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IAEE Energy Forum

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INTERNATIONAL ASSOCIATION *for* ENERGY ECONOMICS

PRESIDENT'S MESSAGE

Since my last message in April, I have participated in three very impressive affiliate events in Nigeria, South Africa and Athens and am on the brink of what promises to be an impressive 2018 IAEE International Conference in Groningen this month. The experiences of the last few months has reinforced my growing sense that "Energy Transition" needs to be seen in a much broader context than the overriding emphasis merely on decarbonization.

A geographic transition from a long the dominant set of developed economies primarily in the Atlantic Basin now moving eastward toward Asia. The natural evolution of trade patterns that goes with it faces not only aggressive US trade policies and sanctions discussed in this issue, but also an imminent decarbonization of tanker markets under new IMO sulfur restriction effective in 2020 that materially impact refinery product slates, global product trade and refinery operations.

Independent of decarbonization, energy poverty and energy access has become a dominant theme in the developing world and these countries have an opportunity for technological leapfrogging the infrastructure choices that have shaped energy systems in the developed economies. You don't see telephone poles in Africa, you see cell phones, drone deliveries compensate for the lack of roads, distributed power replaces central station power needs for land line. Each country has a unique set of resources, culture, history and political systems that affect the choice of transition pathways: "One-size does not fit all."

Setting appropriate goals for a country and for the world in general is only a first step. Knowing where we are at the start of the transition journey is not as easy as it might appear, quality information and its effective communication is a key and a strong part of the IAEE's strategic plan. Flexibility in the face of intervening events along a chosen transition pathway is essential. Th lessons provided by successes and, -- as important, if not more important – failures from the experiences of developed economies can be a help if judiciously used.

Since I got my undergraduate degree in economics 50 years ago, I have learned that markets are usually in disequilibrium and transitions are happening on multiple fronts in response to both internal and external events. Energy markets drew me in almost immediately, with the legacy of my father's already long career as a senior economist with General Electric providing a fabric for a long and enjoyable career. In facing the current challenge, the need to understand national differences makes our involvement very much a two-way street. We need to learn first and teach later. My challenge to the organization and its members is simple: "If we can't contribute productively to the transition debate, what have we and the IAEE been doing for the last 41 years?"

David Knapp

EDITOR'S NOTES

With this issue we introduce a new format to *The Energy Forum*. We hope you'll like it.
In addition to the line-up of articles outlined below, we introduce IAEE's newest affiliate, The South African Association for Energy Economics and also report on the Nigerian IAEE Conference held in Abuja on April 22-24.

Joseph Naemi writes that it used to be easy: we worried about peak oil, the political stability of OPEC and the price volatility of crude and refined products. Now the situation is much more complex. The dream of renewables and the electric car has lulled us into believing our world can live on clean, green energy. The realities are otherwise. Meanwhile oil's reserve replacement ratio has dropped sharply and outside North America spare production capacity has dropped to a low of 2%.

Igor Hernandez notes that sanctions by the U.S. Government on Venezuelan officials and institutions, including PDVSA, the National Oil Company, not only have made financial constraints more stringent for the company, but also have immediate consequences for the short-term operation. He comments on some of these implications for the oil industry in Venezuela.

Saeed Moshiri reviews the oil-macroeconomy relationship concerning both oil-exporting and oil-importing countries and then presents the case for trade and labor migration as factors easing the pain. He uses Canada as a case study to show the importance of trade and labor movements in mitigating the adverse effects of oil price shocks.

Yue Wang and **Zhen Zhu** provide an overview of the natural gas supply and demand conditions for the Eastern Chinese markets. They estimate the cost of gas for the markets as gas pricing information for those markets are extremely difficult to obtain. In doing so, they estimate the gas production costs and transportation costs for various supply sources. Their results suggest that the U.S. LNG exports to those main consumption regions of China can be very profitable.

Mamdouh Salameh argues that the petro-yuan could mark the beginning of the end of the petrodollar. It is possible that the yuan could emerge as the world's top reserve currency within the next decade with the petro-yuan dominating global oil trade.

Eleanor Morrison notes that shale oil production resurfaced with improved efficiency gains, renegotiated (lower) contractor costs, higher oil market prices and technological innovations. It remains to be seen if lower production costs allow shale oil producers to withstand future crude oil price troughs and become a resilient contributor to U.S. oil supply.

David Williams

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:

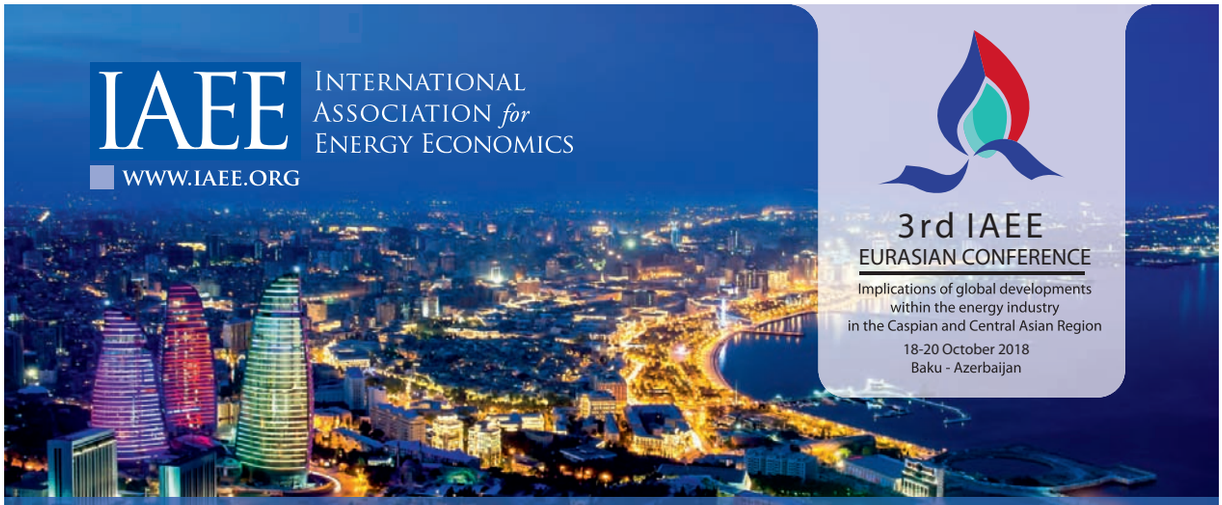
- Providing leading edge publications and electronic media
- Organizing international and regional conferences
- Building networks of energy concerned professionals

NEWSLETTER DISCLAIMER

IAEE/Affiliate Master Calendar of Events

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

Date	Event, Event Title	Location	Supporting Organization(s)	Contact
2018				
September 23-26	36th USAEE/IAEE North American Conference *Evolving Energy Realities:Adapting to What's Next*	Washington, DC, USA	USAEE	David Williams *usaee@usaee.org*
October 18-20	3rd IAEE Eurasian Conference *Implications of Global Developments within The Energy Industry in the Caspian and Central Asian Region*	Baku, Azerbaija	IAEE	Vilayat Valiyev *waliyev@gmail.com*
November 2-4	6th IAEE Asian Conference *Energy Exploitation and Cooperation in Asia*	Wuhan, China		Xiao Jianzhong *xjianzhong@cug.edu.cn*
December 6-7	1st IAEE Southeast European Conference *Southeast European Energy Challenges and Opportunities*	Sofia, Bulgaria		Atanas Georgiev *atanas.georgiev@gmail.com*
December 10-12	3rd AIEE Energy Symposium *Current and Future Challenges to Energy Security*	Milan, Italy		Andrea Bollino bollino@unipg.it
2019				
February 13-15	AAEE Conference *Heading Toward More Democracy in the Energy System – German/English Speaking*	Vienna, Austria	AAEE	Reinhard Haas *haas@eeg.tuwien.ac.at*
March 11-12	7th ELAEE Conference *Latin America: Decentralization, Decarbonization, Efficiency and Affordability in Energy Systems*	Buenos Aries, Argentina	ALADEE	Gerardo Rabinovhich *grenerg@gmail.com*
May 26-29	42nd IAEE International Conference *Local Energy, Global Markets*	Montreal, Canada	CAEE/IAEE	Pierre-Olivier Pineau *pierre-olivier.pineau@hec.ca*
August 25-28	16th IAEE European Conference *Energy Challenges for the Next Decade:*	Ljubljana, Slovenia	SAEE/IAEE	Nevenka Hrovatin *nevenka.hrovatin@ef.uni-lj.si*
October 17-19	4th IAEE Eurasian Conference *Uncapping Central Asia's Potential: How Central Asia can Contribute to Global Energy Security?*	Astana or Almaty, Kazakhstan	IAEE	Vilayat Valiyev *waliyev@gmail.com*
2020				
June 21-24	43rd IAEE International Conference *Energy Challenges at a Turning Point*	Paris, France	FAEE/IAEE	Christophe Bonnery *Christophe.bonnery@faee.fr*
2021				
July 25-28	44th IAEE International Conference *Mapping the Global Energy Future: Voyage in Unchartered Territory*	Tokyo, Japan	IEEJ/IAEE	Yukari Yamashita *yamashita@edmc.ieej.or.jp*
2022				
March	45th IAEE International Conference *Energy Market Transformation in a: Globalized World*	Saudi Arabia	*SAEE/IAEE*	Yaser Faquih *yasser.faquih@gmail.com*
2023				
June 19-22	46th IAEE International Conference *Overcoming the Energy Challenge*	Istanbul, Turkey	TRAEE/IAEE	Gurkan Kumbaroglu *gurkank@boun.edu.tr*



Implications of global developments within the energy industry in the Caspian and Central Asian Region

18-20 October, 2018

CONFERENCE OVERVIEW

The 3rd Eurasian Conference will take place in Baku, Azerbaijan, on October 18 -20, 2018.

In addition to its rich program, with its informal social functions, the conference will provide a unique opportunity for networking and enhancing communication amongst energy professionals from business, government, academia and other circles worldwide.

The conference program is being prepared by an International Program Committee to ensure that critical issues of vital concern and importance to governments and industries are presented, considered and discussed from all perspectives. In this context, many existing sessions on key current energy issues, featuring internationally established speakers and lively discussions, can be expected. The local arrangements are being planned by a Local Organizing Committee to guarantee excellent logistics at best quality. The Sponsorship Committee works to make sure the rich program and arrangements of the conference get available to delegates at affordable rates.

CONFERENCE COMMITTEES

General Conference Chair:
Prof. Dr. Vilayat Valiyev, Director of Institute for Scientific Research on Economic Reforms (ISRER), Ministry of Economy of the Republic of Azerbaijan, Vice President of IAEE for Regional Affairs

Program Committee Chair:
Prof. Dr. Gürkan Kumbaroğlu, Boğaziçi University, Past president of IAEE

Local Organizing Committee Chair:
Mr. Fariz Mammadov, Chief Scientific Worker of ISRER

Sponsorship Committee Chair:
Matanat Pashayeva, Head of Consulting Department of Azerbaijan Energy Engineering and Consulting LLC

Regional Support Committee Chair:
Mr. Arman Kashkinbekov, Director of Association of Renewable Energy of Kazakhstan

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Ministry of Energy of Azerbaijan Republic

A rewarding scientific and rich social program, accompanied by appealing technical tours, await you in the city of winds, land of fire.

TOPICS TO BE ADDRESSED INCLUDE:

The general topics below are indicative of the types of subject matter to be considered at the conference.

- **Petroleum Economics**
- **Economics of Gas Trading**
- **Geopolitical Competition in the Caspian Basin and Middle East**
- **Energy Modeling**
- **Energy Markets and Regulation**
- **Challenges in Gas Supply and Transportation**
- **Energy poverty and Subsidies**
- **Regional Energy Markets**
- **Energy Policy for Sustainable Development**
- **Energy Supply, Demand and Economic Growth**
- **Security of Energy Supply**
- **Regional Electricity Trade**
- **Energy Efficiency and Storage**
- **Regional Strategies for Alternative and Renewable Energy**
- **Energy Finance and Asset Valuation**
- **Risk Management in Energy Eurasian Energy Outlook**

For more detail: www.eurasianconference.org
Contact us: info@eurasianconference.org

False Sense of Balance

BY JOSEPH NAEMI

It used to be easy; we worried about Peak Oil, political stability of OPEC member countries, and the price volatility of crude oil and refined petroleum products – for a long time, that is how the mighty oil industry managed the risks associated with its business; while allocating capital and human resources, to ensure that the international flow of hydrocarbons, satisfied the demands of the Hydrocarbon Man.

Now though, the landscape is a bit more complex. There are structural changes within the global economic and political construct, which are affecting the interpretation of the future; and often erroneously, providing us with a false sense of balance.

The dual dream of renewable energy and electric vehicles, has lulled us to believe that energy will be readily and abundantly available. We are led to believe that our planet shall be a clean, green, and serene world to live in. However, the facts are stacked against such utopianism.

- Renewables have proven to be more difficult to harness, than promoted. Wind power globally, is producing at less than 25% of its reported or installed capacity. Solar power worldwide, is producing at less than 15% of its purported total capacity. In other words, roughly 75% of wind power generation capacity and 85% of the solar power capacity, are for naught. The reasons are obvious; wind does not blow, and sun does not shine, all of the time. Inefficiency aside, the full cycle costs for Renewables, have been higher than estimated; primarily, because of expensive backup generation solutions [think of the giga batteries that are anything but cheap].
- The E.V. Revolution, is even more sensational than the story of Renewables:
  a. Only 25% of the present global output of crude oil, is used for the mobility of passenger cars.
  b. Sales of passenger cars worldwide, have increased by nearly 50% during the past decade. There is no evidence that the next decade, will not be as robust.
  c. Even if, the forecasters were to be right, and by 2030, electric vehicles represent 20% of the global passenger car fleet; it challenges one's intelligence, to accept the theory of massive demand destruction for oil. After all, the math is simple; 20% of 25% equates 5%.
  d. The preceding E.V. penetration forecast, assumes that the global supply of nickel and cobalt, the predominant elements in the rechargeable E.V. batteries; would at least double by 2030, which is a lot easier said than done. Just take a look at the price trajectory of cobalt during the past few years, and a new sense of scarcity becomes palpable.
  e. 35% of current global oil production, fuels; aeroplanes, ships, trains, and trucks. Notwithstanding the Tesla Electric Truck foray, there is negligible evidence that renewables or electrification, shall affect said modes of transportation for people and goods. In the course of the past five decades, global airline traffic has grown by 1,200% (i.e., by a factor of 12). Today, the airline industry worldwide, consumes about 6% of the global production of oil. During the next decade, based solely on Chinese air travel growth, the globe's airline traffic is expected to double; and for validation, look no further than the remarkable share price performance of Boeing. It is noteworthy to mention that an economy class traveller, on a round-trip flight from Europe to Australia; consumes as much oil as an average passenger car does, in a year.
  f. 40% of present global oil production, is consumed by industrial applications, a catch-all category, as distinct from the two previously mentioned consumption segments. By 2050, the human population of Earth, will reach 10 billion. That is an increase of 50% more people to feed, clothe, bathe, provide shelter, education, healthcare, and so on. Plastic bags in supermarkets have mostly disappeared; however, the same fate would be impossible to imagine for toothbrushes, personal hygiene products, cosmetics, fertilizers, synthetic yarns, synthetic leather upholstery in cars &

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aircrafts, and .....!

g. Finally, presuming plenty of affordable metals and minerals to facilitate even a greater E.V. penetration than current optimistic forecasts; where will the electricity be sourced from, for the re-charging of all those batteries? Coal is out, thanks to the Paris Climate Accord; Uranium is out, courtesy of the environmentalists on both sides of the Pacific and the Atlantic; Renewables are unreliable in practice, despite their much-touted contribution; the only logical option is natural gas (and shale gas), with the prerequisite that gas fired power generation capacity, also grows in line with the surge in electricity demand. For the record, the base assumption here, is that there will not be any shortage of gas (either conventional or unconventional). I am not aware of any natural resource embodied in Earth's crust, which can definitively be labelled as infinite.

With the foregoing backdrop, and as a consequence of the negative sentiment that has engulfed the international oil industry during the past several years, accompanied by the resultant capital deployment discipline; exploration investment has been halved, whereby the reserve replacement ratio for oil globally, has declined from approximately 58% in the year 2000 to less than 8% in 2016. What is even more frightening, is that with the exception of North America, spare production capacity worldwide has declined to the lowest level since 1970. In the mid 1980s, the spare production capacity was about 25% of the then consumption worldwide. In contrast; the spare capacity in 2017, stood at a meagre 2% of present consumption. The decimated oil replacement ratio, combined with essentially no spare production capacity, means an utterly soaring oil price on the horizon.

In addition to the above-mentioned imbalance of future oil supply and demand, as global economy continues to grow in order to accommodate the 50% increase in the world's population during the next 30 to 35 years, a critical monetary and thus political transition is occurring; being the emergence of PetroYuan, in replacement of the PetroDollar. The latter terminology, the global role of U.S. Dollar, and the globalization model; have been officially around since 1974. PetroYuan, is reflective of the recent rise of China, whose continuing infrastructure development and evolutionary economic expansion still requires significant quantities of all types of natural resources, and most notably, oil and gas. The loss of the oil market, will surely not be existential to America; however, it poses a real risk for the decline of the U.S. Dollar and a tangible danger to the dominance of American capital. Until the 1950s, the Pound Sterling, was the driver of world economy; and since then, the U.S. Dollar has been in the lead. When will the Yuan take the lead, and how it would impact the dynamics of pricing and distribution of global energy resources is a new dimension of complexity, which requires careful consideration.

