

The Critical Role of Natural Gas for Global Energy Security and the Energy Transition

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Bottom Line Messages

- 1.) Natural gas will be the dominant fuel in the ongoing energy transition creating the need for further exploration and development of natural gas resources.
- 2.) The speed of installing offloading LNG terminals in Germany illustrates that once impossible deadlines for building and developing such projects can be developed at record speeds if the need dictates such action.
- 3.) Similar to the Marshall Plan which accelerated Europe's post- WW II recovery, such action may need to be implemented for providing more global natural gas resources.
- 4.) Expect cost over-runs and delays at LNG projects worldwide including the Canada LNG at Kitimat, British Columbia.
- 5.) Will other LNG projects will be developed in Canada?
- 6.) Not included in our presentation is the global role of renewables which have achieved market significance, but a detailed review of renewables is beyond the scope of our presentation.

Introduction

The world is faced with highly complicated and sometimes bewildering choices of energy consumption and simultaneously needing to urgently deal with the following:

- 1.) Continued world population growth, continued economic growth and the corresponding increasing need for energy.
- 2.) Increasing CO₂ in the earth's atmosphere and related global warming.
- 3.) Society's determination to decarbonize and lower the earth's CO₂ continent.
- 4.) The Russia – Ukraine war is forcing governments worldwide to re-examine their dependence on domestic and imported energy, especially oil and natural gas.
- 5.) Russia's invasion of Ukraine is turning the public and investors' interest in renewables. "The sun shines on all countries, the wind blows on all countries – so they get much more energy sovereign (independent) around that" (Bai, J., January 3, 2022).

This presentation provides our view that natural gas will be of critical importance for global energy security. Gas will be equally important in the necessary energy transition.

Undeniably natural gas is a fossil fuel. However, due to gas being the cleanest burning of the fossil fuels and due to its global availability, our view is that a world-wide gas boom is happening which will assist in flattening and then dampening the curve of atmospheric CO₂.

Figure 1 highlights the major gas producing countries and also their levels of gas production in 2022.

The burning of coal provides major supplies of electricity especially in countries like China, USA, Australia and Poland. The increased availability of gas is an incentive for countries to transition from coal-burning electricity plants to gas-fired plants with a corresponding major reduction in CO₂.

We believe that gas boom will also happen since major gas resources are available worldwide but they have been under-explored and under-developed. Sharply increased gas prices in the past year (Figure 2) have provided a huge incentive to explore for and develop gas resources. Natural gas thus will become the key “bridging fuel” or the “transition fuel” during the energy transition. Figure 1 highlights the world’s largest gas producing countries.

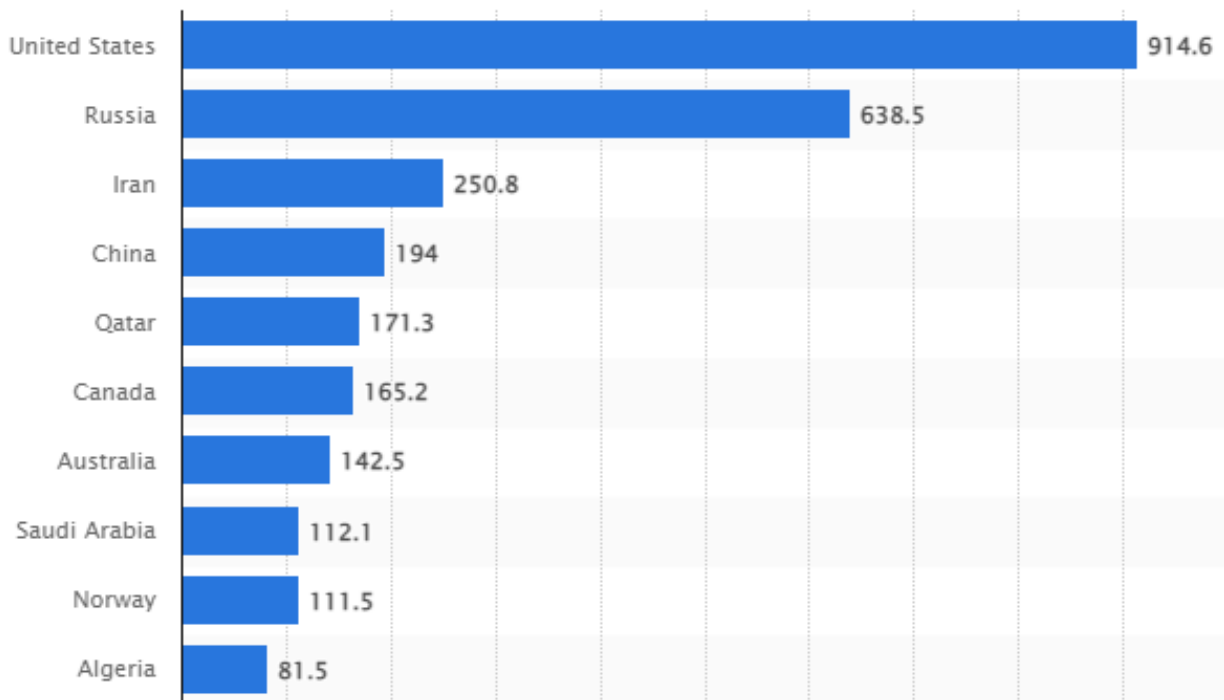


Figure 1. World’s Top Ten natural gas producers. Gas in billions of cubic meters. Excludes gas flared or recycled. From Statista, 2022.

Although there is a worldwide focus now on the energy transition, it is very important for governments and policy makers to realize that the world is still highly dependent on oil. This summary is provided based on current data. Indeed, before the Covid-19 pandemic struck in 2020, the world was consuming close to a near-record of 102 million barrels of oil per day. Now due to the post-Covid-19 economic recovery, oil consumption has resumed almost back to record high rates of consumption.

