NATIONAL ENERGY POLICY INITIATIVE

Expert Group Report

NEP Initiative

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** The views expressed by the experts are their own and are not necessarily endorsed or shared by their affiliated organizations or employers.*

For more complete biographies of each of the Expert Group participants, please see the attached Expert Group Participants Appendix (Appendix A).

Vision Statement

The United States, and the world, must begin a decades-long transition to an energy system that will not run out, cannot be cut off, supports a vibrant economy, and safeguards our health and environment. Today's patterns of energy production and consumption will not deliver these benefits for our children and grandchildren. The way we produce and use energy wastes money, threatens our environment, raises our vulnerability to accident, terrorism and economic shocks, and contributes to instability around the globe.

We must create a new energy system that makes our country and the world more secure. It must be less susceptible to major disruptions and it must meet the needs of people today and of generations to come—providing adequate, affordable, and healthful energy services, for all, forever.

The opportunity to create this new energy future is here and now. New technologies that only a few years ago seemed visionary now provide energy services to millions and demonstrate that this energy future is not only possible but also commercially viable. The sooner we begin to act on key energy policy issues, the more control we will have over our energy future. The longer we wait, the higher the cost of action and the less certain its success.

The opportunity and the need for energy policy change are greatest in four areas:

1) **transportation and mobility;**
2) **electricity services;**
3) **energy security;**
4) **climate change**.

Redirection of government energy research, development and demonstration (RD&D) programs, and procurement practices is also needed to support policy change in these four critical areas.

This Expert Group Report identifies top priority goals and strategies in each policy area to enhance our national security, promote economic growth, and protect our environment today and into the future. It is intended as a starting point for broader public discussion in Congress and other forums.

Executive Summary

The National Energy Policy Initiative convened an independent, bipartisan group of senior energy experts on February 1–3, 2002, at Airlie House in Warrenton, Virginia. The Expert Group's task was to seek consensus on an overarching vision to guide energy policy, and on issue-specific goals and strategies to advance the vision. This Report summarizes that consensus for interested members of Congress and the public.

The Expert Group was informed by a written assessment of the goals and policy priorities of 75 leaders of diverse energy constituencies. (See Appendix A.) It is important to note that the experts invited to participate at the Airlie House meetings sought to define and develop long-term national goals and strategies, not to represent or negotiate on behalf of specific constituencies.

The Expert Group starts with the view that we have a responsibility to use energy resources wisely not only for our own benefit, but for the benefit of future generations. We must also consider the impact of our energy choices on other nations and peoples around the world. Our energy policies should both advance our long-term national interest and provide leadership in the international community.

Energy makes possible many of the benefits of modern life. How we produce and use energy has a major impact on the soundness of our economy and the health of our planet. Energy policy seeks to create the framework that lets energy services be delivered securely, reliably, safely, healthfully, affordably, fairly, durably, and flexibly.

The current energy system of the United States has inadvertently created serious threats to our security, prosperity, and environment. The Expert Group believes that these threats can be greatly reduced by policy changes that better align energy producer, distributor and consumer interests with broader social goals, and that remove barriers to the commercialization of existing and emerging energy technologies.

It is within our power to create an energy system that is much more secure, much more affordable, and much less environmentally damaging. What is needed is leadership—both bold and prudent, both visionary and practical—to begin a decades-long energy transition with immediate action.

The Group identified four top-priority issues for immediate action: transportation and mobility; electricity services; energy security; and climate change. The Group also noted the need for significant changes in government research and development and procurement policies to support action in these areas.

Transportation and Mobility: Oil dependence is a key part of the energy challenge. Making American transportation—now 97 percent oil-dependent—far more efficient and diversifying its fuel sources is the biggest part of the solution. The strategy to achieve this goal needs to integrate transportation technology and system design, fuel diversification, telecommunications, and more sensible land-use. It needs to start now by making road vehicles much more fuel-efficient and by encouraging the development of new fuel sources and systems, such as fuel-cell cars and light trucks, to make vehicles even cleaner and more efficient. In the longer term, the strategy needs to reduce the need for transportation through urban design choices and increased use of telecommunications. This strategy can improve access and mobility for all Americans, with lower cost, emissions, vulnerability, risk, and inconvenience.

Electricity Services: The electric sector's current structures, rules and incentives often produce results that do not meet the public interest. The sector's problems stem in part from rules and habits based on central generation, costly grids, poorly regulated monopolies and command-and-control environmental regulation, and in part from ill-advised reforms. Broadly, laws and regulations need to ensure that the actions most beneficial to customers and the public interest are also the most attractive for producers and distributors. The strategy to achieve these goals should promote fair, thorough, and thoughtfully designed competition, but must be neutral as to scale and technology. In particular, reforms should enable investments in distributed generation, recycled energy, combined-heat-and-power production, and efficient use to compete fairly with investments in centralized generation and large-scale grid development.

Energy Security: Our energy system creates serious risks to our national security in two areas: 1) heavy dependence on imported oil that is subject to price volatility and political disruption; 2) vulnerable energy infrastructure. In the short term, reducing U.S. and global oil dependence will require improvements in transportation fuel efficiency and in the way we manage strategic oil reserves. It could also include use of market mechanisms to internalize environmental and military costs of oil use. In the longer term, we will need to diversify transportation fuel supplies (such as cellulosic biofuels and hydrogen), and further improve transportation efficiency and demand management. Reducing the vulnerability of centralized energy systems to accidental or deliberate disruption will require short-term protection of existing infrastructure. In the longer-term, the strategy should aim to reduce our dependence on highly centralized power systems, by promoting dispersed energy facilities at a variety of scales.

