

## INTELLIGENCE REPORT

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### **CHINA NEEDS OIL: FORECASTING CHINA'S ENERGY IMPORT DEPENDENCY**

#### **SUMMARY**

China's need for energy has skyrocketed over the last 20 years as the country has gotten richer and the middle class—now 400 million—has grown into a significant segment of the population. Energy demands are not being met by domestic production, so China is now a net importer of oil, natural gas, and coal.



China's energy source mix has traditionally been dominated by coal, but the share of energy produced by coal is dropping. China is highly dependent on imported oil, which makes up about 68 percent of their oil consumption. Most comes from Middle East nations, but Russia has recently become China's biggest supplier, and the US is now exporting oil to China as well. Gas makes a small contribution to China's energy needs, but here too China has started importing from Turkmenistan and Russia.

As long as China's economy continues to grow (GDP growth is now at 6.6 percent) and the middle class gets larger, energy demand will grow in proportion. China is expected to increase its demand for energy by at least 34 percent by 2040. Coal's contribution to the energy mix will likely decrease to about 40 percent by 2040, but oil demand will grow and import dependency could reach 80 percent by 2040. The Chinese government is promoting a shift from coal to gas, but the lack of a significant shale gas industry in China means gas imports will increase as well. Energy from renewable sources such as solar and from nuclear power are expected to increase, but not enough to offset increased demand for oil and gas.

The continued dependence on imported oil and gas in the future will likely drive concerns about energy security. As long as China remains dependent on Middle East oil, securing access via Indian Ocean maritime routes, through the Malacca Strait, and onward through the South China Sea will be a national security priority. This is likely motivating China to develop greater naval power projection capabilities to secure these routes, and naval operations in the Indian Ocean have already started.

## THE CHINESE MIDDLE-CLASS AS ENERGY CONSUMERS

Generally speaking, energy demand growth tracks with GDP growth. China's GDP tripled during the period 1980-2005, and energy demand expanded with that. GDP growth has slowed for a number of reasons over the past decade. It was still growing by 10 percent in 2010, but has slumped to 6.6 percent by the end of 2018.<sup>1</sup> While that drop has some significance, projected growth in the 5-7 percent range still exceeds estimates for most developed countries, including the US.

Much of China's continuing GDP growth is based on the rise of its middle class, the major Chinese social phenomenon of the past 20 years. Double-digit GDP growth in 1980-2000 eventually pulled up the standard of living for a significant portion of the Chinese population into what is considered middle class. The real number of middle-class citizens in China is hard to calculate and depends on the definition of middle class. The Economist has defined middle class as people who have roughly a third of their income left for discretionary spending after paying for basic food and shelter, thus making it possible to buy consumer goods, improve health care, and provide for their children's education.<sup>2</sup> The China Bureau of Statistics has stated they consider a family of three with an income between \$15,000 and \$74,000 to be middle class, and that the middle-class population was about 400 million.<sup>3</sup>

Several factors will keep the middle class growing. The Chinese middle class is still only about one-third of the total population. The middle class in the US is roughly half of the population or about 150 million. Because the Chinese middle class now has spending power, it is causing a shift in the overall economy from being production-and-export driven to one where the Chinese themselves are the consumers. And according to Forbes, China appears to be on track to have over one billion middle-class citizens by 2050.<sup>4</sup>

This shift to a consumer-based economy drives energy consumption in a number of ways. For example, electricity demand rises, driven by such factors as the sales of air conditions doubling between 2008 and 2013.<sup>5</sup> The key hallmark of the Chinese middle class is not air conditioners but car ownership. As the auto population continues to grow, so does the need for gasoline.

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<sup>1</sup> [asia.nikkei.com/Economy/China-s-GDP-growth-slows-to-28-year-low-in-2018](http://asia.nikkei.com/Economy/China-s-GDP-growth-slows-to-28-year-low-in-2018).

<sup>2</sup> [www.forbes.com/sites/jamesconca/2012/09/18/the-middle-class-energy-and-terrorism/#1a8efda24c29](http://www.forbes.com/sites/jamesconca/2012/09/18/the-middle-class-energy-and-terrorism/#1a8efda24c29).

