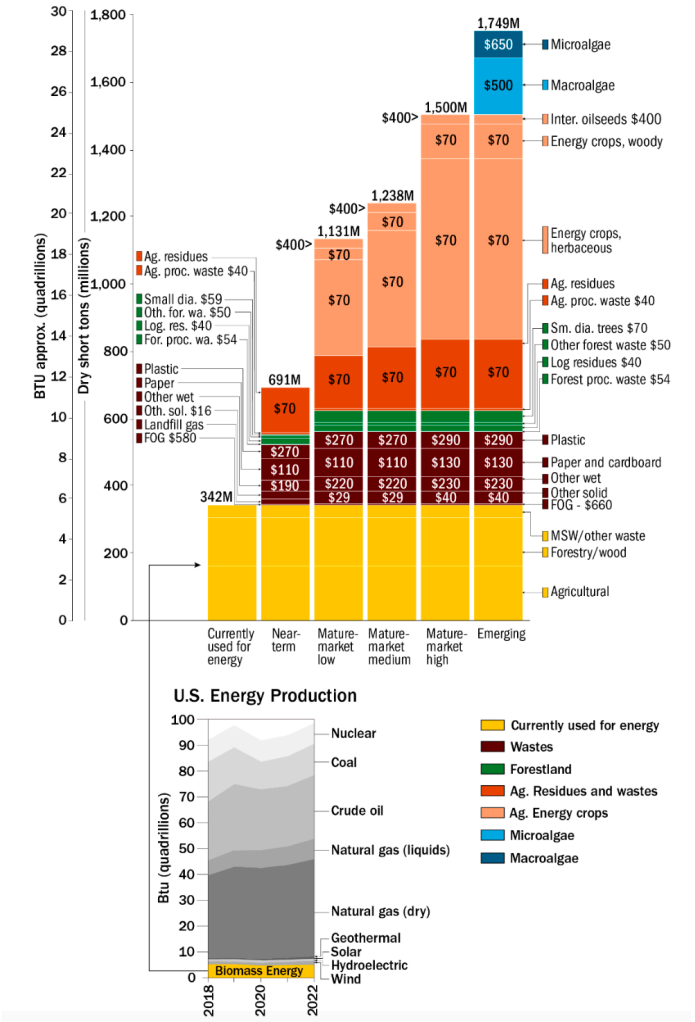


US DOE 2023 Billion Ton Report.

