Independent Statistics & Analysis
U.S. Energy Information Administration

Country Analysis Brief: Russia

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Overview

Russia is the world's largest producer of crude oil (including lease condensate) and the second-largest producer of dry natural gas. Russia also produces significant amounts of coal. Russia's economy is highly dependent on its hydrocarbons, and oil and natural gas revenues account for more than one-third of the federal budget revenues.

Russia is a major producer and exporter of oil and natural gas. Russia's economic growth is driven by energy exports, given its high oil and natural gas production. Oil and natural gas revenues accounted for 36% of Russia's federal budget revenues in 2016.[1]

Russia was the world's largest producer of crude oil including lease condensate and the third-largest producer of petroleum and other liquids (after Saudi Arabia and the United States) in 2016, with average liquids production of 11.2 million barrels per day (b/d). Russia was the second-largest producer of dry natural gas in 2016 (second to the United States), producing an estimated 21 trillion cubic feet (Tcf).

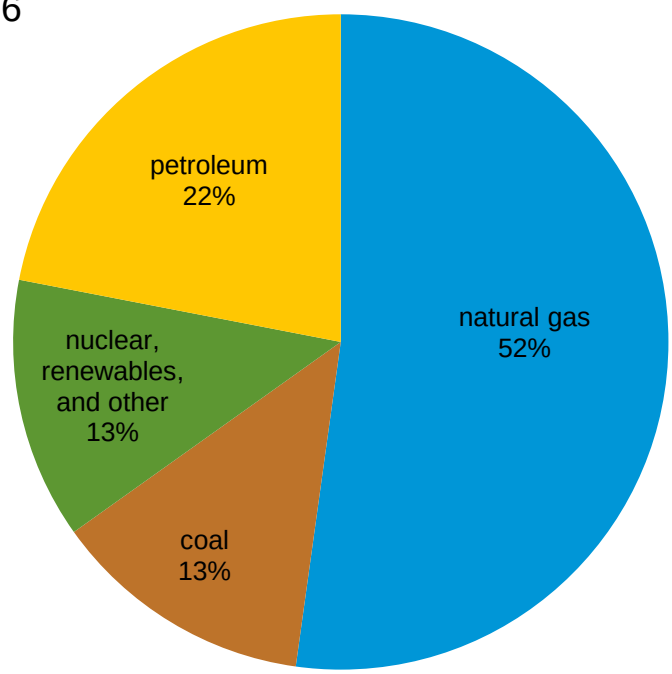
Russia and Europe are interdependent in terms of energy. Europe is dependent on Russia as a source of supply for both oil and natural gas. More than one-third of crude oil imports to European countries in the Organization for Economic Cooperation and Development (OECD) in 2016 came from Russia. More than 70% of natural gas imports to those countries also came from Russia in 2016.[2] Russia is dependent on Europe as a market for its oil and natural gas and the revenues those exports generate. In 2016, nearly 60% of Russia's crude oil exports and more than 75% of Russia's natural gas exports went to OECD Europe.[3]

Russia was the fourth-largest generator of nuclear power in the world in 2016 and had the fifth-largest installed nuclear capacity. With seven nuclear reactors under construction, Russia is second to China in terms of number of reactors under construction as of October 2017.[4]

Source: CIA World Factbook

According to the *BP Statistical Review*, Russia consumed 26.74 quadrillion British thermal units (Btu) of energy in 2016, most of which was natural gas (52%). Petroleum and coal accounted for 22% and 13% of Russia's consumption, respectively (Figure 1).[5]

Figure 1. Russia's primary energy consumption, 2016



Source: U.S. Energy Information Administration, based on *BP Statistical Review of World Energy* 2017

Effects of sanctions and lower oil prices

Sanctions and lower oil prices have reduced foreign investment in Russia's upstream, especially in Arctic offshore and shale projects, and they have made financing projects more difficult.

In response to the actions and policies of the government of Russia with respect to Ukraine, in 2014, through a series of executive orders, the United States imposed progressively tighter sanctions on Russia.[6] Among other measures, the sanctions limited Russian firms' access to U.S. capital markets, specifically targeting four Russian energy companies: Novatek, Rosneft,[7] Gazprom Neft, and Transneft. Sanctions also prohibited the export to Russia of goods, services, or technology in support of deepwater, Arctic offshore, or shale projects.[8] The European Union imposed similar sanctions, although they differ in some respects.[9]

In August 2017, the United States enacted new legislation codifying the existing sanctions on Russia. This legislation also extended the prohibition on providing technology in support of new deepwater, Arctic offshore, or shale projects to cover not only projects in Russia, but also projects anywhere in the world in which a person or entity already subject to sanctions owns 33% or more of the project. The legislation also authorizes the President of the United States to impose additional sanctions on persons or entities providing support to energy export pipelines, but it does not require the President to do so.[10]

Virtually all involvement in Artic offshore and shale projects by Western companies has ceased following the sanctions. In recent years, the Russian government has offered special tax rates or tax holidays to encourage investment in difficult-to-develop resources, such as Arctic offshore and low-permeability reservoirs, including shale reservoirs. Attracted by the tax incentives and the potentially vast resources, many international companies entered into partnerships with Russian firms to explore Arctic and shale resources. ExxonMobil, Shell, BP, and Statoil also signed agreements with Russian companies to explore shale resources. ExxonMobil, Eni, Statoil, and China National Petroleum Company (CNPC) all partnered with Rosneft in 2012 and 2013 to explore Arctic fields.[11] Despite sanctions announced in March 2014, Total agreed in May to explore shale resources in partnership with Lukoil. However, Total halted its involvement in September 2014, as additional sanctions were announced later in the year.

Arctic offshore and shale resources are unlikely to be developed without the help of Western oil companies. However, these sanctions will have little effect on Russian production in the short term as these resources were not expected to begin producing for 5 to 10 years at the earliest. The immediate effect of these sanctions has been to stop the large-scale investments that Western firms had planned to make in these resources.

At the same time as the United States and the European Union were applying sanctions, oil prices fell by more than half, from an average Brent crude oil price of $109/barrel (b) in the first half of 2014 to an average of less than $50/b in January. Both the sanctions and the fall in oil prices have put pressure on the Russian economy in general and have made it more difficult for Russian energy firms to finance new projects, especially higher-cost projects such as deepwater, Arctic offshore, and shale projects.

With lower oil prices, Russian state revenues from oil and natural gas activities have declined dramatically, and the state's budget deficit has grown. In response, the Russian government has implemented or proposed various measures to increase revenues. The Russian government has changed the minerals extraction tax and the export taxes on hydrocarbons several times over the past couple years. The most recent changes and proposals for upcoming changes have generally been in favor of raising the taxes paid by oil and natural gas companies.

In addition to taxes, the Russian government also collects dividends from oil and natural gas companies in which the state is a shareholder. In April 2016, the Russian government directed state-controlled companies to pay out a minimum of 50% of 2015 net income as dividends, nearly double the dividends companies would normally pay.[12] Oil companies have objected to both the tax and dividend increases, arguing that they divert money from capital investment programs. Based on similar arguments, Rosneft negotiated a lower dividend payout in 2016, but the company plans to pay out 50% of 2017 income as dividends.[13]

In January 2016, the Russian government announced its intention to sell some of its shares in several Russian companies, including Bashneft and Rosneft. Bashneft was one of Russia's 10 largest oil producers. In October 2016, the federal government sold its 50.08% controlling stake in Bashneft to Rosneft for $5.3 billion. Then in December 2016, the Russian government announced that it had sold a 19.5% stake in Rosneft for $11 billion. The stake was split evenly between Glencore (a commodity trader) and the Qatar Investment Authority (QIA—Qatar's sovereign wealth fund). In September 2017, Glencore and QIA sold a 14.16% stake in Rosneft to CEFC China Energy for $9.1 billion, retaining 0.5% and 4.7% interest in Rosneft, respectively. The Russian government retains a controlling interest in Rosneft.

Another way to try to increase oil and natural gas revenues is to try to increase prices. In late 2016, the Organization of the Petroleum Exporting Countries (OPEC), Russia, and several other oil-producing countries agreed to limit production from January 2016 through June 2016 to try to stabilize the oil market. Russia agreed to reduce its production by 300,000 b/d versus its October 2016 production level, implementing these cuts gradually to reach the full cut by the end of April 2017. OPEC and Russia have generally adhered to their agreed production cuts, and in May 2017, OPEC and non-OPEC countries met and agreed to extend production cuts through the end of March 2018.

Petroleum and other liquids

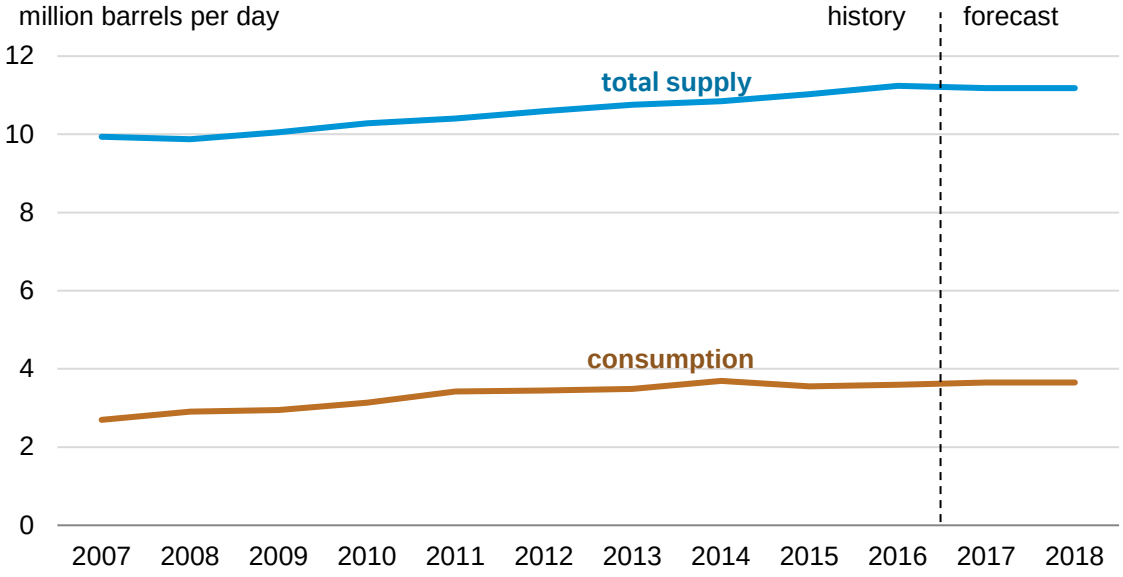
Most of Russia's oil production originates in West Siberia and the Urals-Volga regions. However, production from East Siberia, Russia's Far East, and the Russian Arctic has been growing.

