

# Industry Goals and Measures to Address **CO<sub>2</sub>** Emissions From Aviation

**ICAO GIACC/3**  
**16-19 February 2009, Montreal**

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On behalf of ACI, CANSO, IATA and ICCAIA



# Summary

## ► Analysis

- ▶ Based on most recent ICAO FESG forecasts
- ▶ CO<sub>2</sub> efficiency potentials relative to 2005
  - 15% by 2012
  - 32% by 2020
  - At least 50% by 2050

## ► Key findings

- ▶ Three key drivers of aviation emissions reductions
  - Ongoing fleet renewal
  - ATM modernization and operational improvements
  - Availability of biofuels

# Summary

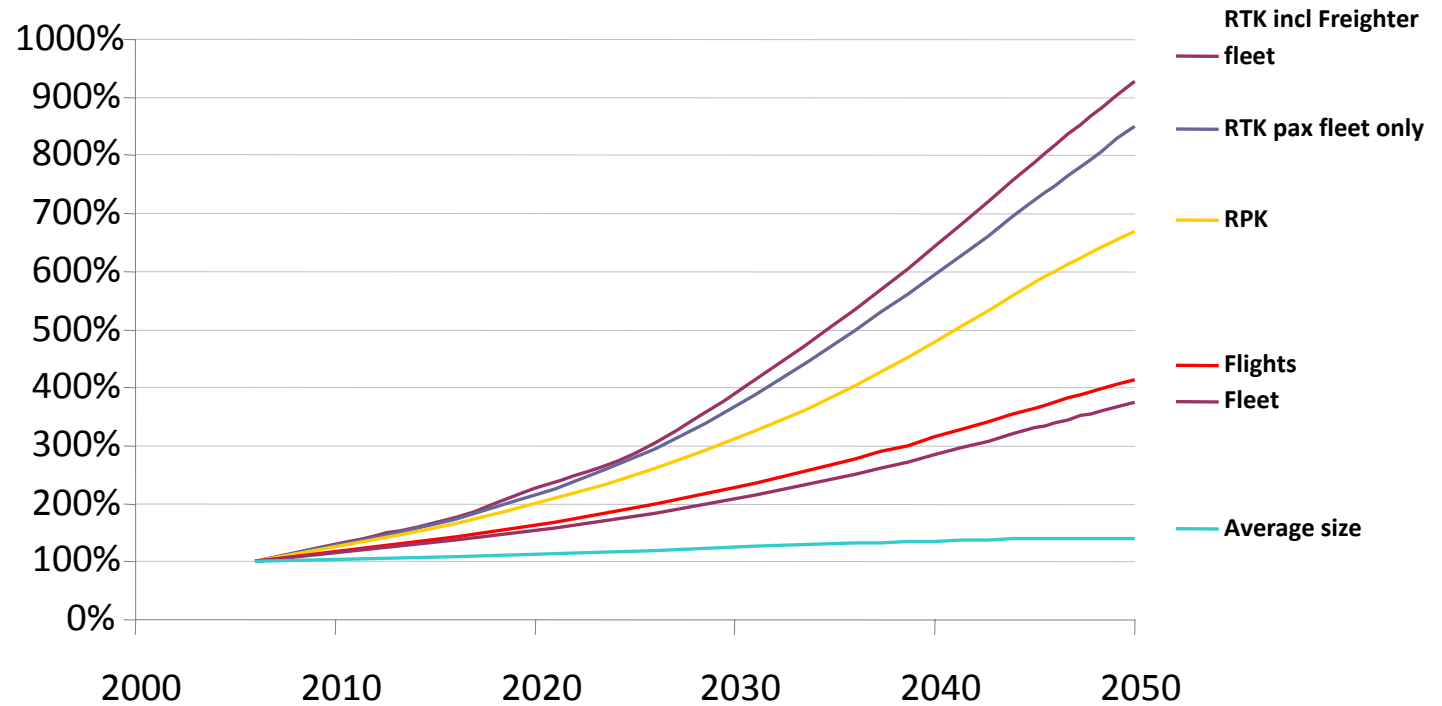
- ▶ Enabling government policy implications
  - ▶ **Support** R&D investments
  - ▶ **Commit** to ATM modernization and reorganization
  - ▶ **Implement** positive legal/fiscal framework for biofuels
  - ▶ **Avoid** multi-layering of charges and taxes



