Energy Security, Innovation & Sustainability Initiative
Progressive Dialogue Series

Discover.

Progressive Dialogue II:
Demand Drivers for Sustainable Energy Solutions

Compete.

Council on
Competitiveness

Progressive Dialogue II: Demand Drivers for Sustainable Energy Solutions

This Proceeding represents views expressed at Progressive Dialogue II and does not necessarily represent the views of the Council membership or the Steering Committee of the Energy Security, Innovation & Sustainability Initiative.

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Demand Drivers for Sustainable Energy Solutions
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Letter from the President

On behalf of the Council on Competitiveness, I am delighted to release *Discover,* the proceedings of the second in a series of three dialogues that have been conducted under the auspices of the Energy Security, Innovation & Sustainability (ESIS) Initiative.

By leveraging its unique convening power and diverse national network of industry, academic, labor and other thought leaders, the Council has tapped a rich vein of knowledge and insights about the drivers of private sector behavior, decisions and investments related to energy management. The Progressive Dialogue Series, generously underwritten by the Department of Energy, is informing the development of a comprehensive public-private action agenda that the Council will release at a national CEO-level Summit in the summer of 2009.

The findings presented within these pages serve as a wake-up call to America's private and public sector leaders: energy and sustainability are shifting the global competitiveness paradigm. For the nation's chief executives, these issues are now blinking rapidly on the dashboard, signaling an array of new risks and opportunities that accompany today's intense global competition for energy and the mounting urgency to contain CO_2 emissions. For the next President, these issues are demanding a bold vision for creating an energy future that meets the challenges of global climate change, while ensuring the continued competitiveness of U.S. industries and the prosperity of all Americans.

There is reason for great optimism. Dialogue experts identified a number of ways in which private sector leaders can improve the bottom line and grow their business by seizing opportunities to improve their energy productivity and develop sustainable energy solutions for their customers. But this requires CEO commitment to achieving energy and sustainability goals, coupled with supportive internal decision frameworks, energy metrics, reward systems and employee awareness. It entails a willingness to engage suppliers and learn from customers on their energy and sustainability challenges.

While there are important steps enterprises can take to improve their competitive positioning that do not require legislation, regulation or federal support, the government nevertheless plays a critical role in setting the enabling conditions that will accelerate private sector energy-related innovation and investment. Dialogue experts called for the next President to move quickly and decisively in setting

rational, integrated, domestic and international energy and climate change policies; restructuring tax policies to spur private sector innovation and the deployment of game-changing energy technologies; fostering an advanced 21st century grid and transmission system and articulating the realities, magnitude and urgency of today's energy security and sustainability imperative to the American public.

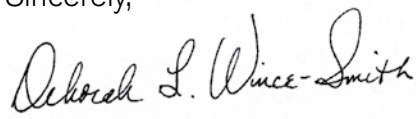
Like all Council projects, the ESIS Initiative is led by a truly remarkable group of corporate, university and labor leaders who serve as members of a Steering Committee co-chaired by Shirley Ann Jackson, President of Rensselaer Polytechnic Institute; D. Michael Langford, National President of the Utility Workers Union of America, AFL-CIO; and James W. Owens, Chairman and Chief Executive Officer of Caterpillar Inc.

The execution of this powerful and thought-provoking Progressive Dialogue Series would not have been possible without the creativity, leadership and dedication of Susan Rochford, Vice President, Energy & Sustainability Initiatives, and the highly talented and equally dedicated ESIS Initiative team: Lars-eric Rödén, former Senior Research Associate, and Kara Jones, Research and Project Associate. I would like to thank and commend them for their efforts.

We offer our special thanks to the U.S. Department of Energy, and in particular, 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 Technologies Program Manager, Douglas E. Kaempf, for their support of the Dialogue Series.

The Council is very excited about the work underway in the ESIS Initiative, and we welcome your feedback and involvement as we move forward in crafting a comprehensive roadmap for a more secure, sustainable and competitive energy future for America.

Sincerely,



Deborah L. Wince-Smith
President

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Executive Summary and Key Findings

Several powerful forces are combining to change the balance of energy supply and demand that has powered global industrialization since the nineteenth century. First, rising standards of living for billions in China, India and the rest of the developing world are increasing global energy demand to unprecedented levels. Second, exploiting new oil, gas and coal resources has become significantly more technologically challenging and expensive, as output from older, more readily accessible sources declines. Last, and perhaps most daunting, managing the risks posed by global climate change requires matching energy supply and demand and, at the same time, permanently cutting greenhouse gas (GHG) emissions from energy use by two thirds or more.

America's private sector leaders are waking up to the magnitude of the world's energy and sustainability challenges and the profound implications they hold for the nation's economic future—and their own competitiveness. The sense of urgency is real and growing. The stakes are high, the rules of the game are changing, and yet in many important ways, the United States—and its private sector—is behind the global curve in responding to these new realities.

The experts participating in Progressive Dialogue II see a clear need for bold leadership and decisive action by both government and private sector leaders. In sharing experiences and perspectives, the Dialogue experts painted an illuminating picture of the current state of the private sector approach to managing energy sourcing, measurement, consumption and investment. They also identified a number of critical factors within their own organizations and in the external operating environment that affect their ability to develop and deploy a range of sustainable energy solutions.

The private sector approach to energy management, which is increasingly identified as a top priority, is still very much in a state of transition. Management disciplines for energy and sustainability are still maturing and not uniformly practiced across the private sector. There appears to be ample room for enterprises to evolve and improve their processes and strategies in these areas. The continuum of practices is wide, with some organizations just beginning to give attention to their energy sourcing, consumption and related carbon footprint, and others having elevated these issues to the uppermost echelons of strategic management.

The U.S. private sector lags behind its counterparts in some regions of the world—particularly the European Union—when it comes to energy and sustainability matters. This difference is attributed to leadership.

Chief executives in the EU are more attuned and responsive to the paradigm shift underway in the world. They are contending with new regulatory regimes that have put explicit limits and values on carbon emissions. They are actively working to retool their way of doing business to conform to new rules—as well as to respond to new customer expectations.

Dialogue II experts see a multi-faceted business case for adopting more strategic approaches to energy management, which is characterized by four major drivers:

1 **Competitiveness**—Access to reliable, affordable and diverse energy sources is critical to attracting and retaining industries and the jobs they provide while also supporting the innovative ecosystem of the nation and its economic regions;

2 **Risk Management**—There are operational, financial, reputational and other risks that are now associated with an organization's energy and carbon footprint;

3 **Stakeholder Interests**—There is a growing demand for transparency and disclosure on energy and sustainability practices;

4 **"Good Business Sense"**—Enterprises increasingly recognize that they can reap bottom and top line benefits and competitive advantage from smarter energy management and sustainability strategies.

All signs are pointing to the need to put a price on carbon going forward, to underscore unambiguously the importance of driving private sector demand for sustainable energy options. In order to stabilize carbon dioxide (CO_2) concentrations, global CO_2 emissions must peak and then decline indefinitely. Stabilizing and ultimately reducing atmospheric concentrations of greenhouse gases can only be achieved by dramatically cutting CO_2 emissions from energy use. In all climate change scenarios, increased end-use energy efficiency from various technologies is essential to controlling the cost of stabilization and making it more affordable.

But there are no silver bullets in curbing emissions, and even though improving end-use energy technologies will make the problem cheaper to manage, it will not make it go away. Experts at Progressive Dialogue II believe that a global commitment to stabilizing CO_2 concentrations will require a carbon price and recommend that the private sector begins to prepare for this inevitability.

Concurrently, U.S. political leadership must be exerted in the international arena to drive for joint action among all nations on climate change. This effort must be directed at both the developing and developed world and should ensure that mechanisms to manage carbon emissions are crafted and implemented in a manner consistent with the economic growth aspirations of all societies.

Progressive Dialogue II experts identified a number of key factors impacting the ability of enterprises to move forward. Some factors are internal and within the sphere of the enterprise to control. Other factors are external and reflect how the government shapes the operating environment for the private sector.

Enterprise Factors

- **Leadership, Vision and Commitment.** The engagement and focus of an organization's chief executive and board of directors on their energy and sustainability agenda is essential to the success of any related initiatives.
- **Performance Standards and Metrics.** Establishing enterprise-wide energy metrics, along with supporting management disciplines, information systems and technologies, are pivotal to improving energy performance and rewarding progress for achieving goals.
- **Internal Decision Frameworks.** The internal decision framework employed by an organization can either inhibit or promote investments in energy efficient technologies and alternative energy sourcing.
- **Supply Chain Expectations and Opportunities.** Bringing energy efficiency goals and metrics into business-to-business interactions in the supply chain can accelerate the uptake of energy saving measures and speed the development of new and more efficient products and services.
- **Information, Education and Awareness.** The lack of information, education and awareness about energy and climate change contributes to enterprise and consumer inertia in moving toward sustainable energy solutions.
- **Competitive Positioning.** Many enterprises see new business and profit opportunities in becoming part of the "sustainability solution" for the markets and customers they serve. In doing so, they position themselves to compete successfully in a world being reshaped by energy security and climate change challenges.

Government Factors

- **Presidential and Federal Leadership.** Energy security and sustainability need to be front-burner issues for the next President, and federal leadership is needed to develop energy metrics and standards; modernize the electric grid and transmission system; and shape a national and international climate change policy framework in the post-Kyoto era.
- **Utility Regulation.** Utilities are uniquely positioned to roll out energy efficiency programs to every company and citizen, in every city, in all 50 states. Yet today, most utilities are inhibited from working with customers to save energy due to the regulatory structure within which they are operating.
- **Fiscal Policy.** A clear, transparent and positive price signal for carbon, along with clear and consistent tax policies, will accelerate investment in more energy efficient capital, plants, equipment and sustainable energy technologies.
- **Research and Development.** Increased government investment in energy-related basic and applied research would provide a strong foundation for private sector energy R&D and commercialization efforts, as it has done for the biomedical, pharmaceutical and computing industries.
- **Education and Awareness.** National leadership is needed to ensure that Americans become more knowledgeable about the fundamental principles of energy and are better prepared to understand the trade-offs that surround all energy choices.

