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## MUSINGS FROM THE OIL PATCH

August 1, 2017

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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

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### Did OPEC Headline Signal The Bottom For Oil Prices?

**All of this data helped lift oil prices**

Last week, *The Wall Street Journal* featured an article with the headline: "OPEC Takes Blame for Low Price." While not on the first page, it was above the fold on the front page of the second section of the paper, meaning it was assigned greater prominence than other articles. Oil prices that morning opened at \$45.62 a barrel for West Texas Intermediate futures but climbed higher by the end of the day to \$46.34, a 1.6% rise. Last week, oil prices exceeded \$49 a barrel. Key factors influencing the move that day included positive news from the OPEC technical meeting being held in St. Petersburg, Russia, at which time the organization assessed the performance of its production cut strategy, as well as data showing a slowing in the U.S. rig count growth, with implications for a slowing in future oil shale output. All of this data helped lift oil prices.

**OPEC expressed concerns about the growing oil supplies from Libya and Nigeria**

Heading into the weekend prior to the St. Petersburg meeting, both Saudi Arabian and Russian oil officials discussed the need for greater compliance with the production cut agreement by OPEC members and its non-OPEC supporters. The comments targeted Iraq and the United Arab Emirates who have failed to curtail their output by as much as anticipated. Additionally, OPEC expressed concerns about the growing oil supplies from Libya and Nigeria who were exempted from the production cut quotas due to internal violence that had reduced their output last year at the time the agreement was being forged.

**In the entire scheme of global oil markets, Ecuador's additional output will have little impact**

While not mentioned as a specific target, OPEC has to be concerned about member Ecuador saying it would no longer participate in the production cut plan and reversed its 25,000 barrels a day output reduction. In the entire scheme of global oil markets, Ecuador's additional output will have little impact. However, the move signals the pressure many of OPEC's smaller

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**He discussed Saudi Arabia's plan to cap its exports at 6.6 million barrels a day starting in September**

members are under for additional income as a result of continuing low oil prices. Ecuador's move highlights OPEC's need to push for greater compliance with the production quota cut, as other member countries may seek to ignore or cheat on the agreement in order to generate additional income.

Another message delivered after those weekend discussions and the Monday meeting was Saudi Arabia energy minister Khalid al-Falih's comments about the need for OPEC to clarify the distinctions between its member output and export data. He discussed Saudi Arabia's plan to cap its exports at 6.6 million barrels a day starting in September. That would translate into a roughly 600,000 barrels a day cut, since Saudi Arabia averaged 7.2 million barrels a day for January through June. A question is what will the country's year-to-date exports average following its summer export reductions?

**The significance of Mr. Falih's announcement was the subtle shift in Saudi Arabia's strategy, moving from a focus on oil production to export volumes**

The traditional summer export cut reflects the need for Saudi Arabia to use more oil to power its electricity plants as air conditioning power demand soars with the summer temperatures. Normally, the country sustains its exports by drawing on its oil inventories during those summer months when consumption rises. The significance of Mr. Falih's announcement was the subtle shift in Saudi Arabia's strategy, moving from a focus on oil production to export volumes. That seems to reflect the frustration Saudi Arabia is having in keeping OPEC's compliance high with the production cut agreement in the face of weak oil prices. Saudi Arabia believes the organization needs to do a better job in reconciling its members' exports against their production so that the oil traders will understand that the oil market has rebalanced and global inventories are starting to trend lower, which will increase oil prices.

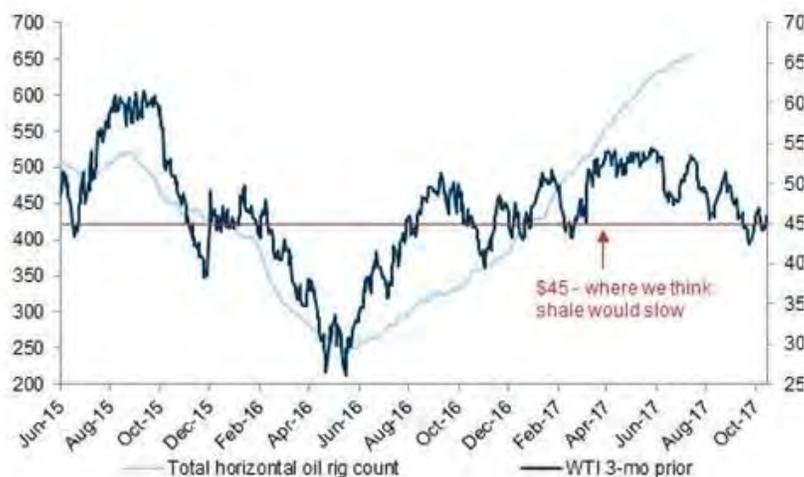
**The organization continues to be challenged in developing a strategy for managing its role within the global oil supply stream that works, given the new dynamics of today's oil market**

The *WSJ* article's headline got us thinking about the 12 step program of Alcoholics Anonymous, something that has been referenced by at least two senior energy executives this year. The first step of the 12 step program to help alcoholics overcome the destructive power of alcohol is to recognize that "...we were powerless over alcohol—that our lives had become unmanageable." That sure seems to describe OPEC's challenge with global oil production. The organization continues to be challenged in developing a strategy for managing its role within the global oil supply stream that works, given the new dynamics of today's oil market. The market's dynamics are being reshaped by the shale revolution, which has created a new supply player who has not been present for the past 45 years – the United States.

Two factors are disrupting the oil market – continued reduction in the breakeven price for shale wells and growing exports of U.S. light oil output, which is surplus to the refining industry's needs. The first factor has contributed to a record-setting rebound in the domestic oil drilling rig count, essentially focused in the prolific Permian Basin oilfields. Many analysts recently grew concerned as oil prices dived

toward \$40 a barrel, but the restated focus on boosting compliance with OPEC's production cut agreement, and the sharp fall in weekly U.S. oil inventories, has restored optimism that the oil market has rebalanced. Inventories are falling, and future oil prices will be meaningfully higher.

#### Exhibit 1. Weak Oil Prices Are Putting Brakes On Rig Count



Source: Tom Whipple, ASPO-USA

**Maybe producers are starting to react to the low oil price environment**

A flattening of the increase in the horizontal drilling rig count with lower prices (advanced three months) as shown in Exhibit 1, suggests that maybe producers are starting to react to the low oil price environment. Last week on its earnings conference call, Anadarko Petroleum (APC-NYSE) CEO Al Walker stated, "The current market conditions require lower capital intensity given the volatility of margins realized in this operating environment. As such, we are reducing our level of investments by \$300 million for the full year." That cut represents roughly a 6.5% reduction in capital spending based on the mid-point of the company's guidance earlier this year for capital spending of \$4.6 billion. Last week's two oil rig count increase muddies any conclusions about how widespread the belief is about this new discipline.

**"The biggest problem our industry faces today is you guys"**

Mr. Walker is one of two industry executives to suggest that the problem plaguing the oil business is loose investment demands by its backers. Earlier this year, he suggested to investors: "The biggest problem our industry faces today is you guys. It's kind of like going to AA. You know, we need a partner. We really need the investment community to show discipline."

Mr. Walker's view had a similar ring to the comments of Schlumberger Ltd. (SLB-NYSE) CEO Paal Kibsgaard who said that U.S. land-based producers are "largely driven by the U.S. equity investors who are encouraging, enabling and rewarding short-term production growth in spite of marginal project economics."

**The absence of adequate financial returns from fixed income investments has forced investors to seek higher returns from riskier equity and alternative investments**

For many investors, especially those involved in private equity, the focus on energy relates to the sector's record of generating outsized returns when commodity prices spike. The absence of adequate financial returns from fixed income investments, due to easy-money policies of central banks since 2008, has forced investors to seek higher returns from riskier equity and alternative investments, such as private equity. This search for higher investment returns is creating greater financial risk for investors and the oil industry. This strategy often ends in regret.