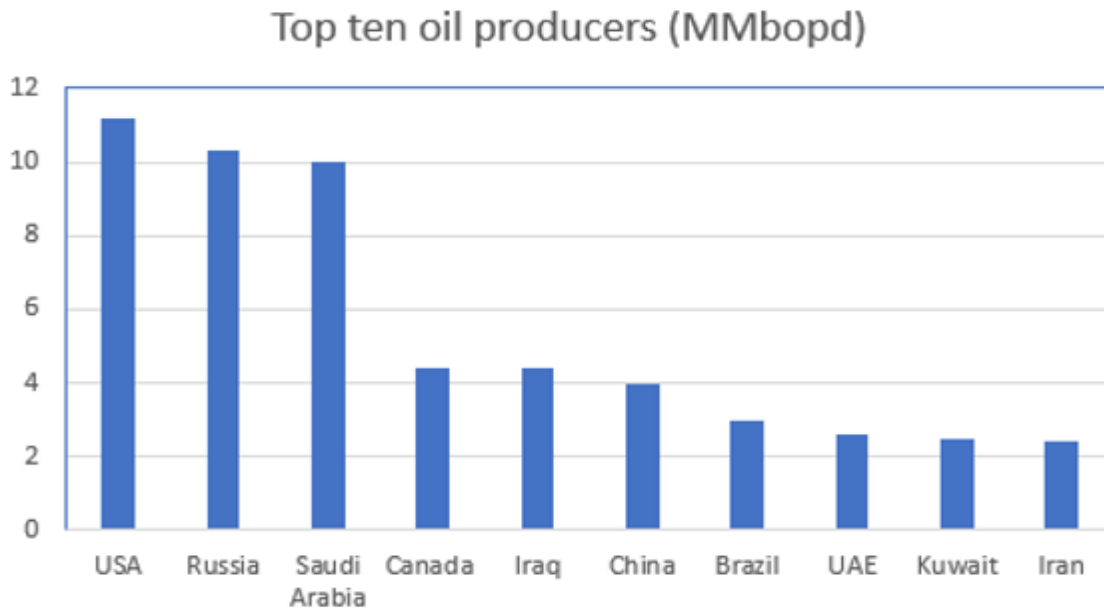


Figure 2. World’s Top Ten Oil Producers. From: Statista, 2022.

The USA is the world’s largest consumer of oil at a rate of 17.2 MMBopd (million barrels of oil per day). To meet its consumption requirements, the USA imports 6.0 MMBopd. China is the world’s second largest oil consumer at 14.1 MMBopd which has resulted in China needing to import oil at a rate of 10.0 MMBopd making it the world’s largest importer of crude oil.

Despite the critical importance of oil to continue to fuel the world’s economy, there remains much uncertainty about oil prices and the availability of oil. In a Special Report in the Oil & Gas Journal by Conglin Xu and Laura Bell, January 9, 2023, they stated “The war in Ukraine pushed up global energy and food commodity prices. High energy and food prices have helped trigger price increases for other goods and services. Central banks around the world are raising interest rates to curb inflation and anchor inflation expectations. The strategy is starting to pay off. However, high interest rates increase financial distress”. In our view, the higher interest rates will definitely dampen economic activity and oil prices.

In the meanwhile, on February 17, 2023 J.P. Morgan Stanley said “Oil Unlikely to Break Above \$100 This Year”. Morgan Stanley sees global GDP growth of 2.2% in 2023, barely recession-proof and below the 3% growth rate in 2022.

The Oil & Gas Journal, January 9, 2023 by Xu and Bell expects the oil market to tighten in 2023 following the European Union ban on Russian crude and products. OPEC+ production cuts also contribute to less oil on the markets. Certainly the US is producing oil at flat out and is not there to fill the gap.

At the time of completing this abstract on February 17, 2023, the global benchmark Brent crude futures were trading around US\$ 84 per barrel.

