IAEE
WWW.IAEE.ORG
INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS

IAEE Energy Forum

Second Quarter 2011 International Association for Energy Economics

President's Message

Three months ago, when I wrote my first President's letter, the global economy was relatively stable, growth was accelerating, and I was relatively certain that the worst was behind us. Although I still believe the worst has passed, turmoil in the Middle East and North Africa has rattled oil markets. And with the disaster in Japan still unfolding, the level of uncertainty has clearly increased.

Oil prices are up 20 percent since the beginning of the year and any increase in oil prices brings with it a discussion of whether the price rise is due to fundamentals or speculation. I view the higher oil prices as a rational market response. Geopolitical turmoil can lead to high prices for two reasons: a disruption in the supply of oil and fears of disruption. Fears of disruption increase stock building, which also puts upward pressure on prices. Until civil unrest reached Libya, there was no physical disruption of world oil supplies. The curtailed supply from Libya is reported to be about 1.2 million barrels per day, and seems to have been offset by increased production from other OPEC countries. It would seem the rise in prices is due to perceived uncertainty of supply in the future, possibly a contagion to larger producers such as Saudi Arabia. The rational response to such uncertainty would be an increase in oil stocks, which we are beginning to see. U.S. crude inventories and floating storage around the world have risen recently.

On the IAEE front, the joint AEA/IAEE session, "Environment, Climate Change and Economics" at the ASSA meetings in Denver, was well attended. The presentations by Philipe Aghion (http://www.iaee.org/documents/2011/ASSA_climate_jan7.pdf), Andrea Bollino (http://www.iaee.org/documents/2011/IAEE_AEA_january07_slides.pdf) and Jean Tirole (http://www.iaee.org/documents/2011/Denver-CPolicy-presentation.pdf) were very thought provoking. Our stand-alone IAEE session on energy modeling had papers by Peter R. Hartley, Kenneth B. Medlock III, Ted Temzelides and Xinya Zhang; Prakash Loungani and Marianna Riggi; Leigh Tesfatsion and Hongyan Li; and Jevgenijs Steinbuks and Karsten Neuhoff, followed by plenty of interesting discussion.

I am pleased to report that the Polish and Russian affiliates are moving forward successfully. Dr. Jerzy Szkutnik has been active in restarting the Polish affiliate and a formal declaration is anticipated in June. The inaugural meeting of the Russian affiliate is planned in Moscow this fall.

I am also very excited to bring you news of further developments in our new publication, Economics of Energy and Environmental Policy (EEEP—http://www.iaee.org/en/publications/eeep.aspx). EEEP will be a peer-reviewed, multidisciplinary publication, focused on policy issues involving energy and environmental economics. It seeks to provide a practical and research-based, yet easily readable and accessible source of information on contemporary economic thinking and analysis of energy and environmental policy issues. The publication will encourages dialogue between business, government and academics and will try to improve the knowledge base for energy and environmental policy formation and decision making. The editors are Jean-Michel Glachant (European University Institute in Florence, Italy), Paul L. Joskow (Alfred P. Sloan Foundation, USA) and Michael Pollitt (Cambridge University, United Kingdom). The call for submissions will be out by the end of this month. I encourage you to be a referee for EEEP. You can sign up at http://www.iaee.org/en/publications/eeepref.aspx. The inaugural issue will be out before year-end.

(continued on page 2)

IAEE INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
WWW.IAEE.ORG

CONTENTS

1 President's Message
9 National Security & Caspian Basin Hydrocarbons
17 China's Oil "Adventure" into Venezuela
21 Hydrocarbon Production Update: Colombia, Brazil, Mexico and Venezuela
27 Allowed ROEs During Economic Crisis Often Fail The Equal Return For Equivalent Risk Standard
31 The Future Paradigm of Energy Pricing in South America
33 A Brief Note On the Oil and Natural Gas Industries In Latin America: Current Situation and Outlook
35 Regulating Generation Investment in Latin America: Future Challenges
43 Calendar

Editor: David L. Williams

PRESIDENT'S MESSAGE *(continued from page 1)*

The planning meeting for the Stockholm conference was held in Stockholm on Feb. 25 and was extremely productive. In addition to a fascinating program, the conference will have two different types of concurrent sessions for the first time. The first, called "Collaborative Conversations," will attempt to bring academics and business people together in the discussion of a single topic. The second, called "Discussant Sessions," will feature longer paper presentations and a discussant for each. We are experimenting with these innovative sessions and plan on having a couple of each type at the conference. Check out the conference program at http://www.hhs.se/iaee-2011/Pages/default.aspx.

The Third Latin American Meeting on Energy Economics scheduled for Buenos Aires on April 18-19 is almost upon us. You can explore the program and register at http://www.elaee2011.org/. It will be followed by the Fourth NAEE/IAEE Conference, April 25-26, in Abuja. The 30th USAEE North American Conference, "Changing Roles of Government, Industry and Research" will be held in Washington, D.C., Oct. 9-12 (http://www.usaee.org/usaee2011/). From the look of the plenary sessions already organized, it promises to be relevant and stimulating.

I look forward to seeing you at all our conferences!

Mine Yücel

Members of the Stockholm Program Planning Committee met in Sweden February 25 to work on developing the conference program. President Mine Yücel Center with Executive Director David Williams to her left.

IAEE Email Policy

At the Rio Council meeting the IAEE Council discussed the use of IAEE's email facilities and agreed to the following policy:

> The IAEE will only send emails to its members on matters pertaining to IAEE business or that of IAEE Affiliates (e.g., Affiliate directly sponsored events). No emails will be sent on behalf of third parties (persons or organizations, including universities). IAEE does not release its email address list.

IAEE Mission Statement

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

We facilitate:

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

We accomplish this through:

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

Editor's Notes

We focus this issue primarily on Central and South American energy matters. However, Brad O'Neil and coauthors, and Zhen Zhu and his coauthors present two interesting articles on other subjects. See below for more detail. We'll return to Central and South American issues in the Summer issue of the *Forum.*

Bradley O'Neil, Robert Hawkins, and Cody Zilhaver address the U.S. working with the European Union to cultivate and leverage relationships within the Caspian Basin ensuring hydrocarbons flow unimpeded from the region. These efforts would decrease Russian and Iranian ability to use these resources as foreign policy tools to coerce neighboring nations and destabilize the region.

Mamdouh Salameh writes that Venezuelan president Hugo Chavez is making steady progress in cementing strategic relations with China. China has funnelled money and expertise into Venezuela's oil industry. With so much to gain in trade and oil, China will strive to keep Chavez in power. The question is would the United States consider this intrusion into its backyard a threat to its national interests or will it treat it as a purely commercial venture by a country seeking to quench its thirst for oil?

Miranda Wainberg reports that hydrocarbon production trends have varied widely among Latin American countries in recent years. She explains that Colombia and Brazil increased production while Argentina, Mexico and Venezuela's production declined and notes that these differences are linked to their "commercial frameworks": hydrocarbon sector organization and governance; NOC organization and governance; fiscal regime design; and regulatory practices and quality.

Donald Murry, Michael Knapp and Zhen Zhu investigate the empirical connection between allowed returns on equity in U.S. electric and natural gas industries and market, regulatory and risk variables in rate cases. The results suggest that allowed returns are positively related to market conditions. However, there is evidence that allowed returns are neither consistent with financial theories on risks and returns and a common regulatory standard.

Philip Walsh notes that energy prices in South America vary greatly among countries depending upon the respective government policies and actions of state-owned energy companies. However, the unsustainable nature of nationalization and domestic energy price subsidies will see future energy pricing determined by the continental integration activities of South American state-owned energy companies.

Gerardo Rabinovich provides a brief overview of the Latin American oil and natual gas situation and prospects for the future.

Rodrigo Moreno and other coauthors describe the evolution of electricity market regulation for generation investment and the recent auction-based mechanism experience in South America, identifying key challenges that will need to be addressed in the near future in order to set an efficient and robust regulatory framework in the long-term. The experiences and challenges identified can also serve other regulators who are currently committed to the design of new and innovative ways to efficiently incentivise generation investment.

DLW

Get Your IAEE Logo Merchandise!

Want to show you are a member of IAEE? IAEE has several merchandise items that carry our logo. You'll find polo shirts and button down no-iron shirts for both men and women featuring the IAEE logo. The logo is also available on a baseball style cap, bumper sticker, ties, computer mouse pad, window cling and key chain. Visit http://www.iaee.org/en/inside/merch.aspx and view our new online store!

INTERNATIONAL ENERGY

A PROFESSIONAL ONLINE FORUM

Give your writing global exposure!

We've been hard at work updating our internet presence with the launch of International Energy: an expansion of our IAEE Energy Blog. We feel this broader platform provides our members another tool to help them share relevant and timely energy economics thinking with a broad international audience. International Energy is an umbrella for three online concepts:

- Publishing of professional articles submitted by members
- Member Public blogging (for public attribution)
- Members only Private blogging (nonattribution) **coming summer 2011**

Key Features and Benefits:

- Top Search Engine Listing
- Translation into 50 languages
- Social Media enabled
- Industry categories for:
  - *Coal*
  - *Oil*
  - *Natural Gas*
  - *Nuclear Power*
  - *Alternatives*
  - *Electricity*
  - *Regulation*
  - *Geopolitics of Energy*
  - *The Environment*
- RSS
- Reader Comments
- Blogger's Bio pages
- Contributor Bio pages
- Advertising space for our Institutional Members
- Widely adopted publishing platform (Wordpress)

As always, this forum is neutral and offered to help our members express their thinking and to forward the IAEE's mission of increasing awareness and networking around energy economics issues.

If you're a member and industry leader in any of our categories, please add International Energy to your choices for getting your timely thinking published. We and the world value your insight.

http://www.international-energy.com
http://www.international-energy.org
http://blog.iaee.org

IAEE
WWW.IAEE.ORG

34th IAEE International Conference

Stockholm June19-23, 2011

Dear Energy Professional

It is a pleasure to announce the 34th IAEE International Conference, entitled "Institutions, Efficiency and Evolving Energy Technologies", to be held in Stockholm, Sweden, June 19-23, 2011.

The conference will bring together a wide international spectrum of energy economists, policy makers, and professionals from all parts of the energy sector and representatives of governments and other public institutions. As usual at IAEE conferences all the major fields of energy economics and policy will be addressed. In addition there will be a special focus on the following topics, in plenary sessions and in a number of specialized concurrent sessions:

- The organization of energy related innovation and technological development
- Evolving technologies and energy use in the transport sector
- The political economy of energy markets
- Energy security
- The design, integration and regulation of energy markets
- Energy demand and energy efficiency

The conference venue is the newly renovated main building of the Stockholm School of Economics, located in the center of Stockholm. More details about the conference, accommodation and the city can be found at the conference website. (www.hhs.se/IAEE-2011)

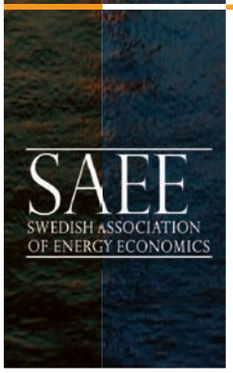
Stockholm in June is very pleasant. Temperatures are usually between 20° C and 25° C, and evenings are light (with sunset after 10 p.m.). The social program includes a Gala Dinner at the famous Wasa Museum and a reception at the Stockholm City Hall, the venue of the annual Nobel banquet. Post conference technical tours are offered free of charge (on a first come first serve basis).

On behalf of the organizing committee I would like to invite you to Stockholm and an exciting IAEE conference.

Lars Bergman
General Conference Chair

Sponsors:

Stockholm School of Economics
preem
bp
VATTENFALL
Energimyndigheten
SVENSKA KRAFTNÄT
Energimarknads inspektionen
Söderenergi
Research Institute of Industrial Economics www.ifn.se



SAEE
SWEDISH ASSOCIATION OF ENERGY ECONOMICS

Some key dates:

Early registration: Until April 18
Very late registration: After May 18

*Registration is online at **www.hhs.seliaee-2011**.*
See registration fees, in SEK, to the right.

	Before Apr18	***Apr18-May18***	***After May18***
Speakers/Chairs	*5000*	*5500*	*6000*
IAEE members	*6500*	*7000*	*7500*
Non-Members	*8000*	*8500*	*9000*
Students	*3000*	*3500*	*4000*
Accompanying persons	*3000*	*3500*	*4000*

Redefining the Energy Economy: Changing Roles of Industry, Government and Research

30th USAEE/IAEE NORTH AMERICAN CONFERENCE
OCT. 9-12, 2011
CAPITAL HILTON HOTEL
WASHINGTON, DC

CONFERENCE OVERVIEW

As we recover from the global recession and the disastrous Macondo deep water oil spill, concerns are once again mounting about energy supply, and especially the environmental and carbon implications of continued heavy reliance upon fossil fuels. Will increasing energy demands once again drive up energy prices? How should governments and firms react in terms of developing or facilitating new supplies and efficiencies? How should resources and alternative energy sources be developed, regulated, financed, traded? The clash of interests resounds starkly here in Washington, at the U.S. government's door, amid new legislation, evolving energy technologies, and continuing price uncertainties. Energy analysts, economists, financiers, developers, regulators, and students—each must revisit some basic assumptions about their roles, methodologies, research and planning focus, and the information they are using.

This conference will bring together in Washington key players in the North American energy sector to address these questions and many others in plenary sessions, concurrent sessions, and a unique student poster session. Those interested in organizing sessions should propose a topic and possible speakers to Wumi Iledare, Concurrent Session Chair (wumi@lsu.edu). This conference will also provide networking opportunities through workshops, public outreach and student recruitment.

HOSTED BY

NCAC
U.S. Association for Energy Economics
National Capital Area Chapter

WITH SUPPORT FROM

USAEE
United States Association for Energy Economics

IAEE International Association for Energy Economics
www.iaee.org

CAEE

AMEE

Conventional and Unconventional Gas and Oil Supplies

- Exploration and Drilling Cost Concerns
- Changing World Oil Supply/Demand Balance
- Protection of Offshore Resources Versus Oil Supplies

Markets and Drivers of Renewable Energy

- Government's Promotional Role
- Integration of Solar and Wind Generation In Power Dispatch
- Capital Markets – Financing Renewables

Energy Efficiency – Defining and Meeting Realistic Goals

- Building Controls and Cost Allocation
- Update on FNMA Rules
- Tightening Standards
- The Minimal Energy Society – Danish Model
- Sudden Acceleration of U.S. Automobile Efficiency Standards

Economic Analysis Methods and Assumptions

- Energy Data Sources
- EIA Reliability Amid Shale Gas Data Difficulties
- IEA Relevance After China Fiasco
- Private Surveys

Rising Role of Government

- Issues in Energy Regulation and Uncertainties
- Energy Trading under Dodd-Frank
- Exchange Trading Efficiencies
- Over-the-Counter Creativity

Changing Geography of Energy Demand

- Atlantic Energy
- Russian Oil and Gas Investment
- Unconventional Energy Revolution – North America, Europe, China

Offshore in Crisis

- Drilling Expansion vs. Constriction
- Rising U.S. Oil Importation
- Macondo = Canadian Oil Sands Bonanza?

Global Warming Legislation Languishing

Natural Gas – Bridge Fuel to More Natural Gas?

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

Global Petroleum Security and Pricing

- OPEC Policies in a Changing World
- Increased U.S. Oil Importation After Macondo
- Oil Supply Crisis Looming?
- Strategic Oil Storage Policies

Electricity

- Coal Power Plant Trade-Offs
- Wind and Solar Market Penetration Issues
- Natural Gas and Wind Generation – Competition or Integration?
- Market Efficiency and Design
- Electricity pricing, fuel pricing and policy

Energy Capital Investment and Allocation

- Wind
- Solar
- Nuclear
- Infrastructure

Global Economic Meltdown and Energy Demand

- Energy Demand Expansion in New Industrial Asia and South America
- China's Energy Policy

Energy Infrastructure

- Capital Investment Requirements
- Costs of Capital
- Pipeline and Transmission Line Financing, Regulatory and Right-of-Way Issues

Energy Technology and Innovation

- Supply Expansion
- Cost Reduction
- Demand and Efficiency

Issues in Moving Beyond Petroleum in Vehicles

- Jumping the Gun with Short-Range Electric Cars
- Who Will Kill the Electric Car This Time?
- Ethanol and Biodiesel

Energy and Wealth Distribution

Energy and Water Issues

30TH USAEE/IAEE NORTH AMERICAN CONFERENCE

CALL FOR PAPERS

We are pleased to announce the Call for Papers for the 30th USAEE/IAEE North American Conference to be held October 9-12, 2011 at the Capital Hilton Hotel, Washington, DC, USA. The deadline for receipt of abstracts is May 16, 2011.

Paper abstracts, giving a concise overview of the topic to be covered and the method of analysis, should be one to two pages. Abstracts should include the following brief sections: (1) overview, (2) methods, (3) results, (4) conclusions, and (5) references. Please visit www.usaee.org/USAEE2011/AbstractTemplate.doc to download an abstract template. NOTE: All abstracts must conform to the format structure outlined in the abstract template. At least one author of an accepted paper must pay the registration fees and attend the conference to present the paper. The corresponding author submitting the abstract must provide complete contact details—mailing address, phone, fax, e-mail, etc. Authors will be notified by July 7, 2011 of their paper status. Authors whose abstracts are accepted will have until September 1, 2011, to submit their full papers for publication in the conference proceedings. While multiple submissions by individuals or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each speaker is to present only one paper in the conference. No author should submit more than one abstract as its single author. If multiple submissions are accepted, then a different co-author will be required to pay the reduced registration fee and present each paper. Otherwise, authors will be contacted and asked to drop one or more paper(s) for presentation.

Abstracts should be submitted online by visiting www.usaee.org/USAEE2011/submissions.aspx
Abstracts submitted by email will not be processed. Please use the online abstract submission form.

STUDENTS

Students may submit an abstract for the concurrent sessions. The deadline for abstracts is May 16, 2011. Also, students may submit a paper for consideration in the Dennis J. O'Brien USAEE/IAEE Best Student Paper Award Competition (cash prizes plus waiver of conference registration fees). The paper submission has different requirements and a different deadline. The deadline for submitting a paper for the Student Paper Awards is July 6, 2011. Visit www.usaee.org/usaee2011/paperawards.html for full details.

Furthermore in addition to submitting a paper, student participation is also sought via the Poster Session; a highly interactive event in which students set up stall around a poster and present the key results of their recent academic work—naturally being relevant to the conference themes—in a quickly repeated series of short sessions including real time Q&A from the conference delegates. Abstracts for the Poster Session must be submitted by the deadline of May 16, 2011. Posters and the presentations will be judged by an academic panel and a single cash prize of $1000 will be awarded to the student with the best poster presentation. Students will be notified by July 7, 2011 of their poster status. Students whose abstracts are accepted will have until September 1, 2011, to submit their final poster electronically (pdf) for publication in the conference proceedings.

Posters for actual presentation at the conference must be brought by the student directly to the conference venue and must be in ANSI E size (34in. wide x 44in. high) in portrait format.

Students may also inquire about our scholarships covering conference registration fees.
Visit www.usaee.org/usaee2011/students.html for full details.

TRAVEL DOCUMENTS

All international delegates to the 30th USAEE/IAEE North American 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, contact USAEE with an email request to usaee@usaee.org. The Conference strongly suggests that you allow plenty of time for processing these documents.

VISIT OUR CONFERENCE WEBSITE AT: WWW.USAEE.ORG/USAEE2011/

6th AEEE Annual Conference, Spanish Association for Energy Economics

Barcelona, 20-21 January 2011

AEEE, the Spanish affiliate of the International Association for Energy Economics (IAEE) held its annual Conference in Barcelona in January 2011. It was the sixth edition of this event, that every year takes place in a different Spanish city (Madrid, Oviedo, Bilbao, Sevilla and Vigo previously hosted the Conference).

Almost ninety academics, researchers, students, regulators and energy professionals met at Casa Convalescència, a unique building of the Catalonian Modernism that has been used since 1930 as hospital laundry, pavilion for terminal illnesses and church. Nowadays, it is the headquarters of the Fundació Universitat Autònoma de Barcelona and accommodates different university activities.

Casa Convalescéncia

Professor Inés Macho chaired the Scientific Committee that prepared the program and selected the papers. On the other hand, Associate Professor Laura Fernández led the Organizing Committee responsible for the logistics of the Conference. Both Committees deserve our thanks for their efforts, as well as different institutions that provided financial support.