Climate Change: Greenhouse gas emissions from fossil fuel use are increasing the risk of climate change. Climate change could impose direct economic costs on the United States, and could also create global economic and political instability. Sustaining and extending the benefits of energy abundance without destabilizing the earth's climate requires prudent action over several decades or more. Starting immediately, energy policies need to send clear signals to producers and consumers to reduce carbon emissions. Those policies need to establish the framework for a smooth and just transition to a more efficient, diversified, and low-carbon energy system. At least in the early stages (and possibly throughout), this decades-long transition could be a net benefit to the economy, because investments in fuel efficiency and new non-fossil fuel technologies can be profitable. Among policy options, either a cap-and-trade system or a carbon tax could efficiently internalize carbon costs across the whole economy, and could be made revenue-neutral, fair, and economically stimulative. To maximize the economic and environmental benefits of action, it will also be necessary to remove barriers to efficient energy use.

Research, Development and Demonstration (RD&D) and Procurement: Achieving the goals outlined above will require federal energy RD&D efforts to be increased, refocused, targeted, and integrated with other government and private efforts. The RD&D system also needs reforms and incentives to facilitate the transition from basic research to commercial application. Strategic federal procurement of energy-related goods and services can also incubate, mature, and reward private enterprise in support of public goods, *e.g.*, via performance-based design fees, infrastructure, and integration between governments and across agencies.

Introduction and Background

The National Energy Policy Initiative (the Initiative) is a non-governmental, non-partisan, foundation-supported project. The Initiative has engaged a group of distinguished energy leaders and experts to develop a set of goals, strategies, and policy options to guide national energy policy.[1] Senior members of Congress have indicated strong interest in the Initiative and plan to review its results and their relevance for pending national energy legislation.

To achieve the Initiative's goals, the organizers, Rocky Mountain Institute and the Consensus Building Institute, began by assessing the views and interests of a wide range of energy leaders on energy policy goals, specific policies and pending legislation, and on the potential for building a broad consensus on national energy policy. The product of that process is the National Energy Issues Assessment, annexed to this Report as Appendix B.

The second stage was an Expert Workshop held at Airlie House in Warrenton, Virginia on February 1–3, 2002. In that Workshop, a highly respected and diverse group of national energy policy experts used the National Energy Issues Assessment as well as their collective wisdom and experience as the basis for discussion. Together, they developed a vision statement for national energy policy, identified key policy issues, and suggested specific goals, strategies and options consistent with the vision to address those issues. Professional facilitators from the Consensus Building Institute assisted the Group and summarized its results.

The product of the Workshop is this Report. The Report is a consensus document. It states the views not only of the participants, but also of a number of experts who were invited to participate but were unable to attend.[2] Those who have lent their names to this document strongly endorse the vision it presents and the policy goals and strategies it recommends. With regard to specific policy options, some of those endorsing the Report believe that these options are worthy of serious consideration and further refinement. Others do not endorse the specific options listed. For those who have reached consensus on this Report, the test of any option suggested here—or any energy policy option—is whether it is consistent with the overarching vision and policy goals, and supportive of the strategies the Group endorsed.

[1] The NEP Initiative is funded by the generous contributions of the William and Flora Hewlett Foundation, the Gordon and Betty Moore Foundation, the Wallace Global Foundation, the Steven and Michele Kirsch Foundation, and the Robert Belfer Family Foundation. These foundations share an interest in promoting a well-informed, consensus-based national energy policy. They have no operational role in or influence on the Initiative.

[2] The experts have endorsed the Report in their individual capacities. Their institutional affiliations are listed for description only. That listing does not imply any endorsement of this Report by those institutions.

Transportation and Mobility

The transportation sector accounts for 27 percent of U.S. primary energy consumption; 97 percent of transportation energy comes from petroleum fuels. Current road and air travel systems, vehicle designs, market structures and consumer behaviors favor highly inefficient and polluting forms of transport. These problems can only be partially addressed through energy policies, and only partially by the federal government. Correcting these problems requires a fundamental reframing of our approach in order to recognize the intersection of energy, transportation, mobility and communications issues. The goals we set and the strategies we pursue must provide economic, environmental and national security advantages.

Goals

National and local policies should promote transportation technologies and systems, land use and transportation demand strategies to provide all Americans with:

- improved access and mobility;
- improved safety and convenience;
- reduced cost;
- greater fuel efficiency;
- significantly reduced emissions; and
- significantly reduced petroleum dependence.

U.S. policy should also support, through bilateral and multi-lateral programs, the pursuit of these objectives abroad.

Strategies

The Group believes that Congress should consider the following strategies in developing energy policies related to vehicle fuel efficiency:

- **fuel economy should increase for all vehicle classes;**
- **increases in vehicle efficiency standards should be sufficiently large to stimulate the development of highly fuel-efficient vehicles and non-petroleum fuel vehicles.**

Options

The Group notes that an increase in CAFE standards is under consideration by Congress. The Group recommends that any changes in fuel efficiency standards should be comprehensive and substantial.