Are we seeing those regrets surfacing, given the extremely poor performance of energy equities this year, or is the higher oil price piñata continuing to entice energy investors to swing for dramatic rewards? If the latter, we would echo Argus Energy's Charles Cherington's warning, somewhat tongue in cheek, that "All forecasters share a common trait: they are wrong. Some are only wrong most of the time and most are wrong all the time."

## **What Is The Role Of The Cost Of Power In State Economies?**

**CNBC is attempting to see what qualities each state is promoting when recruiting businesses to relocate to the state or to increase its investment there**

Earlier this month, CNBC released the network's 11<sup>th</sup> ranking of America's Top States for Business. The winner was Washington, followed by Georgia, Minnesota, Texas and North Carolina. The study is based on measuring each state's performance on 66 metrics in 10 categories that are calculated from studying the economic development material produced by the states. In other words, CNBC is attempting to see what qualities each state is promoting when recruiting businesses to relocate to the state or to increase its investment there. The methodology awards points available in each category based on a state's performance in the category. There were 2,500 total points available. They were distributed as follows:

1. Workforce (425 points)
2. Infrastructure (400)
3. Cost of doing business (350)
4. Economy (300)
5. Quality of life (300)
6. Technology and innovation (225)
7. Education (200)
8. Business friendliness (150)
9. Access to capital (100)
10. Cost of living (50)

**This year's competition was extremely intense with five points separating the top three states**

According to the reporter overseeing the study, this year's competition was extremely intense with five points separating the top three states. He mentioned that the study's methodology had changed, which allowed for states to tie in category ratings.

**We think the poor ratings in the first group of categories should have produced a greater drawback in its overall performance**

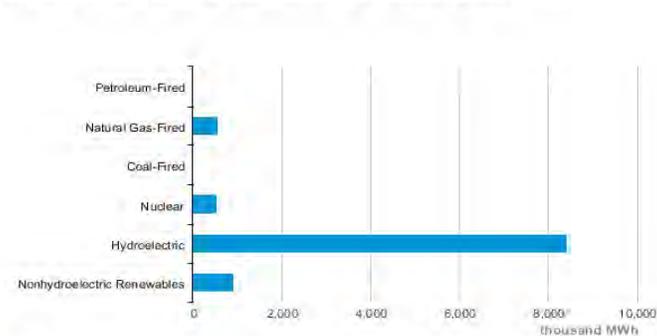
We found the study interesting, and also surprising, based on the categories. Washington, which ranked first overall, was only 32<sup>nd</sup> in Infrastructure, 32<sup>nd</sup> in Cost of doing business, 31<sup>st</sup> in Business friendliness, and 37<sup>th</sup> in Cost of living. The state certainly has some competitive advantages in Technology and innovation (ranked 3<sup>rd</sup>), as it is home to corporate powerhouses such as Microsoft, Boeing, Amazon and Starbucks. It also scored 5<sup>th</sup> in Workforce, 3<sup>rd</sup> in Economy, 5<sup>th</sup> in Quality of life and 8<sup>th</sup> in Access to capital. While these are impressive performances, we think the poor ratings in the first group of categories should have produced a greater drawback in its overall performance.

**The state benefits significantly from cheap hydropower**

One of the measures about state economic performance we thought interesting to study was a state's cost of electricity, especially given the natural advantage certain states have due to their location. For example, in April, Washington state had an overall electricity cost per kilowatt-hour (kWh) of 7.81 cents, which was well below the U.S. average of 10.10 cents/kWh. The state benefits significantly from cheap hydropower, which was helped this past winter by the substantial snowfalls in the west due to El Niño.

**Exhibit 2. Washington State Lives Off Cheap Hydro Power**

Washington Net Electricity Generation by Source, Apr. 2017



Source: EIA

**The dominance of hydropower accounts for the low monthly average electricity cost**

In April, Washington State had just over 80% of its power coming from hydroelectric facilities, with the Grand Coulee Dam the primary contributor. Another nearly 9% of its power came from other renewables, while the balance was split almost evenly between natural gas and nuclear. There was a miniscule amount of power generated by coal and petroleum. The dominance of hydropower accounts for the low monthly average electricity cost.

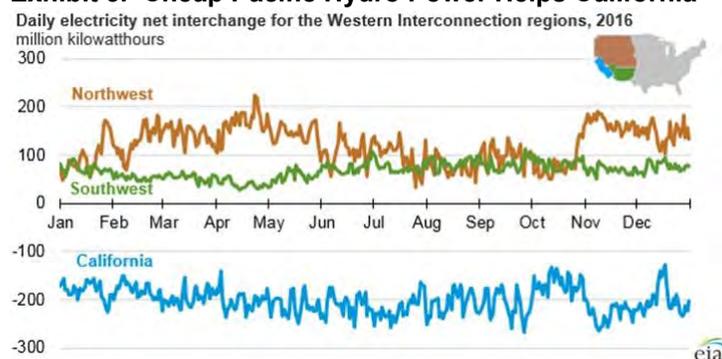
**The second most expensive power was found in New England**

In terms of regions of the country, the most expensive power was found in the noncontiguous Pacific region made up of Alaska and Hawaii. The second most expensive power was found in New England, with an overall cost of 16.38 cents/kWh, but a residential power electricity cost of 19.67 cents/kWh.

**California also benefits from its own cheap hydropower, helped by the record setting snowfall this past year that kept many of the state's ski resorts open past July 4th**

When individual states were ranked after Hawaii (30.33 cents/kWh) and Alaska (21.42 cents/kWh), Massachusetts was 3<sup>rd</sup>, Connecticut 4<sup>th</sup>, Rhode Island 5<sup>th</sup>, New Hampshire 6<sup>th</sup>, Vermont 7<sup>th</sup> and Maine 9<sup>th</sup>. Sneaking in front of Maine was New York and right behind it was New Jersey. Amazingly, California was ranked 16<sup>th</sup>, with a residential electricity cost of 14.09 cents/kWh, still well above the national average. The secret to California's low electricity costs is that it receives roughly 25% of its power from outside the state, principally from Pacific Northwest states, all beneficiaries of cheap hydropower. California also benefits from its own cheap hydropower, helped by the record setting snowfall this past year that kept many of the state's ski resorts open past July 4<sup>th</sup>. In fact, Mammoth Mountain resort reported on its web site that it had received over 600 inches (50 feet) of snow last winter and would still have skiing into early August – a 270 day winter season!

### Exhibit 3. Cheap Pacific Hydro Power Helps California



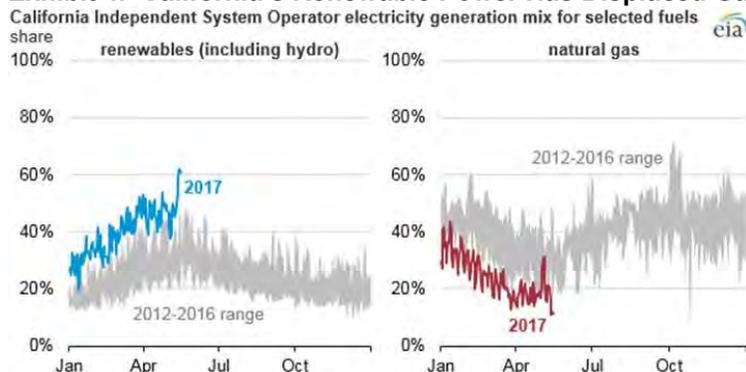
**Texas had an average residential electricity cost of 11.27 cents/kWh, putting it in 38th place**

For those interested, Texas had an average residential electricity cost of 11.27 cents/kWh, putting it in 38<sup>th</sup> place. Unfortunately, the state wasn't the beneficiary of extensive snowfall that could provide long-lasting fuel for power generation. According to the Energy Information Administration's 2015 energy profile of Texas, the state didn't have any hydropower.

