IAEE Energy Forum

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International Association for Energy Economics

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CELEBRATING 40 YEARS ANNIVERSARY

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Editor: David L. Williams

President's Message

Dear fellow members of IAEE,

When we look at the determinants of economic growth, we find that natural resource-rich economies have an additional source of growth, but it is not always well exploited, and what is worse, often ends up becoming a curse rather than a blessing. And, it is astonishing to see how often countries with abundant natural resources, in oil or other extractive resources, have failed to grow faster than countries that have none. The abundance of these resources often leads to conflict, corruption and poverty. Sadly, countries with abundant oil resources are twice as likely to experience civil war as those without it. This trap is called the curse of natural resources, and history has many examples of economies whose wealth in natural resources led to less economic success. For example, Venezuela, the country with the largest oil reserves in the world, is facing a deep economic and political crisis. Transparency International ranks it one of the ten most corrupt economies, and the World Bank's *Doing Business* report ranks it as one of the three countries with the worst business environment.

Too often developing countries with abundant energy resources, such as oil and gas, face multiple problems transforming those resources into wealth. For example, and first, in these economies it frequently occurs that the rents and revenues from these resources are squandered, captured and misappropriated by officials or interest groups, public or private, and that ultimately, they do not benefit its population and future generations. Second, it is common to see problems on the definition of property rights and the rule of law, on the design of contracts, and on the granting of licenses and concession, which do not provide adequate assurances for foreign investors. Third, there exist the risks linked to the fiscal and economic direction of the country, which could be exposed to the volatility of prices of natural resources in world markets, especially if the income associated with the exploitation of these resources is a large fraction of the country GDP or of the government budget. And, in a period of price bonanza, such as high oil prices, that comes with a large inflow of foreign currency, the country might suffer from the Dutch disease; or regard to the criteria by which rents are saved or used, sometimes as foregone rents in the way of wide spread energy and other subsidies, and the impact on fiscal and monetary policy, in the short and long term. Furthermore, in the developing world there is a lack of energy and electricity infrastructure. Today 1.2 billion people lack access to electricity and 2.8 billion lack access to modern cooking facilities These economies are in deep need for a proper institutional, regulatory and business framework to enable the required private investments.

For many decades, the U.S. was the largest energy consumer, accounting for 35% of

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world primary energy consumption in the early 1960s Today it accounts for 17.5%, having recently been surpassed by China with 23% of world primary energy demand. Albeit, in oil and gas, the U.S. remains as the largest world consumer with almost 20% of oil and 23% of natural gas, and third in coal, with 10%. Today China has emerged as the largest energy consumer. It has rapidly augmented its market share in oil, reaching 13% in 2015, up from 3.5% in 1990, and by far leads world consumption in coal, accounting for 50% of world consumption, seconded by India with 11%. On CO_2 emissions, the U.S. accounts for 16.4% of world total, second after China who accounts for 27.3% of total CO_2 emissions.

While the U.S. economy has long been a net energy importer, particularly in oil and natural gas, the shale revolution has begun to turn that upside down. Today, the U.S. has reduced its energy dependency; imported oil accounted for 67% of total U.S. oil consumption in the 2000 decade; in 2015 it accounted for 34.5%. This has been due in part to a reduction in domestic consumption, but also to an increase in local oil production thanks to new technologies which have unleashed important oil and gas resources that were not accessible two decades ago. These have also enabled the country to export increasing amounts of oil and natural gas. Expectations are that by the end of this decade, the U.S. will become a net exporter of natural gas. That was unforeseen a decade ago, when the country's need for crude oil was soaring while its production was falling.

The U.S. has been and will be, for years to come, an important player in world energy markets. This is because of its share in total world energy consumption and production, the key role that energy has in the functioning of its economy, and since the country's dependency on foreign energy sources, often from regions that are politically unstable and exposed to war and conflict. U.S. energy policy and technology has had high leverage in world energy markets, on oil rich locations that often see in the U.S. a reliable business opportunity to sell their products in a stable market, enabling investments that have the potential of improving the living conditions of their population; or, by bringing innovations which uncap energy sources, in FF as well as renewables; and, more recently, for energy importing countries, by increasing world energy security by increasing the supply of FF, in oil and natural gas, and other energy sources. For example, exports from the Sabine Pass liquefaction plant have reached locations as far from the U.S. as Asia. U.S. energy policy also has served as an example of what to do, and sometimes of what not to do, providing examples of successful business models, diverse regulations and industry standards..

IAEE Mission Statement

The International Association for Energy Economics is an independent, non-profit, global membership organisation for business, government, academic and other professionals concerned with energy and related issues in the international community. We advance the knowledge, understanding and application of economics across all aspects of energy and foster communication amongst energy concerned professionals.

We facilitate:

- Worldwide information flow and exchange of ideas on energy issues
- High quality research
- Development and education of students and energy professionals

We accomplish this through:

- Providing leading edge publications and electronic media
- Organizing international and regional conferences
- Building networks of energy concerned professionals

With a new administration in the U.S. Federal government, we have a great opportunity with our newsletter to learn from the ideas and work of our fellows, and to look at U.S. energy policy, and what to expect for the coming years: What will happen in the U.S., energy markets, technology, environmental regulation, and leaderships? What are the expected changes in energy regulation, on tax and trade policy, as well as on energy efficiency, on fuel efficiency standards and environmental regulation? What about the ease of energy infrastructure deployment on the access to fossil fuels and renewables, and on the competitiveness of the U.S. economy and its different industries? And what are the likely impacts elsewhere and the responses to changes in the U.S. energy and environmental policy.

We optimistic that material in this issue of The Energy Forum is in the interest of our broad international audience, and we deeply thank the contributions from our fellow members, as well as your engagement within our different services and activities with IAEE and its affiliates.

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International Association for Energy Economics

Editor's Notes

Energy policy in the new U.S. Administration is a popular topic. The response to our call for articles on the subject has been quite rewarding and we're most appreciative. As a result we'll continue the topic in the next (third quarter) issue and if what you read here strikes a responsive chord and you'd like to add your thoughts, please do so. In the meantime, be thinking about the theme "*renewables and conventional energy resources: challenges, opportunities, complementarities, rivalries and game changers*". We'll tackle that next, most likely in the fourth quarter issue.

Ben Schlesinger writes that energy policy under the Trump Administration is beginning to resemble a stable extension of past policies, with a more production-oriented but still "all of the above" approach. His article takes its signals from a reading of new energy-related cabinet members and recent oil pipeline approvals, and it reviews emerging technological barriers the new Administration is likely to face in trying to resuscitate coal.

Jeff Lane, Jennifer Morrissey and **Andrew Shaw** explore the potential role for states to drive national energy policy in light of the Trump Administration's efforts to roll back regulations affecting the U.S. energy sector. With no comprehensive national energy policy enacted by Congress in over a decade, states have already begun to take initiatives to fill the void. Now with federal regulations expected to be scaled back significantly over the next few years, states will have an even larger role.

Jared Anderson notes that the energy industry - oil & gas sector in particular – is excited about the energy regulation roll back currently underway. But the lack of clarity regarding long-term energy policy goals and impacts leaves energy business leaders cautiously optimistic about the regulatory changes to emerge over the next four years.

Douglas Reynolds considers three alternative U.S. energy policies regarding oil and electric utilities. He suggests keeping oil supply options open such as in Alaska's Arctic, but also considers a gasoline tax and deregulating transportation markets. Another alternative policy for electric utilities includes a stock-option like incentive mechanism for utility managers.

Tom Russo and **Kelly Schaeffer** note that the U.S. Army Corps of Engineers could play a lead role in increasing non-federal hydropower at its dams. Legislation and a Corps-FERC Memorandum of Understanding could facilitate this. However, the Corps' inexperience in reviewing FERC hydropower project proposals are impediments. The Trump Administration may incent the Corps and FERC to implement a program.

Ben Wealer, Victoria Czempinski, Christian von Hirschhausen and **Sebastian Wegel** discuss nuclear power, noting that it is about to lose its short-term competitiveness, with 16GW of capacity already closed or likely to be closed in the near future. Sustainable organizational models are needed to contain decommissioning costs. The biggest challenge is nuclear waste, both with respect to financing and siting long-term and intermediate storage.

Mamdouh Salameh argues that even if Donald Trump's campaign promises were to be fulfilled, their impact on the global oil market and the price of oil would be limited.

Daniel C Mussatti explores how one might craft a national energy policy by recognizing the shortfalls of previous energy policies that refused to incorporate the inevitable forces of economic behavior.

Marc H. Vatter and **Daniel F. Suurkask** estimate effects relevant to a possible shift in U.S. trade policy on electric loads in Mexico. They conclude that, if a shift in trade policy toward Mexico is seen as a realistic possibility, it would be worthwhile to analyze its impact on loads, especially energy loads, in scenarios.

Parag Nathaney and **Rachel Finan** note that though the recent presidential transition has altered the priorities concerning the energy industry, the trend toward utility grid modernization is one domain of the industry that may remain largely on course, potentially even accelerating under new federal policy shifts and recent FERC directives.

Austin Zwick illustrates how fracking is a regional employment magnet for those workers willing to commute by "drive-in, drive-out" from nearby states.

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Energy Policy in the Trump Administration

By Benjamin Schlesinger

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As of mid-February 2017, the new Trump Administration seems pre-occupied with a number of pressing issues apart from energy policy, thus it's still too early to pin down what this will be.

Nevertheless, lack of hard data has rarely stopped others from forging ahead with analysis of this kind, so why wimp out? Trump's is the thirteenth U.S. presidential administration I've lived under, so I've seen a lot of change. In fact, none of the past six transitions I've endured from one party to another was pretty – they were each disruptive, rancorous, and involved too much hubris on the part of the incomings, and too much clucking disappointment on the part of the outgoings. So we'll try and lend some perspective.

President Trump aimed his 2016 campaign toward people who felt displaced by changes in industrial employment and demographic patterns. This includes especially those who've lost jobs to foreign competition or renewable energy, baffled by complex regulations with which they didn't identify, and anxious about the country slipping behind China and other aggressive players.

In the energy space, the Trump campaign promised major push-back against opposition to growth in energy infrastructure, especially the failure to invest in pipelines, and more specifically, against the accelerating decline of coal. Attention to global climate change and greenhouse gas emissions, it was felt, had been overplayed at the expense of U.S. workers.

It's now almost a two months into the new Trump Administration, and energy (fortunately) is not dominating the news. Still, some key elements of their energy policy are becoming clear, including new pieces and some holdovers.

CABINET APPOINTMENTS – NO ENERGY WILD-CARDS

The new Administration's appointments at the leadership level that relate to energy policy suggest a direction that is likely to remain relatively stable. Among these Rex Tillerson and Rick Perry stand out.

- Secretary of State Rex Tillerson, former CEO of ExxonMobil, clearly knows the oil and gas industry, and provides an experienced voice on energy. His Senate testimony was the first by a new Administration official to recognize frankly that global climate change is real, and is an issue that the U.S. must continue to deal with in the future. As a global energy giant, Tillerson's ExxonMobil reflects and internalizes the world's recognition of the problem at both the industrial and political levels. U.S. energy-intensive firms like ExxonMobil, Chevron, ConocoPhillips, GM, Ford, GE, and so many others realize they cannot turn on a dime over one U.S. president or another, but instead operate in a global marketplace that demands conservative assumptions that remain in place going forward, and standardization of products as well. This is not inertia so much as it is practical business sense; in the real world, change comes through technological innovation that alters the old price relationships, not so much from one country or another's regulation of the day. Tillerson's accession to fourth place in the presidential line of succession should, therefore, be reassuring from an energy policy perspective.
- Secretary of Energy Rick Perry spent an unprecedented 16 years as Governor of Texas, the largest energy producing state in the nation, and one who's financial fortunes depend in part on a vibrant producing sector. Texas, the leading U.S. producer of oil, of natural gas, and of wind power – the latter evolved under then-Governor Perry. Again, while not a figure in the international stage, Perry doesn't have to be in his new

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position. He is likely to be a reassuring presence in the new Administration regarding energy policy and programs.

- EPA Administrator Scott Pruitt former Oklahoma Attorney General, is broadly criticized for spending his days suing the very agency he is supposed to lead, but this really misses the point. The tenor of Pruitt's lawsuits has focused substantially on the state-federal relationship, and the need to involve states more carefully in rulemaking. Thus, rather than blindly opposing the CPP and other regulations, Priutt's focus might wind up making them more broadly acceptable. Although the rules may change, the likelihood is that they will enjoy the hitherto missing element of buy-in within many regions. EPA subsidies of wind and solar may be threatened in the new Administration, these may come too late to make much difference because costs of electricity production from both sources have fallen so greatly. This is especially true for solar energy which, when coupled with lower cost battery technologies, threatens to upset existing electricity and natural gas markets, with or without subsidies. All that said, however, we are concerned about Pruitt's statements that CO_2 doesn't cause climate change. Such statements cause confusion, thus risk doing the energy space more harm than good.

In summary, there is little in the new Administration's emerging energy team to suggest that quantum policy changes are in the works, but there will continue to be conflicting statements that cause concern and confusion. In all, the tilt toward domestic energy production is likely to persist, including the "all of the above" philosophy that President Obama championed.

PIPELINES – BUILD THEM

As expected, President Trump has exercised presidential power to move forward with two infamously stalled oil pipelines, Keystone XL and Dakota Access.

- TransCanada accepted the new president's invitation to refile before the State Department for permission to expand the Keystone XL pipeline to carry crude from Alberta's oil sands to markets in the U.S. Gulf Coast region. With hundreds, if not thousands of displaced Petroleos de Venezuela (PDVSA) graduates working in Fort McMurray, Canada's oil sands crude is tailored to fit the very Gulf Coast refineries that have long processed Venezuelan crude. This can only reduce prices to U.S. consumers, and ensure continued employment as well. We would expect Secretary of State Rex Tillerson to write an informed, substantive recommendation that will facilitate presidential approval.

- Construction of ETP's Dakota Access Pipeline was nearly complete when the Corp of Engineers halted work at the Missouri River crossing in response to protests. Protests to the contrary, President Trump ordered the Corps to permit construction and the pipeline is expected to begin flowing oil in March 2017.

Importantly, the Keystone and Dakota pipelines shared a common feature that enabled the new president to approve them singlehandedly – neither project was before the FERC for decision. For this reason, the President did not have to use any special powers, since overriding the FERC was not at issue – both approvals were entirely within the President's purview.

But the FERC is an independent agency, thus it is unclear what an enthusiastic president or even Congress can do to override its powers in any quick time frame. Stalled northeast gas pipelines like Kinder Morgan's Northeast Direct (NED) and Spectra's Algonquin Northeast (ANE) Access are entirely another matter from Keystone and Dakota Access – both require FERC approval and neither has received its FERC certificate. Worse yet, both NED and ANE have fallen victim of a serious energy market failure afflicting the U.S. northeast. The nature of this failure lies in the inability of the region's electricity generation sector to sponsor new pipeline capacity. The problem is compounded by some aggressive opponents in the region in hopes that stalled gas pipelines will prevent gas market growth altogether and thus expidite force acceleraged renewable energy.

In summary, we can expect the new Administration to encourage construction of pipelines and other energy infrastructure, but timing may not be as quick as it was for the Keystone and Dakota Access pipelines.

COAL – ROAD KILL ON THE ENERGY HIGHWAY

Working with Congress, the new Trump Administration may be in a position defer or cancel altogether the Obama Administration's Clean Power Plan (CPP) and other climate and environmental regulations that encumber coal markets. But can they? In large measure, coal is declining in the U.S. not so much because of regulation, but because of deregulation – i.e., deregulation of natural gas and electricity markets.

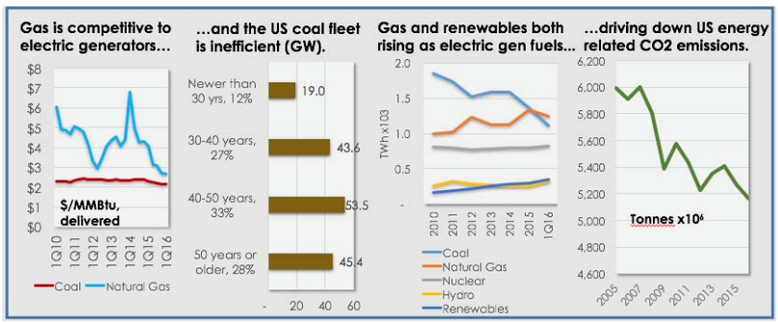

Figure 1 Gas out-competes coal, reducing carbon emissions
Sources: BSA 2016, EIA, Statistics Canada.

Deregulation began with lifting of federal gas field price controls, and continued with FERC's determined support of gas pipeline open access transportation rules. Around the same time, Congress enabled and FERC encouraged development of an independent power generation sector in the U.S. Together, these policies unlocked energy markets in the 1980s and 1990s, leading to a massive splurge in construction of new, high-efficiency gas-fired power plants – over 350 of them in the past two decades, according to EIA. More recently, the great U.S. shale revolution greatly reduced gas prices and future price expectations, adding further impetus to the rush toward gas-fired power generation. The net result has been a decrease in carbon emissions (see Figure 1).

Only the states' push to wind and solar, whose costs have fallen dramatically with increasing production, have challenged natural gas's rising dominance of new electricity generation additions – indeed, the two, gas and renewables, appear to go hand-in-hand in enabling production of low-cost dispatchible energy.

Because of this process, and this gas-renewables team, coal is being run over in the U.S., a kind of energy road kill. All the CPP offered to do was accelerate the process a bit – successive studies by EIA and others project gas and renewable power generation will grow with or without the CPP for the next decade or two. Outside the U.S., coal is suffering even where natural gas carries a high price tag. For reasons discussed above, global concern over climate change caused by greenhouse gas emissions is very real, and coal is the prime culprit.

OUTLOOK – TECH AND MARKET FORCES RULE

Technology is continuing to evolve rapidly, and will continue to drive upsets to energy markets. Just as the shale revolution has rocked U.S. and global markets, so too might the potentially vast impact of the solar-battery combination. Costs pf PV and Li-Ion storage are plummeting toward a tipping point – competitiveness with oil and natural gas. Overnight capital costs of PV alone have fallen below those of coal-fired generation, but solar is temporal (the sun sets every evening), thus poses no serious threat so far. But in the post-subsidies world, battery costs are falling just as quickly as solar and natural gas costs did, thus the increasingly efficient solar-battery combinations are likely to appear first in southern arid regions, then potentially elsewhere as well.

Energy policy at all levels will be challenged by these emerging technologies – whether at the federal level, in the states, in utilities, and in private business decisions. The new Trump Administration has not really positioned itself to stand in the way.

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The IAEE currently meets the professional needs of over 3400 energy economists in many areas: private industry, non-profit and trade organizations, consulting, government and academe. Below is a listing of the publications and services the Association offers its membership.

• **Professional Journals:** *The Energy Journal* is the Association's distinguished quarterly publication published by the Energy Economics Education Foundation, the IAEE's educational affiliate. *Economics of Energy & Environmental Policy* is a new journal published twice a year. Both journals contains articles on a wide range of energy economic and environmental issues, as well as book reviews, notes and special notices to members. Topics addressed include the following:

Alternative Transportation Fuels	Energy Management	Natural Gas Topics
Conservation of Energy	Energy Policy Issues	Natural Resource Issues
Electricity and Coal	Energy Security	Nuclear Power Issues
Emission Trading	Environmental Issues & Concerns	Renewable Energy Issues
Energy & Economic Development	Hydrocarbons Issues	Sustainability of Energy Systems
Energy & Environmental Development	Markets for Crude Oil	Taxation & Fiscal Policy

• **Newsletter:** The IAEE *Energy Forum*, published four times a year, contains articles dealing with applied energy economics throughout the world. The Newsletter also contains announcements of coming events, such as conferences and workshops; gives detail of IAEE international affiliate activities; and provides special reports and information of international interest.

• **Directory:** The Online Membership Directory lists members around the world, their affiliation, areas of specialization, address and telephone/fax numbers. A most valuable networking resource.

