Today’s topic is how the Ukraine war by Russia is likely to affect world energy markets, with primary focus on natural gas. This is a topic widely mentioned in the news, but often discussed briefly without the additional context needed to fully assess the risks and possible outcomes. We will be discussing recent price spikes, Russia oil & gas supplies in relation to world needs, LNG and the US gas market, and key takeaways for this year and 3-5 years in the future.

To provide an expert view, we will interview Mr. Steve Thumb, who is a nationally noted oil & gas expert, who was in charge of oil and gas forecasting for three decades at the widely used source, Energy Ventures Analysis, until he recently retired. Previous to that, he was Vice President of Strategic Planning at the energy divisions of three Fortune 500 Companies. In addition, he has authored or co-authored over 40 EPRI and Gas Technology Institute reports on key oil & gas topics.

We will not be offering any forecasts today, but rather we will try to explain where the world’s oil and gas supplies come from, how much they may be disrupted by the Ukraine War, and what the short and long run implications could be for the US, the EU, and Russia. Spoiler alert – Steve regards the situation as a long run game changer, not just a bad stretch of extreme short run pain and market dislocation. He will explain.

This will be a longer than usual segment because of the richness of the material. Numerical information will be presented and will be available to listeners on Brattle’s and Buchanan’s websites.
International Natural Gas Prices over Past Year

Last Year of Natural Gas Spot Prices
February 15, 2021 - March 16, 2022

Source: Bloomberg Spot Price Indices.
Note: China prices are Hebei delivered prices.
EU Gas Prices – Up to and during the war

Last Month of Natural Gas Spot Prices
February 15, 2022 - March 16, 2022

USD/MMbtu

First wave of Western sanctions & German cancellation of Nord2 pipeline

Russia invades Ukraine

Russia Cut from SWIFT

Russia Deputy PM threatens to cut off gas flow to Europe

Source: Bloomberg Spot Price Indices.
U.S. Henry Hub Spot Gas Prices – past year

Source: Bloomberg Spot Price Indices.
Oil Prices in the Past Year

Last Year of Oil Spot Prices
February 15, 2021 - March 16, 2022

Russia invades Ukraine

Source: Bloomberg Spot Price Indices.
Gas & Oil Prices and Futures

**Natural Gas Spot and Futures Prices**

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>USD/MMbtu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$0</td>
<td>$10</td>
<td>$20</td>
<td>$30</td>
<td>$40</td>
<td>$50</td>
<td>$60</td>
<td>$70</td>
<td>$80</td>
<td>$90</td>
<td>$100</td>
<td>$110</td>
</tr>
</tbody>
</table>

Source: Bloomberg Price Indices.

**Oil Spot and Futures Prices**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>USD/Barrel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$0</td>
<td>$20</td>
<td>$40</td>
<td>$60</td>
<td>$80</td>
<td>$100</td>
<td>$120</td>
<td>$140</td>
<td>$160</td>
<td>$180</td>
<td>$200</td>
<td>$220</td>
</tr>
</tbody>
</table>

Source: Bloomberg Price Indices.
## 2019 World Oil and Gas Production

### Oil Production
(kilometer barrels/day)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>17,045</td>
<td>18%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>11,832</td>
<td>12%</td>
</tr>
<tr>
<td>Russia</td>
<td>11,540</td>
<td>12%</td>
</tr>
<tr>
<td>Other Middle East</td>
<td>9,720</td>
<td>10%</td>
</tr>
<tr>
<td>Africa</td>
<td>8,399</td>
<td>9%</td>
</tr>
<tr>
<td>South &amp; Central America</td>
<td>6,174</td>
<td>6%</td>
</tr>
<tr>
<td>Canada</td>
<td>5,651</td>
<td>6%</td>
</tr>
<tr>
<td>Iraq</td>
<td>4,779</td>
<td>5%</td>
</tr>
<tr>
<td>UAE</td>
<td>3,998</td>
<td>4%</td>
</tr>
<tr>
<td>China</td>
<td>3,836</td>
<td>4%</td>
</tr>
<tr>
<td>Other Asia Pacific</td>
<td>3,814</td>
<td>4%</td>
</tr>
<tr>
<td>Other Europe</td>
<td>3,414</td>
<td>4%</td>
</tr>
<tr>
<td>Other CIS</td>
<td>3,074</td>
<td>3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>1,918</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95,194</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: BP Statistical Review of World Energy 2020, PDF pg. 19

