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IAEE Energy Forum

First Quarter 2013 International Association for Energy Economics

President's Message

I am delighted to have been elected as President of the IAEE, following in the distinguished footsteps of Professor Lars Bergman, with whom I have been collaborating for many years. He weathered his president-elect year by organising the brilliant International conference in Stockholm. I cannot match him there, as the last international conferences I organised (the European Economic Association and Econometric European meetings) were two decades ago. They made me appreciate what a debt we owe to the members who take on such tasks. I have been fortunate in the President-elect year to have attended three IAEE conferences and one of the British affiliate. I was entranced by the atmosphere of the many-templed Kyoto for the Asian meeting last February, as well as being impressed by the quality of the presentations. I used my trip to Japan to brief members of the Diet on UK Energy Market Reform. The Diet was discussing Japanese energy policy post-Fukushima Daichi and collecting reactions of other countries to the nuclear question. I then attended the International IAEE Conference in the magnificent city of Perth,. That afforded the chance to walk in the canopy of the very tall Tingle forest and taste the Margaret River wines. The European meeting in Venice was the biggest ever, set in such a beautiful location, and immaculately run. My final visit for the year was to the local affiliate, the BIEE, held as usual in St John's College Oxford, of just the right size to meet all the usual local suspects but also to welcome visitors from overseas.

I mention these conferences as that was how I first became engaged with the IAEE. The very first International IAEE meeting was held in 1980 in Churchill College, Cambridge, of which I was (and remain) a fellow. That was a year after the first meeting in Washington DC, where I was then in the Research Department of the World Bank working on energy policy. My first Energy Assessment mission was to Papua New Guinea as she embarked on numerous exotic renewables projects to reduce its oil dependence and the high costs of internal transport.

It is interesting to look back at those times and reflect how the world, and with it the IAEE, have changed. 1973 witnessed the first oil shock, and with it a stimulus to the economics of energy. In 1976 I was invited by Joe Stiglitz to visit Stanford with Partha Dasgupta and Geoff Heal to work on energy issues – exhaustible resource theory, security of supply, strategic reserves, investment under risk and uncertainty, oil market modelling, oil taxation – the range of lovely new problems was a wonderful opportunity for young theorists and we made the most of them. Dasgupta and Heal published Economic Theory and Exhaustible Resources, and I started work with Eric Maskin (like Stiglitz, later to become a Nobel Laureate) on the paradoxical consequences of oil import tariffs in a world unable to commit to future policies.

In part, in response to the mid-70s oil shock, IAEE was launched in 1977. Unsurprisingly, the early years were very focused on oil markets, energy security, energy demand and the macro consequences of oil price rises. The first volume of *The Energy Journal* was mostly concerned with these topics, but there was already one article on new energy technologies and one on electricity pricing. Move forward to today and much has changed. Oil prices are still topical, but gas, electricity, carbon emissions and renewable energy have moved centre stage. Initial concerns that the IAEE was too North American are no longer heard as the membership share of North America has fallen to 30% and that of Europe has risen to just under 50%, with Asia/Pacific now at 10%. Membership

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Editor: David L. Williams

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/ListScholarships.aspx

We look forward to your participation in these new initiatives.

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now exceeds 4,000, and the Association is in strong heart, truly international, with excellent journals and the exciting new Economics of Energy and Environmental Policy publication extending our reach. I cannot think of a more exciting time to be President of such an impressive Association and I look forward to meeting many of you in the upcoming conference round.

David Newbery

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International Association for Energy Economics

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

Editor's Notes

The response to our call for articles on energy efficiency was most gratifying. This issue and the next issue of the *Forum* focuses on this subject and there may be some carryover into the third quarter issue as well.

Xioafei Li reports that the composition of China's new leadership has profound implications for its energy sector. The new Chinese leaders will likely continue to support the large national oil companies, as well as make some adjustments. This change-in-the-context-of-continuity dynamic will also impact the various aspects of the oil and gas industry.

Michael Overturf comments that in a recent work, economist Robert J. Gordon describes six headwinds that adversely impact U.S. GDP growth. The fifth headwind asserts that emissions reduction is an 'unpaid bill' of past productivity gains. He analyzes this in detail and discusses the relationship between energy productivity and sustainability in general.

Tim Brennan notes that utility funding and management of energy efficiency programs, while popular, conflict with long-standing policies separating regulated monopolies from competitive markets. Its appeal may rest more on politics than economics.

Fereidoon Sioshansi writes that there is growing evidence across mature OECD economies that electrcity demand growth is falling and may become a thing of the past. He describes the reasons for this and the profound implications for the power sector.

Louis-Gaëtan Giraudet and Sébastien Houde note that moral hazard issues can deter profitable investments in energy efficiency and provide examples of this. Energy-savings insurances and quality standards can mitigate the problem – yet not eliminate it.

Prachi Gupta notes that between 1992 and 2008, U.S. electric utilities aimed at encouraging energy efficiency through demand-side management programs. Panel data from the Energy Information Administration Survey are used in categorical regression models to test whether or not any significant changes have taken place with the introduction of DSM policies. Estimates imply that DSM has a very small effect on peak load reduction and there is substantial regional variability.

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Broaden Your Professional Horizons

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International Association for Energy Economics

In today's economy you need to keep up-to-date on energy policy and developments. To be ahead of the others, you need timely, relevant material on current energy thought and comment, on data, trends and key policy issues. You need a network of professional individuals that specialize in the field of energy economics so that you may have access to their valuable ideas, opinions and services. Membership in the IAEE does just this, keeps you abreast of current energy related issues and broadens your professional outlook.

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.

To join the IAEE and avail yourself of our outstanding publications and services please clip and complete the application below and send it with your check, payable to the IAEE, in U.S. dollars, drawn on a U.S. bank to: International Association for Energy Economics, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122. Phone: 216-464-5365.

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_____**Yes**, I wish to become a member of the International Association for Energy Economics. My check for $100.00 (U.S. members $120 - includes USAEE membership) is enclosed to cover regular individual membership for twelve months from the end of the month in which my payment is received. I understand that I will receive all of the above publications and announcements to all IAEE sponsored meetings.

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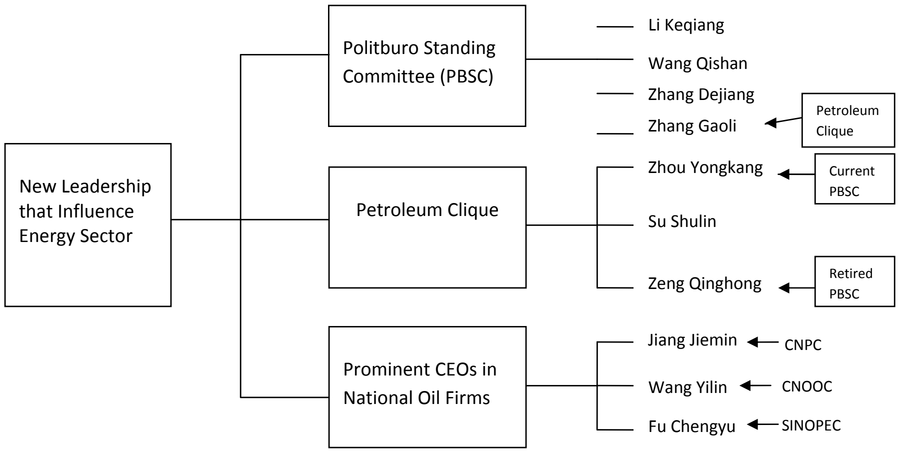
1/13Forum

China's Leadership Transition and the Energy Sector

By Xioafei Li*

Profiles of Potential Energy Leaders

The composition of the new Politburo and their views regarding the large state-owned enterprises (SOE) will have profound implications for China's socioeconomic trajectory in general and for the energy sector in particular. It would be helpful for China watchers to grasp the biographical backgrounds of the top Chinese leaders who will likely govern the country for most of this decade and beyond.



In that regards, I would like to divide the energy-related Chinese leaders into three groups: Politburo Standing Committee (PBSC), a supreme leadership body that perches atop the China's hierarchy; Petroleum Clique, the politicians who made their political fortune through their careers in the oil and gas industry; and the prominent CEOs in China's large oil companies.

The PBSC Group – Xi Jinping will succeed Hu Jintao as president of PRC after the 18th Party Congress in fall 2012. He has long been known for his market-friendly approach to economic development, yet he has also displayed strong support for China's flagship state-owned enterprises, including China's large energy firms. Thus, these firms may continue to monopolize many major industrial sectors in the country under his tutelage. Moreover, Xi's views concerning China's political reforms appear to be remarkably conservative, seemingly in line with old-fashioned Marxist doctrines.

Although Li Keqiang is in line to succeed Wen Jiabao as premier of the State Council after the leadership transition, he is perceived by some to be somewhat too "weak" to be capable in this position. Li will likely continue to resolve some policy issues like promoting innovation in clean energy technology. In addition, he will succeed Wen as head of the National Energy Administration, the highest agency regulating China's energy industry. However, there is a slight possibility that the premiership might be left to a "tough" leader, Wang Qishan.

Wang is almost certain to obtain a seat in the next PBSC. Although he has strong ties with major state-owned enterprises, it is unclear whether he will favor public ownership of the petroleum sector or promote the private investment. Another PBSC candidate, Zhang Dejiang, may continue to promote policies in favor of state dominance, economic protectionism, and the development of SOEs, among which the national oil companies (NOCs) are the most profitable in China and fit well into this category.

Zhang Gaoli is also believed to be an emerging member for the next PBSC. An economic thinker, Zhang advanced the early stage of his career within the oil industry. Although he has extensive leadership experience in the prosperous coastal areas like Shenzhen, Guangdong, and Tianjin, and is considered instrumental in the economic development of these regions, he takes a low-profile approach, and it is, therefore, unclear what his attitude towards the proper development of the NOCs will be. In general, Zhang is known for his pro-market economic policy orientation.

The examination of the policy preferences of this PBSC group seems to show that the top Chinese leaders for the next decade may help PRC flagship companies obtain the status of leading global companies. This does not exclude the engagement of economic mercantilism and protectionism. We expect to see China's national flagship companies' monopoly and overseas expansion as the most crucial factors in the next phase of China's rise.

Petroleum Clique – The Petroleum Clique is another group that may wield great power over the energy sector after the leadership transition. A current member of PBSC and a key member of the clique, Zhou Yongkang, spent a majority of his life in the oil and gas sector. He used to be vice minister of the Petroleum Industry and president of CNPC. It is well-known that Zhou wields significant influence in the oil sector.

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However, his political impact is tarnished due to his step-down from the incoming 18th Party Congress, as well as his support for the former Chinese politician, Bo Xilai. This may result in his loss of right to select his own successor when he retires from the PBSC in the fall of 2012.

Former PBSC member Zeng Qinghong is the chief of the Petroleum Clique. Zeng spent his early years in the petroleum industry before he was elevated to national leadership by then president Jiang Zeming as his trusted adviser. At the time Zeng was in place, most clique members swore loyalty to him. However, Zeng's influence is currently ebbing as Jiang's faction is gradually phasing out of the political platform.

Another major Petroleum Clique member, Su Shulin, has many years of experience working in China's oil and gas production. He spent most of his time as leader of Sinopec. One of the important accomplishments of Sinopec under Su's leadership was its environmental focus. Also under him, the company actively explored renewable energy sources. Starting in 2011, Su has served as Governor of Fujian Province. Considering his diverse governing experiences and his young age, Su is likely to continue to rise in his political career even after the Chinese new leaders assume power.

This second group of petroleum CEOs-turned political leaders, like Su Shulin, made successful transfers in their lives from oil industry to the political realm. Not top tier yet, they are making their way to the 6th generation leadership after Xi. As the CEOs-turned politicians may further enhance their presence at the 18th Central Committee in 2012, the oil industry is expected to be well represented in the future.

Prominent CEOs in NOCs – This group consists of top leaders from the large national oil companies, like Jiang Jiemin, Fu Chengyu, and Wang Yilin. Jiang is a long-term leader of CNPC and a key figure in China's determined expansion of its energy dominion overseas. Fu had been chairman of CNOOC since 2003 and is currently chairman of Sinopec since 2011. However, both Jiang and Fu have never made the jump from the energy business to politics, and they will most likely never be able to make it because they are approaching retirement age. These limitations diminish their chances to become political stars. Their diminished reputations have been reflected by Fu's failure to be elected as one of the SOE delegates to attend the upcoming 18th Party Congress, as well as by Jiang's probability to at most become an alternate member of the Central Committee. The decline of Jiang's political fortune is further portended by his receipt of a warning as a punishment for his responsibility in a pipeline explosion in Dalian last year. Thus, to some extent, one can say the political careers of current NOCs' leaders such as Jiang and Fu's depend upon the patronage of Zeng and Zhou for their rise.

Despite the lack of political say, the energy companies' financial clout and technical expertise provide them with considerable influence over energy projects and policies in China. Their increasing importance in China's political life has been illustrated by the fact that the number of SOE delegates for the 18th Party Congress has increased 3 folds compared with 10 years ago when SOEs first formed a separate group participating in the 16th Party Congress in 2002. In addition, among the delegates from SOEs, a quarter of them are from the energy segment. Analysts may reasonably expect that one or two top business leaders from China's energy majors are among the candidates for Politburo seats. This group of business elite is well aware of the dilemmas and problems faced by the NOCs, and therefore probably are more in favor of a market approach and price reforms.

The biographical features of the new leadership are a sufficient basis for some preliminary judgments about the tendencies of the energy segment. The new leadership will likely continue to support the large NOCs in achieving leading global companies' status. We expect to see China's energy majors continue to enjoy the monopoly advantage and overseas expansion. However, the internal conflict between price control and market-driven forces may push the new administration to make some adjustments on the oil and gas segment, which will become the subject for the next series.

From Price Reform to Pipeline Construction

As China prepared itself for its 18th Party Congress, the political alignment created an opportunity for energy policy change and an impetus to change. The power transition is not just occurring at the apex of political power, but throughout every level of the institutions. Moreover, it is a generational turnover in economic management agencies. In essence, a generation of managers is now stepping down, a group of individuals who went to university during the 1960s, worked through the Cultural Revolution, and then assumed leadership roles during the 1990s. This generation includes China's "energy czar," Zhang Guobao, retired in 2011; and chairman of State-owned Assets Supervision and Administration Commission (SASAC), Li Rongrong, retired in 2010. This turnover in the economic establishment is part of the generational turnover occurring in Chinese society overall.

At the same time, the holdovers from the 17th Party Congress will see political continuity with past policies in the new Politburo under Xi Jinping. For the Central Committee (371 members), the turnover rate at the 18th Party Congress is expected to be somewhere between 60 and 65%. In the State Council, about 70% of the total members will be replaced, mainly due to their ages. In the next administration, we will see China continue to be governed by an oligarchy similar to the Jiang and Hu eras and a growing difficulty in establishing consensus among the leaders.

The aforementioned change-in-the-context-of-continuity dynamics driven by the Chinese leadership shift will have profound impacts upon various aspects of the oil and gas industry.

Oil product pricing reform: China's oil product pricing reform targets reasonable profit margins of around 5% for the Chinese refiners. Effective since December 16, 2011, China took a small step towards natural gas price reform by implementing a trial in the southern Guangdong and Guangxi provinces. The implementation of a permanent pricing reform could be opportune in that the sustained period of lower oil prices helps restrain inflation. However, the odds of a pricing reform in 2012 are believed to be low given the political environment. Yet, it is good news for domestic gas producers that the NDRC has acted, and we expect a nationwide roll-out to fully liberalize wellhead prices before 2015.