• **Conferences:** IAEE Conferences attract delegates who represent some of the most influential government, corporate and academic energy decision-making institutions. Conference programs address critical issues of vital concern and importance to governments and industry and provide a forum where policy issues can be presented, considered and discussed at both formal sessions and informal social functions. Major conferences held each year include the North American, European and Asian Conferences and the International Conference. IAEE members attend a reduced rates.

• **Proceedings**: IAEE Conferences generate valuable proceedings which are available to members at reduced rates.

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U.S. Energy and Environmental Policy Under President Trump: As the Federal Government Scales Back, Will States Step In?

By Jeff Lane, Jennifer Morrissey and Andrew Shaw

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The last comprehensive federal energy legislation was passed by Congress and signed by President George W. Bush in 2007, and was followed by a decade of Congressional gridlock. The Executive Branch was left in the driver's seat, which in turn has given the judiciary an outsized role in shaping policy as rules are challenged by opponents in court at the back end rather than debated in Congress on the front end. This dynamic also has left a void which state and local governments have begun to fill, sometimes tentatively, sometimes innovatively and sweepingly.

Efforts by the Democratic-led Congress early in the Obama Administration to approve "cap-and-trade" legislation to combat climate change were unsuccessful, leaving federal energy and environmental policy-making largely in the hands of the executive branch. President Obama then moved forward aggressively with regulations, executive actions and spending proposals that reflected his agenda to make the U.S. a leader in addressing climate change and supporting clean energy technologies.

Any policy premised on executive action, of course, can be largely undone by a new President with different priorities. President Trump made clear during the campaign that he intended to pursue an energy and environmental policy focused on job growth and deregulation, energy independence achieved through the increased production of fossil fuels — including revitalization of the U.S. coal industry — and a move away from picking "winners and losers" by subsidizing clean energy technologies.

President Trump, with willing partners in the Republican-led Congress, is working quickly to fulfill those promises. This article explores those early actions and other potential changes at the federal level, and describes how state governments will likely continue to push forward with their own climate and clean energy initiatives.

ENERGY POLICY ACTIONS IN THE EARLY DAYS OF THE TRUMP ADMINISTRATION

President Trump has already signed numerous executive orders addressing energy and environmental policy and regulations. In the face of a lack of action from Congress, Executive Orders have become a tool of choice in recent Administrations for guidance to the agencies both on enforcement of statutes and on the policy direction to be pursued. Of course, executive orders are not all immediately implementable, and only have the full force of law if the authority for the action is based on a statute or the Constitution, or on a delegation of discretionary authority to the President by Congress. Executive orders also may be subject to challenge in the courts. Nevertheless, even if not implemented, executive orders certainly impact the policy initiatives coming out of the White House.

Indicative of some of his policy priorities, President Trump directed agencies to revive the Keystone XL and Dakota Access oil pipeline projects within days of his inauguration, and he issued an order to expedite environmental permitting processes for other high-priority infrastructure projects. The Administration has indicated in court filings that it intends to rescind the Bureau of Land Management's rule on hydraulic fracturing on federal and tribal lands. President Trump also signed a broad executive order to reform the Administration's regulatory process, requiring agencies to identify for elimination at least two regulations for every new regulation they issue and establishing a regulatory budget to set a fiscal cap on rules each year (notably, this order would apply only to discretionary rulemakings, not to regulations required to be issued or updated by statutes such as the Clean Air Act).

Meanwhile, the Republican Congress has swiftly taken aim at existing regulations by utilizing the Congressional Review Act (CRA), which gives it the power to disapprove rules finalized in the late stages of the Obama Administration. These include, among others, the Interior Department's Stream Protection Rule (restricting how close coal mines can operate to nearby waterways) and the Securities and Exchange Commission's Resource Extraction Rule issued pursuant to the Dodd-Frank legislation (requiring publicly traded oil, gas and mining companies to disclose payments to foreign governments.) Democrats generally opposed these actions but were powerless to stop them; CRA disapproval resolutions cannot be filibustered in the Senate and thus require only a majority vote. The Methane Waste

Rule (requiring oil and gas companies to reduce methane leaks from drilling operations on federal and tribal lands) is similarly a CRA target.

The Trump Administration has also signaled its intention to revisit the Environmental Protection Agency's (EPA) Clean Power Plan (CPP), the centerpiece of the Obama Administration's climate change agenda and a pillar of the U.S. commitment to reduce emissions as a signatory to the Paris climate agreement. The goal of the CPP is to reduce power sector carbon emissions by 32 percent below 2005 levels by 2030. The CPP establishes state-by-state emissions reduction targets, with options to shift away from coal-fired power by investing in renewable energy, energy efficiency, natural gas and nuclear power. Opponents have argued that the CPP goes beyond EPA's authority to regulate under the Clean Air Act and is unduly burdensome, and the Supreme Court has stayed its implementation pending the resolution of a legal challenge to the rule by numerous states and other stakeholders.

Among the plaintiffs in that lawsuit against the CPP is the State of Oklahoma, whose former Attorney General, Scott Pruitt, was recently confirmed as the new EPA Administrator. Pruitt opposes the CPP and has testified that he intends to "hew closely to the text and intent of the Clean Air Act when considering...further regulation of GHGs under that law." But any Trump Administration attempt to rescind or withdraw the CPP could be complicated and time-consuming. The Trump Administration is reportedly considering a variety of options to roll back the CPP, from issuing a new rule based on a more narrow interpretation of the Clean Air Act, to having the new rule focus only on efficiency improvements for power plants, to taking administrative actions short of issuing a new rule such as deferring enforcement of emissions reductions standards and/or approving lenient state implementation plans. The Administration's proposed fiscal year 2018 budget would eliminate EPA funding for the CPP and other climate change programs as part of a dramatic 31 percent overall reduction in the EPA budget.

With regard to the Paris Agreement on climate change, the Trump Administration has sent conflicting signals. During the campaign President Trump vowed to "cancel" the agreement, but after the election indicated he has an "open mind" about the climate change accord. Incoming Secretary of State Rex Tillerson implied support for continued U.S. participation in his confirmation hearing, stating that the U.S. is "better served" by "having a seat at the table to address this issue at a global basis...." Tillerson also testified, however, that he would review the Obama Administration's pledge to provide $3 billion over four years to the United Nations Green Climate Fund. Before President Obama left office, the State Department had already transferred $1 billion to the Fund. Indeed, the Trump Administration's budget proposal would eliminate State Department's Global Climate Change Initiative and U.S. funding for the Green Climate Fund.

While under President Trump the U.S. may remain a formal signatory to the Paris Agreement, it is important to note that the accord does not bind the new Administration to a particular greenhouse gas emission reduction target. The U.S. pledge and other countries' pledges are voluntary, subject only to mandatory reporting and review requirements. And the U.S. commitment to cut emissions is largely premised on prospective actions such as implementation of the Clean Power Plan and new vehicle fuel efficiency standards and appliance efficiency standards. In addition to the steps it has taken and is considering with regard to the CPP, for example, President Trump has directed the EPA and the Department of Transportation to review the fuel efficiency standards previously approved for model year 2022-2025 light duty vehicles.

Of course, U.S. CO_2 emissions will also be affected by market forces — such as the move away from coal to low-cost natural gas in electricity generation — and by policy and regulatory actions taken at the local, state and regional level. Indeed, with the federal government under President Trump and the Republican Congress acting to reduce regulation and government intervention, in the coming years the center of gravity for energy and environmental policy initiatives may move outside of Washington.

STATES FORGE AHEAD WITH THEIR OWN ENERGY POLICY AGENDAS

In many ways, the next four years could resemble the policy landscape during the 2000s when states forged ahead on climate and clean energy initiatives. For example, last decade, California established its economy-wide greenhouse gas cap-and-trade program, and northeastern states formed the Regional Greenhouse Gas Initiative (RGGI), which established a cap-and-trade program for the electricity sector.

As one might expect, California is expected to take a leading role among the states in shaping clean energy and climate change policy. California Governor Jerry Brown (D) is advocating for an extension of the state's cap-and-trade program from 2020, when it is currently set to expire, to 2030. Moreover, Brown 's plan is to pass the extension with two-thirds of the vote in both chambers of the California

Assembly in order to insulate the cap-and-trade program from future legal challenges. California's current cap-and-trade is currently facing legal challenges from businesses who contend that the emission allowance auctions constitute as a tax, and therefore under state law, requires two-thirds vote from the Assembly. Given Democratic supermajorities in both state chambers, Brown may get two-thirds support for new legislation, which could resolve legal uncertainty associated with the current cap-and-trade program. In addition, California is also scheduled to link its cap-and-trade program with Ontario next year, building upon the current linkage with Quebec.

The nine northeastern RGGI states are also continuing discussions on post-2020 CO_2 caps. RGGI has succeeded in reducing CO_2 emissions while generating revenue from allowance auctions for participating states. With low electricity prices and relatively flat load growth, the RGGI states are now weighing more aggressive annual reductions in its emissions cap. New York Governor Andrew Cuomo (D) is proposing a 3% annual decrease in the emissions cap after 2020. Some stakeholders are also pushing for a complementary emissions containment reserve, which would withhold allowances from the market in the event that allowance prices fell below a certain floor price.

In addition to discussions on RGGI's post-2020 caps, other northeastern states are forging ahead on other climate change and clean energy policy. The Maryland General Assembly recently overrode Governor Larry Hogan's (R) veto on legislation that increases the state's renewable portfolio standard (RPS) from 20% to 25% by 2020. The legislation also bolsters the solar carve-out from 2% to 2.5%. Last year, Connecticut, Massachusetts and Rhode Island partnered on a joint request for proposal for generators to provide the region with clean energy. The states selected seven projects, constituting 460 megawatts, to proceed to the next step of negotiating contracts, discussions which could be completed in the early part of this year. The Massachusetts Legislature may also consider legislation that would require that the state procure all of its electricity needs from renewable sources by 2035 and eliminate fossil fuel usage economy-wide by 2050.

It is not just coastal states that are pushing forward on energy policy, as a number of Midwestern states have recently reaffirmed their commitments to clean energy. In December, Michigan Governor Rick Snyder (R) signed legislation that increases the state's RPS from 10% to 15% by 2021. Other state lawmakers may push bills to roll-back or repeal state RPS, but these bills will likely face opposition from Governors, the renewable energy sector and the broader business community. Notably, last December, Ohio Governor John Kasich (R) vetoed legislation to make the state's RPS voluntary. In vetoing the legislation, Kasich, a former Republican Presidential candidate, stated that eliminating the RPS "risks undermining this progress by taking away some of those energy generation options, particularly the very options most prized by the companies poised to create many jobs in Ohio in the coming years, such as high technology firms." Kasich and the Ohio Legislature may battle again this year over potential changes to the state's RPS.

Finally, the courts will continue to play a significant role in the shaping of energy policy as some states and environmental organizations raise legal challenges to the Trump Administration's energy and environmental actions. For example, the California Assembly recently retained former U,S, Attorney General Eric Holder to advise them on looming litigation, including potential climate change lawsuits, against the Trump Administration. The anticipated litigation strategy is similar to the one employed during the Bush Administration that ultimately resulted in Massachusetts v. EPA, the seminal 2007 climate change case in which the U.S. Supreme Court held that the Clean Air Act provides EPA with the authority to regulate GHG emissions and that the agency must regulate emissions unless "it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do."

Thus, despite Trump Administration efforts to roll back many of the prior Administration's energy and climate initiatives, the next four years could see significant progress on climate change and clean energy through state and regional action. These initiatives, coupled with litigation, could ultimately pave the way for future federal action on climate change, either under the current President, or under a future Administration.

The 2017 IAEE Summer School in Beijing, China
Energy Market: Models and Practice

July 6-15, 2017

Led by Professor Andrew Kleit, PhD
Professor of Energy and Environmental Economics
Pennslvania State University

Prof. Andrew Kleit is a Professor of Energy and Environmental Economics, and his main area of research is Energy, Environmental and Mineral Economics. He has a great deal of teaching, researching and doing project experiences in the field of energy management and policy, global business strategies and energy, energy business and finance and so on. Moreover, he has published more than 50 articles in the Journal of Regulatory Economics, Energy Studies Review, Applied Economics, Resource and Energy Economics, etc., as well as more than 6 books and monographs. He has also received almost 20 research grants.

Content and Schedule

July 6
Registration Whole day
Reception 18:00

July 7-10 and July 12-15
Classes 09:00-12:00

July 7-10 and July 12-15
Seminar 14:00-17:00
Title Energy Market Research in China
Speaker Chinese Researchers

July 15
Closing Remarks 17:00-17:20

Tuition

Students	*US$*	*450.00*
Non Students	*US$*	*750.00*

Includes lectures and materials
Does not include transportation and accomodations.

Registration and Payment Methods

- Particpants must be IAEE members. If you are not, please go to the IAEE website to join: https://www.iaee.org/en/membership/application.aspx
- Participants should send the registration form to Sanmang Wu (wusanmang@sina.com) or Huajiao Li (hli@cugb.edu.cn) before June 15, 2017. After the selection, confirmation emails will be sent to applicants before July 15, 2017.
- The tuition fee of international participants should be paid directly to IAEE before June 15, 2017.
- For Chinese participants, the payment method will be in the confirmation email.

Certificate

All participants who successfully finish the courses will receive a certificate signed by IAEE Executive Director.

Venue

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Hosts

International Association of Energy Economics (IAEE)

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Registration Form

Name _____ Gender:___Male ____Female

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Will you need a room in the student dormitory? ___Yes ____No

E-mail form to Sanmang Wu (wusanmang@sina.com) or Huajiao Li (hli@cugb.edu.cn) before June 15, 2017.

Trump Administration Energy Policy Characterized by Deregulation, Uncertainty and Time Constraints

By Jared Anderson

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The U.S. energy industry craves deregulation almost as much as it craves regulatory certainty, which puts it at a crossroads with the Trump administration. Large energy projects like developing oil fields, building new high-voltage transmission, or constructing new power generation facilities are long-term, capital intensive ventures. The companies that build these projects – along with their shareholders – want as much certainty as possible that regulatory goal posts will not move throughout the course of their investment because this disrupts financial strategy and the models upon which final investment decisions were taken. At the same time, however, energy companies often grumble about onerous regulatory regimes that handcuff their ability to maximize profits. For this reason, the energy industry - oil & gas sector in particular – is excited about the energy regulation roll back currently underway. But the lack of clarity regarding long-term energy policy goals and impacts leaves energy business leaders cautiously optimistic about the regulatory changes to emerge over the next four years.

In addition to regulatory uncertainty in a broad sense, there is apprehension about unintended consequences associated with certain policy adjustments. For example, Chevron CEO John Watson cautiously discussed his views of the border tax adjustment issue during the oil major's Q4 2016 earnings call. "President Trump has indicated that the border adjustment concept is complex and I would agree with that. I think we need to take a close look at perhaps the consequences of that, both some that could be positive and the unintended consequences in terms of impact on consumers, exchange rates and knock on effects on the global economy," said Watson. "I have no doubt the administration will do a good job at doing that and will settle on the right kind of tax reform at the end of the day. But I think we need to have a little patience for the different ideas that are being put out there and hopefully we will get to the right outcome," he added.

Similarly, cautious optimism was on display when Rayan Lance, ConocoPhillips' Chairman and CEO, responded to a question during their Q4 2016 earnings call regarding how the new administration's energy policies might impact the company's operations. "Well, I think it is a little early to tell. We certainly hope that the administration at least in terms of what they've talked about is going to give us a little bit of regulatory relief, which we think is good. There are some things that the last administration were proclamating [sic] that were a bit worrisome on how it might slow the business down, both on the regulatory side and on the infrastructure side. We've seen President Trump make his decisions on DAPL [Dakota Access Pipeline] and on Keystone, so hopefully some of that infrastructure will get moving that's needed to be there."

But when specifically addressing the border tax, Lance went on to say, "I think a lot of uncertainty on the border adjustment tax and its potential impact on how crude and other products move across the border, whether it's south to Mexico or some of the crude that moves down from Canada into the U.S. I think there is a little bit to be seen yet what that means. Does it get exempted or how are the details of that going to unfold. We are watching it closely, but I think it's a little bit too early to tell on that last piece."

And while the Trump administration has quickly moved to roll back several of the previous administration's energy policies – including existing source methane emissions regulations; federal land methane emissions; DAPL and Keystone XL construction; parts of Dodd-Frank and more – these constitute low-hanging fruit procedurally. It is easier to throw out rules that were enacted toward the end of Obama's term but never finalized than it is to erase regulations already signed into law. Lengthy public comment periods of up to a year are required in many cases. And simply removing an existing law is not adequate because it must be replaced with a new piece of legislation that achieves similar intent, which raises the bar for the White House and Congress.

Writing and passing legislation is an arduous, time-consuming process and there are only so many days on the legislative calendar which means energy policy battles will need to be carefully chosen. We also know repealing Obama Care and tackling tax reform are high on President Trump's agenda, which further limits the amount of time and focus that can be directed toward energy policy over the next four years.

An Alternative U.S. Energy Policy

By Douglas B. Renolds

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During the Reagan Administration, I worked as a mechanical engineer in a curious building with solar energy panels on the roof, all pointing downward. The contractor I was working for had received a Department of Energy grant so that they could collect solar energy data, but then turned the collectors downward to protect them from the elements such as hailstorms, monsoons, heavy snowfall and blowing dust. In the mean time, the military defense contractor I worked for had me researching and developing military technology, some of which was used in the Middle East to help stabilize the region and keep the oil fields safe. The company also worked on a few nuclear power projects.

Thus, United States energy policy over the last 30 years has had three pillars: defending Middle Eastern oil and activating domestic oil; researching and subsidizing renewables; and developing nuclear power. But now there are two challenges on the energy horizon: global warming and peak oil. My job here is not to address these controversies, as global climate change may occur no matter what we do, and peak oil may not occur no matter what we do. They both may hurt mine and future generations. Still, these two concerns should be taken into account, since we already have laws and policies in place to reduce carbon emissions and since the U.S. has already spent billions of military dollars defending and stabilizing Middle Eastern oil countries, which suggests that oil scarcity is evident.

Therefore, I consider three energy policies: oil supply, oil demand and electric utilities. On the oil supply side, it is important to keep all options open so that if oil production is constrained from one region, other regions will still be available to provide output to help assuage any oil price shocks. On the oil demand side, we should have a gasoline tax and deregulate some of our transportation markets to allow for alternative modes of transport particularly private mini-buses. Finally, in regard to electric utilities, we need to increase nuclear research, development and the placement of more reactors even as we place an emissions fee on carbon releases. One way we can create incentives for more effective electric utility management, though, is not by instituting competition in power generation, but by instituting a stock-option like incentive mechanism for utility managers.

Start with oil. On the oil supply side, the story is that there is plenty of shale oil around the world, even though, only the U.S. has developed it robustly to date. Poland, for example, found it quite difficult to develop its shale gas because clay is co-located with the shale, thereby reducing the effectiveness of the fracturing. So, even though the Poles were highly motivated to make it work, it has yet to be feasible. In addition, shale oil is often light-weight, so that as shale oil becomes a larger percent of U.S. production, we will see bottlenecks in refining the C3 to C7 hydrocarbon liquids into high octane gasoline and heavier jet fuel and diesel fuel. Considering that conventional oil may be constrained, and shale oil may have refinery bottlenecks, then it's a good idea to have multiple back-up strategies to stabilize the oil market.

One can always debate the merits of the 2003 Iraqi invasion, but one aspect was stabilizing oil-producing regions in the area. Rightly or wrongly, oil supply is important enough that American lives have been repeatedly put at risk. The way to reduce tensions in the Middle East, then, would be to allow greater oil and gas exploration in the U.S. Arctic, and on U.S. off-shore continental shelves. Already, major oil fields in the Middle East, Africa and Western Siberia, are quite mature and could decline all at once. If on top of that, Middle Eastern politics become more volatile, we will see another jolt in the oil market. Therefore, it is prudent to allow oil exploration in the Arctic National Wildlife Refuge (ANWR), the National Petroleum Reserve Alaska (NPRA), the Arctic off-shore, as well as the Atlantic and Gulf Coast off-shore regions. In the 1960s, North Slope prospecting, which discovered Prudhoe Bay, allowed the U.S. to be well positioned in the 1970s to withstand the oil price shocks. Alaskan oil didn't solve the problem; it just mitigated it. Nevertheless, we might see history repeat.