The Future of Biofuels As On-Road Vehicles Electrify

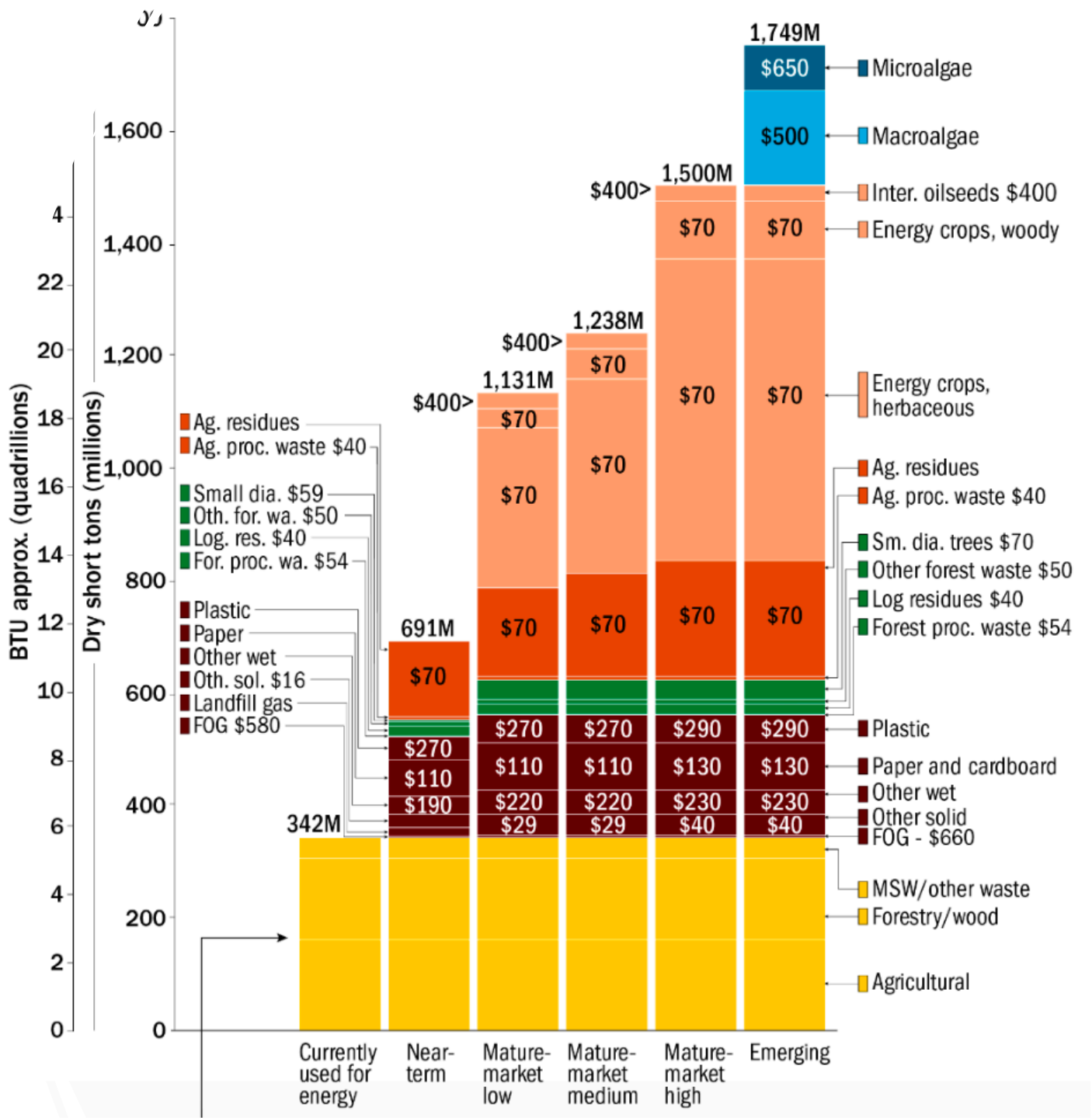
V. M. Thomas

Georgia Institute of Technology

April 29, 2024

Health Effects Institute Annual Conference

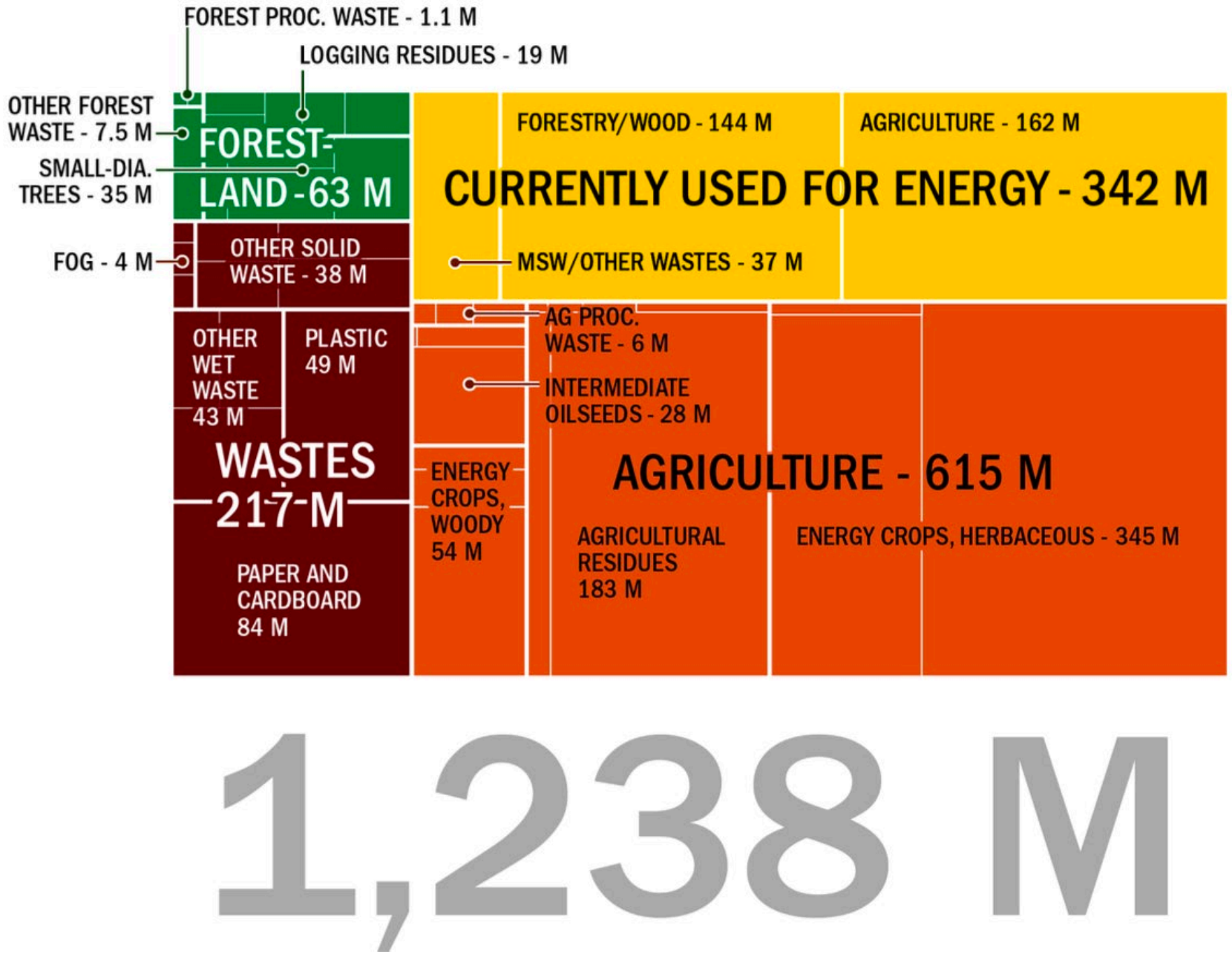
US DOE Projection of Biomass for Biofuel



US DOE 2023 Billion Ton Report.