# Introduction

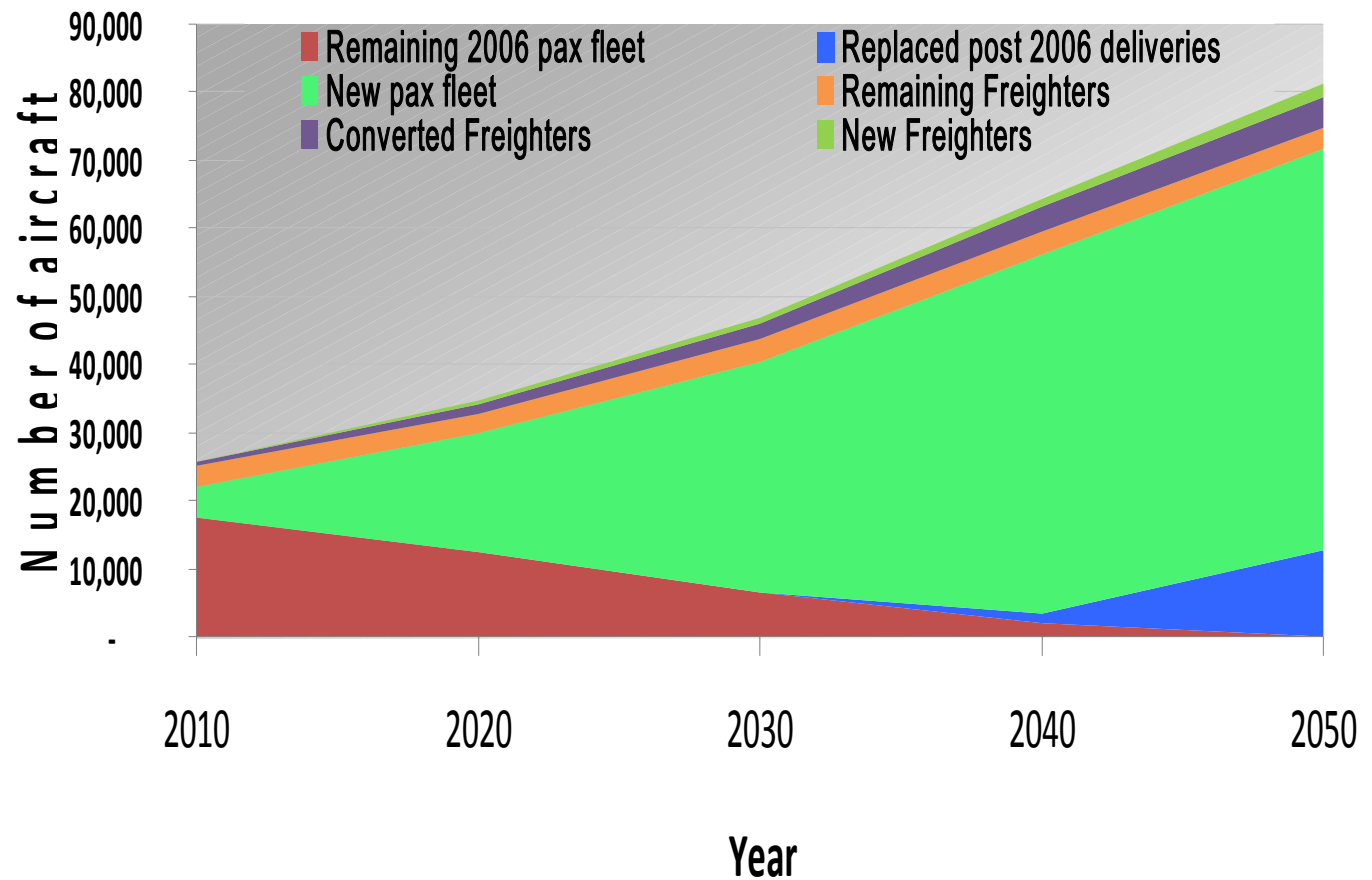
- ▶ Industry is committed to
  - ▶ Make a significant contribution to global CO<sub>2</sub> reductions
  - ▶ Continue to underpin global socio-economic development
- ▶ The four-pillar strategy guides our approach
  - ▶ Invest in Technology (Including alternative fuels)
  - ▶ Fly planes effectively
  - ▶ Build efficient infrastructure
  - ▶ Use positive economic measures
- ▶ Our scope:
  - ▶ CO<sub>2</sub> emissions from a 'gate to gate' perspective, including APU use
  - ▶ Ground service equipment, terminal and ground transport not included

# Projected relative growth 2006 - 2050



Airports Council International | **ACI**  
 Civil Air Navigation Services Organisation | **CANSO**  
 International Air Transport Association | **IATA**  
 International Coordinating Council of Aerospace Industries Associations | **ICCAIA**

# Fleet forecast 2006 - 2050



Airports Council International | ACI  
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# Measures

- ▶ Potential measures identified in five areas
  - ▶ Technology development & implementation
  - ▶ Improved ATM and infrastructure use
  - ▶ More efficient operations
  - ▶ Economic/market-based measures
  - ▶ Regulatory measures
- ▶ When considering measures
  - ▶ Reduction potentials not necessarily additive
  - ▶ Full stakeholder alignment required to achieve maximum potential
  - ▶ Crucial government role in enabling and facilitating implementation of measures