Richard Green (University of Birmingham) was the invited keynote speaker. His terrific presentation dealt with the current situation and reform of the British electricity pool. There were two other plenary sessions. On the one hand, a professional roundtable devoted to regulation and energy efficiency. On the other, a purely academic session covering two hot topics for energy economics research (smart grids and carbon leakage).

Tomás Gómez (U.P. Comillas) Presentation on Smart Electricity Distribution Grids

Twenty five papers were presented in the parallel sessions, with a specific discussant for each paper (the full program can be downloaded at http://www.aeee.es/en/activities.php). It is worth noting that the IAEE collaborated in the dissemination of the call-for-papers of the Conference and, therefore, a good number of researchers from outside Spain also attended the event. This growing international scope of a previously domestic meeting is highly welcomed. The 2011 Young AEEE Researcher award was for Carlos González-Pedraz, for his paper *How much should we pay for interconnecting electricity markets? A real options approach.* He received a certificate, a gift and the refund of registration fees.

Professor Andrea Bollino

Professor Andrea Bollino (IAEE Past-President) addressed the delegates at the closing session and asked researchers to participate in IAEE events and cooperate with colleagues from other affiliates, particularly from neighbouring countries in Southern Europe. Germá Bel (Universidad de Barcelona) and Gonzalo Sáenz de Miera (AEEE President) closed this rigorous but at the same time cosy congress.

The 2012 AEEE Annual Conference will be at Pamplona, a very nice town in the North of Spain, near the French border. The Universidad Pública de Navarra will host the event and Professor Pablo Arocena will be the Chairman of the Organizing Committee. We hope you can participate!

Enrique Loredo
AEEE Treasurer
eloredo@uniovi.es

National Security & Caspian Basin Hydrocarbons

By Bradley O'Neil, Robert C. Hawkins, and Cody L. Zilhaver*

Hydrocarbon reserves (natural gas and oil) from the Caspian Sea and its littoral states once controlled exclusively by the Union of Soviet Socialist Republics (USSR) and Iran now have considerable potential to affect U.S. national security. The U.S., working in concert with the European Union (EU), must utilize both hard and soft power to cultivate and leverage relationships within the Caspian Basin to ensure hydrocarbons flow unimpeded from the region in order to decrease Russian and Iranian ability to use these resources as foreign policy tools to coerce neighboring nations and destabilize the region. The U.S. must boost diplomatic efforts, encourage commercial energy investment, and increase joint-military engagements in Azerbaijan, Kazakhstan, Turkmenistan and Georgia to diminish Russia's regional monopoly of hydrocarbons while creating a wedge between Russian and Iranian energy cooperation to mitigate global natural gas domination.

Figure 1

Power Vacuum

The Caspian Sea is the largest land-locked body of salt water in Central Asia (roughly the size of Japan) and it carries strategic energy implications. See Figures 1 & 2. Since the collapse of the USSR (1991), western oil and natural gas companies poured into the region to exploit energy interests. However, Caspian Sea territorial disputes among all five littoral nations (Azerbaijan, Kazakhstan, Turkmenistan, Russia and Iran) inhibit development efforts. Before 1991, the USSR and Iran divided the Caspian Sea in accordance with governing agreements focusing on fishing rights and blocking foreign-military presence. Today, these agreements prove problematic because they do not accommodate the former Soviet Republics of Azerbaijan, Kazakhstan, and Turkmenistan that are now independent nations.[1]

Figure 2

Immediately following the USSR's collapse, Russia focused inward for survival while Kazakhstan and Azerbaijan focused outward insisting the Caspian Sea be divided based on a median line (Figure 3) where each state maintains a region proportional to its coastline length (Kazakhstan 29%, Azerbaijan 20%, Russia 16%, Turkmenistan 21%, and Iran 14%).[2] In contrast, in an attempt to capture more territory, Iran asserts any division should give each state an equal fifth (20 %) of the Caspian (Figure 4).[3] Ultimately, the littoral nations failed to reach a collective agreement.

With no existing multilateral/international territorial concurrence, Russia

* Bradley O'Neil is a Lieutenant Colonel, U.S. Air Force; Robert C. Hawkins is a Major, U.S. Marine Corps; and Cody L. Zilhaver is a Major, U.S. Army. This paper was submitted to the Faculty of the Joint and Combined Warfighting School in partial satisfaction of the requirements for Joint Professional Military Education Phase II. The contents of this paper reflect the authors' views and are not necessarily endorsed by the Joint Forces Staff College or the Department of Defense.

See footnotes at end of text.

signed bilateral agreements along the median lines with Azerbaijan and Kazakhstan in 2002.[4] These individual agreements entitled each country to exercise sovereignty using the median line for seabed borders and common ownership on the sea surface.[5] All Caspian littoral states desire to resolve the dispute except for Iran which stands to lose six percent of the Caspian Sea if they agree to the median line division.[6] Russia's median line advocacy is in sharp contrast to the monopolistic principles of the former USSR. Russia realizes the economic benefit from relations with the Caspian states is achieved through its vast pipeline network instead of forcing imperialistic influence.[7]

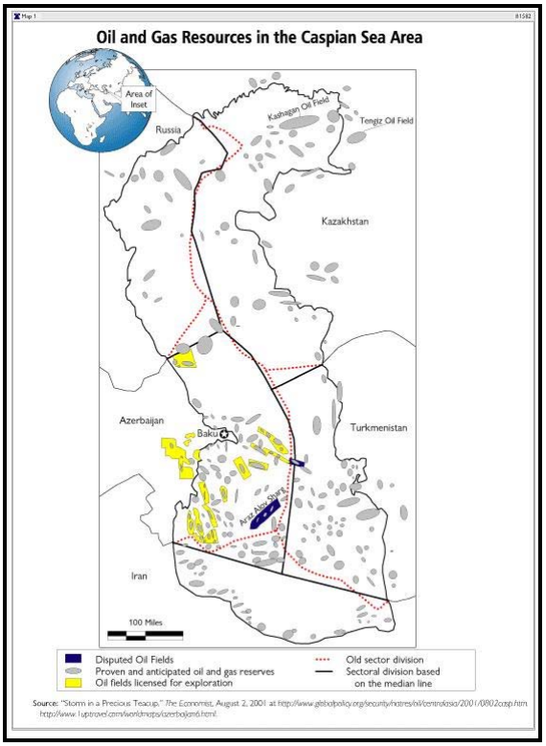


Figure 3[8]

Proposed Divisions of the Caspian Sea

In spite of potential for economic prosperity, border disagreements continue into the 21st century. The first Summit of Caspian Sea Heads of State, held in 2002, failed to achieve anything significant on the sea demarcation or legal status and ended without a final declaration. The littoral nations held a second Summit in 2007 with little progress, except declaring only Caspian countries can deploy military forces in the sea and not allow foreign countries to use their nations as military staging bases against any other littoral state.[10] In November 2010 Azerbaijan hosted the third summit of the Caspian littoral states. Leaders of Russia, Azerbaijan, Iran, Kazakhstan, and Turkmenistan met in Baku and discussed the legal status of the Caspian Sea. No major breakthrough on this issue was achieved. Iran continued to push its own policy. The Iranians maintain the resources of the Caspian not be divided according to the amount of coastland each of state has on the Caspian, but on an equal 20 percent of the Caspian for each nation. In the meantime, regional pipeline politics that distribute the vital hydrocarbons are center stage.

Russia continues to control an elaborate pipeline network created during the Soviet era flowing Azeri, Kazak, and Turkmen hydrocarbons straight to Russia in a south–north direction allowing Russia to control distribution.[11] However, in 2005 construction was completed on the $3.7 billion 1,000 mile east-west Baku-Tbilisi-Ceyhan (BTC) pipeline stretching from Baku, Azerbaijan to Ceyhan, Turkey via Tbilisi, Georgia. The BTC opened access to Central Asian hydrocarbons outside of Russian and Iranian influence, while attempting to traverse the most politically and geographically acceptable areas.

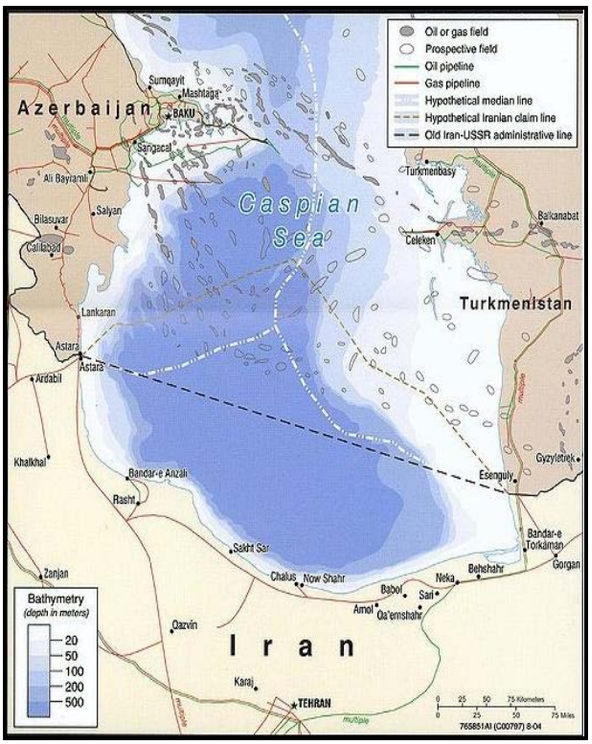


Figure 4[9]

The monumental cost and political maneuvering required in establishing the BTC makes pursuit of similar ventures possible, but problematic. The Trans-Caspian gas pipeline project between Azerbaijan and Turkmenistan manifests more recent frustration of the distribution problem. The proposed natural gas pipeline would run under the Caspian Sea from Turkmenistan to Azerbaijan and send hydrocarbons straight to Europe. The 1,200 mile pipeline stalled due to the failure of Azeri and Turkmen negotiators to agree on a demarcation of their Caspian Sea border.[12] Moreover, Russia is impeding western pipeline initiatives; therefore, investors will not begin construction.[13]

What's at Stake

Proven Caspian Basin hydrocarbon reserves are under developed and investors remain optimistic that significant potential reserves remain undiscovered.[14] Although, the region produces only 2% of today's world oil production, the U.S. Department of Energy (DoE) and Energy Information Administration (EIA) estimate Caspian oil is nearly 15% of total world reserves. Likewise, natural gas production is only three percent of world output, but

these same sources estimate the actual level closer to six percent.[15] However, locating and extracting the natural resources is only the first challenge. Caspian nations are land-locked inside Central Asia. Therefore, companies must transport hydrocarbons through lengthy pipelines transiting unstable neighboring nations before reaching the marketplace. Regional conflicts like the ongoing Armenia-Azerbaijan dispute and the 2008 Russian incursion into Georgia have occurred perilously close to pipelines that snake their way through Central Asia.

In spite of these concerns, the emergence of Caspian hydrocarbons is critically important. They hedge against supply disruptions from other tenuous regions around the world such as the Arabian Gulf, West Africa, and South America and have offset potential price increases during an expected period of rapidly growing demand. Just as important, profits will stimulate economic growth that enhances Central Asia's stability. [16]

Disjointed U.S. Policy

Current U.S. foreign energy policy in the Caspian is in stark contrast to the past strategies under the Clinton and Bush administrations. In the wake of the USSR's dissolution, President Clinton made a concerted effort to secure approval for the BTC pipeline. Likewise, prior to 9/11, George W. Bush's top foreign policy priority was to increase the flow of petroleum from foreign suppliers to U.S. markets.[17] President Bush encouraged commercial investment to increase extraction and distribution capacity including new pipelines sending oil and gas west under the Caspian Sea from Kazakhstan and Turkmenistan to Azerbaijan and thereby joining with the existing BTC pipeline system.

Conversely, the Obama administration is taking a laissez-faire approach to Caspian Basin hydrocarbon extraction and distribution. According to Richard Morningstar, the U.S. Secretary of State's special envoy for Eurasian energy, "we're [U.S.] trying to depoliticize pipelines and only asking that countries make their own decisions in how to produce and distribute resources in the region, rather than having to submit to the control of Russia as the dominant supplier of Europe's natural gas."[18] This liberal U.S. policy approach contributed to Pakistan and Iran agreeing in March 2010 to build a pipeline bringing natural gas to Pakistan. The vast natural gas markets in Pakistan and beyond have potential to enrich a regime with nuclear ambitions and further Iran's influence over a tenuous U.S. partner for the war on terror.[19] Unlike Clinton's administration who oversaw the BTC pipeline, Obama's special envoy for Eurasian energy Richard Morningstar failed to sufficiently influence a proposed pipeline to Pakistan from Turkmenistan that would have met Pakistan's requirements and forced Iran from the marketplace.

Regional Powerhouses

While U.S. energy policy ebbs and flows, Iran and Russia take the nexus of energy and foreign policy very seriously. Iran is a founding member of the Organization of the Petroleum Exporting Counties (OPEC) and the Iranian Energy Minister serves as chairman of the state operated National Iranian Oil Company. Iran controls the third largest oil and the second largest natural gas reserves in the world.[20] Until June 2010, Iran imported Caspian oil, refined it and exported an equivalent amount of Iranian oil from its Southern seaports. This oil swap arrangement provided Iran with opportunities to position itself as a player in the Caspian energy market, but they were forced to cease this practice due to United Nations (UN) and U.S. economic sanctions.[21] However, Iran is working to consolidate its territorial claims in the Caspian Sea for its own hydrocarbon extraction while they build an $8 billion pipeline to deliver natural gas east to markets in Pakistan.

While Iran positions itself to circumvent sanctions and Caspian Sea boundary disputes, Russia's strategy and influence is well established. Russian President Dmitry Medvedev "underscored the power of Gazprom, the $345 billion gas export monopoly he previously chaired. Once a Soviet ministry, Gazprom is the world's largest gas company, accounting for 20% of global supply. It pumps a quarter of Europe's gas, has diversified into oil, power and banking, and controls TV, radio and newspaper interests."[22]

Like the mythical phoenix, Russia uses hydrocarbon exports to fuel its reincarnation from the ashes of the USSR. Russia controls the largest natural gas and the eighth largest oil reserves on earth.[23] It is also the world's largest exporter of natural gas and the second largest oil exporter.[24] Russia's objective regarding Caspian hydrocarbons appears focused on commercial control and limiting competition. In fact, Gazprom boldly states on their webpage "we are keen to use the huge gas resources of Central Asia to optimize its gas supply for export."[25] Russia has significant inroads to the Caspian with its common history to the former Soviet countries and existing infrastructure.

Near and Present Danger

In recent years, Russia developed a strong track record using energy as a foreign policy tool that arguably presents a U.S. national security risk. While commanding USEUCOM, General Craddock expressed concerns about Russia's intent during Congressional testimony stating, "Russia has a desire to influence its neighbors and the international energy market".[26] This intent was demonstrated clearly in January 2006 when Gazprom cut Ukraine's natural gas supply in mid-winter after the fledgling Central Asian nation refused to pay a five-fold price hike.[27]

Critics may argue that Russia already controlled Caspian hydrocarbons during the Soviet era and the U.S. didn't consider this possession a significant threat; therefore no significant threat exists today. In rebuttal, the major difference is the USSR didn't export a significant amount of oil and natural gas to western markets. Western Europe only purchased three percent of their oil and two percent of their natural gas from the USSR in 1989.[28] Today, exports are significantly higher. Many EU nations are highly reliant on Russian hydrocarbons. Nearly 50% of EU members and 75% of candidate countries purchase a fifth and as much as 100% of their natural gas requirements from Russia.[29] When it comes to oil, many of these same EU nations purchase 90% or more of their hydrocarbon requirements from Russia including Poland, Slovakia, Lithuania, and Hungry.[30] [31] Russia created significant inroads supplying energy to the EU in the years since the USSR breakdown. In fact, 26 of 27 EU nations depend on external sources for energy and Russia is meeting their demand providing 33% and 40% of their oil and natural gas requirements, respectively (Table 1).[32]

	EU Member	Foreign Energy Dependency		EU Member	Foreign Energy Dependency
1	Cyprus	100%	15	Germany	61%
2	Malta	100%	16	Finland	54%
3	Luxembourg	98%	17	Slovenia	52%
4	Ireland	90%	18	France	51%
5	Italy	86%	19	Bulgaria	46%
6	Portugal	83%	20	Netherlands	38%
7	Spain	81%	21	Sweden	37%
8	Belgium	77%	22	Estonia	33%
9	Austria	72%	23	Romania	29%
10	Greece	71%	24	Czech Republic	28%
11	Latvia	65%	25	United Kingdom	21%
12	Lithuania 64%		26	Poland	19%
13	Slovakia	64%	27	Denmark	0%
14	Hungary	62%			

Table 1

In spite of Russia's significant leverage, the U.S. and EU must prevent energy cooperation and infrastructural development between Russia and Iran. If Russia and Iran collude to add the Caspian hydrocarbons to their own reserves, collectively they would control nearly 20% of the world's oil and over 55% of the world's natural gas.[33] We are already seeing the beginning stages of this collusion unfold. Gazprom recently signed an agreement with the National Iranian Oil Company to "develop oil and natural gas fields, build processing facilities and transport oil from the Caspian Sea to the Gulf."[34]

Increased Diplomacy

The U.S. and EU require a long-term integrated Central Asian energy strategy. This integration must include diplomatic, information, military, and economic engines of power. First, diplomatic efforts should focus on resolving ongoing maritime territorial disputes. Second, the U.S. should strengthen bilateral ties with each Caspian Basin nation and Georgia to build commercial and security partnerships. Third, USEUCOM and USCENTCOM should leverage embedded interagency and multinational partners to focus on economic development and security cooperation with Central Asian states.

Due to perceived national security implications from Russia and Iran, gaining approval on expanding a western backed pipeline further east into Central Asia will be a tough nut to crack. Furthermore, the current maritime partition of the Caspian Sea is tied to obsolete treaties ratified by the USSR that present a huge obstacle to western energy exploration and extraction.[35] Russia, Azerbaijan, Turkmenistan and Kazakhstan agree on the median line division of the Caspian Sea while Iran favors an equal 20% division.[36] Therefore, the lone holdout is Iran. The U.S. must work unilaterally, or through an intermediary to convince Iran to accept the median line.

The U.S. ceased diplomatic relations with Iran in 1980 and in 1981 Switzerland assumed representation of U.S. interests in Tehran.[37] In the ensuing years, Iran continues to be targeted with U.S. and UN sanctions that support a containment policy. The U.S. has pushed Iran into a diplomatic corner for 30 years with limited results. It is now time to show Iran an escape door. The U.S. and EU must demonstrate to Iran the benefits of U.S. diplomatic relations. If Iran agreed to settle the Caspian Sea borders along the median line the U.S. and Iran can establish diplomatic ties. The newly established diplomatic

ties would serve as a conduit where the U.S. and EU can entice instead of force Iran to comply with UN Security Council resolutions.

President Obama opened a window of opportunity in the National Security Strategy stating "…the U.S. seeks a future in which Iran enjoys the political and economic opportunities that its people deserve."[38] Westernization in Iran is not unprecedented. In 1953, Iran restored diplomatic relations with Britain as a hedge against Soviet influence. A lucrative oil agreement was completed the following year.[39] The westernization eventually became known as the White Revolution. In 1961, President Kennedy propelled the Iranian White Revolution by pushing a series of economic, social, and administrative reforms. These initiatives contributed to unprecedented economic growth fueled by Iran's vast petroleum reserves.[40]

Direct negotiations with either Russia or Iran are not the only options. The U.S. and EU must attempt to strengthen the comparative position of the smaller countries by strengthening the diplomatic foundation of the Azeri, Kazak, and Turkmen governments in relation to Russia and Iran. There are recent successful examples of this type of strategy. After Azerbaijan, Georgia, and Turkey agreed to construct the BTC pipeline, Russia applied tremendous diplomatic pressure to scuttle the project.[41] In 2005, according to Mr. Vuqar Mirsadig (The Caspian Shipping Company), Russia made overt attempts to delay construction by impounding ships carrying pipeline construction equipment at the passage from the Volga-Don channel to the Caspian Sea.[42] However, the U.S. and EU skillfully employed diplomacy while simultaneously encouraging private sector investment in support of the project. According to Global Insight, "[the] BTC would never have become reality without strong political support from the U.S.."[43]

The U.S. and EU can also make a more concerted effort at garnering support in the international community for the Trans-Caspian gas and oil pipeline initiatives. For example, Turkmenistan recently dispatched officials to the UN to participate in creating "an ad-hoc panel of experts that would draft an agreement on international pipeline security".[44] Although the agreement is primarily focused on areas in which security is non existent, Turkmenistan's intent is "…to enlist the help of the UN secretariat and other UN member states to withstand Russia's pressure on energy corridors in its sphere of influence".[45] The U.S. and EU should pressure Russia to comply with this agreement while following Turkmenistan's lead in enlisting the international community to resolve the dispute.

