

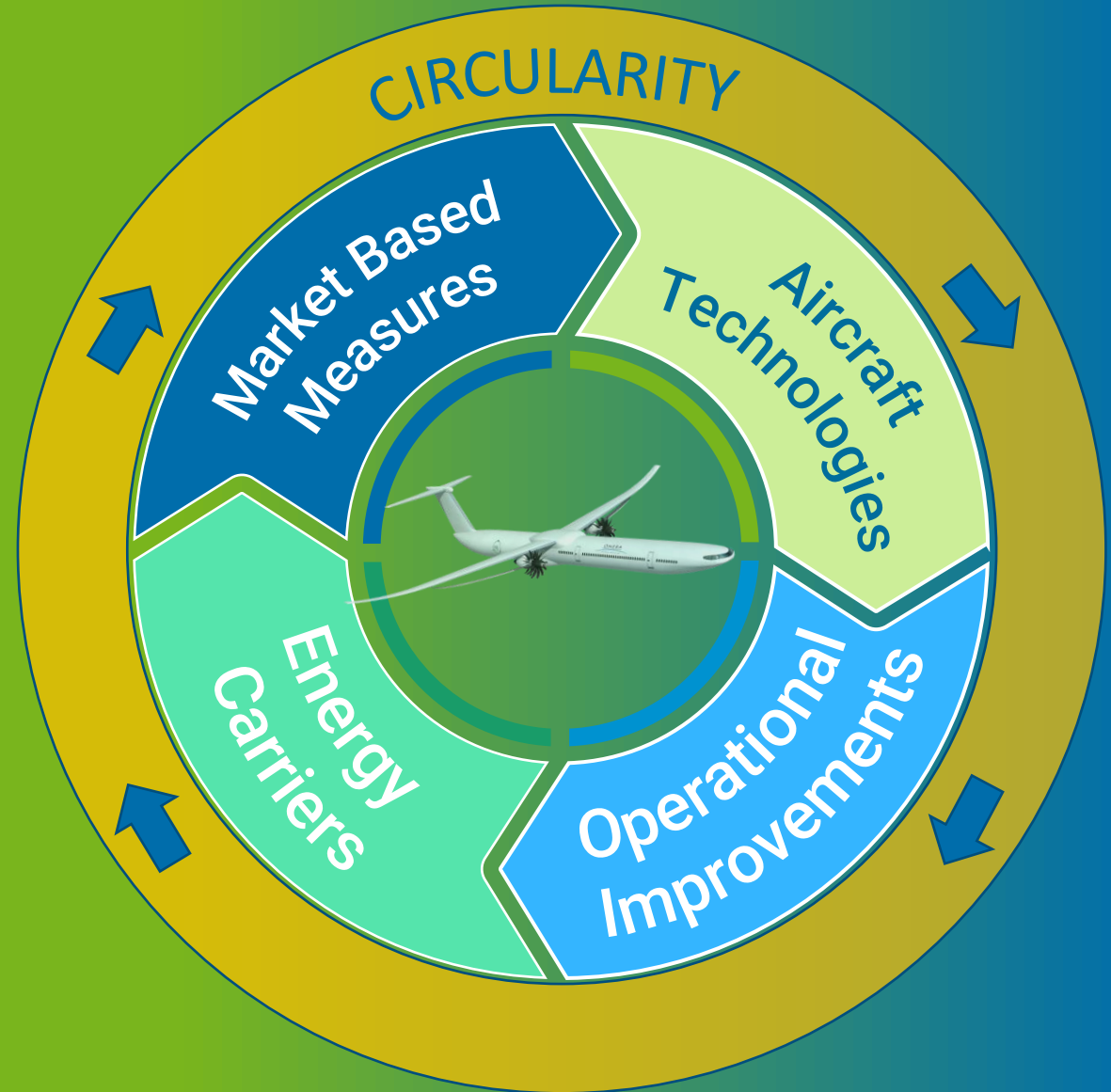


# Circular Economy & New Technology solutions for Clean Aviation



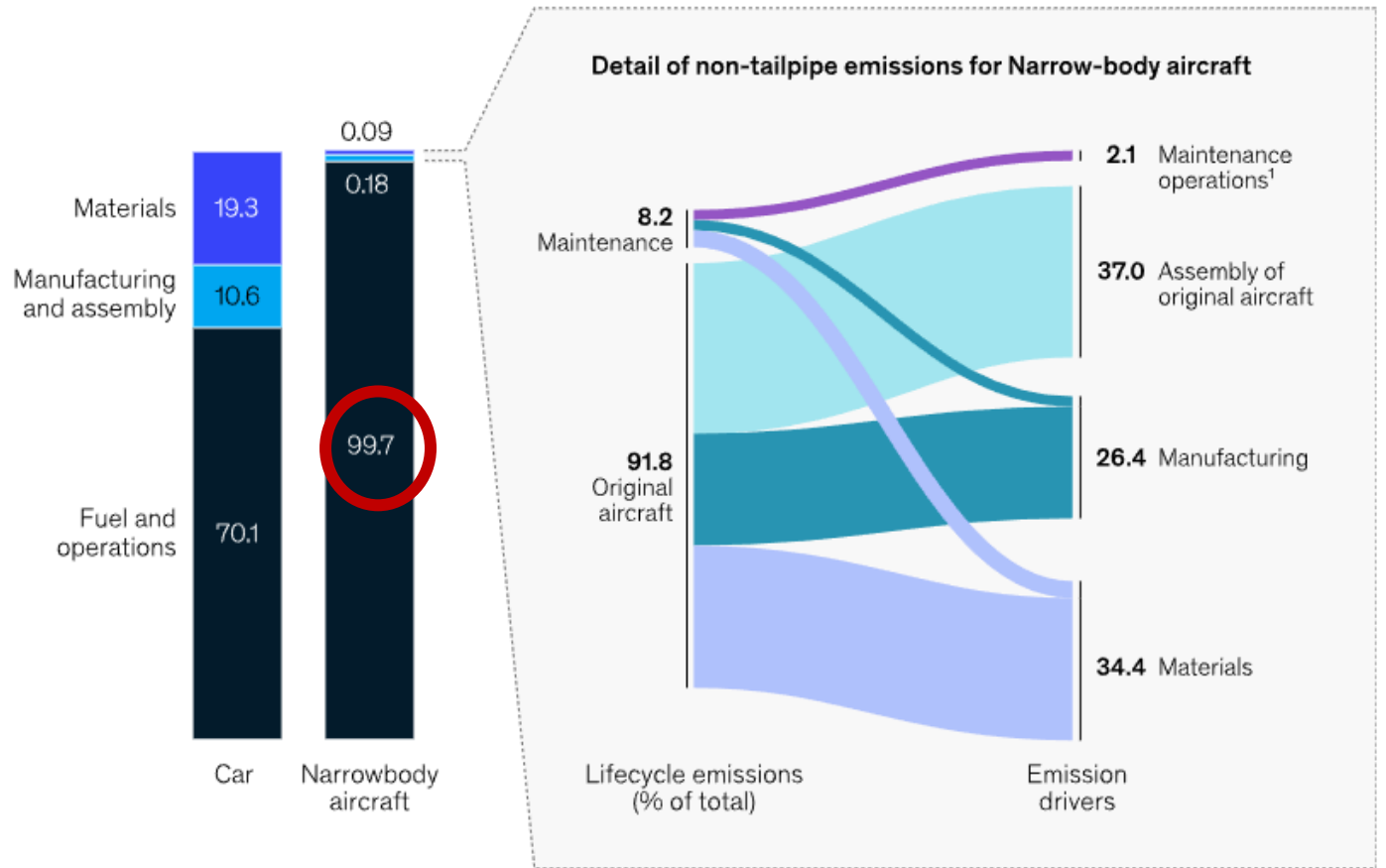
