A³ ConOps Cost-Benefit Analysis

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iFLY Final Presentation
Berlin, June 13, 2011

* Changed "Cost-Effectiveness Analysis" to "Cost-Benefit Analysis" in the revised Technical Annex

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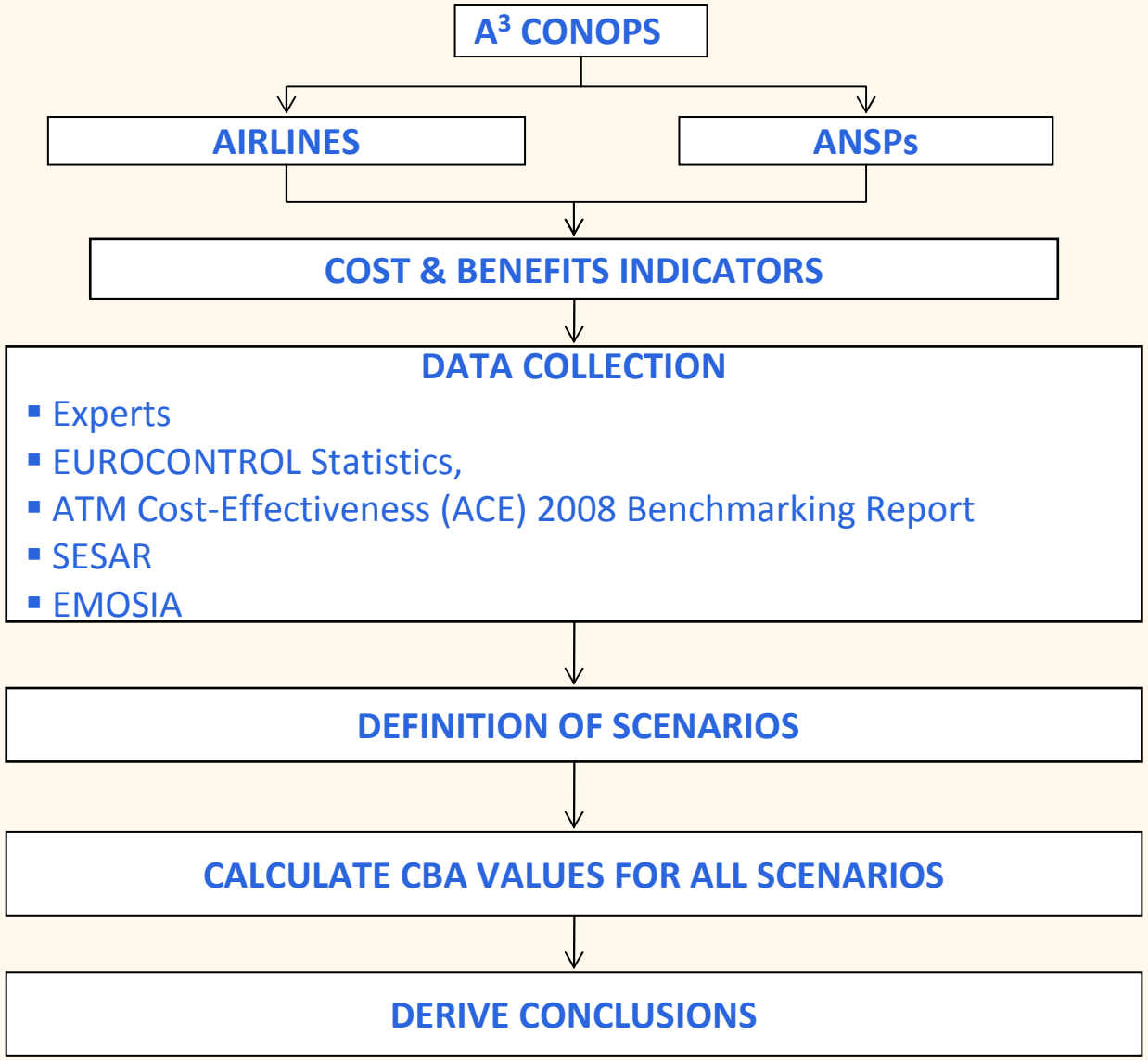
Problem Definition

- A^3 ConOps Economic Assessment
- Degree of Concept Maturity
- Stage in Project Lifecycle
- High Uncertainty in estimating Benefits and Costs
- Consideration of all relevant stakeholders