Russia's Exporting of Oil

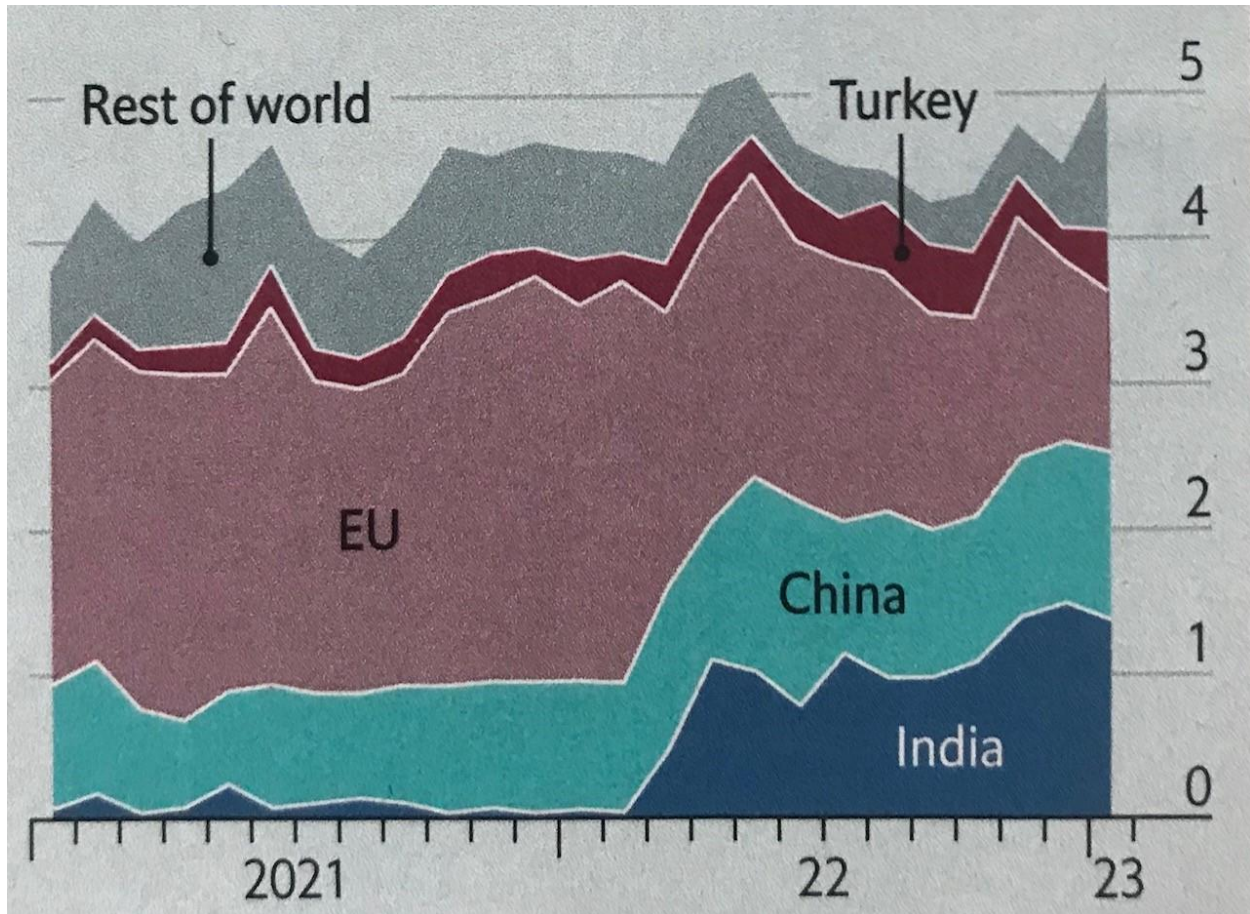


Figure 3. Russia crude oil exports in million barrels of oil per day. Note the decline in exports to the European Union, increase in exports to China and especially a huge increase in exports to India. The oil Russia sells to China and India is sold at a significant price discount. From: Kpler, *The Economist*, February 4, 2023.

According to *The Economist*, February 11, 2023, Russia's revenues from oil and gas fell by 46% in January, year on year, according to the finance ministry. With its spending on the war in Ukraine soaring, Russia's monthly budget deficit ballooned to 1.7 trillion roubles (\$25 billion).

Energy Politics – Global Energy Security

On February 10, 2022, in a major speech to the European Union (EU) the president of the EU, Ursula von der Leyen urged for a faster energy transition and a shift in LNG in response to Russian gas cuts. She said that the EU's master plan for reaching climate neutrality by 2050,

called the European Green Deal, remains the most effective insurance against future increase in energy prices (Upstream, February 14, 2022). Due to Europe's reliance on Russia for 40% of its imported gas and due to the great risk on the availability of Russia's gas, spot prices moved above \$2,000 per 1000 cubic meters in December 2021 triggering a leap in electricity costs across western Europe.

Von der Leyen said "every kilowatt hour of electricity that Europe generates from the sun, wind, hydropower, and biomass makes us less dependent on Russian gas and other energy imports. We have to accelerate the deployment of renewables everywhere in Europe". In the short term, von der Leyen said that the EU members "could do much more" in reducing their dependence on Russian pipeline gas including sourcing alternative supplies of natural gas. She stated:

- "We can jointly procure gas to be a more significant player on the international markets"
- "We can better use and expand our gas storage facilities across Europe. We can build up strategic gas reserves – like we have in place for oil"
- "Today we have more than 20 large Liquefied Natural Gas (LNG) facilities at European ports and Europe's gas infrastructure is deeply interconnected. We are actively engaging with LNG producing partner countries like the US, Norway, Algeria, Azerbaijan and Qatar"

Two weeks after Ms. Ursula von der Leyen gave her speech, on February 24, 2022 Russia invaded Ukraine. Politicians, energy analysts and oil industry analysts and ordinary citizens worldwide immediately began asking the following *questions*:

- Russia's invasion of Ukraine raised urgent questions about Europe's reliance on Russian gas. Was it wise to source 40% of gas supplies from one country, especially one with domestic upheaval and territorial ambition?
- Has Russia's ending of gas exports to Europe opened the way for more sustainable LNG exports to Europe?
- Will the volatile nature of oil and gas prices speed up the use of renewables and raise their value to national security?
- In the UK, soaring gas prices have intensified the debate on energy. The British are asking if their country should continue to invest in high cost and sometimes unreliable renewables? Or should the UK import more LNG from Qatar which is UK's main supplier of LNG?
- Will soaring gas prices accelerate gas exploration and production in Europe in nearby places like Norway?
- Will Europe's ability to import more LNG spur more gas exploration and production in areas further away like the Middle East, Africa and North America?
- Already the USA is the world's largest exporter of LNG. Does the USA have sufficient gas reserves to continue to expand its exports of LNG?
- USA President Joe Biden has promised more LNG exports to Europe. But should not Biden prioritize supplies to American households that also face soaring prices?

- Currently Canada produces no LNG and has under construction the C\$40 billion Shell-operated LNG plant near Kitimat, BC. Should more LNG plants be built along Canada's West Coast?

Mrs. Von der Leyen gave her speech almost exactly a year ago. We explain our views herein on the current global situation on energy with emphasis on natural gas. The senior author lives in Calgary and provides his views on what is happening in North America. Gerard Kreeft living in The Netherlands provides his views on the situation in Europe and beyond.

Global Natural Gas Shortages & Surpluses, 2021 to Present Day

Natural gas prices have been very volatile in the last two years. Prices were rising even before Russia's invasion of Ukraine.

