

Hydrogen in southeast Asia

This fact sheet is intended to inform readers about the present and future hydrogen supply and demand in Southeast Asia, a region whose combined GDP of \$3.6 trillion represents 3.6% of global GDP, positioning it economically between India and Germanyⁱ. Despite its current lag, this region possesses the potential to become a significant market player due to its proximity to Japan and South Korea. Singapore, Malaysia, and Indonesia have each published their national hydrogen strategies.

Conventional Demands

There is no breakdown regarding the region's current demand of hydrogen and its derivatives. The regional demand mainly comes from conventional industrial activities: ammonia, refineries, methanol, and steel production. It is estimated at between 3.46 to 3.93 million tons (Mt) in 2022.

The region consumes 1.8 Mt of hydrogen to produce **ammonia** (10.4 Mt of ammonia or around 6 percent of global production in 2022). Indonesia is the largest consumer of hydrogen (1.2 Mt) which represent 7 Mt ammonia production in 2023ⁱⁱ. The largest plant is in Brunei, with an annual capacity of 0.8 Mt of ammonia, requiring 0.14 Mt of hydrogenⁱⁱⁱ.

Southeast Asia has 5.1 million barrels per day (mb/d) of **refinery** capacity and 3.8 mb/d of throughput in 2022, with Thailand, Singapore and Indonesia having the largest throughputs ranging from 0.8 to 1 mb/d^{iv}. This represents an estimated hydrogen consumption of 0.8 Mt to 1.3 Mt per annum depending on hydrogen usage ratio.

Methanol production capacity (5.6 Mt/y) is concentrated in Malaysia, Brunei and Indonesia, requiring 0.8 Mt of hydrogen. Malaysia's Petronas is the biggest producer and net exporter of methanol with 4.2 Mt total capacity, resulting in 0.6 Mt of hydrogen demand^v.

Only Antara Steel in Malaysia still using the **Direct Reduction Iron** (DRI) technology with output of 0.36 Mt of steel per year using natural gas as feedstock^{vi}. Despite the steel industry's expected growth to 77.1 Mt in 2024 from 48.7 Mt in 2021, the absence of carbon pricing means Blast Furnaces will remain preferred^{vii}. Consequently, any significant increase in hydrogen demand from the existing Antara Steel's hydrogen consumption of 19.8 kt seems unlikely.

New Demand Prospects

In addition to conventional demand, there are several new demand areas currently considered for future hydrogen demand: ammonia co-firing, export-oriented hydrogen, and transportation.

There are ammonia co-firing projects at the planning stage in Singapore, Indonesia, Thailand, Malaysia, the Philippines, and Vietnam. Co-firing is intended to reduce emissions while prolonging coal plants. A 20 percent co-firing rate equivalent to 48 Mt of ammonia or 8.6 Mt of hydrogen demand annually.

Another sector expected to emerge in Singapore is for ship bunkering and aviation fuel^{viii}. The Singapore port provides 50 mton of fuel or 25 percent of global ship fuel demand and is expected to maintain its dominance by implementing sustainable practices. Singapore Maritime and Port

Authority believes methanol is the most suitable carrier but has also taken steps to allow for ammonia bunkering^{ix}. Meanwhile, hydrogen will have negligible significance in road transportation since many countries will rely more on battery EV. There is an operational hydrogen refueling station in Sarawak since 2019 able to produce 130 kg H₂ per day.

Another potential demand outlet would be exports. Japan has a technology-agnostic approach, making fossil derived hydrogen produced by this region the most economical option. Even though the region has a closer proximity, IRENA believes that lower cost of capital in Australia could reduce the region's overall competitiveness^x. Currently, an offtake agreement has been secured to ship MCH from Brunei to ENEOS's refinery in Japan. There are several projects being developed which aim to export hydrogen to Japan and South Korea.

Supply Dynamics

Hydrogen produced in this region is almost entirely derived from natural gas. Malaysia, Indonesia, Myanmar, and Brunei are net gas exporters, while Singapore and Thailand are net importers^{xi}. Malaysia projects that in 2030, biogas gasification (levelized cost at \$1.3/kg) may also be the preferred method instead of either natural gas SMR (\$1.8/kg) or Australia's low carbon hydrogen (\$2.6/kg)^{xii}. Echoing its neighbor, Indonesia projects that renewable electrolysis would only be able to compete with natural gas SMR by 2050^{xiii}.

Most countries in this region have plans to develop low-carbon hydrogen projects. Some notable examples include: H2biscus and H2ornhill project by Malaysia's Sarawak Economic Development Corporation, Singapore's pilot hydrogen plant cooperating with Engie to power Semakau Islands offgrid system, and recent ACWA cooperation with Indonesian PLN.