Russia's proved oil reserves were 80 billion barrels as of January 2017, according to the *Oil and Gas Journal*.[14] Most of Russia's reserves are located in West Siberia, between the Ural Mountains and the Central Siberian Plateau, and in the Urals-Volga region, extending into the Caspian Sea.

In 2016, Russia produced an estimated 11.24 million b/d of petroleum and other liquids (of which 10.55 million b/d was crude oil including lease condensate), and it consumed about 3.6

million b/d (Figure 2). Russia exported more than 7 million b/d in 2016, including about 5.3 million b/d of crude oil and the remainder in products and other liquids.

Figure 2. Russia's petroleum and other liquids supply and consumption



Source: EIA *International Energy Statistics* and *Short-Term Energy Outlook*, September 2017

Exploration and production

Most of Russia's oil production originates in West Siberia and the Urals-Volga regions (Table 1),[15] with slightly more than 12% of production in 2016 originating in East Siberia and Russia's Far East (Krasnoyarsk, Irkutsk, Yakutia, and Sakhalin). However, this share is up from less than 5% of production in 2009.[16] In the longer term, Russia's eastern oil fields, along with the largely untapped oil reserves in the Russian Arctic, may play a larger role. The Russian sector of the Caspian Sea and the predominantly undeveloped areas of Timan-Pechora in northern Russia also may hold large hydrocarbon reserves.

A number of new projects are in development. Some of these new projects may only offset declining output from aging fields and not result in significant output growth in the near term. The use of advanced technologies and the application of improved recovery techniques is resulting in increased oil output from some existing oil deposits.

Table 1. Russia's oil production by region, 2016

Region	Thousand b/d
West Siberia	6,294
Khanty-Mansiisk	4,830
Yamal-Nenets	977
Other West Siberia	487
Urals-Volga	2,498
East Siberia and the Far East	1,338
Krasnoyarsk	426
Irkutsk	364
Sakhalin	344
Yakutia	204
Arkhangelsk	328
Komi Republic	284
Caspian	41
Arctic offshore	36
Other	57
Total	**10,875**

Source: U.S. Energy Information Administration based on Eastern Bloc Research

Russia's oil- and natural gas-producing regions

Urals-Volga

Urals-Volga was the largest producing region up until the late 1970s when it was surpassed by West Siberia. Today, this region is a distant-second producing region, accounting for about 23% of Russia's total output. The giant Romashkinskoye field (discovered in 1948) is the largest in the region. Tatneft operates the field which produced over 300,000 b/d in 2016.[17]

Khanty-Mansiisk

The Khanty-Mansiisk area of West Siberia is Russia's largest oil-producing region, accounting for about 4.8 million b/d of liquids production, nearly 45% of Russia's total production in 2016.[18] One of the largest and oldest fields in Khanty-Mansiisk is Samotlor field, which has been producing oil since 1969. Production from the Samotlor field has been declining since its post-Soviet era peak of 635,000 b/d in 2006. Other large oil fields in the region include Priobskoye, Mamontovskoye, Malobalykskoye, and Prirazlomnoye (Rosneft).[19]

Yamal-Nenets, Krasnoyarsk, and the Arctic offshore

The Yamal-Nenets Autonomous district straddles the Arctic coast of West Siberia, with Krasnoyarsk lying just to the east of Yamal-Nenets. This region is mostly known for natural gas production. Crude oil development is relatively new for the region and has required the construction of new infrastructure.

The offshore Prirazlomnoye field (Gazprom) was discovered in 1989 but only began production in December 2013. The field lies in the Arctic offshore, and Gazprom is developing the field. Production from Prirazlomnoye field is expected to peak at about 100,000 b/d.[20] Novoportovskoye field, also being developed by Gazprom, is located on the Yamal peninsula, far from existing oil infrastructure. In May 2016, Gazprom began loading production from Novoportovskoye field at a new Arctic terminal for seaborne delivery to Europe. Production from Novoportovskoye field is expected to peak at about 125,000 b/d by 2018.[21]

The start-up of the Rosneft's Vankorskoye (Vankor) oil and natural gas field in August 2009 has notably increased production in the region and has been a significant contributor to Russia's increase in oil production since 2010. Vankor, located north of the Arctic Circle in Russia's Krasnoyarsk region near the border with Yamal-Nenets, was the largest oil discovery in Russia in 25 years. Rosneft built a 345-mile pipeline to connect Vankor field to the Transneft oil pipeline system at Purpe. In 2015, the field produced about 440,000 b/d.[22] Rosneft is also developing three smaller nearby fields—Suzunskoye, Tagulskoye, and Lodochnoye—also known as the Vankor cluster fields. Production at Suzunskoye started in late 2016.

To the west of Vankor and the Vankor cluster of fields, on the eastern edge of the Yamal-Nenets region, is another cluster of fields under development. Lukoil's Pyakyakhinskoye oil, condensate, and natural gas field started commercial production in October 2016. Other fields in the area include Gazprom's Zapolyarnoye natural gas and condensate field, as well as the Vostochno Messoyakha, Zapadno Messoyakha, and Russkoye oil fields. Transneft recently completed construction of the Zapolyarye-Purpe and Purpe-Samotlor pipelines to connect these fields to the Eastern Siberia-Pacific Ocean (ESPO) pipeline.

East Siberia

Rosneft's Verkhnechonskoye oil and natural gas condensate field lies in the Irkutsk region near the ESPO pipeline. Production at Verkhnechonskoye field began in 2008, with full production reaching about 160,000 b/d.[23] The Yurubcheno-Tokhomskoye and Kuyumba fields lie in southern-central Krasnoyarsk and connect to the ESPO pipeline via the recently completed Kuyumba-Taishet pipeline. The start of commercial production has been delayed at both fields.

Bazhenov shale

The Bazhenov shale layer, which lies under much of the existing West Siberian resource deposits, also holds great potential. In the 1980s, the Soviet government tried to stimulate production by detonating small nuclear devices underground. In recent years, the government has used tax breaks to encourage Russian and international oil companies to explore the Bazhenov and other shale reservoirs. However, Russian firms have made little progress in developing shale resources because sanctions and low oil prices have hindered shale projects.

Caspian Sea

Lukoil has been actively exploring some of the deposits in the North Caspian Sea, and in 2010, Lukoil launched the Yurii Korchagin field, which produced about 30,000 b/d in 2016.[24] Lukoil launched the Filanovsky field in the second half of 2016. Production at Filanovsky reached 100,000 b/d in June 2017, with plateau production expected to be more than 120,000 b/d.[25] Other discoveries in the area include the Khvalynskoye and Rakushechnoye fields. The development of the region is highly sensitive to taxes and export duties, and any change or cancellation of tax breaks may negatively affect development.

Sakhalin Island

Sakhalin Island is located off Russia's eastern shore. The offshore area to the east of Sakhalin Island is home to a number of large oil and natural gas fields that have had significant investment from international companies. Many of Sakhalin's oil and natural gas fields are being developed under two production-sharing agreements (PSA) signed in the mid-1990s. The Sakhalin-1 PSA is operated by ExxonMobil, which holds a 30% share. Other members of the PSA include Rosneft (through two subsidiaries), Indian state-owned oil company ONGC Videsh, and a consortium of Japanese companies.[26] The Sakhalin-1 PSA covers three oil and natural gas fields: Chayvo, Odoptu, and Arkutun-Dagi. Production started at Chayvo field in 2005, at Odoptu field in 2010, and at Arkutun-Dagi field in January 2015.[27] Sakhalin-1 mainly produces crude oil and other liquids, most of which are exported via the De-Kastri oil terminal. Most of the natural gas currently produced at Sakhalin-1 is reinjected, with small volumes of gas sold domestically.

The Sakhalin-2 PSA covers two major fields—the Piltun-Astokhskoye oil field and the Lunskoye natural gas field—and it includes twin oil and natural gas pipelines that run from the north of the island to the south end of the island, where the consortium has an oil export terminal and a natural gas liquefaction and export terminal. The Sakhalin-2 consortium members include Gazprom, which owns 50% plus one share, Shell with 27.5%, Mitsui with 12.5%, and Mitsubishi with 10%.[28] When the PSA was originally signed, the consortium did not include any Russian companies, and compared with most PSAs, the terms were heavily weighted in favor of the interests of the consortium over the interests of the government. Sakhalin-2 produced its first oil in 1999 and its first liquefied natural gas (LNG) in 2009. The project incurred significant cost overruns and delays, and these issues were part of the justification the Russian government used to force Shell, which at the time owned a 55% interest in Sakhalin-2, and the other consortium members to sell a controlling interest in the consortium to Gazprom.[29]

Russia's oil grades

Russia has several oil grades, including Russia's main export grade, Urals blend. Urals blend is a mix of heavy sour crude oils from the Urals-Volga region and light sweet crude oils from West Siberia. The mixture, and thus the quality, can vary, but Urals blend is generally a medium (about 31°API) gravity sour (about 1.4% sulfur content) crude oil blend and, as such, is generally priced at a discount to Brent crude oil. Siberian Light crude is a higher quality and thus more valuable when marketed on its own, but it can also be blended into Urals crude oil because of limited infrastructure to move it to market separately.[30]

Sokol grade is produced by the Sakhalin-1 project and is a light, sweet crude oil with an API gravity of 35.5° and 0.28% sulfur content.[31] Sakhalin blend includes crude oil produced from the Piltun and Astokh fields under the Sakhalin-2 PSA and condensate produced from Gazprom's Kirinskoye natural gas and condensate field under the Sakhalin-3 license.[32] Sakhalin is a light (42.5°API), sweet (0.16% sulfur content) blend.[33] Sakhalin blend is loaded at the Prigorodnoye port on the southern tip of Sakhalin Island.