Objective

- Develop and apply Cost Benefit Analysis (CBA) to assess the economic viability of A^3 ConOps considering the implications to both Airlines and ANSPs

Cost-Benefit Analysis Methodology



Building Analysis Scenarios for Airlines

- **Uncertain Benefit variables:**
  - *Horizontal & Vertical Flight Efficiency Gain (%)*
  - *En-route ATFM Delay Reduction (%)*
  - *ANSPs en-route charges Reduction (%)*

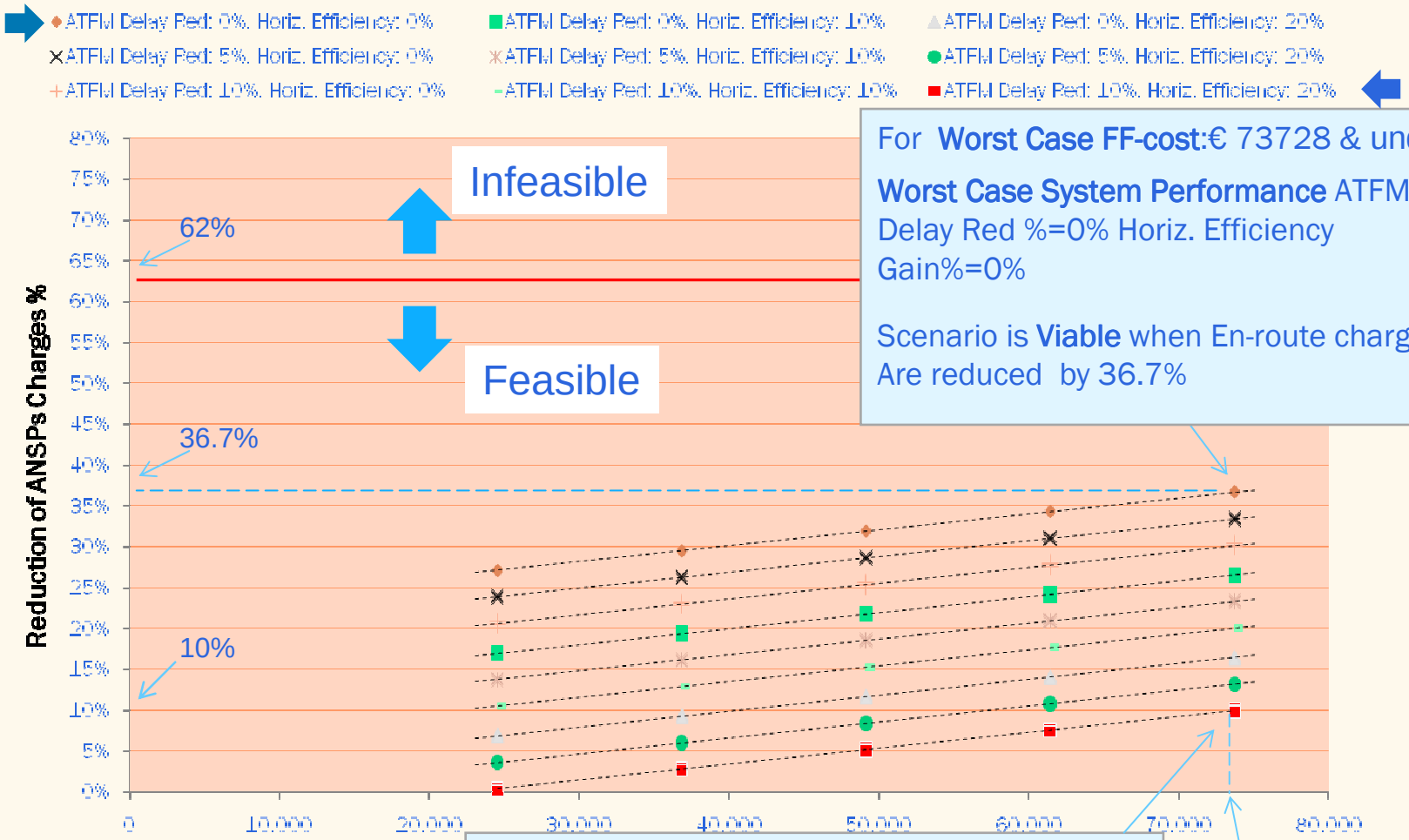
- ***Uncertain Cost Variables:***
  - *Forward-fit per aircraft*