Furthermore, when the Trans-Alaska oil pipeline was first envisioned, there were dire forecasts in its environmental impact statement. Ironically, though, caribou numbers actually increased rather than decreased, as was predicted, after the pipeline was built. Still, it seems inconceivable that saving a few caribou in Alaska is really worth as much as a potential oil war putting American lives at risk in the Middle East. Even such adverse environmental events as the Exxon Valdez oil spill and the BP, Deepwater Horizon oil spill killed or hurt very few people and caused limited environmental damage in comparison to the first and second Persian Gulf wars. Oil leasing should then be allowed to go forward

if the industry believes there are good prospects, with reasonable—but not overly zealous—permitting processes to protect the environment. Open up ANWR, NPR-A and all U.S. off-shore regions.

After all, much of the economic value of oil production goes to local people, and each oil prospect is vetted by those most affected. In fact, oil development also gives native villages funding to help acclimate their homes to permafrost reductions and build Dutch-like dikes to protect against storm surges caused by less sea ice. So, far from ruining Arctic livelihoods, oil development can enhance economies of the north and the environment. Oil and gas activity can give funding for polar bear artificial islands to sustain long swims from the floating sea ice to the mainland. Such islands can provide a natural bear hunting base.

On the oil demand side of the market, electric car development is moving along and can help reduce the need for liquid petroleum fuels, as can high mileage, propane or natural gas vehicles. However, instead of regulating and deciding the kinds of cars that should be built; thereby pushing technologies that may eventually fail, it would be better to simply put a tax on gasoline and let the market decide its own strategy for reducing oil use as a demand side back-up strategy.

Typically the public does not like taxes, such as a gasoline tax, but doesn't mind automotive regulations, such as fleet mileage regulations, even though regulations can be more costly than any given tax. To say that all taxes are bad and all regulations are good loses the nuance of costs and benefits of each. Specific regulations on cars to increase mileage can add costs, can create odd designs for cars and can reduce social benefits. Letting the market decide the kinds of cars to produce is a better choice. A gasoline and diesel fuel tax forces consumers to choose how to reduce their use of gasoline and diesel with either high mileage or alternative vehicles, whichever works better for them. Nevertheless, the need for large vehicles, farming vehicles and aircraft are still going to be strong, so heavy liquid petroleum fuels, not just electric batteries, propane or natural gas, are always going to be needed.

Still, justification for a gasoline tax is needed. You can argue that a gasoline tax would help reduce carbon emissions and reduce the need for gasoline in the event of a peak oil occurrence. However, a more immediate need for the tax is to pay for the billions of dollars spent on military stabilization in the Middle East, where much of the world's oil resides. Plus, you might want some of the gasoline tax money used to maintain American infrastructure, which also adds efficiency to the U.S. economy by better connecting businesses to each other and to consumers. Electric and alternative vehicles can have an electronic chip placed inside to measure mileage so that alternative vehicles can pay a mileage tax for their fair share of infrastructure. Also, a tax on gasoline should not necessarily pay for mass-transit, as each city can fund mass-transit with an inner-city congestion tax, where each vehicle driving on a congested highway can have an on-board electronic chip and be charged a fee for rush-hour driving.

Going further into oil demand, while there is much ado about Uber, self driving cars and working from a distance, another interesting oil demand side policy is to institute some experiments with free markets for alternative mass transit. Poland has a number of private mini-buses, as an alternative to city buses and metro systems, and which allow people to use less oil for commuting purposes. The mini-buses are run by private companies in and around the cities, and the companies are allowed to put route schedules on the side of roads and to pick people up at those locations. This is a kind of de-regulation of metro–bus systems that could be a middle road between taxis and government run mass-transit systems in order to provide a way for commuters to travel that is cheaper than Uber but more flexible than a city bus. It might induce people to use their cars less and save oil. Prototype cities, with mini-bus de-regulation, should be set up. Other cities will then try such de-regulation as they see fit. Ride sharing is also common and useful, but private mini–buses can follow a schedule which helps commuters to better plan their rides.

Besides oil, we need to improve electric utilities where a multitude of energy sources from renewables, to coal, to natural gas, to nuclear power are necessary. Currently, electric utility regulators are much concerned with global warming, but as with the automotive market, regulators tend to reduce carbon emissions using regulations and subsides, such as subsidizing solar and wind power and regulating the use of coal, rather than using markets to get the job done. It is easier for the general public to swallow regulations, rather than carbon taxes, to reduce greenhouse gases (GHG), even though a carbon tax might allow utilities to find more effective, universal solutions. Specific subsidies and specific regulations mean that politicians are picking winners and losers in carbon reduction technologies, rather than letting the markets decide. An alternative policy would be to just choose an appropriate carbon tax and let the utilities decide for themselves the lowest cost method to deal with that climate change cost. In that case, if coal is a cheaper, more reliable generating option even with a carbon tax, so be it.

Policy should not be so much a question of finding the correct carbon tax per ton of carbon emitted, which may never be found; rather, it should be about deciding the best options for reducing carbon and running a utility, given the costs and risks of each strategy. The carbon tax revenues can then be used for research, particularly on nuclear power.

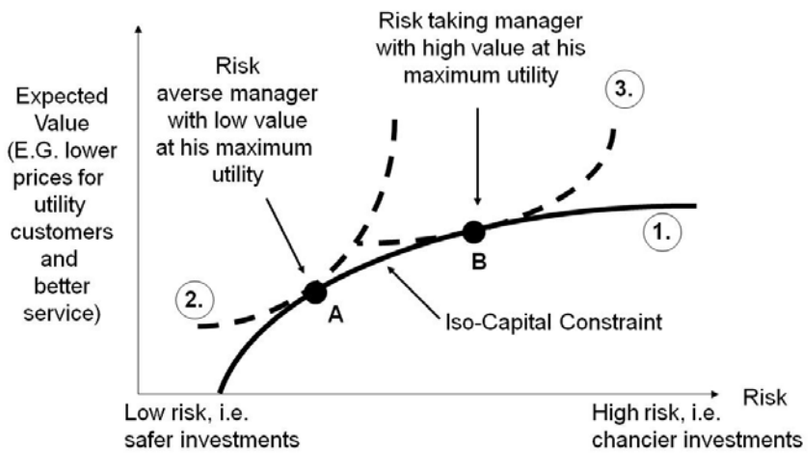
Speaking of nuclear power, the Fukushima disaster should not have happened given the data on Japanese earthquakes and engineering solutions available. Therefore, it would be sensible not to throw out the nuclear option, but to continue to have more pure research surrounding nuclear power, including small modular reactors (SMRs) and thorium reactors. Prototypes can be built and tested at safe test sites in order to see how they work and then eventually put in place. Small nuclear generators, if successful, can be placed close to electric consumers in order to reduce power line losses, and carbon emissions. They can make the management of power markets easier since they will have fewer swings in the power production side than many renewables have. Plus, they can be used for small towns as well as big cities.

Moving forward, the conventional philosophy surrounding electric utilities is that of having a regional distributor, which dispatches power from solar rooftop producers, wholesale generators and interties, and can also ask for smart grid, flex-user reductions. Theoretically, in such a scenario competition should drive prices down and induce innovative technology. However, competition doesn't always work. In the, so-called, competitive automotive industry, pickup trucks cost ten percent more every year despite better technology, multiple competitors and low headline inflation. If competition doesn't work there, it is doubtful it works in the highly constrained, complex and regulated power generation markets. Given all the regulations in the utility sector; the difficulties in managing, dispatching and purchasing electricity; the potential for market power, and the need for long-range planning, the hodge podge of forces can induce high costs. On the other hand, if a regional power market were under a single roof, i.e., a regulated monopoly utility, which generated, distributed and managed all of its own electric power, then you can be sure there would be no incentive to innovate, to cut costs or to reduce customer prices as the rewards to do so are low with a regulated rate of return.

Nevertheless, a monopoly should theoretically be cost effective to manage, to find expense cutting generating options, and to integrate new technologies. For example, if the monopoly utility finds solar energy to be cost competitive given a carbon tax, it can set up its own solar and wind energy projects, contract for them, or manage a set of home rooftop solar and wind projects. If the utility finds a large nuclear reactor to be cost effective, it can build one as part of a suite of alternative generators and back-up power options. All these options are better planned and managed by a regional authority that can gauge how best to fit in the various options considering economies of scale, risk, long term needs and intertie options. But, then, add one wrinkle.

According to Markowitz's (1952a 1952b and 1959) portfolio theory and Friedman and Savage's (1948) risk theory, there is a financial/economic relationship between risk and reward, where investors can choose between less risky bonds, with a low return (low value), and more risky equities, with a high return (high value), or some combination, as shown in curve 1 of Figure 1. An investor with only one investment option would normally have a more risk averse investment utility at point A of Curve 1 and 2. However, if that same investor can diversify his portfolio, his risk averse investment utility moves to point B of Curve 1 and 3. However, a CEO of a single corporation relies on one paycheck and so tends towards a low-risk, safe strategy resembling point A of curve 2, even though investors want the CEO to take more risk and be at Point B of Curve 3, because the investors have nothing to lose as they are diversified.

Therefore, in corporate management theory, investors have found a way to



1. Typical company Iso-capital constraint curve
2. Iso-Utility Curve for more risk averse manager
3. Iso-Utility Curve for less risk averse (more risk taking) manager

Figure 1. Manager Utility Maximization with an Iso-Capital Constraint

move CEOs from the low risk taking point A of curve 2 to the high risk taking point B of curve 3 using stock options. If the CEO's risk taking is successful and company profits expand, then the CEO can sell his stock options for a high price and gain a bonus for his risk taking. If, on the other hand, his risk taking is unsuccessful and there is a company loss, he still receives the lower bound of the option, that way he doesn't lose much, just as investors don't lose much, as they are hedged. We may want to take a page out of finance theory and do the same with electric utility presidents and CEOs, i.e., give each utility manager a stock option–like bonus for reducing rate payer costs, mitigating power disruptions, and increasing market share (which would entail a growing local economy), but guarantee them a lower bound if their efforts are unsuccessful and they raise costs. That is, instead of using competition in electric utilities to force innovative cost cutting, just use a stock-option like bonus.

Many will criticize such a strategy because of the way the 2008 financial crisis played out with too much risk taking for the benefit of investor short run gains, even while society suffered a huge financial crisis. Indeed, this type of utility management strategy could create a California, utility, 2000/2001, style energy crisis. The problem is, based on our energy structure, we may be facing many physical risks from global climate change to peak oil related economic recessions. So, in order to be prepared for these other risk dimensions, we may need more risk taking within each regional electric utility to adapt to change. Therefore, by giving monopoly utilities complete control, by taxing carbon emissions and by giving the utility managers a stock-option like incentive to take more risks, then social value can increase.

In conclusion, the U.S. needs to open up all regions for oil and gas exploration development, particularly the Alaskan Arctic and U.S. off-shore regions, in the event there is another oil price shock. Such development can actually enhance efforts to save the local people and environments. On the demand side, a gasoline tax can induce more oil conservation. Plus, deregulation of city bus systems may give more ways to reduce oil use and still give commuters better ways to move around. Finally electric utility policy needs to impose a carbon emissions fee and use the revenue to continue with researching, developing and using nuclear power, particularly small modular reactors and thorium reactors. However, another innovation that can enhance utility effectiveness is giving managers of utilities stock option like bonuses for optimizing power customer prices and service.

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The Trump Effect on U.S. Hydropower

By Thomas N. Russo and Kelly R. Schaeffer

The U.S. Army Corps of Engineers (Corps) could play a lead role in increasing the number of hydropower projects licensed at its navigation and flood control dams. The biggest challenge to realizing this is not the lack of legislation or new regulations, but rather the lack of experience and familiarity with the review of hydropower project proposals. The Trump Administration's penchant for results over process may provide added incentives to both the Corps and the Federal Energy Regulatory Commission (FERC) to cooperate and facilitate more non-federal hydropower development at Corps dams. Successfully implementing a recently signed Memorandum of Understanding (MOU) between these two agencies is the key to success.

Tom Russo, President of Russo on Energy LLC, is an Energy and Environmental Specialist with over 20 years' experience in hydropower at the FERC. He provides strategic advice on hydropower and conducts training in Hydro 101 and FERC Hydro 101. Kelly Schaeffer, Principal at Kleinschmidt Associates, has worked extensively with the U.S. Army Corps of Engineers as a cooperating agency. She has nearly 25 years of experience with implementing the NEPA process for the Federal Energy Regulatory Commission, the U.S. Department of Energy (DOE), and the U.S. Department of Agriculture-Forest Service.

LOTS OF DAMS WITH NO POWER

There are about 78,000 existing dams in the U.S. that don't have hydropower per the Department of Energy's Oak Ridge National Laboratory study. Many of these dams may not be amenable to hydropower for technical reasons such as the prohibitive cost of power lines to vacate the power to the grid. In other cases, installing hydropower may interfere with existing uses or the dams may not be in very good condition.

While the public may not exactly consider hydropower in the U.S. as a "growth industry", we have no doubt that President-Elect Trump's transition team will make him keenly aware of hydro's potential in making the U.S. energy independent, if not greener. We don't believe that there will be a hydropower rush, nor will environmental reviews be reduced. Instead, the new Administration will simply ask, "What are the obstacles for putting hydropower at existing dams that have no power and what can we do about it?"

Some of these existing non-power dams are operated by the Federal government to promote navigation, irrigation, flood control, and water supply. For Trump, these dams may serve as a virtual "no brainer" and opportunity for those public and private entities wishing to develop green, electric power resources and contribute to America's energy independence. The Corps dams that don't have power facilities will always have navigation and flood control as a major goal; however, those priorities don't preclude developing new hydroelectric power at these dams. It just means that any hydropower construction and operation is subject to the Corps' original purposes of the projects that Congress authorized years ago and the Corps' processes and conditions. Navigation and flood control would still be the major project purpose and hydropower operations could be a secondary benefit.

POWERING EXISTING DAMS IS NOT A NEW IDEA

Congress and the Obama Administration have recognized the potential for adding hydropower to existing dams by passing the Hydropower Regulatory Efficiency Act of 2013. In addition, the proposed North American Energy Security and Infrastructure Act (S. 2012 and H.R. 8) also had hydropower at existing dams in mind. Unfortunately, S. 2012 and H.R. 8 did not make it out of conference and hopefully will be taken up by the next Congress and the Trump Administration.

On a brighter note and with the support from the Department of Energy's Hydropower Program, in July 2016, the Federal Energy Regulatory Commission and the Corps signed a Memorandum of Understanding (MOU) that establishes a framework for coordination between the two agencies to facilitate a timely review and action on hydropower applications on existing Corps dams. This MOU lays out the process for both agencies, but an implementation program has yet to be established. The MOU recognizes that cooperation in preparing a single NEPA document can be used to efficiently review any hydropower proposal. Hence, both the Corps and FERC can fulfill their NEPA obligations and use one document to determine appropriate terms and conditions required under the Clean Water Act and Federal Power Act.

A MOU DOESN'T NECESSARILY EQUATE TO ADDITIONAL HYDROPOWER

While getting federal agencies to work together may be cause for celebration inside the Capital beltway, it may fall short in a Trump Administration that is very results-oriented. It's one thing to spend resources developing a MOU, but entirely another to implement it. The real work is in the latter, which is frequently overlooked or not funded. We firmly believe that Trump's emphasis over the next four years for all federal agencies will be to achieve results—using metrics and moving at the "speed of business". He'll want to know how many hydropower projects can be licensed at Corps using the FERC-Corps MOU and how quickly these projects could be operational. Fortunately, FERC staff are accustomed to processing hydropower applications filed at Corps dams and several projects have been licensed. A bigger challenge and potential hurdle for Corps districts and hydropower developers is how the Corps intends to execute their review process under the MOU. Implementation will not just happen.

The 105-MW Meldahl Project at the Corps' Meldahl Lock & Dam
Source: American Municipal Power, Inc.

The Corps is a diverse organization with eight divisions and over 30 districts in the U.S. Each district follows certain guidelines on a national level, but they also have regional preferences and policies. Due to the "decentralized" nature of the Corps, a knowledge and experience gap may exist at many district offices regarding the MOU and how it could be implemented to increase hydroelectric development in the United States. Corps staff in many districts may not have much experience working with FERC and in some cases, only have limited understanding of the MOU. Also, hydropower developers may not understand what the Corps district staff will require to complete the licensing process.

MAKING IT HAPPEN

Both the Corps and FERC must satisfy their review processes under Sections 404 and 408 of the Clean Water Act and Section 10a of the Federal Power Act, respectively as well as NEPA. Additionally, FERC will take the lead for the NEPA review process under the MOU. Luckily, we do have some success stories and lessons learned on Ohio River Corps dams that should help other Corps districts and developers alike. The City of Hamilton successfully applied to FERC for a license and added hydropower to some Corps dams. The City would probably attest to the fact that it was a lot harder than they initially thought. While a developer would realize savings because they won't incur the costs of building a new dam, they must design and construct a hydropower project so that it meets both the Corps standards and specifications, as well as FERC's.

The Corps policy of cooperating with other federal agencies may be problematic and get in the way of successfully implementing the MOU. Here's why. FERC normally prepares NEPA environmental assessments (EA) instead of environmental impact statements (EIS), because it believes that it can mitigate most adverse impacts by conditioning the license with terms and conditions, including the Corps' mandatory conditions. The overall result is a Finding of No Significant Impact or FONSI. FERC then would ensure over the term of the license that the hydropower operator is complying with the license terms. We underscore that even when a FERC license is issued, the hydropower operation is secondary to the primary purposes of the Corps project, and the Corps dictates when and how the project will operate.

In the above scenario, the EA would be prepared jointly by both the Corps and FERC. However, when you take a harder look how the Corps cooperates with other federal agencies, there is cause for concern. The Council on Environmental Quality's 2016 survey shows that the Corps cooperated with other federal agencies in 50 percent of its EISs, but *less than 1 percent of its EAs.* In fact, the Corps reported that many of the EAs it prepared were "too quick or deemed not significant enough" for the Corps to ask agencies to cooperate or for the agencies to request to be cooperating agencies (CEQ 2016). So, unless the Corps districts change their policies on cooperating in the preparation of an EA with FERC, the MOU will not be successfully implemented.

CLOSING THE KNOWLEDGE GAP

So how do we move forward with implementing the MOU? Closing the knowledge and experience gap is key, but a "one-size fits all" approach is probably not a good idea. The Corps at the national level has already developed the MOU. The implementation will happen at the District level so each Corps District needs to take ownership of the Section 408 process that will be triggered when a hydropower

application is filed with FERC at a Corps dam and be familiar with the processes laid out in the MOU. Getting up to speed would align with President-elect Trump's penchant for results and clearly be beneficial to the Corps and individual staff, as well as FERC staff. Training the Corps staff in implementing the MOU would be a step in the right direction. Hydropower developers require the same training.

The Corps is not the only group that needs to realign their processes and expectations. Potential hydropower developers and applicants should not fall into the "trash on time (TOT)" pit! Some hydropower applicants think that 10 percent of the engineering drawings or subpar drawings will suffice for the Corps' decision making. Wrong! While this info might be delivered "on time", it could ultimately delay the engineering and NEPA environmental reviews—making the entire process tedious and frustrating to all stakeholders. State agencies that issue Clean Water Act section 401 certificates would also probably find such materials unacceptable. Fortunately, developers can address the TOT problem by good communication with the Corps to determine their expectations and submitting timely and quality materials the first time.

In summary, the FERC and Corps MOU has the potential to be a game-changer and could result in greener electric power projects and increased beneficial uses of our waterways. Like all games however, without implementing the plays that are in the playbook, we can't put points on the scoreboard. The Trump administration will want to see numbers on that scoreboard. Attracting applicants requires a thorough knowledge of how the MOU processes translate to on-the-ground actions.