Global Natural Gas Prices

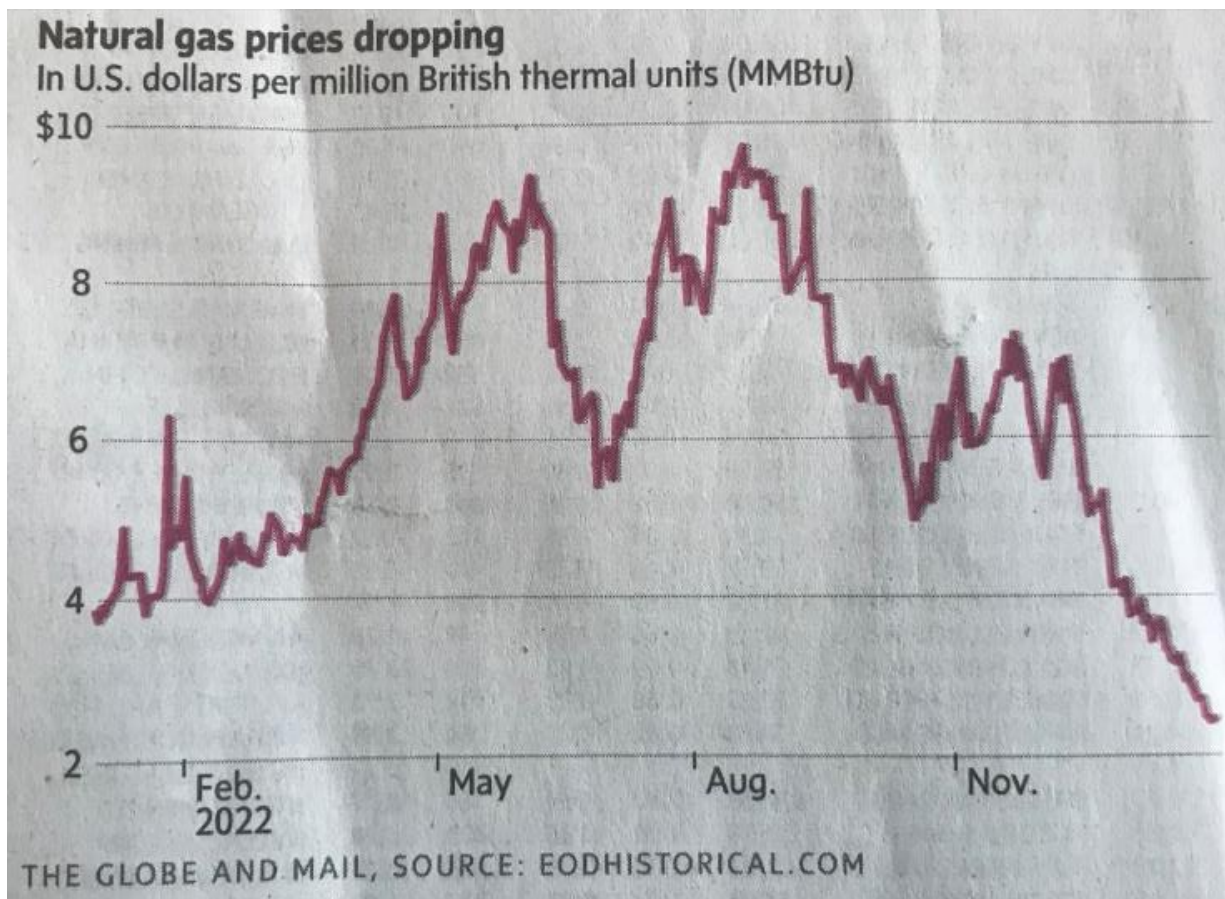


Figure 4. Global gas prices in US dollars per million British thermal units (MMBtu). Prices now are lower than February 24, 2022 when Russia invaded Ukraine. From: *Globe & Mail*, February 7, 2023