<sup>3</sup> [www.inkstonenews.com/society/inkstone-index-chinas-middle-class/article/3000635](http://www.inkstonenews.com/society/inkstone-index-chinas-middle-class/article/3000635).

<sup>4</sup> [www.forbes.com/sites/jamesconca/2012/09/18/the-middle-class-energy-and-terrorism/#1a8efda24c29](http://www.forbes.com/sites/jamesconca/2012/09/18/the-middle-class-energy-and-terrorism/#1a8efda24c29).

<sup>5</sup> [spectrum.ieee.org/energywise/energy/environment/electricity-consumption-could-soar-as-global-middle-class-embraces-ac](http://spectrum.ieee.org/energywise/energy/environment/electricity-consumption-could-soar-as-global-middle-class-embraces-ac).

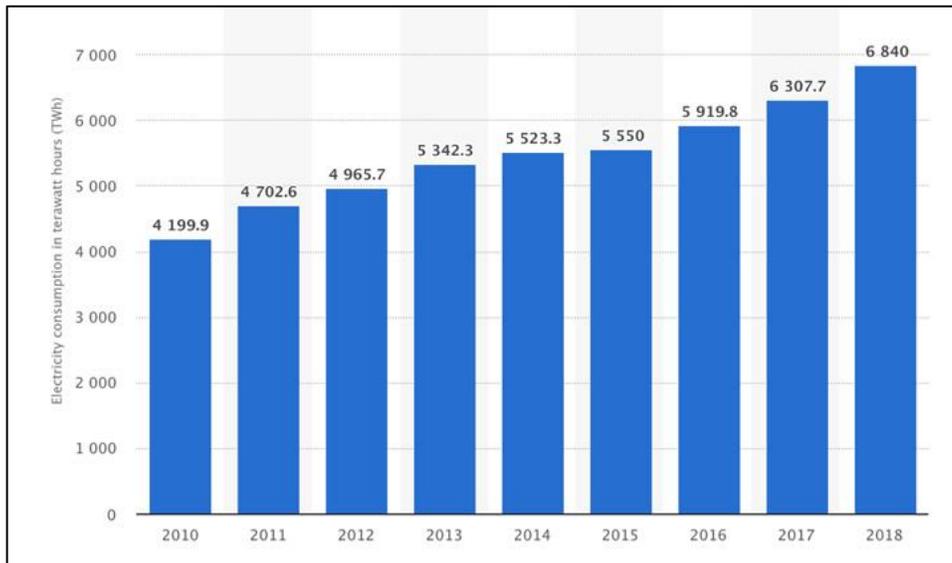


Figure 1. China electricity consumption, 2010-2018 (Statista)

If we expect the Chinese citizen to continue to behave more like middle-class Americans, then oil consumption could start to look like that in the US. Currently, Chinese per capita demand is still only 3.3 barrels per person per year. The US consumes about 22 barrels per person per year.<sup>6</sup> This suggests that Chinese crude oil demand will grow with its middle class.

Research by the Federal Reserve Bank of San Francisco in 2017 projected growth in China's oil demand in part by looking at a more rule-of-thumb measure, the Varian Rule for economic growth. As stated by Hal Varian, "a simple way to forecast the future is to look at what rich people have today; middle-income people will have something equivalent in 10 years, and poor people will have it in an additional decade." Thus, lower-class citizens will raise their living standards over time, contributing to middle-class growth. The Federal Reserve Bank also modeled demand growth through alternate scenarios and concluded that, in a scenario with moderate growth and energy choices, China's oil demand would grow by over 30 percent by 2025.<sup>7</sup>

### CHINA'S ENERGY MIX

China's oil demand should be seen in the context of its total energy consumption. Oil is one energy source, with coal, gas, nuclear, and renewable sources also contributing (see Table 1).<sup>8</sup>

<sup>6</sup> [www.forbes.com/sites/rpapier/2018/07/19/asias-insatiable-oil-demand/#131ce1446e3a](http://www.forbes.com/sites/rpapier/2018/07/19/asias-insatiable-oil-demand/#131ce1446e3a).