The Eastern Siberia-Pacific Ocean (ESPO) blend came on stream in late 2009 and is a mix of crudes produced in several Siberian fields. This grade is exported through the recently constructed ESPO Pipeline to China and through Russia's Pacific coast port of Kozmino to other Asian countries. ESPO blend is a fairly sweet, medium-light blend with a typical gravity of 36.0°API and a 0.47% sulfur content.[34]

Varandey grade crude oil is a light (37.8°API), fairly sweet (0.42% sulfur content) crude. It includes a mix of crudes exported through Lukoil's proprietary pipelines and terminal on the Pechora Sea that opened in 2008.[35] Gazprom Neft's two Arctic fields, Prirazlomnoye launched in 2014 and Novoportovskoye launched in 2016, produce very different grades of oil. Arctic Oil (ARCO) grade from the Prirazlomnoye field is a medium-heavy (24°API), sour (2.3% sulfur content) crude,[36] and Novy Port grade is a medium-light (30-35°API), sweet crude (0.1% sulfur content).[37]

Sector organization

Domestic companies dominate most of Russia's oil production (Table 2).[38] Following the collapse of the Soviet Union, Russia initially privatized its oil industry. Starting in the late 1990s, privately-owned companies drove growth in the sector, and a number of international oil companies attempted to enter the Russian market with varying degrees of success. More recently, the Russian oil industry has consolidated into fewer firms with more state control.

In 2003, BP invested in the Tyumen Oil Company (TNK), forming TNK-BP, a 50-50 joint venture and one of country's major oil producers. However, in 2012 and 2013, the TNK-BP partnership was dissolved, and the state-controlled Rosneft acquired nearly all of TNK-BP's assets.[39] In the previous decade, Rosneft emerged as Russia's top oil producer following the liquidation of Yukos assets, which Rosneft acquired. In 2016, Rosneft further increased its share of oil production in Russia when it acquired the federal government's 50.8% controlling interest in Bashneft, the country's sixth-largest producer.

In 2016, the top five firms in Russia (counting Rosneft and Bashneft as a single firm) accounted for more than 80% of total Russian oil production.[40]

A number of ministries are involved in the oil sector. The Ministry of Natural Resources and Environment issues field licenses, monitors compliance with license agreements, and levies fines for violations of environmental regulations. The Ministry of Energy develops and implements general energy policy. The Finance Ministry is responsible for hydrocarbon taxes,[41] and the Federal Antimonopoly Service regulates tariffs.

Russia has two main hydrocarbon taxes: the minerals extraction tax (MET) and the export tax. The export tax varies for crude oil and for petroleum products. In 2011, Russia changed product export taxes so that export tax rates on all products were lower than the crude oil export tax to encourage investment in refining capacity. In recent years, the government has also offered special MET rates or MET holidays for difficult-to-develop resources such as Arctic offshore and low-permeability reservoirs, including shale reservoirs. Recent increases to the MET rate have increased the value of these previously-agreed MET discounts for difficult resources.

On January 1, 2015, hydrocarbon tax rates changed again. These changes are often referred to as the 2015 *tax maneuver*. Previously, the export tax was about twice as high as the MET. This *tax maneuver* raised the MET and lowered export taxes for 2015 and set out additional changes for 2016 and 2017 that would further raise the MET and lower export taxes. The increases in the MET were designed to roughly balance the decreases in the export taxes, making them roughly revenue neutral, neither increasing nor decreasing overall taxes on the energy industry.[42]

On January 1, 2016, the MET increased in accordance with the previously enacted *tax maneuver*. However, in late 2015, the Russian government adopted a new law that postponed the corresponding decrease in export taxes. This law also substantially increased the MET on natural gas produced by Gazprom in 2016. Throughout 2016 and 2017, several proposals have been made to further raise taxes on the oil and natural gas industry in order to close persistent federal budget deficits.

Beginning January 1, 2018, the Finance Ministry plans to test a new tax system, applying it to several small fields. The new tax would be calculated based on profits rather than values, which is how the MET and export taxes are currently calculated. The profits-based tax could eventually replace the existing tax system, however the Finance Ministry's current proposals face some opposition.

Table 2. Russia's oil production by company, 2016

Company	Thousand b/d
Rosneft	4,021
Lukoil	1,679
Surgutneftegaz	1,225
Gazprom (including Gazprom Neft)	1,117
Tatneft	570
Bashneft	423
Slavneft	300
Novatek	247
Russneft	150
PSA operators	290
Others	853
Total	**10,875**

Source: U.S. Energy Information Administration based on Eastern Bloc Research

Refinery sector

Russia had more than 30 oil refineries with a total crude oil distillation capacity of 5.1 million b/d as of January 1, 2017, according to *Oil and Gas Journal*.[43] Rosneft, the largest refinery operator, owns nine major refineries in Russia.[44] Lukoil is the second-largest operator of refineries in Russia with four major refineries.[45] Many of Russia's refineries are older, simple refineries, with mazut, a low-quality fuel oil, accounting for a large share of their output. Recent tax changes have raised the export duty on mazut and other heavy oil products to equal the export duty on crude oil, eroding the already slim profit-margins of less-complex refineries. Mazut production and exports dropped significantly in 2016 as refinery upgrades continued and as companies lowered utilization at less-complex refineries.

Oil exports

In 2016, Russia exported more than 5 million b/d of crude oil and condensate. Most Russian exports (70%) went to European countries, particularly the Netherlands, Germany, Poland, and Belarus (Figure 3).[46] About 36% of Russia's federal budget revenue in 2016 came from oil and

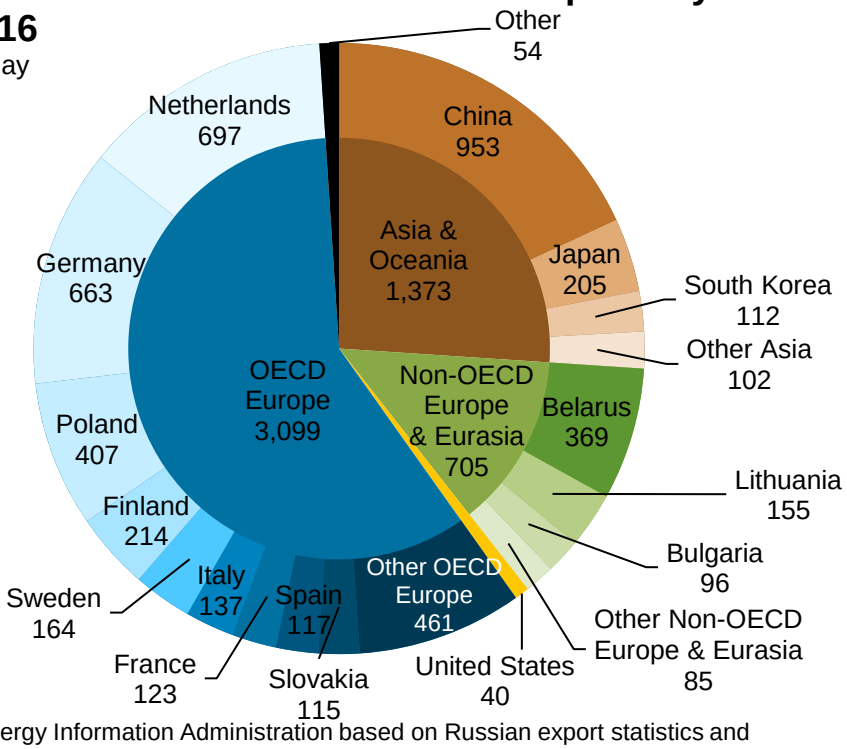
natural gas activities.[47] Although Russia is dependent on European consumption, Europe is similarly dependent on Russian oil supply, with more than one-third of crude oil imports into OECD Europe in 2016 coming from Russia.[48]

Asia and Oceania accounted for 26% of Russian crude oil exports in 2016, with China accounting for a growing share of total Russian exports. In 2016, Russia was the largest supplier of crude oil to China, surpassing Saudi Arabia.[49] Part of the increase in Russian crude oil exports to China has been growing exports to independent refiners—known as teapot refiners—in China. Russian ESPO crude oil does not have to travel as far as Middle East crude to reach Chinese ports. This shorter distance allows Russian crude oil to be shipped in smaller volumes and with more flexible scheduling, which makes it more desirable to independent refiners.

Russia's Transneft holds a near-monopoly over Russia's pipeline network, and most of Russia's crude oil exports must traverse Transneft's system to reach bordering countries or to reach Russian ports for export. Smaller volumes of exports are shipped via rail and on vessels that load at independently-owned terminals.

Figure 3. Russia's crude oil and condensate exports by destination, 2016

thousand barrels per day



Source: U.S. Energy Information Administration based on Russian export statistics and partner country import statistics, Global Trade Tracker

Russia also exports fairly sizeable volumes of oil products. According to Eastern Bloc Research, Russia exported about 1.3 million b/d of fuel oil and an additional 990,000 b/d of diesel in 2016. It exported smaller volumes of gasoline (120,000 b/d)[50] and liquefied petroleum gas (75,000 b/d) during the same year.[51]

Pipelines

Russia has an extensive domestic distribution and export pipeline network (Table 3).[52] Russia's domestic and export pipeline network is nearly completely owned and run by the state-owned Transneft. One notable exception is the Caspian Pipeline Consortium (CPC) pipeline, which runs from Tengiz field in Kazakhstan to the Russian Black Sea port of Novorossiysk. The CPC pipeline is owned by a consortium of companies, with the largest share (24%) owned by the Russian government (whose interests in the consortium are represented by Transneft). KazMunaiGaz (19%), the state-owned oil and natural gas company of Kazakhstan, and Chevron (15%) are the second- and third-largest shareholders in the consortium. Another exception is the TransSakhalin pipeline, owned by the Sakhalin-2 consortium, in eastern Russia (Figure 4).

