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International Association for Energy Economics

IAEE Energy Forum

First Quarter 2014 International Association for Energy Economics

President's Message

The IAEE is a unique organization in many ways. First it is international in its governance structure and membership distribution. IAEE currently has over 4,000 direct and affiliate members from over 100 countries, including 26 affiliates worldwide. Secondly, membership privilege is available to every professional and graduate student interested in the economics of energy and is willing to claim ownership of this unique association as a stakeholder. Thirdly, the early members of IAEE certainly had great insight, when they changed the name of the association from International Association of Energy Economists to International Association for Energy Economics. Subsequently, at every regional and/or international meeting of the IAEE, professionals interested in energy economics and policy issues—engineers, geoscientists, economists, lawyers, geographers, scientists—come from the industry/business sector, academic and government institutions. Let me say, without mincing words, that it is very unlikely to find another association on this planet earth with the type of professional diversity as in IAEE.

Thus, it is a great privilege to have been affirmed by election to chair the IAEE council this year. It was 28 years ago that I attended my first IAEE conference as a graduate student at West Virginia University. So, you can imagine how delightful it is for me as I look forward to attending the 2014 IAEE meeting in New York, 29 years later. I sincerely appreciate the opportunity to be your IAEE president and I look forward to expanding IAEE membership worldwide into areas where we are yet to be fully entrenched. The IAEE Council members cannot do this alone, your assistance is needed and I would encourage you to work with us. Perhaps you can earn membership rewards we designed to grow IAEE membership. We do not want to just grow the individual membership; I want us to work together as a team to also grow our institutional membership. Currently, we have about 30 institutional members. Perhaps, we can work together to get another ten, one at a time. It would be my pleasure to present your ideas to the council on how we can continue to accomplish this growth agenda through your efforts.

Interestingly, when I was elected as USAEE president in 2008, the energy issue at the forefront then was the role of LNG in the U.S. gas market. The United States was then the prime destination for many LNG planned projects. Further, the U.S. was also grappling, around this time, with its rising oil imports to the tune of about 60% of its total consumption. In fact, I remember that in his final state of the union address in June 2008, President George Bush challenged America to seek new sources of clean energy and to reduce its dependence on oil. It seems to me that America heard him loud and clear and today a new energy landscape has indeed emerged in the U.S. Technology and economic incentives have made unconventional hydrocarbon resources desirable and accessible despite environmental and regulatory challenges and constraints. As a result, the U.S. is now better positioned to attain energy self-sufficiency and perhaps, become the leading oil and gas producer worldwide and an LNG gas exporter by 2020, ceteris paribus.

The geopolitical and economic implications of the U.S. becoming an exporter of oil and gas, in the not too distant future, will be momentous. First, is it plausible that if the excess gas in the U.S. finds its way to Europe, then the dependence of Europe on Russian gas will be reduced significantly? Second, African light oil export to the U.S. is already in jeopardy as a result of discounted pricing of light tight oil from shale in the U.S., so would this affect OPEC significantly in terms of its output strategy? Third, because of

(continued on page 2)

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CONTENTS

Editor: David L. Williams

(President's Message continued from page 1)

gas abundance in the U.S., coal export prices have fallen and become attractive in European markets. Fourth, if gas exports from the U.S. to Europe lead to lower gas prices, would the clamor for subsidy incentives for renewable energy be significantly affected? Finally, how realistic is the projection that the U.S., because of shale oil production, will become the top oil producer worldwide given the constraints underlying shale oil and gas development, including environmental challenges, cost of development and producible reserves uncertainty?

Well, as I mentioned earlier, here lies the uniqueness of our IAEE. The organization is fashioned to provide a thorough analysis of the issues the new energy landscape brings with it. In fact, the Opening Plenary Session of the 37th IAEE International Conference in New York on June 16, 2014 has been fashioned to facilitate good understanding of the international implications of U.S. reemergence as a key global energy producer. There are 9 other plenary sessions, (please visit http://www.usaee.org/usaee2014/program.aspx to view the full program), particularly for IAEE members from business and government institutions and our institutional members during the conference. There is a panel on energy and the economy constituted to address energy prices and energy security implications of the emergence of unconventional hydrocarbons in the U.S. The panel on renewable, power prices and grid integration will address technical, regulatory, economic, and business models for the power sector. The panel on oil and gas reserves valuation and financing will address the role of uncertainty which underlies some of the challenges involved in shale development. The fourth and final panel deals with international lessons and perspectives on climate change and carbon policies. For our academic and other energy professionals interested in presenting papers on emerging energy issues, we are offering 60 concurrent sessions with a plan to accept a minimum of 300 papers for presentation. The deadline to submit your abstract is January 10, 2014. Please join us in New York. You will enjoy listening to our experts, invited guest speakers and our energy professionals as they offer their perspectives on these contemporary energy economics and policy issues. The conference website is located at http://www.usaee.org/usaee2014/

Let me also bring to your attention the other IAEE endorsed or sponsored conferences in 2014. As fate would have it, my first assignment as IAEE president in 2014 is to attend the 7th NAEE/IAEE International conference in Abuja, Nigeria on February 17-18. The theme of the conference is Energy Access and Sustainable Economic Development Options for Africa. Our 4th IAEE Asian conference will be held in Beijing, China on Sept 19-21, 2014. The theme of the conference is Economic Growth and Energy Security: Competition and Cooperation. Finally, the 14th IAEE European conference is slated to be held on October 28-31 in Rome, Italy. The theme of the conference is Sustainable Energy Strategies for Europe. In fact, the planning for the 38th IAEE International Conference in Antalya, Turkey on May 24-27, 2015 is in full gear. Please visit www.IAEE.org for more information on these conferences.

The IAEE council is on course to maintain IAEE's quest for excellence advocated brilliantly by David Newbery in 2013, Lars Bergman in 2012, and Mine Yucel in 2011. I must also mention Einar Hope in 2010 and all the past IAEE presidents before him. It has been a pleasure working with these fine men and woman of integrity when I was IAEE Vice President of Finance and later as President Elect. I eagerly

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

look forward to working closely with them as President in 2014. Let me quickly affirm my confidence in every member of the 2014 IAEE council but permit to acknowledge in particular our energetic VP for Conferences, Gürkan Kumbaroglu and our estimable 2014 President-Elect, Peter Hartley. I must also commend David Williams, Sr. and David Williams, Jr. for their tenacity in the management of IAEE. The state of our Association is buoyant because of the efforts of these great men and their staff. The IAEE Energy Journal remains the best in the business and so is the emerging IAEE Energy Economics and Environment Policy Journal. The Editorial staff of our journals must be commended for the excellent work they are doing and of course we cherish our IAEE authors as well.

Finally, for everything that has a beginning, there certainly must be an end. For twenty-one years I have been fortunate to work at LSU Center for Energy Studies. The Center supported my activities in the USAEE and IAEE for those years effortlessly. The Center graciously provided funding for my travels to nearly all IAEE/USAEE conferences since 1992. Without hesitation, LSU Center for Energy Studies became an institutional member. My sincere appreciation goes to Dr. Allan Pulsipher, the Executive Director, and his staff. It is, thus, with mixed feelings that I announced to my IAEE professional colleagues my retirement from LSU effective Jan 3, 2014. I have accepted a position to direct an energy institute for petroleum and energy economics, policy and strategic studies in Nigeria.

Looking forward to seeing you at all IAEE conferences in 2014.

Wumi Iledare

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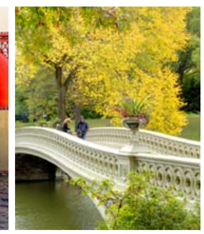
IAEE is a 501(c)(6) corporation and neither takes any position on any political issue nor endorses any candidates, parties, or public policy proposals. IAEE officers, staff, and members may not represent that any policy position is supported by the IAEE nor claim to represent the IAEE in advocating any political objective. However, issues involving energy policy inherently involve questions of energy economics. Economic analysis of energy topics provides critical input to energy policy decisions. IAEE encourages its members to consider and explore the policy implications of their work as a means of maximizing the value of their work. IAEE is therefore pleased to offer its members a neutral and wholly non-partisan forum in its conferences and web-sites for its members to analyze such policy implications and to engage in dialogue about them, including advocacy by members of certain policies or positions, provided that such members do so with full respect of IAEE's need to maintain its own strict political neutrality. Any policy endorsed or advocated in any IAEE conference, document, publication, or web-site posting should therefore be understood to be the position of its individual author or authors, and not that of the IAEE nor its members as a group. Authors are requested to include in an speech or writing advocating a policy position a statement that it represents the author's own views and not necessarily those of the IAEE or any other members. Any member who willfully violates IAEE's political neutrality may be censured or removed from membership.

CONFERENCE OVERVIEW

The relationship between economic growth and energy becomes ever more important as economies around the world struggle to reinvigorate themselves and to develop energy resources in sensible, sustainable ways. Can economic growth be stimulated even with pressure to reduce if not forego certain forms of energy for environmental or safety reasons? Alternatively, can oil, gas and other energy development be a major force that stimulates economic growth? What policy framework would maximize the contribution of energy to growth while encouraging efficient substitution of sustainable for less sustainable sources?

The 37th IAEE International Conference, taking place in New York City in 2014, will focus on these and related issues. New York is the financial center of the United States, a place where multi-billion dollar bets are laid on future economic growth and on energy technologies, and therefore a place where analysis of subjects like these is constantly in demand. Some of the very best minds in energy economics in the world will assemble there for what promises to be one of the best IAEE Conferences ever. Economists from a number of countries will examine questions related to energy and the economy from a wide variety of perspectives. High level policy makers will talk about the challenges they face, while analysts will offer practical, evidence-based approaches to meeting such challenges. The agenda will be filled with top-notch speakers plus 3 days of concurrent sessions, places where the results of specific topical research will be presented and absorbed.

The conference also will offer networking opportunities through informal receptions, breaks between sessions, and student recruitment. These provide opportunities for attendees to renew acquaintances and to forge new ones. There will be special events for students, including paper, poster and case competitions. And as usual, an outside event will spice the conference agenda. If that weren't enough, New York City offers a myriad of cultural attractions from museums to musical, dramatic and athletic performances. Not to mention some of the best shopping in the entire world. It's a conference program and a venue not to be missed.

Topics to be addressed include:

The general topics below are indicative of the types of subject matter to be considered at the conference. A more detailed listing of topics and subtopics can be found at: www.usaee.org/usaee2014/topics.html

- Energy Demand and Economic Growth
- Energy Supply and Economic Growth
- Financial and Energy Markets
- Energy and the Environment
- Non-fossil Fuel Energy: Renewables & Nuclear
- International Energy Markets
- Energy Efficiency
- Energy Research and Development
- Political Economy of Energy
- Public Understanding of and Attitudes towards Energy
- Other topics of interest include new oil and gas projects, transportation fuels and vehicles, generation, transmission and distribution issues in electricity markets, etc.

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37TH IAEE INTERNATIONAL CONFERENCE | JUNE 15–18, 2014 | NYC

ENERGY & THE ECONOMY





PLENARY SESSIONS

The 37th IAEE International Conference will attract noteworthy energy professionals who will address a wide variety of energy topics. Plenary sessions will include the following:

- International Implications of U.S. Energy Renaissance
- Energy & The Economy
- Renewables, Power Prices, and Grid Integration
- International Shale Development: Prospects and Challenges
- Transportation Developments
- Oil & Gas Reserve Valuation & Financing
- Climate Change and Carbon Policies – International Lessons and Perspectives
- Energy Financing
- Utility Business Model
- Global Energy Demand Growth

Travel Documents

All international delegates to the 37th IAEE International Conference are urged to contact their respective consulate, embassy or travel agent regarding the necessity of obtaining a visa for entry into the U.S. If you need a letter of invitation to attend the conference, visit www.usaee.org/usaee2014/invite.aspx The conference strongly suggests that you allow plenty of time for processing these documents.

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SPEAKERS INCLUDE:

Douglas Arent
Executive Director JISEA, National Renewable Energy Lab

Jason Bordoff
Director, Center on Global Energy Policy, SIPA, Columbia University

Michael E. Canes
Distinguished Fellow, Logistics Management Institute

A. Denny Ellerman
Part-time Professor, European University Institute

David Hobbs
Head of Research, KAPSARC

Ralph Izzo
Chairman, President and CEO, Public Service Electric and Gas

Amy M. Jaffe
Executive Director, Institute of Transportation Studies, UC Davis

Steffen Jenner
Policy Advisor, Ecofys Consultancy

John W. Jimison
Managing Director, Energy Future Coalition

Lutz Kilian
Professor of Economics, University of Michigan

David H. Knapp
Managing Director Energy Research Advisor, Energy Inteligence Group

Prakash Loungani
International Monetary Fund

Robert Maguire
Partner, Perella Weinberg Partners

Kenneth B. Medlock III
Senior Director, Center for Energy Studies, Baker Institute, Rice University

Edward Morse
Managing Director and Global Head – Commodities, Citi Research

Karsten Neuhoff
Head of Department, DIW Berlin

David M. Newbery
Director, EPRG, University of Cambridge

Karen Palmer
Senior Researcher, Resources for the Future

Ricardo B. Raineri
Alternate Executive Director – LA, The World Bank Group

Surya Rajan
Director, Strategy, Baker Hughes

Thibaut Remoundos (invited)
Morgan Stanley & Co International plc

Christof H. Ruehl
Group Chief Economist and Vice President, BP plc

Benjamin Schlesinger
President, Benjamin Schlesinger & Assoc LLC

Jigar Shah
Founder, SunEdison LLC

Adam E. Sieminski
Administrator, Energy Information Administration

Katherine Spector
Head of Commodities, CIBC World Markets

Mauricio Tolmasquin
President, EPE (Empresa de Pesquisa Energetica), Brazil

Jose Maria Valenzuela
Director de Sustentabilidad Energetica, Secretaria de Energia, Government of Mexico

Dymphna van der Lans
Senior Director for Public Policy Programs, German Marshall Fund of the United States

Juan Miguel Velasquez
Associate, World Resources Institute

Christian von Hirschhausen
Professor of Economics, TU Berlin

Eirik Wærness
Chief Economist, Statoil ASA

Zhang Xiliang
Professor and Executive Director of the Institute of Energy, Environment and Economy, Tsinghua University

Sonia Yeh
Research Scientist and Lecturer, University of California, Davis

Mine Yucel
Vice President & Sr Economist, Federal Reserve Bank of Dallas

Anthony Yuen
Director and Global Energy Strategist, Citi Research

Visit Our Conference Website at **WWW.USAEE.ORG/USAEE2014/**

Editor's Notes

We begin our coverage of *Energy Poverty* with this issue, but as noted in the following abstracts, include a number of other topics of current interest. Next issue will conclude the *Energy Poverty* subject.

Sebastian Schwenen and Karsten Neuhoff explain that on the German power market, declining prices for peak forward contracts reveal the declining value that conventional peak forward contracts provide to load and generation for hedging price risk. Market design and innovative commercial contracts can reinforce the value of forward contracting, also for effectively signaling and contributing to generation adequacy.

Seyed GholamHosein Hassantash notes that continuation of oil production of Saudi Arabia is problematic, and as production from America's unconventional sources is becoming more economic, U.S. dependence on imports is falling. Geopolitical effects of reduced dependence of the U.S. on Persian Gulf oil are significant. Saudi's recognition of this new situation may result in a better relationship with Iran, enhance cohesion within OPEC and boost Iran-PGCC ties.

Philip R. Walsh and Jason Wu write that remote First Nation communities in northern Ontario, Canada, rely on diesel fuel for electricity generation. Climate change has resulted in shorter winter road seasons that limit trucking and require costly air transport of diesel fuel. They address how energy efficiency and renewable energy technologies can provide solutions.

Gunther Bensch makes the case for distinct energy poverty indices to be part of the Global Tracking Framework proposed by the World Bank. Empirical insights on existing energy poverty measurement approaches are discussed based on the analysis of a unique household dataset covering five sub-Saharan countries.

Philipp Gaggl and Paolo Gentili write that globally 1.3 billion people have no access to affordable, reliable and renewable energy. Together with the World Economic Forum, PwC developed a cross-sector partnership framework for business models scaling up de-central energy access. Impact measurement is a new way to give hard numbers to the total value of economic, environmental and social impacts benefitting all stakeholders involved.

