



Energy Institute

Enhancing the Business of Energy

ENERGY SYMPOSIUM

*America's Future – The Role of Energy and
Policy in Achieving Visionary Objectives*

CONFERENCE REPORT
March 31, 2016



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Executive Summary

The fourth annual Energy Symposium sponsored by the University of Oklahoma Price College of Business Energy Institute was held on March 31, 2016. The program featured 11 speakers with nationally recognized expertise in energy, economics, geopolitics and government and examined important aspects of the theme of the symposium – the role of energy and policy in achieving visionary objectives for our country and its future.

The body of this report details many important thoughts on subjects related to the geopolitical and macro-economic factors that should be considered in driving effective energy policy, as well as specific focus on the best strategy for achieving the best results for all Americans over the longer term – for our economy, our national security and our environment. The energy policy and regulations required to successfully implement and achieve the goals of the strategy were also addressed at a high level.

All speakers acknowledged that the U.S. has perhaps never been better positioned to achieve these visionary objectives all Americans can embrace:

- Robust and sustainable economic growth with low volatility
- Confidence in our foreign relations and national security – founded on our energy security – which provides us an unprecedented position of strength
- Assurance of real, sustainable progress in all areas of environmental concern – driven by right-sized, cost effective energy resource mix and focused on technological innovation as the driver of continuous improvement
- Our ability to use the economic benefits of an effective energy strategy to address other national priorities – education, infrastructure, health, hunger, poverty and security

The key to achieving these objectives lies, in part, to taking maximum advantage of unprecedented breadth and depth of the energy resource options available to our country – much of which has been provided by the breakthrough technologies that led to the shale-sourced oil and gas renaissance in the onshore U.S. over the past 10 years. Thanks to these technologies and the free market-driven investment and innovation that followed, the U.S. now has a reliable, low cost, long life resource for oil and gas which, when combined with the long term “safety net” of massive high-grade coal resources, gives our country exceptional flexibility and confidence in its energy outlook and our ability to influence regional and global environmental improvement going forward.

Video of the event will be available soon at price.ou.edu/energysymposium

Conclusions on Energy Strategy and Policy

- 1. Pragmatic Energy Resource Mix** - The current “All-of-the-Above” Energy Policy our political leaders have adopted is generally the right approach. However, it should be applied without picking winners and losers and must be founded on level-playing-field economic standards. We should use the full array of our energy resources, within the constraints of cost competitiveness and technological effectiveness, to achieve secure long term, low cost, low volatility supplies for U.S. energy needs in electric power generation, industrial fuels, manufacturing and transportation. This includes all hydrocarbon resources as well as all viable renewable resources and nuclear. The exact mix of resources should be governed by pragmatic economic and technological factors alone, with an eye toward continuous improvement in our environment.
- 2. Exports** - We should adopt policies and enabling regulations to fully utilize our current excess capacity in oil, natural gas and high-grade coal resources for export to globally competitive markets, with the objective of providing competitive and reliable energy resource options to our allies and friends who may be partially or wholly dependent on energy supplies from unreliable or unfriendly nations. The recent opening for oil export capability, combined with the more advanced (but regulatory-challenged) potential to export natural gas via LNG processes is a step in that direction. Notable examples where such policies could have great impact on geopolitical challenges are China, Russia and the Middle East. Free market forces and decisions by non-government commercial entities determine where exports will go, but policy and regulations can shape and enable business decisions that are in harmony with geopolitical goals.
- 3. Technology and Innovation** - We should unleash the full potential of energy-related technology and innovation by the private sector and universities and by private-public partnerships to remove economic and technical barriers to the competitive viability of all the energy resources in our arsenal – in order to provide the optimum energy mix in the future, thus assuring the lowest cost, highest impact and highest reliability of our energy foundation going forward.
- 4. Bridge to the Future** - We should recognize the pragmatic limitations of renewable energy resources (especially in the global context) while acknowledging the foundational importance of hydrocarbon resources in our major areas of use – coal and natural gas for electric power generation and oil as the primary source for fuels in the transportation. Further, we should focus technology on expanding the role of renewable energy sources and nuclear in the future, while recognizing that the expanded use of natural gas in power generation and, to a more limited extent, in transportation is the key to continuous environmental improvement in the medium term and the bridge to a broadly effective energy future.
- 5. The Next Big Thing** - Finally, we should focus on the longer term for energy by identifying, developing and applying “breakthrough technologies” to assure we have a viable “next act” in our energy matrix when exhaustible hydrocarbon resources begin to decline.

