

CAN BULGARIA SURVIVE WITHOUT RUSSIAN OIL?

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The short answer is “YES”. The country can get supplies of crude oil and other feedstock from non-Russian sources for the Lukoil’s Neftochim Burgas refinery. The country can also get refined products if those are needed. And the country can probably do that at a cost that would not be much different from what it pays now for oil and for products.

Here is why this is the case.

Patterns of petroleum¹ supply

Over 2015-2020, Bulgaria’s annual consumption of petroleum products was relatively stable, at around

4.5 million tons of oil equivalent per year (toe/y). The country only produced about 25,000 toe/y of crude oil and condensate, equivalent to less than 1% of consumption.

The vast bulk of petroleum consumed in the country ultimately originates in imports, either as crude oil and other feedstock processed in the country’s refineries and then sold as products on its markets, or as products imported from other countries. Data about imports and exports of crude oil and refined products over 2015-2020 is provided in Table 1.

Table 1. Imports, exports and net apparent consumption of petroleum in Bulgaria

	<i>Million toe</i>					
	2015	2016	2017	2018	2019	2020
Imports	8.97	9.05	9.55	8.05	9.26	7.1
Exports	4.45	4.57	4.8	3.54	4.27	2.85
Apparent consumption (incl. stock change)	4.52	4.48	4.25	4.51	4.99	4.25

Source: Eurostat.

Since the country only produces microscopic quantities of crude oil and condensate, it is obvious that imports consist mostly of crude oil and other

refinery feedstock, while exports consist of refined petroleum products.

¹ Crude oil, condensate, refinery feedstock, and refined products.

Refining capabilities

Bulgaria has three refineries:

- INSA's facility located in the village of Belozem in Central Southern Bulgaria;
- The Bulgarian Petroleum Refinery located in the village of Dolni Dabnik in Central Northern Bulgaria; and
- The Lukoil Neftochim Burgas refinery located on the Black Sea coast.

Two more refineries that existed previously are now permanently closed down and scrapped (the 1.5 million toe/y lubricants-oriented Plama located near Pleven, and the 0.1 million toe/y Bimas in Ruse - the oldest one, dating back to 1933).

INSA's facility is a hydrofining one that treats middle distillates (not crude oil) with hydrogen and produces Diesel and gasoil. Its capacity is ca. 115,000 toe/y.

The Bulgarian Petroleum Refinery's facility is a small topping (atmospheric distillation) plant that was constructed in 1994 by the then government-owned Oil and Gas Exploration and Production Plc., which is now part of the Chimimport group of companies controlled by the TIM holding of Varna. The refinery processes crude oil and condensate produced in the marginal fields located in its vicinity and a few other locations, and produces solvents, gasoline and Diesel, as well as various grades of fuel oil. Due to

the natural decline of the output from the fields, the refinery operates well under its nameplate capacity, which is anyway just 45,000 toe/y.

The Lukoil Neftochim Burgas refinery is part of a large and sophisticated petrochemical complex. The original facilities date back to the early 1960's. Over the years, the capacity was expanded, to reach ca. 12 million toe/y by 1974. Then, as the pattern of products demand shifted away from fuel oil to the lighter end of the barrel, the refinery's complexity increased significantly due to the construction of new installations. By the early 90's, Neftochim's refinery had the following main units:

- Atmospheric distillation – 3 units of 3 million toe/y each and 2 units of 1.5 million toe/y each;
- Gas separation / processing (ethane, propane, butane);
- De-sulfurization (naphtha, kerosene, Diesel – 2 units);
- Vacuum distillation (2 units);
- Fluidized bed catalytic cracking (FCC) unit;
- Thermal cracking (visbreaking²) unit;
- MTBE³ production unit;
- Sulfuric acid alkylation⁴ unit;
- Catalytic reforming units (2);
- Naphtha aromatics units⁵;
- Sulfur recovery unit;
- MEROX⁶ unit.