Silvia Pariente-David writes that large scale development of renewable energy (RE) makes the task of the system operator much more complicated, because of the intermittency and variability characteristics of RE. A solution to optimise the deployment of RE at least cost is integration. Moreover, market design principles and mechanisms have to provide the right signals to ensure development of flexibility mechanisms, coordination between operators, proper remuneration of back-up capacity and ancillary services and RE incentives that reflect the real service provided by RE capacity.

Matthew E. Oliver, Charles F. Mason and David Finnoff report that predicted increases in production and demand for natural gas over the coming decades will likely result in persistently congested pipeline routes. As pipeline capacity between two hubs becomes scarce, rents are generated as a wedge is driven between spot prices at the hubs. They quantify this wedge as it measures the cost of congestion to natural gas market participants. Under current pipeline regulation, the scarcity rents are diverted away from the pipeline owner to non-pipeline owners of firm capacity. The diversion weakens the incentive for capacity expansion, and compounds the congestion problem.

Joni Jupesta discusses the energy situation in Indonesia and particularly the role played by palm oil. He lays out an example of how the integration of palm oil and cow farming could help alleviate some of the energy poverty experienced by the country, especially for some of the 66 million people living without electricity access.

Teodora Peneva reports that about 67% of Bulgarian families are not able to afford the basic needs of heating in the winter. Beside low income levels and a large percentage of poor households, there are also other factors that impact the level of energy poverty in Bulgaria, such as excess usage of electricity, lack of low-cost alternatives and poor quality buildings. Details and data are provided on the three main poverty inducing factors in the country.

DLW

The Declining Value of Peak Forward Contracts

By Sebastian Schwenen and Karsten Neuhoff*

The declining prices quoted for peak forward contracts in Germany reveal a declining value that conventional peak forward contracts provide to generation and load for hedging price risk. This also implies that traditional peak forward contracts are less effective in signaling and contributing to generation adequacy and points to the need to assess a potential role for other contract types. Given the limited attention paid to the role of contracting in the German debate on electricity market design, we discuss why the value of contracts declined over the last years, and ask how market design and commercial contract structures can go hand in hand in supporting forward contracting.

On the EEX, much of the recent decline in peak prices is due to surplus generation capacity and high output of renewables, foremost wind and solar generation. As a consequence of decreasing price levels, peaking gas-fired units face low or even negative profitability. In Germany, a debate started on whether such low profitability signals overcapacities or whether peak capacity, that after all is needed to satisfy weather-dependent residual load, should instead be further incentivized via capacity mechanisms. However, this debate is blurred by the fact that the intermittency in RES generation changed the daily price profile, and that load and generation patterns differ across regions. Average prices for peak and off-peak products are, therefore, no longer the appropriate indicators to assess profitability and adequacy of peaking capacities.

Declining Margins for Peaking Units

German power prices declined with lower CO_2 prices, lower power demand and increasing volumes of solar and wind in the system. In 2012, average day-ahead peak prices at times were below estimates of variable costs of CCGT units. As Figure 1 shows, subsequent to March 2012 the monthly average of hourly day-ahead peak spreads for CCGT remained close to zero or negative throughout the year.

However, the units do not necessarily need to operate on all peaking hours. Instead, generators could opt to only sell power at days and periods when spot prices exceed variable generation costs. The solid line in Figure 1 illustrates the revenue from power sales minus variable costs that would be achieved in this case. In periods of large surplus capacity the net-revenue still remains close to zero.

Figure 1 illustrates, that with the large increase of wind and particularly solar generation capacity, the difference between the net revenue – as suggested by a monthly spark spread – and the revenue that can be achieved when operating the plants only in periods when spot prices exceed variable generation costs is growing.

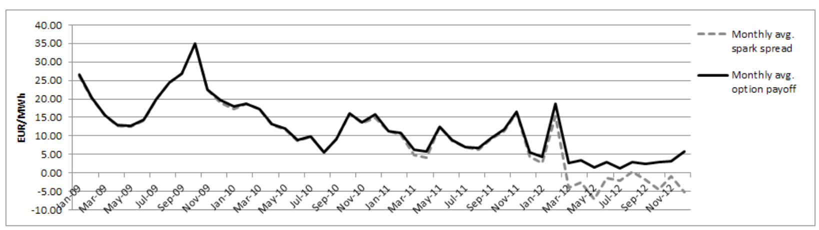

Figure 1: German Day-ahead Spark spread (with fuel plus ETS costs) vs. Option Payoff for CCGT Units (with heat rate of 7,000 BTU/KWh).

Single Pricing Zone Hides Regional Needs

A second aspect to be considered when interpreting information in peak prices is regional generation and load patterns that vary across Germany. Most investments in wind generation have occurred in the northern parts of Germany, while several nuclear power stations have been phased out in the south of Germany, leading to concerns about regional supply adequacy.

This is, however, not reflected in power prices – instead the entire country is part of one pricing zone and peak contracts cover the entire zone. Hence they can only depict information on scarcity across the entire country, but do not respond to potential generation adequacy concerns in parts of the country. Instead, regulators are requiring transmission operators to contract additional generation capacity at the regional level, and transmission operators adjust generation schedules using re-dispatch. Re-dispatch costs and associated revenues are not reflected in peak prices. Furthermore, local re-dispatch can create local market power, and result in the famous inc-dec games that were observed in the Californian and the UK market.

Thus peak contracts do not provide sufficient information on regional supply adequacy. Potential difficulties to meet local capacity needs (or rather to retain capacity on the system where needed), therefore, need to be primarily addressed through better alignment of pricing zones with transmission capacity. If a single German power price, and derived forward products, do not signal scarcity be-

* The authors are with the German Institute for Economic Research, DIW Berlin, Berlin, Germany. Corresponding author, Sebastian Schwenen, may be reached at sschwenen@diw.de

cause there is no scarcity at the aggregate level, but scarcity exists at a regional level, then the power market design also does not provide incentives to invest and maintain plants so as to mitigate scarcity right where it occurs.

Implications for Forward Contracting

About 95% of demand in Germany is covered by forward contracts. With falling day-ahead prices also forward prices decrease as the contracts are anchored at day-ahead spot prices. Therefore negative day-ahead spreads depicted in Figure 1 also indicate that – with revenues from forward contracts alone – CCGT units would run at a loss. However, even where generation signs forward contracts, it can still decide to serve the contracts through power acquired on the spot market at times when the spot price falls below variable generation cost. Thus additional profits can be obtained, increasing the overall value of signing forward contracts. However, given the uncertainty about price profiles, this approach is associated with risks about future price developments.

CCGTs, therefore, either can sign forward contracts and rely on additional revenue or decide not to sell on forward contracts. If due to the risks about future price developments generators decrease contracting volumes and preferably sell spot, then also the overall revenue structures of generators is more opposed to volatile spot prices. Thus also investment planning and finance becomes aggravated.

Given the increasing price risks inherited to contracting, new contract types could offer advantages over traditional forward contracts and enhance (re-)investment finance. In line with the positive option payoff presented in Figure 1, option-style contracts offer one solution. In such contracts load pays an option premium to generation, and whenever needed has access to generation at a predefined power price (typically variable costs of generation). However, it requires further analysis to understand the role such option contracts could play in the overall portfolio of demand. Similarly, even if innovative contract types might offer advantages, it is unclear whether or how sufficient liquidity for new contract types can emerge.

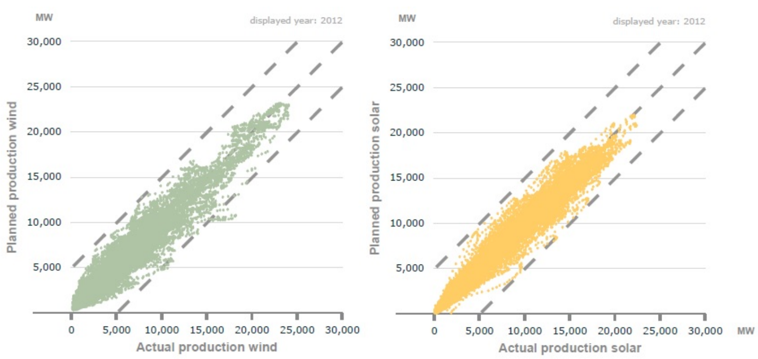

Figure 2: Actual and Planned RES Generation in the German Market in 2012.

Source: Burger (2013), "Electricity production from solar and wind in Germany in 2012", Fraunhofer ISE.

Last, also the reference price for forward contracts might change with increasing RES penetration. While in the U.S. forward sales are anchored at the real-time price, in the EU contracts hedge against the day-ahead price. However, as Figure 2 illustrates, deviations from planned to actual RES production from wind and solar units in Germany can be significant and unexpected additional generation amount to several GW. Unexpected RES production can cause deviations from day-ahead to intra-day prices, and with contracts being settled at the day-ahead price, intra-day price risks remain unhedged. It still remains open whether day-ahead prices or intra-day prices offer the ideal reference for forward contracts.

To conclude, we identified several reasons that reduce the value provided for generation and load with traditional peak contracts as the share of wind and solar power increases in German power generation. This could trigger a change of contract design so as to better meet hedging needs. This could in turn also enhance the effectiveness of mid-term contracting in signaling and managing supply adequacy.

Iran, Saudi Oil Relationship: Friendship or Rivalry

By Seyed GholamHosein Hassantash*

Saudi Arabian Oil History

In the 1970s, about 40 years after its foundation as a country, Saudi Arabia became a key world player in political and economic developments. Although it joined the oil producers' club towards the end of 1930s, the climax of Saudi Arabia's global status concurred with the U.S. maxing out its oil production in 1970. From then on, dependence of the U.S. on the import of crude oil kept rising.

As the world demand for oil grew along with the rise of its import by the U.S., Saudi Arabia rose to be one the few suppliers that could satisfy the global unending appetite for oil. Using this opportunity, Saudi Arabia transformed its status from a major oil producer of about 2.5 million barrel per day (mln bpd) to a super producer in 1974, capable of producing over 8.5 mln bpd.

Following the first and second oil shocks of 1970s, industrial countries adapted a series of policies that resulted in reduced demand for OPEC oil as of the early 1980s. In response to that, and to sustain the price of oil, OPEC members adapted the policy of output reduction. It was always Saudi Arabia that reduced its output the most, and as a result, Saudi's output of over 10.2 mln bpd in 1980 was reduced to a mere 3.8 mln bpd in 1985. Subsequently, Saudi Arabia turned into the main storage of *excess production capacity*, which provided the West with the needed assurance and the U.S. with maneuverability, because it could at will put this capacity to use and supply the market with millions of barrels of crude oil.

The value of Saudi's excess production capacity was demonstrated to the U.S. at different junctures. For instance, it was used in 1986 to decrease the price of oil when the U.S. wanted to exert pressure on Iran to end the war with Iraq, to put pressure on the Soviet Union's oil dependent economy so as to facilitate its downfall, and also to limit Qaddafi's oil revenues that were used to feed his so called "anti-imperialist" freedom movements. Such an action was possible only with the help of the Saudi's excess production capacity. Using the excuse of defending "market share" instead of a policy of defending the "oil price", Saudi Arabia suddenly raised its oil production, flooded the market and caused the oil price to plummet.

Again it was with the help of Saudi's excess production capacity that the Persian Gulf War of 1991-1992 did not cause a big oil shock. Iraq's invasion of Kuwait and the U.S. military offensive to liberate it, and the subsequent burning of the oil wells of Kuwait had deprived the global oil market of the outputs of two major suppliers for a relatively long period of time. That is when Saudi's oil came in to make up for the loss of oil of both. Since then, Saudi Arabia has repeatedly intervened in the oil market in favor of the U.S. and its industrial allies, both physically and psychologically.

The aerial attacks by the West on Libya to help its revolutionary forces topple Qaddafi's regime in the beginning of the Arab Spring resulted in the exit of Libyan oil from the market. Escalation of sanctions against Iran led to the boycotting of its oil by the West. If it was not for the existence of Saudi Arabia's excess production capacity, neither of the cases would be possible.

Why Saudi's Star is in Decline?

Notwithstanding what went above, the following two factors have caused Saudi Arabia's lucky star to be in decline:

First, *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*, written by Mathew Simmons and published in June 2005, put an end to the myth of endless Saudi oil reserves. Based on hundreds of scientific papers plus his own independent surveys, Simmons showed that, first, the estimated remaining oil reserves of Saudi Arabia and the rate of recovery of its oil fields are hugely exaggerated. Second, that over 90% of Saudi oil is produced solely by seven old oilfields, which are in the descending curve of their lifespan and continuation of production from them has become increasingly difficult. Later on, some documents produced by Wikileaks also confirmed the veracity of the claims in this book.

Making up for the natural decline in the production of the major and main oilfields of Saudi Arabia requires huge investments in the fields as well as in the newly discovered smaller ones, which are in no way comparable to the old fields.

Before the publication of *Twilight in the Desert*, the annual forecasts of both the International Energy Agency (IEA) and the U.S. Energy Information Administration (EIA) anticipated Saudi's production to reach as high as 24 mln bpd by 2030. After the book was published and facts came to light, the predictions

* Seyed GholamHosein Hassantash has held various positions in the national Iranian Oil Company (NIOC) including, Director General of the Ministerial Office of the Oil Ministry, NIOC board member and Manager of the Administrative Affairs Department and Advisor to the Oil Minister on Economic Affairs. He was President of the Institute for International Energy Studies from 1997 to 2002.

dropped to 12-13 mln bpd. The materialization of even this much is seriously doubted.

Besides Simmons, Colin Campbell, Samsaam Bakhtiyari and Mamdouh Salameh have also examined the state of Saudi Arabia's oil reserves and have come up with figures ranging from 90 to 145 bln bbl, which are very different from the official statistics of that country. On the other hand, the domestic consumption of Saudi Arabia is increasing rapidly and reached almost 3 mln bpd in 2012. This trend will continue and subsequently reduce the exporting power of Saudi Arabia.

Second, in recent years, production of oil, and especially natural gas, out of unconventional hydrocarbon sources such as oil shale and gas shale in the United States have reduced dependence on the import of oil and gas. The shared energy strategy of both the Democratic and Republican parties of the U.S. is the country's self-sufficiency at the continental level and minimization of dependency on sources out of the continent.

Dependence of America on oil import from the Middle East is falling, and it will be a gas exporter by 2015. One probable scenario is that once the U.S. reduces and later cuts off its dependence on Persian Gulf oil, it will be less interested in the region and will limit its presence in it. Another scenario has the opposite view and holds that reduced dependence on the Persian Gulf oil can, in fact, boost America's maneuverability in the region. After all, dominance over oil rich regions of the world and control of the waterways and corridors of energy transport have always been the power tools and leverages of supremacy of the U.S. over its economic rivals. That means, once the U.S. is no longer in need of resources from the region, its maneuvering power to put pressure on its rivals who are in need of the resources will increase, and any insecurity in the region will only threaten the interests of its rivals.

During the so called Arab Spring developments, America did not allow the breeze of that Spring to cross the boarders of Saudi Arabia. Even the ruling regime in Bahrain owes the continuation of its rule to the help of Saudi Arabia. If there was no concern that success of the opposition in Bahrain would embolden Shiites in the oil rich Eastern regions of Saudi Arabia, then political developments in Bahrain could have had a different outcome, and Saudi Arabia would not have been allowed to intervene in the domestic affairs of that country.

Obviously, as long as Saudi's oil is indispensable in the world market and the U.S. is in need of that market, America will not take the chance of allowing the Arab Spring to get near Saudi Arabia's boarders and this unjustified contradiction in the foreign policy of the U.S. will continue. However, if the U.S. is free from the need of oil and gas from the region, the political and power scene in the Persian Gulf countries may undergo change. Then, it is not clear how dedicated the U.S. would remain to its regional ally (Saudi Arabia), or conversely, how prepared would the U.S. be to compromise this chess pawn to control the economic growth of its important rivals like China.

Ground for Expansion of Iran, Saudi Oil Relationship

The foregoing could pave the way for the enhancement of the Iran/Saudi relationship. Sincere improvement of the relationship with Iran could boost both the level of regional and internal security of Saudi Arabia, and will also neutralize chances of the creation of insecurity by extra-regional powers. Besides, if Saudi Arabia comes to comprehend the new and ongoing developments, the stage will be prepared for planning common energy and oil policies between the two countries. This will help boost OPEC solidarity as well. If a strategic accord is reached between the two, then agreeing on smaller issues like selecting a Secretary General for OPEC will be much easier.

