Efficiency Standards in a Global Climate Framework

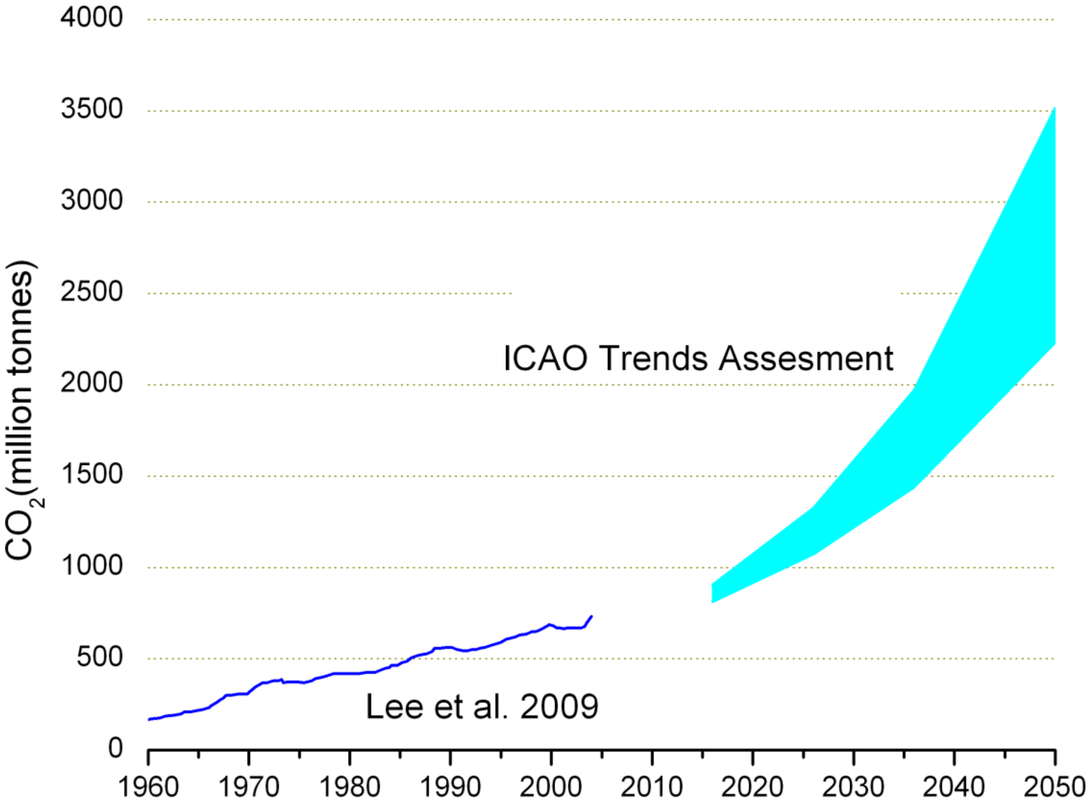
Mazyar Zeinali PhD
Dan Rutherford PhD

A New Flightplan
February 7th 2012
Brussels

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Why Aviation Matters

- 500% growth in emission since 1960
- Expected growth in demand could more than triple aviation's share of anthropogenic CO_2
- Does not include non-CO_2 impact which could significantly increase the climate impact of aviation

