

Energy Security, Innovation & Sustainability Initiative
Progressive Dialogue Series

Define.

Progressive Dialogue I:
The Energy–Competitiveness Relationship



Compete.

Council on
Competitiveness

Progressive Dialogue I: The Energy–Competitiveness Relationship

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Energy Security, Innovation & Sustainability Initiative
Progressive Dialogue Series

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**Progressive Dialogue I:
The Energy–Competitiveness Relationship**

September 13–14, 2007
Airlie Center
Warrenton, VA



**Progressive Dialogue I:
The Energy–Competitiveness Relationship**
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Letter from the President

On behalf of the Council on Competitiveness, I am pleased to release the proceedings from the first in a series of high-level expert dialogues that are being conducted under the auspices of the Council Energy Security, Innovation & Sustainability (ESIS) Initiative. We believe that the insights generated at *Progressive Dialogue I: The Energy–Competitiveness Relationship*, add a valuable new dimension to the national debate about our energy future—and our future competitiveness.

The ESIS Initiative was launched in July 2007 in recognition of the fact that energy security and sustainability have become increasingly important factors of competitiveness in the 21st century. The overarching goal of this undertaking is to enhance U.S. competitiveness and energy security by shaping a public-private agenda to drive private sector demand for sustainable energy solutions and support the creation of new industries, markets and jobs.

A diverse and distinguished Steering Committee comprised of leaders from industry, academia, labor, national labs and other prominent organizations is guiding the Council's efforts. The Steering Committee is co-chaired by Shirley Ann Jackson, President of Rensselaer Polytechnic Institute; D. Michael Langford, National President of the Utility Workers Union of America, AFL-CIO; and James W. Owens, Chairman and Chief Executive Officer of Caterpillar Inc.

We would like to thank the U.S. Department of Energy for underwriting the Progressive Dialogue Series. We greatly appreciate the time and expertise that the Department's leadership is personally dedicating to this undertaking, particularly Secretary Samuel W. Bodman, Assistant Secretary for Energy Efficiency and Renewable Energy Alexander A. Karsner, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy John F. Mizroch

and Office of Industrial Technology Programs leader Douglas E. Kaempf.

We are also very grateful to the more than three dozen high-level experts and several ESIS Initiative Steering Committee members who gave so generously of their time and wisdom over the course of two days at the Airlie Center. We are honoured to have had Daniel Yergin deliver the evening's keynote address. Within the Council, I would like to acknowledge Susan Rochford, Lars-eric Röddén and Kara Jones for doing the "heavy lifting" in conceptualizing and organizing the Dialogue.

In 2008, the Council will conduct two more Progressive Dialogues that will explore the role of the private sector—as the leading innovators, investors and adopters of new energy sources, technologies and management practices and powerful change agents of our national energy system. The desire and ability of the private sector to move forward on these fronts are absolutely pivotal to our nation's success in achieving a more secure, sustainable and competitive energy future. As such, we will work to understand what influences organizational decision-making and investments related to energy and identify the conditions that will drive and enable greater demand for sustainable energy solutions.

We firmly believe that by creating the conditions that will foster private sector innovation and investment in more sustainable energy approaches, we can improve America's energy security and economic productivity and prosperity. As we move forward, we welcome your participation and support.

Sincerely,



Deborah L. Wince-Smith
President

Progressive Dialogue I Participant List

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President
Rensselaer Polytechnic Institute

D. Michael Langford Co-Chair
National President
Utility Workers Union of America, AFL-CIO

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Senior Vice President, Policy and Programs
Council on Competitiveness

Michael Walsh
Executive Vice President
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Executive Summary

In the past forty years, worldwide energy consumption has nearly doubled, driven by population growth, rising living standards and the invention and wide-scale deployment of technologies, products and services dependent upon energy to function. If present trends continue, global energy consumption will double again by mid-century. These demand pressures, coupled with periodic volatility in energy supplies, has put an upward pressure on energy prices in many parts of the world including the United States.

The cost of energy is clearly impacting the competitiveness of the United States. But the story does not end there. The economic toll exacted by maintaining the current state of U.S. energy use, as well as the prospective windfall for ending it, has not been adequately captured or communicated in the context of national competitiveness. A more fulsome understanding of the various ways in which energy is now impacting—and driving—U.S. productivity and global competitiveness will add a critical new dimension to the national debate. This articulation of the business case for action and a policy path forward will create the foundations of a public-private sector action agenda, while also adding momentum to the case for energy system change.

To bring these issues to light the Council on Competitiveness convened 44 senior officials from U.S. industry, labor, government, academia and non-governmental organizations at the Airlie Center outside of Washington, D.C., to participate in the first in a series of three Progressive Dialogues being conducted under the auspices of the Council Energy Security, Innovation and Sustainability (ESIS) Initiative. The Dialogue series is made possible through the generous support of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

Over the course of two days a number of major competitiveness themes emerged from the expert discussions.

These findings are instructive, pointing a way forward for constructive action and change at the national, regional and enterprise level.

National Competitiveness Findings

- **The United States Is a Global Laggard in Energy Productivity.**

The United States is the most energy-intensive developed region today and lags behind its OECD competitors in improving energy productivity. At the same time, many developing regions are making rapid progress in reducing their energy intensity. To the extent that energy is an important part of production costs, the United States is losing competitive ground relative to its global competitors. Energy productivity, like labor and capital productivity, is important for wealth creation. The United States has underinvested in energy efficiency. American business leaders in general are not as knowledgeable or open to the economic opportunity inherent in improved energy management as they should be.

- **U.S. Government Policies and Regulation Can Inhibit Energy Competitiveness.**

There are current policies in place that serve to maintain existing energy technologies, such as depreciation cycles meant to keep old coal plants running, input-based emission standards, rules against hanging wires over streets and subsidies. It may be better to reassess and reform or disas-

semble these policies rather than simply layer new policies over existing ones. Lack of credible policy commitments, those that are sustained over adequate periods of time, can fail to motivate business behavior as intended. Local codes and state government policies can also inhibit the deployment of cleaner energy and energy efficiency technologies.

- **Transparent, Positive Price Signals Are a Key Ingredient in the Innovation Formula.**

To maintain competitiveness and profitability going forward, businesses increasingly need to understand the significant “energy cost” of products they make or resell. The assignment of a market price to carbon, done carefully, can be a driver of innovation. Rather than being framed as a punitive measure to curtail energy use, energy/carbon pricing will work best if businesses or consumers see it as a positive, motivating force to get more value for their money (example: miles-per-gallon ratings of automobiles). Public utilities should also expand the use of motivational pricing. It is important to build excitement around reform and transition by carefully crafting policy and regulatory commitments that seek to motivate not through punitive measures but through incentives that reward innovation and action.

- **America Faces a Severe Energy Workforce Challenge.**

Even as the demand for electricity continues to grow, the United States stands to lose half of the electric power industry workforce within the next five to ten years due to retirement. America’s oil and gas workforce averages 50 years in age. Half are likely to retire in just three years. New energy technologies will not compensate for this workforce shortage. There is also more competi-

tion for talent today across countries and across sectors. Undergraduate students are not aware of the important role that electrical/mechanical engineers will play in addressing environmental challenges and that they could help solve real problems in this arena. More students are choosing careers in finance and business, and fewer are choosing science and engineering. Advanced placement courses are the key to college admissions, yet they are nearly devoid of engineering content. Much more needs to be done in K-12 education and beyond to promote careers in the energy field.

- **Consumers Are a Crucial Part of the Energy–Competitiveness Solution.**

More than 60 percent of energy demand growth is driven by individual consumers. The economy continues to grow despite rising energy prices, and American consumers keep absorbing the higher prices suggesting that the price elasticity threshold has not yet been crossed. To address the consumer role, we need to find attractive ways to modify consumer behavior—not primarily to use less energy, but to get more productivity out of given amounts of energy. We need energy-efficient products whose value to consumers can be articulated simply and concisely. We need to educate consumers better so that they can make wiser and more effective decisions, and we need better information about consumers so that we can pursue smarter innovation.

- **An Integrated Policy Framework is Vital to Ensuring Economic Prosperity, Energy Security and Environmental Sustainability.**

We are confronted with the need to address multiple imperatives at the same time. It is important that we take a systems approach to the various

choices and decisions ahead of us. This includes the assessment and design of public policy measures. As state, regional and international energy and sustainability initiatives proliferate, we need to better understand how these are impacting the ability of U.S. enterprises to compete at the national and global level. This also applies to energy and related technology choices, as each source has its own benefits and limitations. There are trade-offs across these areas, and it is important to employ life-cycle analysis to underpin decisions.

Enterprise Competitiveness Findings

- **Climate Change Is Becoming a Critical Driver of Business Competitiveness.**

Climate change is viewed as an unpredictable, disruptive force (“Hurricane Katrina in slow motion”) that has focused attention on the pragmatic need to better manage energy use. Leading companies recognize that climate change concerns will impact their energy costs and business competitiveness, and they are preparing for that future by assessing their carbon footprints and building these issues into their business strategies. Climate change is having a profound affect on business models and operations, investment decisions and the management of critical industries such as energy and agriculture.

- **Leading U.S. Corporations See Energy and Sustainability Challenges As Opportunities for Competitive Gain—and Are Not Waiting To Act.**

Although industry experts participating in Dialogue I see a pressing need for public policy advances related to energy and sustainability, leading firms are not waiting until these measures

are proposed and implemented to act. A number of the firms already have relevant internal programs and initiatives in place across their worldwide operations. These companies typically view such initiatives not merely as compliance activities but as opportunities—seized or missed—for business development, innovation and competitive advantage. In fact, the ability to exploit energy and sustainability-related opportunities is becoming a barometer for a well-run company.