Commercial Investment

If the Caspian territorial dispute can be resolved, the next logical step is to construct Trans-Caspian oil and gas pipelines connecting hydrocarbon fields on the Caspian east coast with Baku, Azerbaijan on the west coast. Kazakhstan controls one of the largest oil reserves in the world. From Kazakhstan, "(t)he pipeline would transport oil from the offshore Kashagan field, … where it would connect to the BTC oil pipeline."[46] (fig 2) The only current option for transporting Kazak oil to the west coast of the Caspian is via surface vessels which don't have the capacity to make them a viable alternative to Russian oil pipelines. The requirement for oil and gas pipelines beneath the Caspian Sea will become readily apparent in the future as the full potential of Kazak oil supplies are realized. Estimates are, "…within 20 years Kazakhstan could potentially become the largest oil producing nation outside of the Middle East."[47] This creates a continuous link from Central Asia to the southern coast of Turkey and opens up one of the largest known oil reserves to western markets unfettered by Russia and Iran.

Large natural gas reserves in Turkmenistan provide another opportunity to expand corporate investment in pipeline infrastructure. According to the Center for Energy Economics (CEE), Turkmenistan is unable to monetize a large portion of its gas reserves, currently 5th largest in the world, because Russian and Iranian pipelines offer access to limited markets.[48] Plans began in 1999 for a Trans-Caspian natural gas pipeline from Turkmenistan to Baku. This pipeline would connect to existing pipelines in Azerbaijan and Georgia then end in southern Turkey.[49] USEUCOM must leverage effective strategic communications to underscore the benefits associated with this pipeline endeavor to court world opinion. An area to highlight is the lucrative economic development created from underwater pipeline projects across the Caspian Sea. For example, transit countries (Azerbaijan, Georgia, and Turkey) and the exporter (Turkmenistan) will receive huge revenues from a Trans-Caspian natural gas pipeline. Azerbaijan, Georgia, and Turkey will enjoy positive returns along with an increasingly diversified energy portfolio of supplies which will enable the countries to attain greater economic independence. Turkmenistan will enjoy a positive net present value of $80 million per year due to reduced transport expenses.[50] The influx of revenue will increase stability in a region that has been fraught with economic and political uncertainty since the fall of the USSR.

Security Cooperation

USEUCOM and USCENTCOM can directly influence and facilitate U.S. energy policy operationally and strategically. Better economic and security ties along with an effective security cooperation strategy complimenting other aspects of the Whole of Government approach can synchronize and transmit U.S. intentions or mask them. In order to be effective, EUCOMs military to military engagement must balance an effective country engagement with the geo-political consequences associated with the region. Since 2001, the U.S. provided support to the Caspian Guard which is described as "…an initiative which established an integrated airspace, maritime and border control regime for the nations of Azerbaijan and Kazakhstan." [51] USCENTCOM should leverage this program by encouraging Turkmenistan to join the Caspian Guard thereby enhancing capacity for regional security. Turkmenistan's geo-strategic location makes it a prime partner for security cooperation. The country is located east of Azerbaijan; shares its northern border with Kazakhstan and southern border with Iran and Afghanistan. This places the country astride a natural east west transit corridor between Europe and Asia. Consequently, the benefits of increasing Turkmenistan's maritime security capacity are huge as it would increase interoperability with other littoral countries while improving the country's ability to fend off trans-national threats. Increasing the competence and capabilities of indigenous security forces creates stability. Consequently, private sector investment follows thereby increasing economic development.

USEUCOM & USCENTCOM should increase Azeri, Kazak, and Turkmen security capacity improvement through Foreign Military Sales (FMS) programs that provide modern military equipment to foreign nations. In 2002, the U.S. sold three Coast Guard Cutters to Azerbaijan for use in support of the Caspian Guard initiative.[52] Combatant commands must expand FMS programs to put an indigenous face on security initiatives while belaying Russian and Iranian concerns in regards to foreign militarization of the Caspian Sea.

Conclusion

U.S. and EU influence in Central Asia is paramount to the economic and security strategies of both entities. The known and potential Caspian Basin hydrocarbon reserves are significant. Russian and to a lesser extent Iran continue to dominate the control and distribution of these resources. As a result, Russia and Iran have been able to forward their economic agendas at the expense of the Central Asian countries. The U.S. and EU offer a viable pipeline alternative that allow Central Asian countries to retain greater proceeds from hydrocarbon extraction.

The difficulty lies in encouraging Iran to cooperate with a viable division of the Caspian and Russia agreeing to the construction of sub-surface pipelines under the Caspian Sea. In order to achieve these objectives, the U.S. and EU must skillfully balance hard and soft power to dissuade Russia and Iran while gaining the support of the international community. The U.S. must remain vigilant against an obstinate Iran. However, possible diplomatic overtures with Iran could pave the way for a Caspian Sea boundary agreement. At the very least, if rebuffed by the Iranians, the U.S. and EU can attain international legitimacy that may pave the way to resolve the Caspian Sea border dispute and facilitate pipeline construction without acquiescence from Iran.

Footnotes

1 Paul Kubicek, "Russian Energy Policy in the Caspian," World Affairs Vol. 166, No 4 (Spring 2004): 214.

2 Khoshbakht B. Yusifzade, "The Status of the Caspian Sea: Dividing Natural Resources Between Five Countries," Azerbaijan International 8.3, (Autumn 2000), 93.

3 Jim Nichol, "Disputed Drilling Rights in the Caspian Sea," The Belarus Virtual Library (SEP 2007): 4, http://library.by/portalus/modules/english_russia/referat_readme.php?subaction= howfull&id=1188915293 &archive=&start_from=&ucat=14&category=14 (accessed November 2, 2010).

4 Paul Kubicek, "Russian Energy Policy in the Caspian," World Affairs Vol. 166, No 4 (Spring 2004): 214.

5 Iu Merzliakov, "Legal Status of the Caspian." International Affairs, A Russian Journal (March 1999): 2.

6 Sander Hansen, "Pipeline Politics: The Struggle for Control of the Eurasian Energy Resources." Centre international d'études pédagogiques 02/2003, (APR 2003): 32-33.

7 Thomas Waelde, "International Good Governance and Civilized Conduct among the States of the Caspian Region: Oil & Gas as Lever for Prosperity or Conflict" Centre for Energy, Petroleum and Mineral Law and Policy Vol 4-16 (2000): 4.

8 Dr. Ariel Cohen, "Iran's Claims Over Caspian Sea Resources Threaten Energy Security," The Heritage Foundation Backgrounder, No 1582 (September 4, 2002): 1.

9 Wikipedia Online: The Free Encyclopedia. s.v. "Southern Caspian Energy Prospects portion of Iran Country Profile 2004, http://en.wikipedia.org/wiki/File:Iran_southern_caspian_energy_prospects_2004.jpg (accessed November 5, 2010).

10 Dr. Sohbet Karbuz, "The Caspian's Unsettled Legal Framework: Energy Security Implications," Journal of Energy Security, http://www.ensec.org/index.php?option=com_content&view=article&id=244:the-caspians-unsettled-legal-framework-energy-security-implications&catid=106:energysecuritycontent0510&Itemid=361 (accessed October 4, 2010).

11 James Jensen, "Market changes vex Russian gas policies," Oil & Gas Journal (August 2, 2010): 24.

12 Jasper Mortimer, "Reducing Natural Gas Dependence on Russia," Pipeline and Gas Journal (FEB 2009): 45.

13 Zeyno, Baran, "EU Energy Security: Time to End Russian Leverage." The Washington

Quarterly, (5 JAN 2010): 131.

14 Bernard A. Gelb, "Caspian Oil and Gas: Production and Prospects," Congressional Research Service Report for Congress, September 8, 2006, http://italy.usembassy.gov/pdf/other/RS21190.pdf (accessed October 13, 2010).

15 Ibid.

16 Richard Sokolsky and Tanya Charlick-Paley, NATO and Caspian Security: A Bridge Too Far? (Santa Monica: Rand Corporation , 1999), 69.

17 Michael T. Klare, "Bush Cheney Energy Strategy: Implications for U.S. and Foreign and Military Policy," paper presented at the Second Annual Meeting of the Association for Study of Peak Oil Paris, France, May 26-27, 2003, http://www.informationclearinghouse.info/article4458.htm (accessed October 15, 2010).

18 Erin Inman, "Morningstar makes case for Eurasian energy stance," The Stanford Daily, 19 April 2010, http://www.stanforddaily.com/2010/04/19/morningstar-makes-case-for-eurasian-energy-stance (accessed October 13, 2010).

19 Alexandros Petersen, "Energy geopolitics deserves center stage; For U.S. and EU, energy security is tantamount to national security," The Washington Times, February 23, 2010.

20 U.S. Energy Information Administration, "Iran Analysis Brief, January 2010," http://www.eia.doe.gov/cabs /Iran/Oil.html (accessed October 30, 2010).

21 Ebrahim Gilani, "Clouds on Iran's Caspian Horizon," PBS Frontline, October 3, 2010, http://www.pbs.org/wgbh/ pages /frontline/tehranbureau/2010/10/clouds-on-irans-caspian-horizon.html (accessed October 15, 2010).

22 Douglas Busvine, "Medvedev candidacy reinforces Gazprom's clout," Reuters UK (December 10, 2007), http://uk.reuters.com/article/oilRpt/idUKL1029936320071210?sp=true (accessed October 6, 2010).

23 U.S. Energy Information Administration, "Russia Analysis Brief, January 2010," http://www.eia.doe.gov/cabs /russia/ NaturalGas.html (accessed October 30, 2010).

24 United States Energy Information Administration, "Russian Analysis Brief, May 2008." http://www.eia.doe.gov/ cabs/Russia/Background.html (accessed October 15, 2010).

25 International Energy Agency Working Paper Series, "Perspectives on Caspian Oil and Gas Development, December 2008." http://www.iea.org/papers/2008/caspian_perspectives.pdf (accessed October 15, 2010).

26 U.S. European Command, "Statement of General Bantz J. Craddock, USA. Commander, United States European Command Before the House Armed Services Committee on 13 March 2008," United States European Command. http://www.eucom.mil/english/Command/Posture/posture.asp (accessed September 21, 2008).

27 Fred Weir, "Russia-Ukraine Gas Standoff," the Christian Science Monitor, January 3, 2006. http://www.csmonitor.com/2006/0103/p01s04-woeu.html (accessed October 6, 2010).

28 Library of Congress, "Federal Research Division Country Studies Series: Soviet Union," May 1989. http://www.country-data.com/cgi-bin/query/r-12796.html (accessed November 7, 2010).

29 United States Energy Information Administration, "Russian Analysis Brief, May 2008," http://www.eia.doe.gov/ cabs/Russia/Background.html (accessed October 30, 2010).

30 Deutsche Welle. "Analysis: Europe Hopes to Reduce Russian Energy Dependency," http://www.dw-world.de/dw/article/0,2144,3616128,00.html (accessed October 6, 2010).

31 European Commission on Energy, "Hungary Energy Mix Fact Sheet," http://ec.europa.eu/energy /energy_policy/doc/factsheets/mix/mix_hu_en.pdf (accessed October 30, 2010).

32 Europe's Energy Portal, "Energy Dependency Chart," http://www.energy.eu/ (accessed October 30, 2010).

33 Institute for Research, "Middle Eastern Policy Natural Gas Reserves," http://www.irmep.org/datafile.htm (accessed October 22, 2010).

34 International Energy Agency Working Paper Series, "Perspectives on Caspian Oil and Gas Development, December 2008," http://www.iea.org/papers/2008/caspian_perspectives.pdf (accessed October 15, 2010).

35 Dr. Sohbet Karbuz, "The Caspian's Unsettled Legal Framework: Energy Security Implications," Journal of Energy Security, http://www.ensec.org/index.php?option=com_content&view=article&id=244:the-caspians-unsettled-legal-framework-energy-security-implications&catid=106:energysecuritycontent0510&Itemid=361 (accessed October 6, 2010).

36 Energy Delta Institute, "Caspian border dispute poses Europe gas supply questions, July 27, 2009," http://www.energydelta.org/en/mainmenu/edi-intelligence/latest-energy-news/caspian-border-dispute-poses-europe-gas-supply-questions (accessed October 30, 2010).

37 U.S. Department of State, "Background Note: Iran," http://www.state.gov/r/pa/ei/bgn/5314.htm (accessed October 30, 2010).

38 Barrack Obama, "National Security Strategy of the United States, May 2010" http://www.whitehouse.gov/ sites/default/files/rss_viewer/national_security_strategy.pdf (accessed October 30, 2010). 26

39 Iran Chamber Society, "History of Iran White Revolution: The post-Mosaddeq era and the Shah's White Revolution," http://www.iranchamber.com/history/white_revolution/white_revolution.php (accessed October 30, 2010).

40 U.S. Department of State, "Background Note: Iran," http://www.state.gov/r/pa/ei/bgn/5314.htm (accessed October 30, 2010).

41 Jan H. Kalicki, "High stakes hinge on Russia's energy choices," http://www.lexisnexis.com/hottopics/lnacademic/? (accessed October 30, 2010).

42 BBC Worldwide monitoring, "Russia impounds Azeri ships with BP equipment, May 1 2005," http://www.lexisnexis.com/hottopics/lnacademic/? (accessed October 12, 2010).

43HIS Global Insight, "Littoral States Again Fail to Reach Deal on Caspian Sea Legal Status and Ownership of Natural Resources," http://www.ihsglobalinsight.com/SDA/SDADetail10832.htm (accessed October 30, 2010).

44 Catherine A. Fitzpatrick, "EU Seeks to Broker Trans-Caspian Pipeline Deal Between Turkmenistan and Azerbaijan; Russia Finds Project 'Absurd'," http://www.eurasianet.org/node/61716 (accessed October 12, 2010).

45 Ibid.

46Pipeline and Gas Journal, "Trans-Caspian Oil Pipeline Moves Closer, July 2009," http://pipelineandgasjournal.com/trans-caspian-oil-pipeline-moves-closer (accessed October 13, 2010).

47 Global Secuirty.Org, "Caspian Guard," http://www.globalsecurity.org/military/ops/caspian-guard.htm (accessed October 13, 2010).

48 Center for Energy Economics, The University of Texas at Austin, "Trans-Caspian Gas Pipeline Case Study," http://www.beg.utexas.edu/energyecon/new-era/case_studies/Trans-Caspian_Gas_Pipeline.pdf (accessed October 13, 2010).

49 Ibid.

50 Ibid.

51 Global Secuirty.Org, "Caspian Guard," http://www.globalsecurity.org/military/ops/caspian-guard.htm (accessed October 13, 2010).

52 Ibid.

IAEE INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
WWW.IAEE.ORG

CALL FOR PAPERS

Economics of Energy & Environmental Policy

Economics of Energy & Environmental Policy (EEEP), published by the International Association for Energy Economics (IAEE), focuses on policy issues involving energy and environmental economics. EEEP is a peer-reviewed, multidisciplinary publication that provides a scholarly and research-based, yet easily readable and accessible source of information on contemporary economic thinking and analysis of energy and environmental policy issues. The publication encourages dialogue between business, government and academics and improves the knowledge base for energy and environmental policy formation and decision-making. EEEP produces original papers, policy notes, organized symposia on specific policy issues, feature articles, book reviews and commentaries on current energy and environmental policy issues and studies. The editors are Jean-Michel Glachant (European University Institute in Florence, Italy), Paul L. Joskow (Alfred P. Sloan Foundation, USA) and Michael Pollitt (Cambridge University, United Kingdom).

Article Preparation

Economics of Energy & Environmental Policy is a peer-reviewed, double-blind, multidisciplinary international publication. Articles must be high-quality, original papers (never published before) that will contribute to furthering the knowledge base of energy and environmental policy matters.

Please refer to the Article Submission Instructions for detailed guidelines on how to submit articles for publication consideration. The referee and author feedback process is quick, showcasing how timely policy matters and research converge to publication.

Additional Information

- EEEP Aims and Scope
- Article Submission Guidelines
- Become a Referee
- Become a Reviewer
- EEEP Call for Papers (pdf)
- Library Subscription Form
- IAEE Membership

Questions/Comments?

Contact either:

Sophia Ruester, EEEP Managing Editor
Sophia.Ruester@iaee.org

David Williams, IAEE Executive Director
iaee@iaee.org

Are You a Member?

Would you like to receive *Economics of Energy & Environmental Policy*? EEEP is available complimentary with membership in the International Association for Energy Economics. To join IAEE visit http://www.iaee.org/en/membership/index.aspx

Economics of Energy & Environmental Policy is a peer-reviewed, inter-disciplinary international publication published twice per year by the International Association for Energy Economics under the guidance of a distinguished editorial board. The inaugural issue will be published both electronically and in hard copy and sent to all IAEE members on record in January 2012. Regular issues will be published in March and September of each year. EEEP is available on a subscription fee basis for business/academic library use. Contact IAEE at iaee@iaee.org for multiple use subscription fees. EEEP carries advertisements.

Subjects Covered

- Objectives and instruments in climate policy
- Energy market design
- Infrastructure regulation and regulatory policy
- Competition policy
- Emission trading
- Policy of international negotiations and agreements on environmental issues
- Energy, environment and developing countries
- Institutions for policy formation and enforcement
- Sustainability of energy systems
- Energy systems in city planning
- Demand response tools
- Energy security
- Renewable energy policy
- Technology and innovation policy
- Energy efficiency policy
- Natural resources policy for energy extractive industries
- Transportation policy
- Taxation and financial policy issues
- Private-public partnership in energy industries

China's Oil "Adventure" into Venezuela

By Mamdouh G. Salameh*

Introduction

Venezuela is one of the world's largest exporters of crude oil and the largest in the Western Hemisphere. In 2009, the country was the eighth-largest net oil exporter in the world with exports of 1.83 million barrels a day (mbd). The oil sector is of central importance to the Venezuelan economy: it accounts for more than three-quarters of total Venezuelan export revenues, about half of total government revenues, and around one-third of total gross domestic product (GDP). As a founding member of the Organization of Petroleum Exporting Countries (OPEC), Venezuela is an important player in the global oil market.[1]

However, Venezuela's oil industry, hampered by years of mismanagement and shortage of highly trained cadre of engineers and technical staff, is a mess.[2] Even allowing for OPEC's production cuts, Venezuela is currently producing less than 60% of its production potential.[3] Moreover, its refineries are inadequate and long-term plans for expanding production capacity may have to be scaled back because of lack of investments.

Reserves

According to the *Oil & Gas Journal* (OGJ), Venezuela had 99.4 billion barrels (bb) of oil reserves in 2010, the sixth-largest in the world and the largest in South America.

In January 2010, the United States Geological Survey (USGS) estimated that there may be more than 513 bb of extra-heavy crude oil and bitumen deposits and 135 trillion cubic feet of natural gas in Venezuela's Orinoco belt region. That is twice the proven reserves of Saudi Arabia.

Venezuela is pressing forward with plans to become the world's leader in crude reserves. It has been making an enormous energy power play lately, certifying massive oil deposits in the country's Orinoco Belt and increasing ventures with foreign nations particularly China. In 2008, Venezuela announced that it had already certified 50 bb of new reserves.

If all goes according to plan, Venezuela will overtake Saudi Arabia in proven reserves to become the most oil-rich country in the world. President Chavez said recently in a statement that "Venezuela hopes to end 2010 with the incorporation of another 105 bb of proven reserves. With this achievement, Venezuela would become the country with the biggest proven reserves (316 bb) on the planet".[4]

Experts, however, note that Venezuela will struggle to develop its extra-heavy oil reserves in a timely fashion given its lack of infrastructure investment and the ongoing nationalizations. Oil industry experts suggest that Petroleos de Venezuela S.A (PDVSA), the country's state-run oil and natural gas company, needs to invest at least $3 bn annually in its existing fields just to maintain current production levels.[5]

Crude Oil Production & Exports

Venezuela's actual level of oil production is difficult to determine, with the government and independent industry analysts offering different estimates.

In 2009, Venezuela's crude oil production averaged 2.44 mbd with net exports amounting to 1.83 mbd (see Table 1). This is a far cry from the production level of 3.24 mbd in 2000. Numerous causes were responsible for the lower level of production, including natural depletion at older fields, maintenance, and compliance with OPEC production cuts. As of January 2010, Venezuela's OPEC production target was 2.21 mbd.