Figure 4. Major eastern Russian oil and natural gas pipelines

Table 3. Russia's major crude oil pipelines

Facility	Status	Capacity (million b/d)	Total length (miles)	Supply regions	Destination	Details
Western pipelines						
Druzhba	operating	2	2,500	West Siberia and Urals-Volga regions	Europe	completed in 1964
Baltic Pipeline System 1	operating	1.5	730	connects to Druzhba	Primorsk Port on the Gulf of Finland	completed in 2001
Baltic Pipeline System 2	operating	0.6	620	connects to Druzhba	Ust-Luga Port on the Gulf of Finland	completed in 2012
North-West Pipeline System	inactive	0.3	500	connects to Druzhba	Butinge, Lithuania and Ventspils, Latvia on the Baltic Sea	completed in 1968; inactive since 2006
Caspian Pipeline Consortium (CPC)	operating	1.3 by end 2017	940	Tengiz and Kashagan fields in Kazakhstan and Russian Caspian fields	Novorossiysk, Russia on the Black Sea	completed in 2001
Baku-Novorossiysk Pipeline	operating	0.1	830	Caspian and central Asia, via Sangachal Port, Azerbaijan on the Caspian Sea	Novorossiysk, Russia on the Black Sea	completed in 1996
Omsk-Pavlodar-Atasu Pipeline	operating	0.2	650	West Siberia and Urals-Volga regions	Pavlodar refinery in Kazakhstan and China via the Kazakhstan-China Pipeline	part of a series of pipelines originally completed in the 1980s
Eastern pipelines						
TransSakhalin	operating	0.2	500	Sakhalin fields (offshore northern Sakhalin)	Pacific seaport of Prigorodnoye (Southern Sakhalin Island)	completed in 2008

Facility	Status	Capacity (million b/d)	Total length (miles)	Supply regions	Destination	Details
Eastern Siberia-Pacific Ocean (ESPO) Pipeline	operating	ESPO-1 – 1.2 currently, 1.6 by 2020 ESPO-2 – 0.6 currently, 1.0 by 2020 China spur – 0.4 currently, 0.6 by 2018	ESPO-1 – 1,700 ESPO-2 – 1,300 Daqing spur – 660	East Siberian fields and, via connecting pipelines, West Siberian fields and Yamal-Nenets region	Pacific seaport of Kozmino with a spur to Daqing, China	ESPO-1 (Taishet-Skovorodino) completed in 2009 ESPO-2 (Skovorodino-Kozmino) completed in 2012 Skovorodino-Daqing, China spur completed in 2010
Purpe-Samotlor Pipeline	operating	0.5	270	Yamal-Nenets and Ob Basins	connects to ESPO Pipeline	completed in 2011
Zapolyarye-Purpe Pipeline	operating	0.6 (expandable to 0.9)	300	Zapolyarye and Yamal-Nenets region	connects to ESPO pipeline via the Purpe-Samotlor pipeline	completed in 2017; initially expected to operate below capacity as development at connected oil fields has been delayed
Kuyumba-Taishet	operating	0.16 (expandable to 0.3)	440	Yurubcheno-Tokhomskoye field and Kuyumba field	connects to ESPO Pipeline	completed in 2017; initially expected to operate below capacity as development at connected oil fields has been delayed

Sources: U. S. Energy Information Administration based on Transneft, Sakhalin Energy, Caspian Pipeline Consortium, State Oil Company of the Azerbaijan Republic, European Parliament, and Orlen Lietuva.

Ports

The top four Russian ports (Novorossiysk, Primorsk, Ust-Luga, and Kozmino) for crude oil exports together accounted for 84% of Russia's seaborne crude oil exports in 2016 (Table 4).[53]

Table 4. Crude oil exports from Russian ports, 2016

Port	Thousand b/d
Novorossiysk	1,407
Primorsk	978
Ust-Luga	669
Kozmino	594
De Kastri	230
Murmansk	185
Prigorodnoye	112
Others	180
Total	**4,355**

Source: U.S. Energy Information Administration, based on Lloyd's List Intelligence (APEX tanker data)

Novorossiysk is Russia's main oil port on the Black Sea coast. It handles petroleum from Central Asian countries as well as from Russia. The Primorsk and Ust-Luga terminals are both located near St. Petersburg, Russia, on the Gulf of Finland. The Primorsk terminal opened in 2006, and the Ust-Luga oil terminal opened in 2009. Both Primorsk and Ust-Luga receive oil from the Baltic Pipeline System, which brings crude oil from fields in the Timan-Pechero, West Siberia, and Urals-Volga regions. Ust-Luga is also a major port for Russian coal and hydrocarbon gas liquids exports.

Kozmino is located near the city of Vladivostok, in Russia's far eastern Primorsky province, and is the terminus of the ESPO crude oil pipeline. The port opened in December 2009 with an initial capacity of 0.3 million b/d. Kozmino initially received crude oil by rail from Skovorodino until the second phase of the ESPO pipeline opened in 2012.[54] In 2016, almost 0.6 million b/d of crude oil was exported through Kozmino port, slightly below the current capacity.[55]

Hydrocarbon gas liquids

Russian output of hydrocarbon gas liquids (HGL) is expected to grow over the coming years. HGL refers to both the natural gas liquids (paraffins or alkanes such as ethane, propane, and butanes) and olefins (alkenes) produced by natural gas processing plants, fractionators, crude oil refineries, and condensate splitters but excludes liquefied natural gas and aromatics. HGL are produced in association with both natural gas and petroleum products.

Changes in Russia's export taxes have spurred investment in refining capacity to produce higher quantities of gasoline and lighter distillates, instead of the high share of heavier fuel oil and

gasoil the country's refiners previously exported. The increasing use of fluid catalytic cracking and hydrocracking units is expected to result in increased HGL production at refineries. A further boost to HGL supply will come from natural gas processing, as Russian natural gas producers develop richer natural gas resources and as more associated natural gas production (which is currently flared) is connected to natural gas processing plants.

With a surplus of liquefied petroleum gas (LPG)—primarily propane and butane—on the Russian market, major producers have targeted the export market and the development of HGL-fed petrochemical capacity as outlets for their growing production. Traditionally, the main outlet for Russian LPG exports had been shipments to Europe by rail. In mid-2012, Russia's first modern LPG export terminal came online in Taman on the Black Sea. With a design capacity of approximately 30,000 barrels per day (b/d) of pressurized cargo,[56] the port handled, on average, nearly 14,000 b/d in 2016,[57] all brought in by rail. In mid-2013, Sibur, Russia's largest LPG producer, shipped its first LPG cargo out of Ust-Luga, near St. Petersburg.[58] In a first for Russia, the Sibur-operated terminal can handle both pressurized and refrigerated product, and it has recently undergone a capacity expansion from nearly 50,000 b/d to about 75,000 b/d.[59] The Ust-Luga terminal, like Taman, is capable of receiving LPG by rail. Additional volumes of LPG are produced on-site at the Novatek-operated Gas Condensate Fractionation and Transshipment Complex.[60]

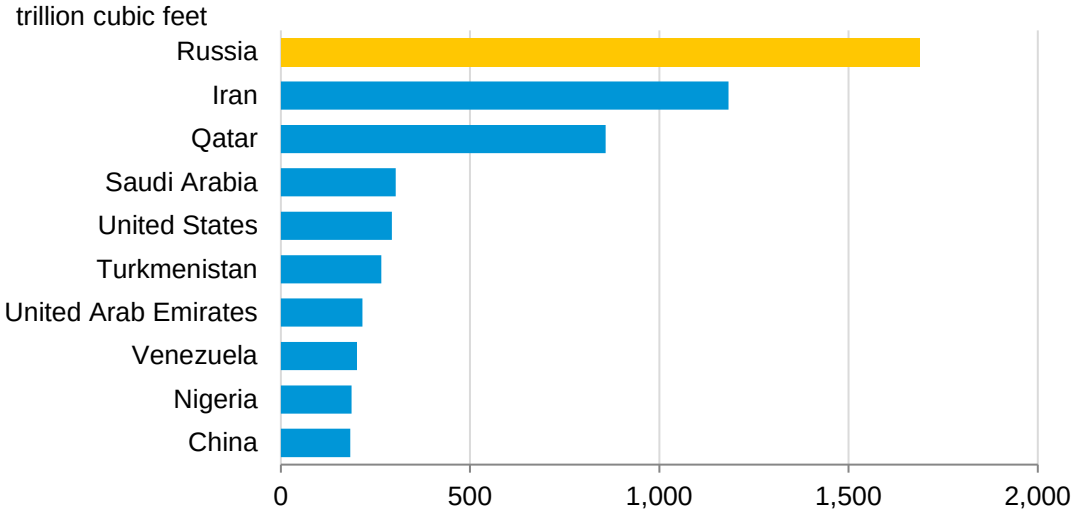
In addition to direct exports, Russian companies are seeking to use domestically produced LPG in petrochemical manufacturing, which would capture more value and minimize their export tariff exposure. In December 2014, Sibur commissioned its propane dehydrogenation (PDH) facility at the Tobolsk-Polymer complex in West Siberia,[61] which can produce 510,000 tons per year of polymer-grade propylene from an estimated 33,000 b/d of propane feedstock. The company plans to further increase its liquids consumption at the Tobolsk site with a proposed 1.5 million ton per year ethylene cracker,[62] which is expected to be in operation by 2021. The feedstock for the $9.5 billion plant is expected to consist primarily of propane and butane. Some ethane will also be used to produce ethylene, propylene, and butylene/butadiene that will then feed into the production of derivative products, including high- and low-density polyethylene and polypropylene.[63] Rosneft is also planning a major petrochemical complex at Nakhodka, on Russia's Pacific Coast, near the Kozmino oil terminal. The new complex will include a refinery and a petrochemical plant with 1.4 million tons per year of ethylene capacity. The petrochemical plant will primarily consume naphtha as a feedstock.[64]

Natural gas

Russia holds the largest natural gas reserves in the world and is the second-largest producer of dry natural gas. The state-run Gazprom dominates the country's upstream natural gas sector, although production from other companies has been growing.

According to *Oil and Gas Journal*, Russia held the world's largest natural gas reserves, with 1,688 trillion cubic feet (Tcf), as of January 1, 2017 (Figure 5).[65] Russia's reserves account for about one quarter of the world's total proved natural gas reserves. Most of these reserves are located in large natural gas fields in West Siberia. Five of Gazprom's largest operating fields (Yamburg, Urengoy, Medvezhye, Zapolyarnoye, and Bovanenkovo)—all of which are in the Yamal-Nenets region of West Siberia—together account for about one-third of Russia's total natural gas reserves.

Figure 5. Estimated proved natural gas reserves, as of January 1, 2017



Source: *Oil & Gas Journal*, "Worldwide Look at Reserves and Production," December 5, 2016

Sector organization

The state-run Gazprom dominates Russia's upstream natural gas sector, producing about two-thirds of Russia's total natural gas output in 2016 (Table 5).[66] While independent and oil company producers have gained importance, upstream opportunities remain fairly limited for independent producers and other companies, including Russian oil majors. Furthermore, Gazprom's dominant upstream position is reinforced by its legal monopoly on pipeline gas exports.

Table 5. Russia's natural gas production by company, 2016

Company	Tcf
Gazprom	14.8
Novatek	2.4
Rosneft	2.4
Lukoil	0.7
Surgutneftegaz	0.3
PSA operators	1.0
Others	1.0
Total	**22.6**

Source: U.S. Energy Information Administration based on Eastern Bloc Research

Much like the oil sector, a number of ministries and regulatory agencies are involved in Russia's natural gas sector. The Ministry of Natural Resources and Environment issues field licenses, monitors compliance with license agreements, and levies fines for violations of environmental

regulations. The Ministry of Energy develops and implements general energy policy and oversees LNG exports. The Finance Ministry is responsible for hydrocarbon extraction and export taxes, while the Ministry of Economic Development supervises tariffs. [67]

The Federal Antimonopoly Service is the main regulatory agency involved in the natural gas sector. This agency regulates pipeline tariffs and oversees charges of abuse of market dominance, including charges related to third-party access to pipelines.