### Gas Production
(kilometer cfs/day)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>89</td>
<td>23%</td>
</tr>
<tr>
<td>Russia</td>
<td>66</td>
<td>17%</td>
</tr>
<tr>
<td>Other Asia Pacific</td>
<td>48</td>
<td>12%</td>
</tr>
<tr>
<td>Other Middle East</td>
<td>26</td>
<td>7%</td>
</tr>
<tr>
<td>Iran</td>
<td>24</td>
<td>6%</td>
</tr>
<tr>
<td>Africa</td>
<td>23</td>
<td>6%</td>
</tr>
<tr>
<td>Other Europe</td>
<td>23</td>
<td>6%</td>
</tr>
<tr>
<td>Qatar</td>
<td>17</td>
<td>4%</td>
</tr>
<tr>
<td>China</td>
<td>17</td>
<td>4%</td>
</tr>
<tr>
<td>South &amp; Central America</td>
<td>17</td>
<td>4%</td>
</tr>
<tr>
<td>Canada</td>
<td>17</td>
<td>4%</td>
</tr>
<tr>
<td>Other CIS</td>
<td>16</td>
<td>4%</td>
</tr>
<tr>
<td>Mexico</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>386</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: BP Statistical Review of World Energy 2020, PDF pg. 36
2019 European Gas Consumption / Russian Gas Production

**European Gas Consumption**
- From Russia: 37.8%
- Other Pipeline & LNG: 24.9%
- From EU: 42.5%

**Russian Gas Production**
- Domestic Consumption: 63%
- LNG Exports: 6%
- Europe: 31%

90% of Russian Imports are via pipelines:
- Nord Stream I to Germany
- Brotherhood through Ukraine
- Yamal through Poland
- TurkStream through Southern Europe

Russian Gas Flows to Europe

2019 European Oil Consumption and Russian Production

**European Oil Consumption**
- From Russia: 44%
- U.S.: 14%
- Middle East: 10%
- Other: 19%
- From EU: 13%

4.9 million barrels/day

**Russian Oil Production**
- To Europe: 19%
- US: 3%
- Other: 7%

<0.1% is exported to China

11.5 million barrels/day

Current Sanctions Against Russia

Sanctions now prevailing against Russia include:

- **Banking** – 7 banks are cut-off from SWIFT messaging system
- **Frozen assets** – affects at least $284B (~45%) of holdings of Bank of Russia
- **Bans on Russian goods**
  - Import ban on nonindustrial diamonds, seafood, and alcohol (Vodka)
  - Export ban on luxury goods (tobacco products, clothing items, jewelry, vehicles, art and antique goods)
- **Transportation** – Russian aircrafts and ships are banned from their airspace and ports
- **Technology** – semi-conductors, chips, sensors, et al. are blocked for sale to Russia, which will affect the compressor stations and pipeline flow management technology

Sources:
Aspirations or declarations to reduce further commerce with Russia include:

- Following the invasion of Ukraine, the European Union announced REPowerEU, which diversifies gas supplies through LNG and pipeline imports and reduces faster the use of fossil fuels.
- This will **reduce the demand from Russian gas by two thirds within a year** and **eliminate the dependence on Russian gas by 2027-2030**

---

**Europe Has a Two Part Plan**

<table>
<thead>
<tr>
<th>Part I: Reduce Russian Gas Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Increase LNG imports</td>
</tr>
<tr>
<td>* Increase pipeline imports from other countries</td>
</tr>
<tr>
<td>* Increase European gas production</td>
</tr>
<tr>
<td>* Increase biomethane and hydrogen imports</td>
</tr>
<tr>
<td>* Conservation and/or fuel switching within the power sector.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part II: Fill Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Attain 90% a capacity factor before winter starts</td>
</tr>
</tbody>
</table>
European Gas Storage Inventories