Acording to industry estimates, about 600,000 barrels a day (b/d) are converted from the extra-heavy crude and bitumen with approximately 9 API to lighter, sweeter crude known as syncrude.

Venezuela nationalized its oil industry in the 1970s, creating a national oil & gas company known as PDVSA. Along with being Venezuela's largest employer, PDVSA accounts for about one-third of the country's GDP, 50% of the government's revenue and 80% of Venezuela's export earnings.[6]

In the 1990s, Venezuela re-opened its upstream oil sector to private investment. This policy facilitated the creation of 32 operating service agreements and four strategic associations, each operated by a non-PDVSA entity. In recent years, Venezuela has moved to largely undo most of these initiatives, including mandating PDVSA majority ownership of all oil projects and increasing tax and

* Mamdouh G. Salameh is an international oil economist, a consultant to the World Bank in Washington, DC on energy affairs and a technical expert of the United Nations Industrial Development Organization (UNIDO) in Vienna. Dr Salameh is Director of the Oil Market Consultancy Service in the UK and a member of both the International Institute for Strategic Studies (IISS) in London and the Royal Institute of International Affairs. He is also a member of the Energy Institute in London.
See footnotes at end of text.

	2000	2005	2006	2007	2008	2009	2010	2015	2020	2030
Production	3.24	2.94	2.81	2.61	2.50	2.44*	2.21*	3.20	4.00	4.50
Consumption	0.50	0.58	0.61	0.60	0.61	0.61	0.63	0.71	0.82	1.05
Exports	2.74	2.36	2.20	2.01	1.89	1.83	1.58	2.49	3.18	3.45

Sources: BP Statistical Review of World Energy, June 2010 / Platts, www.platts.com / US Energy Information Administration (EIA) / Author's projections.
* Compliance with OPEC production cuts.

Table 1
Venezuela's Current & Projected Oil Production Consumption & Exports (2000 – 2030) (mbd)

royalty rates on new and existing projects.[7]

In 2002, nearly half of PDVSA's employees walked off the job in protest against the rule of President Chavez. The strike severely impacted PDVSA, largely bringing the company's operations to a halt. PDVSA fired 18,000 employees following the strike. Industry analysts believe that the strike did permanent damage to PDVSA's production capacity and human resources and remains a major contributing factor to continued declines in production in recent years.

In 2009, Venezuela embarked on a further nationalization of the oil sector when PDVSA took control of many service contractors in the Lake Maracaibo region.

U.S.-Venezuela Oil Ties

The United States is still the largest destination of Venezuela's oil exports. However, Venezuelan oil exports to the United States have steadily declined from 1.74 mbd in 1988 to about 950,000 b/d in 2009 (see Table 2). Historically, Venezuela has been one of the most important suppliers of foreign oil to the United States, but that importance has diminished over time.

One of the fastest growing destinations of Venezuelan crude oil exports has been China. In 2008, China imported 120,000 b/d of crude oil from Venezuela, up from 39,000 b/d in 2005. China is projected to expand its Venezuelan oil imports to 1 mbd by 2012.[8]

Though Venezuela has repeatedly threatened to cut off its oil exports to the United States, analysts say the two countries are mutually dependent. Venezuela supplies around 1 mbd of crude oil to the U.S. market according to the EIA. However, in order to wholly replace the U.S. market – home to refineries that can refine Venezuela's heavy crude oil into a marketable product – Chavez must expand his domestic capacity to refine heavy oil as well as transport it to alternative markets where there are customized refineries. According to the O&GJ, Venezuela's refining capacity currently stands at 1.28 mbd.

	1988	1996	2002	2007	2008	2009	2010
Oil Imports	1.74	1.69	1.42	1.36	1.19	0.95	0.92*
As a % of US imports	26	18	12	10	9	8	7

Sources: BP Statistical Review of World Energy, 1989-2010 / EIA.
* Estimate

Table 2
US Oil Imports from Venezuela (1988 – 2010) (mbd)

PDVSA also wholly owns five refineries in the United States and partly owns four refineries, either through partnerships with U.S. companies or through PDVSA's U.S. subsidiary, CITGO.[9]

The World Bank says that Venezuela will continue in the short term to be a key player in the U.S. market and that it will be difficult in the short term for Venezuela to make a significant shift in supply from the United States. Nonetheless, Chavez has been trying hard to diversify his oil clients in order to lessen his country's dependence on the United States.

China's Oil Involvement in Venezuela

Under the cloak of Washington's indifference, President Chavez is making steady progress in cementing strategic relations with China, which is eager to establish a strong presence in a key, mineral-rich South American economy. China has funnelled money and expertise into Venezuela's oil industry. With so much to gain in trade and oil, China will strive to keep Chavez in power.[10]

In the last six years, China has increased its presence in Venezuela's oil industry dramatically, filling a void as Chavez muscles out U.S. and even local expertise. China's growing role in Venezuela is a direct result of Chavez's systematic drive to supplant U.S. influence in his country.

Bilateral trade between China and Venezuela has grown very significantly from $85.5 million in 1999 to about $9 bn in 2008.[11] Due in part to Chavez's moves to strangle commerce with Colombia to punish it for its close relationship with the United States, China edged out Colombia in 2009 to become Venezuela's second-largest trade partner (behind the U.S. oil market). And while China's exports to Venezuela have grown over 30% per year from 2000 to 2009, U.S. exports have grown by only 6% per year during the same period.

Recent bids by Chinese companies in Venezuela's Orinoco Belt represent a significant leap forward in the size of Chinese investment in the country and the quantity of oil that the Chinese expect to extract.[12]

A series of recent investments and loans totalling $44 bn will expand China's Venezuelan oil imports from 120,000 b/d in 2008 to 1 mbd by 2012.

Although Venezuela continues to discuss oil concessions with Western oil companies, only a few are prepared to invest billions of dollars in Venezuela in light of the regime's expanding nationalization drive. Given its voracious appetite for oil, China is willing to deal with Chavez and is able to extract favourable terms for its investment.

China's payment in July 2010 of $4 bn to Venezuela is the latest tangible evidence of this mutually beneficial relationship. This first payment is part of a deal in which China will lend $20 bn to Venezuela in exchange for oil deliveries over the next ten years. Venezuela is servicing this debt by shipping 200,000 b/d to China.[13]

China's Thirst for Oil

China consumed 8.63 mbd in 2009 and imported 4.42 mbd, making it the second-largest oil consumer and importer in the world behind the United States.[14] China's projected oil consumption in 2010 could reach 9.20 mbd. By contrast, China's oil production in 2010 is forecast to remain relatively flat at around 3.7 mbd. These factors make China crucial to Chavez's strategic objective of ending his country's dependence on oil exports to the United States.

However, in order to wholly replace the U.S. market, Chavez must expand his domestic capacity to refine heavy oil as well as transport it to alternative markets where there are customized refineries.

That is where China comes in. Starting from a minuscule role in Venezuela's oil market at the time of Chavez's election, China is today involved through "upstream" operations, massive capital investments, long-term purchase agreements and strategic planning, in the exploration, exploitation, transportation, refining and distribution of Venezuela's heavy crude oil.

China's National Petroleum Corporation (CNPC) is driving a hard bargain for its participation in the exploration of the "Junin Block 4" in the Orinoco Belt, but it is clearly eager to tap this new oil. Moreover, China is set to begin shortly the construction of a new $8-bn refinery in Guangdong Province that, when it becomes operational in 2013, will be capable of receiving oil produced at the Junin 4 site. This refinery is one of several that would boost China's capability to receive and process more than 1 mbd of Venezuela's crude oil. To open up this new supply chain, China is bankrolling the urgent purchase of four to six oil tankers for the transport of Venezuelan oil exports, with the first of these set for delivery late in 2011.[15]

China's Global Oil Diplomacy

China's growing involvement in Venezuela is an integral part of its global oil diplomacy. China is very aware that its robust economic growth would falter without secure oil supplies. China's global oil diplomacy is, therefore, geared towards ensuring that this never happens.

The growing dependence on oil imports has created an increasing sense of 'energy insecurity' among Chinese leaders. The Chinese military argue that China's energy security needs to be taken 'seriously and dealt with strategically'[16] That means less reliance on the Middle East, less transportation of oil via sea lanes policed by the U.S. Navy, more oil brought in by pipeline across Asia and by tanker across the Pacific and more capability for the Chinese navy to protect Chinese tankers. Henry Kissinger has warned of a potential great-power conflict over oil: this is it.

For decades the doctrine of peaceful rise has meant that China has tried to secure energy and raw materials without confronting the United States and the West. China's long-standing willingness to deal with states that the West regards pariahs is in part a recognition that dealing with Sudan, Angola, Iran or Uzbekistan allows China to avoid direct confrontation with Western interests. However, the larger China has become, the sheer scale of its energy needs has forced it more and more to intrude into areas that the United States regards as its own sphere of influence such as Venezuela.

China's penetration into the U.S. backyard could have profound political and economic implications for the U.S., as it is dependent for one-third of its oil on imports from South American oil suppliers that it can't afford to lose to China. China's global oil diplomacy could bring it into conflict with the United States unless both countries find a constructive accommodation that allows them to do business.

Conclusions

Under the cloak of Washington's indifference, President Chavez is making steady progress in cementing strategic relations with China principally in the oil field. For Chavez, such a strategy enables him to achieve his political ambitions of eliminating U.S. political influence in his country and also reducing his

country's dependence on oil exports to the United States.

For China, its growing involvement in Venezuela is an integral part of its global oil diplomacy. China is very aware that its robust economic growth would falter without secure oil supplies. China's global oil diplomacy is, therefore, geared towards ensuring that this never happens.

Though China's involvement in Venezuela could be construed by some political analysts as an intrusion into the U.S. back yard, China has no interest in supplanting U.S. influence in Venezuela. Its only interest is oil supply security and the diversification of its oil supply sources.

Historically, Venezuela has been one of the most important suppliers of foreign oil to the United States and the U.S. government would have liked to keep its relationship with Venezuela on an even keel. If this is not going to be, it is not a great loss to the U.S. oil market since Canada with as great oil reserves as Venezuela could easily fill the gap.

China's presence in Venezuela should not, therefore, be treated as a threat to U.S. national interests but a purely commercial venture by a country seeking to quench its thirst for oil.

Footnotes

[1] U.S. Energy Information Administration (EIA), Independent Statistics & Analysis, 30 November 2010.

[2] PDVSA fired about eighteen thousands experienced technical personnel in the wake of the 2002 strike.

[3] Calculated by the author on the basis of available data from different sources.

[4] Venezuela Oil Reserves Could Be World's Largest: What It Means for the U.S., AOL News, Surge Desk, p.2.

[5] Cesar J. Alvarez & Stephanie Hanson, Venezuela's Oil-Based Economy, Council on Foreign Relations, February 9, 2009, p. p.5.

[6] EIA, Country Analysis: Venezuela.

[7] Ibid.

[8] Roger F. Noriega, Chavez & China: Challenging U.S. Interests, Latin American Outlook, American Enterprise Institute for Public Policy Research (AEI), No.3, August 2010, p. 2.

[9] CITGO is a wholly-owned subsidiary of PDVSA that has some 14,000 branded outlets (both directly owned and affiliates) in the United States. CITGO operates three refineries (Lake Charles, LA; Corpus Chrisiti, TX; Lemont, IL) with a combined crude refining capacity of 755,400 b/d.

[10] Roger F. Noriega, Chavez & China: Challenging US Interests, p. 1.

[11] "Venezuela Pares China Debt with $20 bn Oil Accord", Bloomberg, August 4, 2010 at www.bloomberg.com/news/print/2010-08-05.

[12] China & Venezuela Sign Agreements on Junin-4 & a Long-term Finance Loan, Your Oil & Gas News, April 20, 2010.

[13] Simon Romero, Chavez Says China to Lend Venezuela $20 Billion, New York Times, April 18, 2010.

[14] BP Statistical Review of World Energy, June 2010, pp. 8-11 & also p. 21.

[15] Roger F. Noriega, Chavez & China: Challenging U.S. Interests, p. 3.

[16] Mamdouh G Salameh, China's Global Oil Diplomacy: Benign or Hostile? (a Paper given at the 31st ISEE International Conference, 18-20 June 2010, Istanbul).

Careers, Energy Education and Scholarships Online Databases

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

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

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

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

We look forward to your participation in these new initiatives.

Hydrocarbon Production Update: Colombia, Brazil, Mexico and Venezuela

By Miranda Wainberg*

Oil and gas production trends have varied widely among Latin American countries over the five year period 2005 through 2009. See Figures 1 & 2. Colombia and Brazil have registered positive production growth while Argentina, Mexico and Venezuela are continuing to struggle with production declines in oil, natural gas or both. These varied results are linked to the "commercial frameworks" for hydrocarbon sector investment in each country, e.g., the policies and regulations associated with hydrocarbon sector organization and governance; national oil company organization and governance; fiscal regime design and regulatory practices and quality.[1]

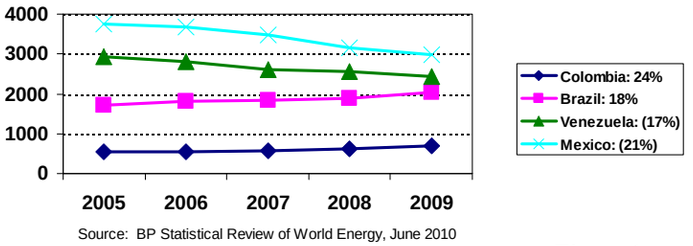


Figure 1
Oil Production (1000 barrels/day)

Colombia: Positive Transformation

In 2003 foreign direct investment in Colombia's hydrocarbon sector had dropped to about $300 million from $1.4 billion in 2000;[2] production and reserves continued to decline and Colombia was in danger of losing its self-sufficiency in oil production as well as its oil exporting status. The hydrocarbon sector was plagued by continuing guerilla attacks. Only 15 percent of the country's sedimentary basins had been explored.

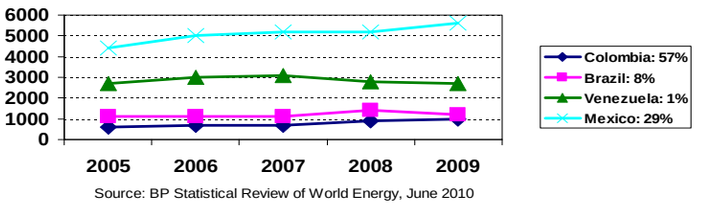


Figure 2
Gas Production (MMCF/day)

By the end of 2009, Colombia saw its oil and gas production grow by 24% and 57%, respectively, from 2005 to 2009.[3] In 2008, 86 companies were operating in Colombia's hydrocarbon sector and foreign direct investment in the sector grew from US$278 million in 2003 to US$3.4 billion in 2008.[4] Capital expenditures by Colombia's national oil company, Ecopetrol, increased from US$617 million in 2004 to close to US$3 billion in 2008.[5]

What occasioned this remarkable turnaround? In 2003 the Colombian government embarked on a major restructuring of its hydrocarbon sector commercial frameworks, particularly in the areas of sector organization and public governance; corporate governance of Ecopetrol; fiscal regime redesign and regulatory regime redesign.

An independent upstream regulatory agency, the National Hydrocarbons Agency (ANH), was created to manage exploration bidding rounds and associated contracts. Private companies were no longer required to partner with Ecopetrol and Ecopetrol had to compete with private companies in ANH exploration bidding rounds. The fiscal regime was revised and made Colombia one of the most attractive hydrocarbon investment areas in Latin America in terms of prospectivity and contractual terms.[6] With the assistance of the military, the Colombian government made significant improvements in hydrocarbon sector security.[7]

Ecopetrol was transformed from a wholly state-owned entity to a mixed economy company, which incorporates private capital of 10% of the total.[8] The company's commercial focus was sharpened with the transfer of regulatory responsibilities to the ANH. As a mixed economy company, Ecopetrol was allowed to separate its investment budget from Colombia's national investment budget and national limits on its debt issuance were removed. The Colombian government assumed responsibility for refunding to refiners gasoline and diesel price subsidies, relieving Ecopetrol of about a US$10 billion burden annually.

Challenges remain for Colombia and Ecopetrol, especially in the areas of reserve replacement, regional hydrocarbon revenue management, security in frontier areas and the timely refund of price subsidies. Nevertheless, the transformation begun in 2003, if it continues, could serve as an example for other governments and national oil companies.

Brazil: Strong Performer Facing Challenges

Brazil is currently the third largest oil producer in Latin America, behind Mexico and Venezuela. Brazil has made strong gains in oil production and, to a lesser extent, in natural gas production, in contrast to the declining BOE production

* Miranda Wainberg is with the Center for Energy Economics, Bureau of Economic Geology, University of Texas at Austin.
See footnotes at end of text.

experienced by Mexico and Venezuela from 2005 to 2009. The country's oil production exceeded consumption in 2009 and Brazil is expected to assume export status for both oil and natural gas as its huge pre-salt fields undergo development and exploitation.

However, Brazil and its national oil company, Petrobras, have not always been significant oil and gas producers. In the early 1990s, Petrobras, in addition to lackluster upstream performance, faced significant financial difficulties and became increasingly reliant on funding from Brazil's already overburdened treasury for its exploration and production program.[9] As a result, in 1995 the Brazilian government introduced major reforms in the areas of hydrocarbon sector organization and governance; Petrobras corporate organization and governance; fiscal regimes and regulatory structures. The 1995 reforms provided the initial platform that would propel Brazil's and Petrobras' strong oil and gas production and reserve growth going forward and served as an example for other countries, most notably Colombia.

Brazil's 1995 hydrocarbon sector reforms included: (1) the loss of Petrobras' hydrocarbon sector monopoly and the introduction of private company competition into all sectors, including the politically sensitive upstream; (2) the establishment of an independent upstream regulatory agency, the ANP, to manage exploration bidding rounds and associated contracts, relieving Petrobras of these non-commercial responsibilities; (3) removal of the requirement for private companies to partner with Petrobras in exploration, and (4) the partial privatization of Petrobras to increase access to international capital markets for investment funds and to subject the company to increased market scrutiny and discipline, thereby compelling improved management performance. Brazilian government voting ownership of the company was reduced from 82 percent to 56 percent.

Today Petrobras is an integrated oil and gas company that is the largest corporation in Brazil and one of the largest companies in Latin America in terms of revenues. It is active in 23 countries with a focus on Latin America. The company is internationally renowned for its innovation and expertise in deep and ultra-deep water exploration and production.[10]

However, Brazil and Petrobras are not without significant challenges and substantial business, execution and financial risks going forward. Pre-salt exploration and development is unknown, technologically complex and very expensive. Petrobras will have to manage a ramp up in capital expenditures and activity of a magnitude it has not had to deal with previously in an environment where it may face services and human resources shortages. As a result of the pre-salt discoveries, the Brazilian government is implementing major changes to the country's hydrocarbon sector organization and governance, some of which are reversing parts of the 1995 reforms and are increasing government influence in the sector.[11] These changes could increase the complexity and uncertainty of Petrobras' and Brazil's future operating environment and could make Brazil's hydrocarbon sector less attractive to private capital.

Mexico: At a Crossroads

In 2004, Mexico ranked third in crude oil production. By 2009 the country had fallen to seventh place. Oil production declined 21% from 2005 to 2009. Although natural gas production increased 29% from 2005 to 2009, Mexico has continued to be a net natural gas importer since 1999.[12] The declining oil and gas production performance of Mexico and its national oil company, Pemex, is linked to the country's commercial frameworks relating primarily to hydrocarbon sector organization and governance; Pemex corporate organization and governance and the fiscal regime for Pemex.

Mexico's hydrocarbon sector organization and governance has had a strong impact on recent Pemex production performance. Since 1938 the Mexican Constitution has granted a monopoly to Pemex with respect to oil and gas exploration and production. As a result, private companies and non-Mexican national oil companies are prohibited from undertaking exploration and production activities in Mexico on an equity basis.[13] This constitutional provision has shielded Pemex from competitive pressures that typically impel improvements in a company's operating practices. In addition, it has deprived Pemex of access to advanced technologies and world class management practices through partnerships and/or joint ventures with third parties in Mexico.[14] As Pemex moves to increasingly complex geologies and frontier areas like the deep water Gulf of Mexico in order to reverse declining production, this lack of access to world class technologies and management practices becomes a serious obstacle to success.

