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**Testimony before the Senate Committee on Energy & Natural  
Resources Energy Research and Development**

Chairman Bingaman, Senator Murkowski and members of the committee, thank you for inviting me to testify today on the critical importance of research and development to addressing America's energy and climate change challenges.

I'd like to start by providing a little background about the Council on Competitiveness—who we are, and how we operate—and on our Energy Security, Innovation & Sustainability Initiative, a top Council priority. The Council on Competitiveness is the only group of corporate CEOs, university presidents, and labor leaders committed to enhancing U.S. competitiveness in the global economy. Our scope of issues reflects many factors that affect a nation's ability to compete—ranging from the business environment for innovation and advancing key enabling technologies, to building a world-class workforce and igniting regional innovation through entrepreneurship.

We have been fortunate to have some of America's best executives as Council leaders. Our current chairman is Chad Holliday, chairman of DuPont. The Council carries out its agenda, and shapes the debate through several mechanisms:

- We analyze emerging challenges.
- We convene leaders who can envision and implement solutions.
- We catalyze and organize action.

We strive to represent the voice of competitiveness and innovation in a wide range of technology, economic, trade, education, and international decision-making fora. And for the past 18 months, we have focused this voice on the dual challenges of energy security and sustainability. These challenges were called out in the Council's National Innovation Initiative four years ago and the urgency for action has only grown in that time.

### **Energy Security, Innovation and Sustainability**

The Council believes that energy security and sustainability are two of the defining and intertwined challenges of our time. For virtually every country, access to affordable energy is a basic need for economic growth, social development, improved standards of living, and increasingly for national security. However, neither an affordable nor a reliable supply of energy is a given for any country. As committee members well know, even as a nation with an immense wealth of natural resources, we face soaring energy demand, price volatility, and supply instability. At the same time, pressure is mounting around the world to mitigate greenhouse gas emissions from fossil fuels—with the prospect of a 45 percent increase in emissions by 2030, driven almost entirely by developing countries.<sup>1</sup>

And without access to cost-effective cleaner energy solutions, developing economies will have no alternative but to increase their dependence on the most rudimentary fossil-fuel technologies, contributing significantly to increased pollution and environmental damage. To summarize, the current trajectory of global energy trends is unsustainable—environmentally, socially, and economically. They are impacting:

- The fundamental ability of American industry to compete in the global economy
- The political ability of our government to play an international leadership role
- The capacity of our military to carry out its missions

Energy security and sustainability are now first-tier economic, national security, and competitiveness concerns. It is, therefore, inevitable that the world will undergo a systems transformation in the way we use and produce energy. As this country moves toward sustainable energy policies and programs, the Council does not believe there is an unavoidable trade-off among economic growth, energy savings, and environmental interests. Indeed, the pending systems transformation offers an opportunity to integrate energy security, sustainability, and competitiveness.

For this very reason, the Council has launched an ambitious Energy Security, Innovation & Sustainability (ESIS) Initiative. Our goal is to shape an action agenda

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<sup>1</sup> 1 International Energy Agency, *World Energy Outlook 2008*, IEA/OECD, Paris (2008).

to drive private sector demand for sustainable energy solutions, while supporting the creation of new industries, markets, and jobs. This initiative is led by James Owens, CEO of Caterpillar; Shirley Ann Jackson, President of Rensselaer Polytechnic Institute and Vice Chair of the Council on Competitiveness; Mike Langford, President of the Utility Workers Union of America; and a steering committee of 40 CEOs, university presidents, labor leaders and national lab directors, the ESIS is focused on:

- The critical link between energy security and national competitiveness
- Identifying drivers of private sector investment in sustainable energy
- Clarifying and publicizing the business case for changing how the private sector thinks about and uses energy
- Examining what leading companies are doing to integrate energy security and carbon issues into their business strategies for productivity and competitive advantage

And most importantly for today's discussion:

- Developing a policy and regulatory framework that will unleash American investment and innovation across all sectors of the economy

We know:

- There is no “silver bullet”
- There is no single technology that can solve the problem
- There is no one policy or regulatory measure that will transform our energy system, protect the environment and mitigate climate change
- We will need every resource we have—coal, oil, gas, nuclear, solar, wind, biomass, ocean and hydropower—AND increased energy efficiency to meet future energy demand.