CONCLUSIONS

Meeting the Need for Sustainable Energy Solutions is a National Challenge of the Highest Priority

The Dialogue II participants arrived at three major conclusions about the nature of the challenges and opportunities that lie before the United States with regard to energy security and sustainability.

It Requires Holistic Thinking. Energy security, sustainability and economic competitiveness are interdependent issues. They cannot be considered in isolation. They require holistic thinking across multiple spheres, including the product and technology levels, the enterprise level and the policy level. The United States is not yet approaching these issues in a holistic way.

It Entails a Multi-Pronged Approach. Just as there is no "silver bullet" technology that will enable America to meet its energy security and sustainability needs, there is no one policy fix or business decision that will get the nation where it needs to go in these areas. The transformation of the U.S. energy system will entail a range of actions by the private sector in tandem with a suite of integrated and coordinated policy measures by government at the state and federal levels. The United States must replace the current patchwork quilt of state energy regulations with a coherent national system that is conducive to private investment and rapid deployment of new and existing energy technologies at scale. America needs a comprehensive roadmap that will drive private sector demand for sustainable energy solutions, enabling the creation of new markets, industries and jobs while enhancing U.S. energy security and competitiveness.

It is a Shared Responsibility. The vision of a secure, sustainable and competitive energy future cannot be realized through the isolated actions of either the public or private sector. As the innovators, investors and adopters of sustainable energy solutions, private sector actors are indeed pivotal in the impending energy system transformation, but they cannot achieve this alone. Government must create the enabling conditions, and consumers must also come to see themselves as part of the solution.

Dialogue Preamble

The Council on Competitiveness launched the Energy Security, Innovation & Sustainability (ESIS) Initiative in July 2007 with a clear goal: to enhance U.S. competitiveness and energy security by shaping a public-private action agenda to drive private sector demand for sustainable energy solutions and to support the creation of new industries, markets and jobs.

The core premises of this Initiative are defined as follows:

- The need for secure, sustainable energy is the defining competitiveness challenge, and *opportunity*, of the 21st century.
- As the innovators, investors and adopters, the private sector is the pivotal actor at the nexus of the energy-sustainability challenge and opportunity equation.
- The private sector needs government to set the enabling conditions to unleash the inherent investment and innovative capacity of American enterprises and create a consistent outlook and regulatory framework for investment decisions and technology development.

Over the course of 2007 and 2008, the Council conducted a series of Progressive Dialogues designed to generate insights and ideas that will help inform the development of a comprehensive public-private action agenda for the 21st century. Each Dialogue engaged a small and select group of experts representing multi-disciplinary perspectives from industry, academia, national laboratories, organized labor, government and other thought leaders. The day-and-a-half offsite sessions provided a platform for the sharing of views, information and ideas among actors in the energy and sustainability spheres—leading to the creation of new insights about the intersection of energy security, sustainability and competitiveness.

The first Progressive Dialogue was held in September of 2007. Building on the Initiative's first premise, the Council enlisted 44 national experts to help define the ways in which energy security and climate change have become critical drivers of competitiveness—at the national and enterprise level.

The second Progressive Dialogue, held in March 2008, turned the focus to the ESIS Initiative's final two premises to: 1) explore, through the lens of enterprise "users," the private sector's role in driving energy system transformation and 2) identify the enabling conditions that government must provide to support this process.

Dialogue II produced a range of findings that are summarized in this Proceeding. The proceedings from the third and final Progressive Dialogue, providing the energy "suppliers" perspective, will be forthcoming in late summer 2008.

Dialogue Proceedings

Enterprise Energy Management—The Current State

There is a Wide Spectrum of Approaches and Broad Variability of Commitment

The Council's first Progressive Dialogue revealed that, while using energy more efficiently strengthens the ability of all companies to compete, the United States is nevertheless a global laggard in energy productivity. This finding suggested a disturbing disconnect. As such, a key objective for Dialogue II was to develop an understanding of how private sector actors are currently approaching energy management[1] within their organizations.

To facilitate this process, the Council conducted an informal online survey of the expert participants in Dialogue II to develop insights in four key areas: 1) Commitment and Goals; 2) Assessment and Measurement; 3) Implementation; and 4) Decision Rules and Decision-Making Process.

The survey found that energy management is a top priority for all organizations, but there is a wide spectrum of approaches being taken. There were also indications that there is ample opportunity to evolve energy management disciplines and further optimize energy use, without the need for government regulation or legislation.

A high percentage of respondents indicated they had made commitments to improving energy performance and productivity and had energy management programs underway. A smaller but still significant portion linked those actions to climate change

1. Energy management encompasses a range of measures designed to optimize energy use, mitigate energy-related risks and minimize energy expenditures.

Charles Calitri, Pfizer Inc

or had a separate climate change commitment. More than three-quarters have planned to make significant energy investments over the next two years.

Return on investment was cited as the single most important determinant of energy investment decisions, and the overwhelming majority of respondents reported using a payback period of 5 years or less. Less than half of those surveyed reported having an internal financing mechanism to fund and support energy management initiatives.

Financial benefits were cited as the most important driver of energy decision-making, but a number of other benefits were also identified as decision-drivers by a majority, including: facility upgrades, employee approval, enhanced public relations, customer approval and risk management.

Risk appeared to be the main factor linking energy issues to overall organizational strategy. Strategies for managing energy risk were almost exclusively focused on the supply side, such as back-up and onsite power supplies and diversification of energy supplies, as opposed to energy efficiency improvements. Government regulation and mandates rank very high as a business driver of energy efficiency measures, after cost and operational efficiencies. Even so, there was a lack of awareness and under-utilization of existing government and utility incentives that promote energy efficiency.

The use of energy metrics is common, but organizations often employ their own unique metrics—meaning that energy data is not currently generated in a manner to allow for benchmarking among companies and industries. Despite the broad indications of a high-level committment to address energy, respondents reported that energy decisions were dispersed across the enterprise and more typically made by facilities' administrators and/or functional unit heads, as opposed to being managed centrally at the top level of the organization.

The U.S. Private Sector is in a Period of Transition

The diversity in approaches to energy management revealed in the Council's informal survey bears out an important finding: the U.S. private sector is in the midst of a very significant transition in its approach to energy and, in some instances, carbon management. Dialogue II revealed a continuum, where at one end, energy has only recently become a focus of the enterprise procurement function, and at the other, it is already a strategic issue, having ascended to the upper echelons of management, including the board of directors.

Dialogue II experts shared experiences and insights about how and why their companies are addressing energy use within their organizations. All offered indications of progress and the achievement of tangible benefits from efforts to improve energy management, but several expressed concern about the pace at which change was occurring and felt a greater sense of urgency was warranted.

Energy is Now Blinking on the CEO Dashboard. A discernable shift is occurring. While many chief executive officers (CEOs) have recognized that they have a "social responsibility" to their stakeholders, considerations for energy and sustainability issues go beyond that now. Financial analysts are starting to ask CEOs questions about their sustainability practices. Energy and climate change are on their way to becoming mainstream issues for top management and executive boards, but they are not quite there yet.

Some Dialogue experts reported that their companies had initiated changes in their internal energy and climate change policies and programs within the last several years. For some, what began as cost-saving efforts directed at energy procurement have evolved to include demand-side efforts to enhance energy use throughout the enterprise.

As such energy management efforts bear fruit, they are attracting the attention of CEOs and other senior

Throughout the 1990s, **The Procter & Gamble Company** (P&G) was considered to have the lowest cost plants in a given country because they took advantage of larger scale operations. At that point in time, the cost of capital was high, but the cost of energy for transportation was low. That is no longer the case. P&G is currently in the process of building 13 new plants, each in close proximity to their consumer base, thereby mitigating some of the environmental impacts, and cost, of transportation. One of these is in the United States. It is the first time in 25 years that P&G is building a plant in the United States.

Julio Nemeth, The Procter & Gamble Company

executives. These issues are percolating up to the top of organizations and awareness is being raised, but Dialogue II experts believe that more work needs to be done to move toward more substantial energy-related investments that, despite having higher pay-offs, require a longer pay-back time.

Energy is Impacting Manufacturing Site Decisions. While acknowledging that some very energy-intensive industries, such as chemicals and cement, have moved outside of the United States in pursuit of lower energy costs, Dialogue II experts reported that talent and taxes still dominate as the primary factors influencing the siting of their operations. Other issues, such as local conditions, labor laws, environmental behaviors and social issues are also considered. Today, energy is among these 'other' considerations but is taking on even greater significance. For some companies, it is the *cost* of energy that is becoming a factor in manufacturing decisions, and the availability of state energy-related tax incentives or utility energy efficiency programs can be deciding factors in siting choices. For others, it is the *carbon impact* of energy that is now factored into their manufacturing site decisions, along with the desire to achieve proximity to the customer and lower transportation costs.

U.S. Business Leadership is Behind the Global Sustainability Curve

When it comes to adherence to sustainability principles, European companies are on a different and faster track than American companies. This shift is being driven largely by national and European Union

Experts convened in small groups for more in-depth discussion.

(EU) commission-wide rules and mandates. The gap is particularly apparent at the CEO level, where managing carbon impact is almost universally viewed as a strategic priority for businesses in the EU. Implementation of sustainability practices is evident throughout European enterprises, reaching all the way to the customer. "They have carbon footprints on their foreheads in Europe," according to one Dialogue expert. Plant managers are empowered to assess and shift their own practices at a local level and are rewarded for helping achieve the broader organization's carbon goals. The concept of carbon neutrality has been more fully integrated into the European consumer mindset—both reflecting and reinforcing the corporate commitment.

- **Marriott International, Inc.'s** rapid global growth over the last 20 years provides a good example of how exposure to more advanced practices overseas can translate into a competitive advantage for a multinational corporation. Initial expansion beyond the United States revealed that there were many energy-saving ways of doing business that could be adopted. The company identified a wide range of best practices that were then woven throughout global operations. Today, energy conservation is a crucial factor in every component of Marriott's business operations worldwide.