With respect to Pemex's organization, the company is a 100% state-owned "decentralized entity" of the Mexican government instead of an independent commercial entity. As such, the company has historically been managed as a government bureaucracy subject to standard government agency operating practices in areas such as procurement of goods and services that have been burdensome and inappropriate for an oil and gas company. In addition, Pemex's annual capital budget is part of Mexico's national budget and must be approved by the Mexican Congress. The company must compete with other social

and economic programs for funding and the level of approved funding historically has led to underinvestment in oil and gas activities, contributing to the recent production declines. Historically the corporate governance of Pemex has been opaque and highly politicized thereby blurring management accountability for results. Multiple government agencies are involved in approving certain Pemex activities and the President of Mexico appoints ten of the fifteen members of the Board of Directors, historically other cabinet officials, as well as the Director General of Pemex.

Pemex has been subjected to an onerous fiscal regime which has led to underinvestment in oil and gas exploration and production, contributing to recent production declines. The Mexican government relies on taxes and dividends paid by Pemex for about 40% of its public revenue and in some years the company has paid up to 90% of its pre-tax profit in taxes and dividends. The company's free cash flow is not sufficient to fund its capital program and, as a result, its debt level has soared. Pemex's access to international debt markets is increasingly predicated on presumed "extraordinary support" by the Mexican government if a crisis should occur.[15]

The Mexican government has tried to address some of these issues in the past without changing the constitution or the basic organization of the hydrocarbon sector and Pemex, most notably the multiple service contract structure for non-associated gas exploration by third parties and intermittent tax relief for Pemex. After seven grueling months of debate the latest reform package was finalized in fall 2008. This package consisted of a number of laws and revisions geared toward facilitating PEMEX investment, gradually integrating some modicum of upstream competition through a restructured service contract, and providing some upstream oversight through the new National Hydrocarbons Commission (CNH). The reforms also targeted improved corporate governance of Pemex through the appointment of independent directors; improving Board of Directors oversight of key operating and financial areas; relieving the company of inappropriate government procurement practices and offering Pemex "citizen's bonds" to Mexican citizens in an effort to subject the company to some level of market discipline. The reform also included a special tax regime with lower tax rates and higher limits on permitted deductions for Chicontepec and deep water prospects. Key questions relative to the effort reform are:[16]

- Will the 2008 energy reform prevent the rapid decline in oil production?
- Can the new model service contracts for exploration and production attract the interest of international oil companies, non-Mexican national oil companies or other private companies?
- Will this new legal framework for the oil industry and the participation of new regulatory agencies facilitate the introduction of further and deeper reforms in the future?

Venezuela: Major Hurdles

Venezuela has the Western Hemisphere's largest conventional proven oil reserves at 172 billion barrels as of year-end 2009. Much of Venezuela's resource endowment consists of substantial extra-heavy crude oil and bitumen deposits, most of which are situated in the Orinoco Belt located in Central Venezuela. Despite its exceptional resource endowment, Venezuelan oil production declined 17% from 2005 to 2009 and natural gas production remained essentially flat. The declining oil production performance of Venezuela and its national oil company, PdVSA, is linked to changes the President Chavez administration has made in hydrocarbon sector organization and governance; PdVSA corporate organization and governance; fiscal regime design and regulatory quality.

In 2005 a new Organic Hydrocarbons Law was enacted in Venezuela which required private companies operating under service agreements contracted with PdVSA in the 1990s to transition to new partnerships with PdVSA pursuant to terms that increased PdVSA's equity interest and operational control in the projects and increased the government's share of the projects' profits. All the private companies except ConocoPhillips and Exxon Mobil transitioned to the new partnership arrangements.[17] In addition, tax rates on oil projects were raised four times since 2004 for oil projects. As a result, although most private investors already in Venezuela remained in Venezuela, the changes in hydrocarbon sector organization and the fiscal regime discouraged new investments and new investors, contributing to the decline in oil production. Venezuela ranked third highest in the Fraser Institute 2009 Global Petroleum Survey for the number of negative factors serving as a deterrent to upstream investment.

The President Chavez regime also made significant changes in PdVSA organization, governance and regulation. PdVSA was once a model for other national oil companies with respect to value creation, managerial and technical competence, commercial relationships and partnerships and government noninterference in commercial matters. In 2003 PdVSA was restructured and 18,300 employees, close to 25 percent of its workforce, primarily those with top management and engineering capabilities, were fired. PdVSA's operations are now more closely supervised by Venezuela's Ministry of Energy and Petroleum

and the Minister now serves as the President of PdVSA. The members of the Board of Directors are appointed by Presidential Decree and can be reappointed indefinitely until removed by the President of Venezuela. The transformation of PdVSA into an organ of the state with the resulting loss of organizational efficiency and effectiveness also contributed to declining oil production.

In 2008 the Venezuelan government changed PdVSA's charter and mission statement to allow it to participate in any industry that could contribute to social development, including health care, education and agriculture.[18] These "non-commercial, non-oil related" obligations are estimated in PdVSA's 2008 annual report to be on the order of $14 billion annually. As a result of these non-commercial obligations as well as the high level of taxes paid by PdVSA to the Venezuelan government which constitute about 50% of the public budget, has led to underinvestment by the company in the hydrocarbon sector in recent years, also contributing to the decline in oil production.

Since the fiscal burdens on PdVSA are unlikely to change while President Chavez remains in office, medium to long term production growth will have to come from private company investment. Recognizing this fact, Venezuela auctioned Orinoco heavy oil blocks to foreign investors under softened fiscal terms in 2009-2010. The U.S. Geological Survey has estimated recoverable reserves of 513 billion barrels in Orinoco, double Saudi Arabia.[19] Consortia led by Repsol, Chevron, ENI and Gazprom, in partnership with PdVSA (60%), bid up to $US80 billion on Orinoco blocks Carabobo and Junin in 2010.[20] The size and attractiveness of the Orinoco "prize" appeared to trump Venezuela's negative investment climate. The development of the Junin and Carabobo blocks will be extremely demanding and will require unprecedented investments, technology deployment and coordination between the companies and Venezuelan authorities.[21] It remains to be seen if such a challenging project can be successfully implemented in Venezuela given its hostile political environment and PdVSA's diminished capacity.

Footnotes

[1] For a more detailed discussion of these considerations for these Latin American NOCs, see Appendix and Companion to Chapter 16 - Hydrocarbon Sector Regulation and Cross-border Trade in the Western Hemisphere in Energy Cooperation in the Western Hemisphere, Center for Strategic and International Studies, 2007 (the Appendix was prepared by CEE-UT); and A Citizen's Guide to National Oil Companies, a joint effort of the World Bank and CEE-UT (http://www.beg.utexas.edu/energyecon/nocs/).

[2] ESMAP, 2005, Comparative Study on the Distribution of Oil Rents in Bolivia, Colombia, Ecuador and Peru, Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP, January 2005).

[3] All references to oil and gas production volumes, increases and decreases based on information in the BP Statistical Review of World Energy 2010 available at www.bp.com.

[4] Armando Zamora Reyes, ANH Director General, 2009 presentation at the Herold Pacesetters Energy Conference.www.anh.gov.co/media/presentaciones

[5] Ecopetrol 2008 SEC Form 20F. http://www.ecopetrol.co.com/english

[6] Armando Zamora Reyes, ANH Director General, 2009 presentation at the Herold Pacesetters Energy Conference.www.anh.gov.co/media/presentaciones

[7] "Politica de Consolidacion de la Seguridad Democratica: Resultados y Retos", January 2008, available at www.anh.gov.co/media/salaPrensa/juan_carlos_pinzon.ppt.

[8] Ecopetrol 2008 SEC Form 20F available at http://www.ecopetrol.co.com/english. The company is authorized to increase private ownership to 20%, which would reduce the government's interest to 80%.

[9] CEE-UT, 2006, "Brazil's restructuring of the Oil & Gas Industry", http://www.beg.utexas.edu/energyecon/new-era/case_studies/Brazil_Restructuring_of_the_Oil_Gas_Industry.pdf.

[10] Eva Dantas and Martin Bell, 2006, "The Development of Firm-Centered Knowledge Networks in Emerging Economies: The Case of Petrobras in the Offshore Oil Innovation System in Brazil," Paper presented at the Druid Summer Conference 2006 on Knowledge, Innovation and Competitiveness: Dynamics of Firms, Networks and Institutions, Copenhagen (June).

[11] Drago, Bruno, 2011, "Brazil Pre-Salt: A New Legal Framework for the Oil Industry in Brazil," Demarest e Almeida Advogados, Sao Paulo and Rio de Janeiro, Brazil (January).

[12] Oil and gas reserves, production and consumption data from BP Statistical Review of World Energy, www.bp.com.

[13] An equity basis would entail ownership of reserves and production.

[14] Further Pemex has not operated internationally, historically, outside of a refining joint venture with Shell in Deer Park, Texas.

[15] "Moody's Global Integrated Oil & Gas Industry Rating Methodology," November 2009 available at www.moodys.com.

[16] Communications with CNH and other government officials. Also see Carlos Manuel Rodriquez and Thomas

Black, March 29, 2010, "PEMEX Performance Contracts May Fail to Attract", Bloomberg.

[17] ConocoPhillips and ExxonMobil sought relief in international arbitration courts.

[18] "Petroleos de Venezuela, S.A.: Full Rating Report," November 19, 2010 available at www.fitchratings.com.

[19] "Venezuela's Carabobo," Financial Times, February 11, 2010 available at www.ft.com.

[20] Voght, David, "Heavy Oil in Venezuela," Presentation to the La Jolla XIX Latin American Energy Conference, IPD Latin America, May 11, 2010.

[21] Mander, Benedict, "Venezuela secures $80 billion oil investment," Financial Times, February 16, 2010 available at www.ft.com.

Special OFID/IAEE Support Fund For Students From Developing Countries

IAEE is pleased to announce the continuation of a special program which offers support to students from developing countries to participate in four of the Association's conferences in 2011. This program is generously underwritten by the OPEC Fund for International Development (OFID) and the International Association for Energy Economics. The support will consist of a cash stipend of up to $1500.00 plus waiver of conference registration fees for a limited number of eligible students, who are citizens of developing countries and current IAEE members (the student can be registered as full-time student in programs of study anywhere in the world), to attend either the 3rd ELAEE conference in Buenos Aires, Argentina, April 18-19, 2011, the 4th NAEE/IAEE International Conference in Abuja, Nigeria, April 25-26, 2011, the 34th IAEE International Conference in Stockholm, Sweden, June 19-23, 2011 or the 30th USAEE/IAEE North American Conference in Washington, DC, October 9-12, 2011.

Application deadlines for these conferences are as follows: Buenos Aires Conference – application cut-off date, January 24, 2011; Abuja Conference – application cut-off date, January 31, 2011; Stockholm Conference – application cut-off date, March 28, 2011; Washington Conference – application cut-off date, July 18, 2011.

Please submit the following information electronically to iaee@iaee.org to have your request for support considered. Make the subject line of your email read "Application to OFID/IAEE Support Fund (mention the conference you wish to attend)."

Full name, mailing address, phone/fax/email, country of origin and educational degree pursuing.

- A letter stating you are a full-time graduate/college student, a brief description of your coursework and energy interests, and the professional benefit you anticipate from attending the conference. The letter should also provide the name and contact information of your main faculty supervisor or your department chair, and should include a copy of your student identification card.
- A letter from your academic faculty, preferably your faculty supervisor, recommending you for this support and highlighting some of your academic research and achievements, and your academic progress.
- A cost estimate of your travel/lodging expenses to participate in one of the above conferences.

Please note that students may apply for this support at only one of the above conferences. Multiple requests will not be considered. Further note that you must be a student member of IAEE to be considered for this support. Membership information can be found by visiting https://www.iaee.org/en/membership/application.aspx

Applicants will be notified whether their application has been approved approximately 14 days past the application cut-off date above. After the applicant has received IAEE approval, it will be their responsibility to make their own travel (air/ground, etc.) and hotel accommodations, etc. to participate in the conference. Reimbursement up to $1500.00 will be made upon receipt of itemized expenses. The cash stipend can only be used to cover transportation and lodging expenses. No other expenses will be covered.

For further information regarding the IAEE support fund for students from developing countries to participate in our conferences in 2011, please do not hesitate to contact David Williams at 216-464-5365 or via e-mail at: iaee@iaee.org

IAEE International Association for Energy Economics
WWW.IAEE.ORG

International Association for Energy Economics
28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA
Phone: 216.464.5365 | Fax: 216.464.2737 | Email: iaee@iaee.org
www.iaee.org

IAEE Merchandise Order Form

Long Sleeve Shirt

This comfortable, wash-and-wear shirt is wrinkle resistant. Made of 55/45 cotton/poly blend. Button-down collar. Dyed-to-match buttons. Patch pocket. Back box pleat. Color: Faded Blue with IAEE logo.

$45 Quantity: _____
Size: ☐ S ☐ M ☐ L ☐ XL ☐ 2XL

Garment Washed Cap

Designed for both women and men, this popular style cap is pigment-dyed and garment washed to achieve a lived-in look and feel. Color: Faded Blue with IAEE logo

$30 Quantity: _____

Mouse Pad

A textured, hard polymer surface with IAEE logo and a background with a relaxing blue background. Size: 7-1/2" x 8-1/2"

$10 Quantity: _____

Key Chain

An oval brass quality key tag with lay flat ring and acid etched, color filled IAEE logo. Size: 1-1/2" x 3-1/2"

$15 Quantity: _____

Bumper Sticker

The IAEE logo on a white, removable self stick vinyl. Size: 3" x 11-1/2"

$7.50 Quantity: _____

Pique Knit Sport Shirt

This soft pique knit is shrink resistant and easy to care for. Made of combed cotton heavyweight pique. Garment washed for softness. Double-needle stitching throughout. Flat knit collar and cuffs. Horn-tone buttons. Side vents. Color: Faded Blue with IAEE logo

$40 Quantity: _____
Size: ☐ S ☐ M ☐ L ☐ XL ☐ 2XL

Custom Silk Tie

A custom designed tie with the IAEE logo. This traditional style tie is made of custom woven 100% silk. Color: Navy Blue with IAEE logo.

$40 Quantity: _____

Pen

Monticello classic executive style smooth twist retractable pen in silver with 24 karat gold plated inclined dome and laser engraved IAEE logo, black ink, packaged in a deluxe two-piece gift box.

$15 Quantity: _____

Static Cling

The IAEE logo on a static cling vinyl for mounting on the inside of a window (car or office) with no adhesive. Easily removed and repositioned. The IAEE logo is in white for greater visibility on tinted windows. Size: 2" x 5-1/2"

$5 Quantity: _____

Shipping/Billing Information

Name: _____

Company: _____

Street Address: _____

City: _____ State: _____

Postal Code: _____ Country: _____

Phone: _____ Fax: _____

E-mail: _____

Mail or fax the completed form to IAEE at the address listed at the top of the page. Orders can also be placed online at www.iaee.org.

ORDER TOTAL: $ _____

Credit Card Number:

_____

Verification Code: _____ Card Type: ☐ Visa ☐ Master

Expiration Date: _____

_____ _____
Signature Date

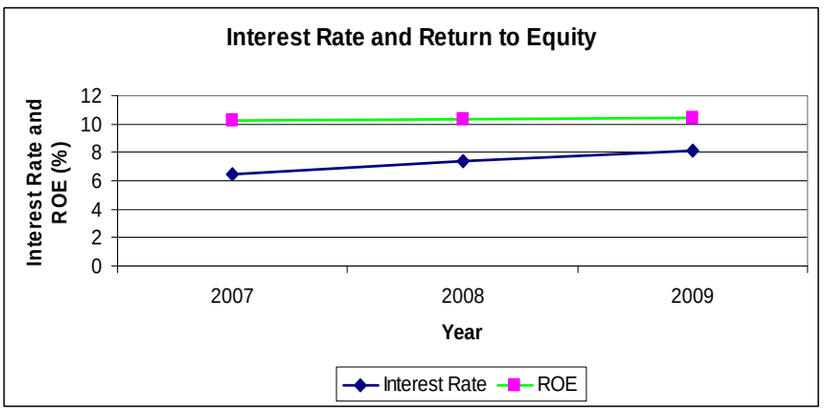
Allowed ROEs During Economic Crisis Often Fail The Equal Return For Equivalent Risk Standard

By Donald Murry, Michael Knapp and Zhen Zhu*

Introduction

Responding to the financial crisis and the recession, the Federal Reserve Board has driven short-term interest rates to historically low levels, but, at the same time , corporate bond rates have been increasing. However, as shown in the graph, over the period from 2007 into 2009 simple observation shows little change in the average allowed returns on common equity (ROE) for gas and electric utilities.[1] In fact, during this period, the Baa corporate bond rate increased 1.65% while the average allowed return increased only 0.16%. On its face, this comparison reveals that many recent allowed ROEs may not meet the standard of setting allowed returns equal to returns on investments in securities of equivalent risks; this is the familiar *Hope* and *Bluefield* standard often cited as the principle for setting allowed returns in utility regulation.[2]

The adjacent comparison shows that allowed returns have not kept pace with the competitive long-term bond market rates during the financial and economic crisis, plus this is one part of the *Hope-Bluefield* standard. The other component of the *Hope-Bluefield* standard is adjusting returns for equivalent risk. The relationships between allowed return levels and measures of risk to equity investors will reveal whether risks are prevalent determinants of allowed ROEs.



Allowed ROEs and Equivalent Risk

To the extent that we can identify quantitative measures of risk, we can test empirically if and how they are linked to the allowed ROEs. For example, we were able to identify some specific, recognized measures of risk and test statistically whether they were linked to the levels of electric and gas allowed ROEs during the financial crisis and the recession study period. Specifically, we identified quantitative measures of financial risk, business risk and regulatory risk, and we estimated their statistical relationship to the allowed ROEs.

Financial Risk to a common stock investor is the uncertainty whether sufficient funds will be available to achieve expected dividends and capital gains after payment of interest on debt and preferred stock dividends. A lower common equity ratio implies that a company has greater obligations to holders of securities that have precedence to revenues; consistent with financial theory, one can expect that the lower the common equity ratio, the greater the financial risk exposure to the common stock holders. Consequently, we tested the hypothesis that during this period utilities' allowed returns were higher for utilities with lower common equity ratios.[3]

Business Risk is the exposure of investors' returns to the uncertainties of a company's day-to-day business activities. For electric and gas utility equity investors untimely and uncertain recovery of operating costs are business risks. For example, potential failure to recover fixed costs through volumetric rates is a risk to utility investors. Also, delayed recovery of storm damage costs is a business risk to electric utilities. Because a firm's beta shows its relative market price volatility, we hypothesized that it should be positively related to allowed returns, and at least a partial surrogate measure for business risk.[4]

Larger electric and gas utilities are likely to have broader customer markets as well as more diverse supplier and transportation sources. In addition, larger firms are likely to have a stronger presence in the financial markets and may have a wider recognition and access to the capital markets. This diversity might mitigate business risks, and one could expect that small utilities may receive higher allowed ROEs than large ones to compensate for this risk.[5] Consequently, we tested the hypothesis that on the average smaller utilities received higher al-

* Donald Murry is a Vice President at C.H. Guernsey & Company and Professor Emeritus at University of Oklahoma; Mike Knapp is an economist at the company; and Zhen Zhu is a consulting economist at the company and Professor of Economics at University of Central Oklahoma. Zhen Zhu may be reached at zhen.zhu@chguernsey.com

See footnotes at end of text.

lowed ROEs than larger utilities.

Regulatory Risk is the uncertainty regarding regulatory decisions that exposes investors to potential failure to achieve anticipated returns. One form of regulatory risk is regulatory lag, or the risk of delay of recovery of incurred costs. This may be nothing more than the elapsed time of a regulatory proceeding. For example, when a utility has the information necessary to support a filing and files a rate case, the elapsed time before approval and the authorization to collect additional revenues is a form of regulatory lag. We used the elapsed time between the filing and order dates as an approximation of regulatory lag.[6] If regulators compensate for the risk of delay, the allowed ROEs will be higher, on the average, the longer the delay.