It is irrefutable that the link between energy flows and the progress of history, is indeed a vital correlation. Energy sources are a key aspect of progress in history, providing the necessary conduit to facilitate change, whether directly or indirectly. Successively, this process affects the communal and economic sophistication of society, as it effectively dictates both the direction and tempo of the progress in our world. The importance of energy flows both in history and the future, can be substantiated through the basic laws of thermodynamics, which suggest that the increasing growth and its intricacy, necessitate a larger source of energy. Accordingly, given the undeniable population growth as a continuous phenomenon, energy flows must grow concurrently; otherwise, humankind will cease to exist. The question of leadership is, therefore, existential and of paramount importance, as is a true sense of balance.

CONFERENCE OVERVIEW

The Trump Administration and changing geopolitical situations are redefining energy directions, layering additional change over ongoing technological and market changes. Removal or revision of regulations, withdrawal from the Paris climate accord, and shifting geopolitical relations add complexity to an energy portfolio still bracing for cyberattacks and weather impacts against vulnerable grids. These geopolitical shifts, and the reactions to them by OPEC, local governments, and other actors, challenge us to chart a path forward through changed and dynamic domestic and international energy and environmental sectors.

The 36th USAEE/IAEE Conference provides a forum for informed and collegial discussion of how the emerging realities will impact all stakeholders—from populations to companies to governments—in North America and around the world.

Nowhere calls out this urgency more clearly than the mid-Atlantic region. The energy mix includes offshore wind, coal mines, nuclear power, solar, and natural gas. Conference attendees will benefit from access to tour some of these facilities as well as tours of federal energy institutions in Washington, D.C.

The Washington, D.C. metro area is the epicenter of energy policy and home to legislators, regulators, and diplomats. It boasts the greatest concentration of think tanks and is a bastion of energy thought leaders that bolster the value of networking opportunities provided by the conference.

The conference will highlight contemporary energy themes at the intersection of economics, public policy, and politics, including those affecting energy infrastructure, environmental regulation, markets vs. government intervention, and international energy trade. Participation from industry, government, non-profit, and academic energy economists ensures robust, insightful discussion.

HOSTED BY

USAEE United States Association for Energy Economics

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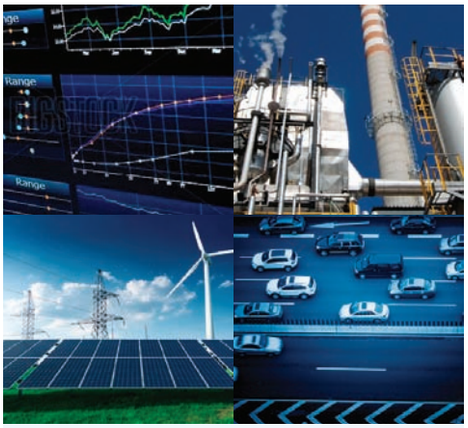

TOPICS TO BE ADDRESSED INCLUDE:

The general topics below are indicative of the types of subject matter to be considered at the conference. A more detailed listing of topics and subtopics can be found by clicking here: http://www.usaee.org/usaee2018/topics.html

- Energy Protectionism in Practice
- Countervailing Winds: International Geopolitical and Domestic Responses to the New Administration
- The New DOE and FERC Agendas
- How Have Energy Markets Responded to the Shift of U.S. Energy Policy?
- Energy Implications of Environmental Regulations: Future and Impact
- International Energy Policy Responses to the U.S. Departure of the Paris Climate Accord
- A Look at Shifts in Energy Supply: Renewables, Coal, and More
- Deregulation of Marine and Land Use: Offshore Access, Extraction, and Pipelines
- Europe, Russia, and U.S. Natural Gas Exports Recent State Energy Policy Developments
- Energy Innovation and Technology
- Other topics of interest including shifts in market structures and fundamentals, including those induced by policy and technological forces.

36TH USAEE/IAEE NORTH AMERICAN CONFERENCE

CONFERENCE SESSIONS & SPEAKERS

Visit our conference website at: **www.usaee.org/usaee2018/**

PLENARY SESSIONS

The 36th USAEE/IAEE North American Conference will attract noteworthy energy professionals who will address a wide variety of energy topics. Plenary sessions will include the following:

U.S. Energy Resurgence – Impact on the Global Geopolitics of Energy • U.S. Energy Policy Deep Dive • Demand and the Vehicle Revolution • Electricity Market Design and Operations in Stress • Energy Innovation Extends Supply Curve • Energy Demand and Behavioral Considerations • Energy Trading and Optimization – How the Business is Changing • The Battery Revolution • Changing Balance of Government Energy Policy and Regulation • Energy Technology Leapfrogging – Could It Happen?

SPEAKERS INCLUDE

Joseph R. Balash
Assistant Secretary of the Interior,
Land and Minerals Management

Peter Balash
Senior Economist,
National Energy Technology Laboratory

Christophe Bonnery
Vice President, Economics and Prospective,
Enedis

Kevin Book
Managing Director,
ClearView Energy Partners LLC

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

Margarita Brouwer-Boulankova
Vice President, ABN AMRO

Jason Burwen
Vice President, Policy,
Energy Storage Association

Sanya Carley
Associate Professor, School of Public &
Environmental Affairs, Indiana University

Travis Fisher
Senior Advisor, U.S. Department of Energy

R. Dean Forman
Chief Economist,
American Petroleum Institute

Herman Franssen
Executive Director, Energy Intelligence Group

Edie Fraser
Chairman and Founder,
STEMconnector/Million Women Mentors

Kenneth Gillingham
Associate Professor of Economics,
Yale University

Thad Hill
President and Chief Executive Officer,
Calpine Corporation

Eric Hittinger
Associate Professor of Public Policy,
Rochester Institute of Technology

Sebastien Houde
Research Scientist, ETH Zurich,
Adjunct Professor, University of Maryland

Madeline Jowdy
Senior Director, Global Gas and LNG, PIRA

Natalie Kempkey
Office of Intg and Intl Energy Analysis,
U.S. Energy Information Admin

Melanie Kenderline
Principal, EJM Associates, Non-Resident
Senior Fellow, The Atlantic Council

Robert Kleinberg
Cambridge, Massachusetts

David Knapp
Chief Energy Economist,
Energy Intelligence Group

Vello Kuuskraa
President, Advanced Resources International

Sarah Ladislaw
Director & Senior Fellow, CSIS

Elaine E. Levin
President, Powerhouse, Washington, DC

Alan H. Levine
CEO and Chairman, Powerhouse,
Washington, DC

Sharyn Lie
Director, Climate Economics and Modeling
Center, U.S. Environmental Protection Agency

Colleen Lueken
Director of Market Analytics, Fluence

Andrew L. Ott
President & CEO, PJM

Karen Palmer
Senior Fellow, Resources for the Future

Jesus Reyes-Heroles
President and former Minister of Energy,
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Ron Ripple
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Scott Sanderson
Principal, Oil and Gas & Digital Leader,
Deloitte Consulting LLP

Benjamin Schlesinger
President, Benjamin Schlesinger
and Associates LLC

Michael Sell
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ERP Program Manager, GARP

Adam E. Sieminski
President, KAPSARC

Linda Gillespie Stuntz
Partner, Stuntz, Davis & Staffier, P.C.

James Sweeney
Director, Precourt Energy Efficiency Center,
Stanford University

Margaret Taylor
Energy/Environmental Policy Research
Scientist, Berkeley Lab

Gordon van Welie
President & Chief Executive Officer,
ISO New England Inc

Frank Verrastro
Senior Vice President, CSIS

Shree Vikas
Director Market Intelligence &
Business Analysis, ConocoPhillips

Tina Vital
Managing Director, Castle Placement LLC

Molly Williamson
Senior Fellow, Middle East Institute

WITH SUPPORT FROM:

Venezuela and U.S. Sanctions: Some Considerations

BY IGOR HERNANDEZ

Igor Hernandez is a Graduate Fellow at the Center for Energy Studies, Baker Institute, Rice University.

See references at end of text.

Since 2015, when President Obama issued Executive Order (E.O) 13692, the U.S. government has imposed several sanctions on Venezuelan government officials and the National Oil Company, Petroleos de Venezuela (PDVSA).

Initially, the sanctions were targeted at "persons involved in or responsible for the erosion of human rights guarantees, persecution of political opponents, curtailment of press freedoms, use of violence and human rights violations and abuses in response to antigovernment protests, and arbitrary arrest and detention of antigovernment protestors, as well as the significant public corruption by senior government officials in Venezuela". These sanctions prevented from engaging in any transactions or dealings with the individuals included in the E.O, among other restrictions.

Later, in 2017, President Trump issued E.O. 13808, that "prohibits transactions by a United States person or within the United States related to certain new debt of PDVSA and certain new debt or new equity of the Government of Venezuela". In addition, E.O, 13808 "prohibits the purchase by a U.S. person or within the United States of most securities from the Government of Venezuela".

These sanctions come at a time when oil production in Venezuela has shown a sustained decline and PDVSA faces a critical situation financially and operationally. Problems in the Venezuelan oil industry are a consequence of years of mismanagement in the industry and were only aggravated with the decline in oil prices that started in 2014. As we will show, financial sanctions have further deteriorated oil activities in the country, not only because of the reduction in financing options for the company, but by introducing additional constraints on daily operations.

One of the implications for PDVSA is that it restricts the ability to get financing through bond issues and loans coming from U.S. institutions. This was one of the main financing mechanisms used by the company in recent years. According to PDVSA's financial statements, financial debt, including bonds and loans, went from less than US$ 3 billion in 2006 to US$ 39 billion in 2017. Initially, the reason behind much of the growth in debt was to alleviate pressures on the exchange rate market, particularly between 2007 and 2011[1]. This is because in the initial offering, dollar-denominated bonds could be purchased in bolivars (the local currency) and then sold in foreign markets. Investors in U.S. markets accounted for a significant part of the final holders of these bonds. Later, as the debt to suppliers grew, PDVSA started to issue promissory notes in order to replace some of the existing debt with providers. With the sanctions in place, PDVSA does not have access to U.S. capital markets, which constraints the possibility of getting financing through this mechanism. Moreover, even if some of the suppliers are not U.S. companies, they also suffer negative consequences from the sanctions. This is because sanctions reduce the liquidity of any promissory notes given by PDVSA, as U.S. financial institutions cannot engage in secondary market transactions involving PDVSA or other issues from the Government of Venezuela.

PDVSA was also involved in financing agreements with several partners in the joint-ventures (JV) operating in the country. For instance, PDVSA and Chevron, which are partners in the Petroboscan JV, signed an agreement by which Chevron could finance PDVSA's share of capital and operating expenditures through loans. The payments of these loans were collected through an offshore account that essentially deducted the loan payments from the oil receipts coming from Petroboscan, with the remainder being distributed among the partners. This structure not only allowed to maintain operations but reduced the credit risk of the projects from this JV by allowing Chevron to have more financial and operational control of the project[2]. Sanctions would then impair the capacity of further extending this agreement, which could affect the recovery of production, which was initially targeted at increasing production to 127,000 barrels per day (bd).

Another aspect by which operations are affected by sanctions are the problems related to U.S. oilfield service providers such as Halliburton. Given the cash flow problems

experienced by PDVSA, payment delays to Halliburton amounted to approximately US$ 1 billion by 2016, which were written-off by Halliburton between these last two years[3]. Given the sanctions, PDVSA does not have the option to delay their payments to Halliburton, as this would be considered financing, which is prohibited by the sanctions. With this, the liquidity in the short term operations is further constrained, but this also means that Halliburton would have to reduce their operations whenever they fail to receive payments from PDVSA. This would imply that regions in which they operate could see accelerated declines in the extraction rate.

Sanctions not only have implications for U.S. companies operating in Venezuela, but has also made partners in upstream activities more cautions in their relations with PDVSA. Given that one of the sanctioned individuals was the CFO of PDVSA, Simon Zerpa, foreign oil companies funding projects in Venezuela, such as China National Petroleum Corporation (CNPC), and financial entities negotiating with PDVSA were avoiding signing agreements that could involve Zerpa, according to some market reports[4].

Having to deal with the finance department while Zerpa acts as a CFO has also affected trading operations. For example, there are reports of problems in the reception of oil cargoes at their final destination, given that banks refused to issue letters of credit to PDVSA customers[5]. These letters are used to guarantee to a seller that a buyer will pay a specified amount on time when a shipment is accepted, and in the absence of these letters, customers would have to pay cash up-front, which could ultimately affect the liquidity position of these customers. This has also led to delays in deliveries as tankers are unable to unload while waiting for letters of credit. According to news reports[6], companies such as PBF Energy and Braskem have already stopped buying directly from PDVSA, and in general, Venezuelan oil exports to the U.S. have shown a decline, going from 1.65 million barrels per day (mmbd) in January 1999, when Hugo Chavez took power, to 472,000 bd in February 2018, a decline of more than 70%. CITGO, the downstream unit for PDVSA in the U.S., is also unavailable to get letters of credit in order to buy crude oil so that they have to pay cash upfront to receive cargoes coming from destinations different than Venezuela. Therefore, their liquidity position becomes more constrained, affecting the situation of the entire holding.

Sanctions have been a factor leading to a higher diversification among U.S. refiners, particularly in anticipation of further actions by the U.S. government towards the Venezuelan government[7]. This is also part of a trend observed in recent years, showing a significant substitution away from Venezuelan crude oil. The declining Venezuelan oil production constitutes a supply risk, and in some cases, there have been reports of problems with crude specifications that prevent their processing in U.S. facilities[8]. In the short term, one way for refiners to access Venezuelan oil without buying directly from PDVSA is through companies such as Rosneft. This is because of the existence of oil-backed loans from Russia to Venezuela, that allow Rosneft to access crude oil, which is later sold through intermediaries that include oil trading firms (given U.S. sanctions against Russia), so that eventually they reach U.S. refiners[9].

In this environment, the Venezuelan government has tried to get around sanctions by issuing the Petro, which according to official sources is a cryptocurrency that is backed by oil reserves coming from one of the extra-heavy oil blocks in the Orinoco Oil Belt. It is not clear what would be the impact of this new currency on markets, for different reasons including the lack of clarity in the initial offering terms and the difficulty in placing a value on the Petro, particularly since it has features of a debt instrument rather than a cryptocurrency. Moreover, Venezuelan law explicitly prevents the use of oil reserves for backing any financial instruments, so it is not clear in which way the Government will honor a commitment if in fact the Petro is treated as a debt security. Also, the reserves included as collateral are included in an area that requires massive investments for their development, with a very high risk. Most of the projects in similar blocks in the Orinoco Oil Belt, that were allocated in 2010 and were supposed to have a combined production of 2.0 million barrels per day by 2019, never went beyond initial stages of development. However, the Venezuelan government has tried to push the adoption of this currency among service providers, and more recently, there have been news reports that the Venezuelan government has offered India a 30 percent discount on crude oil purchases if India uses the petro to make these oil purchases[10]. In this way, it might be that Venezuelan officials are trying to create a market for the Petro in foreign currency, in order to circumvent the use of U.S. financial markets to fund

their operations. This is why on March, 2018, President Trump issued E.O. 13827, that extends the reach of the sanctions to include transactions that could eventually be performed in digital currencies or traditional fiat currencies.

Since the enactment of the first sanctions, there has been speculation on how these actions could escalate in the future, in the absence of political changes in Venezuela. According to some analysts[11], there are at least two different mechanisms that could be used in the future and have severe consequences for Venezuela. First, there is the possibility that the U.S. government forbids the exports of crude oil and products to Venezuela. As of now, projects in the Orinoco Oil Belt require heavy naphta to dilute a large portion of the extra heavy oil output in order to export it. PDVSA also started to buy light crude in 2016 for the Isla refinery in Curacao, but also uses a fraction of this for blending with heavy crude oil. Finally, given the reduction in activity from local refineries, Venezuela increased their imports of gasoline, distillates and components. According to the Department of Energy figures, U.S. exports of crude and products to Venezuela were 136,000 bd in February 2018. Introducing a ban on U.S. exports would severely affect the production of extra-heavy crude oil, which comprises a large component of Venezuela's total crude oil production. In the past, Venezuela tried to use imports of light crude from Russia and Algeria, but this would not only come at a higher cost relative to light crude from the U.S., but it was also reported that the blending using these alternative sources in some cases did not fulfill refineries specifications and therefore could not be placed in the market[12] .

The other possibility would involve the U.S. government banning all imports of crude oil and products coming from Venezuela. Historically, the U.S was the main destination for Venezuelan exports, not only because of its location relative to other large markets, but also because it has a sufficiently complex refinery system to process heavy and extra-heavy crude oil. If we consider the main destinations for shipments currently: U.S, China, Russia and India, U.S can be considered the largest source of cash flow for Venezuela. The reason is that shipments to China and Russia, are used to service the debt from previous loans and therefore, do not involve new inflows for PDVSA or Venezuela as a whole. Moreover, India's oil imports are in the lowest level in 5-years, and there is speculation that the fraction of India imports coming from Middle East could increase in the future. All of this suggests that the financial consequences for Venezuela in the very short-term would be massive.