SASAC's corporate governance reforms - SASAC has begun to exert more influence over the large state-owned firms, including the NOCs. For the next few years we expect to see less severe corruption in the national oil firms, as fighting corruption is one of the goals set out by the SASAC. The power of the corporate leaders in the oil firms might be curbed to prevent them from accumulating too much power to become independent corporate fiefdoms. We also expect to see an establishment of independent boards in the next leadership that will promote the profitability and operational efficiency of the NOCs.

Super Energy Ministry: One of the new developments in this discussion is the creation of a Super Energy Ministry, which we expect to occur in 2013. The objective of this new agency would be to take the energy-related responsibilities of the NDRC, National Energy Administration, SASAC and various other local, provincial and state agencies and roll them into one. However, the two most important controls – pricing setup and investment approval authorities – are said to remain in the NDRC for the time being. Without these two commands, we may wonder about the true effectiveness of the prospect Energy Ministry. In addition, establishing a full ministry not only requires numerous subordinating agencies and staff nationwide, but also needs legal validity. China's *Energy Law* has somehow never been released, although the drafting process was begun long ago by Premier Wen Jiabao in 2005, and the actual documents came into form in 2008. Furthermore, the formation of the Energy Ministry is said to cause tremendous objections from NOCs and other interest-vested organizations as a result of their influence being largely reduced. All this indicates that the setting-up of a Super Energy Ministry is an important and challenging task for the next generation of Chinese leaders, and it may take as long as 10 years to fulfill this mission.

Natural gas and pipeline construction: China has recently begun the construction of the third West-East Gas Pipeline that starts in Xinjiang and takes mainly Central Asian gas to Fujian Province in Southeast China. A fourth pipeline has been planned while discussions to build the fifth are underway. PetroChina may begin the construction of a third cross-border gas pipeline in 2013, and the project may take 2-3 years to complete. In addition, China hopes to double the share of natural gas in its overall energy mix to 8% by 2015. China has recently sped up its pace of shale gas development and will continue to do so in the future. On March 16, 2012, China's National Energy Administration published a shale gas development plan that set ambitious five-year production targets with 6.5 bcm/year by 2015 and 60-100 bcm/year by 2020. Moreover, in December 2011, China issued the 12th Five-Year Plan for coalbed methane development and utilization. From these, we can tell promoting clean energy technology will continue to enjoy a priority for the next administration.

Undergoing an economic slowdown: It is widely agreed that China is facing an economic growth slowdown. This is partially because of economic conditions in Europe, which is the biggest single contributor to the slowdown in Chinese exports. A more fundamental reason is China itself; it is moving out of the long-term phase of high growth. China's labor force is growing at a dramatically slower pace, and in just a few years the labor force will begin to shrink. Moreover, the past consistent high investments led to an abrupt drop in growth.

To prevent such an abrupt transition to slower growth, the government is likely to continue sponsoring or funding large investments in oil and gas projects. At the same time, China's leaders understand that they need to be flexible in order to handle the coming challenges. This awareness may lead to a heightened uncertainty, which will, in turn, generate unexpected changes in oil and gas policy. In addition, the unprecedented economic circumstances may increase pressure upon the incoming leaders to look for ways to break with business as usual, and this may open up opportunities for energy reformers.

Business elites in the party leadership: The CEOs of large national oil firms have become more ambitious in their jockeying for power in the leadership of the Chinese Communist Party. The remarkable presence of senior executives of NOCs among the top national leaders reflects an important trend in elite recruitment in present-day China. The political transition in 2012 will be an important test for the future importance of business interests in Chinese politics, this perhaps foreshadowing a new phase of transformation of state-business relations in this rapidly changing country.

In conclusion, we expect more energy-related policy initiatives to be implemented during the 12^{th} Five-Year Plan of 2011-2015 despite a leadership turnover, and the 13^{th} Five-Year Plan to fine tune the provision of energy in the growth of the Chinese economy. In the second half of 2011, China launched some key changes to the taxation system like a resources tax and a special oil gain levy and some changes to the pricing such as natural gas, and we expect tax adjustments and pricing liberalization to continue throughout 2012-14. However, we do not expect major changes in energy policy to be made between now and a year after the new leadership takes office. The economic issues will likely only gradually head toward resolution in the fall of 2013. That is when the 18^{th} Central Committee is scheduled to hold its Third Plenum. Traditionally, the Third Plenum has been the venue at which a new administration, having consolidated its power and worked out its program, presents ambitious new economic policies, including those for the oil and gas segment.

The Fifth Headwind: Will Moving Towards Energy Sustainability Really Inhibit Industrial Productivity Growth?

By Michael C. Overturf*

Industrial productivity is a social dynamic that has brought great benefit to society in general, raising the standard of living, life span, and the quality of life in general. We are learning that the byproducts of industrial activity are exerting such harm on the local and global environments that some change must occur to mitigate these effects.

In particular, energy inputs take the form of hydrocarbon fuels. The term sustainable energy means that energy consumption can occur indefinitely (which I arbitrarily pegged at 10,000 years) without ill effect, and that it can support the necessary perpetual dynamic of productivity growth.

A survey of literature finds that energy sustainability today is, by and large, a political topic, supported in part by truisms and in part by a misunderstanding of how industrial energy use actually works. If the desired consumption shift is indeed to occur, it must clearly and demonstrably achieve its environmental gains while also maintaining or accelerating productivity growth rates. Is this possible? In this opinion piece, I take a look at how this might occur.

Sustainability isn't the Worst Thing in the World

This question first formed in my mind as I was listening to Steve Dubner of Freakonomics in one of his podcasts. In this particular issue he examined the work of Robert J Gordon and Tyler Cowen, both of whom claim that the United States, and possibly the industrialized world, is doomed to low productivity growth for the foreseeable future, or to put this to greater rhetorical effect, "our golden age is behind us". However, by Mr Cowen's own admission: "Our [economists] ability to predict future growth has never been that great". And then Dubner, in conversation with Kai Ryssdal, said this: "It may be time to think of the U.S. economy not in terms of never-ending growth, which we have been trained to do, but in terms of sustainability, *which isn't necessarily the worst thing in the world*".

Aw, shucks. Is sustainability a good in and of itself, unrelated to productivity growth? Anybody who's sat down with a CFO or CEO of an industrial corporation knows: if an investment does not improve productivity, or revenues, in some way, it's not going to be done.

As an energy professional myself, I know that the value chain of sustainable energy sources is mostly shorter than that of conventional energy, and their capital barriers are lower than ever. So why the downbeat ambiguity, the noble readiness to sacrifice by turning away from the magic productivity engine crank and head into the uncertain forest of sustainability?

The Fifth Headwind

Gordon's paper[1] asserts that all fundamental innovations in communication, transport, and manufacturing technology have been invented, and it is unlikely that anything further will engender growth rates akin to that during the deployment of electricity. He concludes that the United States has six headwinds that will dampen economic growth rates (GDP) for the foreseeable future:

1. Declining Demographics – fewer people working fewer hours;
2. Educational attainment – fewer people completing higher education;
3. Stasis in income inequality – the bottom 99% will not experience significant income growth;
4. Globalization–a nearly infinite[2] source of foreign cheap labor will compete with the U.S. uneducated;
5. Climate change – the cost of reversing past environmental changes
6. And finally, household and government debt.

Although skeptical, I'm not qualified to properly grapple with most of these. The fifth headwind, however, caught my interest, though, as I've seen this in variation from others. Here is the original text from his paper:

> *"Energy and the environment represent the fifth headwind. Part of any effort to cope with global warming represents a payback for past growth. In 1901 the environment was not a priority and the symbol of a prosperous city was a drawing of a factory spewing pure black smoke out of its chimneys. The consensus recommendation of economists to impose a carbon tax in order to push American gasoline prices up toward European levels will reduce the amount that households have left over to spend on everything else (unless it is fully rebated in lump-sum or other payments). India and China are both growing more rapidly than the U.S. and taken together those two na-*

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tions are responsible for double the carbon emissions of the U.S., but they resist suggestions that their growth to high-income status should be curtailed by energy restrictions, since today's rich nations of North America, Europe, and Japan were not regulated in the same way during their 20th century period of high growth."[3]

Apparently economists are now imbued with legislative powers. Anyway, ignoring the crankiness about China and India not stepping up to the plate, the essence of the fifth headwind is this: a cost that is a hangover for past growth, with no current benefit. Does this really stand up to scrutiny?

Energy Consumption and Emissions

The U.S. consumed around 100 quadrillion btus of energy, with only about 10% of this from renewable, or sustainable, sources. Another 8% comes from nuclear power, which many do not classify as sustainable, because of its radioactive waste. The balance, 82%, comes from combusted hydrocarbons.

There are no 'centrally administered' plans to change this mix in the foreseeable future. There are plenty of hydrocarbons available for many more human lifetimes – we can literally cook the planet with the balance of reserves. The EIA forecasts renewable generation growth of 1.9% per year from 2010 through 2035, which does significantly exceed forecast demand growth (0.3% per annum in aggregate), but isn't enough to substantially change the mix.[4]

Yet, emissions are declining, and there is evidence that further reduction in emissions will come about as a *result* of more economic activity, not the other way around.

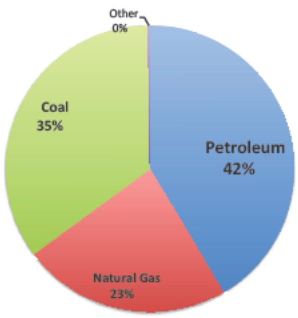

Figure 1, Percentage of Carbon Dioxide Emisssions from U.S. Fuel Consumption in 2012. Total:5.6 billion tons.

Emissions

In 2012 the U.S. emitted 5.6 billion tons of carbon dioxide, with transportation – petroleum combustion – making up the largest share, Figure 1. CO_2 Emissions are currently (2010-2012) on a *downward trend* – the consequence of shifting consumption behavior patterns. The EIA anticipates that that emissions will decline by 0.1 percent per year from 2005 to 2035, as compared with an average increase of 0.9 percent per year from 1980 to 2005.

What are these shifts? On a macroeconomic level we can measure the carbon intensity of an economy, i.e., how much carbon dioxide is emitted per GDP dollar. For the United States, there has been a long term decline in this measure, Figure 2. Over time each financial transaction causes less and less fuel to be combusted. Reasons for this may include a steady shift away from fuel-intensive activities such as manufacturing towards services, which tend to involve more transportation, with less per capita emissions. As this may be, even the most casual observer will detect an inverse relationship between GDP growth and carbon intensity.

The period between 2007 and 2011 is of particular interest, not only because it was a recessionary period, but because other fundamental, unprecedented changes are occurring. Most previous recessions resulted naturally in a flattening or temporary reversal of CO_2 emissions growth.

Since in 2006 - before the most recent recession - gasoline sales in the U.S. have been on a precipitous decline, causing unprecedented refinery closures, and price spikes due to shrinking refinery capacity, Figure 3. An *entire generation of Americans* is combusting less petroleum. But are they emitting more CO_2 through electricity consumption instead?

A similar, but broader trend is taking place in the electric power sector. The exploitation of shale deposits have put large reserves of natural gas on the market at a long term, stable price. Historically, coal has been stable and cheap, but is now being replaced by natural gas[5]. Conventional coal plants emit around 1,200 kilgrams of CO_2 per MWh[6], natural gas emits around 500 kilograms. This represents a nearly 60% emissions reduction while also reducing generating costs and consumer prices. Figure 4 shows new energy generation capacity coming online in the U.S. year-to-date 2012. Led by natural gas, the va-

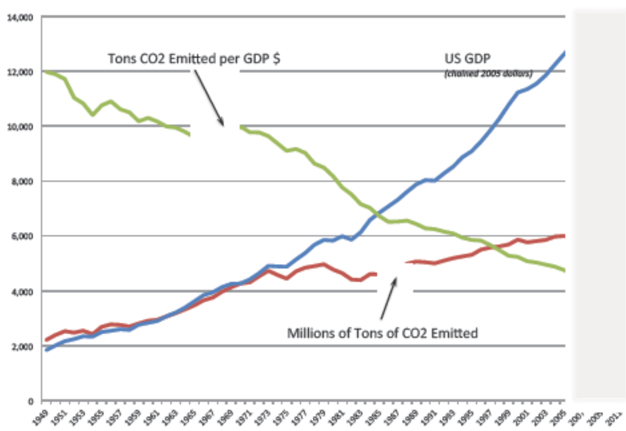

Figure 2, Changes in historical 'Carbon Intensity' of U.S. GDP. Source: EIA & BEA riety of lower emissions technology is increasing significantly, with coal in third place behind wind generation.

Long term capacity plans continue this trend, as can be seen in Table 1, from 2010, projecting registered or intended generation capacity (Megawatts) through 2015. Coal use for power generation is in serious decline; note the higher variance between what was planned for coal in late 2010 (4,304 MW), and the actual 2012 figure in the pie chart above (1,385 MW) in comparison to other fuel sources.

While this organic substitution towards lower emissions is taking place, prices remain flat. Overnight spot prices in the PJM as recently as June 2012 were below $20 per MWh; the year-to-date realtime LMP for the entire PJM region averaged 3.2 cents/kWh. Electricity markets are regional, of course. Unregulated markets will continue to see low electricity prices due to lower natural gas costs and supply competition. Regulated markets are likely to see small price hikes due to investment requirements.

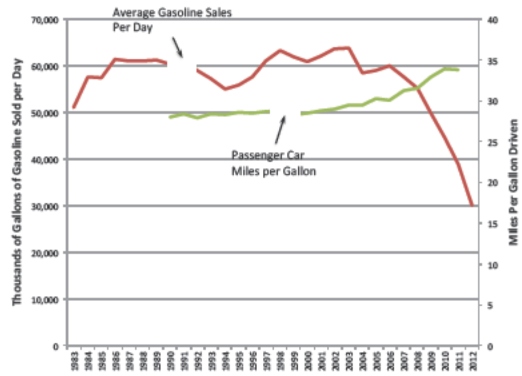

Figure 3, Average Gasoline sales/ day, Passenger car miles/gallon. Source EIA, DOT

Zero Emissions?

Awareness of excessive CO_2 emissions as an adverse pollutant is a recent phenomenon. CO_2 is different than other emissions, such as Nitrous or Sulfur Oxides, in that it is not inherently unhealthy. CO_2 is a volume problem, not a toxicity problem. The ecosphere readily absorbs a certain amount of CO_2, but it appears we are producing more than that.

Therefore, sustainability can be achieved by fractionally reducing CO_2 footprint, not eliminating it - there is probably a floor to the emissions volume cut. I will not hazard a guess what that is, some estimates advocate around 2 billion tons, depending on what other countries do[7]. This would imply a reduction of about 70%.

The U.S. may be able to achieve this level organically, without regulatory mandates, but with technology development, opportunity awareness and prudent investment. Why? Because reduced CO_2 emission is plainly a *byproduct* of cost reductions and productivity improvement – economic stimulants, not depressants.

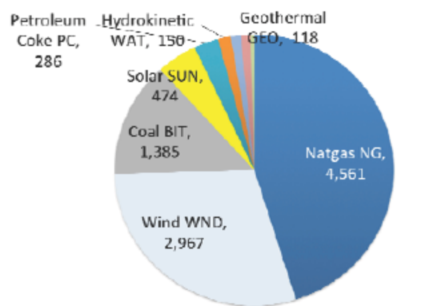

Figure 4, New generation capacity 2012, in MW

Industrial Energy Productivity

In my work I'm not as much focused on residential energy consumption, but rather large commercial and industrial. Industrial energy consumption is about a third of the total, across all uses. Will making these 30 quads of energy supply sustainable lead to productivity growth, stagnation, or reduction?

