thank you.

[The prepared statement of Mr. Hesse follows:]

PREPARED STATEMENT OF DANIEL R. HESSE, CHIEF EXECUTIVE OFFICER, SPRINT NEXTEL CORPORATION

Introduction

Good Morning, Chairman Kerry, Ranking Member Ensign and members of the Subcommittee. I am Dan Hesse, CEO of Sprint Nextel Corporation. Thank you for the opportunity to testify about how the progressive environmental path Sprint is forging is challenging the technology industry to create a greener, more sustainable future.

Our country has been transformed by numerous periods of historic and evolutionary change—from the Industrial Revolution to the dot-com bubble and the Age of the Internet. Today, we are in the midst of a new "green" era. Today's U.S. consumer and the members of this legislative body are sending a "call to action" to corporations to act in the best interests of our people and our planet. Sprint is proud to embrace this opportunity as we make environmental responsibility a cornerstone of our company.

As a result, over the last year, Sprint has received numerous industry awards and accolades; however, perhaps the one I am most proud of is our recent #15 ranking on *Newsweek's* 2009 Green Rankings of top 500 U.S. Corporations, the only U.S. telecom company listed in the top 100. Accolades such as *Newsweek's* Green Rankings are important; however, organizations need to continue to achieve tangible environmental progress toward measurable sustainability objectives. Research supports that the best business strategies effectively target the environmentally conscious consumer.

In my capacity as Sprint's CEO and the Chair of Sprint's Corporate Responsibility Steering Committee, let me take this opportunity to highlight just how seriously Sprint is heeding this call:

Sprint's Corporate Sustainability Initiatives

In 2008, Sprint established and publicly announced a set of 10-year environmental goals, including:

- Securing 10 percent of Sprint's commercial energy use from renewable sources by 2017.
- Reducing greenhouse gas emission by 15 percent by 2017.
- Achieving a wireless device collection rate of 90 percent as compared to device sales by 2017.
- Ensuring that at least 90 percent, based on money Sprint spends, of all Sprint suppliers, comply with environmental standards.
- Reusing or recycling 95 percent of Sprint's Network and Information Technology (IT) e-waste.

Sprint is committed to the belief that we all share in the responsibility to conduct our businesses in a socially and environmentally responsible manner. We base this on the premise that a company is much more than the products and services it sells; the effect a company has on the environment, the people and the communities it serves reflects a company's dedication to being not only a good business, but to being a good corporate citizen.

Renewable Energy Use

Sprint leads the wireless industry within the U.S. in terms of actual renewable energy use by the corporation. Sprint's green-energy initiatives include wind, solar, hydrogen and geothermal power. Sprint began participating and promoting the testing of wind energy in 2004 with the purchase of Green-e wind energy certificates for a building on the Sprint World Headquarters Campus in Overland Park, Kansas. In 2 years, Sprint prevented approximately 1,000 tons of carbon dioxide from entering the atmosphere with these Green-e wind energy certificate purchases.

Sprint expanded its commitment to green-power use, announcing an agreement with Kansas City Power & Light (KCP&L) that facilitated the building of the Spearville, KS Wind Farm. As part of that agreement, Sprint agreed to purchase 87M kilowatt hours per year for its 200-acre Overland Park, KS, headquarters campus from KCP&L via the Spearville, KS wind farm. In 2008, this accounted for 80 percent of Sprint's campus energy needs. This purchase provided a reduction of 87,519 metric tons of C02 equivalents in 2008 and is the equivalent of:

- Taking 16,029 passenger cars off the road for one year,
- Producing 203,533 fewer barrels of oil a year,
- The electricity used in 12,139 households each year, or
- Preserving 610 acres of forest.

Sprint plans to expand its use of green-power and currently ranks in the top 25 purchasers of green-power in EPA's Green Power Partnership Fortune 500 Registry.

Energy Efficiency and Alternative Energy Use to Power Sprint's Wireless Network

Sprint's network consumes approximately 80 percent of its total corporate-energy use. With such a significant percentage, our network is our biggest priority in terms of finding energy improvement opportunities—both through energy efficiency and

deployment of renewable-energy resources. Sprint has a partnership with the Department of Energy to conduct alternative-energy research and currently works with two national laboratories—Sandia in Albuquerque, New Mexico, and National Renewable Energy Lab (NREL) in Golden, Colorado. Their projects include energy storage and photovoltaic-panel research.

In an effort to produce green backup power during commercial power outages, Sprint has already deployed more than 250 hydrogen fuel cells at cell sites, with more installations planned. Sprint is also using solar-powered energy at cell sites in California and New York. The photovoltaic-panels capture solar energy and power the site using sunlight during the day, then switch back to commercial utility power at night. In addition, Sprint is exploring geothermal systems as a way to reduce electricity use by improving cooling efficiency and improving reliability by avoiding high-heat equipment shutdowns. In these systems, the heat from a cell site is transferred to a heat exchange system and cooled through wells drilled in the ground.

In April 2007, Sprint installed a small wind turbine on its Overland Park, KS campus to test the use of wind as primary power for cell sites. The turbine was the first of its kind in the community and continues to provide excellent data for Sprint's energy researchers. It is also iconic of Sprint's commitment to alternative energy.

Sprint's most exciting new achievement on green network energy is its award of a $7.3 million United States Department of Energy grant for the expansion of hydrogen fuel cell deployment. Sprint, already a leader in fuel cells, will use the grant funding to expand its hydrogen fuel cell program at cell sites throughout the United States—creating 72 hours of additional network resiliency, especially critical during emergencies and natural disasters. As part of the grant, Sprint will work with hydrogen fuel cell manufacturers, tank providers and hydrogen suppliers to extend the unassisted run-time to 72 hours (57 hours more than the typical amount currently available). Sprint's innovative work to extend the run-time of hydrogen fuel cells will benefit any industry with a need for longer and cleaner back-up power.

Sprint possesses or has filed for 47 patents in green technology areas, and we have 15 issued patents in hydrogen fuel cell technologies.

Greenhouse Emissions

Sprint understands that greenhouse gas is a critical issue and that reducing greenhouse gas (greenhouse gas emissions) is an important goal. As a large corporation with thousands of locations throughout the United States, Sprint has a role to play in the reduction of harmful greenhouse gas emissions, and is actively engaged in making a difference. Sprint has committed to absolutely reduce its greenhouse gas emissions by 15 percent by 2017 and to increase its use of renewable energy to 10 percent by 2017. The majority of Sprint's greenhouse gas emissions come from energy use in Sprint's network and facilities. Sprint has been actively working to reduce its energy impact for the past several years, as evidenced by our large purchases of renewable energy, investments in alternative-energy research, and development of an energy-conservation program.

- Sprint was the first telecommunications carrier to join the EPA Climate Leaders Program in 2007, and was recognized for our goal to absolutely reduce greenhouse gas emissions 15 percent by 2017. Sprint is the only carrier participating in the EPA Climate Leaders Program and the only one to have published an absolute greenhouse gas emissions reduction goal.
- Sprint achieved a 6.8 percent greenhouse gas emission reduction in 2008 and expects further improvement when we finalize the 2009 results.
- Sprint also participates in the Carbon Disclosure Project (CDP) and received the highest ranking among wireless providers in 2009 for its carbon disclosure efforts. CDP is a non-profit organization, led by institutional investors in partnership with government and non-government organizations (NGO's).

The Greening of Sprint Facilities and Retail Store Locations

Sprint's 200-acre Overland Park, Kansas, headquarters campus is one of the most environmentally responsible campuses in the country. It was designed with the environment and employees in mind and is a source of pride for both campus workers and the surrounding community. Some of the eco-friendly highlights include:

- Capture of site run-off water to use for landscape irrigation (no municipal water is used).
- Restoration of wetlands and natural landscape.
- Plantings of more than 6,000 trees; use of landscaping for shade.

- Dedicating 60 percent of the campus to green space.
- Regional extraction of 81 percent of campus construction materials, reducing transportation emissions.
- Use of People for the Ethical Treatment of Animals (PETA)-certified border-collie program for migratory-bird control.
- A comprehensive composting program that takes food waste and other compostable-waste, such as cardboard, and turns it into useful by-products.
- Use of solar power for signage.
- Preferred parking for drivers of hybrids or carpoolers to encourage reduction of employee greenhouse gas emissions.
- A "Smart Commute" program to help employees find and use alternative transportation options.

Sprint received its first Leadership in Energy and Environmental Design (LEED) certification from the United States Green Building Council (USGBC) for new construction in April 2005, for a building (6480 Sprint Parkway) at our headquarters campus in Overland Park, KS. Sprint received its second LEED certification in mid–2009 through the LEED Retail pilot project for a Sprint retail store in the San Francisco, California area.

All new and refurbished Sprint retail stores will utilize numerous sustainable design elements consistent with LEED design standards that will reduce the carbon footprint of each store by about 19,000 pounds of carbon dioxide annually.

All Sprint retail stores feature a dedicated green section to highlight green products such as the eco-friendly Samsung Reclaim™, solar chargers and cell phone carrying cases made from recycled plastic water bottles. Sprint's eco-charger options include the All-In-One Vehicle and Wall Charger and the SOLIO™ Mono Hybrid Charger. The All-In-One charger offers users the benefit of being an all-in-one car and home/office charger. It also features an inline USB port that allows two devices to be charged simultaneously and operates within EPA's Energy Star guidelines. The SOLIO™ Mono Hybrid Charger allows mobile-phone users to charge their device from the sun or electrical socket allowing customers to recharge their mobile phone anytime, virtually anywhere. Sprint's carry case solutions include two from Nite Ize™, made from 100 percent recycled plastic water bottles and two universal cases made from cotton and linen.

The Greening of Sprint's Accessory Packaging

In November 2009, Sprint expanded its responsible product efforts by launching redesigned and even more environmentally responsible packaging for its entire accessory line. The new designs are smaller, fully recyclable, free of PVC, and include recycled content. Sprint estimates that the redesigned accessory packaging will save 647 tons of waste annually and reduce packaging costs by 35 percent or $2.1 million annually. Highlights of the new accessory packaging include:

- Overall packaging dimensions reduced by 20 to 40 percent.
- Polyvinyl chloride (PVC) clamshell eliminated and replaced with Polyethylene terephthalate (PET 1), a more recyclable and environmentally friendly material that includes 30 percent recycled content.
- Soy- and vegetable-based inks replace petroleum-based ink, exceeding the American Soybean Association SoySeal Standards and reducing the level of volatile organic compounds (VOCs).
- Paperboard is Forest Stewardship Council (FSC) certified—ensuring that the paper travels from an FSC-certified forest to a paper manufacturer, merchant and printer, all of whom have FSC "chain-of-custody" certification. The process promotes conservation and responsible management of forests. The paperboard includes 40 percent pre-consumer waste content and 10 percent post-consumer waste content.

Eco-Conscious Consumer Solutions

One of the benefits of being a communications solutions provider is that Sprint is part of an incredible societal shift toward smart-mobility. Sprint customers use their wireless devices day-in and day-out to communicate remotely with their friends and family, to send pictures, conduct on-line banking, purchase items remotely, find the fastest route to the doctor's office, and even find out where they can recycle their glass bottles.

Sprint's wireless devices can replace alarm clocks, calculators, calendars, note pads, voice recorders, cameras and more. In the sustainability circle, this is called dematerialization, where one is able to eliminate material goods with virtual ones.

Sprint hopes to help customers realize the environmental opportunities their devices offer and intends to provide specific solutions to enable a greener lifestyle.

One of the simplest environmentally responsible solutions Sprint offers its customers is eBilling. Sprint eBill Online Billing eliminates customers' paper bills and thus helps the environment and provides convenient access to customer invoices. Sprint offers consumers a service credit for signing up and staying with eBill. Millions of Sprint customers have already selected this option and avoided the use of an estimated 2 million pounds of paper and emitting 27 million pounds of greenhouse gases.

Sprint has expanded its eco-conscious offerings to include environmentally-themed ringers. In October 2009, Sprint announced the release of downloadable bird-call ringtones in association with National Audubon Society. Customers can choose from among 28 ringtones include the Field Sparrow, Red-bellied Woodpecker and Black-capped Chickadee. Sprint and the National Audubon Society believe the bird song ringtones will help raise awareness of Audubon's mission to protect and conserve birds and their natural habitats. These ringtones are part of an official licensing program of the National Audubon Society from which Audubon will receive royalties.

Sprint's Green IT Efforts

Green Information Technology (IT) is typically defined as the efficient design and use of computing resources. It includes using environmentally-friendly hardware and software, and deploying options such as virtualization, power management and recycling practices. Sprint is committed to being a green IT leader, and Sprint's efforts were recognized in September 2008 at *Computerworld's* Green IT Symposium where Sprint was named a top-five finalist for increasing "green IT" by reducing IT complexity. This recognition was based on Sprint's efforts to simplify its complex IT environment by identifying, consolidating and removing redundant or unused applications and their supporting infrastructures, and by simplifying the hardware and software footprint in Sprint's data centers.

Over a 20-month period, Sprint has significantly reduced its IT-based power consumption by retiring more than 3,850 servers. Not only did this improve energy efficiency, it reduced greenhouse gas emissions by 20,355 metric tons, which is the equivalent of removing more than 3,200 cars from the road.

Sprint has also transitioned to more energy-efficient servers and storage, has consolidated several of its data centers, significantly reduced the applications that are in use and implemented a much simpler hardware and software IT plan that incorporates virtualization and other green IT options.

Two New Environmental Initiatives from Sprint

At Sprint, the innovations we pursue and the new environmental programs in which we engage are both transparent and accountable. While recognition is inspiring, what counts most is tangible environmental progress. It is Sprint's hope to change norms so that what we define as "green" today is "average" tomorrow. Experience has taught us that collective action—working cooperatively with handset manufacturers, non-governmental organizations and government agencies—helps to quickly and broadly establish common standards for better environmental performance.

Today I am proud to announce that Sprint is the first U.S. wireless carrier to establish a set of green design criteria for consumer devices. Moving forward, every handset vendor who manufactures handsets that operate on Sprint's networks must produce handsets that meet or exceed Sprint's new green design criteria and specifications. The green design criteria and specifications support Sprint's product development vision, which is to provide devices and accessories for our customers that are:

- Made of sustainable materials
- Manufactured and packaged sustainably
- Free of potentially hazardous materials
- Highly energy-efficient or even self-charging
- Compatible with interoperable accessories, and
- Fully and easily recyclable

Working in partnership with our handset manufactures, Sprint has developed an industry-first environmental "scorecard" to bolster progress toward Sprint's green design specifications. The criteria in the scorecard better enable Sprint and our vendors to gauge the degree to which each handset manufactured complies with our environmental standards. These handset manufactures include: Samsung, HTC, LG,

Motorola, Palm, RIM and Sanyo. Handsets will be measured according to the following scorecard categories:

- *Environmentally Sensitive Materials*—to improve the removal of environmentally sensitive materials such as Polyvinyl Chloride (PVC), Brominated Fire Retardants (BFR) Phthalates and Beryllium. This category also includes compliance with the European Union's Reduction of Hazardous Substances (RoHS) standards.
- *End of Life Management*—to increase the average recyclability rate and the use of recycled plastics and other environmentally friendly parts.
- *Sustainable Packaging*—to reduce a product's environmental-footprint by eliminating waste and using recycled or eco-friendly materials.
- *Energy Efficiency*—to improve the energy efficiency and reduce the overall consumption of energy by the handset and charger.
- *Innovation*—to raise the bar with new product innovations.