- **Analysis Scenarios definition:**
  - Select a values of B/C from 1 to 2
  - Determine alternative combinations of cost and benefit variables

CBA Assumptions for Airlines

- Horizontal Flight Efficiency Gain: 0-20%
- En-route ATFM delay reduction: 0-20%
- En-route ANSPs Charges: 0-62%
- Retro-fit/Forward-fit Cost was assumed equal to 2 (as in SESAR CBA)
- Analysis period: 2010-2035
- Full scale benefits are encountered by the end of the implementation period (in 2026)

CBA Results for Airlines: B/C=1 (IRR 8%)

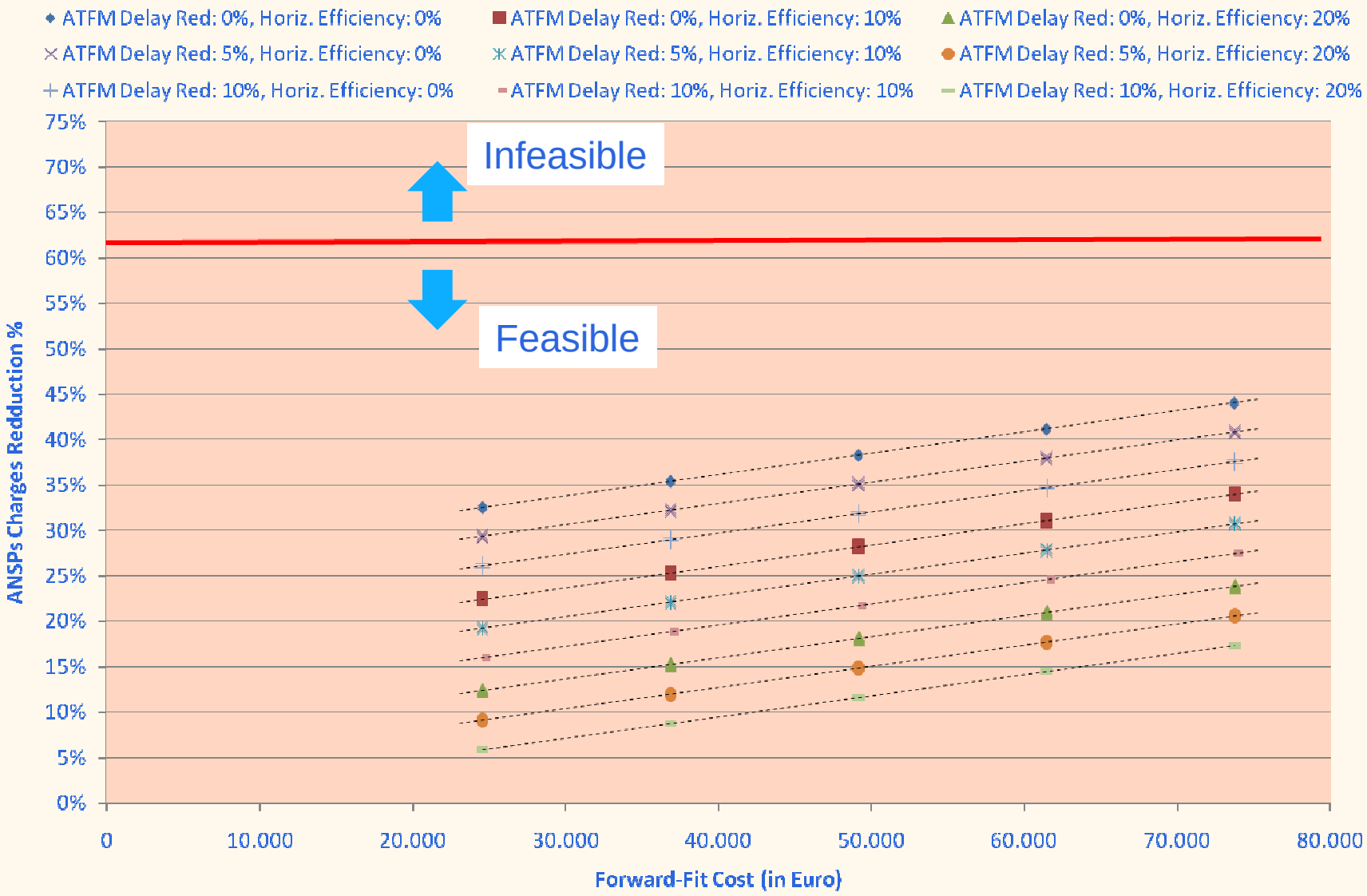


For **Worst Case FF-cost**:€ 73728 & under **Worst Case System Performance** ATFM Delay Red %=0% Horiz. Efficiency Gain%=0%