Exploration and production

In 2016, Russia was the world's second-largest dry natural gas producer (approximately 21 Tcf), surpassed only by the United States (26.5 Tcf). According to Eastern Bloc Energy, which has slightly higher estimates for Russia's total natural gas production than EIA, most of the country's production comes from the Yamal-Nenets region of West Siberia (Table 6).[68]

Table 6. Russia's natural gas production by region, 2016

Region	Tcf
West Siberia	19.3
Yamal-Nenets	17.9
Khanty-Mansiisk	1.2
Tomsk	0.2
East Siberia and the Far East	1.7
Sakhalin	1.0
Krasnoyarsk	0.5
Irkutsk	0.1
Yakutia	0.1
Urals-Volga	1.1
Orenburg	0.7
Astrakhan	0.4
Komi Republic	0.1
Others	0.4
Total	**22.6**

Source: U.S. Energy Information Administration based on Eastern Bloc Research

The Yamal-Nenets region is home to three of the country's historically most prolific fields—Yamburg, Urengoy, and Medvezhye—all of which are licensed to Gazprom. These three fields have been operating for more than 30 years and have seen output declines in recent years but still have significant remaining reserves and large annual production volumes. Gazprom has two other large operating natural gas fields in the region. The Zapolyarnoye field started production in 2001, and in 2013, reached its production design capacity of 4.6 Tcf per year.[69] Zapolyarnoye was supposed to continue to produce at capacity for almost 10 years, but instead it has declined, producing just 2.7 Tcf in 2016.[70] Production at Bovanenkovo field on the Yamal peninsula has been growing since it started in 2012, reaching 2.4 Tcf in 2016. Gazprom plans to

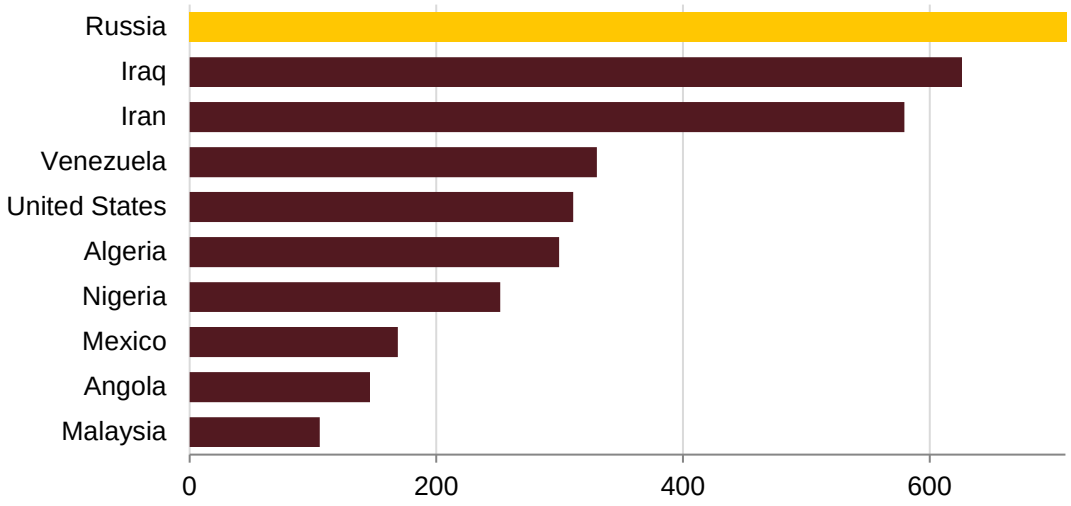
increase annual production to 4.1 Tcf per year after 2019, when the Nordstream 2 pipeline is scheduled to come online.[71]

Gazprom and other producers are increasingly investing in new regions, such as Eastern Siberia and Sakhalin Island, to bring natural gas deposits in these areas into production. Gazprom is currently working to develop two large natural gas fields in Eastern Siberia—Chayadinskoye field in the Yakutia region and Kovytka field in the Irkutsk region. Both fields will connect to the Power of Siberia natural gas pipeline and serve demand in Eastern Russia and China. Additionally, the partners in the Sakhalin 1 project, Rosneft and ExxonMobil, are considering ways to monetize their natural gas reserves, which could include building a new LNG export facility or selling the natural gas to Gazprom to be exported via Gazprom's Sakhalin LNG terminal or planned future pipelines.

Natural Gas flaring

In Russia, natural gas associated with oil production is often flared. According to the U.S. National Oceanic and Atmospheric Administration (NOAA), Russia flared an estimated 850 billion cubic feet (Bcf) of natural gas in 2016, the most of any country. At this level, Russia accounted for about 16% of the total volume of natural gas flared globally in 2016 from upstream sources (Figure 6).[72] A number of Russian government initiatives and policies have set targets to reduce routine flaring of associated gas. Also, regulatory changes have made it easier and more profitable for third-party producers to transport and market their natural gas. According to the NOAA estimates, from 2012 to 2014, flared natural gas in Russia declined on average 9% per year before growing 8% in 2015 and 14% in 2016.

Figure 6. Largest source countries of flared natural gas, 2016
billion cubic feet



Source: U.S. Energy Information Administration, based on National Oceanic and Atmospheric Administration

Natural gas exports

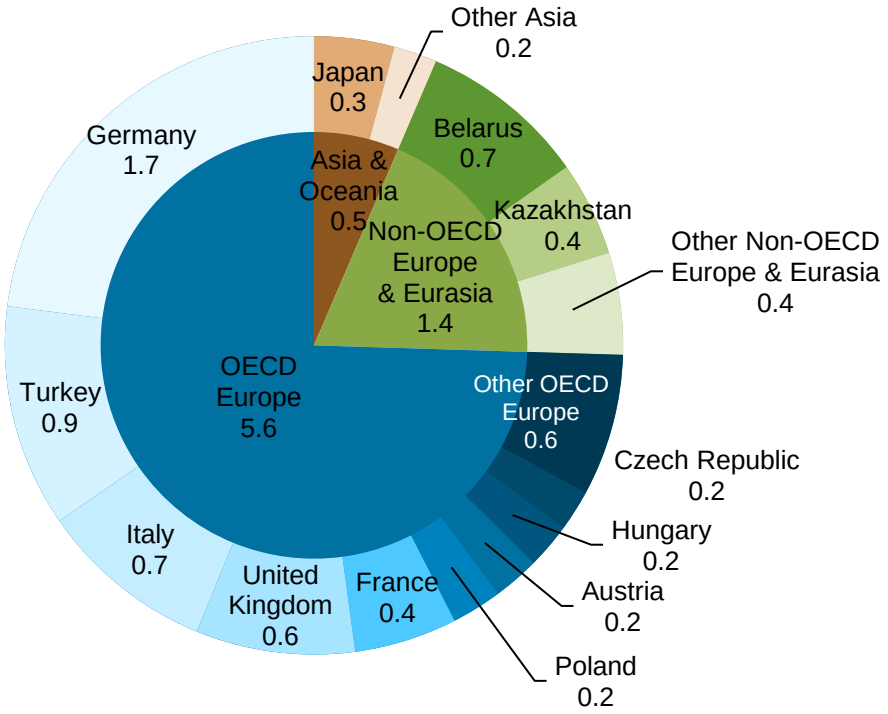
In 2016, almost 90% of Russia's 7.5 Tcf of natural gas exports were delivered to customers in Europe via pipeline, with Germany, Turkey, Italy, Belarus, and the United Kingdom receiving the bulk of these volumes (Figure 7).[73] Much of the remainder was delivered to Asia as LNG. In 2013, Ukraine was Russia's third-largest importer of natural gas, importing 0.8 Tcf from Russia.[74] In 2016, Ukraine imported a total of 0.4 Tcf of natural gas, none of which was purchased from Russia.[75] Because of a pricing and payments dispute and as part of the wider tensions between the two countries, Ukraine has decreased the volume of natural gas it buys from Russia and increased the natural gas it buys from its western neighbors. However, Ukraine still acts as a transit country for deliveries of pipeline natural gas from Russia to Western Europe, and much of the natural gas Ukraine buys from Western Europe physically originates in Russia.

Revenues from natural gas exports in 2015 accounted for about 13% of Russia's total export revenues.[76] While not as large as Russia's export earnings from crude oil and other liquids, Russia still depends on Europe as a market for its natural gas. Europe, likewise, is dependent on Russia for its supply of natural gas. In 2015 and 2016, natural gas imports from Russia accounted for about one-third of natural gas consumed in OECD Europe.[77] Additionally, some countries within Europe, especially Finland, the Baltics, and much of Southeast Europe, receive almost all of their natural gas from Russia.

Since the mid-2000s, natural gas consumption in OECD Europe has generally been flat to declining, prompting Russia to look to Asia and LNG as a means to diversify its natural gas exports. U.S. and European Union (EU) sanctions, implemented in 2014, accelerated Russia's pivot to the east, with Russia signing two pipeline deals with China in 2014 covering exports that could eventually reach 2.4 Tcf per year.

Figure 7. Russia's natural gas exports by destination, 2016

Trillion cubic feet



Source: U.S. Energy Information Administration, based on Russian export statistics and partner country import statistics, Global Trade Tracker

Pipelines

In 2016, Russia's natural gas infrastructure included about 107,000 miles of transmission pipelines and more than 20 underground natural gas storage facilities.[78] Since the late 2000s, Gazprom has been adding major new pipelines to accommodate new sources of supply, including fields in Yamal and Eastern Siberia, and new export routes, including exports to China and new pipelines to Europe that avoid Ukraine.

The Unified Gas Supply (UGS) system is the collective name for the interconnected western portion of Russia's natural gas pipelines (Table 7).[79] The UGS system includes domestic pipelines and the domestic portion of export pipelines in European Russia. In 2007, the Russian government directed Gazprom to establish an Eastern Gas Program (EGP) to expand natural gas infrastructure in eastern Siberia and Russia's Far East. The backbone of the EGP is the Power of Siberia pipeline, which is currently under construction (Figure 4).

