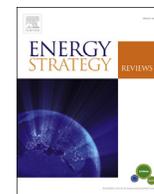




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## Energy Strategy Reviews

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EDITORIAL

## Introduction to Energy Strategy Reviews volume “US energy independence: Present and emerging issues”



This special issue identifies the major strategies that are enhancing the possibility that the United States will become energy self-sufficient in the coming decade and their implications for US responses to climate change. Evaluations include both analysis of the impact of US federal level and state level strategic energy policies already implemented as well as those that are under consideration and discussion. The issue also covers strategic corporate responses to these policies and to ongoing conditions in US energy markets. The volume shows that these strategies have, in fact, are contributing to dramatically different outcomes for the US energy landscape than the era of scarcity that have characterized the US energy situation in the past four decades and offers lessons for other regions of the world.

After decades of dwindling energy supply and rising oil and gas demand, the United States finds itself in a new strategic position. Three decades of policies designed to curb oil demand and growth in transportation fuel use are finally paying off, with US oil consumption falling almost 10% between 2005 and 2013 and expected to find deeper reductions in the coming decades. But the dwindling demand outlook is only part of the new US energy equation. Technological innovation and new investment strategies by US independent oil companies are bringing about a renaissance in US domestic oil and gas production that is making a substantial contribution to the prolific US energy supply outlook. That rise in domestic oil and gas production is considered so promising, it has opened the way for the United States to consider lifting its decades-old ban on oil and gas exports from the lower 48 continental shelf, with large geopolitical and economic consequences.

As *Scott D. Sheffield*, chairman and chief executive officer of Pioneer Natural Resources, a large US independent oil and gas producer, explains in the Vision article that opens the issue, the ban was put in place in the midst of the Arab oil embargo that created long lines at American gasoline stations and soaring prices. At that time, more than 30 years ago, the US Congress decided it needed to act to keep domestically produced oil at home, in the face of what it believed would be a permanent scarcity of supply. *Sheffield* argues that the ban has outlived its usefulness and now threatens to reduce US production because a looming mismatch in the quality of oil being produced

in the United States and the kind of oil needed for processing means that domestic output cannot find buyers from within the domestic oil refining industry. He calls on the United States to lift the ban, quoting a Brookings Institution study that concludes that allowing US crude oil to go to “the refineries that can best process it most efficiently, whether at home or abroad, is in the broad (US) national economic interest.”

The possibility for lifting the US oil export ban comes in the wake of predictions that the country could become energy self-sufficient in the coming decades. US oil demand is expected to decline by more than 20–30% in the next twenty years as *Neff and Coleman* discuss in an analysis of the US long term supply and demand outlook. *Neff and Coleman* tackle the question of whether US supply and demand might equilibrate and the role that US federal automotive policy will play in reducing US dependency on imported oil.

Already, the Obama administration has paved the way for limited exports of liquefied natural gas (LNG) from the United States. *Medlock, Jaffe and O’Sullivan* utilize a dynamic spatial non-stochastic intertemporal general equilibrium model to analyze the geopolitical and economic benefits that might derive to the United States from various possible strategies towards such exports. In their study which uses scenario analysis, *Medlock, Jaffe and O’Sullivan* find that simply accelerating US LNG exports does not best position the United States to reap the greatest and most important benefits it can from exporting its natural gas. One key aim for US LNG exports would be to help diversify

supplies available to Europe as it struggles to limit its exposure to a possible cut off of Russia gas supplies in the wake of an escalating conflict between Moscow and Ukraine over the latter’s future borders and status. The study shows that a US strategy to promote market liberalization together with opening up a higher volume on US LNG exports would be more effective in promoting long term US geopolitical interests.

To date, shale gas proponents have pointed to falling US greenhouse gas emissions in recent years as evidence that rising shale gas production is not only enhancing US energy security but also contributing to the US’ long term ability to combat climate change. In May 2014, the US Environmental Protection Agency announced that in 2012, US greenhouse gas emissions fell to their lowest levels in 17 years. An analysis of the data showed a large drop in US coal-fired electricity, as natural gas and renewable energy gained a larger share of the power market. While wind and solar energy only represent about 5% of total US electricity sources, natural gas is poised to pull ahead of coal as the largest source for fuel for electricity in the US. *Nichols, Victor, and Balash* model five scenarios using the MARKAL energy model to determine if the shale gas revolution will continue to offer both energy security and climate change benefits. The study finds that trade-offs between energy security and climate benefits may ensue in the electricity sector. Under scenarios where high shale resources are available and a carbon price emerges from implementation of carbon policy, study results show that while US net

energy imports can be reduced, the United States experiences a lower diversity of fuel sources for electricity supply.