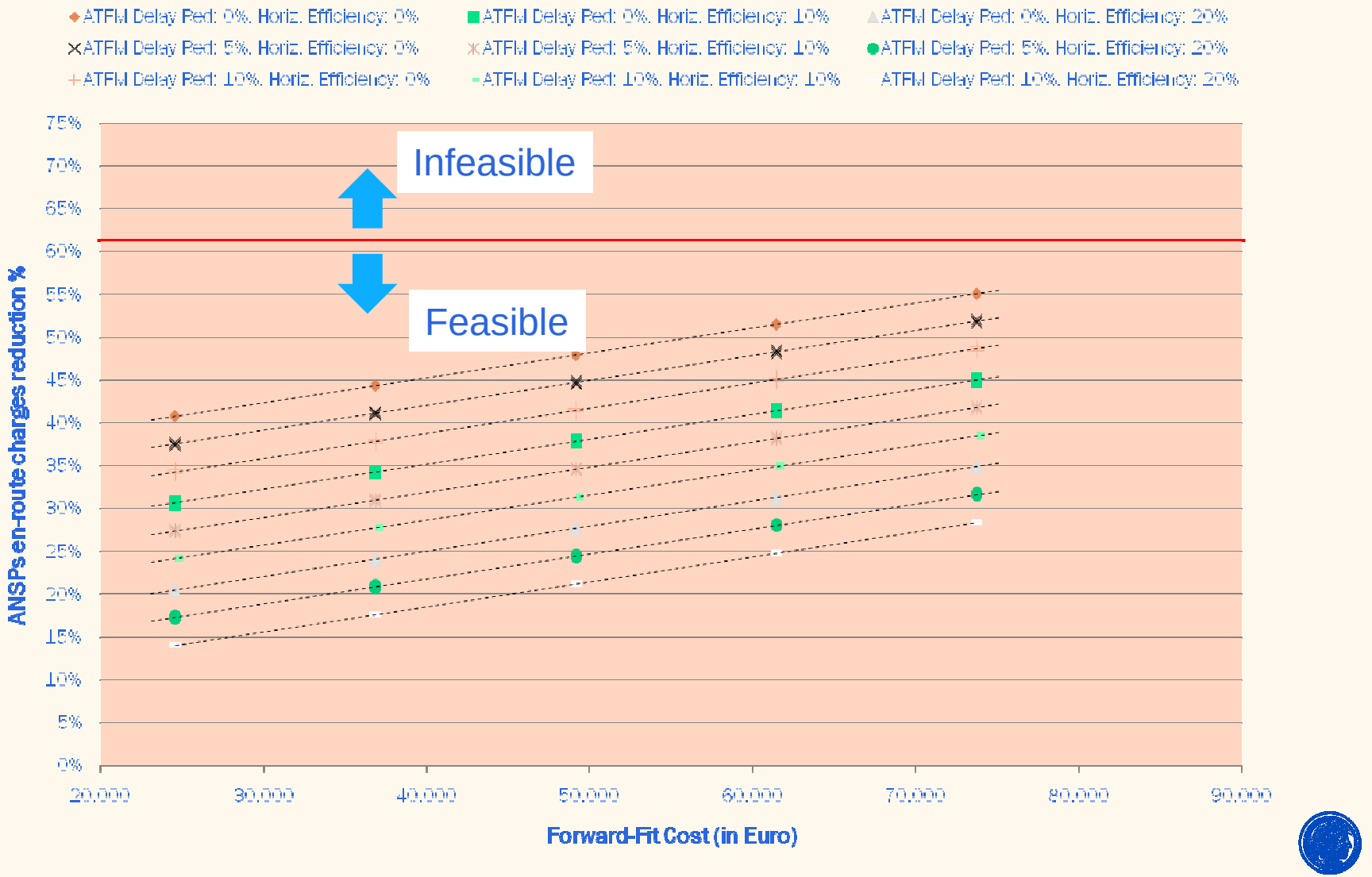
Scenario is **Viable** when En-route charges Are reduced by 36.7%