Table 7. Russia's major natural gas pipelines

Facility	Status	Capacity (trillion cubic feet per year)	Total length (miles)	Supply regions	Markets	Details
Western pipelines						
Yamal-Europe	operating	1.2	more than 1,000	West Siberian fields including Urengoy area	Poland, Germany, and northern Europe via Belarus	first section started operations in 1996
Blue Stream	operating	0.6	750	West Siberian fields including Urengoy area	Turkey via the Black Sea	started operations in 2003
Nord Stream	operating	1.9	760	West Siberian fields including Urengoy area	Germany and northern Europe via the Baltic Sea	started operations in 2011
Nord Stream 2	planning	1.9	760	West Siberian fields including Urengoy area	Germany and northern Europe via the Baltic Sea	planned start in 2019
Urengoy-Ukhta, Bovanenkovo-Ukhta, and Ukhta-Torzhok	operating and under construction	more than 5.0	more than 1,300	Bovanenkovo field on the Yamal peninsula and Urengoy area fields	Western Russia and Europe via Yamal-Europe, Nord Stream, and other routes	Urengoy-Ukhta-Torzhok started operations in 2006; the 1st Bovanenkovo-Ukhta line started operations in 2012
Soyuz and Brotherhood (Urengoy-Pomary-Uzhgorod)	operating	more than 3.5	more than 2,800	West Siberian fields including Urengoy area, Russian Urals fields, and Central Asia	Western Russia and Europe via Ukraine	first major natural gas export lines to Europe, built and brought online during the Soviet era; first section started operations in 1967

Southern Corridor pipelines	construction	2.2	Western route - 550 Eastern route - 1,010	West Siberian fields including Urengoy area	Southern Russia, Turkey, and Europe via Turkish stream pipeline	construction on the Western route is due to be completed in 2017
TurkStream	construction	up to 1.1	more than 500	West Siberian fields including Urengoy area	Turkey and Southeast Europe via the Black Sea	scheduled to start in late 2019
Eastern pipelines						
TransSakhalin	operating	0.3	500	Sakhalin fields (offshore northern Sakhalin)	Sakhalin LNG plant, Prigorodnoye, southern Sakhalin Island	started operations in 2008
Sakhalin-Khabarovsk-Vladivostok	operating	0.2	more than 1,100	Sakhalin fields (offshore northern Sakhalin)	Eastern Russia with potential exports to Asia via proposed Vladivostok LNG or new pipelines	started operations in 2011; expandable to 1.1 Tcf per year with additional compression
Power of Siberia 1 (Eastern route for exports to China)	construction	mainline - up to 2.2 China spur - 1.3	more than 1,200	East Siberian fields including Chayadinskoye in Yakutia region and Kovytka in Irkutsk region	Northeast China with a later extension to connect with the Sakhalin-Khabarovsk-Vladivostok pipeline	deliveries to China scheduled to begin by the end of 2019
Power of Siberia 2 (Altai/Western route)	planning	Initial - 1.1	1,620	West Siberian fields including Urengoy area	China	2020 or later; could lay parallel lines in the future, doubling or tripling the initial capacity

Sources: U. S. Energy Information Administration, based on Gazprom, GazpromExport, Sakhalin Energy, TurkStream, *World Gas Intelligence*, *Nefte Compass*, and *Argus FSU*.

Third-party access to pipelines

Gazprom is sole owner of virtually all of Russia's natural gas pipelines. Russia's 1999 Law on Gas Supply requires owners of all natural gas systems to provide non-discriminatory access to any available capacity with the aim of supplying domestic consumers. Separate regulations established rules for third-party access to the UGS system, but no rules have been established for access to pipelines that are not part of the UGS system. Access to pipeline capacity for exports is not included, as the 2006 Law on Gas Exports grants pipeline export rights exclusively to the owner of the UGS system, which is Gazprom.[80]

Despite these long-standing laws, independent natural gas producers, including state-owned oil companies, have only recently begun to get access to some of Gazprom's domestic pipelines. Actions by the Federal Antimonopoly Service (FAS) have helped promote better third-party access. Between 2008 and 2011, the FAS brought 28 infringement cases against Gazprom related to third-party access.[81] Third-party natural gas transported by Gazprom grew from 12% of UGS system inflows in 2010 to about 23% in 2016.[82] The FAS has also proposed new laws that would fix many of the deficiencies in the current laws and regulations, including the current lack of regulations for third-party access to pipelines that are not part of the UGS system. Many of the recent disputes over pipeline access have been related to eastern natural gas pipelines, which are not part of the UGS system.

Liquefied natural gas

As of September 2017, Russia has a single operating large-scale liquefied natural gas (LNG) export facility, Sakhalin LNG. This facility has been operating since 2009, with the majority of the LNG contracted to Japanese and South Korean buyers under long-term supply agreements. In 2016, Sakhalin LNG exported 10.9 million metric tons (mt) of LNG (approximately 500 Bcf of natural gas),[83] which went to Japan (65%), South Korea (23%), Taiwan (10%), and China (3%).[84]

In 2013, Russia modified its Law on Gas Exports to allow Novatek and Rosneft to export LNG, breaking Gazprom's monopoly on all natural gas exports. Yamal LNG, which began construction in 2013, is owned by a consortium, led by Novatek with a 50.1% interest. Total and CNPC each have 20% interest, and the Silk Road Fund (an investment fund established by the Chinese government) holds the remaining 9.9% interest in the project. The first of three liquefaction trains is scheduled to be online by the end of 2017. The three trains will each have a capacity of 5.5 mt of LNG per year, and they will draw natural gas from the South Tambeyskoye natural gas and condensate field located in the northeast of the Yamal Peninsula.[85] A number of other proposals for new LNG terminals in Russia are in various stages of planning (Table 8).[86]

To transport LNG from its arctic location, Yamal LNG has commissioned the construction of up to 16 ice-class tankers. Exports are mainly aimed at Asian LNG markets, and during most of the year, the ice-class tankers will take cargoes west from the Yamal peninsula directly to Asia, transiting the Arctic Ocean and the Bering Strait. In winter, when the direct route is too ice-bound to be navigable, the ice-class tankers will take cargoes west from the Yamal peninsula to Europe. In Europe, the LNG will be loaded onto regular LNG tankers that will deliver the cargoes to Asia via the Suez Canal.

Table 8. Russia's large-scale liquefied natural gas projects

Facility	Area	Status	Capacity (million metric tons of LNG per year)	Announced start year	Owners
Liquefaction projects					
Sakhalin LNG	Pacific coast	operating	10+	2009	Gazprom, Shell, Mitsui, and Mitsubishi
Yamal LNG	Arctic coast	construction	16.5	train 1 – by end 2017 train 2 – 2018 train 3 – 2019	Novatek, Total, CNPC, and Silk Road Fund, an investment fund established by the Chinese government
Arctic LNG-2	Arctic coast	planning	up to 16.5	by 2025	Novatek
Baltic LNG	Baltic coast	planning	10	post 2021	Gazprom
Far East LNG	Pacific coast	planning	5	post 2020	ExxonMobil, Rosneft, ONGC Videsh, and SODECO, a Japanese consortium
Sakhalin LNG (expansion)	Pacific coast	planning	5.4	post 2022	Gazprom, Shell, Mitsui, and Mitsubishi
Pechora LNG	Arctic coast	delayed	up to 8	NA	Rosneft
Shtokman LNG	Arctic coast	delayed	30	NA	Gazprom
Vladivostok LNG	Pacific coast	delayed	10	NA	Gazprom
Regasification projects					
Kaliningrad LNG	Baltic coast	construction	2	2017	Gazprom

Sources: U. S. Energy Information Administration based on Gazprom, Yamal LNG, Reuters, Rosneft, Sakhalin Energy, Shell, and Total

Russian companies are also interested in building a network of small- and mid-scale LNG liquefaction facilities, mainly to serve remote natural gas demand and to serve transportation demand for LNG in Russia and neighboring areas. There are already a handful of small-scale liquefaction plants in Russia, with total combined capacity of less than 0.1 million metric tons per year of LNG. More than a dozen additional small- and mid-scale facilities are planned or under construction, with total combined capacity of more than 5 million metric tons per year.[87]

Electricity

Russia is one of the top producers and consumers of electric power in the world, with more than 240 gigawatts of installed generation capacity. In 2016, gross electric power generation totaled 1,071 billion kilowatthours, and Russia consumed about 900 billion kilowatthours.

Fossil fuels (oil, natural gas, and coal) are used to generate about two-thirds of Russia's electricity, with hydropower and nuclear each accounting for about one-sixth of total electric generation. Most of the fossil fuel-fired generation comes from natural gas. Russia's gross electric power generation totaled 1,071 billion kilowatthours (BkWh) in 2016,[88] and net electricity consumption was about 900 BkWh. Russia exported approximately 18 BkWh of electricity in 2016 and imported about 3 BkWh of electricity.[89]

Sector organization

Much like the oil and natural gas sectors, a number of ministries and regulatory agencies are involved in the electric sector. The Ministry for Economic Development supervises tariffs and investment in the energy sector. The Ministry of Energy is in charge of general energy policy, including development of the legal framework for the electric sector. The Ministry of Energy also approves investment plans for Russia's electric transmission system.

The main regulatory agency involved in the sector is the Federal Antimonopoly Service, which regulates transmission tariffs and oversees compliance with the unbundling rules and charges of abuse of market dominance in competitive electric markets. The state atomic energy corporation, Rosatom, controls all aspects of the nuclear sector in Russia, including uranium mining, fuel production, nuclear plant engineering and construction, generation of nuclear power, and nuclear plant decommissioning.[90]

Russia has seven regional power systems in the electric sector. These systems are: Northwest, Center, South, Middle Volga, Urals, Siberia, and Far East. The Far East system is fragmented with a weak connection to its neighbor to the west, the Siberian system. The Siberian system is also weakly connected with its neighbor to the west, the Urals system. The remaining five systems covering European Russia are well-integrated with one another and connected to systems in neighboring countries.[91]

The Russian electric sector was restructured in the past decade, and much of it was privatized. The reform required ownership unbundling in the electric sector, separating the industry into largely privately-owned, competitive generation assets and state-controlled, regulated transmission assets. No company is allowed to own both generation and transmission assets. The Federal Grid Company, which is more than 70% owned by the Russian government (directly and through Gazprom), controls most of the transmission and distribution infrastructure in Russia. The grid comprises more than 1.5 million miles of power lines, including slightly less than 100,000 miles of high-voltage cables of 220 kilovolts (Kv) or more. The government has been trying to attract private investment into the wholesale and regional electric generating companies. As part of the market reform, most of Russia's fossil-fueled power generation was also privatized, while nuclear and hydropower remain under state control.[92]

