Reducing Air Travel's Carbon Footprint

Modeling flight efficiency reveals new opportunities for travelers

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Complete paper (Air Travel Carbon and Energy Efficiency) available from http://brighterplanet.com/research

Introduction

Air travel accounts for 3% to 5% of total anthropogenic climate impact, and it's a rapidly-growing emissions source. Travel volume is expected to increase by more than 4% per year through 2025 (ICAO 2010), outpacing aircraft fuel efficiency increases of just 1% to 1.5% per year (IATA 2009, Owen et al. 2010).

Reducing the growth in demand is a key objective for tackling air travel's climate impact. To date the main tactic used has been consumer education – making people aware of the impact of air travel and promoting alternatives like teleconferencing, other modes of transport, or vacationing closer to home. This is good advice, but even travelers who heed it often continue to fly.

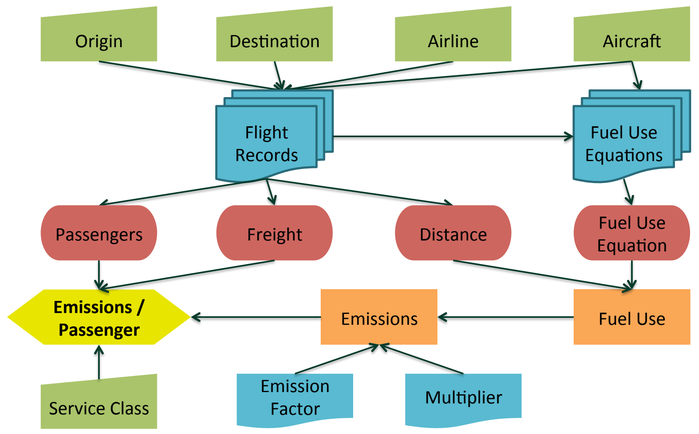
Our goal was to help companies and individual travelers reduce the impact of their remaining 'unavoidable' air travel. To do this we created a model that allows emissions comparisons between alternate flights serving the same route.

International Air Transport Association (IATA). A global approach to reducing aviation emissions. IATA: Switzerland, **2009**.

International Civil Aviation Organization (ICAO). ICAO Environmental Report 2010. ICAO: Montreal, Canada, **2010**.

Owen, B., D.S. Lee, and L. Lim. Flying into the future: aviation emissions scenarios to 2050. *Environ. Sci. Technol.*, **2010**, 44, 2255-2260

Model Outline



Model Description

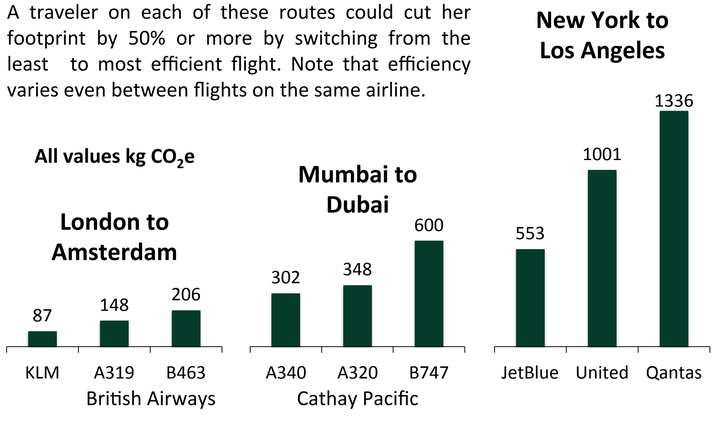
Our model assumes most users will only be able to provide the origin, destination, and possibly airline and aircraft for a flight. We match these inputs to historical flight records in a database covering almost 37 million flights worldwide in 2009, 2010, and 2011, taken from the U.S. BTS T-100 and ICAO Traffic by Flight Stage datasets. We then average across the matching records to estimate the number of passengers, quantity of freight, distance, and aircraft model-specific third-order polynomial fuel use equation for the modeled flight.

We calculate fuel use from distance and the fuel use equation and multiply by an emission factor and a multiplier to account for the climate impact of high-altitude emissions to give total greenhouse gas emissions. We distribute emissions between passengers and freight based on weight, then divide emissions among passengers by service class based on the average size of each service class' seats.