Global Gas Futures

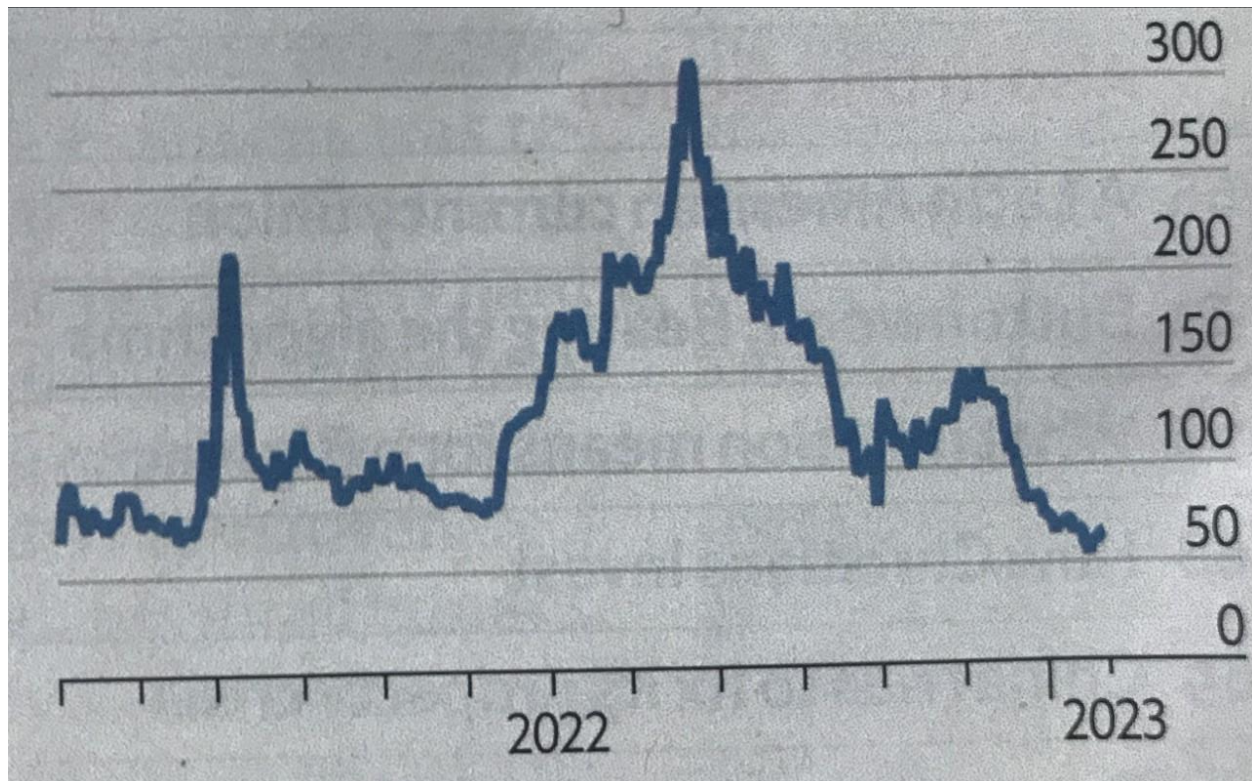


Figure 5. Europe, natural gas front – month futures, Euros per MWh. Gas prices are now lower than February 24, 2022 when Russia invaded Ukraine. From: Schoenle, Refinitiv Datastream, *The Economist*, January 14, 2023.

In 2021 and in the first half of 2022, there were forecasts of natural gas shortages worldwide due to a variety of issues including:

- 1.) The oil price collapse in 2014 – 2015 resulted in a dramatic slowdown in exploration and development of oil and especially gas. Hence, gas is perceived by some to be in short supply.
- 2.) The current global concerns about global warming and record temperatures experienced worldwide in the last few years has resulted in a backlash against oil and gas activities. Many pension funds, sovereign funds and institutional lenders have divested their shares in oil and gas companies. Hence this has made it more difficult for these companies to raise capital for oil and gas exploration and development. This has also led to the current concerns about the availability of oil and gas supplies.
- 3.) We live in a global village and the impact of economic activities in one part of the world can directly impact on other parts of the world. Economists have under-estimated the rate of

economic growth in Asia in the past five years and its impact on the need for energy.

4.) Russia's invasion of Ukraine has dramatically raised concerns worldwide about energy security.

Natural Gas Prices in 2023

However, beginning in early 2023, despite predictions to the contrary, global gas prices have dramatically declined from almost US\$10.00 /MMBTU (million British thermal units) in August 2022 to the current US\$2.50 due to:

- 1.) Higher prices in 2022 resulted in more gas production and ultimately an oversupply which drove down the prices to the current level (from: Brian Donovan, February 7, 2023 Globe & Mail).
- 2.) This winter has been unseasonably warm in Europe and North America resulting in reduced demand
- 3.) Many European countries voluntarily reduced natural gas usage to stockpile gas for the winter months.
- 4.) The Freeport LNG terminal in Texas, which provides 17 percent of US LNG export capacity, shut down in June due to an explosion in the plant. The plant is not expected to be operational again until March, so more US gas will go into storage.
- 5.) Recession fears and the Covid-related lockdowns in China also reduced the demand for gas.

We expect that natural gas markets will continue to be volatile through 2023 as the inflation/recession battle plays out and due to the uncertainty created by Russia's war in Ukraine.

Asia's Role in the Energy Crisis

China is the world's second biggest consumer of oil. However, China is also the world's 3rd largest consumer of natural gas in the world, consuming 370 billion cubic meters (bcm) in 2021. China's enormous need for oil and gas is due to its population of 1.3 billion people and also due its strong economy.

Strong economic growth has been experienced also by Japan, Taiwan, South Korea, Singapore and India leading to sharply increased need for electricity. Japan has reduced its dependance on nuclear electricity due to the Fukushima nuclear power plant disaster and this has led to Japan increasing importing of LNG.

Germany – An Example of Rapid Energy Response to Russia's Invasion of Ukraine

Germany previously imported about half of its gas from Russia and more than a third of its oil. Russia cut of Germany's gas supply in August 2022 while Germany halted Russia's oil imports in early 2023.

In its race to find alternative sources of energy, Germany has reopened coal-fired power plants, delayed plans to shut down its three remaining nuclear power plants and pushed to increase capacity to store natural gas from other countries such as Norway and the USA. On January 18, at the World Economic Forum in Davos, Switzerland, Germany's Finance Minister Christian Lindner said that Germany is no longer reliant on Russian energy. He said "Germany has found new sources of energy. Yes, of course Germany is still dependent on energy imports, but today not from Russian imports but from global markets". At the World Economic Forum in Davos, Switzerland, Mr. Lindner pointed to the speed with which a new liquified natural gas terminal had been built in Germany – in a record eight months, he said. More investments were planned he added. "This is only one example of the enormous change in German policies" he said.

The first full load cargo of LNG for Germany arrived at the LNG terminal in Wilhemshaven in the first week of January, 2023. The gas was loaded at a liquefaction plant in Cameron Parish, Louisiana, USA on December 19, 2022 (Oil & Gas Journal, January 9, 2023). The LNG tanker called Maria Energy was loaded to maximum capacity and brought 170,000 cubic meters of LNG to Germany and marked a historic moment as Germany began weaning itself from its dependence on Russian gas.

Also in January, a second floating regasification unit, FSRU began offloading gas at the industrial port of Lubmin. The Lubmin site is expected to be expanded with the deployment of a second FSRU later this year. Once the two vessels are running by the end of 2023, deliveries will grow to 11.5 Bcm per annum (Upstream, January 20, 2023). The third FSRU terminal is expected to reach operational stage later this year. These three terminals along will add a combined 15 Bcm of regasification capacity, in time for the gas storage refilling season this year. German Vice Chancellor Robert Habeck stated, "For the year 2023 and the winter 2023/2024, I think we have more than justified hope that we will have full storage facilities at the beginning of the winter".