**When all the New England states were measured on the categories of Cost of business and Cost of living, they ranked between 32-45 and 30-47, respectively**

It is obvious that high electricity prices play a role in the cost of doing business and the cost of living for states. The high-cost electricity states also happened to be among the worst performing states in the CNBC competition. Of the six New England states, Massachusetts at 10<sup>th</sup> and New Hampshire at 18<sup>th</sup> performed the best in the overall rankings. The other four New England states ranked between 33<sup>rd</sup> and 46<sup>th</sup> overall. But when all the New England states were measured on the categories of Cost of business and Cost of living, they ranked between 32-45 and 30-47, respectively. New York had worse performance on these two measurements than any of the six New England states. California, which finished in 28<sup>th</sup> place overall in the CNBC poll, was 49<sup>th</sup> and 48<sup>th</sup> in the Cost of doing business and Cost of living categories, respectively.

**Exhibit 4. California's Renewable Power Has Displaced Gas**



Source: EIA

**A question that should be asked is whether the surge of renewables into the state power grid is a contributing factor to high electricity bills and weak economic performance**

**Having one of the highest residential electricity costs has not helped the state in its economic recruiting efforts**

Exhibit 4 shows how California has benefited from the winter snow bonanza. A question that should be asked is whether the surge of renewables into the state power grid is a contributing factor to high electricity bills and weak economic performance. Rhode Island, 5<sup>th</sup> in April's electricity cost ranking with a price of 19.64 cents/kWh, announced last week that after 11 years it had now regained all the jobs lost during the economic downturn that began in December 2006, besting eight states yet to restore their job losses.

In October 2008, nearly two years after the downturn started, Rhode Island surpassed Michigan to have the nation's highest unemployment rate at 8.8%, the worst labor market in the three decades of record keeping. Now all those lost jobs have been replaced. Having one of the highest residential electricity costs has not helped the state in its economic recruiting efforts. That effort has also been hampered by high state and local taxes.

A recent article dealt with rumors of tax revisions being considered by the Republican Congress, including potentially the elimination of the federal deduction for state and local taxes. A table in the article listed the top ten states ranked by the average deduction claimed by taxpayers. Note the three New England states on the list.

1. New York (\$21,038)
2. Connecticut (\$18,940)
3. New Jersey (\$17,183)
4. California (\$17,148)
5. District of Columbia (\$15,452)
6. Massachusetts (\$14,761)
7. Illinois (\$12,878)
8. Maryland (\$12,443)
9. Minnesota (\$12,236)
10. Rhode Island (\$12,139)

The three states on that tax list not mentioned previously include Illinois, with a power cost of 13.20 cents/kWh, a CNBC ranking of 31

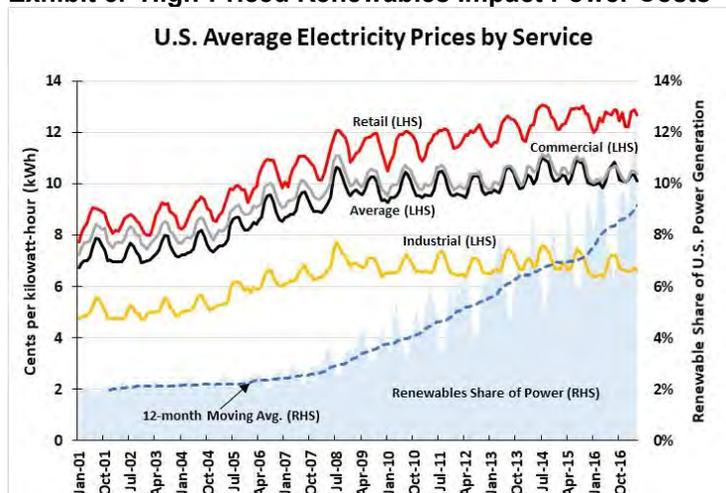
**Another amazing performance was Minnesota that finished 3rd overall in the CNBC competition, but with Cost of doing business and Cost of living rankings of 36 and 31, respectively**

**This trajectory has coincided with residential electricity costs rising to a higher level after 2008 and then to an even higher level after 2014**

and Cost of doing business and Cost of living rankings of 30 and 21, respectively. Another amazing performance was Minnesota that finished 3rd overall in the CNBC competition, but with Cost of doing business and Cost of living rankings of 36 and 31, respectively, and a residential power cost of 13.03 cents/kWh. Maryland had the 15th most expensive residential electricity at 14.33 cents/kWh and a 25th overall CNBC ranking, but with Cost of doing business and Cost of living rankings of 48 and 44, respectively.

Expensive residential electricity is somewhat tied to the growth of renewables. Exhibit 5 shows the average cost of power in the U.S. and the average cost for each category of service: residential, commercial and industrial. We have also plotted the percentage of total U.S. electricity generated by renewables, excluding hydropower. The 12-month moving average of the share of power generation from renewables began climbing at a faster rate in 2008 and has accelerated since 2015. Note that this trajectory has coincided with residential electricity costs rising to a higher level after 2008 and then to an even higher level after 2014.

**Exhibit 5. High-Priced Renewables Impact Power Costs**



Source: EIA, PPHB

**Massachusetts has just passed a mandate for its utilities to buy offshore wind, of which there is none available or even under construction**

While it may be simplistic to link increased renewable use with higher residential power bills, average power bills haven't risen in recent years due to the fall in industrial power prices, which are often tied to special deals for cheaper power. What we do know is that the push by many states for cleaner power has translated into mandates for utilities to use more wind and solar power for fuel. Massachusetts has just passed a mandate for its utilities to buy offshore wind, of which there is none available or even under construction. Maryland is also now pushing the development of an offshore wind farm.

**The primary electricity provider in Rhode Island has just asked for a 53% increase in the fuel cost for residential customers from 6.3 cents to 9.5 cents per kilowatt-hour**

Rhode Island has extended the state's renewable portfolio standard from 14.5% of total power by 2019 to 40% by 2035, and the governor has ordered 100% of the state government's electricity to come from renewable power at that date. The primary electricity provider in Rhode Island has just asked for a 53% increase in the fuel cost for residential customers from 6.3 cents to 9.5 cents per kilowatt-hour, which will lift the average customer monthly bill for 500 kilowatts of electricity by 19%. The rate increase is a reflection of changed power market conditions in New England.

**“When these facilities go off-line, the region goes from having a capacity surplus to a capacity shortfall, creating an increase in capacity prices”**

The health of the New England power market has flipped. “Several major power generating plants in New England have been retired recently, including Brayton Point, Vermont Yankee and Salem Harbor, just to name a few,” said National Grid (NGG-NYSE) spokesman Ted Kresse. “When these facilities go off-line, the region goes from having a capacity surplus to a capacity shortfall, creating an increase in capacity prices.” The New England ISO operator reported that the total cost of the capacity market in 2017–2018 is about \$3.1 billion. In the seven prior auctions, the total capacity cost ranged from about \$1.1 billion to about \$1.8 billion.

**The winter rate rise is directly a function of the lack of transmission capacity to move more natural gas into the region**

National Grid divides its electric billing cycles in Rhode Island into two per year. Rates are typically higher during the cold-weather period, from October 1 to March 31, when electric generators pay a premium for natural gas because of increased demand for the fuel as a heating source. Rates are usually lower in the warmer period, from April 1 to September 31, when heating needs go down. The winter rate rise is directly a function of the lack of transmission capacity to move more natural gas into the region. Efforts to expand that capacity have been blocked by environmentalists in the region, as well as efforts to construct new power plants.