Under the prevailing circumstances, an effort to improve the relationship with Saudi Arabia by the newly elected President of Iran would be a smart move. Within the prospect of the above commentary, the direction of competition and friendships can change as well.

Apart from border disputes between Qatar and Saudi Arabia, the two neighbors have other clashes too. Some Wikileaks documents have revealed that the officials of these two countries have deep seated conflicts. Qatar, as a tiny country with a small population that was once regarded as the weakest link in the Persian Gulf Cooperation Council (PGCC), has now emerged as an actor and player in regional and global developments. Qatar owes all this maneuverability to the enormous revenues it has earned from the oil and gas fields it shares with Iran, who has problem tapping its share from the common fields. This role of Qatar is not all that acceptable to Saudi Arabia, which has always been the main pedestal of PGCC.

Besides, Iran and Saudi Arabia are not happy with the fast and unrelenting development of Iraq's oil industry, though for different reasons. Most major oilfields of Iraq are the ones that are on the border with Iran and naturally common to both countries, and much like Qatar, Iraq is taking advantage of the problems Iran has in developing its share of the fields. On the other hand, Iraq is trying to use the

Basra-Aqaba oil pipeline, the contract for the construction of which was signed recently, to transfer parts of its oil to the Red Sea. This is tantamount to intensifying competition with Saudi Arabia, the only oil producer of the Persian Gulf that could until now supply parts of its oil beyond the Strait of Hormuz and in the Red Sea.

The Saudis must recognize that although they could benefit in the short term from cooperating with the West in implementing oil sanctions against Iran by going along with the oil policies of the U.S. and distancing itself from the biggest regional power, is not in its interests either in the medium or long term.

Clearly, extra territorial powers will care about the security and interests of the region only up to the frontier of their own interests.

IAEE/Affiliate Master Calendar of Events

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

Date	Event, Event Title and Language	Location	Supporting Organization(s)	Contact
2014				
February 17-18	7th NAEE/IAEE International Conference *Energy Access and Sustainable Economic Development for Africa*	Abuja, Nigeria	NAEE	Adeola Adenikinju *adenikinjuadeola@gmail.com*
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*
October 28-31	14th IAEE European Conference *Sustainable Energy Policy Strategies For Europe*	Rome, Italy	AIEE	Andrea Bollino *bollino@unipg.it*
2015				
May 24-27	38th IAEE International Conference *Economic, Environmental, Technological and Security Challenges for Energy*	Antalya, Turkey	TRAEE/IAEE	Gurkan Kumbaroglu *gurkank@boun.edu.tr*
October 25-28	33rd USAEE/IAEE North American Conference *The New Energy Landscape – Balancing Natural Resources Amid Innovation and Environmental Regulation*	Pittsburgh, PA, USA	IAEE/USAEE	David Williams *usaee@usaee.org*
2016				
June 19-22	39th IAEE International Conference *Energy: Expectations and Uncertainty Challenges for Analysis, Decisions and Policy*	Bergen, Norway	NAEE	Olva Bergland *olvar.bergland@umb.no*

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AIEE

14th IAEE European Energy Conference

Sustainable Energy Policy and Strategies for Europe

Rome, 28-31 October, 2014

LUISS University

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will organize **in Rome the 14th IAEE European Energy Conference**
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Smart grids, smart meters, smart cities
Effects of unbundling in the gas sector
Promoting or imposing energy efficiency?
Non-conventional hydrocarbons in Europe
Virtual power plants
Sectorial approach to energy efficiency in industry
The challenge of energy for transportation
Bioenergy and agriculture
Nuclear energy: back to the future?
NIMBY for RES
Formation of prices in gas and electricity markets
North-South cooperation on renewable energy
Local activities and the Covenant of Mayors
Access to energy
CCS: opportunity in different countries
Climate policy and emission trading
Energy poverty in developed countries
Energy supply and security
Market instruments for energy efficiency
Reflections on energy price market
Sustainable communities and citizen-led activities
Sustainable development and economical growth
Technology development
The future energy demand
The perspective of LNG
Towards a low-carbon economy
Wind and solar energy

for detailed information regarding the abstract submission, conference programme, organization and student support, we invite you to visit the conference website:

www.iaee2014europe.it

REGISTRATION FEES

Participants	before July 15	after July 15
Speaker/Chair IAEE Member	€ 525	€ 575
Speaker/Chair Non-Member	€ 600	€ 650
IAEE Member	€ 690	€ 740
Non-Member	€ 790	€ 840
Student IAEE Member	€ 330	€ 380
Student Non-Member	€ 370	€ 420
Accompanying person	€ 330	€ 380

Abstract submission starts January 1st, 2014 - deadline: May 15, 2014

The concurrent sessions will be organized from accepted abstracts. Authors may be encouraged by the Programme Committee to organize specific sessions. Submitted abstracts should be of one or two pages in length, comprising (1) overview, (2) methods, (3) results and (4) conclusions.

We welcome you in Rome!

contact the Conference secretariat:

Tel: +39-06-3227367; +39-06-32652279; Fax: +39-06-3234921 - Email: assaiee@aiee.it; info@iaee2014europe.it

CONFERENCE VENUE

The **LUISS independent university** is placed in one of the city´s most beautiful areas close to Rome´s historic centre.
The conference rooms are modern and provided with all the technical devices.
The Venue's facilities include also a space for the Information and Registration Desk where the participants will have at their disposal throughout the conference computers with Internet access, free wireless connection and a catering area for the coffee breaks and lunches.

THE GALA DINNER

On **Wednesday, October 29, 2014** a gala dinner will be offered to the participants at the **Caffarelli Terrace**, a magnificent terrace with a view to the Piazza del Campidoglio designed by Michelangelo and with the equestrian statue of Marcus Aurelio in its center.

THE CONFERENCE DINNER

On **Thursday, October 30 2014** a conference dinner will be offered to the participants in the charming and elegant **Hall of Columns of the LUISS University.**

THE CONFERENCE PROGRAMME

Tuesday 28/10	
14.00 – 18.00	**Registration**
10.00 – 17.00	IAEE Council Meeting
14.00 – 17.00	IAEE European PhD - students Day
18.00	*Welcome Reception*
20.30 – 22.00	Students Happy Hour
20.30 – 22.00	IAEE Council Dinner

Wednesday 29/10	
08.00 – 18.00	**Registration**
08.00 – 09.00	Breakfast Meetings
09.30 – 10.30	**Opening Plenary Session**
10.30 – 11.00	*Coffee Break*
11.00 – 12.30	**Dual Plenary Sessions**
12.30 – 14.00	*Lunch*
14.00 – 15.30	Concurrent Sessions (8 meeting rooms)
15.30 – 16.00	*Coffee Break*
16.00 – 17.30	Concurrent Sessions
19.00 – 22.30	***Gala Dinner***

Thursday30/10	
08.00 – 18.00	**Registration**
08.00 – 09.00	Breakfast Meetings
09.00 – 10.30	**Dual Plenary Sessions**
10.30 – 11.00	*Coffee Break*
11.00 – 12.30	Concurrent Sessions
12.30 – 14.00	*Lunch*
14.00 – 15.30	**Dual Plenary Sessions**
15.30 – 16.00	*Coffee Break*
16.00 – 17.30	Concurrent Sessions
20.00 – 22.30	***Conference Dinner***

Friday 31/10	
08.00 – 09.00	Breakfast Meetings
09.00 – 10.30	Concurrent Sessions
10.30 – 11.00	*Coffee Break*
11.00 – 12.30	Concurrent Sessions
12.30 – 13.30	**Closing Session**

STUDENTS

students are especially encouraged to partecipate and may attend the conference at the reduced student registration rate.
In addition students may submit a paper for consideration in the *IAEE Best Paper award Competition* (cash prises plus waiver of conference registration fee). Students are also welcome to partecipate in the *Student Poster Session.*

(visit: http://www.iaee2014europe.it/pages/student_events.html; http://www.iaee2014europe.it/pages/student_awards.html)

REGISTRATION AND HOTEL ACCOMMODATION INFORMATION - Ageements were made for special rates/night (from 80 to 150 Euro) in various hotels, close to the conference venue.
Early bird registrations are highly recommended

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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.

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

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- -

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1/14Forum

Building Sustainable First Nation Communities: Alternative Energy Systems in Ontario's Northern Remote Communities

By Philip R. Walsh and Jason Wu*

Introduction

Ontario has 127 First Nation communities and the largest number of First Nation people in Canada according to the 2006 census. For 29 of these communities located in northern Ontario (See Figure 1) the only way to access them on a year-round basis is to do so by air (versus winter road access). Of these communities, 25 rely on diesel fuel for electricity generation. Typical energy and infrastructure costs in these remote communities are very high compared to those in the grid-connected communities in Southern Ontario for a number of reasons. These include higher transport costs for fuel and equipment, a smaller and more dispersed population, higher operating and maintenance costs, specialized infrastructure required for use in cold climates, and the greater need for space heating. Among the 25 communities, 9 function as Independent Power Authority (IPAs) responsible for their own power generation with support from the Canadian government for purchasing diesel fuel and ensuring that it is delivered to these northern communities via the winter road system. The remaining 16 communities are serviced by Hydro One Remotes Communities Inc., a subsidiary of the Ontario provincially-owned electricity transmission utility.

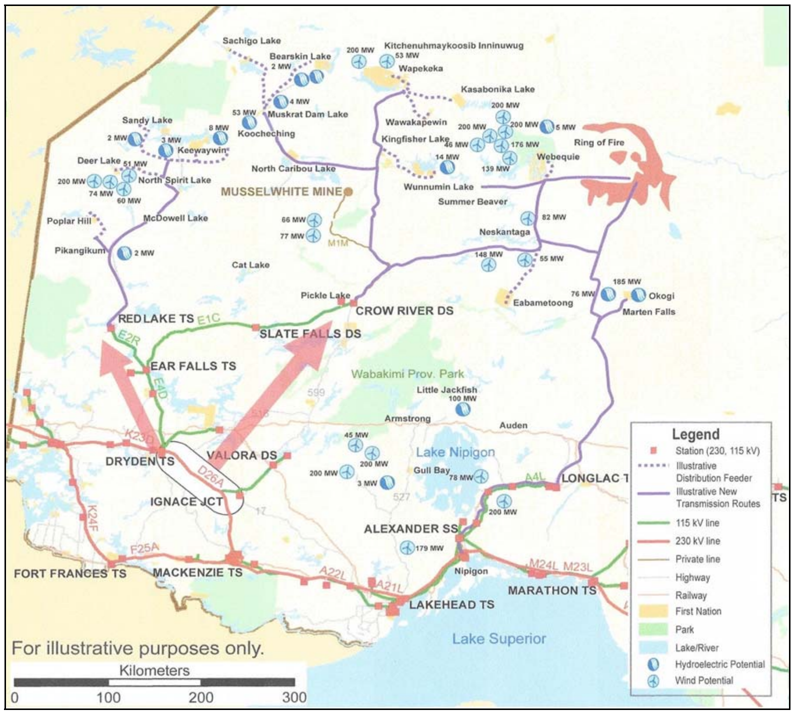

Figure 1: Remote Communities of Northern Ontario with Proposed Transmission Connections

Over the last decade, these communities have experienced shorter winter road seasons and weaker ice conditions that have limited the amount of diesel fuel that can be trucked and subjecting these communities to the risk of insufficient supply unless supplied by air. This latter supply method is extremely costly. Table 1 highlights the size of certain remote communities, their diesel consumption, electricity output and associated greenhouse gas emissions.

These conditions have also led to increased potential for environmental damage resulting from tanker spills and breaking through the ice roads. Within these communities, large tank farms are used to store the diesel fuel and the electricity generation stations are connected via a distribution system. Again, this distribution format creates environmental risks associated with spills, with the Federal government responsible for remediation.

Demand Side Management in Remote Communities

Studies have shown that the principle demand for electricity in Canada's remote communities (aside from the aggregate of residential homes) comes from the operation of: 1) health centres; 2) schools; 3) gymnasiums; 4) cultural centres; 5) wharfs; 6) band offices; and 7) water treatment plants. Within these structures the highest energy usage is associated with baseboard heaters, hot water heaters, HVAC systems, and flood lights. For a typical household in a remote community, the single greatest use for electricity is space heating, accounting for approximately 49% of total electricity consumption, followed by appliances and lighting (27%), domestic water heating (21%), and cooking (3%).

Energy Efficiency Solutions

The most effective means to reducing electricity demand and the need for diesel fuel supply to remote communities is the implementation of energy conserva-

* Philip Walsh and Jason Wu are with the Center for Urban Energy, Ryerson University. Philip Walsh can be reached at prwalsh@ryerson.ca

	Population	Diesel Consumption (L/year)	Electricity Output (GWh/yr)	Transport fuel Consumption (L) Road	Air	35% Road & 65% Air	Emissions from electricity Gen CO_2e (tonnes)	Emissions from delivery trips-CO_2e (tonnes) Road	Air	34% Road & 65% Air
Eabametoong	1,140	1,730,000	6.17	13,589	871,765	571,403	4980	38	5656	3690
Kee-Way-Win	320	660,000	2.36	5,184	332,581	217,992	1910	15	2158	1408
Muskrat Dam L.	255	390,000	1.38	3,063	196,525	128,813	1110	9	1275	832
Neskantaga F.N.	265	530,000	1.9	4,163	267,072	175,054	1530	12	1733	1130
North Spirit Lake	255	490,000	1.74	3,849	246,916	161,843	1410	11	1602	1045
Peawanuck	139	340,000	1.23	2,671	171,329	112,299	990	8	1112	725
Pikangikum	2,443	3,710,000	13.22	29,142	1,869,507	1,225,379	10660	82	12129	7913
Wawakapewin	47	60,000	0.22	471	30,235	19,817	180	1	196	128
Weenusk	225	340,000	1.22	2,671	171,329	112,299	980	8	1112	725
Wunnumin	490	590,000	2.09	4,635	297,307	194,872	1690	13	1929	1258
Total	5,579	8,840,000	31.53	69,439	4,454,566	2,919,772	25,440	195	28901	18854

Source: Arriaga, M. et al. 2012. (Transport fuel consumption and emissions are calculated with values from Hydro One 2012a)

Table 1: Remote Community Energy Consumption

tion and energy efficiency measures. As the cost of electricity generation in these communities is very high relative to urbanized areas in Southern Ontario, the most basic of upgrades to household appliances can create substantial saving over time. Possible energy efficiency options include, but are not limited to: 1) lighting; 2) hot water tank insulation; 3) low flow showerheads; 4) occupancy sensors; 5)building weather-stripping; and 6) equipment timing.

Supply Side Management in Remote Communities

With the concerns raised regarding the practicality of continuing to supply remote communities with diesel for power generation, renewable energy technology options can be considered as a means of meeting their existing and future electricity demand.

Wind Turbines

Wind power is a candidate for an alternative energy system in remote communities in Northern Ontario. Table 2 highlights the costs and benefits associated with remote wind turbine costs. By its very nature, wind turbines are usually site-specific applications and current technologies exist to meet smaller-scale demand scenarios as those presented by these remote communities. However, one of the greatest disadvantages of wind power is the intermittent pattern of its electricity generation. Due to the temporal and spatial variations of wind penetration, the electricity generated by wind turbines often exhibits nonlinear and unbalanced loads and can lead to a number of power quality issues including harmonics, voltage and frequency fluctuations.

Yet, wind turbines may be combined with existing diesel generators in remote communities and the electricity from the wind turbines can be used to offset some, if not all, of the diesel generation when the wind is blowing, while the diesel generators or energy storage systems (batteries) can come online during other periods or for peak power demand.

Low temperature and icing conditions in remote areas present additional challenges for wind turbines but lessons from previous projects in the Yukon, Canada and several European countries including Finland, Norway, and Sweden suggest that properly designed wind turbines can function as expected in harsh sub-Arctic environments.