The goal is to reach 90% full by end of October

Source: GIE AGSI, AGSI+ (gie.eu).
Note: Contains only EU + UK storage. Does not include Ukraine or Serbian data.
Major gas pipelines serving Europe

- **Nord Stream I**
  - RUS->GER
  - 5.3 Bcf/d

- **Nord Stream II**
  - RUS->GER
  - 5.3 Bcf/d (Expected)

- **Brotherhood**
  - RUS->UKR->HUN/ROM/SLO
  - 3.1 Bcf/d

- **Northern Lights**
  - RUS->BEL->POL
  - 4.9 Bcf/d

- **Progress Pipeline**
  - RUS->UKR->HUN/ROM/SLO
  - 2.5 Bcf/d

- **Trans Adriatic Pipeline**
  - AZR->TUR->GRC->ITL
  - 1.0 Bcf/d (expanding to 2.0)

- **TurkStream**
  - RUS->TUR->BUL
  - 3.0 Bcf/d

- **Blue Stream**
  - RUS->TUR->BUL
  - 1.5 Bcf/d

- **Yamal Europe**
  - (parallel to Northern Lights)
  - RUS->BEL->POL/GER
  - 3.2 Bcf/d

- **Trans-Mediterranean**
  - ALG->TUN->ITL
  - 2.9 Bcf/d

- **Maghreb-Europe**
  - ALG->MOR->SPN
  - 1.2 Bcf/d

- **MedGaz**
  - 1.0 Bcf/d

- **GALSI**
  - 1.0 Bcf/d

- **Greenstream**
  - 1.1 Bcf/d

- **From Russia**
- **From other Sources**

**European Gas Production**
(North Sea and Onshore) 21.1 Bcf/d

**From Russia**

**From other Sources**

**UKRAINE**
World Oil and Gas Rig Count, 2018 – Present

World

US Oil
All Other Regions
Permian

US Gas
All Other Basins
Haynesville
Marcellus

Europe
North America
All Other Regions
## World LNG Production

### Trade Movement for LNG in 2020 (Bcf/day)

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
<th>Asia Pacific</th>
<th>Europe</th>
<th>South and Central</th>
<th>Middle East &amp; Africa</th>
<th>North America</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td></td>
<td>10.26</td>
<td>-</td>
<td>0.01</td>
<td>-</td>
<td>0.01</td>
<td>10.28</td>
<td>21.8%</td>
</tr>
<tr>
<td>Qatar</td>
<td></td>
<td>6.94</td>
<td>2.92</td>
<td>0.09</td>
<td>0.31</td>
<td>-</td>
<td>10.26</td>
<td>21.8%</td>
</tr>
<tr>
<td>US</td>
<td></td>
<td>2.55</td>
<td>2.47</td>
<td>0.69</td>
<td>0.13</td>
<td>0.09</td>
<td>5.94</td>
<td>12.6%</td>
</tr>
<tr>
<td>Russian Federation</td>
<td></td>
<td>2.17</td>
<td>1.67</td>
<td>0.01</td>
<td>0.06</td>
<td>-</td>
<td>3.91</td>
<td>8.3%</td>
</tr>
<tr>
<td>Malaysia</td>
<td></td>
<td>3.18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.18</td>
<td>6.7%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>8.32</td>
<td>4.04</td>
<td>0.55</td>
<td>0.39</td>
<td>0.24</td>
<td>13.53</td>
<td>28.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>33.42</strong></td>
<td><strong>11.11</strong></td>
<td><strong>1.34</strong></td>
<td><strong>0.89</strong></td>
<td>-</td>
<td><strong>47.10</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: BP Statistical Review of World Energy 2020, PDF pg. 44
### LNG Expansion Projects