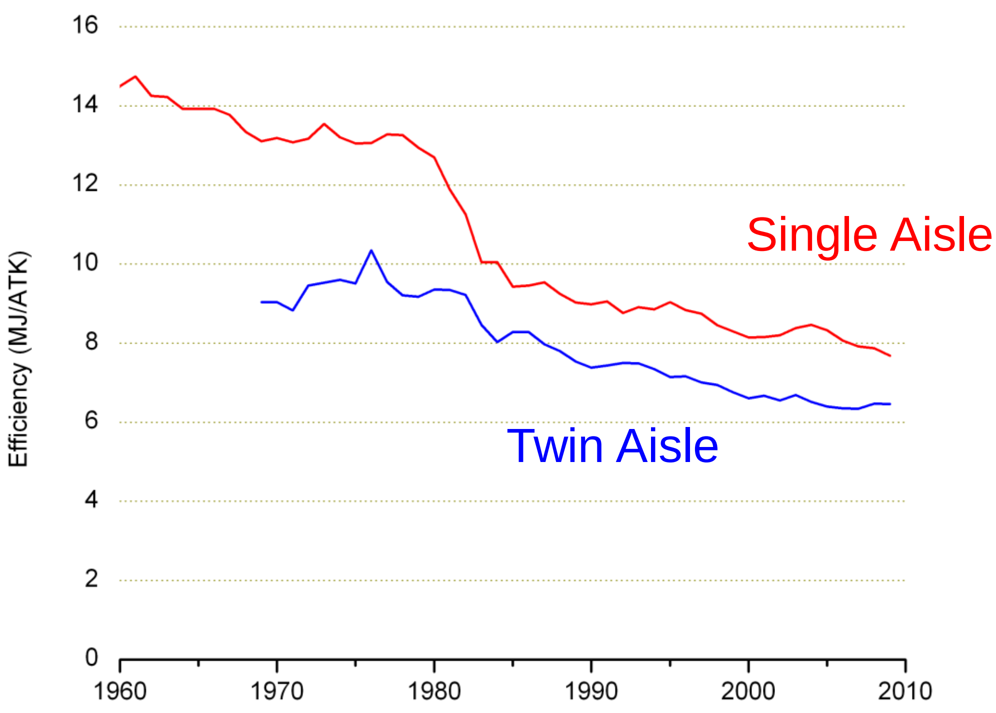


icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Historical Efficiency Trends - Aircraft

- More steep gains from 1960 to 1990
- Efficiency tailing off beyond 1990
  - SA – 1.6% reduction per annum from 1960-1990; -0.6% per annum 2000-2009
  - TA – 1.0 % reduction per annum from 1967-1990; less than 0.2% per annum 2000-2009
- Likely due to
  - Lack of new, more efficient designs
  - Technology being used to boost capability rather than to reduce fuel burn/emissions