### 1. The contribution of renewable energy

The dramatic rise in US energy production is not limited to oil and gas but also extends to renewable energy. The United States has in effect hit the jackpot on both fossil fuels and clean tech simultaneously, leaving it in an enviable position as the economy where cheap and ample energy supply is driving economic growth and wealth creation. The United States has added over 500,000 jobs in the oil, gas and clean tech sectors in the past five years, contributing to a boom often likened to a second industrial revolution. Renewable energy production in the United States has been steadily on the rise, with over 17,000 MW (MW) of solar, wind and geothermal capacity currently under construction. The US Energy Information Administration estimates that that renewable energy will represent one-third of all new electricity generation added to the US grid over the next three years. Installed US solar energy capacity increased 418% between 2010 and 2014 to 12,057 MW. On the transportation fuel side, *Morrison, Parker, Witcover, Fulton, and Pei*, weigh the potential contribution US biofuels policy will be able to contribute to US energy independence. Assessing three supply side approaches – innovations at existing biorefineries, establishment of stand-alone advanced cellulosic facilities or the use of waste oils for renewable diesel and biodiesel, *Morrison, Parker, Witcover, Fulton, and Pei* conclude that bioenergy can contribute the equivalent of 8% of US transportation energy by 2030, helping diversify away from oil. The authors' analysis shows a more pessimistic assessment about the potential of ethanol to overcome constraints that currently limit its use in light duty vehicles in the United States, despite early subsidization of the fuel in the United States.

The prospects that the United States will have an improving energy supply-demand balance that requires less imported oil has prompted policy makers to reconsider US policy surrounding the use of strategic petroleum stocks. The US Strategic Petroleum Reserve (SPR) was created in 1976 to reduce the vulnerability of the US economy to oil producer cutoffs or other kinds of supply disruptions. Strategic stocks play a key role ensuring that the United States and its allies have a defense against economic blackmail by a large oil producer or group of important oil exporting countries. As the United States frees itself from heavy dependence on foreign oil imports and relies increasingly on domestic supplies that are transported by pipeline, it will

require new thinking about the role of the US SPR. *Carmine Difiglio* reviews the current state of oil supply security and argues that while new unconventional oil production technologies are revitalizing US domestic production, the world economy will remain susceptible to globalized oil supply disruptions. There is evidence that the adoption of new American unconventional oil and gas production techniques abroad face significant bureaucratic and structural barriers and will be slow in materializing. *Difiglio* reviews the current challenge to the successful utilization of strategic emergency stockpiles, which are only useful if they are released promptly and in sufficient scale as to prevent large oil price spikes. *Difiglio* argues that strategic stocks have not been utilized adequately in the past to avoid damage to economic performance during past oil supply shocks and that the growth of unconventional oil and gas production could inhibit the ability of the United States to utilize the SPR to its fullest effectiveness. The article highlights the importance of reevaluating US SPR policy in light of changing trends to improve its capacity to meet its aims of protecting the US economy from oil price shocks.

### 2. The US Energy Future.

The remaining analysis articles in the issue provide a glimpse into the future with analysis on how demographic trends in the United States might impact future oil demand as well as strategies to move the US transportation sector to zero emission vehicles. The millennial generation, born between 1980 and 2000, is shaping the United States' changing demographics and future cultural and social norms. More environmentally engaged than their parents and grandparents, millennials' habits and preferences will directly impact future travel behavior trends and the related consequences on energy consumption and the environment. *Polzin, Chu and Godfrey* provide an overview of how millennials are exhibiting different travel behaviors than previous generations. Many millennials are postponing marriage and living with parents longer, obtaining driver's licenses at an older age, and substituting travel for work and social events with increased use of telecommuting and social media. More study is needed before it can be concluded whether millennials will continue to drive less and consume less energy than previous generations but current trends suggest that their tendency to live in urban settings and greater willingness to consider adopting advanced automobile technologies and engage in ride sharing opens the possibility that social and demographic changes might accelerate the lessening of oil use in the United States over time.