#### LNG Capacity Under Construction as of May 2021 (Bcf/day)

<table>
<thead>
<tr>
<th>Country</th>
<th>Liquefaction</th>
<th>Country</th>
<th>Regasification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qatar NFE</td>
<td>16.8</td>
<td>China</td>
<td>7.9</td>
</tr>
<tr>
<td>USA</td>
<td>6.6</td>
<td>India</td>
<td>3.9</td>
</tr>
<tr>
<td>Russia</td>
<td>3.4</td>
<td>Kuwait</td>
<td>1.1</td>
</tr>
<tr>
<td>Kuwait</td>
<td>2.1</td>
<td>Egypt</td>
<td>1.0</td>
</tr>
<tr>
<td>Canada</td>
<td>1.4</td>
<td>Europe</td>
<td>0.8</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.7</td>
<td>Thailand</td>
<td>0.7</td>
</tr>
<tr>
<td>Other (5 countries)</td>
<td>1.4</td>
<td>Japan</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other (9 countries)</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Total by 2025</strong></td>
<td><strong>22.1</strong></td>
<td><strong>Total</strong></td>
<td><strong>18.6</strong></td>
</tr>
<tr>
<td><strong>Total by 2027</strong></td>
<td><strong>32.4</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Qatar North Field expansion Phase 1 will be online in 2025 and Phase 2 in 2027. LNG Canada will be online in 2025. Europe includes Finland, Poland, Turkey, Cyprus and Italy. Following countries are constructing both liquefaction: Kuwait, Mexico, Indonesia and Egypt.

An additional 13 LNG projects have been approved by FERC, but have not started construction. These consist of 3 expansions of existing terminals (5.7 Bcf/Day) and 10 new terminals (20 Bcf/day).
Major pipelines (Eastern Russia)

Altai Gas Pipeline (Power of Siberia 2)  
(Not shown)  
RUS->Western China  
4.8 Bcf/d (expected)

Power of Siberia  
RUS->CHN  
3.7 to 4.6 Bcf/d  
Came online 2019; expanding to 2023

Sakhalin-Khabarosk-Vladivostok Pipeline  
RUS->CHN & LNG Exports  
3.5 Bcf/d (Expected)

Source: Energy & Power Magazine
Russian Difficulty Selling Oil

Even without sanctions, there is emerging reluctance to buy Russian oil

- Shell, after initially announcing a purchase of crude Russian oil, reversed its stance and will close its 500 service stations in Russia (with net closing costs of over $3B)
- International Energy Agency forecasts a potential reduction of 3 million bpd of Russian oil production beginning in April 2022
- Some Russian shipments have been discounted in order to sell -- likely to be marketed privately to get around sanctions
- In addition to reputational risks, there are financial risks like the risk that banks might stop issuing credit to buyers

However, other experts predict an uptick in oil purchases from Russia; a recent Bank of America report notes, there is “no way US E&P and OPEC+ can displace the 8 mn b/d oil exports from Russia in the near term for reasons including supply chain bottleneck and lack of excess supply”

Sources:
1. Oil Price, Russian Oil Exports Rise Despite Reluctant Buyers | OilPrice.com
4. Reuters, Remorseful Shell abandons Russian oil | Reuters
## Major Takeaways – Gas Importing vs. Exporting Countries

### Gas Importing Countries
- Heightened tension between energy security and decarbonization
- Economics for electric vehicles, hydrogen, biomethane have improved
- High gas prices
  - Era of worldwide (2020/Covid-19) gas-on-gas competition is over
  - Regional boundaries and linkages become permanent (for next 5-10 years)
- Europe reduces Russian gas and oil imports
  - However, results below its goal
- Europe greatest challenge will be next winter
  - Unclear if storage will be 90% full
- If Russian oil is curtailed, there is room for UAE, Iraq, Iran, Venezuela to provide capacity
- Tension in solving problem with permanent fossil fuel expansion versus renewable development

### Gas Exporting Countries
- Demand for LNG has increased, and potential profit very high
  - Some 13 projects before FERC approved are developed; US can supply much of the Russian gas lost to Europe
  - Back to long term contracting for LNG? At cost-basis, or opportunity cost margins?
- Higher drilling activity for both gas and oil
  - Less seasonality to natural gas? Prices higher than in 20-teens
  - Depends on how much the majors change their strategies from risk-averse buybacks to expansion
- Economics for electric vehicles improved, eventually damping LR oil sales
- Tension in solving problem with permanent fossil fuel expansion versus renewable development
## Major Takeaways – by time frame and geography