Mature Market Scenario 1.3 B tons

US DOE 2023 Billion Ton Report.

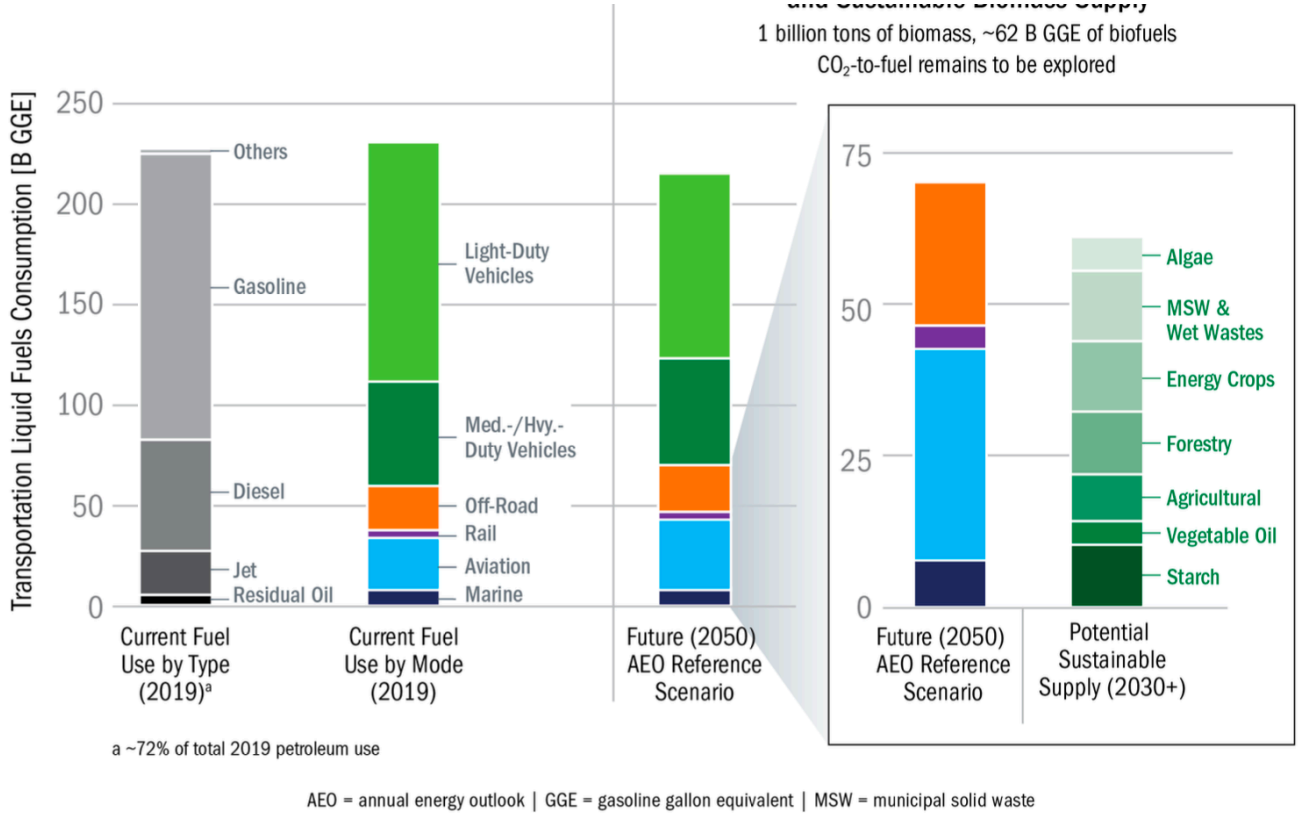


Additional US Biomass Production Capability to 2050

greenhouse gas (GHG) emissions.