Several nations have set more explicit and rigorous requirements for sustainability than the United States, driving private sector adaptation and heavily influencing the business case for action. The European Union has an energy policy called "20–20 by 2020," which entails numerous standards for energy sourcing and consumption aimed at fighting climate change and promoting renewable energy.

> "The key question when I think about these issues is—how do you make the business case? And when I think about these kinds of arguments I'm reminded of the story of FDR being lobbied by advocates for a particular policy, and he ended the meeting by saying, 'You've convinced me it's the right thing to do, now go and muster the political support and make me do it.' And in a business, you have to build the business case."
>
> Andrew Hoffman, University of Michigan

The proposals' primary pledges are a 20 percent reduction in greenhouse gas emissions and an increase of energy production from renewable sources to account for 20 percent of total production by the year 2020.

Other components of the plan include: reform of the ETS (emissions trading system); redirection of ETS proceeds to renewable energy investment and research and development; an EU-wide goal for 10 percent of petroleum consumption to come from sustainable biofuels; individual action plans for each participating country and differentiation of requirements by member states to allow for the wealthier nations to shoulder more responsibility in achieving the end goals. This plan was endorsed in early 2007 by the European Heads of State and was passed by the Commission and the Parliament in early 2008. This standard is now a component of EU law.[2]

European companies are moving ahead to not only meet, but beat, these requirements. The market paradigm is shifting on the United States and its companies.

The Business Case for Sustainable Energy is Multi-Faceted

As energy price and supply volatility continue to increase and global interest and attention to environmental sustainability continues to mount, the business case for pursuing sustainable energy strategies has developed multiple facets. Dialogue II participants identified competitiveness, risk management, stakeholder interests and "good business sense" as the key motivations, with each weighing differently depending upon the nature of the organization.

Competitiveness. There is a sense that there will be winners and losers as the world trends toward sustainable energy, and enterprises naturally want to be among the survivors, if not winners. For certain industries, a dramatic change in the price or availability of specific fuels directly impacts their ability to supply a product and can compel a complete overhaul of the very structure of their business. One expert cited the German company **BASF** as an example of a company that is examining their product line and attempting to redesign their entire industrial process in order to develop their products without creating carbon dioxide (CO_2) as a byproduct.[3]

2. Barroso, José Manuel Durão. "20 20 by 2020: Europe's Climate Change Opportunity," Speech to the European Parliament, Brussels, January 23, 2008.
3. "Carbon Balance," BASF—The Chemical Company, 2008. http://corporate.basf.com/en/sustainability

William Bates, Council on Competitiveness, and Timothy Elder, Caterpillar Inc.

Changes in production standards are not merely a means of keeping up with the marketplace, but are literally tied to the competitiveness of their business and ultimately their industry. Experts commented that being a sustainable business means addressing costs to the global commons.[4] If companies do not sell products that people want to buy and capture all these costs, they will be out of business.

Risk Management. Companies and organizations perceive changes in the price and availability of fossil fuels as a permanent, not temporary, phenomenon. Climate change is seen as real and government action to constrain carbon emissions as inevitable. These forces present a range of operational, market, reputational and other risks that organizations are now recognizing and working to address by implementing energy and carbon management strategies.

Stakeholder Interests. Meeting the expectations of a diversity of stakeholders has become a driver of business decisions. Non-governmental organizations (NGOs) are demanding transparency and disclosure on organizations' carbon footprint. Customers are looking to their suppliers to meet certain energy and environmental standards. Financial analysts are asking questions about the exposure or risk to corporations due to energy and climate change. Chief executives are expecting their organizations to deliver social and environmental, not just economic, benefits to customers, employees and communities. Delivering on such stakeholder expectations generates goodwill from their customers, partners and suppliers and offers another means by which enterprises can compete and excel.

Good Business Sense. Dialogue participants see not just risk, pressure or altruism as driving their decisions and investments in sustainable energy solutions, they see economic self-interest. Within an enterprise, upgrading equipment, replacing light bulbs within buildings, putting solar cells on top of manufacturing facilities or recycling water used in operations makes financial sense. In the marketplace, it makes even more sense to offer customers products and services that reduce energy consumption, improve environmental footprints and thereby enhance competitiveness.

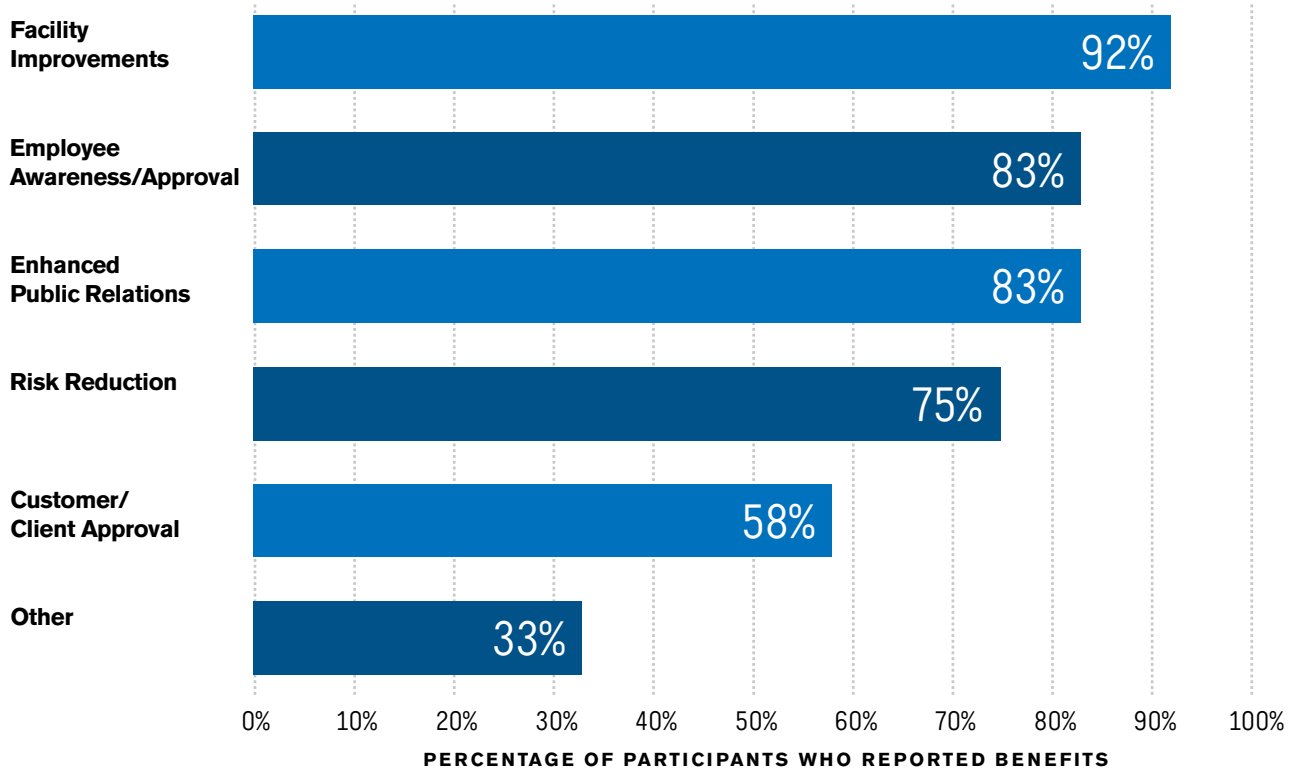
4. Global commons are natural assets outside national jurisdiction, such as the atmosphere.

"There is a tremendous wave of interest that we've experienced from some of [the companies represented at Dialogue II] and many other companies over the last year in addressing energy productivity—but also what I would call generally 'resource productivity'—at a strategic level. We're probably getting a call a week now from companies, and most of these initiatives are coming from the CEO or the CFO [Chief Financial Officer] who want to understand what green means for their business. Certainly energy is at the core of that, but it involves other issues as well in terms of supply chain for other resource-intensive products and the climate change issue generally. So it's definitely a wave that we see cresting. It probably hasn't completely crested yet, but it's certainly built up quite a bit of speed, and I think it's important."

Glenn Prickett, Conservation International

1. Qualitative Benefits of Energy Management

Source: Council on Competitiveness



Note: This chart represents the results of an informal survey and are not statistically significant. Dialogue II participants were asked to identify the benefits their companies experienced after implementing energy management strategies.

Dialogue Proceedings

Two Revolutions in Environmental Thinking

A KEYNOTE PRESENTATION

Daniel C. Esty
Yale University

Innovation is the Key to Environmental Sustainability. Energy security and environmental sustainability are the fundamental challenges of our era. Central to addressing these challenges is supporting U.S. competitiveness through a combination of private and public sector solutions. Since the Framework Convention on Climate Change was launched 18 years ago, there have been two significant changes: a revolution in environmental policy and a green wave sweeping the business world.

Market-Based Policies Drive Innovation. Policymakers are moving beyond traditional command and control regulatory strategies—in which the government requires companies to adopt specific technologies—to market mechanisms that promote innovation. Price signals shift the regulatory dynamics by engaging the private sector as the "engine of change."

In the next few years, mandatory regulations on greenhouse gases are inevitable and price signals will be a central element of the regulatory strategy. The United States will almost certainly employ a price mechanism, whether in the form of cap-and-trade, carbon charges, mandates or some combination of these. These price signals will change the dynamic of the business world. Those companies not paying attention and not acting now will be at a competitive disadvantage.

Daniel Esty addresses Dialogue II expert participants and special guests.

Price signals will drive innovation in the private sector, the key to solving the sustainability challenge. Societal progress on environmental issues is roughly 90 percent due to technology and innovation and 10 percent to direct behavioral changes. Over time, price signals and technology advancement will both foster behavioral change, as people are forced to pay for the environmental harms that they cause.

The good news is that money is already flowing in the direction of alternative and energy efficient technologies. There has been an enormous infusion of money into clean technology with a huge ramp-up

of private sector investment and government R&D funding. This investment will help reduce emissions, increase energy efficiency and move towards carbon capture and sequestration.

Overall, there needs to be a level playing field, rather than the government picking winners. Entrepreneurs should be selling solutions to the companies. A new model of policy must focus on private sector innovation incentives and rewards because it is the private sector that best drives innovation.