Capital cost	• $2,100 to $2,500 /kW installed
Electricity generating cost	• 6-9 ¢/kWh
Benefits	• Decent lifespan (~25 years) • Minimal environmental impact
Difficulties	• Access to capital • Efficiency determined by wind condition • Intermittent power generation

Table 2: Wind Turbine Costs and Benefits

Solar Photovoltaic/passive Solar

For remote communities, the size and modularity of photovoltaic (PV) panels can provide an advantage for energy supply in terms of system packaging and installation. Individual homes or larger power plants can be fitted with solar PV to supplement or offset their own electricity demand. In recent years the cost of solar PV technology has dropped significantly and it can be expected that solar PV power generation will become more economically viable in the near future as the associated costs continue to decrease. A summary of costs and benefits associated with solar PV is shown in Table 3. Previous applications of PV in sub-Arctic conditions in northern Canada have demonstrated the durability and reliability of this technology in extreme climate.

In addition, passive solar energy can also be used directly for water and space heating purposes and can produce significant amounts of heat for buildings, especially when the technology can be incorporated into building construction through, for example, solar exposure maximization in new building design or the retrofitting of passive solar in exterior fascia of existing buildings.

Capital cost	•$9,000 to $10,000 per kW installation capacity
Electricity cost	• 65-80 ¢ per kWh
Benefits	• Long lifespan (30+ years) • Low O&M cost • Good reliability
Difficulties	• Expensive upfront investment • Relatively low capacity factor • High electricity price

Table 3: PV Solar-electric Costs and Benefits

Small-scale Hydroelectricity

For remote communities in northern Ontario another renewable energy source is hydroelectric. With well-established technology and relatively easy operation and maintenance requirements, run-of-river system design can eliminate the need for a dam on the main river by diverting a portion of the river's main stream toward water turbines and therefore minimizing the impact on the surrounding environment as compared to traditional large-scale hydro projects. The costs for new installations can vary significantly depending on location and size (See Table 4) but these systems do benefit from a typically high capacity factor that provides for greater power density and generation efficiency. Run-of-river hydroelectric when compared to other renewable energy technologies is impacted less by fluctuations of energy source and with generally gradual changes in water levels combined with predictable seasonal variations these systems require less power storage capacity and backup systems.

Capital cost	• $1,750 to $10,000 per kW installation capacity • Estimated project costs - $250,000 for a 500 kW project - $15,000,000 for a 6 MW project
Electricity cost	• ~ 5-20 ¢ per kWh
Benefits	• Long year lifespan (30-50+ years) • High capacity factors (70-80%) • Stabilizes long-term electricity costs • On-grid application can offer competitive rates and reduce the need for subsidies
Difficulties	• Environmental impacts • Long construction period • Long payback time

Table 4: Run-of-river Hydro-electric Costs and Benefits

Recent Developments in Integrating Remote Communities into System Supply

In 2012, the Ontario Power Authority (OPA) proposed a plan whereby power transmission facilities would be constructed beyond the City of Dryden to connect remote communities in northern Ontario. Basing their plan on forecasts that the cost of supplying electricity through the supply of diesel fuel would increase by 500 percent over the next 40 years from $CDN 68 million in 2012 to $CDN 350 million in 2053, a projected investment of $900 million to $1 billion from parties that would benefit from the transmission project would result in a payback period 20 to 25 years. According to the OPA, this project would avoid up to $600 million of diesel costs in total.

Conclusions

Despite the recent study supporting the construction of electricity transmission connections into those areas of northern Ontario to service remote communities, the alternative of displacing diesel fuel power generation with renewable energy technologies remains a viable solution. Combining demand-side management solutions with these supply-side management strategies would offer remote communities the opportunity to undertake community-based energy system design that will lead to more efficient use of energy while reducing the environmental impact and risks associated with their current power generation methods.

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2014 4th IAEE Asian Conference

Beijing, China
19-21 September,2014

Energy Economics: New Challenges & Solutions

HOSTS

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First Announcement and Call for Papers

The 4th IAEE Asian Conference

Beijing China, September 19-21, 2014

Energy Economics: New Challenges & Solutions

We are pleased to announce that the 4th IAEE Asian Conference will be held in Beijing, China on September 19-21, 2014. We welcome you to Beijing, the capital of the People's Republic of China, with a rich history and modern cultural developments. There are two categories of concurrent sessions: 1. academic-type energy economics research, and 2. practical case studies on current energy-related issues from government agencies or industries. Experts who are interested in organizing special tracks are encouraged to propose their topics and possible speakers.

TOPICS (including but not limited)

- Energy outlook
- Energy security
- Energy transportation and pipelines
- Regulation and deregulation
- Electricity prices and uncertainties
- Energy policy
- Non-carbon energy technologies
- Prospects for nuclear power
- Geopolitics of energy
- Smart grid and power industry deregulation
- Climate Policy and Emission Trading Scheme
- Effective CO_2 removal
- Energy efficiency
- Energy Investment
- Oil & Gas reserves and production
- Prospects for shale gas development

SUBMISSION OF ABSTRACTS

Abstracts in PDF format, maximum 2 pages in length, covering Overview, Methods, Expected results and References should be submitted via conference website **iaeeasia.csp.escience.cn**.

VENUE

The conference will be held at the new auditorium of Chinese Academy of Sciences and the International Conference Center (GICC) of China University of Geosciences.

KEY DATES

Tracks proposal deadline: March 1, 2014
Abstracts submission deadline: April 1, 2014

CONTACT

Prof.Ying FAN（IaeeAsia2014@casipm.ac.cn)
Prof. Haizhong AN （IaeeAsia2014@cugb.edu.cn）

Sincerely we welcome you to the 4th IAEE Asian Conference in Beijing, China.

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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.

Following the editor's introductory and overview chapter, the volume includes 12 technical papers by participants in the EMF study. Seven chapters provide unique perspectives on the regional price, volumes and trade estimates from individual modeling frameworks. These systems include competitive models of world natural gas markets as well as strategic models of European markets with market power. The remaining five chapters cover important topics discussed by the working group during the study.

The range of issues is comprehensive and intriguing: trans-Atlantic price convergence, the linking of oil and gas prices through future gas-to-liquid (GTL) capacity additions, the critical role of Middle Eastern natural gas supplies, the extraordinary potential for Russia supplies if key constraints can be overcome, potential collusive behavior by Russian and Middle East exporters, the dynamics of transportation and storage capacity adjustments in response to market power opportunities, European markets reliance upon Russian natural gas exports, the interrelationship between resource constraints and market power, reserve appreciation in known North American fields, and improving insights and decisions through use of quantitative models.

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CONTENTS

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Tracking the Energy Poor – Empirical Insights on Energy Poverty Measurement Approaches

By Gunther Bensch*

Energy Poverty Metrics as Part of a Modern Energy Access Framework

The Sustainable Energy for All (SE4All) initiative is currently set up to channel activities for achieving universal access to modern energy by 2030. The initiative is the first to be jointly chaired by the UN Secretary-General and the president of the World Bank Group, underscoring the emphasis placed on energy access. The current challenge for the scientific community is to support operationalizing this universal access goal. A milestone in this endeavour is the multi-tier framework promoted in the recently published Global Tracking Framework (World Bank, ESMAP and IEA 2013).

This multi-tier framework is intended to go beyond binary measures of energy access to capture aspects like the quantity and quality of electricity supplied, the efficiency, safety and convenience of household cookstoves and access to energy services in local enterprises and social infrastructure. This framework is the fruit of lively debates that helped to deepen understanding of energy access as a complex multidimensional construct. It is widely recognized that energy access is a process that undergoes different phases and levels, conceptually organized into various 'tiers' of access to and use of electricity and modern cooking.

Hence, much effort has been put into capturing the intricacies and complexities of the path that stretches from people's deprivation of their basic energy needs to a state of "vibrant and sustainable social and economic growth" (Bazilian and Pielke 2013) empowered by modern energy access. Without trying to thwart the ambition of globally achieving a truly modern access to energy for everyone, it is debatable whether we do not also need a single, easy-to-understand index of energy poverty. Similar to the international poverty line of USD 1.25, which condenses the challenges behind individual economic development, it seems reasonable to also establish a critical threshold for energy poverty. To date, though, there is no clear consensus about the key characteristics of such a metric of energy poverty, which is crucial in effectively identifying the energy-deprived population as well as measures to overcome their deprivation.

An Empirical Analysis of Existing Energy Poverty Metrics

The literature proposes a range of candidates. Eight types of metrics can be distinguished that are typically discussed in the context of energy poverty measurement (see, for example Pachauri 2011 and Khandker, Barnes and Samad 2012). Four of them actually reflect an (absolute) energy poverty concept that – as desired in this context – seeks to identify the people not able to fulfil their basic energy needs: first, a minimum energy consumption threshold approach proposed by Modi et al. (2005) and the UN Secretary-General Advisory Group on Energy and Climate Change (UN-AGECC 2010), second, an income-invariant energy demand approach introduced in Barnes, Khandker & Samad (2011), third the Multidimensional Energy Poverty Index (MEPI) by Nussbaumer, Bazilian & Modi (2012) and fourth the Total Energy Access (TEA) standard presented in Practical Action (2012).[1]

Apart from the MEPI, to date however none of them has ever been applied to real-world data with the aim of determining energy poverty levels. Therefore, I recently analysed all four indices empirically using a rich unique household dataset that accommodates the data requirements imposed by all metrics (Bensch 2013). The data comes from 13 different surveys conducted in both rural and peri-urban areas of five countries in Western and Eastern sub-Saharan Africa: Benin, Burkina Faso, Senegal, Mozambique and Rwanda. The focus on sub-Saharan Africa reflects the energy access situation in the region, which can be considered as particularly demanding. The focus on sub-Saharan Africa furthermore implies a high homogeneity among the analysed countries. While certain energy services, such as space heating, are basically not demanded, the remaining services are indispensable for all households. As a consequence, low consumption levels in these energy services are likely to reflect suppressed demand and, hence, to represent symptoms of energy poverty. Therefore, the used data set allows identifying and expanding the most promising avenues for effective energy poverty measurement data based on a systematic analysis of the same type of empirical data.

In the course of the analysis, the income-invariant energy demand approach has shown a couple of drawbacks which put into question the suitability of the approach. Not least, the reality in the field suggests that – counter to the assump-

* Gunther Bensch is with the Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Essen, Germany. He may be reached at gunther.bensch@rwi-essen.de
See footnote at end of text.

tions inherent in this approach – energy consumption is elastic even among the poorest of the poor. In the following, I will, therefore, discuss main issues that came up in the course of the analysis of the remaining three indices.

Degree of Energy Poverty Differs Widely Across Metrics

While all metrics generally identify a high share of the population as energy poor in the assessed sub-Saharan countries, the index values of the analysed metrics differ up to a range from 0.35 to 0.98 for individual surveys. It is worth noting that the surveys were either baseline surveys for upcoming projects or part of evaluation studies on energy access interventions ranging from improved cookstoves to central grid extension. They do not claim to be in any way representative on a national level. Instead, it seems plausible that the assessed households are slightly better-off in terms of energy poverty than the national (rural or otherwise urban) average. First, for being eligible for energy and particularly electrification interventions, rural communities typically need to have a reasonable level of purchasing power such that households are more likely to afford electricity payments. Second, part of the surveyed households have previously undergone interventions such that their energy situation has already been improved. A comparison with Demographic and Health Survey (DHS) data from the various countries supports this interpretation.

The Minimum Energy Consumption Threshold Approach and the Relevance of Improved Cookstoves

Rates of electrification and household use of non-solid (i.e., liquid or gaseous) cooking fuels are typically relied upon to give a snapshot of energy access in developing countries. There are, however, some handicaps to these two indicators, most notably that connection to the grid can be intermittent and, hence, unserviceable and a range of improved appliances exist to use solid fuels in a healthier and more sustainable way even in the absence of modern non-solid cooking fuels.

The minimum energy consumption threshold approach (also called 'UN-AGECC metric' in the following) can be seen as an extension of these two indicators. Here, two energy poverty thresholds are normatively determined as the sets of energy needs that are deemed indispensable: First, a minimum amount of final energy used in the form of modern fuels and technologies (including improved biomass cookstoves) for cooking and, second, a minimum amount of electricity for all other services, excluding heating and mobility. Concretely, cut-offs are proposed in terms of consumption per year and capita: 40 kilogrammes of oil equivalent (kgoe) for cooking, which is equivalent to 37 litres of liquefied petroleum gas (LPG) or 105 kg of firewood, as well as 50 kilowatt hours (kWh, equivalent to 4 kgoe) for rural households and 100 kWh for urban households.

According to this double threshold metric, energy poverty is virtually universal among the surveyed households. As many as 97 percent turn out to be energy poor, among which around 86 pecent do not consume the amount of modern cooking fuels deemed as sufficient. The cooking component, hence, seems particularly binding, which also becomes clear when taking the example of the subsample from urban Senegal with its high rates of LPG usage (see Schlag and Zuzarte 2008). Here, two thirds of households using exclusively the clean cooking fuel Liquefied Petroleum Gas (LPG) are still considered as deprived in cooking energy, since the threshold is set higher than their per capita consumption levels. At the same time, a large share of those other 14 percent that are not considered as deprived use firewood or charcoal with improved cookstoves. This finding underpins the importance of improved cookstoves (ICS). First, due to the generally overwhelming percentage of the poor who still rely on traditional biomass energy and, second, since the energy poverty metrics legitimately depend crucially on the concept of clean versus traditional cookstoves. The stoves considered as improved in the context of this study have mainly been simple low-cost biomass stoves that are adapted to the needs and habits of the population and locally produced based on metal and/or clay. While they definitely have an effect on woodfuel demand and may in certain circumstances have sizable impacts on human development (Bensch and Peters 2012, 2013), it is still unclear whether they will be universally accepted as ICS by main actors in the field like the 'Global Alliance for Clean Cookstoves' and, hence, which role they are attributed to in alleviating energy poverty. In this regard, a clear and universal catalogue of which types of stoves can be considered as improved is of high relevance.

Figure 1 depicts the energy poverty rates when changing the minimum energy consumption threshold by 25, 50, 75 or even 100 percent. This graph now allows comparing the energy poverty cut-offs imposed by the UN-AGECC metric (values on the right side of the figure) to the electrification and clean cooking access rates, which correspond to the 100 percent reduction in the threshold level. It becomes clear that for electricity, there are larger differences between the pure access-based indicator and the proposed energy poverty index that also accounts for usage intensities, e.g., in urban areas the difference is 26 percent compared to 53 percent, respectively.

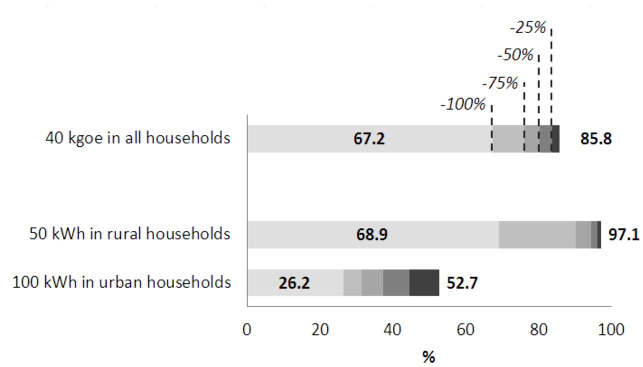

Figure 1: Proportion of Energy Poor According to the Components of the Minimum Energy Consumption Threshold Approach, by Different Threshold Levels.

Composite Indices as an Alternative

The UN-AGECC metric is basically a unidimensional metric, as it aggregates the different energy services to a single, physical unit (the kilogrammes of oil equivalent). As highlighted more recently in the energy policy literature, there are good conceptual reasons to also consider energy poverty as multidimensional. Dimensions that have been attributed to energy include energy for lighting, cooking, heating, cooling, information, communication, productive purposes, mobility and in social infrastructure institutions. Some of these dimensions can only be expressed in terms of ordinal sub-indicators (e.g., usage of improved cooking stoves (cooking), ownership of a fridge (cooling) and, therefore, not aggregated to a single unit. Composite indices are constructed instead that apply cut-offs and weights for each of the individual dimensions and furthermore have a poverty cut-off that determines in how many of these weighted dimensions an individual has to be deprived in order to be classified as poor.

