



# Country Analysis Brief: Saudi Arabia

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## Overview

**Table 1. Saudi Arabia's energy overview, 2021**

	Crude oil and other petroleum liquids	Natural gas	Coal	Nuclear	Hydro	Other renewables	Total
Primary energy consumption (quads)	4.9	4.3	0.0	0.0		0.0	9.2
Primary energy consumption (percentage)	53%	47%	0%	0%		0%	100%
Primary energy production (quads)	22.3	4.3	0.0	0.0		0.0	26.6
Primary energy production (percentage)	84%	16%	0%	0%		0%	100%
Electricity generation (TWh)	147.4	218.6	0.0	0.0	0.0	0.7	366.7
Electricity generation (percentage)	40%	60%	0%	0%	0%	0%	100%

Data source: U.S. Energy Information Administration, International Energy Statistics database and Energy Institute, *Statistical Review of World Energy*

Note: We aggregate hydroelectricity and renewables as other renewables for primary energy production and consumption. We aggregate crude oil and other petroleum liquids, natural gas, and coal fuel sources as fossil fuel-derived fuel sources for electricity generation. Quads=quadrillion British thermal units, TWh=terawatt-hours.

- Saudi Arabia was the world's third-highest crude oil and condensate producer, the world's top crude oil exporter, and OPEC's top crude oil producer in 2022.<sup>1</sup>
- Saudi Arabia is a key member of OPEC+, and in October 2022, Saudi Arabia and other OPEC+ members agreed to crude oil production cuts intended to rebalance the global oil market, hedge against downside risks of decreased oil demand, and raise falling crude oil prices.<sup>2</sup> In May 2023, Saudi Arabia and several OPEC+ members further reduced crude oil production and extended cuts through 2024. Saudi Arabia voluntarily decreased oil production by an additional 1 million barrels per day (b/d) from July 2023 through December 2023, with possible extensions that depend on the status of the oil market.<sup>3</sup>
- Saudi Arabia's [Vision 2030](#) supports extensive renewable energy and nonassociated natural gas development throughout the country and seeks to decrease oil- and associated natural gas-fired electricity generation in favor of renewable-sourced generation.<sup>4</sup> Saudi Aramco expects Jafurah, the largest unconventional natural gas field in Saudi Arabia, to begin production in 2025, and the Saudi National Renewable Energy Program (NREP) expects renewable energy sources to account for 50% of generated electricity in Saudi Arabia by 2030.<sup>5</sup>

Figure 1. Map of Saudi Arabia



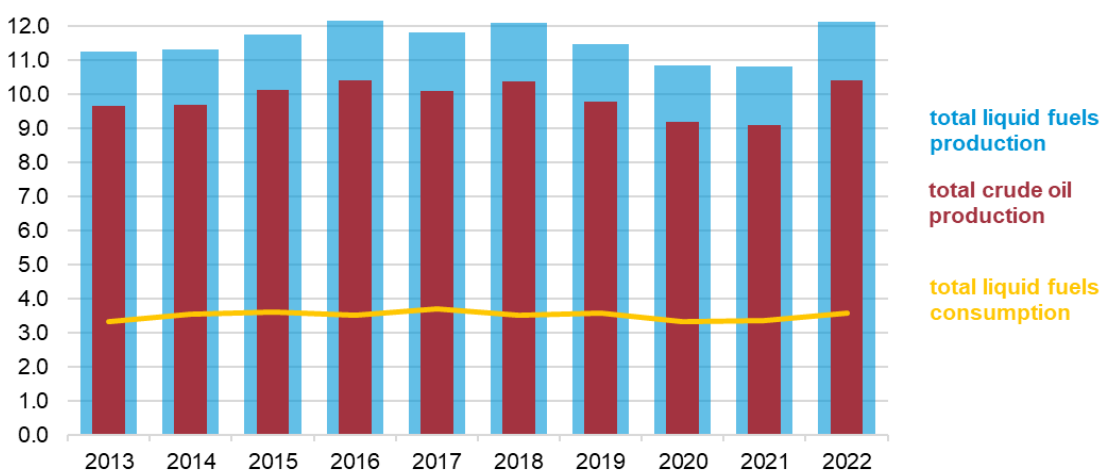
Data source: U.S. Central Intelligence Agency, [CIA World Factbook–Saudi Arabia](#)