THE SYMPOSIUM DISCUSSION & ANALYSIS

- **Difficult Present with Oversupply Sets Stage for U.S. Influence in Global Energy**
- **Annual energy seminar at University of Oklahoma showcases pragmatic policies**

At a time when the unconventional oil and gas bonanza in the U.S. seems to have brought about a painful and lingering period of oversupply and ruinously low prices for those in the oil and gas industry, speakers at the University of Oklahoma, Price College of Business Energy Institute annual Energy Seminar March 31 in Norman, Okla., brought sober and insightful perspective. In the keynote address, Adam Sieminski, head of the federal Energy Information Administration (EIA) told delegates from around the world quite firmly that “the end of fossil fuels is not on the horizon.” And David Gompert, former principal deputy director of U.S. National Intelligence, stressed that the ascendance of the U.S. as a top global energy supplier is a transformative development in world politics.

In particular Gompert noted that the current relationship between the U.S. and China “is a combination of competition and cooperation. Even those who advocate one or the other of those positions admit that there is a combination. It is also important to understand that the combination varies greatly from global to regional, with U.S. and Chinese interests largely convergent on global issues and divergent on regional ones.”

Gompert sat on the opening panel, addressing geopolitical and macro-economic issues. It was moderated by J. Mike Stice, Dean & Lester A. Day Family Chair, OU Mewbourne College of Earth & Energy.

At the global level, noted the high level of cooperation between the two countries in areas as varied as countering nuclear proliferation, combating terrorism, climate change and trade relations. “Regionally that is very different. The relationship is much more one of competition now that China is strong. They oppose our strength in the region. When they were weak, they welcomed a strong American presence as a foil to the USSR or Japan. Now they are saying, ‘we are successful and strong.’”

All the points of friction represent crises waiting to happen, Gompert cautioned. “America cannot afford a policy of just making nice. Just as China once looked to the U.S. to balance interests, now our allies and other countries in the region are looking to us to balance China.”

Turning to one particular dangerous point of competition, China’s aggressive positions regarding the South China Sea, Gompert said, “About 40% of world trade passes through the South China Sea. Those are international waters, and the U.S. will treat them as such.”

That said, he added that the political logic could be replaced by military logic in an unstable crisis. “The political logic is the desire to avoid conflict. But the military logic is the desire to avoid losing a conflict if there were to be one.”

There is a tremendous opportunity in an energy-supply relationship with China, Gompert stated. “Any opportunity to cooperate more and confront less is good for both countries. Adding an energy-

supply relationship could add a moderating influence, perhaps helping to avoid or defuse crisis.”

Divya Reddy, director, global energy and natural resources at the Eurasia Group, expanded on that theme: “Low prices ease the energy security anxiety in many regions and allows for more cooperation between countries. The [environmental] agreement last year between the U.S. and China set the trajectory for diversification in power generation. In the short term there may be snags, but in the long term the trajectory is strong.”

Spot Market in LNG

The U.S. as major participant in the global oil and gas markets also has positive effects on those from a business perspective, noted Ed Morse, managing director and global head of commodities research at Citigroup. Citing one example, he said, “the U.S. is the only seller of liquefied natural gas [LNG] that does not have a destination restriction. That means the cargo can be resold.”

As a result, Morse believes that the U.S. entry to the global LNG trade means that “within a year or two a spot market in deep-sea LNG will emerge with the Henry Hub as the pricing basis.”

While the terms of sale are liberating, what will make them influential is volume. “If Pennsylvania were an independent country,” Morse said, “it would be among the major gas producers in the world all by itself. Production is about 21 billion cubic feet a day, and seems set to rise to 36 Bcf/d. The rocks could sustain production of 40 Bcf/d for decades.”

Citigroup has calculated that U.S. exporters could land LNG in Europe and Asia at levels that under cut current prices in those regions, and still make a profit. Morse added that U.S. LNG has upended more than a few cleverly crafted supply arrangements.

“China thought they were smart fixing the border price for gas out of Uzbekistan and other countries at \$10/mcf. That turns out to have been a dreadful decision. Meanwhile, U.S. and Australian LNG have unhinged global gas-price expectations.”