U.S. Industrial[8] Energy Productivity, also called Energy Intensity, historically somewhat follows the CO_2 emissions per GDP trend:

Interestingly, the correlation between prices and energy intensity is not terribly strong: other factors[9] contribute for this continuous improvement, namely, the introduction of JIT[10] material flow, 'instant' information about demand and supply, and automation. In short, a combination of enlightened management and information technology, the IR3, as Dr. Gordon refers to it. IR3 improved industrial energy productivity by an entire order of magnitude over 50 years – this without knowing or caring about CO_2 emissions, but certainly while suffering SO_2 and NO_x abatement policies, Figure 5.

Fuel	*2011*	*2012*	*2013*	*2014*	*2015*
Natural Gas	11,256	8,756	6,028	4,291	7,387
Wind	7,972	4,711	2,221	349	
Coal	4,873	4,304	290	515	41
Solar Thermal and Photovoltaic	586	2,717	2,673	1,848	471
Petroleum	548	70			
Wood and Wood Derived Fuels	155	485	206		
Other Biomass	128	86	171	93	65
Hydroelectric Conventional	33	155	224	263	22
Geothermal	31	144	185		460
Other	20				
Other Gases		808	4	840	
Nuclear		1,270			
Pumped Storage					

Table 1, Planned electrical production capacity for the U.S., release date 2011. Source: EIA

Lean Meets Mean

The energy industry is not known for its flexibility. No wonder: highly politicized, capital-intensive, millions of customers – these are not attributes that lend itself to quick, adaptive change. But the advantage

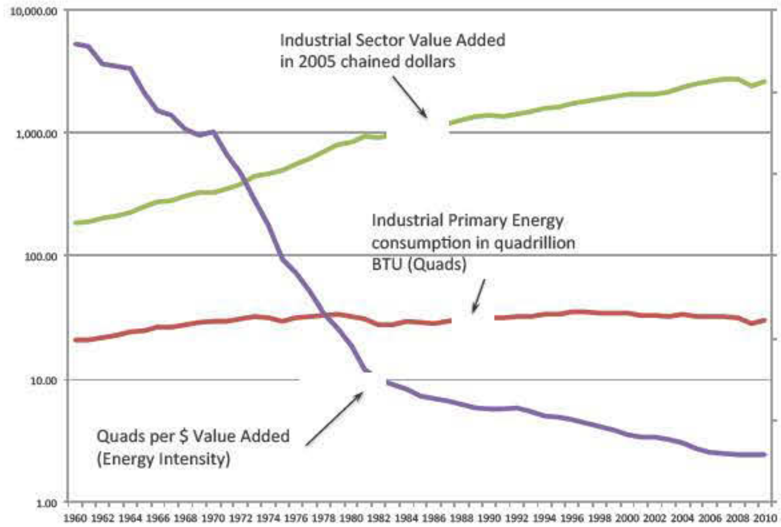

Figure 5, Industrial Energy Intensity over 50 years, Source: BEA, EIA. Note logarithmic y axis.

of latency/waste reduction is powerful – our entire modern material supply was created by the disruptive effects of wide variety, small lot production.

Lawrence Livermore Laboratory estimates that the productivity potential, i.e., the amount of energy wasted (rejected energy) in the current energy infrastructure, is 57% of actual consumption.

This means efficiency alone could make up more than half of desired emissions cuts, while reducing corporate input cost.

The intelligent grid movement, another IR3 offshoot, promises more efficient load balancing, with large scale distributed generation (thousands of more efficient small energy generation systems), to replace the monolithic, central plant.

Why is this interesting? Because onsite generation is a natural 'lean management' approach to energy generation, and the old economics of input fuel volume no longer apply. Energy conversion at the time and place of demand, instantaneously adjusted to either need or market pricing options, could move rejected energy from 57% to 10% or less[11]. Further, intelligent load management accommodates the asynchrony between ambient energy conversion and actual demand.

Although capital requirements can be high, the value chain for distributed energy is shorter and absorbs less cost than the traditional energy portfolio. Industrial firms are installing micro-grids, with CHP plants, renewable energy components, and gas-electric hybrid transportation not because it's a neat thing to do, but because it cuts energy input costs by as much as 50% over delivered market rates. And the by-product, trumpeted by marketers, not CEOs, is reduced atmospheric emissions.

The mean energy input cost reduction afforded to industrial clients by my energy firm is 40%, while reducing CO_2 emissions, by 10%, 15%, or more. Other toxic emissions, such as Mercury, are eliminated wholesale, or completely.

Energy Density

Hydrocarbon fuels such as coal, oil, and gas have a critical advantage over ambient energy such as solar or wind: they meet the energy density requirements of industrial demand. Energy density the amount of energy required per surface area, Watt per square meter (I use kW/m^2).

Why this measure? Because JIT logistics is all about minimizing material and people movement (distance), while maximizing value (what the customer wants). This means that the less area used for production, the more efficient the processes, and the higher labor density (value added motion divided by expended motion) becomes. Surface area is an important measure for an industrial facility.

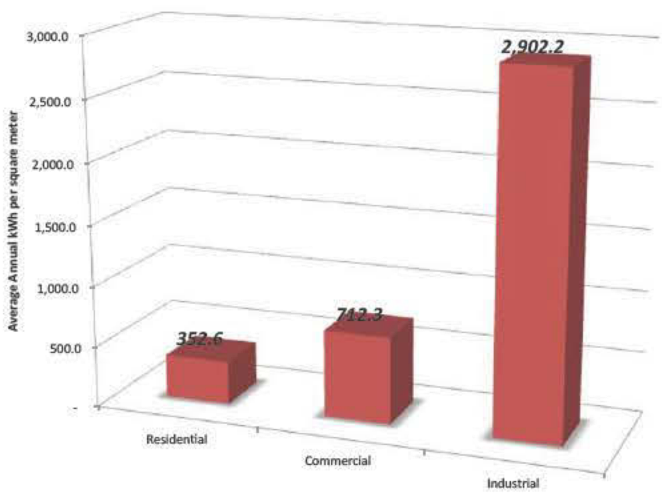

Figure 6, Annual total energy consumption per square meter, by sector. Source: EIA, Overturf (Industrial is small sample set from Food Industry)

Energy demand density is also important in the sustainability discussion because that's how the earth receives its energy from the sun: spread over half the sphere. Hereabouts we can expect anywhere between 360 to 1,800 kWh/m^2 per year, depending on location and weather. Current technology only allows us to harvest roughly 12% of that economically, so that brings the yield down to 40 to 210 kWh/m^2, which is fine for residential or some commercial purposes, as shown in Figure 6.

But solar energy per se is irrelevant, or inconsequential, for industrial purposes: for a median intensity industrial plant one would have to capture solar flux from around 25 square meters for every one square meter used in production. A small 25,000 square meter plant (250,000 square feet) would consume 625,000 square meters of land just for energy generation – 6 acres, under favorable circumstances. Larger plants or more intensive industries have energy density much, much higher than that.

One of the causes of this high density is that industrial plants require temperatures anywhere from 200ºC to 3000ºC to manufacture goods. On a good day, for a short period, the sun is able to convert water into steam for practical purposes, at about 110ºC or so. Large concentrating solar thermal can deliver oils or steam higher than that – for a few hours per day. There is simply no way conceivable at the moment how to continuously power industrial processes with direct solar capture.

Technological substitution is, therefore, a real challenge for the industrial and large commercial sector. Does this mean that there are no lower cost paths that also offer lower emissions? Of course not.

Capital and Sparks

The cost of energy generation plants is hard to pin down from year to year. A coal-fired power plant, that costs around $1,100 per kW of capacity one year, costs nearly $3,000 per kW two years later. Solar PV installations, soaring at $8,000 per kW STC one year, drop to $2,000 three years later.

My perception is that energy conversion technology prices are increasingly volatile, due to fuel shifts, innovations, and regulatory burdens such as emissions controls. A California Energy Commission study in 2010[12] forecast the installed cost of solar PV around $4000 per kW in 2012. It actually came in around $2000 per kW as of this writing.

The recent Prairie State coal powerplant in Kentucky, which went live in June 2012, is an Advanced Simple Cycle system that will deliver 1,600 megawatts of electricity into the Kentucky grid. The plant cost $5 billion to build, at a cost ratio of $3,125 per kilowatt – a number shared with many other peer projects in the western world. The California Energy Commission study baselined the cost at around $1,400 per kW. This is an upward, not downward trend. Plus, like all coal combustion, it puts out a nearly unmanageable amounts of coal ash.

These are big central plants, built by public utilities. Distributed generation is small, costs less, but still consumes capital like any other equipment. Just as this technology has now matured, cash reserves of U.S. companies have exceeded $5 trillion, and interest rates remain at historic lows. At payback rates of less than 36 months, private energy investments offer above average returns at low to moderate risk, and should, therefore, be an attractive investment. Again, regardless of who finances this development, investing in energy emissions reductions provides attractive returns on capital.

The Future Past Gas

Distributed generation technologies offer the lowest LCOE rates of all alternatives, and at the same time afford low and decreasing emissions rates. Current technology offers at least another ten years or more of continuous reduction in cost and emissions for the industrial sector, during which time further cost-reducing technological innovation – in early development now - will become available.

I'm not pretending everything is fine. There are all kinds of structural problems in the energy industry. But change is just starting to accelerate here also, from policy, to technology, to capital intensity – powered by a continually unfolding IR3. Also, very important, the U.S. leads the world with open energy markets: electricity (mostly), natural gas, and oil are deregulated, competitive markets, which quickly expose customers to shifts in cost.

As James Conca at Forbes points out: "The financing issue is key…" Free market forces may be excellent for short-term profits and innovation but cannot address long-term non-market requirements for stability, security and environmental sustainability." Corporations will continue to reduce their costs AND emissions, but capital requirements, although modest on a macro-economic level, will be high. But those investments will be recovered from current and future productivity improvements, not past.

Footnotes

[1] "Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds", Robert J. Gordon, Working Paper 18315, Nation Bureau of Economic Research, Cambridge, MA

[2] The end, or diminishment of growth, of course, means poverty is here to stay for billions of people

[3] Reprinted with permission from 1

[4] It should be said that EIA forecasts beyond a 5 to 8 year timeframe are mathematical, i.e., not based on structural effects

[5] The politics surrounding this shift would lead one to conclude a regulatory force, but, in fact, it is cost that is driving this. It is more profitable to export coal.

[6] http://www.lngfacts.org/resources/PACE_White_Paper.pdf

[7] If the planet absorbs around 11 billion tons, and we're around 25% of global GDP, our 'fair share' would be 2 – 3 billion.

[8] The Industrial sector is comprised of manufacturing, agriculture, mining, and construction

[9] "Explaining Long-Run Changes in Energy Intensity of the U.S. Economy", Wing/Eckhaus, Report 116, September 2004, MIT Program on the Science and Policy of Global Change

[10] JIT – Just in Time

[11] I include transportation in this: electric/hybrid vehicles are charged in time for consumption, the latency time for that energy is much shorter than that of oil, which is captured months, or even years, before ultimate consumption.

IAEE/Affiliate Master Calendar of Events

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

Date	Event, Event Title and Language	Location	Supporting Organizations(s)	Contact
2013				
April 8-9	4th ELAEE Conference *Energy Policy in Latin America: Regional Integration and the Promotion of Renewables*	Montevideo, Uruguay	LAAEE/IAEE	Marisa Leon melon@adme.com.uy
April 22-23	6th NAEE/IAEE International Conference *Energy Resource Management in a Federal System: Challenges, Constraints & Strategies*	Lagos, Nigeria	NAEE/IAEE	Adeola Adenikinju adeolaadenikinju@yahoo.com
June 16-20	36th IAEE International Conference *Energy Transition and Policy Challenges*	Daegu, Korea	KRAE/IAEE	Hoesung Lee hoesung@unitel.co.kr
July 28-31	32nd USAEE/IAEE North American Conference *Industry Meets Government: Impact on Energy Use & Development*	Anchorage, Alaska	USAEE/IAEE	USAEE Headquarters usaee@usaee.org
August 18-21	13th IAEE European Conference *Energy Economics of Phasing Out Carbon and Uranium*	Dusseldorf, Germany	GEE/IAEE	Georg Erdmann georg.erdmann@tu-berlin.de
2014				
June 15-18	37th IAEE International Conference *Energy and the Economy*	New York City, USA	USAEE/IAEE	USAEE Headquarters usaee@usaee.org
September 19-21	4th IAEE Asian Conference *Economic Growth and Energy Security: Competition and Cooperation*	Beijing, China	CAS/IAEE	Ying Fan yfan@casipm.ac.cn
2015				
May 24-27	38th IAEE International Conference *Energy Security, Technology and Sustainability Challenges Across the Globe*	Antalya, Turkey	TRAEE/IAEE	Gurkan Kumbaroglu gurkank@boun.edu.tr

Should Utilities Be in the Energy Efficiency Business?

By Timothy Brennan*

Energy efficiency policy is getting more attention because of the desire to reduce greenhouse gas emissions associated with energy use. For some time, its advocates have touted its virtues as a step toward reducing the amount of oil imported from unreliable or undesirable suppliers. For at least as long, numerous commentators have claimed that consumers routinely fail to invest in energy efficiency (compact fluorescent bulbs, high-efficiency heating and cooling) when the savings over time from reduced spending on energy, at any plausible discount rate, outweigh the up-front cost of the investment.

All of these justifications merit and have received close scrutiny, including the premise underlying all of them that greater energy efficiency significantly reduces energy use. If energy prices are sufficiently high, greater energy efficiency has such a large effect on making these appliances cheaper to use that it could lead to more energy use. This and other "energy efficiency policy puzzles" are the subject of a forthcoming *Energy Journal* article with that title.[1] Here, I want to highlight one such puzzle—the apparent desirability of handing electricity-related energy efficiency programs to distribution utilities.

Energy efficiency has already played a role in designing policy toward utilities. The widespread use of decoupling distribution revenues from use was put into place so utilities would not have an incentive to dissuade consumers from conserving electricity. My sense is that the rationale applies more to the political arena than the market, in that decoupling eliminates an incentive for utilities to oppose energy policies before legislatures and regulatory commissions.[2]

Even if decoupling makes sense as politics, it does not explain why utilities should be the energy efficiency providers. Many industry observers believe that utilities need to change their business model from providing electricity to providing energy services.[3] As an energy services provider, a utility would have the incentive to provide lighting, cooling, and heating at least cost, giving them an incentive to reduce energy costs in particular, i.e., adopt energy efficiency where it is cost-effective.[4] Those who regard energy efficiency as macroeconomically important as well as worthwhile on resource or environmental policy grounds regard this utility involvement as promoting economic growth and recovery overall, especially in recessionary times.[5]

However, these putative virtues of utility involvement in energy efficiency contradict long-standing policies to keep regulated monopolies out of competitive markets. The leading example of this was the Department of Justice's prosecution of its antitrust case against AT&T, leading in 1984 to AT&T having to divest its then regulated local telephone monopolies, with restrictions on their ability to enter other markets that lasted until about 2000, in the wake of the Telecommunications Act of 1996. A less drastic separation—the "Independent System Operator" structured by the "Regional Transmission Organization"—has been a hallmark of national electricity policy since wholesale bulk power markets were opened to competition by Federal Energy Regulatory Commission Orders 888 and 889 in 1996, reinforced by Order 2000 in 1999.

Why Separation?