Even if Venezuela could manage to market their oil production out of the U.S. in response of a potential embargo, the cost of doing so will be higher given the location of alternative markets. There is also a concern among U.S. refiners on the Gulf Coast that in this scenario, their operations could be impacted in the short-term, which could translate to gasoline markets. Although U.S. imports from Canada have increased over recent years, some reports indicate that there will be a point when deeper modifications will be required in refineries to accommodate greater volumes of the Canadian heavy crude[13]. which suggests that the diversification strategy has some limit in the short term, and large refineries, which rely more on imports from Latin America, may have smaller margins given an increase in prices of heavy crude grades.

Venezuelan oil production has shown a decline from an average of 2.6 mmbd in 2004 and 2005, when most of the investments planned in the nineties where finished, to a production of 1.4 mmbd in April 2018, the lowest extraction rate since 1949. Years of mismanagement and changes in the rule of law, including expropriations and steep increases in government take, among other problems involving lack of investments, were part of the explanation of this downward trend, even before sanctions were enacted. The short term operations have also been affected by the large scale of the economic crisis the country faces, as the IMF estimates that Venezuela is expected to contract by 15 percent in 2018, following a cumulative 35 percent contraction over 2014–1714. Monthly inflation is already around 80%, which translates into an annualized inflation of 13,779%15. This has led to a large number of oil workers leaving the industry and a significant reduction in economic activity. Moreover, the Venezuelan government started a process leading to the removal and prosecution of a number of PDVSA executives and replaced the board of directors with members of military forces with no previous experience in the oil sector. This has not only affected the relations between PDVSA and its partners, but it has also affected administrative procedures such as procurement, given that employees are now

concerned about facing corruption charges without apparent justification. More recently, claims and seizure of assets executed by companies such as Conoco-Phillips have also introduced a new layer of concerns for PDVSA, which already has several debt instruments in default. Forecasts about oil production reflect increasing concerns related to supply, with the IEA estimating production at 1.38 mmbd by the end of 2018, while Bank of America suggests that the decline in Venezuela's oil production could be one of the factors leading to an oil price of $100 per barrel.

The dramatic collapse of oil production in Venezuela suggests that even in the absence of sanctions, the industry and the economy will continue collapsing. Based on this assumption, some analysts[16] believe that extending the sanctions have the risk of backfiring, as the Venezuelan government could use the sanctions as an excuse for the entire crisis affecting the country. This could influence public opinion ahead of the presidential elections to be held in Venezuela on May 20th. These elections are not recognized by the U.S. government, given the many objections regarding the legitimacy of the procedure and situation of human rights and overall crisis in the country.

As the economic and political crisis worsens in Venezuela, there is uncertainty about the next steps the U.S. government will take regarding sanctions. What seems to be a more evident reality for oil markets is that in the absence of a change in the current political regime, oil production capacity in Venezuela will continue to decline. Even if a resolution of conflict exists and comprehensive reforms are designed and implemented, there are many challenges that the oil industry in Venezuela will need to address, given the high dependence of the country on fossil fuels exports and the increasing competition in energy markets in general.

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Trade and Labour Migration Effects on the Oil-Macroeconomy Relationship

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Oil has played a critical role in the economic performance of countries across the world for more than half a century. Although oil intensity has decreased in many countries through time, changes in oil prices still generate significant impacts on economic conditions. The effects of oil price changes on economic performance are not homogeneous across countries and depend on whether they are oil-exporters or oil-importers. A rise in oil prices alters the terms of trade in favor of the oil-exporting countries and causes harm to oil-importing countries. The outcome is inverse when oil prices fall. However, trade and labour migration may mitigate the adverse effects of the oil price shocks across the world. In this article, I first briefly review the oil-macroeconomy relationship concerning both oil-exporting and oil-importing countries and then present the case for trade and labour migration as factors easing the pain.

In general, changes in oil prices generate primarily supply-side effects on the economy of oil-importing countries and mainly demand-side effects on the oil-exporting countries. Specifically, rising oil prices increase production costs in the manufacturing sector of the oil-importing countries leading to a decline in output and productivity and to higher prices (Hamilton, 1999; Balke et al., 1999). This is what happened during the first and the second oil-price shock in 1973, when Arab countries cut their oil exports to Western countries due to their support of Israel during the war, and in 1979, when oil-supply fell because of the Iranian revolution. Most of the following economic downturns in the US economy were also preceded with a hike in oil prices (Hamilton, 1999). Monetary policy can also influence how the oil price shock affects the oil-importing countries. Depending on the policy stance of monetary authorities (accommodative, restrictive or neutral), an increase in oil price will impact the economic growth and inflation rate of oil-importing countries differently. For instance, Bohi (1991) and Bernanke et al. (1997) argue that a contractionary monetary policy following an increase in oil prices is the main source of economic slowdown in oil-importing countries. Furthermore, oil price volatility can send ambiguous signals to monetary authorities which then choose a potentially wrong monetary policy, consequently lightening or intensifying the real effects of oil price shock on the economic performance of oil-importing countries (Brown and Yücel, 2002).

The impact of oil price changes on oil-importing economies is, however, not symmetric. That is, although higher oil prices may lead to an economic downturn, lower oil prices may not contribute to economic growth significantly. Studies by Mory (1993), Mork (1994), Ferderer (1996), and Hamilton (1996, 1999) provide empirical support for asymmetric effects of oil price changes on the US economy by showing that negative responses in economic activities to the increase in oil prices are stronger than positive responses to a decrease in oil prices. One possible mechanism that could explain the asymmetric effects of oil price shocks is monetary policy. Assuming that nominal wages are sticky downward, a decrease in oil price and the subsequent rise in productivity and economic activities should be accompanied by a real wage rise to make markets clear. Since nominal wages are not limited to adjusting upward, monetary authorities do not interfere in the market. However, monetary authorities usually run a counter-inflationary monetary policy when oil prices increase and, if nominal wages are sticky downward, real wages will not fall with reduced productivity. Consequently, unemployment will increase, aggregate consumption will fall, and economic activities will be retarded beyond the level that stems directly from the supply shock (Brown and Yücel, 2002). The empirical results on the role of monetary policy in explaining the asymmetric effects of oil price shock are, however, mixed (Tatom, 1993; Ferderer, 1996; Bernanke et al., 1997; Balke et al., 1999). Another channel for explaining the asymmetric impacts of oil price is an indirect effect of adjustment costs (Hamilton, 1988). Adjustment costs could stem from sectorial resource reallocation and coordination problems between several firms and have

an indirect negative impact on economic activities with either oil price decrease or increase. Therefore, when oil prices increase, two direct and indirect negative impacts are in effect retarding economic activities. On the other hand, when oil prices decrease, the direct positive impact is offset by the indirect negative impact and, thus, results in asymmetric effects of oil price shocks.

Unlike the experience of oil-importing countries, for oil-exporting countries, a hike in oil prices is considered good news. In an oil-exporting country, a windfall of oil revenues can improve the standard of living through increasing investment in physical and human capital and technology. This is particularly important as most of the oil-exporting counties are developing countries desperately in need of foreign capital to increase their economic growth. Nevertheless, the expected positive outcome of higher oil prices has not materialized and in some cases, economic conditions have worsened (Smith, 2004; Frankel, 2010). The traditional explanation for the detrimental effects of higher oil prices on the economic performance of oil-exporting countries is provided through the Dutch disease model (Corden and Neary, 1982). An oil boom will generate a de-industrialization process through an appreciation of exchange rates and resource movements, dampening the manufacturing sector in favor of non-traded sectors. Other studies have also examined the role of non-economic factors, such as political systems and institutions, to explain the poor performance of oil-exporting countries (Stevens, 2003, Mehlum et al., 2006).

In a more recent study, Moshiri (2015) shows that the oil price shock effects on many oil-exporting countries are asymmetric. That is, although lower oil prices hurt the economy by cutting oil revenues and spending, higher oil prices do not necessarily generate long-term growth. The asymmetric effects can be due to procyclical fiscal policy and the fixed-exchange rate policy in those countries (Husain et al., 2008; Frankel, 2010). Following a boom in the oil market, governments often increase spending dramatically on social programs and publicly-funded projects. In most cases, these large-scaled investment projects do not generate positive economic outcomes due to poor institutional quality, which leads to rent-seeking behavior and corruption. When oil prices fall, most of the unfinished projects stall due to lack of funding, and unemployment rises (Eifert et al., 2002; Farzanegan, 2011). Fixed exchange rate policies also work against the exports of non-oil products during the oil price fall. The oil reserve funds and international borrowing, which can be used to avoid volatility in economic activities arising from oil price changes, are also not often utilized effectively and borrowing may even exacerbate the condition by accumulating foreign debt.

Most studies on the oil-macroeconomy relationship have focused on a specific or a group of oil-importing or oil-exporting countries. However, with the rise in global trade and labour movements across the countries in recent decades, the dynamics of the relationship might have changed and, therefore, results focusing on countries in isolation might be misleading. The effects of the oil price shocks may spill over through trade or labour mobility between and within the countries. Failure to consider the spillover effects may thus lead to an overestimation of the overall effects of oil price shocks on the economy. Notwithstanding the rich literature on the relationship between oil price changes and macroeconomic performance, studies that include both oil-exporting and oil-importing countries and consider the spillover effects of the oil price shocks are limited. Only a few studies, such as Abeysinghe (2001), Korhonen and Ledyaeva (2008), and Husain et al. (2015), have examined the global impacts of oil price shocks, considering both oil-importing and oil-exporting countries. Abeysinghe (2001) shows that even oil-exporting countries may not be able to escape the negative impact of high oil prices because of the indirect effect through their trade with oil-importing countries. Korhonen and Ledyaeva (2008) also show that although oil-exporting countries such as Russia and Canada benefit from higher oil prices, they also suffer indirectly through their trade with the oil-importing countries which are hit negatively. The oil-importing countries that are adversely affected by the higher oil prices may also benefit from trade with the oil-exporting countries.

The cross-country studies that include spillover effects between oil-exporting and oil-importing countries shed more light on the overall effects of oil price impacts on the economy than single country studies do. However, given the differences in the structures of the economies, institution qualities, and political systems in the sample countries, the aggregate level studies may also be subject to biased estimation results and misleading policy implications. Two recent studies have examined the mitigating

impact of the intra-federal labour mobility on cases of Dutch disease using a state/ provincial panel data. Raveh (2013) shows that although natural resource wealth is a curse in the cross-country analysis, it is a blessing at the provincial level and can lead the economy towards the so-called "Alberta Effect." He argues that the reduced factor mobility costs within federations could reverse, or at least alleviate, the Dutch disease symptoms at the intra-federal level. Beine et al. (2014) also addresses the question of whether Dutch disease symptoms could be overcome or at least mitigated through either interprovincial migration or international immigration flows of workers. They report that Dutch disease symptoms are observed in Canada in the form of a rise in the share of the non-tradable sector, but the immigration of workers into the booming provinces mitigates the effects of the Dutch disease. They also show that the mitigation effect is stronger with interprovincial migration flows and immigration flows associated with the temporary foreign worker programs. Moshiri and Bakhsimogaddam (2018) also investigate the effects of the oil price shocks on the Canadian economy. Canada is an interesting case study for the overall (direct and spillover) effects of the oil price shocks, because it includes autonomous oil-exporting and oil-importing provinces, which enjoy homogeneous institutional and political structures and the same monetary policy. Furthermore, trade and labour migrations take place between provinces without the barriers that exist among countries, even those in the same economic and political blocks. In this context, Canada can then be considered as a world including both oil-importing and oil-exporting countries, but with similar institutions and monetary system, free trade, and labour movement across the nations. Therefore, the oil price shock effects obtained from Canadian data will not be influenced by institutional and structural heterogeneities. Moreover, considering the interprovincial trade and labour movement across provinces will provide more accurate estimates of the spillover effects of the oil price shocks.

Like countries, Canadian provinces are subject to different demand side and supply side effects of the oil price shocks. For instance, high oil prices generate excess revenues for oil-exporting provinces, increasing aggregate demand. However, rising oil prices has adverse impacts on oil-importing provinces, because of

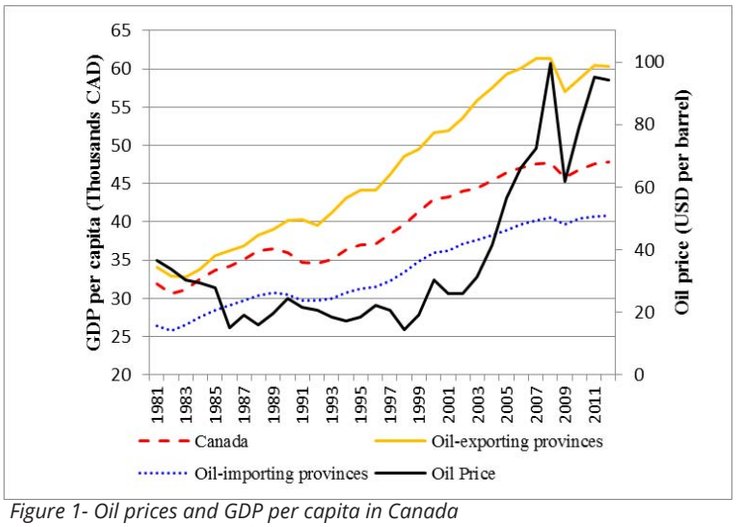

Figure 1- Oil prices and GDP per capita in Canada
Source: Statistics Canada, U.S. Department of Energy (EIA)

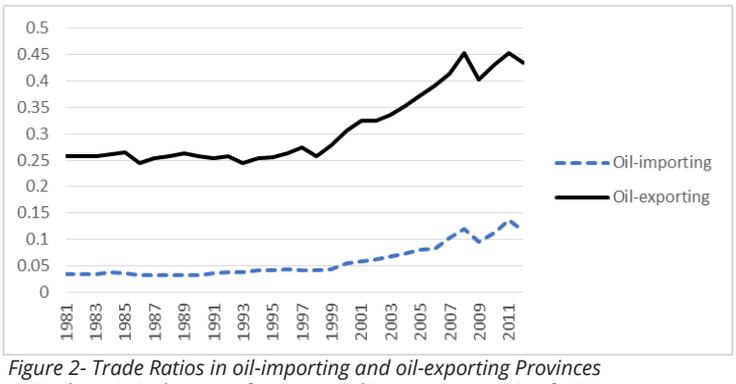

Figure 2- Trade Ratios in oil-importing and oil-exporting Provinces
Trade ratio is the sum of exports and imports as a ratio of GDP.
Source: Statistics Canada, CANSIM Table 384-0038, 384-0002 and 384-0003.

increasing production costs, especially in the manufacturing sector. The standard Dutch disease effect may also be applicable, given the fact that the Canadian dollar moves with the oil prices. In addition to the direct demand and supply side effects in the two groups of provinces, interprovincial trade and labour migration can also influence how the oil price shocks affect the economy. When oil prices rise, the affluent oil-

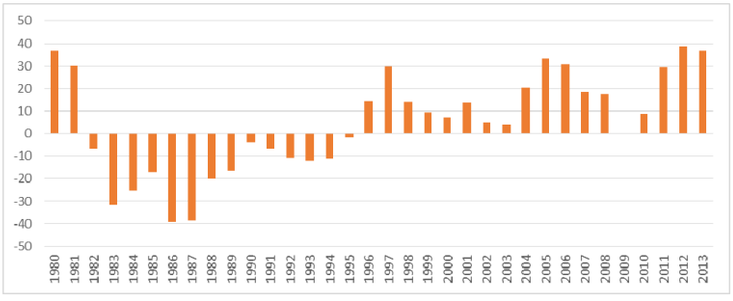

Figure 3- Net Migration from oil-importing to oil-exporting Provinces (1000 persons)
Source: Statistic Canada, CANSIM, Tables 384-0038 and 051-0019.

exporting provinces increase their imports from oil-importing provinces, alleviating the adverse supply side effect on oil-importing provinces. When oil prices fall, the beneficiary oil-importing provinces increase imports of oil and other commodities from oil-exporting provinces, easing the negative effects on the oil-exporting provinces. The labour movement would also have similar countercyclical effects in provinces, as labour moves from oil-importing provinces to oil-exporting provinces during oil booms and in the opposite direction when the oil market plummets (Helliwell, 1981; Raveh, 2013).

Figure 1 shows that per capita GDP in Canada and its two groups of oil-export and oil-import provinces along with the oil price trend for the period 1981-2012. The Canadian economy grew noticeably during the low oil prices in the 1990s and continued to grow, though at slower rates, during the sharp oil price increases in the 2000s. Figure 1 also shows that both oil-exporting and oil-importing provinces have been growing during different cycles of the oil prices, but the growth of oil-exporting provinces has been faster during the oil boom of the 2000s.

Figure 2 shows the interprovincial trade ratios in oil-exporting and oil-importing provinces. The trade ratios are much higher in the oil-exporting provinces, reflecting their lower total GDP compared to the oil-importing provinces, and have been increasing much faster since 2000. Figure 3 also shows the net migration from the oil-importing to the oil-exporting provinces. The oil-importing provinces have experienced a net labour inflow during the oil bust in the 1980s and a net labour outflow during the oil boom beginning in the late 1990s.

