

## A review of motor vehicle fuel demand and supply in Indonesia

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### Introduction

Indonesia is currently the fourth most populous country in the world and the 16th largest economy by gross domestic product (GDP). In recent years, as its economy has rapidly grown, greater numbers of motor vehicles have demanded ever larger volumes of motor fuels. At the same time, Indonesia has struggled to increase the domestic supply of gasoline and diesel enough to meet this increased demand.

The country also seeks to narrow trade deficits by reducing imports of refined petroleum products, and thus the supply gap is increasingly being met by domestically produced palm oil biodiesel. This is a domestic fuel supply distinct from any other major vehicle market. Fuel is important because it plays a major role in vehicle environmental performance. High levels of sulfur and the presence of other additives in fuels lead to higher emissions of tailpipe pollutants and greenhouse gases (GHGs). Dirty fuels can also be a barrier to cleaner vehicles by undermining the most advanced aftertreatment systems.

To better understand how fuel and vehicle policies are interacting in Indonesia, the International Council on Clean Transportation (ICCT) is publishing a series of working papers examining the Indonesian motor fuels market. The first in the series, this paper collates and analyzes key statistics about motor vehicle fuel demand and fuel supply, both domestic and imported. How government policies and regulations impact fuel quality and prices will be discussed in subsequent working papers, and our future research will also explore how regional fuel trade affects Indonesia.

### The motor fuel demand-supply gap

Beginning in 2000, Indonesia's vehicle stock grew on average 10% every year, to more than 138 million vehicles in 2017.<sup>1</sup> From 2013 to 2018, transportation-related diesel consumption grew by 10% and gasoline consumption grew 15%, according to the Indonesian Ministry of Energy and Mineral Resources (MEMR).<sup>2</sup> Details of consumption in

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<sup>1</sup> Zhenying Shao, Josh Miller, and Lingzhi Jin, *Soot-free road transport in Indonesia: A cost-benefit analysis and implications for fuel policy*, (ICCT: Washington, D.C., 2020), <https://theicct.org/sites/default/files/publications/Indonesia-sootfree-CBA-02182020.pdf>.

<sup>2</sup> Ministry of Energy and Mineral Resources of Indonesia. "Handbook of Energy & Economic Statistics of Indonesia 2018 (Final Edition)," (January 2019), <https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2018-final-edition.pdf>.

those 6 years are shown in Table 1, where a surplus in domestic supply is in green, and a deficit is in red.

**Table 1.** Transportation fuel consumption, production, and supply gap in Indonesia (thousand barrels per day), 2013–2018

Year	Transportation gasoline consumption	Transportation diesel consumption	Total domestic refined gasoline	Total domestic refined diesel	Gasoline supply gap	Diesel supply gap (excluding biodiesel)
2013	510.62	381.56	195.59	340.39	-351.04	23.11
2014	517.65	377.92	205.49	355.85	-312.17	-9.70
2015	528.87	277.08	222.40	354.93	-306.47	-93.61
2016	549.69	328.98	256.56	339.67	-293.13	-63.38
2017	571.70	361.82	245.52	368.48	-326.18	-50.98
2018	588.55	419.61	251.07	388.09	-337.48	-33.10

As shown, domestic refinery outputs for both gasoline and diesel increased from 2013 to 2018, but still fell short of transportation demand. The increased output, especially in gasoline, is credited to the installation of residue fluid catalytic cracking (RFCC) at the Cilacap refinery in Central Java in 2015.<sup>3</sup> RFCC is a secondary unit operation to make additional gasoline and distillate fuels in the refining process by creating smaller molecules from larger molecules.<sup>4</sup>