² Visbreaking ("viscosity breaking) allows the processing of heavy (e.g. fuel oil) products into lighter (e.g. gasoline) products. Residual products are fuel oil and bitumen.

³ MTBE (methyl tert-butyl ether) is an octane boosting additive to gasoline which allows the production of gasoline with reduced content of lead or unleaded gasoline.

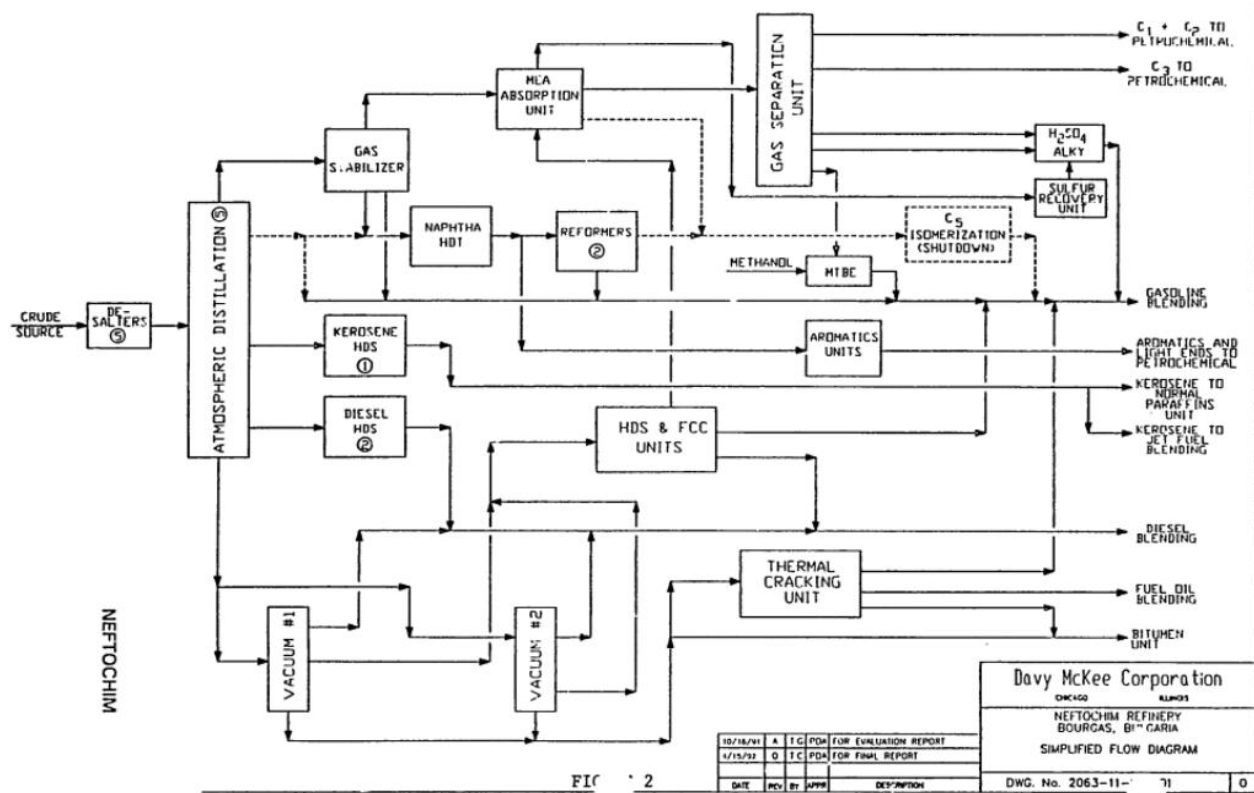
⁴ The alkylation of low-octane refinery products allows the production of alkylate, an exceptionally high octane component of gasoline, thus reducing or eliminating the need to use lead-containing octane boosters.

⁵ The removal of aromatics from naphtha allows the products to be used either directly (e.g. benzene, toluene) or as feedstock to petrochemicals.