We are ready to get the players not only reviewing and understanding the playbook but also getting excited about adding renewable energy to our nation's energy independence portfolio!

Careers, Energy Education and Scholarships Online Databases

IAEE is pleased to highlight our online careers database, with special focus on graduate positions. Please visit http://www.iaee.org/en/students/student_careers.asp for a listing of employment opportunities.

Employers are invited to use this database, at no cost, to advertise their graduate, senior graduate or seasoned professional positions to the IAEE membership and visitors to the IAEE website seeking employment assistance.

The IAEE is also pleased to highlight the Energy Economics Education database available at http://www.iaee.org/en/students/eee.aspx Members from academia are kindly invited to list, at no cost, graduate, postgraduate and research programs as well as their university and research centers in this online database. For students and interested individuals looking to enhance their knowledge within the field of energy and economics, this is a valuable database to reference.

Further, IAEE has also launched a Scholarship Database, open at no cost to different grants and scholarship providers in Energy Economics and related fields. This is available at http://www.iaee.org/en/students/List-Scholarships.aspx

We look forward to your participation in these new initiatives.

CONFERENCE OVERVIEW

Over the last decade, energy markets have experienced a period of extreme volatility. The growth in unconventional oil production in the United States, and the retreat of OPEC from stabilizing the market, have both contributed to the recent sharp decline in oil prices. World events, including Nigerian militant attacks and the return of Iranian crude to the world market, will continue to create uncertainty about world oil supply. Events arising in the US, from first LNG export cargos to the prerogatives of a new presidential administration will also have far-reaching effects for oil & gas markets. At the same time, the US economy's reliance upon electricity continues to grow as demand for the nation's number one fuel for dispatchable generation, coal, is dwindling. The 35th USAEE/IAEE Conference will provide a forum for informed and collegial discussion of how the highs and lows of the current and future energy markets will impact all stakeholders—from populations to companies to governments—in North America and around the world.

What better location to discuss the past and possible future of the energy industry than Houston? It has been known as the "Energy Capital of the World" since Spindletop erupted in 1901, and has remained the home for global oil and gas companies since the early 20th century. Today it is home to offices of most major oil and gas companies.

Houston has seen many oil market booms and busts, but, partly in response to these cycles, it has also developed diverse energy sector industries beyond oil and gas. In particular, Houston serves as the renewable energy innovation headquarters for the state of Texas, which is home to more than 12,000 MW of wind capacity with several thousand more megawatts still under development. Houston also hosts engineering firms focused on energy construction projects, major banks operating in energy trading and energy project finance, major law firms specializing in energy issues, a vibrant software industry focused on energy applications, and a large diplomatic community with analysts focused on energy industry developments.

As the world looks to smooth the ride in oil & gas prices, resolve the dilemmas of energy affordability and environmental responsibility, and cultivate disruptive leaps forward in technology, this conference can provide the perfect setting for discussions around policy approaches, economic indicators and technological drivers. The 35th USAEE/IAEE Conference is sure to contribute to the analysis of these critical issues. Speakers will include key figures from industry, academia and government. The conference also will provide networking opportunities for participants through informal receptions, breaks between sessions, public outreach, and student recruitment. There also will be offsite tours to provide closer insight into why Houston will continue its role as *the* global energy hub in the years and decades to come.

TOPICS TO BE ADDRESSED INCLUDE:

The general topics below are indicative of the types of subject matter to be considered at the conference. A more detailed listing of topics and subtopics can be found by clicking here: www.usaee.org/usaee2017/topics.html

- How to Survive, Adapt & Evolve in Oil & Gas
- Energy Finance and Commerce
- Lifecycle Costs of Energy Technologies
- LNG Markets
- Community Impacts of the Energy Industry
- Energy Risk & Uncertainty
- Electricity Market Outlook: Supply & Demand
- Midstream/Downstream Oil & Gas Trends
- Electricity Grids
- The Future of the Energy Sector & Geopolitical Impact
- Energy in The Age of Volatility
- Other topics of interest including new hydrocarbon projects, transportation innovation, generation, transmission and distribution issues in electricity markets, etc.

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USAEE United States Association for Energy Economics

IAEE International Association for Energy Economics www.iaee.org

USAEE Houston

35TH USAEE/IAEE NORTH AMERICAN CONFERENCE
CALL FOR ABSTRACTS

We are pleased to announce the Call for Abstracts for the 35th USAEE/IAEE North American Conference, *Riding the Energy Cycles*, to be held November 12-15, 2017, at the Royal Sonesta Hotel, Houston, Texas, USA.

The deadline for receipt of abstracts for both the Concurrent Sessions and the Student Poster Session is **MONDAY, JUNE 5, 2017**.

CONCURRENT SESSIONS

There are two categories of concurrent sessions: 1) current academic-type energy economics research, and 2) practical case studies involving applied energy economics or commentary on current energy-related issues. This latter category aims to encourage participation not only from industry but also from the financial, analyst and media/commentator communities. In either instance, papers should be based on completed or near-completed work that has not been previously presented at or published by USAEE/IAEE or elsewhere. Presentations are intended to facilitate the sharing of both academic and professional experiences and lessons learned. It is unacceptable for a presentation to overtly advertise or promote proprietary products and/or services. Those who wish to distribute promotional literature and/or have exhibit space at the Conference are cordially invited to take advantage of sponsorship opportunities – please see www.usaee.org/usaee2017/sponsors.html. Those interested in organizing a concurrent session should propose a topic and possible speakers to Professor Peter Hartley, Concurrent Session Chair (hartley@rice.edu) Please note that all speakers in organized concurrent sessions must pay speaker registration fees and submit abstracts.

CONCURRENT SESSION ABSTRACT FORMAT

Authors wishing to make concurrent session presentations must submit an abstract that briefly describes the research or case study to be presented.

The abstract must be no more than two pages in length and must include the following sections:

a. Overview of the topic including its background and potential significance

b. Methodology: how the matter was addressed, what techniques were used

c. Results: Key and ancillary findings

d. Conclusions: Lessons learned, implications, next steps

e. References (if any)

Please visit www.usaee.org/usaee2017/PaperAbstractTemplate.doc to download an abstract template. All abstracts must conform to the format structure outlined in the template. Abstracts must be submitted online by visiting www.usaee.org/usaee2017/submissions.aspx. Abstracts submitted by e-mail or in hard copy will not be processed.

Student Poster Session

The Student Poster Session is designed to enable students to present their current research or case studies directly to interested conference delegates in a specially designed open networking environment. Abstracts for the poster session must be submitted by the regular abstract deadline and must be relevant to the conference theme. The abstract format for the Poster Session is identical to that for papers; please visit www.usaee.org/USAEE2017/PaperAbstractTemplate.doc to download an abstract template. Such an abstract should clearly indicate that it is intended for the Student Poster Session —alternatively that the author has no preference between a poster or regular concurrent session presentation. Abstracts must be submitted online by visiting www.usaee.org/USAEE2017/submissions.aspx. Abstracts submitted by e-mail or in hard copy will not be processed. Poster presenters whose abstracts are accepted should submit a final version of the poster electronically (in pdf format) by September 4, 2017 for publication in the online conference proceedings. Posters for actual presentation at the conference must be brought directly to the conference venue on the day of presentation and must be in either ANSI E size (34in. x 44in.) or ISO A0 size (841mm x 1189mm) in portrait or landscape format.

Presenter Attendance at the Conference

At least one author of an accepted paper or poster must pay the registration fees and attend the conference to present the paper or poster. The corresponding author submitting the abstract must provide complete contact details—mailing address, phone, fax, e-mail, etc. Authors will be notified by July 21, 2017, of the status of their presentation or poster. Authors whose abstracts are accepted will have until September 4, 2017, to submit their final papers or posters for publication in the online conference proceedings. While multiple submissions by individuals or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each author may present only one paper or one poster in the conference. No author should submit more than one abstract as its single author. If multiple submissions are accepted, then a different author will be required to pay the registration fee and present each paper or poster. Otherwise, authors will be contacted and asked to drop one or more paper(s) or poster(s) for presentation..

STUDENTS In addition to the above opportunities, students may submit a paper for consideration in the Dennis J. O'Brien USAEE/IAEE Best Student Paper Award Competition (cash prizes plus waiver of conference registration fees). The paper submission has different requirements and a different deadline. The deadline for submitting a paper for the Student Paper Awards is July 7, 2017. Visit www.usaee.org/usaee2017/bestpapers.html for full details.

Students are especially encouraged to participate in the Student Poster Session. Posters and their presentations will be judged by an academic panel and a single cash prize of $1,000 will be awarded to the student with the best poster and presentation. For more details including the judging criteria visit www.usaee.org/usaee2017/postersession.html

Students may also inquire about scholarships covering conference registration fees. Please visit www.usaee.org/usaee2017/scholarships.html for full details.

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CAEE

AMEE

Energy professionals meet with IAEE Immediate Past President Gurkan Kumbaroglu to map out a course of action to develop an IAEE Affiliate in Croatia.

IAEE/Affiliate Master Calendar of Events

(Note: All conferences are presented in English unless otherwise noted)

Date	Event, Event Title and Language	Location	Supporting Organization(s)	Contact
2017				
April 3-5	6th ELAEE Conference *New Energy Landscape: Challenges For Latin America*	Rio de Janeiro	ALADEE	Luciano Losekann luciano.dias.losekann@gmail.com
April 23-25	10th NAEE/IAEE International Conference *Theme to be Announced*	Abuja, Nigeria	NAEE	Wumi Iledar wumi.iledare@yahoo.com
June 18-21	40th IAEE International Conference *Meeting the Energy Demands of Emerging Economic Powers: Implications for Energy And Environmental Markets*	Singapore	OAEE/IAEE	Tony Owen esiadow@nus.edu.sg
September 3-6	15th IAEE European Conference *Heading Towards Sustainability Energy Systems: by Evolution or Revolution?*	Vienna, Austria	AAEE/IAEE	Reinhard Haas haas@eeg.tuwien.ac.at
November 12-16	35th USAEE/IAEE North American Conference *Riding the Energy Cycles*	Houston, TX, USA	USAEE	David Williams usaee@usaee.org
2018				
June 10-13	41st IAEE International Conference *Security of Supply, Sustainability and Affordability: Assessing the Trade-offs Of Energy Policy*	Groningen, The Netherlands	BAEE/IAEE	Machiel Mulder machiel.mulder@rug.nl
September 19-21	12th BIEE Academic Conference *Theme to be Announced*	Oxford, UK	BIEE	BIEE Administration *conference @biee.org*
2019				
May 26-29	42nd IAEE International Conference *Local Energy, Global Markets*	Montreal, Canada	CAEE/IAEE	Pierre-Olivier Pineau *pierre-olivier.pineau@hec.ca*
August 25-28	16th IAEE European Conference *Energy Challenges for the Next Decade: The Way Ahead Towards a Competitive, Secure and Sustainable Energy System*	Ljubljana, Slovenia	SAEE/IAEE	Nevenka Hrovatin *nevenka.hrovatin@ef.uni-lj.si*

Nuclear Energy Policy in the United States: Between Rocks and Hard Places

By Ben Wealer, Victoria Czempinski, Christian von Hirschhausen and Sebastian Wegel

INTRODUCTION

Nuclear energy offers some of the most daunting (and under-researched) challenges to policymakers everywhere that it has been developed and used to date, including the United States. In contrast to the policy issues that arise in other areas such as fossil fuel markets, renewables policies, and energy efficiency, where market structures are dynamic and technological progress is fast, the key issues surrounding nuclear energy have remained relatively constant over time and are long-term in nature, extending up to a million years when it comes to waste management. It is, therefore, unsurprising that the new US administration faces similar issues to the previous one, and that these are not very different from issues faced by other administrations over the past decades. Key among them are the financing of nuclear power plants, the decommissioning of obsolete plants, and the storage of nuclear waste in the medium and long run.

The authors are with the Workgroup for Infrastructure Policy at the Berlin University of Technology (corresponding Author: Ben Wealer: bw@wip.tu-berlin.de), where they are part of a long-term research program on nuclear energy, run jointly with the German Institute for Economic Research (DIW Berlin).
They thank Clemens Gerbaulet for research support; the usual disclaimer applies.

See footnotes at end of text.

NUCLEAR ENERGY IN THE UNITED STATES

Figure 1 shows the construction and shutdowns of all reactors in the United States since 1957, as well as a forecast of future shutdowns based on corporate announcements (where available) and the latest reports by the Nuclear Regulatory Commission (NRC). We see growth in the 1960s and 1970s, with construction on not less than 25 reactors having begun in 1968 alone. Construction came to a sharp halt, however, after 1978, leading to the decline of reactor startups after 1987. The last nuclear power plant (NPP) to go online was the Watts Bar 2 plant (in Watts Bar, TN) in October 2016, where construction had begun in 1973. The 2005 Energy Policy Act (EPAct) was intended to relaunch nuclear new builds, leading to four new units that are currently under construction: Summer (SC) 2, 3, and Vogtle (GA) 3, 4. As of today, 99 reactors are still online.

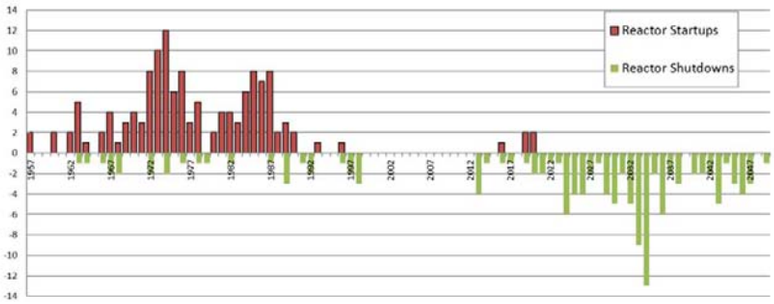

Figure 1: US nuclear power reactor grid connections and permanent shutdowns (1957 – 2050)

Sources: IAEA-PRIS, NRC, Schneider, et al. (2016), and own estimations.

Since the 1970s, nuclear power has played a significant role in overall electricity generation. Figure 2 shows the development of electricity generation from nuclear power plants since 1971 in absolute and in relative terms. Clearly, nuclear power has played an important role since the 1980s, its relative share being constant since. In 2015, nuclear generation was 797 TWh, or 19.5% of total production.

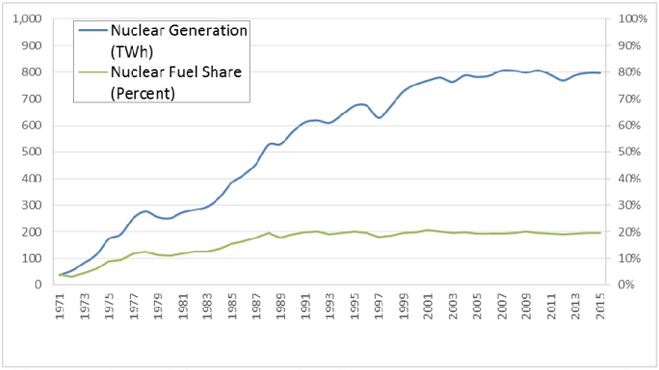

Figure 2: Electricity generation from nuclear power plants in the United States from 1972 (in TWh and relative share)

Source: NEI (2016), based on Energy Information Administration's Monthly Energy Review and Electric Power Annual

POLICY ISSUE 1: RISING COSTS OF NEW BUILDS AND OPERATION

A major issue for the new administration is whether it should intervene to save civil nuclear power. Nuclear power has been unable to attract private capital under competitive market conditions. The recent economic literature observes the absence of an economic case for nuclear electricity, and has rejected the hypothesis of nuclear power becoming competitive as a result of, e.g., rapid diffusion, economies of scale, or positive learning. Among the major reasons for nuclear power's lack of competitiveness are high and rising capital costs, as observed early on by Joskow (1982) and shown since then by Grubler

(2010) and Rangel/Lévêque (2012), among many others. Davis (2012, p. 68) summarizes the consensus of this literature, stating that seven decades after the discovery of nuclear electricity, the industry is still unable to compete with conventional fuels such as natural gas and coal.[1] The few ongoing nuclear power plant projects provide further evidence of this: all are above previous cost estimates and several years behind schedule; see the discussion between Rothwell (Nuclear Energy Organization) and Davis (UC Berkeley), reported by Rhodes (2016).

In addition, a new phenomenon that highlights the challenges to the industry is the loss of operational competitiveness by many nuclear plants, i.e., their inability to generate an operational margin:

~ On the demand side, wholesale prices have fallen, due to weak electricity demand, low natural gas prices, and an increasing share of renewable energies with low incremental costs;

~ on the supply side, the costs of running and maintaining aging NPPs have risen in recent years. The short-run costs include fuel, operation, and maintenance, and also capital additions for these plants, safety requirements, and/or lifetime extensions (e.g., from 40 to 50 or even 60 years). Lovins (2013, p. 5) provides a detailed account of industry data, indicating a range of average U.S. nuclear generating costs between US$24-60/MWh for the period 2009 to 2011. Roughly half of the plants had higher incremental production costs than the average wholesale prices of US$36/MWh.

Nuclear power plant operators are reacting by closing their plants. At present, over 16 GW of nuclear capacity has already been closed down prematurely or is threatened with closure in the near future. Table 1 summarizes the short-run situation of NPPs and the closure announcements made thus far.

	Plant	State	Investor	Capacity (MWnet)	Date of closure
realized	Crystal River-3	Florida	Duke Entergy	860	20.02.2013
	Fort Calhoun	Nebraska	Omaha Public Power District	478	24.10.2016
	San Onofre-2	California	Southern California Edison	1.070	07.06.2013
	San Onofre-3	California	Southern California Edison	1.080	07.06.2013
	Kewaunee	Wisconsin	Dominion Generation	556	07.05.2013
	Vermont Yankee	Vermont	Entergy	620	29.12.2014
			SUM of closed plants:	4.664	
announced	Fitzpatrick	New York	Entergy	855	2017
	Clinton	Illinois	Exelon	1.065	2017
	Quad Cities	Illinois	Exelon	1.880	2018
	Pilgrim	Massachusetts	Entergy	685	2019
	Diablo-Canyon-1	California	PG&E	1.122	2024
	Diablo-Canyon-2	California	PG&E	1.118	2025
			SUM of announced closures:	6.725	
under discussion	Oyster Creek	New Jersey	Exelon	615	
	Prairie Island	Minnesota	Xcel Energy	1.100	
	Palisades	Michigan	Entergy	778	
	Davis Bessie	Ohio	First Entergy	894	
	Ginna	New York	Exelon	581	
	Indian Point	New York	Entergy	1.022	
			SUM of closures currently discussed:	4.990	
			SUM of plants closed, announced or discussed closures	16.379	

Sources: WNISR (2016), webpages of operators

Table 1: Nuclear power plant closures in the United States for economic reasons

Source: Website of operators, Schneider (2016), own estimates.

As traditional utilities are threatened, regulators ponder market design options for the low-carbon energy transformation. Nuclear utilities are lobbying regulators at the federal and state levels to offer incentives for production, e.g., capacity payments, or instate a quota for nuclear power in the respective energy mix, an example being the New York "low-carbon electricity" scheme.[2]

POLICY ISSUE 2: DECOMMISSIONING OF NUCLEAR POWER PLANTS

A second set of policy issues relates to the need for sustainable organizational models to finance and manage the decommissioning of obsolete NPPs. According to the NRC, 35 reactors are currently in permanent shutdown. However, as Figure 1 indicates, several dozen additional reactors will be shut down in the near future, and by 2050 at the latest, the number of shut-down reactors will exceed 100. Given the long list of already shut-down reactors, and the long time span since the first shutdowns occurred in the 1960s, the operational experience with decommissioning NPPs is scarce and cannot be generalized, e.g., regarding the expected decommissioning costs. Of the 35 shut-down reactors, only 13 have been fully decommissioned thus far.[3] Six additional reactors are currently in the decommissioning process[4] and one is currently in the post-operational stage.[5]

However, a large number of reactors have been put in long-term enclosure (12), meaning that they have been "packaged" but left untouched at their initial site, and await decommissioning within the next several decades.[6] Clearly, problems of knowledge management, availability of human and financial resources in the decades to come, and safety issues during the long-term enclosure still have to be resolved.[7]

The estimated and actual costs for decommissioning a reactor vary widely and depend on many factors, including the reactor type, the location of the site, and the existing waste disposal routes. For the

already decommissioned reactors, the average duration was 10 years, which is short by international comparison; one reason for these short decommissioning periods is that—in most cases—large components like the pressure vessel or the steam generators are removed in one piece (i.e., without first being dismantled) and transported to nearby disposal sites. The actual decommissioning costs range from US$280/kW (Trojan plant in Portland, OR) to US$1,500/kW (Connecticut Yankee, CT) of installed capacity.[8] It is uncertain whether future decommissioning will generate significant economies of scale and whether the high variance of costs can be reduced.