Turning to oil, Morse noted that while the other two or three top global suppliers would like to see the prolonged low-price environment contain U.S. production, that genie cannot be put back into the bottle.

“Because the U.S. [and Canada] have highly developed financial services markets, that means oil and gas have essentially unlimited access to capital to develop. There is now a ‘frac-log’ of wells that have been drilled but are uncompleted. As prices recover there will be a rush to complete those wells and bring them into production. I credit Harold Hamm and Congress for the work they did to lift the crude export ban. Those shipments only started last year, and already they are landing and having an impact on those local markets.”

Morse acknowledged that process will take some time, especially given the severe cutbacks that have taken place in the oilfield services sector, but he estimates that however long it takes for prices to recover to the point where investment is viable, the U.S. could increase production by 400,000 to 1 million barrels a day of production within a year.

Putting those numbers in context, Joshua Landis, professor and director of the Center for Middle Eastern Studies at the University of Oklahoma, noted that the Organization of Petroleum Exporting Countries (Opec) used to supply 60% of the world's oil, and that is now down to just 30%. In terms of total production, not shipments, he stated that Russia produces 10.5 million barrels a day, Saudi Arabia 10, and the U.S. 9.5. The fact that the U.S. essentially doubled its production from 5 million barrels a day before the unconventional bonanza has vastly changed the global energy market.

50 is the New 100

“The reality is now that \$50 a barrel is the new \$100,” said Landis. “Producers here in Oklahoma can work at \$40 to \$50 a barrel. The break-even price (because of social costs) for Saudi Arabia is \$96 a barrel, but Saudi is unlikely to ever see \$100 a barrel again. The same budget-related break-even point for Oman is \$92; for Iran it is \$70; for the Emirates it is \$60-70.”

While not disagreeing that unconventional production from North America has changed the calculus for global oil and gas markets, Landis says that the new level of influence that the U.S. now has is not without limit. About 20% of China's oil comes from Iran, he noted, and that China will not be shy about securing alternative supply.

To a large degree, Landis asserted, control over, or at least access to oil has been the determining factor in world affairs for more than a century. “The battles of El Alamein and Stalingrad were all about preventing Hitler from getting access to Middle East oil.”

No discussion of global supply-demand balance and how producers react can omit how all the other countries are responding, stressed Bob Sheppard, former chief executive officer of Soma Oil & Gas. “Russia is now at its post-Soviet peak of production, but there is a lot the country can do in good oilfield practices to improve both its production and its efficiency. That is before any expensive or complex changes.”

In the longer term, there remain large questions about the future of Russian production. Sheppard said that hydrocarbon exports account for about half of all Russia's revenues, so the sector is clearly one of elemental importance to the country. However, the Russian economy as a whole is shrinking, and the strategic expansion plans for production, such as eastern Siberia or the Arctic, are fabulously expensive. There are also vast new supply commitments that have to be taken into account.

The new deals with China reflect a pivot east, says Sheppard, at least a reaction to Europe souring on Gazprom. “Europe has finally twigged to the fact that maybe Gazprom is not the most reliable supplier. But then we have been telling them that for years. What has been shown in Gazprom's dealings [changing rates, terms, and even cutting off supply] is proof that energy policy is inextricably connected to foreign policy.”

That is true, he added, even when it is not apparent. “The Russian intervention in Syria certainly seems to have been a success. They got in, were able to evaluate their military hardware, shore up an ally, and got out before it turned into a quagmire. But they also got some leverage on Saudi Arabia.”

Russia is hardly the only player with less-than-apparent interests. “Iran's return to the global market is inconvenient to the rest of the Middle East, but it is a dramatic problem for Russia,” said Morse at Citi.

“That is because Iran is primarily a supplier to Europe. In the past Iran has suspended agreements with the large refiners in Europe, but all sides on that clearly want to re-engage.”

That also affects Saudi Arabia. “The Saudis saw that they were losing share when China started offering pre-export financing, but only for chunky amounts of supply,” Morse said. “In a low-price environment, the petro-states have an underbelly that is particularly vulnerable. That is their domestic social situation.”

Lower, Longer

Since oil prices tumbled, the focus has been on oversupply, but Sieminski chose to focus on demand for the long-term view. “There are a billion people in the world without electricity. I have been to the slums of Mumbai. Those people deserve electric light and propane to cook. Those are basic human needs.” EIA data show that natural gas for power generation and crude oil for transportation and heating fuel are the most efficient and economical ways of meeting those needs in most regions.