- **Energy Efficiency Powerfully Impacts the Ability of All Companies to Compete.**

The rapid rise in energy costs in recent years has added significantly to the costs of U.S. goods and made it more difficult for U.S. firms to compete with countries with lower energy costs. Higher energy costs have a pervasive effect on the business ecosystem. For example, the transportation, manufacturing and information technology sectors are highly sensitive to the cost of energy. In the agricultural sector, energy prices ripple up and down the supply chain, affecting the cost of producing crops, feeding animals and transporting foodstuffs. Initiatives that increase energy efficiency can powerfully benefit the competitiveness of U.S. business. Energy quality and reliability are also crucial. According to a study by Sandia National Laboratories, annual financial losses from power disruptions in the U.S. amount to \$150 billion and one-third of all computer problems are related to poor power quality.

- **Supply Chains Are Being Pressed to Align with Customer Energy Initiatives.**

U.S. industry participants indicated that they are increasingly extending their interest in improving their energy management and reducing their carbon footprint to apply across their supply

chains. Companies have become much more conscious of the energy costs and related risks that are passed along through the supply chain, and they are actively working to improve practices in this regard. The best firms design processes and innovative technologies with both their suppliers and consumers in mind. Dialogue participants noted that opportunities to optimize energy use exist across all industries, including healthcare, energy, manufacturing and retail. Participants observed that companies that manage their energy well tend to be better managed companies. The supply chain represents a very potent vehicle for promoting energy efficiency across the economy.

Summary

It is clear that the United States faces serious challenges and a new competitiveness landscape as it contends with the twin challenges of energy security and sustainability. America's continued economic growth and prosperity is at risk if we do not improve our energy productivity. Though the policy and regulatory response to these issues is still in flux—and can vary considerably at the state, national and international levels—leading companies are not waiting to act. As they do so, they are realizing significant cost savings and new opportunities for top line growth.

It is becoming evident that business is a powerful agent for promoting change in energy and sustainability practices, particularly as companies begin to push their energy and sustainability initiatives through the supply chain. Increasingly, effective environmental and energy management is viewed as an indicator of good

business management. The private sector more broadly would be wise to be alert to these new competitiveness drivers and customer expectations. The ability of companies to respond to these trends would be enhanced by the development of transparent and positive price signals and a greater understanding of the true cost of energy inputs.

While companies can play a leading role in the transition to a more competitive and sustainable energy future, there are other issues the United States as a nation must tackle. America must elevate the importance of energy productivity as a measure of its economic competitiveness. The impending energy workforce shortages must be acknowledged and aggressively addressed by both the public and private sectors. Consumers must become part of the energy solution, and concurrently, a more influential factor in the energy innovation process.

Finally, the importance of a rational and integrated policymaking process cannot be understated. This may include retiring policies or regulations that serve to inhibit innovation or the deployment of more sustainable energy practices, products and technologies. It may involve greater coordination and harmonization of state, regional and federal policies. It will certainly require a greater level of systems thinking about the choices and trade-offs involved in reconciling our comprehensive need for energy security, sustainability and competitiveness.

Dialogue Proceedings

Energy and Competitiveness— The Need For Action

Deborah Wince-Smith

Council on Competitiveness



The Role of the Council on Competitiveness. The Council on Competitiveness celebrated its 20th anniversary last year as the only group that brings together CEOs across all sectors, leading university presidents and labor leaders to understand the drivers and the evolving agenda needed to ensure America's continued

prosperity, security and success in global markets. The America COMPETES Act, a bipartisan piece of legislation signed into law by President Bush in 2007, is already beginning to have an impact across the nation and directly reflects work done by the Council's National Innovation Initiative (NII) since its inception in 2003. The purpose of the NII was to really understand how innovation is the key to U.S. prosperity, economic growth and standard of living. In this process, we identified a number of critical over-the-horizon issues, including this nexus between energy security, innovation and the ongoing movement for sustainability. The ESIS Initiative is a result of this important recognition. We are very grateful to have one of the principals of the NII, Dr. Shirley Ann Jackson, serving as a Co-Chair along with James Owens of Caterpillar and Michael Langford of the Utility Workers Union of America for this new effort. The work of participants in Progressive Dialogue I will be essential for advancing the understanding of the major energy and sustainability-related challenges and opportunities facing the nation.

Susan Rochford

Council on Competitiveness



The Council Launches A Progressive Dialogue Series. The concept for the Progressive Dialogue Series was born of the recognition that we are operating in a dynamic and rapidly evolving environment. We are witnessing record levels of private and public investment into new energy technology ventures in the United States

and around the world; significant shifts in public sentiment regarding the urgency of our energy and climate change challenges; the introduction of new energy policy initiatives at the state, federal and international levels; and continuing concerns about energy price and supply volatility and the reliability of our energy infrastructure and supply chain.

The aim of the Progressive Dialogue Series is to harness the knowledge of a diverse range of experts from around our nation to forge well-balanced and objective answers to a number of important—but heretofore unaddressed—questions about America's energy future and America's future competitiveness. Participating experts are taking part in a hands-on, real-time research and analysis process that will bring forth new information, insights and analysis about the increasingly critical importance of energy as a factor of competitiveness at the enterprise, national and international level.

STEERING COMMITTEE PERSPECTIVES

Shirley Ann Jackson

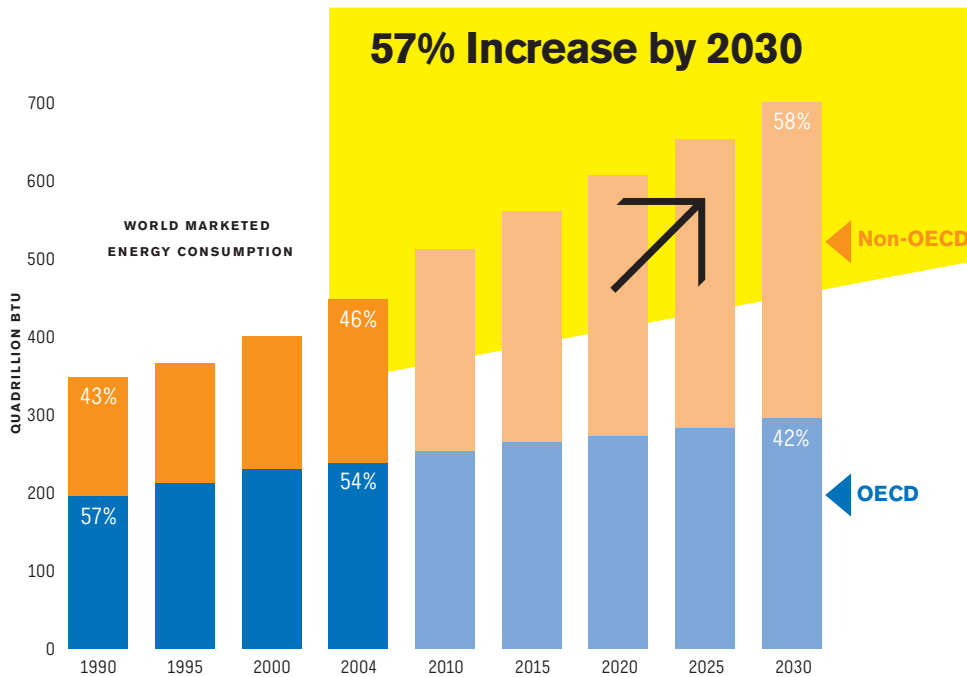
Rensselaer Polytechnic Institute and ESIS Initiative Co-Chair



The Need for Energy Security. Worldwide energy consumption has nearly doubled in the past 40 years driven by population growth, rising living standards, increasingly energy-dependent new technologies and greater energy consumption. If this trend continues, energy consumption will double again by mid-century. Energy independence is not feasible because the challenges are interdependent and global. What must be fostered is energy security, which recognizes the interlinked effects of global business, global competition, global energy supply chains, vulnerability to supply disruptions and cost within a global marketplace. For the foreseeable future there will likely be a mix of solutions that includes innovative extractive and transportation technologies for fossil

1. The United States is Not Alone in its Growing Appetite for Energy. Demand is Projected to Grow in Both Developing and Developed Countries Alike.

Source: Energy Information Administration



fuels, innovative conservation technologies and innovative alternative fuel technologies across a broad front, including nuclear. We must advance discovery and innovation. We need to understand the essential linkages between energy policies and initiatives at the federal and state levels, on the one hand, and, on the other, the competitiveness needs of U.S.-based multinational firms and U.S. firms that operate only domestically but are affected by global marketplace and energy dynamics. We need to understand energy security as a business enabler and business driver. At the end of this Progressive Dialogue Series, we hope to have a policy framework or at least the key questions that need to be addressed by the next Administration. The results of each Dialogue will stand alone (as well as contribute to succeeding Dialogues) so that we can begin to inform and influence the policy framework as we go along.

Michael Langford

Utility Workers Union of America, AFL-CIO
and ESIS Initiative Co-Chair



Talent as a Natural Resource. Americans can feel the impact of energy price and supply volatility at gas pumps and elsewhere as individual consumers and as manufacturing and other businesses. We cannot wait any longer to

address these challenges. Our efforts to do this will have competitiveness implications. Our success will depend not only on innovation but also on the men and women who build and operate the energy infrastructure. New technologies will not compensate for worker shortages caused by the expected retirement of half of the country's 412,000 power workers over the next 10 years. This represents a vast amount of knowledge walking out the door. Many of these are highly skilled jobs. We will need to attract hundreds of thousands of new workers into the energy industry. We will need more resources for education and on-the-job training. We must encourage innovation and also invest in our workforce. This will move America toward real economic security. This Dialogue is important because it is posing questions that haven't been asked before.