Some may be suspicious of having utilities involved in energy efficiency deployment because doing so asks them to reject the policy-driven business model that has guided them for, in some cases, over a century—bringing power to the people, as some might say. Instead, they are being asked to provide "energy services," not electricity itself, with the object of supplying less rather than more electricity to their customers. A more cynical way to say this would be that utilities providing energy efficiency is like the fox guarding the henhouse. Another reason might be that energy efficiency is a dynamic, entrepreneur-driven industry ill-suited to the guaranteed-return regulated culture of monopoly distribution companies.

There may be something to these observations, but evaluating them requires expertise in anthropology, not economics. From the economic standpoint, two rationales for separation have stood out.[6] The first has been discrimination. The justification for requiring the "independent" in "Independent System Operator" is to mitigate the incentive a regulated electricity transmission company would have to favor affiliated generators by providing lower quality or delayed access to competing merchant power providers. With regard to energy efficiency, an analogous concern would be that a distribution utility might provide data on usage patterns or technical aspects of grid connections less promptly or accurately to its energy services rivals than it provides itself. This creates a competitive advantage for the utility's affiliated energy efficiency operations, allowing it to charge higher prices than its rivals and potentially displacing more efficient, innovative providers. The discrimina-

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See footnotes at end of text.

tion potential is particularly for electricity distribution, when regulation holds rates far below what the market would bear and thus creates an incentive to try to get those rates up indirectly by creating artificial advantages in related competitive markets.

The second leading rationale has to do with exploiting regulatory price-setting mechanisms to misallocate costs of competitive enterprises to the regulated sector. One tactic is for a regulated firm to integrate into supply markets and then sell inputs to itself at inflated transfer prices. The classic electricity example, from the era of generation regulation, would be where a utility purchases coal from an affiliated mine at above-market prices, and regulators let electricity prices rise to reflect these artificially higher costs. On paper, the profits show up at the unregulated coal affiliate, although they depend on the regulated price of electricity having upward room to move.

Another cost-misallocation tactic, known as cross-subsidization, is to allocate costs of a competitive unregulated service to the regulated side of the business. An example applicable to the present setting would be if a utility in the competitive energy services or energy efficiency market was able to charge the costs of financing, installing, or maintaining high-efficiency appliances to the books of the regulated distribution sector. This would result in distribution rates going up, with the profits from the ratepayer-funded cross-subsidy showing up on the books of the energy services affiliate. In some cases, the ability to cover costs through cross-subsidy could provide a credible threat of a below-cost "predatory" price that would dissuade more innovative, lower cost energy service providers from entering the business.

However, the cross-subsidy problem of raising distribution and thus electricity rates could turn out to be a virtue, at least in part. To see this, we need to look at why utility involvement in energy efficiency remains popular despite these economic concerns as well as potential conflicts with established business models and cultures.

Why Turn to Utilities?

A variety of programs are available to promote energy efficiency. Some involve providing information, such as Energy Star labeling or websites informing consumers of the savings they might achieve from using more efficient appliances and equipment. Others programs entail equipment subsidies or free or reduced-cost energy audits. These programs all have something in common—they cost money. That does not make them undesirable; the environmental benefits from reduced energy use and the reduced need for added generation and transmission capacity to meet peak demands can outweigh these costs. But they do not make those costs go away.

The policy problem becomes how to cover those costs. Since many of these programs are local, the cost problem sits before local governments. Basic economics suggests that the best way to cover these costs is through general taxes, where the tax code is (ideally) designed to raise revenues to best reflect economic efficiency and society's distributional goals. Implementing this principle, however, means that to undertake economic efficiency programs, a government has to raise taxes. This will be especially unpalatable for state legislatures, which generally lack the option to kick the tax can down the road by running deficits.

But legislatures have another option. If a legislature wants to support energy efficiency but not raise taxes to pay for its programs, they can require the state public service commission to have the utilities it regulates undertake them. Energy efficiency program costs do not disappear, of course, but now instead of raising taxes, they become part of the costs to be covered through regulated rates.[7] Consequently, energy efficiency programs may have fallen into the hands of utilities not because they are the most efficient or desirable entities to carry them out, but because giving it to them allows legislatures to enjoy the political benefits of enacting these programs without bearing the political costs of raising taxes to pay for them. Instead, the costs are covered by increases in electricity distribution charges set in less visible regulatory proceedings.

Although hiding the cost ball in this way may conflict with both efficient coverage of energy efficiency program costs and political transparency in ensuring that the public see the costs, it has a potential countervailing benefit. The justifications for energy efficiency policies rest on the premise that people use too much energy. Absent national carbon tax or cap-and-trade policies, electricity may be too cheap because it does not include costs associated with the prospect of climate change. Until real time pricing is effectively implemented, consumers may use too much electricity at peak periods because its price at those times does not reflect the cost of the added generation and transmission capacity required to meet demand. Finally, as noted above, people may consume too much energy because they fail to invest in more efficient appliances that would, over time, save them more than their up-front costs.

If the underlying premise is that people use too much energy, electricity in particular, the obvious policy response is to raise its price. The effect of having energy efficiency programs borne by distribution utilities is to do just that—raise electricity prices to cover the costs of those programs. The inflation of regulated prices that normally makes cross-subsidization a problem here becomes a positive. To some degree, the benefits of these programs may not be in their direct results, but that their implementation moves electricity prices closer to where they should be to get people to take its true costs into account.

Having and Eating the Cake?

There may be a way to take advantage of the political forces driving leading governments to involve utilities in energy efficiency programs, yet reap the advantages of a competitive energy efficiency sector. This would be to limit the utility to being the fundraiser, but keep it out of active participation. For example, regulators could have utilities collect the money and deposit it into a fund. This fund could be used to support entrepreneurs who would submit bids based on how much of a subsidy they would need per megawatt of energy use reductions, and the funds could be awarded to the low bidders. This would be akin to "mobility fund" auctions recently launched by the Federal Communications Commission to foster rural broadband deployment.[8] The funds could also be used to support a less formalized grant program. A third alternative could be to award prizes to the first to meet a specified efficiency target or the one who can achieve the most by a particular deadline.[9]

For those who support policies to promote energy efficiency, these alternatives have the advantage of greater political feasibility relative to raising taxes to support efficiency programs, along with the indirect advantages from raising electricity prices to cover their costs. They also avoid the potential harms from having regulated distribution companies active in the highly entrepreneurial and potentially competitive markets for supplying energy efficiency and energy services. But in considering all of this, it's important to keep in mind that the need for any of this would decline precipitously were electricity rates better tied to costs, through a combination of carbon taxes and real-time pricing.

Footnotes

[1] Brennan, Timothy, "Energy Efficiency Policy Puzzles," *Energy Journal* 34 (2013, forthcoming).

[2] Brennan, Timothy, "Decoupling in Electric Utilities," *Journal of Regulatory Economics* 38 (2010): 49-69.

[3] A strong and clear statement of this position is Fox-Penner, Peter, *Smart Power* (Washington: Island Press, 2010). Full disclosure: I am a special adviser to the Brattle Group, where Peter is principal and chairman. Readers will soon see that this does not imply agreement with Peter's bottom line, but it really is a good book.

[4] That consumers do not invest in energy efficiency already when it would pay to do so is known as the "energy efficiency gap." Jaffe, Adam and Robert Stavins, The Energy-Efficiency Gap: What Does it Mean?" *Energy Policy* 22 (1994): 804-810. Why consumers do not make such purchases is one of the policy puzzles discussed in Brennan, n. 1 *supra*, particularly regarding its implications for policy evaluation. If people make wrong choices, then the data from supply and demand curves used to perform cost-benefit analyses are invalid. What should take their place is far from clear.

[5] Howland, Jamie, Derek Murrow, Lisa Petraglia and Tyler Comings, "Energy Efficiency: Engine of Economic Growth: A Macroeconomic Modeling Assessment," (Rockport, ME: Environment Northeast, 2009), available at http://www.env-ne.org/public/resources/pdf/ENE_EnergyEfficiencyEngineofEconomicGrowth_FINAL.pdf; President's Economic Recovery Advisory Board, "Memorandum for the President: Energy, the Environment and Technology," (June 17, 2009)available at http://www.whitehouse.gov/sites/default/files/microsites/090520_perab_climateMemo.pdf.

[6] These are described in greater detail in Brennan, Timothy, "Why Regulated Firms Should Be Kept Out Of Unregulated Markets: Understanding the Divestiture in *U.S. v. AT&T*," *Antitrust Bulletin* 32 (1987): 741-93.

[7] In my experience, this should and does entail reviews of whether the benefits exceed the costs. The standard cost-benefit measures for such programs come from California Public Utility Commission, "California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects" (October 2001), available at http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF. A critique of these methods, noting the extent to which they depend upon consumer failure to make privately beneficial energy efficiency investments, is in Brennan, Timothy, "Optimal Energy Efficiency Policies and Regulatory Demand-Side Management Tests: How Well Do They Match?" *Energy Policy* 38 (2010): 3874-85.

[8] Federal Communications Commission, "FCC Launches First-of-its-Kind 'Mobility Fund' Auction to Accelerate Delivery of 3G & 4G to Close Gaps in Mobile Coverage Across the U.S" (May 2, 2012), http://www.fcc.gov/document/fcc-launches-first-its-kind-mobility-fund-auction.

[9] Such prizes are increasingly common, particularly in the climate area. Adler, Jonathan "Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization," *Harvard Environmental Law Review* 35 (2011): 1–45. See also Kalil, Thomas, *Prizes for Technological Innovation* (Washington: Brookings Institution Press, 2006).

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2013 IAEE INTERNATIONAL CONFERENCE 16-20 June Daegu, Korea

Korea Resource Economics Association (KREA)
Korea Energy Economics Institute (KEEI)

Invitation to Daegu, Korea

We are pleased to invite all IAEE members to the 36th IAEE International Conference which will be held at Daegu Exhibition and Convention Center (EXCO) in Daegu, Korea on June 16-20, 2013. Our theme is "Energy Transition and Policy Challenges" and proposed topics of the plenary sessions will include:

- Energy Challenges and Global & Regional Cooperation
- North-East Asia: China, Japan, Korea, Russia, Taiwan and North Korea
- Climate Change and Policy Challenges
- Renewable Energy and Smart Energy Systems
- Urban Energy Systems
- Realizing the Potential of Energy Efficiency
- Unconventional Oil and Gas: Technology and Perspectives

Hoesung Lee
General Conference Chair

Call for Papers

Authors wishing to make oral presentations at the 36th IAEE International Conference at Daegu, Korea, must submit an abstract in PDF format, maximum 2 pages in length, via conference website(www.iaee2013daegu.org) or e-mail to the Program Committee (program@iaee2013daegu.org). The deadline for abstract submission is extended to January 31,2013.

To encourage participations from government agencies and energy-related industries, we add another type of presentation, 'Government and Industry Studies,' in addition to the usual type 'Current Research.' 'Government and Industry Studies' type is for those who want to share current activities and case studies from industry and government sectors.

Authors will be asked to choose between two types of presentations: 'Current Research' and 'Government and Industry Studies,' when you submit your abstract via conference website. If you choose to send your abstract via e-mail, please indicate your type in the abstract.

Key Dates:

- *Abstract submission deadline : January 31, 2013*
- *Notification of accepted abstracts : March 8, 2013*
- *Full paper submission deadline : April 12, 2013*

Suggested Concurrent Session Topics

Energy Cooperation
- Global Cooperation
- Regional & Inter-regional Cooperation
- Super-Grid
- Role of International Energy Institutes and Agencies
- FTA and Energy Cooperation
- Energy Cooperation among North-East Asian Countries
- Energy Issues of North Korea

Energy Transition
- Structural Changes in Energy Supply and Demand
- Transition towards Low Carbon Options
- Centralized v.s. Distributed
- Government's Role on Energy Transition

Climate Change and Policy Challenges
- Carbon Trading Markets and Carbon Pricing
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Tour Program

The city of Daegu, where the 2013 IAEE International Conference will be held, is a placeleading to numerous cultural heritages and tourist spots with excellent transportation network. We prepare several tour programs for participants of the conference. First, exclusive pre-tour programs such as 1-day tour to visit the UNESCO World Heritage Sites near Daegu will be offered for participants who arrive early to Daegu (from 15th to 16th of June). During the conference (from 17th to 19th), half-day tour programs to visit the inner-city of Daegu and its vicinity as well as walking tour to visit downtown heritage and oriental medicine market will be offered for both our delegates and accompanying persons. Technical tours are scheduled on Thursday (20th of June) for all the participants, including tours to visit UNESCO World Heritage Sites, Daegu old downtown areas as well as industrial complex areas such as POSCO, Hyundai Heavy Industries Co., Ltd., and KOGAS.

And finally, for those who wish to prolong their time in Korea, other tour programs will be also offered to delegates. Unforgettable tours such as the tour of DMZ; the most heavily militarized border in the world, and visiting of Jeju island; the most well-known natural tourist attraction in Korea, are just two of the exciting tour sites you can choose to enjoy and explore.

You can easily sign up for any of the tour programs through our conference registration website or on-site tour desk at EXCO, our conference venue, during the conference. All of our tour programs are prepared in cooperation with Daegu Conventions & Visitors Bureau. For more information about tour programs, please visit our Daegu IAEE International Conference website at www.iaee2013daegu.org.

Students

IAEE is pleased to announce its 2013 Best Student Paper Award. A top prize of US$1000 will be given for the best paper in energy economics. Three runner-up prizes of US$500 each will also be given. All four winners will receive a waiver of registration fees to the Daegu 2013 International Conference on June 16-20, 2013.

Students may submit a paper for consideration in the Awards. To be considered for the IAEE Best Student Paper Award, please follow the guidelines in Daegu Conference website (www.iaee2013daegu.org). You must be a full-time student and a member of IAEE in good standing.

The paper submission has different requirements and a different deadline. The deadline for submitting a paper for the Student Paper Awards is March 8, 2013.

Also, students may submit an abstract for the regular concurrent sessions. The deadline for abstracts is January 31, 2013.

Students may also inquire about our scholarships covering conference registration fees. The Daegu 2013 conference organizers are offering a limited number of registration fee scholarships to offset the conference registration costs only to students who will be presenting a paper at the conference. All travel and accommodation costs associated with attending the conference are the responsibility of the recipient.

Students who do not receive a fee scholarship may still attend the conference at the reduced student registration rate. In order to qualify for the student rate, please submit a letter stating that you are a full-time student and are not employed full-time. Please visit Daegu Conference website (www.iaee2013daegu.org) for full details.

Registration

The registration fee includes admission to all sessions, conference documentation, daily lunches, welcome reception at EXCO, awards dinner at the Hotel Inter-Burgo EXCO, and cultural events at Daegu Hyanggyo (Confucian Academy). All documents and name badge can be obtained from the on-site conference secretariat, open for the duration of the conference. Online registration for the 36th Annual IAEE International Conference will be open in January 2013. A confirmation will be sent upon receipt of payment.

	Early (until March 31, 2013)	Late and On-site
Speakers/Chairpersons/Discussants (members)	650 USD	750 USD
Speakers/Chairpersons/Discussants (non-members)	730 USD	830 USD
IAEE Members	850 USD	950 USD
Non-Members	1,000 USD	1,100 USD
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World Natural Gas Markets and Trade: A Multi-Modeling Perspective

Edited by Hillard G. Huntington and Eric Smith

This special issue is an important outgrowth of the Stanford University Energy Modeling Forum (EMF) 23 working group. The volume explores nascent modeling efforts to represent international natural gas markets and trade for improving the understanding of key policy and investment decisions. Although formal modeling is not required to describe the growth of liquefied natural gas or the role of spot markets, decision makers can gain powerful insights from these frameworks.