**Axel KREIN**  
*Executive Director*

# A virtuous circle towards a climate friendly aviation



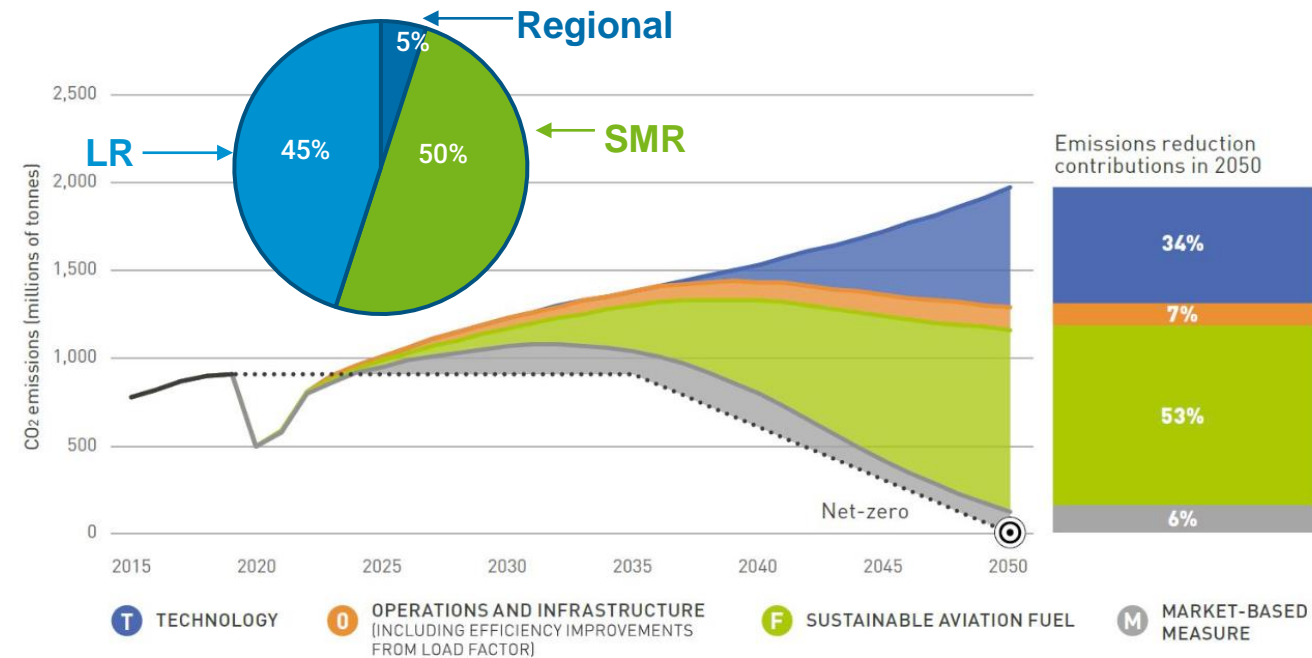
# Fuel-related CO<sub>2</sub> emissions account for 99% of total lifecycle emissions

Lifecycle emissions of a car versus a narrowbody aircraft (both powered by fossil fuels)  
% of total lifecycle CO<sub>2</sub> equivalent