For **Worst Case FF-cost**: € 73728 & under **"Optimistic" System Performance** ATFM Delay Red %=10%, Horiz. Efficiency Gain%=20%, **Scenario Viable** when En-route charges are reduced by 10%

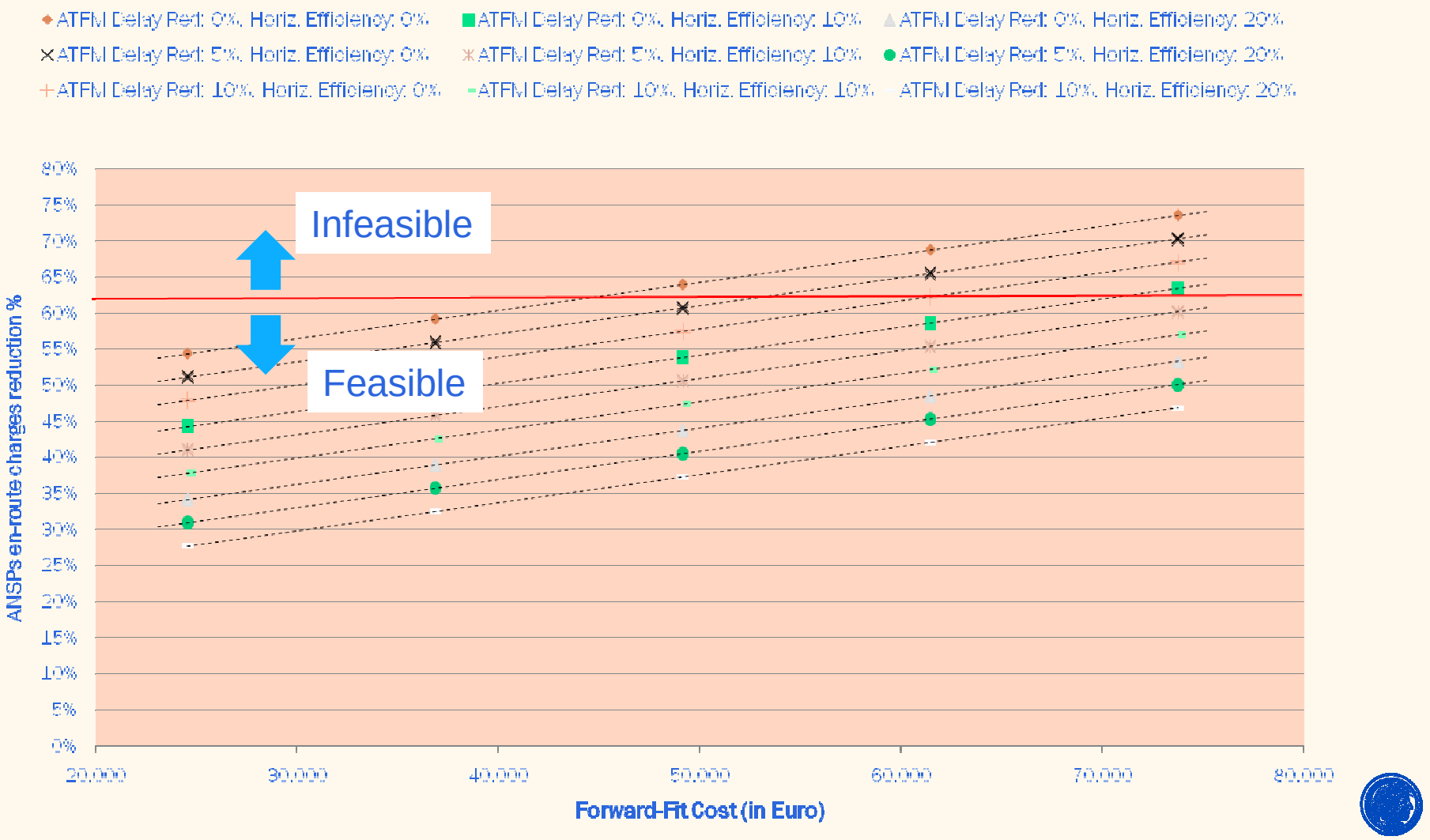
CBA Results for Airlines : B/C=1.2 (IRR: 9.7%)