Japan: Re-embraces Nuclear Power – But Risks Underplaying Renewables

The government of Japan is determined to make the country carbon-neutral by 2050. Japan is a country with scant natural resources such as oil, gas and coal. Accordingly, for Japan to become carbon-neutral as well as to be energy independent, they have a difficult task which requires striking a fine balance between safety, energy security and environmental concerns (Economist, January 14, 2023).

Japan has always been highly dependent on imported oil from the Middle East. The oil crisis of 1973 – 1974 spurred Japan to diversify its sources of energy including expansion of its nuclear plants, LNG receiving plants and also renewable technologies under the banner of the "Sunshine Project". By 2010 Japan had built 54 reactors producing about 25% of electricity production. The Fukushima disaster scuppered the plans to continue to build reactors. New laws were passed to stimulate solar power. The share of renewables in electricity generation doubled from 10% in 2010 to over 20% last year. Yet Japan has mainly filled the gap by turning to LNG and coal (see Figure 5??). Adding on well-regulated nuclear plants in order to phase out coal is sound policy

but there is a risk that this will slow or reverse the momentum behind expanding renewables. “The real issue is how to aggressively and rapidly install more solar and wind”, according to the Tokyo-based Institute for Sustainable Energy Policies. They state “Japan is falling behind the global curve. Japan generates about half as much electricity from renewables as its European peers”.

Japan’s Sources of Energy, 1985 - 2021

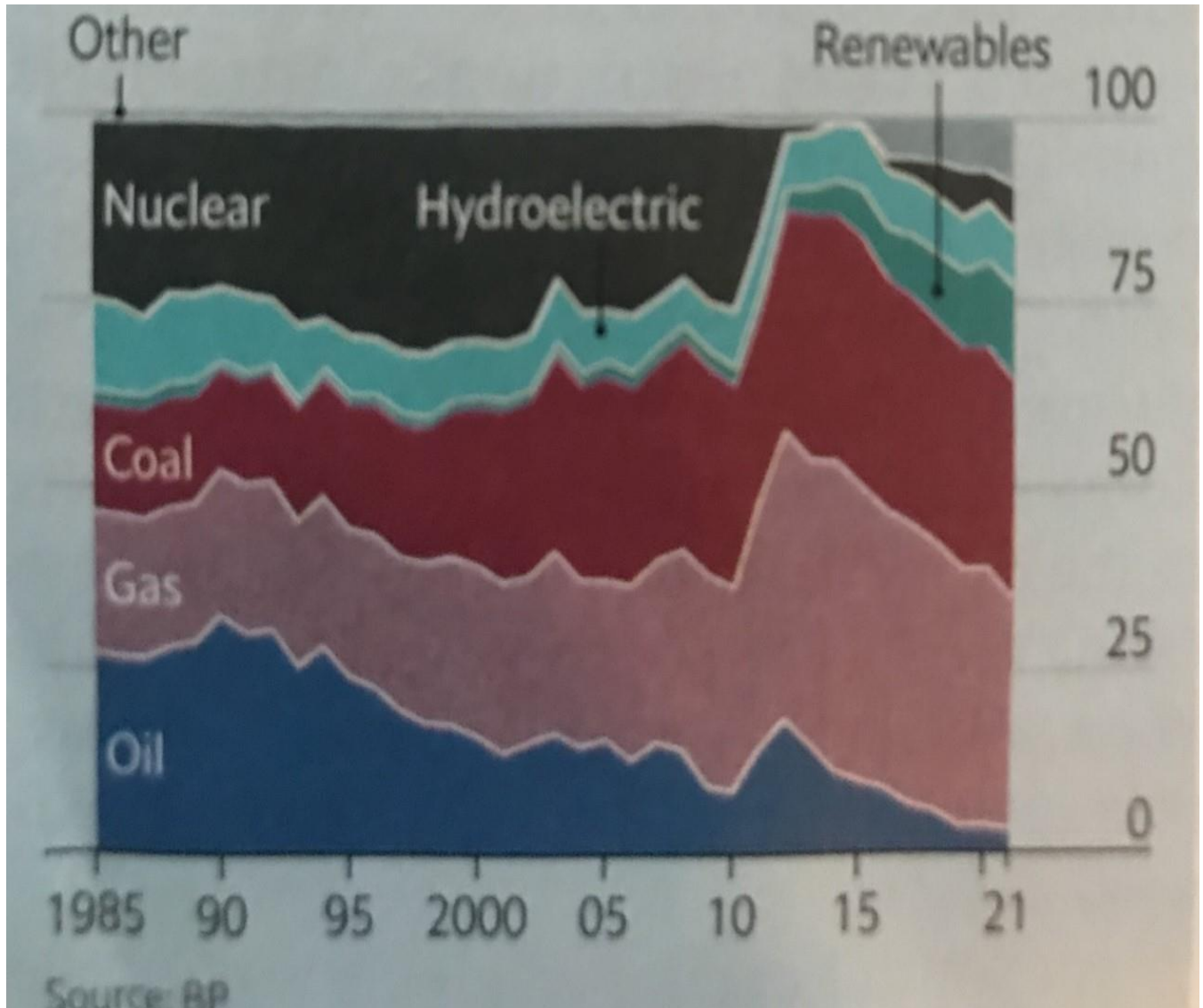


Figure 6. Japan – electricity generation, by source, % of the total. From: BP, *The Economist*, January 14, 2023.

World's Top Producers of Natural Gas in 2021

The following data was published by Investopedia, September 8, 2022.

| Company | Country | Production (cubic feet) |
|-----------------------------|---------|-------------------------|
| Gazprom | Russia | 18.2 trillion |
| China National Petroleum Co | China | 4.4 trillion |
| ExxonMobil | USA | 3.1 trillion |
| BP | UK | 2.9 trillion |
| Chevron | USA | 2.8 trillion |
| Shell | UK | 2.6 trillion |
| TotalEnergies | France | 2.6 trillion |
| Rosneft | Russia | 2.3 trillion |
| Sinopec | China | 1.2 trillion |
| Lukoil | Russia | 1.1 trillion |

Oil Companies Review: BP, Chevron & Shell

It is beyond the scope of our presentation to review all of the major IOCs (International Oil Companies) on their current strategies on oil and gas production and the energy transition. We have herein reviewed BP, Chevron, and Shell. Broadly speaking, the major IOCs are spending between 10 - 30% of their capex on renewables.