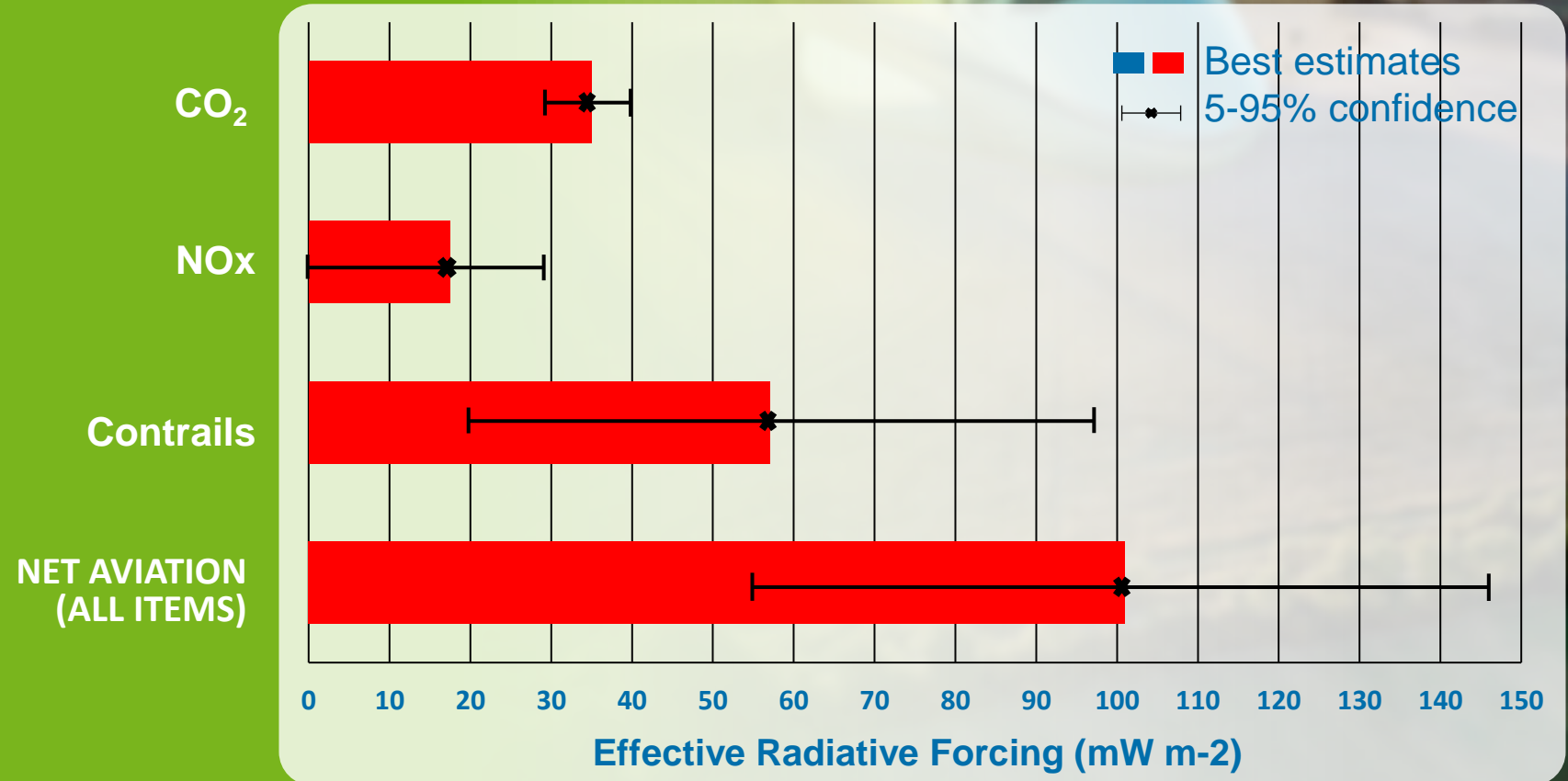
# Technology & SAF (PtL & H<sub>2</sub>) together will trigger disruption

Share of CO<sub>2</sub> emissions in 2019












# Climate impact is **NOT ONLY** about CO<sub>2</sub>

## GLOBAL AVIATION EFFECTIVE RADIATIVE FORCING (ERF) TERMS (1940 TO 2018)



# PtL SAF and H2 vs kerosene

	Environmental IMPACT			Cost		Sust. Energy Demand
	CO <sub>2</sub> 	NOx 	Contrails 	 Fuel price from 2035	 Aircraft & Airports	
 PtL SAF	Net 0	=	↓	↑	=	↑ ↑
 H2 Direct burn	0	=	?	↓	↑ ↑	↑
 H2 Fuel Cell	0	0	?	↓	↑ ↑	↑

# Clean Aviation stands for disruptive technologies & innovations



Short Medium Range  
aircraft



Hybrid Electric  
aircraft

**-30%**  
GhG  
reduction

Aircraft Entry  
into Service  
**2035**

**75%**  
Fleet  
replacement  
by 2050

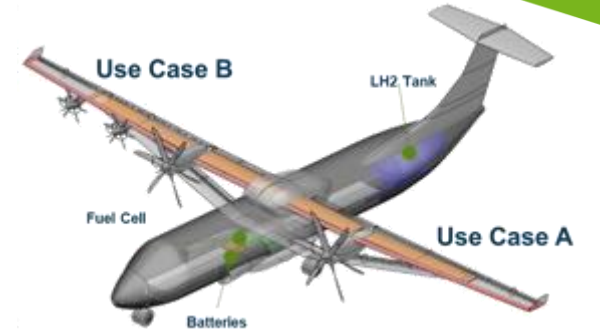
Exploiting  
**synergies**  
within Europe