**The other five states rank: 35, 37, 38, 40 and 48**

Are high electricity costs the cause of the poor CNBC rankings of the New England states? It has to be contributing factor to their poor economies, high living costs and high taxes. A new study from the Mercatus Center on the fiscal condition of states confirms that only New Hampshire makes it to the mid-point of the states. The other five states rank: 35, 37, 38, 40 and 48. Capitalizing on the cheap natural gas in the Marcellus basin would be a start in changing these states' trajectory. We are not holding our breath.

## **Canada's Political Scene Shifts Reflect Struggle Over Energy**

**A week ago, the Canadian political scene changed**

A week ago, the Canadian political scene changed with the votes of the members of Alberta's Progressive Conservatives, a decades' old party in the province, and the Wildrose party approving a merger and creating a new conservative political movement – the United Conservative Party. This seismic political development follows on another radical political shift - the formation of a minority government to rule British Columbia - that has not happened in the province since 1952. These two events highlight the growing

**The green movement's social philosophy has boosted energy and electricity bills significantly and is inflicting financial pain on residents**

importance of energy in Canadian political election campaigns. Now, the focus is shifting to Ontario where the campaign for the June 2018 election is underway and the province's electricity bills have become a prime target.

The political battle lines in Canada are being drawn between the benefits of energy for the economy and the desires of the green social philosophy to restrict and reshape a province's energy business. The result has been that the green movement's social philosophy has boosted energy and electricity bills significantly and is inflicting financial pain on residents, while generating social unrest and dissatisfaction.

**Much like the United States, the early years of Canada's history centered on its eastern regions where the initial populace settled and established the nation**

The divisive issues of energy and green social policies has played a role, and at times a very prominent one, in Canada's political history since its founding. Much like the United States, the early years of Canada's history centered on its eastern regions where the initial populace settled and established the nation, while its western and northern regions remained largely uninhabited, but a source of substantial wealth for individuals and provinces, as well as the nation overall, in the form of natural resources, valuable minerals and substantial food supplies.

**Equalization payments were begun in 1957 to help the Atlantic provinces, who were struggling economically and losing population to other Canadian provinces**

Since the founding of the Canadian federation, payments have been made by the federal government to the various provinces, as the former held the taxing power. These transfer payments were based primarily on the needs of the provinces to provide services for their residents, rather than using an income-equalizing approach. Equalization payments were begun in 1957 to help the Atlantic provinces, who were struggling economically and losing population to other Canadian provinces. The sharing scheme was later modified to provide all provinces with similar per capita income as the average, calculated on the basis of three tax classes, of the two wealthiest provinces – Ontario and British Columbia. The tax classes included personal income taxes, corporate taxes and inheritance taxes. A fourth tax class was created later based on 50% of the energy earnings of a province. At the same time, the measure of equality was reduced to the national average of income, rather than the average of income for Ontario and British Columbia. In 1967, the equalization scheme was further revised to work with every province's tax system, with the exception of energy.

**During the 1970s energy boom, the national equalization scheme was tested**

During the 1970s energy boom, the national equalization scheme was tested as "have not" provinces, those whose per capita income fell below the national average, were owed payments from the "have" provinces, those above the average. At the time, the energy-rich western provinces were "have nots," so they were receiving equalization payments at the same time they were pulling in significant sums from the high energy profits being earned in their provinces due to the sharp rise in commodity prices. This situation fueled significant friction within the nation, essentially a division

**The last energy boom sowed the seeds of greater political and social tension that became evident when the oil collapse killed the boom**

between the provinces in the west versus those in the east. In response, the country's constitution was amended to memorialize the right of poorer provinces to receive equalization payments from the government in order to insure a similar level of government services based on a similar tax scheme across the nation.

Since 2004, the equalization payment scheme has been restructured several times in order to make the payments fairer and to prevent provinces who benefited from the payments from being able to rise above the other provinces when their resource revenues were considered. Although the equalization scheme continues to create a certain amount of friction within the nation, the last energy boom sowed the seeds of greater political and social tension that became evident when the oil collapse killed the boom.

**The NDP win was helped by the splitting of the conservative vote between the Progressive Conservatives and the Wildrose party**

During the boom years, Alberta became home to hundreds of thousands of transplanted Canadians and immigrants seeking high-paying energy jobs. One unintended consequence was that the region's politics shifted. That shift became clear with the results of the 2015 Alberta election in which the New Democratic Party (NDP) won majority control of the legislature and installed its leader, Rachel Notley, as the province's premier. The upset victory, helped by the NDP's growing support among voters in the province's two largest cities, Calgary and Edmonton, ended 44 years of rule by the Progressive Conservatives. The NDP win was helped by the splitting of the conservative vote between the Progressive Conservatives and the Wildrose party.

**Alberta's carbon emissions per capita are high because it is home to the nation's oil sands deposits, the third largest proven oil reserve in the world, while it is only the fourth-most populous province**

Although Ms. Notley never indicated during the campaign that she would institute a carbon tax, it is exactly what she did once in office, increasing residents' cost of living. Alberta's carbon emissions per capita are high because it is home to the nation's oil sands deposits, the third largest proven oil reserve in the world, while it is only the fourth-most populous province. These emissions have made Alberta a target of environmental critics. Eliminating the carbon tax is a high-profile goal of the leadership of the founding parties behind the United Conservative Party. The new party program plans to also balance Alberta's budget and slash its ratio of debt to gross domestic product, which has doubled from 6.1% to 13.8% since 2014, given the slump in oil prices and increased social spending due to the downturn. Alberta obtains 8% of its income from oil and other non-renewable resources, down from 18% three years ago.

**The NDP, in partnership with the Green Party, has assumed power, and with an anti-energy agenda**

Further west, a new minority government is now running the province of British Columbia. The NDP on B.C., in partnership with the Green Party, has assumed power, and has an anti-energy agenda. What this agenda means for the construction of the Trans Mountain pipeline expansion, which was approved by the federal and the former provincial government, is unclear. While it is almost impossible for the project, which expects to begin construction this September, to be stopped by the new B.C. government, it can delay

**The Trans Mountain expansion would nearly triple the capacity of the 1,150 kilometer (932 miles) pipeline from Edmonton, Alberta, to Burnaby, B.C. to 890,000 barrels of oil per day**

**Now, the energy/green battle is shifting east to the 2018 election in Ontario**

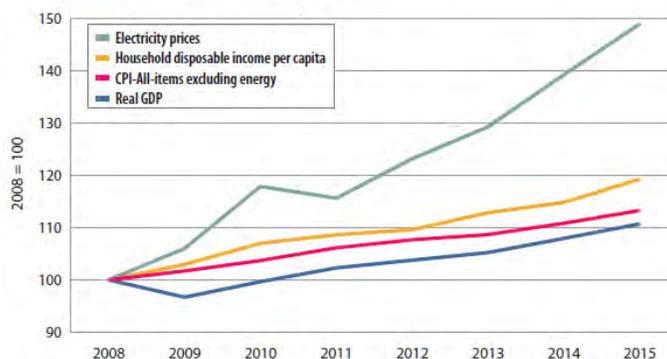
**In 2016, electricity prices had climbed to about 195, while the CPI for all items was at 130**

the process by withholding the permits for river and road crossings, utility access, and construction on Crown land, to name a few, which are necessary for construction to move forward. John Horgan, the new B.C. premier, is at odds with his NDP counterpart, Ms. Notley, in Alberta, and with Canada’s Prime Minister Justin Trudeau, both of whom are supportive of the pipeline project. The Trans Mountain expansion would nearly triple the capacity of the 1,150 kilometer (932 miles) pipeline from Edmonton, Alberta, to Burnaby, B.C. to 890,000 barrels of oil per day, helping Canada access world markets for more of its oil bounty that currently suffers a significant price discount by being held captive to the U.S. market.

Alberta doesn’t have its next election until 2019. The history of provincial minority governments suggests that they seldom complete their full four-year terms. Therefore, given the closeness of the election, it is highly likely that the new B.C. government will experience a similar fate. Now, the energy/green battle is shifting east to the 2018 election in Ontario. Consumers in Ontario are being weighed down by oppressive utility bills as a result of poor policy choices by the government in its attempt to decarbonize the province’s economy.

