

## STEPS 2016 Rail & Aviation Project Intro

STEPS has proposed a Low-carbon Technologies and Fuels for Rail and Air Travel for 2016. This project will continue to progress our on-going analysis of low-carbon technologies and fuels for rail and air travel.

For rail, a deeper simulation analysis will be undertaken of propulsion systems, fuels and configurations, including hybridization, electrification and fuel cells. Raphael Isaac will work closely with experts at Warwick and Leeds universities to estimate potentials and costs using rail drive cycle simulation models housed at these universities. He will also advance the characterization of rail emission LCAs, working with the GREET model, and incorporating new information and greater details than currently exist in GREET.

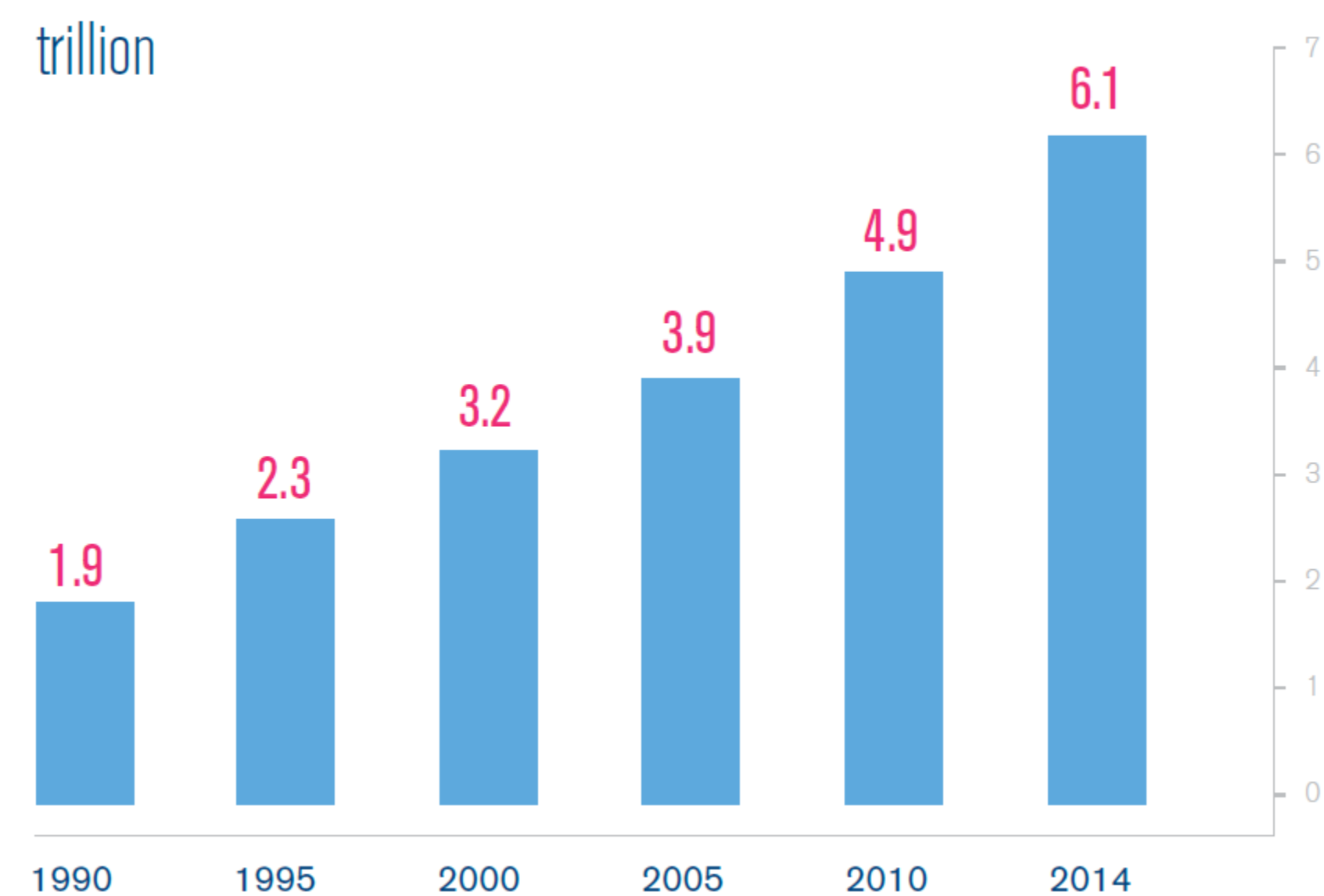
For aviation, Guozhen Li will review the existing air travel and energy use literature, and utilize the AIM (Aviation Integrated Modeling) tool to create new baseline projections for air travel in North America. Additionally, at least one low-carbon scenario will be developed based on adjustments in travel patterns, savings from air traffic control improvements, technology uptake, and alternative fuel potential. Overall, the rail and air studies will provide new projections and insights into the potential for cutting CO2 emissions in these modes, which affect the needed CO2 emissions from other modes and sectors to reach an overall energy/CO2 target.

