NEW ENERGY SOURCES AND NEW GEOPOLITICS - Part I

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Introduction

At a global level, the British Royal Society and Royal Academy of Engineering estimate in their report, we can expect our consumption of energy at least to double in the next 50 years and to grow by a factor of up to five in the next 100 years as the world population increases and as people seek to improve their standards of living. Even with vigorous conservation, world energy production would have to triple by 2050 to support one-third of todays U.S. use per capita.

Given the levels of consumption likely in the future, the Royal organizations caution, it will be an immense challenge to meet the global demand for energy without unsustainable longterm damage to the environment. That damage includes air pollution, carbon pollution linked to global warming, surface pollution and degradation from siting requirements and disposal of waste. This fast increasing demand has forced the developed world to seek new reserves (the Arctic) and new sources (shale) .This is also changing the energy geopolitcs in the world.

Before delving into the content of this articles title, it is essential to know some statistical data on different energy sources as well as reserve distributions, production and consumption. I will evaluate the energy and geopolitical shifts that have arisen from the production of shale gas and light and tight oil in the US and oil and gas reserves in the Arctic. The unconventional energy trend has already impacted energy, geopolitics, and national security. Energy futures and new energy geopolitics will be affected, raising the question: what might the geopolitical and national security implications be?

Fossil Fuels Dominate Primary Energy Consumption

According to the International Energy Agency, 82 per cent of world energy consumption consists of fossil fuels-namely coal, oil, natural gas and the newcomers, shale gas and shale oil. This percentage was the same 20 years ago as it is today. Alternative energy sources more appropriately called renewable energy are still providing only about seven percent of the worlds energy needs (Source: Energy Information Agency). This means that fossil fuels, along with nuclear energy a controversial, non-renewable energy source — are supplying 93 percent of the worlds energy needs.

Highlights:

∀ Coal, natural gas, and oil accounted for 87 percent of global primary energy consumption in 2012.

∀ The International Energy Agency predicts that by 2017 coal will replace oil as the dominant primary energy source worldwide.

∀ Global natural gas production grew by 1.9 percent in 2012, dominated by the US (with 20.4 percent of the total) and Russia (17.6 percent). Other countries accounted for less than 5 percent each of global output.

∀ Oil remains the most widely consumed fuel worldwide, but at a growth rate of 0.9 percent it is being outpaced by gas and coal for the third consecutive year.

Coal, natural gas, and oil accounted for 88 percent of global primary energy consumption in 2013.

Shale Revolution- Shale Gas / Shale Oil

The shale revolution in the US is reshaping global oil and gas markets. The US produced oil at record levels in 2012 and is expected to overtake Russia as the worlds largest producer of oil and natural gas combined in 2013. Consequently, the US is importing decreasing amounts of these two fossil fuels, while using rising levels of domestic natural gas for power generation. This has led to price discrepancies between the US and European natural gas markets that in turn have prompted Europeans to increase their use of coal power. Coal consumption, however, was dominated by China, which in 2012 for the first time accounted for more than half of the worlds coal use.

Estimated shale oil and shale gas resources in the US and in 137 shale formations in 41 other countries represent 10 per cent of the world's crude oil and 32 per cent of the world's natural gas technically recoverable resources, or those that can be produced using current technology without reference to economic profitability, according to a new EIA-sponsored study in 2013

More than half of the identified shale oil resources outside the US are concentrated in four countries □□□□□□□ China, Argentina, and Libya □□□□□ more than half of the non-U.S. shale gas resources are concentrated in five countries □□□□□□ Argentina, Algeria, Canada, and Mexico. The US is ranked second after Russia for shale oil resources and fourth after Algeria for shale gas resources when compared with the 41 countries assessed.

Technically Recoverable Shale Oil and Shale Gas Resources estimates that shale resources considered in conjunction with EIA's own assessment of resources within the US indicate there are technically recoverable resources of 345 billion barrels of world shale oil resources and 7,299 trillion cubic feet of world shale gas resources . While the current report considers more shale formations than were assessed in the prior version of this assessment, it still does not assess many prospective shale formations, such as those underlying the large oil fields located in the Middle East and the Caspian region. Currently, only the US and Canada are producing shale oil and shale gas in commercial quantities.

Unlike an earlier EIA-sponsored study that focused exclusively on natural gas, the new world shale assessment includes shale oil, which has recently been produced in significant volumes in the US . In addition, more and better geologic information has become available for shale formations located outside the US, in part because the earlier report stimulated new work on shale resources in many countries (e.g., Algeria, Argentina, and Mexico).

Uncertainty

These shale oil and shale gas resource estimates are highly uncertain and will remain so until they are extensively tested with production wells. This report's methodology for estimating shale resources outside the US is based on the geology and resource recovery rates of similar shale formations in the US (referred to as analogs) that have produced shale oil and shale gas from thousands of producing wells.

