



Why Flying is Green (and How to Make it Greener)

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Pratt & Whitney
A United Technologies Company

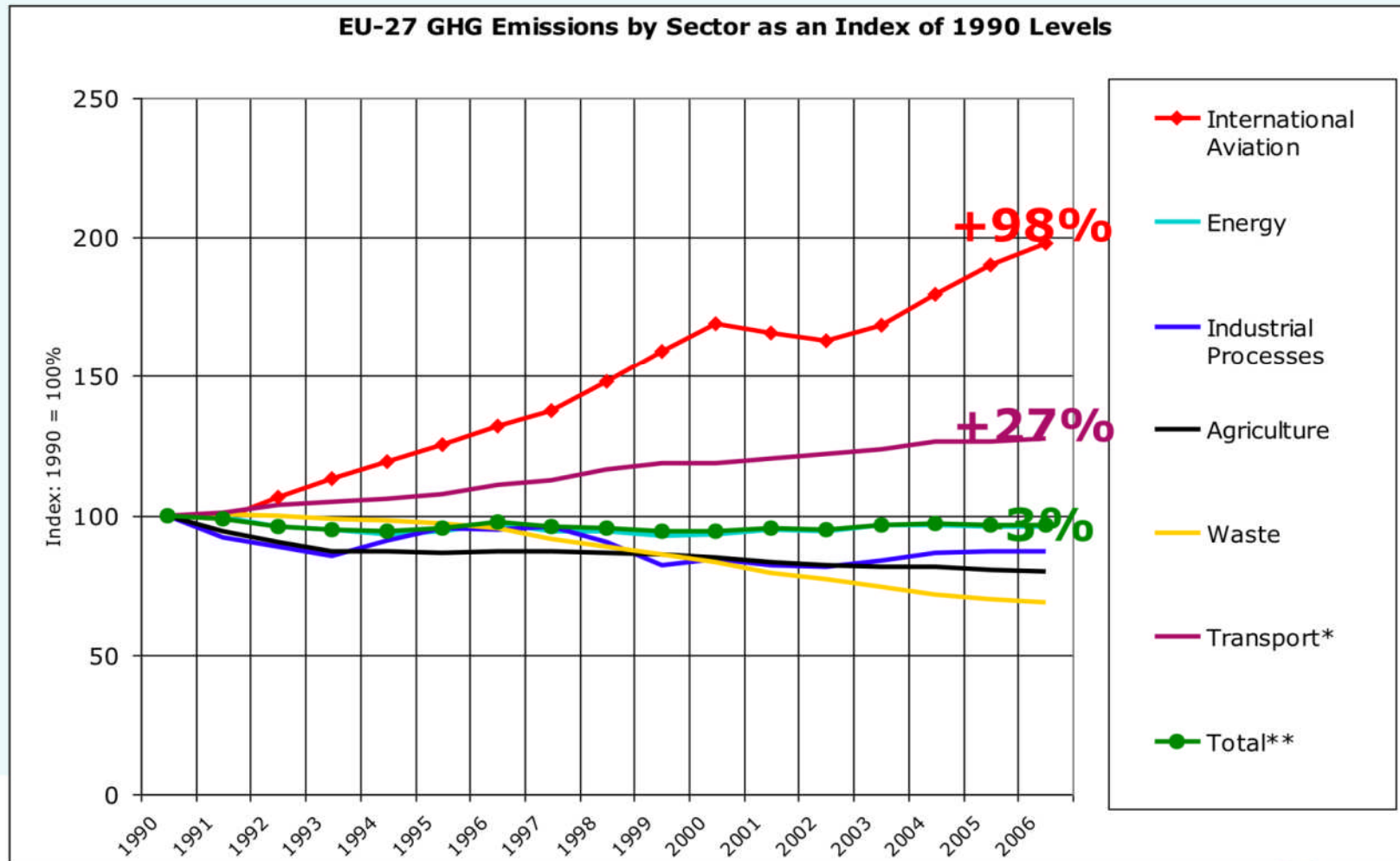
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Outline of this Talk

- Why flying is green
 - Reality rather than rhetoric

- How we will make flying greener still
 - Our investment in technology

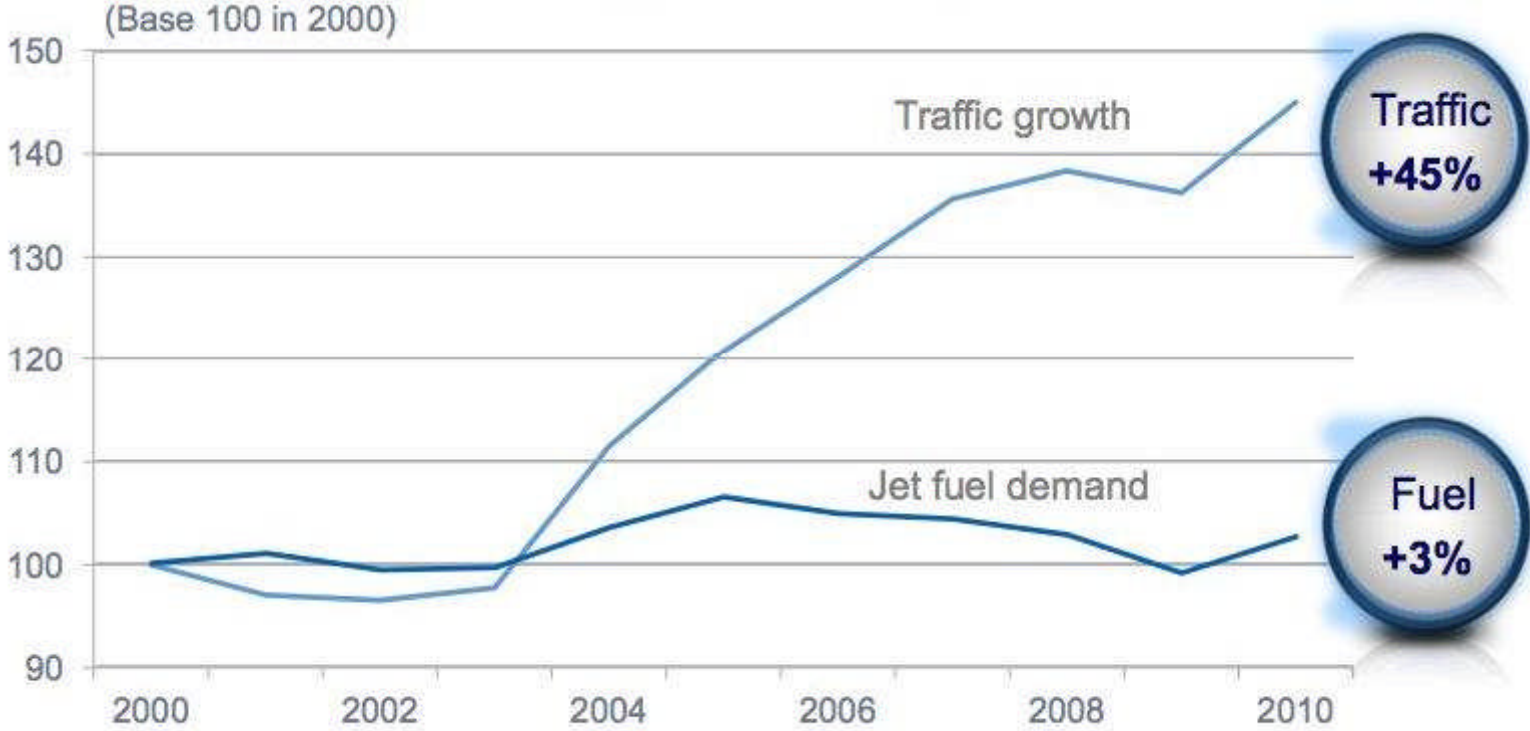
EU Climate Commissioner, "We must address the vertiginous growth in carbon emissions from aviation"
In Europe, aviation emissions have almost doubled whilst total emissions have declined