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Why Demand Growth is Out, Energy Efficiency is in, and the Important Implications of the Two

By Fereidoon P. Sioshansi*

There are growing signs that electricity demand growth, traditionally assumed as "a given," may be slowing to unprecedented low levels, partially as a result of continued gains in energy efficiency. This, plus a number of other trends has important implications for the electric power sector – whose traditional business model has been predicated on steady growth.

Demand Growth is Out

Following the Second World War, U.S electricity demand was growing at near double digits, which meant that installed capacity had to double roughly every 10 years (Table 1). The power sector not only managed to keep up with the growing demand, but it did so while improving reliability and reducing per unit costs of electricity for extended periods during the industry's so-called *golden years*.

But as happens with all mature industries, demand for electricity in the U.S. – and other mature OECD economies – is not growing anywhere as fast, as steadily, or as predictably as it used to. The explanation for the steady decline in demand growth is complex and varied, but is driven by a number of powerful trends further described in this article.

Decade	Ave. U.S. Electricity Demand Growth, %	Rough Time Needed to Double Capacity, Years
1950	9.3	7
1960	7.4	9
1970	4.4	16
1980	2.8	25
1990	2.4	29
00-10	1.0	69
Projection*	0.7	99

*Latest EIA projection
Source: Energy Information Administration

Table 1
Electricity Annual Demand Growth, in %, and Number of Years to Double Capacity

Electricity demand growth in the U.S. has been on a downward trajectory for quite some time (Figure 1). The current official forecast by the Energy Information Administration (EIA) is 0.7% average annual growth under a business as usual (BAU) scenario, which assume no policy changes, for example to further strengthen appliance energy efficiency standards or tighten building codes. In other words, 0.7% is what we'll get if we don't do anything beyond what is already in the pipeline. Others believe that the rate of growth will be slower, 0.6% or lower. At this rate, it will take over 100 years to double U.S. electricity consumption – rather than the 7-10 years it took in the 1950s. For an industry whose business model has been strongly tied to steady demand growth, these are trying times indeed.

Among the fundamental reasons for the decline is that mature and maturing OECD economies are becoming less energy-intensive as they continue to shift to services. Historically, for example, roughly 1/3rd of the electricity consumed in California was used by the industrial sector. That percentage is now close to 10% – mostly because the industrial sector has not grown while the overall size of the pie has, resulting in a shrinking industrial portion. This may be part of the explanation for the difference between the energy intensity of California and U.S. (Figure 2).

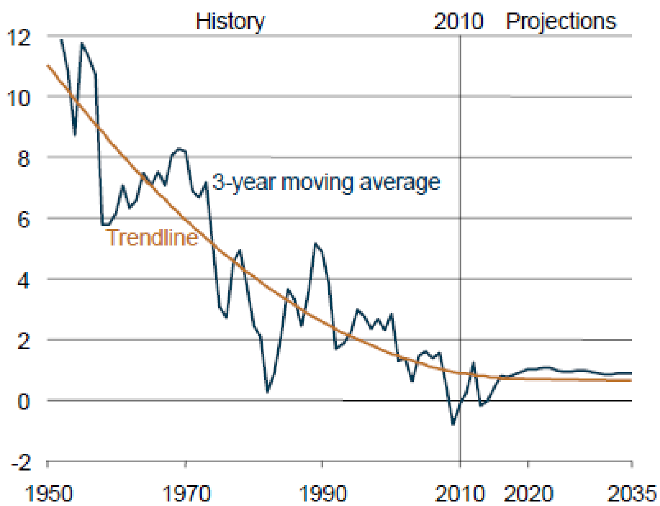

Figure 1
U.S. electricity demand growth, 1950-to present with projections to 2035 in %, with 3-year moving average
Source: Annual Energy Outlook 2012, EIA, June 2012

Other explanations include an aging population, changing lifestyles, shrinking number of occupants per dwelling and smaller houses. Finally, monitoring and managing energy consumption is becoming easier with advancements in technology, allowing consumers to use electricity more productively *and* sparingly. The net result of these and other trends is a virtual flat per capita electricity consumption profile for the U.S. as shown in Figure 3.

Another example where the future growth pattern may be deviating from the past is the average size of the typical new home built in the U.S.. As noted by John Caldwell, as per capita income increased, so did the average size of the new homes (Figure 4). But speculation is growing that the correlation may no longer apply even after the current recession comes to an end.

While many affluent Americans will continue to build ever-larger homes and mansions, there are powerful trends that suggest that not all Americans will want

* Fereidoon Sioshansi is president of Menlo Energy Economics. He can be reached at fpsioshansi@aol.com
See footnotes at end of text.

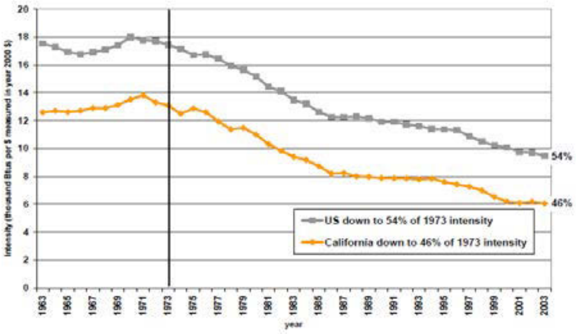

Figure 2
Energy intensity of California vs. the U.S., 1963-2003
Source: 2013 Building Energy Efficiency Standards, CEC, 31 May 2012

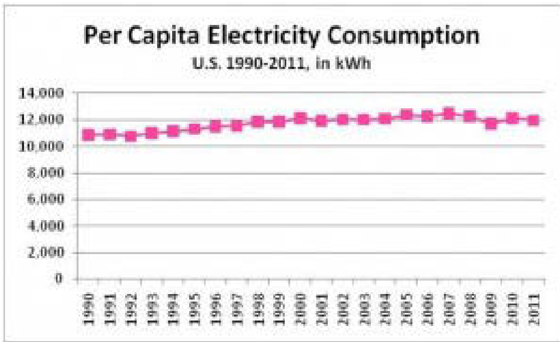

Figure 3
U.S. per capita electricity consumption, kWhrs/ person, 1990-2011
Source: Chris King's blog, eMeter, 6 April 2012

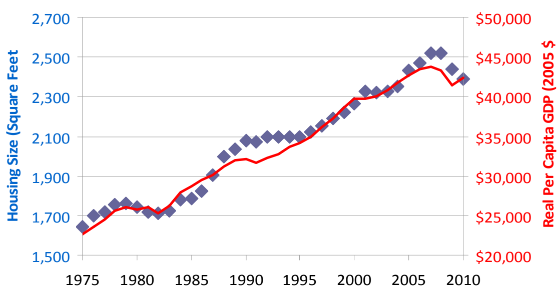

Figure 4
Correlation between income and size of new dwellings built in the U.S., 1975-2012
Source: John Caldwell, Edison Electric Institute

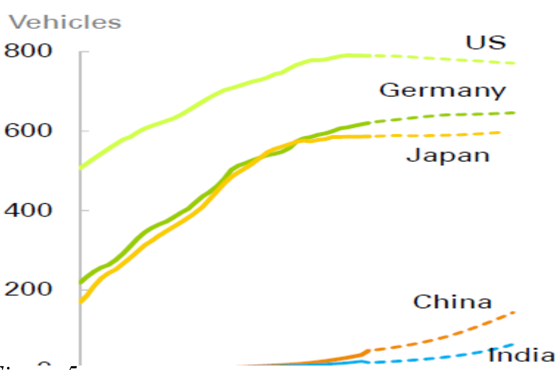

Figure 5
Car ownership in selected countries, cars per 1,000 people
Source: BP Energy Outlook 2030, Jan 2012

bigger homes even when their incomes grow. In 1950, roughly 4 million Americans lived alone, according to U.S. Census data. Today, an estimated 31 million live alone. Would a single person need, or necessarily want, a 2,500 square foot house even if he/she could afford it?

Currently, a third of all U.S. households have a single occupant and over 5 million adults below the age of 35 live alone. Many of these people with no kids prefer to live in smaller homes or apartments closer to work and to the urban amenities they enjoy. Bigger homes in distant suburbs still appeal to large families with kids but this may be a shrinking segment of the population.

Smaller households, smaller dwellings, better insulated homes, and more efficient appliances suggest lower electricity consumption trends. The effect of more stringent building codes and appliance energy efficiency standards, combined with the demographic trends and structural shifts away from energy intensive industry points to declining demand growth rates.

Today, the average U.S. house owns more than 2.5 TVs, and an increasingly number of these are flat-screen TVs, which are getting bigger in size and are electricity guzzlers – the second biggest contributor to the rise of electricity consumption in the residential sector. But if a growing number of homes have a single occupant, how many more TVs will be needed, and more important, how many will be on in a given house at any given time if there are fewer occupants?

It must be noted that the per capita saturation of demand for electricity is not unique. In many advanced economies, the phenomenon of demand saturation is observed in car ownership, number of miles driven, gasoline consumption, beer consumption and so on. As illustrated in Figure 5, car ownership in the U.S., Japan and Germany has flattened. The explanation is that there are simply not enough licensed drivers. With average fuel efficiency of U.S. cars projected to reach 54.5 miles/gallon by 2025, gasoline consumption will further drop. Higher gasoline prices are also contributing to the decline in gasoline consumption. These and other trends are likely to become more pronounced in a number of mature OECD economies with aging populations in the years to come.

Energy Efficiency is In

As anemic as the business-as-usual electricity demand growth already is, there are compelling reasons to believe that it can be further reduced. Not only is such a scenario technically feasible, but by most indications, it will be cost-effective, even excluding the environmental benefits.

A recent study by the Institute for Electric Efficiency, for example, suggests that by simply applying more stringent building codes and appliance energy efficiency standards, U.S. electricity consumption can be flattened or lowered from the current level by 2025 (Figure 6). Getting by on less energy, of course, is nothing new or novel. In his latest book, *Reinventing Fire*, Amory Lovins, presents a scenario where the U.S. can essentially eliminate its reliance on fossil fuels by 2050 while sustaining high living standards *and* economic growth.[5]

Another study by the same institute concludes that energy efficiency budgets at U.S. utility companies are up 80% since 2007 with more state regulators adopting favorable policies that enable utility companies to pursue efficiency as a sustainable business (Figure 7). This has been a major hurdle because under traditional regulations, utilities *lose* revenues if they encourage their customers to conserve. "In the face of successive years of double-digit increases in electric utility company electric efficiency budgets, expenditures, and associated energy savings, we expect continued evolution of regulatory frameworks that support utility efficiency investments," according to Lisa Wood, Executive Director of IEE.

While progress is slow and piecemeal, a growing number of state regulators now allow partial or full recovery of legitimate expenses associated with energy efficiency programs including *lost revenues* (Figure 8). These developments are likely to result in further erosion of demand growth with potentially significant cost savings for consumers, and benefits to the environment.

Another promising development is a requirement that all new residential units built in California must meet a *zero-net-energy* (ZNE) standard starting in 2020, 2030 for new commercial buildings. The definition of ZNE is that the building must generate as much energy as it consumes. As ambitious as this sounds, there are already many examples of developments that meet the ZNE standard – and the marginal costs do not appear onerous. Since California is often a leader in adopting innovative regulations, ZNE-type requirements may become commonplace if California's experience proves feasible and cost-effective.

Moreover, the potential for cost-effective energy efficiency is simply enormous and is not limited to the U.S. A recent study by UK's Department of Energy & Climate Change (DECC), for example, concluded that UK can cut its electricity consumption by 38% by 2030 by implementing cost-effective energy efficiency policies. For those who claim much of the low-hanging energy efficiency opportunities has already been picked, a survey of energy use in large buildings in New York City concluded that some buildings were using 5 times as much energy as others.

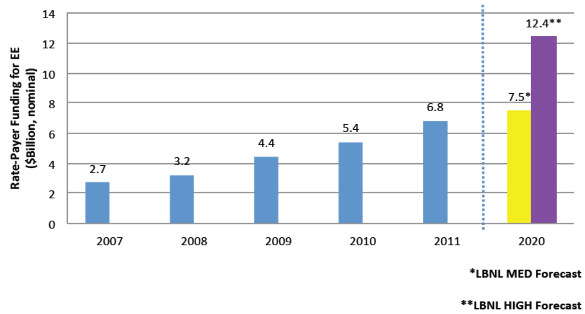

Figure 6
Baseline projection of U.S. electricity demand with 2 alternative scenairos, 2009-2025, in TWhrs
Source: IEE white paper, May 2011

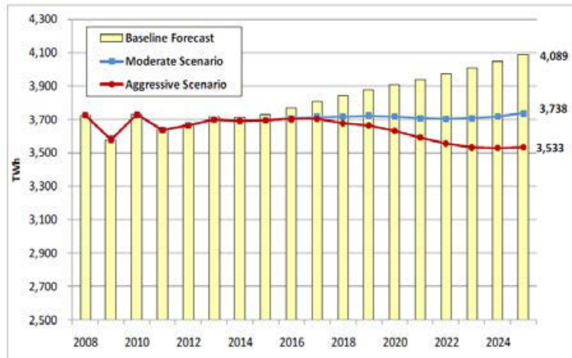

Figure 7
U.S. electric utility energy efficiency budgets, 2007-2011 with forecasts for 2020, in nominal $ billion

Source: 2012 State Electric Efficiency Regulatory Frameworks, Institute for Electric Efficiency, July 2012

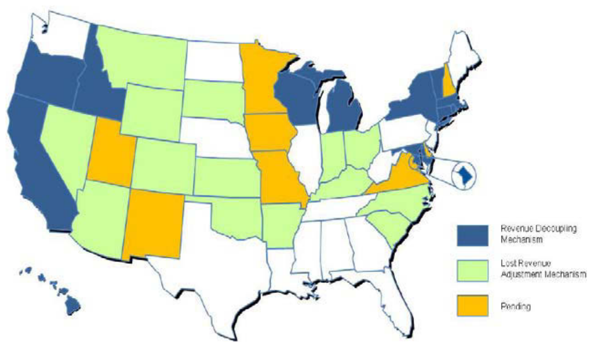

Figure 8
States with regulations allowing lost revenue recovery and decoupling

Source: 2012 State Electric Efficiency Regulatory Frameworks, IEE, July 2012.

Traditional Utility Business Model: Out of Synch

The traditional utility business model, predicated on continued demand growth, made perfect sense during the industry's *golden years*, a period of rapid expansion *and* declining average costs. It made sense to recover costs through a flat volumetric charge.

That business model, however, appears increasingly out of synch with the changing business environment. Costs are rising while demand is not. A big component of the cost is fixed – for example, maintenance of the transmission and distribution network does not vary with volumetric consumption. If consumption flattens or falls over time, as seems to be the case, the volumetric cost-recovery mechanism becomes untenable.

Moreover, two other developments are changing the fundamentals of the electric power business:

- **Rise of "prosumers" –** Rapidly falling costs of customer-side distributed generation (DG), most notably rooftop solar PVs, is likely to turn an increasing number of consumers into prosumers. During certain periods, for example sunny afternoons, Prosumers may generate more than they consume, which they can generally feed into the grid.
- **Net metering –** Current *net metering* policies tend to be generous to consumers who invest in DG, who can buy a shrinking number of kWhrs from the grid at the regulated retail tariff while selling their excess generation, when available, typically at a premium to the gird.

The net effect is that for many prosumers, the electric "bills" dwindles and in some cases may approach nil. However, these customers continue to depend on the grid to balance their usage and generation, which means that the fixed costs associated with grid maintenance remains the same while the revenues derived from the prosumers drop. Clearly, a tariff based on volumetric consumption makes no sense when there is little or no *net* consumption.