- **Biofuels are part of a sustainable transportation fuel strategy to decarbonize all modes.**
- **U.S. biomass can meet the needs of "hard to electrify" modes, such as aviation, marine and rail.**

Focus areas for biofuels:
- **Ethanol for passenger cars**
- **"Drop-in" fuels that can use existing infrastructure such as renewable diesel/sustainable aviation fuels**

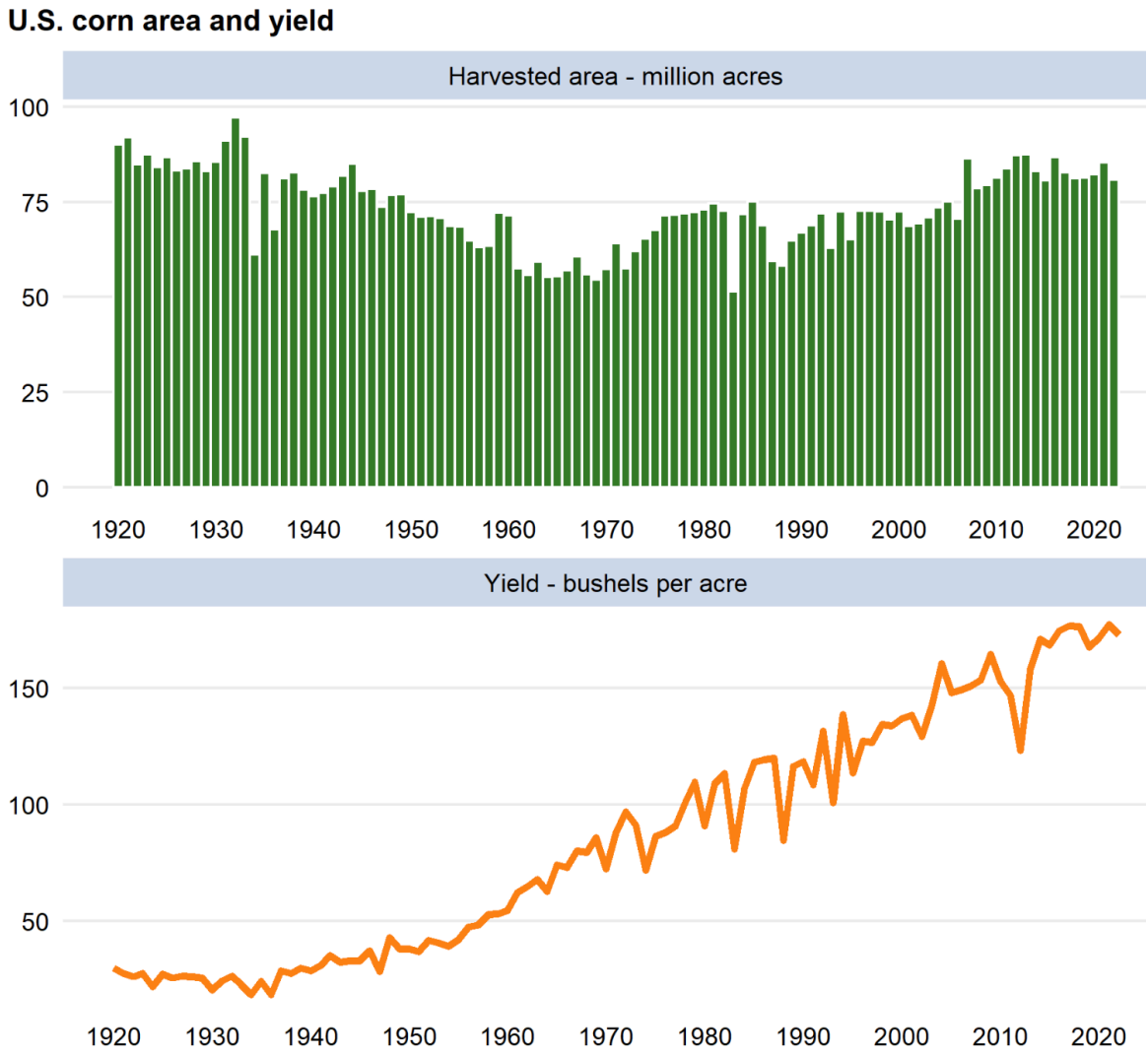


US DOE, Billion Ton Study

1 billion tons of which ~ 200 M tons is forest biomass.

VT: "Assuming 40% mass productivity, it is possible that a significant portion of the ~ 100 M ton US chemical industry could be sourced from biomass." (Fig shows ~ 0.7 B tons biomass. ~100M t chemicals = .25 B tons biomass additional)