<sup>7</sup> [www.frbsf.org/economic-research/files/el2017-24.pdf](http://www.frbsf.org/economic-research/files/el2017-24.pdf).

<sup>8</sup> [www.planete-energies.com/en/medias/close/china-s-overall-energy-balance](http://www.planete-energies.com/en/medias/close/china-s-overall-energy-balance)

Table 1. Primary Energy Consumption (2017)

SOURCE	CONTRIBUTION
Coal	62.0 percent
Oil	19.4 percent
Renewable	11.6 percent
Gas	5.2 percent
Nuclear	1.8 percent

### Coal

Historically, coal has dominated the energy consumption of China. Political changes in China after 1990 brought in a leadership focused on expanding energy production, so they directed the construction of about 600 coal-fired power plants. Between 1990 and 2015, China coal consumption grew from one billion tons per year to four billion tons. According to the Center for Strategic and International Studies, since 2011 China has consumed more coal than the rest of the world combined. As of 2015, 72 percent of electrical power came from coal-powered plants.<sup>9</sup>

With the third-largest coal reserves in the world, China was self-sufficient in coal production for a long time. However, the rise of energy demand drove China to become a net importer of coal by 2009. The primary suppliers of coal to China are now Australia (80 million tons), Indonesia (35 million tons), Mongolia (33 million tons), and Russia (25 million tons). North Korea had been a key source of coal, but sanctions implemented in 2017 blocked further imports.<sup>10</sup>

While total Chinese energy consumption has continued to grow, from 2013 to 2016 Chinese use of coal declined.<sup>11</sup> Coal's share of total energy production was 62 percent in 2017, down from 74 percent in 2007.<sup>12</sup> Energy consumption growth is now led by natural gas (up 15 percent in 2017) and oil (up 4 percent).<sup>13</sup>

<sup>9</sup> chinapower.csis.org/energy-footprint.

<sup>10</sup> chinapower.csis.org/energy-footprint.

<sup>11</sup> rhg.com/research/china-energy-snapshot-2017.

<sup>12</sup> bp-stats-review-2018-china-insights.pdf.

<sup>13</sup> www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/country-and-regional-insights/china.html.

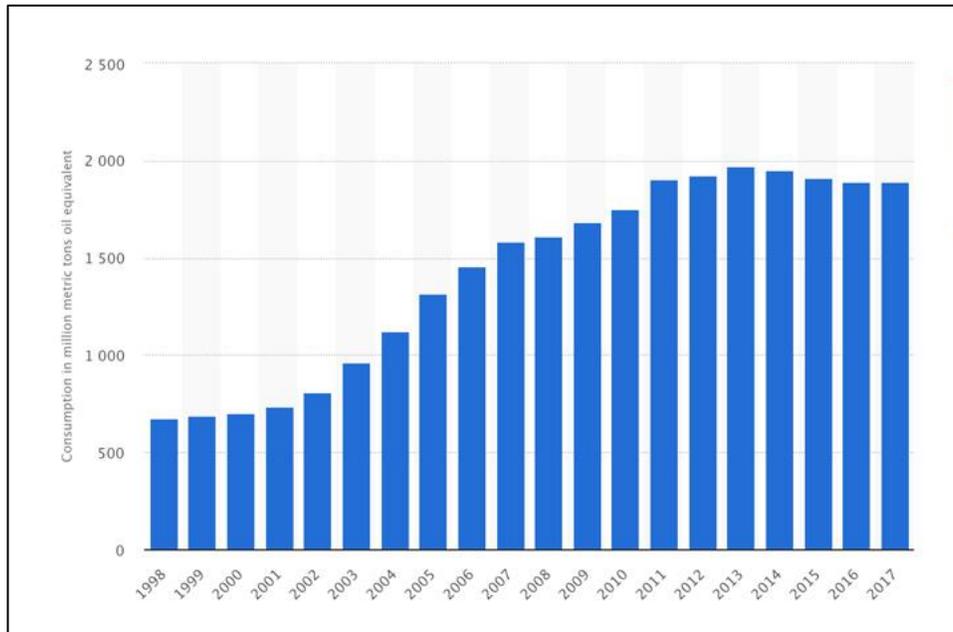


Figure 2. China coal consumption, 1998-2017 (Statista)