## Petroleum and Other Liquids

- Saudi Arabia produced 12.1 million b/d in total liquid fuels in 2022, up 12% from 10.8 million b/d in 2021 (Figure 2).
- Saudi Arabia produced 10.4 million b/d of crude oil in 2022, 14% higher than the 9.1 million b/d in 2021 (Figure 2).<sup>6</sup> This increase drives Saudi Arabia's increased total liquid fuels production, reflecting a gradual reversal of OPEC+ production cuts from 2020.<sup>7</sup>
- Saudi Arabia accounts for 43% (0.5 million b/d) of agreed on OPEC+ production cuts that began in May 2023 and extends through the end of 2024.<sup>8</sup> Saudi Arabia will take an additional oil production cut of 1.0 million b/d from July through December 2023. We expect these oil production cuts to result in decreased crude oil production in Saudi Arabia for 2023 compared with 2022.<sup>9</sup>
- Saudi Arabia produces five grades of crude oil: Arabian Heavy, Arabian Medium, Arabian Light, Arabian Extra Light, and Arabian Super Light. In general, the majority of Saudi Arabia's crude oil is considered sour because its sulfur content is greater than 1% (Table 2).<sup>10</sup>
- Saudi Aramco plans to increase its maximum sustainable capacity for crude oil production by an estimated 1 million b/d, from Saudi Aramco's reported capacity of 12 million b/d in 2022 to 13 million b/d by 2027. Large expansion projects for the Safaniya, Zuluf, Marjan, and Berri oil fields are scheduled to drive this increased capacity. All three are under construction or in engineering phases as of 2023 (Table 3).<sup>11</sup>

- Saudi Arabia held 15% of the world’s proved oil reserves and an estimated 21% of OPEC’s proved reserves in 2022.<sup>12</sup> Saudi Arabia’s reserves include Ghawar and Safaniya, the world’s largest onshore and offshore oil fields, respectively.<sup>13</sup>
- Saudi Arabia consumed 3.6 million b/d in total liquid fuels in 2022, which was nearly 40% of Middle East consumption (9.9 million b/d). Saudi Arabia was estimated to be the largest per capita oil consumer in the world in 2022, not including major transshipment countries (such as the Netherlands and Singapore).<sup>14</sup>
- Oil refining in Saudi Arabia occurs domestically and internationally through either wholly owned, joint, or affiliated refineries held by Saudi Aramco. Saudi Aramco reported that domestic production of refined oil products was 1.6 million b/d in 2020 (57% of Saudi Aramco’s global production). Saudi Aramco reported domestic refining capacity at 2.9 million b/d in 2020 (45% of the global capacity Saudi Aramco held) prior to the Jazan Refinery Complex opening in 2021. Jazan, located in southwest Saudi Arabia, increased domestic capacity by an additional 400,000 b/d in 2021, while throughput remained at 50% (Table 4).<sup>15</sup>

Figure 2. Total annual liquid fuels production and consumption in Saudi Arabia, 2013–2022 million barrels per day




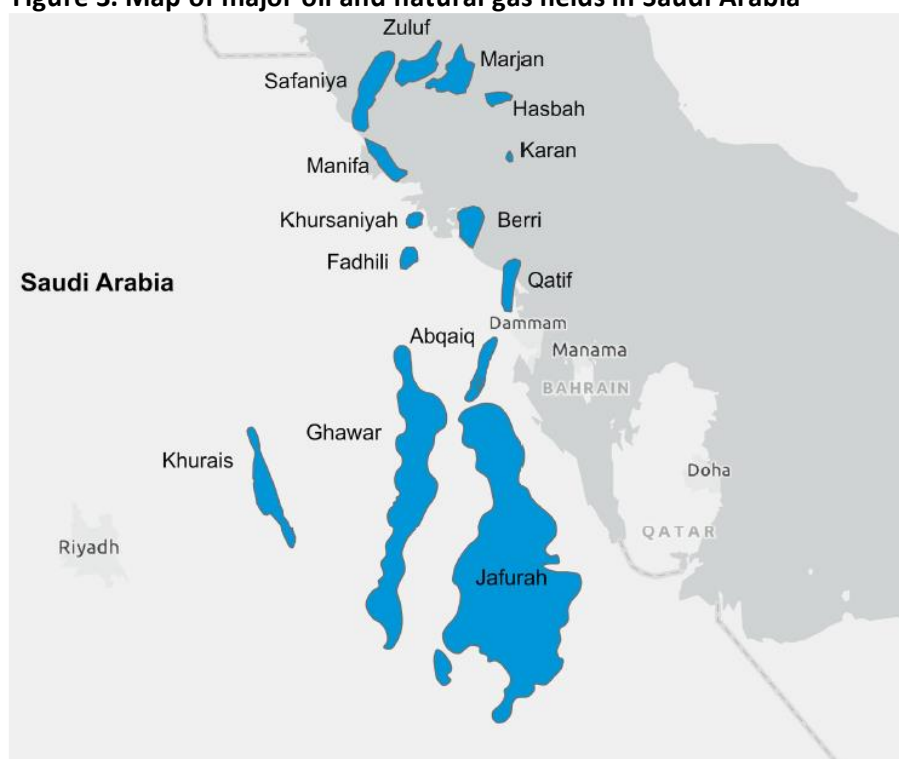
 Data source: U.S. Energy Information Administration, International Energy Statistics database and *Short-Term Energy Outlook* Data Browser; Energy Institute, *Statistical Review of World Energy*