Appendix

Table 1 Demand from Ammonia Production

Country	Ammonia Quantity (Ton)	Hydrogen Quantity (Ton)	Year	Ref
Indonesia	7,000,000	1,239,000	2019	Pupuk Indonesia
Malaysia	1,400,000	247,800	2022	US Geological Survey 2023
Viet Nam	1,200,000	212,400	2022	US Geological Survey 2023
Brunei Darussalam	803,000	142,131	2023	BizBrunei.com
Total	10,403,000	1,841,331		

Table 2 Demand from Oil Refining

Country	Capacity (thousand BPD)	Throughput (thousand BPD)	Hydrogen (ton)		Year	Ref
			Low	High		
Indonesia	1,104	845	180,745	283,409	2023	Energy Institute
Malaysia	955	584	124,917	195,871	2023	Energy Institute
Philippines	180	124	26,524	41,589	2023	Energy Institute
Singapore	1,302	888	189,943	297,831	2023	Energy Institute
Thailand	1,244	1,021	218,392	342,438	2023	Energy Institute

Viet Nam	367	307	65,667	102,966	2023	Energy Institute
Brunei Darussalam	175	130	27,891	43,733	2023	NS Energy
Total	5,327	3,899	834,079	1,307,836		

Table 3 Demand from Methanol Production

Country	Methanol Quantity (Ton)	Hydrogen Quantity (Ton)	Reported Year	Ref
Indonesia	660,000	88,674	2022	Kaltim Methanol
Malaysia	4,150,000	557,573	2022	Sarens
Brunei Darussalam	850,000	114,202	2022	Brunei Methanol
Total	5,660,000	760,449		

Table 4 Demand from DRI Steel Production

Country	DRI Steel Quantity (Ton)	Hydrogen Quantity (Ton)	Reported Year	Ref
Malaysia	360,000	19,800	2022	Midrex

Table 5 Total Existing Hydrogen Market

Demand Sector	Low Refinery (ton H2)	High Refinery (ton H2)
Ammonia	1,841,331	1,841,331
Refinery	834,079	1,307,836
Methanol	760,449	760,449
DRI Steel	19,800	19,800
Total	3,456,659	3,929,416

Table 6 Potential Demand from Ammonia Cofiring

Country	Coal Generation (TWh)	Ammonia Quantity (Ton)	Hydrogen Quantity (ton)
Brunei Darussalam	2.32	232,000	41,064
Cambodia	3.65	365,000	64,605
Indonesia	189.96	18,996,000	3,362,292
Lao People's Democratic Republic (the)	10.81	1,081,000	191,337
Malaysia	77.28	7,728,000	1,367,856
Myanmar	0.89	89,000	15,753
Philippines (the)	49.22	4,922,000	871,194
Singapore	NA	NA	NA
Thailand	38.44	3,844,000	680,388
Viet Nam	114.12	11,412,000	2,019,924
Total	486.69	48,669,000	8,614,413

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- ⁱ World Bank, "World Bank DataBank," [Online]. Available: <https://databank.worldbank.org/indicator/NY.GDP.MKTP.CD/1ff4a498/Popular-Indicators#>
- ⁱⁱ <https://www.pupuk-indonesia.com/media-info/384/detail#:~:text=Pupuk%20Indonesia%20controls%20four%20percent,grey%20ammonia%2C%20still%20emitting%20carbon.>
- ⁱⁱⁱ <https://www.bizbrunei.com/2023/02/brunei-fertilizer-industries-exports-reach-us322-million/>
- ^{iv} <https://www.energyinst.org/statistical-review>
- ^v <https://sarens.prowly.com/217026-the-new-methanol-plant-in-sarawak-will-almost-double-petronas-chemical-groups-current-production-in-malaysia>
- ^{vi} MIDREX Technologies, "World Direct Reduction Statistics 2021," MIDREX Technologies, Charlotte, 2021.
- ^{vii} SEAISI, "The ASEAN Steel Industry Development: Investment and Green Industry Challenges," 30 March 2022. [Online]. Available: https://search.oecd.org/industry/ind/Item_6.3_SEAISI.pdf. [Accessed 6 July 2023].
- ^{viii} MTI, "Ministry of Trade and Industry of Singapore National Hydrogen Strategy," 25 October 2022. [Online]. Available: <https://www.mti.gov.sg/Industries/Hydrogen>. [Accessed 6 July 2023].
- ^{ix} R. w. Neo, "S&P Global Commodity Insight," 3 July 2023. [Online]. Available: <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/lng/070323-interview-singapores-mpa-sees-first-ammonia-bunkering-from-2026-methanol-pilot-to-pave-way>. [Accessed 6 July 2023].
- ^x IRENA, "Renewable Energy Outlook for ASEAN," IRENA, Masdar City, 2022.
- ^{xi} Energy Institute, "2023 Statistical Review of World Energy," Energy Institute, London, 2023.
- ^{xii} MOSTI, "Hydrogen Economy and Technology Roadmap," Ministry of Science Technology and Innovation Malaysia, Putrajaya, 2023.
- ^{xiii} EBTKE ESDM, "Strategi Hidrogen Nasional," 15 12 2023. [Online]. Available: <https://ebtke.esdm.go.id/post/2023/12/15/3680/strategi.hydrogen.nasional>. [Accessed 03 01 2024].