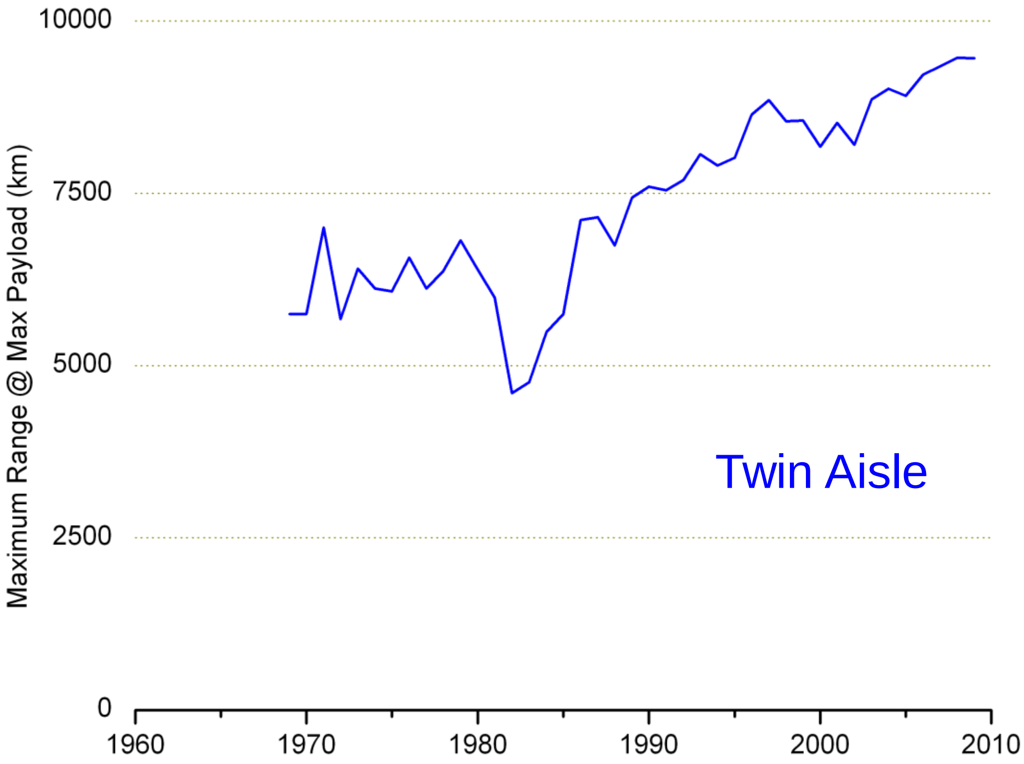
Efficiency for Newly Delivered Aircraft



icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

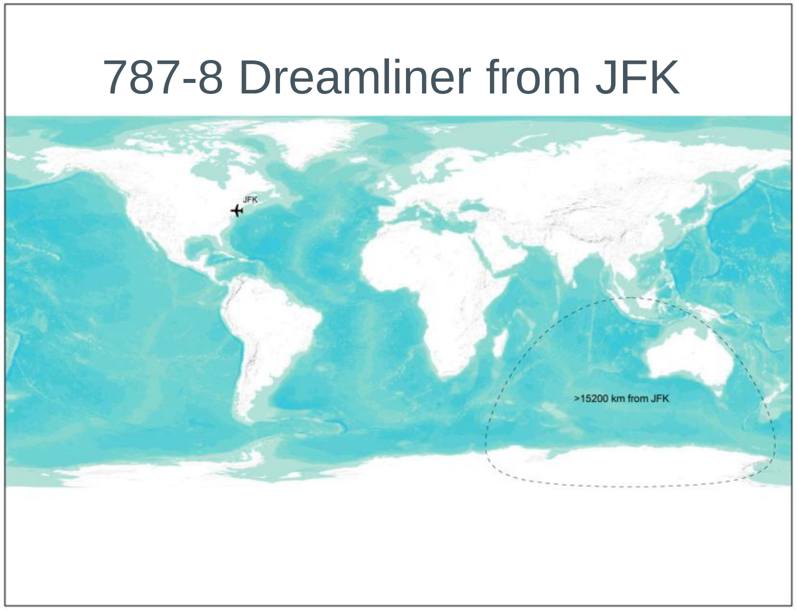
Efficiency Tradeoff – Capabilities v. Fuel Efficiency

- Average range has increase by approximately 25% since 1990
- Upward trend for speed and payload
- Technology gains used for increasing capabilities with tradeoff of efficiency

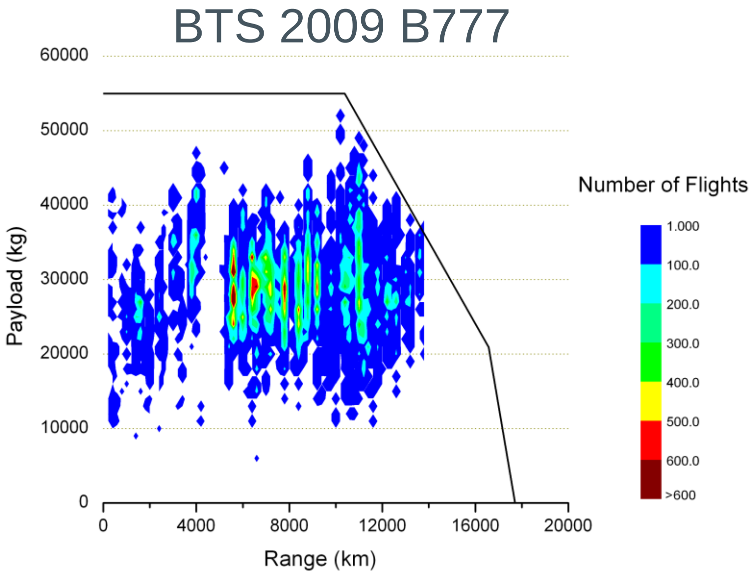


Improve Efficiency Through a Basket of Measures Impacting Supply Side AND Demand Side