<table>
<thead>
<tr>
<th></th>
<th>Europe</th>
<th>Russia</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short run – thru winter 2022/23</strong></td>
<td>Attempt at 2/3 reduction in gas by winter. Need to fill storage to 90%, if possible via increased existing LNG flows; shift electric dispatch towards coal;</td>
<td>High prices offset volume losses. Ruble down 50%, hard currency starvation Buyers reluctant to take Russian oil, many majors unfold their involvement.</td>
<td>Higher consumer prices, esp. for gasoline. Accelerated gas and oil expansion, LNG capacity plans</td>
</tr>
<tr>
<td><strong>Mid/long – 2025- 2030</strong></td>
<td>Attempt at 2/3 reduction in all Russian energy imports; tension over switching to gas vs. renewables; new supplies are LNG, not new pipelines, but will take years to build new LNG capacity</td>
<td>Iron Curtain reestablished? Unlikely to divert lost EU sales to China due to pipeline limits, LNG development expense, blocked access to capital and technology. Oil rerouting competition from expanded OPEC production?</td>
<td>Substantial LNG production and export to EU; Tension over US support for expanded oil and gas vs. renewables, but geopolitical balance favors O&amp;G</td>
</tr>
</tbody>
</table>
About Brattle

The Brattle Group answers complex economic, finance, and regulatory questions for corporations, law firms, and governments around the world. We are distinguished by the clarity of our insights and the credibility of our experts, which include leading international academics and industry specialists. Brattle has 500 talented professionals across four continents. For more information, please visit brattle.com.

<table>
<thead>
<tr>
<th>Our Services</th>
<th>Our People</th>
<th>Our Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and Consulting</td>
<td>Renowned Experts</td>
<td>Thoughtful Analysis</td>
</tr>
<tr>
<td>Litigation and Support</td>
<td>Global Teams</td>
<td>Exceptional Quality</td>
</tr>
<tr>
<td>Expert Testimony</td>
<td>Intellectual Rigor</td>
<td>Clear Communication</td>
</tr>
</tbody>
</table>
Buchanan Ingersoll & Rooney

Buchanan Ingersoll & Rooney is a national law firm with a proven reputation for providing progressive, industry-leading legal, business, regulatory and government relations advice to regional, national and international clients.

For more than five generations, we have played a pivotal role in shattering barriers to energy industry growth and have shaped today’s energy renaissance for coal, oil, natural gas, renewables, utilities and end users.

A go-to law firm for the energy industry, Buchanan has deep experience managing transactional matters, regulatory issues, and complex litigation across the upstream, midstream, and increasingly expanding downstream industries. For more information, visit bipc.com.
Supplemental Slides
U.S. Oil and Gas Rigs vs. Long Term Prices

![Graph showing monthly oil and gas price indexed to January 2018. The graph compares U.S. Long Term Gas Index, U.S. Long Term Oil Index, US Total Oil, US Total Gas, and Non US Oil and Gas in NA.]
LNG Capacity and Utilization

Exhibit 4: Global LNG Utilization
LNG capacity utilization is already running near 5yr highs and there is little spare capacity available.

Exhibit 6: US LNG projects, operational and under review
Despite global need, the US has limited LNG export capacity and is already running at maximum levels, which helps insulate the US from global prices.

Exhibit 7: US LNG projects, approved but no FID
13 US liquefaction projects (22 Bcf/d) have received DOE and FERC approval, but have yet to make a final investment decision.
Major pipelines (Eastern Russia)

- **Power of Siberia**
  - RUS->CHN
  - 3.7 to 4.6 Bcf/d
  - Came online 2019; expanding to 2023

- **Sakhalin-Khabarosk-Vladivostok Pipeline**
  - RUS->LNG Exports to Asia
  - 3.5 Bcf/d

- **Altai Gas Pipeline (Power of Siberia 2)**
  - RUS->Western CHN
  - 4.9 Bcf/d (expected)

- **Sakhalin III Pipeline**
  - RUS->JPN & CHN
  - 2.0 Bcf/d (expected)

- **Sakhalin II LNG**
  - RUS->JPN
  - 1.5 Bcf/d (2.2 Bcf/d expected)

- **Arctic LNG II**
  - RUS->CHN or EUR
  - 2.6 Bcf/d (expected)