Sprint hopes by collaborating proactively with our handset vendors, we will encourage the entire wireless industry to develop new, innovative, greener handsets for all U.S. consumers.

Wireless Recycling

Designing greener handsets is crucial for our industry and is also part of our larger goal to ensure that wireless devices do not end up in landfills. According to recent statistics from the Environmental Protection Agency (EPA) only 10 percent of cell phones are recycled each year in the U.S. Americans annually dispose of 140 million old or unused cell phones and send 65,000 tons of e-waste to landfills. While 40 to 50 percent of Americans recycle paper and other common materials regularly, the truth about e-cycling, which is the reuse or recycling of electronics, is that many U.S. consumers don't.

The implication of low e-cycling rates is significant. Many of these electronics contain valuable metals—such as gold and silver that could be recycled into jewelry, electronics, lawn furniture, car parts, shingles, plastic containers and more. A great example of an innovative use of these reclaimed materials from electronics can be seen in Vancouver, Canada where this year's athletes are receiving Gold, Silver and Bronze Olympic medals that contain materials reclaimed from end-of-life electronics. A recent ABI Research Report found that of 1,000 people surveyed, 98 percent were prepared to return handsets to an operator's store, to a charity, to a refurbishing company or to the manufacturer—but only in return for some compensation; either cash, store credit, or a tax deduction.

Sprint has been at the forefront of recycling efforts in the wireless industry. In 2008, we made a public commitment to achieve a wireless reuse and recycling rate of 90 percent as compared to our device sales. Our current wireless reuse and recycling rate at the end of 2009 was just over 40 percent, well ahead of the industry average. Since 2001, Sprint has collected more than 19 million devices for wireless reuse and recycling.

Today we are announcing the launch of a new, vastly expanded wireless handset buyback program that offers a financial incentive, in the form of instant account credit, to current and new Sprint customers who turn in up to three eligible wireless devices. Sprint's new, expanded Buyback program now accepts *all* eligible wireless devices, regardless of manufacturer or carrier. Through this new Buyback program, current or new Sprint customers can go to one of the more than 1,000 participating Sprint-owned retail stores nationwide or go online to *www.sprint.com/recycle* to convert any eligible old Sprint, Verizon Wireless, AT&T or T-Mobile network phone into an instant account credit.

Conclusion

Chairman Kerry, Senator Ensign and members of the Subcommittee, thank you for holding this hearing today to highlight how the U.S. wireless industry can take our environmental responsibility even more seriously. Sprint is committed, for the long-haul, to "green" our business operations, promote the design of more eco-friendly handsets, increase wireless industry recycling rates, and remain a leader in our industry. In partnership with our handset manufactures and other allies, Sprint will continue to work to introduce greener handsets similar to the Samsung Reclaim™, and to educate our customers about how they can make "greener," more sustainable choices when it comes to handset purchases and end-of-life device management.

I am happy to answer any questions you may have and Sprint looks forward to working with you and your staff on these mutual goals in the coming year.

The CHAIRMAN. Thank you very much, Mr. Hesse.
Mr. Tuck.

STATEMENT OF ADRIAN TUCK, CHIEF EXECUTIVE OFFICER, TENDRIL NETWORKS, INC.

Mr. TUCK. Good morning. My name is Adrian Tuck. I'm the CEO of a smart grid technology company based in Boulder, Colorado, called Tendril.

As a newly minted American citizen, it's an honor to be asked to participate in however small a way in the setting of Federal policy, so I thank you all for the opportunity to testify this morning.

Tendril's sole reason for being is to provide the devices and software that allow consumers and utilities to manage their energy consumption. Our platform works by linking residential energy customers with utilities, and we do so by providing customers with simple-to-use devices, such as smart thermostats and home energy monitors, that allow consumers to manage their energy use. Numerous studies have shown that this kind of energy awareness prompts consumers to reduce their energy consumption.

Our technology communicates with the home in two ways. First, it can utilize new two-way smart meters, as being deployed by utilities in many States. But, second, it can also utilize commercial broadband networks and work with the approximately 60 million American households equipped with drive-by meters that chirp out a one-way signal of the meter's read.

In this setting, we use the broadband capability and the Internet to create a two way communication link, making the smart grid come alive by using meters that are in the field today, and broadband technology that's well understood. We found this approach to be viewed favorably by many State regulators, who are responsible for identifying cost-effective solutions.

Using a platform like Tendril's, consumers benefit by consuming less energy, saving money, and emitting less carbon dioxide. Utilities are better able to optimize loads on the grid and plan for the future by accommodating renewable generation, electric vehicles, and smart appliances. Our studies show that for every 1 million Tendril equipped homes, we can reduce carbon emissions by over 200,000 tons and save consumers over $75 million annually.

Like you, sir, we believe that the transformation of the energy economy will be every bit as great as the transformation of the information and communications economy we've witnessed over the last 20 years. We see similar sustained wealth and job creation opportunities for the Nation if we seize the initiative. We also humbly believe that Google-sized businesses will emerge in this transition, and we're hoping, and working hard, to make Tendril one of them.

In our small way, we've contributed to job creation. We've added approximately 100 well-paid jobs in the last 12 months, and plan to add several hundred more in the years ahead. Indirectly, our systems will support tens of thousands of new and retrained jobs as we deploy.

I'd like to offer three observations for the Subcommittee's consideration:

First, realtime energy information is key to driving energy savings in the home. Today, there's no consistent policy regarding

whether and how consumers can see how much energy they're using in realtime. Three States—Pennsylvania, Texas, and California—stand out for their decisions to guarantee consumers the right to use energy—or, the right to see their energy so they can take action. Some of my own employees complain, in Colorado, that we have smart meters on their homes, but there's no policy from Congress, the State legislature, or the Public Utility Commission to give them the right to use that information.

Federal policy—a consumer's right to know—can begin to correct that oversight. Only with realtime information can we inform, not just how, but when we use energy. I firmly believe that the first step to Federal coordination is to establish clear policies to ensure consumers and entrepreneurs have access to energy data.

Second, the biggest barriers to innovation are not actually technical, but economic. Much work is underway, led by NIST, to adopt standards that enable communication between energy providers and consumers. But, most utilities have little incentive to sell you or me less energy, and in most States, we don't have a choice of energy supply. We think Federal legislation can establish greater coordination and give State regulators more abilities to include national energy priorities within their economic analysis.

Third, like the Information and Communications Revolution, the ultimate driver of change will be the consumer. We, along with partners, such as Best Buy and Intel, are offering compelling solutions to consumers as part of utility programs and where utilities are slow to move without them. We would like to see a consumer rebate program established that would accelerate the deployment of home energy monitors and energy efficiency technologies. In fact, we proposed such a concept as part of our application for a Smart Grid Investment Grant.

The consumer market is a powerful force for change, but, like all markets, it will only be truly effective when it has accurate and actionable information. Federal policies supporting entrepreneurs and American competitiveness can provide that information and support innovation. We, and our trade association, the Demand Response and Smart Grid Coalition, stand ready to work with the Committee as it continues to examine this issue.

Thank you very much for the opportunity to share these thoughts. I look forward to answering any questions you may have.

[The prepared statement of Mr. Tuck follows:]

PREPARED STATEMENT OF ADRIAN TUCK, CHIEF EXECUTIVE OFFICER, TENDRIL NETWORKS, INC.

Introduction

Good morning, my name is Adrian Tuck, and I am the CEO of a smart grid technology startup based in Boulder, Colorado, called Tendril Networks. As a newly minted American citizen, it is an honor to be asked to participate, in however small a way, in the development of Federal policy. I wanted to thank Chairman Kerry, Ranking Member Ensign, and the members of the Subcommittee for allowing me to testify this morning.

Tendril's sole reason for being is to provide the devices and software that allow consumers and utilities to better manage their energy consumption. Our platform works by linking residential customers with their utilities, and we do so by enabling the utilities to provide their consumers with simple-to-use devices such as smart thermostats and home energy monitors that allow consumers to manage their energy use. Numerous studies confirm that this kind of "energy awareness" prompts

consumers to reduce their consumption. Our software allows our partners—such as General Electric—to make smart appliances that can react to prices and environmental signals to modify their energy usage.

Our technology communicates with homes in two ways:

1. It utilizes new 2-way communicating "smart meter" networks being deployed by utilities in many states, and
2. It also utilizes commercial broadband networks for the approximately 60 million American households equipped with "drive-by" meters that chirp out a one-way signal of the meter's read.

In this setting, we use broadband capability and the Internet to create a two-way communication link, making the smart grid come alive by using meters that are in the field today and broadband technology that is well understood. We've also found this approach to be viewed favorably by many state regulators who are responsible for identifying cost-effective solutions.

Using a platform like Tendril's, consumers benefit by consuming less energy, and thus saving money and emitting less carbon dioxide. Utilities are better able to optimize loads on the grid, and plan for the future by accommodating renewable generation, electric vehicles and smart appliances. Our studies show that every one million homes equipped with a system like Tendril's will reduce carbon emissions by over 200,000 tons and save consumers $75 million or more annually.

In our view, energy efficiency is best measured across at least two dimensions. On the one hand, we can and must focus on improving the throughput efficiency of the electric system and the buildings it serves, including programs to fund improvements in insulation, caulking and replacing appliances. On the other hand, we must also consider the real-time market and environmental information that can drive true transactional and behavior changes. The impacts of these changes can drive tangible energy efficiency and environmental benefits.

A recent Department of Energy Report ("The Smart Grid: An Estimation of the Energy and CO_2 Benefits", January 2010) concluded that the development of a smart grid can lead to reductions in carbon emissions of 18 percent by 2030 through direct and indirect effects. The largest single mechanisms include "Conservation Effects of Consumer Information and Feedback Systems." It is clear that engaging the consumer with information technology is a vital component of an effective carbon mitigation strategy.

Reducing peak loads on the grid also has a powerful economic benefit. A report issued by the Government Accountability Office ("Consumers Could Benefit from Demand Programs, but Challenges Remain", August 2004) observed that, "Although the 100 highest priced hours of the year account for only about one percent of the hours in a year, they can account for 10–20 percent of the total electricity expenditures for the year." It is clear that providing solutions to reduce peak demand can provide enormous economic benefits and avoid or defer the need to build new power plants.

We believe the transformation of the energy economy will be every bit as great as the transformation of the information and communication economy we have witnessed over the past 20 years. We see similar sustained wealth and job creation opportunities for the Nation if we seize the initiative. We believe Google-sized businesses will emerge in this transition, and we're working hard to make Tendril one of them. In our own small way, we have contributed to job creation. We've added approximately 100 well-paid jobs in the last 12 months with plans to add several hundred more in the next couple of years. Indirectly, our systems will support thousands of new and retained jobs as we deploy more of them.

Smart Grid is a National Priority

Development of a "smart grid" has forcefully emerged as a national priority, and it was firmly articulated with the enactment of the Energy Independence and Security Act of 2007 (EISA). This Act established that, "It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth. . . ." This national policy includes, "provision to consumers of *timely information* and *control options*" (emphasis added). This policy of smart grid development was reinforced through funding provisions of the American Recovery and Reinvestment Act of 2009.

We highlight the connection between the provision of "timely information" and "control options," because it suggests that Congress, in passing this legislation, considered information to be a key enabling factor of consumer control. In this context, the provision of information is important *not only* for historical analysis of energy

consumption patterns, but also to enable real-time, automated functions by consumers.

This legislative intent is further supported by the EISA's references in this same section to "digital information and controls technology", "deployment of *smart' technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices)", and the "integration of *smart' appliances and consumer devices".

This legislation was amended in the American Recovery and Reinvestment Act to establish conditions upon any Federal funding provided to smart grid projects that, "The Secretary [of Energy] shall require as a condition of receiving funding . . . that demonstration projects utilize open protocols and standards. . . ."

In June 2009, the Federal Energy Regulatory Commission (FERC) released *National Assessment of Demand Response Potential*. This report described the residential customer class as representing "the most untapped potential for demand response." Earlier, in March 2009, FERC issued a proposed policy statement and action plan that noted, "Ultimately, the smart grid will facilitate consumer transactions and allow customers to better manage their energy costs." This policy was finalized in a July 2009 FERC order.

We highlight these FERC statements and policies because we believe these policies suggest FERC's anticipation of information being used by consumers to facilitate real-time market transactions. This is highlighted further by statements accompanying the adoption of this policy by several FERC Commissioners, including Commissioner Marc Spitzer who said, "Equally important, this policy statement is a step toward smarter rates that will enable customers to control their personal use of electricity."

Tendril believes that providing information tools to the consumer is consistent with national policy. Improving system efficiencies, reducing consumer costs and mitigating environmental impacts all depend upon the provision of detailed energy usage information directly to the consumer. Open, non-proprietary consumer access to usage information is a guiding principle for development of policies governing smart grid technologies. We also believe that such access will accelerate technology innovation and help the consumer realize additional benefits.

Moreover, providing consumers with greater transparency and control over how their information is used in the smart grid environment will build consumer trust and confidence in this developing technology. Such increased consumer trust will, in turn, promote public adoption and acceptance of smart grid systems and solutions, which are not ends in themselves but means to achieve policy objectives of clean energy, reliable and secure energy infrastructure, economic development, and market-based options for the consumer.

Observations

I would like to offer up three observations for the Subcommittee's consideration:

1. *Real-time information is the key to driving energy savings*. Today, there is no consistent policy regarding whether and how consumers can see how much energy they are using in real-time. Three states—Pennsylvania, Texas and California—stand out for their decisions to guarantee consumers the right to see their energy use so that they can take action to save energy. Some of my own employees complain that while they have a smart meter at their house, there is no policy from Congress, the state legislature or the public utility commission that gives them the right to useful information coming from the meter. Federal policy—a consumer's right to know—can begin to correct that oversight. Only with real-time information can we inform not just how, but *when*, we use energy. Is energy expensive right now? Are there renewable sources available on the grid currently? That information is collected at the wholesale level, but it does not flow down to the consumer in real time.

As noted above, at least three state utility commissions have addressed the provision of real-time information to consumers. Specifically, Texas, Pennsylvania and California have issued decisions in rulemaking proceedings establishing that advanced metering infrastructure (AM I) must provide consumers with direct, real-time access to electricity usage data by delivering that information directly into the home area network (HAN).