There has been a Sea Change in the Business World. Just three years ago most companies did not understand the importance of bringing energy and the environment into their core strategy. Today that has completely changed. *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage* is a story about several critical logics: command and control, risk and compliance and Wall Street. It is not about how we regulate but what we regulate. Because of projects like the Carbon Disclosure Project, stocks are being revalued based on new considerations. Energy efficiency is becoming increasingly important in households and companies as oil prices soar. This is driving companies to invest in a new energy future.

Stakeholders have broadened and deepened. Communities are now asking environment-oriented questions. Twenty-seven states now have some form of GHG control program and often with a Renewable Portfolio Standard (RPS); and over 600 mayors have committed their cities to meet Kyoto Protocol targets.

Customers have become an important environmental sustainability driver. For example, Wal-Mart's Lee Scott announced that the company will reduce its direct emissions, reduce packaging and ask the same of all Wal-Mart suppliers. Thousands of other suppliers are also asking about how to change their game. A company takes action and then demands it of their suppliers. Companies not on board face real risk as we head toward a carbon constrained future.

In the short-term, there are uncertain times ahead. Climate legislation faces many obstacles, making it unclear that it will be possible to finalize legislation in the next couple of years. We will need to continue to have critical global discussions that include developing nations, such as China and India. However, the long-term is more positive. The United States has and will develop the capacity to capitalize on its entrepreneurial spirit to produce competitive solutions to climate change.

Dialogue Proceedings

Factors Affecting Private Sector Demand for Sustainable Energy Solutions

Following a robust discussion around the current state of energy management at the enterprise-level, the experts participating in Progressive Dialogue II worked to address two fundamental questions to bring forth an understanding of the key factors that can and will drive private sector demand for sustainable energy solutions.

"We really need to get into every CEO's mindset [on these issues] because it shouldn't be fifth on the list or sixth on the list—and every board member should have it in their mindset too."

Joseph Stanislaw, Deloitte & Touche USA LLP

- **Enterprise Factors.** The Council first asked participants to identify the conditions that private sector enterprises must cultivate within their own organizations and in the marketplace to give needed focus to energy-related issues and accelerate the deployment of sustainable energy solutions.
- **Government Factors.** Experts were subsequently asked to identify actions that the government must take to create the enabling conditions that will encourage the private sector to fulfill its role as the driver and change agent in creating a more secure and sustainable energy system.

Enterprise Factors

Leadership, Vision and Commitment

The engagement and focus of the chief executive and a company's board of directors on its energy and sustainability agenda is essential to the success of any related initiatives. Executives set the tone and send the signal throughout the entire organization.

- **Marriott** has been pursuing energy management goals for several years. As of today, they have expanded their programs throughout the company and have even taken the best practices and concepts they have applied in their hotels to their employee base, teaching them energy saving techniques to use at home. Marriott is now measuring their carbon footprint and is partnering with other companies on these issues, both of which have proven to be very beneficial. The company attributes the success of these initiatives to having their CEO leading the agenda.

Dialogue II experts agreed that energy management needs to be raised to the executive level, but they also believe it needs to go beyond that and reach the agenda of the board of directors. The board needs to be knowledgeable about energy and climate change issues. One way to get its attention is to present the issues in terms of risk management.

Many companies received a big wake-up call when hurricanes Katrina and Rita hit. Enterprises would be remiss to consider only the short-term implications of their current energy and carbon risk exposure—they must think several years and scenarios ahead.

> "If you don't have measures, and you don't have meters, how are you going to monitor your progress? And more importantly, how are you going to give credit to somebody who's made an improvement? A lot of our energy cost distribution is still done on an allocation basis. It's based on some percentages that were developed years ago, and it is hard to get somebody motivated to do something about energy when they don't feel like they are charged accurately now, or that they are going to be credited for doing something differently."
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> Raymond Ratheal, Eastman Chemical Company

Performance Standards and Metrics

Establishing and utilizing enterprise-wide energy metrics, along with supporting information systems and metering technologies, are pivotal to optimizing energy management. Because energy prices have been so low for so long, most enterprises have not had the incentive to invest in measuring or monitoring energy consumption to any great extent.

However, energy metrics do matter for several reasons. Metrics enable managers to tell the internal energy story and make the case for process improvements and key investments. Metrics drive performance improvement by revealing progress toward established goals, which in turn drives the reward system. They also permit

benchmarking across industries and economies, thereby providing a more thorough and accurate understanding of comparative energy intensity and productivity performance. When implemented transparently, metrics can enable public recognition of improved energy and carbon management and allow consumers to make informed purchasing decisions. EnergyStar is an excellent example of a public program that recognizes organizations for energy performance, informs consumer choice and moves people in the right direction.

Many organizations have developed some energy measurement systems, but these are often only at the corporate or factory management levels. It is harder to find companies with good energy metrics below that level. Energy performance standards can be an extremely effective way of improving energy efficiency—but metering systems must be in place to implement them. Very often, metering stops at the point where energy comes into the plant, whereas detailed sub-metering of specific activities within the plant would help identify the relative energy-intensity of individual processes. Companies with diverse operations and products need a variety of metrics and metering systems, which are often lacking. This lack of data can mean that allocation of energy costs across the organization is based on historical distribution of energy use that does not reflect current realities.

The **U.S. Department of Energy (DOE)** is working with industries to build an American National Standards Institute (ANSI) standard in energy management systems—and then on down with standards for steam supply, compressed air and other systems. In parallel, DOE is working to ensure there will be ANSI-certified practitioners to assist enterprises in gaining energy certification. Standardized energy management from top to bottom will help manage energy costs and will also make it easier for businesses to identify suppliers with good practices. It is quite possible that in the not-too-distant future, companies will seek certification under ANSI energy management standards in order to assure their status as a preferred supplier to their customers.

> "I've had some great support within the company, but when I really got my support was about seven years ago when we started—as part of our balanced scorecard system—to put energy and energy consumption right up there along with customer satisfaction and all the other measurements that we do as a company. And after that—my program really took off."
>
> Patrick Maher, Marriott International, Inc.

Internal Decision Frameworks

Energy optimization strategies entail investments, not only in metering and information technologies (IT),

What is energy productivity?

According to the Bureau of Labor Statistics, productivity is a measure of economic efficiency, which shows how effectively economic inputs are converted into output. Advances in productivity, that is the ability to produce more with the same or less input, are a significant source of increased potential national income. Energy productivity is the ratio of production (or service) output in dollars to energy input. Energy productivity of the United States is expressed as GDP($)/unit of energy.

but also in deployment of the most energy efficient capital equipment available. This may mean industrial process controls equipment for one company or highly efficient data servers for another. However, Dialogue II experts confirmed that the internal decision framework employed by an organization can either inhibit or promote investments in energy efficient technologies and equipment. Key variables within the decision framework include: financial measures applied to investments; the individuals within the organization who make investment decisions; adequacy of human resources dedicated to identifying efficiency opportunities; and the extent to which energy management is linked to the organization's strategic goals or mission.

Financial Considerations. A common barrier to energy efficiency investments is the rate of return involved. Organizations will tend to favor investments offering the highest rate of return within the shortest period of time, even though the risk associated with the higher return may be greater. The Department of Energy's experience in conducting over 620 plant-level energy assessments last year underscores how the rate of return requirements can be a significant barrier to efficiency investments.

DOE's expert evaluations are typically very well received by plant staff and managers who recognize the value of third party recommendations in convincing corporate managers and boards to approve projects. Nonetheless, DOE found that very few companies approve energy efficiency projects with payback periods as long as three years. The vast majority limit approval to projects that pay for themselves in nine months to one year.

Some Dialogue II experts posited that energy efficiency investments should actually enjoy a much lower hurdle rate because the risk factor for these projects is so low. Unlike investments related to product launches or manufacturing, where there is a huge amount of market risk, energy efficiency investments are almost always successful.

Decision-Makers. A key challenge to instituting energy efficiency measures in organizations is linking business managers with profit and loss responsibility to energy efficiency project evaluations. Businesses are always looking for projects to

Experts convened in small groups for more in-depth discussion.

reduce costs while making them more efficient and competitive in the marketplace. If energy efficiency project decisions remain at the facility or operating plant manager level, many opportunities will be overlooked. These decisions need to be evaluated in the context of the overall business portfolio.

Executive level support for harvesting these energy efficiency opportunities is imperative to their success. Yet because many other issues compete for the attention of the CEO, energy initiatives are at risk of becoming just another issue on his or her already-crowded plate. It is important for managers to create a clear framework for presenting the opportunities, supported when possible by metrics, and to deliver a simple and straightforward action request that the organization's leadership can act upon.

Linkage to Organizational Mission and Strategic Goals. Some enterprises have recognized that there is a direct link between how they manage their energy and how efficiently they can deliver on their mission. Others do not yet see this relationship. For example, at a recent conference of the Federation of American Hospitals, energy was placed far down the list from other top issues in the industry, such as patient comfort, staff satisfaction and infection rates, among others. Energy is not considered a mission-critical issue. However, by improving their energy management, hospitals can increase their

Timothy Elder, Caterpillar Inc.

economic and operational efficiency. The same is true with schools. Energy improvements within schools can support their educational missions by applying energy savings to support other student educational needs.

- Certain projects can overcome payback period barriers by providing high public relations value to the company. **Frito-Lay, Inc.**, for example, is building a new plant in Arizona for Sun Chips that will require so little power that it will essentially be disconnected from the grid.[5] Exceptional facilities connected to product branding and public corporate commitments can garner tremendous internal and external support.

- **CLF Ventures**, an environmental non-governmental organization, works with companies to expand their internal decision frameworks to go beyond cost and profitability measures and include consideration of energy use and related environmental impacts. CLF Ventures has had success in persuading some organizations that by improving the overall sustainability "footprint" of their operations, they also enhance their ability to achieve strategic business objectives.