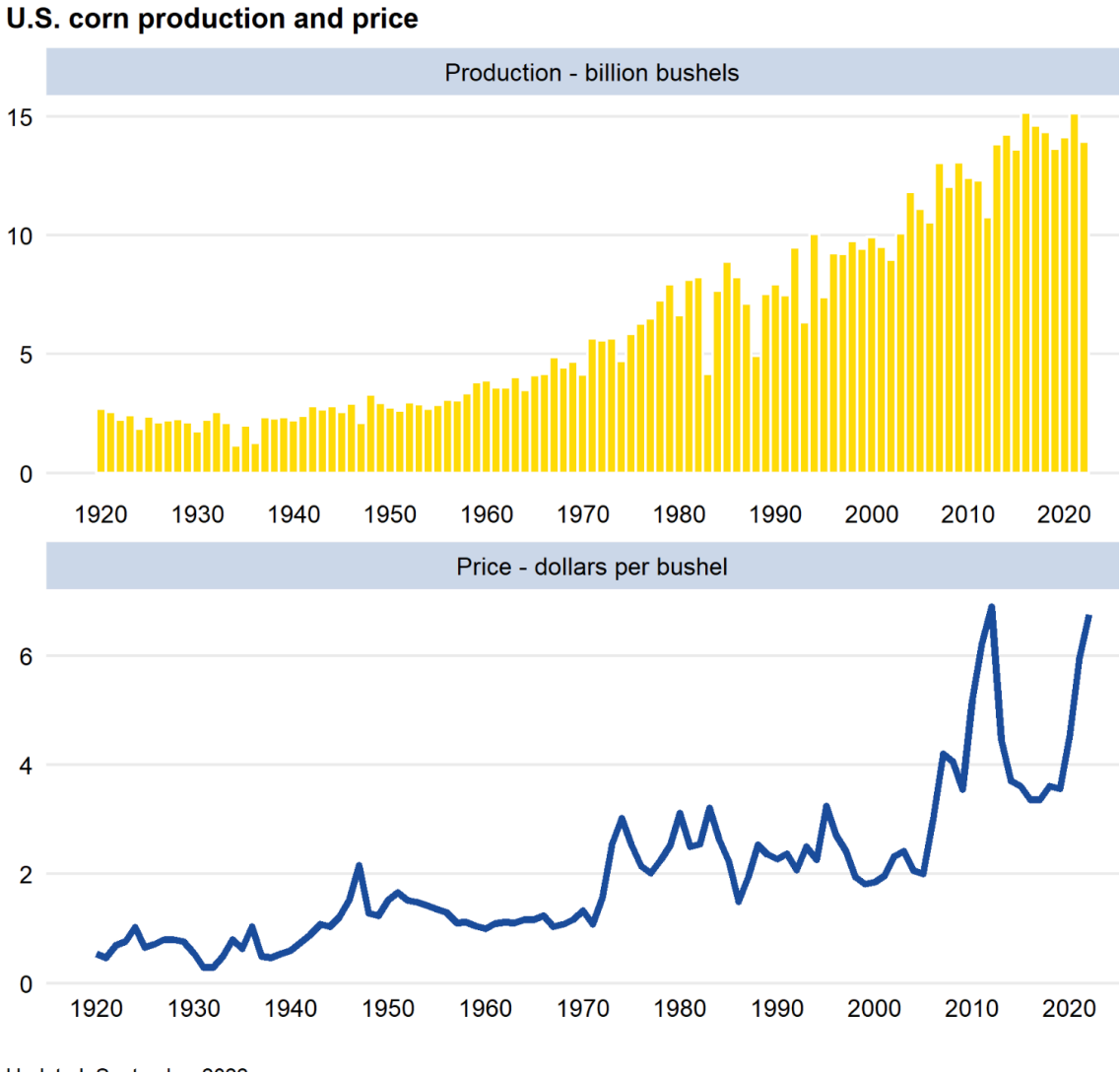
US Corn Area and Yield



https://www.ers.usda.gov/topics/crops/corn-and-other-feed-grains/feed-grains-sector-at-a-glance/#:~:text=Corn%20is%20grown%20in%20most,third%20of%20the%20U.S.%20crop.

US Corn Production and Price

- https://www.ers.usda.gov/topics/crops/corn-and-other-feed-grains/feed-grains-sector-at-a-glance/#:~:text=Corn%20is%20grown%20in%20most,third%20of%20the%20U.S.%20crop.