Moshiri and Bakhshimogaddam (2018) use a panel VAR model to tease out the impacts of the oil price shocks on the Canadian economy considering the trade and migration factors. The main variables included in the model are per capita GD growth rate, interest rate, exchange rate, and oil price shocks. For a robustness check, they also include other variables such as investment ratio, government spending ratio, and real exchange rate. The results of the study show that oil price shocks do not have an overall significant effect on the Canadian economy. Nevertheless, the effects are heterogenous across the two groups of oil-importing and oil-exporting provinces. While oil-exporting provinces benefit from higher oil prices, oil-importing provinces suffer. However, interprovincial trade and labour migration have been able to mitigate those direct effects on the provinces. The results of the counterfactual exercise show that the responses of the economy when trade and labour spillovers are considered are different than those when the spillover variables are absent. Specifically, the long-run (5-year horizon) effect of oil price shocks on GDP growth rate of oil-exporting provinces in the presence of the trade spillover is higher by 0.23 percent, and the negative effect on oil-importing provinces is lower by 0.1 percent. The impulse response differences are also similar when labour migration spillover (0.23 percent and 0.12 percent for the oil-exporting and the oil-importing provinces, respectively) is used. As an alternative way to gauge the spillover impact, the oil shock - GDP growth nexus is also examined in two different periods with low and high trade ratios and labour movements. As Figure 2 shows, the trade ratio has been low and stable between 1981-2000 (25 percent on average) and began to rise markedly afterward (35 percent on average). Furthermore, Figure 3 shows that the net labour migration from the oil-importing to the oil-exporting provinces has shifted from negative to positive in the late 1990s and stayed the same since then. These data provide a form of natural experiment to get an insight about the importance of interprovincial trade and labour migration in the oil-macroeconomy relationship.

The results of the state/provincial studies may also be applicable to oil-exporting and the oil-importing countries in the global context. A new study by Moshiri and Kheirandish (2018) estimates the direct and spillover effects of the oil-price changes on 30 major oil-exporter and oil-importer countries. The sample data shows that more than 70 percent of the total exports of oil-exporters flows to major oil-importers in the developed countries and more than 40 percent of the total exports of oil-importers flows to major oil-exporters in the developing countries. The results of the study also indicate that while higher (lower) oil prices are harmful for oil-importing (oil-exporting) countries, international trade mitigates the direct effects significantly. That is, the boons of higher oil prices for oil-exporting countries spills over to oil-importing countries, and similarly, the positive impacts of lower oil prices on oil-importing countries flow to oil-exporting countries through their trade. Although this study does not specifically examine the international labour migration effect, empirical studies for the federated countries suggest that labour movement across the countries can similarly dampen

the adverse effects of the oil price shocks on both groups of countries.

The results of these studies have important policy implications in national and global contexts, specifically in our current condition, as sanctions and restrictions on trade and immigration are the active policy agenda in the United States. Resuming sanctions on Iran's oil exports and its financial institutions after the recent unilateral exit of the US from the 5+1 nuclear deal will generate an adverse supply shock causing harm to major oil-importing countries in developed and emerging economies, such as China and India, and thus hindering world economic growth. Moreover, restrictions on trade and labour migration will also intensify the negative impacts of the higher oil prices on industrialized and fast-growing emerging economies. On the contrary, stronger trade relationships and labour movement between the oil-importing and the oil-exporting countries will enhance the positive effects of oil price shocks and dampen their negative effects on the economies of both groups.

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While multiple submissions by individuals or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each author may present only one paper or one poster in the conference. No author should submit more than one abstract as its single author. If multiple submissions are accepted, then a different author will be required to pay the registration fee and present each paper or poster. Otherwise, authors will be contacted and asked to drop one or more paper(s) or poster(s) for presentation.

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- Details for the pre-conference Summer School and technical tours will be announced on iaee2019.org

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South African Association for Energy Economics (SAAEE)

The 30th *child* of IAEE

The 30th Affiliate of IAEE, the South African Association for Energy Economics (SAAEE) was launched in Pretoria on the 26th of April 2018. The IAEE President David Knapp, the IAEE President- elect Christophe Bonnery, and Executive Director David Williams were present at the Formal launch event to show their support and hope that SAAEE will promote the topic of energy economics in South Africa and generally, the southern Africa region. They all introduced to the audience that came from various spheres of the South African energy sector the opportunities and knowledge shared within the IAEE network.

In her inaugural speech as a SAAEE President, Prof Roula Inglesi-Lotz from the Department of Economics at the University of Pretoria stressed the need to think out of the box towards tackling the energy challenges faced in the country and the rest of the developing world, such as energy poverty and energy security. Except for the technological improvements and specific skills, well-directed and quality Research and Development (R&D) is imperative. She made a point that no innovative solutions would be discovered without P and D: Productive research – and not research for the sake of research – and Debate and Dialogue. Evidence-based, factual, and unbiased analysis is essential to assist in future policy decisions in South Africa.

Delivering a keynote speech, Mr Barry Bredenkamp, from the South African National Energy Development Institute (SANEDI) of the Department of Energy, stressed the need of such a forum at the national scene of energy in the country. He pointed that the country experiences delays in policy implementation, such as the Integrated Resource Plan for electricity that might cost both in revenue but also foreign and local investment. He illustrated that the technical and engineering skills are available in the country but maybe "...we are not getting the economics right". He concluded pointing that on the agenda of the BRICS working group, hosted in South Africa, is the establishment of an energy economic bureau – for which SANEDI will closely collaborate with SAAEE.

The event closed with a panel discussion among energy experts. Dr S. Labson from TransAfrican Cosulting Group and University of Johannesburg, Miss L. Mashele from the Development Bank Southern Africa (DBSA), Mr D. Milazi from CSIR Energy Centre, and Mr D. Joubert from Eskom shared their thoughts on the topic "Energy Economics: who wins and who loses from South Africa's changing energy mix?"

Roula Inglesi-Lotz

Cost of Natural Gas in Eastern Chinese Markets: Implications for LNG Imports

BY YUE WANG AND ZHEN ZHU

China is the third largest consumer of natural gas in the world, behind the U.S. and Russia. As the country switches to cleaner energy to reduce air pollution and lower carbon emissions, natural gas consumption has increased significantly. For 2017, gas consumption surged due to the 'coal-to-gas' policy in the northern region and industrial consumption increase. Severe natural gas shortages have occurred in China this winter; even major gas production provinces such as Sichuan and Inner Mongolia have undergone gas shortages. Consequently, liquefied natural gas (LNG) imports have surged to a record high to more than 38 million tons, almost a 50% increase compared to that of 2016, making China the second biggest importer in the world behind Japan.

Even though Chinese gas consumption has increased dramatically, it is expected that the consumption will increase substantially more. According to China's clean heating plan for the northern region, the share of clean heating will reach 70% by 2021, replacing 150 million tons of coal.[1] To achieve this target, China will need more gas to replace coal, and gas consumption will likely to keep rising in the future.

As a result of shale revolution, natural gas production in the United States has risen dramatically during the past a few years. Several LNG export projects have been proposed and some projects are already under construction. Energy cooperation between the U.S. and China seems unavoidable in the future. For LNG exporters targeting the Chinese market, an important question would be whether LNG is competitive or not compared to China's own domestic production and other imports, especially given the fact that the Chinese government has unveiled a series of natural gas reforms to create a market-oriented pricing mechanism. Unfortunately, the system has not been established yet and it is extremely difficult to obtain natural gas price information at this time. There are several issues. One is that there is no gas price reference point in China. Second, the gas pricing mechanism is not transparent and public price information is usually not available. This article addresses the issues by estimating the costs of domestic gas and pipeline-imported gas transported to the Chinese eastern coastal markets. Given the fact that the relevant data is usually classified, it is nearly impossible to find direct cost information about gas production and prices in China. We explore a variety of sources to shed light on the issue.

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See footnotes at end of text.

Natural gas consumption and production in China

Natural gas consumption in China has been rising continuously for the past 16 years; however, the growth rate slowed down in the past few years (see Figure 1). In 2017, due to the implementation of 'coal to gas' policy in the northern region, gas consumption has most likely increased remarkably, with a double-digit growth rate since 2014.

Figure 2 shows that Chinese domestic gas production accounted for about 2/3 of the gas supply with the rest coming through pipeline and LNG imports. Figure 3 shows that the domestic production of natural gas has undergone a steady growth for the past 17

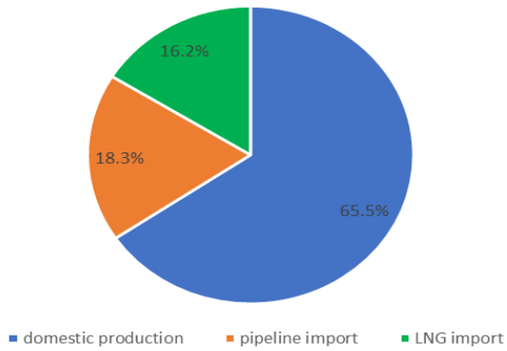

Figure 2: Source of China's natural gas supply (2016)
Source: National Bureau of Statistics (PRC)

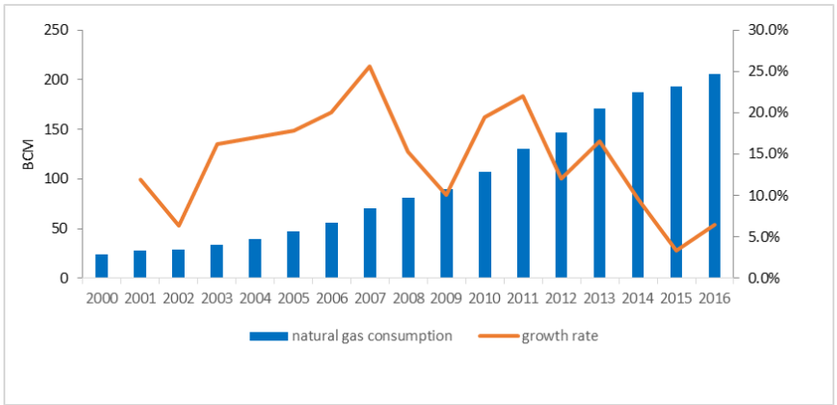

Figure 1: Natural gas consumption in China (2001-2016)
Source: National Bureau of Statistics (PRC)

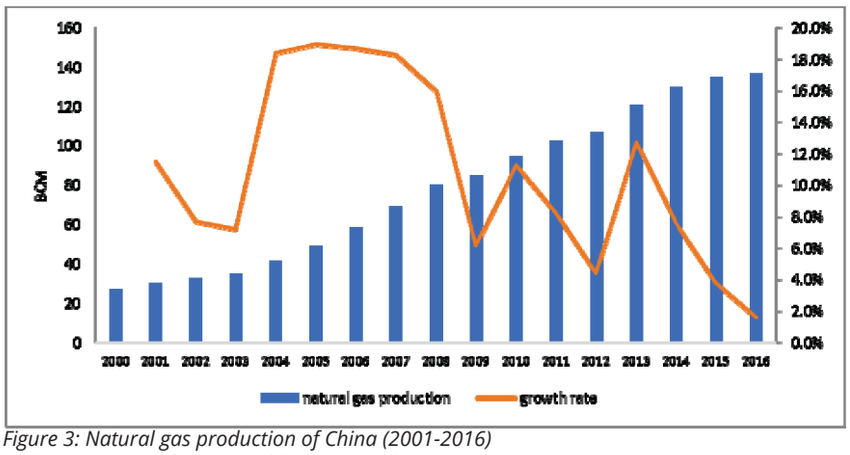

Figure 3: Natural gas production of China (2001-2016)
Source: National Bureau of Statistics (PRC)

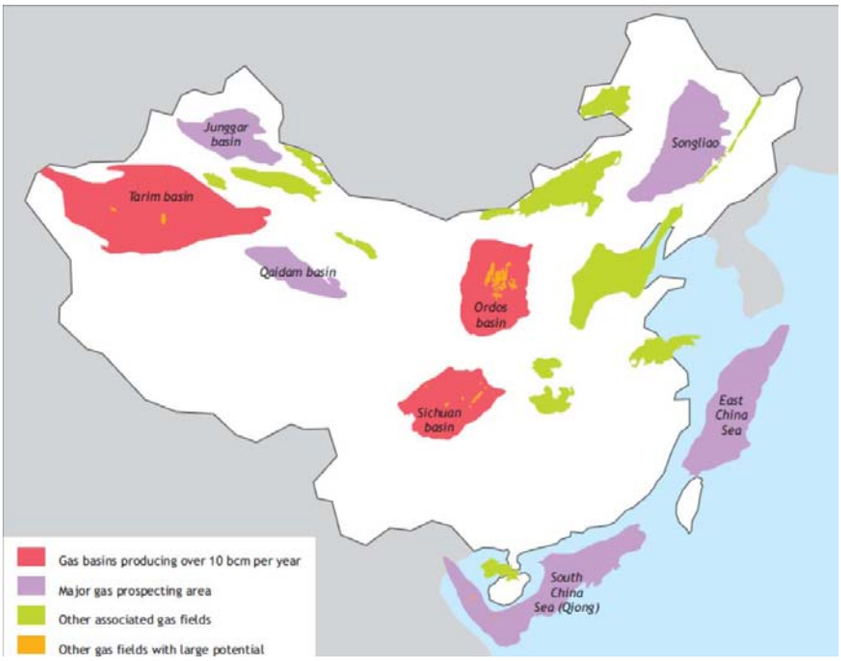

Figure 4: Map of China's Gas Basins
Source: International Energy Agency

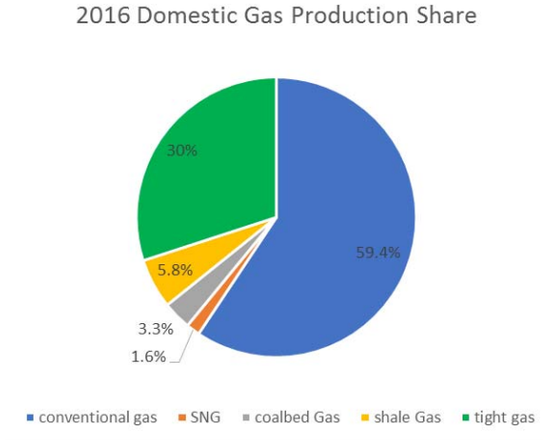

Figure 5: Domestic production by source[2] (2016)

years. Production in 2016 was almost 5 times that for 2000. However, since 2005, the annual gas production growth rate has slowed down significantly with only 1.6% production growth for 2016.

Gas production in China is relatively concentrated geographically. For example, in 2014, production in the Ordos basin reached 42.6 BCM, and production in Sichuan basin and Tarim basin was more than 25 BCM each. The total production from these three basins accounted for 74.5% of all domestic production. In 2016, the largest ten gas fields contributed 51% of all domestic production, and all these fields are located in these three basins (Sichuan Basin, Ordos Basin and Tarim Basin). See Figure 4.

Figure 5 shows with respect to the source of domestic production, conventional gas, which includes tight gas by Chinese definition, still plays a dominant role, despite that the Chinese government has enacted policies to stimulate unconventional gas production.

Gas supply cost at reference cities

In China, a majority of domestically produced and pipeline imported gas is from the western region. Long-distance transportation is usually required to transport gas to the coastal markets. For foreign LNG exporters, the costs of gas at Chinese coastal markets would be an important factor in determining whether LNG is competitive or not.

For reference, three eastern Chinese cities, Guangzhou, Shanghai and Beijing, are used to represent southern, central and northern markets to address this question. See Figure 6 for location of the reference cities and transportation pipelines. The cost of gas at a reference city is the sum of the production cost and transportation fee[3].

Cost of domestic conventional gas transported to reference cities

Chinese gas production cost information is difficulty to obtain, if not impossible. With respect to cost information for conventional gas production, we could not find official cost information except that the average cost of domestic onshore conventional gas (around $6/1000ft3 (1.4 RMB/m3 or $5.56/

MMBtu from a research institution[4], and 0.883 RMB/m3 ($3.5/MMBtu for production cost of CNPC[5]). It is worth noting that before 2013, the ex-factory benchmark price (or first station price) for different gas fields were set by the NDRC (National Development and Reform Commission (PRC)) with a cost-plus method, which included wellhead cost, purification fee and applicable taxes and margins (Sergey Paltsev, 2015). After 2013, a city gate price was set with the netback method, which is linked to fuel oil and LPG. For this article, the average ex-factory prices of industrial use, city gas and residential use[6] for 2010 were used as a benchmark; and the costs of conventional gas at reference city gates (Guangzhou, Shanghai and Beijing) are calculated by adding the transportation cost to the ex-factory price. See Table 1.

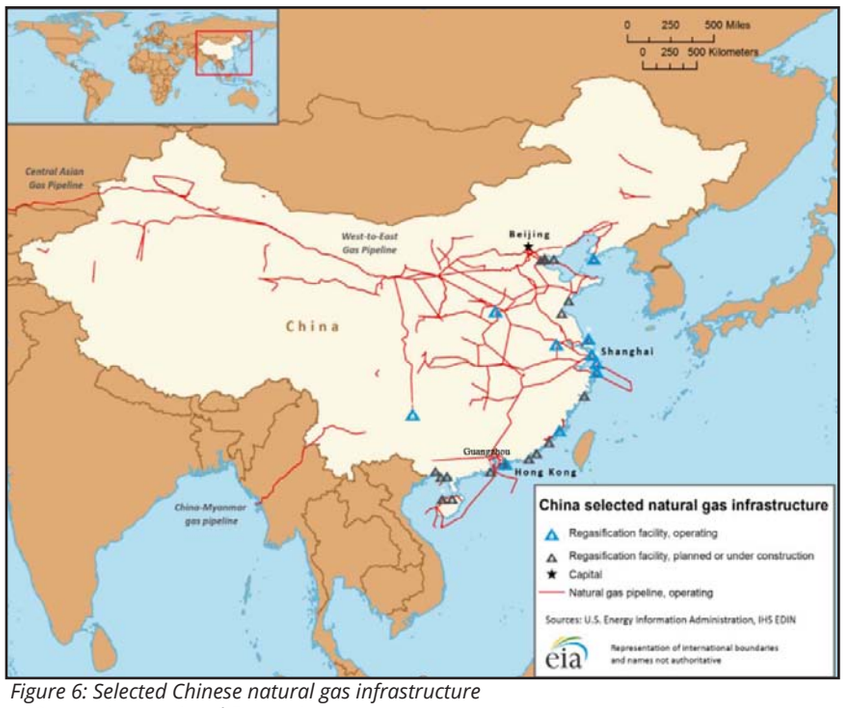

Figure 6: Selected Chinese natural gas infrastructure
Source: International Energy Agency

Cost of tight gas transported to reference cities

Located in the north of Ordos basin, the Sulige gas field is the largest gas field by production. In 2014, the production of that field accounted for over 65% of all tight gas production in China (Yang Zhen, 2016); therefore, the Sulige gas field is used as representative for tight gas production in China.