## Air Travel: Status and Forecasts

In 2014, the air transportation sector carried a total of 3.3 billion passengers, which is more than the population of the world's 3 most populated countries (China, India, and USA) combined (3.0 billion).

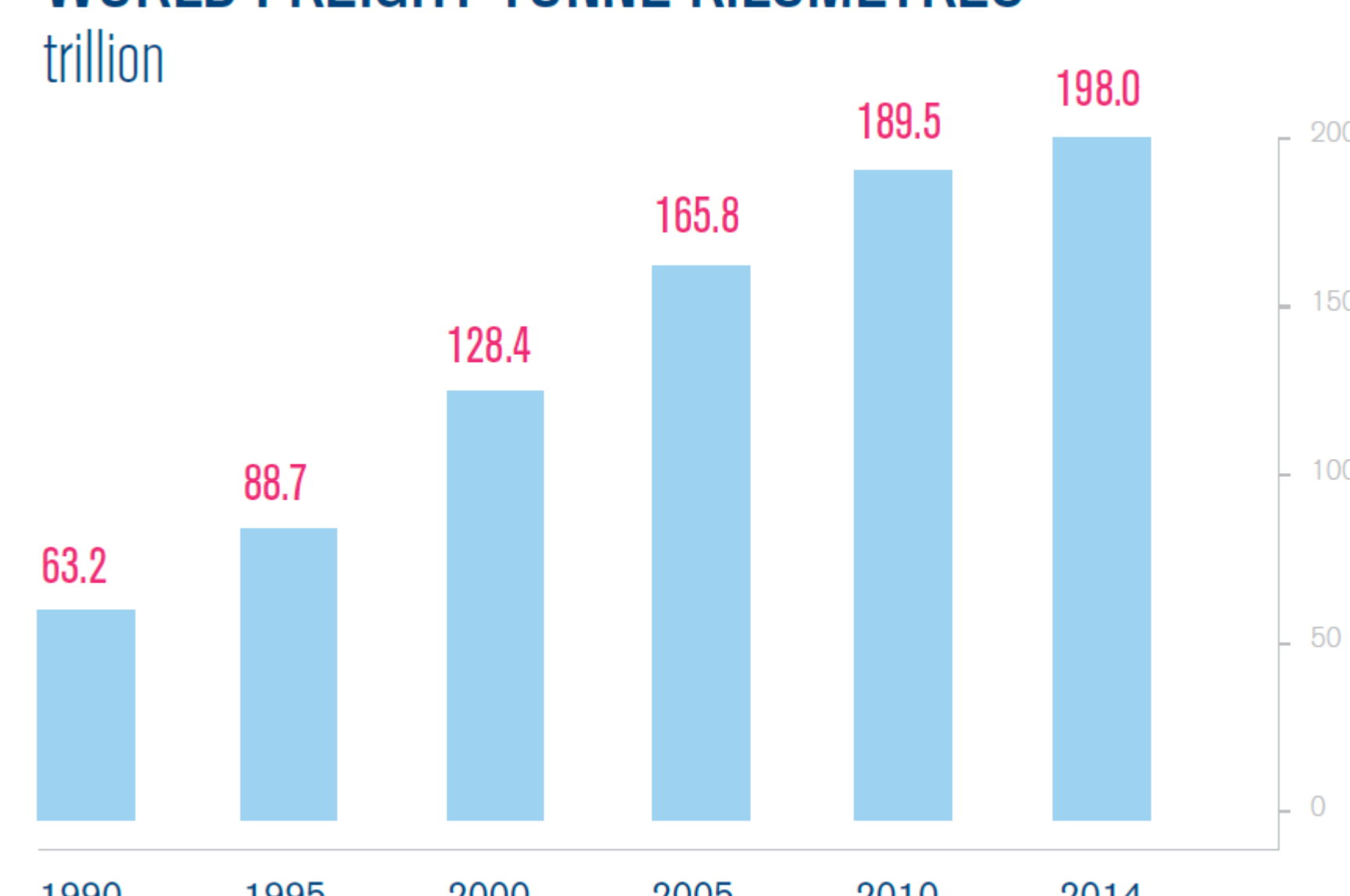
The world total passenger traffic hit 6.1 trillion revenue passenger kilometers (RPKs) in 2014, a steady increasing trend since 1990 (Source: IATA).

