PPHB

ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

June 14, 2016

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Note*: Musings from the Oil Patch reflects an eclectic collection of stories and analyses dealing with issues and developments within the energy industry that I feel have potentially significant implications for executives operating and planning for the future. The newsletter is published every two weeks, but periodically events and travel may alter that schedule. As always, I welcome your comments and observations.* Allen Brooks

Are Industry Crosscurrents Obscuring End To The Downturn?

Last week, the price of West Texas Intermediate (WTI) settled above $50 a barrel for two consecutive days before dropping back at the end of the week to settle close to $49 a barrel, but still up 0.9% for the week

Last Friday brought the second consecutive weekly increase in the Baker Hughes (BHI-NYSE) U.S. rig count. During the final two weeks of May, the overall rig count was flat at 404 rigs before increasing in the first week in June by four rigs and then last week with a six-rig gain. Last week, the price of West Texas Intermediate (WTI) settled above $50 a barrel for two consecutive days before dropping back at the end of the week to settle close to $49 a barrel, but still up 0.9% for the week. Attention is also being drawn to the price action for natural gas, which jumped by nearly 20 cents per thousand cubic feet (MCF), or nearly 10% last week. The impetus for the strength was a weekly natural gas injection that was substantially below analysts' expectations. It suggests that demand was higher and output lower, but the important point is that the shortfall signals that the inventories may not build to as high a level as initially anticipated when the injection season started in April. As a result, natural gas futures prices have climbed from about $2.15/mcf to $2.60/mcf since the end of May.

We would emphasize the word "slowly" as it is difficult to see the industry jumping back into aggressive drilling and completion work

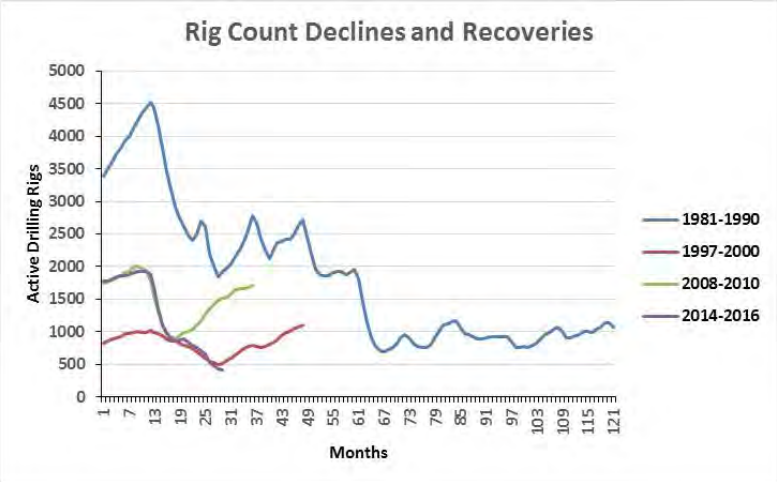
The action within the overall rig count shows interesting trends. Most analysts have been focused on the changes in the oil rig count, which had been consistently falling to new record lows. Each of the past two weeks has seen increases of +9 rigs and +3 rigs, respectively. As the old saying goes, two points makes a trend, so the logical call would be to say that we have seen the bottom in the oil rig count, and with oil prices hovering around $50 a barrel, barring some sharp price reversal, the rig count will slowly recover. We would emphasize the word "slowly" as it is difficult to see the industry jumping back into aggressive drilling and completion work given the continuing uncertainty about the health of the industry recovery and the financial health of its participants.

Maybe more meaningful is that since the start of April, the natural gas rig count is only down three rigs

Natural gas is a different story. As natural gas prices have jumped up in response to some hot weather along with falling production, we have seen the gas-oriented rig count moving along an extended bottom with high volatility. Over the past five weeks, the number of natural gas rigs working changed weekly by +1, -2, +2, -5, +3 rigs. As a result, over the entire period, there has been a one-rig decline. Maybe more meaningful is that since the start of April, the natural gas rig count is only down three rigs.

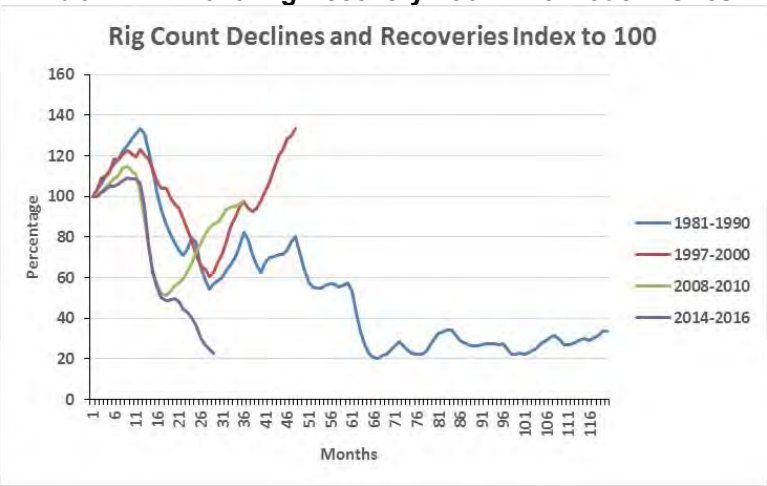
We thought it would be interesting to present the rig count declines and recoveries for significant past industry downturns with both the raw rig count data and the rig count changes indexed to the start of each decline. These charts are based on monthly data so you don't see the current rig count upturn reflected in the 2014-2016 data.

Exhibit 1. 2016 Rig Count Decline Set Record Lows



Source: Baker Hughes, PPHB

Exhibit 2. Will 2016 Rig Recovery Look Like Modern Ones?



Source: Baker Hughes, PPHB

It is likely that the worst of the downturn is over, but it will take an extended period to clean up the damage

Attention will soon shift to projecting the shape of the drilling rig recovery. Will that recovery look more like the 2008-2010 and 1997-2000 patterns or the mid-period recovery of the 1981-1990 rig pattern? It is likely that the worst of the downturn is over, but it will take an extended period to clean up the damage, repair the psyche of the industry executives and the financial health of the industry, and restart the "animal spirits" in the industry that are needed to drive risk taking called drilling and completing wells. As a result, we doubt the recovery will look like the more recent recoveries. We will be monitoring all these trends and other factors that will drive oil and gas prices in order to try to discern how the recovery will unfold.

Does The Future For Electric Cars Mean The End Of Oil?

If you charge up your electric car in Wyoming, 95% of the state's electricity is produced by burning coal

Some analysts have declared that the 20th Century was all about crude oil while the 21st Century will be all about electricity. While electricity is gaining in importance as an energy source, the key force driving its growth is the environmental movement that sees the potential to make this energy source "green," meaning it won't emit carbon when created. That is a very debatable issue. The reality about electricity's greenness is that its degree of green is tied to the fuel used to generate the electricity. For example, if you charge up your electric car in Wyoming, 95% of the state's electricity is produced by burning coal, according to the latest state data from the Energy Information Administration. On the other extreme in tiny Vermont 57% of its power comes from hydro sources and 18% from wind and 3% from solar. Amazingly, 22% of the state's power comes from burning other fuels – primarily wood, so how green is Vermont power?

So while people talk about the environmentally-sensitive residents of Colorado, 81% of its power comes from fossil fuels

In between Wyoming – the presumed dirtiest state – and Vermont – the most environmentally friendly, although many environmentalists are aghast at the use of dams for generating power – lies the rest of the 50 states with varying degrees of clean and dirty fuels creating each state's electricity. Colorado gets 63% of its power from coal, 18% from natural gas, 16% from wind and 3% from hydropower. So while people talk about the environmentally-sensitive residents of Colorado, 81% of its power comes from fossil fuels. In contrast, we could look at New York that only derives 2% of its electricity from burning coal, but it gets 38% from natural gas and 32% from nuclear power plants. Surprisingly, New York generates 4% of its power by burning oil, 2% from other energy sources and a whopping 19% from hydropower. Given this fuel mix, it is surprising how aggressively New York Governor Andrew Cuomo (Dem) is pushing to shut down the state's nuclear power plants while also fighting the use of hydraulic fracturing to tap the state's natural gas resources. Gov. Cuomo is also interested is trying to promote increased use of wind power, especially offshore in the Great Lakes and the Atlantic Ocean, but that effort appears to be going nowhere.

