

Toward a New National Energy Policy: Assessing the Options

Background Report Descriptions

Oil and Gas Security Issues: John Deutch (Massachusetts Institute of Technology)

This paper discusses the various economic and geo-political dimensions of U.S. energy security, and summarizes and critiques recent attempts to estimate the external economic costs of U.S. oil consumption that result from the vulnerability of the U.S. economy to oil price shocks, and from potential U.S. market power. The paper also discusses the extent to which military expenditures, foreign policy constraints, and the flow of petro dollars to rogue nations might be ameliorated by U.S. efforts to reduce dependence on oil.

Reassessing the Oil Security Premium: Stephen P. A. Brown (Resources for the Future) and Hillard G. Huntington (Stanford University)

World oil supply disruptions lead to U.S. economic losses. Because oil is fungible in an integrated world oil market, increased oil consumption, whether from domestic or imported sources, increases the economic losses associated with oil supply disruptions. Nevertheless, increased U.S. oil production expands stable supplies and dampens oil price shocks, whereas increased U.S. oil imports expands the share of world oil supply that comes from unstable suppliers and exacerbates oil price shocks. This paper quantifies several of economic losses associated with oil supply disruptions, taking into account projected world oil market conditions, probable oil supply disruptions, the market response to oil supply disruptions, and the U.S. economic losses resulting from disruptions to the extent they that should be considered externalities.

The Future of Natural Gas: Steven Gabriel (University of Maryland)

This paper provides an overview of the U.S. natural gas market, with particular focus on the adequacy of future natural gas supply to meet increasing demand. It discusses the expansion of domestic production due to advanced natural gas recovery techniques, and the role that may be played by imported Liquefied Natural Gas (LNG). The paper examines possible scenarios involving different assumptions about the likelihood of future supply disruptions, and the integration of the U.S. market with the world gas market.

Abundant Shale Gas Resources: Some Implications for Energy Policy: Stephen P.A. Brown (Resources for the Future), Steven Gabriel (University of Maryland), and Ruud Egging (University of Maryland)

According to recent assessments, the United States has considerably more recoverable natural gas in shale formations than was previously thought. Such a development raises the possibility of a shift in U.S. energy consumption toward natural gas. To examine how the apparent abundance of natural gas might affect U.S. energy markets and the role of natural gas in climate policy, this paper models five scenarios—reflecting different perspectives on natural gas availability, the availability of competing resources, and climate policy—through 2030. Findings show that more abundant natural gas supplies

result in greater natural gas use in most sectors of the economy, and that natural gas could serve as a bridge fuel to a low-carbon future if appropriate low-carbon policies are in place.

The Prospective Role of Unconventional Liquid Fuels: Joel Darmstadter (Resources for the Future)

This paper explores the prospective contribution to the U.S. oil supply of unconventional liquid fuels (*synthetic fuels*, or *synfuels* for short) over the next 20 years. The liquids in question are those derived from U.S. oil shale resources, U.S. coal, and Canadian oil sands, all of which are nonrenewable but exist in great abundance. As fossil resources, however, all three synfuels are more carbon intensive than petroleum products derived from conventional crude oil. This paper explores the economic viability of these fuel sources, and discusses their carbon contribution and various other nongreenhouse environmental uncertainties that remain to be fully addressed. The pursuit of carbon dioxide capture and long-term geologic containment are as vital a research and development imperative for these as for other energy conversion processes, such as coal-fueled electric generation.

The Effects of State Laws and Regulations on the Development of Renewable Sources of Electric Energy: Gary Allison (University of Tulsa) and John Williams (University of Tulsa)

In many ways, states have taken the lead on encouraging the development of renewable energy sources across the country. This paper identifies and assesses state laws, regulations and regulatory actions having the greatest potential to affect the rate at which renewable sources of electric energy are brought online. It covers seventeen of the eighteen most populous states, in which lives about 70% of the nation's population. Laws, regulations and regulatory actions covered include renewable electric energy purchasing and pricing mandates (including Renewable Portfolio Standards, Net Energy Metering, Green Purchasing Requirements and Public Benefits Funding to Support Renewable Energy Production); renewable electric energy purchasing incentives and opportunities represented by Voluntary Green Purchasing Initiatives; laws and regulatory decisions governing the permitting and siting of electric energy generators and electric transmission facilities; and laws and regulatory decisions influencing the demand of electric energy.

Technical Paper Descriptions

Energy Policies for Passenger Transportation: A comparison of costs and effectiveness: Kenneth A. Small (University of California-Irvine)

The U.S. transportation sector accounts for approximately two thirds of the country's total oil consumption, and is almost wholly dependent on oil as the source of transportation fuels. It also accounts for over one quarter of all GHGs emitted in the United States. This technical report analyzes a variety of broad policies simultaneously aimed at reducing the use of oil for vehicle fuels and at reducing transportation sector emissions. These include fuel economy standards, gasoline taxes, and a feebate system that subsidizes the purchase of fuel efficient vehicles while penalizing the purchase of gas guzzlers. Broader impacts of the policies are also discussed, such as their impact on local air pollution,

the international competitiveness of U.S. auto manufacturers, and their distributional impacts across different household income groups.

Hybrid Vehicles and Policies to Reduce GHG Emissions: Virginia McConnell (Resources for the Future) and Tom Turrentine (Center for Transportation Studies, University of California-Davis)

Advanced vehicles provide a particular technological path to reducing oil use and CO₂ emissions in the transportation sector. This technical report provides a detailed overview of the representation of hybrid, plug-in hybrid, and electric vehicles in the literature and in NEMS. It also assesses the impact on emissions and oil consumption, along with the cost-effectiveness, of several policies specifically targeted at encouraging the deployment of these vehicles. This report also discusses broader issues associated with these advanced vehicle technologies, such as consumer preference for these new vehicle types, reliability, and the potential safety issues of new battery chemistries. Specific policies examined include a range of hybrid and plug-in hybrid subsidies.