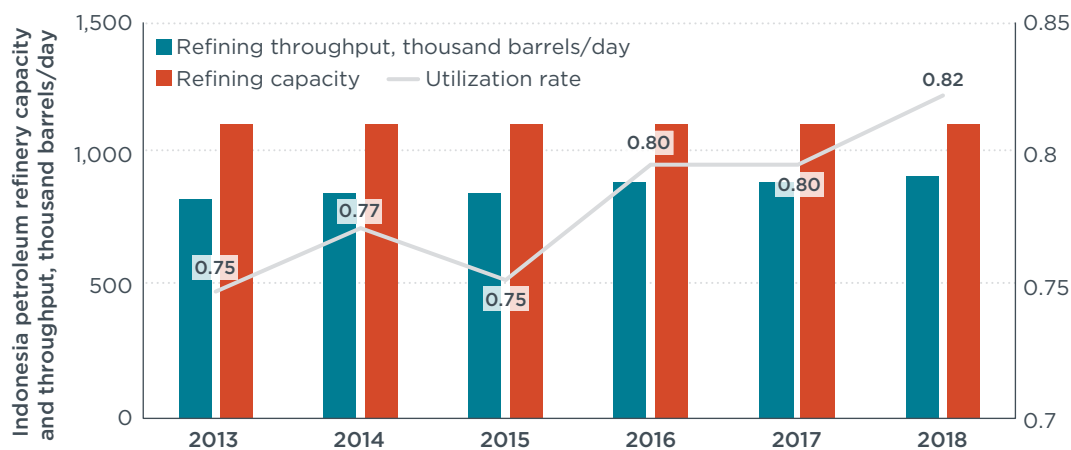
Refineries in Indonesia are operated by the state-owned oil company, Pertamina, and investments are guided by government policy. Indonesia has five major refineries with capacities greater than 100,000 barrels per day. The last new one to open was the Balongan refinery in 1994.

Separate from refinery capacity is refinery utilization. Utilization has improved in Indonesia in recent years, but still falls below that of other nations. Figure 1 shows changes in total refinery throughput and production from 2013 to 2018. Refinery utilization averaged 82.2% in 2018, which is equal to 916,000 barrels per day and is a nearly 10% improvement over the average rate of refinery utilization in 2013.<sup>5</sup> In contrast, though, three large refineries in Singapore operate near 95% of their total capacity of 1.4 million barrels per day. At a 95% rate of refinery utilization, Indonesia could satisfy an additional 179,000 barrels per day of domestic demand.

<sup>3</sup> “Pertamina begins operation of Cilacap RFCC refinery,” The Jakarta Post, November 26, 2015, <https://www.thejakartapost.com/news/2015/11/26/pertamina-begins-operation-cilacap-rfcc-refinery.html>.

<sup>4</sup> United States Energy Information Agency, “Fluid catalytic cracking is an important step in producing gasoline,” December 11, 2012, <https://www.eia.gov/todayinenergy/detail.php?id=9150>.

<sup>5</sup> BP, “BP statistical review of world energy 2019,” (2019), <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>.



**Figure 1.** Indonesia petroleum refinery capacity and throughput, thousand barrels per day

The gap between consumption and domestic production of refined gasoline products in Indonesia was approximately 337,000 barrels per day in 2018, the largest difference since 2013. The supply gap for diesel fuel was far smaller—about 33,000 barrels per day in 2018—but nevertheless domestic supply has failed to meet demand since 2014. Moreover, Indonesia’s proven oil reserves are expected to deplete by 2030, and existing technologies are only capable of extracting between 40% and 50% of the total oil reserves.<sup>6</sup> Indonesia must therefore rely on imports for gasoline and diesel fuel unless and until its situation changes.

## Fuel imports

In 2019, Indonesia’s net import of oil and gas cost \$9.3 billion, and it contributed to Indonesia’s trade deficit of \$3.2 billion.<sup>7</sup> The Indonesian rupiah has depreciated 50% against the U.S. dollar since 2010, and this has increased the cost of fuel imports by 50%, as oil is predominantly traded in U.S. dollars.<sup>8</sup> Unsurprisingly, the Indonesian government is motivated to reduce fuel imports. The macroeconomic impacts of diesel fuel imports are often cited in Pertamina reports and reflected in top-level government policies like Presidential Regulation 66/2018, which mandated an increase in the use of domestically produced B20 biodiesel, i.e., at least 20% bio-content using fatty acid methyl esters (FAME) derived from palm oil.