Further details and the model source code are available at http://impact.brighterplanet.com/models/flight

Typical Variation in Flight Efficiency

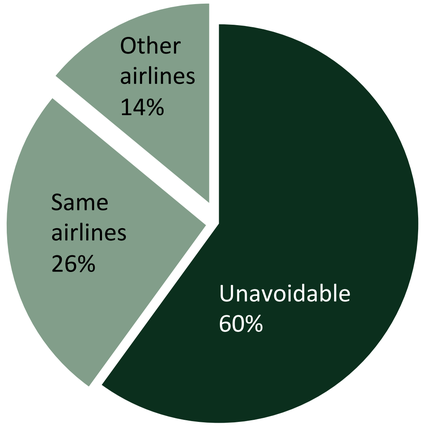
These examples illustrate typical opportunities for emissions savings from considering flight efficiency. A traveler on each of these routes could cut her footprint by 50% or more by switching from the least to most efficient flight. Note that efficiency varies even between flights on the same airline.



Case Study: A Fortune 500 Company

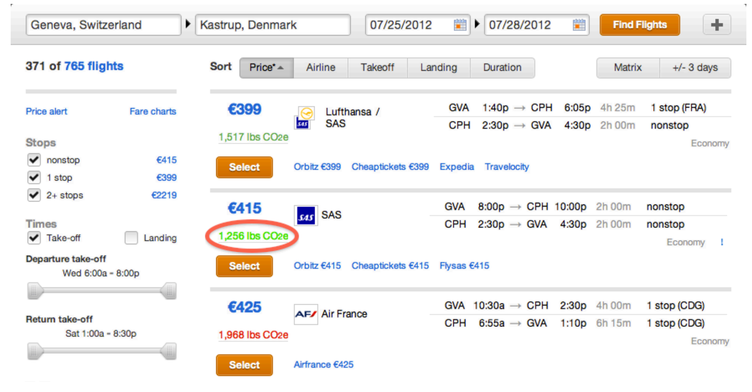
We used the model to analyse emissions reduction possibilities on the 100 most-flown routes of a Fortune 500 company, representing 187,000 flights each year. The company could reduce emissions up to 40% by always choosing the most efficient flights offered – the equivalent of cutting 74,000 flights. They could reduce emissions by a quarter while still flying on the same airline for each route, obviating the need to renegotiate any airline contracts.

