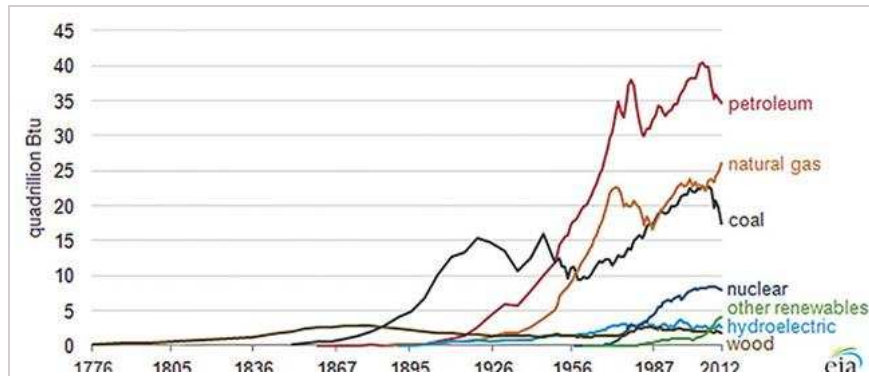


EXPLORER

Unconventionals: Fuel for the Sustainable Switch?

By Heather Saucier



The shale oil and gas boom in the United States has unleashed a slew of numbers. They are a myriad of estimates, hypotheses and calculated guesses from a range of experts – all trying to predict the degree and duration of the nation's newly found energy security.

Unconventional resources are pumping billions of dollars into the country's coffers, creating millions of jobs and favorably tipping the import/export scales for oil, gas and petrochemicals – significantly reducing the country's trade deficit.

With all the facts and figures being tossed about, perhaps the most important is time.

The current, free-flowing supply of hydrocarbons has brought a sigh of relief to many who have been scrambling to find alternatives to dwindling supplies of conventional fossil fuels.

But while some estimate the shale energy boom has handed the nation at least four decades of energy security, this is not a time to rest easy, said past AAPG president Scott Tinker, the director of the Bureau of Economic Geology and state geologist of Texas.

"Unconventional resources have extended the future of oil and gas in this country," he said. "Let's use that time wisely."

Buying Time

The evolution of technology has taken the oil and gas industry from vertical wells to complex horizontal wells, each designed and stimulated to yield the maximum recovery from reservoirs that have remained untapped for years.

Tinker, who co-produced the 2011 award-winning documentary "Switch," which thoughtfully assesses the steps and pieces needed for long-term energy security, said now is the time for our thinking to evolve. The time bought by the shale boom should be carefully used to plan an intelligent "switch" to more sustainable resources.

"Energy powers our lives and we have a remarkable number of options. The transition is going to take many, many decades," Tinker said.

Production of current foundational fuels – oil, gas and coal – through unconventional means is currently on the rise. However, those upward arrows on the graph will inevitably change direction as supplies are depleted.

Sustainable energy, on the other hand, which comprises just 2 percent of the world's power, is steadily rising, albeit at a much slower pace.

Globally speaking, for oil, gas and coal to comprise just half of the world's power supply by 2064, Tinker said:

- The production of natural gas will have to roughly double.

Image Gallery



Emphasis: Unconventional Resources



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- Nuclear reactors must increase three-fold.
- Renewable energy, including wind, solar, biomass and biofuels, will have to multiply by five.

How will we get there?

Getting from A to B

The world's use of oil, gas and coal can be linked to the fact that they are affordable, reliable and, although the clock has begun to tick, available, Tinker said.

But a transition to sustainable energy is no flip-of-a-switch. It took France approximately 30 years to get roughly 80 percent of its electricity from nuclear energy. Denmark took about 35 years to get 20 percent of its electricity from wind.

Energy providers also must be able to fund the hefty upfront costs for large acres of land needed for biofuel, wind and solar farms, and the infrastructure for nuclear reactors.

Politics, industry and researchers must converge to provide an intelligent and efficient transition, Tinker said.

"We need to bring them into what I call the 'radical middle,' where we can recognize we are not always right and make compromises," Tinker said. "Let's build new infrastructure, but build it well. Build pipelines, but build them well. Allowing drilling, but regulate it well. A lot can go on in an intelligent world."

Changes are starting to be seen. Today, oil comprises 34 percent of the world's energy compared to 50 percent 30 years ago. Coal is at 29 percent, while natural gas and nuclear energy are at 23 percent and 5 percent, respectively, and both are climbing, Tinker said.

As experts work out the puzzle for long-term energy security, the "revolution" created by unconventional resources must be seen as an "evolution," Tinker said.

And, he added, the technology that is allowing production of an estimated two-thirds of the nation's natural gas resources and approaching three million barrels of oil per day must continue to improve to sustain consumers during this time of transition.