The MEPI and TEA are two such composite indices, which deliver quite distinct results mainly depending on the normative judgments inherent in the two indices. While the MEPI allows for a certain degree of deprivation (e.g., a household may be considered energy non-poor even though it has neither a fridge nor a radio or a television set), the TEA is far more restrictive in that everybody is considered energy poor who is deprived in any of the six sub-dimensions. With only slight adaptation of the originally proposed sub-indicators, one may come up with a common multidimensional indicator set. In doing so the two metrics can be considered as one metric with the option of context-specifically adapting poverty cut-offs and dimensional weights as illustrated in Figure 2.

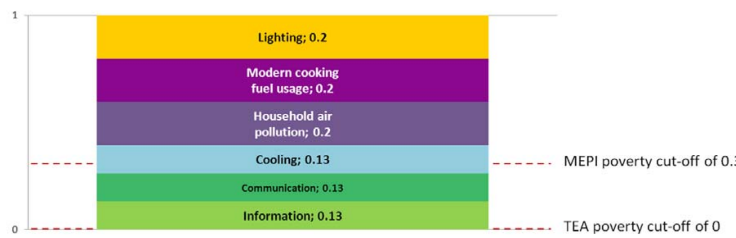

Figure 2: Dimensions, Dimensional Weights and Poverty Cut-offs According to the MEPI and TEA

Note: The dimensional weights refer to those proposed by Nussbaumer, Bazilian & Modi (2012).

The Choice of Metrics and Sub-indicators

In terms of index construction the UN-AGECC metric and the MEPI/ TEA performed well in the given setting, not least owing to the additional information provided through their subcomponents along which all can be decomposed. Deciding on the poverty cut-offs (and dimensional weights, if necessary) is ultimately a process that needs further discussion backed by empirical data, which is supposed to reveal the actual implications of these decisions. The same seems to hold for a definite decision on one of the metrics. If the necessary data are available, it seems recommendable for the time being to continue testing and applying both of them.

The concrete application of the poverty metrics to real-world data revealed that data requirements, however, are high for all metrics. Even having this tailored household energy dataset available, the analysis still had to rely on certain assumptions and conventions, such as energy efficiency factors and improved cooking stove definitions. In addition, even carefully collected data is not immune to measurement error, which can be expected to be particularly pronounced for the consumption of non-market goods as it is the case for collected firewood. The recommendation emanating from this analysis is to restrict a basic energy threshold level to a basket of energy services that can easily and reliably be identified as is basically the case with MEPI/ TEA and to a lesser extent for the UN-AGECC metric.

In order not to miss relevant new developments, it is further recommended to closely follow the technological transformations and coping strategies that come up in energy poor regions of developing countries. The upcoming low-cost lighting devices mentioned in this paper are only one example among many in the dynamic field of energy provision. With this data at hand, it could better be decided on the level of ambition; for example, it seems debatable to reach universal ownership of fridges in the near term, whereas modern cooking can be considered as unanimously indispensable.

Finally, all decisions on sub-indicator choice and modifications need to be harmonized with the multi-tier framework of the Global Tracking Framework. The goal here is to make the energy poverty metrics an integral part of this indispensable instrument for guiding investment flows in the energy sector to where they are needed and to where they can actually make a difference.

Footnote

[1] The arguably most popular metric, the Energy Development Index (EDI) from the International Energy Agency (IEA), is also among the other four metrics. By looking at per-capita commercial energy consumption, the share of the commercial sector in total final energy use, and the share of population with access to electricity, the EDI rather measures a country's degree of transition towards a modern energy infrastructure.

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De-central Energy Access Through Cross-sector Partnerships

By Philipp Gaggl, Gus Schellekens and Paolo Gentili*

The Business Case for Energy Access

Today the world faces manifold and increasing challenges in the economic, social and environmental context. One persisting challenge is the one of reliable, affordable and sustainable access to energy. Some 1.3 billion people or one fifth of the world's population[1] currently do not have access to modern energy facilities such as electricity and lighting. With 588 million people in Sub-Saharan Africa and 623 million people in India and developing Asia without access to electricity, the world`s developing and fast growing regions are in focus. Access to affordable modern forms of energy is not only a prerequisite for economic prosperity, but also needed for social and environmental development and wellbeing. Approximately 470 TWh[2] of energy will have to be provided through off-grid and mini-grid solutions alone to address this challenge.

According to the International Energy Agency investment totalling US$ 48 billion per year will be required by 2030 in order to ensure universal energy access. Considering current yearly investment amounts of US$ 14 billion, there is still a significant gap of US$ 34 billion. This represents a huge investment opportunity for the private sector, which is still struggling to create a business case to invest in this area today. Ironically, the market opportunity for business in enabling energy access is substantial. Large populations lack access to modern energy services worldwide and yet, despite low incomes, still spend US$ 37 billion[3] per year to meet their basic energy needs for cooking, lighting and productive activities. A yet largely untapped opportunity exists when it comes to enabling energy access through de-central electricity or mini-grids, where over 500 million people have the potential to be reached, with directly addressable spending of US$ 4 billion. Today's market for electricity and lighting solutions for these populations represents 274 million households in total.

Innovative solutions and services, as well as substantial investments are needed to unlock this market at the bottom of the pyramid. A key issue to address is the development of market-based, financially viable and long-term sustainable business models. Isolated Corporate Social Responsibility (CSR) or well-intended but unsustainable development projects and aid alone will not provide the much needed transition to enable the access to energy challenge to be addressed at scale.

Cross-sector Partnerships - A New Way of Unlocking the Potential of De-central Electricity

When looking at successful projects and initiatives aiming to provide sustainable access to electricity in rural areas throughout the world, the value of partnerships becomes apparent. For example partnerships can be seen between providers of off-grid, renewable electricity and telecom operators, thus replacing dependency on diesel power and at the same time providing excess energy to nearby households. Other examples show the collaboration between energy providers and local entrepreneurs or NGOs in rural mini-grids, or leveraging the competency of ICT companies for mobile payments of electricity bills. It is clear that partnerships and cross-sector collaboration between business and civil or public sector players already play an important role in delivering off-grid solutions.

Examining this more closely, the specific value of cross-sector partnerships can be seen to:

- Bring together private sector companies (with operations of significant size, and multi-country presence) with local partners to ensure investment power is combined with local market knowledge and Bottom of the Pyramid (BoP)-ready solutions.
- Reduce transaction costs and capital expenses by leveraging core competencies and experience of each partner.
- Build on anchor load demand as a primary market for energy and securing energy beneficiary co-investment in the business model.
- Focus on decentralized, renewable or hybrid solutions which provide levels of energy for productive energy use.
- Provide a scalable and replicable base for business models to have impact at country-wide and global levels.

Partnerships thus hold the promise to overcome existing barriers that currently only favour silo focussed private sector investment. In many cases, they are better suited to do so than single player and single sector approaches.

* Philipp Gaggl is Manager, Sustainability & Climate Change, PwC Austria. Gus Schellekens is Director, Sustainabiity and Climate Change, PwC London and Paolo Gentili is Senior Manager, Energy, PwC Italy. Philipp Gaggl may be reached at philipp.gaggl@at.pwc.com
See footnotes at end of text.

Working with the World Economic Forum during the course of 2012 and 2013, PwC proposed a framework to support new thinking on the use of cross-sector partnerships to unlock the potential of decentralised energy access.[4] The framework, which was developed with more than 40 experts from various sectors including energy, telecoms, consumer goods, nongovernmental organizations, social entrepreneurs, impact investors and others, addresses the interests of all the private, civil and public sector stakeholders involved and looks to catalyse the creation of innovative business models.

The following sectors are exemplary partners that can benefit directly from this type of collaboration:

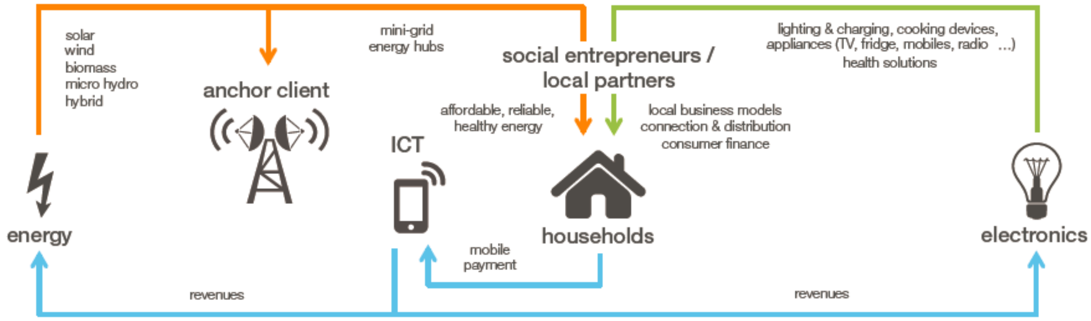
- Energy sector: The core business for energy technology manufacturers and utilities is the sale of energy products and solutions. Value is provided by a reliable anchor client, representing a large initial market. Further value is then expected by extending the service offering to households, enterprises, infrastructure and other energy clients through a mini-grid. Energy demand is expected to rise over time once basic needs have been fulfilled.
- Telecom sector: The core business for telecom providers is the sale of airtime. Stable energy is needed to keep tower operations going. Value is added by receiving energy services from an external energy provider, thus securing energy supply and freeing tied-up capital for core business. Additional value is added by reducing the carbon footprint if renewables are used as the source of electricity. Further synergies in business are attained by offering billing, payment and banking services.
- Other anchor demand: Agriculture, fast-moving consumer goods and mining need energy for their core business activities. Value is added by providing reliable and high levels of electricity throughout the business day.
- Electronics sector: The core business is the sale of devices and appliances. Value is added by stimulating demand through electrification for lighting appliances, electronic devices or healthcare solutions. Further value may be provided by using distribution channels to sell further products such as cooking stoves.
- Local enterprises and social entrepreneurs: The core business looks to provide products fulfilling local energy needs and creating a wider economic, social and environmental impact. Value is added by enabling productive activities through electrification and demand for market and consumer insights. Further value is developed by creating demand for metering, payment, maintenance or construction services.
- Other potential beneficiaries of collaborating on energy access projects would be local financiers and banks, multilateral organizations and other nongovernmental organisations.

The framework and respective cross-sector partners that could be involved in unlocking the partnership potential described above would look to do so through the following steps:

- Look to build on anchor demand that is present, this being a large part of the initial market (e.g., telecom towers, agriculture, SMEs, food processing, infrastructure, etc.). The energy sector electrifies the anchor clients through an off-take agreement.
- Then, the energy company connects households directly through a mini-grid or collaborates with local partners (e.g., energy service companies) and social entrepreneurs to provide access to energy services.
- The electronics sector provides energy dependent devices or appliances directly through local partners or social entrepreneurs; household energy demand is expected to increase over time with the use of products.
- The telecom sector can be an anchor client and also provides mobile payment, billing and banking solutions to the rural population; mobile airtime is expected to increase through cheaper and more frequent charging of mobile devices.
- Over time, energy services are expanded by the mini-grid to other clients (e.g., local companies, infrastructure, more remote clients, etc.).
- Scale is supported through the replicability of the model and the initial anchor client which partners on a large scale, the growing electrification of secondary customers, such as households and their growing energy demand.

The envisioned outcome is that projects create a sustainable impact through collaboration of cross-sector partners (energy, telecom, mining, agriculture, public infrastructure, electronics, etc.) with local partners (social entrepreneurs, small businesses, etc.), supported by local enablers (NGOs, multilateral organizations, banks, financiers, academia, etc.). This supports a business driven approach towards delivering access to energy to rural households and businesses.

Measuring the Impact of Energy Access - Total Impact Measurement and Management (TIMM)



Source: World Economic Forum and PwC 2013

Figure 1: Cross-sector Framework for Energy Access

Bringing cross-sector partnerships and mini-grid business models to scale and facilitating the replication of successful models will both be a viable business case for the energy, telecom and electronics sector to co-invest, and also create an economic, social and environmental impact in that location. A better understanding of the latter may also help overcome some of the challenges typically faced in developing the business case. Having studied numerous examples of decentralised energy access projects and respective partnership based business models, some of the following impacts can be seen to result:

Economic Impacts

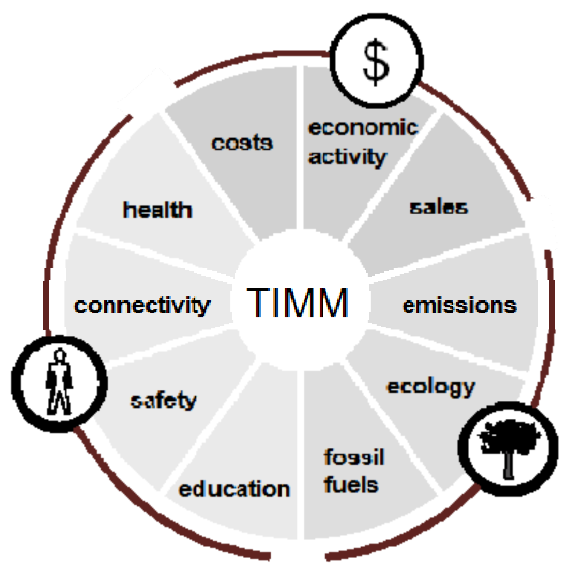
- Costs: Reduction of costs for energy and lighting at the household level as a result of replacing expensive kerosene lighting; reduced operating costs for telecom towers versus conventional sources of energy supply.
- Economic activity: Improved business development and productive activities, through availability of high levels of electricity, e.g., running machinery and devices; jobs created through freed up time for productive activity.
- Sales: Increased sales of energy-dependent devices such as TVs, fridges, radios, blenders, water pumps, fans, irons, mobile phones, healthcare devices, sanitation devices and communication devices.

Social Impacts

- Health: Improved health through replacement of kerosene lighting and better quality of light, powering medical devices, cooling of vaccines, provision of clean water, improved sanitation.
- Safety: Improved sense of safety due to better home and street lighting; increased social cohesion through community lighting.
- Connectivity: Improved access to information, communication and entertainment services, through powering mobile phones, internet services, radio or TV.
- Education: Ability to pursue education and improved quality school work, by making lighting available in the evenings and at night; ability to access information for education purposes, through increased network and IT connectivity.

Environmental Impacts

- Emissions: Reduction in use of fossil fuels and respective GHG emissions, due to replacement with renewable, clean and healthy energy sources (e.g., solar, wind, hydro); reduction of transport emissions (diesel supply).
- Ecology: Reduced deforestation due to lower demand for wood collection; reduction of environmental pollution (e.g., diesel leakages, spills).
- Fossil fuels: Reduced dependency on fossil fuels, increasing energy resilience due to replacement with renewable energy.



Source: World Economic Forum and PwC 2013

Figure 2: Impact Areas of De-central Energy Access

In order to understand the non-financial and the monetary value of these positive economic, social, fiscal and environmental impacts, it is necessary to measure all of these in detail. More informed business decisions can then be taken on the basis of a holistic profit and loss for any energy access projects and support a better understanding of the wider benefits to all affected stakeholders. This then also provides further incentives and arguments for project partners interested in creating a measurable impact.

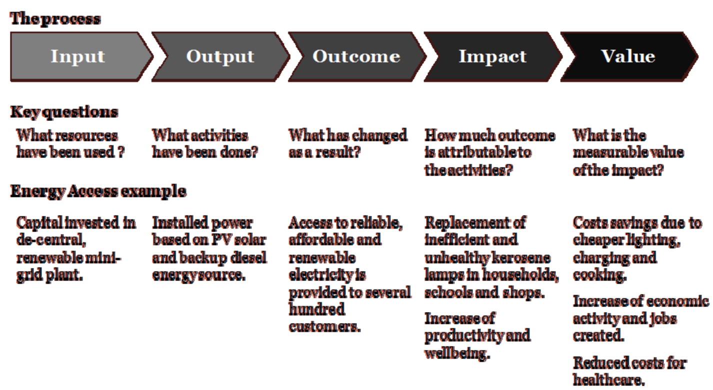
PwC has independently developed a new methodology called Total Impact Measurement and Management (TIMM)[5]. It can be adopted and applied to support a better understanding of the holistic business case for energy access. The key elements of the TIMM approach are:

- Total: A holistic view of social, environmental, fiscal and economic dimensions – the big picture.
- Impact: Look beyond inputs and outputs to outcomes and impacts – understand your footprint.
- Measurement: Quantify and monetise the impacts – value in a language business understands.
- Management: Evaluate options and optimize trade-offs – make better decisions.