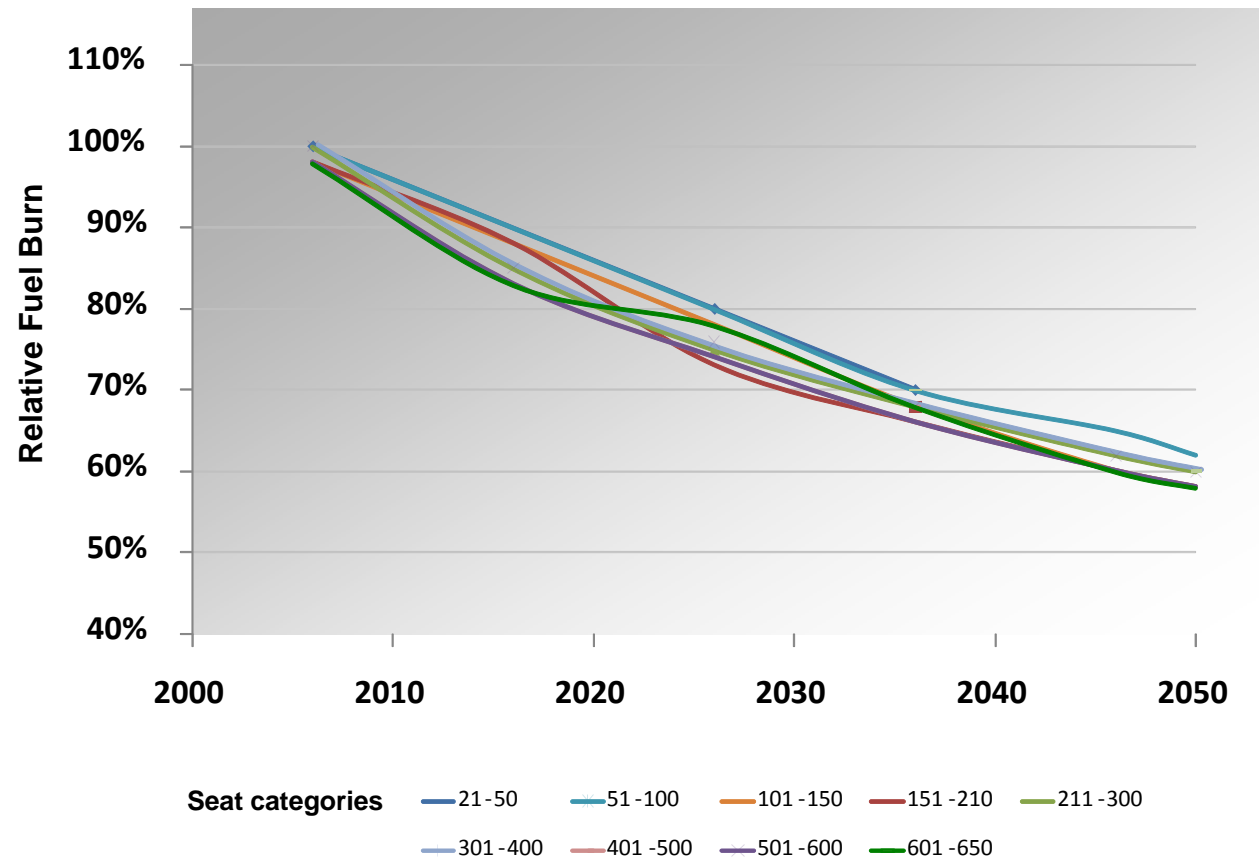
# 1. Technology

- ▶ Newly certified aircraft provide at least 15% fuel burn reduction relative to products they replace
- ▶ Specific technology examples
  - ▶ Blended winglets & raked wingtips
  - ▶ Advanced fly-by-wire control systems
  - ▶ Composites & advanced metal alloys
  - ▶ Advanced turbofan engines
- ▶ No attempt to predict future aircraft designs for 2050
  - ▶ Used ICCAIA high technology scenario to extrapolate fuel efficiency improvements
    - ▶ **1.16% pa**