In our summer home state of Rhode Island, 91% of its electricity comes from natural gas

Our home state of Texas burns coal to generate 26% of its power, while natural gas accounts for 53% of the state's electricity. Both wind and nuclear account for 10% of the state's power with only 1% coming from other sources such as solar and biomass. In contrast, in our summer home state of Rhode Island, 91% of its electricity comes from natural gas, 4% from burning oil and 4% from other sources.

So what does the fuel sourcing mean for power costs in these states? A ranking of the states last fall based on the price per kilowatt-hour of power showed that New York was the fourth most expensive state (second if we exclude Hawaii and Alaska). Rhode Island, even by using so much cheap natural gas, has structural issues in its power market that contributed to its number five ranking for expensive electricity. Vermont, again with lots of green energy, ranks 9th most expensive. Colorado was in 20th place, while Texas was number 35 and Wyoming ranked 49th.

As electricity is gaining importance in the nation's energy mix, the role of electric vehicles is being promoted by environmentalists who see them as a way to end the use of petroleum

As electricity is gaining importance in the nation's energy mix, the role of electric vehicles is being promoted by environmentalists who see them as a way to end the use of petroleum. These same groups are pushing electric cars as the perfect vehicle for autonomous vehicles that are envisioned as a way to reduce the number of cars needed in future economies, with concomitant less use of petroleum fuels. As they build their case, we have been overwhelmed by articles praising the increase in the number of electric vehicles in today's vehicle stock and how they will (need to) grow in order to fulfill the UN climate change agreement.

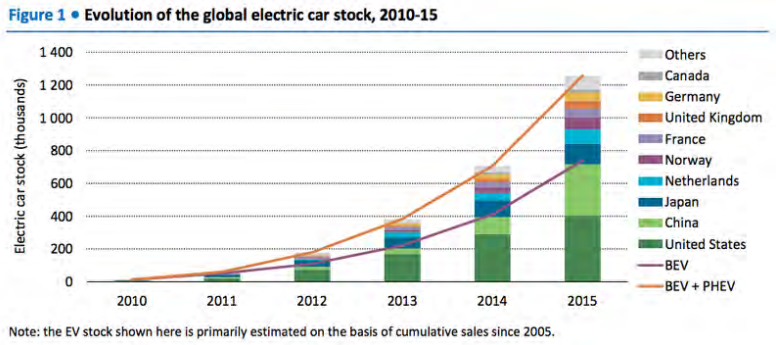
Because it is cumulative, the growth is deceiving

A recent electric car article offered the chart in Exhibit 3 (next page) showing how the number of these vehicles in the world have grown. The chart reflects the cumulative total between 2010 and 2015, showing dramatic growth. Because it is cumulative, the growth is deceiving. More important is the penetration rate of electric vehicles into the world vehicle fleet.

The penetration of electric cars into the American vehicle stock is paltry as 400,000 units barely registers in a fleet of about 300 million vehicles on the road

If we look at the dark green portion of each bar that represents the number of electric cars in the United States, the country has gone from a minimal number in 2010 to 400,000 vehicles in 2015. Yes, that is dramatic growth, but the 2015 number is less than half the number President Barack Obama called for to be on America's roads. More telling is the difference between the height of the dark green portion of the bar in 2014 and 2015, showing that the industry added slightly over 100,000 vehicles. That number comes in a year when the U.S. auto industry produced and sold over 17 million vehicles. The penetration of electric cars into the American vehicle stock is paltry as 400,000 units barely registers in a fleet of about 300 million vehicles on the road.

Exhibit 3. Growth of Electric Car Population Is Impressive



Source: ***vox.com***

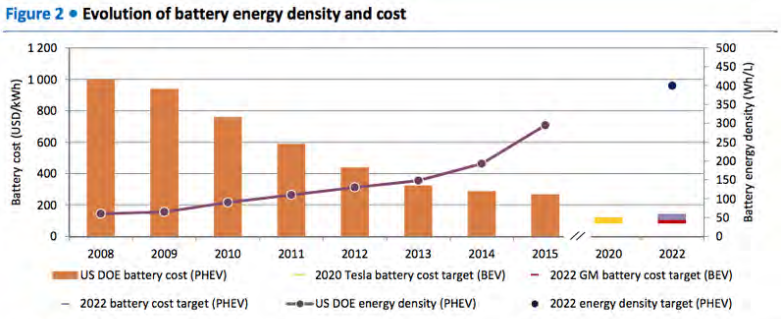
The global industry has over 1.2 million electric vehicles on the world's roads – but that is out of an estimated one billion vehicles

As the chart shows, the global industry has over 1.2 million electric vehicles on the world's roads – but that is out of an estimated one billion vehicles. The point is that for all the dramatic growth (which presentation charts can make look impressive) in the number of electric vehicles on the roads, they barely register as a component of the global vehicle fleet total.

That would suggest that real consumers – not those motivated by making political statements – are not embracing electric vehicles

An interesting area for research into the success of electric cars is to see how many of them are owned by governments – federal, state and municipal – along with ones purchased by utility companies in an effort to demonstrate their environmental sensitivity. Our guess is that in the U.S. these buyers would account for the largest portion of the electric vehicles on the road. That would suggest that real consumers – not those motivated by making political statements – are not embracing electric vehicles, despite the concerted efforts of governments to promote them through mandates and financial

Exhibit 4. Battery Technology And Cost Improving



Notes: USD/kWh = United States dollars per kilowatt-hour; Wh/L = watt-hours per litre. PHEV battery cost and energy density data shown here are based on an observed industry-wide trend, include useful energy only, refer to battery packs and suppose an annual battery production of 100 000 units for each manufacturer.

Sources: US DOE (2015 and 2016) for PHEV battery cost and energy density estimates; EV Obsession (2015); and HybridCARS (2015).

Source: ***vox.com***

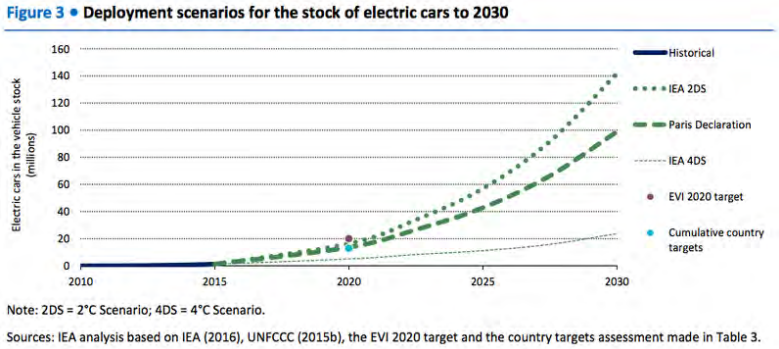
incentives. Others would point to low gasoline and diesel pump prices as a significant reason for the lack of success in selling electric vehicles, but the real problem remains their limited range,

longer refueling times and limited refueling locations. Overcoming "range anxiety," as it is referred to, will require better performance from batteries. Increased battery performance is the holy grail of electric vehicles and has led to companies investing in huge plants in an effort to lower the unit cost, while also seeking greater density to boost performance.

The targets for battery cost and density are aspirational and we recall from similar projections in previous years they have not been achieved

The chart on the previous page of battery density and cost shows an impressive reduction in cost as more vehicles are being produced, but the increase in battery energy density has jumped in the past two years, but one wonders about the validity of the big increase projected for 2015. The targets for battery cost and density are aspirational and we recall from similar projections in previous years they have not been achieved. Without these magnitudes of improvement, it will be difficult for electric cars to significantly increase their penetration of the world's vehicle stock without mandates and regulations.