Supply Side Impact – Efficiency Standard and Capabilities



Range from 14200 km to 15200 km



Majority of flights fall Below Max Capabilities

ICAO Report of the Independent Experts (Doc 9963) –

"…it has been found that quite modest changes in design Mach number, design range, and wing span can lead to additional savings…." comparable to changes resulting from moderate regulatory pressure

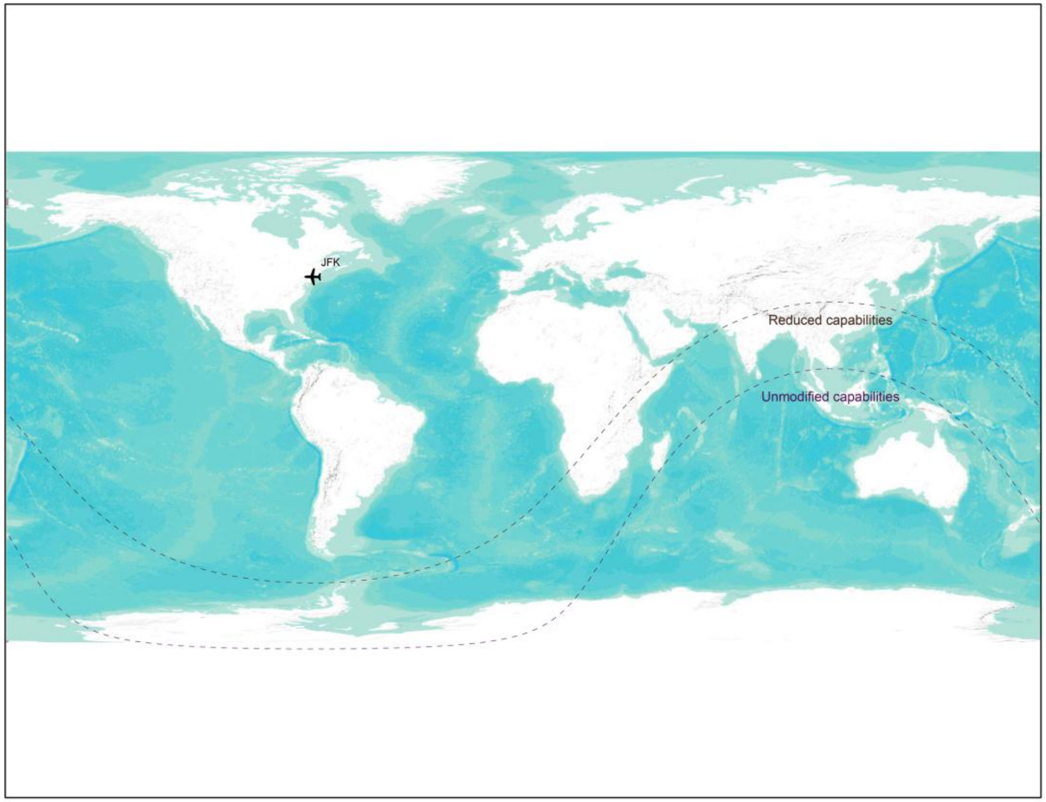
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Supply Side Impact – New Aircraft Efficiency Can Be Improved Significantly Mid-term

- Technology Improvements
  - -10% engine SFC
  - - 8% aero drag
  - +15% structural eff.