CBA Results for Airlines : B/C=1.5



CBA Results for Airlines : B/C=2



Key Findings from CBA for Airlines

- As B/C increases, higher reduction of en-route charges is required for the same level of benefits (ATFM delay reduction & Flight Inefficiency Reduction)
- In the most pessimistic scenario (forward-fit Cost= €73728, ATFM delay reduction=0% & Flight Efficiency Gain=0%) the maximum B/C achieved is 1.68 (IRR: 13.3%)
- Viable B/C ratios can be achieved even if the FF Cost is underestimated by a factor 2-2.5 and system performance results to ATFM delay reduction=0% & Flight Efficiency Gain=0%

Building Analysis Scenarios for ANSPs

- **Uncertain Cost variables:**
  - *One-off Implementation Cost (Transition & Training Cost)*
- ***Uncertain Benefit Variables:***
  - *Operating Staff Cost Savings(%)*
  - *Operating non-staff cost savings(%)*
- **Analysis Scenarios Definition:**
  - Select B/C from 1 to 2
  - Determine combinations of values for Staff Cost Savings (%),Non-Staff Cost Savings (%), and one-off implementation cost

CBA Assumptions for ANSPs

- Analysis Time horizon: 2010-2035
- The (Transition cost/Training cost) ratio was assumed equal to 6
- En-route Staff Cost Reduction up to 70%
- Operating non-staff cost up to 5%

Key Findings from CBA for ANSPs

- The A^3 ConOps changes will have dramatic implications to the en-route ANSPs operations
- This will result to considerable reduction of operating (staff and non-staff) cost
- Transition and Training cost are expected to be the major cost elements for ANSPs
- Overall Service cost is expected to be significantly reduced

Building Combined Analysis Scenarios

- ANSPs en-route staff cost reduction affects En-route charges reduction
- Combined analysis scenarios aim to examine the economic implications to Airlines and ANSPs simultaneously
- Define Analysis Scenarios:
  - Select a B/C value
  - Determine alternative combinations of values for the Airlines and ANSPs uncertain Costs and Benefits Variables

Assumptions for Airlines-ANSPs CBA

- %En-route Staff Cost Reduction: 5%-70% (thus En-route ANSPs Charges Reduction 3.1%-43.4%)
- %Operating (non-staff) Cost Reduction:0%-5%
- Analysis Time Horizon: 2010-2035
- ATFM En-route Delay: 0%-10%

Results from Combined Scenarios: B/C=1.1

For **Worst Case** FF-cost=73728, Staff Cost Red%=10% (en-route charges reduction 6.2%)& ATFM delay reduction= 0%

Scenario is **viable** for Flight Efficiency Gain%=34%

For **Worst-case** FF-cost=73728, Staff Cost Red%= 60% (en-route charges reduction 37.2%), & ATFM delay reduction= 0%

Scenario **viable** for Flight Efficiency Gain%=4%

Concluding Remarks

- A^3 ConOps can be viable for the Airlines even when the operational performance (ATFM delay and Flight Inefficiency reduction) is very low.
- As expected A^3 ConOps will have substantial implications on the role and the staffing level of ANSPs
- On the basis of these results A^3 ConOps seems promising from an economic perspective and it should proceed to the next development stage
- The proposed method could be used to gain knowledge regarding the potential costs and benefits for both stakeholders

