First Movers Coalition

Singapore Situational Analysis | Sustainable Aviation Fuels

June, 2023

First Movers Coalition

First Movers Coalition Context

Seven sectors +1 in scope, representing >30% of global carbon emissions today & most new tech needs

Launched at COP26


Aviation

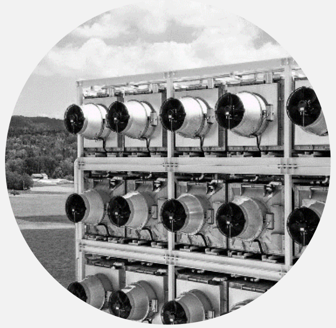

Steel


Shipping


Trucking

Launched at WEF Annual Meeting 2022


Aluminum


Carbon Removal

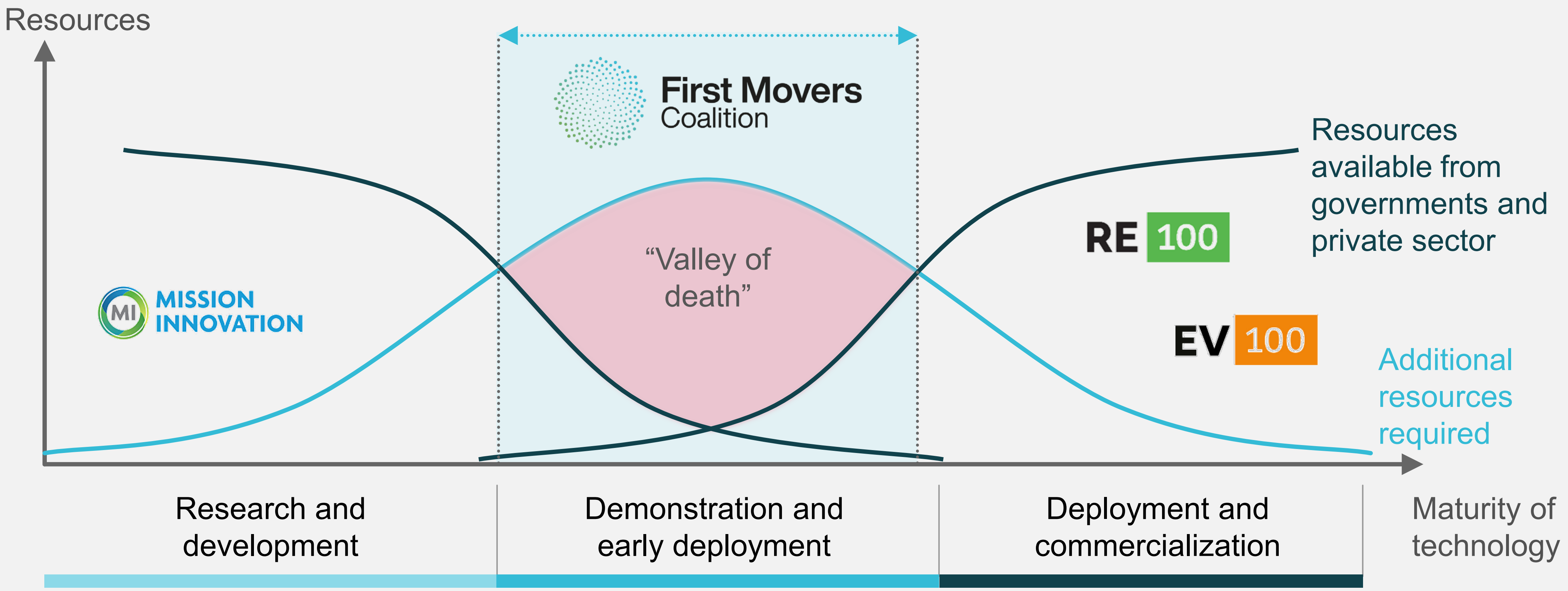
Launched at COP27


Cement / Concrete

To be launched in 2023


Chemicals
(Plastics – PET, PP and PE)

FMC is the only buyers' club to scale emerging tech across hard-to-abate sectors through early demand signals



First Movers Coalition

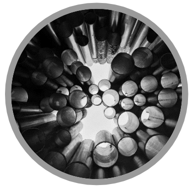
Since WEF and US State Dep. launched the First Movers Coalition…

106 commitment from **85** companies

aggregating to **$12B** of demand for near-zero emissions products

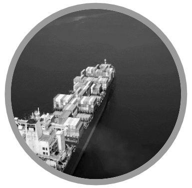
Across 7 sectors representing >30% of global CO_2 today


Aviation

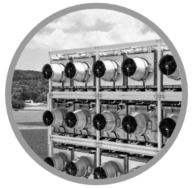

Steel


Aluminum


Cement/Concrete


Shipping


Trucking


Carbon Removal


Chemicals[1]
(Plastics – PET, PP and PE)

1. Chemicals sector to be launched in 2023

The First Movers Coalition aims to harness the purchasing power of the world's leading companies to **accelerate the deployment of next generation technologies needed to decarbonize** hard-to-abate sectors