- Tighter Optimization to Mission
  - 30% reduction in max. range
  - 30% reduction in cargo capacity
  - Small reduction in Mach number

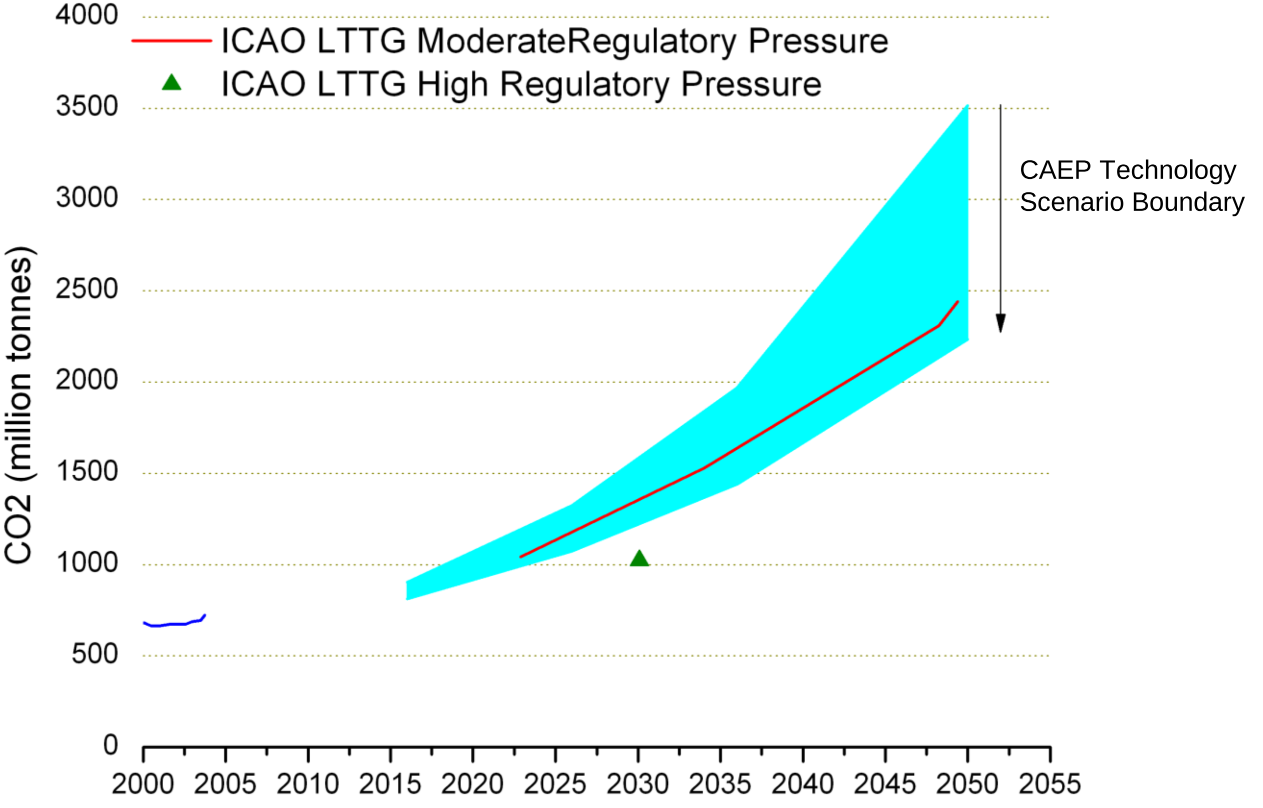
- Results:
  - 23% reduction in airframe weight
  - 11,000 km range (SFO-HKG)
  - 28% reduction in seat-km emissions (777-200ER basis)



THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Supply Side Impact – Efficiency Standard and Technology