TIMM enables management to develop a detailed financial understanding of the social, fiscal, environmental and economic impacts of their activities, while still, of course, making a profit. The real benefit to business of including such analysis is in decision making. With hard data, management has the ability to compare any number of different strategies, make business decisions such as investment choices with confidence as well as being able to evaluate the total impact of each decision and choice they make. There is then also a better understanding of which stakeholders will be affected by which decisions which can help to create more robust buy in from local and international stakeholders.

Outlook

Looking at the global demand for decentralized energy access solutions, the proposed cross-sector approach for new business models and the value of measuring the economic, social and environmental impacts has the potential to provide new avenues to support private sector engagement in this area. Although huge potential exists in emerging markets, developing business models and solutions for decentralized access to energy can also be a new source for innovation in developed markets such as Europe or the USA where similar energy access issues exist. Encouraged by the enthusiastic and engaged approach by business during the development stages, next steps for this area involve more testing and implementation of these new and innovative business models. By focusing on specific project opportunities, taking these all the way to implementation and sharing lessons learned, there is the opportunity to finally scale up efforts aimed at addressing the access to energy challenge globally. We welcome further discussion on the opportunities associated with cross-sector partnership models and the value that measuring energy access impacts can have to support both better decision making and stakeholder engagement.



Source: PwC 2013

Figure 3: Process of Applying TIMM to an Exemplary Energy Access Project

Footnotes

[1] International Energy Agency, World Energy Outlook: "Energy for All – Financing access for the poor", 2011

[2] International Energy Agency, World Energy Outlook: "Energy for All – Financing access for the poor", 2011

[3] International Finance Corporation (IFC), "From gap to opportunity", 2012

[4] http://www.weforum.org/issues/powering-growth-through-transformative-energy-access-partnerships

[5] PwC TIMM methodology: http://www.pwc.com/gx/en/sustainability/publications/total-impact-measurement-management/index.jhtml

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Successful Grid Integration of Renewable Energy:Integration is the Name of the Game

By Silvia Pariente-David*

The Issues: Power market and system operators have increasingly to cope with extreme conditions

Renewable energy (RE) power generation is increasing rapidly around the world, and this trend is expected to continue at an accelerated pace. In 2012, the number of PV megawatts (MW) installed increased, from 28.8GW the previous year, to 30.5GW. The wind capacity installed in 2012 hit a record of 48.4GW, up from 42.1GW in 2011 . However, effectively integrating a higher share of RE into power systems remains a difficult problem for system operators, regulators and policy makers.

RE, and in particular wind and solar, are characterised by a high degree of variability and intermittency, and their availability cannot be forecast with certainty. That makes the task of system operators increasingly complex. System operators (or grid operators) are the entities who ensure that electricity is delivered to all consumers reliably when they need it, at the lowest possible cost. They have to balance power systems on a real time basis, ensuring that supply covers demand 24 hours a day, 7 days a week, 365 days a year, even in the presence of unexpected outages or unavailable capacity because of clouds or lack of wind. That task is particularly difficult in the presence of a high level of unpredictable RE supply.

Moreover, a high proportion of RE is often linked to an increase in distributed generation, as many RE power generation capacity additions are in small sizes (rural electrification, residential roof-top solar panels, etc.). Small residential and commercial RE generators can turn into consumers drawing supply from the grid when a cloud prevents solar generation or wind stops blowing. Managing the load in real time is a difficult task, but is crucial to maintain system reliability.

The growing penetration of intermittent supply of electricity and of distributed generation requires stronger networks, better management of interrelated generation and transmission assets and the large scale development of smart grids.

Key system operation issues in the presence of a high level of RE are: supply variability, supply and demand uncertainty, balancing, stability, adequacy, net load, etc…When wind was first introduced on a large scale in the 1990s, those issues were addressed by increasing the amount of reserve capacity. It was usual to plan the addition of 1MW of fast ramping capacity (combustion turbine) for each MW of wind installed. But that was costly and impeded large scale RE deployment in the absence of strong incentives. Nowadays better techniques are developing to increase the flexibility of the power systems and their ability to cope with intermittency and reliability.

A flexible electricity system is one that can respond reliably and rapidly to sudden changes and fluctuations in demand and supply, due to scheduled or unforeseen variations. System flexibility is essential when integrating a high degree of RE into the power system because of the variability and low predictability in renewable availability. Flexibility of a power system can be increased in several ways:

- Addition of flexible fast ramping capacity
- Diversification of the capacity mix
- Storage
- Congestion management that provides better access to flexible generation assets
- Regional integration and the development of cross-border transmission capacity
- Demand-side management (DSM), that allows better management of load to contribute to system balancing.

However, large scale development of RE have pushed conventional thermal power plants, that can act as back-up reserve, up the merit order curve, and reduced their profitability. Many of these plants in high RE markets such as Spain or Germany are now earmarked for shut-down. To keep them on stand-by, thereby improving system flexibility, those plants should be remunerated appropriately (for instance through a capacity mechanism), to prevent them from shutting down. Market design, policy and regulation., therefore, all have a key role to play in ensuring power system flexibility and reliability in presence of a high share of RE.

From an operational point of view, the ability to cope with intermittency improves when the quality of RE availability forecasts improves. A better knowledge of availability to the grid (or load requirements for distributed generation) helps system operators in their task of system balancing and provision of reliable supply. All operators in markets with a high RE penetration are developing better weather and solar/wind

* Silvia Pariente-David is a retired Senior Energy Specialist at the World Bank and a long-time IAEE member.

forecasting tools and improved real-time decision support tools.

The Solutions: Integration of short-term and long-term, of planning and operations, of generation and transmission and of national markets into regional power pools

As discussed above, a high level of RE penetration makes the task of the power system operator more complex. The system operator needs to integrate several dimensions into its planning and operational activities, coordinating information on physical assets, operation of the power system, information on availability and status of every producer and consumer and economics of the generation and transmission assets.

Coping efficiently and at least cost with RE integration can be done through the integration of several dimensions of power system planning and operations:

i. Integration of planning and operating decisions: long-term capacity expansion planning models used to be run separately from dispatch models. To minimise the need for reserves, capacity expansion models need to take into account the stochastic nature of RE and the ability of the system to address intermittency without necessarily relying on large back-up reserves. This will lower the system cost of RE integration.
ii. Integration of short-term and long-term decisions and processes: besides integration of planning and dispatch models as discussed above, system operators should use consistent information and forecasting tools for short-term and long-term decisions. If operators have access to better forecasting tools, then they will have a better ability to predict availability, therefore, reducing the need for expensive back-up capacity. Ability to handle intermittency in operational decisions need to be incorporated in planning models that decide on reserve needs. Integration of weather forecasts and RE availability into operational and planning tools is critical to RE integration at least cost.
iii. Integration of power generation and transmission: capacity expansion planning and transmission planning used to be separate tasks. Given that flexibility of a power system can be improved by calling on generators in a different balancing area, using transmission infrastructure to wheel power, generation and transmission need to be integrated both in planning and operational decisions. This task is being made more difficult with unbundling and multiplication of players following market liberalisation.
iv. Integration of national markets into regional power markets: regional integration facilitates a high degree of RE penetration, as larger power systems have more "flexibility" than small isolated systems. Merging balancing areas improves flexibility and reliability through geographical spread (wind less likely to be absent simultaneously in geographical distant areas), generation portfolio diversification, sharing of flexible generation assets and sharing of back-up reserves.
v. Integration of policy making, regulation and utility decision-making: power markets should be designed to remunerate stand-by capacity that can ramp up rapidly in case of lack of RE availability, support frequent rescheduling/redispatching, encourage effective transmission congestion management and promote the development of an ancillary services market. Incentive schemes for RE have to reflect the real service they provide, as not all RE capacity supply firm power. Most FiT schemes based on LCOE do not reflect the intermittency and lack of reliability of RE. Finally regulation should be harmonised between interconnected national markets—to create well-functioning regional markets—to encourage reserve sharing, transmission stability and the development of regional markets for ancillary services. An adequate framework of governance is essential to support market coupling, with robust contractual agreements between grid operators and power exchanges/market operators.

Conclusions: A difficult task made possible by better decision support tools

The task of balancing power system in real time in the presence of high RE penetration is complex but made possible thanks to improved algorithms, models, software and decision support tools. System operators are developing comprehensive data bases on RE characteristics, RE availability forecasting models, sophisticated dynamic stochastic models integrating capacity expansion planning and dispatch and multi-nodal (including across countries) models for dispatch, transmission planning and congestion management.

Success also requires coordination of all relevant players, from governments to regulators to operators and a good governance framework, with robust contractual agreements.

Natural Gas Expansion and the Cost Of Congestion

By Matthew E. Oliver, Charles F. Mason and David Finnoff*

With the emergence of new technologies such as hydraulic fracturing and horizontal drilling, large new deposits of oil and gas are poised to become economically viable. As this happens, substantially increased deliveries will make their way into the market, benefiting both producers and consumers. However, these potential benefits cannot be fully realized with the existing transmission capacity. Limited transmission capacity on key delivery routes creates bottlenecks that drive a wedge between the prices consumers pay and the prices sellers receive, lowering consumer surplus and reducing the incentive to develop the new deposits. A question of some policy relevance is therefore: How large is this wedge?

In general, answering this question is quite difficult. Consider the market for natural gas in the United States, illustrated in Figure 1. There are scores of supply sources, and many trading hubs. Hundreds of pipelines connect the various supply sources and trading hubs; the interactions amongst the various supply sources trading hubs and pipelines is, therefore, very complicated.

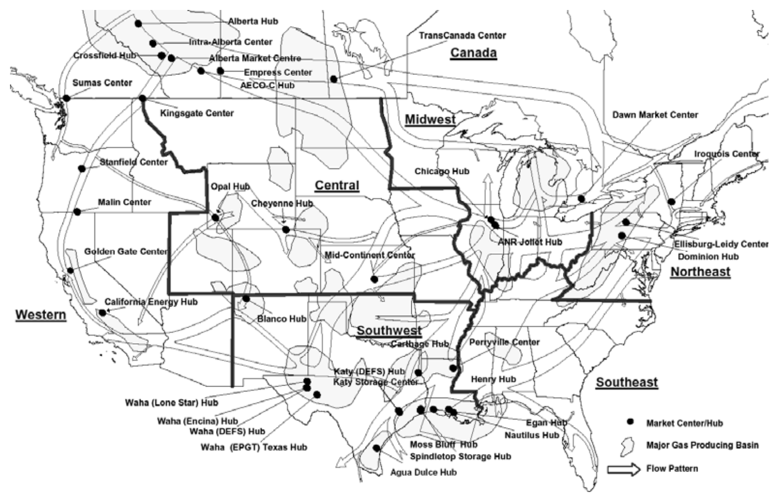

Figure 1: Natural Gas Centers, Hubs, and Major Pipelines.
Source: EIA.

An alternative to evaluating the effect of delivery constraints at the national level is to study a smaller version of the problem—that is, one with fewer sources of supply, fewer trading hubs, and fewer pipelines. In this article, we summarize evidence from such a stripped-down problem involving two trading hubs in the state of Wyoming connected by three pipelines. Gas generally flows from west to east between these two hubs, so that one may interpret the source of supply as represented by the trading hub in the western part of the state (the Opal trading hub) and the source of demand as represented by the trading hub in the eastern part of the state (the Cheyenne trading hub). Our results indicate a persistent difference in prices at the trading hubs, reflecting the cost of transmitting gas between the hubs, in the range of $0.15 per MCF. When scheduled deliveries utilize more than 95% of the available capacity, however, the wedge between the prices at the two trading hubs rises sharply; the tighter are the capacity constraints, the more pronounced is the wedge between the two prices.

The conceptual underpinning for this story is straightforward. The spot price at the upstream hub, which in this case is the trading hub, depends upon the supply curve for upstream sellers and the demand curve for downstream buyers. In turn, the price downstream buyers are willing to pay depends upon the price they believe they can obtain for the gas when they sell it, less the cost of transportation between the two trading hubs. This transportation cost reflects the opportunity costs associated with the use of the pipeline, and can be thought of as a form of tax on the transaction. The "incidence" of this tax upon sellers depends upon the elasticities of supply and demand. The magnitude of this "tax", in turn, is likely to depend positively on the degree to which transmission capacity is constrained; alternatively, it will depend negatively on the amount of unused capacity at a point in time.

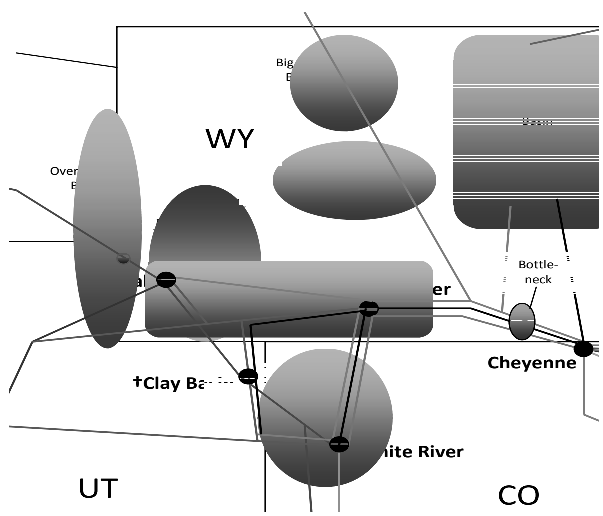

Figure 2: The Rocky Mountain Regional Pipeline Network.

The key logistical features of our example are illustrated in Figure 2.

Most of the natural gas that passes through the Opal trading hub originates in the upper Green River Basin. There, the distribution of the gas is split: some

* Matthew Oliver is with the School of Economics, Georgia Institute of Technology; Charles Mason is the H.A. "Dave" True Professor of Oil and Natural Gas Economics, Department of Economics and Finance, University of Wyoming; and David Finnoff is with the Department of Economics and Finance, University of Wyoming. Charles Mason may be reached at bambuzlr@uwyo.edu

is sent westward, either to Southern California or to the Pacific Northwest; most is sent eastward, ultimately passing through the Cheyenne trading hub. After passing the Cheyenne hub, this gas is sent south towards the Denver metropolitan area, or east towards metropolitan areas in the Midwest. Additional gas enters the pipeline between Opal and Cheyenne; some of this gas is delivered from the Piceance Basin, while some is delivered from the Powder River Basin. Between these three sources of supply, the scheduled deliveries in the pipeline occasionally approaches the three pipelines' combined physical capacity. This situation leads to a "bottleneck" in the pipeline, impeding transmissions.

To evaluate the impact of pipeline capacity constraints upon spot price differentials, we collected data on spot prices at the two trading hubs, scheduled deliveries over the pipeline route that connects the two hubs, and the physical capacities of the pipelines. We have daily observations on these variables for the period between May, 2007 and October, 2010. Using this data, we calculate the difference between the two spot prices (which we call the "basis differential") and the ratio of scheduled deliveries to available capacity in percentage terms (which we call the "utilization rate"). We then sort the data by utilization rate, placing observations into eight cohorts (< 75%, 75%-80%, 80%-85%, 85%-90%, 90%-95%, 95%-97%, 97%-99%, > 99%). For each of these eight cohorts we calculated the mean and median values of the basis differential. Figure 3 illustrates the statistics.

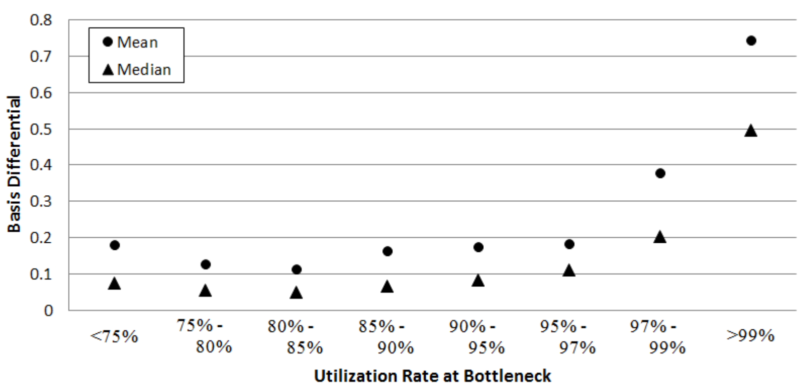

Figure 3: Basis Differential vs. Utlitzaton Rate

When the utilization rate does not exceed 97% we see that the mean basis differential is between $0.10 and $0.20, with the median basis differential roughly half the mean value. Once the utilization rate exceeds 97%, however, the basis differential starts to rise rapidly. For observations where the utilization rate falls between 97% and 99%, the mean basis differential is roughly $0.40 (with a median value of about $0.20). When the capacity constraint is very nearly binding, i.e., when the utilization rate exceeds 99%, the basis differential increases to nearly $0.80 on average (with a median value of $0.50). As a utilization rate in excess of 97% seems likely to signal the imminent potential for capacity constraints to bind, the data suggest binding capacity constraints can exert a powerful effect on spot prices.