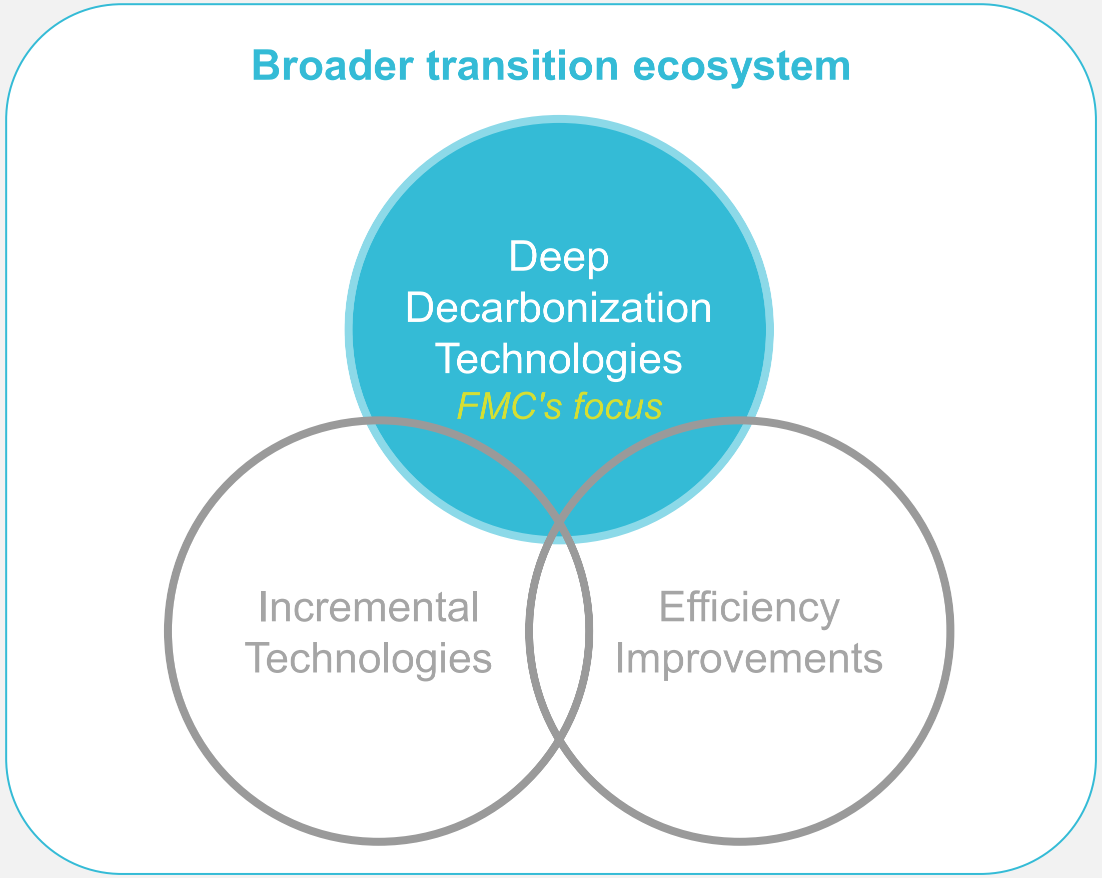
Decarbonizing FMC sectors requires holistic decarbonization approach

Deep decarbonization technologies
Application of transformational technologies to fully decarbonize key industrial processes

Incremental technologies
Adoption of less carbon-intensive technologies to bridge to fully decarbonized world

Efficiency improvements
Improvements on existing processes to lower energy usage in near-term

FMC seeks to play specific role within broader transition ecosystem



All levers and approaches will be critical to return to 1.5°C pathway, but distinct approaches are required to deliver desired outcomes

In-Country Situational Analysis Singapore

Executive summary | Singapore could play a leading role in advancing the regional SAF ecosystem to establish SAF security and meet climate goals

Singapore has staked out a position as a fuel hub for SEA and is taking steps towards transforming into a key SAF hub

- Singapore is the largest oil refiner in Southeast Asia producing 1.3M bbl/d of which 0.2M bbl/d (9Mtpa) is used for jet fuel
- This capacity roughly doubles domestic demand from Changi Airport of 5 Mtpa, resulting in a substantial exports
- Singapore is investing in SAF with planned capacity that will make it the largest SAF hub in Southeast Asia with 1.4 Mtpa by 2025

Developing Singapore's SAF hub will require strong demand signals and offtake to effectively ramp up production

- SAF likely to be scarce for foreseeable future given estimated 2030 global demand of ~18-35 Mtpa vs. 18 Mtpa of announced capacity
- Securing affordable, high-quality SAF supply likely presents strategic advantage for Changi Airport as major regional hub
- Neste and Shell are planning to add up to 1.4 incremental Mtpa of capacity by 2025, but requires offtakers to scale at this rate
- Several regional airlines have committed to 10% SAF by 2030 incl. Air New Zealand, ANA, JAL, Cathay, Malaysia and Qantas Airlines

Planned Singapore SAF currently falls short of FMC target for a >85% LCA reduction, thought pathways exist to close gap

- Planned production will leverage HEFA pathway with UCO and Tallow feedstocks, delivering reported LCAs of up to 80%
- Multiple options exist to increase LCA reduction with low-carbon hydrogen or build-out of next gen. SAF pathways as most promising

Three barriers identified to meet SAF85[2] threshold, but multiple targeted actions could support development of SAF85[2]

- Uncertain willingness to pay green premium for SAF85: Strong demand signal can be demonstrated with various private market efforts
- Limited grid decarbonization and hydrogen access by 2030: Government financial and policy support can improve the economics
- Technology viability for next generation technologies: Public-private partnerships to support R&D and de-risking of investments

1. 80% according to company websites by Neste and Shell, needs to be verified: 2. SAF85 is an FMC term to describe SAF with LCA emissions (including ILUC) >85% lower than conventional jet fuel at 89 gCO2/MJ

The FMC Aviation sector is leveraging airline buying power to accelerate the development of next generation SAF

In process of recruiting more airlines across new geographies

FMC's access to key stakeholders uniquely positions them to accelerate the development of next generation SAF

22 Total commitments in aviation

… resulting in …

~3.5Mt of demand for near-zero sustainable aviation fuels

Airlines and OEMs

Committed to >5% of fuel demand from sustainable aviation fuels with LCA >85% by 2030

BOEING, UNITED, DELTA, AIRBUS, FedEx, DHL, LUFTHANSA GROUP

Airfare/Airfreight purchasers

Committed to partner with air transport operators for >5% of fuel from sustainable aviation fuels with LCA >85% by 2030

RioTinto, BANK OF AMERICA, American Express Global Business Travel, pwc, NOKIA, VATTENFALL, salesforce, Bain & Company, Schneider Electric, AVENA, AUTODESK, Apple, BCG Boston Consulting Group, EY, FMG Fortescue, Deloitte.

12 Government partners

representing 50% of global GDP supporting FMC more broadly

4 key pathways to produce SAF, with unique challenges and potential

	Hydroprocessed esters and fatty acids (HEFA)*	Alcohol-to-jet	Gasification Fischer-Tropsch	Power-to-liquid
Opportunity Description	Mature technology: Safe, proven, and scalable technology	Technology in commercial pilot: Potential in mid-term, given higher GHG reduction possible vs fossil jet fuel; however, significant techno-economical uncertainty		Technology in development: Proof of concept 2025+, primarily where cheap high-volume green electricity is available
Announced global cap.[1]	16.1Mt (88% total)	1.0Mt (6% total)	0.9Mt (5% total)	0.3Mt (2% total)
Feedstock[2]	Waste and residue lipids, purposely grown oil energy plants (e.g., UCO, tallow, palm oil)	Agricultural and forestry residues, municipal solid waste, purposely grown cellulosic energy crops (e.g., sugarcane, corn grain)		CO_2 & green electricity; unlimited potential via direct air capture
LCA % reduction[3]	14%-84% *(proven ability to reach 85%)*	13%-73% *(potential to reach 85%)*	86%-100%	98%
Additional abatement levers	• Regenerative agriculture and cattle management • Renewable power • Green H_2 conversion feedstock • Conversion power with green H_2 instead of natural gas		• Electrified transportation • Renewable power	• DAC CO_2 • Green H_2 produced on-site with renewable power