We also know that we have a tremendous opportunity before us. In fact, these challenges have created a perfect storm for innovation. We can move to a new era of technological advances, market opportunity, and industrial transformation if we can successfully unleash the investment and innovation potential of the private sector to meet the challenges and seize the opportunities arising from these new public-private partnerships.

The ESIS initiative has engaged over 200 of the nation's leading experts from a wide range of perspectives and asked them what enabling conditions are needed to exist to spur private sector innovation and investment. This work led to the September release of the Council's 100-Day Energy Action Plan for the next president and Congress named *Prioritize*, a copy of which is appended to my testimony.

*Prioritize* includes 18 specific recommendations, many of which are relevant to this committee's jurisdiction, but I will focus on one that is central to today's hearing: America must spur technological innovation and entrepreneurship by ramping up

investment in energy R&D and commercialization. This means at least tripling the current federal investment in basic and applied energy R&D; enhancing public-private partnerships with baseline federal funding—to be matched by state and private sector investments—and creating regionally-based R&D test-beds and large-scale commercial pilots for new energy technologies.

Central to this recommendation is the idea that we must be poised to deploy new ideas and innovations that come from the significant new investment in energy research into scalable products, goods and services. And research must be viewed as encompassing basic, applied, development and test beds. If we do not have in place the infrastructure to reap value from our investment, you can rest assured another country will. And when that happens, the jobs and intellectual property will be lost; as well as the component subsystems leading to a hollowing out of the innovation enterprise.

**America must not become just the laboratory to the world—renowned for our ideas, but bleeding away jobs, industries and opportunity.**

As we enter a new era of technological innovation, driven by the twin challenges of energy security and climate change, we must be vigilant in ensuring that we support these nascent industries here at home. We do not want to repeat the errors of our past when despite having achieved scientific and technology breakthroughs in liquid crystal, plasma and other flat panel display technologies, we ceded market leadership to countries like Japan and Korea, as they rapidly scaled up their high quality manufacturing ability and captured the global display market.

We have learned that we cannot divorce our investments in R&D from our efforts to support each stage of the manufacturing continuum. We must design—in manufacturing considerations upfront in the innovation process. We must ensure that we have the appropriate regulatory and financing framework in place to allow our entrepreneurs to move agilely from testing and pilots to manufacturing and large-scale system deployment.

### **The Evolution of Manufacturing**

As the 20th century drew to a close, rising global competition and the broad opening of global markets challenged U.S. manufacturers. As a result, there has been continuing concern about the off-shoring U.S. manufacturing and the loss of U.S. manufacturing jobs.

With the growing strength of newly developing, low-cost competitors such as China, there are many who fear that U.S. manufacturing will spiral into further decline. And it is becoming increasingly clear that the United States cannot compete with commodity products and low-wage mass production systems.

Nevertheless, I believe we must put aside the growing perception that America will inevitably lose its manufacturing edge. And, instead, prepare for a shift in manufacturing that embraces:

- Production and distribution networks that span the globe
- Digitally-infused manufacturing operations, and
- Science-based manufacturing

These could form a new foundation to support a revitalized manufacturing base, and U.S. competitiveness in the very highest-value production activities.

Long-term national and economic security in the United States critically depends on our having innovative and agile manufacturing capabilities. Current economic conditions and energy security challenges have only heightened the need to accelerate competitive advantages for U.S. manufacturing companies in the global marketplace. Manufacturers can maintain their global leadership position only through technological differentiation, not through labor cost advantage.

While energy-saving investments must compete for scarce capital often against near-term priorities, the potential for substantial returns over the long run is real—lower production costs, lower environmental compliance costs, reduced waste, and improved productivity when production inefficiencies are eliminated.

Then there are the rewards of helping customers control their own costs by redesigning products to reduce the energy they consume. Revenues from GE's Ecomagination line of energy efficient, environmentally-friendly products and services have grown to \$17 billion (in 2008) since it was launched 2005. The company invested \$1.4 billion in cleaner technology research and development in 2008 and recently reported that its portfolio of 70 Ecomagination-certified products is four times the number of products it offered in 2005. Still, too many U.S. companies remain underinvested in energy efficiency, and few have adopted strategies that treat energy as a vital dimension of business.<sup>2</sup>

Wal-Mart launched a new green-packaging scorecard in February 2008. By August of last year, the scorecard software system included over 8,000 vendors and more than 170,000 products. Because Wal-Mart is one of the most powerful forces in the world's supply chains, this initiative is a potential game changer in the design of packaging.<sup>3</sup>

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<sup>2</sup> "GE's 2008 Ecomagination Revenues to Rise 21%, Cross \$17 Billion," GE News Center, October 21, 2008.