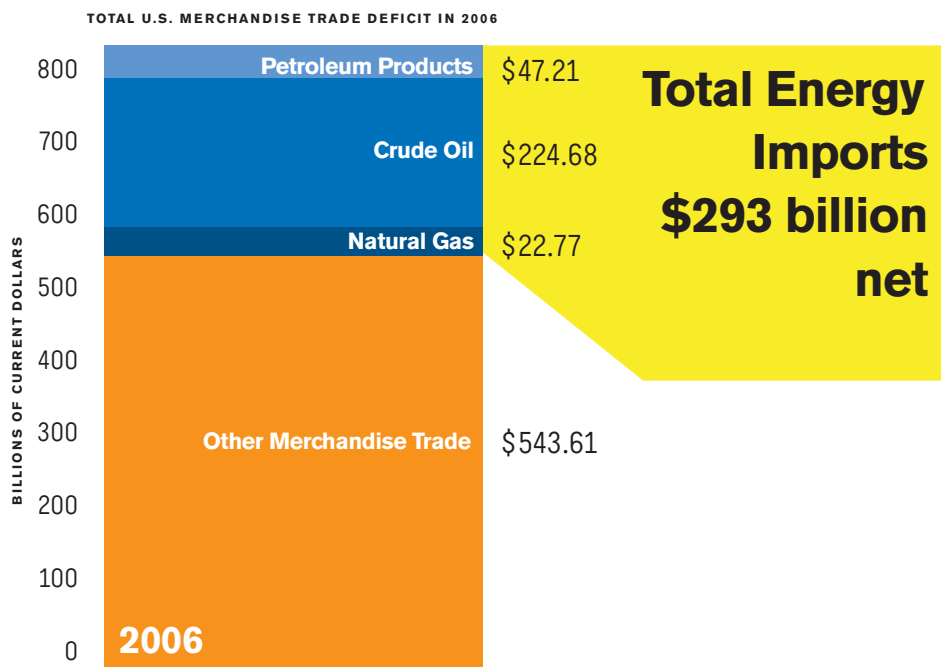
Lou Anna Simon
Michigan State University



The Hidden Opportunity Cost. Capital export is a daunting, seldom-discussed problem for the United States that is inherent in our conventional, petroleum-based economy. Capital export results in the loss of American jobs and greater foreign control of U.S. firms and real estate. In 2006, oil imports were the largest component of the U.S. trade deficit, accounting for 33 percent. The 2006 petroleum deficit was roughly \$270 billion, which was an increase of roughly \$42 billion (or 18 percent) from 2005. Each \$1 billion of trade deficit costs 27,000 U.S. jobs; hence, this increase in oil imports translates into the equivalent of 1.1 million American jobs. This transfer of wealth is expected to continue. Capital export must be considered in combination with other strategic factors, such as the instability of the Middle East and the finite supply of petroleum.

2. Total Energy Imports Accounted for Over One-Third of the U.S. Merchandise Trade Deficit in 2006.

Source: Bureau of Economic Analysis, Energy Information Administration



Robert Rosner

Argonne National Laboratory



Sustainability of Resolve. At some level, we've been here before. Most of us, I think, are definitely old enough to remember the 1970s when we had our energy crisis. When we talk about the word 'sustainable' it also applies to our "stick-

with-it-ness" on focusing on problems-like what we do about energy supply. Americans didn't stick with the energy-saving habits we formed during the '70s—and here we go again. It is crucial to sustain energy initiatives. This is a very serious issue.

The role of innovation is also critical. Innovation comes up in all the baseline scenarios for how to move forward in our energy future in an environmentally benign way. And yet, the process of driving innovation is not well understood and needs to be discussed more.

John Treat

Alternative Hybrid Locomotive Technologies



Small Steps, Substantial Effects. Efficiencies could be applied in many areas, such as transportation, home and office climate control, manufacturing and electricity generation. If we really turn on innovation within the American business and

academic communities, we can find ways to improve energy productivity. Improving our energy productivity also has policy implications, including foreign policy. Even though many people believed the Star Wars program wouldn't work, the Soviets believed it would, and this contributed to the breakup of the Soviet Union. If we increased our energy productivity, this could have a tremendous effect on other countries' attitudes toward us.

A VIEW FROM THE U.S. DEPARTMENT OF ENERGY

John Mizroch

Office of Energy Efficiency and Renewable Energy,
U.S. Department of Energy



The Secretary of Energy is anxious to hear from Progressive Dialogue I participants. Energy is the number one issue facing the world today. It is framed by two different issues: energy security and climate change. The importance of energy

security is reflected in the fact that eight countries in the world control 80 percent of the world's oil. We need to diversify our fuel sources. Climate change will be addressed by a combination of policy, technology, capital markets and finance. I am thrilled to be at the Dialogue and part of the illustrious group the Council has brought together. I hope the group will realistically discuss how America can transform energy use while improving competitiveness.

The 21st century may be the century of cleaner energy. The incandescent light bulb was invented in the 19th century, and we're still using that technology even though transformational technology is available for power generation and energy efficiency. I would like Dialogue participants to address questions such as, why can't we deploy the transformational technology, and not just in the United States? And how do we look at the future, say, 20 years from now, adding jobs while improving the economy and addressing climate change? The results of this Dialogue will be offered to decision-makers and opinion leaders. We will all work together to keep America competitive.

Setting The Stage—Expert Presentations

The purpose of the stage-setting presentations was to equip all Dialogue participants with a common baseline of information and a high-level perspective on the state of the major energy segments and related competitiveness issues.

HOW ENERGY BECAME A COMPETITIVENESS CHALLENGE

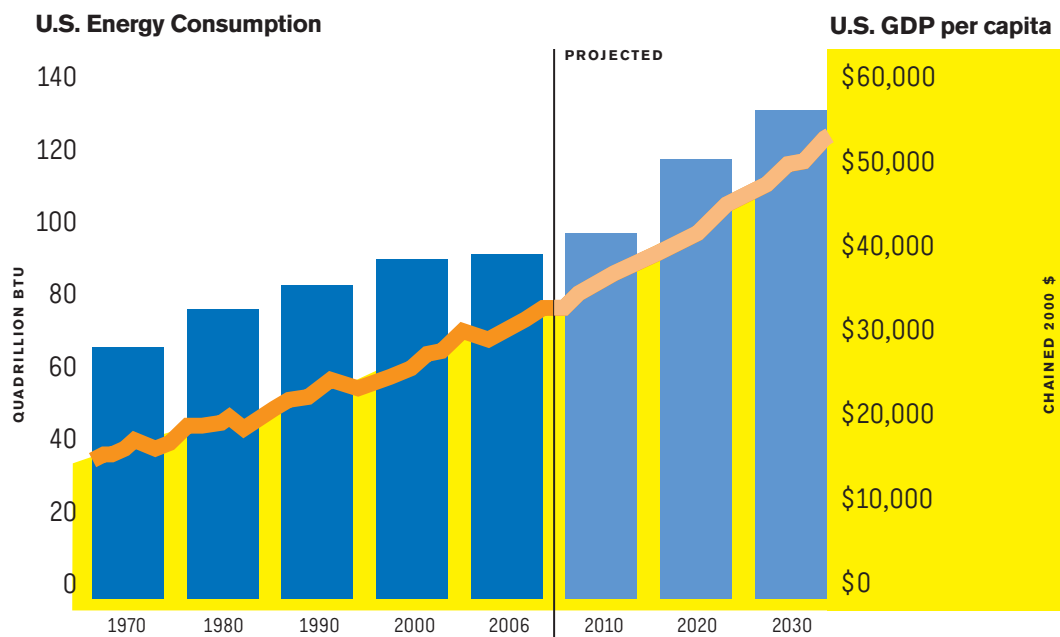
Larry Chorn, Platts

Developing countries use large amounts of energy to fuel their GDP growth. Over time, they become more efficient in using energy. But as you become more efficient, your energy dependence decreases through conservation and by refocusing your GDP on less energy-intensive industries. U.S. energy use per capita rose until the 1970s, dropped during the 1970s energy crisis, and then gradually resumed through the current decade because the United States didn't sustain its energy efficiency efforts.

Power usage is growing in all sectors but more slowly in the industrial sector. In 2006, the United States imported 60 percent of its crude oil needs. The price shocks started in 2000, moving from roughly \$18 to \$80 a barrel today. It's not clear that the United States is using less energy, even though the price has gone up at least four-fold during this period. Jumps in price are usually associated with economic recessions. The impact occurs quickly, within a few months. But in the U.S. energy market, not much price elasticity is evident yet.

3. Population Growth Combined with Increasing Affluence Will Continue to Drive U.S. Demand for Energy.

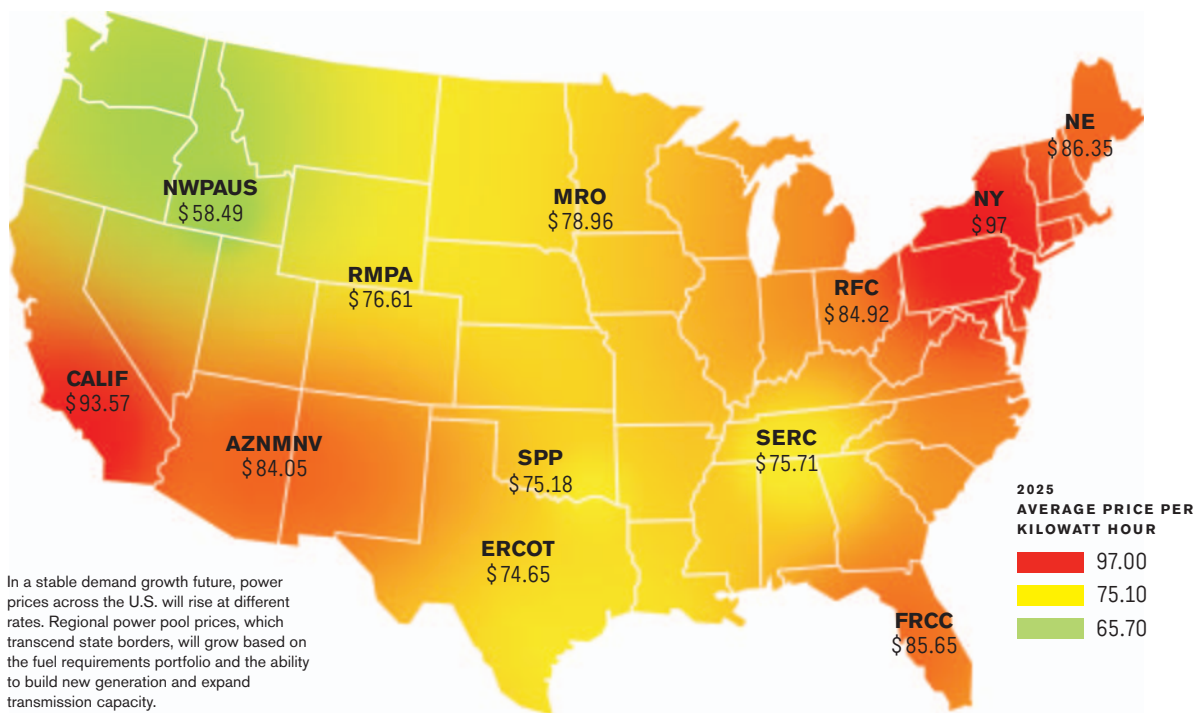
Source: Bureau of Economic Analysis, Energy Information Administration



What is our energy future? If we proceed with “business as usual,” projections through 2017 show the price of everything going up: crude oil, natural gas, coal and electric power. Our demand for all fuels is increasing and this drives the pricing. And after 2025, the projections for electric power get quite ugly.