## Oil

Chinese domestic oil production has never kept up with the growth in demand. In 2016, China was producing only 4 million barrels per day while consuming 11.5 million barrels.<sup>14</sup> China has in fact been a net importer of crude oil since 1993.<sup>15</sup> In 2017, China imported about 8.4 million barrels of crude oil per day, more than the US imported. About 55 percent of China’s imports come from OPEC nations.<sup>16</sup>

China’s oil import dependency reached 68 percent in 2017, the highest in its history.<sup>17</sup> The top ten sources of crude oil imports into China in 2018 are shown in the following chart:<sup>18</sup>

Table 2. Top Ten Oil Import Sources for China (2018)

SOURCE COUNTRY	IMPORT VALUE	SHARE OF IMPORTS
Russia	\$37.9 billion	15.8 percent
Saudi Arabia	\$29.7 billion	12.4 percent
Angola	\$24.9 billion	10.4 percent
Iraq	\$22.4 billion	9.4 percent
Oman	\$17.3 billion	7.2 percent
Brazil	\$16.2 billion	6.8 percent

<sup>14</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>15</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

<sup>16</sup> [oilprice.com/Geopolitics/Asia/The-Unforeseen-Consequences-Of-Chinas-Insatiable-Oil-Demand.html](http://oilprice.com/Geopolitics/Asia/The-Unforeseen-Consequences-Of-Chinas-Insatiable-Oil-Demand.html).

<sup>17</sup> [bp-stats-review-2018-china-insights.pdf](http://bp-stats-review-2018-china-insights.pdf).

<sup>18</sup> [www.worldstopexports.com/top-15-crude-oil-suppliers-to-china](http://www.worldstopexports.com/top-15-crude-oil-suppliers-to-china).

Iran	\$15.0 billion	6.3 percent
Kuwait	\$11.9 billion	5.0 percent
Venezuela	\$7.0 billion	2.9 percent
United States	\$6.8 billion	2.8 percent

Imported sources are shifting, with the Saudi share of oil imported by China dropping and increased imports from Africa, South America, and Russia.<sup>19</sup> Russia became China’s largest supplier of crude oil in 2016, displacing Saudi Arabia. Deliveries from Russia hit one million barrels per day that year. Despite instability in Iraq and Iran’s problems over the US withdrawal from the nuclear agreement, both countries remain major sources of crude oil for China. Economic development and infrastructure deals with African countries have laid the groundwork for China to use Africa as a greater source for oil.

The US also started selling crude oil to China in early 2016 after the U.S. government lifted its self-imposed ban on oil exports. In 2017 the U.S. sold China about 5.5 million tons of crude, or about 10 percent of all U.S. crude oil exports.<sup>20</sup> In 2018, about 22 percent of the oil that the U.S. was exporting was going to China.<sup>21</sup> China is now the largest foreign purchaser of U.S. oil.<sup>22</sup>



Figure 3. Oil tanker docking in Qingdao

**Renewable**

China’s renewable energy market is dominated by hydropower, producing about 8 percent of China’s total energy. China quadrupled its hydroelectric generation capacity between 2000 and 2015.<sup>23</sup> China is now seeking to diversify the sources of its electricity production by development of other renewable energy resources. By 2015, about 12 percent of Chinese energy consumption came from renewable sources.<sup>24</sup> China now produces one third of all global wind-power energy and two-thirds of the world’s solar-powered energy.<sup>25</sup>

<sup>19</sup> [www.scmp.com/business/companies/article/2134794/chinas-2018-crude-oil-import-rise-80-cent-can-it-close-its-us](http://www.scmp.com/business/companies/article/2134794/chinas-2018-crude-oil-import-rise-80-cent-can-it-close-its-us).

<sup>20</sup> [www.scmp.com/business/companies/article/2134794/chinas-2018-crude-oil-import-rise-80-cent-can-it-close-its-us](http://www.scmp.com/business/companies/article/2134794/chinas-2018-crude-oil-import-rise-80-cent-can-it-close-its-us).