In Texas, the Public Utility Commission established a policy through a rulemaking procedure to implement provisions within 2005 legislation HB 2129 and subsequent rulemakings.

In Pennsylvania, the Public Utility Commission established a policy in June 2009 regarding Smart Meter Procurement and Installation (Docket No. M–

2009–2092655) in which they directed that information be delivered via electronic and "open, nonproprietary two-way access."

Finally, we note that the California PUC issued a decision in December 2009 (R.08–12–009) requiring that all AM I deployment in the state must also provide direct access to usage data.

These state regulations could provide useful models for potential Federal legislation addressing the consumer's ability to access energy usage information in real time.

In December, our trade association, the Demand Response and Smart Grid Coalition, joined with leading companies including General Electric and Google to support a Call to Action released during the climate meetings in Copenhagen. These companies called on nations and regulators to ensure access to: (1) real-time home energy consumption, (2) pricing information, and (3) carbon intensity information of delivered energy. Together, we concluded that "[w] e can't solve climate change if people are in the dark about how they use energy in their own homes"

I firmly believe that the first step to Federal coordination is to establish clear policies that ensure consumers and entrepreneurs have access to the data.

2. *The biggest barriers to innovation are not technical, but economic*. Much work is underway to adopt standards that enable communication between energy providers and consumers, but most utilities have little incentive to sell you or me less energy. And in most states, we don't have a choice of energy supplier. We think that Federal legislation can establish greater coordination and give state regulators more abilities to include national energy priorities within their economic analysis models.

As a general rule, state regulation was not established to encourage innovation. Rather, it was established to manage cost-effective solutions to known challenges of energy distribution. If we hold as a goal the encouragement of innovation, then Federal leadership will be a welcome contribution to the industry. Federal leadership—in the form of policy, legislation and funding—will serve to identify national priorities around energy efficiency, renewable energy, reduced greenhouse gas emissions, and the adoption of new technologies, such as electric vehicles and smart appliances. These identified national priorities provide a foundation upon which state commissions can align local rates and regulation.

In addition to Federal leadership, we see a benefit from a coordination of Federal activity. Currently, many agencies are making significant contributions to the development of the smart grid. NIST is working with industry to accelerate the development of standards. When established, FERC may promulgate rules establishing the standards. FERC is also developing a National Action Plan for Demand Response to reduce peak loads, and it is examining barriers to the integration of variable energy resources, such as renewable energy. The FCC has indicated that its National Broadband Plan will include strategies to encourage innovation and increased energy efficiency. We strongly support the FCC's initial recommendations regarding the National Broadband Plan. In particular, we support the integration of broadband into the smart grid and provisions to ensure consumer access to information. The DOE is supporting research and development, as well as deployment, through the Smart Grid Investment Grant Program and Smart Grid Demonstration Grant Program funded in the American Recovery and Reinvestment Act. The DOE's smart grid research also received a boost in funding in the President's 2011 budget. Finally, The White House Office of Science and Technology Policy recently initiated an examination of smart grid policy, and Congress has made significant steps toward passing energy and climate legislation that further emphasizes smart grid development.

It is our opinion that all of the efforts will be strengthened by an overarching Federal strategy for smart grid that can inform and coordinate each of the individual efforts.

3. Like the telecom revolution, *the ultimate driver of change will be the consumer*. We, along with partners such as Best Buy and Intel, are offering compelling solutions to consumers as part of utility programs and, where utilities are slow to move, without them. We would like to see a consumer rebate program established that would accelerate the deployment of home energy monitors and energy efficiency technologies. In fact, we proposed such a program as part of the smart grid funding in the Recovery Act.

Federal consumer rebates have proven effective in other industries to drive consumer adoption. For example, the TV Converter Box Coupon Program helped

drive the transition from analog to digital television. Similarly, the State Energy Efficient Appliance Rebate Program is currently being widely promoted by retailers such as Sears as an effective mechanism to drive consumer adoption of more energy efficient appliances. We believe that a similar consumer rebate program that focuses on the deployment of home energy monitoring systems will bring enormous benefit to the Nation in the form of energy efficiency improvements, technology development, and job creation.

Of course, consumer confidence will be reinforced though cyber-security and data privacy protections much like those that enable convenient online financial transactions. I understand that the full Committee will be examining cyber-security and critical infrastructure this afternoon, and I urge the Committee to consider the topic in the context of our future of smart grid capabilities and our national energy efficiency goals.

Conclusion

The consumer market is a powerful force for change. But like all markets, it will only be truly effective when it has accurate and actionable information. Federal policy, supporting entrepreneurs and American competitiveness, can provide that information and support innovation. We and our trade association, the Demand Response and Smart Grid Coalition, stand ready to work with the Committee as it continues to look at this issue.

Thank you for the opportunity to share these thoughts. I look forward to answering any questions you may have.

The CHAIRMAN. Thank you, Mr. Tuck. We appreciate it.

Ms. Wigle, I think I added a G to your name, and I take it back. [Laughter.]

The CHAIRMAN. Thank you.

Ms. WIGLE. Thank you very much.

The CHAIRMAN. Thanks.

STATEMENT OF LORIE WIGLE, DIRECTOR, ECO TECHNOLOGY PROGRAM OFFICE, INTEL CORPORATION AND PRESIDENT, CLIMATE SAVERS COMPUTING INITIATIVE (CSCI)

Ms. WIGLE. Mr. Chairman, Senators, thank you very much for the opportunity to speak on this important topic of energy efficiency and information and communication technology.

I work for Intel Corporation as our General Manager for Eco-Technology, and also have the privilege of being President of Climate Savers Computing Initiative, which is a consortium focused on driving energy efficiency of computing, itself.

What I'd like to do this morning is talk about a framing device, similar to what the—Mr. Chairman introduced initially, and then talk a little bit about what we see as the inhibitors and potential policy actions that can be taken to increase the adoption of ICT to benefit energy efficiency. And last, I'd like to introduce an organization called the Digital Energy Solutions Campaign, which is another group that's come together to tackle this problem.

First of all, if you think about it, in 2007 Gartner Research published a study that documented that global CO_2 emissions from computing were at 2 percent. And I think you all understand that we, as an industry—Intel, from—at a microprocessor level; our customers, at the system level—are doing everything we can to optimize that 2 percent. And you'll hear a little bit more about that, I think, later as the conversation goes on. And, in fact, I think you can consider energy efficiency a basis for competition, for most of our industry.

On the other hand, I think we've put too little emphasis on how information and communications technology can benefit the other

98 percent. And, in fact, there was a report released in 2008, called "Smart 2020," that documented that global CO_2 emissions could be reduced by 15 percent through the application of technology. The areas that they called out in that report were smart grid, smart buildings, smarter transportation, better logistics systems, as well as smarter motors and the use of technology to substitute for transportation. And, in particular, it'd be great if I could be doing this testimony from my home in Oregon instead of traveling to Washington, D.C.

So, there is clearly an opportunity. And Intel, as a company, and many of our counterparts, are participating in the businesses associated with this.

One might ask, though, why we're not seeing more rapid adoption in these areas. This has been documented, as I said, for almost 2 years now.

We believe, part of the problem is lack of awareness, this lack of understanding of the benefits of ICT in these deployments. But, there are also other problems associated with just the lifecycle of such investments. The reality is that the people who are making the up-front investments are often not the people who pay the ongoing operating costs, and that goes across a lot of different areas. For example, buildings—you think about building stock; the architects and the designers may not be thinking about what it costs to actually operate the building. So, that's definitely an area where we can see improvement by connecting those things.

In terms of policy, some of the recommendations that we would make is for the Federal Government to actually establish a roadmap for the implementation of ICT, to lay out the steps that should be taken on a timeline, to lead by example. The government, at all levels, is a large employer, owner of building stock, fleet operator. And so, the government, leading by example, both delivers efficiency, as well as provides a role model for private enterprise.

We also believe there's an opportunity to establish tax incentives and other incentives to promote the more rapid incorporation and adoption of technology. And, along with my colleague from Tendril, we also believe that giving utilities the incentives to actually drive efficiency or sell megawatts—as opposed to megawatts, is really, really important.

And last, we can improve what we can measure. So, we would really encourage policy and development of methodologies for measuring the effectiveness of ICT in delivering energy efficiency. We have some work underway in Japan, in the EU here, which we would be happy to share.

Last, this organization that Intel has helped co-found and is now populated with a number of industry companies as well as NGO's and trade associations—the Digital Energy Solutions Campaign,—is in place, has put together, I think, a really good foundation for actions that could be taken here. And we would welcome the opportunity, either as DESC or as Intel, to support the further work of the Subcommittee.

Thank you very much.

[The prepared statement of Ms. Wigle follows:]

PREPARED STATEMENT OF LORIE WIGLE, DIRECTOR, ECO TECHNOLOGY PROGRAM OFFICE, INTEL CORPORATION AND PRESIDENT, CLIMATE SAVERS COMPUTING INITIATIVE (CSCI)

Thank you, Chairman Kerry, for the opportunity to address this hearing focused on the role of information and communications technology (ICT) in improving energy efficiency throughout the U.S. economy. My name is Lorie Wigle. I direct Intel's Eco Technology Program Office and also serve as President of the Climate Savers Computing Initiative (CSCI). I am here today to stress the importance of the Federal Government adopting policies that support and enable the full potential of ICT to drive significant energy efficiency gains throughout the economy.

Recent studies have estimated the ICT industry's contribution to the world's energy and carbon footprint to be 2 percent and rising.[1] This is what we call the "micro story"—the energy consumption and carbon dioxide (CO_2) emissions associated with individual ICT devices. A major focus of government policy in recent years has been on reducing the growth of ICT's direct footprint. Many of those same studies, however, have highlighted the significant role ICT can play in reducing the footprint of the rest of society—the other 98 percent—through the energy efficiency gains such technologies can help enable. We call this the "macro story."

The Triple Challenge of Climate Change, Energy Security and Economic Growth

The U.S. and the world face three difficult challenges simultaneously: Our climate is changing at the same time that we face significant energy security and economic growth challenges. Finding public policies that address all three must be a priority.

Improving society's energy efficiency is the best way to begin addressing the challenges of climate change, energy security and economic growth. By using energy efficiency to lower energy demand, we can reduce emissions of CO_2, reduce the need for energy imports and free up resources for economic growth.

Fortunately, energy efficiency measures are not only cost effective but, in many cases, have a negative marginal cost, meaning they create wealth for society overall. Energy efficiency measures, including approaches driven by ICT, provide a foundation for economic growth by enabling carbon-reducing actions at lower cost, or even a savings of resources.

The ICT Industry Has Made Great Progress on the Micro Story

The ICT industry has made great progress in improving the energy efficiency of the products it designs and manufactures. The chart[2] below shows that progress made in the energy efficiency of computation has been orders of magnitude greater than progress made in other technologies.

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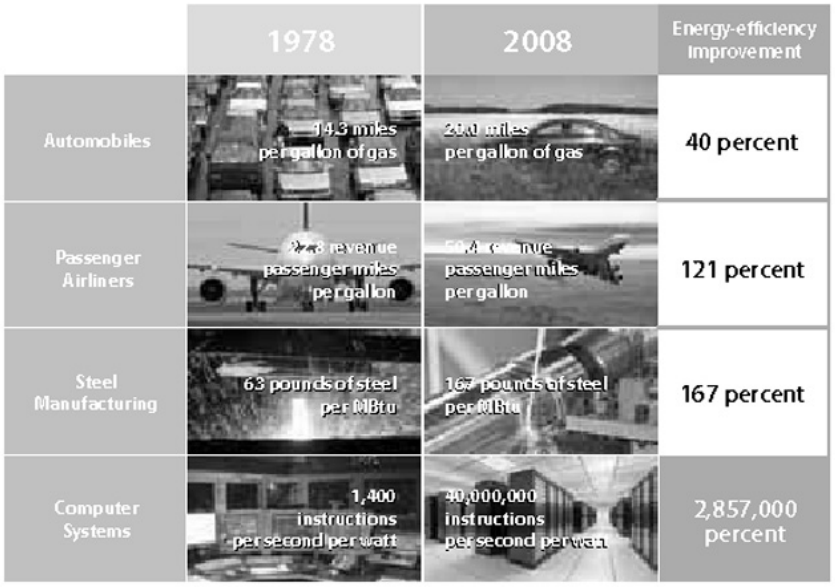
[1] Gartner Estimates ICT Industry Accounts for 2 Percent of Global CO_2 Emissions," Gartner press release, April 2007.

[2] Based on statistical comparisons compiled by the Technology CEO Council.



What's more, the industry has not become complacent and continues to find new ways to deliver products that perform more work while consuming less energy.

Studies Show that Greater Energy Reduction Potential Lies in the Macro Story

Substantial evidence shows that the gains realized by improving the efficiency of ICT devices are dwarfed by the much greater gains from using and networking these devices to improve the energy efficiency of society as a whole. The American Council for an Energy Efficient Economy (ACEEE) looked at the impact of ICT on the energy efficiency of the U.S. economy. The ACEEE report highlights the nexus between ICT and energy intensiveness of the U.S. economy: "Information and communication technologies (ICT) have transformed our economy and our lives, but they also have revolutionized the relationship between economic production and energy consumption." Specifically, ACEEE found that increasing deployment of ICT in the U.S. over recent decades has been a significant causative factor in the declining energy-intensiveness of the U.S. economy. Comparing the micro and macro story effects, ACEEE concludes that, "For every extra kilowatt-hour of electricity that has been demanded by ICT, the U.S. economy increased its overall energy savings by a factor of about 10. . . . The extraordinary implication of this finding is that ICT provide a net savings of energy across our economy."[3]

Building on the work of McKinsey and others, The Climate Group and the Global e-Sustainability Initiative (GeSI) in 2008 produced a report entitled, "Smart 2020: Enabling the Low-Carbon Economy in the Information Age" that found that ICT strategies could reduce global carbon emissions by up to 15 percent in 2020 against a baseline of business as usual.[4]

Examples of Where the Potential Lies

Focusing on the U.S. alone, a follow-up report by The Boston Consulting Group for The Climate Group and the GeSI found that the potential emissions reductions from ICT-enabled energy efficiency could be even greater—from 13 to 22 percent over the same period. This report identifies, as illustrations, a number of specific ICT-based technologies that hold particular promise, including:

- *Smart Motor Systems*—Optimized for energy efficiency, smart motor systems control and adjust power usage output through variable speed drives and intel-

[3] ACEEE, "Information and Communications Technologies: The Power of Productivity: How ICT Sectors Are Transforming the Economy While Driving Gains in Energy Productivity," Laitner and Ehrhardt-Martinez, February 2008."