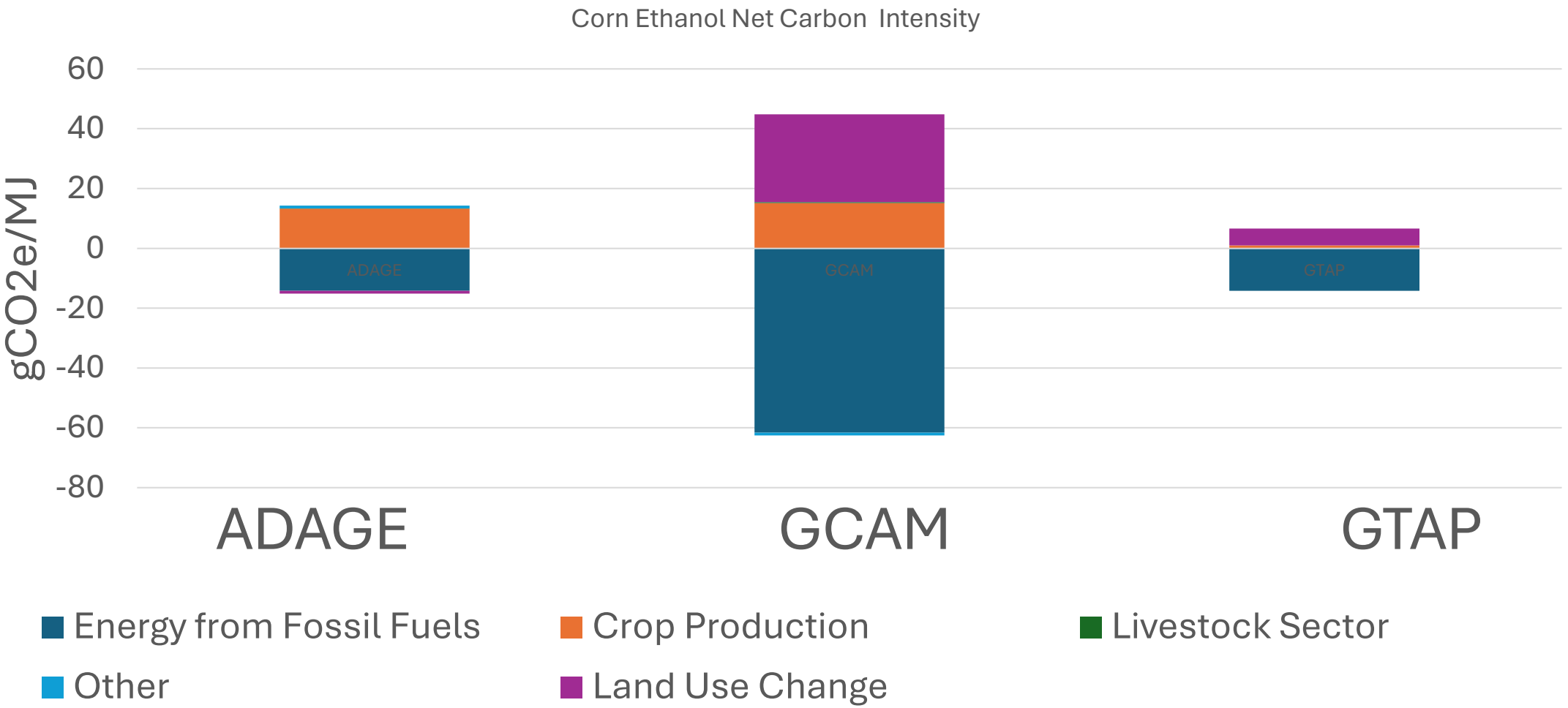


US Corn Ethanol Carbon Intensity

		Models with Energy Markets					
		ADAGE	GCAM	GTAP		GLOBIOM	GREET
Sector/stage-specific emissions	Energy from Fossil Fuels	-15	-65	-15	Biofuel Production	x	29
	Crop Production	14	16	1	Crop Production	9	x
					Feedstock Production	x	16
	Livestock Sector	0.1	0.3		Livestock Sector	-1	x
	Other	1	-1		Fuel Use	x	0.4
	Land Use Change	-1	31	6	Land Use Change	13	8
Totals	Agriculture, forestry, and land use	14	47	7	Agriculture, forestry, and land use	21	24
	Global GHG Impact	-1	-19	-8	Global GHG Impact	x	x
	Supply Chain GHG Emissions	x	x	x	Supply Chain GHG Emissions	x	53