Supply Chain Expectations and Opportunities

The competitiveness of any enterprise is directly affected by the competitiveness of their suppliers. Some companies are already starting to manage their supply chain from this perspective. Bringing energy efficiency goals and metrics into business-to-business interactions will accelerate the uptake of energy saving measures and speed the development and deployment of new, more efficient products and services. In fact, organizations have the opportunity to "multiply themselves" through the supply chain by extending their own energy-related performance requirements to their suppliers.

Several experts reported that their organizations have incorporated energy efficiency performance requirements into their evaluation of suppliers. Energy efficiency can be a pivotal factor in choosing among suppliers that are otherwise similar in terms of price, performance and other measures. For very

5. "Being Green," Frito Lay, Inc., 2007. http://www.fritolay.com/fl/flstore/cgi-bin/ProdSubEV_Cat_572347_NavRoot_633003.htm

large companies, such requirements exert a powerful influence over suppliers competing aggressively to win their business.

Information, Awareness and Training

A recurring theme in Dialogue II was the important role that information, education and awareness must play in moving organizations, markets and consumers to embrace sustainable energy solutions. Companies do not invest in more efficient manufacturing technologies because they do not know that they exist. Consumers do not purchase more energy efficient appliances because they do not realize the higher upfront price of the product will be more than covered by energy savings achieved over its service life. Both companies and consumers are concerned about climate change, but they do not recognize the strong linkage between energy consumption and carbon emissions.

Dialogue II participants identified the lack of energy information, education and awareness as a key factor in one of the major market failures confronting the United States—consumers not significantly reducing their energy consumption despite steadily rising energy prices.

Employee Education. An organization's success in implementing energy and sustainability goals is closely linked to the level of management knowledge and employee awareness and training on these issues. Information is a critical enabler to driving progress. Education and information distribution on energy issues assist employees in

"I was really surprised at the lack of and critical need for information—information about the problem as well as a possible solution. So there are technologies that are out there, but how industry does or does not go after those technologies, or understand where to get the information, is an issue. One thing I think is really needed is to build the educational infrastructure and underpinnings so we will have the innovation and the leadership needed to be a global leader in this whole area."

Douglas E. Kaempf, U.S. Department of Energy

evaluating decisions. Changing the mindset around energy does not require legislation or regulation. It is achievable through management commitment and chief executive leadership. Every employee in an organization could benefit from fundamental training on energy management, the organization's energy goals and how such goals relate to the employee's function. Formation of a cross-functional energy committee could be an effective tool in this regard.

Consumer Education. Consumer knowledge plays a critical part in the private sector demand equation. For example, it is possible today to buy a basic washing machine for $400 or buy a hyper-efficient duet washing machine for $1,100. Most people would balk at the $700 price differential because most people do not conduct net present value calculations prior to making a purchase. Calculations to determine energy and water savings reveal that in Michigan that money will be returned to the consumer in 4.8 years, using a conservative discount rate. In California, consumers get that money back in 1.2 years.

However, when a consumer goes to the store, there is typically no information provided about the overall lifecycle cost of their pending investment. The consumer simply sees the difference between a $400 washing machine and a $1,100 washing machine. The purchasing decision is based on only the comparable information that is provided: price. The private sector can equip consumers to make more enlightened choices about the products and services they purchase by calculating and disclosing relevant information about energy and carbon impacts.

Competitive Positioning

Beyond addressing their own energy costs and carbon footprint, many organizations have the opportunity to be a part of the sustainability solution for the markets and customers they serve. They can design energy considerations into technology development, products and services, or in the case of educational institutions, into curricula and research. By addressing energy and carbon issues in the marketplace, enterprises will also better position themselves to compete successfully in a global economy that is being rapidly reshaped by these forces. When all is said and done, delivering sustainable energy solutions is about making money.

Dialogue II experts believe that the opportunities to deliver sustainable energy solutions to the market arise when companies take a holistic, systems-based approach to the market and their customers' needs.

- **Caterpillar** illustrated this point by explaining how the company has evolved its approach to improving the efficiency of its earth moving machinery, resulting in reduced fuel consumption and carbon emissions. Viewed at the component level, the engine has been optimized for fuel efficiency over the last century and only represents a small opportunity for further improvement, in the neighborhood of 5 percent. In contrast, when the company looked at the whole power train as a system, including the engine, transmission, driveline, hydraulics and cooling system, the opportunity increased to approximately 15 percent. Taking a step further, and viewing how their products

performed and interacted on the customer site, the company was able to demonstrate reductions in fuel consumption in excess of 30 percent to accomplish a given job. Building upon this success, the company identified yet a further market opportunity for offering consulting services to assist its customers on which types of machines they should use and how they should go about using them and even about how to orchestrate an entire work site to get the job done efficiently.

This approach is a win-win for the suppliers and customers. The supplier wins additional business by helping the customer become more competitive.

Customers are central to identifying market opportunities in sustainable energy solutions. On the supply side of this issue, there are whole new partnership arrangements emerging among oil companies with information technology companies, car companies and mining companies. This has never happened before. These partnerships reinvent business models and potentially accelerate the product innovation and deployment process. When a private enterprise becomes truly customer-oriented, partnerships are going to drive adoption of sustainable energy solutions much more quickly because there will be more commonality of interest in tying the value chain together.

"There's just a lot of opportunity, but it will require us to work with our customers in different ways than we have in the past. So we have to understand their needs and provide complete solutions to them, rather than just a product to do a specific job."

Paul Stark, Caterpillar Inc.

The Role of End-Use Energy Technology in Addressing Climate Change

FEATURED PRESENTATION

James A. Edmonds
Joint Global Change Research Institute, Pacific Northwest National Laboratory

Emissions of carbon dioxide from fossil fuel use have been growing since the dawn of the industrial era. This in turn has lead a steady increase in the concentration of CO_2 from preindustrial levels around 280 parts per million (ppm) in the atmosphere to present concentrations in excess of 380 ppm. Stabilizing the concentration of carbon dioxide is the goal of the Framework Convention on Climate Change, a treaty that the United States and more than a hundred and forty other parties have ratified.

Since the Industrial Revolution, humans have introduced about 300 billion tons of carbon into the atmosphere from fossil fuel burning. Models predict that humans may add an additional 1,400 billion tons by the end of the century due to population and economic growth. Humans are also creating other greenhouse gases such as methane, nitrous oxide and a wide range of industrial compounds, though the dominant source of GHGs this century is presently and is anticipated to remain CO_2.

In order to stabilize CO_2 concentrations in the atmosphere, global emissions must peak and then decline indefinitely. This is because climate change depends on the concentration of this gas, which in turn depends on cumulative, NOT annual, CO_2 emissions. While deforestation and other land-use change contribute CO_2 to the atmosphere, the largest human-introduced contributor of this gas is the burning of fossil fuels. Stabilizing atmospheric concentrations of CO_2 can only be achieved by dramatically cutting emissions from energy use. The Global Energy Technologies Strategies Program (GTSP)[6] developed several scenarios to stabilize atmospheric concentrations that are economically efficient—that is, were constructed to minimize the cost of making dramatic energy transitions.

End-Use Energy Technologies

End-use technologies play a pivotal role in reducing CO_2 emissions. In all scenarios, increased end-use energy efficiency is essential to controlling the cost of stabilizing atmospheric CO_2 and rendering stabilization affordable. In one numerical experiment conducted by the GTSP, increasing the rate of energy intensity improvements by a quarter of a percent per year reduced by $6 trillion the cost of limiting average global surface temperature change to two degrees Centigrade, relative to preindustrial levels. Of course, such improvements will require investments in the development of new technologies for use in buildings, industry and transportation.

Technologies with improved energy efficiency that use electricity have a special place in helping stabilize the concentration of CO_2. In the short-term,

6. The GTSP is comprised from a core group of scientists from Battelle and the Department of Energy's Pacific Northwest National Laboratory (PNNL), as well as the Joint Global Change Research Institute, which is a partnership between PNNL and the University of Maryland.

those technologies help reduce the need for fossil fuel-based electricity. Over time, more efficient, electric end-use technologies will work with the power-generation sector, which can take advantage of a wide range of climate-friendly technologies, such as CO_2 capture and storage, nuclear power, wind and solar power, bioenergy and other renewables, to jointly reduce emissions.

There are no technology silver bullets in curbing emissions, and while improving end-use energy technologies will make the problem cheaper to manage, improving these technologies alone will not make the climate problem go away.

Stabilizing the Concentration of CO_2 Implies a Price on Carbon

CO_2 concentrations are not stabilized in the GTSP business-as-usual cases. Even with accelerated technology development, CO_2 concentrations do not stabilize absent limits on CO_2 emissions. This in turn means that carbon will have a price in any stabilization regime. The private sector should be very aware that stabilization implies either an explicit or implicit price on carbon, and the more stringent the constraint on emissions and concentrations, the higher the carbon price.