[4] Smart 2020: Enabling the low carbon economy in the information age," The Climate Group.

ligent motor controllers. Smart motors monitor energy use and utilize that data for energy and cost savings. Wireless networks enable inter-machine and system communication for further optimization, and simulation software improves overall plant and manufacturing process design. Smart motor systems have a total abatement potential of 970 Megatons (Mt) CO_2 emissions in 2020.[5]

- *Smart Logistics*—Smart logistics include a variety of ICT applications that enable reductions in energy demand through better journey and load planning. This includes software to improve transport network design, inter-modal shifts to a more efficient form of transport, eco-driving, route optimization and inventory reduction. Smart logistics have a total abatement potential of 1.52 Gigatons (Gt) CO_2 emissions in 2020.[6]
- *Smart Buildings*—Smart buildings (new and existing) are optimized for energy efficiency through technologies that make their design, construction, and operation more efficient. Smart buildings use building management systems that employ a computerized, intelligent network of electronic devices designed to monitor and control the mechanical systems (heat and air conditioning) and lighting. They also use solutions to automate power control and/or remotely power on and off devices like PCs. Smart buildings have a total abatement potential of 1.68 Gt CO_2 emissions in 2020.[7]
- *Smart Electrical Grids*—Smart grids integrate ICT applications throughout the grid, from generator to user, to enable efficiency and optimization solutions. These solutions include smart meters to help customers use energy more wisely, as well as: interactive energy generation systems, advanced grid management solutions, demand management systems, greater integration of renewables and transmission and distribution loss reduction equipment. Smart grids have a total abatement potential of 2.03 Gt CO_2 in 2020.[8]
- *Travel Substitution*—Broadband availability can significantly reduce carbon emissions by supporting telework and making many business trips unnecessary. Teleworking alone can contribute savings up to 260 Mt CO_2 emissions each year.[9]

More About the Potential for the Smart Grid Challenges with Today's "One-way" Power Grid

The way the world delivers electric power is based on designs and plans that date back many decades. It's based largely on a "single-direction delivery" model: a big power plant that sends out power to lots of homes and commercial buildings that receive it.

No one thought that the grid would someday have to support solar power coming from millions of rooftops, or electricity being generated by thousands of wind turbines. But that's the future—and the electricity grid has to get much more "intelligent" to deal with all these different sources. It has to manage energy supply and consumption across the network in a more real-time, efficient fashion, using new metering technologies.

On the consumption side, commercial and residential building waste a tremendous amount of energy because building owners don't know how much energy they are using in real-time, and lack any kind of feedback loops or digital controls to optimize their energy use.

"Smart Grid"

The "smart grid" aims to solve all those problems. By harnessing microprocessors, wireless communications, the Internet, and other technologies, we can not only integrate these new renewable energy sources, but reduce energy waste, and give consumers more information about how they're using power.

Examples of "Smart Grid" Intelligence

There are a number of integrated microprocessor applications. For example, a modern wind turbine needs as many as 16 embedded microprocessors to control various motor functions, and to enable the turbine to exchange data and operational status with the grid. In the grid itself, embedded processors are being used in grid substations, which locally monitor and manage electricity flow. In smart buildings, low power and embedded processors are being designed into energy management systems and interactive touch screen displays, to help building owners monitor and

[5] Smart 2020 Report.
[6] *Ibid.*
[7] *Ibid.*
[8] *Ibid.*
[9] *Ibid.*

control their energy use. As the smart grid communications network develops, electricity meters, smart buildings, and utility data centers all must continuously exchange data and communicate with each other over great distances, which can be well served by Broadband technologies such as WiMAX.

The Need for Standards

The most critical element is in a word: Interoperability. An issue facing smart grids is the absence of an agreed upon specification prescribing how all grid components should be architected and made to communicate with each other.

There are many competing standards and proprietary protocols. To help address this interoperability challenge, Intel recommends that grid systems and consumer-side systems should be designed as "open" platforms and that they make use of Internet protocol. In other words, they should be designed to flexibly support a variety of standard software components and secure interfaces. In June, Intel hosted an IEEE meeting in Santa Clara that brought in energy industry experts to discuss creation of open smart grid standards. And we are actively participating in the process that NIST is leading.

An open grid system will also be "future-ready", supporting new innovations and the integration of future applications and service.

Home Energy Management Systems

Consumers are looking for ways to reduce their energy costs and carbon footprints, by employing microprocessor-based "smart home" technologies. Intel is developing technology for "Home Energy Management Systems", which visually show the consumer their real-time energy use, and enable them to control their energy use, through a "dashboard" which is viewable on any screen: whether it be their Home PC, or on a dedicated Touch Screen Display in their home, or on their Internet-connected TV. Studies have shown that by providing consumers with these types of dashboards and control tools, they are able to reduce their peak home energy use by as much as 40 percent.[10] Empowered by such computer-based dashboards, home area networks, and social networks, consumers are taking control of their personal energy use, and collaborating with others to reduce their carbon footprints. The rise of the "Personal Smart Grid", in which a consumer is able to monitor and control the behavior of their personal energy assets, spanning rooftop solar panels, smart appliances, and plug-in hybrid/electric vehicles, while taking advantage of the wider smart grid, is imminent if not already upon us.

What is Missing?

While the ACEEE study shows the historic role ICT has played in reducing the energy- and carbon-intensiveness of the U.S. economy, the Smart 2020 analyses demonstrate that even greater benefits are possible. Going forward, the question must be asked: What is missing? What is needed to realize the full energy efficiency potential of ICT?

Realizing this full potential will require aggressive public policies to correct market failures, remove implementation barriers and provide ICT-adoption incentives. Barriers to overcome include:

- Lack of information and understanding about the energy efficiency benefits of ICT.
- Perceived high up-front purchase costs and lack of understanding of lower life-cycle costs.
- "Principal/agent" issues where people occupying a space or operating a business don't pay the energy bill.
- The perception that many energy efficiency gains are too small to bother with individually when, in fact, they have a major impact when implemented throughout a region or country.

Policies to Realize the Potential of ICT

Governments can take many actions to encourage ICT adoption. While policies will vary depending on national circumstances and cultures, potential actions include:

- *Establishing a national strategy or roadmap* for the use of ICT to improve energy efficiency and reduce CO_2.
- *Leading by example* at all levels, governments—the largest employers, landlords, fleet operators, etc., in the country—demonstrate that the benefits of tele-

[10] The Brattle Group "The Power of 5 Percent", *The Electricity Journal*, October, 2007.

commuting, smart building technologies, teleconferencing and other solutions can help drive better understanding in the private sector of the benefits of ICT.

- *Expanding the availability of broadband* throughout society to take advantage of telecommuting, video conferencing, smart grids and the many energy efficiencies possible through intelligent connected devices.
- *Establishing tax and other incentives* for businesses and consumers to accelerate their purchase and deployment of ICT devices.
- *Changing electricity utility regulation* to permit utilities to earn money from energy-efficiency ("negawatts"), not just from the sale of electricity.
- *Helping create agreed-upon protocols/approaches* for measuring the energy-efficiency and climate impacts of ICT in other economic sectors.

Digital Energy Solutions Campaign (DESC)

To begin addressing some of the barriers to the realization of the full macro story potential of ICT, Intel and other high-tech companies founded and Intel co-chairs a relatively new organization called the Digital Energy Solutions Campaign (DESC). DESC is a coalition of ICT companies, allied with NGO's and trade associations, dedicated to promoting the adoption of public policies, such as those I have just enumerated, that will enable ICT to realize its full potential to improve societal energy efficiency and reduce our carbon footprint.

DESC member companies, in addition to Intel, include AMD, APC, AT&T, Cisco, Dell, EMC, HP, Infineon, Johnson Controls, Microsoft, National Semiconductor, Nokia, Opto 22, Sony, Texas Instruments, and Verizon. In addition, a number of non-governmental organizations and associations are affiliated with DESC, including ACEEE, the Alliance to Save Energy, The Climate Group, the Information Technology Industry Council, ITS America, CompTIA, the Semiconductor Industry Association, TechNet, the Technology CEO Council, and the Telework Coalition.

"ICT and Greening the Federal Government

Intel commends the Obama Administration for the October "Executive Order focused on Federal Leadership in environmental, energy, and economic performance." It represents in concrete form the DESC policy principle of the Federal Government leading by example. We understand that the Executive Branch is very busy figuring out the best way to measure existing performance to provide a baseline for assessing future progress. As it pertains to ICT, the Executive Order clearly encompasses both the micro and macro stories. But we recognize that is perhaps easier to focus on the micro—the Federal Government purchasing more efficient ICT equipment—than it is to focus on how that equipment might be used to improve the energy and environmental footprint of the overall operations of Federal agencies. Intel and DESC stand ready to work with the Office of Management and Budget and the Office of the Federal Environmental Executive to explore best practices in bringing ICT to bear in reducing that footprint."

In the End It Is All About the 100-Percent Solution

Successfully addressing the three challenges of climate change, energy security and economic growth will require attention to both the micro story (improving the energy efficiency of ICT devices) and the macro story (promoting the enabling energy efficiency role of ICT in other sectors). The ICT industry needs to continue to design and produce more energy efficient devices. And policymakers need to implement programs that address the full energy efficiency potential of deploying such devices and the ICT systems they enable. The Green IT Promotion Council in Japan speaks of both the "green of IT" (micro) and "green by IT" (macro). The goal clearly should be to "minimize the 'micro' and maximize the 'macro.'"

Key Initiatives to Advance the Micro Story

In addition to each individual company in the industry driving the energy efficiency and minimizing the environmental impact from their products, we're also collaborating to drive systemic efficiencies together. Two groups are playing a critical role here: The Green Grid and Climate Savers Computing Initiative. Intel is a founding member of both.

The Green Grid

The Green Grid is a global consortium of IT companies and professionals seeking to improve energy efficiency in data centers and business computing ecosystems around the globe. The organization seeks to unite global industry efforts to standardize on a common set of metrics, processes, methods and new technologies. The participating companies contribute technical resources to develop and disseminate

these metrics and best practices in order for IT departments to optimize their operations.

Climate Savers Computing Initiative

Climate Savers Computing Initiative is focused on improving the energy efficiency of individual computers by improving power delivery (largely through power supply technology) and driving the adoption of power management (PCs going into low-power states when not in use). When the organization was founded in June 2007, the goal was taken to reduce CO_2 emissions from computing by ~50 percent or 54 million tons. To-date the savings from these two focus areas are on the order of ~$36 million tons. More than 550 companies have joined the organization and committed to purchasing energy-efficient PCs and servers for new IT purchases, and to broadly deploying power management.

Conclusion

The ICT industry is aggressively pursuing efficiency at both the micro and macro level and we are eager to collaborate with the Committee to further the policy agenda that supports these efforts.

The CHAIRMAN. Thank you very much, Ms. Wigle. Appreciate that.

Ms. Winkler.

STATEMENT OF KATHRIN WINKLER, CHIEF SUSTAINABILITY OFFICER, EMC CORPORATION

Ms. WINKLER. Thank you, Chairman Kerry and Members of the Subcommittee, for this opportunity to discuss the role of ICT in an energy efficient economy.

My name is Kathrin Winkler. I'm Chief Sustainability Officer for EMC Corporation, a Hopkinton, Massachusetts-based Fortune 500 technology company. EMC specializes in building information infrastructure. This is the digital foundation for storing, protecting, and getting the maximum value from information assets. This morning, I'd like to convey three points—I think you've heard them; it's always hard to be last——

[Laughter.]

Ms. WINKLER.—but they all warrant repetition—that ICT is driving efficiency aggressively within our industry, that ICT is central to unlocking increased energy efficiency and reducing greenhouse gas emissions throughout our economy, and that Congress has a role to play in working with industry to realize ICT's full potential.

Looking first at information technology's use of energy, the industry has dramatically increased performance per kilowatt in virtually every generation of our products. Our customers expect us to reduce their operating costs and help them defer or avoid the capital costs of data-center expansion. Our stakeholders are asking us to reduce our carbon footprint. And our technology culture has efficiency as a core design principle of good engineering.

For these reasons, the industry finds itself competing on three levels—on the energy efficiency of our products, in how we're reducing the carbon footprint of our operations and of our supply chains, and, most importantly, in the market for products and services that make ICT operations more efficient. Efficient operations are important because the greatest opportunity for reducing energy consumption in ICT comes not from the products themselves, but from how they're reused, from consolidating underutilized equipment and eliminating over-provisioning resources.

One of the most game-changing technologies in this arena is server virtualization, software that enables a single physical system to run multiple operating systems at one time. Without virtualization, most servers are being used at only 5 to 15 percent of capacity. With it, companies can consolidate hundreds servers down to a few dozen. Server virtualization initiatives based on software from one company, VMware, have measured aggregate power savings estimated to be greater than the electricity consumed annually in all of New England for heating, ventilation, and cooling.

With the amount of data growing 60 percent per year, other breakthroughs focus on efficiency of the data storage infrastructure. Solid-state drives, for example, consume 38 percent less power than their predecessors for capacity and 98 percent less for performance. Data de-duplication eliminates redundant data, reducing the amount of hardware, and thus, energy used to manage it.

"Cloud computing," referred to in the President's budget as essential, quote, "to achieve efficient IT and effective IT," is a model that delivers ICT as a service. It offers even greater consolidation and can offload peak demand, thus reducing over-provisioning in corporate data centers. EMC uses these technologies in our own ICT infrastructure, which has contributed to our reduction of greenhouse gas emissions by nearly 20 percent per dollar of revenue in the last 3 years.

ICT firms are also cooperating. In organizations such as the Green Grid, we bring together end users, vendors, and service providers to develop metrics, build tools, educate data-center operators, and collaborate with government and industry organizations around the globe. Yet, this is only one-fiftieth of the story. As we've heard, it's estimated ICT generates 2 to 2½ percent of global greenhouse gas emissions. But, of the other 98 percent, studies have shown that by 2020 ICT could abate as much as five times the emissions as it generates. This phenomenon is already apparent in our home State of Massachusetts, historically a leader in information technology and now a State whose energy productivity is one of the highest in the Nation.

We see ICT's potential in the energy sector with emerging smart grid technology, where ICT will provide the information and tools for utilities and consumers to make more informed decisions. We see ICT's potential in the transportation sector. Where does the engine for reducing fuel use through optimization of routing and of freight packing, as well as aggregating fleet performance data to evaluate vehicle technologies, fuel choices, and even driving styles?

There are many other examples, but there are barriers, too. Congress can help us overcome obstacles to reducing the 2 percent by demanding that Federal Government lead by example, implementing best practices in technologies in what is the largest ICT infrastructure in the world, bridging split incentives in the Federal infrastructure through institution of appropriate reporting mechanisms, continuing investment in cloud computing and next- generation ICT research and standards development at NIST, and collaborating with industry to promote the development of metrics and tools. To leverage the potential of ICT for the other 98 percent, Congress should expand the availability of broadband, as we have

heard, to connect cities and rural areas, and collaborate with industry to develop a national strategy for the use of ICT to improve energy efficiency and reduce CO_2 in the economy.