4. U.S. Electric Power Costs Are Projected To More Than Double By 2025 Under “Business As Usual” Scenario.

Source: Platts Power Outlook Research Service



The United States is increasingly competing for energy supplies and energy security. Take for example, the following potential scenario: Russia regains control of some former Soviet Union states and periodically restricts natural gas flows into Western Europe. This could increase European demand for liquefied natural gas (LNG) from European sources, which in turn could restrict the U.S. ability to import LNG. Gas prices in the United States would “rocket up”, and they would stay there. The implications for the economy would be enormous.

Today about 80 percent of power comes from fossil fuels and about 20 percent from nuclear. Unless we start building nuclear plants more aggressively, or

put so much wind and solar in place to take the load off, Platts sees fossil fuels remaining as the primary energy source for at least the next three decades. A nuclear plant takes seven to 12 years to get in place, and a large power plant also takes seven or more years. We have some decisions to make very quickly or we will find ourselves behind the eightball.

The largest problems are those that can not be repaired quickly, such as losing a world-scale refinery. This can cause prices to rise dramatically.

But there is reason for optimism. The United States has historically shown a great ability to innovate once it achieves consensus.

PROSPECTS FOR RENEWABLES

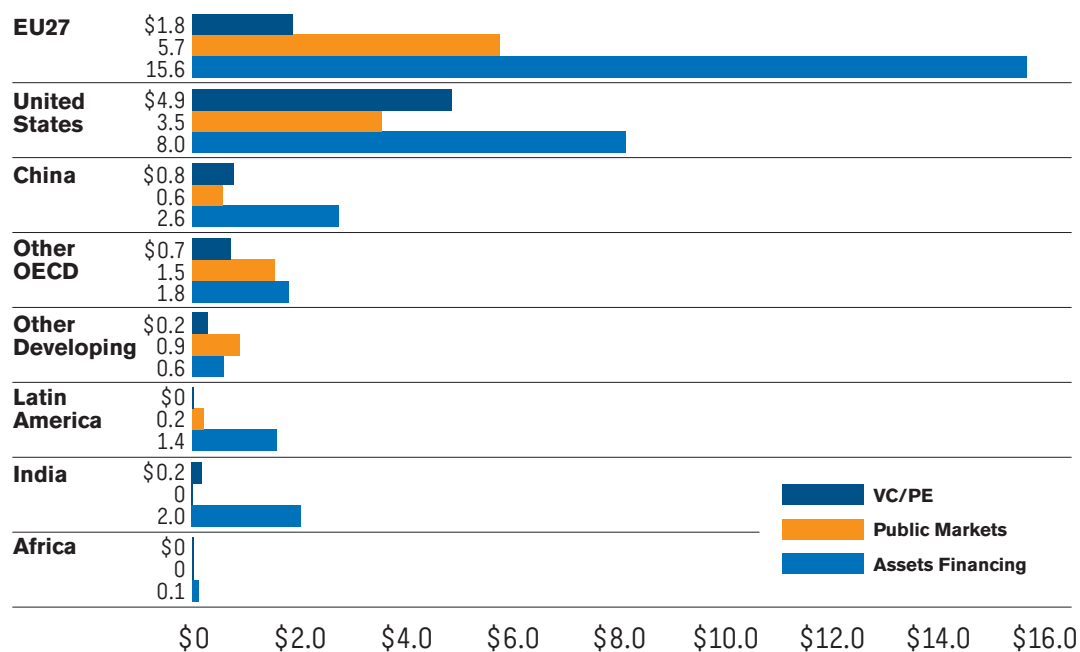
Scott Sklar, The Stella Group

There is no one technology that deals with the energy issues we face; a blend of efficiency and renewable technologies will be needed. Recent studies showed that far more private venture capital is now going into clean energy than into fossil energy.

Renewable portfolio standards now exist in 20 states. The big-population states are taking the initiative. As renewable technologies scale, they go down in cost. However, biomass is the laggard. Although the United States has a large biomass capacity (for example, ethanol), there are many competing uses for it. A new Massachusetts Institute of Technology (MIT) study shows that America is using 5,000 megawatts of geothermal energy and has a capacity of nearly 90,000 megawatts. Traditional hydro power use is declining, but in the next decade other water technologies will be deployed, such as tidal energy and freeflow hydro without dams or diversions. Wind power is good but is not always where the populations are. Concentrated

5. Global Investment in Sustainable Energy, by Type and Region, 2006 in Billions

Source: SEFI, New Energy Finance



Note: Grossed-up values based on disclosed deals. VC/PE figures: include PE buy-outs, and investor exits made through OTC market offerings. OTC & PIPE deals are included. Figures in brackets refer to (disclosed deals / total deals). Public Market figures: represent location of exchange on which as company raises money, not the location of the company. Includes investor exits through Public Market offerings. Figures in brackets refer to number of (IPOs / Secondaries / Convertible & Other). Asset Financing figures: represent total investment, and so include new build and refinancing of clean energy projects. Acquisitions of projects are not included. Figure in brackets refers to (total deals).

solar power is a Southwest technology and has been a reliable resource for California. The United States has enough for about 9 million megawatts.

Grid tied renewables are growing at about 10–15 percent a year, and overall renewables are growing at about 30–35 percent a year in terms of investment and output. Not all of this is tied to the grid. The question is whether the grid can handle the expansion. A very important consideration is power quality.

Twenty years ago, when we weren't a digital economy, the sags and surges in the grid and the transients did not matter as much. But today, according to a Sandia National Laboratory study, losses from power disruptions cost more than \$150 billion a year. As a result, the private sector and the military is turning to on-site power generation for everything from data centers to telephone systems and even basic HVAC equipment. Sophisticated digital equipment cannot be run with poor, unpredictable power quality. One-third of all computer problems are due to power quality. We may see that there will be several systems, with the richest part of society, companies and individuals, getting the most reliable power quality. Will we have a system that can provide the same level of power quality to the bottom third of our society as it does to the upper third?

“Ultimately, having choice in the market place changes things. We still have supply constraints, but once you have choice, every option costs less. In another 15 years, two-thirds of energy users will probably have options that cost less than what they're paying now.”

Scott Sklar, The Stella Group

OPEN DISCUSSION HIGHLIGHTS

Energy storage is “the Holy Grail” for system optimization and recovery from grid outages. Utilities are motivated to sell, not save, electricity. They do not make much profit from renewables. To give renewables time to develop and take hold, we must press on energy efficiency, and there must be incentives (for example, tax credits, grants, bonds) for more rapid integration into buildings and vehicles. Efficiency must come first to give lag time for renewables. In our lifetimes we will see paint applied to buildings that produces electricity. But it takes a long time for advanced technologies to percolate into the economy.

We have a very fragile grid system and energy delivery systems (pipelines, electricity—all of it) that are very easy to disrupt. The United States needs to follow industries like the Internet, cellular phones and the seamless and smart grids with their networks, because we are at considerable risk—not just from terrorism but severe weather patterns as well.

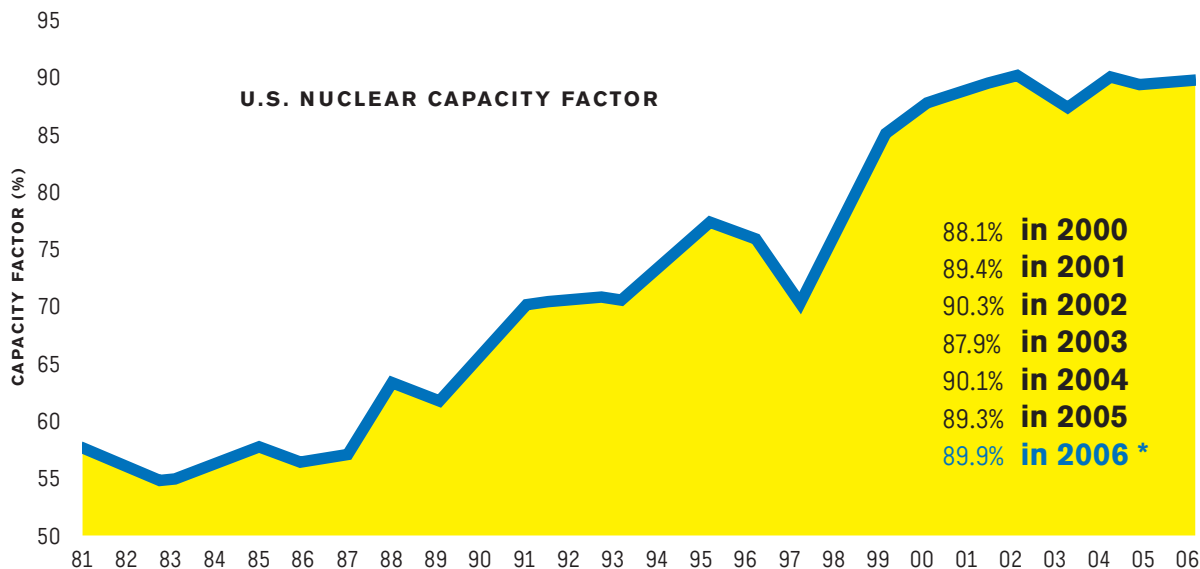
FORECAST FOR THE NUCLEAR INDUSTRY

Angelina Howard, Nuclear Energy Institute

We need all our energy sources to generate electricity. Each source has advantages and disadvantages. In the United States, there are 104 nuclear plants that produce 20 percent of our power generation (16 percent worldwide). No nuclear units are under construction in the United States today, but about 40 are in the planning stages (although it's uncertain whether all will be built). Nuclear baseload power is a 24x7 reliable source. Today, America's nuclear plants are operating at 85 percent to 90 percent of capacity—as high as can be expected. We've brought down the cost of generation to about 1.7 cents per kilowatt hour, lower than everything but hydroelectric generation. The foremost concern is the safety of these facilities. The Nuclear Regulatory Commission put together a rigorous process for license renewal. There is strong public support for nuclear power, but NIMBY [not in my backyard] is always a factor. Major investments are being made in the design and engineering for new plants. One challenge is getting the investment to build these plants.