While that outlook was heartening, the immediate focus for most energy executives is the current price of oil, and what the near-term prospects are for recovery in the hard-hit industry.

“We just revised our outlook for crude oil,” said Sieminski, “and we expect West Texas Intermediate crude to remain low, as compared to recent levels. The projected price for next year is \$40 a barrel, which is down from \$50 a barrel in our previous outlook. Also, the confidence band on that projection is very broad,” reflecting a high degree of uncertainty.

In seeking a glimmer of hope for the near term, Sieminski noted that inventory accumulation has decreased. “EIA believes that supply is still greater than demand, and that inventories are still building, but that the rate of that building has slowed.”

The turning point could be next year, at least in global markets. “It could take until the end of 2017 for the worldwide supply-demand balance in crude oil to come back to some balance,” said Sieminski.

That said, he also suggested some leading indicators. “If that happens, then about six months prior to the physical markets coming back to balance, the financial markets will start to react. That means that about this time next year we could start to see some indications.”

EIA data show that North American oil production has fallen by 500,000 barrels a day for the last 6 months, but also that OPEC production is growing. Sieminski is not looking for big new liftings from either Iran or Iraq. “They are starting to top out in terms of current production. Iran will get a bit of a bounce from the lifting of the sanctions, but they will have trouble attracting capital,” to increase production further.

The other country to watch is Venezuela, he advised. “If you are looking for a geo-political challenge, then it could be Venezuela. Their production is 3 million barrels a day, of which 800,000 barrels a day comes to the U.S., mostly heavy sour crude to the big Gulf Coast refineries.”

Sieminski noted that there is a good deal of potential production held back in the U.S., wells

drilled but not fractured, but cautioned that bringing those barrels to market would not a matter of flipping a switch. Indeed he stressed capital destruction in the U.S. oil patch. “There will be \$200 billion in assets written down this year, and over the long term, debt to equity ratios are rising while return on equity is falling.”

Sieminski said that EIA projections show that renewable sources of energy can be expected to account for an increasing share of the growth in energy consumption over the next several decades. Far from being a sour note, he added that underpins the assertion that fossil fuels are anticipated to remain a major portion of the global energy equation for the foreseeable future.

“We think that gasoline-only vehicles will retain their current share of the transportation fuels mix. The growth in new vehicles will skew to those powered by natural gas or electricity. Natural gas will grow most strongly among all fossil fuels, and by 2030, natural gas consumption could be greater than that of coal worldwide.” Of total world energy consumption, about a third is liquids, mostly oil, which is primarily used for transportation fuel.

Consumption Rising, and Changing

In the U.S. the fuels demand was about 90 million barrels a day when measured in 2014, and is projected to grow to as much as 120 million barrels a day by 2040. “Half of our oil and gas comes from hydraulic fracturing,” noted Sieminski. “There is also considerable production of natural gas liquids (NGLs). “Actual crude oil production in the U.S. is about 80 million barrels a day, but total liquids production, including NGLs is close to 96 million barrels a day.”

He also offered some data on power consumption. According to the EIA, U.S. generating capacity will grow from 4 trillion kilowatt hours in 2014 to 5 TkwH by 2040. In that same timeframe the fuel mix in that generating capacity will shift as well. Gas-fired power will rise by half from 26% of total generating capacity to 40%. Renewables will double from 13% to 26%. Nuclear will remain flat in kilowatt hours but will decline in relative percentage. And coal will decline from 40% to 20%.

The persistent low global prices for oil as a result of oversupply have thrown the various producing regions in to sharp contrast in terms of cost of production. Sieminski noted that is true around the world, around the U.S. and also in Canada. “In Canada there is traditional conventional production, there are the oil sands, and there is unconventional development. They all have different break-even points.”

Echoing price points mentioned earlier in the symposium, Sieminski said he agreed that \$40 a barrel is too low. “That just won’t work for too many producers. But \$50? \$60?”

He left the question open, going on to explain that cost of production is more highly variable in the U.S. than anywhere else due to local costs of operation, technology, and the investors backing each producer, field, even well.

Technology has been overlooked as a key factor in the price of production and in total volumes lifted, Sieminski noted. “That was one of the things that were terribly wrong with the whole ‘peak oil’ idea. It discounted technology, and then continuing innovation within technology.”