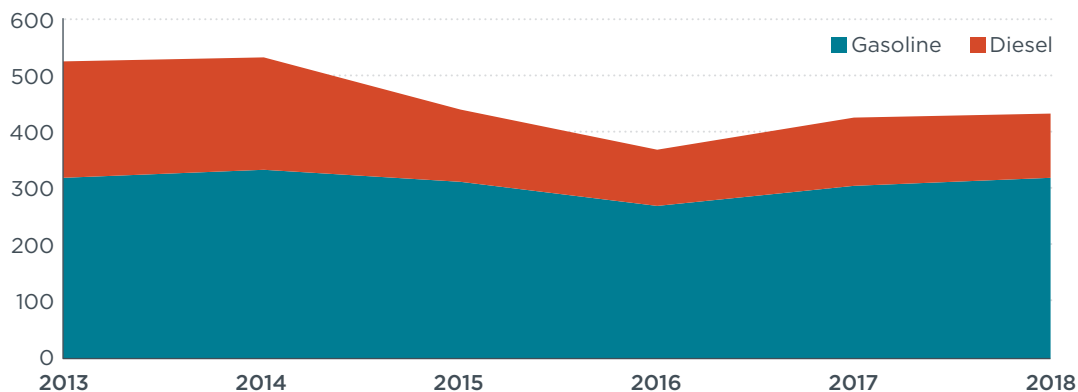
Indonesia has succeeded in recent years in curbing fuel imports. Figure 2, below, shows MEMR’s official statistics of petroleum product imports from 2013 to 2018.<sup>9</sup> The volume of imported refined motor fuels was approximately 95,000 barrels less per day in 2018 than in 2013. While the total volume of gasoline imports in 2018 was relatively unchanged from 2013 at around 320,000 barrels per day, the volume of imported diesel fuels dropped by more than 45%.

6 “Indonesia’s proven oil reserves to last just 12 Years: Arcandra,” *The Jakarta Post*, March 27, 2018, <https://www.thejakartapost.com/news/2018/03/27/indonesias-proven-oil-reserves-to-last-just-12-years-arcandra.html>.

7 Herman, “Indonesia’s trade deficit narrows by third in 2019,” *Jakarta Globe*, January 15, 2020, <https://jakartaglobe.id/business/indonesias-trade-deficit-narrows-by-third-in-2019>.

8 XE, “XE: USD / IDR currency chart. U.S. dollar to Indonesian rupiah rates,” Accessed March 6, 2020, <https://www.xe.com/currencycharts/?from=USD&to=IDR&view=10Y>.

9 Ibid.

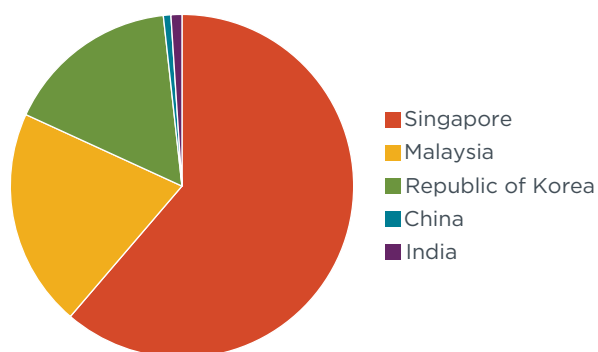


**Figure 2.** Imported refined petroleum products, thousand barrels per day. Source: Ministry of Energy and Mineral Resources of Indonesia (2019)

Imported diesel fuels accounted for less than 27% of total diesel fuel consumption in 2018, and that compares with 54% for imported gasoline products that same year. The recent reduction in the overall share of fuel imports needed to meet domestic demand was the result of policies including investments in refinery capacity and the promotion of alternative domestic fuel production, especially the abovementioned palm oil biodiesel.