Table 2. Crude oil grades from Saudi Arabia

	API gravity index	Sulphur content	percentage of crude oil reserves
Arabian Heavy	Less than 29	More than 2.9%	35%
Arabian Medium	29 to 32	2.2% to 2.9%	17%
Arabian Light	32 to 36	1.3% to 2.2%	34%
Arabian Extra Light	37 to 40	0.5% to 1.3%	13%
Arabian Super Light	More than 40	Less than 0.5%	1%

Data source: Saudi Aramco

**Figure 3. Map of major oil and natural gas fields in Saudi Arabia**

Data sources: Saudi Aramco, Esri, HERE Technologies, Garmin, United Nations Food and Agriculture Organization, U.S. National Oceanic and Atmospheric Administration, U.S. Geological Survey, Rystad Energy

**Table 3. Top oil field development projects in Saudi Arabia, 2023**

Oil field	Location	Type	Pre-existing capacity thousand barrels per day	Additional capacity thousand barrels per day	Total capacity thousand barrels per day	Expected completion year
Safaniya	Northeastern coast	Offshore	1,200	700	1,900	2027
Zuluf	Northeastern coast	Offshore	800	600	1,400	2026
Marjan	Northeastern coast	Offshore	500	300	800	2025
Berri	Eastern coast	Offshore and onshore	250	250	500	2025

Data sources: Energy Intelligence, Saudi Aramco, *Oil & Gas Journal*, and Atlantic Council

Note: Saudi Aramco expects Marjan to provide an additional 2.6 billion cubic feet per day in natural gas production and 360,000 barrels per day in ethane and natural gas liquids (NGLs).

**Table 4. Saudi Aramco refining operations, 2021**

Refinery	Location	Capacity thousand barrels per day	Throughput thousand barrels per day	Utilization percentage	Economic interest percentage	Partner
Jazan	Saudi Arabia	400	200	50%	100%	N/A
Ras Tanura	Saudi Arabia	550	402	73%	100%	N/A
Yanbu	Saudi Arabia	250	216	86%	100%	N/A
Riyadh	Saudi Arabia	130	84	65%	100%	N/A
SASREF	Saudi Arabia	305	250	82%	100%	N/A
SATORP	Saudi Arabia	440	396	90%	63%	N/A
YASREF	Saudi Arabia	430	338	79%	63%	Sinopec
SAMREF	Saudi Arabia	400	316	79%	50%	ExxonMobil
Petro Rabigh	Saudi Arabia	400	273	68%	38%	Sumitomo
<b>Domestic total</b>		<b>3,305</b>	<b>2,475</b>	<b>75%</b>		
Motiva (Port Arthur)	United States	635	539	85%	1	N/A
S-Oil	South Korea	669	637	95%	62%	S-Oil
Hyundai Oilbank	South Korea	690	--	--	17%	Hyundai Oilbank
FREP	China	280	207	74%	25%	Sinopec, ExxonMobil
Idemitsu Kosan	Japan	945	--	--	8%	Idemitsu Kosan
PRefChem	Malaysia	300	48	16%	50%	Petronas
<b>International total</b>		<b>3,519</b>	<b>1,431</b>	<b>76%</b>		

Data sources: Saudi Aramco and Middle East Economic Survey

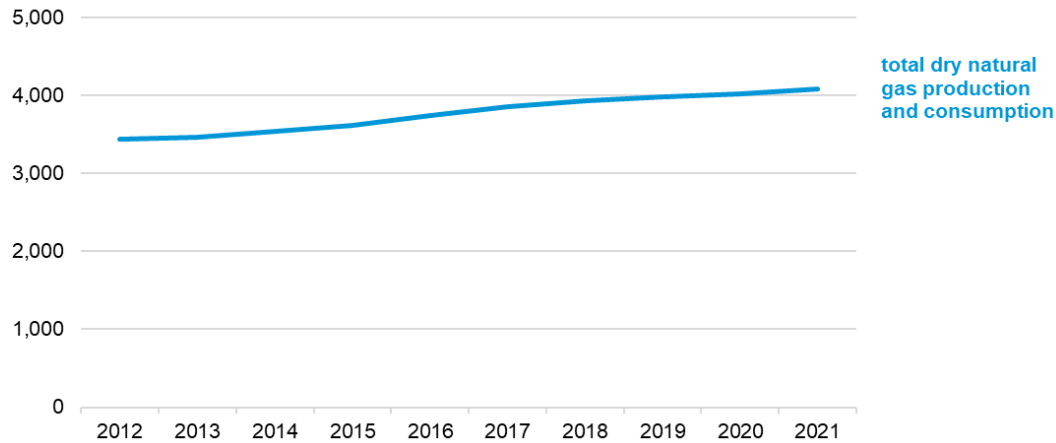
Note: Throughput and utilization for Hyundai Oilbank and Idemitsu Kosan are not publicly available and are excluded from the total international utilization calculation. N/A=not applicable, --=not available.