To summarize, ICT industry is in a race to the top. We are investing in technology and business-model innovation. We are collaborating to drive standards and competing to drive the market. Investments in research and innovation will be critical, but we needn't wait. The means to realize huge efficiencies in ICT and across a broad range of industry sectors are available today. Through its actions, Congress can accelerate our transformation to an energy efficient economy.

EMC is passionate about the current and future contributions being made by the ICT industry. We thank you, Chairman Kerry and Members of the Subcommittee, for this opportunity to share our perspective.

And I ask that my full statement be made part of the record.

Thank you.

[The prepared statement of Ms. Winkler follows:]

PREPARED STATEMENT OF KATHRIN WINKLER, CHIEF SUSTAINABILITY OFFICER, EMC CORPORATION

Thank you, Mr. Chairman, Ranking Member Ensign, and the member of the Subcommittee for this opportunity to discuss the role of Information and Communication Technology (ICT) in enabling a more energy-efficient economy. My name is Kathrin Winkler and I am the Chief Sustainability Officer for EMC Corporation. EMC is a Fortune 500 technology company headquartered in Hopkinton, Massachusetts. We specialize in building information infrastructure, the digital foundation that enables the applications and information that nearly every organization needs to be effective.

EMC commends this committee for seeking ways to fully marshal the power of ICT as a foundation for realizing the potential of energy efficiency, the ultimate renewable resource.

This morning, I'd like to focus on three major subjects:

1. How the ICT industry is delivering efficiencies in its own use of energy;
2. Why ICT is central to unlocking increased energy efficiency and reducing greenhouse gas emissions throughout our economy; and
3. How government and industry can work together to unleash untapped opportunities with technologies and techniques available today.

It is well known that ICT has been a key driver of economic productivity in this Nation for the past half-century. What is less well-known is that, as the American Council for an Energy Efficient Economy (ACEEE) demonstrated in its 2007 report,[1] ICT has also been a key driver of energy productivity.

Technology pervades and to a large extent enables every aspect of our economy and our lives. The web has become the world's dominant commercial infrastructure. It supports everything—transportation, the electric grid, supply chains, telephony, education, entertainment, and so on. And the digital information that courses through it is dematerializing more and more of human activity, allowing us to create economic value while reducing our use of physical resources. When you realize that only 20 percent of humanity has access to the web, you get a sense of how much upside remains unrealized.

ICT and the 2%

Let us look first at the ICT industry's direct impact on energy use. The ICT industry has dramatically increased the energy efficiency of its own products and services, improving performance per kilowatt-hour in virtually every generation of product. There have been a number of compelling drivers for this. First is the principle of good engineering requires efficiency to be considered in every design. This has been a core value at EMC since its inception 30 years ago.

[1] *http://www.aceee.org/press/e081pr.htm.*

Second, there is the constant drive to reduce operational cost for our customers. A continual improvement in price/performance of information technology combined with rising electricity prices means that costs for power and cooling are actually overtaking the costs for hardware.

Third, there is an effort to avoid capital costs. Data centers can cost hundreds of millions of dollars to build new. Capital projects like data center construction or expansion can the delay implementation of business-critical applications by months or years. Businesses that do not have the capital to build out new data centers may miss new growth opportunities as a result.

And fourth, there is the need to reduce greenhouse gas emissions from the use of fossil fuels upon which we still depend for so much of our grid energy.

The Competition for Efficiency

Energy efficiency is a compelling issue for our customers. Data centers can consume as much as 100 times the energy per square foot as a typical office building. As a result, the ICT industry finds itself competing on three levels. First, with regard to the energy efficiency of our own products, we offer more efficient power and cooling architectures and features that allow products to adjust dynamically to the loads placed on them.

Second, we compete to reduce our carbon footprint within our own operations and throughout our supply chains.

And third, we compete in the market for products that enable efficient ICT infrastructure, because the most significant and immediate opportunities for energy reduction come not from the products themselves, but from how they are used. The greatest energy waste comes from powering underutilized ICT assets and from inefficient use of ICT resources.

Technological Advancement

I'd like to share some examples of how EMC and our industry peers are addressing this market.

EMC offers products and services that help our customers manage their information assets with the same rigor with which they manage their other critical corporate assets and without compromising quality, reliability, or business performance.

For example, EMC is majority owner of the Palo Alto, CA-based company VMware. VMware provides a software tool called virtualization that has dramatically changed the technology landscape and ushered in an exciting new phase of ICT consolidation through *server virtualization*. Server virtualization enables a single physical server to run multiple operating systems at one time. Without virtualization, most servers use at only 5 to 15 percent of their capacity while still drawing most of their power load. With virtualization software, loads can be consolidated onto fewer physical systems for huge energy savings. A typical server virtualization initiative can result in hundreds of underutilized servers being consolidated down to several dozen. Gartner Group estimates that 1.2 million workloads currently run in VMware virtual machines; this represents an aggregate power savings of about 8.5 billion kWh—more electricity than is consumed annually in all of New England for heating, ventilation and cooling.[2]

With data volume growing at 60 percent per year, additional technological breakthroughs have focused on the efficiency of the storage infrastructure. Solid state drives, also known as flash drives, have no moving parts, and consume 38 percent less power as their predecessors for same capacity and 98 percent less for same performance. Where spinning disks continue to be utilized, technology exists to "spin down" the disks when they are not being accessed. Additionally, data de-duplication technology transparently combines redundant copies of data—including all 20 slightly different versions of your last slide presentation—reducing the amount of hardware required to backup all those copies.

Cloud Computing, the concept of delivering ICT as a service, much as electricity or telephony are delivered, holds the promise of even more efficient use of ICT resources. Compute clouds can further consolidate systems for greater efficiency and faster deployment. And by using cloud resources to serve peak demand, ICT managers can avoid over-provisioning their own data centers. The President's budget refers to cloud computing as essential "to achieve efficient and effective ICT" and describes the Administration's plans to offer limited cloud computing options throughout the Federal enterprise.

EMC is using these technologies in our own data centers, and by doing so, has saved $4.3M over a four-year period and reduced our carbon footprint by over 60

[2] *http://www.vmware.com/virtualization/green-it/*.

million tons of CO_2. Energy efficiency in our data centers and throughout our corporate facilities allowed us to grow our revenue by more than 50 percent from 2005 to 2008 while reducing our emissions per dollar of revenue by 19 percent. And, by engaging our employees in finding new efficiency opportunities, we are on track to achieve an additional 30 percent reduction in energy intensity over 2005 by 2012.

Coopetition

While ICT firms are competing with one another, we are also cooperating to accelerate implementation of best practices, establish standards for interoperability, and identify new opportunities for efficiency. Organizations such as The Green Grid bring together end users, vendors, and service providers to develop metrics, build tools, educate the community on how to save energy, and collaborate with government and industry organizations around the globe to share knowledge and create a common lexicon for ICT efficiency.

The Other 98%

Yet, this is only 1/50th of the story. It is estimated that ICT accounts for 2 percent of global greenhouse gas emissions. What about the other 98 percent? McKinsey tells us that investments in energy efficiency alone could deliver up to half of the emission abatement required to cap greenhouse gas concentrations at 450 parts per million.[3] Further, they tell us that applying information technology for efficiency in five categories of investment could eliminate nearly 8 metric gigatons of greenhouse gases by 2020—five times more than it will generate.

The analysis by the American Council on an Energy Efficient Economy shows that during the last two decades, ICT has already produced between six and fourteen kWh of savings for every kWh it has consumed. This phenomenon is apparent in our home state of Massachusetts, historically a leader in information technology, and now a state whose energy productivity is one of the highest in the Nation.[4]

We must take care not to implement policies that would have the perverse effect of inhibiting investment in technologies that will consume some energy, but can abate much more. We do not want to be kilowatt-wise and megawatt-foolish.

ICT in the Broader Economy

I would like to cite just a few of the many examples of how information technology is driving energy efficiency across the broader economy.

The emerging smart grid not only uses information technology to transmit rate, usage, and control data, but it will have the information for accurate forecasting and provisioning of electricity, and for responding quickly to external influences such as weather events or unanticipated demand. Consumers will have the information they need to understand the cost implications of their day-to-day choices, enabling them to adjust their behavior accordingly. And it is ICT security technology that will give consumers the confidence they need to participate in what must be an "all hands on deck" effort.

In transportation, ICT is the engine for reducing fuel use through optimization of routing and of freight packing. And our customers in this segment tell us it is doing much more. Aggregating information from their fleets enables them to understand the impact of fuel choices, vehicle technologies, and even driving styles to further remove energy waste.

These same capabilities applied to other dimensions of our infrastructure—buildings, transportation, agriculture—will create systems that are not only automated, but that adjust to demand and other influences such as outside temperatures to generate further efficiencies.

Nor should we overlook the role of ICT in research and development, where high performance computer modeling is accelerating design of new materials and technologies for clean energy and energy storage.

And of course virtual meeting technologies such as web conferencing and TelePresence are having a real and immediate impact. In EMC, our investments in eConferencing have reduced our carbon footprint, saved travel expense, and increased our productivity—a classic win-win-win.

These are but a few of the many examples of ICT as an enabler of energy efficiency. Organizations such as the Digital Energy Solutions Campaign, disseminate information to and collaborate with stakeholders to find, encourage, and measure ICT-enabled energy reduction and carbon abatement.

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[3] *http://www.mckinseyquarterly.com/How__IT__can__cut__carbon__emissions__2221.*

[4] *http://www.mass.gov/Eoeea/docs/doer/pub__info/Giudice%20FCC%Testimony%201130 2009.pdf.*

Implementation Obstacles

But there are barriers in both the 2 percent and the 98 percent.

There is still a significant population of stranded and underutilized ICT assets, particularly in smaller data centers that don't have the expertise or capital to invest in improvements. The body of knowledge still resides in the hands of a relatively small number of practitioners. And many data centers and businesses simply haven't taken advantage of the technology and best practices that are available to be deployed today.

In fact, these smaller data centers are proliferating in the national government. The EPA Report to Congress on Server and Data Center Energy Efficiency estimated that the Federal Government's electricity cost for its servers and data centers was $450 million in 2006 and was doubling every 5 years, putting the cost for 2011 at nearly $900 million. A 1998 survey of Federal agencies identified 432 agency data centers. In September 2009, agencies reported that the number of Federal data centers had grown to 1,100. This trend runs counter to the well-established best practice of consolidating to fewer data centers to reduce costs, energy consumption, and environmental impacts, while improving service and performance.

Role of Congress

Congress has a role to play in removing the barriers to reducing ICT's 2 percent. Congress should focus on four key areas:

1. Demand the Federal Government lead by example to drive energy-efficiency throughout its ICT enterprise by aggressively pursuing virtualization, and ICT/data center consolidation.—Congress, through its various Committees, has oversight responsibility for the largest ICT infrastructure in the world; the President's FY 2011 budget requests $79.3 Billion for information technology. OMB included in the FY 2011 budget a plan to drive ICT consolidation: "OMB will work with agencies to develop a Government-wide strategy and agency plans to reduce the number and cost of Federal data centers. This will reduce energy consumption, space usage and en-vironmental impacts, while increasing the utilization and efficiency of IT assets . . ." *Congress should request and review these strategic plans as part of the annual appropriation process and provide the resources necessary to accelerate OMB's ICT consolidation plans*.

2. Bridge split financial incentives in Federal data centers.—In many government data centers, those responsible for purchasing and operating the ICT equipment report to the CIO while those responsible for the power and cooling infrastructure typically pay the utility bills. This leads to a split incentive, in which those who are most able to control the energy use of the ICT equipment (and therefore the data center) have little incentive to do so or even insight into their own usage. This could be remedied by Congress requiring that agency CIO's report on data center energy consumption and provide a baseline to Congress for future comparison.

3. Continued investment in cloud computing and next generational ICT research at NIST.—Government has become an early adopter of cloud computing. As with the deployment of other promising technologies like smart grid and electronic health records, cloud computing will not be fully realized without open interoperability, data portability, and security standards. Congress should fully fund NIST's Cloud Computing Standards Effort.

4. Collaborate with industry to promote the development of measurement tools for government and private sector data center operators.—Industry continues to struggle to develop acceptable models to measure data center efficiency. Without reliable efficiency methodologies on which to base rebate programs, it is difficult and expensive for utilities to conduct tests themselves and many simply forego rebate programs. With an estimated 1200 regulated utility service areas in the United States, there is tremendous potential for replication of successful programs. With Energy Efficiency Resource Standards mandates in more than 19 states, Congress should assist in providing useful measurement tools for the state PUCs to incentivize energy conservation in data centers.

Similar barriers exist across the other 98 percent. Split incentives discourage ICT investment in leased facilities by both landlords and tenants. Capital investments in efficiency, while showing attractive returns, may still be prohibitive, particularly for small and medium businesses. There is a shortage of expertise and tools for applying best practices in disciplines that could have a substantial impact. And there are many places that simply do not have infrastructure such as broadband on which to build next generation ICT solutions.

Congress can act right away in three key areas.

1. *Expand the availability of broadband.* EMC strongly supports Congressional programs that expand the reach and quality of broadband in this country. Broadband is vitally needed to take advantage of telecommuting, video conferencing, and the many energy efficiencies possible through intelligent connected devices. Moreover, connected cities and rural areas are vital to the success of the Administration's drive to digitize health records, enable the energy Internet, and connect rural schools. While, each of these programs will increase the energy demand for ICT systems, they will provide much greater efficiencies to the broader economy.

2. *Call for a national strategy for the use of ICT to improve energy efficiency and reduce CO_2 in the economy.* A major barrier is an agreed-upon protocol or approach for measuring the energy-efficiency and climate impacts of ICT in other economic sectors. Congress should encourage the Executive Branch to develop a national strategy or roadmap for the use of ICT to improve energy efficiency and reduce our greenhouse gas emissions.

3. *Expand public-private partnership.* The transformation to an energy-efficient economy will be accelerated through complementary actions in public policy, open standards, and technological innovation that can only be achieved through collaboration across segments, and between government and private industry.

Conclusion

To summarize, the ICT industry is in a race to the top. We are investing in technology and business model innovation. We are collaborating to drive standards and competing to drive the market.

Technology and best practices already exist and are in use today; they could have an even greater impact if we conquer the implementation barriers. While we need to continue to invest in innovation, we must also accelerate deployment, and strengthen the public-private partnership to provide both the incentives and the means for economy-wide energy efficiency and reduction of carbon emissions. And we must not focus only on the ICT industry itself—but also on how it enables the other 98 percent, lest we save ICT kilowatts at the expense of economic megawatts.

Last year marked the 20th anniversary of the World Wide Web. Its inventor, Tim Berners-Lee was asked recently where the web could take us tomorrow. He spoke of the emergence of a web of data that people can share and mash up and use at will, saying "I think when we have a lot of data available on the web about the world, including social data, ecological data, meteorological data, and financial data, we'll be able to make much better models from which to draw conclusions."

Thank you, Mr. Chairman, Ranking Member Ensign, and the member of the Subcommittee for this opportunity to share our perspective. EMC is passionate about the current and future contributions being made by the ICT Industry in enabling energy efficiency, the ultimate renewable resource.