Tier	Volume of use	PG&E	SCE	SDG&E*
Tier 1	Within baseline	13	13	14
Tier 2	101-130%	15	16	16
Tier 3	131-200%	30	24	24
Tier 4	201-300	34	28	31
Tier 5	>300%**	34	31	NA

* SDG&E has slightly different rates for summer and winter, making it more complicated for consumers

** PG&E shows 5 tiers but the price for the top 2 tiers is shown as the same

Table 2
California's current tiered residential rates, in cents/kWh for the 3 large investor-owned utilities

Source: Utility websites

Among the factors contributing to the rise of prosumers is rising tiered pricing, which is a dominant feature of residential tariffs in high cost California and has become contentious. As shown in Table 2, under a rising tiered residential tariff, high consumption consumers face higher rates at the margin, which motivates investment in energy efficiency and/or rooftop solar PVs.

There are a number of other factors encouraging energy efficiency in ways that were not practical or feasible until recently:

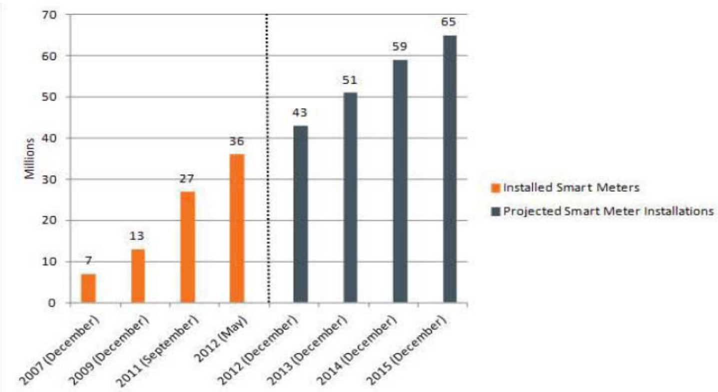

Figure 9
Smart meter installations in the U.S., 2007-2015, in millions

Source: Utility-Scale Smart Meter Deployments, Plans, and Proposals, IEE, May 2012

- **Prices to devices –** A revolution in how electricity is priced, and how smart price signals can directly communicate with smart devices – allowing consumers to be essentially bypassed – is quietly in the making. Many who have examined consumer behavior have reached the conclusion that the best way to proceed is through automation with little or virtually no human interface, the so-called "set-and-forget" principle.[11]
- **Smart meters –** The promise of *prices to devices* is now within reach as increasing numbers of households are fitted with smart meters and two-way communication technology, which can deliver the price signal to devices within the customers' premises. IEE predicts that roughly half of U.S. consumers will have smart meters by 2015 (Figure 9), with similar projections for many OECD countries.
- **Consumer engagement –** For many, the notion of the consumer as a passive agent at the receiving end of the industry's long value chain is outdated. Only recently, however, has the industry focused on turning things around by *reengaging* the disengaged consumers.
- **Demand response –** Interest in demand response (DR) programs, broadly defined as anything that influences consumers to reduce load during peak demand periods and/or shift load to off-peak periods usually in response to incentives or price signals, is on the rise.

New Business Paradigm

The main points of the preceding discussion can be summarized as:

- Future electricity demand growth in mature economies is asymptotically approaching zero;
- Rise of distributed generation will turn many consumers into prosumers with net metering policies determining the scope and speed of the migration;
- The long-term impact of smart meters, smart prices and smart devices is significant especially if assisted by regulatory endorsement of dynamic pricing; and
- The effect of energy management technologies is likely to be considerable as a new generation of companies master the art of not merely *informing* but *enabling* consumers to become proactive and *engaged*.

The information revolution, which has thus far only superficially penetrated the electric power sector, is likely to make a pronounced impact in how electricity is delivered, measured, priced, monitored, consumed and managed. There are three major steps in the evolution of information technology:

- First is better ways of *measuring* what is delivered, not just how many kWhs, but when it is consumed. This is now possible with sophisticated smart meters.
- Second is consumer *enablement*, becoming trivial with ubiquitous communication technology, allowing consumers or their designated agents, to monitor and manage what devices use – or in the case of prosumers – produce energy.

- Third and final piece of the puzzle, currently in its infancy but predicted to turn into a burgeoning industry, is consumer *engagement*, allowing consumers – or their designated agents or programmable smart devices – to respond and react to the signals received in ways that reduces costs and improves service quality and reliability.

Clearly, the volumetric basis for cost-recovery seems out of place in an environment where most costs – much of generation, virtually all transmission and distribution assets – are fixed. As Ralph Cavanagh has observed, if we were to design a scheme for utility cost recovery from scratch today, it would most likely not be solely or mostly based on volumetric sales and flat cents/kWhrs[2].

Footnotes

[1] John Caldwell, Edison Electric Institute, posted e-mail

[2] It must, however, be noted that the trend toward smaller number of people per dwelling tends to increase – not decrease – per capita consumption. Yet the energy efficiency gains could overcome this, resulting in lower net consumption per household.

[3] U.S. has more cars than licensed drivers.

[4] IEE white paper, May 2011

[5] Reinventing Fire, Amory Lovins, 2011.

[6] A new development at UC Davis, called West Village, housing 3,000 students reportedly meets the ZNE definition suggesting that entire communities generating as much electricity as the consume are feasible.

[7] Capturing the full electricity efficiency potential of the UK, DECC, July 2012

[8] Office of Long-Term Planning & Sustainability, NYC City, July 2012

[9] This has become a major concern because consumers on net metering tariffs are essentially allowed to bypass paying the considerable costs associated with grid maintenance– which is among the factors, which encourages consumers to become prosumers in the first place. By doing so, the fixed costs associated with the maintenance of the grid as well as the lost revenues for consuming fewer kWhrs are passed on to the remaining consumers, resulting in further rate increases for consumers without DG.

[10] Net Metering, Diane Caldwell, New York Times, 4 June 2012

[11] Customer view of smart grid – Set and Forget? Harper-Sloboszewics, P. et al, in Smart Grid, Sioshansi, F. (Ed.), Elsevier, 2011.

[12] To highlight the point, consider a distribution company with little or no generation or transmission and no retailing business. Such stand-alone distribution companies actually exist, for example, in Australia, where this is already the case.

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"To keep on doing business, the modern company still needs a franchise from society, and the terms of that franchise still matter enormously."

– John Micklethwait and Adrian Wooldridge, *The Company: A Short History of a Revolutionary Idea**

CONFERENCE OVERVIEW

As the global economy follows a precarious path to full recovery, the challenge of meeting growing energy needs in an increasingly volatile world with finite resources becomes ever more urgent. All parties—from governments and non-governmental organizations to energy producers and consumers—have a stake in fostering smarter energy development and use that minimizes adverse environment effects and consumer costs. The 32[nd] USAEE/IAEE North American Conference will address the issues, challenges, and opportunities of industry-government relations as the stakeholders strive to meet their respective goals for commerce and society.

Although private industry carries out most energy development, governments—charged with reflecting the broad spectrum of society's values—create the context in which development occurs. Consequently, the relationship between industry and government is central to the question of how to promote energy development and use that is efficient and environmentally sound. Countries, states, provinces, and communities around the world seek to unlock their energy resource potential, encourage new technologies, and assure equitable distribution of benefits. Industry holds the necessary technical expertise and experience. Industry-government relations will be crucial in determining where and how the world's energy resources are developed, and which products are brought to market at what price. That evolving relationship will influence everything from fiscal systems and consumer costs to climate change and environmental health.

Alaska is an appropriate setting for a conference addressing the issues, challenges, and opportunities of industry-government relations in energy use and development. As one of North America's great energy producing regions, Alaska has a long history of dynamic industry-government relations. Alaska's role in satisfying energy demand features prominently in energy policy debates both nationally and internationally. The conference will bring together energy researchers and practitioners to explore these themes through a series of plenary sessions, concurrent sessions, and a poster session. The conference will also provide networking opportunities through informal receptions, breaks between sessions, public outreach, and student recruitment. A selection of offsite tours will be offered to highlight Alaska's uniquely beautiful environment as well as the state's role in the North American energy supply chain.

TOPICS TO BE ADDRESSED INCLUDE:

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- Trends in Wind and Solar Electric Generation
- Development of Geothermal, Tidal and Wave Resources

Electricity Generation and Distribution

- Electricity Pricing, Fuel Pricing and Policy
- Innovation in Distributed Generation and Storage
- Smart Metering and Smart Pricing
- Post-Fukushima Future of Nuclear Power
- Technology and Regulation for Isolated Electricity Systems

Climate Change and Environmental Issues

- Effects of Voluntary and Unilateral Mitigation Programs
- Impact of Drought on Hydroelectric Generation
- Emission Standards and Coal

Natural Gas – Bridge Fuel to More Natural Gas?

- Shale Gas Revolution and Water Issues
- LNG Trade
- Global Gas Contracts vs. Spot Market Trading
- Role of Gas in Meeting Renewable Portfolio Standard or CO_2 Emission Standards

Energy Efficiency

- Building Controls and Cost Allocation
- Energy Efficiency Rules for Government Sponsored Home Loans
- Motor Vehicle Efficiency Standards
- Energy Efficiency in Fishing, Forestry, and Ecotourism

Alternative Transportation Fuels and Vehicles

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- Ethanol and Biodiesel
- Electric and Hybrid Vehicles

Energy and the Economy

- Transmission Infrastructure for Distributed Electric Generation
- Economic Impact/Forecasting Models

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- Environmental Regulation in Developing Countries
- New Energy Technologies to Reduce Wealth Disparities
- Aluminum Smelting and Energy-Intensive Industries
- Access to Energy

Role of Government: Issues in Energy Regulation and Uncertainties

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- Regulation of Pricing of Carbon Emissions: Impact on Energy Markets
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32ND USAEE/IAEE NORTH AMERICAN CONFERENCE

CALL FOR ABSTRACTS

We are pleased to announce the Call for Abstracts for the 32nd USAEE/IAEE North American Conference, ***Industry Meets Government: Impact on Energy Use and Development***, to be held July 28-31, 2013, at the Hotel Captain Cook, Anchorage, Alaska, USA. **The deadline for receipt of abstracts is Thursday, February 21, 2013.**

Abstracts will be accepted for Concurrent Sessions and a Poster Session.

Concurrent Sessions

1) Reports on Current Research

This Category provides a forum for the presentation and discussion of papers that describe an analysis that has either been completed or substantially revised by the author since the last USAEE Annual Conference.

Abstract Format

Authors wishing to make presentations at the conference under this category will submit an abstract that describes, briefly, a research project that is of significance within the field of energy economics and of general interest to the membership at large.

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

a. Overview (summary of the topic, background, and significance) A concise statement of the research problem including its background and the extent of its significance (e.g. locally, regionally, globally),

b. Methodology,

c. Results,

d. Conclusions,

e. References.

Please note that the abstract must discuss work that is completed or very near completion. The abstract is not intended to be the proposition of a research topic that the author intends to study in detail only after the abstract Committee has accepted the topic. Those interested in organizing a complete concurrent session on current research should propose a topic and possible speakers to Matt Berman, Concurrent Session Co-chair (matthew.berman@uaa.alaska.edu).

Please visit www.usaee.org/USAEE2013/PaperAbstractTemplate.doc to download an abstract template. All abstracts must conform to the format structure outlined in the abstract template. Abstracts submitted in other formats will not be processed. Abstracts must be submitted online by visiting www.usaee.org/USAEE2013/submissions.aspx. Abstracts submitted by e-mail or in hard copy will not be processed. **The deadline for receipt of abstracts for both the Concurrent Sessions and the Poster Session is Thursday, February 21, 2013.**

2) Reports on Case Studies of Applied Energy Economics

This Category provides a forum for non-academics to present and discuss professional activities in the field of energy economics that have been undertaken by the author since the last USAEE Annual Conference. Case studies conducted by students and/or faculty members as part of academic research should be reported in the "Current Research" category (above).

Abstract Format

Authors wishing to make presentations at the conference under this category will submit an abstract that describes, briefly, an issue, problem or other challenge within the field of energy economics that is of interest to the Association's membership and that the author has addressed by personal, professional involvement (e.g. field work, research and/or analysis)

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

a. Overview of the topic including its background and the extent of its significance (e.g. locally, regionally, globally) and a statement of the author's responsibility in addressing the matter.

b. Methodology: How the matter was addressed

c. Results: Outcome of the actions used to address the matter.

d. Conclusions: Lessons learned, and next steps.

Please note that the abstract is not intended to be the proposition of either a "Desk Study" or an activity that the author intends to undertake only after the Abstract Committee has accepted the topic. Those interested in organizing a complete concurrent session on case study reports should propose a topic and possible speakers to Mina Dioun, Concurrent Session Co-chair (mdioun@diounenergy.com).

While presentations in this category are intended to facilitate the sharing of professional experiences and lessons learned, presentations that overtly advertise or promote proprietary products and/or services are unacceptable. Those who wish to distribute promotional literature and/or have exhibit space at the Conference are invited to avail themselves of sponsorship opportunities – please see www.usaee.org/usaee2013/sponsors.html.

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Poster Session

At this event, participants will be able to present their current research or case studies to all 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 Poster Session is to be used to display current research or case studies and is not to be a medium for promotion of professional goods or services.

Poster presenters whose abstracts are accepted should submit a final version of the poster electronically (in pdf format) by May 31, 2013 for publication in the online conference proceedings. Posters for actual presentation at the conference must be brought directly to the conference venue and must be in ANSI E size (34in. wide x 44in. high) in portrait orientation.

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 April 12, 2013, of the status of their presentation or poster. Authors whose abstracts are accepted will have until May 31, 2013, 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 to submit abstracts, 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 March 29, 2013. Visit www.usaee.org/usaee2013/paperawards.html for full details.

Students are especially encouraged to participate in the Poster Session. Posters and their presentations will be judged by an academic panel and a cash prize (minimum $500; up to $1,000 at judges' discretion) will be awarded to the student(s) with the best poster presentation.

Students may also inquire about our scholarships covering conference registration fees. Visit www.usaee.org/usaee2013/students.html for full details.

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Double Moral Hazard and the Energy Efficiency Gap

By Louis-Gaëtan Giraudet and Sébastien Houde*

Are we missing opportunities for profitable investments in energy efficiency? As Adam Jaffe and Robert Stavins made clear in an influential paper in 1994, the answer could very well be 'yes', provided that one can prove that such investments are subject to market failures. Since then, economic analysis has sought to identify and quantify market failures that induce an 'energy efficiency gap', i.e., a suboptimal level of energy efficiency investment.

In an ongoing project, we contribute to this line of research by examining information asymmetries, which is one classic market failure that has hitherto received little attention in the energy efficiency literature. This article summarizes early results, focusing on moral hazard issues and policy solutions to address them. It takes a broad perspective in which interactions between moral hazard and other market failures, such as environmental externalities, as well as other market barriers to energy efficiency (e.g., consumer heterogeneity) are taken into account.

How Moral Hazard can Affect Energy Efficiency Decisions

Moral hazard problems arise when one or several contracting parties take actions that are not fully observable to the others, but impact the final outcomes of the transaction. Such a situation is common in the context of building energy retrofits. Our first result shows that when the actions of the contractors (i.e., installers of energy-saving technologies) are not fully observable, contractors will under-provide quality, and opportunities for further energy savings will be left untapped.