In addition, the Group recommends careful consideration of the following transportation-related energy policies:

- A revenue-neutral system that gives incentives for purchase and sale of energy-efficient vehicles, such as the fuel efficiency credit trading system recommended in the recent National Research Council study on CAFE standards, or an equivalent feebate system. This system could be combined with financial incentives for accelerated scrappage of inefficient vehicles.
- Experiment with real-time pricing for driving and parking (including cash-out options for those who don't use employer-provided parking);
- Use government purchasing to accelerate development and production of energy-efficient/low-emissions vehicles (*e.g.* "Golden Carrot" program for first commercially available high-efficiency vehicles).
- Pay-at-the-pump car insurance (drivers pay for their comprehensive insurance through fees collected at the time they purchase gasoline; liability insurance would continue to be purchased separately).
- Improve U.S. military fuel efficiency by promoting fuel efficiency in weapons system design, acquisition and logistics, as recommended by the Defense Science Board (*Report of the Task Force on Improving Fuel Efficiency of Weapons Platforms*, May 2001).

Longer-term "transformative" options:

- Support research, development and deployment of hydrogen fuel-cell vehicles as long as they meet technology-neutral criteria for energy efficiency, environmental impact, and commercial viability. It may also be necessary and advisable to support technologies for integrated deployment of stationary and mobile uses of hydrogen fuel cells.
- Support the development and commercialization of non-petroleum transportation fuels that can displace a significant fraction of current oil consumption (see also the Energy Security section).
- Support smart growth initiatives in cooperation with state, regional and local governments, including support for local projects that reduce transportation demand and increase use of mass transit, walking and bicycling.
- Support urban design and infrastructure projects and programs that reduce transportation demand and increase the use of mass transit in developing countries.

Electricity Services

Electricity production, distribution and consumption decisions are often driven by incentives and constraints that do not serve the broader public interest. The driving factors include highly centralized generation, costly grids, poorly regulated monopolies and command-and-control environmental regulation, as well as ill-advised reforms. Historically, technology choices favored large plants and central generation, and public policy goals led to a regulatory model supporting monopoly protection of power generation and distribution. While this approach helped to electrify America, it is now burdening society with low fuel conversion efficiency, costly investments in transmission and distribution infrastructure, high transmission and distribution losses, and disincentives to technological innovation.

More recent regulatory changes have not always helped align private and public interests. Current environmental rules allow electricity producers to benefit by extending the lives of dirty and inefficient power plants. New Source Review regulations have contributed to the stagnation of electric generation efficiency—which has not improved in the United States over the past 40 years. Emissions limits based on fuel inputs actually penalize efficiency. Some regulated utilities still earn a higher return by building new power stations than by investing in more cost-effective efficiency improvements. In some cases, deregulation aimed at promoting competition has allowed existing regulated owners to block competing power generation in order to avoid loss of revenue from their monopoly-owned wires.

Nuclear Power

Nuclear power does not contribute greenhouse gas emissions. However, cost, potential vulnerability to radiation releases, and uncertainty about long-term waste management raise serious questions about its future use as an energy generation technology. We recommend the following strategy with regard to nuclear power:

- *Future nuclear power plants should be licensed only if they substantially reduce the environmental, safety, security and proliferation risks of the current plants.*
- *Approval of a nuclear waste management method that safeguards the public is essential to any future expansion of nuclear power. Until that decision is made and until the wastes can be moved to their destination, onsite protection against all realistic threats should be assured.*
- *Nuclear power should meet the same market tests that other supply and demand options for providing energy services are required to meet.*

To resolve these problems, utility regulation at the state and federal levels needs to align incentives for electricity producers, distributors, and consumers with social goals. Ratemaking and other regulatory reforms are needed to make the actions that are most beneficial to customers and to the public the most profitable to suppliers and, conversely, to make actions that harm public and/or consumer interests unprofitable. These reforms should promote competition while preserving other societal values: universal service, high reliability, environmental and climate protection, transparency, and public involvement. Where public ownership of electric systems is the preferred option and is consistent with the policy goals outlined above, that choice should be respected.

Goals

The rules governing electricity and heat generation, distribution, and use must change to achieve the following goals:

- minimize the total cost of providing energy services;
- reduce environmental impacts from the generation and use of electric power, including reductions in both carbon dioxide releases and emissions of criteria pollutants;
- make the electric power generation and distribution system more secure against natural disasters, accidents and terrorist attack;
- assure the resilience, reliability and power quality of electric service to customers; and
- encourage technological innovation and allow ready market entry of alternative supply and demand options.

The Group notes that changing the rules to achieve these goals is complicated, and that there can be unintended consequences to well-intentioned changes. Therefore, we strongly recommend a focus on simplicity and transparency, as well as a clear delineation of federal, state, local and private sector roles in electricity systems.

Strategies

Policy making in the electricity sector should be guided by the following strategies:

- **Restructure the current regulated monopoly system with appropriate rules to encourage competition while maintaining universal service, reliability, environmental and climate protection, transparency, and public involvement.** Markets for generation and distribution should encourage competition while safeguarding against concentration and abuse of market power.
- **Encourage adoption of new technologies and innovations while maintaining environmental protection.** Set environmental performance targets, rather than specifying pollution control technologies. Regulations should be structured to put end-use efficiency on an equal footing with low-/zero-emissions technologies.

- **Eliminate barriers to the commercialization of emerging generation, distribution and end-use technologies that reduce environmental impacts, increase technological efficiency and lower costs.** Allow distributed power, combined heat and power, renewable technologies and demand-side investments to compete fairly with traditional power generation and delivery systems.