Exhibit 5. Electric Car Growth Appear Dramatic



Source: ***vox.com***

The increases in electric vehicles needed under these scenarios are impressive

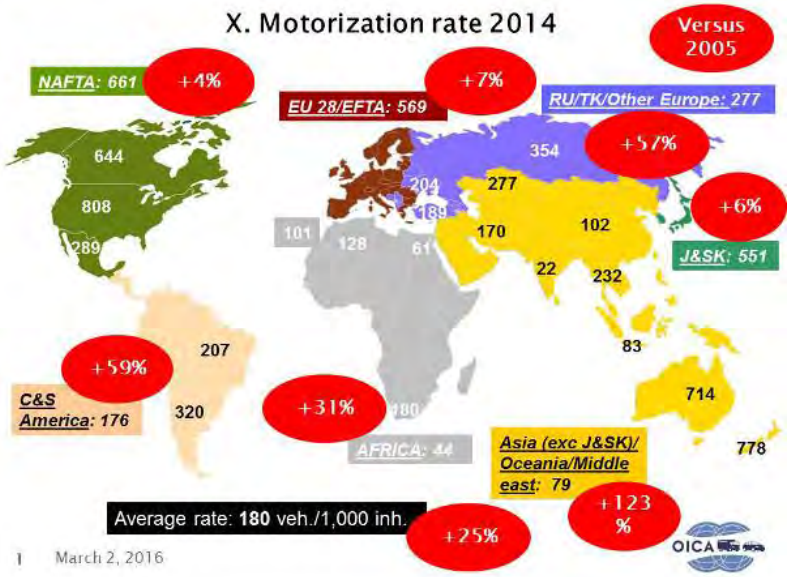
The chart in Exhibit 5 shows multiple projections to 2030 of the number of electric vehicles that need to be in the world's fleet under different climate change targets. The projections show what is supposedly needed to meet the Paris Climate Change Declaration to limit carbon emissions, the International Energy Agency's 2° C and 4° C temperature scenarios. The increases in electric vehicles needed under these scenarios are impressive: an 18-times increase for the 4° C scenario; an 83-times increase to meet the Paris Declaration; and a 117-times increase for the 2° C scenario. What do they mean for the success of electric vehicles?

The estimate for sales this year calls for 74.3 million units, which is projected to rise to 100 million units in 2020

According to the International Organization of Motor Vehicle Manufacturers, the world's car industry sold 66 million units in 2015. The estimate for sales this year calls for 74.3 million units, which is projected to rise to 100 million units in 2020. It is difficult to project where the global automobile industry is heading in terms of unit sales by 2030, but the chart produced by the organization shows that the growth in the motorization rate between 2005 and 2014 provides a clue. The most rapid growth has occurred in Asia,

excluding Japan and South Korea, followed by Russia and Other Europe and then Africa and South America. Most of these regions are heavily populated so increased motorization is likely.

Exhibit 6. Less Developed Economies Drive Vehicle Sales



Source: OICA

If we use the 100 million units target for 2020, one can see that even under the most ambitious scenario, electric cars would represent only a little over 9% of total vehicles sold

If we make a quick calculation of the annual electric vehicle sales required to meet the 2030 environmental scenario targets, the industry needs to be selling 1.4 million a year to meet the 4° C scenario, 6.6 million units a year for the Paris Declaration and 9.3 million units a year for the 2° C scenario. If we use the 100 million units target for 2020, one can see that even under the most ambitious scenario, electric cars would represent only a little over 9% of total vehicles sold. Given this outlook, one could conclude that there is not only a future for the global petroleum market, but it will be needed for personal transportation.

The government has indicated that over time it would move the manufactured-by ban to 2010, in order to allow only vehicles that are ten years old or younger on its roads

The greater risk for the petroleum industry is the growing movement to ban the sale of conventionally-powered vehicles such as being considered by the Norwegian government or others. Additionally, we see various cities around the world talking about banning automobiles from their streets. The question is why they would be banned. In certain cases the effort is to improve air quality as in Paris. There the city government is seeking to ban vehicles built before 1997 and motorcycles built before 1999 from driving in the city. The government has indicated that over time it would move the manufactured-by ban to 2010, in order to allow only vehicles that are ten years old or younger on its roads. The belief is that modern cars are less polluting, which is true. Of course, it is an easy step to promote electric vehicles as the preferred vehicles for driving in the city. Oslo, Norway is discussing banning cars from its central city

while boosting public transportation as an offset and to improve the walking and bicycling experience of citizens. No one is sure that their plan will work if implemented.

The growth of the electric vehicle market may be less impressive than some current forecasts suggest

Without outright bans on conventionally-powered vehicles, increased financial incentives for the purchase and use of electric cars, or significant performance improvement in these vehicles, the growth of the electric vehicle market may be less impressive than some current forecasts suggest.

Wind Energy In Europe Looking At A Changed Outlook

DONG derived 62% of its revenues on operational offshore wind farms in 2015 from subsidies and other financial support

Over the past several years, one could not avoid seeing articles discussing the growth and success of wind energy in Europe and how this power source was leading those economies into a "green future." We were reminded of that history when reading an article about the 98 billion crowns ($15 billion) initial public offering (IPO) in Denmark of DONG Energy (DENERG.CO), a leading utility company that is the world's leader in offshore wind. The company has major projects in the UK and Germany, including the 1.2 gigawatt Hornsea 1 project, which will become the world's largest offshore wind farm when completed in 2020. It also recently opened offices in the United States (Boston) and Taiwan to pursue new offshore wind opportunities. Offshore wind, however, is one of the most expensive sources of renewable energy. Some investment analysts are concerned that DONG is heavily reliant on government renewable energy subsidies. DONG derived 62% of its revenues on operational offshore wind farms in 2015 from subsidies and other financial support, such as Green Certificates in Britain.

Exhibit 7. Hornsea 1 Will Be Largest Offshore Wind Farm

Source: ***Offshore Wind***

In another utility development, shareholders of EON ES (EONGY-OTC), the large German utility company approved splitting the

company into two business – one focused on renewable energy, networks and retail customers and the other retaining its fossil fuel power plants and trading business. Over 99% of the shareholders voted in favor of the split, which reflects the green energy leanings of both the German citizenry and their government. Unfortunately, the German, Denmark and UK governments are backtracking on their subsidies for wind power as the economic reckoning of continuing them is hitting home.

The German, Denmark and UK governments are backtracking on their subsidies for wind power as the economic reckoning of continuing them is hitting home

The Danish center-right government of Lars Loekke Rasmussen has moved to scrap an electricity tax that has provided subsidies for wind turbines since 1998. The government says its decision follows a complaint from the European Union alleging that the subsidy favors domestic businesses over foreign ones. Denmark's Wind Energy Association estimates that such a change would lead to a massive drop in additional new wind energy capacity. It believes that this government move is dangerous, but it is mostly dangerous to its members. The Association projects that new capacity additions would fall to around 50 megawatts a year in 2017-2020, or one quarter of the average annual additions of 215 megawatts of wind during 2013-2016.

Denmark's Wind Energy Association estimates that such a change would lead to a massive drop in additional new wind energy capacity

Analysts point out that Denmark already derives more than 40% of its electricity from wind power, which could be considered a mature industry and no longer in need of support. Denmark still has a goal to be fossil-fuel free by 2050. The government's Energy Minister, Lars Christain Lilleholt, stated that attaining that goal "has to be done in the most cost-efficient way." Part of the reason for the policy reversal is a reflection of the government's political support. The largest group within the ruling bloc in the government is the anti-immigration Danish People's Party, which says that domestic considerations such as care for the elderly take priority over the concerns (profits) of foreign investors. The party's leader, Kristian Thulesen Dahl said, "You have to remember this is a billion-figure cost that we're passing on to the Danes. While some investors may be annoyed by the fact that they won't make as much money, that's no biggie, it's just business. We also have a responsibility to discuss the costs we impose on Danes."

Denmark still has a goal to be fossil-fuel free by 2050

In neighboring Germany, a similar revolt against the cost of green energy has forced the government to alter its subsidies for renewables. In 2011, following the Fukushima nuclear power plant accident, Germany adopted an energy policy that involved shutting down all its nuclear power plants by 2022 and replacing the power with renewables – primarily wind and solar with some biomass. Germany's goal is to have 40-45% of its electricity consumption generated by renewable fuels by 2025, compared with 25%, currently. Long-term, the country aims to have 80% of its power come from renewables. The problem is that the cost of supporting the transition to renewable fuels has become too costly for the German economy and its citizens.