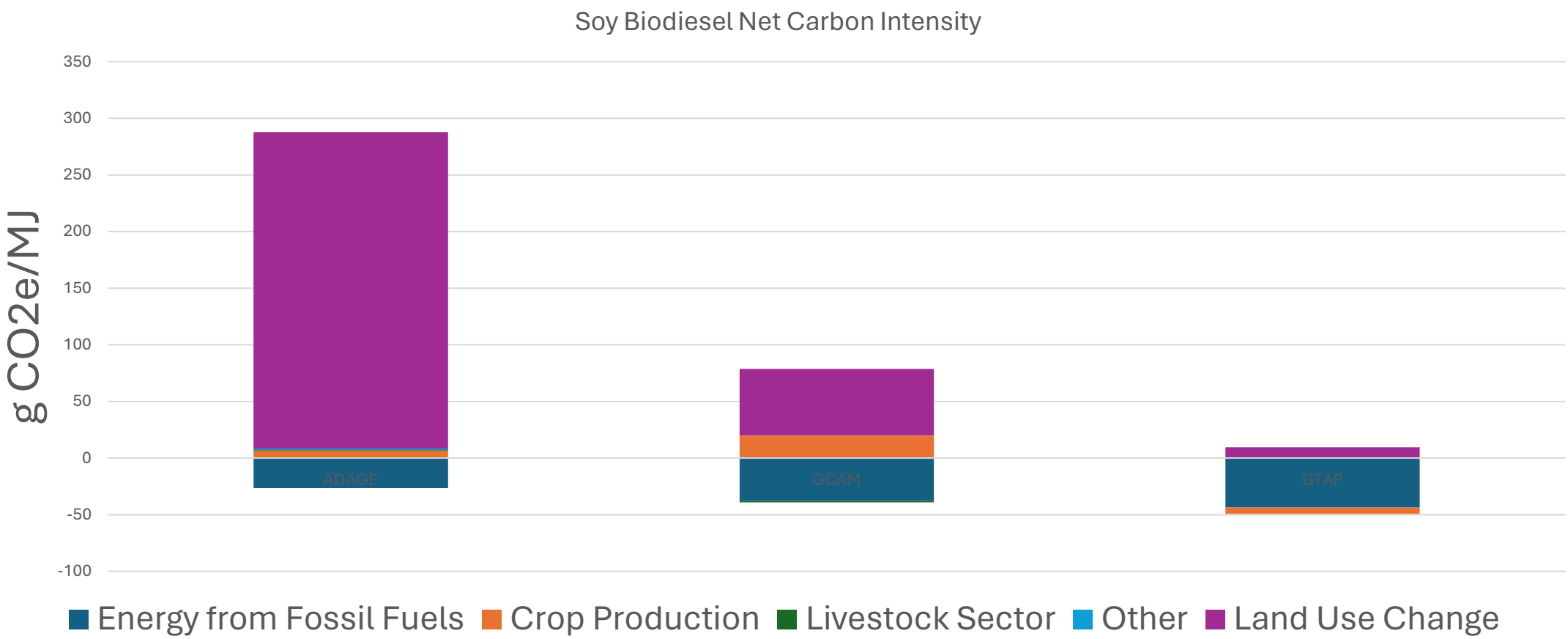
EPA Model Comparison Study

US Corn Ethanol Net Carbon Intensity



Market models, include reduction in fossil fuel use. Expect value to be negative. Gasoline is about 90.

US Soy Biodiesel Net Carbon Intensity



Market models, include reduction in fossil fuel use. Expect value to be negative. Diesel is about 90.

What Else Could Happen for Aviation

- Fly Less
- PtL: Power to liquids: Capture CO2 from the air, make H2 from electrolysis, and create synthetic aviation fuel and diesel.
- Hydrogen as an aviation fuel
- Electric Heavy Duty Freight Trucks
- Hydrogen Fule Cell Heavy Duty Freight Trucks