## Natural Gas

- Saudi Arabia meets natural gas consumption with domestic production and does not import natural gas. Natural gas production and consumption increased 2% from 4.0 trillion cubic feet (Tcf) in 2020 to 4.1 Tcf in 2021 (Figure 4).<sup>16</sup> Saudi Aramco expects domestic demand for natural gas to grow 3.7% per year from 2021 to 2030 because of increased demand for natural gas-fired power generation.<sup>17</sup>
- Associated natural gas production in Saudi Arabia changes alongside increases or decreases in crude oil production, and it was 52% of Saudi Arabia's total natural gas production in 2022 (Figure 5).<sup>18</sup> Saudi Arabia flared 66 billion cubic feet (Bcf) of associated natural gas in 2022 at an average intensity of 17 cubic feet per barrel (cf/b) of oil produced. The World Bank ranks Saudi Arabia as the 13th-largest natural gas flaring country for 2022, but the average intensity at which Saudi Arabia flared its natural gas was well below that of other top oil-producing countries.<sup>19</sup>
- Nonassociated natural gas is a rising proportion of Saudi Arabia's total natural gas production, increasing from 22% in 2012 to 48% in 2022 (Figure 5). Increased production of nonassociated natural gas allows Saudi Arabia to meet domestic natural gas demand despite shifts in crude oil production that limit associated natural gas output. For example, the proportion of nonassociated natural gas peaked at 52% of Saudi Arabia's total consumption in 2020 at a time when crude oil production declined significantly during the COVID-19 pandemic (Figure 5).<sup>20</sup>
- Jafurah, the largest unconventional natural gas field in Saudi Arabia, contains 200 trillion cubic feet (Tcf) in estimated reserves of natural gas.<sup>21</sup> Located east of Ghawar, Jafurah is currently under development and is scheduled to begin production of nonassociated natural gas in 2025 and provide 2.0 Bcf/d of natural gas by 2030 (Figure 3).<sup>22</sup>

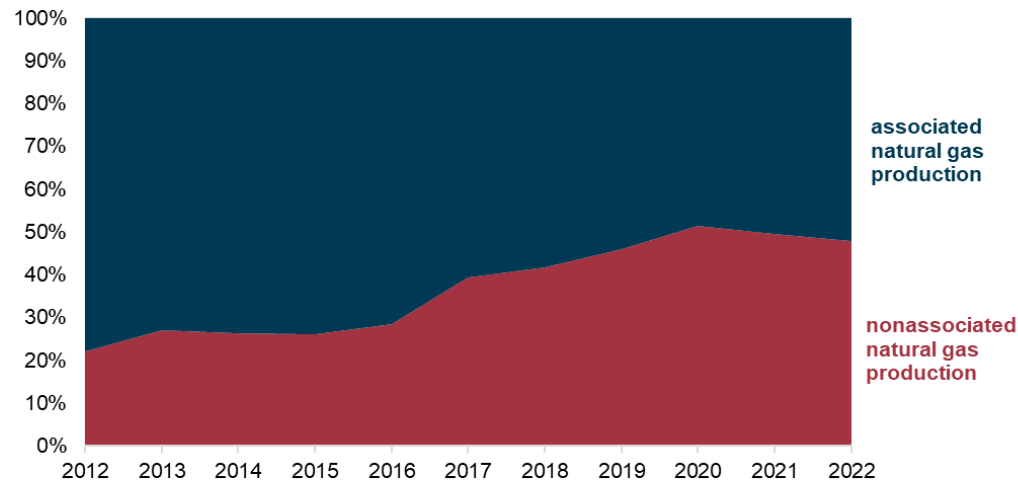
- Saudi Arabia seeks to begin exporting natural gas as part of [Vision 2030](#).<sup>23</sup> According to a 2016 analysis of Vision 2030’s natural gas development plans, Jadwa Investments estimates that average year-over-year increases in production will need to exceed 6.6% between 2020 and 2029 for Saudi Arabia to viably export natural gas.<sup>24</sup>

Figure 4. Total annual dry natural gas production and consumption in Saudi Arabia, 2012–2021  
billion cubic feet



**eia** Data source: U.S. Energy Information Administration, International Energy Statistics database  
Note: All natural gas consumption is met with domestic production.