In neighboring Germany, a similar revolt against the cost of green energy has forced the government to alter its subsidies for renewables

Producers would also be forced to sell green energy competitively on the market starting in 2017 rather than enjoying priority treatment with guaranteed prices

The agreement last week calls for reduced subsidies for new producers of wind energy while those for biogas would practically disappear. Producers would also be forced to sell green energy competitively on the market starting in 2017 rather than enjoying priority treatment with guaranteed prices. Chancellor Angela Merkel's government has agreed with its Bavarian allies to expand subsidies for new power plants using biomass, an energy source favored by farmers in the south of Germany. The agreements still need to be approved by the parliament, but Chancellor Merkel's government coalition has a huge majority assuring its approval.

What this means is that greater competition will be introduced into the clean-energy sector

Vice Chancellor Sigmar Gabriel said the agreement readied Germany for a "paradigm shift in supporting renewable energy". The shift was to "synchronize" the expansion of renewables rather than to follow the motto of "the more, the better," to ensure the electricity generated ends up where it is needed. What this means is that greater competition will be introduced into the clean-energy sector. Wind and solar projects, starting next year, will be put out to tender, rather than automatically launched with generous state subsidies and guaranteed returns.

Germany has experienced an increase in its carbon emissions at the same time its renewable power capacity and share of national energy output has increased

Government support under the existing energy plan has helped boost the share of wind, solar and other renewables to about one-third of Germany's electricity production last year, but it has created operational and cost problems. Much of the wind power is offshore and in the northern region of the country, while substantial amounts of power must be transported to the south. This has meant that more transmission capacity needed to be built. Additionally, the intermittency factor of wind and solar power has contributed to an increased use of imported coal from America to be mixed with the low energy lignite coal of Germany to power plants for standby power. As a result, Germany has experienced an increase in its carbon emissions at the same time its renewable power capacity and share of national energy output has increased.

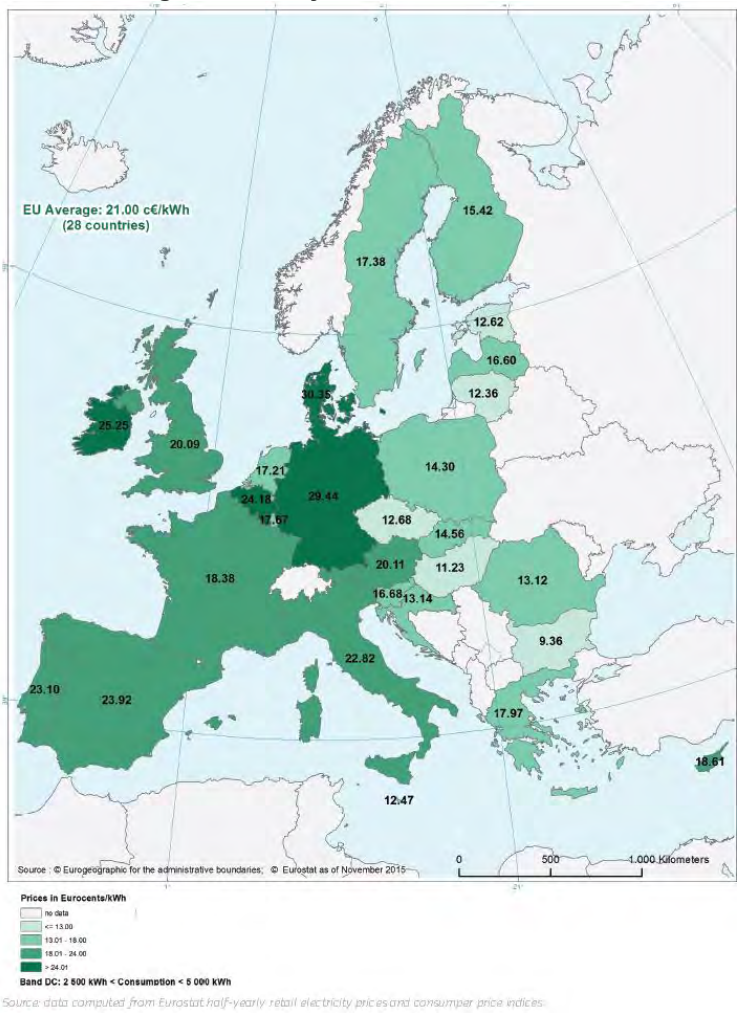
Germany's retail electricity costs to the second highest in Europe

The renewable energy subsidies are financed by households and many companies as they are largely passed on as surcharges on power bills. The impact of these subsidies has been to raise Germany's retail electricity costs to the second highest in Europe (see Exhibit 8), trailing only Denmark, as of the third quarter of 2015, according to data from the Market Observatory for Energy of the European Commission.

"The project economics wouldn't work; the wind speeds don't allow for it."

Across the English Channel, a similar realization about the cost of wind energy has surfaced. Hugh McNeal, chief executive of the British wind industry's trade body RenewableUK, recently stated, "We are almost certainly not talking about the possibility of new plants in England. The project economics wouldn't work; the wind speeds don't allow for it." This declaration is significant because it reflects the poor economics of onshore wind without subsidies. The

Exhibit 8. High Electricity Prices Are In Dark Colored Countries



Source: Market Observatory for Energy of the European Commission

British Conservative government has fulfilled its pledge to eliminate the subsidy to landowners who allow wind turbines to be installed on their property and the financial subsidy to the wind farm developer.

Now they will have to sell their electricity to the national grid under a competitive bidding system

Under the prior subsidy program, wind farms were guaranteed to receive double the wholesale price for the electricity they produced. Now they will have to sell their electricity to the national grid under a competitive bidding system. In addition, the subsidy pool for green energy has been capped, where before it was effectively limitless. Part of the thrust in changing the renewable energy subsidies was to shift them away from onshore and in favor of offshore where the wind resource is stronger and more stable, even though the cost to produce is much greater. That is part of the rationale for the subsidy shift, although there was growing opposition from residents due to the visual and noise pollution of onshore wind turbines.

According to government reports, there is still 425 megawatts of onshore wind capacity in England in the turbine planning system

At the present time, the UK reportedly has 4,000 onshore wind turbines powering four million homes. Another 3,000 turbines have been granted planning permission, but most will likely not be built given the change in subsidies. According to government reports, there is still 425 megawatts of onshore wind capacity in England in the turbine planning system. It will be interesting to see how many of these planned megawatt capacity additions are actually built.

The subsidy costs are becoming too great of a financial burden for economies that are struggling to grow

Despite all the studies attempting to demonstrate how cost-competitive wind energy is with coal and natural gas energy, the subsidy costs are becoming too great of a financial burden for economies that are struggling to grow, especially in light of the rapidly growing social costs they are facing as a result of aging populations and exploding immigration. We expect many governments around the world that have embraced renewable energy without thinking through the economic and social costs on their power systems will begin re-examining the long-term financial challenge they face. This does not mean the death of renewable power, but by failing to weigh the costs against the benefits, countries may wind up worse off economically without that examination.

Canada Struggles Over Its Role In The Future Energy World

Canada's politics demonstrate that truth

Geopolitics are always a wildcard for the energy industry. Canada's politics demonstrate that truth. The election of Rachel Notley, leader of the New Democratic Party (NDP), as Premier of Alberta in May 2015, kicked off a period of increased anxiety and uncertainty about the future of the province's energy and environmental policies. That political change was followed five months later by the surprising election of the Liberal Party to rule the nation. The election results were a surprise because the Liberal Party and its leader Justin Trudeau had been given little chance of achieving an outright majority in Canada's Parliament.

It was immediately obvious to energy industry participants following Ms. Notley's election that the cost of operating an energy business in Alberta would increase

In matter of six months, the energy business went from operating under conservative and supportive governments in Alberta and Ottawa to trying to determine how tax and environmental policies would be changed under liberal politicians. It was immediately obvious to energy industry participants following Ms. Notley's election that the cost of operating an energy business in Alberta would increase given her party's push to extract greater revenues from those companies. At the same time, the push for greater environmental regulation in Alberta chilled confidence about the pace of energy business growth.

The federal election reflected a rejection of a fourth term for Conservative Party leader Stephen Harper and his pro-energy policies. That position was demonstrated by the Prime Minister's aggressive support for the Keystone XL pipeline that was ultimately rejected by U.S. President Barack Obama. The surprise election of

Mr. Trudeau as Prime Minister caused many residents to scramble to discern whether his campaign rhetoric, especially about new energy projects and environmental policies, would become reality, or was merely designed to gain votes.