- **Soyuz-Vostok Pipeline**
  - RUS->MON->CHN
  - Size TBD

- **From Russia**

- **Russian LNG**

- **Future Russian LNG**
  - RUS -> CHN or EUR
  - 9 Projects planned by 2034
  - 29.4 Bcf/d (expected)

- **Yamal LNG**
  - RUS->CHN or EUR
  - 2.3 Bcf/d

- **Sakhalin-Khabarosk-Vladivostok Pipeline**
  - RUS->LNG Exports to Asia
  - 3.5 Bcf/d

- **Altai Gas Pipeline (Power of Siberia 2)**
  - RUS->Western CHN
  - 4.9 Bcf/d (expected)

- **Sakhalin III Pipeline**
  - RUS->JPN & CHN
  - 2.0 Bcf/d (expected)

- **Sakhalin II LNG**
  - RUS->JPN
  - 1.5 Bcf/d (2.2 Bcf/d expected)

- **Arctic LNG II**
  - RUS->CHN or EUR
  - 2.6 Bcf/d (expected)

- **Future Russian LNG**
  - RUS -> CHN or EUR
  - 9 Projects planned by 2034
  - 29.4 Bcf/d (expected)

Source: Gazprom via Business Insider
# Russian Gas Expansion and Routing Options

## Summary of Russian Gas Projects

### Gas To The East That Can Go To West

<table>
<thead>
<tr>
<th>Capacity (BCFD)</th>
<th>Online Status</th>
<th>Source of gas</th>
<th>Purpose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 trains: 2.2 BCFD</td>
<td>Nov. 2017</td>
<td>Yamal fields near Arctic circle</td>
<td>To China</td>
<td>Yamal LNG</td>
</tr>
<tr>
<td>3 trains: 2.6 BCFD</td>
<td>Sept. 2019</td>
<td>Siberia fields and interconnects with Yamal hub to Europe</td>
<td>To China</td>
<td>Siberia Power -2 Pipeline (Altai Gas P/L)</td>
</tr>
<tr>
<td>3 trains: 2.6 BCFD</td>
<td>Trains 1 &amp; 2: 2009</td>
<td>Arctic gas fields; exports can go to China or Europe</td>
<td>To China</td>
<td>Arctic LNG 2 LNG</td>
</tr>
<tr>
<td>2.67 BCFD</td>
<td>Trains 3 &amp; 4: 2025</td>
<td>China has a 29.9% ownership in project; Currently producing 14% above nameplate or 2.6 BCFD</td>
<td>To China</td>
<td>Future LNG Projects</td>
</tr>
</tbody>
</table>

### Gas To The East Only

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<tr>
<td>3.53 BCFD</td>
<td>Dec. 2019</td>
<td>Siberia fields and interconnects with Yamal hub to Europe</td>
<td>To China</td>
<td>Sakhalin II LNG projector</td>
</tr>
<tr>
<td>3.67 BCFD</td>
<td>June 2021</td>
<td>Arctic gas fields; exports can go to China or Europe</td>
<td>To China</td>
<td>China has a 20% ownership in project</td>
</tr>
<tr>
<td>2.0 BCFD</td>
<td>May 2023</td>
<td>China has a 29.9% ownership in project; Currently producing 14% above nameplate or 2.6 BCFD</td>
<td>To China</td>
<td>Entire program in doubt due to financing and access to technology</td>
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### Gas To Far Eastern Russia

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<tbody>
<tr>
<td>1.0 BCFD</td>
<td>2023</td>
<td>Siberia fields and interconnects with Yamal hub to Europe</td>
<td>To China</td>
<td>Entire program in doubt due to financing and access to technology</td>
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<tr>
<td>1.0 BCFD</td>
<td>2024</td>
<td>Arctic gas fields; exports can go to China or Europe</td>
<td>To China</td>
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<td>2.0 BCFD</td>
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<td>1.0 BCFD</td>
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### Gas To China

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<td>1.0 BCFD</td>
<td>2018</td>
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(1) Needs $4.5 billion in financing of which 50% from China, 33% from Japan and rest unknown. Russia currently can't get sensors, semiconductors, chips, etc.