1. Estimate from as of November 2022 announced projects from public research, not comprehensive; 2. Non-exhaustive; 3. Reduction of LCA emissions from conventional jet fuel at 89 gCO2/MJ (including ILUC); Source: Mission Possible Partnership, Clean Skies for Tomorrow; CORSIA Eligible Fuels – Life Cycle Assessment Methodology report; BCG analysis

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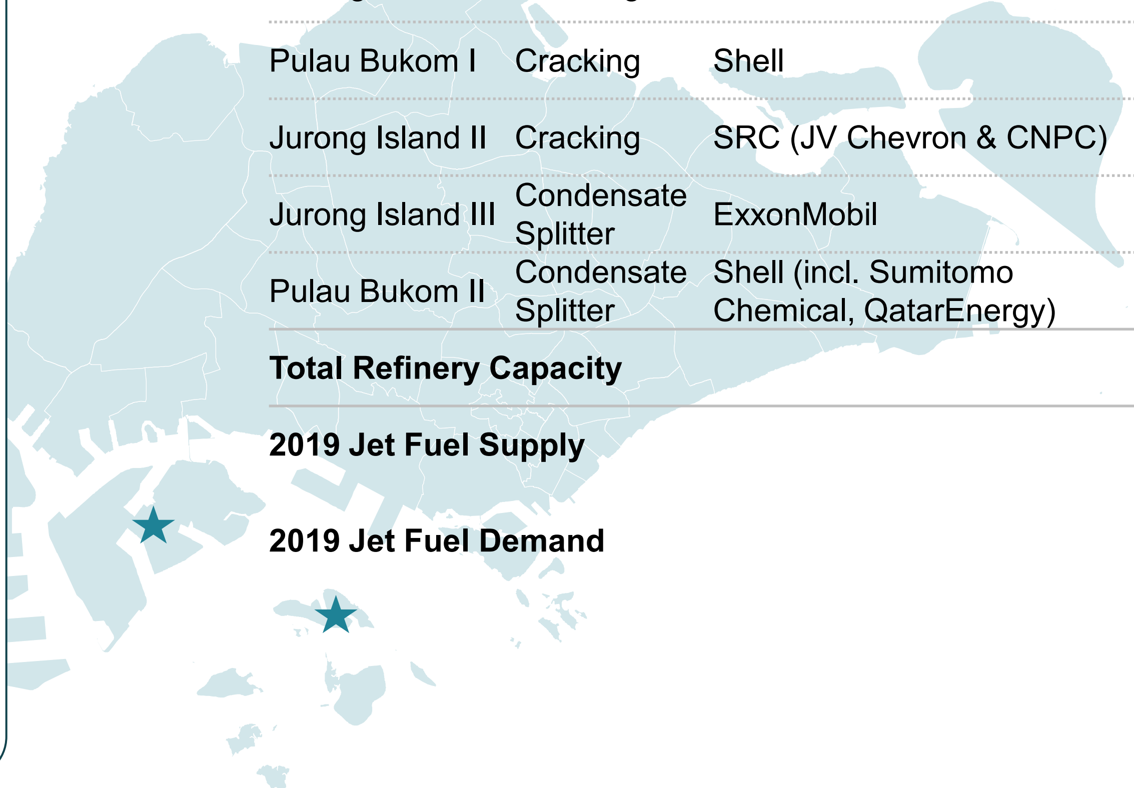
Singapore is the largest refiner in SEA producing 1.3 million barrels per day

The refining sector accounts for >19% of the countries emissions, with total energy sector representing 72%

Key Facts

- **Country emission goals:** Net zero 2050; ~60MtCO2e in 2030 (~11% reduction 2019)
- **Carbon tax:** $3.7/tonne from 2019 to $37-60/tonne in 2030 (*incl. gov. target to capture 2 MtCO$_2$/year by 2030*)
- **Power generation:** 95% of generation from natural gas (*lim. expected change to 2030*)
- **Jet fuel export/import[2]:** ~55-75% supply exported and ~25-60% of demand imported

Refinery	Type	Owner	Emissions[3] (MtCO2)	Capacity (kbbl/d)	Capacity (Mtpa)
Jurong Island I	Cracking	ExxonMobil	6.1	592	30.9
Pulau Bukom I	Cracking	Shell	3.1	307	16.0
Jurong Island II	Cracking	SRC (JV Chevron & CNPC)	3.0	290	15.1
Jurong Island III	Condensate Splitter	ExxonMobil	0.5	90	4.7
Pulau Bukom II	Condensate Splitter	Shell (incl. Sumitomo Chemical, QatarEnergy)	0.4	70	3.7
Total Refinery Capacity			**13.0 (19%[1])**	**1,349**	**70.4**
2019 Jet Fuel Supply			**1.6 (2%[1])**	**171**	**8.9**
2019 Jet Fuel Demand			**1.0 (1%[1])**	**102**	**5.3**



1. Percent of total 2019 GHG emissions in Singapore of 67.3 MtCO2e; 2. Range from 2017-2021 according to EMA Imports/Exports; 3. Estimated from avg. 14-28 MtCO2e/kbbl depending on type of refinery
Note: USDSGD of 1.34; Source: GlobalData; EMA; CAIT Climate Watch; BMI Singapore Power Report; BCG analysis

Longer term supply security can become a strategic advantage for airlines and air hubs as demand growth is expected to outpace supply

Nascent market, need to scale up global production capacity by >25x to achieve net zero goals by 2050

Illustrative estimate

		2019	2030	2050
Jet fuel Consumption Mt/year[1]	Global	330	410	615
	SEA	23	27	40
	Singapore	5.3	5.9	8.7
Estimated volume of SAF demand Mt/year	Global	-	18-35	400-554
	SEA	-	1.4-2.7	26-36
	Singapore	-	0.3-0.6	5.7-7.8
			5-10% of total jet fuel consumption[3]	*~65-90% of total jet fuel consumption[3]*
SAF production capacity[2] Mt/year	Global	1.3	18.3	>25x ramp up needed
	SEA	-	2.9	11x ramp up needed
	Singapore	-	1.4[4] *by 2025*	5x ramp up needed

1. Assumes traffic CAGR ~2% after air traffic returns to pre-Covid state in 2025. 2.Publicly announced SAF production est. capacity as of Nov. 2022, assumes all projects come online; 3. Based on DNV estimates for SAF blending, EU mandates, and potential improvements for 100% maximum blending level in the future (from 50%); 4. Based on theoretical maximum SAF/HVO production yield and split; Source: DNV; EU Commission; ICAO SAF Stocktaking 2020; GlobalData; EMA; BCG Biofuels database; BCG analysis