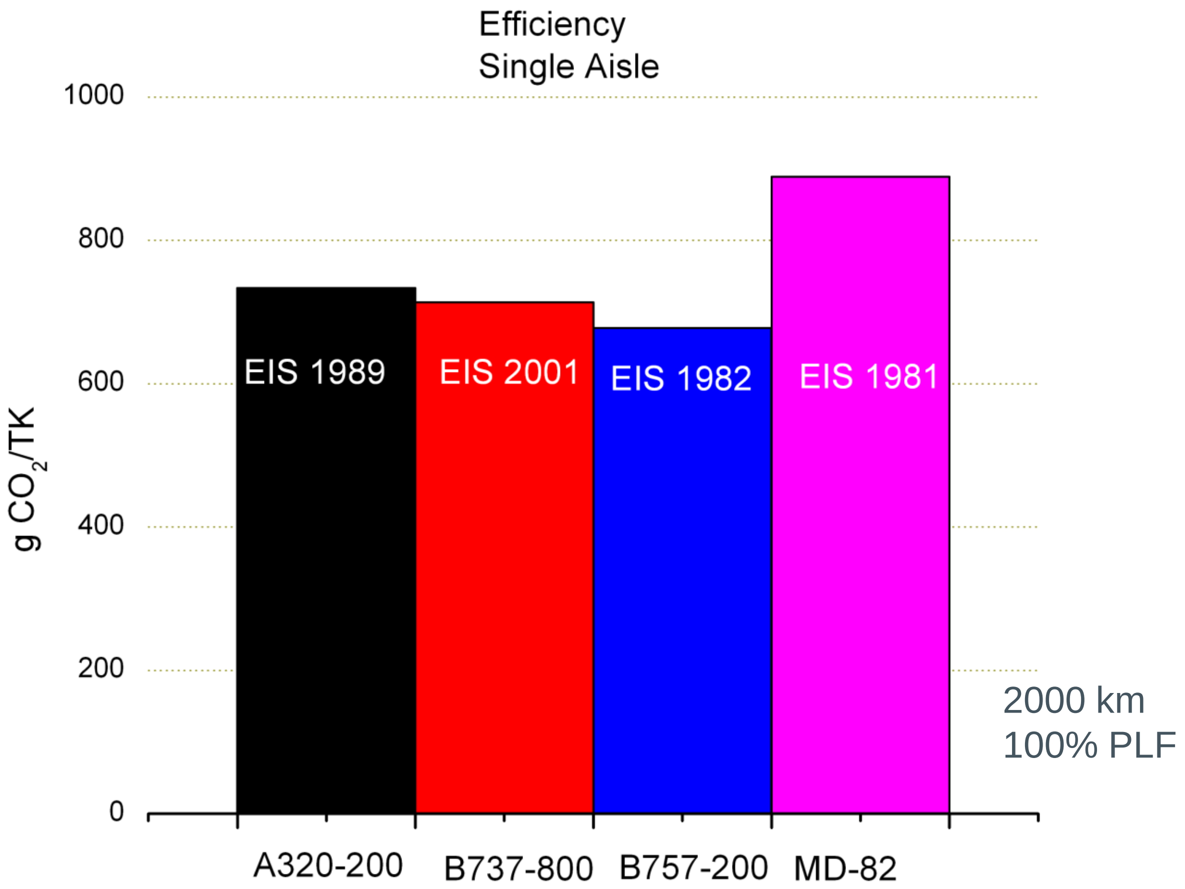
- ICAO global CO_2 standard would provide supply side improvements
- ICAO has concluded that moderate regulatory pressure may almost double efficiency trend beyond BAU
- Beyond technology impact – new designs, capabilities (e.g. range, speed), and one size fits all?



THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Demand Side - Efficiency for 2010 Top Half of Aircraft Fuel Flown by US Airlines

- Top Half - 7 aircraft account for over 50% of all reported Aircraft Fuel in 2010
- Aircraft with 1982 entry-into-service best performer
- Worst performer 25% more emissions than Best Performer
- Choice of and how airlines use aircraft matter



icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Demand Side Efficiency Example

- Best Performer
  - B757-200 – 737 g CO_2/TK
- Worst Performer
  - MD-82 – 951 g CO_2/TK
- Worst from ATL to IAH Approx. 29% less efficient than best on CO_2 basis
- Improve Demand side efficiency – MBM's

THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Summary

- Both Supply and Demand Side Impacts on Efficiency
- An efficiency regulatory standard influence will be reflected in supply side technology and design
- MBM’s influence on demand side efficiency includes gains in fleet and operations, among others.