Because they have proven to be quickly producible in large volumes at a relatively low cost, shale / tight oil and shale gas resources have revolutionized US oil and natural gas production, providing 29 percent of total US crude oil production and 40 per cent of total US natural gas production in 2012. However, given the variation across the world's shale formations in both geology and above-the-ground conditions, the extent to which global technically recoverable shale resources will prove to be economically recoverable is not yet clear. The market impact of shale resources outside the US will depend on their own production costs and volumes.

For example, a potential shale well that costs twice as much and produces half the output of a typical US well would be unlikely to back out current supply sources of oil or natural gas. In many cases, even significantly smaller differences in costs, well productivity, or both can make the difference between a resource that is a market game changer and one that is economically irrelevant at current market prices.

Several nations have begun to evaluate and test the production potential of shale formations located in their countries. Poland, for example, has leased prospective shale acreage and drilled 43 test wells as of April 2013. Argentina, Australia, China, England, Mexico, Russia, Saudi Arabia, and Turkey have begun exploration or expressed interest in their shale formations.

China and Coal

China, not surprisingly, accounted for the lions share 71 per cent of the global increase in energy consumption in 2013 . Coal production in that country now accounts for almost half (49.5 percent) of coal production worldwide, according to BP.

Although it occupies the number-two spot behind China, the US has the worlds largest proven reserves of coal: 237,295 mmt, which is more than double that of China, and amounts to 27.6 per cent of global reserves. Another interesting note: Germany last year was the only country in Western Europe where oil generation from coal rose: 2.1 percent, or enough to produce 44.6 mmt of coal-based oil.

Natural Gas

In the last 20 years, absolute natural gas reserves have increased enormously. The Middle East, Europe and Eurasia have access to the largest shares of global natural gas reserves, but as with oil, the decrease in the development of new gas fields stands in discrepancy to the increased energy demand.

The proved natural gas reserves worldwide have risen from 96.4 trillion cubic metres (tcm) in 1984, to 142.9 tcm in 1994 and 179.5 tcm in 2004.

In 2004 by far the greatest proportion of the world's natural gas reserves were owned by the Middle East (40.6%), and Europe and Eurasia (37.5%). While the Asian-Pacific region and Africa had close to 8% of the reserves, North America, Middle and South America each had only about 4%.

As with oil, the increase of the total gas reserves in the past can not disguise the fact that the decline in the development of new gas fields stands opposed to increasing energy demands. The point at which the amount of gas recovered is greater than the increase in reserves is therefore also drawing closer as far as natural gas is concerned. In the long term natural gas cannot compensate for the finiteness of oil.

According to estimates made by the BP energy company, the gap between the development of the reserve supply of natural gas and increased consumption is no longer particularly large: it increased by a mere 0.83 tcm from 2004-2005, whereas yearly consumption in 2004 amounted to around 2.75 tcm.

According to BP's calculations of natural gas reserves as related to annual production, it will only take 65.1 years to use up the natural gas reserves completely if conditions remain otherwise constant. In 1981 it was almost 60 years, and by 2001 the development

of gas fields had caused this to increase to 70 years.

If each region were only able to utilise its own reserves, all of North America would have less than 10 years time until it would have to make do without gas; Europe and Eurasia would lie a little below the world average. Only the gas-rich Middle East could continue to use the same amount of natural gas for almost 250 years from their reserves.

As with oil, critical voices point out that the numbers from the energy companies, from which it is already clear that the natural gas reserves are limited, can be seen as too optimistic. This is primarily due to the fact that amount of the reserves has a positive effect on the balance sheet, and therefore on the stock market value of the company - when in doubt, the temptation to assume larger reserves is strong.

It is also assumed that the countries producing natural gas have an interest in large reserves in order to slow down the development of alternative energies. As is the case with oil, there's a lack of objective data relating to natural gas, as the available information is coloured by economic and environmental interests.

Nuclear Energy

Renewable energy and nuclear power are the world's fastest-growing energy sources, each increasing by 2.5 per cent per year. However, fossil fuels continue to supply almost 80 per cent of world energy use through 2040.

As of May 2014, 30 countries worldwide are operating 435 nuclear reactors for electricity generation and 72 new nuclear plants are under construction in 15 countries.

Nuclear power plants provided 12.3 percent of the world's electricity production in 2012. In total, 13 countries relied on nuclear energy to supply at least one-quarter of their total electricity.

Non-Fossil Renewable Energies

As noted previously, renewable energy provides only about seven per cent of the worlds energy needs. Renewable energy is energy derived from natural processes (e.g. sunlight and wind) that are replenished at a faster rate than they are consumed. Solar, wind,

geothermal, hydro, and some forms of biomass are common sources of renewable energy.