A recent study by the Fraser Institute showed how utility bills in Ontario have far outstripped household disposable income per capita as well as consumer prices, excluding the cost of energy, over the 2008-2015 period. Another report showed, based on data indexed to 100 in 2002, that in 2016, electricity prices had climbed to about 195, while the CPI for all items was at 130. These analyses show how utility bills in the province are hurting consumer finances.

**Exhibit 6. Ontario’s Electricity Bills Have Soared**  
Comparative growth in electricity prices, inflation, the economy, and income, Ontario, 2008 to 2015 (2008=100)



Sources: Statistics Canada, CANSIM Tables 326-0021, 384-0040; calculations by authors.

Source: Fraser Institute

The government claims that a major reason for the increase in electricity rates was the spending necessary to refurbish the power system and to secure additional power sources. In 2009, the

**The law's aim was to create 50,000 green jobs, but the latest province data points to only 10,000 jobs having been created**

Ontario legislature enacted the Green Power and Green Economy Act designed to expand renewable energy production, encourage energy conservation and create green jobs. The law's aim was to create 50,000 green jobs, but the latest province data points to only 10,000 jobs having been created. The law also enacted various feed-in tariffs for renewable power purchased from suppliers in the province that were designed to promote their development. The generators were guaranteed their contract rates for 20 years, and the contracts were with the Ontario Power Authority to insure that future governments could not change them.

**Roof-top solar in 2009 had a starting feed-in rate of C\$0.80 (\$0.64) per kilowatt-hour**

Roof-top solar in 2009 had a starting feed-in rate of C\$0.80 (\$0.64) per kilowatt-hour (kWh). As of January 1, 2017, that rate had been reduced to C\$0.32-C\$0.29/kWh (\$0.26-0.23 kWh), depending on the size of the installation, due to the surge in installed capacity. The lucrative initial feed-in incentive stimulated 50,000 applications for solar installations of up to 10 kilowatts. As of 2011, only 9,000 of those installations had been connected. According to the Independent Electricity System Operator's (IESO) web site last week, it is still accepting applications until December 28, 2017, for up to 28 megawatts (MW) of Micro Fit power system installations out of the 50 MW authorization.

**New wind farms are provided a guaranteed price and preferred access to the transmission grid**

Wind power has also benefitted from the Green Power Act. Again, these new wind farms are provided a guaranteed price and preferred access to the transmission grid. Because, like solar, wind is an intermittent power source, it often is delivered when the power is not needed so it must be dumped (shipped elsewhere) where the IESO must pay the recipient to take the power. A 2013 Fraser Institute report stated this about wind:

**"Eighty percent of Ontario's generation of electricity from wind power occurs at times and seasons so far out of phase with demand that the entire output is surplus and is exported at a substantial loss"**

"On average, due to daily and seasonal wind patterns in Ontario, a 1% increase in wind power production coincides with a 1% reduction in consumer power demand. Eighty percent of Ontario's generation of electricity from wind power occurs at times and seasons so far out of phase with demand that the entire output is surplus and is exported at a substantial loss. The Auditor-General of Ontario estimates that the province has already lost close to C\$2 (\$1.6) billion on such exports. Data from the Independent Electricity System Operator (IESO) shows Ontario now loses, on average, C\$24,000 (\$19,300) per operating hour on such sales, totaling C\$200 (\$161) million annually. The loss rate will continue to grow with every new wind turbine installation because the mismatch between the timing of wind-powered generation and Ontario electricity demand is structural."

The closure of coal-fired power plants, the decision to cancel two natural-gas fired power plants and a questionable future for the three nuclear power plants in the province are certainly going to impact consumer utility bills. A study by the Ontario Ministry of Energy projected that electricity bills might rise from C\$138 (\$110) in 2013

to C\$210 (\$169) a month in 2032, a 52% increase, but the ministry is revising its estimates.

A more important question is what has happened to Ontario consumer power bills. A February study by *CBC* showed a significant cost increase over the past decade. Roughly 90% of Ontario's five million residential and small business customers use time-of-use pricing. The cost is divided into three categories: off-peak, mid-peak and on-peak pricing.

**When totaled, the average household bill in Ontario rose from C\$40.03 (\$32.19) in 2006 to C\$83.18 (\$66.90) per month in 2016, more than a doubling**

Off-peak pricing applies to electricity used between 7 p.m. and 7 a.m., as well as weekends and holidays. Since 2006, the price for this power (in Canadian dollars) rose from 3.5 to 8.7 cents/kWh, an increase of nearly 150%. This power category represents about 65% of consumer electricity consumption. Mid-peak pricing, about 18% of power usage, has seen its cost climb by more than 85%, from 7.1 to 13.2 cents/kWh. On-peak pricing has gone up from 10.5 to 18.0 cents/kWh, more than a 70% increase. On-peak pricing accounts for about 17% of a customer's usage. When totaled, the average household bill in Ontario rose from C\$40.03 (\$32.19) in 2006 to C\$83.18 (\$66.90) per month in 2016, more than a doubling.

**That expense has risen from an average of C\$351 (\$282) million per month, or roughly C\$4 (\$3.2) billion annually in 2009 to more than C\$1 billion (\$800 million) per month, or C\$12 (\$9.7) billion annually now**

Much of the price increase is due to the growing Global Adjustment fee, a hidden expense on a consumer's bill, but which represents the cost of renewable energy contracts for wind and solar electricity, the cost of operating and refurbishing Ontario's two nuclear facilities owned by the government, as well as a number of conservation and green energy programs. Also in that fee are the payments toward Ontario Hydro's bad debts, any amount of money lost when selling electricity to the U.S., which in 2015 totaled more than C\$1.7 (\$1.4) billion, along with the curtailment expenditure, or payments for energy supplies to not produce electricity. That expense has risen from an average of C\$351 (\$282) million per month, or roughly C\$4 (\$3.2) billion annually in 2009 to more than C\$1 billion (\$800 million) per month, or C\$12 (\$9.7) billion annually now.

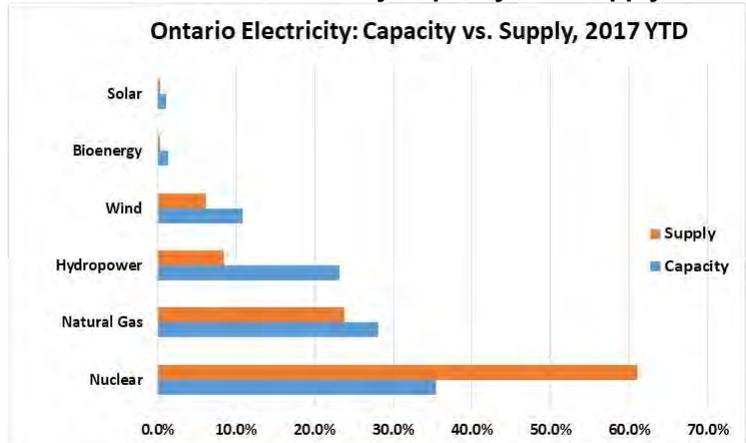
**It is a mess because it has promoted inefficient power sources with expensive price tags**

Exhibit 7 (next page) shows the year-to-date Ontario power market – capacity and supply – by fuel source. For all the efforts of the Green Power and Green Economy Act, the Ontario power market is a mess. It is a mess because it has promoted inefficient power sources with expensive price tags. It is forcing politicians to go through extreme contortions to figure out how to mitigate the cost of this policy before next year's election.

