Higher, Faster, Farther & Greener?

Low Carbon Aviation Technology Challenges & Opportunities

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July 8, 2019

Historical Perspective

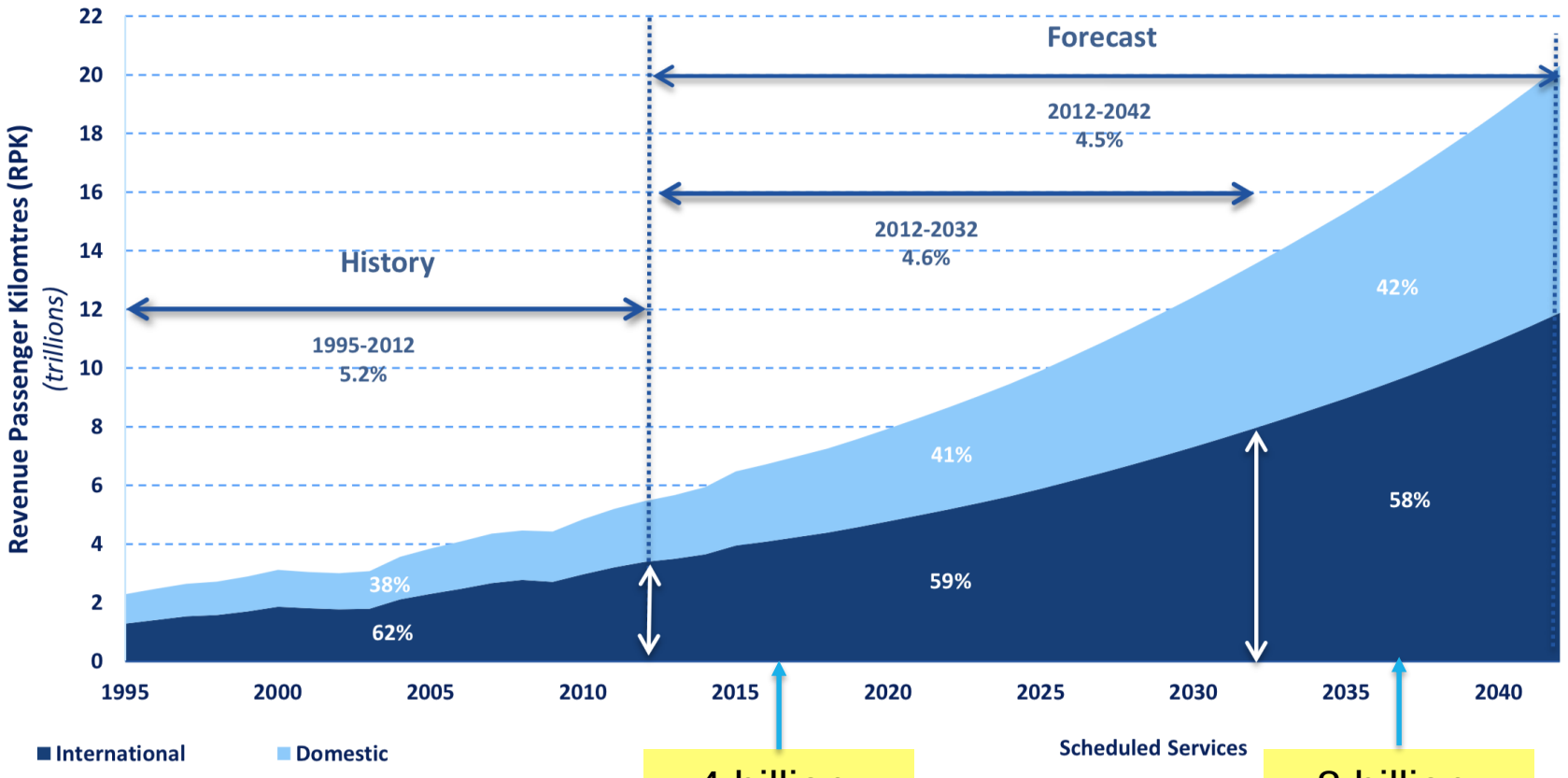
New York to Paris (Le Havre) Example

Passengers	2100	350
Duration	6 days	6 hours
Fuel Consumption	Coal, 5400 tonnes	Kerosene, 24 tonnes
Emissions Rate (g CO_2/pkm)	>1000	>100