The CHAIRMAN. Thank you, Ms. Winkler.

And, without objection, it will be made part of the record. All of your statements will be made part of the record as if read in full.

Let me begin by asking Mr. Chopra—you talk about the smart grid—a number of you have mentioned the smart grid—and we all hear the virtues of a smart grid, and obviously I am supportive of that, but I get a little frustrated, in a sense, talking about a smart grid, when we don't really have an American grid. I mean, we just don't have a grid. And it's one thing to talk about it being smart, when we can't even sell energy produced in Arizona to New England, et cetera.

So, what are we going to do about getting a grid in America? Because we've got an East Coast grid, a West Coast grid, a Texas grid, and this tiny line up north in Chicago, North Dakota, et cetera. That's it. A gaping hole in the center of our Nation which prohibits investment because you can't get a return on investment, based on the size of the market, et cetera, for the kind of energy you produce in one place. Help me with that, can you?

Mr. CHOPRA. Yes. Well, Mr. Chairman, you—you've put your finger on a very important component to this, which is ensuring we

have the market conditions that would spur investment, that would essentially connect the pieces that you're describing. That's why the President has been committed to working with Congress on enacting and implementing a comprehensive market-based policy. And the goal, obviously, is to achieve a great deal of efficiencies in the system, but also to address the greenhouse gas emissions challenge.

The CHAIRMAN. Let me stop you for a minute. Have I missed something? Am I—is there a proposal on the table for the national buildout of a grid which has preemption so we don't spend the next 20 years with one State fighting with the other over where the connection goes?

Mr. CHOPRA. No. But, I appreciate the—there is a task force that is clearly focused on this issue and will clearly look forward to working with the localities on how we address the jurisdictional issues around the transmission networks, the research and development capacities to ensure that we have the right storage capabilities so that the energy that's produced in one location can be efficiently transmitted and stored——

The CHAIRMAN. Well——

Mr. CHOPRA.—so that then——

The CHAIRMAN.—I have to——

Mr. CHOPRA.—it can——

The CHAIRMAN.—tell you, I——

Mr. CHOPRA.—be deployed——

The CHAIRMAN.—I mean, I'm not often—you know, I don't often express frustrations publicly about things, but this—on the Administration—but this is one where I just—I don't get it. I don't understand why this was an issue, almost number one. You want to get the economy moving, way back, last January. This—it seems to me, you've got to build out America's grid. And nothing will do more to excite capital flow to some of these other things than the idea that you've got this enormous national market of—accessible to you.

Mr. CHOPRA. Mr. Chairman, we absolutely concur with that. That's why we put over $3.5 billion, from the Recovery Act, dedicated toward—with your support and Congress's action—to invest in the components that would be enabling of that vision. So, you need to look at the ability to produce renewable energy. You need to look at the transmission issues, both from a policy standpoint and from a technology standpoint. You've got to address the storage issues. And so, we have comprehensive activities in each of these domains.

But, perhaps I misunderstood your question. To the extent that there—there are, basically, movements on all of these fronts, Mr. Chairman, that are taking place now, as we speak, called for over the last year, since we've been working on these issues.

The CHAIRMAN. Does FERC need to be overhauled to make it happen?

Mr. CHOPRA. Well, Mr. Chairman, I—with all due respect, that is not my area of expertise, and it would——

The CHAIRMAN. Fair enough.

Mr. CHOPRA.—frankly, welcome the——

The CHAIRMAN. Fair enough.

Mr. CHOPRA.—the ability to——

The CHAIRMAN. No, that's fair.

Let me ask you, Mr. Hesse—and you might comment on this, any of you—but, you mentioned, I think, Mr. Tuck, that the market is—you know, the market of technology in 1990s, et cetera, was a big market. This is much bigger. In fact, I think the market of the 1990s was about a trillion-dollar market with a billion users. The energy market is a $6- to $10-trillion market, with potential of 6 billion-plus users.

It's hard for me to understand why your company, or Sprint or someone else, are, sort of, you know, the exception rather than the rule. Where is American enterprise in understanding that the transformation of the American economy is in energy efficiency—alternative, renewable, et cetera—rather than watching China, India, South Korea, Germany, France—all of them are rated well ahead of us, in terms of, you know, their ability to be low-carbon-intensity economies. Can you help me understand that?

Mr. HESSE. Well, I can't speak for all other companies, Mr. Chairman; I can speak for Sprint's point of view. I mean, we're moving aggressively in this area, because it's just—it's good business.

Number one, I think, customers like doing business with companies that share the same values. And when you do the research about what customers are looking for, I think that's—you know, that's number one.

Number two, there has to be a good return on investment as you invest in these new technologies. And we have found that to be the case, in terms of reducing our energy expenses——

The CHAIRMAN. Let me just——

Mr. HESSE.—reducing paper——

The CHAIRMAN.—ask you——

Mr. HESSE.—expenses——

The CHAIRMAN.—to comment—and you could also—as you all have—answer this question—To what degree is the pricing of carbon a critical element of exciting that investment and providing a certainty or a signal in the marketplace for people to invest?

Mr. HESSE. Well, you know, we just do the—you know, the—if you will, the financial analysis of what the capital costs are, what the investments are. Because generally there's an up-front investment to almost every green or new technology; and then, of course, we compare it to the cost of carbon and the cost of energy, and you figure out your payback. And it is very much an economically driven decision.

The CHAIRMAN. But, you're seeing it as an—economically-driven on the plus side?

Mr. HESSE. Yes, we are. We're seeing these as good investments to make.

The CHAIRMAN. How——

Mr. HESSE. For——

The CHAIRMAN.—do you——

Mr. HESSE.—two reasons. It stimulates demand for our products and it—number two, it reduces our costs.

The CHAIRMAN. And maybe you can help us just understand how it pays to take back 19 million devices.

Mr. HESSE. Well, actually, because—the reason is because there are valuable materials, as we mentioned—you know, even though the Olympics only come along once every 4 years, there are lots of other uses for the materials. And what we have found is—what we have done historically is, when customers return devices, a number of them, the phones——

The CHAIRMAN. We're not going to tell——

Mr. HESSE.—can be——

The CHAIRMAN.—the athletes that they are recycled.

[Laughter.]

The CHAIRMAN. We're going to tell them that they're innovatively produced.

[Laughter.]

Mr. HESSE. That's correct. But, a number of—one of the reasons we take them back is, a number of phones can be put back into the system and sold as "used," either in the United States or around the world, and that is good, in terms of getting as much maximum life out of these devices as possible. Other devices, they don't have a use in the market, but there are materials, like gold and silver, that the value is in excess of the cost—because there is a cost of environmentally recycling this. And what we have done historically is, whatever that difference is, we donate that additional profit to an organization called For Net Safety, which keeps the Internet safe for children. But, it still has not stimulated—you know, "We'll take your phone," that hasn't stimulated enough return or recycling of phones, and that's why we are now adding an additional financial incentive to do that. But, net-net, there is value in these devices, and it just makes no sense for consumers to throw them away.

The CHAIRMAN. Does anybody else want to comment? And that's my last question.

Mr. TUCK. You asked why we were falling behind to other parts of the world, related to things like the smart grid, and you talked about the size of the market. I don't think it is a market yet. It's a great opportunity, but—I think the one thing that the U.S. taught the world, in the telecoms market, was that the role of government was to create a level playing field and allow private companies to compete in the space, by giving access to information and ensuring things like the price of carbon. In our case, now the price of carbon is a well understood thing. And neither of those things yet exist enough to make this market move.

So, I can't compete in lots of places, because I don't have access to data that I need of the systems. So, I don't need money, I don't need a check from the government; I need a marketplace. And, really, regulation can provide me with access to consumers, with their permission, consumption information so that I can provide innovative services to them to help them save money. And I don't have that level playing field at this point.

The CHAIRMAN. Senator Johanns.

STATEMENT OF HON. MIKE JOHANNS,
U.S. SENATOR FROM NEBRASKA

Senator JOHANNS. Mr. Chairman, thank you.

I want to compliment the panel. I have found this to be very, very fascinating testimony.

Let me, if I might, zero in maybe a little more on the micro level, Mr. Tuck. And I'm going to start with you, because I want to understand what we can do, from a policy standpoint, to follow up on your last comment.

Let me give you a hypothetical. Let's say that I own a commercial building, or maybe I own just my home, and I want to get a better idea of, minute by minute, how much energy is consumed. You know, somewhere out there, there is a gas meter and there is an electric meter, but, quite honestly, it doesn't do me a lot of good. It does the utility company a lot of good, because they send me a bill every month. How do I interface with that so, literally, if I wanted to call this up on a laptop or some other device, I could look at what's going on with our energy use and try to get a handle on how better to manage that? Tell me the impediments to making that happen today.

Mr. TUCK. So—thank you, Senator. There are two parts to that. One is technical and one is procedural.

The technological one is that about half the homes in North America are already equipped with a meter that, with a very simple piece of self-installed technology, you would be able to get access to your gas, water, and electricity meter in your home, and then view via a website or on a dedicated device or on your smart phone. So, the other half of the homes need to be fitted with something; and I don't know, you know, whether your home would fit. But, the more important piece is that you don't yet have rights to that information. And so, the ability to access that information in realtime as a consumer of the energy consumption in your home is not currently a right that's afforded to you by all utilities. And so, getting clarity, at the Federal level, about what the rights should be for consumers to get access to that information, is critical.

Senator JOHANNS. Are the utilities against that?

Mr. TUCK. I don't think so, sir.

Senator JOHANNS. OK.

Mr. TUCK. The temptation here is to demonize the utility. I don't think that's the case. I think they just have a lot on their plate. Utilities do what regulators tell them to do, and regulators haven't told them to do this yet.

Senator JOHANNS. How best would you go about accomplishing that technical step, if you will?

Mr. TUCK. I think the technical piece of fitting homes with smart meters is well underway. There's a NIST process, which has defined a set of standards, and——

Senator JOHANNS. OK.

Mr. TUCK.—and the stimulus dollars are moving forward, which will help get meters into people's homes. But, for the people who already have them, or at least a type of meter that would work, I think some sort of best-practices model that States could follow would be an important piece of work that could be done.

Senator JOHANNS. OK.

Mr. Chopra, let me ask you about the grid issue, because that's a puzzling issue, I think, for everybody involved. And yet, I think

the Chairman makes a good point, that's kind of an entry point for a lot of issues here.

What would it take to make that happen where we would have better connectivity? For example I represent the State of Nebraska. As you know, we're a 100-percent public power State. It's worked well for our State. But, it's the only one in the country, and sometimes we feel like, when the debates occur on grid and smart grid, et cetera, that nobody connects with that fact. Help me think through that. What steps are necessary to create the smart grid that you always hear about?

Mr. CHOPRA. Well, I would say it starts with a set of data standards and energy standards that would allow different inputs, if you will—supplies—whether it be a solar panel on your roof or a small micro plant, if you will, that can commute—that can produce power for your neighborhood. How can that supply connect into a system that can meet the needs of your home, your neighborhood and ensure that the utility has the right control systems in place so that the energy is reliable in delivering a certain amount of output?

So, you need to understand how do you input energy to the system. You then need a mechanism to transmit that energy. And that's where I said earlier to the Chairman, the notion of storage as one of the technological innovations that could be helpful in enabling this so that if, for example, you have a wind—a modest capability to capture wind, but it only—it's only producing enough energy during certain times of the day, which, by the way, don't coincide with the times of the day when we're at peak demand.

Senator JOHANNS. Yes.

Mr. CHOPRA. So, having storage, an ability to capture that energy, and then to be able to distribute that and use it when there are otherwise periods of peak demand, that's an innovation—a technological innovation that we need to work on as a society. Storage helps on solar, wind, and almost all nature of renewables. They all have the same need.

There's this information component, that Mr. Tuck so kindly and thoughtfully described, which is, What is the standard by which I should—do I want to log into *www.checkhereformyenergystatistics .com*?

Senator JOHANNS. Yes.

Mr. CHOPRA. That's probably a little silly, in the sense that you wouldn't even know what to do with the long string of numbers. Today, you and I get a bill once a month.

Senator JOHANNS. Yes.

Mr. CHOPRA. So, if there's a data standard—an open standard, where an entrepreneur in your State knows the protocol, can build an interesting application that can consume that data that Mr. Tuck is going to help release through some of his devices, then maybe someone comes up with an interesting text-messaging system that alerts you, so you can make judgments about your usage.

So, one of the challenges on smart grid is, we—it's defined very broadly. There are policy barriers. I think the Chairman very thoughtfully described this notion of: How do you deal with the transmission issues across the country? There are capital issues: How do we fund the equipment necessary to produce the energy, to transmit it, and to manage the information components of this?

And there are a set of these technological standards and technological innovations, as I alluded to.

I hope that was moderately helpful.

Senator JOHANNS. It's helpful. My time is up, but I want to wrap up with this thought. You know, we go through these agonizing arm-wrestling debates on cap-and-trade et cetera, et cetera, but it seems to me like there is so much potential here, if we could just figure out how to bridge that. And you know what? It's something that would get a tremendous amount of support. We want to do more wind energy in Nebraska. We have a lot of wind. The wind blows——

[Laughter.]

Senator JOHANNS.—the wind just—we see that as a great potential and an opportunity, and we want to develop that. We're big supporters of that. So, my hope is that maybe this hearing spurs some discussion about some of those things. I see this as kind of low hanging fruit, to be honest with you. And it sure seems to me there has got to be a way to figure out some of these issues. It really does have the potential to be a win-win for a lot of people.

Mr. CHOPRA. Just rest assured, we would be very keen to work with you on this issue. We deeply believe there's value here to be unlocked, and the private sector has been a phenomenal partner in driving innovations, here. So the opportunity here is rich, and we would be keen to work together.

Senator JOHANNS. Great.

Mr. Chairman, thank you.

The CHAIRMAN. Thank you, Senator.

Senator Brownback.

Senator BROWNBACK. Thank you, Mr. Chairman. Appreciate that, and a good panel. I appreciate that, as well.

If I could just build on the wind comment, because we've got a lot of it in Kansas——

[Laughter.]

Senator BROWNBACK. We've got a new concept now, we call "stranded wind." So, we now have wind farms that are built in the western part of the State that we cannot get the wind energy out of. Mr. Hesse, you guys are buying wind off of a wind farm. Most of our transmission lines are built to take it from, generally, power plants in the eastern part of the State, and move it west. The wind farms are in the west, and there's just not the capacity.

We're trying to get, through the Southwest power pool now, a big V-line that has the 765 voltage, the big voltage to carry the wind out, and we're getting mixed reviews from some of the other States, on whether they want to help us to pay for this, or not. They're saying, "Well, look, we want to sell our wind. We've got it, too." I understand. And they do. But, my point in saying all this is that the transmission issue is critical and you have been a big help on that.