# HER Clean Aviation concepts

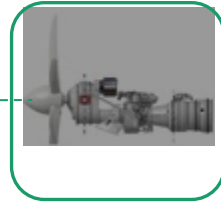


TRL3 by 2024  
TRL4 by 2026

**-50%**  
Block Fuel



PROPULSION



HE-ART



AMBER



NEWBORN

WING



HERWINGT

SYSTEMS



THEMA4HERA



HECATE

LH2 STORAGE



H2ELIOS

CERTIFICATION & DIGITALIZATION







# SMR ACAP Clean Aviation concepts



TRL3 by 2024  
TRL4 by 2026



TRL2 by 2024  
TRL3 by 2026



## PROPULSION



HEAVEN



SWITCH



OFELIA



CAVENDISH



HYDEA

## WING



UPWING

## FUSELAGE



FASTER H2



H2ELIOS

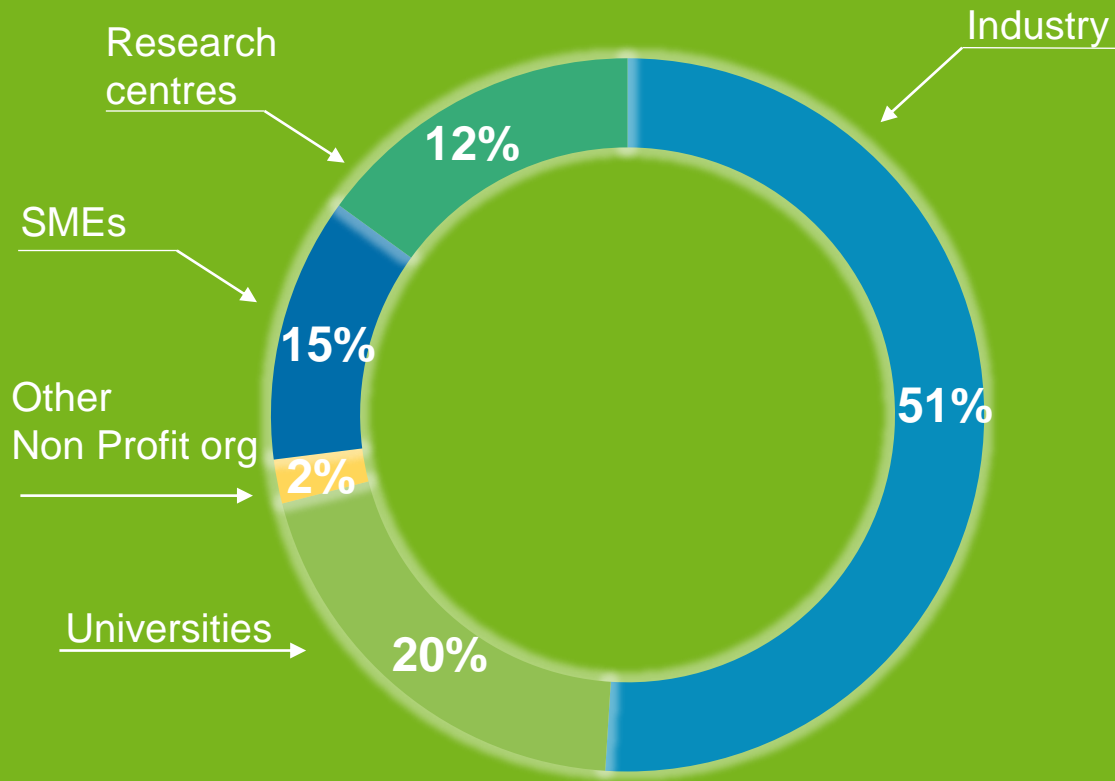