Potential Emissions Reductions

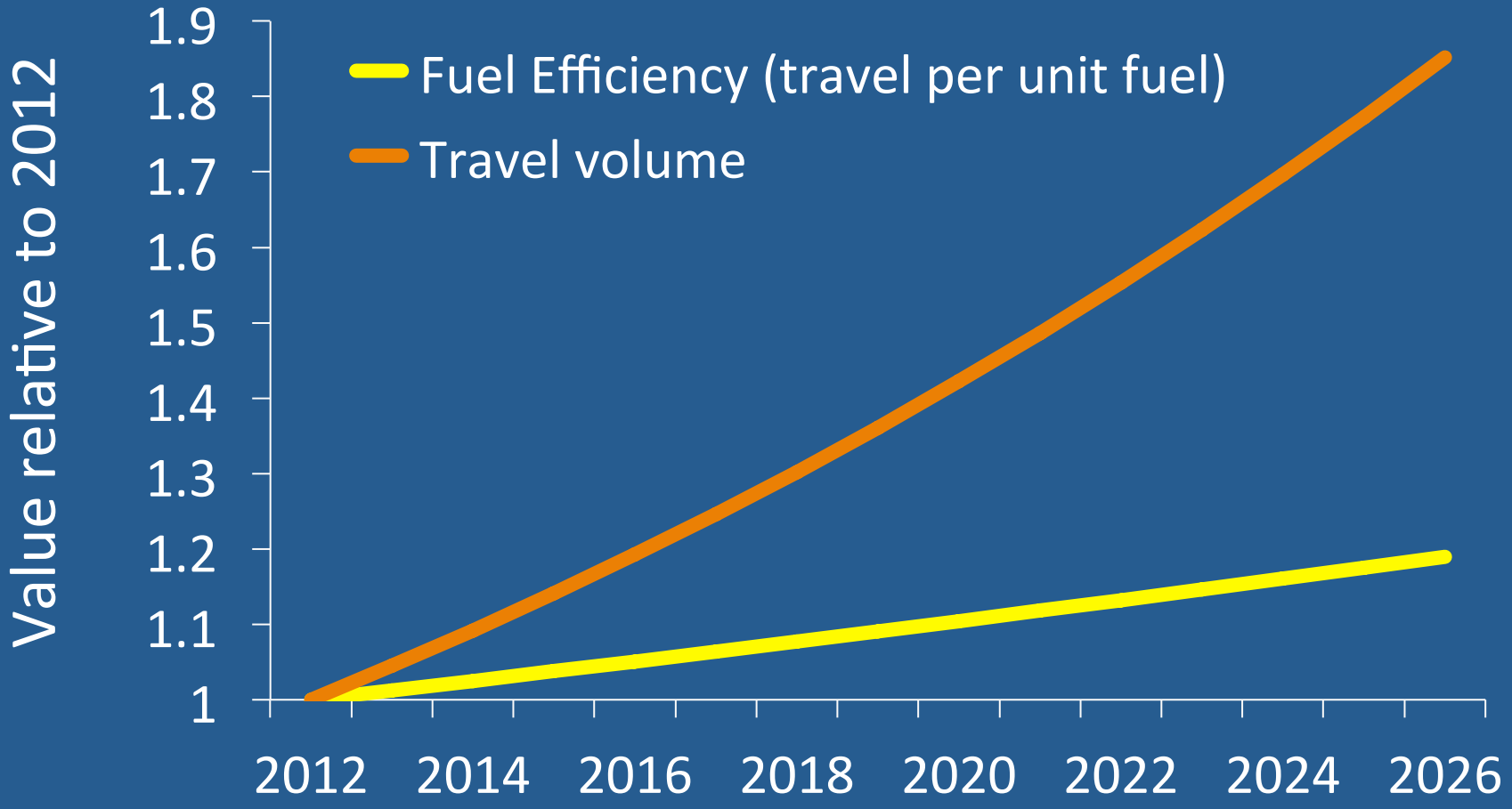


Example Application: Careplane

Careplane (http://careplane.org) is a browser plugin that uses the flight model to add emissions to online flight search