We do have an energy bill that's out of committee, it's a bipartisan bill, I think there were only five or six votes against it; it has some transmission pieces in it, not as robust as some would like. But, I hope we can get that to the floor and move it, because transmission is the critical component on this.

Mr. Hesse, how did you guys, you run off of wind power, how do you get it there? Or did you just say, "We're going to buy so much wind off of this farm to help in the development of that wind farm operation?"

Mr. HESSE. Well, I first have to give credit to my predecessors at Sprint for making that decision when the Sprint campus was built. We were one of the anchor tenants, working with KCP&L to really justify their investment and build off that wind farm.

But, what we're doing to take it further, we're testing wind turbines on campus today to see if, in addition to hydrogen fuel cells, we can use other technologies, like wind, to power cell sites. Because our network really is—it's our big use of power in our industry. It's not headquarters so much. To run a network, to run servers, computers, cell sites, and what have you, that—you know, that takes a lot of power consumption. We're using solar—we're testing solar in places like California that don't have as much wind, but may have more sun. But, basically, just a very good—you know, very close level of cooperation with our power company, KCP&L. And we planned the building, if you will, of this wind farm, together with other companies. We—you know, we came together to get it built.

Senator BROWNBACK. Because what I'm finding for a number of wind developers, they have to have an anchor buyer——

Mr. HESSE. That's exactly——

Senator BROWNBACK.—for the wind. But, if they can get that, they'll build it, because they've got to be able to cover their investment. I really appreciate you guys doing that.

Mr. Chopra, in the Ag sector, and Mr. Hesse held up his phone; part of it's made out of corn. They've got a series of different new products, and this is a movement that started 15 years ago. I remember a guy came in once, years ago, when I was Ag Secretary in Kansas, and he had a skeet made out of cornstarch. You know, that's kind of a simple little thing, but it's normally petroleum-based. But what a great little simple idea. It would be very easy to kind of double back with some of these guys and say, "What is it you want to do?" Mr. Hesse, I just had in my office some Johnson County Community College people that want to build a green home in Johnson County, with Pittsburgh State University. They've developed a foam rubber that's used in Mustang cars now, it's made out of soy beans, so it's recyclable; or if you get stuck in a snowstorm, it's edible.

[Laughter.]

Senator BROWNBACK. I'm not exactly sure about that, but it's made out soy, anyway. But, they've got a green concrete they're working on, and they want to build a green house, literally "green" house in the area, and I thought it is a great innovative idea, and yours would be a great company for them to work with on this. And I hope that they can work with you, and move that on forward.

Mr. Tuck, are you suggesting that you have a national piece of legislation on the "right to know"? Is that what it would take, because I hear you saying that half the homes have this information readily available, but they don't have a right to get it.

Mr. TUCK. To be honest, sir, I'm not expert enough to know where the policy needs to sit. I can just identify that something

needs to be done, because there are some States that are moving ahead, and others that aren't. And what I hear from State regulators is that, at a minimum, they'd like to see some guidelines, some sort of best-practices template put together that people could follow. I don't know if it extends all the way through to national legislation.

Senator BROWNBACK. But, you have three States that have enacted legislation like this, if——

Mr. TUCK. Yes.

Senator BROWNBACK.—I heard you right?

Mr. TUCK. Yes.

Senator BROWNBACK. Is there a cost associated with that?

Mr. TUCK. I don't believe so, sir, no.

Senator BROWNBACK. So that they've been able to do that, and just that information has to be readily available to the consumer.

Mr. TUCK. That's correct.

Senator BROWNBACK. Those things have always impressed me, that when I know what's going on and I react accordingly. One of my daughters has a Prius car; and that dial, I'm always kind of playing a game with it: How efficient can I be?

[Laughter.]

Senator BROWNBACK. And then I can measure how much they've been really going fast. I have daughters that drive differently, and they get different performances out of those cars. But, I think it's a good way for us to be able to go.

I really appreciate it, and particularly want to say the Sprint company, Mr. Chairman, and others, have done an outstanding job. They have the premier sporting facility in Kansas City, the indoor sporting facility. They've done it in a very ecologically sound fashion. The things that they do are, I think, phenomenal, and I think they present a real case study of how a company can step up and do the right things. It doesn't cost more, and it actually creates markets to be able to do that. I didn't realize the medals were recycled at the Olympics; I appreciate understanding that.

I close on this comment. Years ago, I had a chance to carry the bill for Congress to give Mother Teresa the Congressional Gold Medal, and she and her group asked to recycle it and melt it down, to sell the gold to give to poor. They were going to do it in another fashion, and we said, "Why don't you not do that. Just auction it off, you'll get more money for it." But, I think that's a really interesting way for us to highlight and to showcase the great things that we can do that help us as a society, costs nothing, and really show the right way. Appreciate your leadership.

Thank you, Chairman.

The CHAIRMAN. Thank you, Senator Brownback.

Senator Klobuchar.

STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM MINNESOTA

Senator KLOBUCHAR. Thank you very much, Mr. Chairman.

I've decided to stay away from wind, I learned long ago that 20 States, including my own, claim themselves to be the Saudi Arabia of wind.

[Laughter.]

Senator KLOBUCHAR. But, I thought I would focus more on some of these energy efficiency issues and, really, first off, the marketing piece of this, because I did a series of energy efficiency forums across my State and found that we were doing some interesting things. Some of—even some of our smaller utilities—I mean, obviously, we're home of Excel, and we also have 3M and Best Buy. We believe in giving consumers information, and that they're going to make the right decisions. But, one of the things I found was that some of the experiments they'd done in certain neighborhoods, when consumers found out how much their neighbors were expending, that it got them more interested in saving that energy.

So, could—well, maybe you want to start, Mr. Chopra. Could one or two of you just address that piece of this, how you get people to see that it's not just the base price, but it's also how much you can save in the future, and what's the best way to do that.

Mr. CHOPRA. Senator, I just—I so concur with your view. And frankly, we wanted to tap into the innovative spirit of the American people. That is why we launched the Smart Grid Forum today. We have a great deal of conversation that takes place in Washington, but the premise was, How do we take this conversation all across the country so that consumers, suppliers, utilities, other stakeholders can share what they want to see coming out of the data effort here, the consumer access to that data, so that, basically, more and more of those applications can thrive? I'd love the language Mr. Tuck used about a "marketplace." And there's a great deal we can do in the here and the now to push. That's why this online forum over the next several weeks is going to surface those ideas, allow the American people to talk about which ones are more or less intriguing. And frankly, the bottom line is, if we can tap into the information—that's what the smart grid grants, in part, are doing; they're putting resources into communities to connect them to those modest technology capabilities to free the data, if you will. And now, if we can start to get folks to build innovative games or apps or other programs so that it would help people—you know, I might be more interested in looking at my neighbors' usage; someone else might be more interested in a price signal; one might want to infer a price signal, assuming we had a time-of-use pricing deployed. So, there could be lots of motivations, and we just want a marketplace that can grow off of the raw material——

Senator KLOBUCHAR. OK.

Mr. CHOPRA.—which is the data.

Senator KLOBUCHAR. Thank you. Anyone aware of what works best with consumers to try to get them interested in this and how to save money in their own households?

Ms. WIGLE. One of the things——

Senator KLOBUCHAR. Why——

Ms. WIGLE. If I might. One of the things that we've realized is, it's really important to engage consumers as they evolve. So, a lot of utilities have done experiments where they provide usage information—or energy usage information to consumers. And what happens is, it's very, very interesting to them for a couple of weeks, and then they lose interest in it.

So, what we believe is, you actually need to provide solutions that can evolve as they are becoming more and more mature with

regard to their interaction with their usage. So, it might start with just understanding it, but then being able to take action, set policy, do comparisons, and set goals for themselves. It would be really cool to have utility programs that assign points when you are hitting your targets, and actually introduce——

Senator KLOBUCHAR. Yes——

Ms. WIGLE.—an element of achievement.

Senator KLOBUCHAR.—what they told me was just finding out how much it costs you if you leave the lights on or if you don't leave the lights on——

Ms. WIGLE. Exactly.

Senator KLOBUCHAR.—in your own home.

Ms. WIGLE. Action oriented.

Mr. TUCK. So, we are very much involved in projects in several states, when we did exactly that. We gave consumers the ability to look at their own consumption in isolation and then start to share information about themselves and see comparisons of other people in 3,000-square-foot homes, and so on.

Senator KLOBUCHAR. They like to compete with their neighbors.

Mr. TUCK. Yes.

[Laughter.]

Mr. TUCK. We found that that was the biggest driver. So, we tested——

Senator KLOBUCHAR. OK.

Mr. TUCK.—three drivers: saving money, saving the planet, and beating your neighbors. And beating your neighbors trumped everything else.

[Laughter.]

Senator KLOBUCHAR. Of course. I would have guessed it.

Ms. WINKLER. Senator——

Senator KLOBUCHAR. OK.

Ms. WINKLER. Senator——

Senator KLOBUCHAR. Yes.

Ms. WINKLER.—I'd just like to add one thing, though. I think it's important to recall the issue, also, of split incentives. And so that while having—you know, turning your energy down when you go to sleep at night or when you're away from the home is very important, but a huge amount of saving can come from investing in that, as well.

And we do have the problem that, a lot of cases, the capital investment needs to be made by somebody other than the——

Senator KLOBUCHAR. I——

Ms. WINKLER.—party——

Senator KLOBUCHAR.—understand.

Ms. WINKLER.—that's paying for the energy.

Senator KLOBUCHAR. OK. And I'm—maybe I'll—you can—we can correspond about this. I just want to move on to one other topic. And that is e-waste. And I appreciated, Mr. Hesse, what you said about the—recycling the cell phones. But, I have a bill, actually, the Electronic Device Research and Development Act, because we've seen this huge increase—2 billion computers, televisions, wireless devices, printers, gaming systems, and other devices have been sold since 1980, generating 2 million tons of electronic de-

vices. Best Buy has worked on this, of getting incentives for people to bring back theirs so it can be recycled.

I guess this one is for Mr. Chopra, just quickly. What do you see as the future of this?

Mr. CHOPRA. Well it's—there are multiple dimensions. So, there are communities where they've built programs, where school districts will accept old computers, have the kids learn how to refurbish those computers, and then make them available to help them close the digital divide. That's not a technological innovation as much a sort of an interesting programming effort.

On innovations in materials and design, we continue to see research and development, through a number of programs that we fund in the National Science Foundation and others, to look at next-generation information technologies. We have a coordinating program called——

Senator KLOBUCHAR. Right, and that's what this bill is focused on trying to get that research——

Mr. CHOPRA. R&D.

Senator KLOBUCHAR.—going so that we can develop technologies that create less waste and can be more easily recyclable.

Mr. CHOPRA. Well, as always, we'd be keen to work with you——

Senator KLOBUCHAR. OK.

Mr. CHOPRA.—on any and all of those ideas.

Senator KLOBUCHAR. Thank you.

One last thing, Mr. Hesse, I do appreciate the work that Sprint is doing, but do remember, as much as we want to compete on green and compete on new technologies, if people are locked in on early termination——

[Laughter.]

Senator KLOBUCHAR.—you're not going to be able to compete, because they're not going to be able to pick another product, because of whatever desire they have, if they're locked in with an outrageous early termination fee.

Mr. HESSE. Senator, if I might make a comment on that point. Customers have a choice of—they can go prepaid—and they have three choices with Sprint. They have Boost, Virgin, or Assurance Wireless. And we believe we have the most consumer-friendly prorated fees in the industry. And, as you know, there are significant subsidies that come along with these phones, and we don't want customers switching back and forth too often, because it just adds to the e-waste problem or issue.

One other thing I will say, what's called—in terms of the question, Senator, you asked earlier—one of the advantages of this industry is what's called dematerialization. So, I was just talking to a few people walking in, they no longer carry watches, calculators, alarm clocks, cameras, and other devices because they're all included in here. So, that's one of the other benefits of the wireless——

Senator KLOBUCHAR. OK.

Mr. HESSE.—industry.

Senator KLOBUCHAR. Very good. But, do remember, you could do these fees, as long as they're prorated and as long as they are—make sense with the difference between the actual cost and the dis-

count. And, as you know, I've been much more focused on Verizon's fees lately. So, thank you very much.

Mr. HESSE. Well noted, Senator.

[Laughter.]

The CHAIRMAN. Senator DeMint.

STATEMENT OF HON. JIM DEMINT,
U.S. SENATOR FROM SOUTH CAROLINA

Senator DEMINT. Thank you, Mr. Chairman. I apologize for being late and missing a lot of the testimony, but I am very interested in this.

I won't make you rehash a lot of what you've already talked about. But, just on the energy efficiency front of how to use technology communication, I'm just curious about the consumer demand at this point. What are you seeing in the products you're making, the concepts you're discussing? Do you sense that consumers, on their own, are looking to buy, to use the technologies that are available, and in development? Do you see this as something where the market will actually drive more innovation and development? Really any of you? What are you seeing on the wireless front, Mr. Hesse?

Mr. HESSE. Well, we have been extremely pleased, Senator, with the success of this particular device. But, the—you know, the early research, when we launched it, told us that it was risky. Consumers, at the end of the day—and in my comments earlier, I talked about recycling—if there's a financial incentive——

Senator DEMINT. Right.

Mr. HESSE.—customers are very interested. That really drives them. And the key to the success of this phone is that we—Senator, is that we cut no corners. It's a full 3G phone, full QWERTY, Blue—you know, stereo Bluetooth; it had to have all the features and be at the same, or better, price performance than the other products on the market. So, our challenge is that consumers—when all things are equal, consumers will go green. But, if it's more expensive or if the consumer needs to give something up, we're still not at the point—they're—of course, they're a small segment of the consumer base that will be looking for green, but it's still a fairly small segment. So——

Senator DEMINT. So, we're at the early adopter stage, really, in using a technology to reduce an energy footprint.

Mr. HESSE. Yes, Senator. But, what I will say is that there—we in the industry—and one of the reasons that we've—we announced, today, these design principles for the manufacturers—we have the ability to lead the carriers, the manufacturers by—there are a lot of technologies that we could choose to deploy that would make devices both perform very well and be at a good cost and be greener. So, I think there's an opportunity for us just to show more leadership, as well. And when you do that, consumers will buy it.

Senator DEMINT. Any other thoughts on——

Mr. TUCK. Yes, Senator, I'd say that studies have shown that there are sections of society that are willing to pay quite a reasonable amount of money to put systems into their homes in order to make them more efficient, but they are dwarfed by the people who aren't. That said, what we're seeing is, in our work with partners

like GE, what we're able to do is create new appliances, where the cost of the new appliance is no more than the one that it would replace, and yet it's significantly more energy efficient. So, fridges that can talk to the grid and decide to make ice at night rather than during the day, when there's plenty of wind around, and those kind of things, are the kind of appliances where consumers will buy them because they consume 30 to 50 percent less energy and don't cost any more at the point where they replace their appliances. But, it's not going to trigger them to go out and swap their existing fridge.