It was further elevated when President Obama embraced him as a kindred soul on social and environmental issues

Mr. Trudeau, the son of Pierre Trudeau, the Prime Minister of Canada from 1968 to 1984, was dismissed by many during the campaign for his lack of political experience. They said he was trading on the name and fame of his father. By leading his party into a majority position in the Parliament, Mr. Trudeau's stature was raised. It was further elevated when President Obama embraced him as a kindred soul on social and environmental issues. The two leaders combined to push through the Paris Climate Change agreement, which improved Canada's stature in the environmental world. The real measure of Prime Minister Trudeau's elevated stature was being hosted by President Obama at a state dinner, something Mr. Harper was never offered during Mr. Obama's first seven years in office.

Executives are also recognizing the difficult position of the Canadian energy industry as they search for catalysts to help revive the business

The increase in taxes, a new royalty regime in Alberta and new rules for evaluating the worth of new oil and gas pipelines in Canada has the energy business on edge. The global oil and gas industry downturn has devastated the Canadian industry causing significant capital spending cuts, substantial layoffs of both field and home office staffs, and dramatic financial restructuring. The impact of the downturn on the industry is now being assessed as executives are finally gaining a perspective on the magnitude of the damage. Executives are also recognizing the difficult position of the Canadian energy industry as they search for catalysts to help revive the business. For energy, the issue is simple – Canada is rich in oil and gas resources, but it lacks sufficient access to world markets. The Canadian crude oil resources are among the largest in the world, if one counts the country's oil sands reserves. However, the Canadian oil and gas industry was built with a North American focus and with North American outlets. With the shale revolution in the U.S. boosting its supply plus an aggressive push for renewables trimming demand at the margin, Canada's output is struggling to find market opportunities both in the United States and elsewhere. Unfortunately, the opportunities seem limited.

Like many oil-rich countries, Canada's oil output has grown sharply since 2010 as world oil prices soared above $100 a barrel

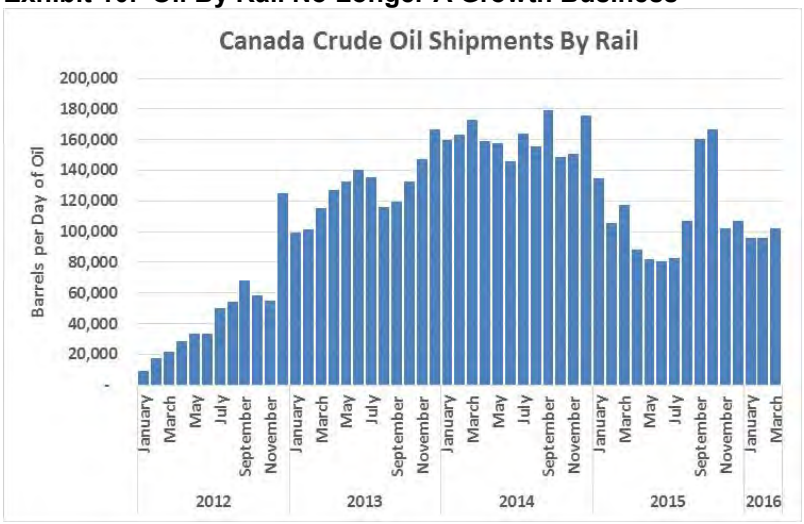
Like many oil-rich countries, Canada's oil output has grown sharply since 2010 as world oil prices soared above $100 a barrel. The high price and supposed need for greater oil supply incentivized conventional oil producers to step up drilling and fracking activity along with oil sands producers expanding their existing mines and opening new ones while also stepping up in situ recovery projects. The growth in oil output convinced the pipeline industry to expand existing lines and propose new ones to the United States such as Keystone. Because expectations were that all the additional output flowing through these new pipelines would be oil sands bitumen, considered to be one of the dirtiest oils on the planet, the proposed

Exhibit 9. Alberta Oil Output Growth Solid

Source: ***Financial Post***

pipelines became high-profile targets for environmentalists. As production outstripped the ability of the pipeline industry to move the supply to the U.S. market, shippers turned to railcars to get the oil there.

Exhibit 10. Oil By Rail No Longer A Growth Business



Source: National Energy Board, PPHB

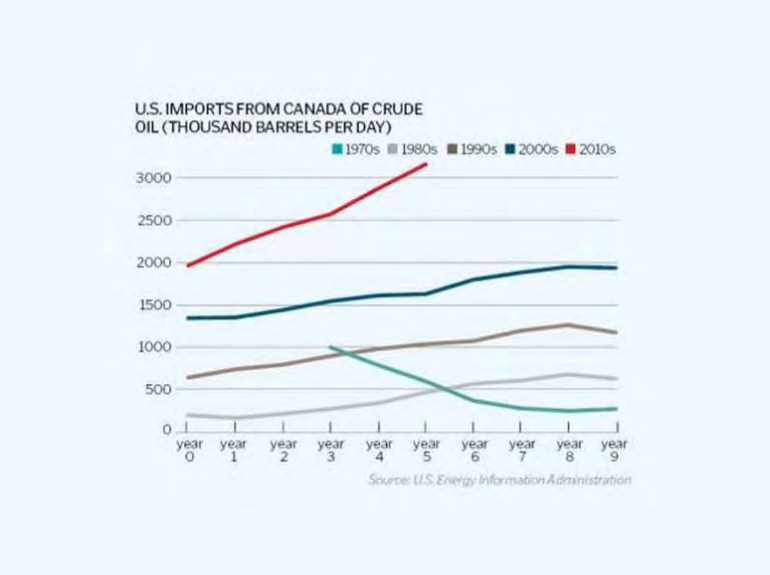
Rail shipments fell sharply in 2015 along with the decline in oil prices

Canadian crude oil shipments to the United States rose dramatically during 2012, setting the stage for even more volume being shipped in subsequent years. Rail shipments fell sharply in 2015 along with the decline in oil prices. Prospects suggest that shipments of oil by rail will remain restrained as a result of the forced shut-ins of Canadian oil sands output due to the forest fires near Fort

The output fall will eventually impact the volumes shipped both by pipelines and rail

McMurray. Many oil sands producers maintain crude oil storage facilities in southern Alberta, which have enabled them to sustain their shipment volumes for a while, but the output fall will eventually impact the volumes shipped both by pipelines and rail. As the mines come back online, production and exports will rise, however, the International Energy Agency (IEA) predicts that Canadian oil sands output will fall by an average of 400,000 barrels per day in June due to the fires, signaling that the recovery will take a while.

Exhibit 11. Canadian Oil Volumes Continue Growing



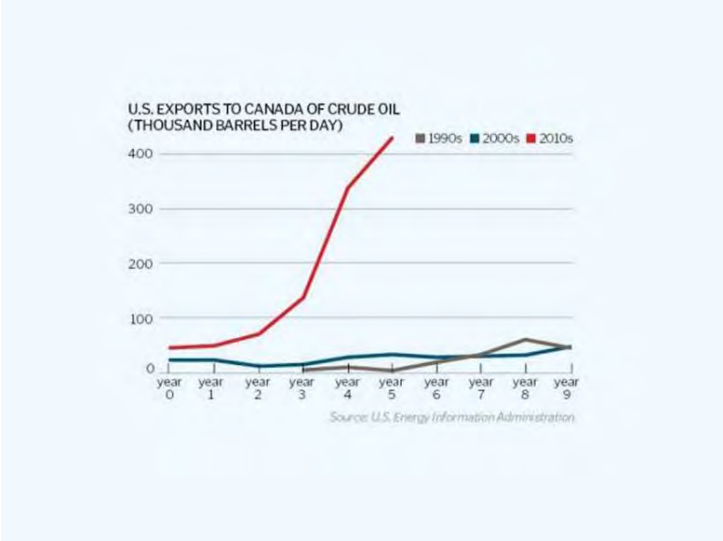
Source: ***Financial Post***

The net result of these trends is that U.S. oil exports to Canada now represent nearly 15% of oil import volumes coming here

The history of crude oil shipments to the United States has shown steady growth since the 1980s. During the 1970s, Canada was a significant supplier of oil to the U.S., but that outlet was shut down as the dramatic price rise due initially to the Arab oil embargo of 1973-1974 and the Iranian revolution in 1978-1979 cut U.S. consumption. Once the world recovered from that oil industry downturn, Canada became an important oil supplier to the U.S. The recent shale revolution sent domestic output sharply higher. At the same time, high oil prices crimped consumption due to increased energy efficiency putting further downward pressure on oil use. The growth of U.S. oil supply plus new export pipelines into eastern Canada has resulted in sharply higher oil volumes moving north of the border. The net result of these trends is that U.S. oil exports to Canada now represent nearly 15% of oil import volumes coming here.