Economics, Energy and GHG Implications of LNG Trucks: Alan J. Krupnick (Resources for the Future)

This paper examines the case for and against natural gas vehicles becoming an important component of the U.S. transportation system, with a particular focus on the use of liquefied natural gas (LNG) in the heavy-duty trucking market. The paper explores how changes in fuel price differential (between natural gas and diesel), first-cost differential, and interest rate may affect the economic potential of LNG trucks, and also examines the effects on oil consumption of imposing a mandatory penetration rate of LNG trucks in the heavy-duty fleet.

Using Cap-and-Trade to Reduce Greenhouse Gas Emissions: Lawrence H. Goulder (Stanford University)

Policymakers throughout the world are discussing—and in some cases, implementing—market-based approaches to reducing CO₂ (and other GHGs), namely cap-and-trade or emissions tax systems. Each system has its merits; carbon taxes have the potential, for example, to raise large amounts of federal revenue which, if used to cut taxes that distort labor and capital markets, can generate relatively large gains in economic efficiency. Cap-and-trade systems can be designed to encourage the price stability found under carbon taxes through price-stabilizing provisions like allowance banking and borrowing. A further important design issue is the scope of the program in terms of which emissions sources are included, either directly or indirectly through emissions offset provisions.

This paper evaluates broad GHG emissions pricing policies at the national level against a number of metrics. The report features a central cap-and-trade case that includes or modifies several key features found in recent federal legislation, and also examines several alternatives reflecting different possibilities for policy stringency, offset availability, coverage, and the form of pricing instrument.

Energy Efficiency in the Residential and Commercial Sectors: Maximilian Auffhammer (University of California, Berkeley) and Alan H. Sanstad (Lawrence Berkeley National Laboratory)

There is substantial potential for improvements in energy efficiency to meet relentlessly increasing demand for electricity. According to one estimate, energy efficiency gains may meet about half of the predicted load growth by 2025, with annual savings in energy costs exceeding \$100 billion by the end of this period (NAPEE, 2007). However, the effectiveness of energy efficiency programs may be limited by various market obstacles.

Energy efficiency programs include appliance and building code standards, smart grid applications, state regulatory reform, financial incentives for efficiency investments, and information dissemination programs such as LEED (Leadership in Energy and Environmental Design) and Energy Star. This paper specifically explores the costs and effectiveness of a set of building and appliance codes similar to those in recent federal legislation, and also explores the value of additional investment to spur greater innovation in energy efficiency technology.

Residential Retrofit Ground Source Heat Pump Benefits Assessment: Xiaobing Liu (Oak Ridge National Laboratory)

Geothermal heat pumps (GHP) are a relatively new technology for space conditioning and water heating, but have been proven capable of significantly reducing energy use and summer peak electrical demand in buildings. At the same time, less than 1 percent of homes have GHPs, and industry experts have determined that barriers to the wider application of GHPs include high first costs to consumers, lack of knowledge and/or trust in GHP system benefits, limited design and installation infrastructures for GHP systems, and lack of new technologies and techniques.

This report assesses the energy savings, CO₂ emissions reductions, reduction in peak electrical demand, and utility cost reductions, from retrofitting all U.S. single-family homes that have space heating, space cooling, and water heating equipment with state-of-the-art GHP systems. The analysis shows that such retrofits could save 44 percent of existing primary energy consumption for space heating, space cooling, and water heating in U.S. single-family homes; reduce CO₂ emissions from space heating, space cooling, and water heating from these homes by 44 percent; save consumers \$56.2 billion in utility costs; and reduce summer peak electrical demand by 182 GW. This report feeds into an analysis of two policies—a subsidized loan and a direct subsidy—designed to spur additional installation of GHPs at a more realistic penetration rate.

Nuclear Energy in the US National Energy Modeling System: 2010-2030: Geoffrey Rothwell (Stanford University)

Approximately 20 percent of U.S. electricity is generated from 103 nuclear plants currently in operation. Due largely to public concerns about safety, waste disposal, and nuclear materials proliferation, no new plants having been commissioned since 1978. Recently, however, concerns over energy security and climate change, along with continued growth in demand for new generation capacity, have prompted renewed interest in nuclear power as a relatively secure and low-emissions source of electricity. This technical report discusses the policies available to stimulate new nuclear plant development, the impacts of these policies on the costs of power generation, their cost-effectiveness at reducing GHG emissions, and the time at which new plants might become operational. Specific policies assessed

include the expansion of federal loan guarantees. The report also qualitatively addresses the broader issues related to nuclear power generation, including accident risks, siting difficulties, and long-term disposal issues.

Modeling Policies to Promote Renewable and Low Carbon Sources of Electricity: Karen Palmer, Richard Sweeney and Maura Allaire (Resources for the Future)

Renewable energy sources for electricity generation include wind, solar photovoltaics, solar thermal, hydroelectric, geothermal (including distributed geothermal), waves, tides, ocean thermal energy, and various types of biomass. Although the *potential* energy from renewable sources is vast, the current costs of harnessing that energy, especially upfront capital costs, are high relative to the costs of conventional power generation. In addition, concerns exist regarding intermittency and transmission costs. This paper provides a brief background on such concerns, while also examining the costs and effectiveness of a series of federal portfolio standards designed to encourage the growth and deployment of such clean energy technologies. Some portfolio standards focus exclusively on renewables, while others expand coverage to include generation from nuclear, new natural gas plants and other clean energy sources.