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Planned capacity may enable Singapore to play a leading role in advancing the regional SAF ecosystem to establish SAF security and meet climate goals

Highest SEA SAF capacity & jet fuel demand in Singapore

Country	SAF production capacity	Jet fuel demand
Vietnam	None	~3
Thailand	0.3	~6
Singapore	1.4	~6
Philippines	0.1	~2
Malaysia	0.3	~3.5
Indonesia	0.9	~5

Key
- xx Announced SAF production capacity in 2030[1], Mt/year
- xx Jet fuel demand in 2030[2], Mt/year

Note: Production may be diverted to HVO depending on local preference and incentives

SAF market in SEA planning for HEFA fuels

Largest announced SEA SAF projects

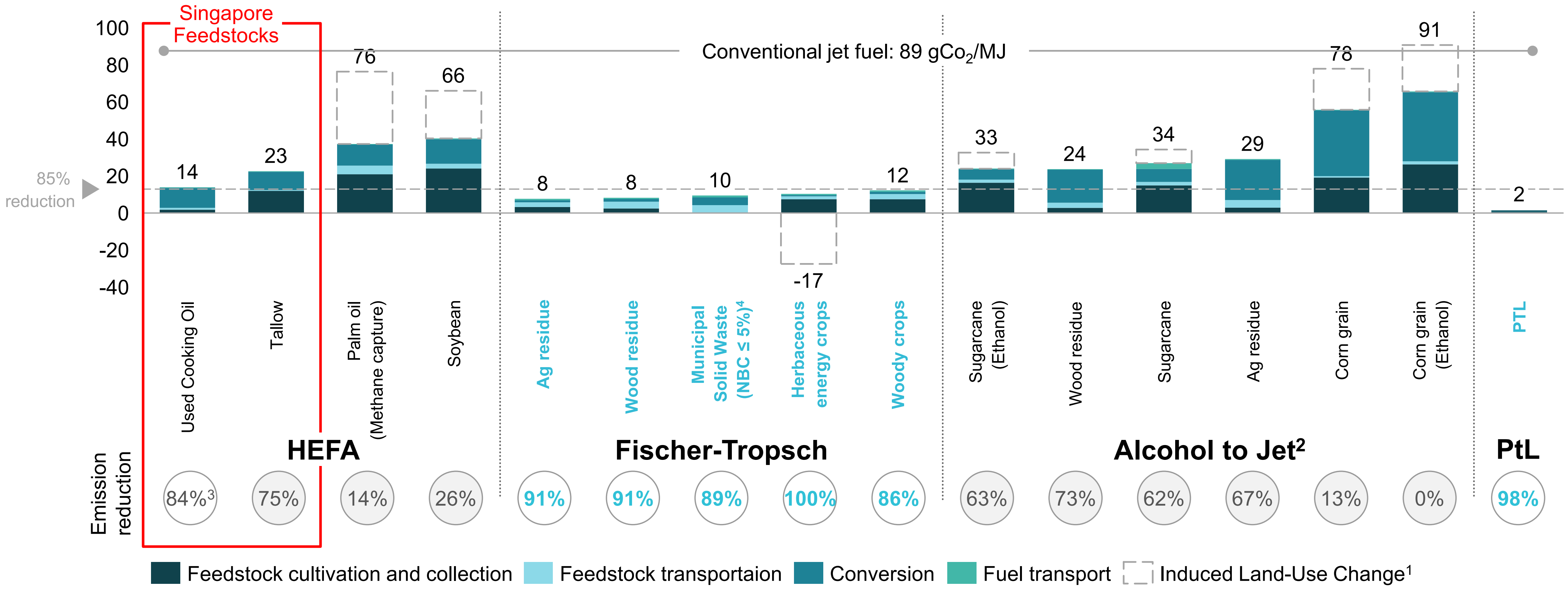
	Refinery	Year	Feedstock & technology	LCA	Capacity[2] (mmtpa)
NESTE	Tuas Singapore	2023	UCO, animal fats, waste veg. oil *HEFA*	<=80%	1.0
PERTAMINA	Cilacap	2021	Vegetable oil (palm[3]), UCO, fats *HEFA*	33%-72%[4]	0.2
PERTAMINA	Plaju	2025	Vegetable oil (palm[3]), UCO, fats *HEFA*	33%-72%[4]	0.7
VANDELA VENTURES	Sabah Maju Jaya	2025	UCO, animal fats, waste veg. oil *HEFA*	<=80%.	0.3

1. Publicly announced projects as of February 2023; 2. fuel demand in Singapore taken from EMA and jet fuel demand in other countries taken from GlobalData; 3. ISCC REDII certified for HVO production, so feedstock employed could be compliant with RED II Art. 29 criteria; 4. Depending on methane capture (58%) and 50/50 split CPO/UCO in future (72%)
Source: EMA, GlobalData, BCG analysis

Current Singapore SAF refineries leverage high LCA reduction HEFA pathways

LCA reduction potential depends heavily on geography of feedstock and conversion process

SAF: Average lifecycle emissions of different feedstocks and technologies (gCO_2/MJ)



1. Induced land-use change (ILUC) emissions may differ based on geography. Values provided are averages from specified geographies in CORSIA data; 2. Alcohol to Jet can use either ethanol or isobutanol as a feedstock, which in tern can be made from different crops; 3. Within range where some UCO HEFA may meet FMC benchmark; 4. Non-biogenic carbon
Note: List of feedstocks is non-exhaustive. Source: CORSIA Eligible Fuels – Life Cycle Assessment Methodology report

3 potential levers to increase Singapore LCA from 80% to >85% FMC target

Levers	Decarbonization opportunity	Levers to decarbonize (non-exhaustive)	Decarbonization viability in Singapore context
New production pathways *Deep-dive to follow*	Fischer-Tropsch (FT) and Power-to-Liquids (PtL) SAF have pathways to SAF85	• FT and PtL are already >85% • Alcohol-to-Jet potential pathway with waste residue but would require improvements to conversion emissions	• Meaningful capital investments and sourcing of feedstock required but presents potential to reach SAF85
Conversion *Deep-dive to follow*	*15%-75% of LCA emissions* Energy-intensive conversion of feedstock with treatment, hydrogenation, and separation	• Low-carbon H_2 used as a feedstock and as a power source	• Hydrogenation using low-carbon hydrogen presents potential to get to SAF85; hydrogen availability in Singapore unknown
Feedstock management	*25%-85% of LCA emissions* Feedstock cultivation, collection, transport and ILUC	• Regen. agriculture methods & improved cattle mgmt. • Electrified & optimized transport • Supplier region management	• Transport decarb. not at scale by 2030 • Near-term challenges with regen. ag. • Existing Singapore feedstock waste residue w/o ILUC; potential in other SEA regions