## LH2 STORAGE

## CERTIFICATION

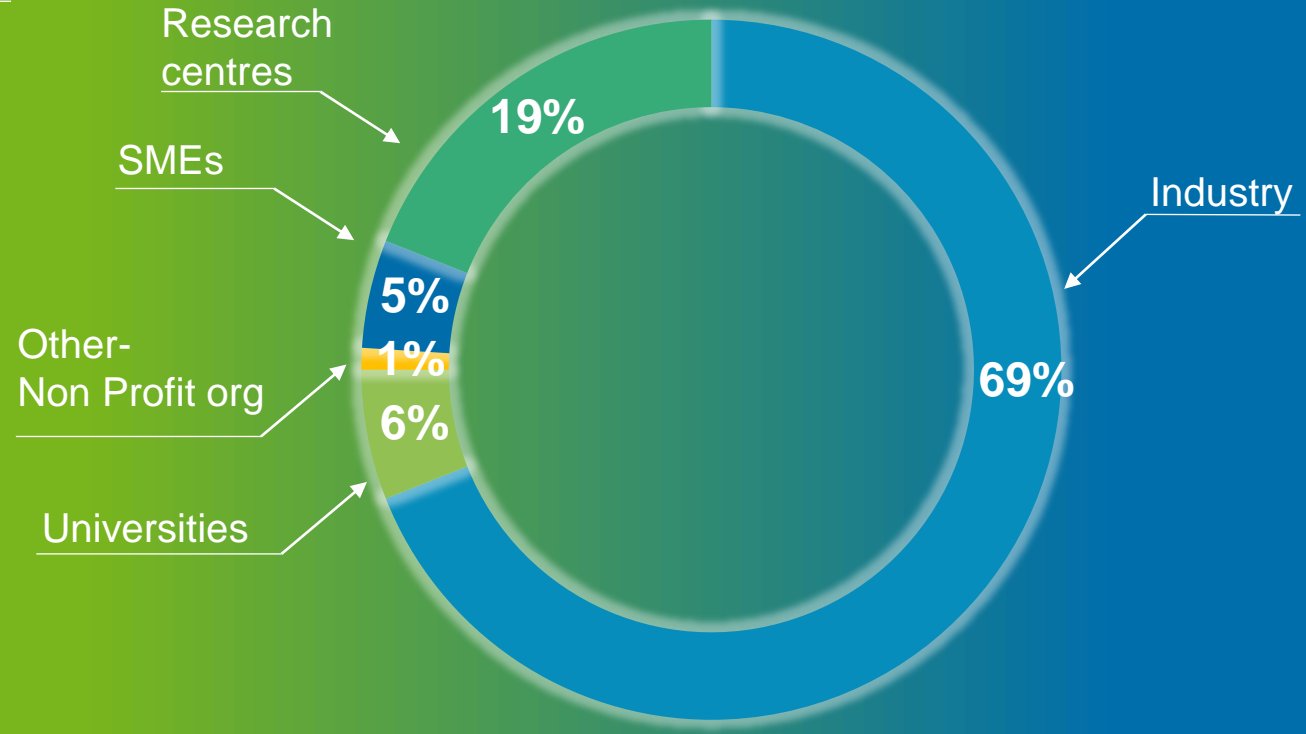


# Participation in Clean Aviation Call 1 & 2

Participation in funded projects  
278 participants



Share of budget for all participations  
EU Funding 810 millions €



# Circular economy in aviation



1

Eliminate waste & pollution

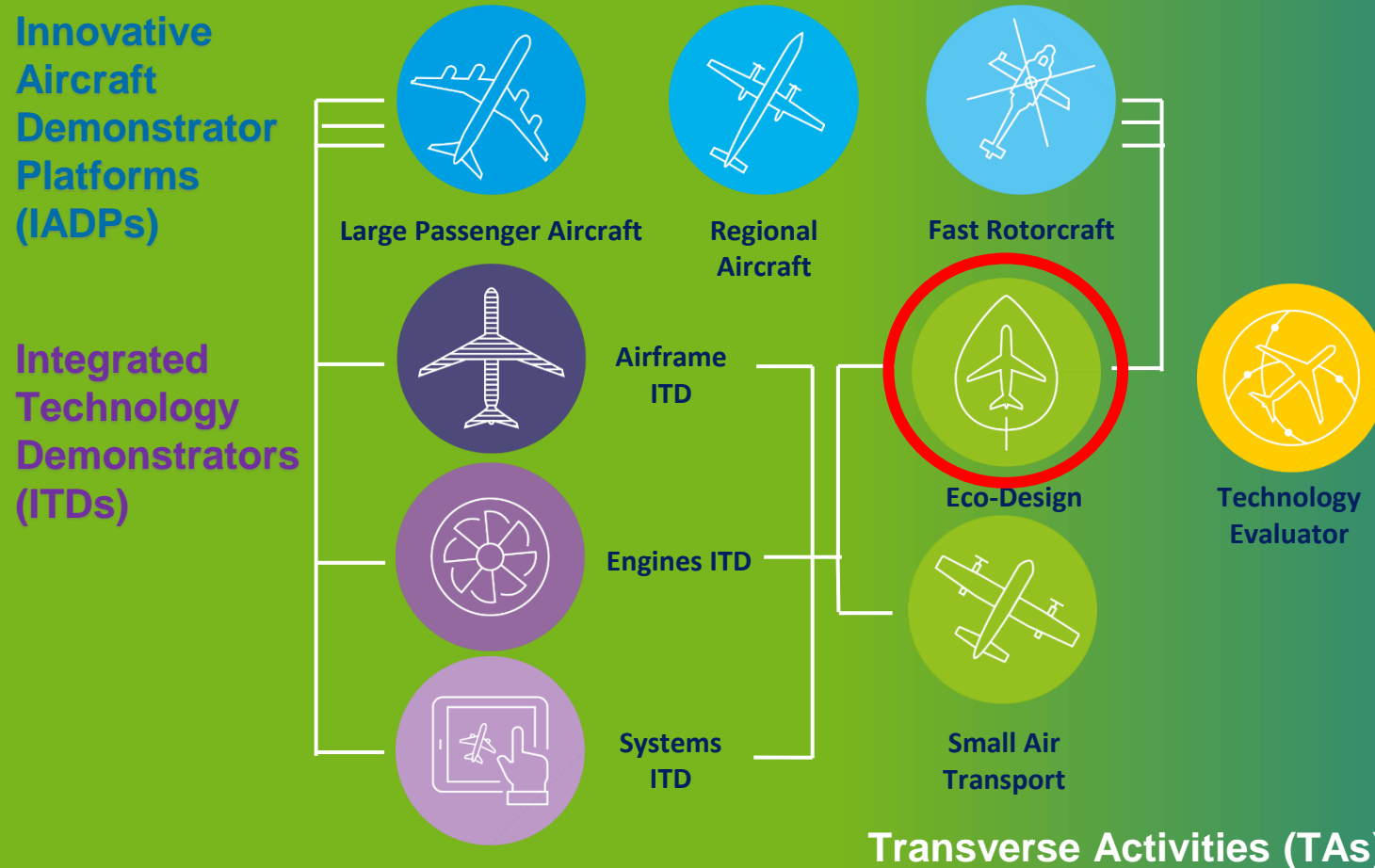
2

Circulate products & materials  
at their highest value

3

Regenerate nature

# Integration of Eco-Design: a major achievement of Clean Sky 2



# HAIRMATE: healthy & hybrid Aircraft Seating Moulds



Simple seat design  
composed of 5 parts, easily  
recyclable due to a single polymer



An innovative process to  
manufacture and test a new  
seating structure

# SPARTA: Scrap of thermoplastic composites materials

Solution to advance towards sustainable recycling by obtaining:

- **New high-quality thermoplastic composite products**, manufactured with recycled materials, in which up to 80% of the waste is used
- **Production cost approx. 20% lower** than in current mechanical recycling and scrap reprocessing due to the reduction in the number of operations and the automation of manufacturing processes.