Source: EU energy and transport in figures - Statistical pocketbook 2009, DG TREN



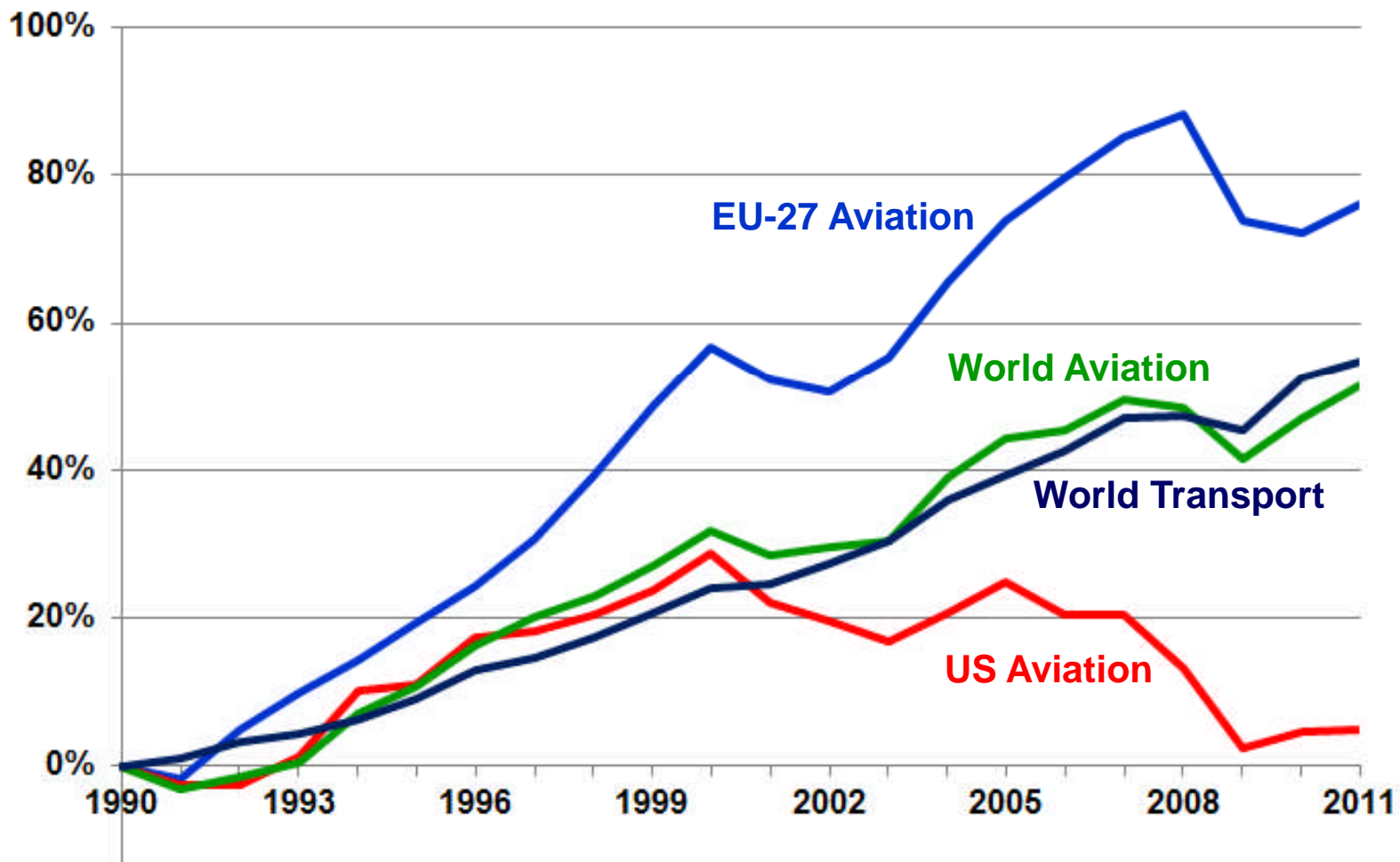
US Air Travel and Jet Fuel Use this Century