	Sichuan-Chongqing gas fields (RMB/m3)	Changqing gas fields[8] (RMB/m3)	Xinjiang gas fields (RMB/m^3)
05/2010 (average ex-factory price or first station price)	1.402	1.25	1.065

Table 1: NDRC natural gas prices for different gas fields[7]

A sweet block (M-block) has been studied for economic evaluation (Yang Zhen, 2016). Yang found that for a gas price of 1.26 RMB/m3 ($5.01/MMBtu) at the Changqing field, the after-tax IRR for existing wells would be only 1.6%, which is far below the cost of capital. For the future wells of the M-Block, the after-tax IRR will be -6.1%, with a net cash flow of -5.05 billion RMB. To get a reasonable after-tax IRR, the gas price at the Yulin city gate (near Sulige gas field) should be around 1.60 RMB/m3 ($6.36/MMBtu). Thus we use the economically feasible city gate price of 1.68 RMB/m3 ($6.68/MMBtu), which will generate an IRR of 8% for the sweet M block, to calculate the costs at the city gate of Guangzhou, Shanghai and Beijing.

Transportation costs from Sulige to Shanghai, Guangzhou and Beijing are 0.583 RMB/m3 ($2.32/MMBtu), 0.675 RMB/m3 ($2.68/MMBtu) and 0.285 RMB/m3 ($1.13/MMBtu), respectively. Therefore, the total costs for Sulige tight gas to reach these city gates are 2.263 RMB/m3 ($8.99/MMBtu), 2.355 RMB/m3 ($9.36/MMBtu) and 1.965 RMB/m3 ($7.81/MMBtu) accordingly.

Cost of shale gas transported to Shanghai

Even though China has one of the largest shale gas reserves in the world and the Chinese government has enacted favorable policies in the past years to promote shale gas production, there are still various obstacles for shale gas development. Currently, all the shale gas is produced in the Sichuan basin, where the terrain is rough and population density is high. In addition, the geological situation of Sichuan basin is more complex compared to that of the United States. For example, over half of the shale gas reserve is more than 3500m deep, and cannot be extracted economically today (Dong Dazhong, 2014). The average cost of a shale gas well in China[9] is 50 million RMB (7.5 million USD) to 100 million RMB (15 million

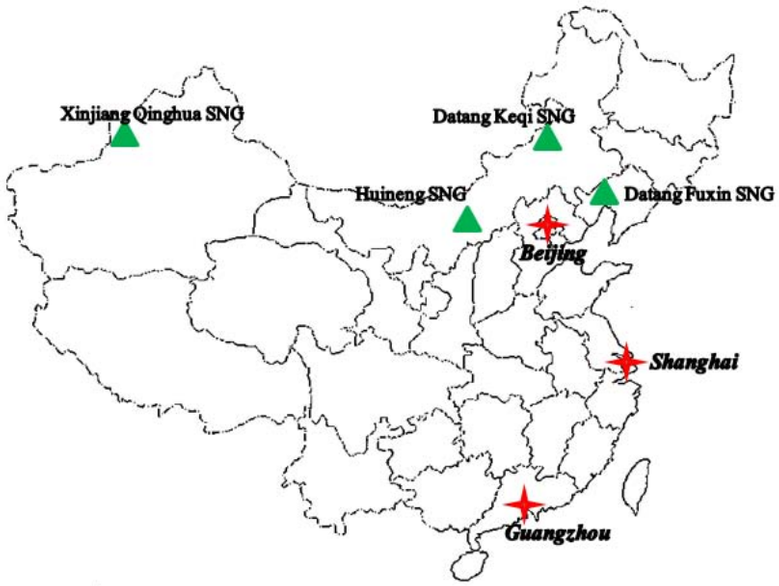

Figure 7: SNG projects in China

USD), which is much higher than that of the United States. Due to these disadvantages, the Chinese government subsidized the shale gas industry. The subsidy is 0.3 RMB/m3 ($1.19/MMBtu) from 2016 to 2018, and will be 0.2 RMB/m3 ($0.79/MMBtu) for 2019 and 2020[10].

Shale gas extraction was expensive in the past. For example, in 2014, the wellhead cost of shale gas in the Fuling gas field (Sichuan Basin) ranged from $11.2/MMBtu to $21.1/MMBtu[11]. According to Sinopec, shale gas development could not break even without 0.4 RMB/m3 ($1.59/MMBtu) subsidy in 2014[12]. It's hard to say whether the current cost is still as high as that, given the fact that for the Weiyuan block of CNPC, the drilling cost has been lowered from 130 million RMB ($19.7 million USD) to about 50 million RMB ($7.6 million USD) in 2017[13].

One thing worth noting is that, in 2011, when China launched the first tender for shale gas exploration, 6 companies competed for 4 blocks. In 2012, the second tender was launched and 16 bid-winning companies obtained rights to explore 19 blocks. However, it was 5 years later when the third tender was launched due to technological challenges, higher exploration costs and environmental issues[14]. The challenges faced in the shale gas development can also be corroborated with the fact that in 2015, ConocoPhillips retreated from China's shale gas development. One year later, in 2016, Shell also stopped its shale gas development in the Sichuan Basin.

Due to very limited information about the progress of shale gas development in China, the cost of $11.2/MMBtu was used to calculate the production cost of shale gas for the Shanghai city gate. The pipeline network owned by Sinopec was used as the basis to calculate the transportation fee. The cost of transportation to Shanghai is 0.6342 RMB/m3 ($2.52/MMBtu). Therefore, the cost of shale gas at the Shanghai city gate is estimated to be $13.72/MMBtu.

Cost of synthetic natural gas (SNG) transported to the reference cities

The Chinese government promoted the development of synthetic natural gas (SNG) as a source of gas supply. Currently, there are 3 SNG projects that are already in production, and they all located in either Xinjiang or Inner Mongolia (see Figure 7).

Due to the fact that gate prices of natural gas in these two provinces are the lowest in China, these three projects all face profit challenges. For the Datang Keqi SNG project located in Inner Mongolia, the initial settlement price with CNPC[15] was 2.75 RMB/m3 ($10.9/MMBtu), which could generate a profit of about 0.7 - 0.8 RMB/m3 ($2.8/MMBtu - $3.2/MMBtu) with the government's subsidy of 0.2 RMB/m3 ($0.8/MMBtu). The production cost of Datang Keqi SNG is estimated to be in a range of 2.15 RMB/m3 ($8.54/MMBtu) to 2.25RMB/m3 ($8.94/MMBtu), which can be corroborated by a report[16]stating the cost of Datang Keqi SNG being around 2.2RMB/m3 ($8.74/MMBtu). As for the Xinjiang Qinghua SNG project, the first-stage production capacity is 1.375 BCM/year, with a production cost of 1.6 RMB/m3 ($6.36/MMBtu). The other project, Inner Mongolia Huineng[17], whose first stage was completed in November 2011, has a production capacity of 0.4 BCM/year with a production cost of SNG of 3.4 RMB/m3 ($13.5/MMBtu). For this project, even when the second stage is completed, the cost would still be as high as 2.3 RMB/m3 ($9.14/MMBtu), which is substantially higher than the benchmark city gate price of Inner Mongolia (1.24RMB/m3 or $4.93/MMBtu). After having been put into production for more than 2 years, all three projects generated negative returns.

For this article, we use Datang Keqi and Xinjiang Qinghua SNG projects as the benchmark to calculate the costs of synthetic natural gas transported to Beijing, Shanghai

and Guangzhou city gates. For the Datang Keqi project, the initial settlement price 2.75 RMB/m3 ($10.93/MMBtu) is used to calculate the cost at the Beijing city gate. The project is located about 400 km north of Beijing. An exclusive pipeline was built for the project, which is linked to the pipeline network of CNPC to reach Beijing. The length of the pipeline is 320 km to Bakeshiyin station (northeast of Beijing), and the unit cost is 0.9787 RMB/(1000m3*km)[18]. For the Xinjiang Qinghua SNG project, the production cost of 1.6 RMB/m3 ($6.36/MMBtu) was used. The distance to the eastern coastal market is much further compared to that of Datang Keqi.

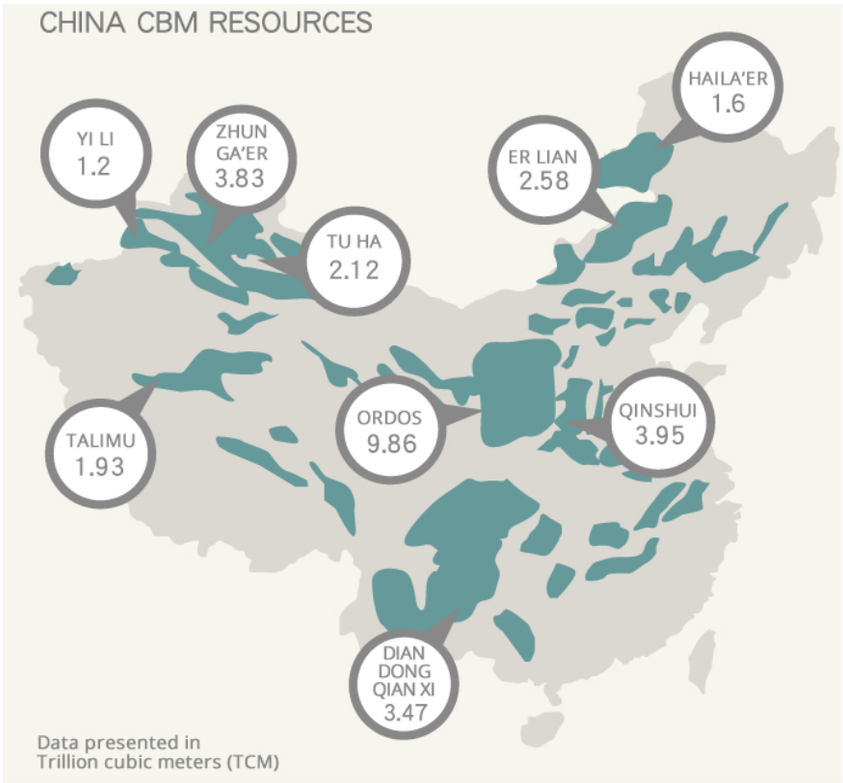

Figure 8: China coalbed gas resources
Source: Sino Oil and Gas

Cost of coalbed gas transported to Shanghai

China has a coalbed gas (also known as coalbed methane or CBM) reserve of 36,800 BCM with a depth less than 2000 meters deep. Currently, two industry bases were established in the Qinshui basin (Shanxi Province) and Ordos basin. In 2014, the total amount of coalbed gas produced in these two basins accounted for 94.6% of all coalbed gas production in China (Mu Fuyuan, 2015).

In the past, the Chinese government has set an ambitious target for coalbed gas. For example, the 12th 5-year plan for natural gas development has set the coalbed gas production for 2015 to be 16 BCM. However, actual production for 2015 was only 4.4 BCM. The 13th 5-year plan has lowered the coal bed gas production target to 10 BCM.

The coalbed gas industry faces many challenges such as low reserve grade and lack of proper technique. Beside technological difficulties, these coalbed gas producers also lack pipeline connection to existing trunk lines. The specialized transportation line can be expensive. For instance, the unit cost of the transportation line from Qinshui coalbed gas to Boai of Henan province is 3.5047 RMB/(1000m3*km), which is more than thirteen times higher than that of the east section of the West-East transportation line[19].

For a cost estimate, Qinshui coalbed gas project is used as reference to calculate the cost of coalbed gas transported to Shanghai. The main transportation line is from Qinshui gas station to Shanghai via West-East Pipeline A for a distance of 1081.14 km. As the unit cost is 0.2429 RMB/(1000m3*km), the total transportation cost amounts to 0.2626 RMB/m3 ($1.04/MMBtu).

Figure 9: West-East Gas pipeline of China
Source: World Iron & Steel

Year	Average Brent oil price($/bbl)	Average import price (RMB/m³)
2011	111.26	2.08
2012	111.63	2.46
2013	108.56	2.17
2014	98.97	2.17
2015	52.32	1.64
2016	43.64	1.17

Table 2: Annual Brent oil price and imported gas price in Xinjiang
Source: EIA, Urumqi Customs District

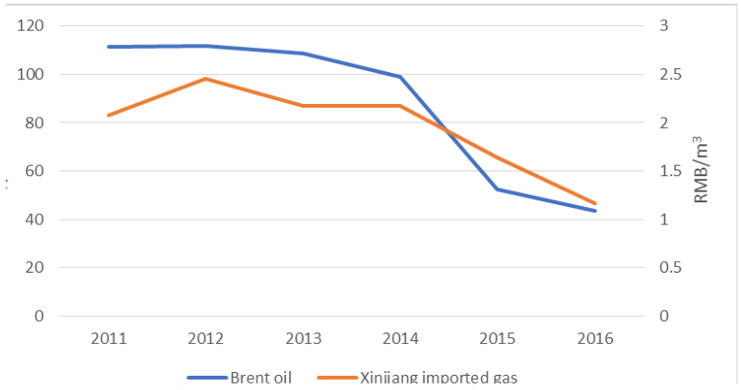

Figure 10: Prices of Brent oil and Xinjiang imported gas

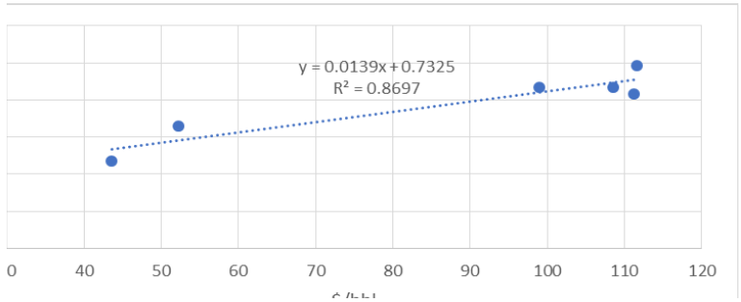

Figure 11: A regression analysis of Brent oil price and Xinjiang imported gas price

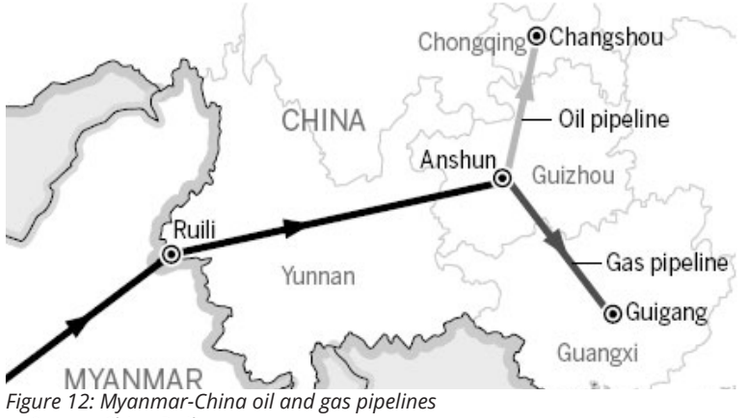

Figure 12: Myanmar-China oil and gas pipelines
Source: China Daily

Currently, the Chinese government subsidizes the coalbed gas production at 0.3 RMB/m3 ($1.19/MMBtu). According to Opsteel,[20] the cost of coalbed production is around 2 RMB/m3 ($7.95/MMBtu). Lingfeng (Lingfeng, 2017), in a study of premium reserves, showed that for an ex-factory price of 1.25 RMB/m3 ($4.97/MMBtu), the after-tax IRR will be 2.9%, which is far below the benchmark IRR of 8%. With an ex-factory price of 1.25 RMB/m3 ($4.97/MMBtu), the project needs a 0.77 RMB/m3 ($3.06/MMBtu) subsidy to achieve 8% IRR. Thus the cost of Qinshui coalbed gas is estimated to be 2 RMB/m3 ($7.95/MMBtu), and the total cost of Qinshui coalbed gas at Shanghai city gate is estimated as 2.2626 RMB/m3 ($8.99/MMBtu).

Cost of Central Asia and Myanmar imported gas transported to reference cities

CNPC is the only pipeline gas importer in China. However, due to the high cost of imported gas and low city gate price, CNPC has been losing money for years. For gas imported from Central Asia, a long-distance transportation is required to reach the Chinese border city Horgos. The pipeline then runs several thousand kilometers to arrive at the eastern coastal market. See Figure 9. The total pipeline length is 4901 km from Horgos to Gangzhou.