The Risk Regressions

To measure the impact of the risk variables on the allowed ROEs, we estimated the following regression equation:

$$ROE_i = a_0 + a_1ER_i + a_2Beta_i + a_3Cap_i + a_4Elect_i + a_5DL_i + e_i \quad (1)$$

where ROE is the allowed rate of return on common equity, ER is a utility's equity ratio, Beta is the *Value Line* beta for a utility, Cap is a utility's market capitalizations, Elect is a dummy variable, taking the value of 1 for elected regulatory authorities and 0 for appointed authorities, and DL is regulatory lag, as measured by the elapsed time from filing to decision. We estimated separate regressions for the gas and electric allowed return decisions during the period of 2007 to early 2009.[7]

Variables	Electric	Gas
Constant	7.935***	8.869***
	(18.72)	(16.80)
Financial Risk		
Equity Ratio	0.0375***	0.0269***
	(4.956)	(3.05)
Regulatory Risk		
Dec Lag	0.015**	0.0046
	(1.97)	(0.26)
Elected	-0.113	-0.1927
	(-1.127)	(-1.61)
Business Risk		
Beta	0.489***	0.085
	(2.955)	(0.23)
Capitalization	0.0115*	0.0216
	(1.737)	(1.41)
Number of Observations	101	85
Adjusted R Squared	0.137	0.134

Note: t-values are in parentheses. ***, **, * denote significance at 1%, 5% and 10% levels, respectively.

Table 1. Risks and Allowed ROEs: A Regression Analysis

Significantly, as shown in Table 1, for the gas distribution utilities allowed ROE decisions, none of the financial,[8] business or regulatory[9] risk variables that we measure was statistically significant with the hypothesized sign. This means that we could not statistically link any of these risk variables to the allowed ROEs set in the local gas distribution decisions during this recent market crisis and recession period. These measureable risk variables did not account for the differentials in allowed ROEs among gas distribution utilities, which one would expect according to the *Hope-Bluefield* standard.

In the case of the electric utility regression, as shown in the Table, we were able to determine only a limited link statistically, as hypothesized, between the differentials in allowed returns and the quantified measures of risk. Again, the financial risk variable did not have the hypothesized sign. The electric utilities with low common equity ratios generally did not receive higher allowed ROEs. As in the case of the gas distribution utilities, the allowed ROEs generally did not recognize any added business risk of small electric utilities. Contrary to the gas distribution regression, we did determine, however, that the level of allowed ROEs was statistically linked to the utilities' market betas, here representing a measure of business risk.[10] As to the regulatory variables, similar to the gas distribution utilities case, whether the regulators were elected or appointed did not influence the level of allowed ROEs during this period. However, the regulators did appear to compensate the electric utilities somewhat for risks associated with the regulatory lag of a rate proceeding.[11]

Conclusions

In this analysis, we found that, in seeming conflict with the frequently cited *Hope-Bluefield* objectives, the recent allowed ROEs have not increased as long-term market interest rates increased during the period of the financial crisis and economic recession of 2007-09. We also determined statistically, in apparent conflict with financial theory in some instances, that measureable variations in risk variables

did not account for the differentials in allowed ROEs in the gas distribution rate decisions. Although we determined some links between the ROE differentials in the electric utility decisions and measureable risk variables, they were relatively weak. Over all, the empirical evidence is quite strong that the allowed ROEs during the period of the financial crisis and the economic recession in many instances have deviated from the principles of the often cited *Hope-Bluefield* standard.

Footnotes

[1] For this comparison we identified and studied the allowed returns in 101 electric utility and 85 local gas distribution utility rate cases as reported by the Regulatory Research Associates over the period from 2007 and 2009.

[2] The frequently cited sources of this equivalent risk standard are two decisions by the United States Supreme Court: *Bluefield Water Works and Improvement Company vs. Public Service Commission, 262 U.S. 679 (1923) ("Bluefield")*, and the *Federal Power Commission vs. Hope Natural Gas Company, 320 U.S. 591 (1944) ("Hope").*

[3] Although bond rating agencies describe other factors that influence their ratings in addition to the common equity ratio, Murry, Zhu and Knapp (2008) found bond ratings and equity ratios to be substitute predictors of allowed returns for gas and electric utilities.

[4] Regulatory authorities commonly accept the beta as a measure of risk when they adopt the Capital Asset Pricing Model as a method to measure the cost of common equity:

$ROE_i = R^f + b_i(R^m - R^f) + e$, where b_i is the beta of firm i, R^f is the risk-free rate, and R^m is the market return. For most utilities, beta is positive and less than 1; therefore, the higher the beta, the higher the estimated return.

[5] See Ibbotson (2008): "One of the most remarkable discoveries of modern finance is that of a relationship between firm size and return. The relationship cuts across the entire size spectrum but is most evident among smaller companies, which have higher returns on average than large ones."

[6] Investor uncertainties associated with regulatory treatments of such factors as fuel and gas cost recovery, depreciation of invested capital, revenue decoupling and rate design are surely important, but they do not lend themselves readily to cross-sectional empirical measurement.

[7] We corrected for heteroscadasticity by using the ROBUSTERROR option in the RATS statistical package.

[8] Our findings in this study showing that recent allowed returns were not higher from utilities with lower common equity ratio differs from the findings in some earlier studies of allowed ROEs and financial risk. Those studies determined that allowed returns were generally consistent with financial theory. See, for example, Joskow (1972) and Hagerman and Ratchford (1978), Studies in recent years, similar to the present study, failed to find a link between allowed ROEs and financial risk. See Fan and Cowing (1994) and Murry, Zhu and Knapp (2008)

[9] For related studies of the effects of regulatory procedures on allowed ROEs see Fitzpatrick, Dennis B., John W. Settle, and Glenn H. Petry. (1988) and Quest, Troy, (2007).

[10] The beta variable in the electric utility regression had the hypothesized positive sign and was statistically significant at the .01 level.

[11] The regulatory lag variable in the electric utility regression ha)d the hypothesized positive sign and was statistically significant at the .05 level.

References

Fan, Dennis K., Thomas G. Cowing, 1994. "Regulatory Information, Market Expectations, and the Determination of the Allowed Rate of Return," Journal of Regulatory Economics, 6:433-444.

Fitzpatrick, Dennis B., John W. Settle, and Glenn H. Petry. 1988. "An Empirical Examination of Rate of Return Regulation in the Electric Utility Industry: 1971-1982." Journal of Economics and Business 40: 27-44.

Hagerman, Robert L., and Brian T. Ratchford. 1978. "Some Determinants of Allowed Rates of Return on Equity to Electric Utilities." Bell Journal of Economics 9: 46-55.

Ibbotson SBBI: 2008 Valuation Yearbook, Chapter 7, page 121. Edited by James P. Harrington: Morningstar, Inc, Chicago, IL.

Joskow, Paul L. 1972. "The Determination of the Allowed Rate of Return in a Formal Regulatory Hearing." Bell Journal of Economics 3: 632-644.

Murry, Don, Zhen Zhu and Mike Knapp, 2008. "Linking Risk and ROE," Public Utility Fortnightly, Jan, 30-33.

Quest, Troy, 2007. "Do elected public utility commissioners behave more politically than appointed ones?" Journal of Regulatory Economics, November, 318-337.

IAEE/Affiliate Master Calendar of Events

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

Date	Event, Event Title and Language	Location	Supporting Organizations(s)	Contact
2011				
April 18-19	3rd ELAEE Conference *Energy, Climate Change and Sustainable Development: The Challenges for Latin America* http://www.elaee2011.org/ Language: Spanish & English	Buenos Aires, Argentina		Gerardo Rabinovich gerardoa@speedy.com.ar
April 25-26	4th Annual NAEE/IAEE International Conference *Green Energy and Energy Security: Assessing the Options for Africa in a Global Energy Market*	Abuja, Nigeria	NAEE	Adeola Adenikinju akiniwayemi@hotmail.com
June 19-23	34th IAEE International Conference *Institutions, Efficiency and Evolving Energy Technologies* http://www.hhs.se/iaee-2011	Stockholm, Sweden	SAEE/IAEE	Lars Bergman lars.bergman@hhs.se
October 9-12	30th USAEE/IAEE North American Conference *Redefining the Energy Economy: Changing Roles of Industry, Government and Research* http:/www.usaee.org/USAEE2011/	Washington, DC	USAEE/NCAC/IAEE	USAEE Headquarters usaee@usaee.org
2012				
February 20-22	3rd IAEE Asian Conference *Growing Energy Demand, Energy Security and the Environment in Asia*	Kyoto, Japan	IEEJ	Kenichi Matsui *kmatsuijr@aol.com*
June 24-27,	35th IAEE International Conference *Energy Markets Evolution under Global Carbon Constraints: Assessing Kyoto and Looking Forward*	Perth, Australia	AAEE/IAEE	Ron Ripple r.ripple@curtin.edu.au
September 9-12	12th IAEE European Conference *Energy Challenge and Environmental Sustainability*	Venice, Italy	AIEE/IAEE	Edgardo Curcio e.curcio@aiee.it
November 4-7	31st USAEE/IAEE North American Conference *Transition to a Sustainable Energy Era/ Opportunities and Challenges*	Austin, Texas	USAEE/CTAEE/IAEE	USAEE Headquarters usaee@usaee.org
2013				
June 23-27	36th IAEE International Conference *Realizing the Potential of Energy and Material Efficiency*	Daegu, Korea	KRAEE/IAEE	HoesungLee hoesung@unitel.co.kr

The Future Paradigm of Energy Pricing in South America

By Philip Walsh*

Increasing volatility in energy pricing is a relatively recent global phenomenon that has perplexed regulators and energy policy makers in both developed and developing nations. For those countries who have adopted policies of deregulated energy markets, the volatility factor has been cause for concern. Nations whose energy markets are still state-regulated may have mitigated the impact of energy pricing volatility domestically but the costs related to minimizing consumer costs are ultimately borne by the citizens themselves in increased government deficits.

South America is comprised of have and have-not states in terms of domestic energy supply. These varying levels of energy security have led to different regulatory structures marked by a dominance of state-owned or controlled energy companies and varying degrees of privatization and foreign investment in energy-related capital projects. These differing approaches increase the barriers to co-ordinated regional development of energy resources that could contribute to a more efficient energy marketplace and related pricing benefits to domestic customers.

Energy pricing in South America, like that in Southeast Asia, has been influenced by, and is complicated by government subsidization. For those countries seeking to enter into global energy trade agreements and/or increased foreign investment to expedite the development of energy resources and related infrastructure, there are market pressures to equalize domestic energy pricing with global prices. These market pressures are resisted by domestic economies that rely on lower cost energy to grow.

Energy Supply

South America can be divided into "energy have" and "energy have not" countries. Relying on 2008 data provided by the International Energy Agency the latter category includes certain countries such as Brazil, Chile, Peru and Uruguay, who are, on balance, net consumers of energy (See Figure 1). The former category includes countries such as Venezuela, Columbia, Ecuador, Bolivia and Paraguay who are net suppliers of energy. Of course, the energy balance of each of these countries can be dominated by one or more energy types (See Table 1). For example, Paraguay may be a net supplier of energy but this is due entirely to its abundant (relative to its own needs) hydro-electric resources. In fact, Paraguay is essentially the only country that has sufficient excess electrical generation capacity to be a dominant exporter of electricity on the continent, with Brazil its primary beneficiary. However, it remains heavily dependent on the import of refined oil products. For Venezuela, a similar situation exists in that its net supplier status is predominantly associated with crude oil exports but, as opposed to Paraguay, it has sufficient reserves of coal, natural gas and installed hydro-electric power generation to potentially satisfy all of its energy needs. In terms of conventional fossil fuels, the ratios of reserves to annual consumption vary greatly among the South American countries (See Table 2).

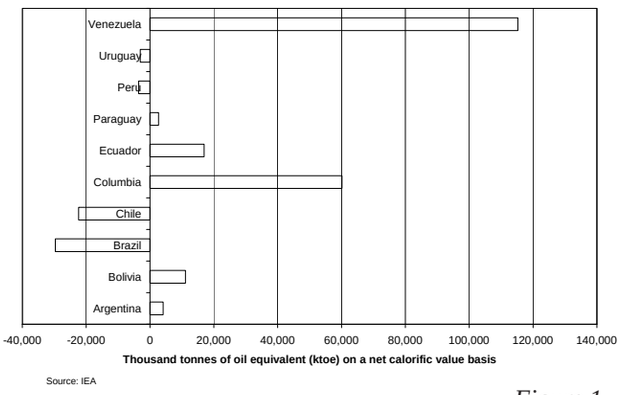


Figure 1
Net Annual Energy Balance (2008)

Energy Policies

With the variation in energy self-sufficiencies the respective policies of each country also vary. Emboldened by their relatively excessive reserves, Venezuela, Ecuador and Bolivia have implemented policies that have increased state ownership of energy reserves and subsidized domestic energy costs, risking future alienation of foreign investment both from within, and outside of, South America. However, such policies may be unsustainable. Argentina's experience with artificially low utility tariffs (16 to 27 times lower than residential tariffs found in neighbouring Chile and Brazil) and the dominance of state-owned energy companies have limited investment in the energy sector to the point that Argentina has seen its energy reserve base deplete to a point that it is now facing becoming an "energy have not". Venezuela and Ecuador can currently rely on revenues generated from the exporting of high priced crude oil to offset the impact of subsidies on their respective GDPs but Bolivia, whose greatest energy asset is its natural gas reserve, is in a more difficult predicament. Its recent energy

* Philip Walsh is Associate Professor, Entrepreneurship & Strategy, Ted Rogers School of Business Management, Ryerson University, Toronto, ON Canada. He may be reached at prwalsh@ryerson. ca

	Coal and Peat	Crude Oil	Oil Products	Natural Gas	Electricity	Total
Argentina	-1136	2830	3137-	236	-471	4124
Bolivia	0	333	-480	11241	0	11094
Brazil	-11805	2683	-7468	-9451	-3630	-29671
Chile	-4111	-10881	-6638	-655	-99	-22384
Columbia	44057	13467	2452	71	120	60167
Ecuador	0	18217	-1205	0	-43	16969
Paraguay	0	0	-1317	0	3982	2665
Peru	-650	-3998	1116	0	0	-3532
Uruguay	-1	-2029	-851	-83	-81	-3045
Venezuela	4346	79470	32068	-669	40	115255

Source: IEA

Table 1
Net Energy Balance[1]
[1] *in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis*

policies have led to significant declines in its natural gas reserves which are now jeopardizing its ability to maintain export agreements that generate revenues. On the other hand, the so-called "energy have not" states of Brazil and Chile, with their historical need for energy imports, have adopted policies that are more favourable to investment. These countries are recognizing that energy price volatility is best addressed through security of supply that comes with continual investment in energy infrastructure and supply. Brazil in particular is on the verge of becoming, if it is not there already, an "energy have" country.

The Future Energy Price Paradigm

The apparent unsustainable nature of nationalization and domestic energy price subsidies will see a return to negotiated arrangements with foreign energy companies, the result of which will be increased investment and additional domestic energy supply. Mutual satisfaction on the part of both sides lies in the ability to "balance" the market pressure to equalize domestic energy pricing and global prices with the resistance exerted by domestic economies seeking to grow through lower energy costs. Interest in negotiating with those South American states that have pursued nationalistic energy policies has re-surfaced as exemplified by potential investments in Bolivia by Russia's Gazprom and China's Sinopec. A more likely scenario to emerge will be the continuation in activities by dominant South American state-owned energy companies that will see further integration of energy ownership within the continent and lower price volatility as security of supply risk is lessened. Firms such as Petrobras, the Brazilian state-owned oil company, with its recent announcement of new oil and natural gas projects in Bolivia (natural gas), Argentina (natural gas) and Uruguay (offshore oil) are increasing their access to continental energy reserves and promoting greater energy supply options. The overall impact on energy pricing will be a short-term increase in energy pricing at the domestic level for those countries currently employing policies of subsidization. Higher prices will encourage greater development which in turn will provide more reliability of supply. For those jurisdictions with market-based energy pricing, further integration of South America's vast energy resources will provide economies of scale leading to lower energy prices and improved reliability of supply.

	Coal	Crude Oil	Natural Gas
Argentina	234	10	9
Bolivia	-	27	358
Brazil	321	19	15
Chile	177	2	45
Columbia	1231	17	15
Ecuador	-	107	17
Paraguay	-	-	-
Peru	123	7	101
Uruguay	-	-	-
Venezuela	1957	202	191

Table 2
Ratio of Recoverable Reserves to Annual Consumption

References

CIA World Factbook (2010) https://www.cia.gov/library/publications/the-world-factbook/

De La Paz Vela, M. (2010) "Dollarization: Ecuador's Monetary Management", Americas Quarterly, Summer 2010.

De Oliveira, A. (2010) "Energy Security in South America, The Role of Brazil", International Institute for Sustainable Development.

Hanson, S. (2008) "Energy Bottlenecks in South America", Council on Foreign Relations.

International Energy Agency (2010) http://www.iea.org/stats/index.asp

Mares, D.R. (2004) Natural Gas Pipelines in The Southern Cone, Program on Energy and Sustainable Development.

Monge, C., Viale, C., Bedoya, F. (2010) "Analisis Quincenal: Latin America Update, December 2010", Revenue Watch Institute.

Schipani, A. (2010) "Bolivia launches ambitious energy plans", Financial Times.

U.S. Energy Information Administration (2010) http://www.eia.doe.gov/cabs/

Van Schaick, A. (2010) "Bolivia nationalizes energy firms". Aljazeera.net.

A Brief Note On the Oil and Natural Gas Industries In Latin America: Current Situation and Outlook

By Gerardo Rabinovich*

Natural resources in Latin America are abundant; especially, its proven reserves of oil and natural gas.

Proven oil reserves have grown considerably during the last 30 years, in spite of the fact that in some big countries, such as Mexico and Argentina, they have declined in absolute terms (see Figures 1 and 2). The existence of non-conventional oil in Venezuela, heavy oil in the Orinoco strip and deep off-shore high-quality oil in Brazil increases the revenue prospects for these countries. If the reserves volume in these countries are confirmed, Venezuela and Brazil would become the second and eighth oil-producing country, respectively, in the world.

This scenario is confirmed by the continued growth of oil prices, which are predicted to continue rising at an annual avarage rate of 10 US$/barrel. This tendency reflects the increasing shortage and depletion of this source of energy that makes producers turn to more expensive technologies and processes in order to satisfy demand, thus turning to projects in newly profitable developments[1].

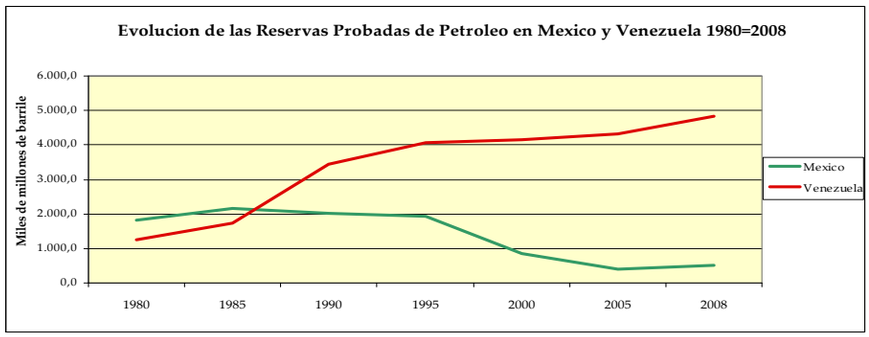


Figure 1
Proven Reserves of Oil in Mexico and Venezuela 1980-2008

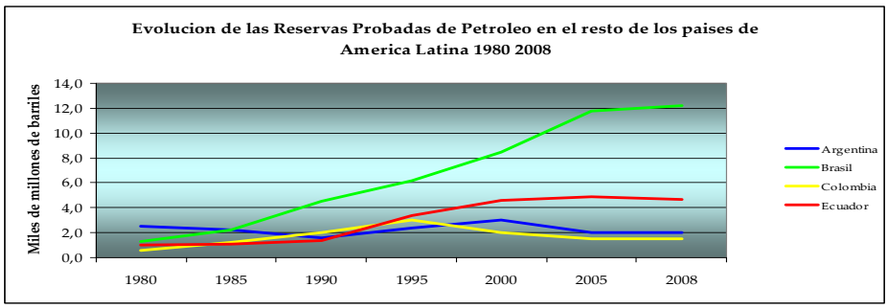


Figure 2
Proven Reserves of Oil in Argentina, Brazil, Colombia and Ecuador 1980-2008

In Latin American oil-producing countries, the states are mainly responsible for the property and development of resources. This can be seen both in national law and in the consolidation of domestic enterprises. Governments are, therefore, able to capture most of the revenues generated by the activity and in some cases, like Venezuela, they apply funds to political and social objectives. Where resource availability diminishes, e.g., the case of Mexico, this may affect international capital flows needed for the development activity. Nevertheless, in those cases where economic expectations are high, multinational majors and national oil companies from countries such us Iran, India, China and Russia appear. We now see, for example, companies such as SINOPEC, Gazprom, CNOOC and Iran Oil Company either buying other oil enterprises or being very interested in the Latin America petroleum industry. This is a new geopolitical situation that raises questions regarding the future success or failure of these new ventures and the adaptive capacity of these companies to the culture and social structures of Latin-American countries.