Figure 5. Associated and nonassociated natural gas production in Saudi Arabia, 2012–2022  
percentage



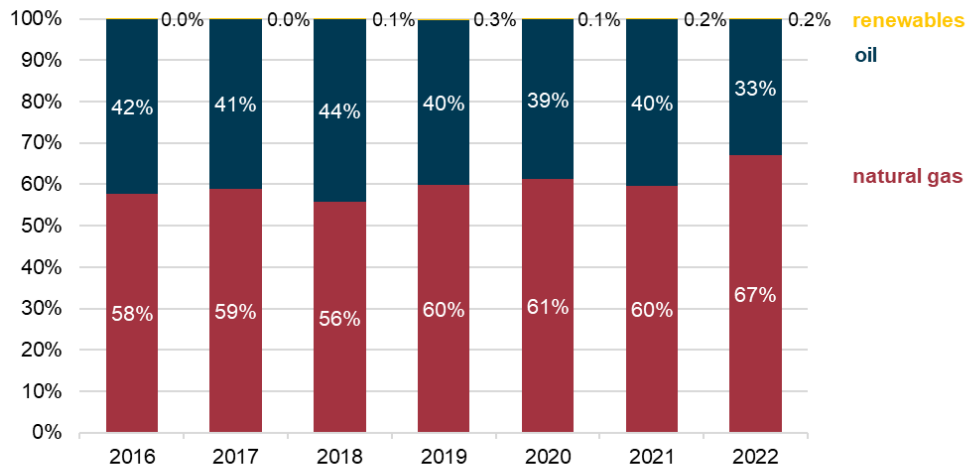
**eia** Data source: Rystad Energy UCube



## Electricity

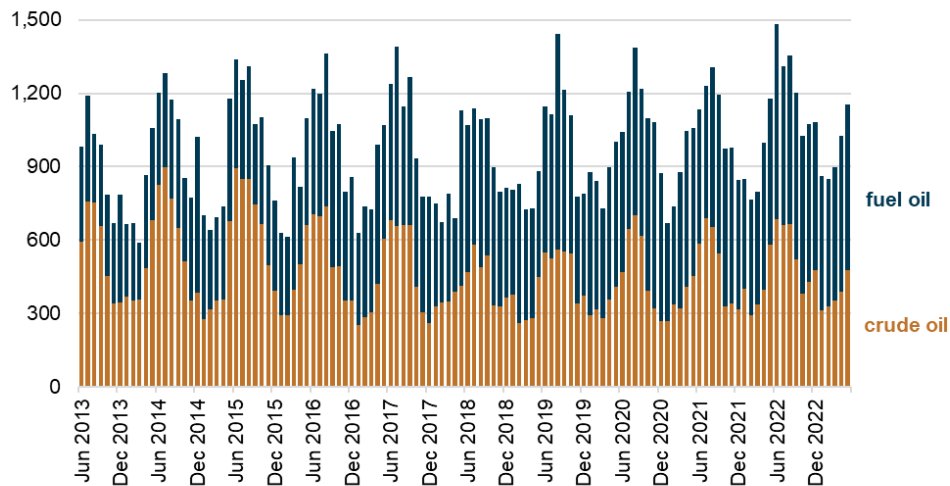
- Saudi Arabia generated an estimated 374 terawatt-hours (TWh) of electricity in 2022, up 2% from 367 TWh in 2021.<sup>25</sup> In 2022, Saudi Arabia generated 67% of its electricity from natural gas (up from 60% in 2021), 33% from oil (down from 40%), and less than 1% from renewables (the same as in 2021) (Figure 6).<sup>26</sup>
- Increased electricity demand during the summer months in Saudi Arabia drove oil-fired power generation (crude oil and fuel oil) up 9% year over year, increasing from 1.0 million b/d in 2021 to 1.1 million b/d in 2022 (Figure 7).<sup>27</sup> Oil-fired power generation supplements Saudi Arabia's natural gas-fired power to help meet demand for electricity. Despite minimal offsets from increased capacity to generate electricity from renewables and nonassociated natural gas, the demand for oil-fired power generation increased following declines in crude oil production and associated natural gas production.<sup>28</sup>
- Doosan Enerbility and Korea Electric Power Corporation (KEPCO) are constructing the Jafurah Cogeneration Plant east of Riyadh, which is scheduled to come online in 2025.<sup>29</sup> The plant's production capacity, 320 megawatts, will supply power to the Jafurah natural gas field, which will ultimately supply natural gas for domestic electric power generation, water desalination, and steel production throughout Saudi Arabia.<sup>30</sup>
- Water desalination accounted for 6% of electricity consumption in Saudi Arabia in 2020, and production of desalinated water in Saudi Arabia doubled from 1.1 billion cubic meters (Bcm) in 2010 to 2.2 Bcm in 2021.<sup>31</sup> Saudi Arabia's Saline Water Conversion Corporation (SWCC) is upgrading multiple desalination plants to reduce their energy consumption by 2024. New requirements for these plants call for less than 3 kilowatt-hours (kWh) per cubic meter of desalinated water, instead of the traditional 15 kWh. In total, the desalination plants receiving these upgrades account for 94% of Saudi Arabia's desalinated water production.<sup>32</sup>
- Renewable energy sources made up less than 1% of electricity generation in Saudi Arabia from 2018 to 2022 (Figure 6).<sup>33</sup> The Saudi National Renewable Energy Program (NREP) intends to increase this share to 50% by 2030 through several solar and wind projects.<sup>34</sup> Saudi Arabia's General Authority for Statistics reported 13 NREP projects as underway in 2020 (Table 5), and the Saudi Power Procurement Company (SPPC) announced a series of new agreements for wind projects and solar projects through 2022 and 2023 (Tables 6).<sup>35</sup> Additional updates for major projects include:
  - The Dumat Al Jandal wind farm began generating power in August 2021. It has the largest capacity of any wind farm in the Middle East, and it is the first wind farm in Saudi Arabia.<sup>36</sup>
  - The Sakaka solar project started operations in June 2021; it is the first utility-scale solar power project in Saudi Arabia.<sup>37</sup>
  - The Rabigh solar project in Makkah Province began operations in April 2023.<sup>38</sup>
  - Saudi Arabia's ACWA Power and Water and Electricity Holding Company signed agreements for Al-Shuaiba 2 in November 2022; it will have the largest capacity of any single-site solar power plant in the world.<sup>39</sup>