# 1. Technology

## ► Relative improvement of new aircraft



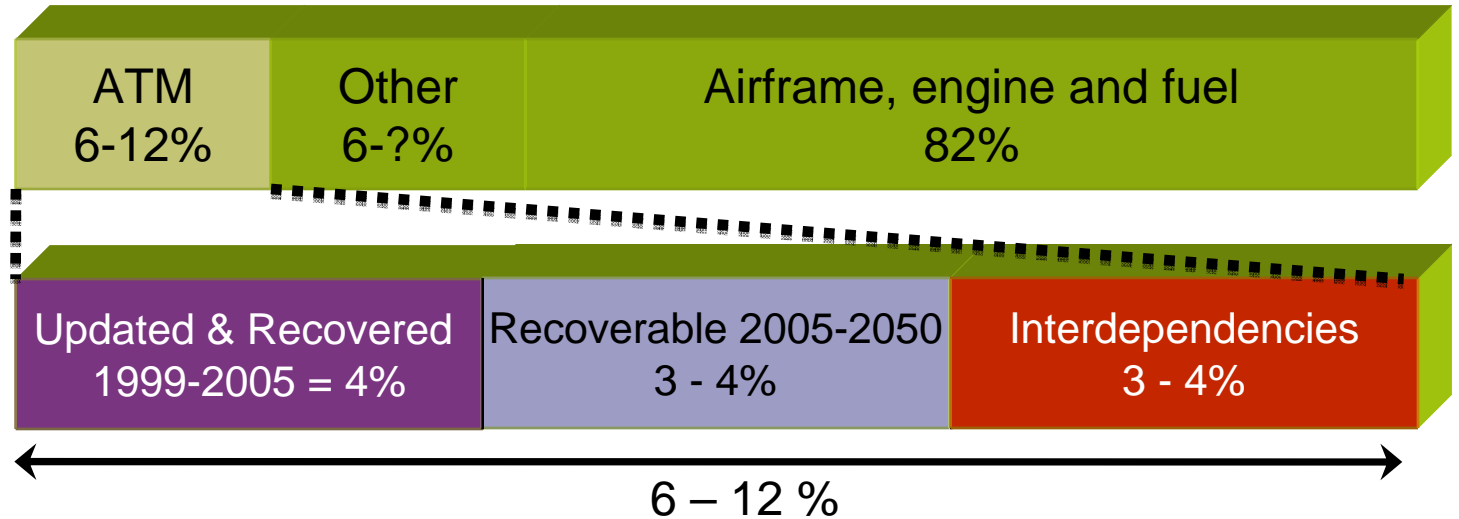
## 2. Operations

- ▶ Analysis based on approximately 100 airline visits carried out by IATA Green Teams
- ▶ Full implementation of identified opportunities would lead to an average 5% saving on the overall CO<sub>2</sub> budget