BP

BP's Forecast on the World of Energy Up to 2035

In its benchmark 2023 Energy Outlook, BP forecasted the following:

- 1.) Russia's war in Ukraine and a surge in energy prices in 2022 is expected to accelerate the global transition to clean energy and low-carbon power as countries boost domestic energy supplies including oil, gas, nuclear, renewables, hydrogen, and coal.
- 2.) BP predicts that the Ukraine war will slow global economic activity by 2035 by about 3 percent in comparison with last year due to higher food and energy prices as well as reduced trade activity.
- 3.) In 2022, global trade routes changed dramatically as Russia halted most of its gas exports to Europe and Europe banned imports of Russian oil.
- 4.) BP predicts that by 2035, oil consumption will be down to 70 to 80 million barrels of oil per day, compared to today's consumption of about 102 million barrels of oil per day.
- 5.) BP aims to rapidly grow its renewables unit and slash oil and gas output by 2030 (Global & Mail, January 31, 2023).

BP's Current Strategy on Oil, Gas, and the Energy Transition

The February 11, 2023, issue of *The Economist* mentioned QUOTE “BP’s share price has surged due to BP’s announcement of a record annual profit of \$27.7 billion. The company increased its dividend and share buy-back program. But it lowered its target for cutting fossil-fuel production, from 40% by 2030 to 25%. Like others in the industry, BP is squeezed between keeping shareholders happy with high returns from pumping oil and gas and pushing towards a net-zero economy. “We’re responding to what society wants,” mused BP’s CEO Bernard Looney” UNQUOTE.

A significant data point about BP’s approach on the energy transition is that in 2022, BP invested \$4.9 billion, around 30% of its total \$16.3 billion capital expenditure into what it called “transition growth engines”. We are not clear on what is included in those growth engines.

Chevron and the Energy Transition

Chevron has estimated it will invest more than \$10 billion by 2028 in lower-carbon technologies (Upstream, January 27, 2023). The company’s efforts at decarbonization are the responsibility of its Chevron New Energies division. The president of the division, Jeff Gustavson counts the Bayou Bend CCS as one of Chevron’s “foundational projects” with total potential CO2 sequestration capacity of 225 to 275 million tonnes. The project, on an industrial stretch of the coast near Beaumont and Port Arthur will use carbon capture technology Chevron is piloting in California’s San Joaquin Valley. The Bayou Bend CCS project is targeting first injection of CO2 in 2025.

In the Upstream, January 27 article Gustavson explained that obtaining federal permits for Class VI wells, as injection wells for CO2 sequestration are known to be time-consuming and a backlog of applications could lead to longer wait times. Moreover, the profitability of low-carbon initiatives remains largely unproven. But Gustavson is hopeful. In addition to government incentives, such as the Inflation Reduction Act’s increase of the 45Q tax credit from \$50 per tonne of CO2 captured and stored to \$85 per tonne, private-sector businesses that have made low-carbon pledges will be willing to pay for CCS as a service.

“The future is lower carbon” according to Gustavson, “Large industrial emitters are very, very interested in what they can do to lower their carbon footprint. Now we must work through what is the best, lowest-cost way to get that done”.

We estimate that Chevron currently invests only 10 – 15% of their annual capex on CCS and developing renewables. We expect that this will ramp up substantially in the next decade.

Shell and the Energy Transition

Shell's Current Dilemma

Shell has just announced its highest results of the last 115 years: \$40 billion in annual adjusted profit for 2022. Yet investor interest has been muted at best. Shell's share price has only shown a downward spiral of 17 percent in the 2018-2022 period. The Dow Jones Industrial Index in the same period January 2018-December 2022 rose 31 percent: increasing from 25,295 to 33,147.

Annual capital expenditures in the near term, according to Shell, could be in the range of \$23-\$27 billion. The breakdown of Shell's capex is not given but all indications are that as in the past the lion's share will go to its upstream and integrated gas and chemicals. Renewables share is unknown.

There is the matter of Shell's *Powering Progress*, a three-step plan designed by the company to transform and fully prepare the company for the energy transition:

- 1.) "Growth pillar includes our service stations, fuels for business customers, power, hydrogen, biofuels, charging for electric vehicles, nature-based solutions, and carbon capture and storage. It focuses on working with our customers to accelerate the transition to net-zero emissions."
- 2.) "Transition pillar comprises our Integrated Gas, and our Chemicals and Products businesses, and produces sustainable cash flow."
- 3.) "Upstream pillar delivers the cash and returns needed to fund our shareholder distributions and the transformation of our company, by providing vital supplies of oil and natural gas."

Will Shell be able to implement this strategy? Based on Shell's share price, we have the impression that the global investment community is not embracing Shell's vision for its future.

The IOCs' Competitors

The competitors of the IOCs are rapidly growing green energy firms. They are flexible, move quickly and are all Europe-based. These include Enel, the Italian power company, Engie, the French energy giant, the Spanish power company Iberdrola, and Orsted, the Danish energy giant which is rapidly growing through wind power both onshore and especially offshore..

For more up-to-date information about Shell and the European green energy firms, we refer you to the article published by Gerard Kreeft titled "Son of Rainmaker: An Open Letter to Wael Sawan, Shell CEO", published in *Africa Oil + Gas Report*, February 17, 2023.

Canada's Role in the Energy Transition

Most Canadians are not aware that Canada ranks amongst the world's largest oil and gas producers. Nor are they aware of how much the oil and gas industry contributes to Canada's economy. Our view is that CO₂ in the atmosphere certainly must be reduced. Canada as a major

gas producer can assist in the reduction of the world's burning of coal. To achieve this, Canada needs to expand its export of LNG beyond the LNG plant under construction near Kitimat, BC.