Source: ATA

Growth in CO₂ Emissions

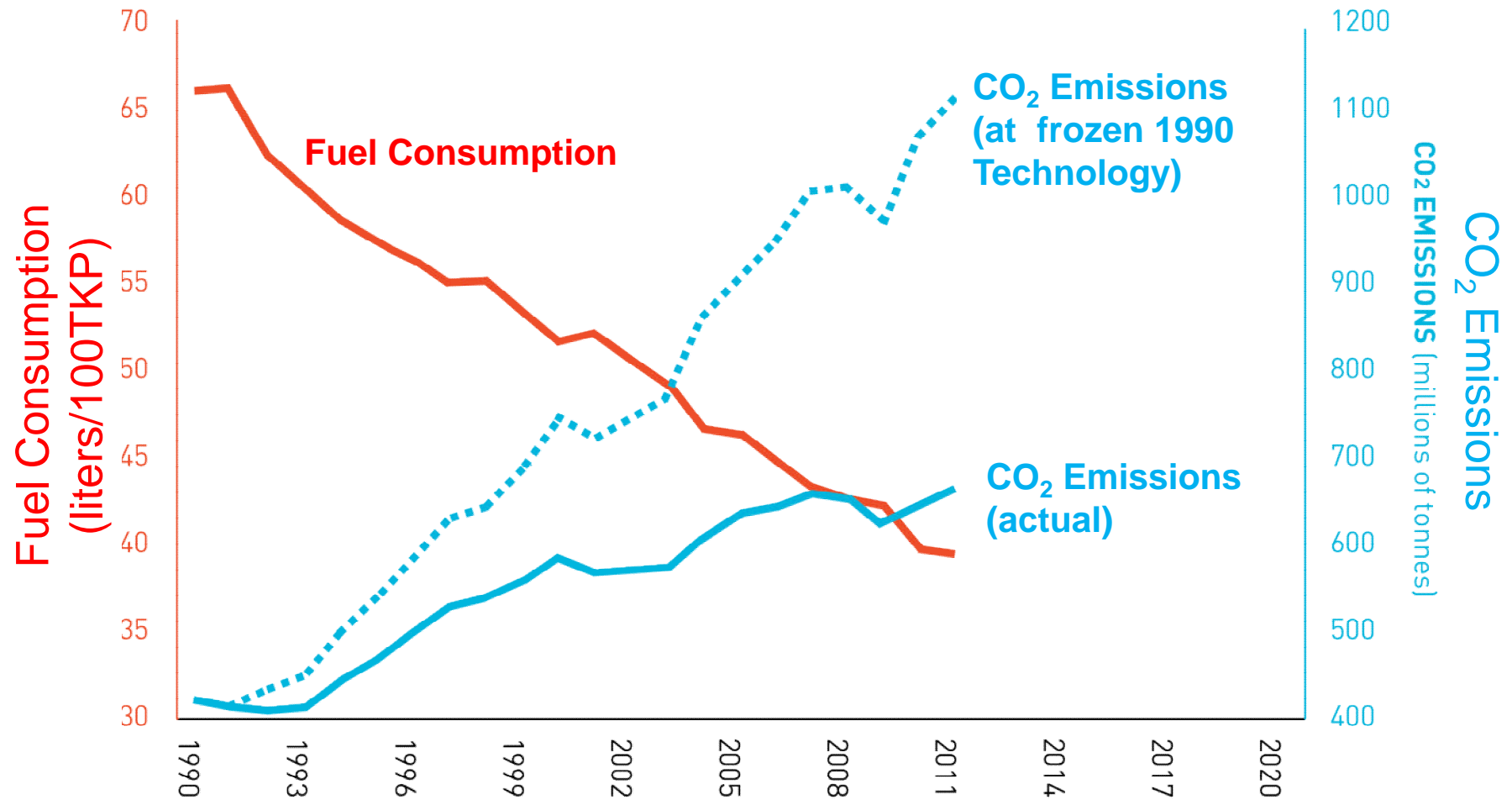
1990 Baseline



Source: International Energy Agency (domestic + bunkers)