Decommissioning is not a particularly difficult operation per se, but the sheer number of NPPs to be decommissioned raises issues of capacity and appropriate organizational models, such as own-production, tendering, and public and/or private procurement. A method that was recently used for decommissioning the Zion 1 and 2 reactors was to transfer the decommissioning license to a third party (here: the waste management company "Energy Solution"); compensation schemes are difficult to define (e.g., cost-plus, fixed price, etc.). Competition between service providers may help to bring costs down; yet some centralization of knowledge is useful to bundle experience and reap economies of scale.

It is unclear whether the funds earmarked for decommissioning will be sufficient. As of December 2014, the balance in the decommissioning trust funds was about US$53 billion.[9] If this sum is put in relation to the installed net capacity, the specific cost to decommission the around 100 reactors is about US$600/kW. It is probable that the decommissioning trust funds will not be able to cover all the decommissioning costs in the foreseeable future. A recent audit by the US Office of the Inspector General concludes that the estimates should be based on the best available knowledge from research and operational experience, but the NRC formula is based on studies conducted between 1978 and 1980,[10] leading to the possibility that the actual costs might be significantly higher. The audit recommended among other things that the funding formula be reevaluated to determine whether a site-specific cost estimate would be more efficient.

Two recent cases highlight the inherent risks of insufficient financing. Exelon reported shortfalls in the decommissioning fund for three reactors ranging from US$6 million to US$83 million.[11] However, Exelon was granted a 20-year license extension (by the NRC) with the idea of allowing additional time to increase the decommissioning fund. If the difficulties of raising operational benefits continue, this strategy is at risk. A second operator stated in the audit that the NRC minimum formula estimated decommissioning costs of US$600 million, but the site-specific decommissioning cost estimate done by the operator was US$2.2 billion.[13] There seems to be a need to revise the methodology to estimate future decommissioning costs to guarantee that the necessary funds are available when decommissioning begins, and the organizational model for financing may need revision as well. The operational difficulties of current operators of nuclear power plants shed new light on the situation, which differs from those prevalent in the past.

POLICY ISSUE 3: INTERMEDIATE AND LONG-TERM STORAGE OF HIGH-LEVEL NUCLEAR WASTE

By far the most daunting issue is high-level waste management (HLW), i.e., the handling of waste from military operations and from spent nuclear fuel (SNF) in power plants. Challenges arise with respect to the siting and timing of storage as well as financial aspects of the process. HLW decay will take over a million years, and very costly technical equipment is required to separate, treat, transport, and store this waste. Total SNF amounts up to about 79,000 metric tons; around 78% of which is stored in pools, and the remaining 22% in dry casks known as Independent Spent Fuel Storage Installations (ISFSI).[13] Figure 3 shows the distribution of SNF by State; some clustering is observable

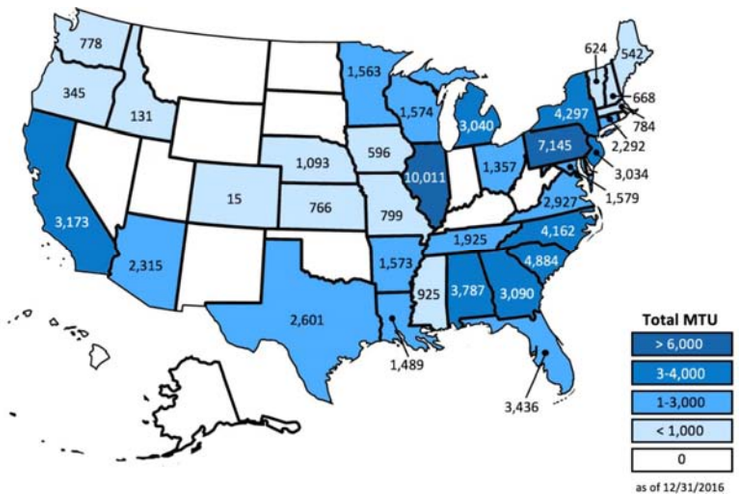

Figure 3: Regional distribution of high-level nuclear waste in the US (in metric tons)

Source: Own estimates, based on NRC (2011)

in New England, in the Midwest (mainly Illinois), the Southeast, and the West (California, Arizona).[14]

At present, no long-term HLW disposal site exists in the United States. Following the 1982 Nuclear Waste Policy Act (NWPA), Yucca Mountain (NV) was identified as a potential site and the necessary research was conducted. The project was approved in 2002 by Congress, but was not pursued due to a lack of political consensus; federal funding for the site ended in 2011. Another long-term storage site is the Waste Isolation Pilot Plant (WIPP) close to Carlsbad, NM: a LLW and transuranic waste disposal facility developed by the military. For technical and legal reasons, WIPP cannot be used for SNF (Warner North, 2013, p. 2).

The absence of a HLW repository not only increases the risks of accidents and attacks on decentralized waste storage sites; it also implies a significant liability for the DOE. Since 1998, DOE has been obligated to take SNF but is unable to deliver, which forces local utilities to store SNF on their own sites, including already decommissioned sites. For this interim storage, the utilities require substantial financial compensation from the DOE.

As the search for a storage site continues, the issue of centralized interim storage sites becomes all the more urgent. In its 2013 strategy paper, the DOE plans to site, design, and operate a consent-based pilot interim storage facility by 2021. The initial focus of this facility is on accepting SNF from already shut-down reactor sites. A larger interim storage facility should then be available by 2025; here the DOE is only responsible for the siting and licensing. The plan is that this facility be able to accept enough SNF to reduce government liabilities.[15] Regional interim storage sites may offer a safer and less costly alternative to storing fuel at the power plant sites, and attempts are underway to identify and place such interim storage sites, most likely at existing large NPPs or LLW waste disposal facilities. Private service suppliers are becoming more active on the interim storage front. These include Waste Control Specialists LLC, which are applying for a license to build a storage installation in Texas (~10,000 tons capacity), and Holtec International, planning an interim SNF facility near the WIPP facility in New Mexico.

Financial flows to manage the future storage of HLW are irregular at present. Following the 1982 NWPA, electricity ratepayers were required to pay a tenth of a cent per kilowatt-hour into the nuclear waste fund held by the DOE in exchange for the administration accepting SNF for disposal. As the DOE failed to deliver, the fee was abandoned in 2014. Already, DOE has spent over US$10 billion in legal penalties, and the administration currently estimates that total damages could amount to $20.8 billion—if the government begins accepting fuel in 2020. If the administration fails again to deliver, the liabilities could increase by hundreds of millions of dollars annually (BRC, 2012, p. 79).[16]

The Blue Ribbon Commission "On America's Nuclear Future", set up in 2012 by the Secretary of Energy at the request of the former President, conducted a comprehensive review of policies, including a suggestion to fund the waste management program (BRC, 2012, pp. 70–80). According to the final report, the annual fee revenues and the unspent balance in the waste fund have become inaccessible to federal budgeters and appropriators after a series of actions by successive administrations and Congress, and have forced them to take money away from other federal priorities to fund waste management activities. The commission, therefore, recommended a two-stage transition: first, non-legislative actions that would allow full access to future waste fee revenues, and second, legislative action as part of an independent waste management organization that would allow it to function as an autonomous self-financed entity.

A reform of the financing scheme is urgent to restore stability in the sector. DOE is currently the main actor but might need institutional support to become more flexible and to accumulate and maintain knowledge. Preparing a physical scheme for storage must go hand in hand with financing, and both require immediate attention. The proposal to found a new organization with the central task of licensing, building, and operating the facility with assured access to funds and overseen by Congress and the appropriate government agencies, as proposed by the Blue Ribbon Commission, might be the right starting point to tackle the serious problem of nuclear waste.

CONCLUSIONS

Nuclear policy has been a dilemma for previous U.S. administrations, and there is no reason to believe that this will change with the new administration. To the contrary: the recent loss of short-term competitiveness of nuclear power plants increases the need to take effective action soon. The decommissioning of plants has not been a major policy issue to date, but this may change as the number of reactors awaiting decommissioning continues to rise rapidly, as cost estimates continue to vary, and financing is not fully assured. New governance structures might yield the benefits of scale economies

while maintaining the information advantage of incumbent NPP operators. Long-term storage of waste requires special action with respect to siting interim sites as well as one or two long-term sites in a consensual process, while cleaning up the financial flows to make the process sustainable.

Footnotes

[1] For a recent methodological reference on the economics of nuclear power plants, see Rothwell (2015).

[2] New York Department of Public Service (2016, pp. 27-33): Staff White Paper on Clean Energy Standard. New York.

[3] Successfully decommissioned: Big Rock Point (MI), Connecticut Yankee (CT), CVTR (SC), Elk River (MN), Fort St. Vrain (CO), Maine Yankee (ME), Pathfinder (SD), Rancho Seco Unit 1 (CA), Saxton (PA), Shippingport (PA), Shoreham (NY), Trojan (OR), and Yankee Rowe (MA).

[4] Slighted for decommissioning: Humboldt Bay (CA), San Onofre-2 and -3 (CA): Three Mile Island 2 (PA), Zion 1 and 2 (IL).

[5] The latest shutdown reactor is Fort Calhoun 1 (NE) and was shut down in October 2016.

[6] The following plants are in a stage of long-term enclosure: Crystal River 3 (FL), Dresden 1 (IL), Fermi 1 (MI), GE EVESR (CA), GE Vallecitos (CA), Indian Point 1 (NY), Kewaunee (WI), Lacrosse (WI), Millstone 1 (CT), Peach Bottom 1 (PA), San Onofre 1 (CA), and Vermont Yankee (VT).

[7] Additionally, three reactors are in entombment; here, radioactive contaminants are permanently encased on-site in materials such as concrete: Bonus (Puerto Rico), Piqua (OH), and Hallam (NE).

[8] The total costs including site restoration amounted to US$836 million for Connecticut Yankee (also named Haddam Neck) and US$308 million for Trojan. OECD/NEA (2016, p. 76): Costs of Decommissioning Nuclear Power Plants. Paris.

[9] Office of the Inspector General (2016, p.5): Audit of the NRC's Decommissioning Funds Program. Washington, DC.

[10] Office of the Inspector General (2016, op cit., p. 10).

[11] Exelon shortfalls: Byron Station 2 US$83 million, Braidwood Station 1 US$6 million, and Braidwood Station 2 US$15 million. NRC (2016). The shutdown of the reactors is now scheduled for 2046/47.

[12] Office of the Inspector General (2016, op cit., p. 10).

[13]The amounts are estimated using existing data of 2011 and 2015 along with adding the calculated per-year production of new waste.

[14] In addition, 20,000 canisters of defense-related high-level radioactive waste need to be stored (Alley, Alley, 2013, p. xiv).

[15] Department of Energy (2013, p.2): Strategy for the management and disposal of used nuclear fuel and high-level waste. Washington, D.C..

[16] These damages have not been paid using money from the waste fund but from the taxpayer-funded Judgment Fund, which is overseen by the Department of Justice (BRC, 2012, p. 79)

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How Will Donald Trump's Election Promises Impact Global Oil?

By Mamdouh G. Salameh

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See footnotes at end of text.

Among notable promises made by U.S. President-elect Donald Trump during his presidential campaign were four particular ones that attracted the attention of the world because of their geopolitical implications and their impact on the price of oil. These were the dismantling of the nuclear deal with Iran, lifting the sanctions on Russia, enhancing U.S. oil production and a strong dollar.

Whilst most declarations made by U.S. presidential candidates during their election campaigning would be quickly forgotten once they are installed inside the White House, it might be wise to analyse these promises in case Mr Trump stuns the world by fulfilling some or all of them.

WILL DONALD TRUMP DISMANTLE THE IRAN NUCLEAR DEAL?

U.S. President-elect Donald Trump has vowed to rip up the Iranian nuclear agreement on Day 1 and re-install sanctions on Iran.[1] The move could potentially have far-reaching geopolitical consequences for the United States, the Arab Gulf region and the global oil markets.

The 2015 deal between the P5+1 nations (U.S., France, the UK, Russia, China and Germany) and Iran was one of the signature achievements of the Obama administration, one that produced multiple benefits. First, it significantly reduced tensions between Iran and the U.S., a relationship that had become so hostile in the preceding years that the drumbeats of war could be heard in Washington. Second, the agreement put restraints on Iran's nuclear program. For Iran, the deal also paved the way for a return to international markets and allowed it to ramp up oil production and exports. All told, Iranian oil exports had dropped from 1.67 million barrels a day (mbd) in 2011 to just 0.89 mbd by 2015. Iran has since restored much of that lost output (see Table 1).

(Mbd)

	2010	2011	2012	2013	2014	2015	2016	2020	2030
Production	3.54	3.58	3.74	3.56	2.78	2.84	3.56	3.40	3.35
Consumption	1.87	1.91	1.92	2.05	2.01	1.95	2.09	2.57	3.63
Net exports /Imports	1.67	1.67	1.82	1.51	0.77	0.89	1.47	0.83	-0.28

Table 1
Iran's Current & Projected Crude Oil Production, Consumption, Exports & Sustainable Capacity, (2010-2030)

Sources: IEA's World Energy Outlook 2015 / BP Statistical Review of World Energy, June, 2016/ OPEC Annual Statistical Bulletin 2016 / Author's Estimates.

There are not many issues on which Europe, Russia and China all agree, but there is one: ensuring that President Trump does not undermine the Iran nuclear deal.

There are legitimate grounds for concern that Donald Trump's administration or Congress could sabotage the deal to which Mr Trump has referred as a "disaster" and vowed to dismantle. The president-elect has also surrounded himself with people like Rudolph Giuliani and John Bolton, who have said they want an immediate end of the deal. Mr Trump's pick to lead the CIA, Mike Pompeo, recently said he looks to rolling back this disastrous deal with the world's largest state sponsor of terrorism.[2]

As Mr Trump decides in what direction he will take his Iran policy, countries that have partnered with the United States on Iran must draw a line. They should firmly tell the president-elect that as long as Iran continues to meet its obligations under the deal, they will do so as well. They should also make clear that if either Congress or the American president unravels the deal, other world powers will go their way with Iran.

There is a good chance that after intelligence briefings show Mr Trump how United States' security interests have benefited from the deal, he will come to realize the importance of keeping it intact.

But Mr Trump may also be persuaded by the hawks with whom he has surrounded himself to swiftly deliver a death blow to the deal by seeking to renegotiate American commitments on easing sanctions. This could result in the re-introduction of secondary U.S. sanctions against international companies doing business with Iran.

However, some countries, including American allies in Europe and Asia could reject the Trump administration's demands. As such, oil flows would be re-routed from countries that comply with Washington's demands to those that refuse to comply. If a major oil importer like China decides not to cooperate

with President Trump, the U.S. effort to contain Iran will likely fail.

It will be Mr Trump, as president, who will have to deal with these repercussions. Because the international coalition that previously supported sanctions on Iran will not be put back together, America's economic leverage on Iran will be much weaker, increasing the likelihood that Iran will ramp up its nuclear programme and, in turn, increasing the risk of American military action.

On November 14, 2016, 28 European leaders unanimously reiterated their "resolute commitment" to the deal regardless of the outcome of the American elections. Heads of state from the five countries that negotiated the deal with Iran would undoubtedly feel personally betrayed by the American president's withdrawal. This is likely to put the United States in a confrontation with Russia, China and Europe not just on Iran but on other issues such as the Islamic state, the war in Syria and North Korea, where Mr Trump needs their cooperation.

Walking away also would leave the U.S. with few options outside a military strike to curtail Iran's nuclear ambitions because European powers probably wouldn't agree to return to the crippling sanctions regime that Tehran previously faced.

Central Intelligence Agency Director John Brennan told BBC last month that it would be "the height of folly if the next administration were to tear up that agreement."

So, it seems likely that the deal will remain in place. The alternative is a war with Iran prompted by Israel, which the United States neither can afford nor can win without using tactical nuclear weapons.

For the global oil market, dismantling Iran nuclear deal will hamper Iran's efforts to rebuild its ailing oil industry. Even without sanctions, it will take Iran more than 3-5 years and $200 bn of investments to repair the damage in its reservoirs, according to the International Energy Agency (IEA).[3]

For oil prices, a reduction in Iran's oil exports resulting from a possible re-introduction of American sanctions, could lead to a tighter global oil market and push oil prices steeply upward. However, the geopolitical risk would arguably be more important. It could heighten tensions between Saudi Arabia and Iran, which could escalate to war that would engulf the whole region.

Iran's Defence Minister Hossein Dehgan was quoted by Reuters News Agency saying that Donald Trump's election has led to "unease, particularly among Persian Gulf States". He also said that "enemies may want to impose a war on Iran but if such a war were to occur it will mean the destruction of Israel and will engulf the whole Gulf region".[4]

Saudi Arabia and other Gulf Cooperation Council (GCC) Countries view Iran's nuclear programme as a smokescreen for developing nuclear weapons. This, they believe, poses the greatest challenge to their oil wealth and strategic security.[5]

In balancing Iran's power it is tempting for Saudi Arabia to turn to nuclear weapons as part of a larger strategy to counter Iranian influence. Saudi leaders are on record suggesting that the Kingdom would counter nuclear Iran by acquiring nuclear weapons too.[6]

LIFTING THE SANCTIONS ON RUSSIA

President Obama established the current Ukraine-related sanctions on Russia in 2014 through executive orders that Mr Trump could undo with the stroke of a pen.

Senate democrats are powerless to stop Donald Trump from easing or lifting Ukraine-related sanctions against Russia after he takes office. Their outcry on sanctions could become a shriek this year as confirmation hearings begin for Exxon Mobil CEO, Rex Tillerson, whom Mr Trump picked for secretary of state. Mr Tillerson would bring close ties to Russian president Putin and an open scepticism of sanctions as a policy tool to a Trump administration that wants to collaborate with Russia on fighting the Islamic State.

Mr Trump could easily get around lifting the sanctions on Russia by using a provision called a "national security waiver" that allows the president to ignore provisions of the law if "such a waiver is in the national interests of the United States."

Democrats are worried that if the Trump administration weakens sanctions against Russia, the European Union could move to follow suit, imperilling the entire effort. And whilst the United States and Russia are not large trade partners, the European Union does an enormous amount of trade with Russia. More than 50% of Russian exports of goods went to EU countries in 2014, according to the Congressional Research Service.

Putin is not interested in a reset with the Trump administration that doesn't involve the lifting of sanctions. Putin hopes that he and Donald Trump can work together to end the crisis in Russian-American relations as well as address the pressing issues of the international agenda and the search for effective

responses to global security challenges.

Russia has more than $8 trillion worth of untapped oil and gas, but it needs sophisticated Western technology and services to actually extract it. In the run-up to 2014 sanctions, Exxon Mobil, led by Mr Tillerson, and Russia's oil giant Rosneft invested $3.2 billion in a project for drilling for oil in the Kara Sea in the Arctic — a region that Rosneft estimated could have more oil than the entire Gulf of Mexico. But the sanctions forced Exxon Mobil to halt drilling.[7] Moreover, Russia estimated that Western sanctions cost its economy in 2015 more than $100 bn – by now, it is likely to have cost many billions more. [8]

Exxon Mobil's involvement in the Russian Arctic could have a very significant impact on the global oil market and prices, in that it could, in a few years, add more than 1.5 mbd to Russia's current oil production of 11.2 mbd thus consolidating Russia's position as the top oil producer in the world.[9]

And while nobody can predict which direction Trump's policy vis-à-vis Russia will take, his nomination of Mr Tillerson for the post of U.S. Foreign Secretary could be a clear sign of intent that Mr Trump may be considering easing sanctions on Russia if not lifting them.