**While nuclear power represents 36% of the province's electric generating capacity, it has produced 61% of the power so far this year**

As the chart shows, while nuclear power represents 36% of the province's electric generating capacity, it has produced 61% of the power so far this year. On the other hand, wind and solar account for 12% of generating capacity, but have produced less than one terawatt (TW) of power out of the 150 TWs generated year-to-date in 2017. The generating capacity of Ontario was 36,564 megawatts (MW), but according to IESO data, the historical record for summer

**Exhibit 7. Ontario’s Electricity Capacity And Supply Balance**



Source: Ontario IESO, PPHB

**Ontario is oversupplied with generating capacity, which adds costs to the bills of utility customers**

**The idea of revising the cost of the power system in Ontario by remortgaging the debt in such a way as to lower current power costs, but raise them “over the horizon,” is not a long-term viable solution**

power demand in the province was 27,005 MW, while winter’s peak demand was 24,979 MW. The summer peak was on August 1, 2006, while the winter peak was on December 20, 2004. Compared to current generating capacity, these peaks represented 74% and 68%, suggesting that Ontario is oversupplied with generating capacity, which adds costs to the bills of utility customers.

Correcting the policy actions will require much time and cost-sharing reconfiguration. Applying band aids to the problem as the current Ontario government is doing, will only create worse problems for residents in the future. The idea of revising the cost of the power system in Ontario by remortgaging the debt in such a way as to lower current power costs, but raise them “over the horizon,” is not a long-term viable solution. It is a political solution that fails to recognize the high costs to the power system of inefficient renewables. The experience with renewables in Ontario, as well as Germany and several Scandinavian countries, demonstrates the dilemma they pose for reducing carbon emissions while trying to keep consumer utility bills low. Residents are owed an estimate from politicians of what these policies will mean to their finances.

**Electric Vehicles Boosted By Recent Announcements**

**These steps are in line with the recently announced ban on similar cars in France, but less aggressive than plans in Norway and India**

The British government announced last week that it plans to ban the sale of gasoline and diesel powered cars and vans of any type by 2040. It also said that it will begin a special tax on owners of diesel powered cars in 2020, and that it will provide funds to municipalities in need of help to clean up illegal nitrogen dioxide (NO2) emissions from diesel cars on their roads. These steps are in line with the recently announced ban on similar cars in France, but less aggressive than plans in Norway and India. Norway targets banning these cars by 2025, while India wants them to be ended by 2030. Environmental critics suggest the UK and French bans will not help

**Another possible step may allow cities to ban diesel cars from their roads, something that would only be allowed if no other option existed**

them to achieve their mandates for controlling climate change. With cars having an expected life of 15 years, banning sales in 2040 means these vehicles will be on the road until at least 2055.

The British declaration is part of a £3 (\$3.9) billion plan to control pollution from diesel cars that resulted from a law suit. The group that brought the suit sought a scheme to eliminate diesel cars by having them bought back. U.K. Environmental Secretary Michael Gove said that his plan would not involve a diesel car buyback as it was hard to punish people who bought them ten years ago in response to the government's push to have people embrace diesel cars due to their lower carbon emissions. Another possible step may allow cities to ban diesel cars from their roads, something that would only be allowed if no other option existed.

Another surprising development was the report that Royal Dutch Shell Plc (RDS.A-NYSE) CEO Ben Van Beurden will switch in September to a plug-in Mercedes-Benz S500e from his present diesel car. Already, Shell's CFO Jessica Uhl drives a BMW i3 electric car. This information fits with the company's shift toward a portfolio of cleaner fuels that started with the purchase of BG Group, a company focused on natural gas.

**"If policies and innovation really work well, I can see liquids peaking in demand in the early 2030s and maybe oil will peak a little bit earlier if there's a lot of biofuels coming into the mix as well"**

Mr. Van Beurden has commented on the potential for peak oil demand. "If policies and innovation really work well, I can see liquids peaking in demand in the early 2030s and maybe oil will peak a little bit earlier if there's a lot of biofuels coming into the mix as well," he said. Shell is planning on investing as much as \$1 billion a year in its New Energies division as the transition toward renewable power and electric cars accelerates. The company has said that it sees opportunities in hydrogen fuel cells and next-generation biofuels for air travel, shipping and heavy freight transport, areas for which batteries aren't adequate.

**The push in Europe to ban internal combustion engine powered vehicles at some point in the future is mushrooming**

The push in Europe to ban internal combustion engine (ICE) powered vehicles at some point in the future is mushrooming, as a very recent German court decision now allows the city of Stuttgart to ban diesel vehicles from its streets. The decision was related to the diesel car emissions software scandal involving German automobile companies. The battle was over whether the car makers could repair or replace the diesel engines, buy them back from their owners, or face them being banned. The court allowed the latter outcome, while sidestepping the other remedies. Stuttgart officials are studying the ruling and have not announced a plan. The German court ruling could be used by other cities in Germany to restrict diesel cars, and possibly all ICE vehicles. The mayors of Paris, Madrid, Mexico City and Athens have said they plan to ban diesel vehicles from their city centers by 2025.

Banning diesel engines, and potentially all ICE cars, will boost electric vehicles (EVs). But are they as green as portrayed? An

**The analyses were performed to show that when the correct heating values of the fuels were used, results may be different than shown by many other studies**

analysis of how EVs compare to gasoline powered cars on measures of energy efficiency and carbon emissions shows that in the real world EVs beat ICE cars in certain cases, but not in all cases, which suggests a possible cheaper emissions solution.

The analysis was conducted by Willem Post and posted on the Wind Task Force web site. The comparison evaluates four ICE cars using E10 gasoline (90% gas/10% ethanol) with 28, 34, 40 and 52 miles per gallon (mpg) ratings. The highest mpg rated car is represented by the Toyota Prius hybrid. The analyses were performed to show that when the correct heating values of the fuels were used, results may be different than shown by many other studies.

With respect to source energy, E10 fuel's rating, which is reduced due to exploration, extraction, processing and transport, as the primary energy fed to the vehicles has to be multiplied by 1.2639. With respect to electricity, Mr. Post wrote: "Electrical energy has a source energy, which is reduced due to exploration, extraction, processing and transport, to become the primary energy fed to power plants, which convert that energy into electricity, which after various losses, arrives at user meters. Therefore, the energy fed to the meter has to be multiplied by 2.8776 to obtain source energy." Based on the 2013 U.S. CO2 emissions of 2,053 million metric tons to match the available 2013 electricity generation data, the EV and E10 vehicles have the following values:

**Exhibit 8. How E10 Vehicles Perform In Emissions Study**

<b>E10</b>				<b>Prius</b>
mpg	28	34	40	52
kWh/65 miles, to wheels	16.67	16.67	16.67	16.67
Btu/kW	3412	3412	3412	3412
Btu/65 miles, to wheels	56878	56878	56878	56878
miles in one hour	65	65	65	65
Btu/gal	112114	112114	112114	112114
Btu/65 miles, T-t-W	260265	214336	182185	140143
eff, T-t-W	<b>0.219</b>	<b>0.265</b>	<b>0.312</b>	<b>0.406</b>
SE factor	1.2639	1.2639	1.2639	1.2639
eff, SE basis	<b>0.173</b>	<b>0.21</b>	<b>0.247</b>	<b>0.321</b>
gal/65 miles, T-t-W	2.321	1.912	1.625	1.25
Btu/65 miles, SE basis	328948	270899	230264	177126
lb CO2/gal, SE basis	23.95	23.95	23.95	23.95
lb CO2/mile, SE basis	0.86	0.7	0.6	0.46
g CO2/km, SE basis	241	199	169	130
g CO2/km, T-t-W	191	157	134	103
L of E10/100 km, T-t-W	8.4	6.92	5.88	4.52
<b>Energy efficiency, SE basis</b>				
EV better than E10, %	27.3	11.7		
EV worse than E10, %			3.9	35.1
<b>CO2, SE basis</b>				
EV better than E10, %	44.3	32.3	20.4	
EV worse than E10, %				3.5

Source: Wind Task Force, PPHB

**With respect to carbon emissions, the EV is only outperformed by the high mpg E10 vehicle**

As shown from that data, the EV outperforms the two lower mpg E10 vehicles on energy efficiency related to source energy. With respect to carbon emissions, the EV is only outperformed by the high mpg vehicle.