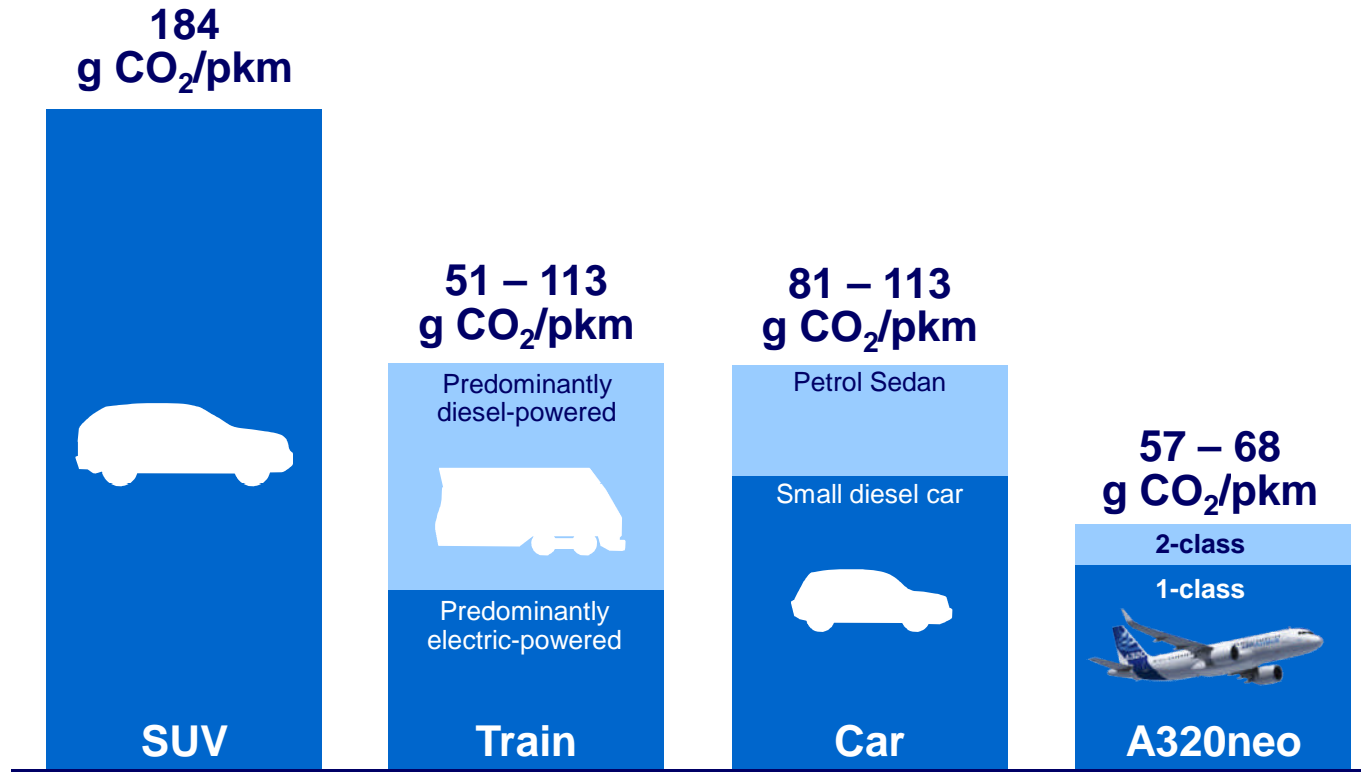
Climate Change Concerns

Commercial Fleet Performance Progress Since 1990



Source: ATAG

Aircraft as Low Carbon Transportation

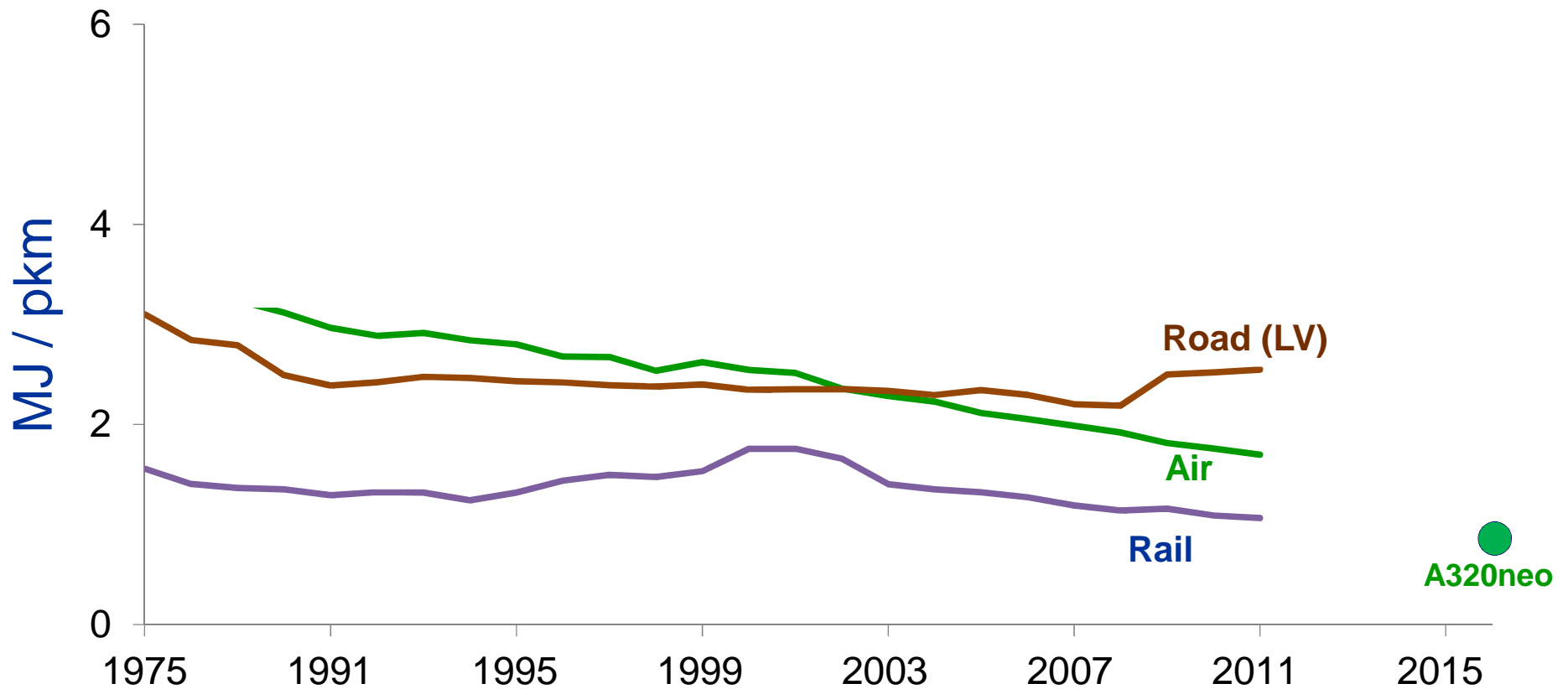


- Equivalent grams CO₂ / passenger kilometers, assuming average modal load factors (1.6 passengers for SUV and cars, 38.7% for diesel train, 47.6% for electric trains, 80% for A320neo / PW1133G-JM engines).
- Electric trains are assumed to have typical CO₂/kWh electrical generation factors, reflecting a mix of fossil fuels, nuclear, and hydroelectric sources.

P&W, after The Boeing Company

US Transportation Energy Intensity

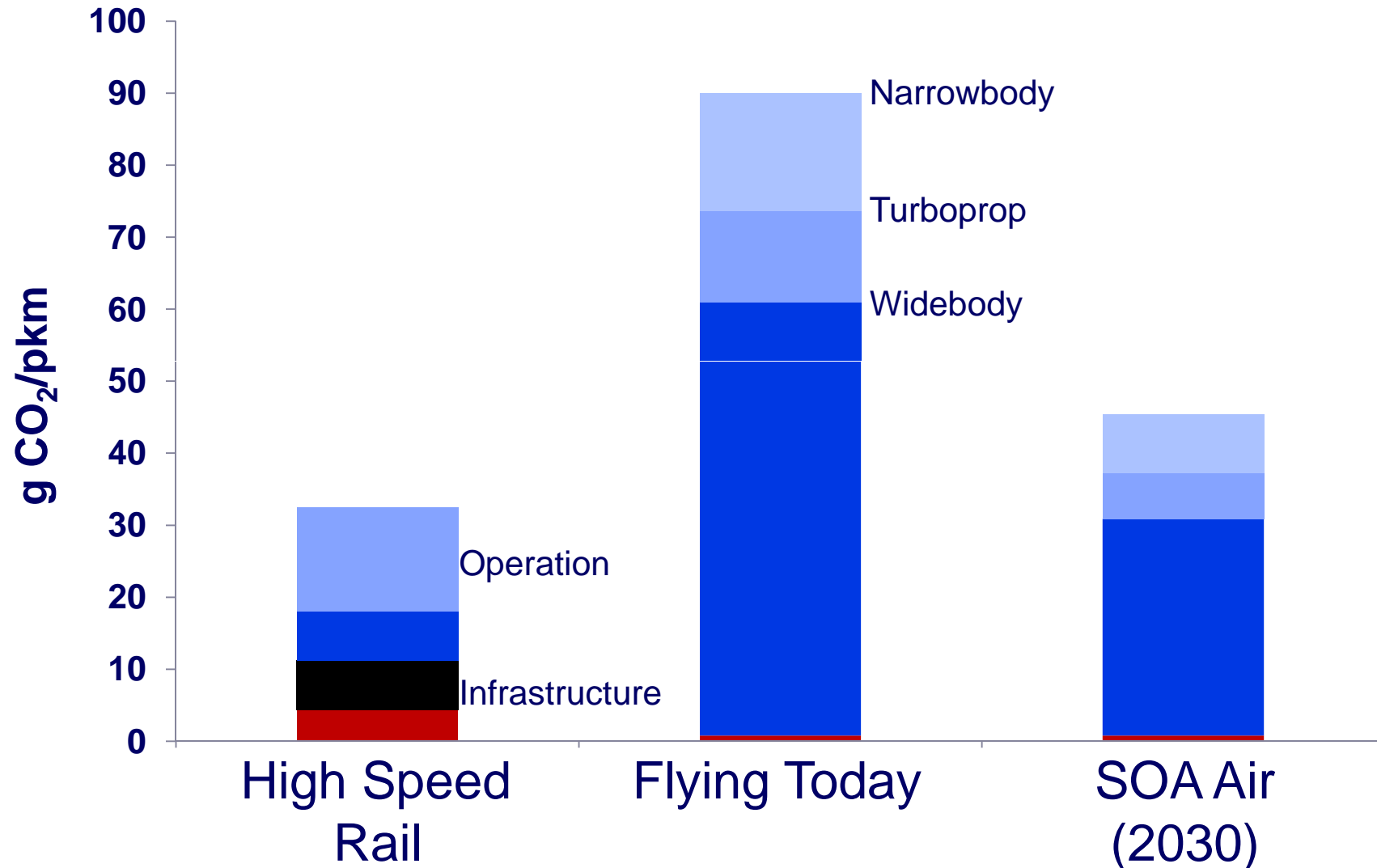
Sector Consumption per Passenger/Km (pkm)