The critical issue for Canadian oil producers, especially its oil sands producers, is gaining increased access to world markets. The producers desire that outlet because without it they are subject to potentially lower prices if oil prices stay low and American refiners

Exhibit 12. Canada Now Getting More U.S. Oil



Source: ***Financial Post***

are unwilling to pay market prices for Canadian volumes they know the producers have to sell.

"The U.S. is now a rejuvenated force in oil and gas production, one that poses huge risks to Alberta's market share"

The challenge for Canadian producers due to the revival of the U.S. oil industry and the lack of alternative markets for Canadian output was highlighted in the report produced by the panel that recently reviewed Alberta's royalty rates. The panel said, "The U.S. is now a rejuvenated force in oil and gas production, one that poses huge risks to Alberta's market share. This is problematic, since we have long relied on the U.S. as our primary (and to some extent, only) customer, and we do not have sufficient means to move and sell our oil and gas to other countries."

The opposition to these pipelines is coming from the First Nations whose property is being crossed, along with the environmental movement

On the drawing boards are several oil pipelines that could move western Canada's crude oil to the East and West Coasts where it could be shipped to world markets. The opposition to these pipelines is coming from the First Nations whose property is being crossed, along with the environmental movement. In the case of TransCanada Corp.'s (TRC-NYSE) Energy East pipeline to move Alberta oil across Canada to an oil export port on the East Coast, the opposition is coming from politicians and environmentalists throughout the eastern provinces.

Canadian natural gas exports to the United States peaked in 2007 and have declined steadily since

The natural gas market is also challenged by changes in the U.S. gas market and the failure of Canada to develop liquefied natural gas (LNG) export opportunities. Canadian natural gas exports to the United States peaked in 2007 and have declined steadily since. The decline coincides with the growth of U.S. natural gas output due to the success of its shale revolution. The growth in U.S. supply has more than satisfied the increased demand from more natural gas being burned to generate electricity.

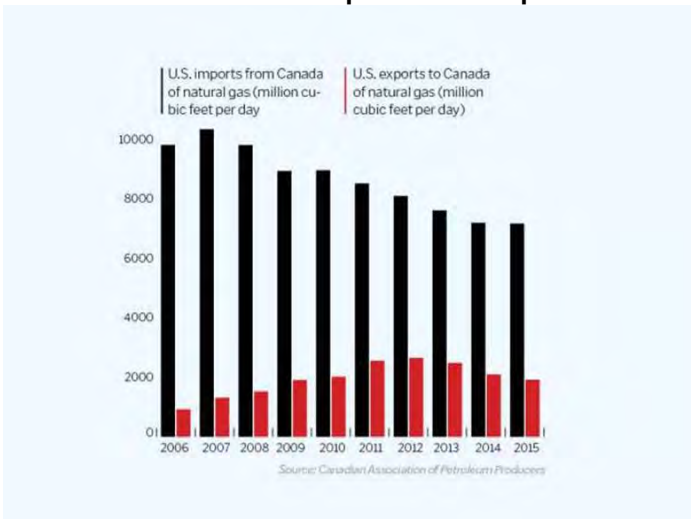
Exhibit 13. Canada's Oil Industry Needs More Market Access

Source: Oil Change International

In the 1990s, Canada's natural gas exports to the U.S. grew rapidly as U.S. output fell and prospects for its recovery were considered dim

In the 1990s, Canada's natural gas exports to the U.S. grew rapidly as U.S. output fell and prospects for its recovery were considered dim. During that time, gas consumption was curtailed and natural gas prices fell to $1.00 per thousand cubic feet (mcf). The low price curtailed gas-oriented drilling, especially in the Gulf of Mexico, which was declared to be the "Dead Sea" by John Laborde, CEO of Tidewater, Inc. (TDW-NYSE) at that time. U.S. dependence on Canadian gas imports rose sharply.

Exhibit 14. Canada Gas Exports Most Impacted



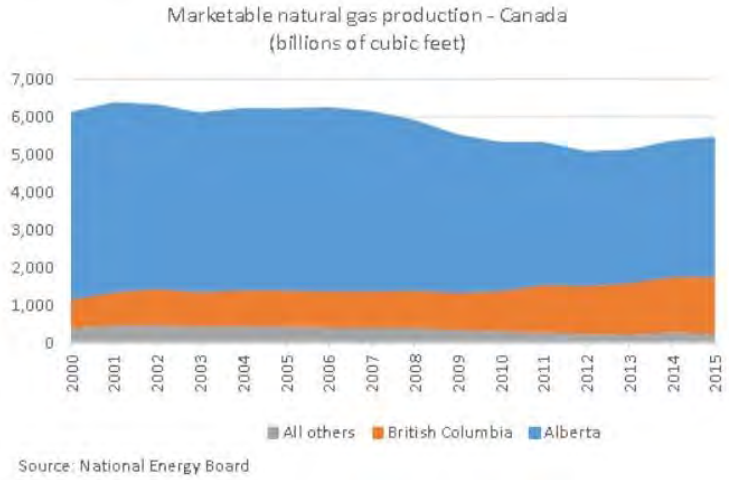
Source: *Financial Post*

The dynamics of the North American natural gas market has translated into lower marketable gas output for Canada

Canada is also importing more natural gas from the United States, especially in the eastern provinces. These trends of falling gas imports from Canada and increased exports to Canada are shown in Exhibit 14. The dynamics of the North American natural gas market has translated into lower marketable gas output for Canada. Its gas output reached a high during the first few years of the 2000s. Production fell in 2008-2009 due to the financial crisis and recession

that cut demand. Afterwards, production growth was limited by the dramatic growth of U.S. shale gas output. Between 2009 and 2015, U.S. gas output from shale grew to 37 billion cubic feet per day (bcf/d), nearly four times Alberta's total production of natural gas of 10 bcf/d.

Exhibit 15. Canada Gas Production Has Declined Recently



Source: National Energy Board

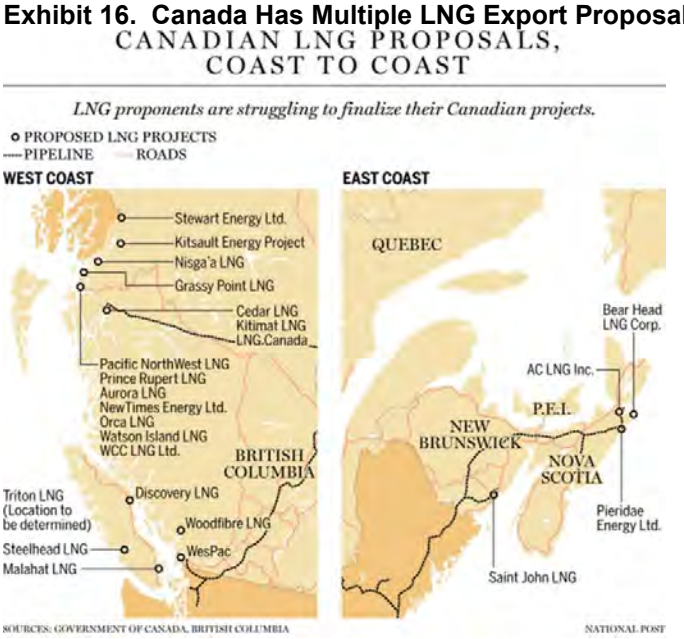
The U.S. natural gas industry was fortunate that its gas supplies were close to the coast where the LNG terminals were located, plus the interstate pipeline network to move that gas was in place

The biggest difference now between the Canadian and the U.S. natural gas markets is the pace of development of LNG export facilities. In the U.S., when it became obvious that the shale gas revolution was providing substantial volumes of supply and engineers were predicting "hundreds of years of supply growth at low prices," domestic gas producers realized that the supply glut would depress prices. They lobbied for the right to export surplus natural gas to international markets where gas prices were higher than could be earned in the U.S. even after considering the cost of liquefying the gas, shipping it to foreign markets and re-gasifying the volumes. Both U.S. and Canadian producers sought LNG export licenses and planned to build export terminals. Many of the U.S. proposals involved utilizing existing LNG import terminal infrastructure that only needed liquefying facilities along with the necessary export permits. Canada was not as fortunate because it lacked LNG import terminals and pipeline infrastructure. The U.S. natural gas industry was fortunate that its gas supplies were close to the coast where the LNG terminals were located, plus the interstate pipeline network to move that gas was in place.