**Exhibit 9. How EV Performance Has Improved**

EV	2013	2016
kWh/65 miles, to wheels	16.67	16.67
eff, M-t-W	<b>0.684</b>	0.684
kWh/65 miles, M-t-W	24.371	24.371
kWh/mile	<b>0.375</b>	0.375
Btu/kW	3412	3412
Btu/65 miles, M-t-W	83155	83155
SE factor	2.8776	2.8776
Btu/65 miles, SE basis	239287	239287
lb CO2/kWh, SE basis	1.2712	<b>1.1275</b>
lb CO2/mile, SE basis	0.477	<b>0.423</b>
g CO2/km, SE basis	134	<b>119</b>

Source: Wind task Force, PPHB

**In this case, only an E10 with a mpg rating of 45 or greater will have less CO2 emissions than an EV**

When cleaner electricity grid data is used (2016), the EV does even better. Note that the 2016 CO2 emissions are lower than the 2013 data – 1,821 versus 2,053 million metric tons. Assuming that the electricity generation data is similar for the two years, then the pounds of CO2 per kilowatt-hour drops to 1.1275 from 1.2712 and the EV CO2 emissions per mile falls to 0.423 from 0.477. In this case, only an E10 with a mpg rating of 45 or greater will have less CO2 emissions than an EV.

**The bottom line is that high-efficiency ICE vehicles, including hybrids, will have greater energy efficiency than EVs, and less CO2 emissions than EVs, on a source energy basis**

According to the blog post, an upstate New York owner of a Tesla Model S measured his house meter kilowatt-hours (kWh), his vehicle meter kWh, and the miles he drove for one year and sent in his data. There was significant variation in the kWh/mile data, with an annual average of 0.392 kWh/mile, for meter-to-wheel efficiency. The range of monthly measures was between 0.290 and 0.400 kWh/mile. This real world data shows a measure higher than the 0.375 kWh/mile used in the comparison of EVs to ICE vehicles. This higher efficiency has the effect of reducing the 45 mpg threshold for ICE vehicles to outperform EVs. The bottom line is that high-efficiency ICE vehicles, including hybrids, will have greater energy efficiency than EVs, and less CO2 emissions than EVs, on a source energy basis. Moreover, the technology of hybrids is more established and would be less costly in transitioning the world to a cleaner vehicle fleet. Remember, these analyses also don't necessarily capture the legacy emissions of EVs and ICE cars, a significant penalty for EVs. Maybe EVs are not the wisest environmental choice.

## Canada's Energy Sector Receives An LNG Body Blow

**In the case of natural gas, Canada's export volume growth over the years was propelled by the need for increased supply to meet America's growing gas consumption**

**Exporting crude oil to U.S. refiners has been the most feasible and easiest option for Canadian producers**

**As long as the wellhead discounts exist, Canadian oil will find a welcomed home in the U.S. oil market**

**The legislative push to increase state mandates for using more renewable fuels is powerful and is capturing more market share**

The health of the Canadian economy has been, and continues to be tied to the long-term development of its natural resource sector, in particular its oil and gas industries. Throughout Canada's history, its energy sector's health has depended on increased exports to the United States. In the case of natural gas, Canada's export volume growth over the years was propelled by the need for increased supply to meet America's growing gas consumption when U.S. supplies were inadequate due to low gas prices and/or heavy-handed regulation that restricted supply development. For crude oil, the peak in U.S. production in 1970 opened the door for increased exports from Canada, which continued to grow over time until recently.

The United States has the largest refining capacity in the world, while Canada's is merely one-tenth the size. That means exporting crude oil to U.S. refiners has been the most feasible and easiest option for Canadian producers, as opposed to investing in building refineries and having to then figure out how to export petroleum products to the U.S. and/or the world. The U.S. Gulf Coast refining industry has multiple options for selling its output globally, suggesting it can maximize profitability many ways, especially if it can buy cheaper feedstocks.

After 2007, as U.S. shale gas output accelerated, Canada's natural gas exports declined. On the other hand, Canada's crude oil and bitumen exports to the U.S. have grown steadily since 2010, largely due to U.S. production declines and the opportunity to export more refined product to the world. For Canada's oil, its only real export option is to the U.S., which weakens its negotiating strategy. As a result, Canadian wellhead prices fell to a meaningful discount from U.S. wellhead prices, which is further depressed due to their increased transportation cost. As long as the wellhead discounts exist, Canadian oil will find a welcomed home in the U.S. oil market. Natural gas is another story.

If U.S. natural gas output grows, or the country's consumption fails to increase, Canadian supplies will continue to struggle to find room in this market. Increased natural gas consumption had depended on the cleaner-burning fuel displacing the cheaper, but much dirtier, coal. That struggle continues, largely shaped by the relative cost of the two fuels. The shutting down of more old coal-fired power plants will further challenge the domestic coal business. The question for natural gas is what fuel will be selected to power the electricity generating plants needed in the future. The battle lines are now being drawn between natural gas and renewable fuels – wind and solar. The legislative push to increase state mandates for using more renewable fuels is powerful and is capturing more market share. For domestic natural gas output, the safety valve is exports as liquefied natural gas (LNG). Canada doesn't have a safety valve.

**The project planned to ship 12 million tons per year (MMt/y) of LNG from Northeast British Columbia in 220 annual shiploads**

Any hopes for such a safety valve being created just received a huge body blow with the announcement by Malaysia's state-owned Petronas that its C\$26 (\$20.8) billion, majority-owned Pacific NorthWest LNG project has been canceled. The project included liquefaction and export facilities on Lelu Island within the District of Port Edward, British Columbia, on land administered by the Prince Rupert Port Authority, along with a pipeline to haul the gas to the terminal. The project planned to ship 12 million tons per year (MMt/y) of LNG from Northeast British Columbia in 220 annual shiploads. The gas supply is being developed by Progress Energy Canada Ltd., purchased by Petronas in 2012, and was to be moved to the coast via a pipeline to be built and operated by a subsidiary of TransCanada Corp. (TRP-NYSE). The project's minority partners included Sinopec, JAPEX, Indian Oil Corporation and PetroleumBRUNEI.

The LNG project received a final investment decision (FID) in June 2015, subject to two conditions. The first condition was satisfied on July 21, 2015, after the Legislative Assembly of British Columbia approved the Project Development Agreement legislation. The final condition was a positive regulatory decision on the project's environmental assessment by the Government of Canada, which was received on September 27, 2016.

The announcement of the project's cancellation was in response to concerns about the new terms for its go ahead, a tougher LNG market outlook following Qatar's recent expansion announcement, and a global LNG price that is about a quarter of what it was three years ago when the Petronas project's plans were being considered.

**Petronas faced new demands from the recently installed British Columbia government**

Petronas faced new demands from the recently installed British Columbia government. Premier John Horgan signaled the new mandates in a letter to the province's new energy minister. In his mandate letter, Premier Horgan indicated the government wanted higher carbon taxes, a "fair" return for the resource, partnerships with First Nations, and protection for "our air, land and water including living up to our climate change commitments." These increased demands mean higher costs for the project at the same time the price for LNG in the Asian market is a fraction of what it was three years ago. These demands came at the same time the global LNG market looks to be heading toward a significant oversupply condition following Qatar's July 4<sup>th</sup> announcement that it would be expanding its LNG export capacity from 77 to 100 MMt/y, or about a 30% increase.