1. For HEFA technology pathway range depends on the feedstock
Source: CORSIA Eligible Fuels – Life Cycle Assessment Methodology report

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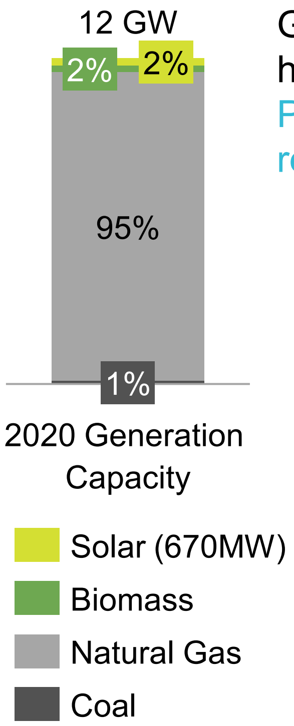
Low-carbon hydrogen offers near-term pathway to LCA >85%, though with incremental cost to SAF production

Domestic blue hydrogen production most attractive option, but challenges remain

Blue H_2 can be used as a feedstock to reduce HEFA conversion emissions to 85% LCA, but will materially add cost

- Blue H_2 production requires developing a carbon hub before 2030; carbon capture possible in Singapore with viable nearby storage[1] and key part of EDB plan for >2MT hub by 2030 (full hub potential >20Mt)
- Singapore SAF projected to be more expensive (2-5x more than conv. jet fuel) than existing SAF even before additional cost from blue H_2

Green hydrogen production not a near-term option given grid composition



Green H_2 represents promising hydrogenation pathway and key PtL feedstock but requires ample renewable power

- Singapore grid currently reliant on Natural Gas and space to deploy renewables highly limited (*2GW target by 2030, max. potential 8.6GW*)
- Renewable power of Green H_2 imports would be required, likely at a material cost addition

While Singapore's Net Zero by 2050 strategy presumes a key role for low-carbon hydrogen over the long-term…

…near-term pathway to secure hydrogen remains unclear and would require policy support

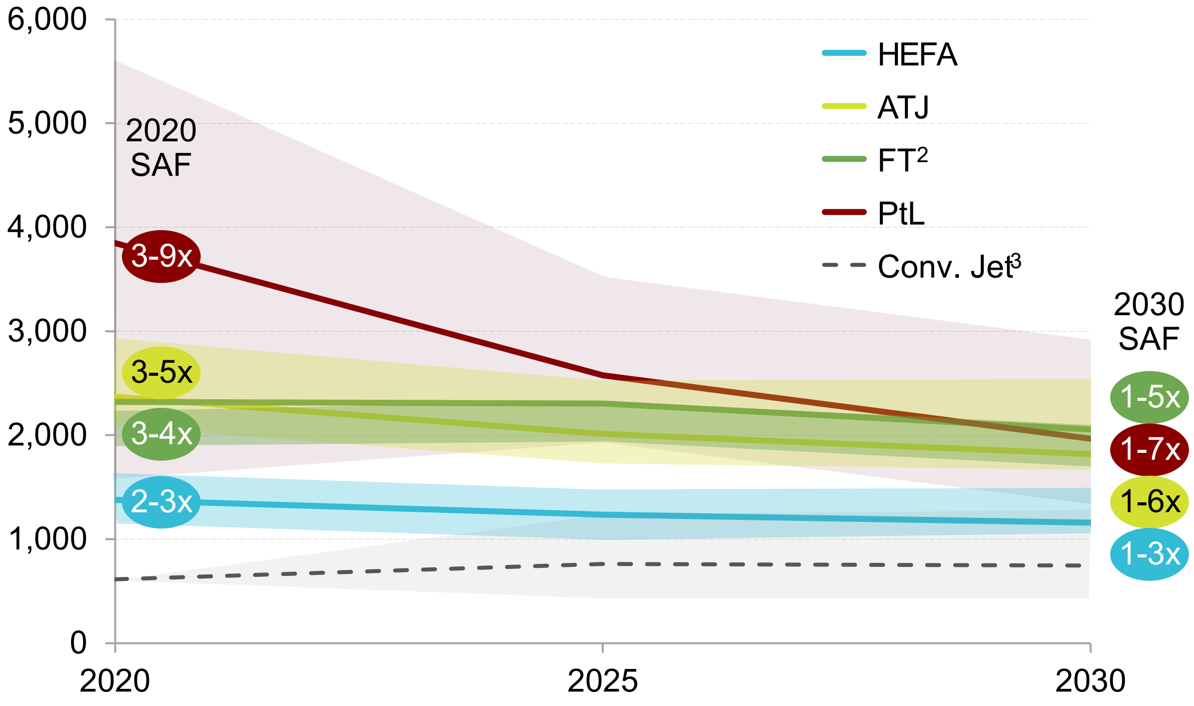
1. Carbon storage in Singapore requires development of transport solutions to neighboring countries (Indonesia, Malaysia)
Source: BMI Singapore Power Report; EMA; 2022 Singapore Hydrogen Strategy; EDB Singapore; Mission Possible Partnership (MPP) analysis

New production pathways could also produce cost-competitive SAF85 by 2030

HEFA advantaged to 2030, but other pathways are expected to enter the market and could become viable alternatives

Global production costs by SAF pathway[1] ($/ton)

(Compared to conventional jet fuel min/max forecast)



Data indicates Singapore is like to have higher HEFA SAF production costs than global avg. in large part due to feedstock selection and local context, which may impact cost evolution dynamics

Implications for Singapore SAF hub

- By 2030, HEFA cost may converge to conv. jet fuel, but scarcity will likely justify ongoing price premium
- Cost of alternative pathways expected to reduce meaningfully, minimizing HEFA advantage resulting from lower CAPEX retrofits
- To maintain a regional leadership position in the SAF market, Singapore will likely need to evaluate when and how to invest in new production pathways
  - Singapore HEFA production expected to have a higher 2-5x premium due to feedstock
  - Risk of falling behind other SAF technologies with highest LCA reductions as other market offer incentives benefiting FT and PtL pathways