How much of the world's energy comes from renewable sources?

In 2013, the world relied on renewable sources for around 14% of its primary energy supply, according to IEA statistics. Renewables accounted for 20 % of global electricity generation and 3% of global energy consumption for road transport in the same year.

How much has wind power grown since 2000?
Global wind power capacity was 238 Gigawatts (GW) at the end of 2011, up from just 18 GW at the end of 2000, with an average growth rate of over 25% over the past five years.

How much has solar photovoltaic (PV) grown over the last decade?
Solar photovoltaic (PV) directly converts solar energy into electricity using a PV cell; this is a semiconductor device. The global total of solar PV was roughly 67 GW at the end of 2011, to be compared with just 1.5 GW in 2000. Over the past five years, solar PV has averaged an annual growth rate of over 50 per cent. Growth has been mostly concentrated in a few countries, where PV generates today a few percent of total yearly electricity production.

How much has biofuel production grown over the last decade?
Global biofuel production grew from 16 billion litres in 2000, to more than 100 billion litres in 2010. This biofuel provides around three per cent of the worlds fuel for transport. (In Brazil, biofuel provides 23 per cent of all transport fuel, compared with four per cent in the US and three per cent in the European Union).

In the IEA scenarios, what is the outlook for renewables?

Renewables increase their penetration significantly in all long-term scenarios. For example, in the central scenario of the World Energy Outlook, the New Policies Scenario , which takes account of broad policy commitments and plans that have been announced by countries , renewable electricity generation grows threefold from 2009 to 2035. In the 450 Scenario , which is in line with limiting global warming to about 2°C , renewables grow even more; by a factor of almost four. As a carbon dioxide emissions reduction option, renewables and biofuels come in second only to energy efficiency improvements in IEA scenarios.

What is the impact of renewables on energy security?

Energy security and diversification of the energy mix is a major policy driver for renewables. Growth of renewables generally contributes to energy diversification, in terms of the technology portfolio and also in terms of geographical sources. Use of renewables can also reduce fuel imports and insulate the economy to some extent from fossil fuel price rises and swings. This certainly increases energy security. However, concentrated growth of variable renewables can make it harder to balance power

systems, which must be duly addressed.

Are renewables competitive?
The renewable energy sector is demonstrating its capacity to deliver cost reductions, provided that appropriate policy frameworks are in place and enacted. Deployment is expanding rapidly. Non-hydro renewables, such as wind and solar PV, are increasing at double-digit annual growth rates. Costs have been decreasing and a portfolio of renewable energy technologies is becoming cost-competitive in an increasingly broad range of circumstances. Established technologies such as hydro and geothermal are often fully competitive. Where resources are favourable, technologies such as onshore wind are almost competitive. However, economic barriers remain important in many cases. In general, costs need to be reduced further. Moreover, fossil fuel subsidies and the lack of a global price on carbon are significant barriers to the competitiveness of renewables.

The Fossil Fuel Dilemma

Fossil fuels exist, and they provide a valuable service. Its not so much that we use fossil fuels for energy that is problematic, but its the side effects of using them that causes all of the problems. Burning fossil fuels creates carbon dioxide, the number one greenhouse gas contributing to global warming. Combustion of these fossil fuels is considered to be the largest contributing factor to the release of greenhouse gases into the atmosphere. In the 20th century, the average temperature of Earth rose 1 degree Fahrenheit (1°F). This period saw the most prolific population growth and industrial development which was and remains totally dependent on the use of energy – in Earths history.

The impact of global warming on the environment is extensive and affects many areas. In the Arctic and Antarctica, warmer temperatures are causing the ice to melt which will increase sea level and change the composition of the surrounding sea water. Rising sea levels alone can impede processes ranging from settlement, agriculture and fishing both commercially and recreationally. Air pollution is also a direct result of the use of fossil fuels, resulting in smog and the degradation of human health and plant growth.

But there are also the great dangers posed to natural ecosystems that result from collecting fossil fuels, particularly coal and oil. Oil spills have devastated ecosystems and coal mining has stripped lands of their vitality. These among others are the primary reasons to discontinue the pursuit to tap the vast oil reserves in the Arctic National Wildlife Refuge (ANWR).

Oil fossil fuels come from marine plants and animals and are found only underneath the ocean or under land that was covered by the oceans millions of years ago. This oil rig is located offshore in the Arabian Gulf. (Photo: Saudi Arabian Embassy – London)

The oil, coal and natural gas companies know these are serious problems. But until our renewable energy sources become more viable as major energy providers, the only alternative for our global population is for these companies to continue tapping into the fossil fuel reserves to meet our energy needs. And you can pretty much count on these companies being there providing energy from renewable sources when the fossil fuels are depleted. Many oil companies, for example, are involved in the development of more reliable renewable energy technologies. For example, British Petroleum Company, today known as BP, has become one of the worlds leading providers of solar energy through its BP Solar division, a business that they are planning on eclipsing their oil production business in the near future.