⁶ MEROX is a proprietary technology developed by UOP. MEROX selectively "sweetens" (reduces the acidity) of petroleum products by oxidizing the foul-smelling mercaptans into disulfides. The disulfides remain in the product, so the total sulfur content stays the same. The process allows the refinery to use crude oil with high mercaptans sulfur content.

Figure 1 illustrates the refinery configuration as of 1992.

Figure 1. Neftochim refinery simplified flow diagram, 1992



Source: Davy McKee Corporation: Characterization Report – Bulgarian Petroleum Refining Sector. Chicago, IL, 1992. USAID Contract EUR-001 5-C-00-1 011-00, p. C.1.2.

From the list and Figure 1, it is obvious that already by the early 90s Neftochim was capable of processing medium heavy, high sulfur, mercaptan containing crude oil, as well as – of course – any of the lighter, “sweeter” (lower sulfur content) crudes available on the world market. And it actually did: apart from the Soviet Export Blend brand⁷ which it got from oil exporting terminals in the Black Sea (Novorossiysk, Tuapse, Odessa – then still in the USSR), Neftochim processed oils exported by Libya

⁷ The Soviet Export Blend crude oil grade was the predecessor of the Urals grade. It was essentially a crude oil of identical quality, sold at the time under a different label. Urals is a mixture of mostly Russian crude varieties, but does contain crudes produced elsewhere in the former Soviet Union, e.g. Kazakhstan, just as Soviet Export Blend did. Urals has a specific weight of ca. 31 degrees API

(e.g. Sarir), Syria (Syrian Light), Algeria (Saharan Blend), and a few other countries.

In 1999, Neftochim was privatized. The new owner (Lukoil) faced the need to further upgrade the refinery, so that it could meet stricter quality and environmental standards, notably the complete elimination of lead from gasoline and the strict limits on the content of aromatics and sulfur in various refined products. Besides, demand continuously shifted to the light end of the barrel,

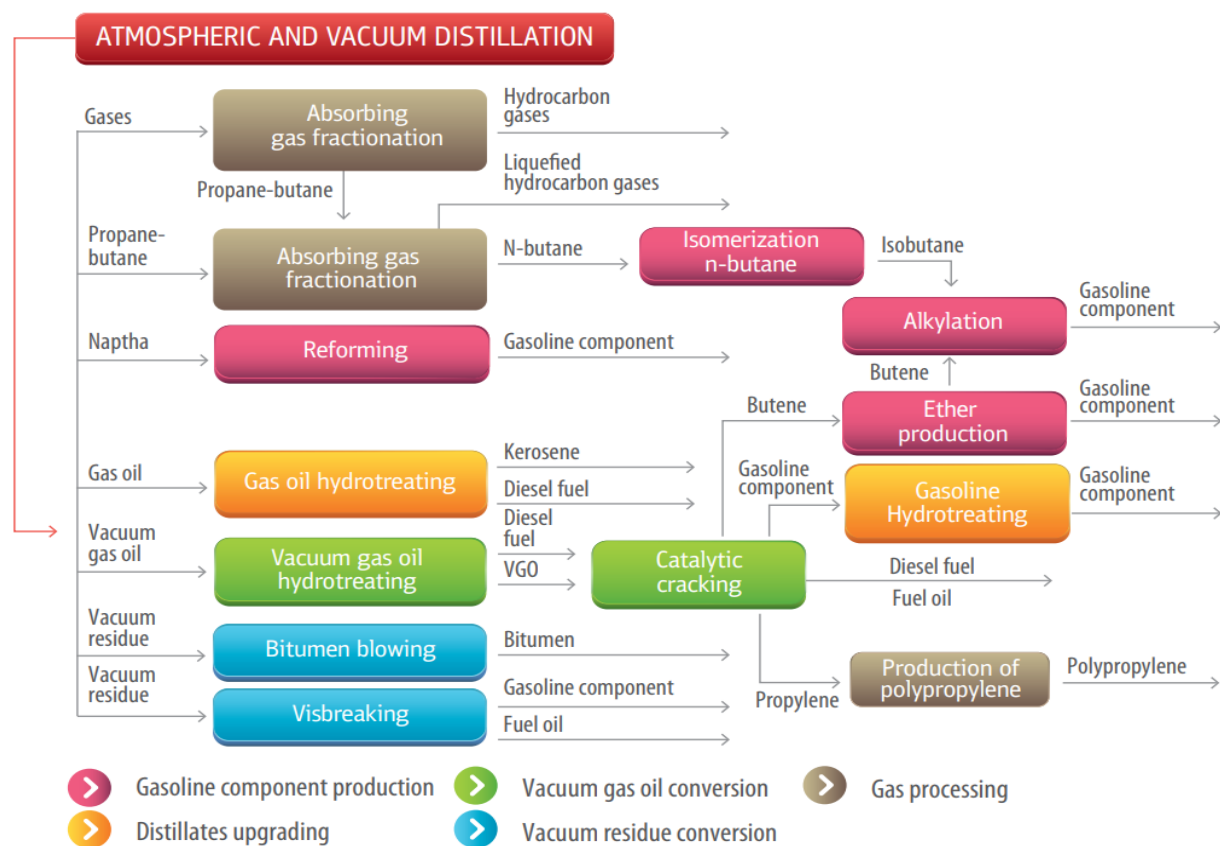
and contains ca. 1.5% sulfur, which makes it a medium heavy, rather sour kind of a crude oil. Urals is a “benchmark” crude oil grade, i.e. other brands of Russian crude oils are priced by using Urals “benchmark” prices. Urals accounts for ca. 80% of Russia’s oil exports, with its main market being Eastern & Central Europe and the countries along the north coast of the Mediterranean Sea.