Source: Bureau of Transportation Statistics, US DOT

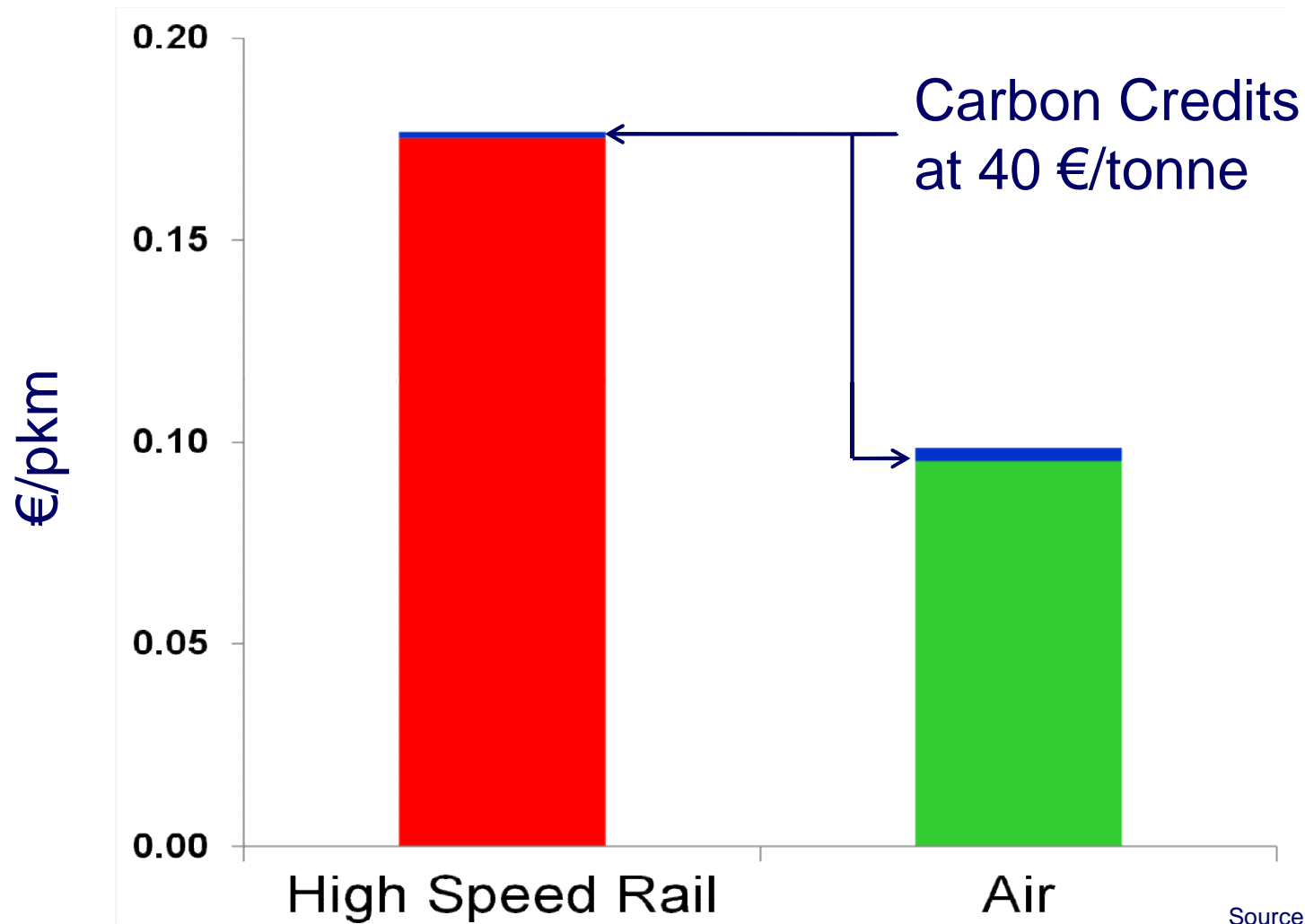
CO₂ per Passenger per Kilometer (gCO₂/pkm)

Trains and Planes



Cost of Carbon Neutral Travel

Trains and Planes



Source: The Annals of Regional Science (1997) 31:189–215

A Greener Future

Pratt & Whitney – Dependable Engines



Wasp Engine
1926



Turbofan Engine
2014

A New Era of Regional and Narrowbody Aircraft

The GTF™ Engine's 15+% fuel-burn reduction inspired six new narrow body platforms and 6,000 aircraft orders