### 3. Infrastructure: ATM

IPCC  
(1999)  
Aviation  
Emissions

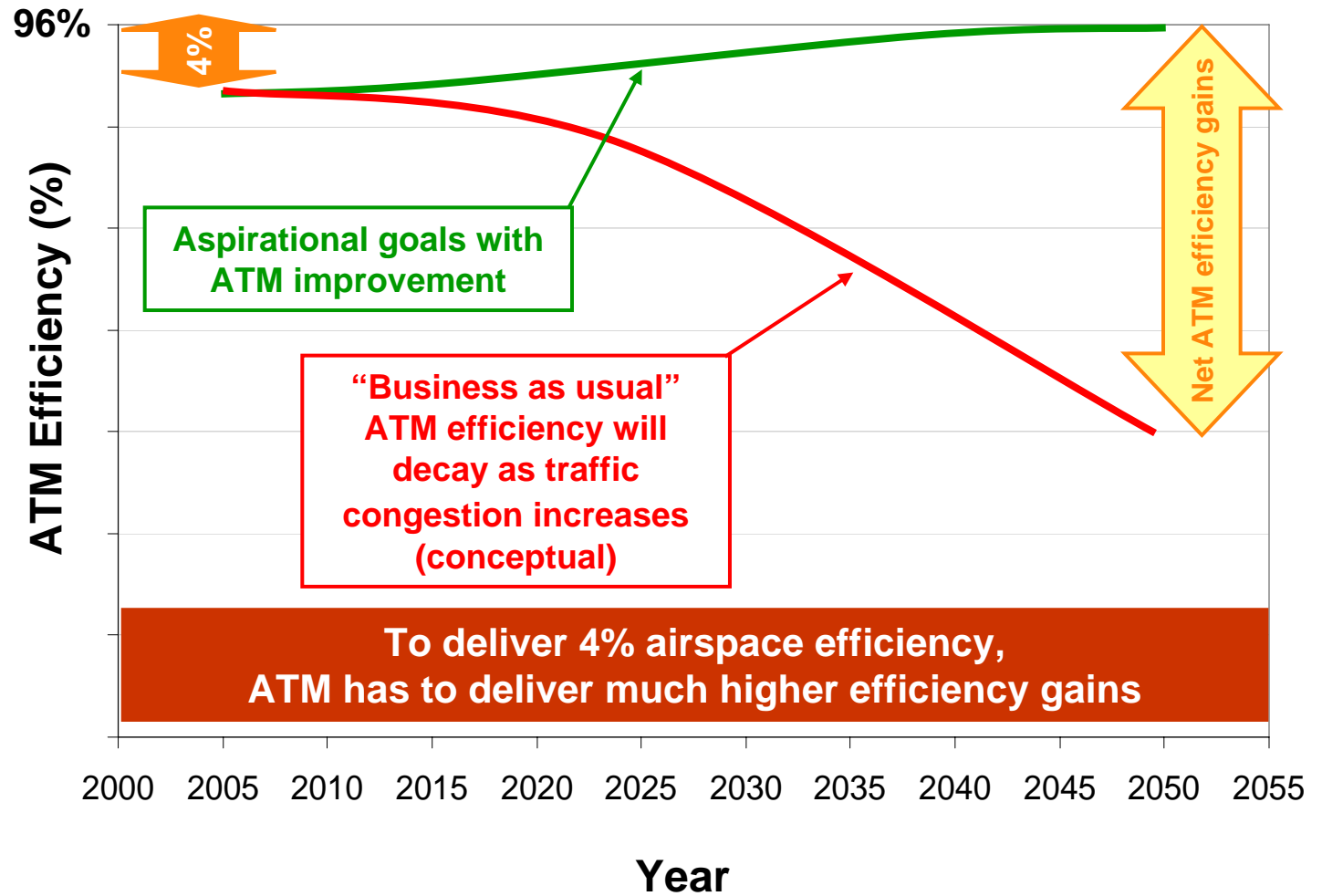


CANSO  
(2008)  
ATM  
Goals

- ▶ Since IPCC (1999) ATM has delivered up to 4% improvement
- ▶ Unrecoverable 3-4% inefficiency foreseen due to interdependencies
- ▶ CANSO goal to recover remaining 3-4% by 2050, while traffic quadruples

# 3. Infrastructure: ATM

## Airspace efficiency & air traffic growth



## 4. Infrastructure: airports

- ▶ Total potential CO<sub>2</sub> saving from APU use is ~ 4.2 Mt in 2007
  - ▶ ACI estimates
  - ▶ Projected fuel saving from FEGP/PCA is 0.6% of total industry fuel burn



# Fuel efficiency goals

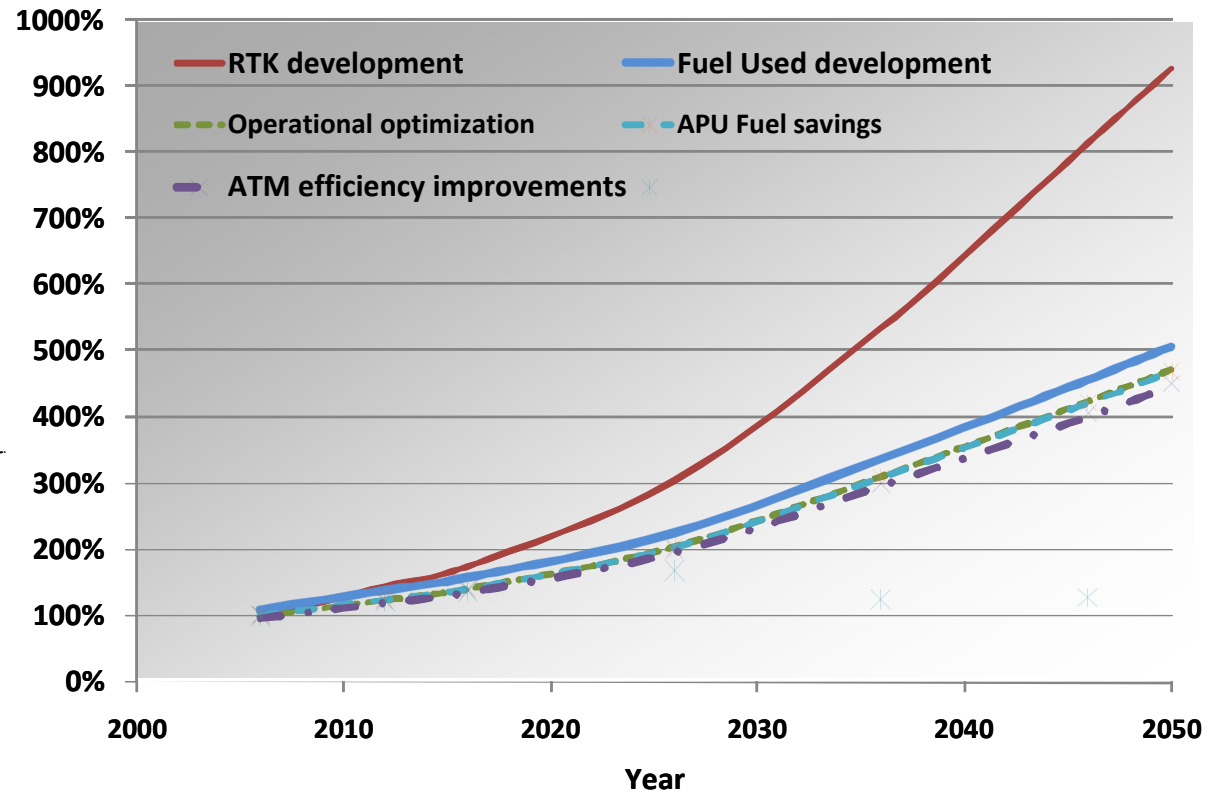
Year	Traffic growth (RTK) <sup>a)</sup>	Fuel efficiency improvement goals <sup>b)</sup>	CO <sub>2</sub> savings potential (Mt/yr) <sup>c)</sup>
2012	40%	15%	170
2020	130%	29%	485
2050	750%	50%	3,590

a) Based on ICAO FESG traffic forecast 2008, expressed in revenue tonne-kilometres (RTKs).