For the sake of illustration, consider a homeowner willing to insulate the walls in her house. She might be motivated by reducing her heating bill, and perhaps ancillary attributes unrelated to energy, such as aesthetic refreshing or acoustic comfort. Suppose that the homeowner cannot perfectly observe the energy saving performance of the job completed by the contractor. That is, she does not have the technical skills to judge whether the insulation panels have been properly connected, although she is aware that any such defect will deter the thermal performance of the installation. Anticipating that the contractor is aware of her limitations, she will expect him to save on installation costs and complete a poor job. Any claim that he will provide the highest quality, enabling her to maximize energy savings, will be considered *cheap talk* by the homeowner. We show that the contractor will not deviate from these expectations and indeed complete the lowest possible quality job. Absent policy intervention, quality will not be contractible and thus under-provided. This conclusion holds irrespective of the structure of the market, from competitive industry with free entry, which is the most likely case (Zabin et al., 2011), to monopolistic industry.

Were energy performance perfectly observable, the homeowner would demand the level of installation quality that reduces her marginal energy expenditure up to the marginal benefit she derives from space heating. Outside this condition, the contractor does not internalize the benefits his actions provide to the homeowner and a wedge arises between social and private surplus. The wedge gets larger if, in addition to the moral hazard, one considers the environmental externalities associated with energy consumption.

Such quality problems might be substantial and affect any energy end-use technology for which installation is a significant input, such as HVAC system or window replacement. As of 2008, only 15% of central air conditioning installations in existing dwellings met satisfactory quality specifications in California (Messenger, 2008). In the commercial sector, where retrofit projects are deployed over a large scale, the gap can be sizeable. Overall, the energy savings that would thereby remain untapped could be around two quadrillion end-use BTUs, which is a lower bound of the contribution of building shell and HVAC system improvement in existing buildings to the *technical* potential for energy efficiency in the U.S. by 2020, as assessed by McKinsey & Company (2009).

Government Intervention: Conditions, Instruments and Efficiency

A natural conclusion to the demonstration that moral hazard induces an energy efficiency gap is that some government intervention is justified. We show, contrary to normal intuition, that addressing moral hazard might not always be warranted in a world with large environmental externalities.

It is easy to see that it is always desirable to internalize environmental externalities, regardless of whether or not the contracting parties overcome the moral hazard. Social welfare cannot be maximized as long as they do not account for the broader externalities produced by their actions. However, the reciprocal is

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not necessarily true: if environmental externalities are not (or cannot be) internalized, then it might be desirable to maintain, rather than undo, the moral hazard. This can actually occur if the so-called 'rebound effect' (i.e., the elasticity of the demand for energy service with respect to energy efficiency) is beyond a certain level, which can be derived analytically. In this case, if solving the moral hazard leads to noticeable improvements in energy efficiency, then energy consumption could actually increase. As a result, environmental externalities would be larger.

Notwithstanding this extreme and rare 'backfire' situation, we can consider for the rest of the analysis that environmental externalities are internalized through energy price, so that we only need to worry about the moral hazard. Now, what policy instrument can fix it?

A social planner would like to get the contractor to provide the optimal level of quality and the homeowner to consume the optimal quantity of energy service. This could be achieved by a quality standard forcing the contractor to offer the level of quality that is optimal to a representative consumer. Yet such instrument suffers from the classic criticism that it abstracts from heterogeneity in consumer valuation of energy service. For instance, an owner who visits his holiday house infrequently, thus having a low heating consumption, would have to pay the price of a high quality retrofit that would save energy in excess of what would have been optimal to him. Now if the stringency of the standard is below what would be optimal to the consumer, as long as performance remains unobservable to her, the contractor will not offer more than the standard.

Besides regulatory instruments, one might think of incentive-based mechanisms. Energy-savings insurance, whereby the contractor bears a share of the consumer's energy bill (perhaps above a certain threshold), is one example. Such contract, however, is subject to a second moral hazard: by lowering the marginal energy expenditure to the consumer, in equilibrium it decreases her marginal benefit, hence increasing her consumption of energy service (e.g., by setting heating thermostat to a higher temperature). Whereas optimal quality would be provided by the contractor if he *fully* insured the savings (in order to minimize insurance payouts), energy service would be consumed optimally by the consumer were she *not* insured. As a result, the only insurance that can be sustained in equilibrium features incomplete coverage, and only brings about a second-best outcome.

In the end, in such context where both parties can take hidden actions, the only way to bring about the first-best outcome is to involve a perfectly informed third-party (perhaps with the help of a smart meter). This is very unlikely to be implemented, as it would incur prohibitive transaction costs.

The instruments reviewed are already available in the marketplace. Various types of quality certifications exist, most notably those provided by the Building Performance Institute (BPI) and the Residential Energy Services Network (RESNET). Likewise, energy-savings insurances have been present in the commercial sector for about twenty years (Mills, 2003), and start to percolate in the residential sector (see for instance Green Homes America). As normative analysis just showed, these instruments cannot fully restore economic efficiency. This does not mean, however, that they cannot be welfare-improving.

Plugging in Numbers: Size of the Gap and Policy Effectiveness

To get a sense of the magnitude of the problems at stake, we have developed an analytical model of insulation sales that is calibrated to the U.S. market. Numerical assumptions are detailed in Box 1.

We find that social welfare (measured as the sum of consumer's utility and firm's profit) derived from space heating consumption could be doubled, were both moral hazard and energy externalities fixed. Simply undoing the moral hazard closes about two-thirds of the gap. The results are displayed in Figure 1 in a Jaffe & Stavins-like 'energy efficiency gap diagram' (welfare vs. energy efficiency), as well as in an 'energy gap diagram' (welfare vs. energy consumption).

When it comes to policy instruments, quality standards of different stringencies (each based on what would be optimal for one specific representative consumer) will yield different welfare improvements.

BOX 1

A homeowner of median income is assumed to live in a house of average size. She consumes natural gas for space heating with a price-elasticity of -0.8 and responds to energy efficiency improvements with a 20% rebound effect (which is below the 'problematic' range mentioned in the text). When considering an insulation project, she discounts future energy expenditures over ten years (which is close to the duration of either average house occupancy or energy-savings insurance contracts), at a 7% discount rate and using a constant natural gas price of $12 per thousand cubic feet. She contracts with an insulation contractor who allocates three installers a day. Job completion takes at least one full day. At this input level, job is sold $2,400 and expected energy savings are 5%. Performance increases as installers work longer and mobilize higher skills, up to 25% for three-day operation. Workers are paid $5 an hour at the end of the first day and wages escalate to $30 at the end of the third day. From a social perspective, it is assumed that energy consumption produces, over 30 years (which is the physical lifetime of energy efficiency investments), CO_2 emissions that cause damages worth $30/t$CO_2$ in constant annual present value.

Yet it is possible to find one stringency level that brings society remarkably close to the first-best outcome. Comparatively, energy-savings insurances achieve lower welfare gains on average. Still, those can be non negligible in absolute value, amounting to 15% of the welfare enjoyed in the *laissez-faire* situation. This is achieved through optimal insurance coverage as low as 13% on average. These results are displayed in Figure 2.

Conclusions

Our analysis suggests that moral hazard can induce a significant energy efficiency gap. This insight is relatively new, as most of the literature so far has reached the conclusion that it was hard to find market failures explanations for the abnormally high implicit discount rates observed in energy efficiency decisions, which can be seen as a manifestation of the energy efficiency gap (Gillingham et al., 2009; Allcott and Greenstone, 2012). While these studies have focused on the role of possible undervaluation of energy efficiency by consumers, ours underlines that the behavior of the firms should not be excluded from the analysis.

In terms of policies to address moral hazard, we show that the first-best outcome can only be attained to the extent that energy performance can be made perfectly observable. Since no technology can meet that goal, government intervention will only generate a second-best outcome, even though it can get very close to the first-best. Our numerical simulations suggest that the various types of quality certifications already implemented may be worthwhile, although more empirical support is needed to determine whether they are set at satisfactory stringency levels, and what administrative costs they incur. Energy-savings insurances might not perform as well as quality standards. Still, even with modest coverage they could deliver welfare gains that should not be disregarded. This is perhaps itself a paradox that firms in constant search of new marketing strategies have not relied more heavily on such schemes.

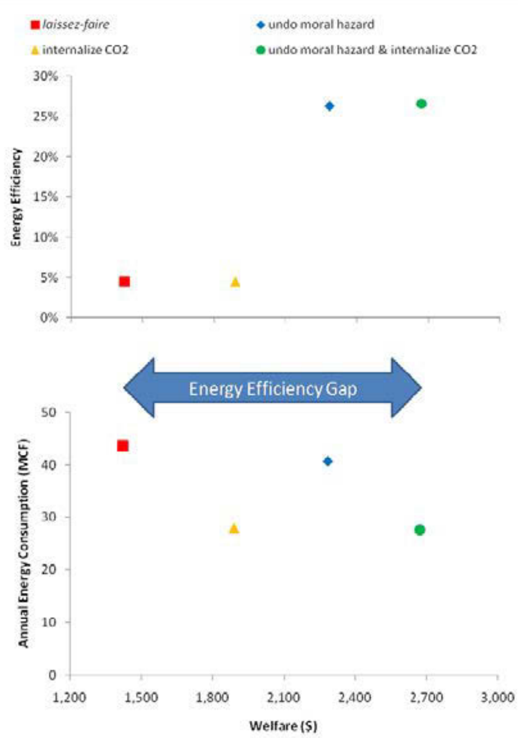

Figure 1

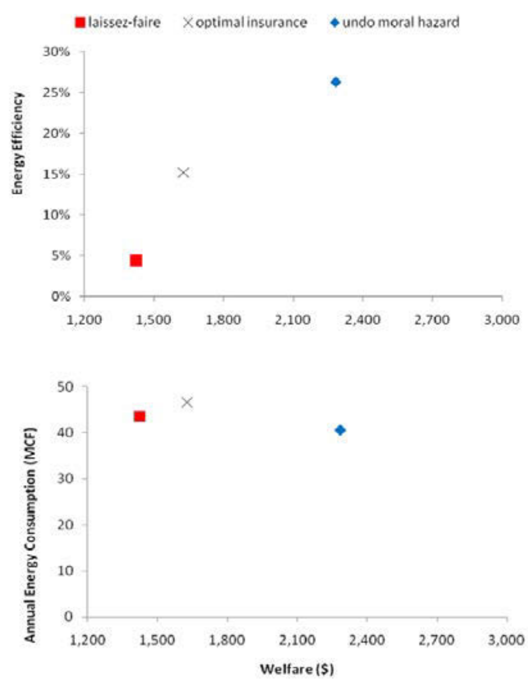

Figure 2

References

Allcott, H, M. Greenstone, 2012, "Is There an Energy Efficiency Gap?", *Journal of Economic Perspectives*, 26(1):3-28

Gillingham, K., R.G. Newell, K. Palmer, 2009, "Energy Efficiency Economics and Policy", *Annual Review of Resource Economics*, 1(1):597-620

Jaffe, A.B., R.N. Stavins, 1994, "The energy-efficiency gap: What does it mean?", *Energy Policy*, 22(10):804-810

McKinsey & Company, 2009, *Unlocking Energy Efficiency in the U.S. Economy*

Messenger, M., 2008, *Strategic Plan to Reduce the Energy Impact of Air Conditioners*, California Energy Commission Staff Report (CEC-400-2008-010)

Mills, E., 2003, "Risk transfer via energy-savings insurance", *Energy Policy*, 31(3):273-281

Zabin, C., T.W. Lester, J. Halpern-Finnerty, "Chapter Four: Case studies of the HVAC, residential retrofit, and commercial lighting controls sectors", p.89-118, *in* Donald Vial Center on Employment in the Green Economy, *California Workforce Education and Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response*, 2011, University of California, Berkeley, Institute for Research on Labor and Employment.

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First Program Announcement and Call for Papers

Energy Economics of Phasing out Carbon and Uranium

13th European IAEE Conference
18-21 August 2013 in Düsseldorf, Germany
Hilton Düsseldorf Hotel
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Dear Energy Colleague,

The ambitious renewable energy policy of the European Union and the German Government has stimulated an unanticipated increase of renewable electricity generation capacities. Likewise the renewable shares in the heating and the transportation sectors are on the rise. New global industries have been created which are flourishing in spite of still uncompetitive costs.

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We look forward to seeing you in Düsseldorf!

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Preliminary Program

18 August 2013	18:00 -20:00	Welcome reception
19 August 2013		Student Breakfast, Opening ceremony, Plenary and Dual Plenary Session, Concurrent Sessions, Gala Dinner
20 August 2013		Plenary and Dual Plenary Session, two blocks of Concurrent Sessions, Offsite Event
21 August 2013	Until 13:00	Concurrent Sessions, Closing Session

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Concurrent sessions will be organized from accepted abstracts. Please submit abstracts of one to two pages in length, comprising (1) overview, (2) methods, (3) results, and (4) conclusions. Please also attach a short CV. The lead author submitting the abstract must provide complete contact details: mailing address, phone, fax, e-mail etc. At least one author of an accepted paper must pay the registration fee and attend the conference.

Authors will be notified by May 2013 of their paper status. While multiple submissions by individual or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each speaker is to deliver only one presentation in the conference. If multiple submissions are accepted, then a different co-author will be required to pay the reduced registration fee and present the paper.

All information and abstract submission soon at http://iaee2013.gee.de

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Impact of Demand Side Management Programs on Peak Load Electricity Demand in North America, 1992 to 2008

By Prachi Gupta*

Introduction

Demand side management (DSM) is a means of using existing energy production facilities more efficiently by reducing price volatility and improving electric grid reliability. The demand for electricity is not steady, varying along a range of different timeframes. Increased demand for energy during the summer peak hours, in particular, puts a strain on the transmission and distribution systems. The primary objective of DSM is to maximize the use of efficient base load generation by managing consumption patterns, shifting consumption from periods of peak demand to off-peak and reducing the need for production capacity that sits idle except during peak demand surges.

The purpose of this paper is to see whether or not there has been a reduction in the peak to base load production ratio in the United States as a consequence of the introduction of DSM programs in the time period 1992 to 2008.

The Department of Energy defines Demand-Side Management (DSM) programs as:

"The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers to energy and load-shape modifying activities that are undertaken in response to utility-administered programs." [1]

Utilities implement DSM programs to achieve two basic objectives- energy efficiency and peak load management. Energy efficiency is primarily achieved by conservation programs that reduce energy usage on a permanent basis, for example, turning the thermostat a few degrees higher during summer. Peak load management focuses on shifting demand to off-peak periods and has been introduced to different market segments.

Year	Total Actual Peak Load Reduction	Energy Efficiency	Load Management
1997	25,284	13,327	11,958
1998	27,231	13,591	13,640
1999	26,455	13,452	13,003
2000	22,901	12,873	10,027
2001	24,955	13,027	11,928
2002	22,936	13,420	9,516
2003	22,904	13,581	9,323
2004	23,532	14,272	9,260
2005	25,710	15,351	10,359
2006	27,240	15,959	11,281
2007	30,253	17,710	12,543
2008	32,741	19,650	13,091

Table 1. DSM Actual Peak Load Reductions by Program Category, in megawatts[2]

The notion of DSM began in the 1970s in response to increasing peak-load electricity demand especially as a result of summer air conditioning. Two laws passed by the federal government in 1978, the Public Utility Regulatory Policies Act and the National Energy Conservation Policy Act, were triggered by rising public awareness of limited energy resources and the need for conservation. These acts marked the beginning of utility conservation and load management programs in the United States. By the late 1990s, a growing number of states had adopted the idea of energy conservation and started allocating DSM budgets. In 1992, the Energy Policy Act (EPACT) amended the NECPA laws to increase clean energy use and improve overall energy efficiency. To promote DSM, the federal government launched another national energy policy initiative in 2005. With the Energy Policy Act of 2005, the federal government took its first steps directly related to DSM. EPACT 2005 included tax incentives for DSM projects that outperformed the minimum energy code.