WORLD REVENUE PASSENGER KILOMETRES



Source: IATA Statistics

WORLD FREIGHT TONNE KILOMETRES



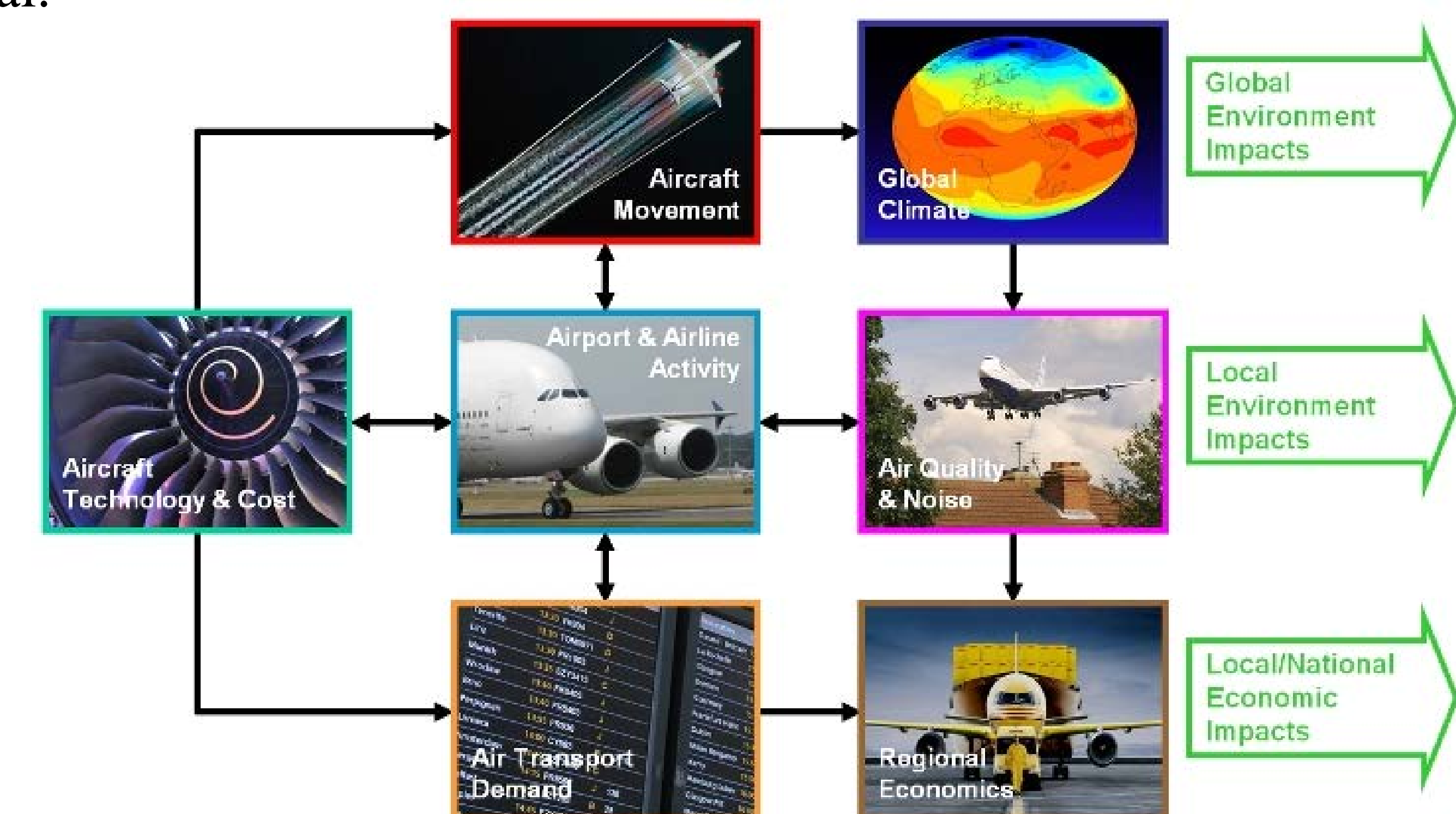
Source: IATA Statistics

We reviewed the air traffic forecasts from major passenger aircraft manufactures, Boeing and Airbus, and major air transport organizations, the International Air Transport Association (IATA) and the International Civil Aviation Organization (ICAO).

	Boeing	Airbus	IATA	ICAO
Forecast period	2015-2034	2015-2034	2015-2035	2013-2016
Cost for access	free	free	\$\$\$\$	\$\$\$
Annual traffic growth rate	Passenger RPK 4.9% Freight RTK 4.7%	Passenger RPK 4.6% Freight RTK 4.4%		Passenger 2015 6.3% 2016 6.5% Freight 2015 4.2% 2016 4.4%
Fleet growth	(P+F) 2014 21.6K→ 2034 43.6 +22K in 20y; 38K new a/c	(P+F) 2014 19K→ 2034 38.5K +19.5K in 20y; 32.6K new a/c		

## Research Methodology and Goals

The Aviation Integrated Modeling (AIM) tool will be used. AIM is modeling project with the goal of developing a policy assessment tool for aviation, environment and economic interactions at local and global levels, now and into the future. AIM's architecture contains a set of integrated modules of the key elements relevant to the project goal.



Source: Aviation Integrated Modelling (AIM) Project  
<http://www.aimproject.aero/index.html>

The research goals for the STEPS 2016 project includes:

- Create new baseline projection for air travel in North America
- Develop low-carbon scenario(s) based on adjustments in travel patterns, air traffic management improvements, technology uptake, and alternative aviation fuels.
- Explore CO2 reduction potentials from the air sector