b) Fuel efficiency is expressed in litres of fuel used per RTK.

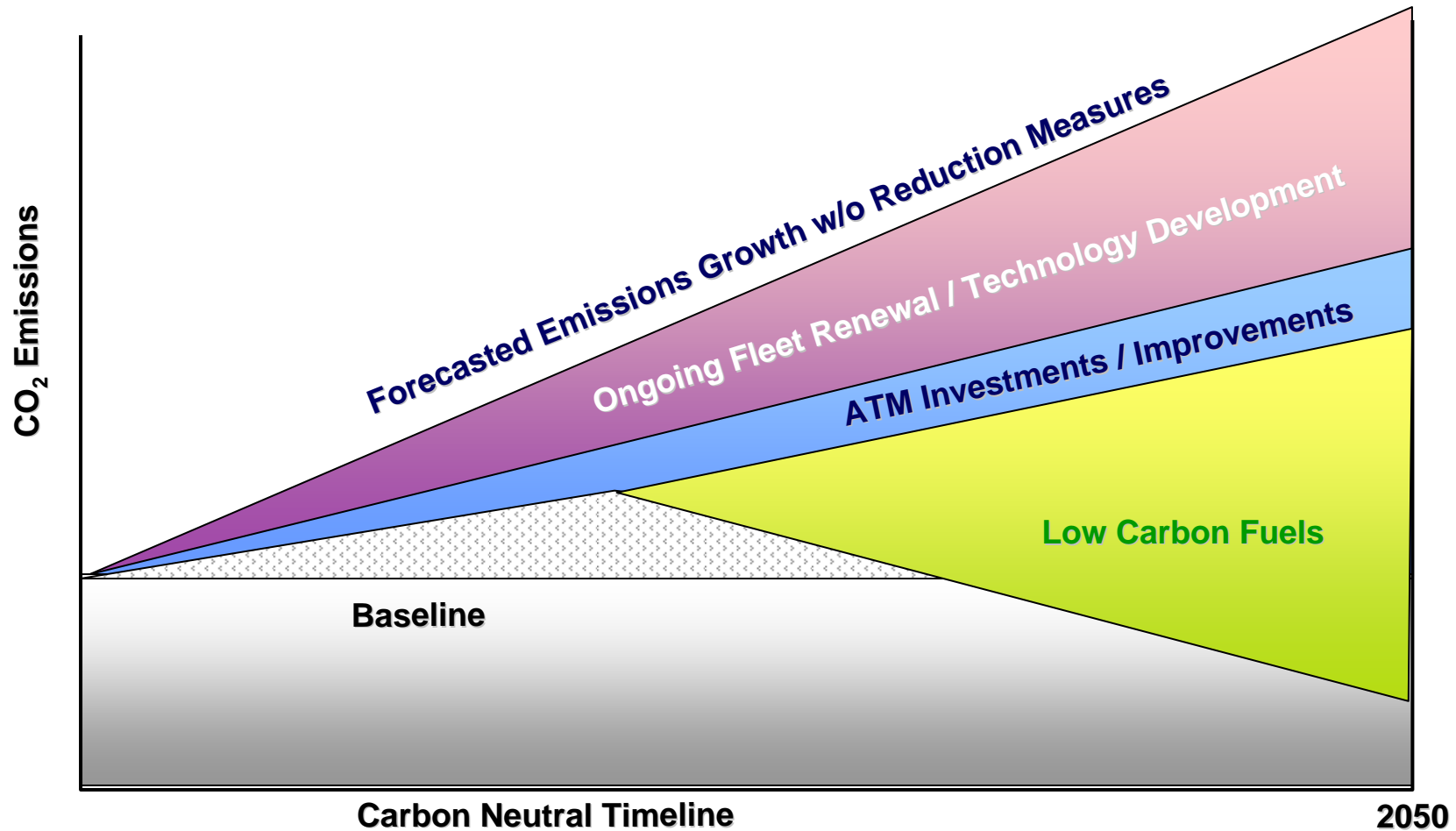
c) This includes estimated annual savings from fleet renewal, ATM and operational improvements, and reduced auxiliary power unit (APU) use, expressed in millions of metric tonnes per year (Mt/yr). It does not include estimated CO<sub>2</sub> reductions from biofuel use.