<sup>21</sup> [www.cnbc.com/2018/10/09/china-is-dramatically-cutting-us-oil-imports-analyst-says.html](http://www.cnbc.com/2018/10/09/china-is-dramatically-cutting-us-oil-imports-analyst-says.html).

<sup>22</sup> [www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem](http://www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem).

<sup>23</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

<sup>24</sup> [www.worlddata.info/asia/china/energy-consumption.php](http://www.worlddata.info/asia/china/energy-consumption.php).

<sup>25</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

## Gas

Although gas remains a minor source for energy in China, by 2017 growth in demand for gas meant that China was importing 38 percent of its natural gas needs. Currently China's primary source for gas is Turkmenistan, but a 30-year deal signed with Russia in 2014 is expected to start the flow of natural gas from Russia by the end of 2019.<sup>26</sup>

## Nuclear

As of 2018, China was operating 41 nuclear power reactors for electricity generation. Nuclear power generation has grown an average of 15 percent over the past ten years,<sup>27</sup> but still represents a small portion of overall energy production in China.

## FUTURE ENERGY DEMAND

The Chinese energy market is now 40 percent larger than that of the United States, although US energy consumption *per capita* is still three times that of China.<sup>28</sup> As mentioned above, this suggests that there will be significant per-capita growth as the population gets richer. Some estimates say that China's total energy consumption will increase somewhere between 34 and 48 percent by 2040, depending on government policies.<sup>29</sup>

## Coal

Coal will probably become a reduced segment of the total energy mix in the future. There are still some previously-planned coal-powered power plants under construction in China, but few new starts. The IEA's most recent World Energy Outlook estimated that coal will represent only 40 percent of the energy mix by 2040.<sup>30</sup> Energy production investment money has largely shifted to nuclear, natural gas, and renewable sources.<sup>31</sup>

## Oil

The International Energy Agency (IEA) has estimated that China will remain the single most important country for oil demand growth through 2030.<sup>32</sup> Even with expectations for electric vehicles changing the oil needs for transport,

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<sup>26</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

<sup>27</sup> [bp-stats-review-2018-china-insights.pdf](http://bp-stats-review-2018-china-insights.pdf).

<sup>28</sup> [www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand](http://www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand).

<sup>29</sup> [link.springer.com/article/10.1007/s12182-016-0136-z](http://link.springer.com/article/10.1007/s12182-016-0136-z).

<sup>30</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>31</sup> [rhg.com/research/china-energy-snapshot-2017](http://rhg.com/research/china-energy-snapshot-2017).

<sup>32</sup> [www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand](http://www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand).

China is expected to become the world's largest oil consumer, passing the US by 2030.<sup>33</sup>

China appears to be making no attempt to solve their oil problem by increasing domestic production. The 2020 goals for oil production in the 13<sup>th</sup> Five Year Plan were about the same as the levels of production achieved in 2016.<sup>34</sup> The collapse of oil prices in recent years, creating relatively high break-even costs for existing oil fields, is cited as causing a reduction in Chinese capital investment in expanding oil exploration. Output is expected to decline in mature existing fields. The IEA estimates that domestic production will continue to sink to about three million barrels per day by 2040.<sup>35</sup>



Figure 4. China's Daqing oil field

China National Petroleum estimates that China's import dependency had reached 70 percent by 2018. This dependence is still rising and could increase to 80 percent by 2040.<sup>36</sup> In terms of volume, reliance on imported oil is expected to reach over 15 million barrels per day by 2040.<sup>37</sup>

China's dependency on the Middle East as an oil source is only going to increase, as the IEA predicts that China will double its Middle East imports by 2035.<sup>38</sup> However, supply deals and pipeline infrastructure indicate that Russia will remain a major supplier to China for at least the next decade. Russian pipeline construction to China has included two new lines that branch off from the East



Figure 5. ESPO Pipeline spur to China (IEA)

Siberian Pacific Ocean (ESPO) pipeline, one completed in 2011 and the second completed in 2017. Total capacity of the lines is 600 thousand barrels per

<sup>33</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>34</sup> [www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem](http://www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem).

