

Clean Sky: Europe's sustainable aviation programme

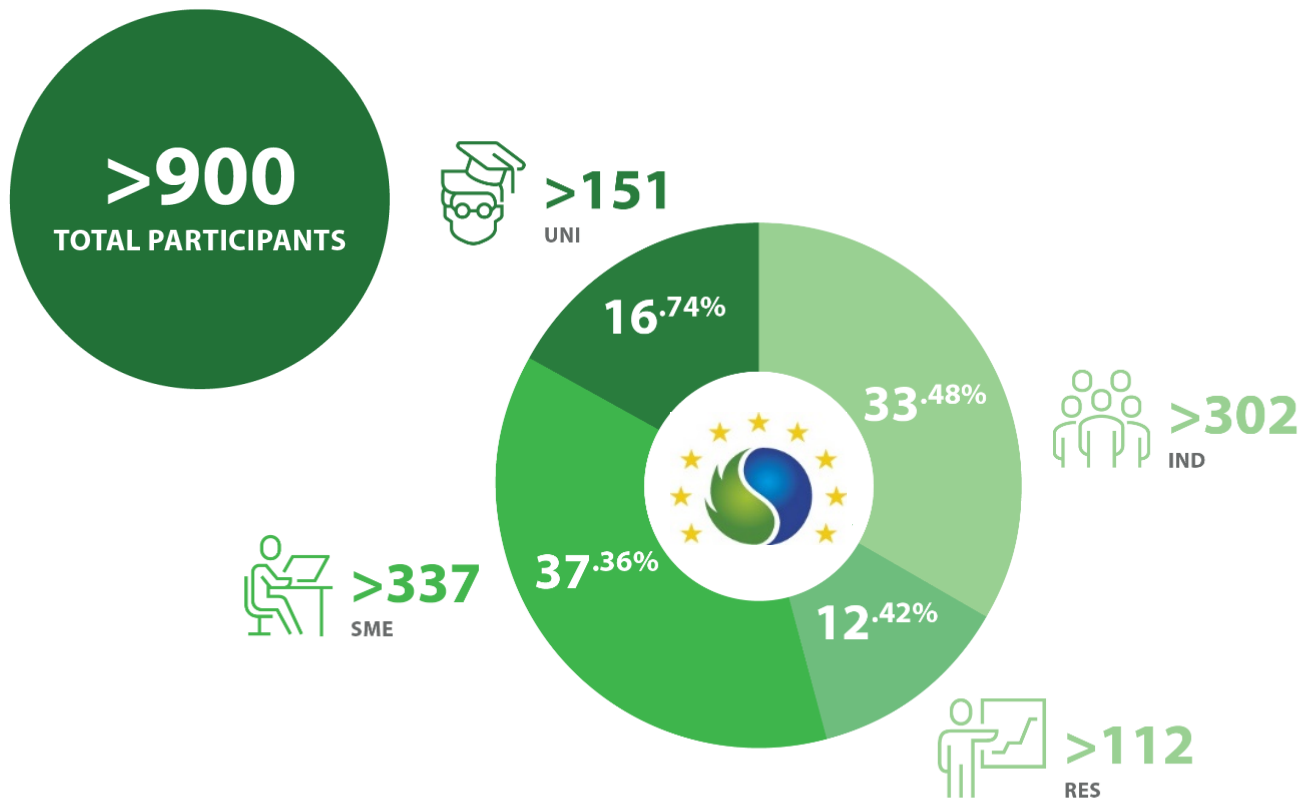
Axel Krein

Executive Director, Clean Sky

*Innovair Annual Conference
29 October 2020*



Clean Sky 2: an open and inclusive PPP



- €4 billion Public-Private Partnership Programme
- Large SME participation with a high percentage of SMEs being first-time EU programme participants
- Broad geographical spread and widening of aeronautics sector
- Newcomers from other sectors providing key innovation impetus (e.g. automotive)



Clean Sky = an efficient and high-performing EU-wide eco-system



Clean Sky 2: major demonstrators

Breakthroughs in Propulsion Efficiency



Very High Bypass Ratio (VHBR) Large Turbofan
TRL 6 - 2023



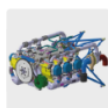
Ultra-High Propulsive Efficiency (UHPE)
TRL 5+ - mid-2022



Advanced Geared Engine Configuration (HPC and LPT technology demonstration)
TRL 5 - 2023