Options

In light of the goals and strategies outlined above, the following policies deserve serious consideration by federal and state regulators (recognizing the need for appropriate balance and coordination of federal and state authority):

- Eliminate regulatory barriers to the co-production of electricity, heat and cooling at all scales.
- End generation protection within monopoly territories and open all wholesale power systems to competitive bidding.
- Encourage new generation technologies such as renewables to enter the market, by expanding opportunities for consumers to purchase power from such sources.
- Allow non-utility developers equal market opportunity to enter distributed generation in competition with other providers. With appropriate structural protections, consider allowing wires companies to develop and own distributed generation.
- Enable power producers to construct and use private wires to distribute power directly to their customers.
- Adopt uniform, nationwide standards for simple, safe interconnections of small generators, including parked fuel-cell vehicles, to the grid.
- Provide incentives to improve transmission and distribution efficiency through interactive management of the grid. Promising technology options include real-time, two-way metering and real-time pricing and billing so as to optimize the utilization of grid capacity and reduce congestion problems.
- Adopt policies that create equivalent financial incentives and rewards for providing a given amount of electricity or electricity savings through centralized power production, distributed generation, or end-use efficiency.
- Provide better information, standards, procurement practices, and incentives to significantly increase energy efficiency in buildings and appliances.

Energy Security

America's energy system depends predominantly on depletable fossil-fuel resources with harmful effects on the environment. Oil and natural gas have a history of price volatility, and a significant share of our oil resources must be obtained from politically unstable regions. In addition, the current system for acquiring and distributing these fuels is fragile and vulnerable to accident and sabotage. Dependence on these fuels and reliance on centralized energy facilities and networks place our nation at risk.

Of total U.S. primary energy use, 39 percent comes from oil, of which just over half is imported. Even in peacetime, the United States pays tens of billions of dollars a year for the readiness costs of military forces whose primary mission is intervention in the Persian Gulf region. A significant portion of those costs can be attributed to protection of oil production sites and transport routes. The economic, diplomatic and military cost of oil dependence is likely to increase as low-cost reserves become increasingly concentrated in that region, further increasing the potential market power of a few countries.

Remaining U.S. oil reserves are limited and relatively expensive to exploit. More fundamentally, increased domestic production of oil and gas would not decrease the economy's vulnerability to oil price shocks, because oil is a commodity traded in world markets and a supply disruption anywhere will affect prices everywhere. Therefore, it is unlikely that increased domestic production of oil and gas from Alaska or the lower 48 states can significantly reduce our growing vulnerability to disruption of foreign supplies.

Goals

A diversified, resilient, and environmentally sound energy system could make major contributions to national security and prosperity. Greatly improved efficiency in energy production and use and accelerated development of alternative fuels, especially in the transportation sector, stand out as the highest priorities.

Strategies

- **Begin immediately to reduce the oil dependence of the United States and our key allies and trading partners, emphasizing the transportation sector.** Maintaining viable petroleum reserves and optimizing domestic production are useful short-term strategies.
- **Reduce oil use substantially over the long-term, and encourage and help key allies and trading partners to do the same.** To do so, the United States needs to build a more diverse portfolio of fuel sources, increase fuel efficiency, and reduce service demand, particularly in the transportation sector. (See the Transportation and Mobility section.)

- **Ensure that national infrastructure protection strategies reduce vulnerabilities in U.S. energy infrastructure.** A key priority should be to begin a long-term shift away from centralized power production and distribution, by encouraging distributed production and generation. (See the Electricity Services section.) Short-term risks to electric transformer, control, and switching centers, nuclear power plants, major pipelines, oil refineries and gas processing plants, liquefied natural gas terminals, and their control and communications systems should also be addressed. However, short-term infrastructure protection strategies need to maintain public access to information about utility infrastructure and its regulation.

Options

The Group believes the following policies are worthy of serious consideration:

- Increasing transportation vehicle and system efficiency, and introducing non-petroleum vehicles. (See the Transportation and Mobility section.)
- Accelerated RD&D and commercial deployment (preferably via a major public/private partnership) of new ways to convert cellulosic biomass to transportation fuels while protecting and enhancing soil fertility and the sustainability of farm and forest practices.
- Strategic cooperation to increase the amount of emergency oil reserves available to the United States and key allies and trading partners, including distributed product stocks downstream.
- Assess the security risks of energy infrastructure projects requiring federal funding or approvals, including comparison of proposed expansions or life extensions of potentially vulnerable energy transportation facilities with alternatives that may have lower vulnerability, (*e.g.* using demand management or distributed generation to reduce the need for new infrastructure).

Climate Change

There is a growing scientific consensus that human-induced climate change is a significant risk in our lifetimes, and may be far more harmful to future generations. Use of fossil fuels in the United States and worldwide is the major source of this risk.

The fossil fuel era has created the abundance and mobility that many people in industrialized countries now enjoy. To make these same benefits available to billions of people around the world who do not yet enjoy them, and to future generations, we must find less carbon-intensive and more efficient ways to deliver energy services. Fortunately, it may be possible to reduce greenhouse gas emissions from energy use in ways that benefit our economy.

Goals

The prudent public policy is to start now to address the problem, in order to change longer-term patterns of energy investment, production and use. Over time, we need to make a systematic, orderly, and fair transition from a carbon-dominated energy system to a significantly less carbon-intensive system. The ultimate goal is to stabilize atmospheric carbon concentrations at a level that does not seriously disrupt our climate.

Sending a strong, clear policy signal now is necessary to initiate real progress in the short term, and to establish a framework for the longer-term transition. In the short term, we can reduce carbon emissions and make economic gains by using fossil fuels more efficiently. Meanwhile, we can continue and accelerate the shift to lower carbon emissions in several ways (*e.g.*, by substituting natural gas for coal and increasing use of renewable energy). Over longer time periods, we can explore the development of technologies to capture and store carbon emissions.

In both the short and the long term, the United States has a responsibility and an opportunity to take an international leadership role on climate change. We can use our dominant position in international trade, technology transfer and development assistance to provide new non-carbon energy technologies and services that reduce projected increases in fossil fuel use by developing countries.