Senator DEMINT. All right.

Yes.

Ms. WINKLER. I think it's—this also goes back to the issue of information. The way it works today, when you get your electricity bill—and you see what happened over last month—you have no idea what the specific actions were that you took that generated that. That linkage is nonexistent between your behavior and the bill that you get.

Senator DEMINT. Right.

Ms. WINKLER. So, it's going to be the availability of information that's going to allow consumers to act on that.

Senator DEMINT. Yes.

Ms. WIGLE. And I would also just add, with regard to computers themselves, we see huge interest in energy efficiency, particularly in two areas. One is data centers, where often it's not the cost of the energy, it's the fact that they're running out of power and cooling capacity in a facility, so they're looking at having to build a whole new data center if they can't get more energy efficient equipment. The other is, we are—have been able to realize incredible efficiency gains because of battery powered devices and optimizing energy efficiency so we maximize battery life. And we're able to take those technologies then and apply them to other computing platforms, which is a very important area of innovation.

Senator DEMINT. That's very helpful.

Mr. CHOPRA. I'll just make one observation. Beyond the consumer, the enterprises, whether it be government agencies or companies, are increasingly incorporating, as part of their requirements, energy efficient technology solutions when they compete for certain activities. So, more and more of the private sector is adopting principles to spur this activity.

The young lady at the end, on cloud computing, is an example. More and more of organizations that are looking at modernization in their information technology infrastructure are essentially demanding solutions that have that energy efficiency as part of the equation.

Senator DEMINT. That's encouraging.

Again, thank you all for your testimony.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator DeMint.

Mr. Tuck, before we sort of wrap up here—a number of you, I want to try to clarify a few things. First of all, your company, is it highly focused on, or exclusively focused on, the relationship between the home and the energy provider? Is that the information that your—or——

Mr. TUCK. Sir, it has been, up until now. We believe that that variable pricing is coming to the electricity market, and that's going to be a big driver of consumer change. So, people's appliances will move. We do intend, this year, to market test with our partners, such as Best Buy, models where the consumer can buy energy efficiency technology from us, independent of the utility, to understand what the likely takeup of that technology will be. But, up until now, it's been solely through the utility.

The CHAIRMAN. And are you looking at, sort of, home management in a home-contained system that would control various appliances and different things within the home, or not?

Mr. TUCK. We are, sir. We're working with appliance manufacturers to make sure their new appliances are compatible with our system and the grid's—the standards that NIST is bringing out. But, we're starting by focusing on the thermostats. So, the thermostat consumes about 40 percent of the energy in a typical home in North America. And we believe that, essentially, the thermostat is in the same place that the VCR was; nobody knows how to program it. And——

[Laughter.]

Mr. TUCK.—and, if we can do to the thermostat what TiVo did to the VCR—make it very, very simple and intuitive for people to understand it—we can see dramatic savings from that, and it will have a significant impact on a homeowner's consumption.

The CHAIRMAN. Boy, the simpler you can make it. Menu-driven.

Mr. TUCK. Yes.

The CHAIRMAN. It makes a difference.

Decoupling, I assume, is pretty critical. I mean, if we—you know, we have this absurdity where the more you—energy you use, the more you—you know, we just don't have the right incentive in the system. I assume you would all agree that we could take a step to try to build the proper incentive into the system. Is that correct?

Mr. TUCK. That is correct, sir, yes. I think that's right. I think that the biggest impedance to roll out is the fact that utilities don't really have a business model yet, in many States, in order to continue to support their shareholders and meet the national priorities associated——

The CHAIRMAN. So, if——

Mr. TUCK.—with them.

The CHAIRMAN.—they could actually earn money by using less energy, it would be effective.

Mr. TUCK. It would be effective, sir, yes.

The CHAIRMAN. Right.

Ms. Wigle you, in your testimony, talk about energy efficiency measures in not only effective, but, in many cases, have, quote, "negative marginal cost," meaning they create wealth for society overall. Can you just sort of fill that out for the Committee a little bit?

Ms. WIGLE. Yes. The observation is, actually, by making the investment, we save money. It's—you know, sometimes we use the trite expression of "doing well by doing good." But, if you look at things like smart buildings, as an example, making that up-front investment, if you look holistically at the lifecycle of the building, we actually realize economic benefit.

The CHAIRMAN. You know—so, that strikes me—I mean, the level—McKinsey & Company has done an analysis—I think they call it the carbon cost abatement curve—and they begin——

Ms. WIGLE. That's right.

The CHAIRMAN.—with the least, sort of, thing to do—a light bulb, whatever—and they progress through all the complicated things that we can consider. The first 20 or 30 years of the reduction of emissions in the United States actually pay for themselves.

Ms. WIGLE. That's right.

The CHAIRMAN. They're free, because of the efficiencies that you get when you put them in place. I know companies, Hewlett Packard, IBM, Cisco Systems—I mean, you could run a list—Dupont, Dow Chemical—all of them have reduced their emissions already—10, 20, 30, 50 percent, in some cases—and they're making money doing it.

Ms. WIGLE. And growing.

The CHAIRMAN. And growing. And growing globally. Why are we—have such trouble getting people to understand this? I mean, here we are, falling behind China, India, South Korea, Germany, France, other countries. We're—we need to kick our economy into gear, and we have this—sort of, excuse me, but kind of knee- jerk, somewhat ideological resistance to the notion that moving in this direction with the right incentive is somehow going to upset the apple cart. Do any of you believe it is? Why are we having this problem, in your judgment, getting people to understand the economic benefit of what so many companies are understanding for themselves?

Mr. TUCK. I think, at the residential level, people don't have the information, sir. I think that's the challenge.

The CHAIRMAN. Well, what about at the corporate level? I'm talking——

Mr. TUCK. Right.

The CHAIRMAN.—smart corporate leaders. I mean, there's a reason Lou Hay, down at Florida Power & Light, and there's a reason that, you know, General Electric, Jeff Immelt, is moving in these directions, right? Why don't more people see——

I'll give you an example. You know, because I am New England trained, I was walking around this building during the snowstorm when nobody was here. The escalators were turning 24/7, just burning. Nobody was on them. You go to Europe, you go to Asia, that doesn't happen. They have an infrared light, it shuts off when nobody's on it, saves energy. We are the most profligate energy wasters in world, are we not? Why, still?

Ms. WIGLE. Well, I think part it comes to norms and behavior. We talked a little bit about that in the setting of the home. I mean, today the societal norms don't value energy efficiency. And that's something that we need to work on over time, to showcase companies—and I would actually put Intel in the list of companies you listed who have embraced energy efficiency, reducing——

The CHAIRMAN. Intel——

Ms. WIGLE.—our——

The CHAIRMAN.—was one, correct.

Ms. WIGLE.—our CO_2 emissions, our footprint overall while we grow, and setting those goals. I mentioned in my testimony, both

verbal and written, you know, the idea of laying out a national roadmap. You know, I think that the government could do some things to put the framework in place, put goals in place. One of the things that we did with the nonprofit that I lead—Climate Savers Computing Initiative—is, we took a goal, of reducing CO_2 emissions from computing by very specific amount of 54 million tons, and then we're measuring ourselves against that. You know, we need to do that across some sectors, and make those—the progress toward those goals visible. I think that could help a lot.

The CHAIRMAN. Now, if you——

Ms. WIGLE. But——

The CHAIRMAN.—have done that, and you had met a goal that had been set by the government, let's say, of what you ought to reduce, and you'd more than met the goal, would you like to be able to sell your surplus to someone else who needs it?

Ms. WIGLE. Of course.

The CHAIRMAN. Would any of you want to refuse that option?

[No Response.]

The CHAIRMAN. Makes sense, doesn't it? I think it's called capitalism.

Yes. Ms.——

Ms. WINKLER. Well, I just want to add—you know, you said that much energy efficiency is free—I want to add that it's often actually a driver of productivity. So, a very simple case that was mentioned earlier by Mr. Chopra about—if we talk about teleworking or virtual meetings, for example—that actually not only, you know, saves money and saves emissions and saves energy, but also gives us more time to be more productive.

I do think that there's an element of leadership, that we want to highlight the companies here. I also believe that EMC is a leader in this space and would like—highlight them further, but also the Federal Government can do, as well. If we look at the data centers, for example, the home of some 1,100 data centers, there's a lot of——

VOICE. 1,200.

Ms. WINKLER.—opportunity to stand up and show—1,200, excuse me——

[Laughter.]

Ms. WINKLER.—wow, it grew a hundred—and stand up and really show——

The CHAIRMAN. Let——

Ms. WINKLER.—through——

The CHAIRMAN.—me ask you a question. How long has EMC had a chief sustainability officer?

Ms. WINKLER. Eighteen months. But, we have had very aggressive energy efficiency programs in place since—pretty much since 1997.

The CHAIRMAN. Well, I'm a—I congratulate you on it. I mean, I don't think that, a number of years ago, we'd have had a company with a chief sustainability officer. I think it's a terrific concept.

Share with us a little bit more how EMC is providing either the clean energy jobs or information that's helping people to reduce their energy use?

Ms. WINKLER. Well, the way we look at our impact or our role in the world, we look first in our own operation, obviously. So, reducing energy consumption, reducing emissions from everything we do within the facility, and, beyond, that through our entire value chain, so working with our suppliers. But, where we believe, and where we know, we have the biggest impact is helping our customers reduce energy consumption in their data centers and beyond, in their businesses.

We're actually investing, more than we ever have historically, in research and development in the areas, for example, of cloud computing—in particular, of cloud computing. Which is really——

The CHAIRMAN. Explain cloud——

Ms. WINKLER.—the next——

The CHAIRMAN.—computing to the layperson.

Ms. WINKLER. Cloud computing is, effectively, where you have pooled resources so that you can very dynamically access the resources that are needed and then make them available for other use. Cloud computing can occur within a data center or within an IT infrastructure, such as the Federal IT infrastructure, that allows you to share those resources when they're needed, but still retain the control, still retain the security, still retain the trust that people expect to have from their own data center. And through our investment in that, we are in R&D, which is largely through engineers. We have a huge, and growing, engineering population, over 8,000 of whom are, in fact, in our home State, and as well in our services organization, which is working with our customers to help them then get energy efficiency in their data centers and their businesses, and turn those investments to growing their businesses instead of paying for electricity.

The CHAIRMAN. Mr. Hesse, share with us a sense of how Fortune 500 companies and large Federal agencies are, sort of, keeping up with the demand for information services today, or for—as a provider of information services, what's your sense of the demand curve?

Mr. HESSE. Well, the demand curve for—if we were to use data usage on wireless networks as a proxy for the demand for information services, because—when we would talk about information to one person, it's information; to another person, it might be entertainment. But, it is growing at an unprecedented rate, and it will continue to grow at even a faster and faster rate. And that's why we're working with the FCC and the government, as well as, you know, the marketplace to bring 4G services, fourth generation.

And actually, you know, if you take a look at wireless technology—and we're talking about where the U.S. is with respect to the rest of world in energy efficiency—in wireless technology—you know, wireless was invented in the United States. In what was called first generation or analog, we were the leaders. In second generation, which is digital, which made text messaging possible, Europe became the leader. In third generation, which is, kind of, high-speed data—not super fast, not quite as fast as your cable modem, but fast enough—that's 3G, that's kind of the market today—Asia, in essence, became the first and the leader. In 4G, the U.S. has the opportunity to be first again.

And in terms of the utilization of mobile technology, not only for commuting, but GPS, location-based services, all sorts of information that can be transferred to these devices—the reading of the meters—smart meters, smart grid could be done over wireless networks so you don't need technicians, you don't need truck rolls. The opportunity for this industry to use information, and the information that will be increasing and go over wireless networks, to improve our carbon footprint is enormous.

The CHAIRMAN. You mentioned 3G/4G. I thought I might ask you to play referee and tell us whether Luke Wilson is telling the truth about the——

[Laughing.]

Mr. HESSE. I'm sorry, I missed that——

[Laughing.]

Mr. HESSE.—the end of it.

Mr. CHOPRA. The ads that Verizon——

Mr. HESSE. Oh.

The CHAIRMAN. You can't have missed the ad.

Mr. HESSE. Yes, I love them. We're just ducking underneath the fire of that one.

[Laughter.]

The CHAIRMAN. Senator DeMint, do you have any more questions?

Senator DEMINT. No, sir.

The CHAIRMAN. We're going to leave the record open for—til the end of the week, in case other colleagues want to try to submit some questions.

Is there any—let me ask you one last question before I do that. What are—give me, sort of, your one, two, three—or one or two or whatever it is—priority that we have to do soon—and sooner rather than later—to empower this transformation? What do we need to do? What are the government policies that would make the greatest differences to each of you?

Why don't we leave you, Mr. Chopra, to respond at the end. Why don't you begin, Ms. Winkler?

Ms. WINKLER. OK. Certainly I would say the promotion of broadband, which you spoke about at the beginning. We really need to extend broadband, which is in addition to wireless and infrastructure that's going enable all of this. And particularly—and I think Ms. Wigle brought this up, which is building a national roadmap or national strategy so that we can educate the rest of the Federal Government, as well as private industry, on how they can harness energy efficiency.

The CHAIRMAN. OK.

Ms. WIGLE. Yes. I would echo those two, and maybe elaborate the second one a little bit, in terms of having clear metrics, being able to measure the progress that we're making, and making that very visible, because that goes to changing attitudes and behaviors.

The CHAIRMAN. Mr. Tuck.

Mr. TUCK. Open access to energy information, a blueprint for utilities to make money in an energy efficient world, and an encouragement of time-of-use-type pricing, variable pricing, as a model, going forward.

The CHAIRMAN. Mr. Hesse.

Mr. HESSE. Mr. Chairman, I would echo broadband as being important. The second, I give the government credit for, in the Economic Recovery Act, which I mentioned earlier, providing grants—the Department of Energy—in areas that will allow us to mitigate the very large investment cost to—and research cost—associated with researching and deploying new forms of energy efficient technology. So, the DOE grants have been very helpful.

Mr. CHOPRA. Mr. Chairman——

The CHAIRMAN. Do you want respond to any of those?

Mr. CHOPRA. Just to the—all of the ideas that were referenced were very, very bullish on opportunities. And we clearly look forward to working with you on establishing the policy framework to unlock this really huge job creation potential, investment potential. And so, we look forward——

The CHAIRMAN. Well, we——

Mr. CHOPRA.—to working you, sir.

The CHAIRMAN.—really appreciate that. And we sure want to do it. I think we're very committed to that, and the Committee's going to work hard to see how we can accelerate it, and work with the Administration to do that.

A huge future out there, and a lot competition, a lot of hungry people in other countries, so we need to get our act together. And I hope we will, rapidly.

We're very grateful to all of you for taking time to be here today. Thank you very, very much.

We stand adjourned.

[Whereupon, at 11:26 a.m., the hearing was adjourned.]

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