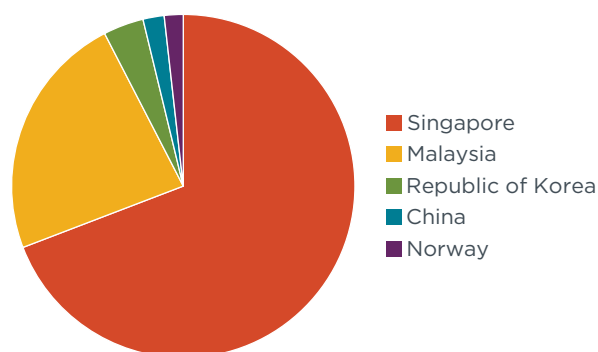
A breakdown of imports by country of origin shows where Indonesia’s fuel dependencies are, and this is shown in Figure 3.<sup>10</sup> Singapore and Malaysia are important regional trading hubs and sources for refined fuel products arriving to the Indonesian market. Referred to jointly as the “Singapore Strait,” they have accounted for more than 85% of Indonesia’s total gasoline imports over the last few years, and are also a major source of diesel. South Korea is another important provider of diesel, and accounted for about 16.4% of total diesel imports in 2017. Subsequent research will investigate fuel trading in the Singapore Strait and its implications for Indonesia.

**Source of diesel imports into Indonesia in 2017, thousand barrels/day**



**Figure 3a.** Indonesian diesel imports by country of origin in 2017, thousand barrels/day. Source: Badan Pusat Statistik BPS-Statistics Indonesia

**Source of gasoline imports into Indonesia in 2017, thousand barrels/day**



**Figure 3b.** Indonesian gasoline imports by country of origin in 2017, thousand barrels/day. Source: Badan Pusat Statistik BPS-Statistics Indonesia

Pertamina is the primary fuel importer, and other retailers like AKR, Shell, and BP import smaller quantities. Pertamina imports mostly through its trading and procurement arm, Integrated Supply Chain (ISC). Both procurement and sales are done through direct negotiations or closed tenders to business partners registered with Pertamina.

<sup>10</sup> Badan Pusat Statistik BPS-Statistics Indonesia, “Statistik Perdagangan Luar Negeri foreign trade statistics, impor/imports,” (April 2019), <https://www.bulelengkab.go.id/assets/instansikab/126/bankdata/statistik-perdagangan-luar-negeri-indonesia-impor-2018-jilid-i-87.pdf>.

Scant information on the suppliers of the imported fuel is publicly available. Pertamina's ISC has about 120 bidders registered as suppliers of oil, gas, and other oil products. Identities of the shippers and where the imported fuel comes from can only be obtained via sporadic media reports, interviews with industry practitioners, and third-party shipping intelligence databases that are not available to the public. These shipping databases contain relevant information on a type of fuel import voyage called a spot cargo fixture, and this includes the trading companies which charter the voyages, where the fuel is loaded for shipment, and destination ports in Indonesia.<sup>11</sup>

Information about fuel suppliers and their supply contracts is important for understanding the price of the fuels. Proprietary shipping databases only include chartering spot contracts. They do not provide information about fuel-carrying vessels owned by oil trading companies. The databases also do not record longer-term contracts ("time charters"). The chartering contracts listed on such databases are not exhaustive and do not cover all voyages that transport fuel into Indonesian ports.