The strategies that we use to reduce the risk of climate change can and must also mitigate other environmental problems, contribute to national prosperity and enhance national security. The transition to a less carbon-intensive system might provide net economic gains for the United States. The Group recognizes that making the transition may cause dislocations and costs for some groups. Therefore, we support policies to smooth the transition and assist those who are adversely affected. However, delaying action may make the transition more disruptive and expensive.

Strategy

Use an economy-wide, market-based and revenue-neutral instrument—either a carbon tax or an emissions cap-and-trade system—to internalize the costs of carbon emissions, reduce carbon intensity of energy use, and reallocate revenues to reduce distortions in the economy.

The most effective way to send a clear policy signal in the short term that also establishes the right framework of long-term incentives is to create a single, economy-wide instrument that allows energy producers and consumers to choose the way they respond to changing price signals. The two leading candidates for this instrument are a carbon tax and a carbon emissions cap-and-trade system. Properly structured, either option could internalize environmental costs in an economically efficient way, encourage cost-effective strategies to reduce net carbon dioxide emissions, and achieve revenue neutrality.

To be revenue neutral, the proceeds from a carbon tax should be offset by reductions in taxes on income, capital or other goods and services that have net benefits to social welfare. In the case of a cap-and-trade system, revenue neutrality could be achieved either by allocating emissions permits without charge, or by auctioning permits and reducing taxes on socially beneficial activities by an equivalent amount.

Options

The Group also believes that the following complementary policies could support the goal of economically and environmentally beneficial carbon reductions:

- removal of market barriers to and stronger policy signals for energy efficiency in production, distribution, and use, through standard-setting regulations and incentive programs;
- removal of market and regulatory barriers to the use of non-fossil energy sources for electricity and transportation (See Electricity Services and Transportation and Mobility sections.);
- stimulating accelerated development of new non-carbon energy technologies that advance economic, environmental and security goals. (See Energy Research, Development, Demonstration and Procurement section.)

Energy Research, Development, Demonstration and Procurement

Public and private energy research, development and demonstration (RD&D) programs have the potential to support progress on each of the major policy issues discussed in the previous sections. These programs often provide a high rate of return and are highly correlated with new patents and market investment in new technologies. Nevertheless, America's and the world's public and private investment in energy RD&D is declining. Failure to sustain and expand support of effective RD&D programs that promote innovative technologies will make it extremely difficult to meet the other goals advanced in this Report.

U.S. federal energy RD&D programs have generally not been designed to deliver commercially viable breakthrough technologies. Primary problems include limited incentives for public-private partnerships focused on commercial viability, pressure to maintain programs that have strong political constituencies whether or not they have delivered positive results, and institutional barriers to inter-agency and public-private cooperation on projects that require multi-disciplinary expertise.

Goals

The federal government's role in energy RD&D can and should be bolstered to combat declining emphasis and funding in the private sector and to capture important public goods.[3] Taxation and incentive policies also need to provide significant, stable financial incentives for private sector RD&D.

Strategies

- **Focus RD&D on innovative technologies that lower cost, reduce environmental impacts, and enhance security.** All RD&D should be evaluated prospectively and retrospectively for its contribution to economic, environmental, and security goals. The portfolio of RD&D should span a continuous spectrum from basic research to applied development with a path to market. The scale and integration of RD&D efforts must not be narrowly constrained, but large enough to encourage broad thinking and nurture breakthroughs.
- **Better utilize research partnerships.** Federal energy-related RD&D should more effectively engage expertise from other agencies in addition to DOE, and also involve universities and the private sector. To the extent possible, research should rely on consortia of governments, corporations, universities, and other research institutions such as national laboratories.

[3] Similar recommendations have been stated by the President's Council of Advisors on Science and Technology in 1997 and by several other assessments in recent years.

- **Increase federal RD&D funding for projects that meet tests of economic and commercial viability and have the potential to deliver environmental and/or security benefits.** At the same time, the federal government should develop "stopping rules" to help assess when to terminate projects that no longer hold adequate promise.
- **Create appropriate incentives for private partners to invest in federal RD&D projects.** The federal government needs to better support, encourage, and leverage greater private-sector RD&D investment. Competitive funding processes for research should be used wherever practicable, especially when research is to be conducted by one group rather than an industry consortium.

Federal Procurement

The federal government is the largest single consumer of goods and services in the world. As such, it has a tremendous opportunity to display leadership by promoting and providing a venue to further national public interests through its procurement system. During the past few years this system has begun to make strides in removing systemic barriers to the promotion of domestic goods that advance national security, efficiency, public health, and environmental quality. Sustaining and continuing to improve procurement incentives can significantly accelerate the commercial deployment of emerging energy technologies, systems and services that provide public goods.

Goals

The federal government should use its procurement practices to incubate and mature critical public policy initiatives in the areas of transportation, fuel choice, and energy efficiency. Strategic use of procurement policy can help to align the interests of private enterprise (as well as state and local governments) with the public good.

Strategies

- **Reform procurement practices to facilitate energy choices that lower cost, enhance security, and reduce environmental impact.** Update antiquated procurement rules based solely on minimum private internal cost to incorporate broader public purposes. Amend current contract requirements to recognize financial barriers for innovative technologies. Optimize current investments in technology transfer. Adopt appropriate performance-based procurement practices for both goods and services to reward cost-effective energy efficiency. For example, when procuring federal design services, favor performance-based fees that reward architects and engineers for what they save, not what they spend.
- **Use procurement practices to promote cleaner and more efficient technologies for transportation, buildings and facilities, and energy supply purchases.** Establish infrastructure for advanced fuel and vehicle purchases. Increase opportunities for other efficiency investments, including combined heat and power, and for renewable resources, procured both directly and as green power through the grid.
- **Promote development and adoption of better procurement practices outside the federal government.** Provide information and support to help state and local governments make similar changes.