It is well known that unconventional resource plays overturned the whole concept of peak oil, but even within hydraulic fracturing there was continuous and rapid innovation and development, Sieminski said. “Fracturing used to be done the entire length of the well bore. Now it is cut into segments. Multi-stage fracking is much better; you get more oil and gas for the same effort.”

Roughly speaking, 80% of the hydrocarbon comes from 20% of the fractures, Sieminski noted, another example of the ubiquitous 80:20 rule. “If some smart person could find a way to identify in advance what those highly productive fractures are going be, then we would see another quantum leap in production,” said Sieminski.

Sieminski stressed that barrels are volumetric units of measure, which leads to the curious phenomenon of refinery gain. “If you put a barrel of crude into a refinery you might expect to get a barrel of refined products out the other end, but actually you get more than a barrel,” he explained. “It’s like a bag of microwave popcorn. What comes out weighs the same, but takes up more room. Refining crude actually pops the hydrocarbon molecules into forms that have greater volume. So a barrel of gasoline weighs less than a barrel of crude. If we were in Europe and used metric tons, then there would be no difference.”

Policy Lags, But So Does Debt

Not surprisingly, the panel on energy strategy and policy issues underscored the importance of both policy and politics to catch up to the new reality in energy supply and economics. Bruce Stover, moderator, and president of BHS Enterprises, and member of the board for the OU Energy Institute, said, “our country has never been in as good a position as it is today in both breadth and depth of energy resource options to effect positive change in the world in terms of economics, foreign policy, national security, and the environment.”

Geopolitically “U.S. suppliers to Japan, Korea, and China will have influence that we do not currently have,” stated Mark Snell, president of Sempra Energy. “But with LNG we really all need to take a deep breath and wait to see what happens. These shipments have only just started. By the end of 2019 there should be about 8-9 Bcf/d of exports. That is a lot of gas. That could increase to as much as 12-15 Bcf/d by 2024.”

As those volumes are moving off shore, “gas will become the predominant producer of power in the U.S. shortly,” said Snell. “We do not have to put ourselves at a disadvantage to achieve a healthy energy mix. For example, we figure each new electric car is equal in demand to half a house. But if all those cars are being changed between midnight and 5:00 a.m. when demand is lowest, there may not be need for new infrastructure to support that demand.”

Scott Sheffield, chairman and chief executive officer of Pioneer Natural Resources stressed that there remain some variables upstream. “At \$50 oil the industry cannot grow. As one of the healthiest companies in the industry, we have \$2 billion in cash and \$2 billion in debt, so essentially we have zero debt. We are also the only large company still hedging oil. The industry needs \$60 oil to grow domestic production.”

Even when that level is reached, Sheffield added, there is some serious reckoning to be done

regarding debt. “Our industry carried roughly \$200 billion in debt two years ago, and that grew to \$550 billion before the downturn. That is just way too much debt. Even when prices come back, the industry will have to pay off a lot of debt before we can all start growing again.”

Growth in the industry is mostly predicated on growth in demand for the resource, which is now bound up in environmental policy. Mark Mills, president of Digital Power Group, indicated that it is not useful to debate human effects any more. “It is obvious that humans are having an effect on the planet. There are lots of humans using lots of hydrocarbons. The debate is not whether or not there is an effect, but the degree of that effect,” and then what to do about it.

Mills noted that in 1973 30% of all the oil used in the U.S. was consumed in transportation fuel, the rest was for heating, power, and feedstocks. Today the ratio is the opposite: 70% of the oil consumed in the U.S. goes for transportation fuel, with just 30% going to other uses.

Hal Quinn, president and chief executive officer of the National Mining Association, noted that coal represents about 25% of the total generating capacity in the U.S., but that it actually delivers roughly 38-40% of the power. That level was once close to 50%. “So what we see is a source of power that can change scale affordably, reliably, and easily. There is an incredible infrastructure bulge around coal production and delivery.”

While there is little dispute over coal’s capability to generate power, Quinn also addressed the environmental concerns. “This has been one of the biggest critiques of coal,” he acknowledged. “Since coal has been thrust to the forefront as the workhorse of our electricity, coal use increased 90% since the 1970’s. But at the same time, because of technology and investment, emissions dropped 92%.”