According to the web site of Canada's National Energy Board, there are 44 applications for LNG export permits

According to the web site of Canada's National Energy Board, there are 44 applications for LNG export permits. Industry attention is focused on the status of the proposal by Pacific North West LNG, a subsidiary of Malaysia's Petronas for a terminal in Prince Rupert, B.C. The federal review of this proposal was due in April, but the new Canadian Environment Minister Catherine McKenna added

Exhibit 16. Canada Has Multiple LNG Export Proposals



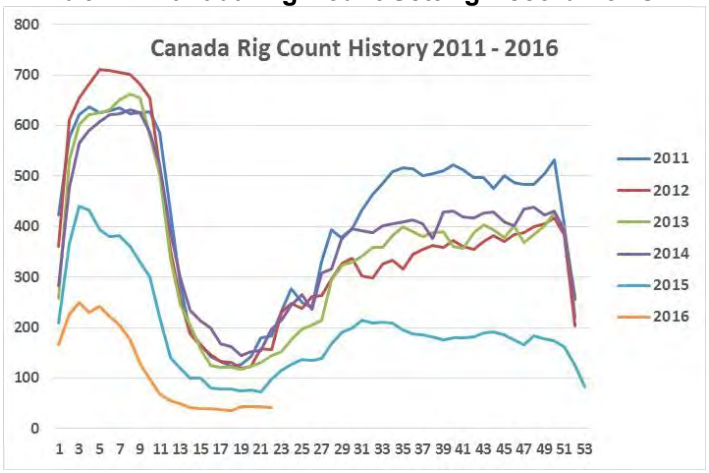
Source: ***Financial Post***

further environmental hurdles to the review process. The most likely project to follow the Petronas one is Shell Oil's LNG terminal at Kitimat, B.C.

Assuming the project moves forward, the first Canadian LNG shipment would likely occur after 2020

The Petronas project is "on the clock" with a decision by Minister McKenna due in the next several months. If the decision is positive and there are no new restrictions on the project, then a final investment decision (FID) can be made. Assuming the project moves forward, the first Canadian LNG shipment would likely occur after 2020. The prospect that project moving forward, with possibly a second one on the horizon, would be a boost to Canadian oilfield activity. The recent industry downturn has so devastated the Canadian producing and service industries that drilling rig activity has fallen to levels not seen in decades. Without a catalyst such as the Petronas LNG project that would prompt producers to begin drilling the natural gas resources necessary to support the exports, the Canadian service industry will struggle to re-size itself and become profitable at lower levels of activity for the foreseeable future.

Exhibit 17. Canada Rig Count Setting Record Lows



Source: Baker Hughes, PPHB

The future of the Canadian energy business is reaching a critical point in its history

The future of the Canadian energy business is reaching a critical point in its history. Regulatory and market access for Canada's oil and gas output will set the direction and pace of development for the country's industry, and especially its service industry. The oil price recovery is a welcome salve for the damage to the industry, but the regulatory rulings on the West Coast LNG projects and Energy East will be crucial for the long-term future. Stay tuned for decisions this summer.

Will Autonomous Cars Arrive Sooner Than Later?

Mr. Schmidt said that autonomous vehicle technology is ready for public roads and it is regulation that is holding it back

According to Eric Schmidt, the executive chairman of Alphabet Inc. (GOOG-Nasdaq), the parent company of Google, autonomous vehicles will arrive on America's roads within years rather than decades. Is this wishful thinking given the intense focus of his company on this technology, or will he prove correct? In a presentation at his company's recent annual meeting, Mr. Schmidt said that autonomous vehicle technology is ready for public roads and it is regulation that is holding it back. His statement came on the same day that the National Highway Transportation and Safety Administration (NHTSA) said that next month it will be releasing documents that will serve as the foundation for national regulations for autonomous vehicles. The framework won't bar states from setting additional standards, which is the issue most autonomous vehicle developers are concerned about.

The auto companies see a potential patchwork of state laws as a significant hurdle for designing and building vehicles acceptable in all states

The auto companies see a potential patchwork of state laws as a significant hurdle for designing and building vehicles acceptable in all states, as is the current norm. For example, in California, autonomous vehicles are mandated to have steering wheels, pedals and a driver. While the rules are a disappointment to Google that is promoting a vehicle much like an amusement park ride with no steering wheel or pedals, evidence from tests in bad weather report

that autonomous vehicles are frequently forced to shut down and turn over control of the car to a human driver. Without a steering wheel and pedals it would be impossible to drive the car. New Jersey, on the other hand, wants to establish a special autonomous driver's license that would kill the concept being promoted of self-driving vehicles carrying non-drivers, either because they are under-age or do not have a driver's license due to a physical impairment, and without a driver having to be present. We wonder how this would impact the idea of summoning vehicles (for-hire or one's personal vehicle) to pick up someone and take them where they need to go. In the case of a personal vehicle, the concept is that after delivering the person, the car could be sent home or to a remote parking space.

Without a steering wheel and pedals it would be impossible to drive the car

Mr. Schmidt indicated that he didn't know the exact timetable for autonomous vehicles to be on roads. "It's very hard to know," he told the shareholders at Alphabet's annual meeting. "The consensus I think within the company is that it's some years, not decades, but it is very much dependent on regulation. And it also depends on where you are. It's obviously a great deal easier to do this in areas that, for example, have ample parking." It appears from his remarks that he views the main rationale for getting autonomous vehicles on America's highways soon is their potential impact on the highway traffic death toll, estimated to total 32,800 people in 2016.

"The consensus I think within the company is that it's some years, not decades, but it is very much dependent on regulation"

Mark Rosekind, the head of the NHTSA, speaking at an auto industry conference discussed the safety aspect of autonomous vehicles. Highway deaths from traffic accidents jumped last year to 38,300 from 32,675 in 2014. The increase in highway deaths was obviously a by-product of the growth in miles traveled in response to an improved economy and sharply lower gasoline prices. We think the ubiquitous presence of cell phones is a contributing factor to more traffic accidents and deaths. As Mr. Rosekind suggested, "It's a 747 crashing every week for a year, that's what the losses are on our highways. And that is unacceptable." He further suggested that the bar for safety due to autonomous vehicles needs to be raised. "We need to set a higher bar if we expect safety to actually be a benefit here."

The increase in highway deaths was obviously a by-product of the growth in miles traveled in response to an improved economy and sharply lower gasoline prices

The NHTSA head didn't disclose what would be included in the regulations for autonomous vehicles that would be released in July by his boss, U.S. Transportation Secretary Anthony Foxx. At the beginning of 2016, Sec. Foxx announced that his department would issue guidelines on safe deployment of autonomous vehicles within six months. Mr. Rosekind said that the rules to be announced will be provide "deployment and operational guidance for how to get all of these autonomous new safety technologies on the road safely." He also indicated that his agency would provide a "model state policy" for local regulations of autonomous vehicles to "help support a uniform, consistent framework" of rules for manufacturers and travelers. He also stated that the agency will identify "new tools and

The rules to be announced will be provide "deployment and operational guidance for how to get all of these autonomous new safety technologies on the road safely."

authorities to really help advance if not accelerate getting these new technologies on the road safely." We wonder whether this will be another case of the federal government picking winners and losers in regulating/promoting this new technology.