The **Coastal GasLink pipeline** currently under construction runs from Dawson Creek to Kitimat. This 670 km-long pipeline will transport gas from the northeastern British Columbia's Peace River area to the Shell led LNG plant at Kitimat. Owners of this pipeline are TC Energy Corp, KKR & Co Inc and the Alberta Investment Management Corp. The pipeline had an initial budget of Cdn \$6.6 billion which increased last summer to \$11.2 billion. On February 1, 2023 the operator of the pipeline, TC Energy announced that the final costs are expected to soar to \$14.5 billion. The increased costs are due to: 1.) Higher labour costs (2.) Skilled labour shortages (3.) Environmental protests (4.) Construction delays due to impacts of contractors' underperformance and disputes (5.) Unexpected events like erosion and sediment control challenges.

TC Energy also stated, "Once complete, CoastalGasLink will be Canada's first direct link for LNG deliveries that will further support displacing 60 to 90 million tonnes of CO₂ emissions annually – an important step along the energy transition" (reference: Globe & Mail, February 4, 2023).



Figure 4. CoastalGasLink pipeline, 670 km from Dawson Creek to Kitimat. Reference: Reuters, CBC, February 1, 2023.

At Kitimat, the **LNG Canada** plant currently under construction at an estimated cost of \$18 billion will liquify and export the gas to overseas. In January 2023 the plant's operator, London-based Shell PLC announced that the facility will be powered by natural gas rather than by hydro-electricity as originally planned thus adding to the project's carbon footprint.

In addition to Shell PLC are the other co-owners of LNG Canada includes Malaysia-based Petronas, China's PetroChina, Japan's Mitsubishi Corp and South Korea's Kogas. This is the largest investment ever taken in Canada the current estimated cost of \$32.5 billion for the plant and pipeline. Total costs are forecasted at \$45 billion for the terminal, pipeline and drilling.

The Western Canadian Sedimentary Basin has extensive subsurface reservoirs which produced major volumes of oil and gas. These reservoirs had the capacity to store oil and gas for millions of years. These reservoirs can be equally capable of sequestering CO₂. Accordingly, my view is that the geologists, geophysicists, reservoir engineers and energy economists who were involved in previous exploration and development of oil and gas, those skill sets will also be increasingly needed in further exploration and development of natural gas and defining and developing reservoirs for CO₂ capture and storage.

Concluding Statements

Global. Due to natural gas' critical role in the energy transition and its ability to contribute to global energy security, we see much increased exploration and development for gas worldwide.

Canada. Since the oil price collapse in 2014 - 2015, Canada's oil industry has been full of doom and gloom. However, the industry has rebounded. The end of Covid-19 has oil and gas demand returning and improved oil and gas prices. Due to the urgent need for gas and LNG, also due to the need for the world's economies to decarbonize, combined with the concerns about global energy security, we foresee a world of opportunities for Canada's natural gas industry.

At the same time the Canadian oil industry is committed to reducing its carbon footprint. The Pathways Alliance is committed to reaching net-zero emissions. The companies which are partners in the Pathway Alliance are Canadian Natural Resources, Cenovus, ConocoPhillips Canada, Imperial Oil, MEG Energy and Suncor. They have advertised in the Globe & Mail, February 18, 2023 QUOTE "We are making clear strides to net zero. Oil sands operations contribute significant carbon emissions in Canada – so the six largest companies are using several pathways to get to net zero. We've teamed up to invest in technology and innovation as part of a robust plan. In the past decade, we've cut our emissions by an average of about 22% per barrel – there is more to come. Part of our plan includes developing a carbon capture and storage net work to reduce 10 million tonnes of CO₂ emissions annually by 2030. It's one more way we're making progress on the path to net zero. See our plan in action. [PathwaysAlliance.ca](https://www.pathwaysalliance.ca)

UNQUOTE. The group looks to embark on building a large-scale carbon capture, utilization, and storage (CCUS) network in Alberta which is estimated to cost \$16.5 billion (Calgary Herald, February 17, 2023).

About the Authors

Tako Koning is Holland-born and Alberta-raised. He graduated in 1971 with a B.Sc. in Geology from the University of Alberta and in 1981 with a B.A in Economics (1981) from the University of Calgary. He was employed by Texaco beginning in 1973 for thirty years in Canada, Indonesia, Nigeria and Angola. He worked in a variety of positions including geologist, assets manager, portfolio manager and vice president exploration. He has also worked in Angola as a consultant for Tullow Oil and the American/British consultancy of Gaffney, Cline & Associates. He is a long-term member of many professional societies including the Canadian Energy Geoscience Association (legacy Canadian Society of Petroleum Geologists), Canadian Society of Exploration Geophysicists, Association of Professional Engineers and Geoscientists of Alberta and the American Association of Petroleum Geologists. He lives in Calgary.

Gerard Kreeft was born in the Netherlands and grew up in the village of Burdett in southern Alberta. He graduated in 1971 with a B.A. from Calvin University, Grand Rapids, Michigan and in 1980 with a M.A. from Carlton University in Ottawa. He was founder of EnergyWise, based in the Netherlands which managed and implemented energy conferences and seminars worldwide. He has Dutch and Canadian citizenship. He writes on a regular basis about the oil industry, energy politics and the energy transition for Lagos, Nigeria-based *Africa Oil + Gas Report* (AOGR) and he also contributes to the Institute for Energy Economics and Financial Analysis (IEEFA), based in Cleveland, Ohio. In 2022 he published a book titled "*The 10 Commandments of the Energy Transition – And Other Essays on How to Power our Society Without Imploding the Economy or Destroying the Planet*", published by FriesenPress, Altona, Manitoba. He continues to live in Arnhem, The Netherlands.