MRJ



A320neo



MC-21



CSeries

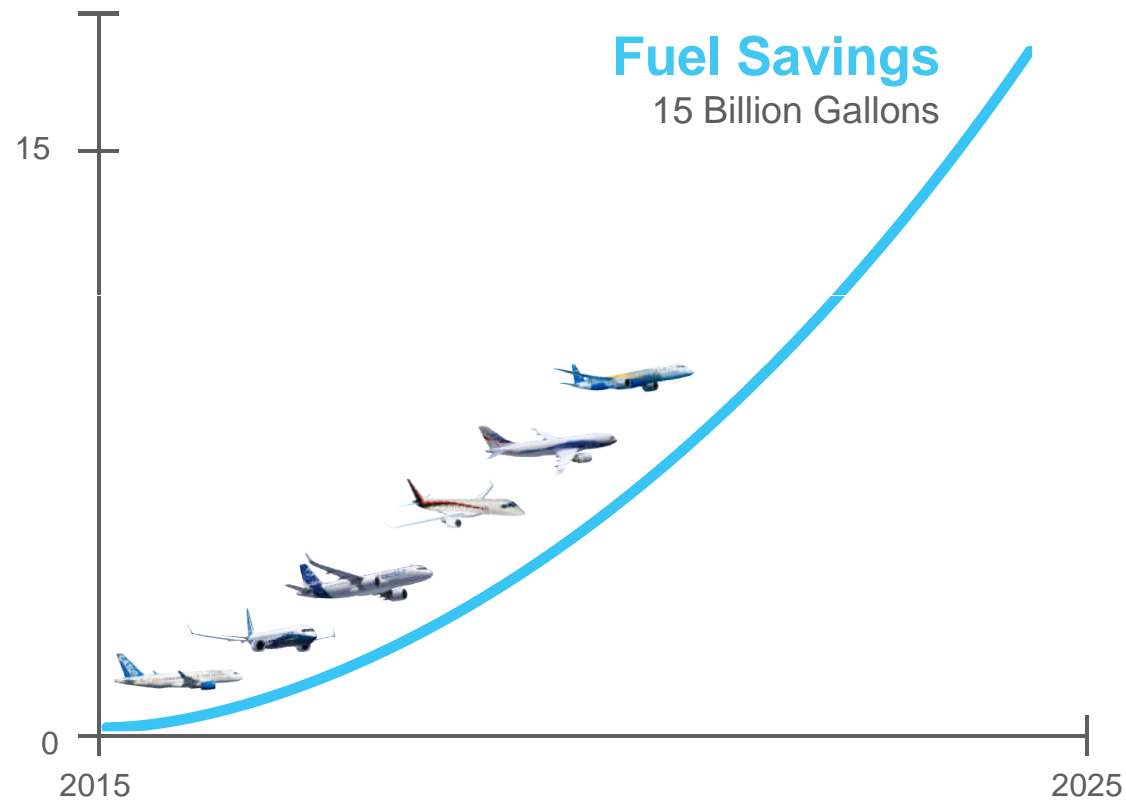


737 MAX

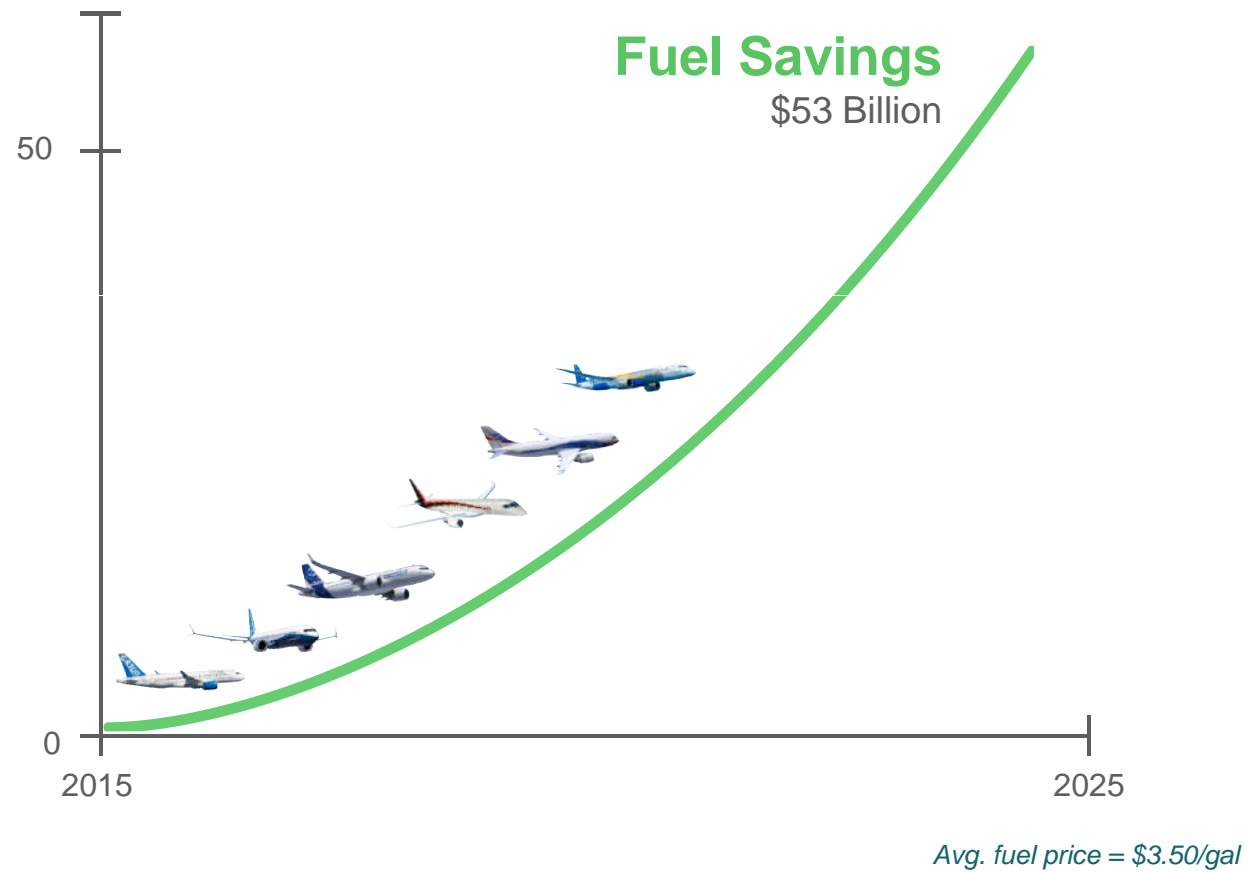


E-Jets E2

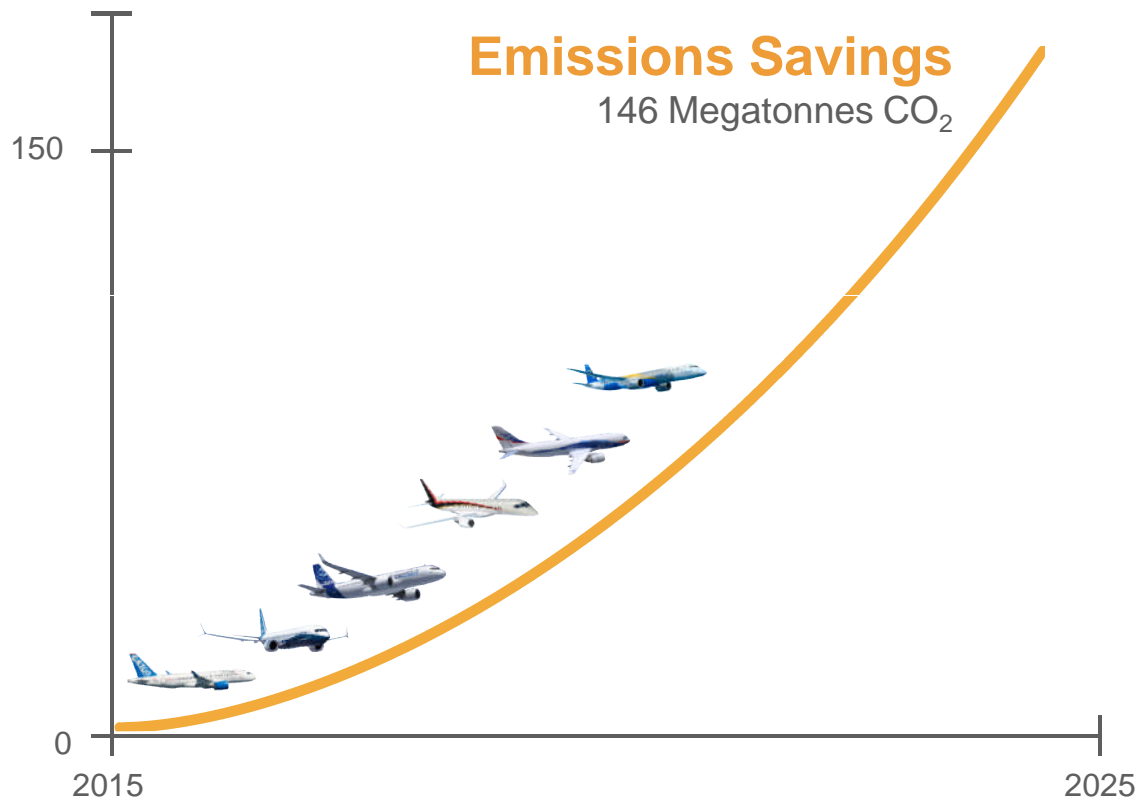
Savings Over the Next Decade



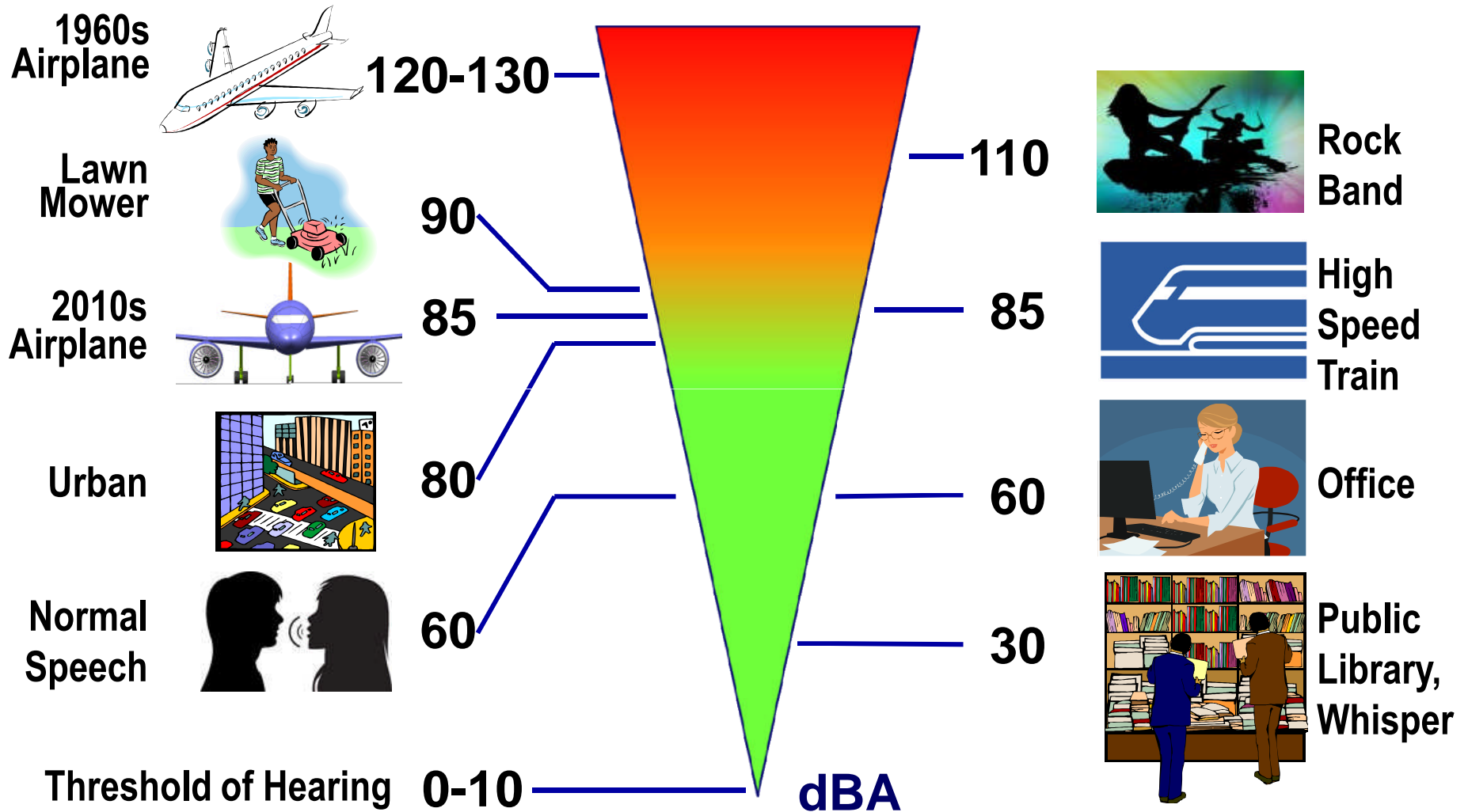