# Total relative fuel use



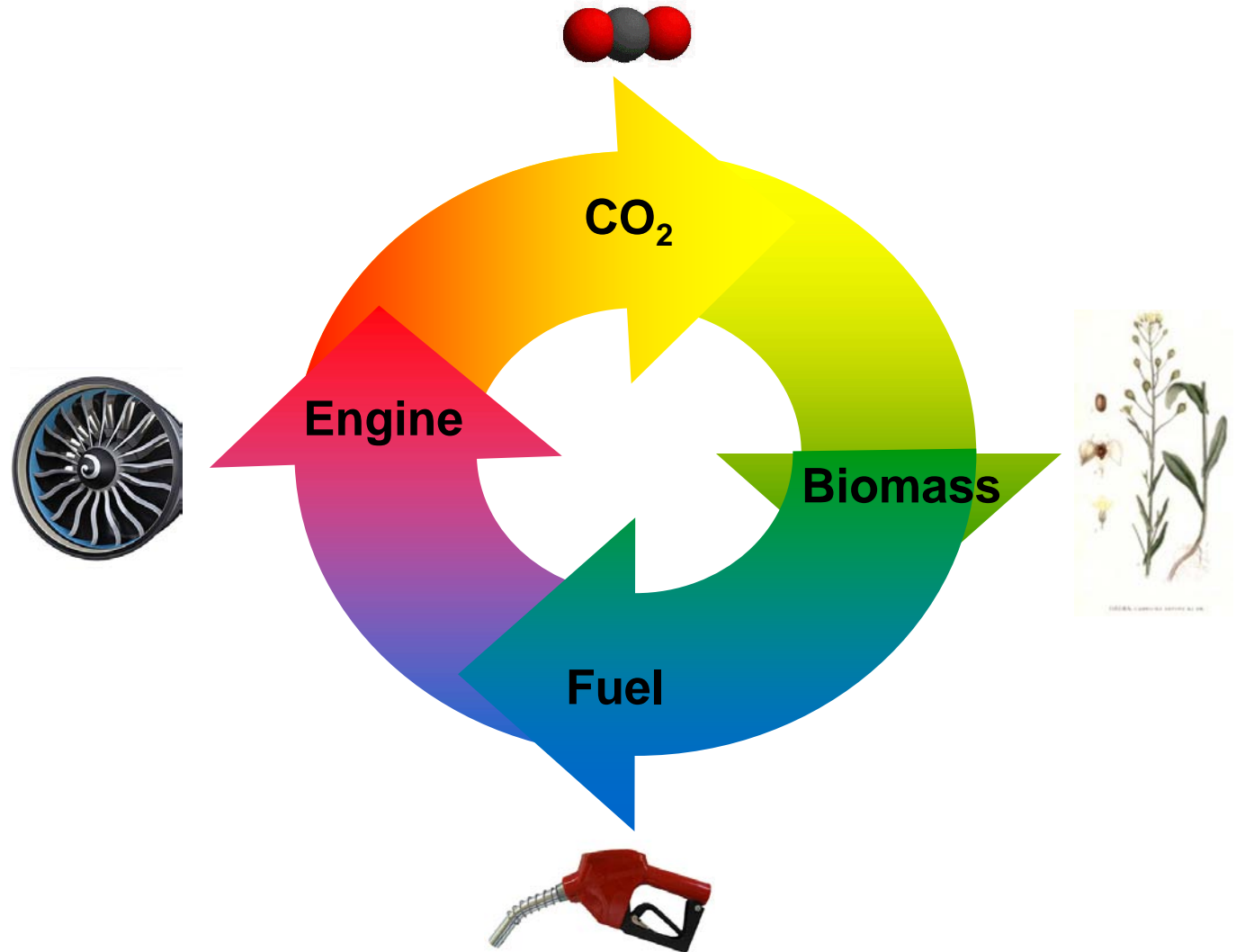
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# Key Drivers of Emissions Reductions





# Alternative fuels





# Alternative fuels (1)

- ▶ Crucial to reducing aviation's carbon footprint,
- ▶ Potential use of less carbon-intensive aviation fuels
  - ▶ Jatropha, camelina, halophytes, algae, etc.
  - ▶ Must meet strict sustainability criteria
  - ▶ Regional differences / solutions
- ▶ Very promising and fast developing area
  - ▶ Successful tests in recent months
  - ▶ Next milestone is certification
  - ▶ ICAO Workshop highlighted significant progress
- ▶ Biofuels will also contribute to
  - ▶ New revenue streams for developing countries
  - ▶ Energy security for local/national economies