ENHANCING U.S. OIL PRODUCTION: DONALD TRUMP'S VISION

Donald Trump aims to increase U.S. oil production and make the United States a powerful voice in the global oil market along Saudi Arabia and Russia. This objective would certainly be made easier with the projected rise in oil prices as a result of the OPEC and non-OPEC oil producers' agreement to cut production by almost 1.8 mbd. Rising oil prices will enhance U.S. shale oil production.

Donald Trump believes that shale oil production could make the United States self-sufficient in oil and could also add 2 million new jobs in 7 years. He considers America's energy dominance a strategic economic and foreign policy goal. Mr Trump also wants to unleash America's estimated $50 trillion in untapped shale oil and natural gas reserves.[10] To achieve this objective Mr Trump plans to ease the process for leasing federal lands. Overall, the impact of Trump's oil policies is likely to be small. Most shale oil production relies on private lands (or public leases), and the regulatory apparatus for oil and gas won't change much. In 2014, only 21% of U.S. oil production and 14% of gas came from federal lands, according to the most recent data from the Energy Information Administration.

On balance, U.S. oil production will not increase too much above the current 8.77 mbd. A recent Columbia University report estimates that U.S. shale would see an increase in output of 300,000 to 900,000 barrels a day (b/d) in the next few years taking total production to 9-10 mbd, if oil prices rise above $60 per barrel.[11] Moreover, any increase in U.S. shale oil production of such magnitude will have little impact on the oil price in view of the recent production cuts by OPEC and non-OPEC producers.

The United States will never achieve oil self-sufficiency and will remain a major oil importer for the foreseeable future to the tune of 7-8 mbd.

ENHANCING THE VALUE OF THE U.S. DOLLAR

Following the election of Donald Trump, the dollar surged 2% in value against the Chinese Yuan and a 3.1% against a basket of 10 leading global currencies.[12]

The dollar's strength has been especially dramatic against the Chinese Yuan, which Trump repeatedly targeted in his campaign, accusing the Chinese government of currency manipulation to benefit its economy.

The weaker Yuan and stronger dollar could be a gain for U.S. consumers and businesses buying goods made in China. On the flip side, when the dollar is strong, U.S. exports become less competitive and more expensive for the Chinese to buy. This divergence could lead to calls to impose tariffs and also set the stage for the return of protectionist rhetoric.

Investors expect Mr Trump's proposals to boost fiscal spending, cut taxes and loosen regulation will bolster economic growth and ultimately prompt the Federal Reserve to step up the pace of short-term interest-rate hikes. Investors say the biggest boon for the dollar could be higher U.S. interest rates. Mr Trump's plans for big fiscal spending are expected to boost inflation and bolster the case for lifting U.S. rates.[13]

During the presidential campaign, Mr Trump threatened to slap tariffs on countries like China, which he claims are gaining an unfair trading edge due to poor trade deals or purposely depressing their currencies. But tariffs could cause problems as consumers lose the benefit of lower prices while the U.S might not gain much. In retaliation, China could liquidate its holdings of U.S. Treasury bills estimated at $1.2 trillion pushing U.S. interest rates higher, tilting both countries into recession and possibly engaging in a trade war. Meanwhile, the possibility of a Chinese/U.S. military confrontation in the South

China Sea grows.

The race to buy dollars – fuelling the dollar rally – has only intensified following the election of Trump, as foreign investors sell low-yielding investments at home for higher-yielding U.S. assets. Trump's vow to borrow and spend on domestic projects has helped push interest rates to their highest levels of the year as investors expect the Trump administration to sell Treasury bills to finance its domestic spending. China and Japan are major buyers of U.S. debt and they will be needed to finance U.S. planned domestic spending. However, the U.S. economy is already facing a high level of indebtedness estimated currently at almost $20 trillion (107% of GDP).[14] This suggests that any change in monetary policy would have to be carried out in a gradual manner and that any corresponding strengthening would be gradual.

What is, however, certain is that a strengthening of the U.S. dollar will also equally strengthen the petrodollar by which oil is priced and sold worldwide.

Raising the value of the dollar exerts a downward pressure on oil prices. On the other hand, by devaluing the petrodollar at any point in time, the actual purchasing power of the oil revenues of OPEC and non-OPEC oil producers, declines against other world currencies. This would cause inflation because the value of the petrodollar vis-à-vis other world currencies will also decline. In other words, the trade balances of the oil-producing countries with the rest of the world deteriorate causing them to spend more of their revenues on imports and this pushes inflation up.[15]

CONCLUSIONS

Even if Donald Trump's electioneering promises were to be fulfilled, their impact on the global oil market and the price of oil would be limited if not insignificant.

Any upward pressure on oil prices and a tightening of the global oil market resulting from the dismantling of the Iran nuclear deal would be offset by the extra oil production coming from Russia's arctic region.

Equally, any increase in U.S. shale oil production would be undermined by a decline in global oil demand resulting from the rising value of the dollar against other currencies. This will exert a downward pressure on the oil price thus leading to a reduction in shale oil production and rising production costs.

Footnotes

[1] Nick Cunningham, "What Happens to Oil if Trump Tears Up Iran Nuclear Deal?" Oilprice.com, 23 November, 2016, accessed on 6 January 2017.

[2] Ellie Ceranmayeh, "Will Donald Trump Destroy the Iran Deal", published by the New York Times on November, 2016.

[3] Mamdouh G Salameh, "A Nuclear Iran Poses Real Threat to Oil Resources & Strategic Security of the GCC Countries" (a Paper given at the Arab Centre for Research & Policy Studies' Gulf Studies Forum, December, 5-7, 2015, Doha, Qatar).

[4] Reuters News Agency, 13 December, 2016.

[5] Mamdouh G Salameh, "A Nuclear Iran Poses Real Threat to Oil Resources & Strategic Security of the GCC Countries".

[6] A. Alsharif & A. McDowall, "Saudi Prince Turki Urges Nuclear Option Againt Iran", Reuters, December 6, 2011.

[7] www.vox.com accessed on 3 January 2016

[8] Ibid.

[9] Estimated on the basis of current U.S. oil production of 8.77 mbd and data from the U.S. Energy Information Administration (EIA) showing that the Gulf of Mexico contributes 17% to total U.S. oil production.

[10] An America First Energy Plan: Donald Trump's Vision, www.donaldjtrump.com/policies/energy, accessed on 7 January 2017.

[11] A Report by The Centre on Global Energy Policy, Colombia University, published December 2016.

[12] Chelsey Dulaney, "U.S. Dollar Rally Finds New Life under Trump", Wall Street Journal, 13 November, 2016.

[13] Ibid.

[14] Data from the Bureau of Economic Analysis (BEA) of the US Department of Commerce.

[15] Saudi Arabia's Oil Strategy & Its Impact on Oil Prices" (A presentation at the Regional Oil Conference organized by the Arab Administrative Development Organization (ARADO) of the Arab League, 17-18 May 2016, Cairo, Egypt).

Is a Rational U.S. Electric Power Policy Possible?

By Daniel C. Mussatti

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See footnotes at end of text.

This January we began a new approach to an energy policy for the United States. Past rhetoric of "drill, baby, drill" and "all of the above" have again moved to the front of the fray, and the President has already signed two Executive Orders that expedite the environmental permitting for the Keystone XL and Dakota Access pipelines. But while these old sayings have a certain degree of appeal at the fifty-thousand-foot level of detail, upon closer inspection, they are like junk food: bland calories, devoid of usefulness. What we need, instead, is a mantra that is more precise—a targeted policy that is a bit less inclusive than the entire energy needs of the U.S.

Tackling the whole energy policy of the United States is a daunting task. A total energy policy involves not only the electricity sector, but (among others) those of transportation, heating and air conditioning, and process engineering as well—all of which have very different characteristics and requirements. You may be able to take the fossil fuels out of electricity, but you cannot do so for the transportation sector—when was the last time you saw a wind powered Boeing 777? Given these differences, a carbon-free energy policy seems highly problematic. In the words of former U.S. Senator George Allen (VA), "there is no single silver bullet [to meeting energy needs] . . . we need silver buckshot."[1] So how do we proceed? In some ways, it is not very different form the riddle "how do you eat an elephant?" One bite at a time. This paper takes a first bite by examining the opportunities available for a national electricity policy by examining the economics of power generation without consideration of any necessary changes to the grid infrastructure. With apologies for the simplifications that have been used to make the points of this article succinctly, for anyone who so desires, all the data used are readily verifiable from the Energy Information Administration at www.eia.gov.

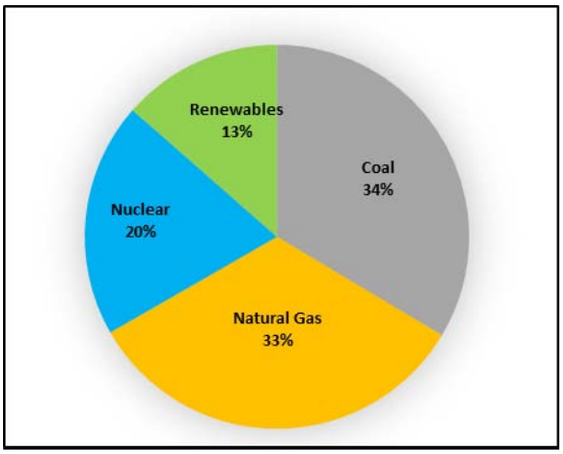

Figure 1: 2015 Average Daily Electricity Generation by Fuel

Source: U.S. Energy Information Administration, February 2016 Electric Power Monthly, Table ES1.A. Total Electrical Power Industry Summary Statistics, 2015 and 2014.

When establishing an energy policy for the United States, the first question one should ask is "How much energy do we need?" followed closely by "How much do we have?" According to the Energy Department, we need is "a lot;" somewhere in the neighborhood of 11.17 billion kWh per day in 2015. Of that amount, coal contributed 34 percent (3.8 billion kWh), natural gas about 33 percent (3.68 billion kWh), nuclear contributed 20 percent (2.23 billion kWh), and hydro and non-hydro renewables contributed about 13 percent (1.45 billion kWh). This power was supplied by a 2015 U.S. generating fleet of about 1,069,332.2 MWe. That inventory included: 284,501.7 MWe of coal fired generation, 438,723.5 MWe from natural gas, 98,729 MWe from nuclear fuels, and 182,020.6 from renewables; with the difference being made up from petroleum byproducts and other small contributors. Figures 1 and 2 display the differences between these two sets of data.

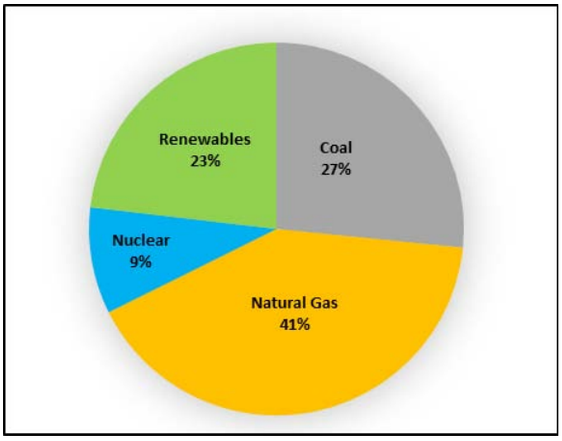

Figure 2: December 2015 US Electricity Generating Fleet by Fuel

Source: U.S. Energy Information Administration, February 2016 Electric Power Monthly, Table 6.1. Electric Generating Summer Capacity Changes (MW), November 2015 to December 2015

The data are from the same source, for the same year, and, most likely, from the same team of analysts, so what causes the differences between what we consume (left side) and where it comes from (right side)?

On the surface, the data do not fit the prevailing political narrative. For the past decade, federal policy has revolved around restricting carbon-based and nuclear energy in favor of the carbon free generating alternatives of wind and solar power. By now nuclear and natural gas should be contributing less power (in terms of their inventory share) than the data show—and coal should be almost a thing of the past. But coal and nuclear generation actually provide more than their inventory share. Coal provides about a third of

the electricity produced in the U.S. while it represents only slightly more than a fourth of the nation's generating capacity, an "overachievement" of about 26 percent. More significantly, the US nuclear fleet constitutes slightly less than one tenth of the country's generating capacity, but produces about two-tenths of its power, a 116 percent overachievement. Natural gas provides less than one might expect, given all the planned new generation that has sprung up because of the recent discoveries of cheap gas. Gas generates about twenty percent less than its inventory share, with 41 percent of the country's capacity but only a third of its actual power.

On the other side of the prevailing narrative are the renewables, which one would expect to be a flourishing industry that is steadily eroding the market shares of all other energy sources. However, the optimistic announcements of unprecedented growth in the green energy industry should be tempered by the rule of small numbers, that data based upon small populations can often generate extreme observations. From the hyperbole, one would expect to see vast tracts of land across the country where environmentalists can point with pride to their fully (or near fully) carbon free generation; but as of 2015, that was not the case. All renewables (including hydro, biomass, and other fringe energy sources) amounted to about a quarter of the national generating fleet but provide less than one-seventh of its power—an underrepresentation of about 45 percent.

Why is it that coal and nuclear power plants provide more than their share of the electricity generated in 2015? Economics. The thesis of this paper is that despite the efforts to force a change in our energy production pattern through green policies and regulations, the current electricity market continues to follow basic economic principles. The differences reveal that after a decade of manipulation of the electricity marketplace to elicit specific culturally appropriate energy results, the long-established queueing process for electricity generation still works. Sort of.

Before deregulation, the queueing of generating units to support electricity demand was straight forward. As demand increased, the utility added the next available unit in the queue, starting with the least cost generator and sequentially adding units (ranked from the cheapest to most expensive cost of production). This ensured the utility always produced the needed amount of electricity at the lowest possible cost. (The dual of that is that the company maximized its profits.) Coincidentally, the cheapest generators were also those that produced the greatest amount of electricity. Coal was not crowned King because it was pretty. Coal is cheap, abundant, and can be processed into a useable form at a reasonably low cost. And more importantly, it has one of the highest energy contents per volume, which allowed for the construction of large generating units. Cheap to operate and capable of generating large quantities of electricity on a continuous basis, coal and nuclear power plants proved to always be first-run alternatives, with natural gas and other fuel types relegated to perform on a less continuous basis, depending on their cost of production and their ability to ramp up quickly to meet spikes in demand.

This regulated market process was feasible because the utility was not playing free market economics, they were playing Monopoly: Utility A could not offer their electricity to someone in service area B, and vice versa for Utility B. And the market was also playing Monopsony, since users could not reach out to generators outside their service area. Their only source of electricity was their friendly neighborhood public utility. The key here is the word "public." Electricity markets are considered "natural monopolies" because the infrastructure necessary for their function acts as a barrier to entry for competitors. No one would install hundreds of miles of transmission lines on the chance they can find a market, and no utility would willingly allow a competitor access to the transmission lines that they installed and maintained. So (with recognized exceptions ignored here for simplification), the standard operating procedure for the regulated electricity market was one company for one service area. And because monopolies tended to abuse their market power, there was a high probability for extraordinary abuse, so regulatory oversight groups—utility commissions—were established to provide oversight and price control.

We are told today's electricity marketplace is a vastly different sort of creature. Clearly, that is somewhat true, with some markets displaying all the characteristics of the old regulated utility system and others operating a wide open "enter at your own risk" approach to entry (and everything in between). Deregulation has even more complexity. Independent System Operators and Regional Transmission Organizations purchase power from a competing group of dedicated power companies, independent generators, companies that discovered their waste heat could be converted to electricity, and entrepreneurial minded citizens with a roof full of solar panels. And, just to cloud up the waters, the demand for electricity is more complex than just the needs of the people. There are power purchase agreements, reliability reserves, interties opportunities for import and export, and transmission constraints

to consider. Given all of this complexity, all available power is offered hourly (or, in the case of Texas' ERCOT region, quarter-hourly) to the ISO or RTO, which must then choose who gets to contribute to the hourly demand and who does not.

Regulators and policy makers would argue that this added complexity has rendered the old way of thinking obsolete. As Jon Wellinghoff, the chairman of the Federal Energy Regulatory Commission said on April 22, 2009, "I think baseload capacity is going to become an anachronism. . . Baseload capacity really used to only mean in an economic dispatch, which you dispatch first, what would be the cheapest thing to do. . . You can't ramp up and ramp down a nuclear plant. And if you have instead the ability to ramp up and ramp down loads in ways that can shape the entire system, then the old concept of baseload becomes an anachronism." [2] Wellinghoff was a bit ahead of his time in that the smart grid is not yet here; but from what he said at the time, it is apparent our leadership would like us to believe that the establishment of a national energy policy for electricity must be as highly complicated as the heterogeneous set of markets that it seeks to wrangle. That is not the case. In many important ways, the new deregulated electricity market is pretty much the same as its regulated predecessor, and that is what simplifies our identification of a reasonable electricity policy.

For illustration purposes, consider a stylized representation of how a modern ISO works. The ISO or RTO starts with an estimate of what the demand will be for the next hour of delivery, then examines its list of electricity suppliers who have agreed they would be ready, willing, and able to provide electricity for that hour. This list is pre-sorted (in dollars per kilowatt hour) from the cheapest to the highest bid, and the ISO starts at the top, sequentially adding more suppliers to the roster of that hour's suppliers until the total expected demand has been reached. For the selected suppliers, all of them enter the market simultaneously at the beginning of the hour. (It is this point that some power experts use to base their proclamation of the death of baseload power.)

All suppliers with bids greater than that of the highest supplier selected have bid too high and unless something unexpected happens during the hour, must wait until demand increases enough for them to sell in the market at their bid price, or they can revise their price for greater competitiveness in the future (this is the economics part). Revising prices downward makes sense in that a lower price gives you a better chance at participating in the market, but there is a down side. At some point, even if the supplier were to sell every watt of the energy it produces, if it cannot cover its costs, it will not stay in business. So, what is the lowest possible price that the seller can bid and still survive? In the short run, the supplier must cover its variable costs—those costs that are directly related to the actual production of electricity. Capital cost payments, general overhead, and other such sunk costs are irrelevant to the survival of the supplier in the short run, so in the end it is in the supplier's best interest to bid the variable price of its production and ensure its best chance at being able to make it another day.

Figure 3 displays a simplified electricity marketplace with an hourly demand for electricity of Q* MWh. In the bid process, the ISO would rank order all the (variable cost) bids for that hour, resulting in the step-wise electricity supply curve starting with hydro on the left and ending in the high cost land of cogeneration, diesel, and very old (inefficient) power plants. Each horizontal step indicates a different generator, which allows us to display differences within each fuel type. For instance, there are two coal-fired generators available, each about the same capacity, but one with slightly lower variable costs. For natural gas, there are four different variable costs. In this example the ISO would choose, in order, the hydro unit, the nuclear unit, both coal units, and enough of the lowest cost natural gas units so that the total capacity to be distributed to the grid for that hour was equal to Q*. This establishes the market price for that hour as P*.