tools, allowing a traveler to consider climate impact when choosing an itinerary. Shown here is an example on kayak.com.



Air travel: a growing problem



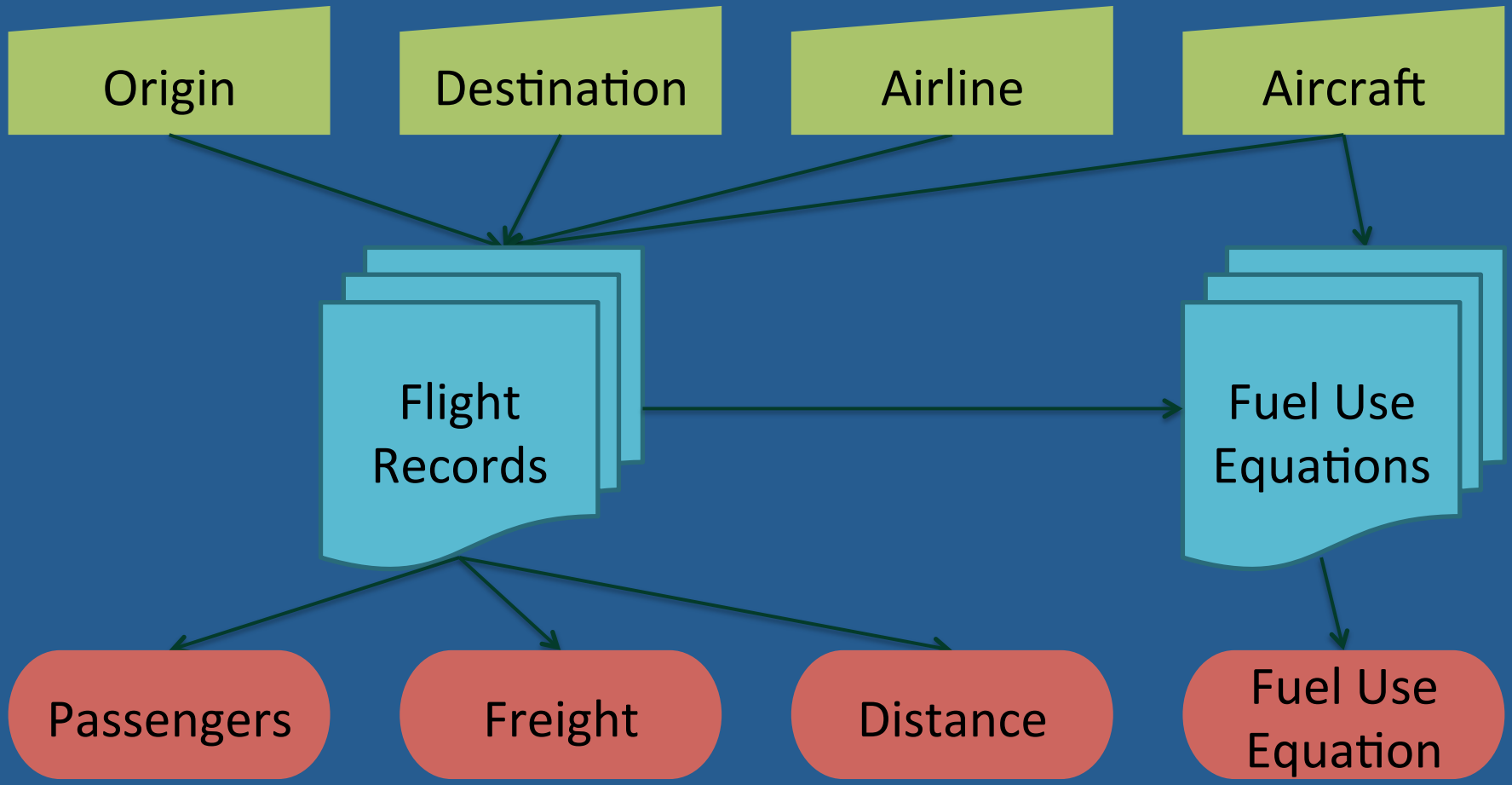
How can we reduce emissions?