Future Supplies for Future Energy

Just how limited are our fossil fuel reserves? Some estimates say our fossil fuel reserves will be depleted within 50 years, while others say it will be 100-120 years. The fact is that neither one of these projections is very appealing for a global community that is so heavily dependent on fossil fuels to meet basic human needs. The bottom line: We are going to run out of fossil fuels for energy and we have no choice but to prepare for the new age of energy production since, most certainly, human demands for energy will not decrease.

Modern windmills have become very efficient at transferring the energy of wind to electricity. Wind power is an important part of the overall renewable energy sources for the future.

Nobody really knows when the last drop of oil, lump of coal or cubic foot of natural gas will be collected from the Earth. All of it will depend on how well we manage our energy demands along with how well we can develop and use renewable energy sources.

And here is one very important factor: population growth. As the population grows upwards towards nine billion people over the next 50 years, the worlds energy demands will increase proportionately. Not only will it be important for renewable energy to keep up

with the increasing population growth, but it must outpace not only these demands but begin replacing fossil fuel energy production if we are to meet future energy needs.

By the year 2020, world energy consumption is projected to increase by 50 percent, or an additional 207 quadrillion BTUs. If the global consumption of renewable energy sources remains constant, the worlds available fossil fuel reserves will be consumed in 104 years or early in the 22nd century.(Source: US Department of Energy) Clearly, renewable energy resources will play an increasingly vital role in the power generation mix over the next century.

The Ultimate Energy Sources as the Underdogs

Solar energy is having the most immediate impact on home energy needs, and is expected to provide the energy needs for one billion people by the middle of this century. Homes can be fitted with solar panels, such as the ones pictured above. (Photo: Maui Green Energy)

Sun, wind and water are perfect energy sources ☀□□□□□□□ on where you are. They are non-polluting, renewable and efficient. They are simple: all you need is sunlight, running water and/or wind. Not only do the use of renewable energy sources help reduce global carbon dioxide emissions, but they also add some much-needed flexibility to the energy resource mix by decreasing our dependence on limited reserves of fossil fuels.

Essentially, these renewable energy sources create their own energy. The object is to capture and harness their mechanical power and convert it to electricity in the most effective and productive manner possible. Theres more than enough renewable energy sources to supply all of the worlds energy needs forever; however, the challenge is to develop the capability to effectively and economically capture, store and use the energy when needed.

Hydro Energy

Hydropower is the electrical energy derived from turbines being driven by flowing water in rivers, with or without man-made dams forming reservoirs.

Presently, hydropower is the worlds largest source of renewable electricity. China is the leading hydropower producer, followed by Brazil, Canada, the US and Russia. Hydropower

represents the largest share of renewable electricity production. It was second only to wind power for new-built capacities between 2005 and 2010.

The IEAs Energy Technology Perspectives 2010 BLUE map scenario which sets the goal of halving global energy-related CO2 emissions by 2050 (compared to 2005 levels) projects that hydro could produce up to 6,000 terawatt-hours in 2050, roughly twice as much as today.

Hydropowers storage capacity and fast response characteristics are especially valuable to meet sudden fluctuations in electricity demand and to match supply from less flexible electricity sources and variable renewable sources, such as solar PV and wind power.

Some countries, like Paraguay, Zambia and Norway, generate between 98 per cent of their electricity from hydroelectric power. About 20 per cent of the worlds electricity is currently generated from hydropower with China, Canada and Brazil leading in installed capacity respectively.

Hydropower could double its contribution by 2050, reaching 2,000 GW of global capacity and over 7,000 TWh. This achievement, driven primarily by the quest of clean electricity, could prevent annual emissions of up to 3 billion tonnes of CO2 from fossil-fuel plants. The bulk of this growth would come from large plants in emerging economies and developing countries.

Wind Energy

Worldwide Wind Capacity is close to 300 Gigawatt. 14 GW of new installations in the first half of 2013, after 16,5 GW in 2012.Worldwide wind capacity has reached 296 GW, 318 GW expected for full year.Dramatic slump in US leads to global decrease, partly compensated by new markets. China has reached total capacity of 80 GW

Part I Evaluation

I try to put detailed explanations in a wide approach in this part of my article. I consider conventional and emerging energy resources. Non-renewable energy source are supplying 93 percent of the worlds energy resources. This trend will continue. The unconventional energy trend has already impacted energy, geopolitics, and national

security. Energy futures and new energy geopolitics have already been changed, raising the question of geopolitical and national security implications.

I will examine conventional and emerging energy sources' impact on new geopolitics in the 21st Century in my next article.

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