1. Includes feedstock, OPEX and CAPEX costs; 2. WEF Clean Skies for Tomorrow report assumed $0 feedstock cost from municipal solid waste, but feedstock in Singapore more likely dry biomass – cost is adjusted; 3. Singapore Jet historical price forecasted with US EIA reference, high oil and low oil price scenarios
Source: WEF Clean Skies for Tomorrow Report; US EIA; Refinitiv; BCG analysis

Targeted actions by key industry players could unblock the market for SAF85

Supply inhibitors	Potential unblockers (Illustrative)
Uncertain willingness to pay green premium for SAF85	• **Demand:** Improved carbon trading services and corporate buyers' club could create demand signals and design and introduce structural offtake mechanisms • **Demand:** FMC to continue recruiting major airline buyers ahead of COP28 • **Financial support:** Singapore government could drive greater demand with supply-side production incentives
Limited grid decarbonization and H_2 access by 2030	• **Financial & policy support:** Singapore government to build supply chain for affordable low-carbon hydrogen • **Financial support:** For carbon capture to produce blue H_2 in-country and store carbon in nearby regions • **Policy support:** Singapore government to develop partnerships with nearby countries for carbon storage pipelines and infrastructure
Technology viability for next gen. technologies	• **Financial support:** Singapore government could consider incentives for R&D of new SAF technologies • **Financial support:** Preferential capital or financing structures to lower capital cost or de-risk investment in next-gen SAF

State of financing to support SAF development in Singapore

Available financing will need to be supplemented by private and broader geographic public funding to drive decarb. efforts

Non-exhaustive

Singapore's government has issued multiple initiatives in support of SAF and broader decarbonization efforts

NCCS
- Carbon Tax in 2019 from S$5/t$CO_2$e ($3.7) up to S$50-S$80/ tCO_2e ($37-60) by 2030

MOF
- Budget of public sector issuance of up to S$35 billion of green bonds by 2030

MAS
- MAS Green & SL Loan Grant Scheme (GSLS) to support companies in obtaining green financing
- Significant Infra. Gov. Loan Act (SINGA) framework for issuance of green bonds
- Green Finance Industry Taskforce (GFIT) green taxonomy for low carbon transition incl. aviation

CAAS
- CAAS S$50M ($37M) investment fund to support the development of a sustainable air transport hub
- Several partnership incl. CAAS aviation accord with NZ, US, UK & Japan, and gov. collaborations with US, UK & Indonesia on climate action & financial cooperation

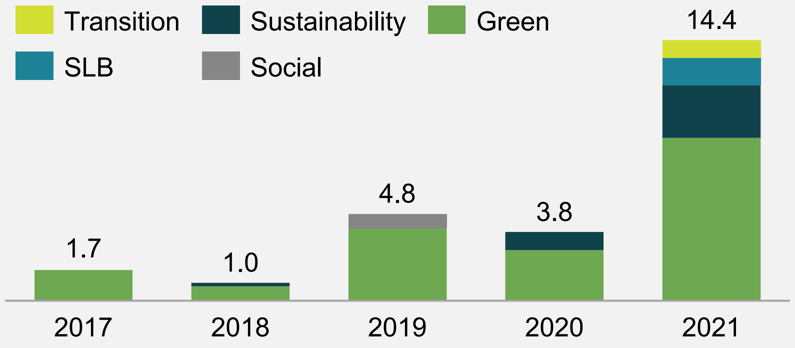
- Currently no supply-side production incentives (like the US IRA) in Singapore or broader SEA for SAF, hydrogen or Carbon Capture, Utilization & Storage (CCUS)

Dedicated private funding to support SAF development in Singapore is growing

TEMASEK
- Temasek committed initial S$5B ($3.6B) to GenZero in 2022, an investment platform for technology-based solutions such as SAF, low-carbon materials and CCUS
- Singapore's Climate Impact X (CIX), in partnership with GenZero, and AirCarbon Exchange are launching global exchanges and marketplaces for high-quality carbon credits
- CAAS, Singapore Airlines and Temasek partnered to launch SAF credits in July 2022 for 1ktpa of SAF with a 35% reduction in LCA emissions

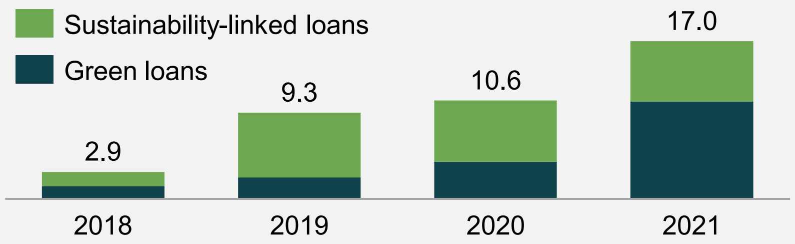
Green, Social, Sustainability, Sustainability-linked and transition bond issuance volume in Singapore

Issuance Volume (SGD billion)



Green and sustainability-linked loan volumes in Singapore

Volume (SGD billion)



Source: MAS Sustainability Report 2021/2022; Singapore Ministry of Finance; Singapore Green Finance Centre; CAAS; Company websites

Several finance sources that can accelerate further FDI growth

Legislative packages

The Inflation Reduction Act with 370 B$ investment into addressing climate change with the goal of reducing greenhouse gas emissions to 50% below 2005 levels by 2030

The US Department of Energy will provide 6 B$ for Industrial Decarbonization Projects, providing up to 50% of the cost of projects targeting the highest emitting industries

EU Global Gateway 300 B EUR to boost investments in infrastructure development around the world ensuring the highest social and environmental standards,

The Green Deal Industrial Plan builds on previous initiatives and relies on the strengths of the EU Single Market, complementing ongoing efforts under the European Green Deal (100B EUR) and REPowerEU (210 B till 2027)

Multilateral institutions

The Partnership for Global Infrastructure and Investment 600 B USD collaborative effort by G7 to fund infrastructure projects in developing nations with the goal to close the infrastructure gap in developing countries while tackling the climate crisis.

World Bank: The Climate Change Action Plan 2021–2025 aims to advance the climate change aspects of the WBG's Green, Resilient, and Inclusive Development approach, which pursues poverty eradication and shared prosperity with a sustainability lens ($31.7 billion in 2022)

ADB set the ambition to mobilize $100 billion for climate financing from 2019–2030

The European Bank for reconstruction and development launched the Green Economy Transition (2021-2025) with 36B$

Private Sector Initiatives

Glasgow Financial Alliance for Net Zero (130 T USD), a coalition of leading financial institutions committed to accelerating the net-zero transition.

BlackRock has raised 4.5 billion out of a 7.5 billion-target for a new fund to invest in infrastructure assets aimed at climate-focused projects.