Finally, *Greene, Park and Liu* consider the challenges for the United States to transition to zero emission vehicles (ZEVs) and completely eliminate the need for oil-based fuel for transportation by 2050 in an effort to institute sharp reductions in greenhouse gas emissions (GHGs). Global warming and the burning of fossil fuels for transportation are intricately interrelated. The transportation sector represents 28% of all GHG emissions for the United States and 13% of global GHG emissions. Without tackling the contribution to emissions from light duty vehicles, it will be next to impossible for policy makers to address the grave challenges posed by climate change. The study considers a wide range of public policy interventions over different time scales, intensity and approaches that would be necessary to accomplish a complete transition to electric and fuel cell vehicles. The study, using a systems model utilized in a recent National Research Council study, finds that considerable uncertainties exist because of the long lead times to such a policy, strong positive feedback effects and regional and international interdependencies and that strong interventions into markets will be necessary including both policies influencing vehicle development as well as fuels markets. As the United States becomes more energy independent, the interdependence between US energy security and climate policy will weaken, making it harder to form broadening political coalitions for climate action. US policy makers will have to overcome this new trend in forging future environmental strategies.

### 3. Lessons from State Initiatives

In a case study that explores how political challenges can thwart the expansion of low carbon energy even when concrete societal and economic benefits exist, *Li, Solomon, Wellstead* analyze whether Michigan's inability to enact a large expansion of the state renewable energy portfolio standard (RPS) constitutes a true policy failure. The Michigan Renewable Energy Amendment 2012 (Proposal 3) referendum, aimed to increase the state's use of renewable energy from 10% to 25% of total electricity generation, failed to attract sufficient votes for passage. *Li, Solomon, Wellstead* offer a cost-benefit analysis that demonstrates the measure would have yielded large avoided costs switching to wind and solar away from new-builds for natural gas as well as provided substantial health and environmental benefits. Yet a negative political campaign that threatened billions of dollars in increased energy costs prompted a majority of voters to reject the measure. Still a majority of Michigan voters are still found to support renewable energy and the study argues that rather than

being a policy failure, Proposal 3 is a “resilient” success that provides lessons on what factors should be emphasized in policy decision making. This political analysis study highlights the possible difficulty that the United States might face as it tries to implement President Barack Obama’s new Environmental Protection Agency (EPA) rules for stationary carbon pollution by increasing the level of renewable energy in the United States.

In contrast to the Michigan example, California has been a leader among US states in advancing ambitious policy solutions to environmental and energy challenges since the 1960s. In an important case study on the California experience, *Sperling and Eggert* assess the programs that have been implemented in California and the successes and limitations of the state’s efforts to decarbonize its economy. Many of California’s policy innovations have spread worldwide and stimulated many new clean energy and automotive technologies now in widespread global use. *Sperling and Eggert* discuss how California is adopting a new set of comprehensive policies, regulations and incentives to reduce greenhouse gas emissions, with a particular emphasis on vehicles, fuels and mobility and what lessons those policies and rule-making offer for future strategies.

Despite ongoing policy challenges, including some inherent tensions between US energy security policy and US climate policy, there is much reason for optimism. As the analysis in this Special Issue of Energy Strategy Reviews shows, many of the energy strategies chosen by the United States over the past three decades are starting to pay off, yielding both environmental and security benefits. We hope the lessons discussed in this Special Issue will show the wisdom and potential for action even when the payoffs to strategic policies are counted in decades, not years. The US experience gives hope that similar efforts to address climate change through concerted policies to reduce coal and oil consumption at the same time promoting innovation in lower carbon fuels can produce continued improvements in the US energy and climate landscape. We also hope the wide range of studies sheds light for other automobile-focused consuming countries that are studying policy options to enhance their own energy security and environmental performance.

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oversight and editorial work. A special thanks is due to Scott Sheffield of Pioneer Natural Resources for his contribution to the debate on US energy independence and ongoing participation in University of California Davis symposia on the topic of transformational trends in US energy.

We express our gratitude to ESR and its Chief Editor, Ruud Weijermars, for inviting and guiding me in this effort and to UC Davis Graduate School of Management and Institute of Transportation Studies for allowing me to take the time to develop this volume and supporting its success with contributions.

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