Malaysia

Mapping Out Malaysia’s Aviation Decarbonisation Blueprint

Learn about Cascade

Malaysia has adopted its net-zero emission reduction targets in coordination with ICAO’s long-term aspirational goals (LTAG). These targets, alongside the baseline and projected emissions, are modelled in the Boeing Cascade Climate Impact Model:

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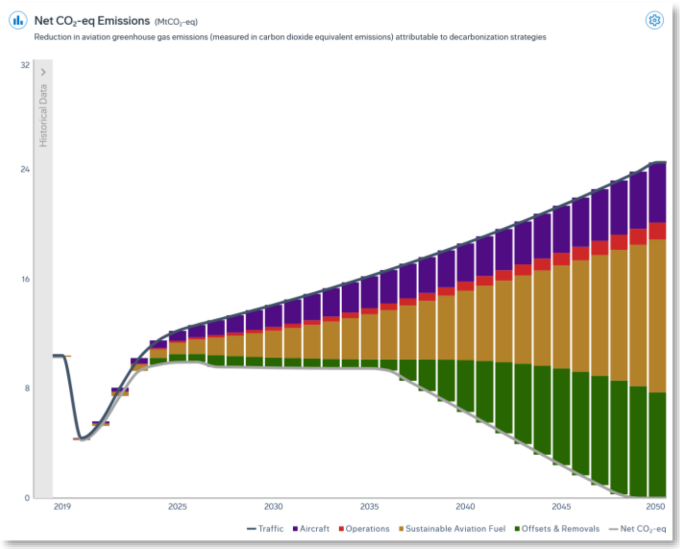
24.5 $MtCO_2$-eq emissions

Without improvements in aircraft, operations, or the use of sustainable aviation fuels (SAF), Malaysia’s aviation CO_2 emissions could more than double from 10.4 $MtCO_2$-eq 2019 baseline emissions to 24.5 $MtCO_2$-eq emissions in 2050.



Recreation of Malaysia’s Aviation Decarbonisation Blueprint in Cascade, with equivalent projected emissions using a 2.8% traffic growth rate

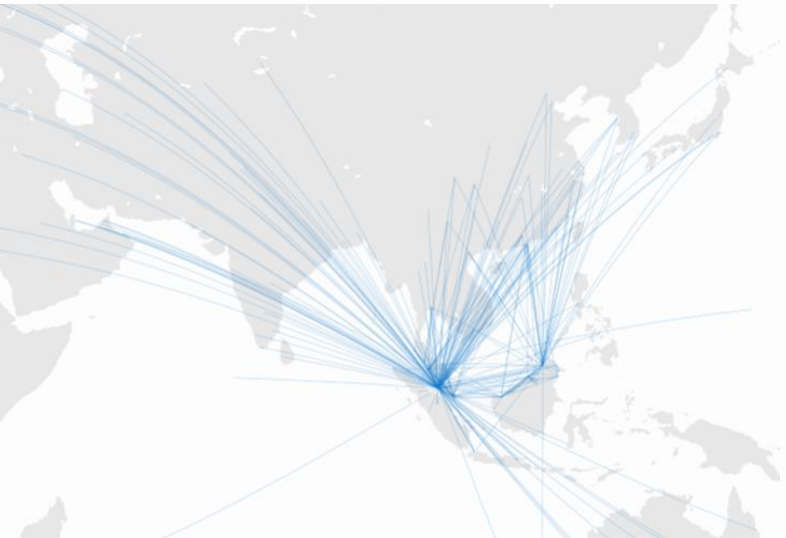
Malaysia’s 2050 Net Zero Reduction Targets from 2019 Baseline Emissions[1]

- **18%** Aircraft technologies
- **5%** Operational improvements
- **46%** Sustainable aviation fuel (SAF)
- **31%** Market-based measures (MBM)

Turn Insights into Action

Malaysia holds significant potential for Sustainable Aviation Fuel production by leveraging extensive biomass waste availability from rice, oil palm waste, and non-standard coconut.[2]

Flight routes departing from Malaysia in 2019



4.6 Billion Litres Of SAF will be needed in 2050 to reach Malaysia’s 46% SAF emission reduction target

Opportunity for Action

With the existing biomass waste to produce SAF, Malaysia can reduce its reliance on fuel imports and grow local economies

By 2050, the value of SAF produced is projected to reach \$3-4 billion USD, reflecting its economic significance and potential to drive regional growth through job creation and technological advancement.