At a policy level Quinn stressed that “this is not just a coal issue, it is a hydrocarbon issue. We have policies in the U.S. that address carbon concerns in a very expensive and symbolic way. It is all about substitution, renewables for fossils, and within fossils, gas for coal.

“But if you do the math it doesn’t make any difference,” Quinn continued. “It won’t materially change the carbon emissions. At scale all the substitutions have limits of deliverability or price. If you are really interested in the climate issue, you have to go back to technological development. Not just basic R&D but applied engineering. These technologies are around. They just have to go from demonstration to commercial scale.”

There was a consensus on the panel that gas and oil now play very different roles in the global energy mix, and that the growing U.S. presence as an exporter of both commodities is beneficial both domestically and internationally.

“We are going to be pushing a lot of [high-priced] gas out of the global LNG market,” said Rusty Braziel, president of RBN Energy, “just as we did with crude. That is a good thing for buyers. Also, Canada does not take much of our gas, but we are taking less of theirs, which enables them to export elsewhere.”

Beyond the lack of destination restrictions for LNG from the U.S., Snell added another advantage for buyers. “We are the only gas exporter that also has significant domestic demand. That is a huge advantage for buyers. When you are buying from a U.S. supplier, you are only committing to the cost of liquefaction, about \$3 an mcf. After that, if you don’t need the gas, you can release it to the local market. That means great flexibility and security.”

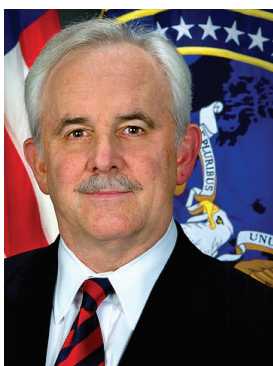


SYMPOSIUM SPEAKERS



RUSTY BRAZIEL is the president and CEO of RBN Energy, a leading energy market analysis and advisory firm in the field of energy markets and information. Previously, he spent 20 years with Chevron (Texaco), serving as vice president of natural gas marketing and trading and manager of NGL supply. Braziel also served as vice president of business development for The Williams Companies, president of Altra Energy Technologies and co-owner of Bentek Energy (now Platts/McGraw-Hill). He is also the author of *The Domino Effect*, a bestseller book about understanding energy markets.

Braziel is a member of the board of directors of Wyoming Refining Company and the North American Energy Standards board. He holds BBA and MBA degrees in business and finance from Stephen F. Austin University.



DAVID GOMPERT is a distinguished visiting professor at the U.S. Naval Academy and senior fellow at the RAND Corporation. He previously served as principal deputy director and acting director of National Intelligence. Prior to that, Gompert was a senior fellow at the RAND Corporation, and was the senior advisor for National Security and Defense, Coalition Provisional Authority in Iraq. He was president of RAND Europe after serving as president of RAND and director of the National Defense Research Institute. Gompert served as special assistant to President George H. W. Bush and senior director for Europe and Eurasia on the National Security Council staff. He has held a number of positions at the State Department over numerous administrations, and served in the private

sector from 1983-1990.

Gompert has published extensively on international affairs, national security and information technology. He is a director of Bristow Group, Inc., and STG Group, Inc., and is an advisory board member of the U.S. Naval Academy Center for Cyber Security Studies. He holds a bachelor's degree in engineering from the U. S. Naval Academy and a master of public affairs degree from the Woodrow Wilson School at Princeton University.



JOSHUA LANDIS is the director of the Center for Middle East Studies and associate professor at the University of Oklahoma's College of International Studies. He writes "Syria Comment," a daily newsletter on Syrian politics that attracts over 100,000 readers a month. Landis travels frequently to Washington D.C. to consult with government agencies and speak at think tanks. Most recently, he has spoken at the Woodrow Wilson Institute, Brookings Institute, USIP, Middle East Institute and Council on Foreign Relations.

Landis is a frequent analyst on TV and radio, recently appearing on PBS News Hour, the Charlie Rose Show, al-Jazeera, Frontline, NPR and BBC Radio. He received his bachelor's degree at Swarthmore College, master's degree at Harvard University and Ph.D. at Princeton University.