6. Sustained Reliability and Productivity

Source: Global Energy Decisions, Energy Information Administration



* Preliminary

Note: Capacity factor is the ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period. (Energy Information Administration)

The Energy Policy Act of 2005 provided investment stimuli for new nuclear as well as other types lower emitting power generation. The federal loan guarantee is the most important of these because it addresses the construction cost. Another challenge is spent fuel management. Small quantities are stored at the nuclear plant. We're making the reprocessing of spent fuel a priority. We're doing extensive R&D

over the next 35 to 50 years to develop technologies to recycle used fuel, and we're looking at the Yucca Mountain site in Nevada for long-term storage. We will need 45 new nuclear plants to achieve 25 percent of U.S. electric power generation by 2030. There is strong potential for high temperature reactors for deployment in the 2020s.

OPEN DISCUSSION HIGHLIGHTS

Electricity demand is driving decisions about new nuclear plants more than whether the states in question are regulated or deregulated. The number of nuclear engineering students and other types of engineers needed to run nuclear plants is a concern. Although the number of students wanting to major in nuclear engineering is going up, the number of graduates is still small. The issue is the scarcity of professors, many of whom have been retiring because of the hiatus in building plants. Union apprentice programs have been re-started on the construction and operation sides.

THE ENERGY PRODUCTIVITY OPPORTUNITY

Matt Rogers, McKinsey & Company

Based on recent McKinsey Global Institute research, energy productivity will be the single largest approach to meeting global growth in demand over the next 25 years. There are 135 quadrillion BTUs of positive NPV (net present value) energy productivity investments available on a global basis that could improve the competitiveness of the United States, and competitiveness and growth on a global basis.

Looking at the data, country by country, sector by sector, shows that this is a developing market story. 85 percent of energy demand growth is going to occur in developing nations. It is also important to note that it is a consumer story. Consumers drive 60 percent of global growth. To address climate change

and think about the energy equation on a global basis, we must think more about how to address the consumer. And this is a different problem than we faced in the 1960s and 70s.

If we look at this just as a U.S. problem, we won't have much impact on it. China will pass the United States in energy consumption by 2020 or before. By

“Fundamentally, in the United States, we have not had either the price signals, the regulatory issues, or frankly, the commercial focus on energy productivity as an important source of economic competitiveness. Therefore, our rate of change historically, and our rate of change on current course, is not as rapid as our major economic competitors.”

Matt Rogers, McKinsey & Company

2020, Middle East consumers will use more oil than Europe. The United States needs to engage China, India and the Middle East to solve this problem. U.S. energy demand growth is accelerating to 1.6 percent per year from 1 percent per year over the past two decades, and this is good news about our economy becoming wealthier.

There are very substantial energy productivity investments that could make U.S. demand growth flat over the next 20 years. Our recent study shows residential and commercial energy efficiency in the United States improving over the next decade, but at a much lower rate than in China. On its current course, America will remain the most energy-intensive developed economy over the next 20 years, even as developing regions are making very rapid progress bringing energy intensity down. The U.S. rate of change is not as strong as its OECD competitors. This is where we get into the competitiveness question, because if energy is an important part of production costs, and our rate of change is slower than our major competitors, then our delta in economic wealth creation will go against us during that time period.

There are market failures due to policy distortions, lack of information among consumers, “agency” issues between landlords and tenants and related financing issues as to who has access to capital—all of which affect investments in energy productivity.

The goal should be not to make consumers use less or suffer more but to get more productivity out of a given amount of energy. If we can do this, it will improve our overall productivity and economy over time.

It was the demand-side phenomenon that took us here, and we would argue that if the prices stay at high levels, the demand-side responses will hold the basis for taking us out of the current oil situation. We are starting to see behavioral changes in response to higher prices. It takes about three years for these to become apparent. In the 2010–15 period, the most powerful force will be substitution, such as bio-fuels in the transportation sector. The 2015–2020 period will see the accelerating impact of innovation, with regulators also taking action.

What is energy productivity?

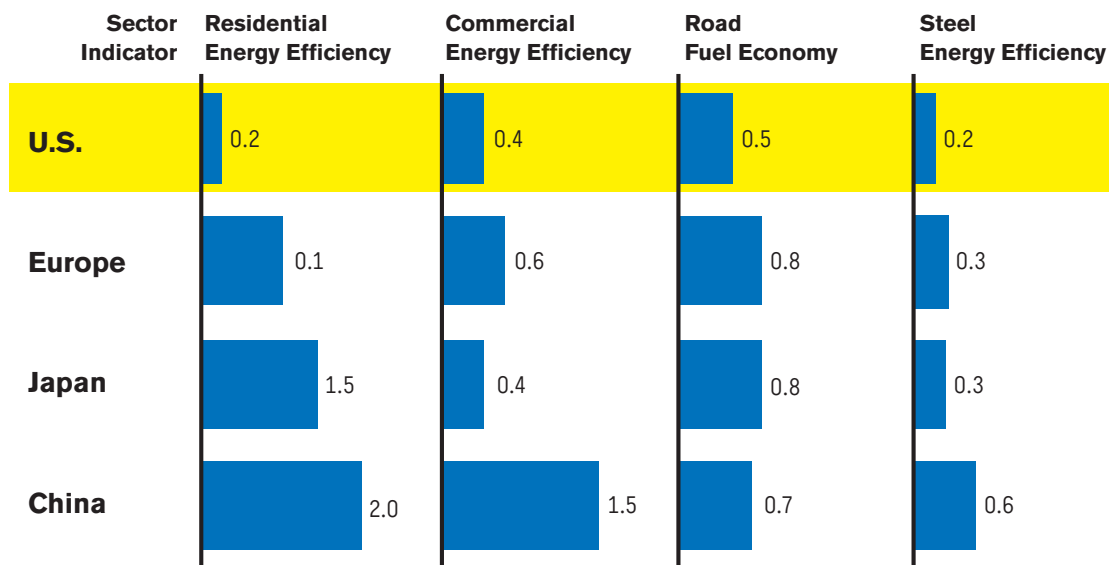
Like labor or capital productivity, energy productivity measures the output and quality of goods and services generated with a given set of inputs. McKinsey Global Institute measures it as the ratio of value added to energy inputs, which is the inverse of energy intensity of GDP, measured as a ratio of energy inputs to GDP.

Source: McKinsey & Company

7. Energy Productivity Improvements Are Lower in the United States Than in Europe and Japan Across all Sectors.

Source: Energy Information Administration, Lawrence Berkeley National Lab China Energy Group, McKinsey Global Institute

ANNUAL IMPROVEMENT OF ENERGY-PRODUCTIVITY INDICATORS, 2003–2020



OPEN DISCUSSION HIGHLIGHTS

The markets are still relatively inefficient in underwriting energy efficiency. (A few banks give a few thousand dollars off for energy efficient homes, for example.) In terms of financing energy investments, the markets have been somewhat paradoxical. Because capital has been widely available, energy inefficiency has actually been encouraged. Companies could finance increased energy costs and put in on their balance sheets. Countries have done it by keeping subsidies up, and automakers did it by putting higher subsidies for fuel inefficient vehicles on their balance sheets. Low interest rates have actually contributed to energy inefficiency.

The Implications of the Energy–Competitiveness Challenge

AN OPEN DISCUSSION

Moderator: Shirley Ann Jackson, Rensselaer Polytechnic Institute



Discussion Highlights:

- It is important to increase energy productivity (GDP output for every BTU input), but the calculation should include the multiplier effect on the economy of the related investments.
- Based on the presentations, it is striking how important the consumer is in the energy equation. We must motivate consumers, including the top and bottom quintiles, to get involved. We need to innovate energy efficient products—the value of which can be articulated to consumers simply and concisely. Given that today's energy challenges are demand-driven, it is vital that we drive efficiency among end users and extract as much benefit from this as we can. Consumer education is essential.
- Energy price differentials do have an impact on an economy's energy productivity. For example, it takes 28 percent more fuel to drive a mile in the United States than in the European Union, mainly because higher gasoline prices have incentivized higher fuel efficiency in Europe. At the same time, it is important to recognize that there is not a uniform reaction to price signals across the economy—some industries and small businesses are more sensitive to price fluctuations and are hit harder by the increases.
- Market failures are inhibiting U.S. energy productivity. These include not only lack of information among consumers but also misplaced incentives, principal agent problem, etc. In tandem, there are policies in place today that effectively lock in incumbent technologies. Market friendly standards in combination with removal of market distorting policies and regulations can help the United States make progress. These reforms need to include the state and local level, and there should be alignment on these efforts between the state and federal level.
- It is important to understand the time relationship as to when other energy and related technology options are available and what material difference they can make. Without a sense of direction and forward goals, it will be difficult to set priorities for investments and actions. There is a lag time between R&D investments and innovation. We need to understand that relationship if we are to succeed in cranking up innovation.