It is not clear how the imported gas price is determined at Horgos customs. However, it is suggested that the gas price is linked to the oil price (Chen, 2014). The imported gas price and annual Brent oil price from 2012 to 2016 are shown in Table 2 and plotted in Figure 10. It appears that there is a tight connection between these two prices and the regression line in Figure 11 confirms such a relationship.

China started to import natural gas from Myanmar in 2013. The import amount in 2016 reached 2.86 million tons (approximately 3.89 BCM), accounting for 10% of all the pipeline imports of natural gas. The gas supply is mainly from Myanmar's offshore gas field Shwe, which has a daily production of about 500 MMcf, and around 80% of the production is transported to China[21].

Figure 12 shows the Myanmar-China oil and gas pipeline. The transportation distance between Ruili of Yunnan province and Guigang of Guangxi province is 1727 km. The unit transportation cost is 0.4109 RMB/(1000m3*km). For simplicity, Guangzhou is used as the reference city to calculate the cost of Myanmar imported gas transported

to the southeastern coastal market of China[22].

Figure 13 plots the Brent oil price along with the Myanmar imported gas price. Again, it is not clear what kind of pricing mechanism was applied for natural gas imported from Myanmar, except that He (He Chunlei, 2014) stated that the price of natural gas import from Myanmar was linked to the oil price. Figure 14 provides some preliminary evidence supporting He (2014) based on regression analysis of Myanmar imported gas price on Brent oil price.

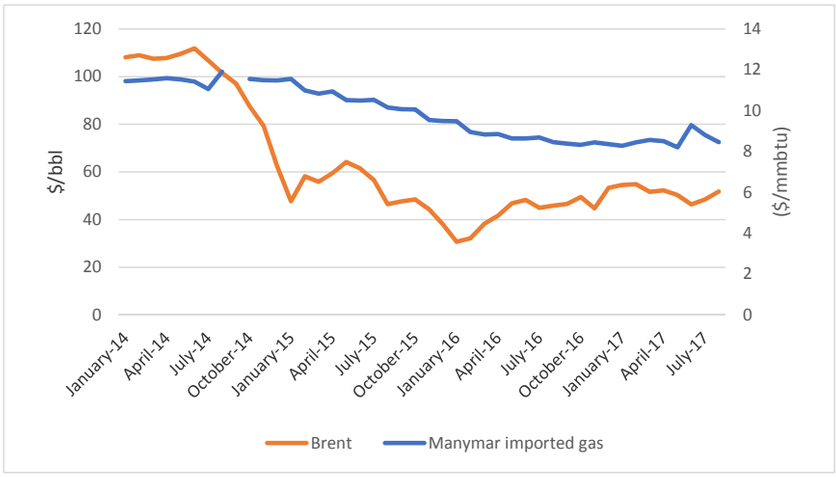

Figure 13 Brent oil price and Myanmar imported gas price
Source: China Customs and China-nengyuan.com

Summary of gas prices for reference cities

After adding the transportation cost, which is calculated by multiplying the unit transportation fee by the transportation distance, the costs of gas from different sources at the reference cities are shown in Table 3:

Conventional gas from the Ordos basin and Tarim Basin is cheaper compared to gas from other sources; and it can be transported to coastal markets with costs lower than $8/MMBtu. However, it is cautioned that our study uses the 2010 ex-factory price of gas for conventional gas. It is likely that cost of production has increased. For example, from 2011 to

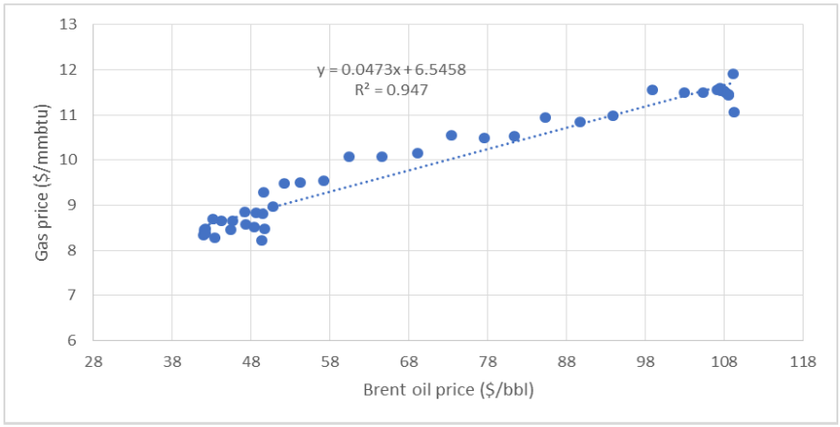

Figure 14. Relation between average twelve-month Brent oil price and Myanmar imported gas price

	Conventional					SNG			Pipeline import	
	Sichuan Basin	Ordos Basin	Tarim Basin	Tight gas	Shale gas	Datang Keqi	Xinjiang Qinghua	Coalbed gas	Central Asia	Myanmar
Beijing		6.12	6.58	7.81		12.71	8.91		8.74	
Shanghai	8.09	7.28	6.88	8.99	13.72		10.15	8.99	9.98	
Guangzhou		7.67	7.68	9.36			9.97		9.8	13.07

Table 3: Costs of gas transported to reference cities ($/MMBtu)

2015, the production cost of CNPC[23] had risen from 0.631 RMB/m3 ($2.51/MMBtu) to 0.883 RMB/m3 ($3.51/MMBtu). In addition, the remaining conventional resource has a low grade and therefore the cost of exploration will probably increase[24]. All of these suggest that the costs at reference cities may be higher than our estimated costs.

In calculating tight gas and coalbed gas cost, we have applied the economic analyses of sweet blocks; thus, our estimates should be lower than the actual costs of tight gas and coalbed gas at reference city gates.

The costs of pipeline imported gas are based on Brent oil price of $60/bbl. For natural gas imported from Central Asia, the costs are estimated to be around $10/MMBtu at the Shanghai and Guangzhou city gates. The gas imported from Myanmar is more expensive than that imported from Central Asia. If the oil price is higher than $60/Bbl, then the costs will be higher than our estimated costs in the coastal markets.

The delivery cost of U.S. LNG to China

The U.S. export of LNG to China increased substantially in the last couple of years and the upward trend is expected to continue

given the increased demand from China and still relatively low gas price in the U.S. For LNG exporters targeting the Chinese market, the delivery cost of LNG compared to the gas costs at reference city gates would be important in determining whether LNG is competitive or not. As there are always risks associated with the LNG value chain, from exploration to shipping and marketing, it is difficult to ascertain the delivery cost of LNG. One report mentioned that U.S. LNG can be shipped to Tokyo for a fixed price of $8/MMBtu[25]. Since the distance between Tokyo and the coastal region of China is relatively short compared to the shipping distance between the United States and East Asia, it is reasonable to infer that the $8 delivery cost can also be applied to the coastal market of China.

The economic viability of U.S. LNG exports to Asia and Europe was examined by Ripple (Ripple, 2016), who found that under the terms of the BG contract and low day rate shipping costs, U.S. LNG can be delivered to Tokyo at a cost of $5.6/MMBtu. Assume the regasification cost to be $0.35/MMBtu, then the gas cost out of the regasification facilities would be $5.95/MMBtu. Ignoring the transportation between LNG processing plant and city gate, it is reasonable to assume the cost at the reference city gates to be around $6.00/MMBtu, which is lower than the cost of Chinese domestically produced gas and pipeline imported gas.

In general, the U.S. LNG can be cost competitive in China's coastal market, especially compared to domestically-produced unconventional gas and imported gas from both Central Asia and Myanmar.

Footnotes

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(See References on page 33)

The Petro-yuan: A Momentous Game Changer for the Global Energy Markets, the Global Economy & Sanctions

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See footnotes at end of text

The 26th of March 2018 will go in history as the most momentous day for the United States' economy, China's economy and the petrodollar and also for China's status as an economic superpower. In that day China launched its yuan-denominated crude oil futures in Shanghai thus challenging the petrodollar for dominance in the global oil market. And in that very day 15.4 million barrels of crude for delivery in September 2018 changed hands over two and a half hours—the length of the first-day trading session for the contract[1]

Exactly one week after China launched its crude oil futures, the petro-yuan surpassed Brent trading volume (see Chart1). How long will it take it before overtaking the petrodollar?

The truth of the matter is that China does not plan to allow the U.S. financial system to dominate the world indefinitely. Right now, China is the number one exporter on the globe and the largest crude oil importer in the world and also the world's biggest economy with a GDP of $23.57 trillion in 2017 (compared to $19.38 trillion for the U.S.), based on purchasing power parity (PPP).[2]

The Chinese would like to see global currency usage reflect this shift in global economic power. At the moment, most global trade is conducted in U.S. dollars and more than 60% of all global foreign exchange reserves are held in U.S. dollars. This gives the United States an enormous built-in advantage.

Today, the U.S. financial system is the core of the global financial system. Because nearly everybody uses the U.S. dollar to buy oil and to trade with one another, this creates a tremendous demand for U.S. dollars around the planet.

So if the U.S. financial system is the core of the global financial system, then U.S. debt is "the core of the core. Unfortunately, U.S. debt is growing far more rapidly than GDP is, and therefore it is completely and totally unsustainable.

The Chinese understand what is going on, and when the dust settles they plan to be the last ones standing. In fact, they have already got the ball rolling with the launch of their crude oil futures contract.

Moreover, China has entered into a very large currency swap agreement with the euro zone that is considered a huge step toward establishing the yuan as a major international currency. This agreement reduces the share of the U.S. dollar in trade between China and Europe.[3]

How Big a Threat Is the Petro-yuan to the Petrodollar?

The petro-yuan could be a death blow for an already weakened U.S. dollar and the emergence of the yuan as the dominant world currency.

Back in 2015, the first of a number of strikes against the petrodollar was dealt by Russia. Gazprom Neft, the third-largest oil producer in Russia, decided to move away from the dollar towards the yuan and other Asian currencies. Iran followed suit the same year using the yuan for payment for Iranian oil.[4]

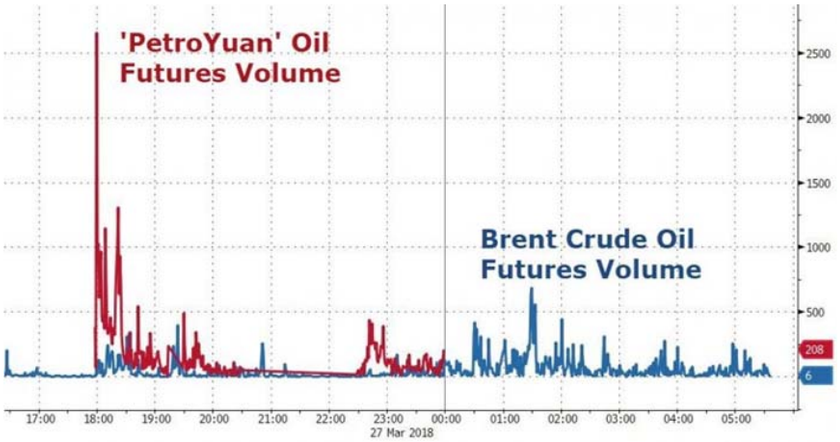


Chart 1
Source: Courtesy of Oilprice.com (accessed on 2 April 2018).

Another blow hit the petrodollar in 2017 when China became the world's largest importer of crude oil (see Chart 2).

With major oil exporters finally having a viable way to circumvent the petrodollar system, the U.S. economy could soon encounter severely troubled waters. First of all, the dollar's value depends massively on its use as an oil trade medium. When that is diminished, we will likely see a strong and steady decline in the dollar's value.

Chart 2

The petrodollar is backed by Treasuries so it can help fuel U.S. deficit spending. Take that away and the U.S. economy will be in trouble leading to a devaluation of the dollar. Contrast this with a petro-yuan convertible to gold.

The launching of the petro-yuan could be a "wake up call" for the United States. Moving oil trade out of the petrodollar into the petro-yuan could take initially between $600 billion and $1000 billion worth of transactions out of the petrodollar.[5]

Will the Petrodollar Survive the Petro-yuan?

At the very least, if the dollar's future role diminishes, then there will be surplus dollars, which unless they are withdrawn from circulation entirely, will result in a lower dollar on the foreign exchanges. While it is possible for the U.S. Federal Reserve to contract the quantity of dollars circulating around, it would also have to discourage and even reverse the expansion of bank credit, which would be judged by central bankers to be economic suicide. For that to occur, the U.S. Government itself would also have to move firmly and rapidly towards eliminating its budget deficit. But that is being deliberately increased by the Trump administration instead.[6]

The Bretton Woods agreement, designed to make the dollar appear "as good as gold", ended in 1971 with the discarding of the international gold standard by the Nixon administration. Today the ratio of an ounce of gold to the dollar has moved to about 1:1350 from the post-war rate of 1:35, a huge loss of the dollar's purchasing power.[7]

Since the Nixon shock in 1971, the Americans have been adept at perpetuating the myth of the mighty dollar, insisting gold now has no monetary role at all. By cutting a deal with the Saudis in 1973, Nixon ensured that oil, and in consequence all other commodities, would be priced in dollars.

That was until now. Once the process starts, triggered perhaps by the petrodollar's loss of its trade settlement monopoly, it is possible that the dollar could initially lose between a third and a half of its purchasing power against a basket of commodities, and a similar amount against the yuan.

With the petro-yuan a reality now, China will, in effect, be making a claim to global oil reserves. That would definitely be against American interests as the "black gold" has been practically backing the U.S. dollar as well as a humungous U.S. debt.[8]

On the other hand, Russia has been ever more willing to back the idea of global trade independent of the dollar. Also, the the BRICS alliance (Brazil, Russia, India, China & South Africa) is already targeting the dollar-dominated world of trade and economics.[9]

Russia and China have stepped up their alliance to a level where the Russian ruble is an acceptable tender at many places in China while other countries such as Iran and Venezuela will use the petro-yuan to undermine the petrodollar and reduce the impact of U.S. sanctions on their economies.[10]

China has effectively cornered the gold market in support of the petro-yuan (see Chart 3).

The petrodollar system breaking

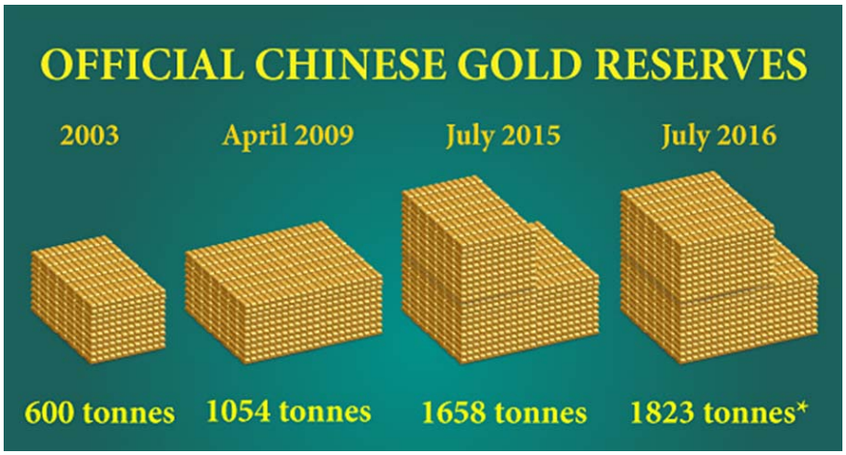


Chart 3 Chinese Official Gold Reserves, 2003-2006
Source: Chinese Gold Market Infographic, Bullion Star.

down, where oil is no longer paid for in dollars internationally, essentially would be the death knell to the U.S. dollar as the global reserve currency. A decreasing demand for the petrodollar would result in an increase in interest rates of U.S. bonds, a rise which would cause severe budgetary issues to the U.S.. It would also decrease significantly the effect of U.S. sanctions.

A petro-yuan fully convertible to gold on the Shanghai and Hong Kong exchanges would certainly support what may very well become "Oil for Gold" or "Petro-yuan for Gold".

Could the Petro-yuan Unseat the Petrodolar

It won't be easy to unseat the petrodollar without the participation of some major oil producers like Russia and Saudi Arabia. Between them Saudi Arabia and Russia account for 26% of global oil production and 25% of oil exports. Russia is already on board along with Iran and Venezuela.[11]

China is now trying to persuade Saudi Arabia to start accepting the petro-yuan for its crude oil. If the Chinese succeed, other oil exporters could follow suit.

On balance, I think Saudi Arabia will compromise by accepting the petro-yuan for oil exported to China and the Asia-Pacific countries whilst continuing to accept the petrodollar for exports to the European Union (EU) and the United States. Even such a compromise will still tip the balance in favour of the petro-yuan since 75% of Saudi oil exports go to China and the Asia-Pacific region.

A Looming Trade War between China & the United States

The launching of the crude oil benchmark on the Shanghai exchange could mark the beginning of the end of the petrodollar. The United States is not going to take this potential threat lying down.

The imposition of tariffs on Chinese goods could be viewed as the first shots in the petro-yuan/petrodollar war of attrition. If a trade war between China and the United States erupts, China will not run from a fight with the United States and will retaliate by imposing its own sanctions on U.S. exports. And to punish the United States financially, China could also offload its holdings of U.S. Treasury bills estimated at $1.3 trillion.[12]

Oil prices could be dragged down over fears of a brewing trade war. The case for oil going higher largely hinges on exceptionally strong demand projected to grow in 2018 by 1.7-2.0 million barrels a day (mbd), a robust economy and a virtual re-balancing of the global oil market. A trade war would upset the oil market's bullish sentiments.