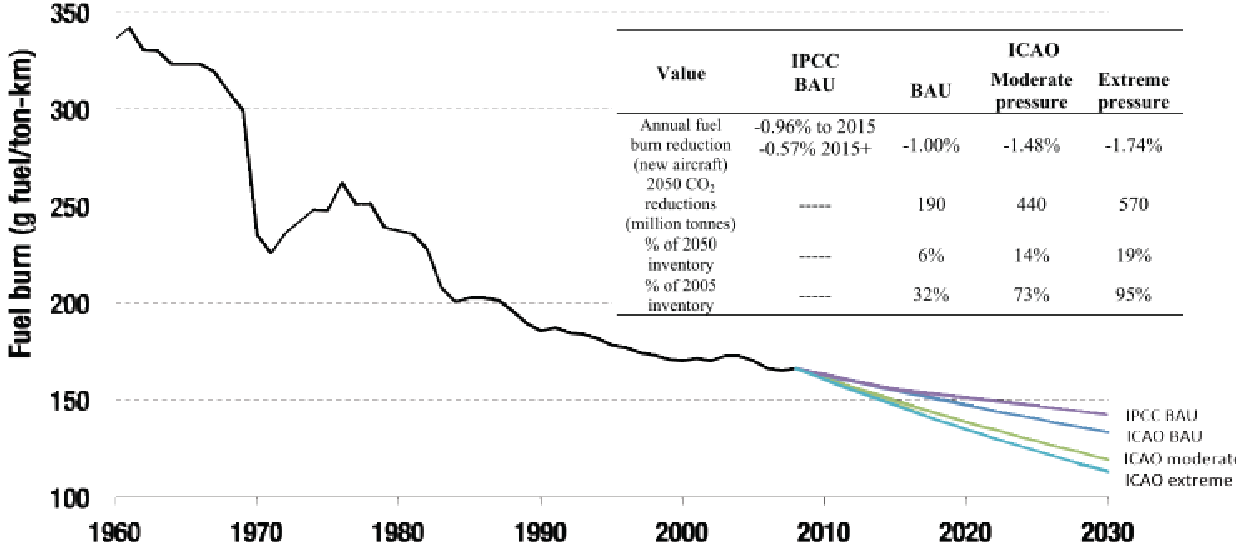
Thank You

Mazyar Zeinali
mazyar@theicct.org
415 202 5747

Policy pressure can help improve efficiency

- ICAO Report – Policy pressure can reduce emission significantly beyond BAU
- **Significant Opportunities for Improvement**

Average fuel burn for new jet aircraft, 1960-2030



Value	IPCC BAU	ICAO BAU	ICAO Moderate pressure	ICAO Extreme pressure
Annual fuel burn reduction (new aircraft)	-0.96% to 2015 -0.57% 2015+	-1.00%	-1.48%	-1.74%
2050 CO_2 reductions (million tonnes)	-----	190	440	570
% of 2050 inventory	-----	6%	14%	19%
% of 2005 inventory	-----	32%	73%	95%

ICCT (2009). "Efficiency Trends for New Commercial Jet Aircraft, 1960 to 2008."
ICAO (2010). Fuel Burn Technology Goals Review

"The [independent experts] have come to realise that a considerable part of the benefit of improved technology introduced in the past has been used to improve the performance of the new aircraft, mainly range, rather than to reduce fuel burn per ATK."

"Report of the Independent Experts on the Medium and Long Term Goals for Aviation Fuel Burn Reduction from Technology." 2010. ICAO Doc 9963.

icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Demand Side - Aircraft Fuel (US)

- 4 aircraft with entry-into-service (EIS) in 1980s
- Only 1 with EIS post 2000 (2001)
- What Does this mean for Emissions?