The lack of publicly available information makes understanding the full picture of fuel imports challenging, but one thing that is clear is that Indonesia has relatively weak fuel quality standards. For example, Indonesian standards permit the sale of gasoline fuel grades with no limit on aromatics such as benzene, which is a known human carcinogen and a low-cost octane enhancer. In Western Africa, where fuel quality standards have historically been generally lax, companies have profited from the sale of low-quality gasoline or diesel. These fuels can utilize blend stock like pyrolysis gasoline and light cycle oil, and this is seen by some as "blend-dumping."<sup>12</sup> However, in February 2020, Economic Community of West African States (ECOWAS) announced that the countries will limit imports to 50 parts per million or less sulfur fuels and require a minimum of Euro 4/IV vehicle emissions standard for imported vehicles from January 1, 2021. This was a major development in fuel quality and vehicle emission standards in West Africa.<sup>13</sup> Indonesia can follow the example of ECOWAS and guard against receipt of dirty fuels by adopting fuel quality standards for imported fuels aligned with Euro V specifications for diesel and gasoline.

## Planned investments in domestic production

As mentioned above, Indonesia is taking actions to increase domestic production of fuels. Table 2 lists all major refineries in Indonesia and includes some details of their future plans. Pertamina has launched two initiatives: the Refinery Development Master Plan (RDMP), aimed at the "[revitalization] of existing refineries," and the Grass Root Refinery (GRR) initiative, aimed at the construction of new refineries.<sup>14</sup> The government also encourages private investment in refinery expansion (see MEMR Regulation 35/2016).<sup>15</sup> Pertamina aims to refine 2 million barrels per day by 2025, a level it believes would achieve, at least temporarily, a sufficient supply to meet domestic demand.<sup>16</sup>

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11 A fixture is the contract through which a trading company charters a vessel belonging to a shipping company for a single voyage (i.e., "spot cargoes" or "spot fixtures"). A "fixture" is distinct from a "time charter," which is a contract through which a company rents a vessel under a long-term contract, e.g., one year.

12 Marc Guéniat, Marietta Harjono, Andreas Missbach, and Gian-Valentino Viredaz, "Dirty diesel: How Swiss traders flood Africa with toxic fuels," (Public Eye, 2016), [https://www.publiceye.ch/fileadmin/doc/Rohstoffe/2016\\_PublicEye\\_Dirty\\_Diesel\\_Report.pdf](https://www.publiceye.ch/fileadmin/doc/Rohstoffe/2016_PublicEye_Dirty_Diesel_Report.pdf).

13 CCAC Secretariat, "West African ministers adopt cleaner fuels and vehicles standards," February 28, 2020, <https://www.ccacoalition.org/en/news/west-african-ministers-adopt-cleaner-fuels-and-vehicles-standards>.

14 Pertamina, "Strengthening commitment, securing energy: Pertamina annual report 2018," (2019), [https://www.pertamina.com/Media/File/20191128\\_AR-pertamina-18-eng-web\\_REV-CEO.pdf](https://www.pertamina.com/Media/File/20191128_AR-pertamina-18-eng-web_REV-CEO.pdf).

15 Pertamina, "Moving further: 2017 Pertamina annual report," (2017), [http://pertamina.jp/wp-content/uploads/2017\\_Pertamina\\_Annual\\_Report\\_ENG.pdf](http://pertamina.jp/wp-content/uploads/2017_Pertamina_Annual_Report_ENG.pdf).