Figure 6. Electric power generation by fuel type in Saudi Arabia, 2016–2022 percentage



eia Data source: BP, *Statistical Review of World Energy* and Energy Institute, *Statistical Review of World Energy*  
 Note: Individual percentages might not add to the total because of rounding.

Figure 7. Total monthly oil burn in Saudi Arabia, 2013–2023 thousand barrels per day



eia Data source: Joint Organisations Data Initiative, Oil World Database  
 Note: Assumes all fuel oil consumption is burned.

**Table 5. Saudi National Renewable Energy Program (NREP) projects, 2020**

Project	Type of project	Project capacity megawatts
Sudair	Solar	1,500
Rass	Solar	700
Al-Shuaiba	Solar	600
Dumat Al-Jandal	Wind energy	400
Jeddah	Solar	300
Rabigh	Solar	300
Saad	Solar	300
Sakakah	Solar	300
Qurayyat	Solar	200
Wadi ad-Dawasir	Solar	120
Layla	Solar	80
Medina	Solar	50
Rafha	Solar	20

Data source: Kingdom of Saudi Arabia, General Authority for Statistics

**Table 6. Announced renewable energy projects in Saudi Arabia, 2022–2023**

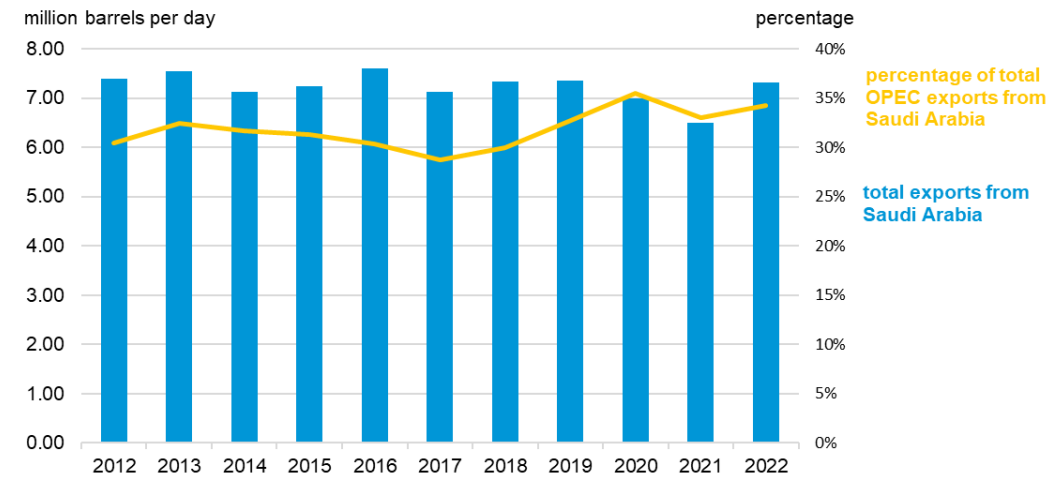
Project	Type of project	Project capacity megawatts
Al-Shuaibah 2	Solar	2,060
Rass 2	Solar	2,000
Al-Kahfa	Solar	1,425
Saad 2	Solar	1,125
Al-Henekiyah	Solar	1,100
Yanbu	Wind energy	700
Al-Ghat	Wind energy	600
Waad Al-Shamal	Wind energy	500
Tubarjal	Solar	400