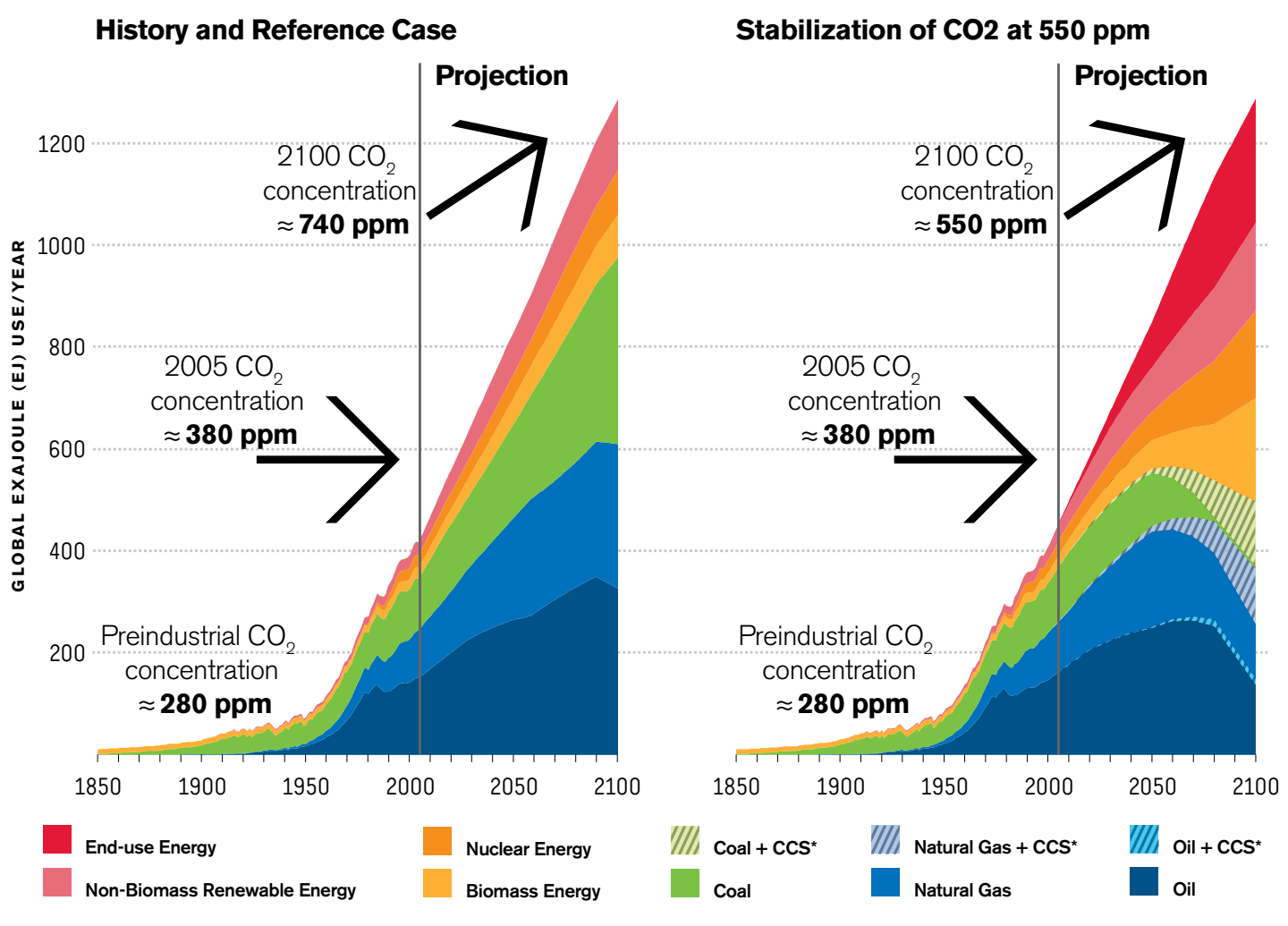
Furthermore, for any long-term limit on the concentration of CO_2, the price of carbon must increase over time as allowable emissions get ever smaller. Many people envision that the opposite is true—that the initial price will be a high one and that it will come down. Though costs may decline for some individual technologies that are employed to reduce emissions,

"A price signal—either implicit or explicit—for carbon emissions will be necessary for climate-friendly technologies to be deployed on a large enough scale, over the course of this century, to stabilize the concentration of CO_2 and other greenhouse gases. It is hard to imagine a corporate board approving a billion dollar investment in a CO_2 scrubber and taking on the liability of storing emissions in a geologic repository, if there is no value on the carbon that is captured."

James A. Edmonds, Pacific Northwest National Laboratory

2. Stabilizing CO2 Concentrations Means Fundamental Change to the Global Energy System

Source: Global Energy Technology Strategy Program



*Carbon Dioxide Capture and Storage (CCS)

on the whole this assumption is false. In reality, a rising price is needed to engage an ever expanding set of technologies to continually reduce society's carbon emissions. It is not enough to harvest the "low hanging" technological "fruit"; rising carbon prices are needed to enable the harvest of technological "fruit" in the middle of the technology "tree" as well. And ultimately, carbon prices must be sufficiently high to allow for the harvest of all the "fruit."

Fundamental Change to the Global Energy System

A business-as-usual case typically results in atmospheric concentrations of over 700 ppm by the end of the century. Stabilizing atmospheric CO_2 concentrations between 450 and 550 ppm, a goal widely discussed by policymakers, would require fundamental changes to the global energy system. The world would have to shift away from a system dominated by oil, gas and coal—with CO_2 emissions freely vented to the atmosphere—to one dominated by non-emitting energy forms and/or the capture of CO_2 from fossil fuel use.

One global energy system that could stabilize the concentration of CO_2 at 550 ppm was modeled for the GTSP. By the end of the 21st century, this modeling system had deployed larger shares of end-use energy efficiency, nuclear energy, biomass and non-biomass renewable energy, and much of the fossil fuel use was associated with CO_2 capture and storage. By 2100, this model had captured and stored 150 billion tons of carbon in geologic formations deep under ground. It deployed thousands of 1,000 MW nuclear power plants and millions of wind turbines worldwide. In addition, under this scenario, the largest single crop covering the surface of the planet was bioenergy plantations.

The challenge of scale is impressive. And, the challenge is not just at the middle or end of the century. Near-term technology challenges are similarly impressive. For example, by the year 2020, that same 550 ppm stabilization scenario had already captured and stored 70 million tons of carbon per year, compared to the one million ton of carbon that is at present stored in monitored storage facilities annually.

Investments in R&D to Help Lower the Cost of Stabilizing Greenhouse Gas Concentrations

R&D investments that result in improved climate-friendly technologies help reduce the cost of stabilizing GHG concentrations. Changes to the global energy system will take place throughout the 21st century and into the 22nd century. While emissions mitigation always begins with the presently available technologies, investments that improve the suite of technologies lower the cost of stabilization. Therefore, technological improvements are needed in the short, mid and long terms. R&D can help improve the existing suite of technologies in the near and mid-terms. In the long term, investments in basic science will help expand the foundations upon which entirely new climate-friendly technologies can be built.

William S. Rees, Jr., Deputy Under Secretary for Laboratories, U.S. Department of Defense; Deborah Wince-Smith, President, Council on Competitiveness; and Arden L. Bement, Jr., Director, National Science Foundation

Ray O. Johnson, Vice President and Chief Technology Officer, Lockheed Martin Corporation; C. William Booher, Jr., Chief Operating Officer, Council on Competitiveness; and Patrick Maher, Senior Vice President, Engineering, Marriott International, Inc.

Peter D. Blair, Executive Director, National Research Council; William Bonvillian, Director, Washington Office, Massachussetts Institute of Technology; Kathryn Clay, Minority Professional Staff Member, U.S. Senate Committee on Energy & Natural Resources; and Suzy Tichenor, Vice President, High Performance Computing Initiative, Council on Competitiveness

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Government Factors

Presidential and Federal Leadership

Energy security and sustainability need to be front burner issues for the next president. Just as chief executives within the private sector must be the visionaries and champions of their organization's efforts in these areas, so too must the next president of the United States set an overarching framework and high goals for the nation. In addition to presidential leadership, there are several areas within the nexus of America's energy security, sustainability and competitiveness challenge where Dialogue II experts believe there is no substitute for a concerted federal role. These are areas where neither the private sector nor the states alone can create the conditions conducive to driving innovation, investment and deployment of sustainable energy solutions. These are areas that require coherent and consistent national policies that will act to streamline and accelerate both public and private sector efforts. A "patchwork quilt" of rules, regulations and initiatives in these areas inhibits U.S. progress. Key areas for federal leadership are energy metrics and standards, the electric power grid and transmission system and international negotiations in a post-Kyoto era.

Metrics and Standards. The United States has dramatically improved labor productivity in recent decades in tandem with the wide-scale deployment of information technologies. Energy productivity has also improved but more slowly and less consistently than other measures of productivity. Today, the United States has one of the lowest levels of energy productivity of any developed economy. Credible,

Alexander Karsner, Assistant Secretary, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

widely available information on energy performance is a critical enabling condition for industries and enterprises as they seek to improve their energy productivity. Improving government energy statistics would be a cost-effective and valuable public investment. It will also support the development of industry-wide and enterprise-level metrics for energy management. Formal requirements in the form of codes, standards or other targets will enhance market conditions for the development and deployment of more energy efficient equipment and thereby improve enterprise-level energy productivity. National coherence in these areas will further accelerate market demand for and penetration of energy efficient technologies.

Critical Infrastructure. The ability of the U.S. private sector to deploy cleaner energy alternatives and effective demand response programs is heavily dependent upon the state of the underlying energy infrastructure and, in particular, the electric grid. Dialogue II experts consider a robust, reliable and advanced grid, that can accommodate a range of energy sources, as a fundamental condition for success. Yet today there are severe constraints in the system that inhibit the most economic flows of energy to market. The costs of transmission "congestion" run in the tens of billions of dollars just within a single regional system according to some experts. Distribution losses now account for almost 10 percent of all electricity generated in the United States—with an even greater share in the most congested regions.[7] Moreover, business and other energy consumers routinely experience power disruptions resulting in lost productivity from downtime. Investment in the grid and transmission system will be needed over the coming years just to serve continuing load growth arising from growing electricity demand.

International Negotiations. Energy security and climate change are global challenges that are interdependent and interlinked. The United States cannot address either of these issues in a vacuum, nor can we "solve" these changes on our own. It is therefore important that the United States get its own house in order to interact credibly in the international arena and to achieve global buy-in to the sustainability strategies that America develops. The United States can achieve this role by stepping up strategic bilateral support for actions in developing countries to tackle climate change, including expanding and deepening partnerships for energy efficiency and renewable energy development in countries like Brazil, China and elsewhere. Similarly, the United States needs to step up vigorously and assume a true leadership role in terms of creating an effective successor to the Kyoto Protocol that will set global targets for emissions and include all major emitters, not just developed nations.

Utility Regulation. Reaching into every home, school and business in the United States, electric and gas utilities are uniquely qualified to help drive private sector demand for sustainable energy solutions. Utilities could roll out energy efficiency programs to every company and citizen, in every city, in all 50 states. Yet today, most utilities are inhibited from working with customers to save energy due to the regulatory structure under which they are operating. With limited exceptions, utilities are rewarded to sell, not save, electrons. Utilities are also well positioned to play a key role in the development of energy efficient devices and technologies, yet research and development by the industry is quite low as compared to other industries.