Glossary of Terms

accelerated scrappage incentives
Incentives designed to encourage operators to scrap inefficient end-use energy using equipment and upgrade to more efficient models. Can also reward people who scrap an inefficient or polluting car without replacing it. Need not have any effect on classic or antique cars, since the scrappage is voluntary.

barriers
Obstacles or market failures that make it difficult or impossible for an individual, firm, or agency to use energy in a way that saves money.

biofuels
Liquid fuels and blending components produced from biomass feedstocks, used primarily for transportation. Traditionally biofuels meant chiefly ethanol fermented from starch, such as corn, but more recently it comprises a vast range of fuels (such as oils, esters, and alcohols) made by diverse processes (including enzymes) from mainly non-edible feedstocks (such as cellulose and hemicellulose from farm and forest wastes).

CAFE standards
Corporate Average Fuel Economy (CAFE) requires vehicle manufacturers to comply with the gas mileage, or fuel economy, standards set by the Department of Transportation (DOT). CAFE applies only to cars; DOT administers separate, parallel standards for light trucks. CAFE values are obtained by combining the city and highway fuel economy test results and computing an average, which is weighted by vehicle sales. Tests are conducted in a laboratory by operating vehicles on a dynamometer. The Environmental Protection Agency administers the testing program that generates the fuel economy data and determines the procedures for calculating the fuel economy values for CAFE. The National Highway Traffic and Safety Administration, part of the Department of Transportation , is authorized to assess penalties based on the information EPA supplies and to modify the standards.

cap-and-trade
A form of air-emissions regulation. This scheme places an overall limit on air emissions for a group of emitters, allowing each a certain amount of emissions. The emitting companies are then permitted to trade any reductions below their regulated emissions level to other emitting companies.

carbon emissions
The carbon-based byproducts of combustion of hydrocarbon fuels that are allowed to escape into the atmosphere. Typically carbon dioxide, but also includes carbon monoxide and miscellaneous uncombusted hydrocarbons.

carbon intensity
A term describing the amount of carbon emissions per unit of useful energy delivered to a final customer. The greater the carbon intensity, the greater the amount of carbon emissions per unit of energy.

carbon tax
A tax levied on fossil fuels based on the content of their elemental fossil-fuel carbon. Designed to favor energy sources not based on fossil-fuel carbon and fossil fuels with the highest energy per unit of carbon.

cellulosic biomass
Nonfossil organic matter including wood, woody farm and forest wastes (such as straw and corncobs), and other plant materials that can be converted into climate-safe liquid and gaseous fuels. Cost-effective ways to do this are generally relatively new and emerging technologies.

central generation
Refers to a form of large, centralized electricity generation, transmission, and distribution infrastructure typified by a widespread, complex grid of conducting wires that transmit electricity from large generating facilities to many thousands of individual customers.

climate change
A term used to refer to all forms of climatic modification, but especially to significant change from one prevailing climatic condition to another. In some cases, "climate change" has been used synonymously with the term "global warming;" scientists, however, tend to use the term in a wider sense inclusive of natural changes in climate, including climatic cooling.

combined-heat-and-power production
An electricity generating facility that produces electricity and another form of useful thermal energy (such as heat or steam) used for industrial process heating, or for space heating or cooling purposes.

command-and-control environmental regulation
Government statutes and regulations that specify particular technological solutions to environmental problems.

commercialization
Programs or activities that increase the value or decrease the cost of integrating new products or services.

congestion
Limitations in the ability of an electric or gas transmission system to carry energy because capacity is inadequate to carry all the desired energy at once at that location.

criteria pollutants
Air pollutants that the EPA has identified and set standards for, to protect human health and welfare. The six pollutants are: ozone, carbon monoxide, total suspended particulates, sulfur dioxide, lead, and nitrogen oxide. The term, "criteria pollutants" derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. It is on the basis of these criteria that standards are set or revised. Regulation of two further pollutants—mercury and carbon dioxide—is under discussion.

DOE (U.S. Department of Energy)
The federal agency responsible for research and development of energy technology, marketing of federal power, the nuclear weapons program, and energy policy.

Defense Science Board
The Defense Science Board (DSB) is composed of members designated from civilian life by the Under Secretary of Defense (Acquisition, Technology and Logistics). It advises the Chairman of the Joint Chiefs of Staff, the Secretary of Defense, the Deputy Secretary of Defense, and the Under Secretary of Defense for Acquisition, Technology and Logisticson scientific, technical, manufacturing, acquisition process, and other matters of special interest to the Department of Defense. This report refers to the May 2001 DSB report *More Capable Warfighting Through Reduced Fuel Burden*.

demand, electricity
The rate at which electric energy is delivered to or by a system, part of a system, or piece of equipment, at a given instant or averaged over any designated period of time. Also called "load;" not to be confused with the economic sense of the word "demand," which is the quantity bought at a given price.

demand side, demand-side alternatives
The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers gen-

erally to energy and load-shape modifying activities that are undertaken in response to utility-administered programs. It does not refer to energy and load-shape changes arising from the normal operation of the marketplace or from government-mandated energy-efficiency standards.