The Hard Truths About Energy

A KEYNOTE PRESENTATION



Daniel Yergin addresses Progressive Dialogue I expert participants and special guests.

Daniel Yergin

Cambridge Energy Research Associates (CERA)

Oil's rapid rise creates an incentive for this discussion and its urgency. One major force shaping the energy challenge is economic growth, which is lifting poor people out of poverty on a large scale in places like India and China and creating growing numbers of middle income people. This is evident in the millions of new cars sold in Russia and India, let alone China. All this growth requires a lot of energy. Each week, China adds the equivalent of two coal-fired power plants. Modern societies are good at solving problems—for example, cars with lower emissions, according to a National Petroleum Council study.

Energy will certainly loom large in U.S.-China relations. There are also energy security issues, as for example the natural gas question between Russia and Western Europe. Resource nationalism is once again at the fore. In many ways, the real issue is energy insecurity, accentuated by the access question

—can you get in and develop the resources—and the huge problem of the rapid rise of costs in the energy sector. For example, according to the new IHS/CERA Cost Index, an upstream oil project started today will literally cost double what the same project would have cost had it be started three years ago. One reason for the high cost of oil is the shortage of people and equipment. One sees similar forces at work on the cost structure in the electric power industry.

There are two positive factors. First, we have never seen so much stress on energy efficiency, across the board. This is true in Europe and in the United States. China is changing, too, although price is a complex issue for Beijing. Another new thing is what I've dubbed "The Great Bubbling" in energy R&D. Especially interesting is the entry of the venture capital community. VCs are now investing billions annually in clean energy, far more than just a couple of years ago.



*Former Senator J. Bennett Johnston,
Chairman, Johnston & Associates*



*Ralph Peterson, Chairman and CEO,
CH2M Hill*



*Dr. Shirley Ann Jackson, President,
Rensselaer Polytechnic Institute*

The National Petroleum Council (NPC) recently completed a major study entitled “The Hard Truths about Energy.” The starting thought for the study was concern about the future of oil and gas supplies. There were 350-plus participants—65 percent from outside the oil and gas industry—who looked at more than 100 other private and publicly commissioned energy studies to arrive at a balanced assessment of the outlook for energy supplies in the coming decades. The study concluded that:

- World energy demand will probably grow about 60 percent over the next 25 years unless there are very dramatic changes in energy efficiency.
- The energy mix will include oil, gas, coal, renewables and nuclear.
- The world is not running out of oil, but there is an access issue, as well as technical challenges.
- The risks are growing around energy—where it's located, the supply chain, the scale and cost of the environmental impact. These risks are adding to the challenges for the global economy.
- The solution is to use everything, including demand moderation, oil and gas, renewables, nuclear, etc.

- Energy independence is not foreseeable in the near future. The issue is about enhancing U.S. energy security, including by such means as strengthening U.S. trade relations.
- We need well-functioning global energy markets.
- We must address the reality that 55 percent of the U.S. oil and gas workforce is 10 years or less from retirement—similar to the power industry.
- Carbon constraints will be a very important part of the future energy equation.

The NPC report made five major recommendations:

- 1 Pursue both energy efficiency and conservation.
- 2 Expand and diversify the U.S. energy supply. Exploit marginal oil and gas well. Another example: Although exploration is not allowed off the U.S. East Coast today, it would be constructive to at least assess what might be there, using today's technology and environmental practices.
- 3 Strengthen U.S. and global energy security.
- 4 Promote science education and technology leadership.
- 5 Address the need for carbon constraints.

OPEN DISCUSSION HIGHLIGHTS

Since its publication, the NPC report has generated debate, especially from people who believe the world is running out of oil, about the weighting of the recommendations. There has also been debate about the report's push for strong fuel efficiency in autos. Regarding a possible fuel tax, nothing is likely to happen ahead of the Presidential election. An MIT study on coal said it is still too early for reliable data on carbon sequestration. There has been considerable surprise on the macroeconomic side: as prices rose, demand didn't seem to fall; there was no elasticity. This raised the question, have we hit the threshold yet or is there a lag? We need to develop a consensus on the elements of energy policy and how to move it forward. The Chinese are very concerned about energy issues. They are heavily occupied with their own environmental issues. In order to participate in the global energy security system, India and China need to see this as a global market that is not rigged against them.



Governor John Engler, President, National Association of Manufacturers and Council President, Deborah Wince-Smith



Richard Meserve, President, Carnegie Institution and Angie Howard, Vice President and Executive Advisor to the President, Nuclear Energy Institute



George Manoogian, Director of Strategic Planning and Special Projects, Utility Workers Union of America, AFL-CIO; Michael Langford, National President, Utility Workers Union of America, AFL-CIO; Ann Randazzo, Director, Center for Energy Workforce Development

The Energy–Competitiveness Relationship

INDUSTRY PERSPECTIVES

Moderator: Robert Fri, Resources for the Future

When familiar information on energy is viewed through the lens of competitiveness, it takes on a new dimension. The NPC report concluded that the energy system is consumer driven. Energy policy that works is policy that serves the consumer. And because oil and gas resources are mainly in the hands of the non-private sector, energy depends as much on foreign policy as energy policy. We all understand that energy technology will be a big part of the solution, but how it comes to be and how it gets deployed is a process that we don't understand very well. As others here have commented, maybe we need to think about how innovation really works. We are now going to get away from the big picture of the scene-setting presentations and get to some ground truth. We are going to ask real competitors in the global marketplace, who are facing real threat and real opportunities from the changing energy system, to tell us what they see.



James Fischer, U.S. Department of Agriculture; Marilyn Brown, Georgia Institute of Technology; Gene Huang, FedEx Corporation; Robert Fri, Resources for the Future; Peter Evans, General Electric Company.

Gene Huang

FedEx Corporation

By 2030, transportation will be the largest consumer of energy. Today, transportation depends almost exclusively on liquid petroleum fuel. Industry has been relentless in pursuing fuel efficiency. Hybrid engines are being tested for truck fleets. Real growth for transportation volumes is projected at roughly 6–6.5

percent per year but fuel consumption at only 2–2.5 percent. Part of the fuel efficiency comes from new materials, part from operational measures. It is much more difficult to apply new technology to air fleets because the average life of a plane is 25 years. For trucks, the life cycle is roughly three years, so it's easier to adopt new technology. An uninterrupted fuel supply is essential. Jet fuel imports account for 12 percent of U.S. demand, so a goal of zero imports would be unrealistic. Major international oil companies provide less than 20 percent of global oil, with the other 80 percent government-controlled. Most new sources of oil are in Asia and Europe, not the United States. Within NAFTA, Canada and Mexico have oil and natural gas, and this might help meet U.S. demand. FedEx increased its storage capacity after Katrina, as did most U.S. companies. In our case, this included storage at airports. We also developed contingency plans on a worldwide basis.

James Stanway

Wal-Mart Stores, Inc.

Wal-Mart operates the first- or second-largest private truck fleet in the United States and is China's

seventh-largest trading partner. We are the largest private electricity consumer in the United States. Our goals are to reduce cost and exposure by moving to 100 percent renewable energy consumption and decarbonizing our supply chain. We've boosted our energy efficiency within our own footprint by, for example, using LED lighting in collaboration with GE. This close collaboration has brought about significant reductions in energy consumption. We also have goals for making our truck fleets more efficient, such as using hybrid 18-wheel trucks.

With projects this big in the United States, local policies and codes can prohibit more energy-efficient changes. We need something that's standardized if we're going to get energy technology out there quickly. Compact fluorescent light bulbs can make a big difference on the customer side. In our Sam's Club operation, the cost of sales to small businesses has historically impeded new technology adoption. We're testing ways of marketing energy services to small businesses. For our supply chain, we have a technology transfer program that could be very powerful if it works. For the products we sell ourselves, we've asked about 50 supplier companies for information on the energy embedded in their products. Many lack expertise and see this as compliance issue rather than a business development issue. It is not about compliance. It's important to understand where the energy is in your supply chain. The companies that are good at this today tend to be European.

Scott Brown

Exelon Corporation

In the electric industry, energy is our business. Congress passed an Energy Policy Act in 1992, and after it was implemented in 1999, this act opened up the wholesale marketplace in our industry. It allowed competition to replace command-and-control in local markets. It allowed companies to sell into other markets. It led to new players, including independent power producers and independent transmission companies and resulted in the consolidation of companies along with new technologies, such as the combined cycle gas turbine. There were winners and losers. The Exelon nuclear fleet in the late 1990s had availability of 50 percent. By the end of 2000 this had risen to more than 90 percent. Availability is over 96 percent today in our fleet of 17 nuclear plants. We also saw the emergence of organized regional markets, thanks to the formation of a large transmission highway where the best products can be sold over a wide area. Over 70 percent of the wind energy in the United States is sold in these organized markets. On a macro basis, since 1990, U.S. electricity prices have decreased 15 percent with inflation accounted for, yet demand has increased. With new science, we now know that climate change is real, so the electric industry has a big challenge. There is also the challenge of the global economy that's produced double-digit increases in fuel costs. Federal legislation will call for the reinvention of how

"We haven't abandoned the Bentonville legend. We're still going to drag you in and talk to you about price. But there are going to be environmental metrics now, too. And we want to reward those high performers. So if there's a product with environmental attributes, delivers a great customer value, then we can give it some extra shelf space. And we firmly believe that the companies that go through the kind of processes and thinking in taking this risk out of the supply chain and down to the individual companies—these are going to be the better companies to work with in the long run."

James Stanway, Wal-Mart Stores, Inc.

“I heard a theme throughout the talks, and it was one of the ones I circled. And my walk-away was the value of looking at the supply chain. And I think we have to look at the supply chain on energy production as well.”

Scott Brown, Exelon Corporation

we produce and deliver energy in this country. We need to see consumer behavior changes. The big challenge for policymakers is whether to go forward with market competition or command-and-control. We think the struggle of competition has to be there.

Jody Howard

Caterpillar Inc.