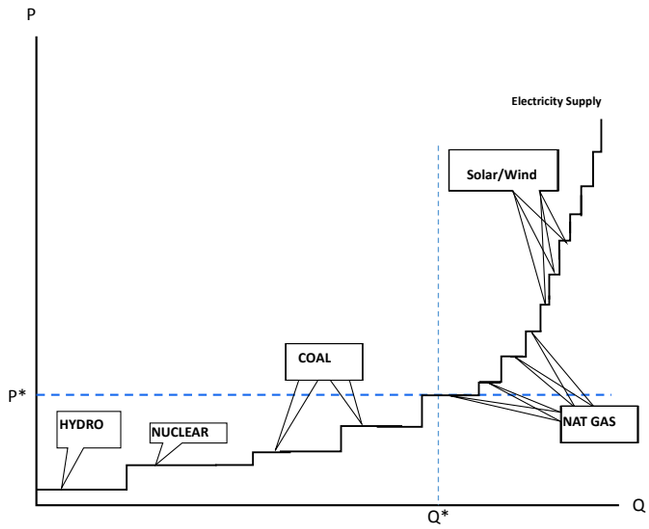

Figure 3: A Stylized Electricity Pricing Model

This is no different than the old-time monopoly utility would have done in choosing its generation

mix. There is no illusion of diversification of generation—any other combination of generators that could produce Q* would necessarily carry a higher market price. There is no altruistic effort to push green energy over carbon-based generation, either, for the same reasons. The most altruistic combination of generators that can be assembled is the one that costs the least to the public, which is what the old-time utility and the present-day ISO both choose (because it is the one that minimizes their own costs / maximizes their own profits).

In recent years, the electricity market has seen impossible extremes in pricing—order of magnitude increases in cost per kWh and negative pricing. Both extremes coexisting in the same market are indicative of market interventions that have introduced unexpected consequences while offering frustratingly little progress toward the altruistic goal. Recent subsidization of wind farms has produced a boom market in the production and installation of the giant turbines, doubling wind's generation share between 2010 and the present, but still only 4.7 percent of 2015's total generation. Similarly, utility-scale solar (photovoltaic) capacity contributed about one-tenth of one percent of total U.S. generating capacity while constituting three and five percent of the total U.S. capacity additions in 2011 and 2012, respectively. This matches the incongruities found between Figures 1 and 2. The conclusion appears compelling: that no matter how much effort is put into changing the course of the U.S. generating fleet, the forces of free market influences still dominate the electricity industry.

So, what is the optimal electricity policy for the U.S.? The one that minimizes the cost of electricity to all consumers. Subsidization of unproven and unsupportable energy sources such as the recent push for wind and solar as baseload power are at best inefficient—and at worst, wasteful of resources better used to achieve other ends. Clearly, there is a role for nudging industry in the environmentally right direction. But if a clean green generating machine were economically feasible, why hasn't some new-age Thomas Edison developed it? And if industry were to believe that such an item was on the technological horizon, why hasn't such a device been sought? Technology forcing legislation was used in the late sixties to make more fuel-efficient cars. It was originally thought to be impossible and unaffordable, yet as the deadlines drew nearer, car manufacturers designed the first catalytic converters. The same can be done today, but not by subsidizing the installation of technologies that are not quite able to support themselves, but instead, by the surgical stimulation of well designed, peer reviewed research into new inventions. Development will take care of itself as innovations arise.

Today there are cheap and readily available energy sources to power the U.S. economic growth until these new technologies prove themselves full scale. However, while nuclear generation is almost entirely devoid of carbon dioxide and criteria pollutants, nuclear power plants are expensive and time consuming to build. Modern clean coal technologies have the proven ability to provide low pollution levels, but megawatt for megawatt, these new designs are growing uncomfortably close to the costs of a nuclear plant. As a stop gap between the realities of now and the promises of the future, America needs those baseload units, and a clever government should be able to figure out how to mitigate the cost of construction to bring those coal and nuclear generators on line. Perhaps through tax incentives, low-interest loans, and expedited permitting processes.

Economic terms seem quaint on the surface, but there is something subtly elegant in the philosophy of laissez-faire—the concept of minimal intervention in favor of the power of self-interest. If we need some iconic image to represent viable U.S. electricity policy—a modern day Rosie the Riveter that could capture the essence of this new philosophy in a manner that is unmistakable, then perhaps that icon should be a suited bureaucrat, briefcase in hand, with his leg firmly attached to a really big anchor.

Footnotes

[1]Text of Former Virginia Governor and United States Senator George Allen's speech "McCain, Obama, and America's Security" October 29, 2008 at Bowker Auditorium, University of Massachusetts.

[2] (New York Times, 4/22/2009, Noelle Straub and Peter Behr, "Energy Regulatory Chief Says New Coal, Nuclear Plants May Be Unnecessary")

The Impact of International Trade on Electric Loads in Mexico

By Marc H. Vatter and Daniel F. Suurkask

Marc Vatter and Daniel Suurkask are with Birch Energy Economics, Post Falls, Idaho. Vatter can be reached at marc@appliedecon.net **The authors wish to thank the staff at EPIS, Inc., the Comisión Federal de Electricidad, Seguro Energy Partners, and E3 for their ongoing support and cooperation in their work in Mexico. We are grateful that we are happy in our work, for this is a gift from God (Ecclesiastes 2:24). Any errors are our responsibility.**

See footnotes at end of text.

INTRODUCTION

We estimate effects relevant to a possible shift in U.S. trade policy on electric loads in Mexico. We find exports to be a highly significant predictor of energy loads and a significant predictor of peak loads in models that do and do not include GDP and a trend toward greater efficiency in the use of electricity. These results are consistent with trade impacting load through high load factor, industrial customers. We conclude that, if a shift in trade policy toward Mexico is seen as a realistic possibility, it would be worthwhile to analyze its impact on loads, especially energy loads, in scenarios.

The North American Free Trade Agreement liberalized trade among Canada, Mexico, and the United States and went into force in January of 1994. From 1990 to 1994, Mexico ran trade deficits with the United States, but it ran trade surpluses with the United States every year from 1997 to 2014, and those surpluses grew at 8.6% p.a.[1] Trade across the Rio Grande was an issue in the 2016 U.S. presidential campaign, and a shift toward a more protectionist stance in U.S. trade policy appears to be a real possibility.

The wholesale electric market in Mexico is restructuring along lines established in other countries. The state-owned utility, Comisión Federal de Electridad (CFE), is in the process of creating transmission, distribution, supply, and six generation subsidiaries, each of which will be managed separately. The different generation subsidiaries will compete with one another and other entrants in spot and forward markets managed by the system operator, Centro Nacional de Control de Energía (CENACE). The restructuring has prompted a flourish of planning and analysis on the part of existing and new market participants, and the possible shift in U.S. trade policy adds an element of uncertainty to those efforts.

ECONOMIC DEVELOPMENT AND LOADS IN MEXICO

If one were to look back over the past 20 or 30 years, one might be tempted to conclude that Mexico is stuck in a "slow growth" trend, and that its aspirations to realize developed country status have in large part not been realized. But the same observer would likely acknowledge a fundamental economic transformation over the same time frame. Gone is the day of only low end manufacturing – clothing, textiles, and simple assembly. In its place is a diversified industrial base, led by high-end manufacturing. Mexico now ranks as the seventh largest producer of cars in the world, with many of the major car manufacturers having or soon to have major operations in the country.[2] Like the automotive industry, the aerospace, plastics, and medical device industries have seen tremendous growth.

In fact, Mexico has been able to establish itself as a manufacturing powerhouse, using to its advantage its proximity to the world's largest consumer market and its low wages relative to the U.S. Manufacturing now represents approximately 18 percent of GDP.[3]

Much of the export-oriented, high-end manufacturing is in the north of the country, along the U.S. border. Monterrey, in the Northeast region, has a very large manufacturing base, and is a major steel producing area. Electronics manufacturing is also important in the northern states of Chihuahua and Baja California.

Increasingly, however, owing to several factors, including the continuation of infrastructure development, high- and medium-end manufacturing in Mexico is now increasingly prevalent away from the U.S. border, in states such as Guanajuato, Aguascalientes, San Luis Potosi, and Queretaro, collectively called the "Bajio".[4] Stratfor elaborates:

> Unlike the border states, the central lowland region is a part of Mexico's economic and political heartland. It hosts a large, educated population, and its climate is the most temperate in the country. It is centrally located, with relatively easy access to ports on both coasts, the United States to the north, and Mexico City in the south.
>
> Geography has benefited the Bajio, as have improved transportation infrastructure, comparatively better security, and efforts to attract investment. More manufacturing investment and output will bring

Mexico's industrial core closer to Mexico City and populations in need of jobs. Bajio manufacturing will not replace manufacturing activity along the border, but it gives Mexico an opportunity to develop more evenly and sustainably.[5]

In the south of the country, in the Oriental and Yucatan Peninsula (hereinafter "Peninsular") regions, in addition to the petroleum industry, low-end manufacturing of goods like clothing and textiles continue to make an important – and growing – contribution to the economy. Low-end manufacturing in these regions of Mexico has benefited, in part, from strong wage and transportation inflation in China.

We also mention the importance of the tourism and hospitality industry in the economic development – and load growth – of different areas of the country, but especially around Cancun, a popular tourist destination, in the Peninsular region.

Figure 1 shows the regions on a map of Mexico. (The Bajio is situated in the Occidental region.)

Figure 1: Mexican Regions[6]

Electric load growth and load shapes, as one might expect, reflect this economic transformation. Over the 1997-2015 period, load growth has averaged 3.0 percent. Over the same period, GDP growth has averaged 2.4 percent. As with growth in GDP, load growth has been quite variable over this period. GDP growth and load growth, for the period 1997-2015, are shown in Figure 2.

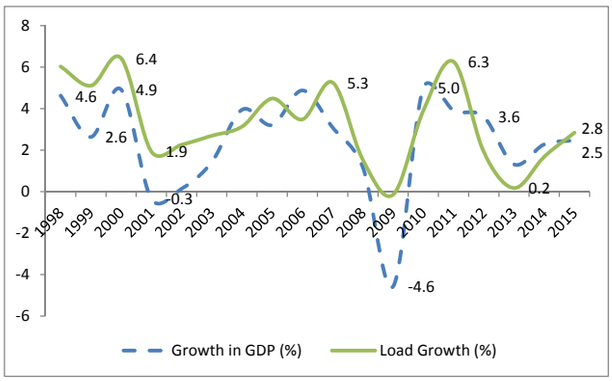

Figure 2: GDP & Load Growth, 1997-2015[7]

On the whole, Mexico has high load factors, with the electric grid covering most of Mexico maintaining an average 78% load factor between 2010 and 2015.[8] This, of course, reflects the large manufacturing base, as well as the relatively low penetration of air conditioners and a large body of population in the relatively temperate Mexico City and surrounding areas. In the North of the country, where temperatures are more extreme, load factors are lower than elsewhere, notwithstanding the manufacturing base. The primary driver of peak loads in the North of the country, then, is the use of air conditioning. In contrast, in the Central region, including Mexico City, the annual peak is typically in the winter around the Christmas festivities, owing to decorative lighting on homes and businesses, electric space heating, and additional lighting requirements owing to the shorter days.

Figure 3 shows the distribution of load across the regions, and over the months. Estimated 2016 loads are shown in average hourly megawatts, by region and by month.

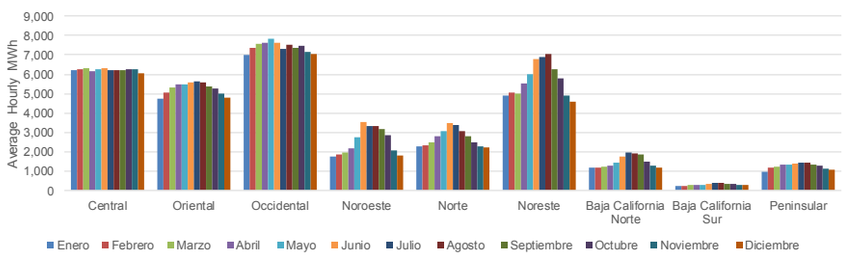

Figure 3: Monthly Load by Region[9]

As can be observed from the chart, the two regions with the most load, Central and Occidental, have a relatively flat monthly load profile, owing largely to temperate weather year-round. The Noreste, Norte, Noroeste, and Baja California Norte loads exhibit more seasonal variation because of more extreme summer temperatures.

RESULTS

Table 1 shows results from estimation. The constant terms in Model I represent the annual rate of growth in Baja California (Norte), and the coefficients on the indicator variables represent adjustments by region. Energy loads in Baja California grew at 3.7% during the sample period, and peak loads there grew at 3.5%. Loads in Peninsular grew considerably faster, and loads in Central grew considerably more slowly.

Model II introduces exports. In the absence of GDP and a trend toward energy efficiency, exports are highly statistically significant in the energy equation, and significant in the equation predicting peak load. These results are consistent with exports driving loads disproportionately through their impact on high load-factor, manufacturing customers. However, the domestic economy is certainly an important driver of electric loads.

Model III introduces a GDP variable from which variation dependent on exports has been removed. Variation in exports may still cause variation in GDP, but variation in GDP that is independent of exports is now included in the model. The GDP variable is statistically significant in both the energy and peak load equations. Exports continue to be highly significant in the energy equation and significant in the equation predicting peak load. Results are still consistent with international trade substantially involving manufactured goods produced by industrial customers with high load factors. Domestic economic activity also appears to be a stronger driver of energy than of peak load.

		Model							
Variable		I		II		III		IV	
	GWH	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Percent Change	Exports			0.107	0.026	0.107	0.024	0.111	0.023
	GDPd					0.531	0.114	0.524	0.110
	Year							-0.001	0.000
Indicator	Baja Sur	0.013	0.009	0.017	0.009	0.017	0.008	0.017	0.008
	Central	-0.016	0.009	-0.016	0.009	-0.016	0.008	-0.016	0.008
	Noreste	-0.001	0.009	-0.002	0.009	-0.002	0.008	-0.002	0.008
	Noroeste	-0.004	0.009	0.001	0.009	0.001	0.008	0.001	0.008
	Norte	0.001	0.009	0.001	0.009	0.001	0.008	0.001	0.008
	Occidental	-0.001	0.009	0.000	0.009	0.000	0.008	0.000	0.008
	Oriental	-0.006	0.009	-0.004	0.009	-0.004	0.008	-0.004	0.008
	Peninsular	0.015	0.009	0.017	0.009	0.017	0.008	0.017	0.008
	Constant[a]	0.037	0.006	0.027	0.006	0.014	0.007	2.697	0.818
	MW	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Percent Change	Exports			0.071	0.033	0.071	0.032	0.077	0.031
	GDPd					0.397	0.152	0.387	0.147
	Year							-0.002	0.001
Indicator	Baja Sur	0.020	0.011	0.024	0.011	0.024	0.011	0.024	0.011
	Central	-0.022	0.011	-0.024	0.011	-0.024	0.011	-0.024	0.011
	Noreste	0.001	0.011	0.003	0.011	0.003	0.011	0.003	0.011
	Noroeste	0.001	0.011	0.007	0.011	0.007	0.011	0.007	0.011
	Norte	0.005	0.011	0.004	0.011	0.004	0.011	0.004	0.011
	Occidental	-0.002	0.011	-0.001	0.011	-0.001	0.011	-0.001	0.011
	Oriental	-0.011	0.011	-0.011	0.011	-0.011	0.011	-0.011	0.011
	Peninsular	0.015	0.011	0.016	0.011	0.016	0.011	0.016	0.011
	Constant[a]	0.035	0.008	0.027	0.008	0.018	0.009	3.520	1.092

[a] Applies to Baja California (Norte).

Table 1: Effects of National Exports on Electric Loads in Mexican Regions

Model IV adds a deterministic trend ("Year") to reflect improving efficiency in the use of electricity. Consistent with expectations, its coefficients are negative and significant in both the energy and peak load equations. Exports continue to be highly significant in the energy equation and significant in the equation predicting peak load. The GDP variable is highly significant in the energy equation and significant in the equation predicting peak load. The trend toward efficiency appears to have explanatory power.

Across all four models, the largest difference in regional effects between the energy and peak load equations are in Central and Oriental. The differences in Central can be attributed to a program designed to shave peak load during the sample period, and to a temperate climate and relatively flat load, as shown in Figure 3. The differences in Oriental, which is near Central America and west of Peninsular, are attributable to industrial growth. At the turn of the century, low wages in China made it difficult for Mexico to compete in markets for light manufactured goods, but rising wages in China have since changed that, and we forecast that load factors will rise in the Oriental region and hold steady in Peninsular, despite falling somewhat nationwide. According to Stratfor, the low-end manufacturing is set to grow rapidly in the Oriental region.

> ...the area in central-southern Mexico is large, populous and still relatively underdeveloped. It is in this area, which includes the states of Campeche, Veracruz, Chiapas and Yucatan, where we see the type of low-end development that fits our criteria. Mexico's ability to develop its low-wage regions does not face the multitude of challenges China faces in doing the same with its interior.
>
> ...rising wages in China have once again shifted the equation in global manufacturing. Average manufacturing labor costs in Mexico are now almost 20 percent lower than in China, whereas in 2000, Mexico's labor costs were 58 percent more expensive than China's.
>
> ...low-end manufacturing of goods like clothing and textiles is continuing to expand in southern Mexico, in cities like Campeche and Veracruz...[10]

For this reason, we forecast a rise in load-factors in that part of the country.

CONCLUSION

Exports are a highly significant driver of energy loads and a significant driver of peak loads in Mexico, with or without accounting separately for GDP and a trend toward efficiency in the use of electricity. If a change in U.S. or other countries' trade policies toward Mexico is seen as real possibility, it would be

worthwhile to examine scenarios in which the effects of trade on electric loads, especially energy loads, are taken into account. A, possibly extreme, benchmark could be established in a load-forecasting model that did not explicitly include international trade, but did include GDP. If exports no longer led economic growth in Mexico, so that exports and GDP grew at the same rate, forecast GDP growth could be lowered by 2.38% - 1.23% = 1.15% from what one would assume with no change in trade policy, where 2.38% is the rate of growth in Mexican GDP during the sample period, 1997 2015, which included the Great Recession, and 1.23% is the rate at which GDP would have grown had GDP and exports grown at the same rate during those years.

Footnotes

[1] Source: World Bank; http://data.worldbank.org/data-catalog/wits, accessed December 30, 2016.

[2] "Despite fears, Mexico's manufacturing boom is lifting U.S. workers," Aug 21, 2016. Available at http://www.latimes.com/projects/la-fi-manufacturing-boom-mexico/, accessed Jan 19, 2017.

[3] "Mexico's Manufacturing Sector Continues to Grow", Apr 6, 2015. Available at https://www.stratfor.com/analysis/mexicos-manufacturing-sector-continues-grow, accessed Jan 19, 2017.

[4] The corresponding electric region is Occidental.

[5] "Mexico's Manufacturing Sector Continues to Grow", Apr 6, 2015. Available at https://www.stratfor.com/analysis/mexicos-manufacturing-sector-continues-grow, accessed Jan 19, 2017.

[6] Source: PRODESEN 2016.

[7] Sources: Secretaría de Energía (SENER) and Organization for Economic Cooperation and Development (OECD).

[8] Load factor is a measure of the load shape, namely average load divided by peak load. The higher the load factor, the less capacity is required to meet the energy requirements.

[9] Source: SENER, with modifications by authors.

[10] "Mexico's Manufacturing Sector Continues to Grow," April 6, 2015. Available at http://www.forbes.com/sites/stratfor/2015/04/08/mexicos-manufacturing-sector-continues-to-grow/#71e061373c9e, accessed May 2, 2016.

Energy Policies under a Trump Administration: The Implication for Distribution Utilities & Grid Modernization

By Parag Nathaney and Rachel Finan

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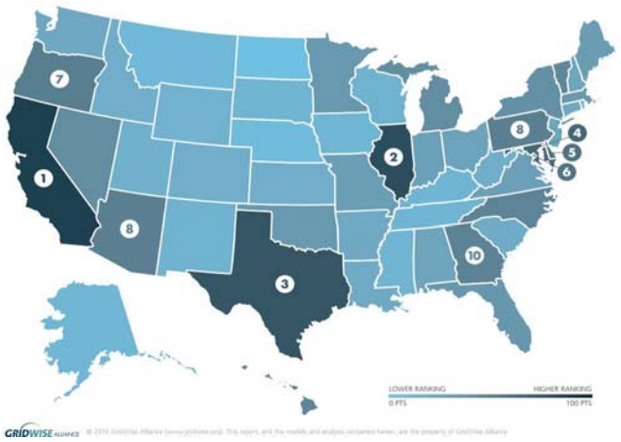
See footnotes at end of text.