16 Pertamina, 2019

**Table 2.** Major petroleum refineries in Indonesia

Refinery name	Location	Operated by	Capacity in 2018, barrels/day	Capacity by 2026 by official projections, barrels/day	Remarks
<b>Cilacap</b>	Central Java	Pertamina	348,000	400,000	— Candidate for being revitalized through the RDMP project.
<b>Balikpapan</b>	East Kalimantan	Pertamina	260,000	360,000	— Candidate for being revitalized through the RDMP project, divided into two phases.
<b>Dumai/Sungai Pakning</b>	Central Sumatra	Pertamina	170,000	300,000	— Candidate for being revitalized through the RDMP project.
<b>Plaju</b>	South Sumatra	Pertamina	118,000		— Pertamina is partnering with UOP, a Honeywell subsidiary, to co-process at Plaju and Dumai refineries for palm oil biodiesel production. <sup>a</sup>
<b>Balongan</b>	West Java	Pertamina	125,000	269,000	— Candidate for being revitalized through the RDMP project.
<b>Tuban</b>	East Java	TPPI	100,000	400,000	— New refineries under construction through the GRR project.
<b>Bojonegoro</b>	East Java	Tri Wahana Universal	18,000 <sup>b</sup>		— Ceased production in 2018 due to changes in crude oil prices, based on MEMR Ministerial Decree No. 4028 K/12/MEM/2017, which made production not economically feasible. <sup>c</sup>
<b>Kasim</b>	West Papua	Pertamina	10,000		
<b>Cepu</b>	Central Java	Migas	3,800		
<b>Bontang</b>	East Kalimantan	Pertamina		300,000	— New refineries under construction through the GRR project, in collaboration with Oman's Overseas Oil and Gas LLC (OOG). However, the partnership ended in March 2020 and Pertamina is considering relocating the project. <sup>d</sup>
<b>Total capacity, barrels/day</b>			1,152,800	2,178,000 <sup>e</sup>	

Sources: Ministry of Energy and Mineral Resources, 2019; Pertamina, "What we do: Downstream business," Accessed April 7, 2020, <https://www.pertamina.com/en/downstream>; Oil and Gas Directorate, Ministry of Energy and Natural Resources, "Laporan Tahunan Capaian Pembangunan 2018: Pemanfaatan Gas Bumi Untuk Energi Berkedialan," (2019), <https://migas.esdm.go.id/uploads/uploads/files/laporan-tahunan/Laptah-Migas-2018---FINAL.pdf>; and Pertamina, 2019.

a Wilda Asmarini. "Indonesia's Pertamina ends deal with Italy's Eni for palm oil fuel project - Pertamina CEO," Reuters, January 28, 2020, <https://www.reuters.com/article/indonesia-pertamina-palmoil-idUSL4N29Y1BS>.

b Rambu Energy, "Tri Wahana Universal to build 10 mini oil refineries worth US\$1.2 billion, others to follow," August 31, 2015, <https://www.rambuenergy.com/2015/08/tri-wahana-universal-to-build-10-mini-oil-refineries-others-to-follow/>.

c Arnold Sirait, "Kilang Tri Wahana Universal Berhenti Beroperasi," *Katadata.co.id*, April 1, 2018, <https://katadata.co.id/berita/2018/04/01/kilang-tri-wahana-universal-berhenti-beroperasi>.

d Reuters. "Indonesia's Pertamina to relocate \$10 billion refinery project from Bontang," *TODAYonline*, March 2, 2020, <https://www.todayonline.com/world/indonesias-pertamina-relocate-10-billion-refinery-project-bontang>.

e This total value assumes that other refineries not mentioned in Pertamina's annual reports do not undergo expansions of capacity, and the 300,000 barrel per day capacity originally planned for Bontang GRR Project does not change after its relocation.

The success of refinery upgrade and expansion initiatives depends upon their timely implementation, but projects have suffered setbacks. Pertamina's planned upgrade to the Cilacap refinery to raise capacity from 348,000 to 400,000 barrels per day was originally scheduled to be completed in 2021. However, it has been delayed twice. The first delay pushed the completion date to 2023, and then a second postponement further set the date back to 2026.<sup>17</sup> Also, the Bontang GRR project in East Kalimantan is being relocated and is unlikely to be completed by the 2026 deadline.<sup>18</sup> Pertamina estimates it will need U.S.\$115 billion to make the country energy self-sufficient, and the