The implication is that capacity constraints (and the associated congestion) can be excessively costly to natural gas market participants. Figure 3 demonstrates the potential for a five-fold increase in the median basis differential if the utilization rate increases from 95% to 99%! As the capacity of the bottleneck we consider is roughly 3.2 million MCF/day, with an estimated 22% of the gas flowing transacted at spot prices (FERC, 2010) the magnitude of the 99% utilization rate median differential implies $352,000 per day in transport costs. Because the Federal Energy Regulatory Commission (FERC) regulates transmission tariffs the pipelines are unable to capture the scarcity rents. Instead, non-pipeline owners of firm capacity capture the rents in the unregulated secondary market for transportation services. This diversion of scarcity rents away from the pipeline owner ultimately weakens the incentive for capacity expansion, compounding the congestion problem and resulting in an increased likelihood of binding capacity constraints. Thus, if pipelines are unable or unwilling to keep pace with the almost certain growth in demand for natural gas transmission over the coming decades, significant cost increases may well undermine the ability of the national market to fully integrate spot prices across geographic locations.

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Using Biogas from Palm Oil Residues to Enhance Energy Access in Indonesia

By Joni Jupesta*

Introduction

The United Nations Rio+20 Summit in Brazil in 2012 committed governments to create a set of sustainable development goals (SDGs) which should be integrated into the Millennium Development Goals (MDGs) after their 2015 deadline (Griggs et al, 2013). It clearly spells out that the framework for actions will be drawn from the outcome document, which will help reporting on the follow-up and implementation. The outcome from the Incheon meeting in March 2013 underlined that a framework for action is very important and should integrate an approach to the core sustainability challenges of climate change adaptation and mitigation, water management, food security, and sustainable energy in anticipation of the adoption of Sustainable Development Goals (SDGs). Implementation of this framework should be pursued by practitioners and institutions in different sectors and at different scales. The driving principles for these SDGs remain: reducing poverty and hunger, improving health and well-being, and creating sustainable production and consumption patterns (UNOSD, 2013).

The Asia Pacific region, where the world's major population and economic growth are, can show the global impact of sustainable development, partly due to the fact that this region includes an advanced economy such as in Japan and key emerging economies such as China, India and Indonesia. With the human population set to rise to 9 billion by 2015, definition of sustainable development must be revised to include the security of people and the planet (Griggs et al., 2013). Defining the integrated goals of SDGs brings enormous challenges such as the tradeoff between energy provision and food security in the context of biofuels (Jupesta, 2012). Further in developing countries, biofuels could become the solution for poverty alleviation and rural development. The global development agenda should also have a goal that explicitly focuses on improving agricultural systems and rural development in an integrated manner, to adequately address the need for changes that are required to make agriculture more productive and more sustainable. This paper focuses on the potential of biogas from palm oil waste to enhance energy access in Indonesia. With the fourth largest population in the world with 241 million inhabitants, Indonesia is the largest economy in the Southeast Asia region (BPS, 2013). This country showed consistent stable economic growth of 4.7% p.a, between 1990-2011 and is projected to grow at a 6.2% rate from 2011-2020; the highest among other ASEAN members (IEA, 2013).

Energy Situation in Indonesia

In 2008, fuel and electricity subsidies amounted to 14 and 6 billion USD, respectively, equaling total central governmental capital and social spending. Oil and gas contributed to 31.5% of government revenues in 2006, but decreased to 20.4% in 2008, as a result of depleting oil resources and an oil production decrease from 9 x 10^9 barrels in 1987 to half of that in 2007. For these reasons, the government enacted the so-called Mix Energy Policy (in 2006), to reduce dependency on oil by the use of a mixture of energy sources. It is expected to utilize local resources to make renewable energy (e.g., biofuel). The target was to reduce the share of fossil oil in providing energy from 52% of total energy consumption (as in 2006) to 20% by 2025. By that year, the remaining energy should come from coal (35%) and gas (30%), whilst renewable energy sources are hoped to provide 15% of total energy consumption.

Figure 1 shows the Mix Energy Policy based on Presidential Decree No. 5 (2006), which states that the share of renewable (geothermal and hydropower) will increase from 4% to 15% within 20 years. Biofuel was introduced with the objective of fulfilling 5% of the total energy consumption by 2025. Biofuel development could create at least 4 and 7 million jobs by 2010 and 2025, respec-

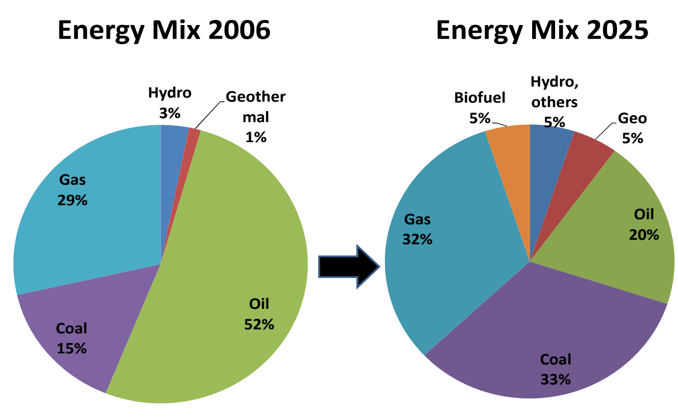

Figure 1: Indonesia's Energy Policy Mix

* Joni Jupesta is an Environment Advisor at PT. Sinar Mas Agri Resources and Technology (SMART) Tbk in Indonesia, and a Visiting Research Fellow at the United Nations University- Institute of Advanced Studies (UNU-IAS) in Japan. The views expressed are the views of the author and do not necessarily reflect the views of his affiliation.

tively (Jupesta 2012). However biofuel consumption is still relative low. This is due to low technical implentation and unfavourable pricing which makes industry reluctant to invest. In 2013, the government enacted new regulation shown in Table 1 to accelerate biofuel consumption in transportation, industry and power plants (ESDM, 2013). The biofuels here are biodiesel (BD), bioethanol (BE) and pure vegetable oil (PVO). The biofuel feedstock for biodiesel comes mostly from palm oil.

	January 2015			January 2020			January 2025		
Sector	BD	BE	PVO	BD	BE	PVO	BD	BE	PVO
Transportation PSO	10%	1%	10%	20%	5%	20%	25%	20%	20%
Transportation Non PSO	10%	2%	-	20%	10%	3%	25%	20%	5%
Industry and Commercial	10%	2%	10%	20%	10%	20%	25%	20%	20%
Power Generation	25%	-	15%	30%	-	20%	30%	-	20%

Table 1: Obligation of Biofuel as Mixture with Oil Fuel (ESDM, 2013)

From a demand perspective, the electrification rate in Indonesia is 73%. This leaves 27% of the population (~66 millions) still living without electricity access. This is mainly caused by the high infrastructure cost of grid connections due to the geography of the archipelago and the mountainous nature of some of the region. More than 103 million people in Indonesia (~42% of total population) still use biomass as cooking fuel (2010), which causes a negative externality, i.e., health problems due to indoor pollutants (IEA, 2013, and Bailies, 2005).

Palm Oil in Indonesia

Palm oil is the most important agricultural commodity in Indonesia and plays a significant role in the country's development. The palm oil sector produced 24.4 million tons of Crude Palm Oil (CPO) and 5.3 million tons of Palm Kernel Oil (PKO). It employs 5 million people and generated an income, by export, of US$ 19.1 billion in 2012. Palm oil plantations are owned by small land holders (45%), the private sector (47%) and the state (8%). CPO has many applications in the food industry e.g., cooking oil, and the non-food industry. e.g., biofuel; while PKO is a common ingredient in processed foods, soaps and personal care products. The average yield of palm oil ranges from 6 million ton/ha to 7.5 million ton/ha. This is, respectively 17.9, 14.6 and 11.15 times higher than those of soybean oil, rapeseed oil and sunflower oil with the same land area. Five percent of the palm oil produced globally is used as feedstock for biodiesel. The growth rate of palm oil plantations has gone up rapidly from 14,000 ha /annum (1967-1980) to 365,000 ha/annum (1991-2010). The projected global demand for palm oil products -crude palm oil and palm kernel oil- will grow 186% from 2010 to 2025. Table 2 shows the major producers of palm oil

Countries	2007	2008	2009	2010	2011
Indonesia	16.800	19.200	21.000	21.000	22.100
Malaysia	15.823	17.735	17.566	16.993	18.880
Thailand	1.020	1.300	1.310	1.380	1.830
Nigeria	835	830	870	885	900
Colombia	780	778	802	753	765
Ecuador	385	418	448	380	460
Others	2.905	3.045	3.107	3.367	4.159
Total	38.548	43.306	45.103	44.758	49.094

Table 2: Major Producers of Palm Oil in throusand tonnes (2007-2011) (Oil World, 2012)

Biogas from Palm Oil Residues

The palm oil in Indonesia is located in rural areas, spread mostly on Sumatera and Kalimantan islands which have a relative low electricifcation rate compared with Java island. The main products produced from palm oil are CPO and PKO. However, residues such as fibre, shell, fronds, palm kernel cake and empty fruit bunches are also produced. Most palm oil producers are small land holders with less than 50 hectares. The empty fruit bunches and fronds can be coverted into paper, while fibre and shell could be used as boiler fuel to generate steam in the palm oil mill (Sulaiman, 2011). On the other hand, palm kernel cake is underutilized and has a low economic value compared with the other residues. Considering its significant protein and nutrient contents, palm kernel cake could have more value added as one of the feedstocks in cow farming.

In the integration of palm oil with cow farming, the feedstock for the farming could be secured from palm oil residues and biogas from cow manure could be utilized for the cooking and lighting of the household. The lighting here refers to mantle lamps and the cooking refers to the gas stove. This biogas can help overcome the lack of electricity access in the remote areas of palm oil farming in the Sumatera and Kalimantan islands. Figure 2 shows the integration of palm oil with cow farming. Having four cows could produce biogas to supply up to six hours of cooking and up to eight hours of one light. Table 3 shows an economic analysis of palm oil/cow farming integration for a small land holder with four cows.

While the grass is obtained for free directly from the farm, the palm kernel cake is obtained from the nearest palm kernel mill derived from the palm oil processing. The operational costs consist of transportation, mixing, munching and labor. The analysis shows that the integration will bring a net revenue of US$ 174.8 per month in addition to the biogas for household cooking and lighting. Further, the biogas could also reduce the dependency on biomass for cooking which causes indoor pollution. Indonesia still had 103 million people (~42%) who relied on biomass for cooking in 2011 (IEA, 2013).

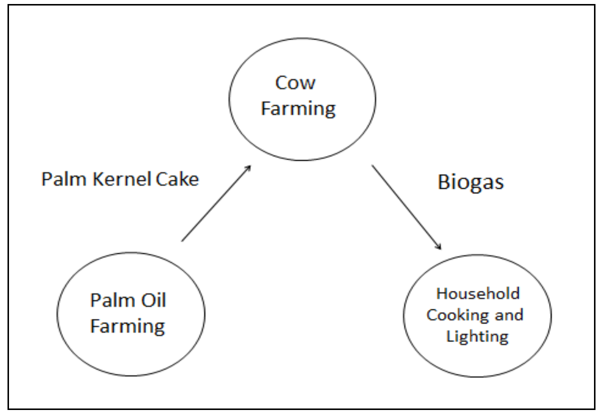

Figure 2: Integrated Palm Oil/Cow Farming

Summary

The post 2015 development agenda will incorporate Sustainable Development Goals as a continuation of the Millenium Development Goals. Energy access is still the top priority of the development agenda, with multiple objectives: poverty alleviation, income generation, gender equality, economic development, environment sustainability, etc. Lessons from Indonesia show that the integration of palm oil farming with cow farming could deliver several benefits: less air pollution from replacement of biomass with biogas for cooking and the economic benefit of suppling clean energy and a monthly income. In the case of the small land holder with four cows, the biogas produced could provide up to 6 hours of cooking and up to 8 hours of lighting by mantle lamp. With an average weight gain of 30 kg per month for one cow, the income benefit was US$ 174.8/month.

	kg/ month	Price US$/kg	Total
Material Cost			67.9
Grass	396	-	-
Palm Kernel Cake	288	0.16	46
Paddy bran	64	0.15	9.6
Molasses	28	0.1	2.8
Salt	7.2	0.1	0.7
Urea	7.2	0.35	2.5
Ultra Mineral	14.4	0.44	6.3
Operational Cost			9.9
Total Cost			77.8
Revenue (Cow)	120 kg	2.1	252.6
Net Revenue			174.8

Table 3: Economic Analysis of Palm Oil/Cow Farming Integration

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The following individuals joined IAEE from 9/1/13 to 12/31/13

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Energy Poverty: The Bulgarian Case

By Teodora Peneva*

Introduction

"As winter approaches, millions of people who don't have the money to heat their houses are left to fend for themselves", said Brenda Boardman this October, the primary "researcher, strategic thinker and campaigner" in the world of fuel poverty, as the Environmental Change Institute of Oxford University celebrated her 21 years of research in the field in 2012.

As winter approaches, two thirds of the Bulgarian people are left to fend for themselves, and there haven't been many years of research behind these numbers in the past. Yet, energy poverty is quite severe in Bulgaria. Documents of Eurostats and statistics from the Statistics of Income and Living Conditions survey since 2008 show over 67% of the people limiting their heat comfort in the winter due to lack of money. Compared to an average of 8% for the EU and 16% for the post-social regime member countries in Central-East Europe, this number is distressing. In fact, this is just the subjective perception of the respondents in the survey. But this number can not be far from true.

All the three factors determining the level of energy poverty - e.g., low income, high energy prices and poor quality buildings - are present. Specific measures and social policies for each factor are ineffective, targeting a very limited part of the population and providing very low heat allowances, for the poorest groups, in particular. Since there is no specific research being done so far, or published by the National Statistical Institute, only guesses can be made that the energy poverty level likely worsens each year, or fluctuates depending on climate conditions. A mild winter at the end of 2012, however, couldn't stop social protests against high electricity bills in the beginning of 2013. The government managed to keep electricity prices at the same level for the first time this year, leveraging costs by changes in various taxes for business, producers, and exporters, and sharing the cost burden between different market participants. In each of the preceding years price increases of between 5% and 10% were registered for households, twice a year. Increases in energy prices were much greater than increases in income, resulting in social protests, political pressure, speculation, and other negative consequences.

High Energy Prices

In fact, electricity prices in Bulgaria are the lowest amongst countries in the EU. Statistics on electricity prices in the EU from 2011 show (Figure 1) Bulgaria with the lowest retail price per kWh. One would ask why do we call this high energy prices then? The main problem is the low income level, but there are also problems with the energy consumption structure in the country. Electricity accounted for over 55% of Bulgarian household energy consumption in 2011, according to data estimates from the World Bank. Around 20% is from wood consumption, 9% from coal, some 11% from district heating, and just 1-2% from gas. Few countries in the climate conditions of Bulgaria use so much electricity for household heating. This is ineffective and results in higher costs for primary energy, compared with other ecologic and lower cost energy sources. This share has increased in past years, with many users of district heating switching gradually to electricity in order to be able to control energy costs.