If the U.S. auto industry sells an equivalent number of units as it is selling now, then the 2035 forecast for autonomous vehicle sales will represent about a quarter of new car sales

At the conference, a researcher with IHS Automotive unveiled its latest forecast for autonomous vehicles. They expect several thousand self-driving cars to be on U.S. roads in 2020 and to grow to almost 4.5 million units by 2035. If the U.S. auto industry sells an equivalent number of units as it is selling now, then the 2035 forecast for autonomous vehicle sales will represent about a quarter of new car sales. So how much impact will the self-driving cars have on a fleet that is still largely composed of conventionally-fueled cars?

The Adrian Flux policy does give discounts for driverless features

An interesting development is that British insurance company Adrian Flux has offered "the U.K.'s first personal driverless car insurance policy," according to *The Guardian*. You don't have to own a fully autonomous car in order to buy and benefit from one of their policies, since self-driving cars are not available and likely won't be available until 2020 or later. The Adrian Flux policy does give discounts for driverless features, which spans the range from lane detection, auto parking, and collision avoidance through to ABS, or antilock braking systems.

The insurance policy also covers claims arising from incidents in which the car is at fault, which will become a serious liability issue for the insurance industry as it is unclear whether the auto company or its software developer may be held liable in certain accidents

The Adrian Flux autonomous vehicle insurance policy has other modern technology coverage terms. It includes coverage for satellite failure or other outages that affect navigation systems, vehicle operating system failure, the loss or damage because a human didn't override a faulty self-driving system, failure to install software and security updates and patches, and loss or damage if the car gets hacked. The insurance policy also covers claims arising from incidents in which the car is at fault, which will become a serious liability issue for the insurance industry as it is unclear whether the auto company or its software developer may be held liable in certain accidents. From the description of the Adrian Flux autonomous vehicle insurance policy terms, it would seem they have decided that they are insuring the car rather than the driver.

Exhibit 18. Testing Autonomous Braking Systems

Source: Insurance Institute for Highway Safety

The two auto insurers offering rate discounts cite crash data showing that vehicles equipped with automatic braking are involved in fewer rear-end crashes

At the same time the Adrian Flux was announcing its self-driving vehicle policy, an article by the *Associated Press* reports that only two of the eleven largest U.S. auto insurers offer discounts for the various new electronic safety devices such as automatic braking, lane departure warning, or blind spot detection. That is significant since these new electronic safety devices are expensive options for new car buyers. The two auto insurers offering rate discounts cite crash data showing that vehicles equipped with automatic braking are involved in fewer rear-end crashes. The other insurers say they are studying their claims data before deciding whether to offer discounts. According to a new report from the Insurance Institute for Highway Safety, 40% of rear-end crashes would be cut if all cars had automatic braking, meaning that about 700,000 crashes a year would be prevented, based on 2013 data.

"Something that used to cost 60 or 70 bucks for an emblem to be replaced now can cost a couple of grand."

One of the offsets to the policy discounts is increased repair costs associated with these electronic safety devices. The radar sensors and cameras used for automatic braking are expensive to replace. They are often located within emblems or bumpers. According to a spokesman for Allstate Insurance, "Something that used to cost 60 or 70 bucks for an emblem to be replaced now can cost a couple of grand." We also have little experience with what maintenance costs for these safety systems are going to be.

The insurers have also pointed out that they often cannot tell from the vehicle identification number (VIN) whether the car has the new technology

The implication of the article was that the insurance companies will slowly grant discounts for these electronic safety devices. The problem is that the discounts currently being offered are minor. In one case, the discount was $30 on a $1,000 policy, or 3%. Equally important, the automatic braking technology can add as much as $2,000 to the purchase price of such an equipped vehicle. The insurers have also pointed out that they often cannot tell from the vehicle identification number (VIN) whether the car has the new technology. As a result, insurers are working with the auto companies to get better information about new cars and how they are equipped.

The problem is that the public may not want this technology

Does all this focus on driverless cars and autonomous vehicle technology matter? It does if you are working for a high-tech company aggressively developing autonomous vehicle technology, or an auto company planning on building and selling these models and being in the mobility business, or a government official who sees autonomous vehicle regulation as a new career opportunity. The problem is that the public may not want this technology. A recent survey by the University of Michigan, which had results similar to a survey it conducted in 2015, showed that 43.8% of those surveyed don't want self-driving features in cars, 40.6% favor partially-equipped vehicles, and only 15.6% are in favor of totally-driverless features. Another survey conducted for AAA found that 75% of those surveyed stated that they felt too afraid to ride in a self-driving car.

The AAA survey points to the challenge for this technology, which is important considering cars are one of the largest expenditures an average person makes

These cross-currents in the auto market over autonomous vehicle technology will act as a brake on the pace of its acceptance. Forecasters like to focus on leading-edge technologies and extrapolate their penetration rates in their forecasts. The AAA survey points to the challenge for this technology, which is important considering cars are one of the largest expenditures an average person makes. As data from the subprime automobile lending business has demonstrated, people will pay their car note ahead of all other credit bills because they are critical for generating income. We wonder how rapidly autonomous vehicle technology will be accepted by the public. Is it possible, as one person has suggested, that driverless cars are a solution in search of a problem?

Nonexistent U.S. Offshore Wind Gets Strange Boost

Because offshore wind is developing so slowly, they may not benefit from these tax breaks

An article we read providing a mid-year update on the U.S. offshore wind business had some interesting revelations. The article began by citing the positive comments of speakers at the recent American Wind Energy Association (AWEA) annual conference in New Orleans about the positive impact of Congress's extensions of the production tax credit (PTC) and investment tax credit (ITC) for renewable fuels in December 2015. Yes, this legislation has provided greater certainty for onshore wind farm developers, but because offshore wind is developing so slowly, they may not benefit from these tax breaks.

"Offshore wind has tremendous potential in the United States, but unlike the onshore wind sector, offshore still has a long way to go to reach critical mass"

In commenting about offshore wind, the authors of the article wrote: "Offshore wind has tremendous potential in the United States, but unlike the onshore wind sector, offshore still has a long way to go to reach critical mass. [No surprise as there are no offshore wind farms now.] The recent PTC/ITC extensions ramp down by the early 2020s. As a result, only a few early offshore projects are likely to be far enough along to benefit from the PTC/ITC extensions. Absent a further tax incentive specifically directed to offshore wind, as recently proposed by Senators Markey (D-Mass) and Whitehouse (D-RI), offshore wind will continue to rely on state-level policies to build out the necessary supply chain."

So while there are attractive reasons for constructing offshore wind farms – the greater wind resource, its more stable nature – their economics do not work without subsidies, even with high-priced power purchase agreements forced on the local electricity companies by government mandates.

The article went on to talk about the mandates in Massachusetts, New York and Maryland supporting offshore wind development. They also mentioned the legislation to boost offshore wind for New Jersey, but it was vetoed by Governor Chris Christie (R-NJ). The article also discussed the positive effort of the federal government to develop offshore wind resource leasing.

Icebreaker was chosen over wind projects offshore Virginia and Oregon

What the article failed to mention was the Department of Energy's recent grant of $40 million to Lake Erie Energy Development Co. for its proposed "Icebreaker" project for six 3.45 megawatt wind turbines to be installed 8-10 miles off the coast of Cleveland. Icebreaker was chosen over wind projects offshore Virginia and Oregon. We wonder about the determining factor that secured the award.

It will take significant subsidies to make these offshore projects viable, but political forces will make it happen

Offshore wind power is hugely expensive compared to all other forms of electricity generation. It will take significant subsidies to make these offshore projects viable, but political forces will make it happen. The importance of the upcoming presidential election was the concluding point of the offshore wind mid-year update.

"By contrast, a Clinton Administration in 2017 could be fertile ground for executive actions seeking to accelerate progress in the industry"

The authors wrote: "The outcome of the upcoming presidential election obviously will be critical for offshore wind. Donald Trump is on record as a virulent opponent of offshore wind and has embraced a fossil-focused energy policy. By contrast, a Clinton Administration in 2017 could be fertile ground for executive actions seeking to accelerate progress in the industry. Offshore wind participants should begin organizing now to present transition materials and advocate for inclusion in first 100 days initiatives." Do you think they consider Hillary Clinton's election a slam dunk?

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