The Mother of Invention

Prior to 2007, the U.S. Energy Information Administration (EIA) did not report any data on shale gas and tight oil. At the time, the industry was largely pursuing conventional resources – although in more challenging environments – as more accessible reservoirs had been tapped to the max.

The need for hydrocarbons became a catalyst for the development of technology that could take operators to the Arctic, desert and deep sea. The majority of drilling has moved offshore into depths of 8,000 feet and greater.

As computers capable of processing huge amounts of data in quick intervals of time became available in the mid-1990s, 3-D seismic became an invaluable tool for mapping reservoirs, said AAPG Honorary member R. Randy Ray, a consulting geologist/geophysicist of R3 Exploration in Denver. The number of geophones used in the mapping process jumped from 100 to 10,000, significantly sharpening the images of reservoirs and enabling more efficient drilling, he said.

Back on land, the late George Mitchell of Mitchell Energy was experimenting with horizontal drilling in the Barnett shale from the 1980s to the early 2000s, determined to recover the Fort Worth Basin's abundant supply of natural gas despite countless detractors. The right combination of horizontal drilling and multi-stage hydraulic fracturing unlocked hydrocarbons trapped in impossibly tight pores of shale.

"Once the Barnett shale started to work, the shale boom was on," Tinker said. "Many companies were born and built a whole portfolio around leasing and developing shale."

At the time, natural gas was the major play, as gas prices were on the rise. Then, the same combination of technology was applied in the Bakken formation in North Dakota and Montana – and it proved just as effective in recovering larger, tight oil molecules.

"The biggest step change in my whole career is horizontal drilling and multi-stage fracing," said AAPG Honorary member and past AAPG president Steve Sonnenberg, professor and Charles Boettcher Distinguished Chair in petroleum geology at the Colorado School of Mines. "If it were not for that combined technology, much of the Bakken would be uneconomical to produce."

In the 2000s, advanced downhole technology in geosteering enabled engineers to actually see into the wellbore as they steered the drill bit through the rocks. Drill bits and downhole motors also advanced. The trial and error process of drilling was giving way to accuracy and precision.

As time has progressed, the legs of horizontal wells have begun stretching over two miles in lateral

length. The recent record for the number of hydraulic fracture stages in one horizontal well is 92, Tinker said, noting its location in the Eagle Ford shale.

"Computing technology, communications technology and drilling technology continue to evolve and allow us to explore in ways that were never possible before," Tinker said. "We're working with the same rocks. We are just using new technologies to extract the resources.

"It used to be that if you cored a shale sample, you'd get fired," he said in tongue-in-cheek mode. "Now, if you don't core a shale you get fired."

Unconventional Nation

The direct and indirect effects of unconventional resources have created 1.7 million jobs in the United States, and a projected three million jobs will be created by 2020, according to IHS.

It also has added \$62 billion to the country's economy.

According to the EIA, the domestic production of oil, gas and coal satisfied 84 percent of the total U.S. energy demand in 2013.

EIA statistics also show that the shale energy boom has:

- Enabled the export of chemicals.
- Attracted investors from Europe, Asia and the Middle East.
- Reduced petrochemical imports.
- Reduced the nation's trade deficit.
- Enabled many to trade coal for natural gas for home electricity.
- Lowered carbon emissions.

Clearly ahead of all other countries in its development of unconventional resources, the United States has much to credit for its success.

Already in place, according to IHS, are a well-developed energy infrastructure, private-sector ownership of mineral rights, a competitive industry with many independent operators, access to risk capital, flexible and adaptive supply chains, and supportive state regulations and fiscal regimes.

"We have a tremendous volume of unconventional resources in this country, and they are greater than I think anyone ever thought," Sonnenberg said. "One of the most important things for people to realize is the technology out there to extract it is ever increasing, it is ever increasingly environmentally friendly, and I think the future is very bright."

Make It Brighter

While the United States is reaping the benefits from its energy boom, around the world are over one billion people without access to electricity, Tinker said.

"In the coming decades, the energy needs of India and China will surpass the United States and all of Europe," he said.

While experts gather around the table to solve the puzzle of the energy switch, Tinker revealed another energy alternative that, if employed by the world's 5.4 billion energy consumers, would make a solid impact on the need for resources: efficiency and conservation.

If more people turned off lights, insulated their homes, repaired leaks, installed radiant barriers and used energy-efficient appliances, a marked difference could be seen, he said. This personal cultural shift would translate to business, industry and government.

"We need to change the way we think about energy so we can change the way we use it," he said.

Among a host of energy-saving techniques adopted by Tinker and his Austin-based family is the recent purchase of a golf cart used to run errands near their home and take their kids to school.

"There's a tremendous role that each of us plays in efficiency," he said. "What you do and what I do are the most important part of our energy future."

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