Another relevant issue regarding the petroleum scenario in Latin America is the little success that liberalization policies implemented in the ´90s have had. In some cases (such as Bolivia, Venezuela, Ecuador and to a lesser extent Brazil) the process has been reversed. In other countries (such as Argentina or Colombia) the policies have been mantained but have not generated the expected results. The most successful example of liberal policy implementation in the hydrocarbons sector is Peru, which has liberalized the petroleum industry while applying clear rules of operation. Nevertheless, the resource magnitude in Peru is relatively small, and makes one wonder what would happen if large oil fields were discovered.

With regards to the natural gas industry, projections show an important growth of domestic markets and, consequently, wide development of international trade.

Further, natural gas geopolitics has been modified in Latin America since the Argentinian energy crisis of 2004. The unilateral decisions taken by this country

* Gerardo Rabinovich is Managing Executive of the Instituto Argentino de la Energía, Buenos Aires, Argentina. The contribution of Ms. Veronica Gutman in the preparation of this article is appreciated.
See footnote at end of text.

resulted in a significant loss of confidence in the regional physical integration processes of natural gas. The alternative to diversification and supply security that importing countries found was liquefied natural gas (LNG). Many projects and investments have been designed and some of them are materializing given the supply needs of markets.

Natural gas supply became more expensive as a consequence of LNG penetration, but the regional price structure is still extremely dispersed and makes it difficult to determine a trend towards equilibirum that would facilitate both the development of domestic markets and the investments needed on the supply side. It is estimated that US$ 280 billion will be needed to sustain demand growth up to 2030.

A question that is being posed within the natural gas industry is related to the development of non-conventional gases, which have had unexpected growth in North America and have transformed the outlook for the natural gas industry worldwide. This has generated excess capacity in international trade and resulted in a price decrease in regional markets. Nevertheless, in Latin America the application of technologies capable of exploiting compact-sand natural gas (tight gas), shale gas or other possibilities that would extend the borders of proven reserves are still new.

These possibilities belong to a medium and long term horizon. For the time being, regional natural gas integration is evolving very slowly, multilateral agreements aimed at building a regional market are still immature and bilateral agreements-that could be rather urgent-are hard to implement. Natural gas export growth from Bolivia to Argentina is the clearest example.

The contract break-off between Argentinean supply companies and Chile and Brazilian buyers caused a loss of confidence that radiated though out the region and will take a long time to restore. Given this, supply security and vulnerability to reductions of natural gas by international providers have become priority issues for decision makers in the energy sector and, especially, in the natural gas industry.

Footnote

[1] Denis Babusiaux, Pierre René Bauquis: "Una explicación al agotamiento de los recursos petroleros y a la evolución de los precios del petróleo" Instituto Francés del Petróleo (ENSPM-IFP), Paris, 2006.

IAEE Past President ('95) Kenichi Matsui Recognized

Friends, colleagues and family of Kenichi Matsui met on 26 February for a wonderful and memorable gathering in celebration of his Outstanding Contribution to the IAEE Award bestowed during the Calgary USAEE/IAEE North American Conference. A comprehensive slide show displaying Kenichi's impressive career as an energy economist as well as his hobbies/travels and family life were shared with those who attended. Below are two pictures Kenichi wished to share with the entire IAEE membership. Kenichi keeps forging new ground in the field of energy and economics and will be instrumental in putting together the 3rd IAEE Asian Conference which will take place in Kyoto, 20-22 February, 2012. More information on this conference can be found by visiting here.

Party attendee under the banner "Cerebration Party for Kenichi Matsui's Outstanding Contribution to the IAEE Award". Kenichi wearing the IAEE shirts and holding IAEE cap.


Professor Karasawa wears Kenichi the IAEE shirt presented to Kenichi by the Party Attendee.

Regulating Generation Investment in Latin America: Future Challenges

By Rodrigo Moreno, Luiz. Barroso, Hugh Rudnick, Bruno Flach, Bernardo Bezerra and Ssebastian Mocarquer*

Introduction

A key concern for South American countries is how to procure new generation resources to supply demand, optimising reliability levels and cost impacts on consumers. Historically, this procurement activity has been very challenging due to factors such as uncertainty in load growth rates, limited access to financing, lack of enforcement in the case of delays in construction, deficient legal and regulatory institutional arrangements etc. More recently, the problem complexity has been compounded by environmental concerns about land use, impacts on biodiversity, indigenous populations and greenhouse gas emissions and climate change.

Many different approaches to energy procurement have been applied in these countries over the past decades, ranging from direct government investment in the 50s and 60s, use of Power Purchase Agreements (PPA) between government agencies and energy producers in the 70s and early 80s and, with the worldwide power sector reforms starting in the mid-80s, reliance on private investment driven by economic signals from short-term energy markets and administratively set capacity payments. Although details and circumstances vary widely among countries, it can be said that none of these approaches has been very successful – as it may be inferred from the large number of countries who experienced severe supply difficulties at some point (Maurer, Pereira and Rosenblatt, 2005). As a consequence, there is great interest in innovative experiences on this topic.

Since 2004 some South American countries such as Brazil, Chile, Peru and Colombia have been relying on new auction-based schemes to incentivise the entrance of new generation capacity. This scheme reflects the regulator's willingness to ensure a certain amount of new generation capacity under competitive conditions and facilitates the introduction of new financial instruments that can help to complete the electricity market: it auctions long-term supply contracts or call options backed, in some cases, by firm energy resources.

During the past years, these arrangements have been getting increased attention from investors, governments and multilateral agencies. One of the reasons for this interest is the large amount of capacity that has been already contracted. Altogether Brazil, Chile, Peru and Colombia have contracted for over 62,000 MW of new generation capacity between 2005 to 2010, with delivery dates from 2008 to 2018. Other interesting results from the South American auctions include:

- Successful private investment in new large-scale hydroelectric plants: about 18,000 MW in Brazil, including Santo Antonio and Jirau hydro plants (3,500 MW each) and Belo Monte hydro plant (11,233 MW) at prices of about 45 USD/MWh. In addition, about 3,000 MW have been auctioned in Colombia;
- Successful auction of other renewables such as wind, biomass and small hydro: more than 6,000 MW have been contracted, in most cases at very competitive prices (about 80 USD/MWh). In fact, wind power prices have proved to be among the lowest in the world in the case of Peruvian and Brazilian auctions.
- Wide variety of auction arrangements: (i) all-against-all auctions in which hydro, natural gas, coal, oil, biomass etc compete directly with each other; (ii) renewable-only auctions in which small hydro, biomass and wind plants compete with each other; (iii) biomass- and wind-specific auctions; and (iv) project-specific auctions (applied to the very large Brazilian hydro plants).
- Joint auctions: with multiple buyers and sellers that have a tendency to be organised as centralised processes in order to obtain benefits from economies of scale.
- Diverse auction mechanisms: first price sealed-bid auctions; descending clock (dynamic) auctions with or without elastic demand curves; hybrid and combinatorial mechanisms.
- Different types of contracts: mid- and long-term forward contracts, call options and reliability options.
- Diversity of investors: ranging from large companies established in the country to new local and foreign investors and first-time-power-system investors.

* Rodrigo Moreno is with the Imperial College, London; Luiz Barroso, Bruno Flach and Bernardo Bezerra are with the PSR, Rio de Janeiro; Hugh Rudnick is with the Pontificia Universidad Catolica de Chile; and Sebastian Mocarquer is with Systep Ingenieria y Disenos in Chile.

See footnotes at end of text.

- The first objective of this article is to briefly describe the evolution of market regulation for generation investment and the recent auction-based mechanism experience in South America. Focus will be given to countries where the auctions have been having a more active role, i.e., Brazil, Chile, Peru and Colombia. The ultimate aim is to identify key challenges that will need to be addressed in the near future.

Early generation investment incentives in South America

The early electricity market design in South America was fundamentally centred on system marginal pricing. Short-term energy electricity markets were created, trusting that spot prices[1] would promote the efficient use of existing generation resources and provide signals to foster the interest of investors in building new capacity if needed (Schweppe et al, 1988). An imbalance between supply and demand caused by demand growth, for instance, would result in spot price increases and thus would create incentives for the construction of new plants. Moreover, the optimal amount of capacity could recover total costs, i.e., expected spot market revenues would be enough to remunerate investment and cover operational costs. In addition, energy bilateral contracts were to be freely negotiated between generators and consumers, subject to a reference price that was determined by the regulator in order to stimulate efficient contracting by distribution companies.

Furthermore, capacity payments were established in some countries such as Bolivia, Chile, Colombia and Peru in order to complement generators' energy revenues and provide incentives for the entrance of new capacity. In the capacity payment approach, the capacity price (a value expressed in $/kW.month) is determined administratively by the regulator. Except for Colombia – that has replaced the regulated capacity payment by a market-based reliability option – capacity payments are employed in Peru, Bolivia and Chile up until today.

On the other hand, Brazil adopted the firm supply concept – implemented as firm energy certificates assigned to generators – and complemented its energy-only market with an obligation of consumers to have at least 85% of their consumption in contracts backed by firm energy certificates.

The challenges of generation investment in Latin America: why did the early design fail?

This early design was initially very successful in allowing power systems to improve efficiency and security of supply with an increasing number of new agents. Under this era, energy trading started to be massively promoted by private entities between different countries, e.g., Chile-Argentina-Bolivia-Brazil; electrification was significantly enhanced, e.g., Brazil increased its demand coverage from 85% up to about 98% nowadays (World Bank, 2005); prices to end customers decreased and the security and quality of supply was significantly improved, e.g. Argentina extraordinarily decreased his unsupplied energy from about 16% a month in the late 80s to nearly zero in the late 90s.

Despite all these positives aspects, this basic design has presented a number of problems in most of the countries that later led to, in some cases, severe energy crisis. Electricity shortages – or severe risk of shortages –have been observed in the region (for example, Brazil (2001), Chile (1999 and 2004) and Peru (2006)). In addition, capacity payments did not suffice to stimulate the availability of generation and ultimately the early design failed to promote generation adequacy in the region.

The early market designed failed because of various reasons. Firstly, the economic signal provided by the energy spot market has proven to be too volatile and difficult to correctly indicate and stimulate the entrance of new capacity. This is especially true for countries with a high hydro share, where the occurrence of conjuncture favourable hydro conditions can drive the spot prices downwards even if there are structural problems with supply. The second reason is the combination of strong demand growth (over 5% yearly) and regional economic instability, creating uncertain conditions for trading energy between neighbouring countries and impacting on energy price expectations.

Furthermore, some Latin-American power systems are also affected by challenges related to the financing of new generation which is done under a project-finance mode and where lenders require a stable long-term project's revenue stream in order to concede affordable long-term financing rates.

All these factors makes generation activity very risky, inhibits the closing of financing for new projects and makes development of new generation more difficult on a constant basis. Capacity payments in Chile, Colombia and Peru only represent a small part of the overall generator income and its role is very limited by the uncertainty of the energy spot market.

It is worthwhile to mention at this point that bilateral contracts between generators and large consumers, with prices negotiated between the parties involved, may reduce risk and make them immune from unstable energy spot prices. They represented in the past, and do today, a way to assure investment from

interested parties like the mining industry in Chile. Nevertheless, these bilaterial contracts only represent part of the portfolio contracted by a generator while many other contracts, particularly with small consumers, were still representing high risks to investors given their direct link to the evolution of the system marginal costs.

Beyond energy-only markets and capacity payments: long-term contract auctions and call options

The sequence of problems, crises and, in general, adverse events that dominated South America in the early 00's motivated a search for new mechanisms to ensure generation adequacy. Because the energy spot price does not provide adequate signals for new investments and given the difficulties in defining a regulated capacity payment, a convergence was observed to use auction mechanisms in which potential investors compete to obtain a long-term energy contract or a call option such as the one proposed in (Vazquez, River and Arriaga, 2002). Auctions encourage the participation of many participants, foster competition and allow for efficient price discovery.

The conceptual aspect of the new proposal is to carry out auctions of long-term energy contracts called ahead of time, so that winners can have enough time to develop their investment and a minimum revenue is guaranteed for a number of years. At the same time, investors have to cover their bids by using capacity certificates that ensure physical coverage and security of supply[2]. In order to create a market for contracts, all consumers, both regulated and free (i.e. non-regulated large consumers), are forced to contract 100% of their consumption (demand growth, contract expiration with a decommissioning plant, etc.) in a long-term fashion through forward or call option contracts.

Whilst Chile and Peru have set very similar rules to auction contract renewals and new energy contracts, Brazil and Colombia have followed a completely different path. Implementation details can be seen in (Bezerra, Barroso and Pereira, 2011; Crampton and Stoft, 2007; Dutra and Menezes, 2005; Mocarquer et al 2009; Moreno et al, 2010a). Main auctions' characteristics can be found in Table 1:

Looking ahead: identifying challenges in the new framework

The new framework has been generally assessed as a positive reform and generation investment has been clearly boosted. Apart from the experiences and lessons (Moreno et al, 2010b), there are a number of challenges that need to be analysed in details if one wants to prove that this proposal is, in effect, efficient and robust in the long-term.

1. **Correct auction design**: auction design is critical to ensure that contracts for future supply are being allocated to the right investors at efficient prices. Flaws in incumbent auction design have been already identified in (Moreno et al, 2010b) and these involve issues such as future price indexation, network charges' uncertainty and price clearance mechanisms. For example, network charges uncertainty could lead to a significant bid price increase and ultimately to an inefficient contract allocation if this is not tackled properly in the auction design.
2. **Demand response and energy efficiency**: 100% demand coverage through fixed(indexed)-price long-term forward contracts such as in Brazil, Chile and Peru could lead to a situation in which demand becomes completely irresponsive to short-term price signals. Although capacity charges during peak demand hours can contribute in this respect, potential real-time price mechanisms would be difficult to implement in the future (e.g., when Smart Meters arrive). In this respect, call options can, in contrast, effectively allow real time demand response whilst spot prices are lower than the strike prices and, at the same time, incentivise generation investment through fixed revenue streams.
3. **Competition and market power**: competition is, in principle, ensured in investment through the auction mechanism and in operation through the wholesale electricity market. Auctions also make the market more contestable, ensuring a better behaviour of incumbent agents (Baumol, 1982). However, for an auction to work, it is important to attract bidders and to stimulate bidders to behave competitively. A condition that shadows competition analysis is the presence of State owned companies in several of the countries analysed, where opportunities for political price manipulation are a risk that needs to be observed carefully, particularly in a country like Brazil (e.g., governments may try to lower auction prices by bidding low values in the auction processes).
4. **Efficient pricing**: the separation in the competition between existing and new capacity indeed facilitates the entrance of new comers in Brazil. However, whilst in Colombia existing generators take the clearing price from the new capacity's auction, in Brazil existing generators compete in different auctions that clear at different prices. Hence, very diverse prices between existing and new energies arise which can be, in the case of the former, affected by the aforementioned pres-

	Brazil	Colombia	Chile	Peru
Capacity mix	Hydro 75%, thermal 125%	Hydro 65%, Thermal 33%	Hydro 40%, Thermal 60%	Hydro 60%, Thermal 40%
Load growth (per year)	5-6%	4-6%	4-6%	5-8%
Objectives of the procurement	Attract new capacity	Attract new capacity	Attract new capacity	Attract new capacity
Specificity of the electricity procured	Specific project; specific technology and "any energy"	All technologies and projects compete	All technologies and projects compete	All technologies and projects compete
Degree of centralisation	Joint auctions by distribution companies organised by the government	Joint auction to ensure reliability, closing gap between supply and demand organised by a government agency	Distribution companies organise and manage their auctions, possibility of joint auctions	Distribution companies organise and manage their auctions, possibility of joint auctions
Buyers	Regulated users	All consumers	Regulated users	Regulated users, but free consumers can be included
Sellers	Separate auctions for existing and new capacity	New energy	All existing and new generation (in the same auction)	All existing and new generation (in the same auction)
Load forecast responsibility	Distribution companies are required to inform their load forecasts in each regular auction to supply regulated market	Regulator and planner provide demand, auction bridges the total system gap	Done by distribution companies, auction supplies the regulated market	Done by distribution companies, auction supplies the regulated market
Grace period	1-3-5 years ahead for 1,5,15 year contracts tied to energy certificates	3 to 7 years ahead	3 years ahead for any period up to 15 years	3 years ahead for any period up to 15 years
Total to date	31	1	3	3
Volume (MW)	57,000 MW of new capacity	3,000 MW	4.2 average GW	3.0 average GW
Auction process	2-phase hybrid auction	Descending clock auction	Sealed-bid combinatorial auction with pay-as-bid rule	
Energy policy decisions	Specific auctions for technologies and projects	All technologies compete together	All technologies compete together	Separate auctions for renewables
How often are auctions organised?	There are regular auctions to contract new capacity, government can organise specific (additional) auctions whenever needed	At planner's discretion, whenever there is a gap between total system future demand and supply	Disco(s) decide	Disco(s) decide

Table 1: Main auctions' characteristics per country

ence of the State as a bidder.

5. **Integration of renewables**: energy auctions have been also used in South America to promote renewable generation. Peru and Brazil are the leaders, but Argentina and Uruguay have also been conducting auctions to procure wind plants. Although renewable generation can be fostered by the aforementioned auctions, it becomes a critical problem to decide how much capacity should be initially auctioned and to what extent these resources still need additional incentives to successfully enter the market.

6. **Dealing with long-term uncertainty**: demand, fuel cost and availability and a number of important variables to be considered for a long-term investment plan are uncertain. Therefore, mechanisms to supply electricity demand in the future should be flexible enough in order to deal with an array of future scenarios in an efficient and secure fashion. In this respect, the auction mechanism to commit investors at present needs further improvements in, for example, indexation formulas. Indeed, prices can change in time according to the indexation formulas specified in the contract, forcing the auctioneer – and, ultimately, consumers – to take a risk position when allocating contracts.

Final Remarks

Concerns over electricity supply adequacy indicate that investment in new generation capacity looks as a promising activity in the future not only because of the increasing level of development and electrification of Latin-American countries, but also because of the efforts of a number of Latin-American governments to change regulation as to incentivise new entrants. In this line, considerable improvements have been made in regulatory frameworks across the region resulting in significant new investments. However, a set of challenges at fundamental and practical levels have been implicitly left for future analysis and development. Failing to address them could result in another wave of regulatory changes in the future

Footnotes

[1] Excepting Colombia, most countries of the region did not implement a bid-based system for dispatch and price formation. Instead, the "spot price" was calculated as a marginal cost of a dispatch model for scheduling decisions in Peru, Chile and Brazil.

[2] The adequacy guarantee of a generator is a MWh or MW rating that reflects the generator's contribution to the overall system supply reliability. These can be calculated by the regulator following several methodologies such as the one in (Batlle and Vazquez, 2000).

References

Batlle, C., and Vazquez, C. (2000). A probabilistic model for capacity payments distribution in a deregulated wholesale electricity market. Proceedings of the Sixth International Conference on Probabilistic Methods Applied to Electric Power Systems (PMAPS), Madeira, Brazil.

Baumol , W. (1982). Contestable markets: an uprising in the theory of industry structure. American Economic Review. 72 (1):

1-15.

Bezerra, B., Barroso, L.A., Pereira, M.V. (2011). Bidding strategies with fuel supply uncertainty in auctions of long-term energy call options. to appear in IEEE Transactions on Power Systems 2011.

Cramton, P. and Stoft, S. (2007). Colombia firm energy market. Proceedings of the Hawaii International Conference on System Sciences, January 2007.

Dutra, J., and Menezes, F. (2005). Lessons from the electricity auctions in Brazil. The Electricity Journal, Volume 18, Issue 10, December 2005, Pages 11-21.

Maurer, L., Pereira, M., Rosenblatt, J. (2005). Implementing power rationing in a sensible way: lessons learned and international best practices. ESMAP – World Bank, Washington.

Mocarquer, S., Barroso, L.A., Rudnick, H., Bezerra, B., Pereira, M.V. (2009). Energy policy in Latin America: the need for a balanced approach. IEEE Power & Energy Magazine, Vol.7, Issue 4, Page(s): 26 - 34.

Moreno, R., Barroso, L., Rudnick, H., Bezerra, B, Mocarquer, S., Flach, B., Moreno, J. (2010a). Lessons from five years of experience in energy contract auctions in South America. 33th IAEE International Conference, Rio de Janeiro, June 2010.