Caterpillar is involved on many sides of the energy issue. Our products and technologies are used worldwide to harvest, transport and convert fuels. Our power generator products represent one-third of our business. We are also the world’s largest producer of clean diesel and natural gas engines. Our key choices have been around operational efficiency in plants/facilities, energy efficient products for our customers and advocating policy decisions that are environmentally friendly, but economically sound. Conservation is a critical step to buy time, but it is not enough. We need to fully leverage existing technologies and resources. In my lifetime, today’s main fuels will remain the main fuels, so we have to use them efficiently. We need the flexibility to develop more energy supplies, including nuclear and diesel fuel. And we need to invest in developing new technologies and sources, including alternative and renewable fuels. Ultimately, we need a balanced energy portfolio that includes traditional and new energy technologies. We need not just national, but global, legislation.

Glen Lewis

University of California, Davis

Energy and climate change issues are critical in all aspects of the food and agriculture supply chain, including the energy costs of crop production and animal feeding. California is the world’s fifth-largest producer of food and agricultural commodities and the largest producer in the United States. People take food safety and availability for granted, but this system is very fragile. After 9/11, food safety and security received more attention. This is really a national security issue. Only certain areas of the world can produce food, and climate change can affect weather patterns critical for food production. Increased soil temperatures require more irrigation, and that creates higher energy costs. Logistics are another concern: the fresher produce people want, the greater its perishability because of increased transportation frequency. The food industry is heavily regulated, but it has a strong history of innovation—and as many business case studies can reference, industries and countries that are heavily regulated are typically the most innovative and competitive.

“What we found in Dupont was we first set our energy efficiency goals in the pretty early ‘90s, and it really took putting a thumb on the scale to get people to actually pay attention to that as a preferred place to put their dollars. Because in the manufacturing segment, the first place you want to put your dollars is in more pounds. What we did is say, ‘You know what?... Figure out how to make more pounds with less energy. Make energy efficiency a productivity tool. You’re going to do better that way.’ But it really does take a level policy and focus to bring even those cost-effective investments up to the top of the pile so people look at them differently.”

Michael Parr, Dupont



John Keith

Pfizer Inc.

The pharmaceutical industry is not a major user of energy because its products are low in mass—there is not as much to make or ship. Still, energy is a major and growing cost for pharmaceutical firms. On a pound-for-pound basis, pills are very energy-intensive products because of their long, complex manufacturing processes and supply chains. Pfizer conducts extensive R&D that is very energy-focused. The pharmaceutical industry is global and highly competitive. No one has a dominant share in any market. Competition from Indian pharmaceutical companies is very real, for example. In the United States, more than 50 percent of prescriptions are from generic pharmaceutical companies. Over-the-counter medicines have even higher volumes. There is growing sensitivity to the cost of energy and the

“Our experience has been that the more we look into energy efficiency, the more we find opportunities, conventional opportunities, like making our buildings more efficient, and process opportunities, by making greener processes. In fact, we’re not seeing a bottom to this well. We’re not seeing that we’re running out of low-hanging fruit.”

John Keith, Pfizer Inc.

cost of goods. We’ve looked at energy efficiency for more than five years and have teams focused on this around the world.

As energy prices and competition with generics have increased, we have paid more attention to energy-efficient, green operations. The availability of the energy supply is critical. Any interruption could result in the loss of product through lack of refrigeration or other factors. On the R&D side, an interrupted energy supply could mean the loss of a year’s work. To ensure reliability, we focus on back-up suppliers, but there’s only so much you can do on site. A lot has to come from the grid. Hospitals and clinics have very high energy costs and opportunities for improving efficiency. The cost of health care is a major concern in the United States, and energy is a big factor in health care costs. I’ve seen little evidence that people are paying attention to this.

Elizabeth Cheney

Shell Energy Resources Company

Fossil fuels are at the heart of the energy system and should continue to be part of the mix. The world produces 85 million barrels a day of fuel and consumes a bit less than this. We need near-term access to untapped energy sources, such as off the continental shelf. Shell is developing technology to get more out of current sources. We expect unconventional sources to grow within our portfolio, includ-

ing technologies that are not oil-based, such as wind, solar, hydrogen, and second-generation biofuels. Our goal is to make a substantial commercial business out of at least one of these. Unconventional sources could grow to one-third of our supply mix by 2015. The key is to manage our carbon footprint. We are doing many things in this area. We have a corporate commitment to sustainable development, which we define as meeting current needs without compromising the ability of future generations to meet their needs. This includes safeguarding the health of our employees and the communities where they work. We also have workforce challenges, especially the “crew change” that will be needed because of the retirement of the aging workforce.

“We see Shell’s ability to remain competitive as greatly impacted, or maybe dependent upon, our ability to access new resources; expand our own conventionals; develop technologies around alternatives; manage CO² emissions; maintain our license to operate through economic, environmental, and social responsibility; and continue to develop our workforce. And these things not only have to be done, but have to be done very well!”

Elizabeth Cheney, Shell Energy Resources Company

OPEN DISCUSSION HIGHLIGHTS

- Decarbonization of the supply chain is very complicated. The first step is to understand how much energy is in the products we get from suppliers. We need to start bringing the supply chain up the learning curve.
- A lot of energy is embedded through feedstock use. As we think about energy costs, we need to think about feedstocks.
- There is little difference between the energy efficiency performance of overseas foreign suppliers and U.S. factories. Some companies have standards that call for terminating any supplier in any part of the world that intentionally disregards environmental standards.
- If a coal-fired plant increases its efficiency by 1 percent, that means 100,000 fewer tons of CO². These are the types of efficiencies to look for.
- To get to significant scale in biofuels, significant breakthroughs in innovation are needed. There ought to be open access, transparency and opportunity for innovators to take the business risk and be rewarded for it.

INTERNATIONAL DIMENSIONS OF THE ENERGY–COMPETITIVENESS RELATIONSHIP

Moderator: John Mizroch, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

The United States has five percent of the world’s population yet accounts for 25 percent of the world’s energy use today. The most significant global developments in the 20th century were not the invention of the computer, the Internet or penicillin, but population increase and urbanization. These developments have had incalculable effects and will drive what happens in this century.

In 1950, there were 191 cities in the world with a population of one million or more, and two megacities (8 million or more), New York and London. Today, China alone has over 40 cities with populations of four million people.

In 1950, there were 70 million vehicles in the world. Today, there are more than 800 million. China alone—which had around one million privately owned vehicles in 1992, and sold over seven million in 2006—now has as many as 30 million vehicles and is projected to have over 200 million in two decades. Department of Energy estimates show that in a short time, the world will add half a billion vehicles to today’s one billion.

Three of the world’s largest, most important nations have not signed the Kyoto Protocol. At least 50 percent of what multi-nationals make is outsourced. The rest of the world has the means, the capital and the right to develop. How do we influence things under those circumstances? Whatever we do in the United States is fine, but we’re less than 5 percent of the world population.

We’re playing a multidimensional chess game, where we see the nationalization of energy resources and their potential use for political purposes.

Peter Evans

General Electric Company

Global energy dynamics include rapid economic growth, rising prices, workforce shortages and global warming concerns. There is a basic structural change in the marketplace. The need to develop new technology solutions is driven by higher energy prices, the need for energy security and for more diverse solutions and concern about the environment. GE has a strong commitment to developing new energy technologies through worldwide acquisition and organic growth.

About four years ago GE bought a wind business. It was considered kind of a small thing but not really part of the main business of supplying power to the

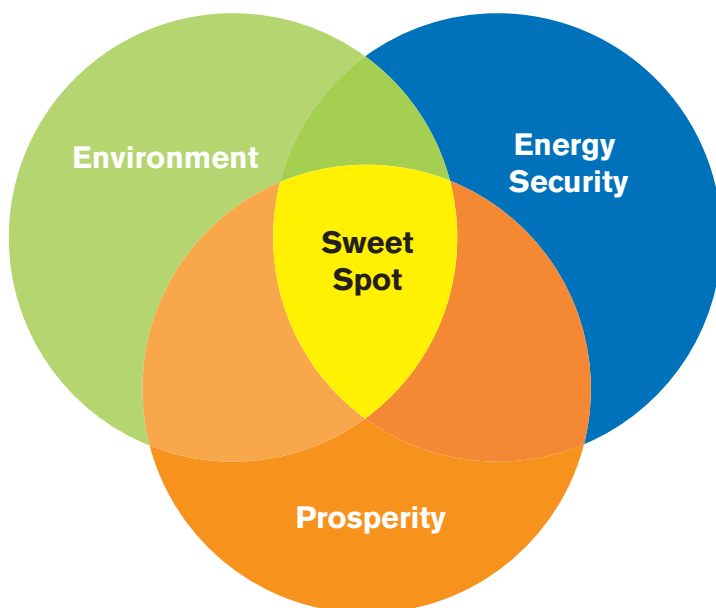


energy generation system. That has changed. We have grown that business from about a half a billion to four billion dollars. And a lot of investment is going into making wind a mainstream generation technology.

There are two types of government policies that breed demand: “demand-pull” policies such as environmental regulations, administrative measures, tax incentives, and subsidies; and “supply-push” policies such as providing market information to address market failures and diplomacy engagements with other countries. Some government interventions can distort markets and lead to policy failures. Lack of credible commitment is one example. Another is protectionism. A concern I have is that environmental regulations are often a mask for protectionism. We need to be vigilant about green industrial policy. The United States has maintained an open trade system, and we need to keep this up in a carbon-constrained world.

8. Energy Security, Innovation and Sustainability –What is the Optimal Policy Focus?

Source: GE Energy



“Obviously there are multiple goals that we are trying to achieve. One is energy security. One is environment. One is prosperity. I think that these overlap. And so what we need to focus on is thinking about how we can develop policies that hit that sweet spot that combine all of those. But certain policies can—if they are too far out of that sweet-spot—lead to the dead rat syndrome, where you are concocting products or policies that maybe achieve some but not all of the goals that you are trying to achieve.”