<http://www.genewscenter.com/content/Detail.asp?ReleaseID=4266&NewsAreaID=2>

<sup>3</sup> Connolly, Kate Bertrand. "Wal-Mart's Scorecard Drives Sustainable Packaging," FoodProcessing.com, August 2008. <http://www.foodprocessing.com/articles/2008/371.html>

Yet, conventional wisdom holds that manufacturing is characterized by the four D's—dirty, dumb, dangerous...and disappearing. Nothing could be further from the truth. Modern American manufacturing, which has dramatically changed from its earlier definition, is growing—in size, complexity and market importance. For the past 50 years, the value of manufacturing output has increased by 3.7 percent per year.<sup>4</sup> Modern American manufacturing profits have outperformed those of other sectors and manufacturing productivity increased faster than the national average.<sup>5</sup> In other words, a great many American manufacturers have made major adjustments to the changing needs of the marketplace and are doing very well. But they cannot do it alone.

American public officials, opinion leaders and investors also need to understand and vigorously support these changes if we are to regain and retain our international leadership position. If America fails to adapt, we risk losing this critical underpinning of our economy and failing to reap the value from the investments in next generation energy technologies. America's edge lies with forward-looking, high-value manufacturing that looks well beyond traditional assembly and fabrication of products. Consider the new paradigms of manufacturing:

**Mass Production has evolved to Mass Customization:** As more countries enter the global marketplace, the competition has shifted rapidly to new kinds of added value that require new kinds of skills. Just as basic product design has moved beyond the work of draftsmen with pencils and T-Squares to highly sophisticated computer driven Cad-Cam programs, more of the value-add within manufacturing began to come from the activities integrally associated with production: marketing, financing, customer service and managing quality, variety, customization, innovation, convenience, novelty and speeded operations. Each of those affects not only the quality of the product being made and its competitive price, but its value to customers as well. All of which are key elements in the process of modern manufacturing.

**Services and Manufacturing have merged:** The Council's National Innovation Initiative highlighted this convergence. Surveys by Deloitte Research found that the average profitability of service operations is more than 75 percent higher than overall business unit profitability. The most profitable service businesses (the top 25 percent) are more than three times as profitable as the average business unit. Across the manufacturing companies that were studied, what have traditionally been considered service revenues average just over a quarter of total revenues but deliver

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<sup>4</sup> Strauss, William A. "Is the U.S. Losing Its Manufacturing Base?" Presentation at 61st Annual Meeting of the Midwestern Legislative Conference, Chicago, IL, August 21, 2006.

<sup>5</sup> Ibid.

46 percent of the profits.<sup>6</sup> For many producers, there would be little or no profitability without the so-called service business. In other words, modern manufacturers have actually integrated elements of the service sector into the manufacturing process in order to maximize their competitiveness, and public policy must recognize and encourage that process.

**High Value Jobs:** Another way to look at this change is that approximately 75 percent of jobs in the United States are classified as service sector jobs, but a significant portion of these jobs, in reality, remain part of the extended manufacturing enterprise.<sup>7</sup> As manufacturing companies restructured—outsourcing (not off-shoring) functions that could be provided most cost-effectively outside the company—many jobs that did not directly deal with fabrication were simply reclassified as service jobs even though they remained as essential parts of the modern manufacturing process. It is also essential to note that in different areas of the country new jobs in the modern manufacturing sector have been created as new small and medium-sized companies are established to fill continuing and growing needs. America's data collection systems, a relic of an industrial economy, simply do not capture or reflect this integration of services and manufacturing. Knowing the importance and the changed nature of manufacturing are critical steps for policymakers, but not the whole story. As we stand ready to tackle the challenges of energy security and sustainability, we must ensure that America's federal investments in research and development and America's premier research capabilities are leveraged to provide the strongest possible outcomes. A primary example of this is the U.S. government's high performance computing (HPC) capabilities.

### **The Critical and Transformational Role of HPC in Manufacturing**

The use of high performance computing for modeling, simulation, and analysis has already provided a competitive advantage for many of the manufacturing Fortune 50.