<sup>35</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>36</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

<sup>37</sup> [oilprice.com/Geopolitics/Asia/The-Unforeseen-Consequences-Of-Chinas-Insatiable-Oil-Demand.html](http://oilprice.com/Geopolitics/Asia/The-Unforeseen-Consequences-Of-Chinas-Insatiable-Oil-Demand.html).

<sup>38</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

day. Major long-term oil delivery contracts have also been signed between Russia and China. In 2009, the China Development Bank made \$25 billion in credit available to the Russian oil firms Rosneft and Transneft. This deal included Rosneft's commitment to building the first ESPO spur, and Transneft committed to shipping 300 thousand barrels per day for 20 years. A later deal with Rosneft included shipment of another 300 thousand barrels per day for 25 years in exchange for prepayment by China. Deliveries on these deals started in 2018.<sup>39</sup>

## Gas

Government policy has promoted the growth of gas in the energy mix, primarily to counteract the air pollution that comes from coal-powered energy generation. In 2018, China also became the world's largest importer of natural gas. Government policy has set a goal of increasing gas use to make it 15 percent of total energy use, suggesting that annual gas consumption will more than double by 2030. Since there is little expansion of shale oil development in China at present, which means that meeting the growth in demand depends on imports.<sup>40</sup>

## Renewable

Looking to the future, some developments suggest that China's energy needs will shift, with government policy attempting to move China in the direction of a more services-based economy with a cleaner energy mix.<sup>41</sup> Growth in renewables' contribution to China's energy mix will largely come from deployment of solar energy generation infrastructure.<sup>42</sup>

## Nuclear

The 13th Five-Year Plan (2016-2020) called for the construction of 40 additional nuclear power plants.<sup>43</sup> China is expected to overtake the United States by 2030 and become the world leader in nuclear-powered electricity



Figure 6. Planned nuclear power plant for Hunan Province (2017)

<sup>39</sup> [theasiadialogue.com/2018/03/28/the-new-king-of-chinas-crude-oil-imports-russia-and-the-competition-for-market-share-in-china](http://theasiadialogue.com/2018/03/28/the-new-king-of-chinas-crude-oil-imports-russia-and-the-competition-for-market-share-in-china).

<sup>40</sup> [www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand](http://www.petroleum-economist.com/articles/markets/outlook/2018/china-to-dominate-global-energy-demand).

<sup>41</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>42</sup> [www.statista.com/statistics/512764/transition-to-renewable-energy-in-china-outlook-by-source](http://www.statista.com/statistics/512764/transition-to-renewable-energy-in-china-outlook-by-source).

<sup>43</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

generation,<sup>44</sup> but nuclear will remain a small segment of overall energy production.

**CONCLUSIONS: STRATEGIC IMPLICATIONS OF IMPORT DEPENDENCE**

The data above indicate clearly that China will remain an oil (and other fossil fuel) importer for the foreseeable future. This is the natural cost of a society enriching itself without the domestic reserves of fossil fuels or robust alternative energy sources. The middle class will continue to grow as a segment of the Chinese population. The middle class has expectations about lifestyle that the Chinese peasant and factory workers of 20 or 30 years ago never contemplated. Satisfying these expectations takes more energy, and will require even more going forward.

The chart in Figure 7. from British Petroleum’s 2019 Energy Outlook<sup>45</sup> provides a succinct summary of China’s energy mix forecast out to 2040. Renewable sources and nuclear power generation are expected to increase, but these are expected to barely make up the shortfall from coal as coal production falls as a share of total consumption. The projected real growth in overall energy consumption will be made up by increasing oil and gas, and since domestic production of these are not being expanded, China can only cover the increased demand by imports.