demonstration
The application and integration of a new product or service into an existing or new system. Most commonly, demonstration involves the construction and operation of a new electric technology interconnected with the electric utility system to demonstrate how it interacts with the system. This includes the impacts the technology may have on the system and the impacts that the larger utility system might have on the functioning of the technology.

distributed generation, distributed power
Small-scale, modular, and dispersed electric power generation that is located on or near the energy consumer's site, is integrated with the electric power system, is incorporated into the economic structure, and is accommodated by appropriated regulatory and administrative regimes. The transformation of scale from large, central power stations to small-scale, local siting is being driven by new technologies, market structures and actors, information systems, grid archictures, analytic methods, and control techniques.

distribution losses
Losses of electrical energy due mainly to resistance in wires and to magnetic losses that heat the iron in transformers. Approximately 7–8 percent of U.S. electricity is typically lost in the transmission and distribution system between the central power station and the customers' meters; at peak periods, when maximum demand and hot weather heat the wires and equipment, those losses can double.

distribution system
The portion of an electricity system that is dedicated to delivering electric energy to an end user.

energy
The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatt-hours, while heat energy is usually measured in British thermal units (BTUs).

energy efficiency
Using less energy to perform the same function. For the purpose of this paper, energy efficiency is distinguished from DSM programs in that the latter are generally utility-sponsored and -financed, while the former is a broader term not limited to any particular sponsor or funding source.

energy infrastructure, energy system
The entire system that captures energy and energy-rich materials from the natural environment and delivers these products to end-use consumers.

feebates
A feebate combines a fee with a rebate. People who choose to buy inefficient energy-using devices, such as gas-guzzling cars, are charged a fee according to how much social cost they impose; their fees are used to pay rebates to other people whose efficient choices save social cost. Can be combined with accelerated scrappage by, for example, making the rebate for buying an efficient new car depend on the *difference* in efficiency between the new car you buy and the old car you scrap. Can also be used to encourage savings of other resources, such as water or wastewater.

fuel cell
An electrochemical device that combines a fuel and oxidant (typically hydrogen and oxygen) to convert chemical energy directly into electricity without combustion. Fuel cells differ from conventional electric cells (batteries) in that the active materials, the fuel and oxidant, are not contained within the cell but are supplied from an outside source. High-school chemistry courses often do an experiment where an electric current splits water into hydrogen and oxygen. A fuel cell reverses this reaction, recombining those gases into electricity, hot water, and nothing else.

fuel-cell cars, vehicles
Vehicles that use a fuel-cell power unit to drive electric motors for propulsion.

fuel efficiency
The fuel consumption of a motor vehicle, typically expressed in miles traveled per gallon of fuel.

'golden carrot'
A form of R&D incentive that uses aggregated government purchasing power to commit to pay an attractive price for a large number of units of an exceptionally efficient device meeting specified requirements. Only the first such device brought to market is eligible for the incentive. the purpose of the incentive is to overcome manufacturers' chicken-and-egg problem of bringing new technologies to market by eliminating their market risk of introduction.

grid
The complex system of wires, transformers, switchgear, and controls that delivers electricity from power stations to end-use customers. It includes both transmission, which carries large amounts of electricity, often over long distances, and distribution, which carries smaller amounts over shorter distances to local customers. Nearly all power failures and problems with power quality originate in the grid.

hydrogen
A colorless, odorless, flammable gaseous element. It is the lightest of all gases and the most abundant element in the universe, occurring on earth chiefly in combination with oxygen in water and also in acids, bases, alcohols, petroleum, and other hydrocarbons.

hydrogen fuel-cell vehicle
A fuel-cell vehicle that uses hydrogen from an on-board storage tank as its only fuel.

interconnection
The connection point of a distributed electricity generating unit to the electricity grid.

internalize
To reflect in a market price, *e.g.*, for energy, the value of the social and/or environmental costs which its use imposes on others, such as pollution.

light truck
A pickup truck or SUV weighing less that 25,000 lbs.

liquefied natural gas (LNG)
Natural gas that has been condensed to a liquid, typically by cooling the gas to minus 327 degrees Fahrenheit. LNG has much higher energy per unit volume than natural gas in the gaseous state and is typically used for shipping large quantities of natural gas across oceans in specially designed tanker ships.

market-based instrument
Statutory or regulatory policy mechanisms that are designed to meet public policy goals while complementing or enhancing market-based

competition. Generally, they set compliance standards and avoid prescriptive rules regarding specific solutions, requirements, or options.

market power
The ability of a single economic actor (or small group of actors) to have a substantial influence on market prices.

monopoly
A market condition where a single firm is the sole seller of a product without close substitutes.

New Source Review (NSR)
Major stationary sources of air pollution and major modifications to major stationary sources are required by the Clean Air Act to obtain an air pollution permit before commencing construction. The process is called New Source Review (NSR) and is required whether the major source or modification is planned for an area where the national ambient air quality standards are exceeded (non-attainment areas) or an area where air quality is acceptable (attainment and unclassifiable areas).

non-utility developers
A corporation, person, agency, authority, or other legal entity that develops electric generating capacity and is not an electric utility. This generation capacity is then sold by non-utility power producers, which include qualifying cogenerators, qualifying small power producers, and other non-utility generators (including independent power producers) without a designated franchised service area, and which do not file forms listed in the Code of Federal Regulations, Title 18, Part 141.

nuclear power
Electricity generated for public consumption using nuclear fission.

performance-based design fees
A system of payment under which architects or designers are paid on the basis of how well their designs perform, rather than on the basis of how expensive the design is to formulate and build. This system aligns the incentives of the architect or designer with the goal of designing energy-efficient buildings and other products.