Data source: Saudi Press Agency

## Energy Trade

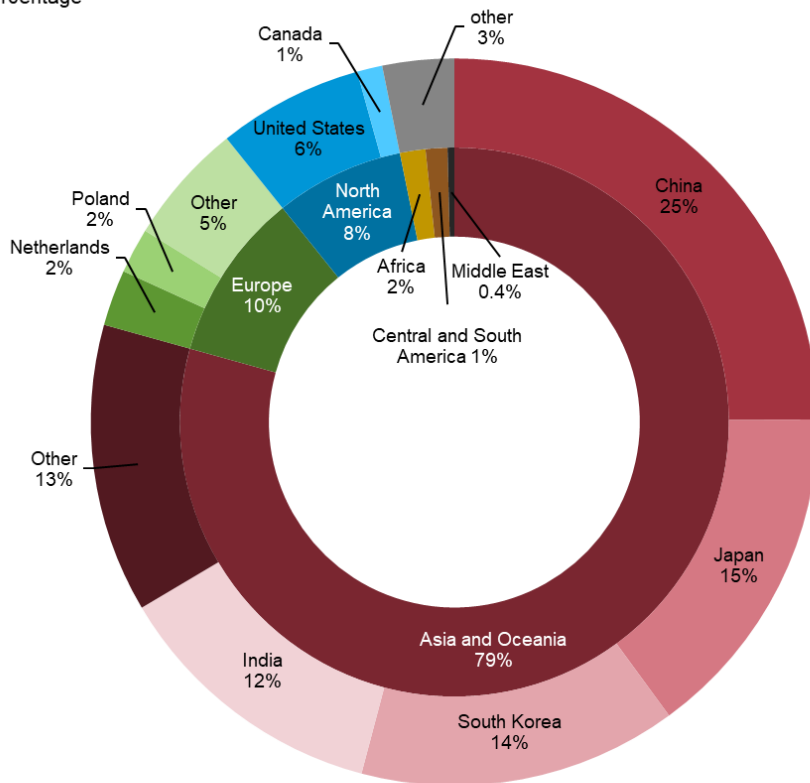
- Saudi Arabia exported an estimated 7.3 million b/d of crude oil in 2022, up 13% from 6.5 million b/d in 2021 as a result of increased annual crude oil production.<sup>40</sup> Saudi Arabia's crude oil exports were 34% of all 2022 exports from OPEC members (Figure 8).<sup>41</sup>
- According to customs data from Global Trade Tracker, countries in Asia were Saudi Arabia's primary export market for crude oil and condensate. Countries in Asia received 79% of Saudi Arabia's total annual exports in 2022, up from 72% in 2018 and subsequent years of steady year-over-year increases (Figure 9). China is Saudi Arabia's top crude oil importer, accounting for 25% of 2022 exports, followed by Japan, South Korea, and India (Figure 10).<sup>42</sup>
- Saudi Arabia imported 257,000 b/d of fuel oil in the first half of 2023, up 51% year over year from 171,000 b/d in the first half of 2022, driven by increased imports from Russia (Figure 11). Imports of fuel oil from Russia initially increased during the summer of 2022 to meet demand for power generation in Saudi Arabia. Substantially higher imports began in February 2023 because of discounted prices for fuel oil from Russia.<sup>43</sup>

Figure 8. Total annual exports of crude oil and condensate from Saudi Arabia and OPEC, 2012–2021



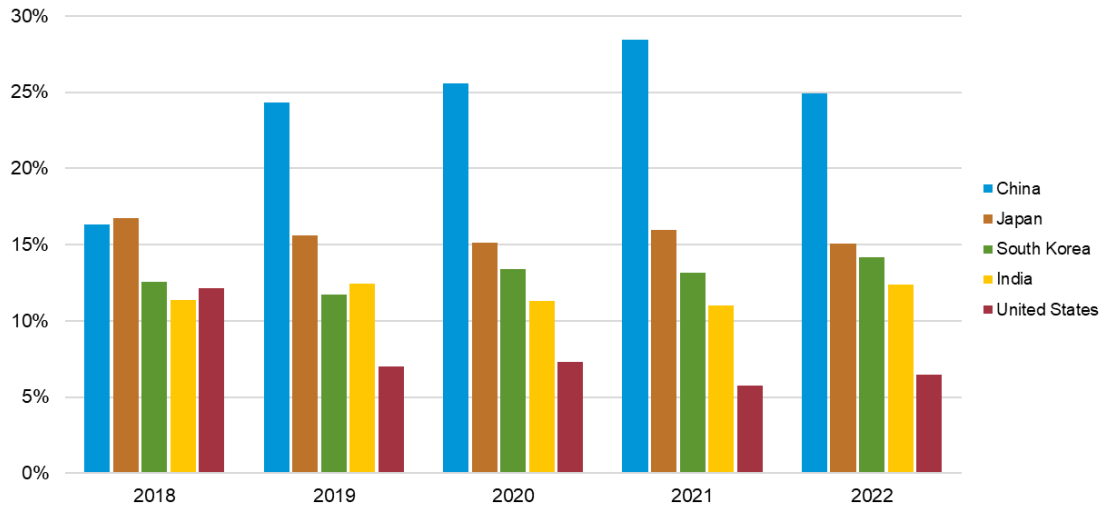
Data sources: U.S. Energy Information Administration, International Energy Statistics database; Energy Institute, Statistical Review of World Energy; BP, Statistical Review of World Energy; the Organization of the Petroleum Exporting Countries (OPEC)