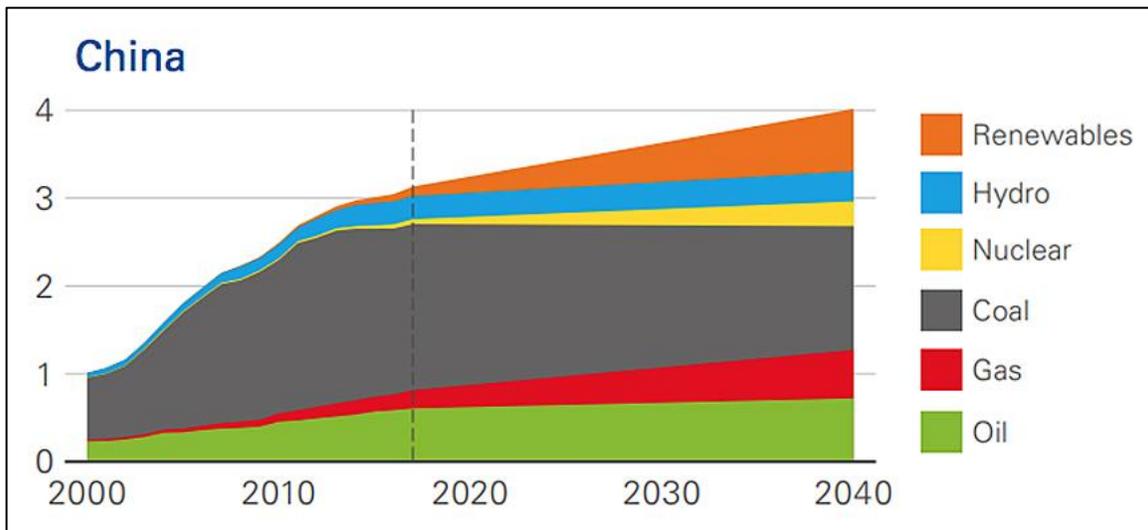


Figure 7. China primary energy consumption, 2000-2040 (BP)

The need for imported oil and other fossil fuels creates vulnerabilities for China, since a significant volume of its imports come from less-than-stable parts of the world, principally the Middle East. Since 80 percent of its imported oil

<sup>44</sup> [www.iea.org/weo/china](http://www.iea.org/weo/china).

<sup>45</sup> [www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf](http://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf).

passes through the Malacca Strait, the need for uninterrupted use of these maritime routes introduces more uncertainty.<sup>46</sup>

The drive for energy security has included diversification of sources through oil-for-loan deals with countries like Angola, Venezuela, Brazil, Russia, and Kazakhstan.<sup>47</sup> One other hedge against import uncertainties is the creation of a strategic oil reserve. China has been reluctant to give out information about a reserve, although they did report in 2014 that they have accumulated about 90 million barrels for a reserve. However, since this represents about nine days of use, a reserve of this size falls far short of the OECD standard of 90 days of import reserves.<sup>48</sup> Thus, choke points in the maritime routes from the Middle East will remain major concerns for China.

The turn to Russia as a major oil source does offer some relief from the vulnerability of Indian-Ocean maritime routes. The reliability of Russia as a source may depend on many things, including Russia's economic viability in the long term and the political relationship. The fact that Russia and China have entered into a relationship over oil does not necessarily signal happy relations for the future. After all, China is becoming a more communist nation in some ways, and Russia is not a socialist fraternal nation as it was in the past.



Figure 8. Russia / China 30-year Oil Deal

Geographic vulnerabilities are likely behind China's heavy expenditure on its Belt and Road Initiative which includes the construction of port facilities along the Indian Ocean and into the Arab Peninsula and Africa. The expansion of Chinese naval operations in the Indian Ocean appears in part to be a show of force in defense of the routes from Middle East energy sources. Protection of these routes is likely also part of the motivation for China's strident claims to islands in the South China Sea, sitting astride the maritime routes but closer to home. These claims are being supported by the recent militarization of

<sup>46</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

<sup>47</sup> [www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem](http://www.csis.org/analysis/energy-fact-opinion-chinas-net-oil-import-problem).

<sup>48</sup> [chinapower.csis.org/energy-footprint](http://chinapower.csis.org/energy-footprint).

several island groups through construction of small military installations on islands of no obvious intrinsic value other than location.



Figure 9. Indian Ocean route for majority of China's imported oil

This picture of Chinese energy needs, current and future, should make clear that China has serious national security interests in maintaining access to oil and gas imports, and that maintenance of access will likely drive economic relationships and the push of Chinese naval power out beyond its regional waters. Limited Chinese naval operations in the Indian Ocean over the last few years are probably a foreshadowing of further efforts at naval power projection into this region.

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