### Exhibit 10. North American LNG Export Terminals CANADIAN LNG DREAMS DASHED AS PETRONAS BACKS OUT



**IMPORT TERMINALS**

- APPROVED – UNDER CONSTRUCTION – FERC
- 1 Corpus Christi, TX: 0.4 Bcfd(Cheniere –Corpus Christi LNG)
- APPROVED – NOT UNDER CONSTRUCTION – FERC
- 2 Salinas, PR: 0.6 Bcfd(Aguirre Offshore GasPort, LLC)
- APPROVED – NOT UNDER CONSTRUCTION – MARAD/USGC
- 3 Gulf of Mexico: 1.0 Bcfd(Main Pass McMoranExp.)
  - 4 Gulf of Mexico: 1.4 Bcfd(TORP Technology-Bienville LNG)

**EXPORT TERMINALS**

- APPROVED – UNDER CONSTRUCTION – FERC
- 5 Sabine, LA: 1.4 Bcfd(Cheniere/Sabine Pass LNG)
  - 6 Hackberry, LA: 2.1 Bcfd(Sempra–Cameron LNG)
  - 7 Freeport, TX: 2.14 Bcfd(Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction)
  - 8 Cove Point, MD: 0.82 Bcfd(Dominion–Cove Point LNG)
  - 9 Corpus Christi, TX: 2.14 Bcfd(Cheniere –Corpus Christi LNG)
  - 10 Sabine Pass, LA: 1.40 Bcfd(Sabine Pass Liquefaction)
  - 11 Elba Island, GA: 0.35 Bcfd(Southern LNG Company)
- APPROVED – NOT UNDER CONSTRUCTION – FERC
- 12 Lake Charles, LA: 2.2 Bcfd(Southern Union –Lake Charles LNG)
  - 13 Lake Charles, LA: 1.08 Bcfd(Magnolia LNG)
  - 14 Hackberry, LA: 1.41 Bcfd(Sempra -Cameron LNG)
  - 15 Sabine Pass, TX: 2.1 Bcfd(ExxonMobil –Golden Pass)
- APPROVED – NOT UNDER CONSTRUCTION – CANADA
- 16 Port Hawkesbury, NS: 0.5 Bcfd(Bear Head LNG)
  - 17 Kitimat, BC: 3.23 Bcfd(LNG Canada)
  - 18 Squamish, BC: 0.29 Bcfd(WoodfibreLNG Ltd)

- CANCELLED
- 19 Lulu Island, BC (Pacific Northwest LNG)

\*FERC: Federal Energy Regulatory Commission  
\*\*MARAD: United States Maritime Administration

SOURCE: FERC/DOE NATIONAL ENERGY

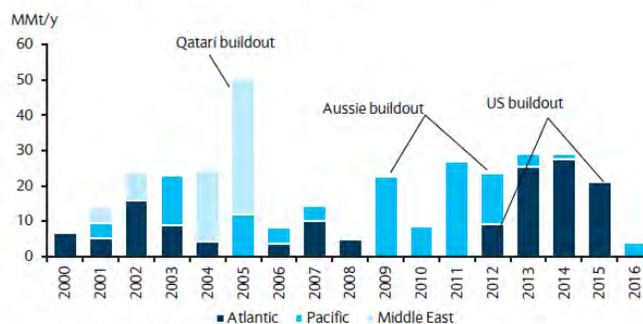
Source: *National Post*

**Earlier this year, Wood Mackenzie analyst Saul Kavonic forecasted a global surplus of about 17.8 MMt/y of LNG by 2019**

As pointed out by several commentators, the Petronas decision seemed more like a rebuke of the newly installed NDP/Green government than a critique of the LNG market. They point to the fact that U.S. LNG projects are continuing to go forward in the face of the “soft LNG market” that Petronas cited. In fairness, there haven’t been any U.S. LNG terminal announcements since Qatar’s expansion announcement. That additional capacity will now be added to the planned global LNG capacity expansion to 454 MMt/y by 2020, up from around 340 MMt/y at the end of last year. The industry capacity growth is being driven by expansions in Australia and the United States, as well as terminals in East Africa and Russia. Earlier this year, Wood Mackenzie analyst Saul Kavonic forecasted a global surplus of about 17.8 MMt/y of LNG by 2019.

### Exhibit 11. History Of Global LNG Capacity Buildout

Global LNG FIDs have reached their lowest volumes since 1999; we expect 2017 to be another slow year given current market conditions



Source: Company reports, Barclays Research

Source: Barclays

**The Qatar expansion represents a 23 MMt/y increase, a volume similar to those posted in 2002-2004, 2009 and 2015**

Earlier this year, Barclays’ published a report on oil and gas industry capital spending, in which the authors discussed the LNG market. They produced a chart (Exhibit 11) showing the history of global LNG FIDs by year since 2000. The Qatar expansion represents a 23 MMt/y increase, a volume similar to those posted in 2002-2004, 2009 and 2015. This expansion will enable 2017 to deliver a healthy capacity expansion. The key point of this chart is that LNG terminal projects in Canada were proposed during the window around the time of the financial crisis period of 2008, but was missed because of fear of delivering gas volumes around now, when people worried about a global oversupply. Now it looks like the next window for LNG terminals for Canada won’t appear until the 2020s.

**As long as Canada’s oil and gas has to flow south to markets – either in the U.S. or as exported volumes – it will suffer at the wellhead**

The concern for Canada’s energy business is that its oil and gas production will continue to struggle to gain direct access to world markets helping ensure higher wellhead prices for its producers. As long as Canada’s oil and gas has to flow south to markets – either in the U.S. or as exported volumes – it will suffer at the wellhead, reducing producers’ income as well as tax revenues flowing into provincial and federal coffers. The Petronas decision could become a challenge for the Canadian oilfield service industry as its

subsidiary, Progress Energy Canada, is one of the most active Canadian drillers, seeking to develop gas output capacity for the LNG project. The optimistic view for Canada's oil and gas industry future to be helped by the Petronas project has now been crushed. The world of Canada's oil and gas will not be destroyed, but its long-term growth prospects will need to be reassessed.

## Is Toyota The Real Auto Technology Leader?

**The company says it has developed the technology to produce a solid-state lithium-ion battery**

Toyota Motor Corp. (TM-NYSE) recently disclosed information about patent applications it has filed in the U.S. dealing with new lithium-ion battery technology that could significantly reduce the charging time for EVs and double their range. The company says it has developed the technology to produce a solid-state lithium-ion battery. The new battery employs a solid glasslike plate for transporting lithium ions within the battery rather than using liquid electrolytes. This plate allow closer packing of lithium-ion batteries, which now cannot be packed tightly due to the fire risk it creates. Looser packing means less charge in the battery pack and, therefore, fewer miles traveled on a single charge.

**Another advantage of these solid-state batteries is that they can handle higher charging currents safely**

Since these solid-state batteries can be packed more tightly, more power can be put into the same space occupied by a current lithium-ion battery, significantly boosting a vehicle's range. Another advantage of these solid-state batteries is that they can handle higher charging currents safely. That allows for faster charging times, assuming the remote charging stations are equipped with more powerful charging current equipment.

**Solid-state batteries eliminate the need for many of the safety features of current lithium-ion batteries, which will help boost their relative cost advantage**

According to the patent applications, solid-state batteries are less susceptible to temperature variations than liquid electrolyte batteries, which is a hidden issue for many EVs who suffer lost power and range due to extreme heat and cold. Additionally, solid-state batteries eliminate the need for many of the safety features of current lithium-ion batteries, which will help boost their relative cost advantage, thereby improving the economics for EVs.

**They only revived their BEV in response to Chinese demands in order to compete in its EV market**

It is interesting that Toyota has made such technological breakthroughs in battery technology since the company had abandoned its efforts to develop a Battery-EV in favor of pushing its hybrid technology. They only revived their BEV in response to Chinese demands in order to compete in its EV market. Now they may have a highly competitive BEV in the market by the early 2020s, assuming their technology continues to perform in line with the patent application claims.

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