Reaching Energy Emission Targets through SAF Production and Malaysia's Responsible Energy Transition Pathway (2050)

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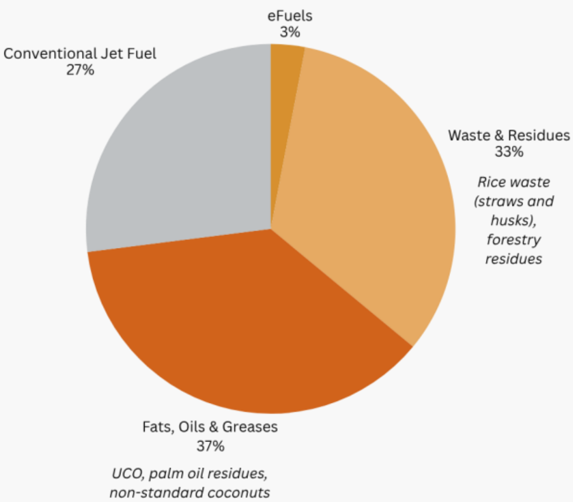
This scenario assumes that Malaysia's 46% emission reduction target is achieved through local SAF production leveraging a variety of different feedstocks. This is coupled with improvements to hydrogen and electricity production pathways for eFuel production via Malaysia's Energy Transition Roadmap based on the projected power system installed capacity mix in 2050.[3]

Feedstock market shares in 2050

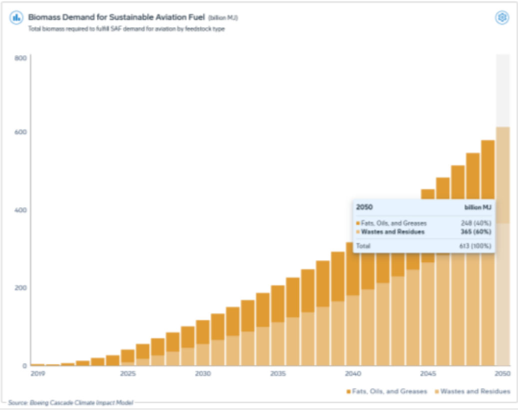


Malaysia's Carbon Intensity Advantage

A techno-economic assessment conducted by GHD and supported by Boeing highlights Malaysia's progress in reducing carbon emissions through palm oil residue pathways, specifically palm fatty acid distillate (PFAD) and palm oil mill effluent (POME).

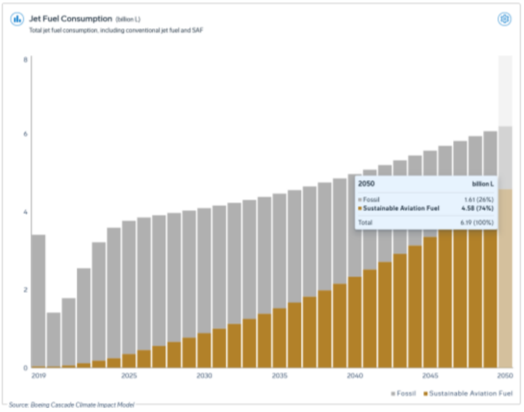
The carbon intensity for PFAD is 15.6 gCO2-eq/MJ via HEFA, while POME is at 14.9 gCO2-eq/MJ via HEFA. These values are **lower** than the CORSIA default life cycle emissions for palm oil (closed pond), which stand at 76.5 gCO2-eq/MJ SAF. This reduction is largely **due to the absence of land use change** associated with the use of palm oil waste in Malaysia.

Malaysia's Biomass Demand in 2050



Biomass-derived feedstocks are essential for producing SAF. To meet the growing demand, significant investment in SAF infrastructure is necessary to support and scale production effectively.

4.6 billion L of SAF to fulfill local demand represents 74% of jet fuel consumption



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SAF refineries are required in this scenario[6]

Boeing's Efforts in Malaysia

Advocacy

- **Supporting federal policy** action for SAF scaling
- **Advancing fuel security** discussion on SAF as a sovereign risk mitigation measure
- **Collaborating on feedstock diversification** to leverage Malaysia biomass feedstocks with low carbon intensity scores

Collaboration

- **Partnership** with Malaysia Aviation Group in four areas critical for aviation decarbonisation:
  - ➢ Traffic | Aircraft | Operations | SAF
- **Driving capability building** through the annual MyAero Sustainable Aviation Symposium in partnership with National Aerospace Industry Corporation (NAICO) Malaysia
- **Charitable contributions** of >$800,000 in support of 11 local organizations – with a focus on STEM education, nurturing aerospace talents, environmental conservation and empowering rural entrepreneurs

Thought Leadership

- **Regional SAF studies** in collaboration with the Roundtable on Sustainable Biomaterials (RSB) Southeast Asia SAF Feedstock study
- **ASEAN Agriculture Waste to SAF Technoeconomic Assessment** in collaboration with the ASEAN Secretariat, GHD, Canadian Trade and Investment Facility for Development