Figure 9. Saudi Arabia crude oil exports by region and country, 2022



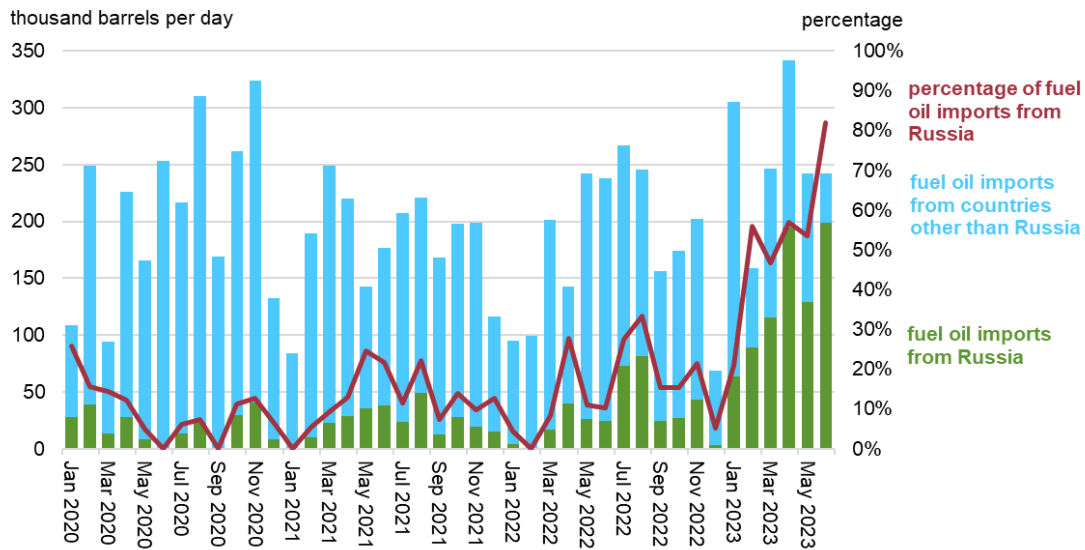
Data source: Global Trade Tracker  
 Note: Individual percentages might not add to the total because of rounding.

Figure 10. Top five importers of crude oil from Saudi Arabia, 2018–2022  
percentage of total exports



eia Data source: Global Trade Tracker

Figure 11. Total monthly fuel oil imports in Saudi Arabia, 2020–2023



eia Data source: Kpler

- <sup>1</sup> U.S. Energy Information Administration, International Energy Statistics (accessed June 2023); Energy Institute, *Statistical Review of World Energy*, 2023.
- <sup>2</sup> Maha El Dahan and Ahmad Ghaddar, Reuters, “Why are OPEC+ supply cuts failing to boost oil prices?,” July 4, 2023; Alex Lawler, Reuters, “OPEC oil output falls on Saudi cut and Nigerian outage, Reuters survey finds,” July 31, 2023.
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- <sup>4</sup> Kingdom of Saudi Arabia, *Vision 2030* (accessed July 2023).
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- <sup>6</sup> U.S. Energy Information Administration, *Short-Term Energy Outlook* Data Browser (accessed August 2023);
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- <sup>8</sup> Oil & Gas Journal, “OPEC+ surprises markets with voluntary cuts of 1.15 million b/d,” April 3, 2023.
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- <sup>20</sup> Rystad Energy UCube (accessed June 2023).
- <sup>21</sup> Saudi Aramco, “Jafurah: the jewel of our unconventional gas program,” December 29, 2022.
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- <sup>26</sup> Energy Institute, *Statistical Review of World Energy*, 2023.
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- <sup>41</sup> OPEC, Data Download, *World crude exports by country* (accessed August 2023).
- <sup>42</sup> Global Trade Tracker, Analytics, *Country Level Trade Flows* (accessed July 2023).
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