Ask people not to fly!

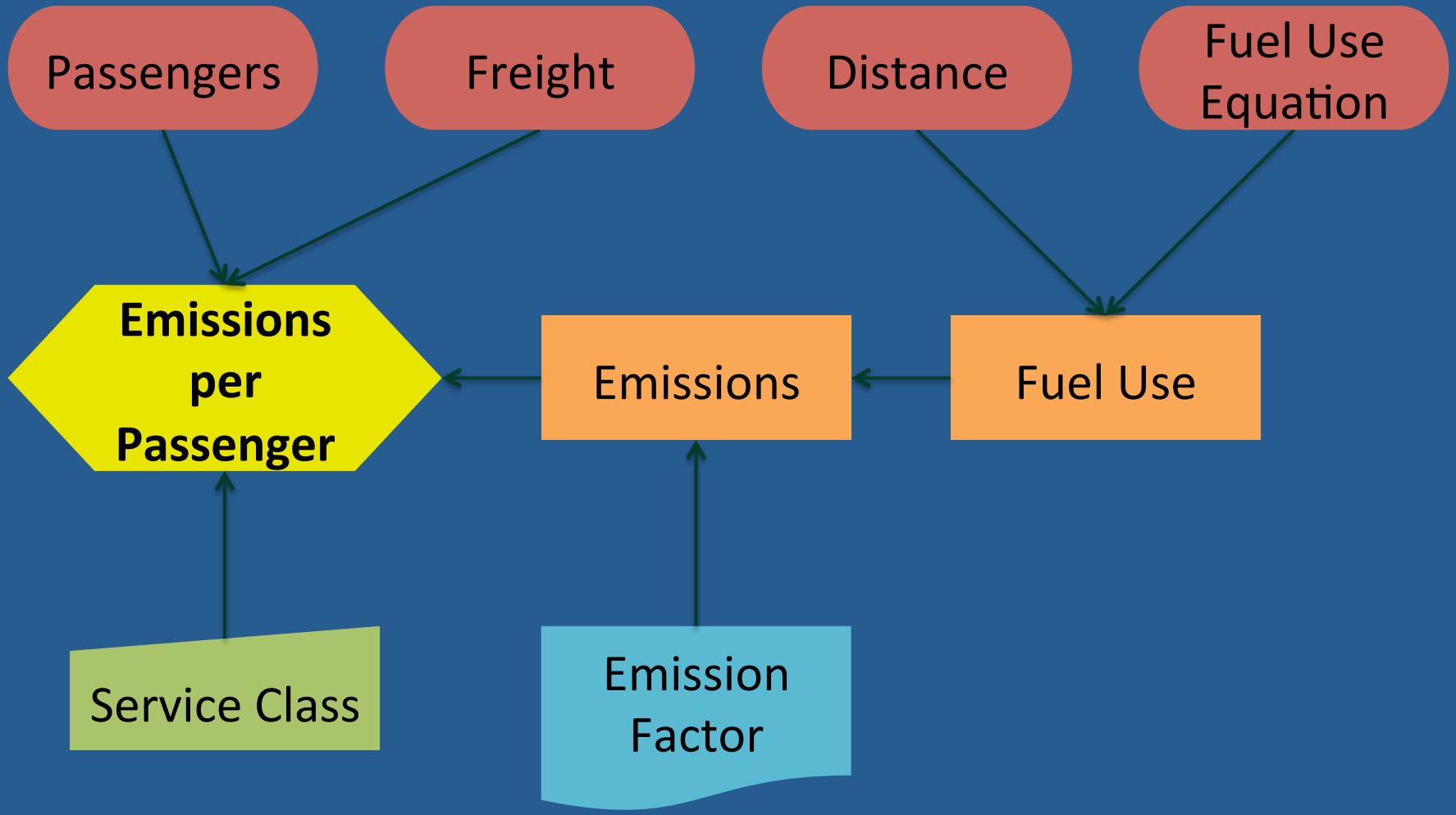
But many will anyway.