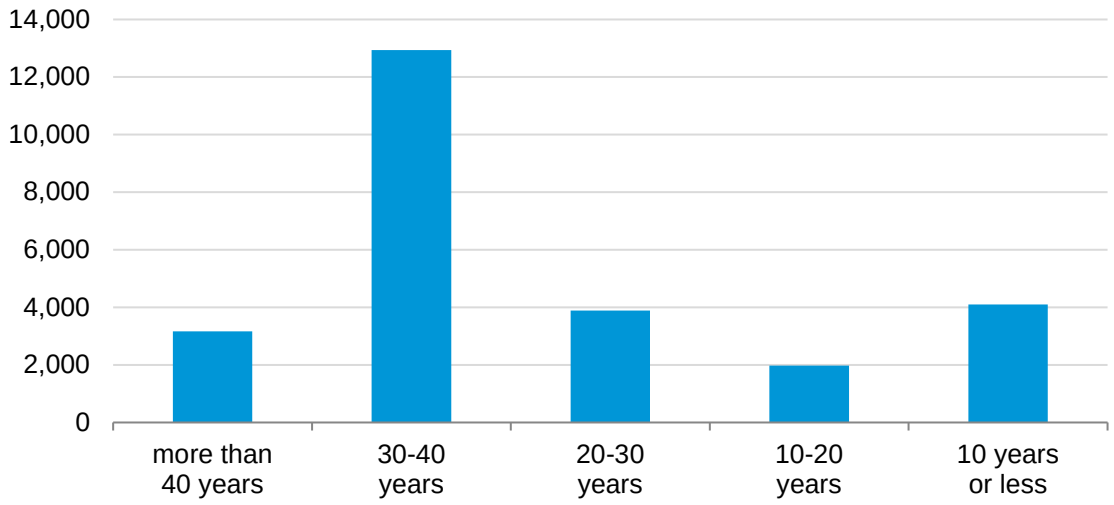
Nuclear power

Russia has an installed nuclear capacity of more than 26 million kilowatts distributed across 35 operating nuclear reactors at 10 locations. Nine plants are located west of the Ural Mountains. The exception is the Bilibino plant in the far northeast.[93]

Russia's nuclear power facilities are aging. The working life of a reactor is considered to be 30 years, but Russia has an active life-extension program. The period for extension is established by the government as 15 years, and 24 of Russia's nuclear reactors, accounting for about 60% of the country's operating nuclear capacity, are 30 or more years old (Figure 8).[94] Eleven of the country's 35 nuclear reactors use the high-power channel reactor (RBMK) design employed in Ukraine's Chernobyl plant.[95] Russia's newest reactor, the 1,114 megawatt electric (MWe) Novovoronezh 6 reactor began commercial operation in February 2017.[96]

Figure 8. Operating nuclear capacity in Russia, by age

megawatt electric



Note: Capacity age is as of September 1, 2017; capacity for the Beloyarsk 4 reactor is included.
Source: U.S. Energy Information Administration, based on International Atomic Energy Association, Power Reactor Information System

Russia's current federal target program envisions a 45% to 50% nuclear power share of total generation by 2050 and a 70% to 80% share by 2100. To achieve these goals, the rapidly aging nuclear reactor fleet in Russia will need to be replaced with new nuclear power plants. As of July 1, 2017, seven new nuclear reactors were officially under construction across Russia with 5,468 MWe net generating capacity (5,904 MWe gross). One of the plants under construction is a floating nuclear power plant, which is scheduled to be commissioned by 2019.[97]

In addition to the seven nuclear reactors currently under construction, another 26 units are planned, with a total gross generating capacity of more than 28,000 MWe. These units are planned to be completed between 2020 and 2035.

Coal

Russia has sizeable coal reserves and is the world's third-largest exporter of coal.

With 177 billion short tons of coal at the end of 2016, Russia held the world's third-largest recoverable coal reserves, after the United States and China. Russia produced 425 million short tons in 2016, making it the sixth-largest coal producer in the world behind China, India, the United States, Australia, and Indonesia.[98] Almost 80% of Russia's coal production was steam coal, and slightly more than 20% was coking coal.[99]

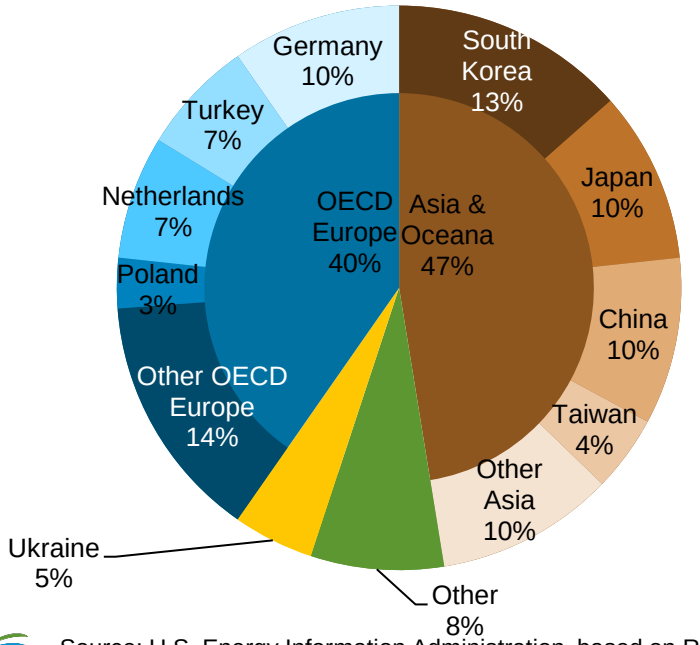
In 2016, Russia consumed about 45% of its coal production[100] and exported the rest. Although coal accounts for a relatively modest share of Russia's total energy consumption, coal is a more vital part of consumption in Siberia, where most Russian coal is mined.

More than half of Russia's coal production comes from the Kuzbass basin in central Russia. Kuzbass coal must travel long distances by rail to reach ports in the west or the east of the country for export to European or Asian consumers. This long overland transport generally puts Russian coal at an economic disadvantage to competing sources of coal. Even so, in 2016, Russia was the third-largest coal exporting country in the world, exporting 189 million short tons, seaborne and overland. The top two coal exporters in 2016 were Australia and Indonesia.

Russia's coal exports have generally grown steadily since the late 1990s, with exports to Asia growing strongly in the past few years. In 2016, 47% of Russia's coal exports went to Asia (Figure 9).[101] Russia's total coal exports have almost doubled over the past decade, and exports are expected to continue to grow in the future.

Russia's coal-exporting ports are geographically located to serve either European or Asian markets. Some of Russia's major coal ports include Murmansk, Ust-Luga, and Tuapse, all of which lie in the West and handle exports to Europe. Vanino and Vostochny lie in the East and handle exports to Asia.[102] China and some East European countries receive coal imports from Russia directly by rail.[103] Russia has plans to expand port capacity to facilitate more coal exports to Asia.

Figure 9. Share of Russia's coal exports by destination, 2016



Source: U.S. Energy Information Administration, based on Russian export statistics and partner country import statistics, Global Trade Tracker

Notes

- Data presented in the text are the most recent available as of October 31, 2017.
- Data are EIA estimates unless otherwise noted.

[1] Ministry of Finance of the Russian Federation, Annual report on execution of the federal budget, (updated April 28, 2017).
[2] EIA estimates based Global Trade Tracker (subscription)
[3] EIA estimates based on International trade data, Eurostat and Russian export statistics and partner country import statistics, Global Trade Tracker (subscription).
[4] International Atomic Energy Association, Power Reactor Information Service, updated October 1, 2017.
[5] BP Statistical Review of World Energy 2017 – Underpinning data (accessed July 5, 2017).
[6] The United States first announced limited sanctions in March 2014. Additional US sanctions, including broader economic sanctions, were announced over the course of the year, through September 2014. For additional details see U.S. Department of State, Ukraine and Russia Sanctions.
[7] "Announcement of Treasury Sanctions…" http://www.treasury.gov/press-center/press-releases/Pages/jl2572.aspx, (accessed April 13, 2015).
[8] "Announcement of Expanded Treasury Sanctions…" http://www.treasury.gov/press-center/press-releases/Pages/jl2629.aspx, (accessed April 13, 2015).
[9] The European Union (EU) first announced limited sanctions in March 2014, and first announced broader economic sanctions in July 2014. For additional details see European Union, EU sanctions against Russia over Ukraine crisis.
[10] Countering America's Adversaries Through Sanctions Act, Title II—Sanctions with Respect to the Russian Federation and Combating Terrorism and Illicit Financing, (2017).
[11] Henderson, James and Julia Loe, "The Prospects and Challenges for Arctic Oil Development," Oxford Institute for Energy Studies, (November 2014), p. 34.
[12] Gazprom Bank, "50% dividend payout threshold approved for state-controlled companies," (April 20, 2016).
[13] *Nefte Compass*, "Rosneft to Hike Dividends at Kremlin's Request," (June 29, 2017), p. 8.
[14] *Oil & Gas Journal*, "Worldwide Look at Reserves and Production," (December 5, 2016), p. 22.
[15] Table 1: Eastern Bloc Research, " Oil production by region, mn tons," *Russian Energy Monthly*, Vol XXX No. 11, (January 2017), p. 8. Note, the Eastern Bloc Research figures may include crude, condensate, and NGL.
[16] Eastern Bloc Research, *CIS and East European Energy Databook 2014*, "Table 6 Production of oil+condensate by region, mn tons," (2014), p. 2. Note, the Eastern Bloc Research figures include crude, condensate, and NGL.
[17] Tatneft, Oil and Gas Production, (accessed October 3, 2017).
[18] Eastern Bloc Research, " Oil production by region, mn tons," *Russian Energy Monthly*, Vol XXX No. 11, (January 2017), p. 8. Note, the Eastern Bloc Research figures may include crude, condensate, and NGL.
[19] Note there are two large oil fields in Russia named Prirazlomnoye. One is operated by Rosneft and is located onshore in the Khanty-Mansiisk area of West Siberia. The other is operated by Gazprom and is located in the Arctic offshore.
[20] Gazprom Neft, Press Release, "Oil production at Gazprom Neft's Prirazlomnoye field to increase almost two-fold," (March 16, 2016).
[21] Gazprom, Press Release, "First cargo of Yamal oil shipped from Arctic Gate offshore terminal," (May 25, 2016).
[22] Rosneft, Press Release, "Rosneft Oil Company has successfully closed the transaction of selling 15% shares in Vankorneft JSC to ONGC Videsh Limited," (May 31, 2016).
[23] Rosneft, OJSC Verkhnechonskneftegaz, (accessed September 13, 2017).
[24] Lukoil, Press Release, "Nine million tonnes of oil produced at Lukoil's North Caspian fields," (April 3, 2017).
[25] Lukoil, Press Release, "Lukoil produces three million tonnes of oil at Vladimir Filanovsky field," (July 11, 2017).
[26] Exxon Neftegas Limited, Consortium members, (accessed April 29, 2015).
[27] Exxon Neftegas Limited, Press Release "Sakhalin-1 Project Begins Production at Arkutun-Dagi Field," (January 20, 2015).
[28] Shell, Sakhalin-2 – an overview, (accessed April 29, 2015).