To trace the progress of DSM activities across different states, the U.S. Energy Information Administration collects survey data from utilities on actual peak load reduction, the amount of reduction achieved by consumers that participate in utility DSM programs at the time of peak load.

Table 1 summarizes the total actual peak load reduction reported each year from 1992 to 2008, reflecting changes in the demand for electricity during peak periods resulting from deploying programs such as energy efficiency and load management. It is these variations in the peak load reduction that is the subject of statistical analysis in this paper.

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See footnotes at end of text.

Previous Research

The focus of DSM studies is to identify factors that affect the peak demand. These factors include factors such as growth in population and housing units, income growth, and weather.

Whether or not DSM has a significant impact on peak load reduction is a question that has been addressed by a number of researchers. Studies of DSM have principally focused on the gross costs and benefits and have used aggregated data (Loughran and Kulick, 2004; Auffliammer, Blumstein, and Fowlie, 2008; Johnson, 2008; Gillingham, Newell, and Palmer, 2006; Freeman, Intorcio, and Park, 2010). The problem with using aggregate data is that it is difficult to analyze how different consumer groups such as residential, small and medium scale industries and the commercial sector have responded to the introduction of DSM programs. Only few studies have explored the question of how DSM affects peak load at the micro-level (Horowitz, 2007; Faruqui and Sergici, 2008). These studies attempted to estimate end-users response to prices. However, in a complex model with several clusters of consumers, it proved to be impossible to predict how each and every group has responded to DSM programs.

Traditional rationales for DSM programs were threefold: (1) they addressed the problems associated with electricity use, (2) providing an alternative policy response, that was (3) more consistent with environmental objectives. Over the last decade, utility-sponsored DSM programs have encompassed a wide range of activities including direct load management, installation of energy efficient technologies, and attempts to lower emissions as well as to stimulate economic growth (Loughran and Kulick, 2004). Concurring with Loughran and Kulick, Auffliammer, Blumstein and Fowlie (2008) argued that DSM programs can help reduce peak demand through subsidies and various forms of dynamic pricing. Dynamic pricing, such as providing seasonal rates or time-of-use pricing provide an opportunity to consumers to respond to price signals and shift load from on to off peak periods.

DSM programs can be classified into three types, price responsive programs under which consumers can choose how much load they shift from peak to off-peak hours based on electricity prices, triggered programs in which consumers agree to reduce their load based on contractual language, and government mandated programs. Traditional DSM studies have focused on the first two categories and only recently has there been much attention paid to enforcement by federal and state regulators. If there exists government intervention, then how does it affect the growth of DSM?

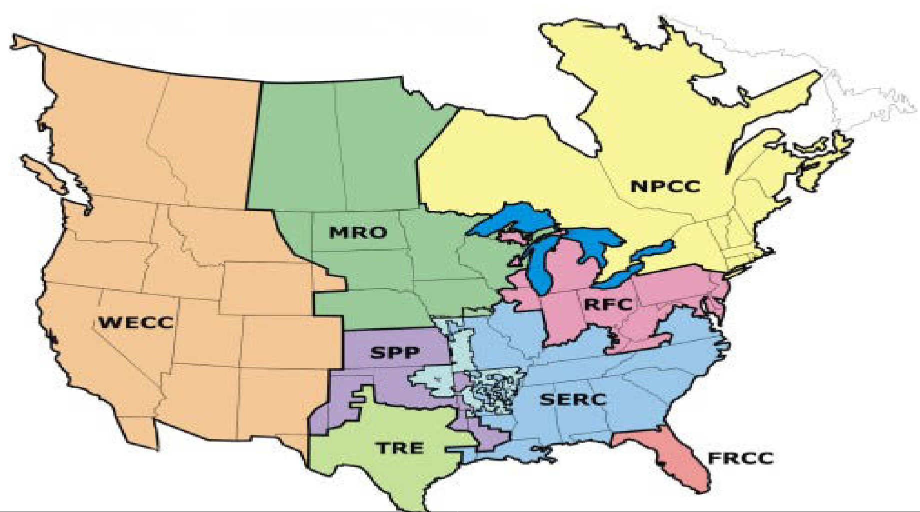
It was after the energy crisis of the 1970s that federal regulators and state commissions began implementing policies that would encourage energy conservation. A growing number of states had adopted the idea of energy conservation. Johnson (1998) highlights the regulatory initiatives that have contributed to the growth of DSM in recent years. State mandated programs stimulate economic growth and increase the effective long-term energy supply by reducing dependence on foreign energy sources (Loughran and Kulick, 2004). This argument was rejected by Freeman, Intorcio, and Park (2010). Some states show greater energy savings with state mandated programs while others saw utilities playing a major role in delivering efficiency programs.

The literature shows that a variety of factors can affect consumption patterns, with only modest positive effects of DSM interventions. As the previous studies indicate, the results of the use of DSM to reduce peak load on the demand-side are ambiguous. Future programs need to be tailored to specific market objectives and to balance both public and private interest.

Research Problem

To what extent did the peak load reduction ratio change with the introduction of DSM programs between 1992 and 2008? The literature offers little guidance to answer this question. I, therefore, develop a regression model in which peak load reduction ratio, a continuous dependent variable, is hypothesized to be a function of a number of categorical independent variables, including years, markets, and end users. The model permits the following questions to be addressed:

- Are there any marked changes in the peak load reduction ratio over time associated with the introduction of DSM programs?
- Does the peak load reduction ratio vary by end-users? Do shifts in consumption patterns vary by type of consumer? Coefficients are calculated by user type.
- Does the peak load reduction ratio vary by market? Dummy variables are entered into the model for each North American Electric Reliability Council region.
- Does the peak load reduction ratio vary by type of consumer in different markets, i.e, is there an interaction between the two previous questions?



FRCC - Florida Reliability coordinating Council **MRO** - Midwest Reliability Organization **NPCC** - Northeast Power Coordinating Council **RFC** - Reliability First Corporation	**SERC** - SERC Reliability Corporation **SPP** - Southwest Power Pool **TRE** - Texas Regional Entity **WECC** - Western Electricity Coordinating Council

Figure 1: North American Electric Reliability Council Region Map (US)

The Data

To estimate the effectiveness of DSM programs, the data on actual peak load reduction is collected by end-users and by NERC regions. Data aggregated at the end-user level includes industrial, commercial, residential, and transportation sectors. The regional level data are collected by eight North American Electric Reliability Corporation (NERC) regions as shown in figure 2. NERC is a nonprofit organization established to maintain mandatory reliability standards for the bulk electric system in North America.

The data is utilized from the Energy Information Administration (EIA) data form EIA-861. Form EIA-861 is a mandatory annual census of approximately 3,200 electric utilities in the United States which was implemented in January 1985.

Estimation Methodology and Empirical Results

This study began with the question of whether or not any significant changes have taken place with the introduction of DSM policies. To address this question, I formulated the model that tests peak load reduction as a function of end-users, regions, years, and the interaction of end-users and regions. In the usual notation, the overall function can be written as follows: $Y = f\ (U, R, T, I)$ where Y is the percentage of peak load reduction, U represents dummy variables for the end-users. R includes eight regional dummy variables for regions, T denotes dummies for years from 1992 to 2008, and I captures the U * R interactions.

The model has the following form:

$$Y_{urt} = \alpha + \beta_u U_u + \beta_r R_r + \beta_t T_t + \beta_{ur} I_{ur} + \varepsilon_{urt}$$

$$Y_{urt} = P_{urt} / S_{urt}$$

The dependent variable is constructed by dividing actual peak load reduction (P_{urt}) by the summer peak load (S_{urt}), measured in megawatts. Summer peak load represents the maximum load during the summer months from June to September. The set of independent variables, obtained from EIA data, includes dummy variables for end-users (U_u), 8 regional dummies (R_r) and dummies for years (T_t).The base cases are Industrial end-user, the Texas Region (TRE), and year 1992.

In order to generate empirical evidence relating to the hypothesis that peak load reduction varies by years, end-users, and regions, we regress peak load reduction ratio function of end-users, regions, years. It was found that DSM did have a positive effect; however the extent of response mainly varied from one region to another. These results are quite robust in the summer peaking regions that have employed DSM programs to offset the heavy use of air-conditioning. A notable end-user variability of reductions in peak demand also is discovered. The greatest sectoral response to peak load management initiatives has been in the commercial sector, followed by the residential and industrial sectors. Controlling for other variables, regions with the greater peak load reductions are populous regions such as MRO and WECC with sharp summer peaks. Active government involvement, as shaped by state regulations in these regions, has had positive outcomes in terms of achieving prescribed energy savings targets. The least progress has been made by the NPCC region, a winter-peaking region with less cooling demand during summer months. Interaction variables that were entered into the model to test whether or not there have been behavioral shifts by end-users in different NERC regions seem to demonstrate positive results in the commercial sector that occurred in the NPCC region. It can be explained by the market mechanisms in the Northeast that have encouraged significant development of DSM programs.

None of the NERC regions reveal substantial peak load reductions by the transportation sector. The transportation sector is heavily dependent on petroleum, primarily in the form of gasoline and diesel. Energy use in the transportation sector might be improved and diversified in several ways: improving the energy efficiency of the vehicles and the transportation system, by expanding the range of fuel and engine options available to motorists, including alternative fuels and electricity/battery operated vehicles, and diverting traffic from individual vehicles to mass transit are all examples.

We also witness a possible DSM-related uptick in the recent years which indicate that we may have finally started to see a strong uptick with the government intervention to support DSM programs in 2005. Significant end-user shifts are also traceable in the WECC and MRO regions in the years after 2002, when government-embraced DSM measures were introduced to combat the U.S energy crisis of 2002 and 2001. These efforts to reduce peak load and increase energy awareness have been proliferating, as indicated by an uptick in peak load reductions in the years 2008 and 2009.

Summary

Indeed there is evidence that by 2007 and 2008 there appears to have been a positive effect of introduction of DSM programs, but the overall amount of peak load reduction is very small and there is substantial regional variability. The empirical results support the hypothesis that there are spatial variations in peak load reduction ratio by user type and between regions. They do not, however, address issues of regional variation in peak load seasonality and the associated need for DSM tailoring, an important area for follow-up research.

Public policies have also played a significant role both by promoting energy-efficient technologies in the residential and commercial sectors via DSM that has led utilities to employ programs that reduce operating costs, promote public energy conservation, and shift peak load demands. Government's involvement to promote demand response began with the EPACT1992, which required utilities to increase clean energy use and improve overall energy efficiency, and continued with EPACT 2005, which set new directions to attain clean energy use across all the sectors while also managing peak loads.

As evident from the empirical results, since 2005 DSM has been focusing on expanding traditional load management and interruptible programs. Just as power supplies vary by region and peak load demand vary regionally by user and by seasons, so must DSM if it is to produce additional load smoothing. It is the intersection of region, user, and season that must be the focus of the next round of research, to enhance DSM via strategic targeting.

Footnotes

[1] U.S. Energy Information Administration Glossary, http://www.eia.doe.gov (Accessed December 5, 2011)

[2] U.S. Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report," Electric Power Annual (January 2010), Tables 9.1, 9.6 and 9.7.

Biblography

Auffliammer, Maximilian, Carl Blumstein, and Meredith Fowlie (2008), "Demand-Side Management and Energy Efficiency Revisited," The Energy Journal, Vol. 29.

Arimura, Toshi H., Richard Newell, and Karen Palmer (2009), "Cost-Effectiveness of Electricity Energy Efficiency Programs," Journal of Economic Literature, 09-48.

Faruqui, Ahmad and Sanem Sergici, "Moving Toward Utility-Scale Deployment of Dynamic Pricing in Mass Markets," Institute for Electric Efficiency Whitepaper, June 2009.

Freeman, Luisa, Dr Shawn Intorcio, and Jessica Park, "Implementing Energy Efficiency: Program Delivery Comparison Study," Institute for Electric Efficiency Whitepaper, March 2010.

Gillingham, Kenneth, Richard Newell, and Karen Palmer (2006), "Energy Efficiency Policies: A Retrospective Examination," Annual Review of Environment and Resources, 31: 161-192.

Horowitz, Marvin J. (2007), "Changes in Electricity Demand in the United States from the 1970s to 2003," The Energy Journal, Vol. 28(3): 93-119.

Johnson, Karl F., "Commercial Lighting and Demand-Side Management: A Utility Perspective from the United States," Electric Power Research Institute Report, 2008.

Loughran, David S. and Jonathan Kulick (2004), "Demand-Side Management and Energy Efficiency in the United States," The Energy Journal, Vol. 25.

Talukdar, Sarosh and Clark W. Gellings, 'Load Management,' IEEE Press, 1984.

U.S. Energy Information Administration http://www.eia.doe.gov (accessed December 5, 2011)

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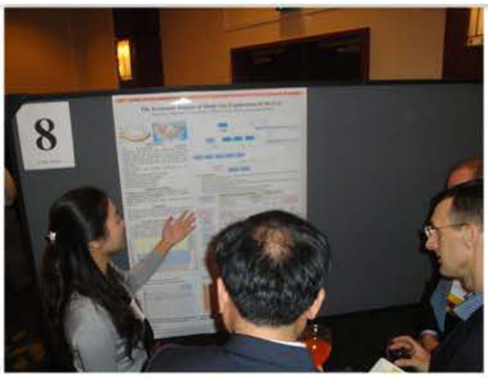
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Publications

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8-12 April 2013, IEA Energy Training Week 2013 at Paris, France. Contact: Assen Gasharov, International Energy Agency Email: training.programme@iea.org URL: http://www.iea.org/training/etw2013

8-12 April 2013, International Gas Value Chain Course at Amsterdam. Contact: Janet Smid, Course Manager, Energy Delta Institute, Netherlands Email: smid@energydelta.nl URL: http://www.energydelta.org/mainmenu/executive-education/introduction-programmes/international-gas-value-chain

14-17 April 2013, 40th Annual International Energy Conference IRCEED at Boulder, CO. Contact: Dorothea El Mallakh, Director, IRCEED, 850 Willowbrook Road, Boulder, CO, 80302, USA Email: iceed@colorado.edu URL: www.iceed.org

16-18 April 2013, FDFC13 Fundamentals & Developments of Fuel Cells at Karlsruhe, Germany. Contact: sara.heimolinna@eifer.org, Organisation Committee, EIFER European Institute for Energy Research, Karlsruhe, Baden-Württemberg, Germany URL: http://fdfc2013.eifer.uni-karlsruhe.de/

16-19 April 2013, LNG 17 at Houston, TX, USA. Contact: Jay Copan, Executive Director, LNG 17, USA. Phone: 919-740-7799 Email: jcopan@lng17.org URL: www.ing17.org

16-20 June 2013, 36th IAEE International Conference: Energy Transition and Policy Changes at Daegu, Korea. Contact: Hoesung Lee, KRAEE, Korea Email: hoesung@unitel.co.kr

28-31 July 2013, 32nd USAEE/IAEE North American Conference - "Industry Meets Government: Impact on Energy Use & Development" at Anchorage, Alaska. Contact: David Williams, Executive Director, USAEE, 28790 Chagrin Blvd., Suite 350, Cleveland, Ohio, 44122, USA. Phone: 216-464-2785. Fax: 216-464-2768 Email: usaee@usaee.org URL: www.usaee.org

8-10 October 2013, Energiemarkten at To be determined. Contact: Janet Smid, Course Manager, Energy Delta Institute, Netherlands Email: smid@energydelta.nl URL: http://www.energydelta.org/mainmenu/executive-education/introduction-programmes/energiemarkten-2

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