Could travelers choose cleaner flights?

Our model: inputs & averaging

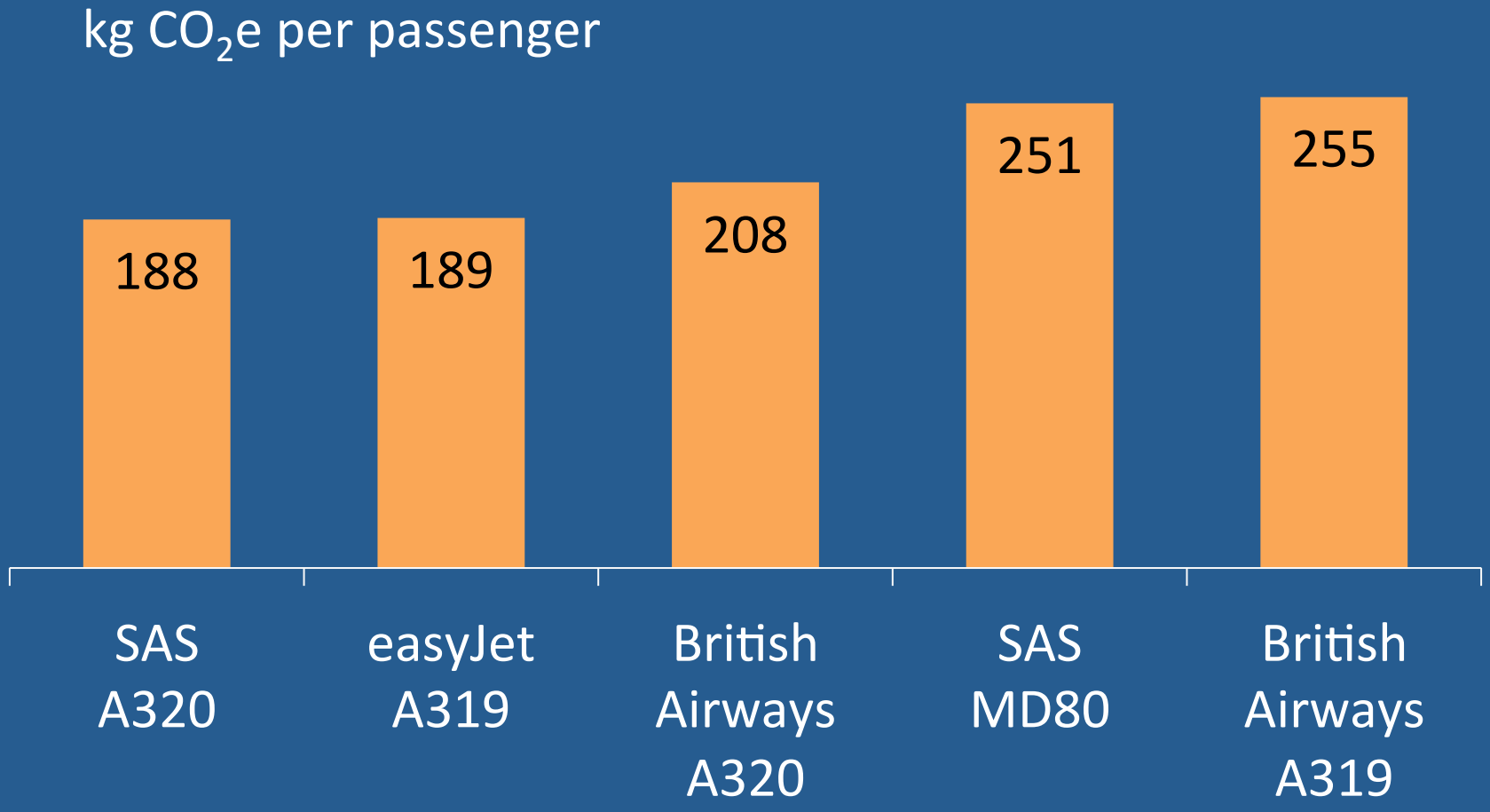


Our model: emissions calculation

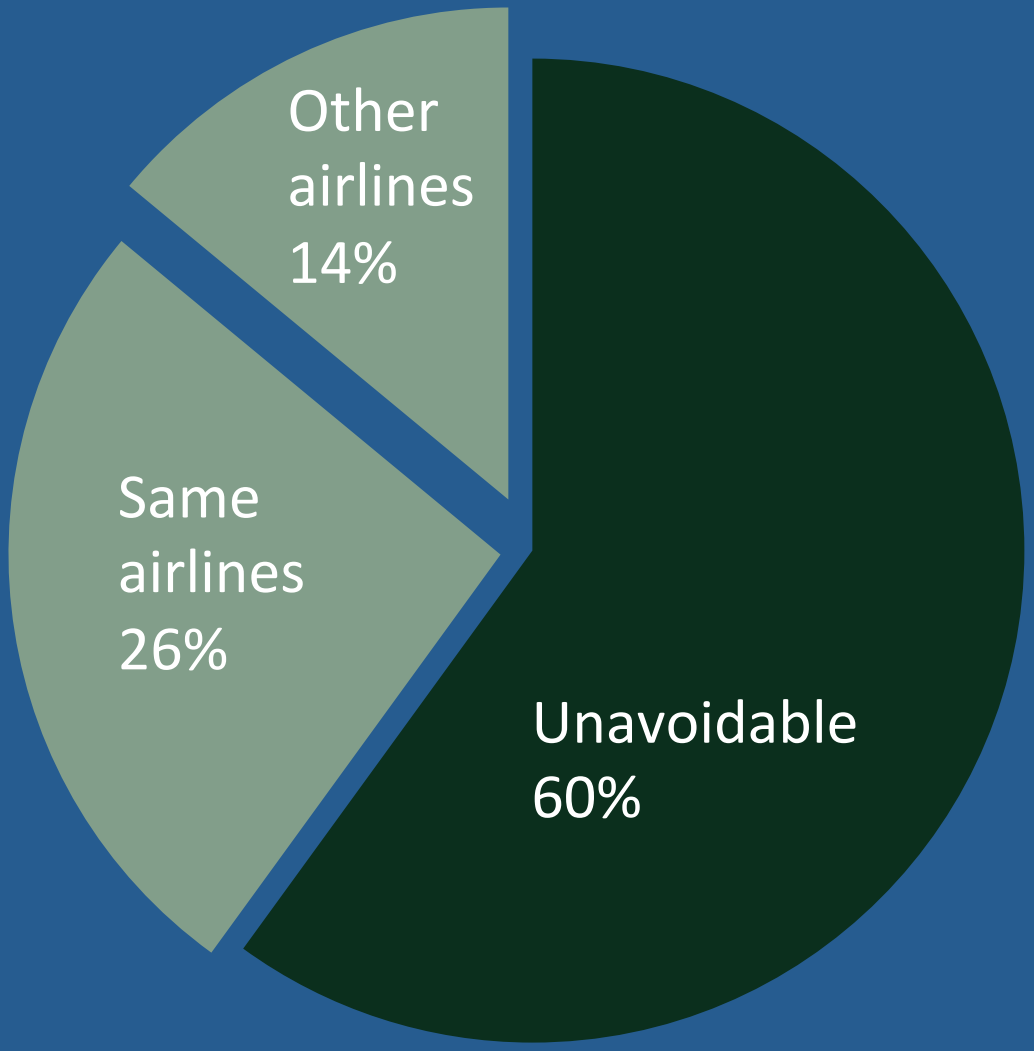


Flights vary in efficiency.