which necessitated upgrades, too. The first step taken by Lukoil was the mothballing of the two smaller atmospheric distillation units, bringing down the capacity to ca. 9 million toe/y.

In 2006-2007, work was carried out to reduce emissions and the construction of a unit for isomerization of n-butane with 50,000 toe/y capacity was completed. In 2009, a new unit for sulfuric acid alkylation with 300,000 toe/y capacity

was put into operation, and construction of a Diesel fuel hydrotreatment unit was completed. In 2010, a Diesel hydrotreatment unit and FCC naphtha hydrotreatment unit were commissioned, as well as a sulfuric acid regeneration facility. Already by 2009, the refinery met Euro 5 product standards as well⁸. Figure 2 illustrates the refinery configuration after the implementation of the upgrades.

Figure 2. Neftochim refinery simplified flow diagram, 2014



Source: Fact Book 2014, Lukoil. p. 44.

Next, new facilities were constructed by 2015 in order to increase the depth of processing from 76% to 90% and ensure fuel oil production with sulfur content below 1%, thus meeting European requirements. In particular, a modern facility for deep processing of vacuum residue was constructed. The facility includes a 2.5-million toe/y

year residue hydrocracker, as well as amine, sour water stripper and hydrogen production units. Other upgrades were also undertaken throughout the refinery.

In a nutshell, **Lukoil Neftochim's refinery of today is ranked among the top 10% of refineries worldwide in terms of Nelson Complexity Index**

⁸ Cf. Fact Book 2014. Lukoil, 2014, p. 44.

(NCI)⁹, with its NCI value assessed at 13 and the crude oil conversion factor (“depth of refining”) standing at 87. This means that the refinery is capable of processing lower quality (heavier, higher sulfur content) grades of crude oil, as well as other heavy feedstock (refinery residuals) into highly refined, more valuable products. This also means that the variety of crude oil grades and other feedstock that the refinery can efficiently process encompasses the bulk of crude oil grades traded on international markets and residuals obtained at other, less sophisticated refineries.

As a matter of fact, **Lukoil Neftochim Burgas already processes millions of tons of non-Russian oil (ca.**

40% of overall annual throughput), and there is no technical bottleneck within the refinery which could prevent increasing this share.