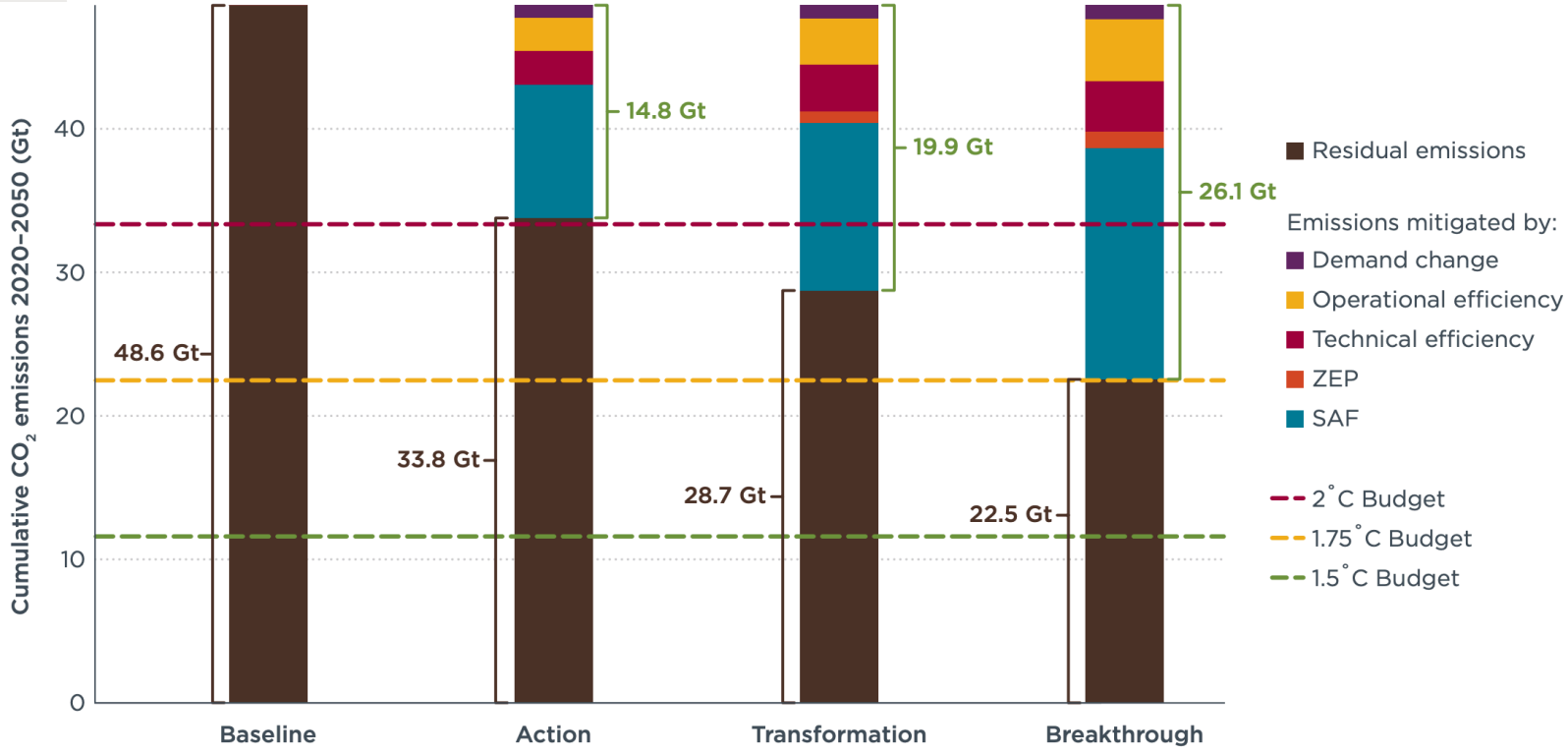


Figure 2. Cumulative global aviation CO_2 emissions by scenario and measure, 2020-2050[13]

What Else Could Happen for Aviation

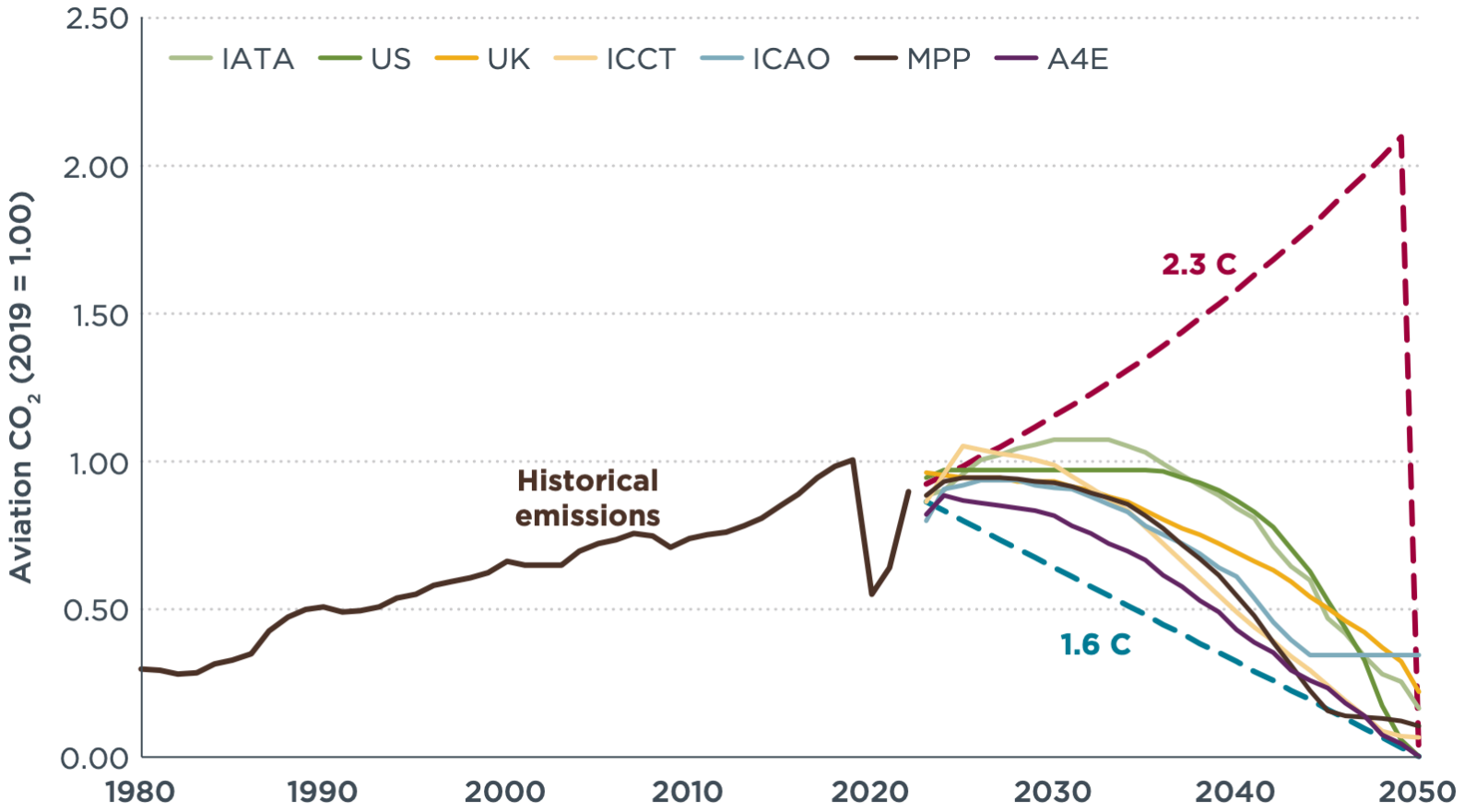


Figure 1. Historical and projected CO_2 emissions from aviation, 1980 to 2050, normalized to 2019[11]

ICAO Aspirational Goal Zero Emissions by 2050.