Savings Over the Next Decade



Savings Over the Next Decade

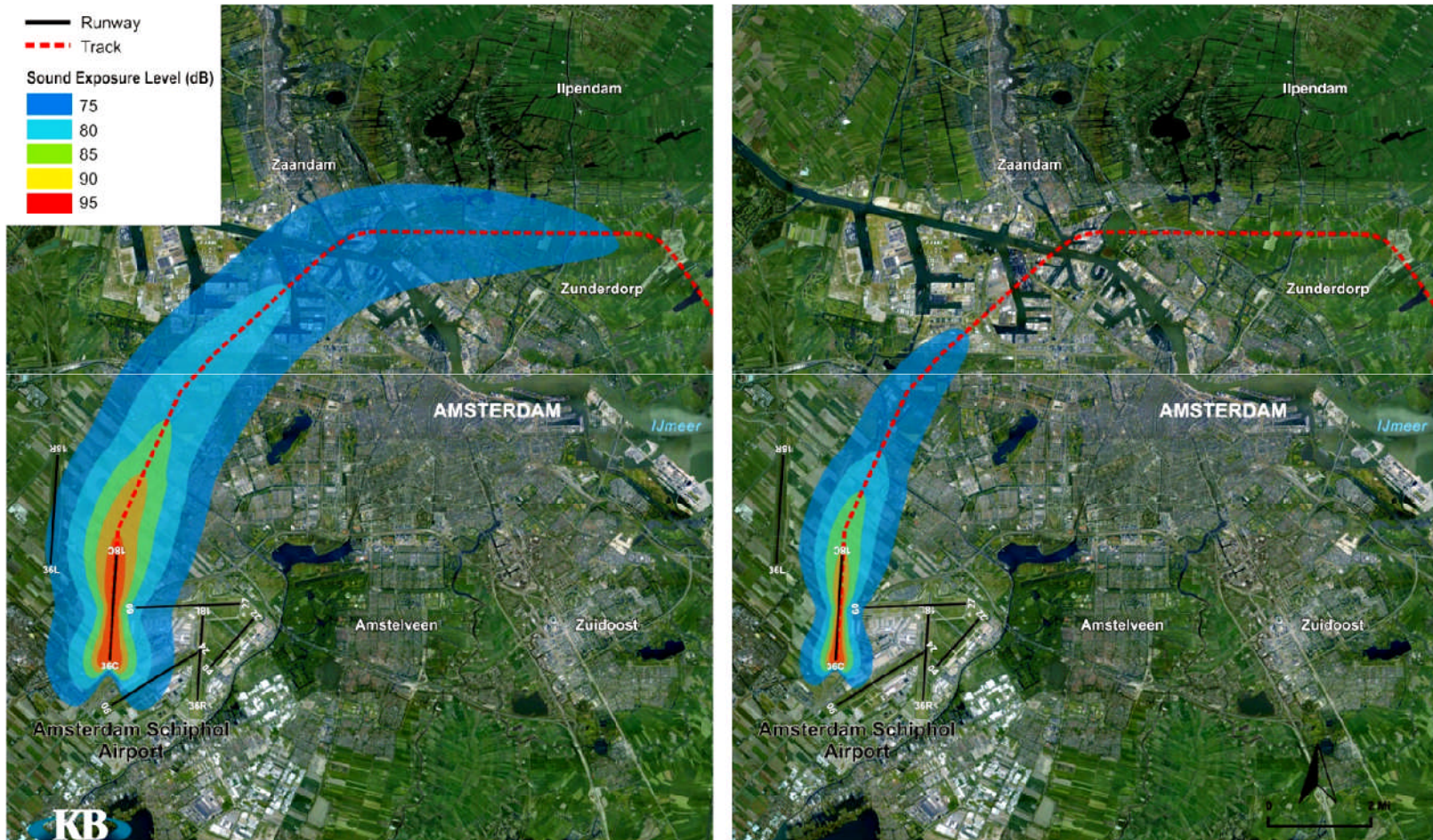


Noise in Perspective



Extraordinary Community Noise Reduction

70-75% Reduction in Noise Impacted Area

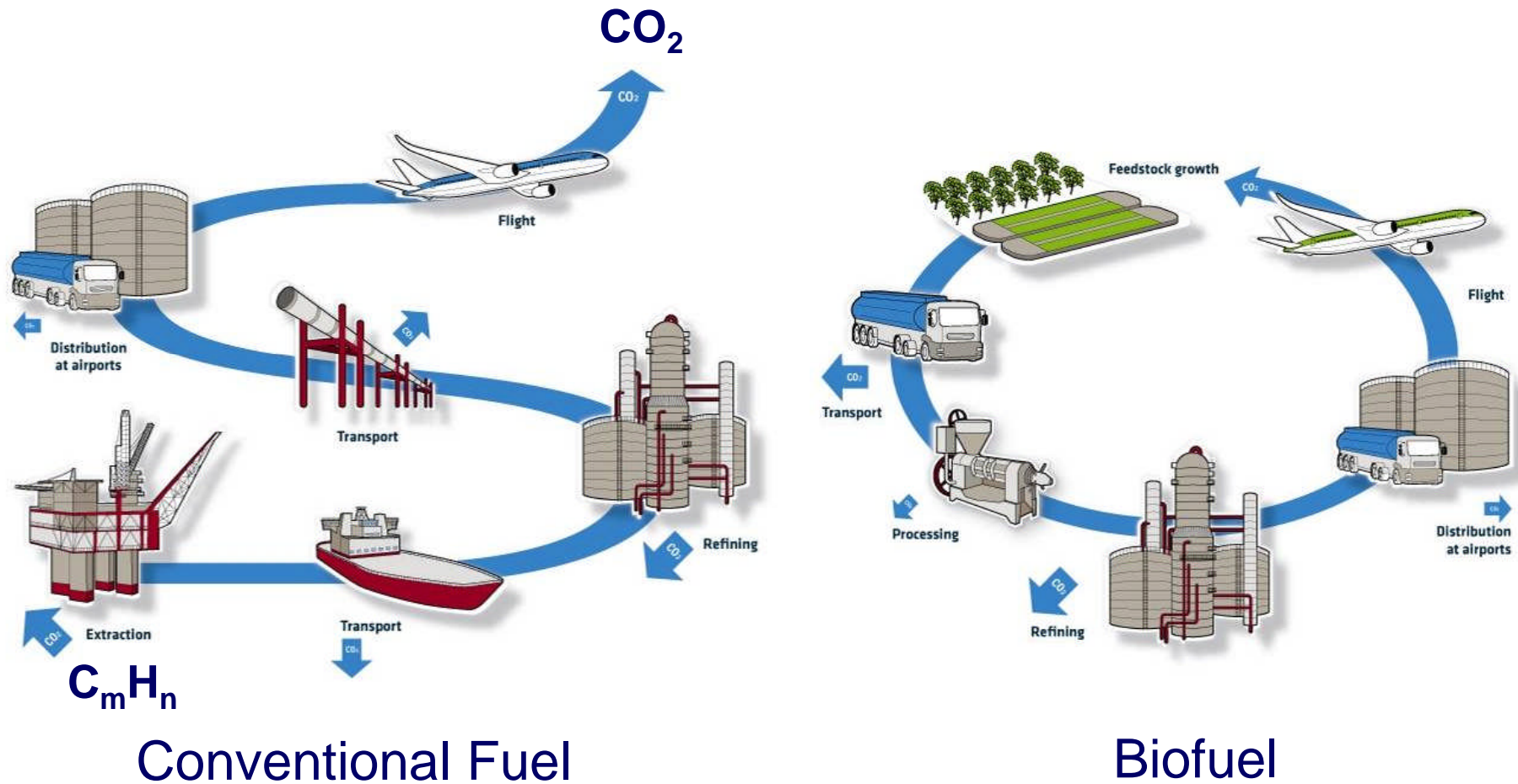


Today's Narrowbody Aircraft