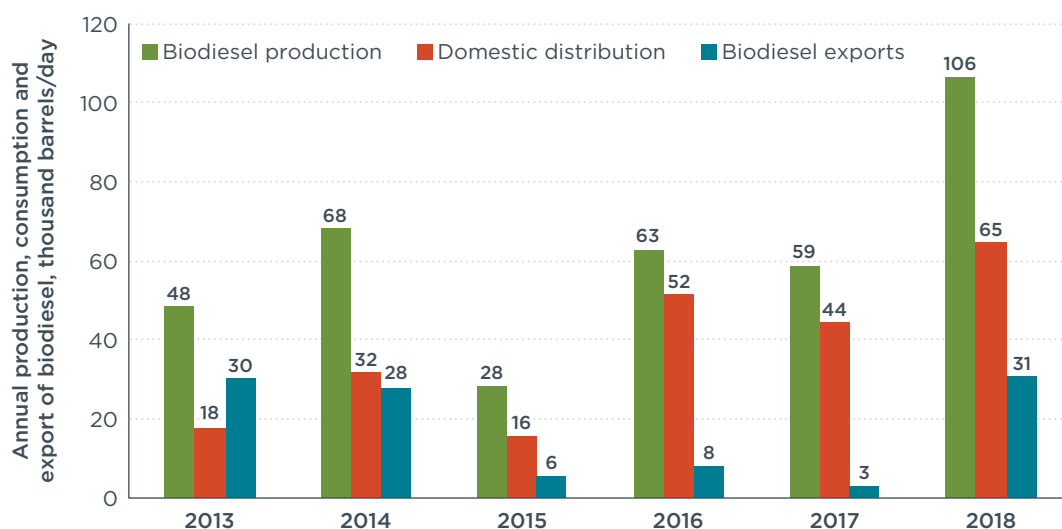
17 Henning Gloystein, and Fergus Jensen, "Unlikely twins and differing fortunes: Malaysia's Petronas & Indonesia's Pertamina," *Reuters*, March 7, 2019, <https://www.reuters.com/article/us-petronas-pertamina-insight-idUSKCN1QOQGR>.

18 Reuters, 2020

company reported a 16% decrease in net profits in 2019.<sup>19</sup> The COVID-19 global pandemic adds additional financial uncertainty, and Indonesian upstream oil and gas regulator SKK Migas recently lowered its 2020 oil and gas production targets to below 2019 levels.<sup>20</sup> If these upstream projections are any indication, downstream refinery production is likely to be similarly scaled back.

## The rise of palm biodiesel

Indonesia has developed the world's largest palm oil industry. It accounts for half of global production, and the country is increasing palm oil biodiesel production to displace consumption of petroleum diesel.<sup>21</sup> According to BP Statistical Review 2019, Indonesia's total national biofuel production increased at an average annual rate of 28.6% over the past decade, and grew from 780 million liters in 2010 to 5.6 billion liters in 2018—a more than 6-fold increase.<sup>22</sup> Statistics from Indonesia's Biofuel Producers Association (APROBI) also show that biodiesel production more than doubled from around 48,000 barrels per day to 106,000 barrels per day during the period 2013 to 2018 (Figure 4).<sup>23</sup> Government policy to fill the domestic production gap in refined petroleum diesel with a domestic supply of palm oil biodiesel appears to have succeeded in reducing diesel fuel imports.



**Figure 4.** Production, domestic distribution, and export of biodiesel in Indonesia from 2013 to 2018. Source: Asosiasi Produsen Biofuel Indonesia

The increases in domestic consumption of biodiesel were enabled, in part, by recent declines and uncertainties in biodiesel exports. The European Union, once the top destination for palm oil exports, imposed anti-dumping import duties on Indonesian biodiesel from 2013 to 2018.<sup>24</sup> While biodiesel exports did pick up briefly in 2018, in 2019, the European Union began another round of tariffs on Indonesian biodiesel.<sup>25</sup> Low crude

19 Gloystein & Jensen, 2019 and Norman Harsono, "Low oil prices push Pertamina's 2019 profit down 16% to \$2.1b," *The Jakarta Post*, February 4, 2020, <https://www.thejakartapost.com/news/2020/02/04/low-oil-prices-push-pertaminas-2019-profit-down-16-to-2-1b.html>.