London - Copenhagen



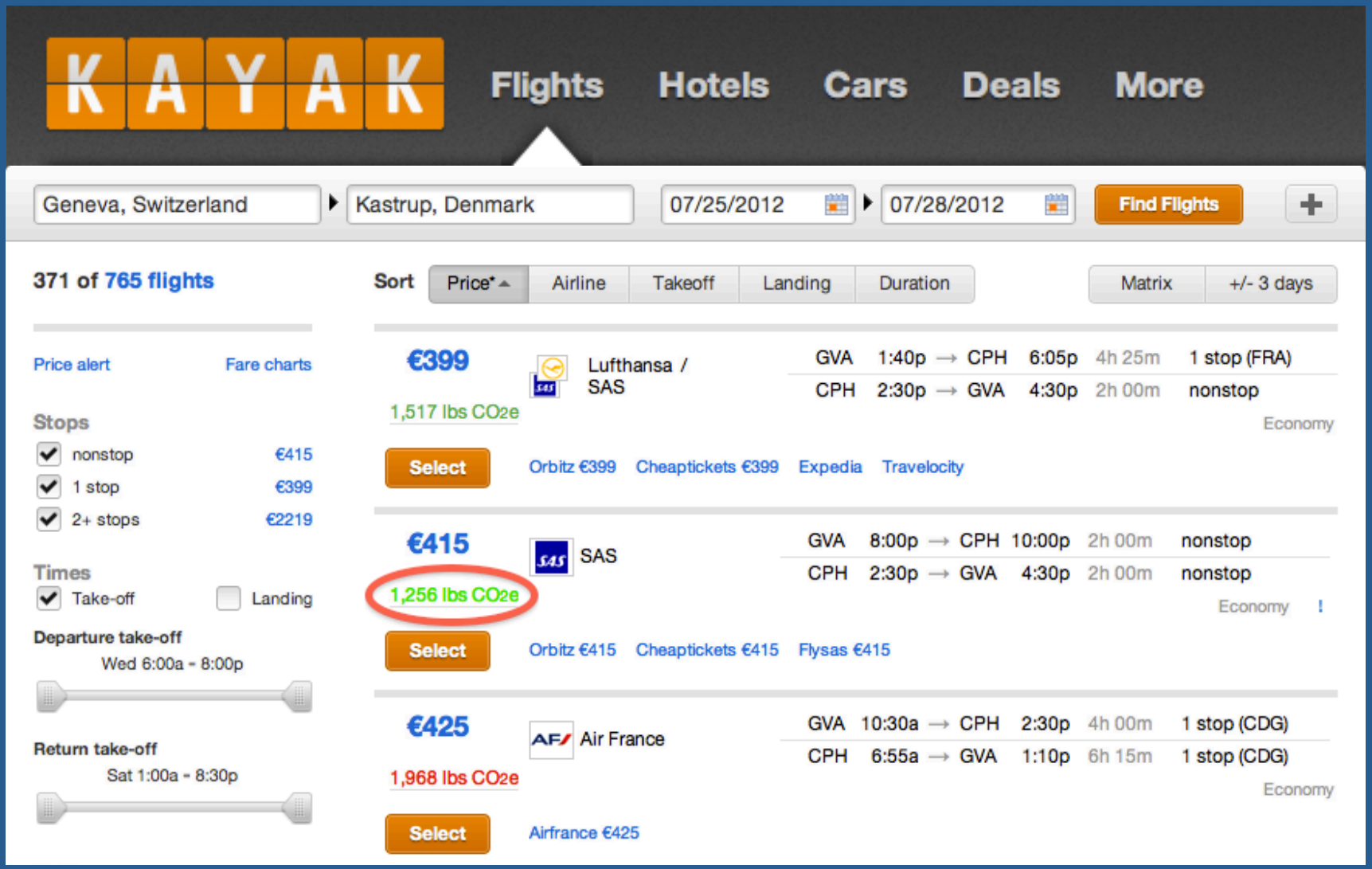
A Fortune 500 company



Top 100 routes

40% potential savings

Application: careplane.org



For more information…

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Model details & source code:

http://impact.brighterplanet.com/models/flight

Paper on Air Travel Carbon and Energy Efficiency:

http://brighterplanet.com/research

Careplane browser plugin

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