The International Energy Agency (IEA) said in a new report that a U.S.-China trade war could result in a reduction in global oil demand by an estimated 690,000 barrels a day (b/d).[13]

Chinese officials expressed a desire to avoid a trade war, but China might not hold its fire forever against a White House reportedly preparing new tariffs on China as it tries to step up the pressure on Beijing. The U.S. is also reported to be drawing up prohibitions on Chinese investment in advanced U.S. technology, "whether by acquisition, joint ventures, licensing or any other arrangement," the Wall Street Journal reported.[14]

Nobody wins in a game of tit-for-tat tariffs. In a war of escalation, both sides would find it hard to back off. But the U.S. has more to lose. The Chinese economy today is highly integrated with the world economy. The U.S. is a large but declining market. If its trade threats have no effect, it will lose credibility as a hegemonic power.[15]

In time, President Trump will realize that China will not bend the knee before him and stop his trade war against it and let the petro-yuan and the petrodollar find their niches in a global oil market estimated at $14 trillion. This is far better than damaging the global economy and themselves by a trade war.

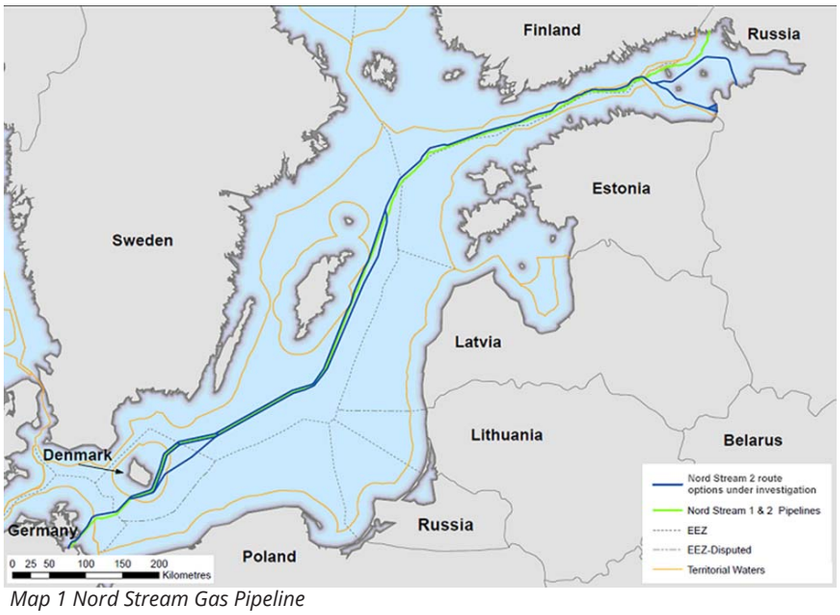
Impact of the Petro-yuan on Sanctions

The petro-yuan will help decrease significantly the effect of U.S. sanctions on Russia, Iran and Venezuela. It provides a viable way for major oil exporters to circumvent the petrodollar system.

Russia

In imposing new sanctions on Russia, the U.S. Congress aimed to punish Russia for its alleged meddling in the U.S. elections in 2016. Still, these sanctions were mostly motivated by U.S. self-interest and geopolitics.[16]

The target of these sanctions as in the previous ones is Russian banks and companies as well as Russian oil and gas projects. The new law tightens some of those limits a bit – for instance, U.S. companies can't participate in any energy project in which Russian entities have a stake of 33%



Map 1 Nord Stream Gas Pipeline

or more.[17] This certainly applies to the U.S. oil giant Exxon Mobil's involvement in the Russian Arctic with its Russian counterpart Rosneft.[18]

However, the most contentious issue could well be the sanctions on pipelines such as Nord Stream II whose construction will start in 2018 and will be finished by the end of 2019.[19]

Nord Stream II, with dual lines totalling 55 bcm/y capacity, would traverse the Baltic Sea along a route parallel to the existing Nord Stream I (also 55 bcm/y capacity) eventually providing up to 110 bcm/y of Russian gas supplies to Germany and the North-West European gas market (see Map 1).

The U.S. has always been opposed to Nord Stream II, which it views as Russia's attempt to tighten its hold on Europe's energy supplies.

Some in the European Union (EU) have accused the U.S. of wanting to displace Russia as a gas supplier to Europe. While there is some truth in this, U.S. LNG can't compete with Russian gas supplies to Europe.

Currently, Russia supplies almost 40% of the gas consumed by the EU. With the decline of domestic resources, this amount is likely to increase.

Germany receives 57% of its natural gas and 35% of its crude oil from Russia. This is one reason Germany has been an outspoken critic of the recent U.S. sanctions. Germany supports the construction of Nord Stream II. The pipeline would help safeguard German energy security and needs.

Germany fully approved Nord Stream 2 at the end of March this year, and is confident that the approvals from the other four countries (Finland, Sweden, Denmark & Russia) along the route of the pipeline will come soon. In April, Finland granted the first of two approvals for the project. Germany views Nord Stream 2 as a necessary piece of infrastructure and that whatever the political sentiment towards Russia in Europe, economies need fuel.[20]

Iran

It is very probable that President Trump will pull out of the Iran nuclear deal and re-impose sanctions on Iran on the 12th of May this year.

Obviously, much of the focus will be on the immediate impact on Iran's oil supply. A report from Columbia University's Centre on Global Energy Policy from March 2018 predicted that U.S. action to re-impose sanctions might knock 400,000 to 500,000 b/d of Iranian oil exports within a year.[21]

However, contrary to claims by Colombia University, Iran will not lose a single barrel of oil exports from U.S. sanctions. The reason the pre-nuclear deal sanctions against Iranian oil exports were effective was because of two things: one the imposition of sanctions by the EU on insurance companies ensuring Iran's oil cargoes, and the other the United States sanctions on banks dealing with Iran.

The EU is not going to re-impose sanctions on Iran and Iran will be using the petro-yuan as payment for its oil exports thus neutralizing U.S. sanctions on banking.

And while the re-introduction of sanctions might scare away western investment, it can't stop China's and Russia's investment in Iran's oil and gas industry.

Venezuela

If the U.S. expands sanctions on Venezuela to include the oil industry and restricts U.S. exports of oil products such as naphtha that are crucial for diluting Venezuela's extra-heavy oil, oil production in the country sitting on the world's largest oil reserves, would further suffer.[22]

And despite U.S. sanctions, neither Venezuela's economy nor its oil industry will collapse now or in the future because China and Russia, who extended billions of dollars to Venezuela, have a vested interest in not letting this happen.

And since the bulk of Venezuela's oil

exports go now to China, it is logical that Venezuela will accept the petro-yuan for payment thus nullifying U.S. sanctions.

In addition to the petro-yuan, Venezuela will accept payment for its oil in its own cryptocurrency--El Petro—which will be backed by more than 5.3 billion barrels of oil supporting $267 billion worth of financial instruments.[23]

Conclusions

The Petro-yuan could prove to be a momentous game changer for the global energy markets, the global economy and the effectiveness of U.S. sanctions.

It is probable that the yuan will emerge as the world's top reserve currency within the next decade with the petro-yuan dominating global oil trade.

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Southeast Europe: Crossroads of Energy, Economics and Geopolitics

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Independent Shale Oil Producers: The Next Chapter

BY ELEANOR MORRISON

Eleanor Morrison is Managing Director of Commodity Reach Ltd and a PhD student at SOAS, University of London. She may be reched at eleanor_morrison@soas.ac.uk

Shale oil production survived the crude oil price collapse in the second half of 2014 and is expected to return to pre-collapse levels in 2018, thereby allowing U.S' oil supply to reach 10 million BPD. Underpinning this resilience is a combination of four key factors: operational efficiency gains, lower service contractor prices, stable oil market prices and technological innovation. Shale oil suppliers are dominated by a combination of private and public traded independent oil producers with sub-investment grade ratings or zero rating. Investors and lenders, while optimistic with the future of improved producer financial performance, continue to be undecided on future financial returns of these firms. Producers still continue to outspend their cash flows which in turn is problematic for long term operations and investor confidence.

Shale and tight oil production increased from 0.8 million to 4.9 million barrels per day (BPD) from 2010 to 2015, rising from 15% to 52% of total U.S. crude oil production.[1] This exceptional growth pattern spurred many long term forecasts predicting United States would soon be independent of crude oil imports. The addition of this production resulted in the global supply curve shift to the left, under constant demand patterns, resulting in lower prices. The price of crude oil declined dramatically in the second half of 2014, and by the year-end 2016, in excess of 90 private and public independent producer firms filed for bankruptcy protection or restructuring[2], represented over 70 billion in secured and unsecured debt.[3]

Oil producers are exposed to two types of risk which contribute to cash flow and earnings volatility, market price risk and exploration risk. Market price risk can be hedged with the assumption that market access and cost of hedging is not prohibitive. Oil producers will implement hedging policies to limit downside market risk exposure, using derivative instruments such as forwards, futures, options, and collars. These producer price hedging strategies are based on expected annual production in future years. In the run up to 2014, while some firms had prudent hedging strategies in place, many other firms were exposed to riskier hedging strategies such as 3-way collars which do not provide floor price protection under large negative oil price innovations. Early termination of hedging also occurred, driven by a firm's desire to lock in profit margins from hedge transactions, to support operating profits. After the 2014 negative price innovations, lenders required oil producers in financial distress to terminate in-the-money hedges and to direct cash flow for mandatory debt repayments. This action exposed producer cash flows to further market price decreases.

Oil producers achieved improved efficiency from drilling optimization complemented with horizontal well operational experience. This has reduced the time from well identification to crude oil extraction from the ground. Improved communication processes mean that experienced workers, laid off during the oil price collapse, can readily return to active employment, minimizing hiring and additional training costs. Producers took advantage of the market price collapse to renegotiate lower prices and more flexible contract terms with service providers. Rigid take-or-pay service provider contracts were one of the contributors to producer financial difficulties. Technological advances throughout the supply chain have improved decision processes, communication, and engineering practices. Since information and data flows from all projects can be analyzed remotely, decision making can occur from a central office.

Artificial intelligence applications in horizontal well drilling are undergoing rapid growth. Sceptics who still prefer the "old way" of basic geological data surveys and gut feel are now considering the merits of large scale applications of data analysis and machine learning models outputs. Large volumes of data from an unconventional well can now be gathered, stored and utilized to increase the speed of analysis on future drilling opportunities.[4] There is a transition away from the current industry standard of using soft data sources such as fracture length, width, height and conductivity to access probability and size of a potential well to a model that utilizes hard data sources. These sources include field measurements obtained during the fracking process such as

fluid and proppant type, injection pressure, injection rate and volume. The advantages of this new generation of modeling benefits in finding new viable wells, thereby reducing exploration operations risk. These models also provide guidance on optimisation of actual hydraulic fracturing processes for specific wells.

The majority of small to mid-cap independent producers use Resource Based Lending (RBL) structures, to finance exploration and production operations, as opposed to bonds and term debt products. Commercial banks have accepted upstream producer risk exposure via issuing asset backed RBL facilities, which are sized by calculating the net present value of producing assets and applying a discounting mechanism, to represent asset and firm risk. RBL lenders have unilateral authority to modify the producing asset valuation and associated redetermination of borrowing lines of credit. This feature means that RBL's are a weak form of liquidity, compared to traditional fixed term lending and can increase company default risk. Lenders place maximum and minimum production hedging ratios on borrowers to ensure cash flow availability to service RBL debt instruments.

After numerous bankruptcies during 2015-2016, Shared National Credit (SNC) Program[5], a federal group that monitors credit risk and risk management practices, reviewed the RBL structures and associated risk reporting, on lender balance sheets. In 2017, SNC announced new provisions on loan underwriting, risk evaluation and covenant maintenance. Lenders must now analyse loan risk on the timely repayment of all outstanding secured debt rather than an individual loan agreement. Attempts by independent producers to add further capital via debt can be highly scrutinized. There must be strict adherence to loan covenant terms in lending agreements for firm's capital profile, debt/total capital, and performance ratio debt/EBITDA.[6] The resulting impact to borrowers is higher interest rate costs assigned to RBL structures and more rigorous monitoring of financial covenants. Lenders have also discussed implementing policies for excessive cash balances on producer balance sheets, in such a manner that liquidity above a specified threshold must be allocated to reducing the loan principle, putting a constraint on a management's ability to plan for future capital investments.

Cash flow is the important variant for firm's debt holders, for both bond holders and loan providers. Prudent cash flow and capital structure decisions are important as market prices are unlikely to climb back to pre-2014 levels. Russian and OPEC curtailments have established a market observed floor around 50 USD/Bbl. As oil prices increase, Russian and OPEC constituents will take advantage of higher market prices by increasing production output. This means that independent shale producers need to operate on a positive cash flow basis within an oil price range of 50-60 USD/Bbl. Recently, at these levels of market prices, shale producers are actively hedging, which demonstrate profit margins are positive.

The effect of recent changes to U.S. tax reform remain unknown. Corporate tax reductions from 35% to 21% of net income could stimulate acquisition activity in the E&P sector. The large global oil corporations may decide to increase their presence in the United States shale oil sector to complement existing portfolios of longer term drilling and production resources. In the equity market run up during the Trump Presidency, small to mid-cap producers have lagged the S&P 500 equity index performance. Investor return on equity demands are becoming relevant as this horizontal drilling and production sector matures. Regardless of what the future holds, independent shale oil producers should be mindful of the reticence of investors to weather another wave of bankruptcies. The oil market price collapse in 2014 resulted in many solvency issues and has some analysts and investors questioning the business model. Independent shale producers collectively need to demonstrate positive a cash flow performance for this industry to preserve and grow capital investment.

Footnotes

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NAEE/IAEE 2018 Conference Review

The new era in the global energy landscape has implications on emerging energy economies because of changes in technology, economics and public policy. These changes have turned major energy importers to exporters; unconventional energy sources becoming conventional and made renewable energy components of the global energy supply mix, significant. These changes portend great consequences, and perhaps, opportunities for emerging economies, like Nigeria, transiting to optimal energy and economic growth for sustainable economic development goals. It is, however, still worrisome that Nigeria is yet to achieve a quantum energy leap to achieve sustainable economic development despite several decades of significant quantum of petroleum revenue that comes with huge hydrocarbon production.

Against this backdrop, the 11th NAEE/IAEE International Conference, held in Abuja on April 22-24, 2018, provided a platform for energy professionals and stakeholders in the private sector, academia and government agencies/institutions to crossbreed ideas and information on the "Dawn of a New Era in the Global Energy Landscape: Implications for an Emerging Economy". 250 participants attended the opening ceremony at the Petroleum Technology Development Fund (PTDF) Conference Center. Engr. Funsho Kupolokun, former GMD of Nigerian National Petroleum Corporation chaired the conference and the Executive Secretary of PTDF, Dr. Bello Aliyu Gusau was the Chief Host. The IAEE President, David Knapp

Wumi Iledare, NAEE President, Delivers the Welcome Address

and Dave Williams, IAEE Executive Director attended the conference as Special Guests of Honor. Over 60 technical papers were presented on several sub themes of the conference theme. Three plenary sessions offered opportunities for energy experts to discuss issues relating to the conference theme, and to offer strategies for achieving Nigeria's economic growth and development, in the face of changing global energy landscape.

Prominent amongst the issues raised at the various plenary sessions were concerns about the four petroleum industry reform bills; failures of the power sector as well as the potentials for utilizing Nigeria's various energy resources in a sustainable manner. The oil and gas industry was recognized still, as potentially the major driver of Nigeria's

David Knapp Delivers the Opening Remarks at NAEE 2018

quest for achieving increased economic growth in the new energy era.

Regarding the Oil Sector

Nigeria economy exhibits some resource course syndrome, such as a stagnant industrialization, very low contribution of the sector to national economy in terms of GDP (currently 10% of GDP). In spite of its low contribution to GDP, the nation has relied heavily on revenue from petroleum for budget allocations, constituting 90% of foreign exchange earnings; 80% of government revenue; and 60% of government tax receipts. This situation culminates in an unbalanced economy.

It was widely acknowledged by stakeholders at the NAEE conference that this situation resulted from a poor institutional and energy sector governance framework, inadequate technical skills to manage the sector, and lack of transparency and accountability in the sector. These issues, in addition to uncertainty in the fiscal framework for the industry, have jeopardized investors' confidence in the sector.

Against this background, the new

Petroleum Industry Governance Bill (PIGB) is viewed, despite perhaps its imperfections, to provide a shift in paradigm from oil revenue dependence to reliance on hydrocarbon as an input for powering Nigeria's economy. Some of the underpinnings of the new bill, which is awaiting the assent of the president to become an Act include:

- A transition to value creation rather than dependence on oil and gas sales for revenue collection.
- Building governance and institutional structures for efficient management of the sector with clearly define roles.
- Single point authority for revenue collection/management and avoidance of economic populism.
- Enhancement of the role of the market system in creating economic efficiency in the sector.
- Revenue and resource diversification for sustainable economic development.
- Removal of discretionary award of natural resource assets, which for years have constituted barrier to entry in the domestic oil and gas sector.

Regarding the Natural Gas Sector

Globally, natural gas production and consumption have been rising, especially for power generation. This improvement is in accordance with its relatively cleaner and low carbon emission characteristics. Hence, it's increasing deployment as a transition fuel.

Nigeria's demand for natural gas for domestic and export purposes is also rising. Unfortunately, the lack of requisite fiscal policies and infrastructure to maximally exploit its huge natural gas resources remain a great hindrance.