EDWARD MORSE has been managing director and global head of commodities research for Citi since 2011, where he built the commodities research strategy team after building similar groups both at Lehman Brothers and Credit Suisse. He has taught at Princeton, Columbia and Johns Hopkins Universities, and worked as a senior fellow at the Council on Foreign Relations. Morse also served as the Deputy Assistant Secretary of State for Energy Policy, and in management at Phillips Petroleum Co. He is a co-founder of PFC Energy, a former publisher of Petroleum Intelligence Weekly and president of Energy Intelligence Group, and also worked at Hess Energy Trading Company.

The author or co-author of numerous books and articles on energy, commodities and international affairs, Morse is chair of the New York Energy Forum and an advisory board member for the Center on Global Energy Policy at Columbia University.



MARK MILLS is a physicist, senior fellow at the Manhattan Institute, faculty fellow in the McCormick School of Engineering at Northwestern University and CEO of the Digital Power Group. He writes a tech column for Forbes and co-authored the 2005 book *The Bottomless Well*. Mills was earlier a partner in a boutique venture fund, and co-authored a tech investment newsletter. He served in the White House Science Office under President Reagan and, early in his career, was an experimental physicist and development engineer in the fields of microprocessors, fiber optics and missile guidance.



HAL QUINN has been president and CEO of the National Mining Association since 2008. He has represented mining's interests before the executive, legislative and judicial branches of government in a number of positions, including as NMA's executive vice president and general counsel. Quinn served in similar positions with the National Coal Association prior to the formation of the National Mining Association through the 1995 merger of the American Mining Congress and National Coal Association.

Quinn serves on the International Energy Agency's coal industry advisory board and on the board of directors of the United States Energy Association and the National Energy Foundation. He also serves as president of the American Coal Foundation and is a member of the Society for Mining, Metallurgy and Exploration. He received his undergraduate degree in economics from Denison University and his law degree from Wake Forest University.



DIVYA REDDY is the director of global energy and natural resources for Eurasia Group. She focuses on natural gas, coal and climate change, particularly the global impact of political and policy developments in various countries on commodities markets and investment environments. Reddy also leads Eurasia Group's coverage of Australian politics and its resources sector, and follows U.S. energy policy developments from Washington.

Prior to joining Eurasia Group in 2007, Reddy worked as a research associate at the Council on Foreign Relations focusing on energy, immigration and homeland security. She has previously worked as an investment banking analyst in the natural resources group at Bear Stearns & Co. She holds a B.A. in economics from Pomona College and an M.A. in international development from Georgetown University.



SCOTT SHEFFIELD is the chairman and CEO of Pioneer Natural Resources. He began his career with Pioneer as the fifth employee of Parker & Parsley Petroleum in Midland, Texas, and sole staff engineer. By 1991, he was chairman and CEO of Parker & Parsley, and under his leadership, Parker & Parsley merged with MESA Inc. to form Pioneer in 1997. Pioneer is considered a leader in developing oil-rich shale plays and ranks as the most active operator in the Permian Basin and one of the most active in the United States.

Sheffield serves on the boards of the National Petroleum Council, Santos Ltd., and the Maguire Energy Institute of the SMU Cox School of Business. He graduated from the University of Texas at Austin with a bachelor of science in petroleum engineering.



BOB SHEPPARD joined Soma Oil & Gas in August 2013. He is a non-executive director of the Blackrock Emerging Europe Trust and is a director of DTEK Holding BV, the largest private energy company in the Ukraine. Sheppard is also a senior adviser to BP on Russia and the FSU. He served on the board of TNK-BP until 2008 and was president of Sidanco prior to the merger that created TNK-BP. In his 40 plus years in the energy business, Sheppard has been the president of Amocos operations in Argentina and Egypt after serving as its vice president for the U.K. North Sea. He also served as managing director of Gulf of Suez Petroleum Company.

Sheppard earned his bachelor's degree in physics and mathematics from the University of Wyoming, and his executive M.B.A. degree from Columbia University.



ADAM SIEMINSKI was sworn in as the administrator of the U.S. Energy Information Administration in 2012. Before that, he served as senior director for energy and environment on the staff of the National Security Council, as well as senior energy analyst for Deutsche Bank. He has served in leadership positions for the International Association for Energy Economics and the affiliated U.S. Association for Energy Economics. Sieminski also has acted as a senior adviser to the Energy and National Security Program at the Center for Strategic and International Studies, and in 2006, Sieminski was appointed as a member of the National Petroleum Council.