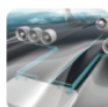
Business aviation / short range Regional Turboprop
TRL 5 - 2022



Light weight and efficient Jet-fuel reciprocating engine [Small Aero-Engine]
TRL 6 - 2019



Reliable and more efficient operation of small turbine engines [Small Aero-Engine]
TRL 6 - 2019

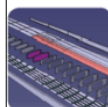


Hybrid Propulsion Ground Test Bench
2020



Novel Aircraft Configuration & Scaled Flight Test
2021

Advances in Wings and Aerodynamics



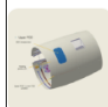
Adaptive Wing Integrated Demonstrator Flying Test Bed
2022



Integrated Wing Technologies Flying Test Bed
2020 & 2023



Advanced Laminar Flow on Wings and Empennage



Laminar Nacelle Virtual
TRL 5 - 2019

Future Cockpit and Flight Guidance Systems



Disruptive Cockpit Demonstrator (Function preparation test)
2023



Active Regional Cockpit
2020



BizJet Enhanced Cockpit Concept
2022



Avionics for Extended Cockpit Demonstrator -
2020



Affordable SESAR Compliant cockpit for Small Aircraft

Novel Aircraft Configurations

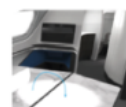


NextGenCTR demonstrator - Next Generation Civil



RACER - Rapid And Cost-Effective Rotorcraft

Optimal Passenger Environment

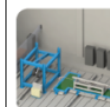


Full Scale Mock-up of Business Jet Office Centered Cabin
2021

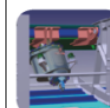


Innovative Cabin & Cargo Systems Technologies
2021

More Electric Aircraft & Systems



Regional Aircraft 'Iron Bird' Systems Integration - 2021



Innovative Electrical Wing - 2021



Electric Drive Landing Gear System [E-LDG]



Advanced Electrical Environmental Control System [E-ECS] Demonstrator



Full Chain demonstration: Electrical power generation, distribution and usage

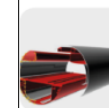
Innovative Structures and Production Systems



Advanced Rear End Demonstrator
2023



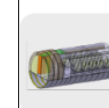
Functional Cabin & Cargo Demonstrator of new integrated systems



Next Generation Multifunctional Fuselage Demonstrator automated cabin assembly & structure integration



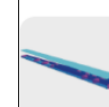
Advanced Lower Center Fuselage Demonstrator



Regional Aircraft Fuselage / Pax Cabin Integrated Demonstrator



Affordable aerostructures for Small Air Transport



Advanced Small Aircraft Wing Box in Out-of-Autoclave CFRP
2020



A PPP delivering on its commitments



Spotlight on Sweden

- 15 participants in 30 projects
- Saab and GKN as Members
- 2 MoUs signed in Feb 2016: Västra Götaland & Östergötland

REPLAB – process development for laser-based methods for additive manufacturing

FIA – a flexible automation cell for low volume manufacturing, to be used for the manufacturing of GKN's lightweight structural engine parts

Additive manufacturing lab - new powder bed electron beam 3D-printer, located at PTC Trollhättan for 3D printing in metal

SVIFT – setting up and developing 'Aerospace Cluster Sweden' for SMES

Innovative Materials Arena – hub for knowledge exchange and innovative collaboration projects

Additive coordination in East central Sweden (ACES) - a collaborative platform for additive manufacturing development

Collaboration activities with Brandenburg (advanced materials) and Campania (aerospace)

Internet of Things Hub Sweden

Digitisation coordinator for 3D printing/AM, linking Teknikcollege, the academy, Region Östergötland, Innovative Material Arena, Visual Sweden and industry



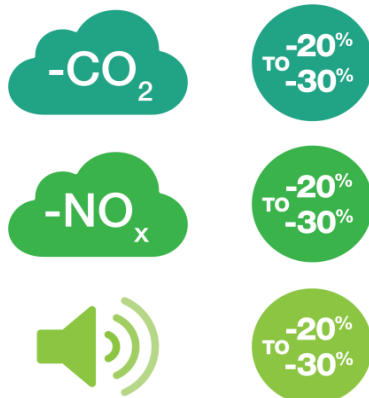
Impact of COVID-19

- Huge impact on entire global aviation sector
- Immediate actions taken by Clean Sky:
 - Call 11 deadline deferred
 - Release of pre-financing and payment for projects was accelerated
 - Timelines for projects experiencing COVID-19 related difficulties were amended
 - New ways of working for business continuity
- Manageable initial delay (approx. 4 months) to Clean Sky 2 programme
- Detailed impact and recovery analysis ongoing