# Alternative fuels (2)

- ▶ Analyzed two scenarios for the commercialization of bio-jet – one optimistic and one pessimistic
- ▶ Elements of the analysis
  - ▶ Yield efficiency
  - ▶ Capital costs
  - ▶ Refinery construction time
- ▶ Market viability defined as:
  - ▶ threshold at which annual biojet usage reaches 1% of total fleet fuel usage
  - ▶ ~ 700 m US gallons or 2.65 Bn litres

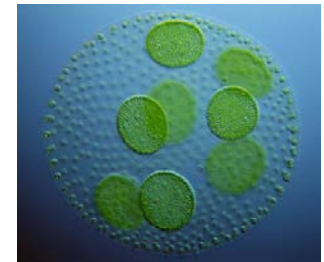


# Alternative fuels (3)

- ▶ Optimistic vs pessimistic scenario
  - ▶ Market viability will be reached in 2015.
  - ▶ Pessimistic scenario in 2021
  - ▶ Due to uncertainties, no attempt to project biofuel availability beyond 2021
- ▶ Assumed Carbon recovery rate of 80% on a full carbon life-cycle basis
- ▶ Biofuels are not a significant contributor to CO<sub>2</sub> savings in the 2012 timeframe

# Alternative fuels (4)

- ▶ By 2020, biofuels benefits are small but significant
  - ▶ I.e. an additional CO<sub>2</sub> saving of 3% (34 Mt CO<sub>2</sub>)
- ▶ Indicative volumes required for carbon-neutral growth at 2020 levels
  - ▶ By 2029, a biojet supply of 223 bn litres
  - ▶ By 2030, 238 bn litres
  - ▶ By 2035, 391 bn litres
  - ▶ By 2050, 1,051 bn litres
- ▶ Beyond 2050, biofuels could drive emissions well below today's levels



# CO<sub>2</sub> intensity goals

- ▶ Includes potential CO<sub>2</sub> benefits from future biofuel use in aviation

Year	Traffic growth (RTK) <sup>a)</sup>	Fuel efficiency improvement goals <sup>b)</sup>	CO <sub>2</sub> intensity reduction goals <sup>c)</sup>	CO <sub>2</sub> savings potential (Mt/yr) <sup>d)</sup>
2012	40%	15%	15%	170
2020	130%	29%	32%	485
2050	750%	50%	n/a	3,590

a) Based on ICAO FESG traffic forecast 2008, expressed in revenue tonne-kilometres (RTKs).

b) Fuel efficiency is expressed in litres of fuel used per RTK.

c) CO<sub>2</sub> intensity is expressed in kilogrammes of CO<sub>2</sub> emitted per RTK. This includes CO<sub>2</sub> benefits from biofuel use.

d) This includes estimated annual savings from fleet renewal, ATM and operational improvements, and reduced auxiliary power unit (APU) use, expressed in millions of metric tonnes per year (Mt/yr). It does not include estimated CO<sub>2</sub> reductions from biofuel use.

# Required Investment

- ▶ Identified aspirational goals require
  - ▶ Estimated total investment in excess of USD 7 trillion would be required by 2050
- ▶ This amount includes investment in
  - ▶ New, more efficient aircraft
  - ▶ ATM modernization programmes
  - ▶ Biofuel production & distribution



# Roles of stakeholders

- ▶ **Manufacturers**

- ▶ Develop and deliver more fuel efficient equipment

- ▶ **ANSPs**

- ▶ Implement improved ATM procedures and modernization programmes
- ▶ Influence State airspace design

- ▶ **Airports**

- ▶ Provide sufficient infrastructure capacity

- ▶ **Airlines**

- ▶ Invest in fleet renewal while satisfying demand
- ▶ Realize improvement potentials offered by product and system providers



# Roles of stakeholders

## ▶ Governments

- ▶ Implement fiscal and legal policies that enable accelerated introduction of appropriate CO<sub>2</sub> reduction measures
- ▶ Support R&D funding
- ▶ Ensure necessary airport capacity
- ▶ Ensure airspace efficiency through:
  - Proper institutional arrangements
  - Improved civil/military coordination
  - Improved ANSP governance
  - Performance-based regulations

# Policy measures

- ▶ We need positive measures that:
  - ▶ Support industry in reducing its net carbon emissions
  - ▶ Stimulate private and public investments
  - ▶ Support clean technologies
    - ▶ Including alternative fuels
  - ▶ Minimize compliance costs and competitive distortions
  - ▶ Recognize socio-economic benefits

# Implementation considerations

- ▶ We need global solutions to a global problem
  - ▶ Sector-specific approach
  - ▶ Based on common vision
  
- ▶ Key principles
  - ▶ Consensus based
  - ▶ Avoid competitive distortions
  - ▶ Recognize global investment requirements
  - ▶ Strong ICAO leadership needed

**Industry is committed to work  
with ICAO/GIACC to forge a  
global framework to reduce  
aviation CO<sub>2</sub> emissions**

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# Q & A

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