He is a member of the Washington, D.C., investment professional society, and holds the Chartered Financial Analyst designation. He received both an undergraduate degree in civil engineering and a master's degree in public administration from Cornell University.



MARK SNELL is president of Sempra Energy after serving as the company's executive vice president and CFO. Previously, he was group president overseeing Sempra Energy's businesses outside of the company's two California utilities. Prior to that, he served as chief financial officer of this group. Before joining Sempra, Snell was executive vice president and CFO for Earth Tech, as well as executive vice president and CFO of Dames and Moore. He also served as chief finance and administrative officer for Latham & Watkins, executive vice president and CFO of World Oil Corp., and senior manager and certified public accountant at the L.A. office of KPMG.

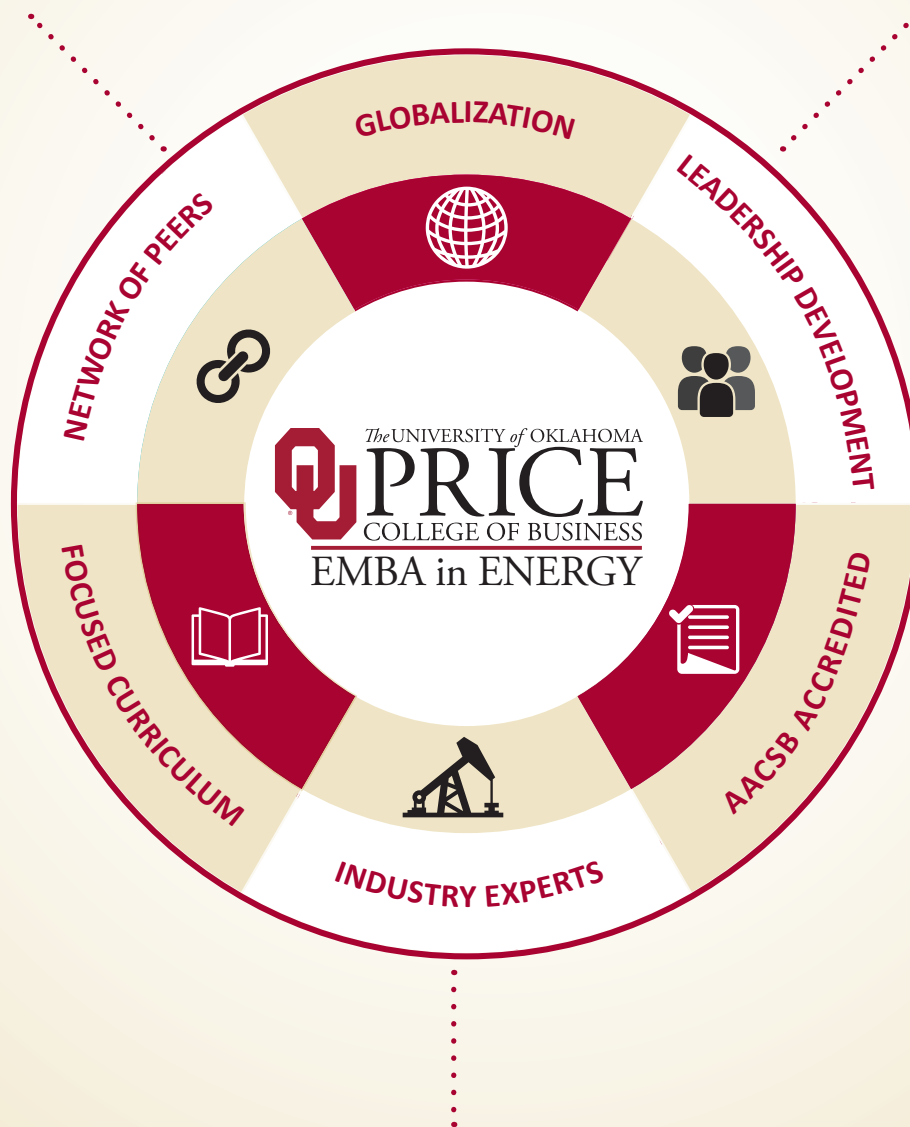
Snell is chairman of the board of directors of San Diego State University's College of Business Administration and a member of the board of trustees of Hubbs-SeaWorld Research Institute and Rady Children's Hospital and Health Center. He holds a bachelor's degree in accounting from San Diego State University.

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