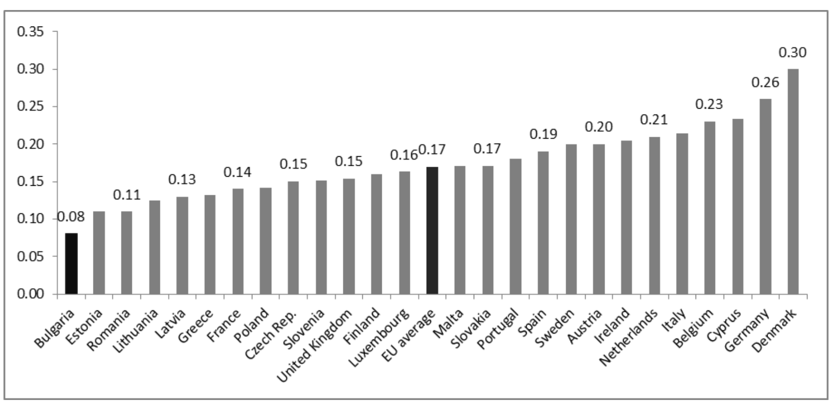

Figure 1: EU Electricity Prices (kWh).

The gas supply network for households is underdeveloped, and meets severe barriers for development, thus leaving people with no access to a gas heating alternative during the winter. One of these barriers is the price of gas. Gas prices in Bulgaria, unlike electricity prices, are among the highest in the EU. In the few cities where gas networks were established and developed for households, the gas price became too high for affordability, so many people who connected to the gas grid in the beginning, quickly stopped using it for heating during the winter.

Central heating is used by around 11% of households, in specific regions, in 18 cities in the country. This type of heating, usually the most efficient and clean

* Teodora Peneva is a PhD student in the Business Department of Sofia University, Sofia, Bulgaria. She may be reached at teodorapeneva@hotmail.com

energy source, offering the ideal price-performance ratio with low cost and high comfort, has severe problems in Bulgaria, becoming not a solution to energy poverty, but rather a cause for poverty. Central heating grids were designed and developed in the 1980s in Bulgaria, when the government subsidized a big part of energy prices, and usage in the multifamily panel buildings reached 100% of households. With increasing overall poverty levels and removal of the state subsidies for district heating prices at the end of the 1990s, there was a rapid decrease in users within the buildings. This made the distribution cost for those remaining in the buildings higher, and bills unpredictable. Gradually, entire buildings started switching off the grid and using electricity. In this way, households could manage the energy costs and limit their bills to affordable levels.

Control of the energy bill became the first reason for choice of heating type at the beginning of the 2000s and continued over the decade. Affordability improved slightly in 2007, right before the global financial crises, which is shown in Figure 2 taken from National Statistical Institute data.

It is hard to estimate what percentage of this was exactly for energy, and what level of comfort this percentage has afforded. Very likely, the energy bill took the higher portion of the expenditure. This hypothesis is based on simple calculations for monthly bills and income levels.

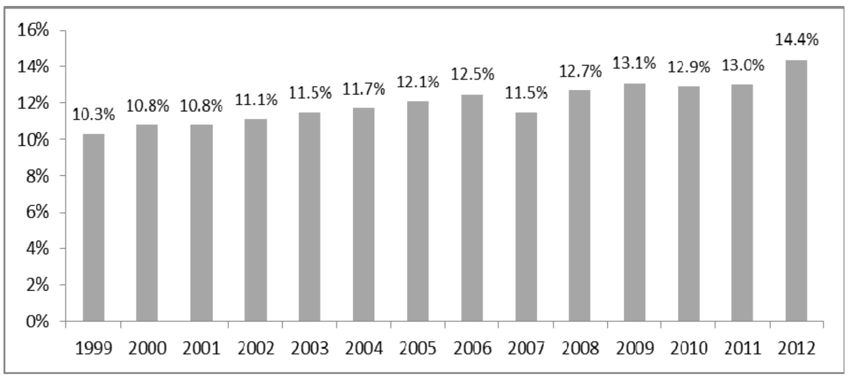

Figure 2: Expenditures by Bulgarians for Housing, Energy, Fuel and Water as a Percent of Total Household Income.
Source: National Statistical Institute.

Low Income

Bulgaria set a minimum salary of just 158 Euro per month in 2013 and the average salary reached 408 Euro per month in August 2013, with significant variations across the country. If we accept the energy poverty definition adopted by the UK government as "A household is considered to be fuel poor if it would need to spend at least 10% of its income in order to heat the house to an acceptable level of warmth", then a household with income below 400 Euro spending more than 40 Euro per month for heating in the winter is energy poor. Usually, energy bills exceed this amount in Bulgaria, or if limited, then there are serious limitations in the comfort levels. The question then is how many households have income below 400 Euro?

According to Eurostat, in 2011, countries with the highest share of persons being at risk of poverty or social exclusion were Bulgaria (49%), Romania and Latvia (both 40%), Lithuania (33%), Greece and Hungary (both 31%), with the highest at-risk-of-poverty rates being observed in Bulgaria, Romania and Spain (all 22%) and Greece (21%). With a population of over 7mil. people, this means over 1.6mil. people are at risk of poverty in Bulgaria. And for the EU it means 17mil. are poor, a very high number. And all of these, are certainly energy poor. The poverty line in Bulgaria was estimated at 123 Euro in 2013. See Figure 3.

The government has social programs aimed at decreasing those below the poverty level, and even has special social aids for heating (heating allowance) for the most affected groups. However, of the 22% of the population (around 1.6 million people) living below the poverty line in Bulgaria, only about 210,711 households are receiving social heating assistance for the 2012/2013 season. The amount of money that has been given is relatively small (33 Euro), compared with heating costs (over 40 Euro on average), and the criteria for approval quite severe. Another severe problem is the quality of buildings. Even if people manage to somehow afford 30-40 Euro per month for heating, they receive a lower comfort due to high heat losses.

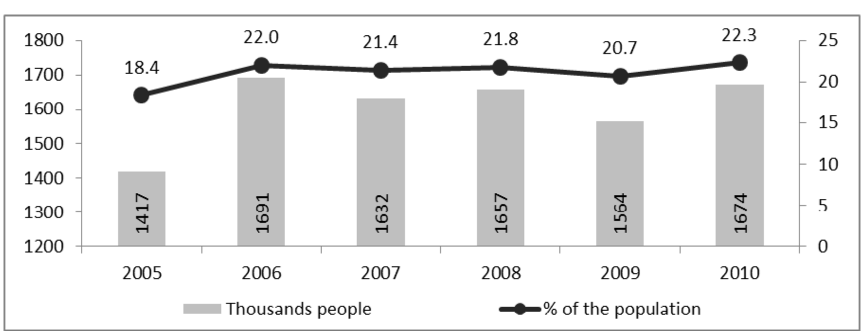

Figure 3: Bulgarian People Below the Poverty Level

Poor Quality Buildings

According to the National Program for Housing Renewal in Bulgaria adopted in 2005, over 20% of the buildings are panel buildings, most of them needing renewal.

Experts estimate that there are 680,000 buildings that will be needing renewal in the 10 to 15 years after 2005. Of these, 360,000 are panel buildings, 150,000 concrete buildings and 170,000 massive buildings. The biggest problems are with buildings built using large-panel technology. Around 83% of the panel buildings are located in regional cities, and in many big cities they represent around 50% of all housing.

A few energy efficiency credit programs for multifamily household buildings were applied in the country in recent years, but not very successfully. The biggest program, REECL, provided 46,027 credits in the period from September 2006 to September 2013. The process of renewing buildings with credits is slow and not applicable if 5% of the building's household are poor. This is the main barrier for popularization of energy efficiency programs with credits. Poor households cannot afford any additional cost, and cannot invest in energy efficiency. The energy poverty itself has become a barrier to energy efficiency programs.

Conclusion

Fighting energy poverty this severe is not an easy job. The Bulgarian government applies various measures to reduce overall poverty, but the lack of in-depth research in the field of energy poverty in particular, affects the results of other social policies. Unexpected and unpredictable energy costs in the winter push more and more households below the poverty line during the winter season, and only part of them are able to receive a heating allowance. The level of the energy poverty can only increase, as progressing integration of the electricity markets is not expected to keep electricity price levels in Bulgaria as they are in 2013. The problem needs more attention from all levels and institutions, and a continual monitoring on an annual basis. Currently, the parameters of the SILC survey applied in all EU countries are not specifically designed to cover energy poverty; this can not help the work on decreasing the EU poverty. Having more concrete data and analysis, policies can be more effective and focused.

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14-16 January 2014, LNG 360 Forum Latin America and Caribbean at Omni Houston Hotel, 4 Riverway, Houston, TX 77056, US. Contact: Neill, Howard, DMG Events, 3 Stamford Landing, Suite 400, 46 Southfield Avenue, Stamford, Connecticut, 06902, USA. Phone: 44 0 203 615 2869, Email: neillhoward@dmgevents.com, URL: http://atnd.it/Hrq1Di

20-23 January 2014, Central and East Africa Mining Investment Summit at Kensington Close Hotel, Wrights Lane, London, W8 5SP, United Kingdom. Contact: Bilal Azmat, Resourceful Events, Level 4, 333 George Street, Sydney, New South Wales, 2000, Australia. Phone: +44 (0) 207 216 6080, Email: bilal.azmat@resourcefulevents.com, URL: http://atnd.it/1atA8hZ

22-23 January 2014, Global Energy Career Expo Aberdeen at Aberdeen Exhibition and Conference Centre , Bridge of Don, Aberdeen, Scotland, AB23 8BL, United Kingdom. Contact: Anthony, Webb, DMG Events, Northcliffe House, 2 Derry Street, London, W8 5TT, United Kingdom. Phone: 02036152877, Email: anthonywebb@dmgevents.com, URL: http://atnd.it/16zEZkc

22-23 January 2014, ESCO Europe 2014 - EPC Conference at Hotel Fira Palace Barcelona, Avda Rius I Taulet, 1-3, Barcelona 08004, Spain. Contact: ESCO Europe 2014, Synergy, 0. Email: chantal@synergy-events.com, URL: http://atnd.it/4901-0

26-29 January 2014, Process Safety for Power and Utilities at IQPC, Knowledge Village, Dubai, United Arab Emirates. Contact: Vidhya, Suman, IQPC Middle East, Knowledge Village, Dubai, Dubai, United Arab Emirates. Phone: 00 9 71 4 364 2975, Email: vidhya.suman@iqpc.ae, URL: http://atnd.it/19IVyGR

27-29 January 2014, Oil and Gas Intellectual Property Summit at IQPC, 129 Wilton Road, London, SW1V 1JZ, United Kingdom. Contact: Will Robinson, IQPC UK, 0. Phone: 0207 368 9300, Email: enquire@iqpc.co.uk, URL: http://atnd.it/HbHm2O

27-30 January 2014, Turkey & Central Africa Mining Investment Summit at Intercontinental Hotel, Asker Ocagi Cad. No:1 Taksim, Istanbul 34435, Turkey. Contact: Bilal Azmat, Resourceful Events, Level 4, 333 George Street, Sydney, NSW, Australia. Phone: 207 216 6056, Email: bilal.azmat@resourcefulevents.com, URL: http://atnd.it/1atBLMF

27-30 January 2014, 2nd Annual West African Energy Infrastructure Security at Accra, Ghana. Contact: Shirelle Haines, Hanson Wade, Charter House, 13-15 Carteret Street, London, Not Selected, SW1H 9DJ, United Kingdom. Email: info@hansonwade.com, URL: http://eis-westafrica.com/

27-29 January 2014, 2nd Annual LNG Bunkering Summit at Crowne Plaza (TBC), Nieuwezijds Voorburgwal 5, Amsterdam 1012, Netherlands. Contact: Carly Greene, Mr., IQPC UK, 129 Wilton Road, London, SW1V 1JZ, United Kingdom. Phone: 0207 368 9300, Email: enquire@iqpc.co.uk, URL: http://atnd.it/HrRXrf

27-27 January 2014, Innovation and Energy Sustainability at Barcelona. Contact: Noelia Vera, Innovation and Sustainabliity, Funseam, Baldiri Reixac, 4. Tower Bloock I., Barcelona, 08028, 08028, Spain. Phone: +34934033766, Email: assistant@funseam.com, URL: www.funseam.com

28-30 January 2014, EPC Contracts for Power & Utilities at Johannesburg, South Africa. Contact: Vera Wong , Marketing Executive, Infocus International, 105 Cecil Street, Raffles, Choose from list, 069534, Singapore. Phone: 6563250276, Fax: 6562245090 , Email: vera@infocusinternational.com, URL: http://infocusinternational.com/epcpower/index.html

28-30 January 2014, 3rd International Conference Grid Integration of Offshore Wind Energy at Swissôtel Bremen, Hillmannplatz 20, Bremen, 28195, Germany. Contact: Conference Team, IQPC Germany, 0. Email: eq@iqpc.de, URL: http://atnd.it/1bpBxJz

28-28 January 2014, II International Academic Symposium R&D on Energy at Barcelona. Contact: Chair of Energy Sustainability IEB-UB, Barcelona Economics Institute (IEB) - University of Barcelona (UB), IEB. FUNSEAM, Parc Científic de Barcelona - Auditorio. C/Baldiri i Reixac, 4-8, Barcelona, 08028, Spain. Phone: +34934034646, Email: ieb@ub.edu, URL: www.funseam.com

28-29 January 2014, 2nd International Nuclear Decommissioning Summit at Radisson Blu Hotel, Karl-Liebknecht-Str. 3, Berlin, 10178, Germany. Contact: Dennis Schurich, Germany. Phone: 49030209130, Email: dennis.schurich@iqpc.de, URL: http://atnd.it/1bTkEL1

29-30 January 2014, Natural Radiation Management Middle East (NORM) at Hilton Abu Dhabi Hotel, Corniche Road West st., Abu Dhabi, 00001, UAE. Contact: Laura Delaney, Informa, 0. Phone: 020 7017 5518, Email: energycyustserv@informa.com, URL: http://atnd.it/15OlFz3

04-06 February 2014, Gulf Industry Fair at Bahrain International Exhibition and Convention Centre, 158 Avenue 28, Sanabis 11644, Manama, Bahrain. Contact: Ahmed, Suleiman, Trade Arabia, PO Box 1100, Manama, Manama, Bahrain. Phone: 97317299116, Email: ahmed.suleiman@tradearabia.net, URL: http://atnd.it/19YElcJ

February 04 - March 04 2014, Gas to Power & LNG Journal: Gas Energy Forum 2014 at Mexico City. Contact: barbara@gastopowerjournal.com, Conference Producer, Gas to power Journal, 2-5 Benjamin street, London, London, City of, EC1M 5QL, United Kingdom. URL: http://gastopowerjournal.com/gas-to-power-journal-events/item/2314-gas-energy-forum-2013#axzz2lrBsZipS

05-06 February 2014, LNG Shipping Conference 2014 at Le Meridien Piccadilly Hotel, 21 Piccadilly, London, W1J 0BH, United Kingdom. Contact: Maritime, Customer Services, Informa Maritime Events, PO Box 406, West Byfleet, KT14 6WL,, United Kingdom. Phone: 020 7017 5510, Email: maritimecustserv@informa.com, URL: http://atnd.it/1ifwLzA

10-12 February 2014, Oil and Gas Mobility Summit at Kensington Close Hotel, Wrights Lane, Kensington W8 5SP, UK. Contact: Elena, Patten, IQPC UK, 129 Wilton Road, London, London, SW1V 1JZ, United Kingdom. Phone: 02073689499, Email: elena.patten@iqpc.co.uk, URL: http://atnd.it/5125-0

12-13 February 2014, 16th Annual E&P Information and Data Management at Millennium Gloucester Hotel London, 4-18 Harrington Gardens Kensington & Chelsea, London, SW7 4LH, UK. Contact: Andrew, Gibbons, United Kingdom. Email: pharma@smiconferences.co.uk, URL: http://atnd.it/18rHALf

19-20 March 2014, Argus European Base Oils Markets 2014 at Swissotel The Bosphorus, Bayildim Cad. No.2 Macka, Besiktas Istanbul, 34357, Turkey. Contact: Laura McAulay, Argus Media, 175 St John Street , Argus House, London, EC1V 4LW, United Kingdom. Phone: 02077804341, Email: baseoilconf@argusmedia.com, URL: http://atnd.it/5102-0

24-26 March 2014, Deep Sea Mining Summit at Kensington Close Hotel, Wright's Lane, London, W8 5SP, UK. Contact: Stacey Cross, IQPC UK , 129 Wilton Rd, London, SW1V 1JZ, United Kingdom. Phone: 020 7368 9420, Email: enquire@iqpc.co.uk, URL: http://atnd.it/5028-3

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