TPG Rise Climate with 7.3 B USD the dedicated climate investing strategy of TPG's global impact investing platform

Note: Non-exhaustive, selected examples
Source: BCG Analysis

Appendix

First Movers Coalition

Glossary of terms

FMC: First Movers' Coalition

SAF: Sustainable Aviation Fuel

SAF85: FMC term to describe SAF with LCA emissions (including ILUC) >85% lower than conventional jet fuel at 89 gCO2/MJ

LCA: Life Cycle Assessment; evaluation of environmental impact of product, in this case, total greenhouse gas emissions over entire lifecycle

ILUC: Indirect Land Use Change

bbl/d: barrels per day of crude oil equivalent

Mtpa: Million tonnes per annum

HEFA: Hydroprocessed Esters and Fatty Acids

UCO: Used Cooking Oil

CCUS: Carbon Capture, Utilization and Storage

H_2: Hydrogen

CO_2: Carbon Dioxide (CO2e = CO_2 equivalent for all greenhouse gases)

DAC: Direct Air Capture

CCUS: Carbon Capture Utilization and Storage

SEA: Southeast Asia

HVO: Hydrotreated Vegetable Oil

US IRA: United States Inflation Reduction Act

Singapore climate landscape overview

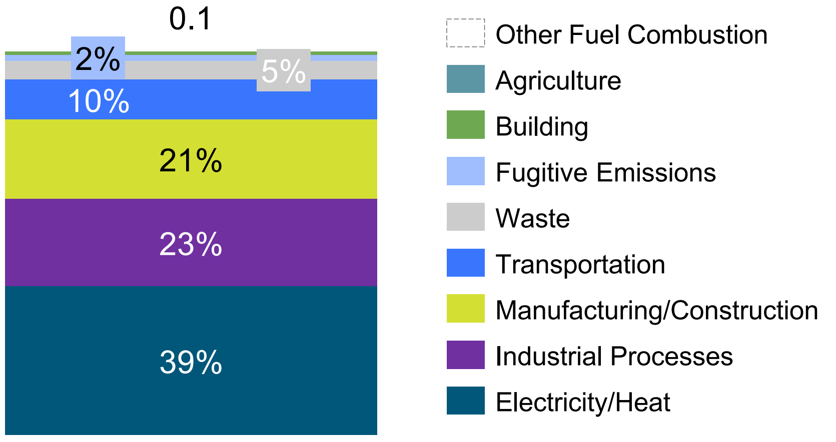
2021 GDP | $424B: ~1% of APAC GDP

Climate overview

Net Zero	Yes; Ambition for net zero by 2050 or beyond
Paris agreement	Yes; signatory + INDCs[2]
Intermediate targets	Reduce emissions intensity by 36% by 2030 vs 2005 baseline
ETS[1] / Carbon Tax	Yes; S$5($3.7)/tCO2e

Emissions by sector

($GtCO_2e$, 2019)



Relative emissions, 2019

~.3% APAC	~.1% global

Key incentives

- Road tax incentives to adopt electric vehicles
- US$2 billion green investments programme (GIP) in public market investment strategies with strong green focus
- Public sector will issue up to SGD35 Bnof green bonds by 2030

Policies and targets

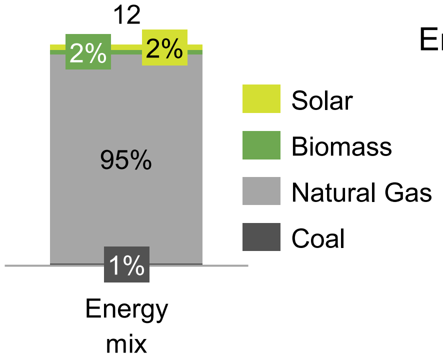
2020 Long-Term Low Emissions Development Strategy, aims to halve emissions from their peak in 2030 by 2050

Additional goals

- Phase out internal combustion engine vehicles by 2040
- Install 1.5GW by 2023 and 2GW by 2030 of solar power gen.
- Ban new diesel cars and taxis from 2025
- Will enforce legally binding climate-linked financial disclosures by 2022

Energy Mix

Generation Capacity (GW, 2020)



Emissions reduction pathway

- Govt. exploring collaborations to meet RE 2030 target by importing 100MW of RE sources from Malaysia
- 2-year trial seen as first step towards strengthening regional grid architecture

1. Emissions Trading System (e.g., Cap-and-trade) 2. Interim Nationally Determined Contributions

Source: OECD, Bloomberg, CAIT, IMF, EMA, Worldbank, BCG analysis

Singapore air hub has made varying progress compared to global benchmarks, with opportunities to accelerate

Non-exhaustive

Singapore	Sustainable Aviation Fuel (SAF)	Carbon offsetting	New and emerging aircraft technologies	Improve operational efficiency
National level progress, including CAAS	**Nascent SAF production volume** Neste: 1.0 Mt/year Shell: 0.55 Mt/year[1] **SAF pilot study** **SG-NZ sustainable aviation MOA,** which includes SAF trial	Singapore has **volunteered for the pilot phase of CORSIA** **Supports other states** in their implementation of CORSIA monitoring, reporting and verification (MRV) system	**Conducting studies** on feasibility and requirements to support future hydrogen-powered aircraft operations; in partnership with AIRBUS, CHANGI airport singapore, Linde	**Study and find international collaboration** on operational efficiency to reduce airborne time and fuel use
CHANGI airport singapore		Actively **explore various sources and markets** to purchase carbon offsets	**Conducting studies** on emerging tech e.g., electric infrastructure, hydrogen feasibility	
SINGAPORE AIRLINES	**Pilot study** on the use of SAF in Singapore Signed the Global SAF Declaration to promote the acceleration of SAF R&D and adoption	**Voluntary carbon offset program** for air passengers **Sourcing** for high-quality carbon offsets	Closely **monitoring the emerging technologies** to be introduced by OEMs **One of the youngest and most efficient fleets**	**Ongoing initiatives** around flight operations, total missions mgmt., engine wash, light weighting, route planning,

1, Shell's SAF facility plan is subject to final investment decision
Source: SIA; CAAS; Changi Airport; press release

RECAP

First Movers Coalition

Created through a partnership between the **World Economic Forum & the US State Department,** through **the U.S. Special Presidential Envoy for Climate, John Kerry**

Leverages collective purchasing power of companies globally to send a clear **demand signal to scale up critical emerging technologies** essential to the net zero transition

Members include **major global firms with substantial purchasing power** across the value chains of eight emissions-intensive sectors

The FMC **formally launched at COP26** in Glasgow (November 2021)