Some of the highlighted challenges limiting gas sector development for economic expansion include:

- Lack of or inadequate fiscal and regulatory framework for the gas sector, thus hindering access to finance for natural gas projects.
- Lack of requisite infrastructure for gathering and processing, as well as transportation of gas.
- The issue of incessant pipeline vandalism and barrier to entry in gas midstream and downstream.
- Lack of legal framework for natural gas contracts and poor pricing of the resource. These are disincentives to investors in natural gas infrastructure development.

In spite of these challenges, with governments' renewed interest and focus at developing the gas sector through designing separate fiscal policy for natural gas development and the 7-Big wins, the prospect for natural gas development is bright as reviewed at the NAEE/IAEE conference. The 2017 gas sector policy is integrated in its approach and aimed at incentivizing natural gas development and utilization. The policy resolves a number of pertinent gas development issues, as follows:

- Natural gas fiscal terms are disentangled from those of oil to encourage investment in the natural gas sector.
- Enhancement of natural gas utilization using available technologies, as opposed to continued flaring. This will serve as a temporary bridge to the future, especially against the backdrop of inadequate infrastructure.
- Encouraging new participation in the gas sector by creating opportunities for deployment of mini/micro gas capture and extraction technologies instead of venting natural gas.
- Addressing environmental inequality resulting from gas flaring in the Niger Delta, as well as saving the ecosystem within the region.

In addition, the policy provides stringent measures against gas flaring as well as a criterion that those bidding for petroleum projects in the country must have a comprehensive solution to the gas flare problem. These measures will dis-incentivize operators from natural gas value destruction and the consequent environmental damage.

Regarding the Power Sector

There is a consensus among stakeholders at the conference, the strong nexus between energy consumption and economic growth. In spite of the abundant energy resources in Nigeria, GDP is negatively impacted by inadequate electricity supply. For decades, Nigeria's power generation and distribution have barely grown beyond 4.5GW. This is abysmal, for a nation with about 36 Billion barrels of proved crude oil reserve, over 180TCF of natural gas reserves and a population of nearly 200 million people.

Although the government has made efforts to reform the sector, a larger population of the inhabitants still suffers from electricity insecurity. The main causes of failure to implement the electricity sector reforms hinge on the political economy and legal framework and not technology; which in part, arose from the benefits and costs to the

vendors of imported generators, and disco owners' desires to protect and defend their advantages; the degree of ineffectiveness and inefficiency of the regulatory agencies in dealing with the challenges resulting from unbundling the sector and the competition issues therefrom, as well as poor mix of technology.

Regarding Renewable Energy

Renewable energy adoption and utilization in electricity generation have received increasing attention worldwide. This results from increasing interest in environmental sustainability and carbon emissions reduction from energy consumption. Interestingly, Nigeria has huge renewable energy resources. However, they are underdeveloped and underemployed in the electricity sector, partly because of overdependence on petroleum, and inadequate policy and institutional frameworks for adoption and integration ofrenewables in the energy mix. However, with government's renewed interest in diversifying the energy supply mix, renewables are expected to become a major source of electricity generation, especially for off-grid utilization.

2018 NAEE Stakeholders' Recommendations

The conference x-rayed some of the challenges militating against the Nigerian energy sector, and the prospects for the country, especially in the face of changing global energy landscape. The following are recommendations to energize Nigeria's path in the new energy era:

- There is need to recognize that natural resources exist not as an entitlement for creating economic and environmental damages; hence, Nigeria must manage her petroleum assets transparently and equitably, for energizing the economy through value creation rather than a primary source of revenue.
- The need for strategic investment in refineries for increased production of petroleum products domestically, rather than continued importation, which is unsustainable, as it is prone to price volatility in the international commodities markets as well as geopolitical issues.
- Government must take steps to end subsidy in the petroleum sector as it has constituted a distortion in the market, as well as a disincentive for investment in the sector.
- Government could re-invest the money meant for subsidy payment into renewable energy and gas infrastructure development projects.
- Government should deploy the right of pre-emption to ensure processing of hydrocarbons in Nigeria, by amending Section 6 of the Petroleum Act.
- There is a need to minimize the footprint of bureaucracy which has been a major cause of the rising cost of oil and gas production in Nigeria.
- Going forward, government institutions must be governed by laws rather than by individuals.
- Government must allow markets and economic efficiency to drive our economic growth and development.
- The bane of Nigeria's poor performance has been lack of long- term strategic plans, thus, there is need for restoration of development plans (long-term economic planning), with macroeconomic indices designed to measure and assess performance; rather than the short-termism practiced today. Such long-term strategic plans and the various components of the Petroleum Industry Reform Bills must align with national economic aspirations, promote growth and development in the petroleum and energy sectors, create a conducive business environment, and less bureaucracy for greater ease of doing business.
- Right mix of monetary policies should underpin all efforts toward delivering the country in the new energy era.
- Our reforms must be hinged on market- based solutions. This will improve the business environment as well as investors' confidence.
- In the quest to advancing Nigeria's energy course, effort must be geared towards safeguarding health, safety and the environment.

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中国地质大学 China University of Geosciences

2018 6th IAEE Asian Conference

Wuhan, China

2-4 November, 2018

Energy Exploitation and Cooperation in Asia

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Chinese Academy of Sciences

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Energy Exploitation & Cooperation in Asia

That will be held at the Optics Valley Kingdom Plaza Hotel**, Wuhan, China**, **2-4 Nov. 2018**. The conference will be organized by School of Economics & Management, CUG(Wuhan), School of Humanities & Economic Management, CUGB, School of Economics & Management, BUAA, Institutes Of Science And Development, CAS and Hubei University of Economics.

Some suggested topics for discussion (but not limited):

- Energy pricing issues within Asian economies
- Forecasting Asian energy demands and supplies in total and by primary energy source and geography
- Forecasting needed energy infrastructure investments in Asia
- Opportunity and challenge in energy exploitation and cooperation
- National security and strategic implications of meeting Asian energy growth
- Energy efficiency improvements
- Possible changes in the structure of Asian energy markets
- The Impact of Advanced Energy Technologies
- Energy and Electricity markets reform
- Grid and Power industry
- Climate change policy and effective CO_2 removal
- Investment issues in liberalized markets
- Economics of Oil and Gas (Upstream, Midstream, Downstream)
- Electricity and Gas Trading
- Energy Poverty, Subsidies and Tax Policies
- Geopolitical Impacts on the Energy Sector in Asia

We have confirmed following professors to be **Keynote Speakers**

Nov.3rd, Saturday, Plenary Session I

Zhang Zhongxiang

Founding dean, Ma Yinchu School of Economics; Director, Tianjin University, Environmental and Industrial Economics; China Country Representative, the European Association of Environmental and Resource Economists.

Title: *Global and Asian Governance Mechanisms in The Energy Market*

Masakazu Toyoda

Chairman & CEO, The Institute of Energy Economics, Japan

Title: *Forthcoming*

Timo Kuosmanen

Professor, Aalto University School of Business; Docent, University of Eastern Finland, Department of Business.

Title: *(De)Regulation of Energy Sector: Yardstick Competition of Local Monopolies in Electricity Distribution*

Nov.3rd, Saturday, Dual Plenary Session

Gürkan Kumbaroğlu

Professor, Department of Industrial Engineering, Boğaziçi University

Title: *Diffusion Prospects for Electric Vehicles, Infrastructure Requirements and Sustainability*

Philip Andrews-Speed

National University of Singapore, Energy Studies Institute, Senior Principal Fellow

Title: *Meeting Multiple Energy Challenges A Institutional Perspective*

Larry Chow

Retired Professor, Department of Geography, Hong Kong Baptist University; Hong Kong Baptist University Foundation Honorary President

Title: *Projection of Word Oil Prices: A Combination of Technical Analysis and Fundamental Factors.*

Chen Bin

Professor of Beijing Normal University's School of Environment; Editor of the Journal of Ecology

Title: *Forthcoming*

Zhang Xiliang

Professor/Fellow, Director of Energy Systems Analysis Research Institute, Institute of Nuclear and New Energy Technology, Tsinghua University; Executive Director, Institute of Energy Environmental Economics, Tsinghua University

Title: *CO_2 Emission and Climate Change*

Nov.4th, Sunday, Dual Plenary Session

Zhu Lei

Adjunct Professor, School of Economics and Management，Beihang University

Title: *Energy Investment and Technology Evaluation*

Yan Jinyue

Energy engineering expert; "Applied Energy" Editor-in-Chief; Chairman of Swiss China Science and Technology Cooperation Promotion Association, Overseas Chinese Academy of Sciences.

Title: *Transition of Energy Systems*

Nov.4th, Sunday, Concluding Plenary Session II

Adonis Yatchew

Professor, Economics Department, University of Toronto; Editor-in-Chief, The Energy Journal

Title: *Forthcoming*

David C. Broadstock

Deputy Director, CESEF, Hong Kong Polytechnic University;
IAEE Council member and Representative of Asia-Oceania of IAEE

Title: *Supporting OBOR Investment Through Socially Responsible ('Green') Finance：Opportunities, Challenges and Policy Priorities*

Ronald D. Ripple

IAEE, Vice President
Mervin Bovaird Professor of Energy Business and Finance, University of Tulsa

Title: *The Belt and Road Discussion Related to Natural Gas Movements in The Region and into China.*

Learn more about the conference by visiting

http://iaee2018.csp.escience.cn

Welcome you in Wuhan!

WELCOME NEW MEMBERS

The following individuals joined IAEE from 3/1/2018 to 6/15/2018

Slyvia Aarakit
Makerere University Business School
UGANDA

Miriam Aczel
Imperial College London
USA

Brendah Akankunda
Makerere University Business School
UGANDA

Ariane Albers
IFPEN
FRANCE

Kassim Alinda
Makerere University Business School
UGANDA

Eric Allain
Cour des Comptes
FRANCE

Jose Ricardo Uchoa Cavalcanti Almeida
BRAZIL

Hedaya Alolayani
King Abdulaziz University
SAUDI ARABIA

Funda Altun
Ankara University
TURKEY

Bosco Amerit
Makerere University Business School
UGANDA

Carolyn Amon
USA

Nastaran Ansari
Amirkabir University of Technology
IRAN

Mohammad Ansarin
Rotterdam Sch of Mgt Erasmus Univ
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Yoko Arai
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Calendar

03-04 July 2018, EV Infrastructure Summit in London - July 2018 at America Square Conference Centre, 17 Crosswall, Greater London, EC3N 2LB, United Kingdom. Contact: Phone: 02078710122, Email: rmorrissey@solarmedia.co.uk, URL: http://go.evvnt.com/227033-2?pid=204

09-11 July 2018, Engineering, Procurement and Construction (EPC) Contracts for Energy Industry - Johannesburg at Singapore. Contact: URL: http://www.infocusinternational.com/epcenergy/index.html

17-20 July 2018, Energy Storage & Grid-Connected Electric Vehicles (EVs) - Johannesburg at Johannesburg, South Africa. Contact: Email:vincs@infocusinternational.com, URL: http://www.infocusinternational.com/energystorage/

03-06 September 2018, ECMOR XVI: 16th European Conference on the Mathematics of Oil Recovery 2018 at World Trade Center, Edif. Este, Moll de Barcelona, s/n, Barcelona 08039, Spain. Contact: Phone: +31 88 995 5055, Email: ecmor@eage.org, URL: http://go.evvnt.com/154381-0

03-05 September 2018, International Conference on Power Engineering at Edinburgh, UK. Contact: Phone: 203 7691755,Email:powerengineering@alliedconferences.org, URL: http://powerengineering.alliedacademies.com/

04-07 September 2018, Mastering Renewable & Alternative Energies - Johannesburg at Johannesburg, South Africa. Contact: URL:http://www.infocusinternational.com/renewable/index.html

06-07 September 2018, International Conference on Earth Science and Climate Change. at Zurich, Switzerland. Contact: Phone: 6531080483, Email: earthscience@meetingint.org, URL: https://www.meetingsint.com/conferences/earthscience

10-14 September 2018, POWER WEEK Africa at Johannesburg, South Africa. Contact: Email: vincs@power-week.com, URL: http://www.power-week.com/Africa/index.html

10-14 September 2018, Gas / LNG Contracts: Structures, Pricing & Negotiation at Port of Spain, Trinidad and Tobago. Contact: Phone: +65 6325 0274 , Email: abigail.harris@infocusinternational.com, URL: http://www.infocusinternational.com/gascontracts

11-13 September 2018, Argus Methanol Forum at The Westin Houston, 945 Gessner Road, Houston, 77024, USA. Contact: Phone: 713-766-5001, Email: kendall.webb@argusmedia.com, URL: https://go.evvnt.com/232177-0?pid=204

12-14 September 2018, Coal Association of Canada National Conference, Vancouver 2018 at Westin Bayshore Vancouver, 1601 Bayshore Drive, Vancouver, V6G 2V4, Canada. Contact: Phone: 17807579488, Email: info@coal.ca, URL: http://go.evvnt.com/214420-1?pid=204

13-15 September 2018, 10th Argus Americas Crude Summit at Hilton Americas, 1600 Lamar Street, Houston, 77010, United States. Contact: Phone: 7139680000, Email: umer.qureshi@argusmedia.com, URL: http://go.evvnt.com/136463-1

13-15 September 2018, WC Climate Change 2018:Impacts & Responses at Holiday Inn Rome Pisana,Via della Pisana, 374,00163 Roma RM, Italy. Contact: Phone: +1 408-352-1010, Email: climatechange@innovinc.org, URL: https://climatechange.innovincconferences.com/

17-20 September 2018, Power Purchase Agreement (PPA) - Johannesburg at Johannesburg, South Africa. Contact: Email:vincs@infocusinternational.com, URL: http://www.infocusinternational.com/ppa/index.htm

18-19 September 2018, BIEE 12th Research Conference at Blavatnik School of Government, Oxford OX2 6GG, UK . Contact: Email:conference@biee.org, URL: http://www.biee.org/conference-list/consumers-heart-energy-system/

09-10 October 2018, RECSO EnviroSpill - Conference and Exhibition 9-10 October 2018 at Emirates Palace, West Corniche Road, Abu Dhabi, United Arab Emirates. Contact: Phone: 02033289581, Email: james@bme-global.com, URL: http://go.evvnt.com/235429-0?pid=204

10-11 October 2018, China Energy Assembly at China World Summit Hotel, China World Tower 3 (China Ballroom), No.1 Jianguomenwai Avenue, Beijing, 100004, China. Contact: Phone: +442073847963, Email: simon.hoare@energycouncil.com, URL: http://go.evvnt.com/237524-0?pid=204

14-16 October 2018, Argus Fuel Oil Summit at W South Beach, 2201 Collins Avenue, Miami Beach, 33139, United States. Contact: Phone: 7137665001, Email: kendall.webb@argusmedia.com, URL: http://go.evvnt.com/236117-0?pid=204

14-19 October 2018, The Society of Exploration Geophysicists 88th Annual Meeting at Anaheim Convention Center, 800 W Katella Ave, Anaheim, CA 92802, United States. Contact: Phone: 1 (918) 497-5500, Email: meetings@seg.org, URL: http://go.evvnt.com/151569-0

15-17 October 2018, SPE Russian Petroleum Technology Conference at Holiday Inn Sokolniki, 24 Rusakovskaya St., Moscow, 107014, Russia. Contact: Phone: 79263294551, Email: mberezinskaya@spe.org, URL: http://go.evvnt.com/208723-0?pid=204

15-17 October 2018, Hydro 2018 - Progress Through Partnerships at Gdansk, Poland. Contact: Phone: 44-20-8773-7244, Email:hydro2018@hydropower-dams.com, URL: www.hydropower-dams.com

15-16 October 2018, World Congress on Climate Change at Rome, Italy. Contact: Phone:408-429-2646, Email:climatechange@pulsussummit.com, URL: https://climatechange.pulsusconference.com/

16-18 October 2018, Solar & Storage Live - 16-18 October 2018, NEC, Birmingham, UK at NEC, North Avenue, Marston Green, Birmingham B40 1PW, United Kingdom. Contact: Phone: +44(0)2078710122, Email: jandrews@solarmedia.co.uk, URL: https://go.evvnt.com/230942-0?pid=204

16-18 October 2018, International SAP Conference for Mining and Metals, Prague, 2018 at Clarion Congress Hotel Prague, 33 Freyova, Praha 9, 190 00, Czech Republic. Contact: Phone: 01212003810, Email: j.duffy@tacook.com, URL: http://go.evvnt.com/227005-0?pid=204

22-23 October 2018, 9th World Convention on Recycling and Waste Management at Osaka, japan. Contact: Phone: 7025088061, Fax: 7025088061, Email: wastemanagement@geologyseries.com, URL: https://wastemanagement.conferenceseries.com/

22-24 October 2018, Offshore Energy Exhibition And Conference 2018 at Amsterdam RAI, Europaplein 22, Amsterdam, 1078 GZ, Netherlands. Contact: Phone: +31 (0)10 209 2674, Email: pmu@navingo.com, URL: http://go.evvnt.com/213625-0?pid=204

22-26 October 2018, Gas / LNG Contracts: Structures, Pricing & Negotiation at Johannesburg, South Africa. Contact: Email:abigail.harris@infocusinternational.com, URL: http://www.infocusinternational.com/gascontracts

22-23 October 2018, 3rd International Conference and Expo on Petrochemistry & Natural Resources at PRAGUE, Czech Republic. Contact: Phone: 7799790001, Email: petrochemistry-2018@scientificfederation.com, URL: petrochemistry-2018@scientificfederation.com

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