Lukoil does not offer processing services to other parties at its Neftochim refinery. In addition, Lukoil Neftochim also operates a product pipeline that links the facilities to major cities and product depots in Southern Bulgaria all the way to Sofia, the nearby oil port of Rosnets, and ca. 90% of the oil product storage capacity in Bulgaria. **In essence, access to all major petroleum infrastructure in Bulgaria is foreclosed by Lukoil, a situation which induces propensity to market abuse.**

The Lukoil Neftochim Burgas refinery is technically able to efficiently process the widest variety of crude oils traded on international markets, as well as other feedstock such as refinery residuals. Any claim that the refinery can only process Russian crude oil grades, notably Urals, is simply false.

Re-visiting the regulatory framework for third party access to petroleum infrastructure in Bulgaria is long overdue. The status quo is one of monopolistic dominance that is prone to foreclosing competition.

Crude oil grades available in the Black Sea and the Mediterranean

Table 2 lists certain grades of non-Russian crude oil available from ports within the Black Sea and the Mediterranean. Only grades similar or lighter and with lower sulfur content than Urals are listed.

The crude oil grades listed in Table 2 are by far not an exhaustive representation of the non-Russian

grades available in the Black Sea and the Mediterranean. And yet, just those add up to more than 4 million barrels per day (bpd), equivalent to some 200 million toe/y. This is about 30 times more than Lukoil Neftochim’s annual throughput in recent years, i.e. **less than 3% of just the crude oil flows shown in Table 2 would suffice to run the Neftochim refinery in “business as usual mode” without any Russian oil!** And this is without even considering other possible suppliers, such as those in the Gulf (Kuwait, Iraq, Saudi Arabia, UAE, etc.) or along the West Coast of Africa.

⁹ Cf. Caruso, P., Garcia, D., and de Sá, J., “Full Potential Oil Refining in a Challenging Environment,” Bain & Company, September 20, 2016. The NCI indicates the ability of a refinery to produce lighter, more heavily refined and valuable products from a barrel of oil. The index measures the complexity and cost of each major type

of refinery equipment. In forming the index, the distillation column is given a value of 1 and the other units are assigned a value based on conversion and cost relative to the distillation column. The larger the Nelson index of a refinery, the more complex it is.

Table 2. Selected Black Sea and Mediterranean crude oil grades

	Grade	Deg. API	Sulfur, % wt	Country	Port	Throughput, '000 bpd
Black Sea	CPC	46.6	0.55	Kazakhstan	Ozereevka	1200
	Azeri Light	34.9	0.55	Azerbaijan	Supsa	145
Mediterranean	Saharan Blend	46.0	0.1	Algeria	Arzew, Bejaja, Skikda	1250
	Sarir	38.0	0.83	Libya	Marsa el- Hariga	120
	Suez Blend	30.4	1.65	Egypt	Ras Shukheir	300 (est.)
	BTC	36.6	0.16	Azerbaijan	Ceyhan	1000

Tanker logistics and cost issues

The ability to process certain grades of non-Russian crude oil is, of course, not sufficient by itself to move away from the use of Russian oil: there should also be a possible way to procure, transport, and deliver non-Russian crude oil to the refinery. In this context, the basic facts that need to be considered are the following:

- The port of Rosenets is able to handle tankers not exceeding certain dimensions (overall length, maximum draft, etc.), which limit the size of the cargo at about 70,000 tons. Freight rates for such tankers are quoted as “Long Range 1” (LR1) under the Average Freight Rate Assessment (AFRA) scale used in the tanker shipping industry.
- By modern standards, such tankers are relatively small and can be loaded at almost all oil exporting terminals in the Black Sea and the Mediterranean. They can also pass through the Bosphorus, where the maximum size of tankers is about 120,000 tons.
- If Neftochim only uses Russian Urals, there will be a need for about 100 round trips of a LR1 tanker from / to Novorossiysk / Tuapse in order to deliver 7 million toe/y, the typical Neftochim refinery throughput in recent years.
- The typical turnaround time for a tanker from Rosenets to Novorossiysk or Tuapse, the two main Russian ports within the Black Sea which are the ports supplying Urals to the refinery, is 10-12 days, including 48-72 hours turnaround time in each of the ports (4-6 days total) and ca. 3 days of sailing one way (about 6 days total). The distance between Rosenets and Novorossiysk is ca. 480 nautical miles.
- The distances from various oil loading terminals in the Black Sea and the Mediterranean to Rosenets are approximately the following (in nautical miles):
 - Ceyhan (Turkey, BTC): 1000
 - Marsa el-Hariga (Libya): 1000
 - Suez (Egypt): 1000
 - Arzew (Algeria): 1500
 - Ozereevka (CPC – Kazakhstan oil via Russia): 500
 - Supsa (Azeri oil via Georgia): 620

With the above in mind, one can easily deduct that switching to CPC (Kazakhstan) and/or Azeri oil (Supsa) within the Black Sea will not change transportation costs, while switching to Mediterranean crude oil will increase transportation costs two- to three-fold on a per-unit (barrel or ton) basis.

One can also easily assess by how much under the worst-case scenario (switching 100% to the most distant supplier, namely Algeria), the per-unit cost of oil supplied to Neftochim will increase. For example, in late March 2022 the daily AFRA LR1 tanker rates were reported at ca. \$25,000 per day¹⁰.

Consequently, one would pay ca. \$300,000 for a round trip to Novorossiysk, but three times that

amount for a round trip to Arzew, a difference of \$600,000. While this may sound like a lot, the per-barrel increase will amount to just a dollar or so (a LR1 tanker carries about 500,000 barrels of oil), i.e. a surcharge of about 1% over the current price of crude oil. This means that a move in oil price of just 1% up or down will override the change in the delivered cost of the oil to Rosenets.

Concerns about the increased cost of transportation of crude oil to Lukoil Neftochim Burgas when switching to non-Russian oil are irrelevant when switching is within the Black Sea and marginal at best when switching to oil originating from other sources.

Conclusions

- There are no technical, logistical or economic barriers to switching to non-Russian crude oil at Lukoil Neftochim Burgas, the only refinery that is of any consequence in Bulgaria.
- In the current debate at European level regarding the possible introduction of a ban on imports of Russian oil to the European Union, Bulgaria's siding with landlocked Central European countries is irrational. Hungary, Slovakia and the Czech Republic either do not have physical ability to obtain alternative crude oil supplies (Hungary and Slovakia), or (in the case of the Czech Republic) lack the full capacity to do so in 2022. On the other hand, Bulgaria can procure all the oil it needs from many sources already in 2022.
- Bulgaria's oil and refined products markets are monopolistic, both in terms of commodity and of services markets. There is not even a pithy of an attempt to address the problem, and over the years the risk of major upheaval has only been growing. This risk will never be addressed
- without diversification of crude oil supplies and strict implementation of open infrastructure access rules, especially access to refined products storage and port services, for all parties engaged in refined products trade.
- Lukoil Neftochim Burgas is part of a vertically integrated oil company that forecloses access to refining services and to the only oil port in Bulgaria to any party outside Lukoil. The same applies to pipeline transportation of petroleum products within Bulgaria. In fact, Lukoil controls ca. 90% of these markets in Bulgaria, a share that exceeds the market dominance of Rockefeller's Standard Oil before the Sherman Act of 1890.
- Diversifying crude oil supplies away from Russia is thus going to be only the starting point in a long uphill battle for Bulgaria, on the road to its energy security and independence. Taking a wrong political step at European level at the fork in the road to such security and independence is hardly the right choice.

¹⁰ Cf, for example: Miller, G., "Why Russia-Ukraine war has not ignited crude tanker rates (yet)," *American Shipper*, March 23, 2022.