First Movers Coalition

Overview of FMC

106 **total commitments** from 72 companies across 7 sectors

…resulting in…

$12B **in demand** for near-zero-emission products

…supported by…

15 **government partners** representing 50% of global GDP

Steering Board

Aluminum
Apple
Ball Corp
Bang & Olufsen
CBA
Constellium
Ford Motor Company
Novelis
PepsiCo
Trafigura
Volvo Group

Aviation
Airbus
American Express GBT
Apple
Autodesk
Aveva
Bain & Company
Bank of America
Boeing
Boston Consulting Group
Deloitte
Delta Airlines
Deutsche Post DHL Group
EY
FedEx
Fortescue Metals Group
Nokia
PWC
Rio Tinto
Salesforce
Schneider Electric
United Airlines
Vattenfall

Carbon Removal
AES
Alphabet
Boston Consulting Group
EGA
Microsoft
Mitsui O.S.K. Lines
Salesforce
SwissRe
Trafigura

Cement / Concrete
CCC
Etex
General Motors
RMZ
Vattenfall
Ørsted

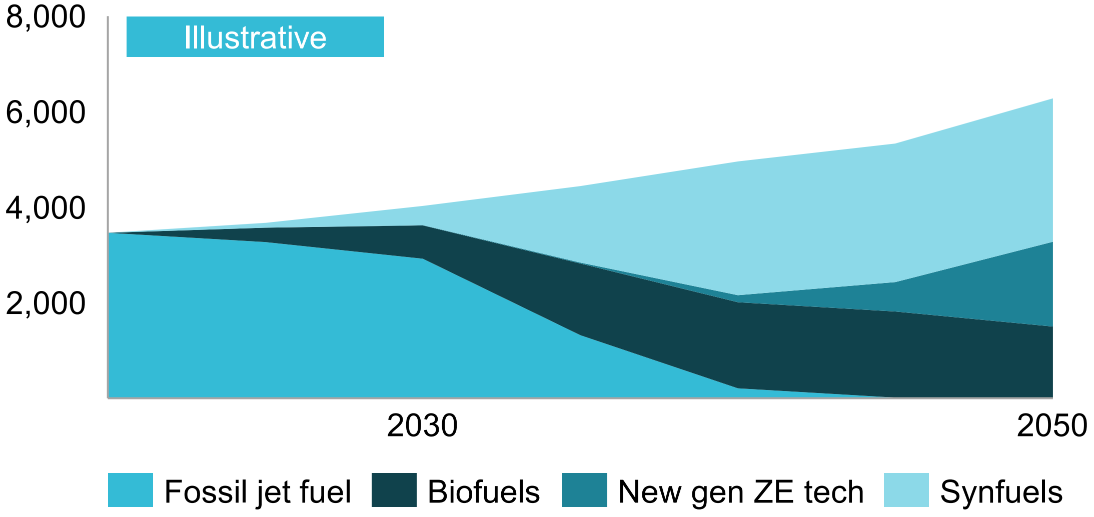
Trucking
Agility
Cemex
Dalmia Cement
Fortescue Metals Group
HeidelbergCement
Holcim
National Grid
Norge Mining
PepsiCo
Rio Tinto
Scania
SSAB Swedish Steel
Vattenfall
Volvo Group

Shipping
A.P. Møller – Mærsk
Agility
Aker ASA
Aker Biomarine
Amazon
BHP
Fortescue Metals Group
Höegh Autoliners
Mitsui O.S.K. Lines
Rio Tinto
Trafigura
Western Digital
Yara International

Steel
Aker ASA
Alfa Laval
CCC
Ecolab
Enel
Engie
Ford Motor Company
Fortescue Metals Group
Iberdrola
Invenergy
Johnson Controls
Mahindra
Marcegaglia
Ørsted
ReNew Power
Scania
Trane Technologies
Vattenfall
Vestas
Volvo Group
ZF Friedrichshafen AG

Aviation: Commitment scope

Energy demand (TWh)



Technologies in FMC scope

- Sustainable Aviation Fuels[1] with LCA GHG reduction ≥ 85%
- New generation near–zero emissions propulsion technologies, incl.
  - Battery–electric
  - Hydrogen turbine and fuel cells

Airline

"By 2030, we will replace at least 5% of conventional jet fuel demand with sustainable aviation fuels (SAFs) that reduce life–cycle GHG emissions by 85% or more when compared with conventional jet fuel, and/or using zero–carbon emitting propulsion technologies

Airfare/airfreight purchaser

"By 2030, we will partner with air transport operators to replace at least 5% of conventional jet fuel used for our air travel/freight with sustainable aviation fuels (SAFs) that reduce life–cycle GHG emissions by 85% or more when compared with conventional jet fuel, and/or zero–carbon emitting propulsion technologies

1. Neat SAF with >85% LCA, using the Schneider–Kildee–Brownley–Brown–Cantwell definition.
Disclaimer: the Climate Pathway scenario is the result of an analysis assuming aggressive cost reductions, progressive technology developments and future breakthroughs, and high investments from 2021 onwards

Aviation: Detailed commitment

Subject of demand signal

Utilization of cutting-edge SAFs & propulsion technologies for air travel by 2030

In-scope:

- **Sustainable Aviation Fuels with LCA GHG reduction ≥ 85%**[1]
- **New generation near-zero emissions propulsion technologies**, incl. battery-electric, hydrogen turbine and fuel cells
- Other technologies with LCA GHG reduction ≥ 85%

Out-of-scope:

- More established SAFs – i.e. with LCA GHG reduction < 85%[1]
- Fossil jet fuels
- Carbon offsets
- Efficiency improvements

Ambition

Airline / Air freight - By 2030, we will replace at least 5% of conventional jet fuel demand with sustainable aviation fuels (SAFs) that reduce life-cycle GHG emissions by 85% or more when compared with conventional jet fuel, and/or zero-carbon emitting propulsion technologies

OR

Airfare / airfreight purchaser –
By 2030, we will partner with air transport operators to replace at least 5% of conventional jet fuel used for our air travel / freight with sustainable aviation fuels (SAFs) that reduce life-cycle GHG emissions by 85% or more when compared with conventional jet fuel, and/or zero-carbon emitting propulsion technologies

1. Neat SAF, using the Schneider-Kildee-Brownley-Brown-Cantwell definition - fuels that can be beneficial to worker health and safety in the airport environment and in the surrounding communities - safety and training of crews are vital activities to be built out further after COP26.

Get in touch

Laia Barbarà,
Industry Decarbonization Lead, Aviation
World Economic Forum
Laia.barbara@weforum.org

Robert Boyd,
FMC Aviation Champion,
Boeing Fellow

Robert.boyd@weforum.org

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WORLD ECONOMIC FORUM