[29] Krysiek, Timothy Fenton, "Agreements from Another Era: Production Sharing Agreements in Putin's Russia, 2000-2007," Oxford Institute for Energy Studies, (November 2007), pp. 19-26.
[30] Annenkova, Anna, "Russian Benchmarks of Black Gold," *Oil of Russia: Lukoil International Magazine*, No. 4 (2012).
[31] ExxonMobil, Sokol, (accessed September 11, 2017).
[32] *Nefte Compass*, "Russia Exports New Crude Oil Grade," (February 19, 2015), p. 3.
[33] Argus, Methodology and specifications guide, Argus crude, "Asia-Pacific, Sudan, ESPO Blend, Sakhalin Island assessments," (August 2017), p. 24.
[34] Argus, Methodology and specifications guide, Argus crude, "Asia-Pacific, Sudan, ESPO Blend, Sakhalin Island assessments," (August 2017), p. 24.
[35] Energy Intelligence, *World Crude Oil Handbook*, 2017 edition, p. 398.
[36] Gazprom Neft, Press Release, "Almost three million barrels of Arctic oil delivered to Northwest Europe," (April, 17, 2015).
[37] Gazprom, Press Release, "First cargo of Yamal oil shipped from Arctic Gate offshore terminal," (May 25, 2016).
[38] Table 2: Eastern Bloc Research, " Oil production, mn tons," *Russian Energy Monthly*, Vol XXX No. 11, (January 2017), p. 8. Note, the Eastern Bloc Research figures may include crude, condensate, and NGL.
[39] BP, Working in Russia, (accessed August 4, 2016).
[40] Eastern Bloc Research, " Oil production, mn tons," *Russian Energy Monthly*, Vol XXX No. 11, (January 2017), p. 8. Note, the Eastern Bloc Research figures may include crude, condensate, and NGL.
[41] International Energy Agency, *Russia 2014: Energy Policies Beyond IEA Countries* (June 2014), pp. 20-22 and 192-193.
[42] Henderson, James, "Key Determinants for the Future of Russian Oil Production and Exports," Oxford Institute for Energy Studies, (April 2015), pp. 36-48.
[43] *Oil & Gas Journal*, "Worldwide Refining Survey," (December 5, 2016).
[44] Rosneft, Refining, (accessed September 9, 2017).
[45] Lukoil, Oil Refining, (accessed September 11, 2017).
[46] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[47] Ministry of Finance of the Russian Federation, Annual report on execution of the federal budget, (updated April 28, 2017).
[48] EIA estimate based on Global Trade Tracker, (subscription).
[49] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[50] Eastern Bloc Research, "Oil products trade, 2015, 2016," *Russian Energy Monthly*, Volume XXX No. 12 (February 2017), p. 22.
[51] Clipper Data (accessed September 12, 2017).
[52] Table 3: Transneft, Projects; Sakhalin Energy, TransSakhalin pipeline system; Caspian Pipeline Consortium, General information; State Oil Company of the Azerbaijan Republic (SOCAR), Baku-Novorossiysk oil pipeline; Orlen Lietuva, Terminal and pipelines; European Parliament, Gas and Oil Pipelines in Europe, "Pipelines from third countries," (November 2009) p. 11; *Nefte Compass*, "Transneft Seeks to Offset Upstream Delays," (April 16, 2015) p. 5; Rodova, Nadia, "Capacity crunch threatens Russia's ESPO oil exports," *Platt's Oilgram Price Report*, (February 4, 2015) pp. 1, 34; and *Argus FSU Energy*, "Transneft stalls ESPO feeder line," (January 28, 2016), p. 1.
[53] Lloyd's List Intelligence (APEX tanker data).
[54] Transneft Kozmino Port, About the Company, (accessed April 28, 2015).
[55] Lloyd's List Intelligence (APEX tanker data).
[56] Tamanneftegas, Technical characteristics of the complex, (accessed September 15, 2016).
[57] Clipper Data (accessed September 11, 2017)..
[58] Sibur, "First gas carrier loaded at the new LPG transhipment terminal in Northwest Russia," (June 19, 2013).
[59] Sibur, "RDIF, leading international co-investors and Sibur close deal for investment into marine terminal at Ust-Luga," (November 3, 2015).
[60] PR Newswire, "NOVATEK Completes Construction Of The Second Stage Of Ust-luga Complex," (October 16, 2013).
[61] Chemicals Technology News, "SIBUR commences propylene production using UOP technology at Russian plant," (December 18, 2014).
[62] Sibur, "SIBUR proceeds with ZapSibNeftekhim project," (September 16, 2014).

[63] Hydrocarbon Processing, "Winners: Top HPI projects of 2015," (accessed August 16, 2016).
[64] Rosneft, "Rosneft and Mitsui & Co., Ltd Sign Memorandum of Understanding to Jointly Develop FEPCO Project," (April 29, 2013).
[65] *Oil & Gas Journal*, "Worldwide Look at Reserves and Production," (December 5, 2016), p. 22.
[66] Table 5: Eastern Bloc Research, "Our Predictions: Gas Production, BCM," *Russian Energy Monthly*, Vol XXXI No. 2, (April 2017), p. 13.
[67] International Energy Agency, *Russia 2014: Energy Policies Beyond IEA Countries* (June 2014), pp. 20-22 and 192-193.
[68] Table 6: Eastern Bloc Research, "Our Predictions: Gas Production, BCM," *Russian Energy Monthly*, Vol XXXI No. 2, (April 2017), p. 13.
[69] Gazprom, Zapolyarnoye field, accessed August 15, 2017.
[70] *Argus FSU Energy*, "Gazprom Production Outlook: Heartland decline continues," Volume XXI No 11 (March 23, 2017), p. 5.
[71] Gazprom, Bovanenkovskoye field, accessed August 15, 2017.
[72] National Oceanic and Atmospheric Administration, NESDIS-Earth Observation Group, Global Gas Flaring Observed from Space, Upstream flares, Data Files Download, (accessed October 18, 2017). Note NOAA flaring data differs from EIA published flaring data.
[73] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[74] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[75] Naftogaz of Ukraine, "2016 results: Ukraine procured all imported gas from Europe," (February 3, 2017).
[76] EIA estimate based on data from UN Comtrade Database, (accessed September 12, 2017).
[77] EIA estimate based on data from BP Statistical Review of World Energy 2017 – Underpinning data (accessed July 5, 2017); Gazprom Export, Delivery statistics; and Cedigaz Statistical Database.
[78] Gazprom, Transmission and Underground Gas Storage Facilities, (accessed August 23, 2017).
[79] Table 7: Gazprom, Gas pipelines and Strategy; GazpromExport, Transportation, and Projects; Sakhalin Energy, TransSakhalin pipeline system; Nord Stream 2, The Pipeline; *World Gas Intelligence*, "Gazprom Braces for Yet More Pain," (January 7, 2015), pp. 2-3; *Nefte Compass*, "Russia, Turkey to Speed Up Turk Stream," (August 11, 2016), p. 3; and *Argus FSU*, "Gazprom revises PoS 1 plans," (May 19, 2016), p. 11.
[80] Yafimava, Katja, "Evolution of gas pipeline regulation in Russia: Third party access, capacity allocation and transportation tariffs," Oxford Institute for Energy Studies, (March 2015).
[81] Yafimava, Katja, "Evolution of gas pipeline regulation in Russia: Third party access, capacity allocation and transportation tariffs," Oxford Institute for Energy Studies, (March 2015), pp. 16-17.
[82] Gazprom, Transmission, accessed August 23, 2017.
[83] Gazprom, Press Release, "Gazprom and Shell address Sakhalin II expansion and Baltic LNG project," (June 1, 2017)
[84] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[85] Yamal LNG, About the project, (accessed September 6, 2017).
[86] Table 8: Gazprom, Sakhalin II, Shtokmanovskoye field, LNG regasification terminal in Kaliningrad Region, and Baltic LNG; Shell, Sakhalin-2 – An Overview; Yamal LNG, About the Project; Pechora LNG, LNG Plant; Rosneft, Gas Strategy; Reuters, "Novatek says some Arctic LNG-2 output would go to spot market," (June 17, 2016); and Reuters, "Russia's Gazprom delays Baltic, Sakhalin LNG projects," (March 13, 2017).
[87] Henderson, James, "Russian LNG: Progress and delay in 2017," Oxford Institute for Energy Studies (March 2017), pp. 16-17 and International Gas Union, ".2012 – 2015 Triennium Work Report: Small Scale LNG," (June 2015), p. 56.
[88] Russian Ministry of Energy, Statistics, accessed August 8, 2017.
[89] EIA estimates based on Russian export statistics and partner country import statistics, Global Trade Tracker (subscription).
[90] International Energy Agency, *Russia 2014: Energy Policies Beyond IEA Countries* (June 2014), pp. 20-22 and 192-193.
[91] Belobrov, Vladimir, Electricity Markets in Russia, accessed April 27, 2015.
[92] International Energy Agency, *Russia 2014: Energy Policies Beyond IEA Countries* (June 2014), pp. 183 and 198.
[93] World Nuclear Association, Nuclear Power in Russia, (accessed July 23, 2017).

[94] World Nuclear Association, Nuclear Power in Russia, Table: Power reactors in operation, (accessed July 23, 2017).
[95] World Nuclear Association, RBMK Reactors, (accessed July 23, 2017).
[96] World Nuclear Association, Nuclear Power in Russia, (accessed July 23, 2017).
[97] World Nuclear Association, Nuclear Power in Russia, (accessed July 23, 2017).
[98] BP Statistical Review of World Energy 2017 – Underpinning data (accessed July 5, 2017).
[99] Eastern Bloc Research, *Russian Energy Monthly*, "Table: Coal in 2015, 2016, mn tons," Volume XXX No 12 (February 2017) p.11.
[100] BP Statistical Review of World Energy 2017 – Underpinning data (accessed July 5, 2017).
[101] Russian export statistics and partner country import statistics, Global Trade Tracker, (subscription).
[102] Suek AG, Seaborne Deliveries, (accessed July 7, 2017).
[103] Suek AG, Railway Deliveries, (accessed July 7, 2017).