Scenario Assumptions

- Malaysian domestic and international departures only.
- Well-to-wake emissions scope. Revenue Mass for unit of measurement for payload.
- Moderate traffic growth rate of 2.8%. This figure was derived from the forecast emission profile from the Malaysian Aviation decarbonisation (MADB) Blueprint.[1]
- The Malaysian Aviation Decarbonisation Blueprint doesn't explicitly mention whether the reduction targets assume a 2019 or 2023 emissions baseline. However, Malaysian aviation emissions in 2019 and 2023 differed by less than 2%, so the net effect is effectively the same.
- As part of the 18% emissions reduction target through Aircraft Technologies, the MADB report does not explicitly include hydrogen or electric aircraft. This scenario assumes the absence of hydrogen or electric aircraft and instead assumes the 18% target is reached through a 'MODERATE' fleet renewal strategy, with a fleet renewal phase of 25 years. This assumption is formulated based on the average fleet age of the two largest airline operators in Malaysia, Air Asia and Malaysian Airlines, with an average fleet age of 10.5 years[4]. This fleet renewal pathway is combined with an ambitious allocation of Advanced Conventional aircraft market shares. The projected market share distribution of Advanced Conventional aircraft by 2050 is as follows: Regional aircraft at 40% with Entry Into Service (EIS) in 2035, Single Aisle aircraft at 40% with EIS in 2040, and Widebody aircraft at 30% with EIS in 2045. The MADB report encourages airlines to operate the latest generation fleet wherever possible.
- The 5% Operational Improvements reduction target is largely driven by enhanced Air Traffic Management measures, with a complete airspace redesign slated for 2041.[1] As such, this scenario assumes a Flight and Traffic Management improvement of 2.7% from 2019 baseline figures, and a load factor of 83%.
- The ambition level for hydrogen as a renewable energy source is set to 'MODERATELY HIGH'. Malaysia is embarking on an ambitious journey to establish itself as a regional leader in green hydrogen production by 2050. Key targets outlined in the Hydrogen Economy and Technology Roadmap (HETR) and the National Energy Transition Roadmap (NETR) include generating up to 2.5 million tonnes per annum (Mtpa) of green hydrogen by 2050, as part of an overall hydrogen production volume projected to reach 16 Mtpa under an emission-driven scenario.[3]
- The breakdown of electricity sources as a renewable energy source mirrors Malaysia's Responsible Transition Pathway (2050).[3] This pathway is applicable to the entire energy grid, but this scenario assumes the breakdown of sources is the same for the aviation sector. For more information, please see Exhibit 5.2: Projected power system installed capacity mix 2050.
- The market shares for SAF feedstocks have been derived from two key sources: GHD's Techno-Economic Assessment Report on Promoting the Production of Sustainable Aviation Fuels from Agricultural Waste in the ASEAN Region[12] and interviews with industry subject matter experts. Although eFuels were not explicitly mentioned as a SAF source in the GHD report due to the biomass-focused nature of the analysis, this scenario assumes a nominal 3% market share for eFuels by 2050, providing a more generalized picture of the SAF market in 2050. *Note: Novel Energy Crops are excluded from this assessment, as are Sugars & Starches, as the feedstock evaluation did not specify these types.*

Feedstock Category	Market Share	Carbon Intensity	Notes
eFuels	3%	Production Energy Intensity = 0.25 MJ/MJ	Cascade default production energy intensity
Fats, Oils and Greases	37%	16 gCO_2-eq/MJ	Carbon intensity based on likely and feasible palm oil production pathways PFAD and POME (via HEFA).[2] (Cascade default value 22g gCO_2-eq/MJ from CORSIA). Feedstocks included in this analysis: UCO, palm oil residues, non-standard coconuts
Sugars & Starches	0%	-	
Novel Energy Crops	0%	-	
Waste & Residues	33%	6g gCO_2-eq/MJ	GHD study with rice waste (straws) at 5.6CO_2-eq/MJ via FT pathway. (Cascade default value 6g gCO_2-eq/MJ from CORSIA). Feedstocks: forestry residues, rice wastes (straws and husks)

Sources

1. Ministry of Transport Malaysia, "Malaysia Aviation Development Blueprint," https://www.mot.gov.my/en/Pages/Aviation/MADBlueprint%20BI%20FA.pdf.
2. ASEAN, "Techno-Economic Assessment Final Report," https://asean.org/wp-content/uploads/2025/04/12634962-RPT-6-Techno-Economic-Assessment-Final-Report_April-2025.pdf#SAF.
3. Ministry of Economy Malaysia, "National Energy Transition Roadmap," https://ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf
4. Asia Aviation Public Company Limited, "Network and Fleet," https://www.aavplc.com/en/about/network-and-fleet.
5. Planespotters.net, "Malaysia Airlines," https://www.planespotters.net/airline/Malaysia-Airlines.
6. International Air Transport Association (IATA). "Financing the Energy Transition: A Roadmap to 2024." https://www.iata.org/en/programs/sustainability/reports/financeroadmap2024/
7. Fueling Net Zero, An ICF Report for ATAG Waypoint 2050 https://aviationbenefits.org/media/167495/fueling-net-zero_september-2021.pdf. The $3-4 billion figure was calculated for the assumption of cost of $760-900 per tonne of SAF in 2050