Both of these problems—inadequate energy efficiency programs and insufficient R&D investments—are tied to the outdated regulatory structure that still governs the vast majority of electric utilities in the United States. Although the Federal Energy Regulatory Commission (FERC) retains authority, states almost universally regulate the retail cost of electricity, and in many places where utilities are still vertically integrated, state agencies have very broad regulatory authority throughout the entire process. Under most state regulatory systems, utilities are paid more for selling more electricity and are only allowed to recover a narrowly defined list of "costs of service."

7. *Annual Energy Outlook 2006*, Energy Information Administration, July 2007.

James Kim, CMEA Ventures, and Peter Halpin, World Resources Company

California stands out as an exception to the dominant utility model in the United States. The state has decoupled utility earnings from total electric sales and has also explicitly linked utility payments to promoting customer energy efficiency. As a result, California utilities have made large investments in customer energy efficiency training programs and related research and development. Training reduces the risk for businesses unsure of which technologies to invest in and closes knowledge gaps. Rebates offered by utilities on materials such as cool roofs, HVAC, sensors and lighting address both risk and funding concerns. Some utility company rebate programs also help transform the market by piloting new materials and technologies at no cost and no risk to the customer, in the hope that the products will be proven at the trial facility and then rolled out to other sites.

Fiscal Policy. Government fiscal policies are powerful drivers of investments. In the case of investment in sustainable energy solutions, Dialogue II experts focused on two key issues: first, the need for the government to establish a clear, transparent and positive price signal to value carbon; and secondly, clear and consistent tax policies that will accelerate investment in more energy efficient plants and equipment. A value on carbon will relieve ambiguity in the marketplace and accelerate investment in cleaner energy technologies. Reform of tax policies will remove unintended impediments to new investment and accelerate the turnover of less efficient capital stock and equipment.

Tax Policy Impacts on Capital Stock Turnover. When new, more efficient technologies become available, depreciation rules can prevent companies from investing in new systems until the now obsolete investment can be fully depreciated—which in some cases can take decades. The depreciation schedules are particularly long for the electric power industry. Consider the effect on a utility company in the process of constructing a coal-fired plant when an alternative technology becomes available—perhaps a solar scheme. Rather than converting the plant under construction into a solar plant, the company is compelled to wait in order to write off a $3.5 billion investment over many years. If the company were able to write off the obsolete investment more quickly and convert to the newly available alternative, they could potentially cover the cost up front.

Investment in information technologies, which for many companies represents a large capital expense, provides a good example of the powerful impact of fiscal policies on technology. The ability of U.S. companies to write down their IT investments within a relatively short time has allowed for the rapid

"Capital depreciation laws can actually slow Moore's Law down to a certain extent, not in the development of technology, but the adoption of it. Long term technical innovation is necessary, but near term solutions are critical. For example, if I use the computer as an example, and I'm sitting without a computer today and I need to increase my productivity, I have a choice to make whether I buy a computer now, or I wait six months and get a more powerful, cheaper computer. And in six months, I have the same dilemma in front of me again. The computer's depreciation schedule changes the equation."

D. Mitchell Jackson, FedEx Corporation

and continuous upgrade of systems as improved technologies became available. In an ideal world, capital stock would turn over as rapidly as new technologies became available—consistent with avoiding waste of resources. Current depreciation rules for more energy efficient equipment actually stall such movement, not in the development of new energy efficiency technologies, but in their adoption.

Research and Development

Government has a critical role to play in speeding the development of advanced energy technologies and in reducing the risks associated with demonstrating capital-intensive and large-scale energy technologies. Increased government investment in energy-related basic research can provide a strong foundation for private sector energy R&D and commercialization efforts, much like it has for the biomedical, pharmaceutical and computing industries. The federal government, as a large and ready customer of sustainable energy solutions, can also use its purchasing power to accelerate the penetration and mass deployment of new technologies into the marketplace.

The government needs to support research in the basic sciences and engineering, funding for which has been in decline for the last decade. The government should be a catalyst for change: creating research initiatives and legislation to promote, facilitate and accelerate U.S. adaptation to today's environmental and energy realities. This agenda should include research in urban redevelopment, re-engineering of the transportation network as well as social behavioral changes such as telecommuting.

Partnerships between national labs, universities and industry are potentially powerful assets. The United States has vast scientific resources in the form of established laboratories, research facilities and an accomplished scientific community. Government can

help tap into this potential by applying scientific and engineering resources to large-scale energy needs like the development of an intelligent national electric grid. Government policy has the potential to help overcome impediments to advancing technology solutions developed in the national energy labs by supporting the commercialization of such technologies.

Public Education and Awareness

There is a huge need for public awareness and education on energy and sustainability issues, from K-12 through graduate education and extending out to the general public. Education of primary school children can teach energy fundamentals while instilling values of environmental stewardship.

Higher education cannot yet meet the needs of the energy sector for highly-trained employees. Oil and gas companies are desperate for highly-trained employees they do not have. There will soon be no operators for nuclear power plants in the United States; the country will need to recruit them from France. The nation needs educational programs that go beyond traditional educational silos to take a multi-disciplinary approach to produce energy professionals, such as 'green engineers,' who can view energy issues in a holistic manner. For example, the curriculums of schools of architecture, engineering and business management could be better integrated.

Experts noted that one of the drivers of change in the future will be consumer-based "energy literacy." Already seen on a small scale, energy literacy is and will be an essential driver of the value shift toward popular support of energy and climate sustainability. On the local level, literacy efforts are already under-way. Take, for instance, Atlanta, Georgia, where strong sustainability goals have not only been set, but the goals and accompanying practices form an integral aspect of the public school system curriculum.

Experts also cited surveys indicating that the majority of Americans think they are already doing all they can to be energy efficient, but when benchmarked to European consumers, they are actually much less efficient. Most Americans do not understand basic energy terms and their knowledge about energy and climate change is quite low. For example, more than half of the electricity in the United States comes from coal-power plants, which means that when an average citizen turns on the lights, turns up the thermostat or plugs in an appliance, that person is quite likely dispatching a coal-fired plant. The public does recognize that coal plants cause emissions and pollution, yet assigns blame to the utility company, failing to link their personal energy consumption with the utility's energy production, emissions and pollution. This information disconnect is a concern that warrants national leadership. Without such leadership and communication—including advertising and broad-based education reforms—the American public is less likely to move.

The 100 Watt Light Bulb Analogy.

We need to consume approximately 2,000 kilocalories per day to sustain our lives. This rate of energy consumption is equivalent to keeping one 100 watt light bulb continuously lit.

In the United States, each of us consumes energy at a rate of 101 light bulbs. When corrected for the energy embodied in the negative national trade balance, our rate of energy consumption increases to 109 light bulbs.

In comparison, 70 percent of the world's population—including China—uses less than 10 light bulbs per person; 40 percent of the world's population—including India—uses four or less. In this low-consumption end, there is a strong correlation between energy consumption and quality of life indicators such as life expectancy, infant mortality rate and education. In this context, it is unreasonable to expect countries, like China, to lower their economic growth rate.

Many countries with higher quality of life indicators than the United States consume fewer than 55 light bulbs per person—less than half the energy we consume; these include: Israel, Hong Kong, Denmark, Austria, Switzerland, Italy, France, Sweden, Ireland, Spain, New Zealand, Taiwan, Finland, South Korea, United Kingdom and Japan. In fact, we can sustain exceptional quality of life with about 30 light bulbs per person with today's technology.

A 25 percent reduction in carbon-based energy consumption in America would be equivalent to the sum of its oil imports. While this reduction still keeps us at a high 80 light bulbs per person rate of consumption, the positive implications are far reaching—from international relations to climate effects. These observations suggest that U.S. competitiveness today is not limited by lack of energy but by our attitudes and our choices.

Carlos Santamarina, Georgia Institute of Technology

The Role of Transmission in Achieving Energy Efficiency

FEATURED PRESENTATION

Joseph L. Welch
ITC Holdings Corp.

As the nation's only fully-independent electric transmission company, ITC is responsible for providing a bridge between electricity generators and distribution to customers. The company has about 15,000 miles of high-voltage electric transmission and serves roughly 25,000 megawatts of peak load across its grid.

State of the Electric Grid

The electric grid in the United States is in disrepair, threatened by an inadequate, aging infrastructure and a deficit in human capital. There are blackouts, increased system losses, lack of infrastructure to support generation additions, such as renewables, and lack of regional transmission capacity to facilitate regional markets. There have already been several wake-up calls, such at the Northeastern blackout of 2003. It is a miracle that blackouts and other disruptions do not happen more often.

Typical photos from the U.S. transmission system illustrate a decaying energy infrastructure. The infrastructure is plagued by loose bolts and cables, rotten wood, overgrown vegetation, wind damage, rust, missing conductors, cracked footings, flooded stations, out-dated and inefficient equipment and collapsing towers. The current condition of the grid is contributing to a significant loss of energy efficiency and reliability. Further compounding the situation is the fragmented grid system that prohibits moving around electricity, creating congestion and causing huge cost penalties across regions.

State of the transmission system, provided by ITC Holdings Corp.

How Did We Get Here?

A fresh coat of paint is not going to suffice in fixing the system that has been neglected for the past 20-30 years. The majority of the country's electric infrastructure was built in the '50s, '60s and '70s, and without regular maintenance, its life cycle is significantly shortened. Over the past couple of decades, regular maintenance was forced to be scaled-back to adjust for rising costs and maintain earnings for shareholders. The issue here is not that the former utility managers mismanaged the system. This system is in disrepair as a result of rate freezes and backward-looking ratemaking structures that incentivized companies to cut maintenance and a shift to regional energy markets that has changed the way the transmission system is utilized.

This situation is exacerbated by the current lack of expertise in operating the system due to an aging

energy workforce, a shortage of university programs with electric power courses and a lack of training programs for field or skilled trade workers.

At the inception of ITC, the company was required to develop its own workforce and was challenged in doing so. About 80 percent of the workforce is at retirement age and about 15 percent are 25 years old and younger. The nation has nothing in the middle. In order to develop an employee base, ITC developed the largest electrical journeyman's training program in the United States in cooperation with several universities. ITC had to supply people to train students and also had to donate towers, relay and protective equipment for the program.