**80%**  
Material  
Recovery



**-30%**  
CO<sub>2</sub> reduction



**-20%**  
cost reduction



# Re-INTEGRA: Innovative End of Life for recycling integral welded Aerostructures

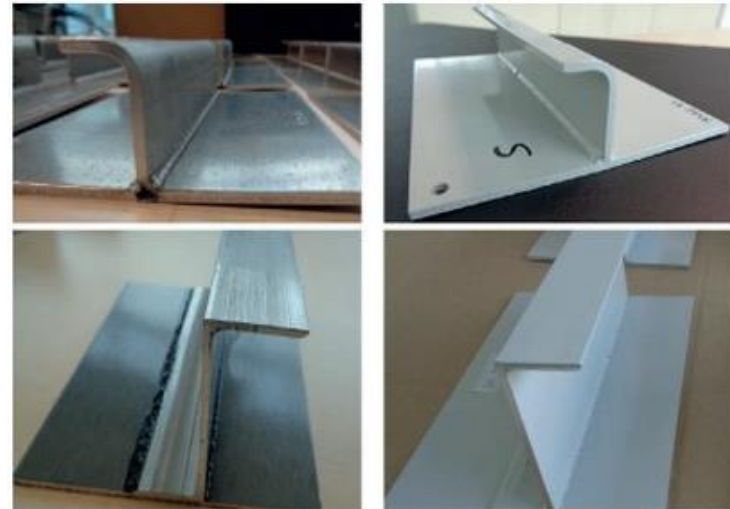
84%

Recovery of  
alloy elements



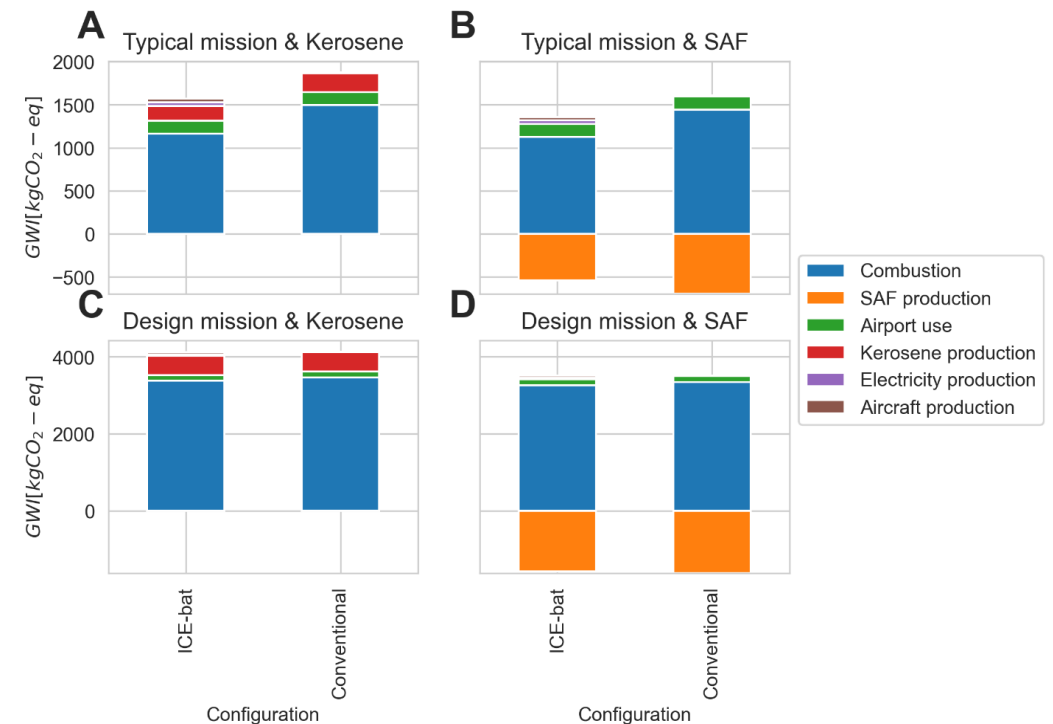
## ENVIRONMENTAL OBJECTIVES

- **Valorise old scrap** to obtain premium quality aeronautical grades and avoid downcycling
- **Reduction of CO2 emissions** in the manufacture of fuselage panels
- **Provide designers with a smart tool** to support future eco-design best suitable type of coatings, welding fillers & technologies



# GENESIS: Gauging the ENvironmental Sustainability of electric aircraft Systems

- **Full LCA performed** – including end-of-life for batteries, fuel cells and all other elements
- **Technological roadmap** for short, medium and long term scenarios (with different battery types, fuels, materials, etc.)
- Data are available on **OPEN SOURCE**





# Clean Aviation

## Workshop: Recycling in Aviation

16-17 November  
Valencia, Spain



Recycling in Aviation

Clean Aviation Workshop  
November 16th – 17th, 2023  
Paterna, Valencia

# Powering partnerships and synergies in Europe

FROM CLEAN SKY 2

TO CLEAN AVIATION



Clean Hydrogen  
Partnership



The region of Occitanie,  
France



The region of Campania,  
Italy

# Call to Action

Sustainable  
Aviation:  
**GhG**  
&  
**Circularity**

The window of  
opportunity for  
impact  
is **NOW!**

New forms of  
**Collaboration**  
& **Partnerships**  
are essential!





Co-funded by  
the European Union

**Thank you**

[www.clean-aviation.eu](http://www.clean-aviation.eu)

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