These companies employ in-house advanced computing and have access to high performance computing hardware, software, and technical resources through partnerships with national laboratories. Many of these companies recommend that adoption of modeling, simulation, and advanced computing be accelerated throughout the U.S. manufacturing sector. For example, Pioneer Hi-Bred, a DuPont company, uses HPC to manage and analyze massive amounts of molecular, plant, environmental and farm management data, allowing them to make product development decisions much faster than by using traditional experiments and testing alone. For Pioneer, the result has been faster improvement in new seed products, staying ahead of the competition, a major jump in innovation and productivity, and

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<sup>6</sup> Koudal, Peter. *The Service Revolution in Global Manufacturing Industries*, A Deloitte Research Global Manufacturing Study, (2006). <http://www.deloitte.com>

<sup>7</sup> Council on Competitiveness, *Thrive: The Skills Imperative*, Washington, D.C. (2008).

the ability to help meet some of the world's most pressing demands regarding the availability of food, feed, fuel, and materials.

**The Transition to “Simulation-Based Manufacturing”:** A substantial effort toward wider adoption of modeling and simulation requires the commitment of intellectual capital, computer hardware and software for complex problem solving, and other resources from among the diverse advanced computing assets spread across the nation's regions, states, and advanced computing centers. This truly successful national initiative will leverage these vital resources from a new public-private partnership to bolster the U.S. manufacturing sector.<sup>8</sup>

**New Manufacturing “Call to Action” on the 21st Century Manufacturing Enterprise:** To these ends, the federal government should issue a “call to action” to U.S. manufacturing sector leaders and create a national manufacturing initiative enabled by advanced computing. These leaders in advanced computer-enabled design and manufacturing should be asked to leverage their expertise in modeling, simulation, and analysis and partner with the federal government to improve U.S. manufacturing competitiveness. The outcome of this call to action will be to accelerate and broaden the use of modeling and simulation, to increase penetration of these tools into smaller companies (pushing these tools further down into the supply chain), to solve the biggest complex problems with the latest techniques, and compete through innovation.

Through the national laboratory system, the federal government offers the greatest scientific and engineering resources, computer assets, and research software to be deployed for the initiative. Importantly, the United States and Japan are the only significant manufacturers of HPC machines—an incredible advantage that must be utilized for economic growth. To succeed, the initiative should also call upon, bring together, and leverage (all of) the nation's most advanced computing resources—state to state, region to region, center to center.

### **Committee Draft Legislation**

Thank you also for the opportunity to comment of the draft legislation on Energy Research and Development. We strongly endorse the proposal to double funding for applied energy research and development. The Council further urges the Committee to act upon the recommendations made in *Prioritize* to triple both basic and applied energy research and development.

The Council applauds the energy workforce development provisions as proposed by the Committee, as they also are closely aligned with the intent of our recommendations in *Prioritize*. We urge the Committee/Congress to go further by

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<sup>8</sup> Interviewed Mark Cooper, Pioneer Hi-Bred International, Inc., and Lane Arthur, DuPont, in June 2008.

adopting the Council's recommendations to create a \$300 million Clean Energy Workforce Readiness Program. This program should be specifically designed to foster partnerships between the energy industry, universities, community colleges, workforce boards, technical schools, labor unions, and the U.S. military, with the goal of attracting, training, and retaining the full range of skilled workers for America's clean energy industries.

And, at the very least, the Department of Labor should be required to assess, classify and widely publicize the demand-driven needs for energy-related occupations. It should also be required to align federal workforce investment programs and state-directed resources to support skills training and career path development in energy fields for American citizens.

With regard to the scholarships and fellowships proposed, the Council would urge the Committee to consider making these portable (controlled by the student) to ensure the maximum flexibility for the students to follow the most current thinking and technologies in these areas.

Under the section on Grand Challenges Research Initiative, the Council would propose that a requirement for small businesses representation in the consortia be included.

### **Conclusion**

Thank you again for this opportunity to provide testimony on this important topic for American competitiveness. The Committee's support for research and development, including the enactment of the America COMPETES Act and recent increases in the stimulus package speaks to the forward-looking vision of the Senators sitting on the dais. I would only urge that you dedicate the same passion to ensuring the infrastructure exists and is utilized to generate value in the form of jobs, new businesses and new opportunities from these critical investments.