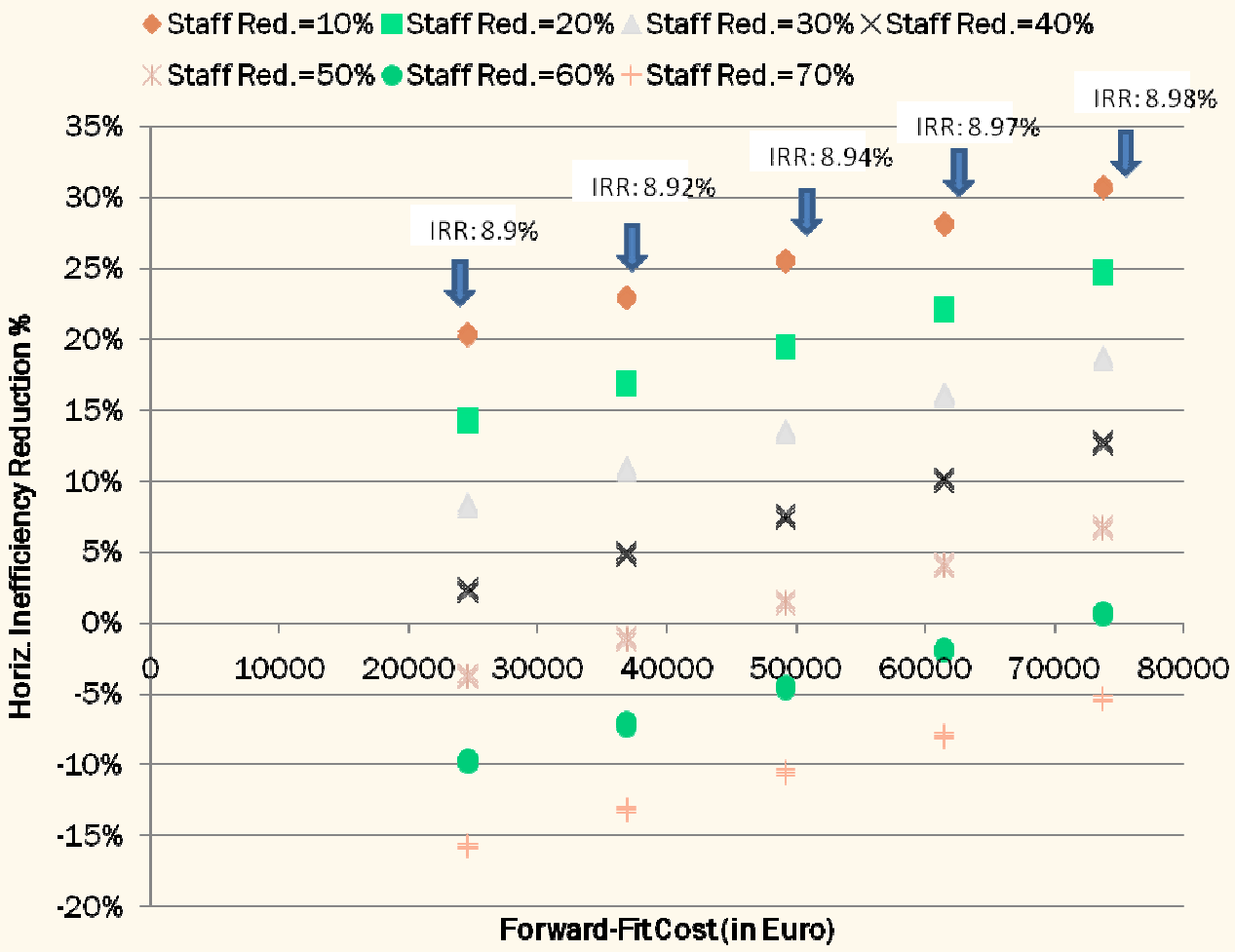
THANK YOU FOR YOUR ATTENTION

ANY QUESTIONS?

Input Data for CBA

Category of Variables	Variable	Input Value
	Discount Rate	8%
Time Variables	***This Year***	2010
	Benefit Start Year	2026
	Benefit End Year	2035
	Final Year	2035
	Implementation Duration	8 years
	Start Year	2013
	Pre-Impl. Start year	2013
	Pre-Imp duration	10 years
Baseline Variables	***Aircraft BL number***	16759 (2009)
	Aircraft Growth Rate (annual)	3%
	Annual Retirement Rate	2%
	BL Annual Flights	10.1 (2009)
	Average Flight Duration (min)	106
	BL Delay per flight TS	1,9 min
	S1 Horizontal BL Flight Path Inefficiency % (TS)	3.7%
	Vertical Flight Inefficiency	0.6% (of the jet fuel consumed per flight)
	Jet Fuel Price	655 €/mt
Cost Variables	***Forward-fit Cost***	€24576 (2010)
	Overall Annual Operating Cost	66.3 M€
	Airlines One-off Implementation cost (Training)	3.86 B€
	Total Pre-Implementation Cost	5.85 M€
Benefit Variables	***Cost per unpredictable Delay Minute***	89.76 €/min
	Cost per flight minute	69.77 €/min
	Incremental Efficiency Gain (%)	0%
	Incremental Delay Reduction	0%