Companies like ITC face numerous other challenges as they work to maintain and upgrade the nation's transmission infrastructure. For one, acquiring new equipment can be costly and time consuming. ITC system transformers cost in the neighborhood of $8-$10 million, and with no domestic manufacturers of this equipment, it takes about 18 to 24 months to get one. Another challenge is improving the siting process to reduce the amount of time it currently takes to connect new generation sources, like renewable energy production, to the grid.

Six Degrees of Transmission

Transmission represents approximately seven percent of the end-use consumer's electricity bill, but it provides much more value. The nation's transmission system offers "six degrees" of service: reliable energy delivery, efficient regional dispatch of generation, competitive wholesale markets, demand response programs, economic development and increased access to renewable resources.

Many legislators and customers calling for increased production of electricity from renewables do not realize that the ability to meet RPS requirements is dependent on the transmission system. Renewable energy potential and electricity demand are not located in the same places.

In some states, such as Iowa, renewable generation potential far exceeds total electricity demand. In other states, such as Michigan, renewable energy electricity demand exceeds production potential. Therefore, to meet RPS requirements, high-voltage transmission capacity will be needed to move renewable power from producer states to those that wish to import it.

Transmission as Efficiency Driver

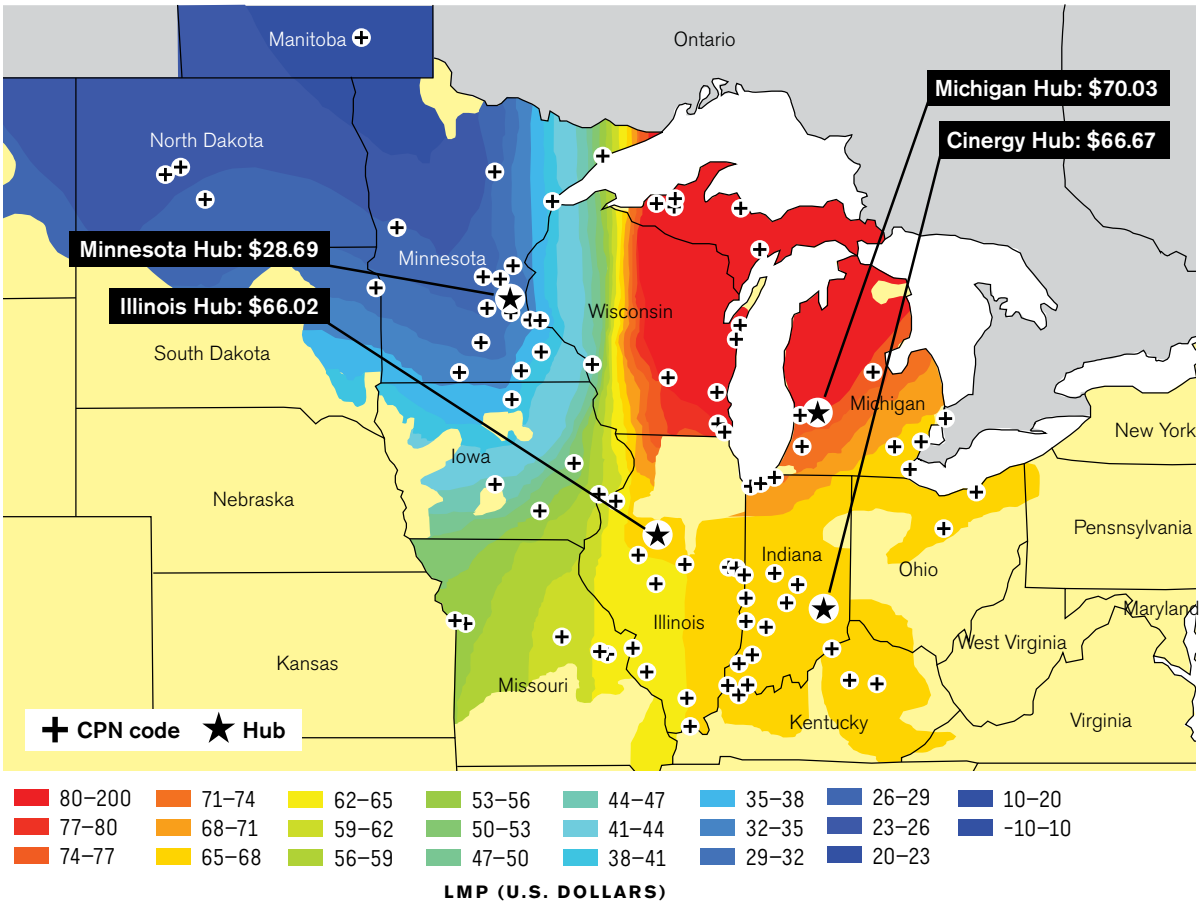
ITC has been promoting the building of a national high-voltage transmission system—the electric equivalent of interstate highways—to enable dramatic efficiency improvements in the electric system by allowing for the siting of traditional generation closer to energy resources. In addition to enabling efficient use of renewable resources, siting generation close to locations rich in fuel resources would save enormous amounts of energy currently used to transport fuel.

For example, building a power plant on the coal field, separating and sequestering the CO_2 back into the mine and moving the electricity generated to where it is needed on a high-voltage electric transmission wire would reduce the cost of the power and its related emissions. This would also reduce system losses worth millions of kilowatt hours.

Policymakers need to understand the vital role that the transmission system plays as a facilitator of efficiency programs, renewable resource integration

3. Market Price Impact of Congestion in Electricity Transmission

Source: Midwest Independent Transmission System Operator (ISO)



Note: This LMP (locational marginal pricing) contour map from the Midwest ISO shows selected commercial zones with their respective LMP values. This map represents one period within one day in 2007.

and regional energy markets. The system currently faces enormous constraints resulting from electric infrastructure in serious need of repair and expansion, timely permitting and siting processes, an aging workforce and a fragmented grid system. System constraints prohibiting an efficient transmission network must be eliminated so that all energy can flow regardless of whether it is renewable, nuclear-generated, coal-based or from clean coal technologies. To drive this evolution, it is essential that new training and education programs be established to attract new talent to the industry.

Conclusions

Meeting the Need for Sustainable Energy Solutions is a National Challenge of the Highest Priority

The experts participating in Dialogue II provided valuable insights into the current state of energy management among U.S. enterprises. They also identified a number of distinct areas where changes in private and public sector action would serve to propel enterprises across the United States to develop and deploy a wide range of sustainable energy solutions—thereby enhancing the nation's energy security and competitiveness and creating new markets, industries and American jobs. By the end of the brief, but impactful journey of discovery that two days of intense dialogue provided, the expert participants arrived at three conclusions about the nature of the challenge and opportunity that lies before the United States.

It Requires Holistic Thinking

Energy security, sustainability and economic competitiveness are interdependent issues. They require holistic thinking across multiple spheres, including the product and technology level, the enterprise level and the policy level. The United States is not yet approaching these issues in a holistic way. For example, products are often designed without life-cycle analysis (through production, consumption and disposal stages) and without consideration for how these will interact with other products and systems. The energy performance of buildings is evaluated on an individual basis rather than as parts of a system, leaving huge efficiency gains on the table. Focus on immediate financial returns inhibits enterprises from making energy-related investments that will reap long-term economic benefits and also contribute essential efficiency gains to the U.S. economy. Energy security, sustainability and economic policy experts are operating in silos, without considering the cause and effect that actions in one area have upon the other. A holistic approach—employing life-cycle analysis as appropriate—is needed to ensure that U.S. public and private sector actors are making well-informed choices, decisions and investments in technology, infrastructure, capital equipment and human resources, which together serve the nation's conjoined energy and sustainability interests.

It Entails a Multi-Pronged Approach

Just as there is no 'silver bullet' technology that will enable America to meet its energy security and sustainability needs, there is no one policy fix or business decision that will take the nation where it needs to go in these areas. The transformation of the U.S. energy system will entail a range of actions by the private sector in tandem with a suite of integrated and coordinated policy measures by government.

Although a critical component of any forward strategy, measures to increase the energy productivity of the U.S. economy alone will not suffice. While recognized as a powerful stimulus for investment in efficiency and alternative energy sources, higher energy prices or a market price on carbon alone will not drive all the actions needed to create a secure and sustainable energy future.

The United States will need to take action on multiple fronts—energy research and development in both

the public and private sector, education on energy and environmental issues, workforce training and development, fiscal policies to encourage infrastructure investment and capital stock turnover and development of enabling energy metrics and standards—to name just a few. America needs a comprehensive energy roadmap that will drive private sector demand for sustainable energy solutions and enhance U.S. energy security and competitiveness.

It is a Shared Responsibility

The vision of a secure, sustainable and competitive energy future cannot be realized through the actions of either the public or private sector alone. As the innovators, investors and adopters of sustainable energy solutions, private sector actors are indeed pivotal to energy system transformation. But governments must create the enabling conditions, and consumers must come to see themselves as part of the solution. Public-private partnerships are often cited as a necessary vehicle to achieve social, environmental and economic change. The support for partnerships reflects the reality that there are shared responsibilities in meeting common challenges, and that no one sector, organization or individual has all the ideas, resources or influence to achieve a desired outcome.

Three areas ripe for public-private collaboration are research and development, workforce development and public education. From research in basic sciences to licensing of specific technology developments, the nation's universities, energy laboratories and businesses must expand and deepen partnerships to develop sustainable energy solutions. Universities, companies, labor unions and government at the state and federal level must work together to address critical workforce issues.

The success of both government and private sector initiatives will depend upon the will of the public to embrace change. An important shared responsibility for public and private sector leaders is to bring sharply into light the magnitude and urgency of both the challenges—and the opportunities—that the need for energy security and sustainability presents for America.

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- Forging public and private partnerships to drive consensus
- Galvanizing stakeholders to translate policy into action and change

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Energy Security, Innovation & Sustainability Initiative Program Leadership

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