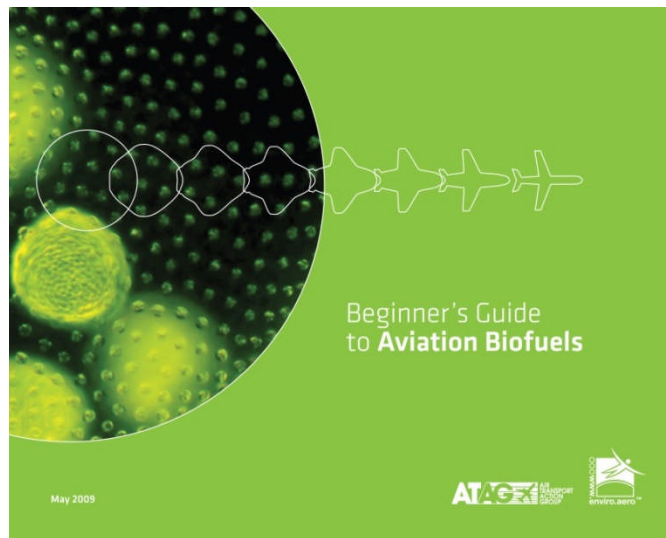
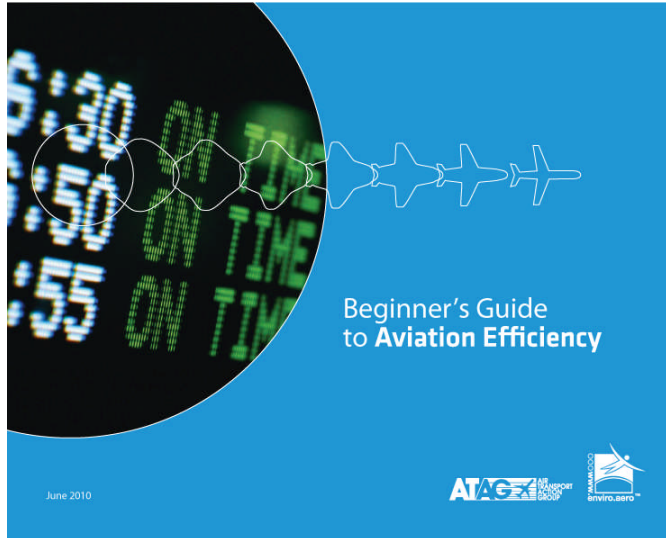
PW1000G Powered Airplane

Innovation in Energy – Solar Powered Airplanes

Sustainable Drop-in Biofuels for Reduced CO₂



ATAG – Generating the Message



ATAG – Air Transportation Action Group