performance-based procurement practices
A system for making purchasing decisions in which the performance of a product over time, and therefore energy costs, is considered along with price.

petroleum (crude oil)
A naturally occurring, oily, flammable liquid composed principally of hydrocarbons. Crude oil is occasionally found in springs or pools but usually is drilled from wells beneath the earth's surface.

portfolio management
The functions of resource planning and procurement under a traditional utility regulatory structure. Portfolio management can also be defined as the aggregation and management of a diverse portfolio of supply (including demand-reduction) resources which will act as a hedge against various risks that may affect specific resources (*i.e.*, fuel price fluctuations and certainty of supply, common mode failures, operational reliability, changes in environmental regulations, and the risk of health, safety, and environmental damages that may occur as a result of operating some supply resources). Under a more market-driven power sector with a power pool or "poolco" wholesale market structure, a portfolio manager would aggregate and manage a diverse portfolio of spot-market purchases, contracts-for-differences, futures contracts and other market-hedging-type contracts and mechanisms.

power
The rate at which energy is transferred. Electrical power is usually measured in watts. Also used for a measurement of capacity to produce or deliver electricity at a given rate. Electric power delivered at the rate of one kilowatt for one hour totals one kilowatt-hour of electrical energy.

proliferation, proliferation risks
The spread of nuclear weapons and the capability to build nuclear weapons beyond the handful of governments currently capable of building such devices.

RD&D
Research, development and demonstration (see definitions for "Research and Development" and "Demonstration").

readiness costs
The costs associated with maintaining military personnel and equipment to respond to a conflict.

real-time pricing
The instantaneous pricing of electricity based on the cost of the electricity available for use at the time the electricity is demanded by the customer.

regulated monopoly
A monopoly subject to government regulations which define its franchise territory, operations, and finances. (See also "monopoly.")

reliability
Electric system reliability has two components—adequacy and security. Adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities. Security is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system facilities.

renewable resources
Renewable energy resources are naturally replenishable and virtually inexhaustible in duration, but are limited in the amount of energy that is available per unit of time. Renewable energy resources include: biomass, hydro, geothermal, ocean thermal, wave, tidal, solar and wind. Utility renewable resource applications include bulk electricity generation, on-site electricity generation, distributed electricity generation, non-grid-connected generation, and demand-reduction (energy efficiency) technologies.

research and development (R&D)
Research is the discovery of fundamentally new knowledge. Development is the application of new knowledge to develop a potential new service or product. Basic power sector R&D is most commonly funded and conducted through the Department of Energy (DOE), its associated government laboratories, university laboratories, the Electric Power Research Institute (EPRI), and private sector companies.

restructure/restructuring
The reconfiguration of electric and gas utilities and the regulatory and statutory regimes that govern them.

revenue-neutral
Describes a measure that does not result in a change in revenue to the government.

smart growth initiatives
Community-based initiatives to develop locally without necessarily increasing the size of the community using measures such as promoting infill development, affordable housing, public transportation, walkable communities, and/or clustering development to allow for contiguous green space.

strategic reserves (Strategic Petroleum Reserve)
The Strategic Petroleum Reserve consists of government-owned and -controlled crude oil stockpiles stored at various locations in the Gulf Coast region of the country. These reserves can be drawn down in response to severe oil supply disruptions. The target is to have a reserve of 750 million barrels of oil. Use of the reserve must be authorized by the President of the United States.

technology transfer
Technical assistance given to developing countries to promote use of new technologies.

transmission
The movement or transfer of energy over an interconnected group of distribution systems and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

two-way metering
A metering system that allows the measurement of both the electricity sold to a customer from the utility, and electricity sold to the utility by a distributed generator.

utility
A regulated entity which exhibits the characteristics of a natural monopoly that is operated in the public interest. For the purposes of electric industry restructuring, "utility" refers to the regulated, electric company. "Transmission utility" refers to the regulated owner/operator of the transmission system only. "Distribution utility" refers to the regulated owner/operator of the distribution system which serves retail customers. About three-fourths of the U.S. electric utility industry is privately owned ("investor-owned utilities"), the rest publicly owned (Federal power authorities, municipal utilities, rural electric cooperatives, and others such as electricity-selling irrigation districts).

wholesale power systems
The purchase and sale of electricity from generators to resellers (who sell to retail customers) along with the ancillary services needed to maintain reliability and power quality at the transmission level.

wires company
Regulated utility company that owns, and may construct and maintain, wires used to transmit wholesale power. It may or may not handle the power dispatch and coordination functions. It is regulated to provide non-discriminatory connections, comparable service and cost recovery.

The National Energy Policy Initiative, or "NEP Initiative" was developed with three stages: an Initial Assessment, an Expert Group Workshop, and an Expert Group Report. The project was created and administered by Rocky Mountain Institute (Snowmass, Colo.) and the Consensus Building Institute (Cambridge, Mass.). It was funded by the William and Flora Hewlett Foundation, the Gordon and Betty Moore Foundation, the Wallace Global Fund, the Steve and Michele Kirsch Foundation, the Belfer Family Foundation, the GAG Charitable Corp., and the Janelia Foundation. These foundations share an interest in promoting a well-informed, consensus-based, national energy policy. They have no operational role or influence on the Initiative.

The National Energy Policy Initiative convened an independent, bipartisan group of senior energy experts on February 1–3, 2002, at Airlie House in Warrenton, Virginia. The Expert Group's task was to seek consensus on an overarching vision to guide energy policy, and on issue-specific goals and strategies to advance the vision. This Report summarizes that consensus for interested members of Congress and the public.

NEP Initiative

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