20 Wilda Asmarini, "UPDATE 1-Indonesia cuts 2020 oil, gas production outlook - SKK Migas," *Reuters*, April 16, 2020, <https://www.reuters.com/article/indonesia-oil-production-idUSL3N2C42P1>.

21 Food and Agriculture Organization of the United Nations, "FAOSTAT data - crops: oil, palm," Accessed March 4, 2020, <http://www.fao.org/faostat/en/?#data/QC/visualize>.

22 BP Statistical Review's figures also include bioethanol, of which Indonesia only produces 10,000 tons a year. BP, 2019

23 Asosiasi Produsen Biofuel Indonesia, "Anggota APROBI," Accessed April 7, 2020, <https://aprobi.or.id/partners>.

24 Stephanie Searle, *International policy and market drivers of Indonesian palm oil demand*, (ICCT: Washington, D.C., 2019), <https://theicct.org/publications/international-policy-and-market-drivers-indonesian-palm-oil-demand>.

25 Philip Blenkinsop, "EU hits Indonesian biodiesel with import duties over subsidies," *Reuters*, December 9, 2019, <https://www.reuters.com/article/us-eu-indonesia-biodiesel-idUSKBN1YD1HG>.

oil prices have further reduced the competitiveness of biodiesel exports, a situation that could continue for some time as a result of COVID-19. The only exception to the trend was 2015, when the Indonesian government suspended an older version of a biodiesel subsidy program while setting up the Palm Oil Estate Fund (POEF). The suspension resulted in a decrease in domestic consumption of biodiesel fuel.

Indonesia today subsidizes biofuel producers to offset the higher cost of the fuel. This is done by drawing from POEF revenues, which come from levies on exports of palm oil and palm products. In September 2018, the Indonesian government mandated that all diesel fuel at the pump be B20.<sup>26</sup> The government has a timeline to further raise the bio-content to 30% in diesel by 2021 and 40% by 2022, a slightly delayed schedule due to COVID-19.<sup>27</sup> Pertamina announced it would even start piloting the production of 100% palm oil biodiesel by June 2021.<sup>28</sup> Greater domestic supply, subsidies for producers, and domestic blending mandates constitute a suite of measures designed to ensure domestic sources of diesel fuel are available in sufficient quantities to limit future diesel fuel imports.

## Conclusion and upcoming work

There is a rising demand for motor fuels in the Indonesian transportation sector, and this is expected to grow as the nation's economy prospers. Investments in domestic refinery production and utilization have not matched the scale and timing needed to equal this growth in demand. While fuel imports are one way the government has met surging domestic demand, the government has also invested in alternative domestic fuel supplies, particularly palm oil biodiesel. Indeed, as a percentage of total domestic fuel consumption, fuel imports have actually decreased overall. Nonetheless, the need for imports coupled with weak fuel standards puts the quality of the imported fuels in doubt. Because fuel quality has direct consequences for the environmental performance of the vehicle fleet, future working papers in this series will examine fuel price setting policies, fuel quality standards, and more.

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26 Bernadette Christina, "Indonesia launches B30 biodiesel to cut costs, boost palm oil," *Reuters*, December 22, 2019. <https://www.reuters.com/article/us-indonesia-biodiesel/indonesia-launches-b30-biodiesel-to-cut-costs-boost-palm-oil-idUSKBNIYR0D2>

27 Cantika Adinda Putri, "Pemerintah Guyur Rp 2,5 T Untuk Sawit, Buat Apa?" *CNBC Indonesia*, June 16, 2020, <https://www.cnbcindonesia.com/news/20200616173855-4-165849/pemerintah-guyur-rp-25-t-untuk-sawit-buat-apa>.

28 Reuters, "Indonesia's Pertamina to start production of B100 biodiesel next year: CEO," *ET Energyworld*, June 29, 2020, <https://energy.economictimes.indiatimes.com/news/oil-and-gas/indonesias-pertamina-to-start-production-of-b100-biodiesel-next-year-ceo/76683576>.