The U.S. power and utilities sector is in the midst of significant transformation and uncertainty, driven by declining load growth, innovative technologies, evolving regulations, changing consumer preferences and the emergence of non-utility competitors. The recent Presidential transition has added even more ambiguity as to the future of the industry, with some pontificating that it's a "new dawn" for fossil fuels and the death of environmental regulations, while others assert that economics will keep renewables thriving despite President Trumps' promise to halt clean energy initiatives.[1] However, the trend toward utility grid modernization is one subsection of the industry that may remain largely on course, potentially even accelerating under new federal policy shifts.

Capital spending by the largest investor-owned U.S. electric and gas utilities is expected to be significant going forward. Utility grid modernization initiatives include a suite of measures such as integration of information and communication systems to manage the grid efficiently; greater automation of decision making; enhanced visibility into grid operations and the ability to collect, synthesize and assess data at increased levels of granularity. The primary drivers of industry spending for grid modernization include utility programs to replace aging infrastructure, implement smart grid technologies, and integrate greater amounts of renewable/distributed energy technologies. The recent change in administration and its emphasis on infrastructure spending is expected to further expedite the pace of these grid modernization initiatives across the U.S.



Figyre 1: Overall Results: GridWise Alliance Grid Modernization Index ranking of all 50 States & DC based on movement toward a modernization grid.

There has been a growing acknowledgement that Distributed Energy Resources (DERs) like rooftop PV, electric vehicles and batteries have seen high levels of deployment recently and are expected to see significant penetration in the near future, due to declining costs and changing consumer preferences. Some states such as New York, California, and Minnesota have already acknowledged this trend and initiated regulatory proceedings focusing on innovative rate design and mandates that further enhance customer adoption of these technologies. Even states such as Pennsylvania, Illinois and recently Ohio have made strides in grid modernization recently, partially due to supportive state policies.

The Federal Energy Regulatory Commission (FERC) acknowledged these industry changes in its Notice of Proposed Rulemaking (NOPR) on Energy Storage and DER aggregations, which mandates Independent System Operators/Regional Transmission Organizations (ISOs/RTOs) to develop participation models that allow DERs (mainly in the form of aggregates) to participate in the wholesale markets and provide all eligible services: energy, capacity and ancillary.[2] DERs are connected to the distribution system and their dispatch by ISOs/RTOs to service wholesale market needs will need closer coordination with distribution utilities, which may in turn require utility investments in new analytical capabilities, technologies, tools, and planning approaches. The recently issued FERC NOPR on energy storage and DER aggregation is expected to provide a further impetus to grid modernization initiatives, especially when considered against the backdrop of the previously discussed drivers.

In addition to mandating ISOs/RTOs to allow DER aggregations to participate and provide energy, capacity and ancillary services to the wholesale market, FERC also instructs ISOs/RTOs to explore the opportunities of allowing DERs to provide services which have traditionally not been procured through market mechanisms, such as primary frequency response and black-start. Some of these services may primarily involve power 'injection' into the distribution system from customer-sited DERs. 'Injection' has a significantly different impact on the distribution system as compared to 'load reduction'. The impact

of load 'reduction' or 'curtailment' through demand response on the distribution system is relatively well-understood by the utilities, due to the history of demand response programs in the US.

Injection requires enhanced real-time ability to monitor and control the system, especially for coordinated injections from DER aggregations. The ability of the utilities to do so currently is limited. The enabling technologies to enhance this capability include distribution automation, DER management system (DERMS), etc.

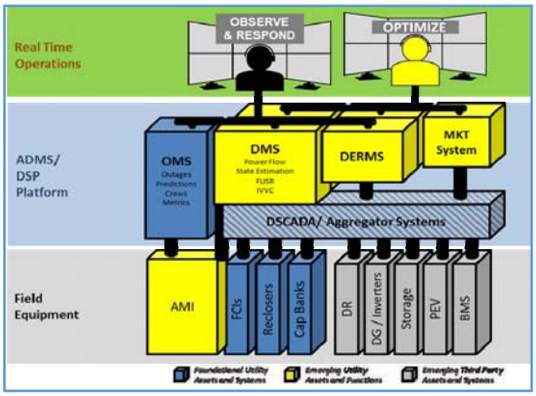


Figure 2: Enabling Technologies to Enhance Real-Time System Monitoring & Control

Source: Joint Utilties of New York, Supplemntal Distribution System Implementation Plan, November 2016.

In addition to enhanced real-time monitoring and control, utilities may require a revised methodology for the DER interconnection process that is currently in place today. The current interconnection process does not necessarily evaluate the impact of injections into the distribution system from sub-resources forming DER aggregations acting in tandem to ISO dispatch instruction. In cases when the dispatch of aggregated DER by the ISO/RTO causes reliability issues on the distribution system, the utilities may need to curtail the response of it. However, this analysis will require utilities to simulate the impact of DER aggregations' injection in real-time and then subsequently responding to the outcome of the simulation. This will require investments which develop enhanced real-time monitoring, control and automation of the grid. Such investments have the potential to be prioritized under the new Presidential administration's push for infrastructure spending.

Further, the FERC NOPR, by proposing to lower the barriers to entry for DERs into wholesale markets, may also necessitate utilities to develop more granular and sophisticated forecasting and planning techniques that assess the impact of DER performance on the local system and utilities' procurement from the wholesale markets. This also presents utilities an opportunity to allow DERs to connect to the grid strategically; i.e., where DERs can provide the greatest locational benefits. This may help utilities actively incorporate DERs as a planning tool to reduce, delay or avoid capital expenditures. However, this needs to be accompanied by regulatory reforms which incentivize utilities to avoid capital expenditures rather than expanding them. Deciphering locational value of DERs requires developing analytical tools which can process granular system information. This presents an opportunity to utilize infrastructure spending on advancing analytical capabilities.

It is expected that DER-related activity will escalate across the country as ISOs/RTOs begin to comply with the NOPR. Thus, states under the purview of the ISOs/RTOs that have not seen substantial DER participation or DER penetration currently, may also begin to notice some level of activity. This may expedite the need for grid modernization in these regions as well.

Thus, while the presidential transition has undoubtedly injected uncertainty into the energy and power industries in general, the priorities for utilities may remain largely the same. The new administration's emphasis on infrastructure development, combined with the recent FERC NOPR and continuously changing consumer demands will continue to drive utilities – especially those backed by supportive state regulatory commissions – toward grid modernization initiatives. Specifically, utilities will be driven to develop: more granular and sophisticated forecasting and planning tools/techniques to capitalize on the locational value of DER; a revised methodology for DER interconnection that takes simultaneous power injection from DER aggregations into account, not simply power curtailment; and strategies for articulating the need for investment in enabling capabilities (innovative technologies, analytical tools, workforce development, etc.) in the context of infrastructure development and reliability.

Footnotes

[1] See Chicago Tribune "Oilmen take Washington, signal dawn of new U.S. energy era, " 2016. http://www.chicagotribune.com/business/ct-washington-trump-cabinet-oil-interests-20161214-story.html, also Bloomberg news, "Economics will keep wind and solar energy thriving under trump," 2016. https://www.bloomberg.com/news/articles/2016-11-23/economics-will-keep-wind-and-solar-energy-thriving-under-trump

[2] Federal Energy Regulatory Commission, "Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators," November, 2016. https://www.ferc.gov/media/news-releases/2016/2016-4/11-17-16-E-1.asp#.WKcBI28rKUl

Where Do Frackers Call Home?

By Austin Zwick

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See footnotes at end of text.

Scholars have found that resource extraction, and fracking in particular, occurs in boom-bust cycles (Jacquet, 2006; Christopherson, 2011). Though production of a gas well-site may last decades, the labor necessary is frontloaded to the first few months as the majority of the labor is needed in the preparation and construction of the well-site (Jacquet, 2009). Afterwards, the well is drilled by a small team and then fracked by an even smaller one. Although over 400 workers step foot on a well-site, the total employment impact is only approximately 13 full-time employees (Jacquet, 2011). The regional boom in employment is not due to a single well-site, but rather the cumulative effect of thousands of well-sites being constructed, drilled, and fracked within a relatively short timeframe. Nowhere is this truer than the Bakken Shale formation along the North Dakota and Montana border, where over 4,600 wells have been drilled and fracked between the development of the technology in 2007 and December 2012 (N.D. DMR, 2012). Additional labor is necessary to supply secondary, support, and social goods and services to these frackers.

This leads to resource boomtowns being defined by "too many unfilled jobs and not enough empty beds" (Jacobsen and Parker 2014). In order to house growth, Storey (2010) describes the rise of a new organizational structures for extractive industries as 'Fly-In/Fly-Out' (FIFO), in which workers spend a certain number of days working onsite after which they return to their home communities for a specified rest period. Most of the FIFO literature has focused on industrial mining in Western Australia (Haslam-McKenzie 2011; Haslam-McKenzie and Hoath 2013; Perry and Rowe 2014), but this live-work arrangement began by offshore oil workers in Mexico (Gramling 1995) and has since been applied to other extractions situations including mining in northern Canada (Storey, 2010; Finegan and Jacobs, 2015) and fracking in the United States (White, 2012; Ruddell et al., 2014). New construction is typically not undertaken as the shorter lifecycle of the extraction process means that capital outlays to build anything more than a temporary camp no longer make financial sense as spatially fixed, expensive upfront housing is a poor investment for a temporary industry (Storey and Shrimpton 1988). Houghton (1993) explains that industrial firms choose to bring in temporary employees using the FIFO approach because "large scale capital outlays on urban infrastructure are replaced by transport costs" which are distributed across the lifespan and productivity levels of the project. As most mining projects are located in rural regions that have little by way of pre-existing infrastructure, FIFO is a necessity. This raises the question of where these workers call home.

Data was obtained from the U.S. Census Longitudinal Employer Household Dynamics' (LEHD) Origin-Destination Employment Statistics (LODES) main and auxiliary databases from 2007 and 2012 (LEHD LODES, 2016). This data is based on employers' business addresses and employees' mailing addresses as found on their paychecks, and can be downloaded as Census block groups corresponding with an origin (home address) and destination (work address). This data is typically used to quantify commuting patterns. The data was then cut down to the work locations of the 14 counties in North Dakota[1] and 3 counties in Montana[2] on which the vast majority of the Bakken Shale sits. This data gives insight as to where workers come from and whether they plan on staying or not, as indicated by their declared permanent residency, but will not give a complete picture because: (1) employers may declare their business office at a different address than the worksite where the worker is employed (particularly an issue as the individual fracking sites do not have addresses), (2) workers may declare a local address as their temporary mailing address (such as a P.O. Box), and (3) workers may obtain in-state residency for a temporary stay. All of these possibilities make it likely that the numbers presented are conservative estimates. The 2007 numbers were then subtracted from the 2012 numbers to come up with the number and location of new commuters and then were mapped onto the 2012 TIGER Census U.S. Counties Shapefile (CENSUS TIGER, 2012), as seen in Figure 1.

This data indicates that almost 50,000 jobs were gained in the Bakken Shale between 2007 and 2012. To find how many support jobs the fracking industry is producing, a crude calculation would be the total employment change, divided by the product of the average number of wells per year multiplied by 13 FTEs (Jacquet, 2011), the result implies that four support jobs are created for each fracker employed. In the map, black counties are those in the sample. Yellow represents home counties with little to no change (fewer than 20 people, gains or losses) in commuting patterns. Successively darker shades of green indicate home counties with successively increasing commuting patterns. No home

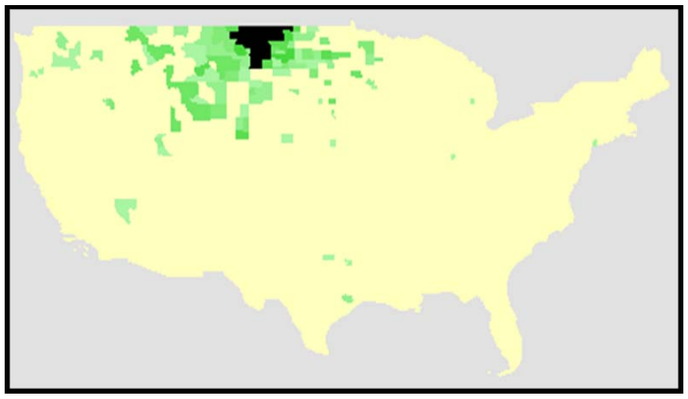

Figure 1. Bakken Shale Workers Home Addresses by County

counties had a large decrease in commuting. This data shows that the Bakken Shale has become a regional magnet for employment with the greatest gains in the neighboring counties within the states of North Dakota, South Dakota, Montana, Idaho, and Wyoming. A smaller number of people commute from farther away states such as Texas, Nevada, and Washington. This shows that, rather than a literal "fly-in, fly-out" as presented in the academic literature, the phenomenon more closely resembles a "drive in, drive out" employment opportunity for regional workers. Other shale plays most likely exhibit a similar pattern, but further research is needed.

Footnotes

[1] Billings, Bottineau, Bowman, Burke, Divide, Dunn, Golden Valley, McKenzie, Mountrail, Renville, Slope, Stark, Ward, and Willams counties

[2] Richland, Roosevelt, and Sheridan counties

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Calendar

23-26 April 2017, 44th Annual International Energy Conference at Boulder, CO USA. Contact: Phone: 303-442-4014, Fax: 303-442-5042, Email: iceed@colorado.edu, URL: www.iceed.org

24-25 April 2017, Global Water Summit 2017: Intelligent Synergies at Madrid Marriott Auditorium Hotel and Conference Center, Avenida de Aragon No 400, Madrid, 28022, Spain. Contact: Phone: 01865204208, Email: cmarchesi@globalwaterintel.com, URL: https://go.evvnt.com/108102-0

24-25 April 2017, 6th Annual Smart Water Systems at London, United Kingdom. Contact: Phone: +44 (0)207 827 6068, Email: tchung@smi-online.co.uk, URL: https://go.evvnt.com/74675-0

25-27 April 2017, ConMin West Africa 2017 at Abuja International Conference Centre, Central Area, Area 11, 900 Herbert Macaulay Way, Abuja, 900001, Nigeria. Contact: Phone: +4989552912338, Email: angelina.loeffler@imag.de, URL: https://go.evvnt.com/68043-0

25-26 April 2017, Best Practices & Financial Risk at Houston, TX USA. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/best-practices-financial-risk/

25-27 April 2017, Argus Asian Petroleum Coke 2017 at TBA, Mumbai, India. Contact: Phone: 6496 9977, Email: samson.yeo@argusmedia.com, URL: https://go.evvnt.com/73939-0

26-27 April 2017, Energy Risk Management at Jersey City, NJ USA. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/energy-risk-management/

27-28 April 2017, Upstream Oil and Gas Fundamentals at Houston, TX. Contact: Phone: 888 871-1207, Email: info@emi.org, URL: https://emi.org/course/upstream-oil-and-gas-fundamentals/

27-28 April 2017, 3rd Annual Congress on Biofuels and Bioenergy - 2017 at Dubai, UAE. Contact: Phone: +17025085200, Fax: +16506181414, Email: biofuelsconference@insightconferences.com, URL: http://biofuels-bioenergy.conferenceseries.com/middleeast/

01-03 May 2017, Waterpower Week in Washington 2017 at Capital Hilton, 1001 16th St NW, Washington, DC, 20036, United States. Contact: Phone: 9185084386, Email: brandont@pennwell.com, URL: https://go.evvnt.com/59631-0

01-02 May 2017, Argus Canadian Crude Summit at Calgary,Canada. Contact: Phone: 7134007846, Email: sarah.mireles@argusmedia.com, URL: https://go.evvnt.com/86283-0

02-03 May 2017, Introduction to Energy Trading & Hedging at Houston, TX USA. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/introduction-to-energy-trading-hedging/

03-04 May 2017, Argus Canadian NGL Summit at Marriott Downtown, 110 9th Avenue SE, Calgary, T2G 5A6, Canada. Contact: Phone: 7134007846, Email: sarah.mireles@argusmedia.com, URL: https://go.evvnt.com/86284-0

04-04 May 2017, Intro to Energy Trading for the Non-Trader at Houston, TX USA. Contact: Email: btaylor@emi.org, URL: https://emi.org/course/intro-to-energy-trading-for-the-non-trader/

08-11 May 2017, Mastering Renewable & Alternative Energies at Johannesburg, South Africa. Contact: Phone: +6563250351, Email: vincs@infocusinternational.com, URL: http://www.infocusinternational.com/renewable/index.html

08-09 May 2017, US Offshore Wind 2017 Conference and Exhibition at Hyatt Regency Long Island Hotel, 1717 Motor Parkway, Hauppauge, New York, 11788, United States. Contact: Phone: +442073757239, Email: adam@windenergyupdate.com, URL: https://go.evvnt.com/108131-0

08-10 May 2017, SPE Reservoir Characterisation and Simulation Conference and Exhibition at Jumeirah at Etihad Towers, West Corniche, AL khubeirah, Abu Dhabi, 111929, United Arab Emirates. Contact: Phone: +971 4 457 5800, Email: ydadapeer@spe.org, URL: https://go.evvnt.com/105112-0

08-10 May 2017, Argus US Natural Gas Markets at Hilton Houston Poat Oak, 2001 Post Oak Blvd., Houston, 77056, United States. Contact: Phone: 7134007846, Email: sarah.mireles@argusmedia.com, URL: https://go.evvnt.com/81083-0

09-11 May 2017, Symposium Mines Guinea at Sheraton Grand Conakry, Kipe Centre, Emetteur, Commune de Ratoma, Conakry, Guinea. Contact: Phone: +4402077004949, Email: barbora@ametrade.org, URL: https://go.evvnt.com/77878-0

10-11 May 2017, OandM and Lifecycle Management Strategies for CCGT Power Plants at Crowne Plaza, Holliday Street, Birmingham City Centre, Birmingham, B1 1HH, United Kingdom. Contact: Phone: +441212003810, Email: j.strumilowska@tacook.com, URL: https://go.evvnt.com/106954-0

10-11 May 2017, Oil Industry Economics at Houston, TX USA. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/oil-industry-economics-from-wellhead-to-gas-pump/

10-11 May 2017, All-Energy Exhibition and Conference at Scottish Exhibition and Conference Centre (SECC), Exhibition Way, Glasgow, G3 8YW, United Kingdom. Contact: Phone: 02084398860, Email: emma.salter@reedexpo.co.uk, URL: https://go.evvnt.com/75306-0

10-11 May 2017, All-Energy Exhibition and Conference at Scottish Exhibition and Conference Centre (SECC), Exhibition Way, Glasgow, G3 8YW, United Kingdom. Contact: Phone: +44 (0)20 8271 2179, Email: all-energy@reedexpo.co.uk, URL: https://go.evvnt.com/75306-0

14-18 May 2017, Gas / LNG Contracts: Structures, Pricing & Negotiation - Dubai at Dubai, UAE. Contact: Email: vincs.kong@infocusinternational.com, URL: http://www.infocusinternational.com/gascontracts/index.html

15-19 May 2017, International Gas Value Chain Course at Amsterdam, The Netherlands. Contact: Phone: +31 (0) 88 1166827, Email: tooms@energydelta.nl, URL: https://www.energydelta.org/mainmenu/executive-education/introduction-programmes/international-gas-value-chain

15-16 May 2017, Technical Analysis at Calgary, Alberta Canada. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/technical-analysis/

16-17 May 2017, Natural Gas Economics 101 at Houston, TX USA. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/natural-gas-economics-101/

16-17 May 2017, IDTC: 17th International Downstream Technology & Strategy Conference at Rixos Libertas Dubrovnik, Liechtensteinov put 3, Dubrovnik, 20000, Croatia. Contact: Phone: +359 884 884 535, Email: marina_marchovska@europetro.com, URL: https://go.evvnt.com/84907-0

17-18 May 2017, Energy Risk Management at Calgary, Alberta Canada. Contact: Phone: (888) 871-1207, Email: btaylor@emi.org, URL: https://emi.org/course/energy-risk-management/

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