Aviation Passenger Traffic

ICAO ECONOMIC DEVELOPMENT

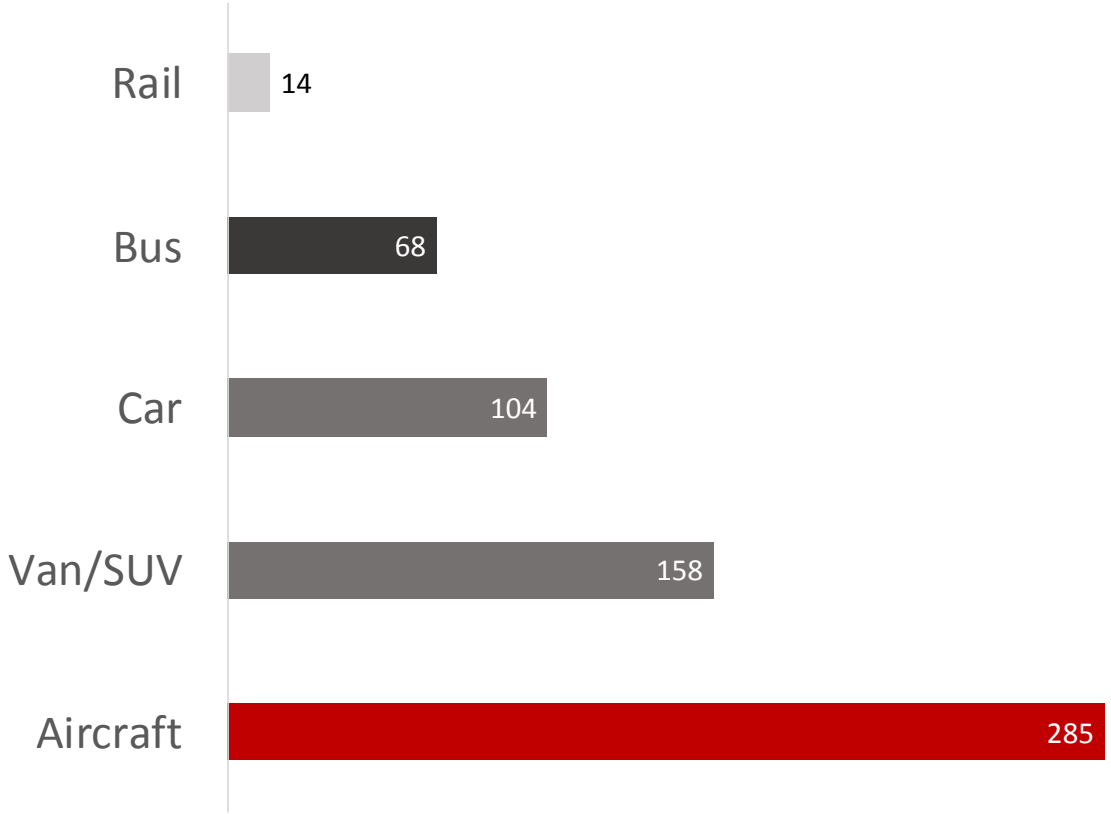
Global Passenger Traffic Forecasts



arpa·e CHANGING WHAT'S POSSIBLE

Distance-Specific Emissions

CO_2 Emissions (g / km / passenger)



Reference: https://www.eea.europa.eu/media/infographics/co2-emissions-from-passenger-transport/view, https://www.nasa.gov/feature/aviation-renaissance-nasa-advances-concepts-for-next-gen-aircraft

Market Challenge – Speed

SUSTAINABLE BUSINESS JUNE 17, 2019 / 3:16 PM / A DAY AGO

FAA moves to support growth of civil supersonic air industry

3 MIN READ

WASHINGTON (Reuters) - The U.S. Federal Aviation Administration (FAA) said on Monday it is moving to rewrite testing rules to allow for the eventual return of civil supersonic air travel.

FILE PHOTO: The last British Airways passenger Concorde flight lands at London's Heathrow airport from New York, October 24, 2003. Stephen Hird/Reuters/File Photo

At an event in Paris on Monday, Acting FAA Administrator Dan Elwell said the agency is working to "enable the return of civil supersonic travel, while ensuring the environmental impacts are understood and properly addressed."

Higher Speed

- More Interconnected World
- Higher Energy Consumption

[Reuters – June 17, 2019]

CO_2 Emissions Drivers

$$\widehat{M}_{CO_2} = \frac{W_{Total} / N_{Passengers}}{L/D} \frac{\acute{M}^{Fuel}_{CO_2}}{\eta_{propulsion}}$$

$[kg_{CO2}/pkm]$

Fuel Carbon Intensity $[kg_{CO2}/kWh]$

Aircraft Performance
- Total weight / passenger [N/p]
- Lift to drag ratio

Propulsion System Efficiency

***Also need high energy density [kWh/kg] and low cost [$/kWh] fuel for attractive aircraft performance*

Technology Needs

https://www.nasa.gov/feature/aviation-renaissance-nasa-advances-concepts-for-next-gen-aircraft

1. Energy storage
   a) Low carbon intensity
   b) High specific energy (w/storage)
   c) Low cost

2. Efficient, light weight & low cost
   a) Aircraft
   b) Propulsion Systems

Next Steps

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- Watch for upcoming workshops & programs

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