Moreno, R., Barroso, L.A., Rudnick, H., Mocarquer, S., Bezerra, B. (2010b). Auction approaches of long-term contracts to ensure generation investment in electricity markets: lessons from the Brazilian and Chilean experiences. Energy Policy, Vol. 38 (10), October 2010, pp. 5758-5769.

Schweppe, F. C , Caramanis, M. C., Tabors, R. D. and Bohn, R. E. (1988). Spot pricing of electricity.ISBN 0-89838-260-2, Kluwer Academic Publishers, Boston, MA.

Vazquez C., River M., and Arriaga I.P. (2002). A market approach to long-term security of supply, IEEE Transactions on Power Systems, 17 (2).

World Bank (2005). Benchmarking data of the electricity distribution sector in the Latin American and Caribbean region 1995-2005.

Welcome New Members

The following individuals joined IAEE from 1/1/11 to 2/28/11

Lateef Akinpelu
University of Ibadan
NIGERIA

Kemal Anbarci
Chevron
USA

Arne Andresen
NORWAY

Veronica Araoz
NHH
NORWAY

Nuray Omur Aridici
Student
UNITED KINGDOM

Victor Babale
University of Surrey
UNITED KINGDOM

Mario Barbella
ITALY

Valeria Barbi
ITALY

Angela Margherita Bellomo
Pricewaterhousecoopers Spa
ITALY

Daniel Berger
Face- UFMG
BRAZIL

Vatsal Bhatt
Brookhaven National Laboratory
USA

Attilo Bisio
West Park Associates
USA

Maki Bissig
IWB
SWITZERLAND

Ann Christin Boeng
Statistisk Sentralbyra SSB
NORWAY

Guido Bortoni
Autorita per l'Energia Elettrica
ITALY

Felipe Botelho Tavares
GEE-UFRJ
BRAZIL

Brandon Bridge
USA

Michael Brisson
USA

Stephen Bull
Statoil
USA

Luciano Buscaglione
Anigas
ITALY

Ramses Omar Cabrales
Federal Energy Regulatory Comm
USA

Sergio Camillucci
ENEA CR Bologna
ITALY

Andrea Caramagna
ITALY

Angelo Caranfa
ITALY

Vincenzo Carinci
ITALY

Andrea Carmallino
ITALY

Emiliano Catalina
ITALY

Luigi Ceccarini
ITALY

Julián Chevallier
University Paris Dauphine
CGEMP
FRANCE

Gianpaolo Chimenti
Pricewaterhousecoopers Spa
ITALY

Chi Kong Chyong
University of Cambridge
UNITED KINGDOM

Analiza Ciatti
ITALY

Tim Cofer
USA

Carla Cohen
USA

Natasha Collins
Battelle/PNNL
USA

Alberto Constantiello
ITALY

Charles Cook
Energy Institute
USA

Emre Coskun
Sabanci University
TURKEY

Ryan Crago
DeGolyer and MacNaughton
USA

Meter Crawford
INTEK Inc
USA

Paolo Cristofoletti
ITALY

Donald Curry
USA

Michele Cosimo
Dalena Ref Ricerche per L Economia la Fin
ITALY

Andrea D'Alessandro
ITALY

Daniel Davi Arderius
Endesa
SPAIN

Tullia De Dominicis
ITALY

Marco De Santis
ITALY

Laura Di Giuseppe
ITALY

Diego Di Palma
ITALY

Fabio Di Pasquale
ITALY

Caroline Dieckhoener
Energiewirtschaftliches Institut
GERMANY

Fabio Dubini
Edison
ITALY

Anette Einarsen
Point Carbon
NORWAY

Even Enggrav
Norwegian School of Economics
NORWAY

Alex Engh
Sund Energy
NORWAY

Adrian Fahrni
OMPEX AG
SWITZERLAND

Dayo Fawibe
USA

Roberto Fernandez Fernandez
Universidad de Vigo
SPAIN

Heather Fookes
Davies Park Exec Search Consultants
CANADA

Simona Foroni
ITALY

Roger Fouquet
Basque Centre for Climate Change
SPAIN

Francesco Galasso
Pricewaterhousecoopers
ITALY

Marizio Galeotti
IEFE Universita Bocón
ITALY

Sofia Galligani
Imperial College London
UNITED KINGDOM

Cesar Gallo
Fundacion Repsol
SPAIN

Elisabeth Sand Gimming
Statnett
NORWAY

Vance Ginn
Texas Tech University
USA

Xavier Martinez Giralt
Univ Autonoma de Barcelona
SPAIN

Marina Gonzalez Vaya
ETH Zurich
SWITZERLAND

Guilio Grandi
Pricewaterhousecoopers Spa
ITALY

Alessandro Grandinetti
Pricewaterhousecoopers SpA
ITALY

Felix Groba
German Inst of Econ Resch
GERMANY

Lee Gross
USA

Marco Guerrera
ITALY

Ali Uygar Gurbuz
Zorlu Enerji
TURKEY

Faustino Gutierrez
USA

Julia Beatriz Gutierrez Lopez
University of Leicester
COLOMBIA

Mari Hegg Gundersen
Olje Og Energidepartementet
NORWAY

Matthew Hannon
University of Leeds
UNITED KINGDOM

Peter Hardegger
Pasl Scherer Inst
SWITZERLAND

Susannah Howieson
Science and Policy Tech Inst
USA

Cem Isik
Atatürk University
TURKEY

Olaf Islei
Ofgem
UNITED KINGDOM

James Johnson
Spectrum Group International Inc
USA

Gizem Keskin
USA

Yeong Jae Kim
USA

Craig Kimball
Southern Methodist University
USA

Tony Knowles
National Energy Policy Institute
USA

Martin Koller
Ctr for Energy Poly and Econ
SWITZERLAND

Rolf Korneliussen
Statnett
NORWAY

Jens Krause
Pembroke College
UNITED KINGDOM

Joeti Lall
ISEEESA
CANADA

Jessica Lamb
USA

Dennis Larson
AECOM
USA

Marius Ley
ETH Zurich
SWITZERLAND

Eric Lowe
USA

Ian Luciani
BP Alternative Energy
UNITED KINGDOM

Samuel Lussac
Ctr Emile Durkheim Univ of Bordeaux
FRANCE

Monica Maduekwe
Univeristy of Dundee
UNITED KINGDOM

Valentina Mangano
ITALY

Paolo Andrea Mascagni
ITALY

Mziyanda Mbuseli
Eskom Holding Ltd
SOUTH AFRICA

Nils Mellquist
Deutsche Asset Management
USA

Antonio Merino
Repsol
SPAIN

Ingrid Mittet
Statnett
NORWAY

Simone Mori
ENEL Green Power
ITALY

Daniel Mulet Lind
USA

Emre Mutlu
Cathedral Court University
UNITED KINGDOM

Sigbjorn Nome
Norges vassdrags og energie-director
NORWAY

Ngoh Okoh
AR Analytics
NIGERIA

Olakunle Olawale
RL Energy Ltd
NIGERIA

Laura Oleson
NRCAN
CANADA

Fiona O'Meara
Bord Gais Eireann BGE
IRELAND

Raymond Orbach
Energy Institute
USA

Jose Luis Ortega Rojo
CEPSA
SPAIN

Ola Oyan
Statnett SF
NORWAY

Rui Paisana
UniCV Universidade de Cabo Verde
CAPE VERDE

Elisabetta Pellini
Surrey University
UNITED KINGDOM

Blanca Perea Solano
Pricewaterhousecoopers
SPAIN

Sonia Perez Perez
Embajada Britanica
SPAIN

Yuliya Pidlisna
BI Norwegian School of Economics
NORWAY

David Powell
MGIMO
RUSSIA

Sonja Powell
UNITED KINGDOM

Vitaly Protasov
Institute for Energy and Finance
RUSSIA

Felix Puime Guillen
Universidad de Vigo
SPAIN

David Ramberg
USA

Rodrigo Ramirez-Pisco
CITCEA
SPAIN

Erik Rego
University of Sao Paolo
BRAZIL

Daniele Revel
LEPII-EDDEN
FRANCE

Gabriela Rivera Cordero
ITALY

Flavio Rottenberg
ITALY

David Saltiel
AREVA Inc
USA

Aliyu Sani
Zenith Bank plc
NIGERIA

Vito Giuseppe Scarola
ITALY

Benjamin Scholz
Columbia University
GERMANY

Hans Gunter Schwarz
RWE AG
GERMANY

Antonio Sgobba
ITALY

Inga Shamsutdinova
UNITED KINGDOM

Abhishek Somani
USA

Alison Steck
USA

Romano Stefani
Dolomiti Energia
ITALY

Peter Sweatman
Climate Strategy
SPAIN

Inaiê Takaes Santos
Federal University Rio de Janeiro
BRAZIL

Silvia Tardioli
ITALY

Roman Terentiev
USA

Zach Tuchman
DeGolyer and MacNaughton
USA

J Tomaz V Pereira
University of Campinas
BRAZIL

Francesco Vallone
CogenPower
ITALY

Péter Simon Vargha
MOL Hungarian Oil and Gas Plc
HUNGARY

Petter Vegard
Hansen Point Carbon
NORWAY

Giancarlo Villa
Esso Italiana
ITALY

Juan Villada
Universidad Nacional
COLOMBIA

Juliana Vorono
Petrologica
UNITED KINGDOM

Calliope Webber
Greengold Ltd
UNITED KINGDOM

Jasper Weener
Dubai Petroleum Establishment
UNITED ARAB EMIRATES

Candida Whitmill
mc2 Energizing Business
UNITED KINGDOM

Malgorzata Wiatros-Motyka
The University of Nottingham
UNITED KINGDOM

Martine Moe Winsnes
Statnett SF
NORWAY

Qiaosheng Wu
China University of Geosciences
CHINA

Simon Yeung
Chevron Hong Kong Ltd
HONG KONG

Sara Zahidi
UNITED KINGDOM

Elena Zampini
ITALY

Marco Zanchi
UGF Merchant
ITALY

Dali Zhang
National University of Singapore
SINGAPORE

Member-Get-A-Member Campaign

IAEE's Member-Get-A-Member campaign continues in 2011. IAEE believes you know quite well the value of membership in our organization. Furthermore, membership growth is one of the Association's top strategic initiatives. With your knowledge of our organization's products/services, publications and conferences, we know that you are in the ideal position to help us grow. The process to win rewards for your self is quick and easy!

Here's How the Program Works:

- For each new IAEE member you recruit, you receive THREE months of membership free of charge.
- New Members must complete the online IAEE membership application form at https://www.iaee.org/en/membership/application.aspx Make sure the member(s) you refer mentions your name in the "Referred By" box located on the online membership application form.
- The more new members you recruit the more free months of membership you will receive. There is no limit to the number of new members you may refer.

Membership Recruitment Period and Additional Incentive:

- This special program will run from January 1, 2011 – May 1, 2011.
- The Member that refers the most new members to IAEE during this timeframe will receive a complimentary registration to attend the Stockholm IAEE International Conference (this prize may be assigned by the winner to another member, yet must be used for complimentary registration to attend the Stockholm conference only).

IAEE Tips for Success:

- Promote the benefits of IAEE membership - Share your IAEE passion with others! Visit https://www.iaee.org/en/inside/index.aspx for a brief overview of IAEE.
- Connect with colleagues – Invite your co-workers, colleagues and friends to IAEE conferences.
- Keep IAEE membership applications at your fingertips - Please contact David Williams at iaee@iaee.org and request that membership applications are mailed to your attention. Feel free to hand these out on your travels.
- Let IAEE do the work for you – Send us an email at iaee@iaee.org letting us know who should be invited to join IAEE (we need full name and email address) and we will contact who you refer to see if they have an interest in joining IAEE. If the member joins during the timeframe above you will be given three months of membership free per member you recruit!

We encourage all members to help our organization grow. At the same time, you will be rewarded with free membership months and an opportunity to have your conference registration fee waived at a coming IAEE conference.

Thank you for making IAEE the great organization that it is!

Publications

Fuel Cells: Technologies for Fuel Processing. Dushyant Shekhawat, J.J. Spivey and David Berry, Editors (2011). 580 pages. Price: $140.00. Contact: Order Department Elsevier Science & Technology Books, 30 Corporate Drive, Suite 400, Burlington, MA 01803. Phone: 781-313-4726. Email: d.oconnell@elsevier.com URL: www.elsevier.com

Renewable Energy: Physics, Engineering, Environmental Impacts, Economics & Planning, 4th Edition. Bent Sorensen. (2010). 958 pages. Price: $120.00. Contact: Order Department Elsevier Science & Technology Books, 30 Corporate Drive, Suite 400, Burlington, MA 01803. Phone: 781-313-4726. Email: d.oconnell@elsevier.com URL: www.elsevier.com

The Oxford Handbook of Regulation. Robert Baldwin, Martin Cave and Martin Lodge, Editors (2010). 752 pages. Price: $120.00. Contact: Order Department, Oxford University Press, 2001 Evans Road, Cary, NC 27513, USA. Phone: 800-451-7556. Fax: 919-677-1303. URL: www.oup/us and use promo code 29181

Calendar

13-14 April 2011, European Biomass to Power at Vienna, Austria. Contact: Justyna Korfanty, ACI Europe, 5/13 Great Suffolk Street, London, SE1 0DS, United Kingdom. Phone: 44-20-7981-2503 Email: jkorfanty@acieu.net

13-13 April 2011, Solar meets Glass 2011 at Berlin, Germany. Contact: Anja Kleppek, Solarpraxis AG, Zinnowitzer Straße, Berlin, Berlin, 12489. Phone: 030-726296-305 Email: anja.kleppek@solarpraxis.de URL: www.solarpraxis.de/en/conferenze/solar-meets-glass/general-information/

14-15 April 2011, Thin-Film Industry Forum 2011 at Adlershof, Berlin. Contact: Julia Heithecker, Solarpraxis AG, Zinnowitzer Straße 1, Berlin, Berlin, 10115, Germany. Phone: 030-726296-302 Email: julia.heithecker@solarpraxis.de URL: www.solarpraxis.de/en/conferences/thin-film-industry-forum-2011

14-15 April 2011, 12th Forum Solarpraxis at Berlin, Germany. Contact: Anja Kleppek, Solarpraxis AG, Zinnowitzer Straße 1, Berlin, Berlin, 10115, Germany. Phone: 030-726296-305 Email: anja.kleppek@solarpraxis.de URL: http://www.solarpraxis.de/en/conferenze/11th-forum-solarpraxis/general-information/

18-19 April 2011, Ohio Fuel Cell Symposium 2011 at North Canton, OH. Contact: Roger Hillson, Marketing, Ohio Fuel Cell Coalition Email: roger.hillson@fuelcellcorridor.com URL: www.fuelcellcorridor.com

25-26 April 2011, 4th Annual NAEE/IAEE Intl Conf: Green Energy and Energy Security - Assessing the Options for Africa in a Global Energy Market at Abuja, Nigeria. Contact: Adeola Adenikinju, Nigeria Email: akiniwayemi@hotmail.com

9-10 May 2011, Gas Transport and Shipping Course at Groningen. Contact: Janet Smid, Account Manager, Energy Delta Institute, Netherlands. Phone: +31 (0) 50 524 8308. Fax: +31 (0) 50 524 8301 Email: smid@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/specific-programmes/gas-transport-shipping-course

12-13 May 2011, Solar Industry Summit UK 2011 at Grand Connaught Rooms, London. Contact: Severine Scala, Solarpraxis AG, Zinnowitzer Straße 1, Berlin, Berlin, 10115, Germany. Phone: 030-726296-326 Email: severine.scala@solarpraxis.de URL: www.solarpraxis.de/en/conferenze/solar-industry-summit-uk-2011

16-20 May 2011, International Gas Value Chain Course at Hampshire Hotel Groningen. Contact: Rik Cents, Account Manager, Energy Delta Institute, Groningen, Netherlands. Phone: +31 (0) 50 524 83 19 Email: cents@energydelta.nl URL: http://www.energydelta.org/mainmenu/executive-education/introduction-programmes/international-gas-value-chain

23-27 May 2011, De Gaswaardeketen at The Netherlands. Contact: Nynke Feenstra, Energy Delta Institute, Netherlands. Phone: +31 (0) 50 524 83 14. Fax: +31 (0) 50 524 83 01 Email: feenstra@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/introduction-programmes/de-gas-waardeketen

1-2 June 2011, Profitable Partnerships to Maximize Smart Grid Tech Penetration at San Jose, CA. Contact: Baruch Hecht, Conference Organiser, SmartGrid Update, 70 Hudson St, 6th Floor, Hoboken, NJ, 07030, USA. Phone: 201-204-1677 Email: bhecht@smartgridupdate.com URL: http://www.smartgridupdate.com/smartgridtechnology/download-brochure.shtml

6-10 June 2011, Gas Market Liberalisation and Regulation Course at (to be determined). Contact: Rik Cents, Energy Delta Institute, Netherlands. Phone: +31 (0) 050 524 8319. Fax: +31 (0) 050 524 8301 Email: cents@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/specific-programmes/gas-market-regulation-course

6-10 June 2011, Gas Strategy Course at (to be determined). Contact: Rik Cents, Account Manager, Energy Delta Institute, Netherlands. Phone: +31 (0) 50 524 8319. Fax: +31 (0) 50 524 8301 Email: cents@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/specific-programmes/gas-strategy-course

17-19 June 2011, 2011 CES China Conference: Ten Years after WTO Accession: China and the World Economy at Beijing, China. Contact: Junjie Hong, Professor Email: hongjunjie@yahoo.com URL: www.china-ces.org

19-23 June 2011, 34th IAEE International Conference: Institutions, Efficiency and Evolving Energy Technologies at Stockholm, Sweden. Contact: Lars Bergman Email: lars.bergman@hhs.se URL: www.hhs.se/iaee-2011

June 29, 2011 - July 3, 2011, Western Economic Association International 86th Annual Conference at San Diego, CA. Contact: Meeting Coordinator, WEAI, 18837 Brookhurst St, Ste 304, Fountain Valley, CA, 92708, USA. Phone: 1-714-965-8800. Fax: 1-717-965-8829 Email: info@weai.org URL: www.weai.org

9-12 October 2011, Redefining the Energy Economy: Changing Roles of Industry, Government and Research at Washington, DC. Contact: David Williams, Executive Director, USAEE, 28790 Chagrin Blvd Ste 350, Cleveland, OH, 44122, USA. Phone: 216-464-2785 Email: usaee@usaee.org URL: http://www.usaee.org

10-12 October 2011, Energiemarkten at The Netherlands. Contact: Jasper Hofman, Account Manager, Energy Delta Institute, Laan Corpus den Hoorn 300, Groningen, Netherlands. Phone: +31 (0) 50 524 8308. Fax: +31 (0) 50 524 8301 Email: hofman@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/introduction-programmes/energiemarkten-2

24-28 October 2011, International Gas Value Chain Course at The Netherlands. Contact: Rik Cents, Energy Delta Institute, Netherlands. Phone: +31 (0) 50 524 83 19. Fax: +31 (0) 50 524 83 01 Email: cents@energydelta.nl URL: http://www.energydelta.org/en/mainmenu/executive-education/introduction-programmes/international-gas-value-chain

INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
WWW.IAEE.ORG

IAEE ENERGY FORUM

Volume 20, Second Quarter, 2011

The IAEE Energy Forum is published quarterly in February, May, August and November, by the Energy Economics Education Foundation for the IAEE membership. Items for publication and editorial inquiries should be addressed to the Editor at 28790 Chagrin Boulevard, Suite 350, Cleveland, OH 44122 USA. Phone: 216-464-5365; Fax: 216-464-2737. Deadline for copy is the 1st of March, June, September and December. The Association assumes no responsibility for the content of articles contained herein. Articles represent the views of authors and not necessarily those of the Association.

Advertisements: The IAEE Energy Forum, which is received quarterly by over 3800 energy practitioners, accepts advertisements. For information regarding rates, design and deadlines, contact the IAEE Headquarters at the address below.

Membership and Subscription Matters: Contact the International Association for Energy Economics, 28790 Chagrin Boulevard, Suite 350, Cleveland, OH 44122, USA. Telephone: 216-464-5365; Fax: 216-464-2737; e-mail: IAEE@IAEE.org; Homepage: http://www.iaee@iaee.org

IAEE Energy Forum
Energy Economics Education Foundation, Inc.
28790 Chagrin Boulevard, Suite 350
Cleveland, OH 44122 USA

PRSRT STD
U.S. POSTAGE
PAID
Hanover, PA
Permit No. 4