Peter Evans, General Electric Company

Jayant Santhaye

Lawrence Berkeley National Laboratory

On the technology front, our lab does a lot of R&D. We signed a \$500 million contract with BP recently. We expect a lot of new biofuels science in the next five years. Tech transfer from the labs to industry has grown in our lab and other DOE labs.

For private sector firms, intellectual property rights are a major challenge for competitiveness. But an even bigger problem is unequal environmental controls. If American manufacturers put controls into their plants but Chinese manufacturers don't need to do it, the Americans are at a competitive disadvantage. Developing countries have resisted, from a government perspective, dealing with emissions controls. But they have been trying to reduce local air pollution. If we develop technologies that allow them to do both, it would be an enormous benefit. Many technologies exist today but are not being implemented in developing nations. Many of these are negative cost solutions. We need to figure out what the transaction costs are and work around them.

Michael Walsh

Chicago Climate Exchange, Inc.

We operate the European Climate Exchange and Chicago Climate Exchange. A capital markets-based, positive mechanism for managing emissions creates enormous advantages for those that embrace that pricing and management mechanism. The country in the world with the most emissions under contractual commitments by the end of this year will be America and no longer Germany. The potential for terrestrial carbon sequestration (for example, trees) is largely ignored in the United States. We need to focus on a business emissions budget. There should be aggressive mitigation goals with solid enforcement. We should let the market work. Many improvements are very low-tech and just require organizing.



Robert Estill, Marathon Oil Corporation and John Amdall, Caterpillar Inc.



Mark Petri, Argonne National Laboratory and Michael Parr, DuPont

“So, if we let the market work, encourage grabbing of that low-hanging fruit, use a positive pricing system, you’re going to get competitive advantages thrown off as a result—better materials used, better energy used, smarter management of both quantities and prices. These are things we are seeing from a cap and trade tool!”

Michael Walsh, Chicago Climate Exchange, Inc.

OPEN DISCUSSION HIGHLIGHTS

- Top-down solutions are not going to emerge. Progress will occur company by company, and the private sector can show governments what to do. An exciting side benefit of an emissions budget is that people want to beat it. They take ownership of the problem. Cap-and-trade could be the dominant tool, although not the sole tool. The market responds powerfully to innovative incentives, not to punitive policy.
- The implementation details of a carbon pricing mechanism are extremely important and that is where a lot of the debate will happen. It may make more sense to do cap-and-trade within nations rather than as a global regime.
- Quantification of emissions is not so difficult, but the definition of what we cover and how we allocate is difficult. It is unlikely that we will go to a single standard. There are different types of crude oil, for example, and different accounting methods in the United States and Europe.
- The National Commission on Energy Policy (NCEP) has spent time discussing the cap-and-trade system. The NCEP endorses it because it promotes innovation and carbon reductions of the cheapest nature. For example, if a company can not afford to reduce their carbon they can focus elsewhere and buy emission credits from someone else. We need to put a cap on the cost of a permit and have this cost rise over time. We need to put a cost on carbon. Tax and cap-and-trade are not that much different in that respect.
- There is a powerful tool in supply chain management to change the dynamic around carbon. As supply chains become more global and interlinked, customers are telling companies what to do and what not to do.
- Whether we implement carbon taxes or cap-and-trade, if global businesses have price structures driven by this and competitors are not subject to it, that creates an incentive for outsourcing to those places.
- We may not get cap-and-trade right the first time, but it is better not to wait for perfection.

WORKFORCE COMPETITIVENESS WITHIN AN ENERGY SECURITY FRAMEWORK

Moderator: Carl Van Horn, John J. Heldrich Center for Workforce Development,
Rutgers, The State University of New Jersey

Many ambitious plans have been discussed in this Dialogue, and none can be achieved without an effective workforce strategy. On the labor demand side, there is more competition for talent across countries and across sectors. Other sectors are demanding the same kinds of skills. Also, there has been a decline in the number of U.S. laborers. College attendance is probably at maximum level. There are also many examples of dislocation in the American workforce. On the supply side, there is debate about immigration policy in the United States. All of this is happening in the context of a complex, local-state-federal intergovernmental structure. If some government intervention is needed, what are those policy pearls? We also need to think about the consequences of energy changes in dislocating industries: which workers will pay the price?

Limited Natural Resource—A Well-Educated and Skilled Workforce

Energy companies are experiencing all of the workforce challenges faced by other U.S. firms, but the problems are more severe than in other sectors of the economy:

- The average age for workers in the energy industry is near 50, whereas the average age of all U.S. workers is just above 40.
- At least half of electric utilities' technical workforce may retire in the next 5 to 10 years.
- America's oil and gas workers average 50 years in age. Half are likely to retire by 2010. Retirements will occur at all skill levels—from equipment operators and truck drivers to scientists and engineers. There is an inadequate supply of qualified replacement workers. For example, enrollment in U.S. undergraduate engineering programs fell 79 percent between 1982 and 2004.
- Demand for 250,000 replacement workers in the energy utility field (2007–2017) is projected to far exceed current supply—not including thousands more needed to fill related construction jobs.
- By 2010, the shortfall in the supply of electric lineworkers may be as high as 10,000—21 percent of the current number working for utilities or outsourcing companies.

Source: John J. Heldrich Center for Workforce Development, Rutgers, The State University of New Jersey

Ann Randazzo

Center for Energy Workforce Development (CEWD)

The CEWD, formed in March 2006, is consortium of major national associations for the energy industry. It also has members who are electric and natural gas utilities. The organization came together around a single issue: creating a new energy workforce. It decided to pursue strategies that could be developed regionally. Baby boomers will start retiring in five years. This will hit utilities four years earlier than other industries. We face losing half our workforce in the next five years while the demand for electricity is increasing. Energy companies are willing to invest in bricks and mortar; the obstacle is finding new workers to build and run new plants while we are also replacing retiring workers. There is a significant need for more skilled workers in the electricity and natural gas industries. Some companies are already having problems with this. CEWD identified the most critical job categories and conducted a survey to quantify how many new workers would be needed in each category. Some of the results: 30,000 new line workers, 30,000 new power plant technicians and 15,000 new technicians will be needed. We must understand what skills are involved so that we so can develop the right training programs and partnerships with educational institutions. We also need to look at mid-career hires and the military.

“What is the challenge when we are dealing with this workforce? We’ve got two things: we have an aging workforce at the same time that we have an aging infrastructure.”

Ann Randazzo, Center for Energy Workforce Development



George Manoogian

Utility Workers Union of America (UWUA), AFL-CIO

Technological changes will make production more efficient but won't compensate for the labor shortage on the near horizon. The UWUA is partnering with companies with which we have contracts to create pockets of educational opportunities across the country. We are asking educational institutions to put in place the needed curricula.

How will we deliver cost-competitive energy? Unless we create a trade policy in the United States that recognizes how we do business with other countries, our utilities won't be on a level playing field with the rest of the world. The whole world needs to implement some of the same standards that U.S. utility companies have to follow. GE and Wal-Mart are already ensuring that their non-U.S. suppliers meet their environmental standards. The U.S. government needs to do the same thing and keep our utilities on a level playing field with the rest of the world.

“The one thing that I really learned that was different than what I had thought about on both energy and in the context of climate change is better understanding the workforce constraints—understanding the fact that we have very limited skilled labor to really implement the kinds of energy-related investments we think are going to be necessary over the next several decades.”

Joseph Aldy, Resources for the Future

Douglas Banes

United Brotherhood of Carpenters & Joiners of America

When we add costs to our utilities, it threatens U.S. companies' competitiveness. America needs not just free trade but fair trade. For the past 10-15 years there has been a shortage of skilled workers. The number one issue in the 2000 FMI study on U.S. construction markets was the fierce competition for talent. There are problems recruiting new workers into our industry. There are perceptions of intransigent managements and pay no better and benefits much worse than in most industries. We have been taking these problems seriously and offer extensive apprenticeship programs, along with skilled training at 230 centers in the United States and Canada, certification for millwrights and college-level training programs.

“No one likes outages at home, but these will become longer and longer if we don't have a trained workforce that's large enough.”

George Manoogian, Utility Workers Union of America, AFL-CIO

OPEN DISCUSSION HIGHLIGHTS

- **The workforce issue is huge for energy producers and consumers. Science education needs to be made attractive and fun. Career progression needs to be better articulated to young people. Hiring is not enough; you need to also retrain workers from other sectors.**
- **The necessary quality of education is not there. In the eighth grade, kids choose college over the technical track.**
- **Undergrads are not hearing about the relationship between electrical and mechanical engineers and the environment. They are not being told they can help solve real problems in this field. The teachers and textbooks do not do this.**
- **The National Science Foundation has been grappling with this education issue for some time. More students are choosing finance and business, and fewer are choosing science and engineering, which pay much less.**
- **The teachers themselves need to be educated. The United States has created a national structure in which advanced placement courses are the key to college admissions, and they are essentially devoid of engineering content.**
- **There is a fundamental disconnect between universities and industry. People are graduating with little sense of what is available in the marketplace or how to get a job in energy.**

Dialogue I Postscript

Following the Workforce Implications discussions, Dialogue participants broke up into three groups to address a number of questions designed to help the Council on Competitiveness encapsulate and distill the outcomes from the two-day convening. In the course of these small group discussions, the experts developed conclusions, “take-aways” and also put forth ideas and suggestions for how both the government and private sector could step up to meet the challenges and opportunities presented by the need for energy security and sustainability. The group’s output is reflected in the themes that have been articulated in the Executive Summary of this proceeding. They have also been integrated into the ongoing deliberations of the Steering Committee for the Energy Security, Innovation & Sustainability Initiative. The Council would like to express its deep appreciation to all who participated in Progressive Dialogue I for their active engagement, thoughtful contributions, good will and for committing their valuable time to this Initiative.

“My take-away from this Dialogue is that the carbon footprint is going to be a key element of competitiveness for businesses; they are going to start to focus on it. I am going to look for that in the business plans and annual reports that I get and see if companies have a strategy for this or not.”

Nag Patibandla, Rensselaer Polytechnic Institute

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