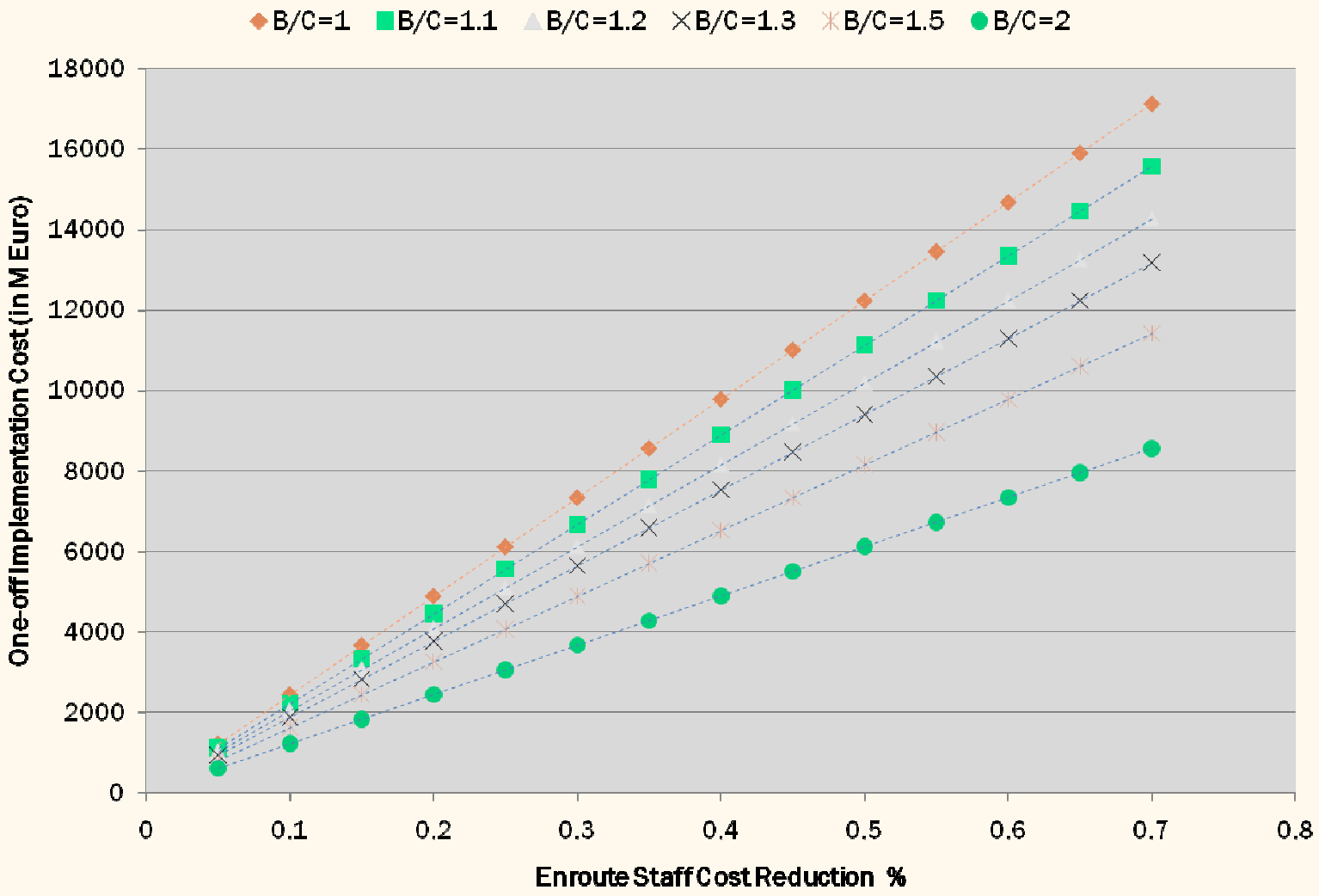
Results from Combined Scenarios: B/C=1.1 (II)



ATFM delay reduction= 5%

Staff Cost Reduction %	One-Off Implem. Cost (in Million €)
10	2224.07
20	4448.15
30	6672.23
40	8896.31
50	11120.39
60	13344.47
70	15568.55

CBA Results for ANSPs: Operating Cost Red 0%



CBA Results for ANSPs: Operating Cost Red 5%