European aviation for a green recovery

Clean Sky 2 Environmental Objectives



vs. best aircraft in 2014



Difficult times present us with new opportunities...
The Green Deal: climate neutrality and EU competitiveness



Private stakeholder's Shared Vision and Commitment for the proposed Clean Aviation Partnership



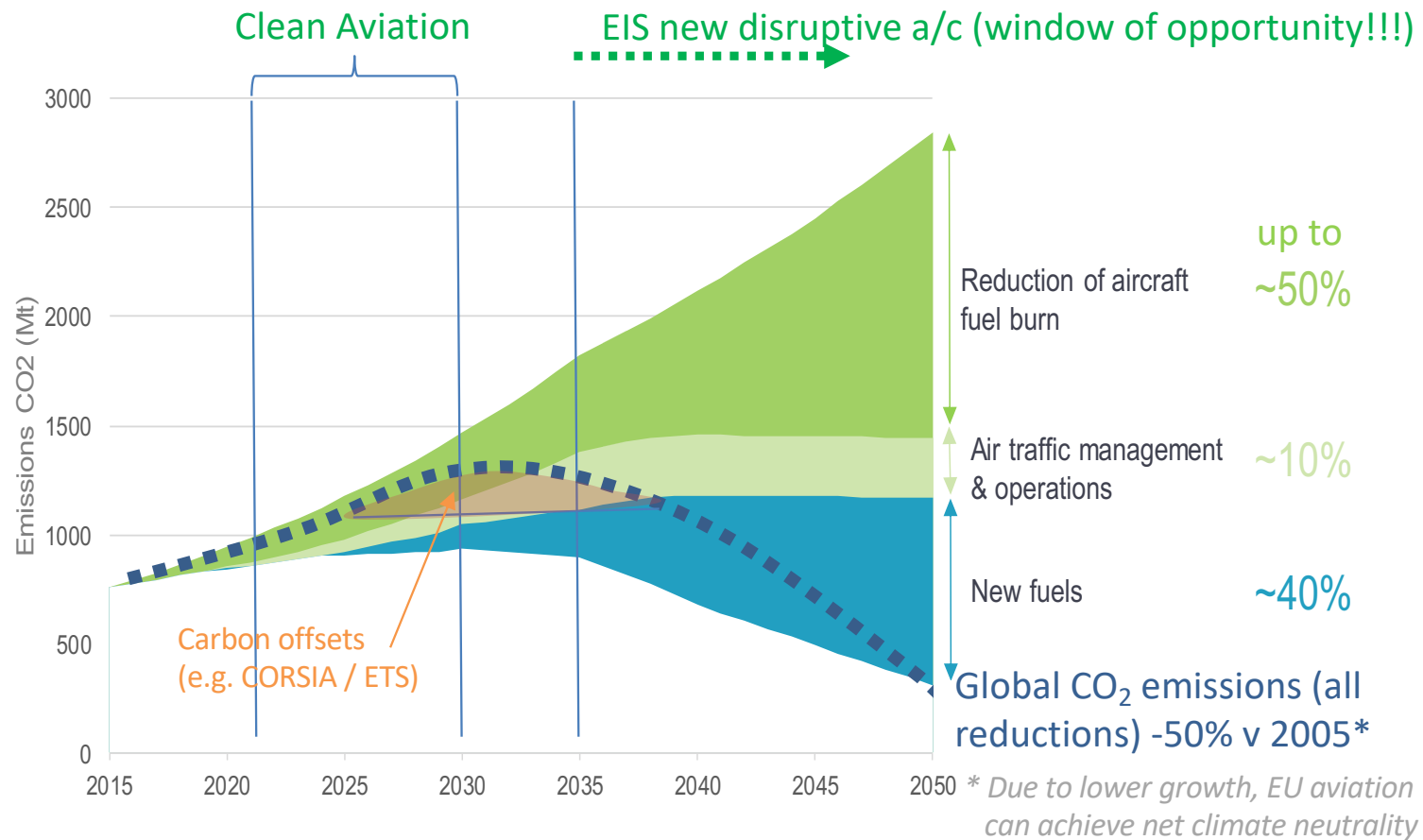
University of Stuttgart
Germany



A Shared Vision: climate-neutral aviation by 2050



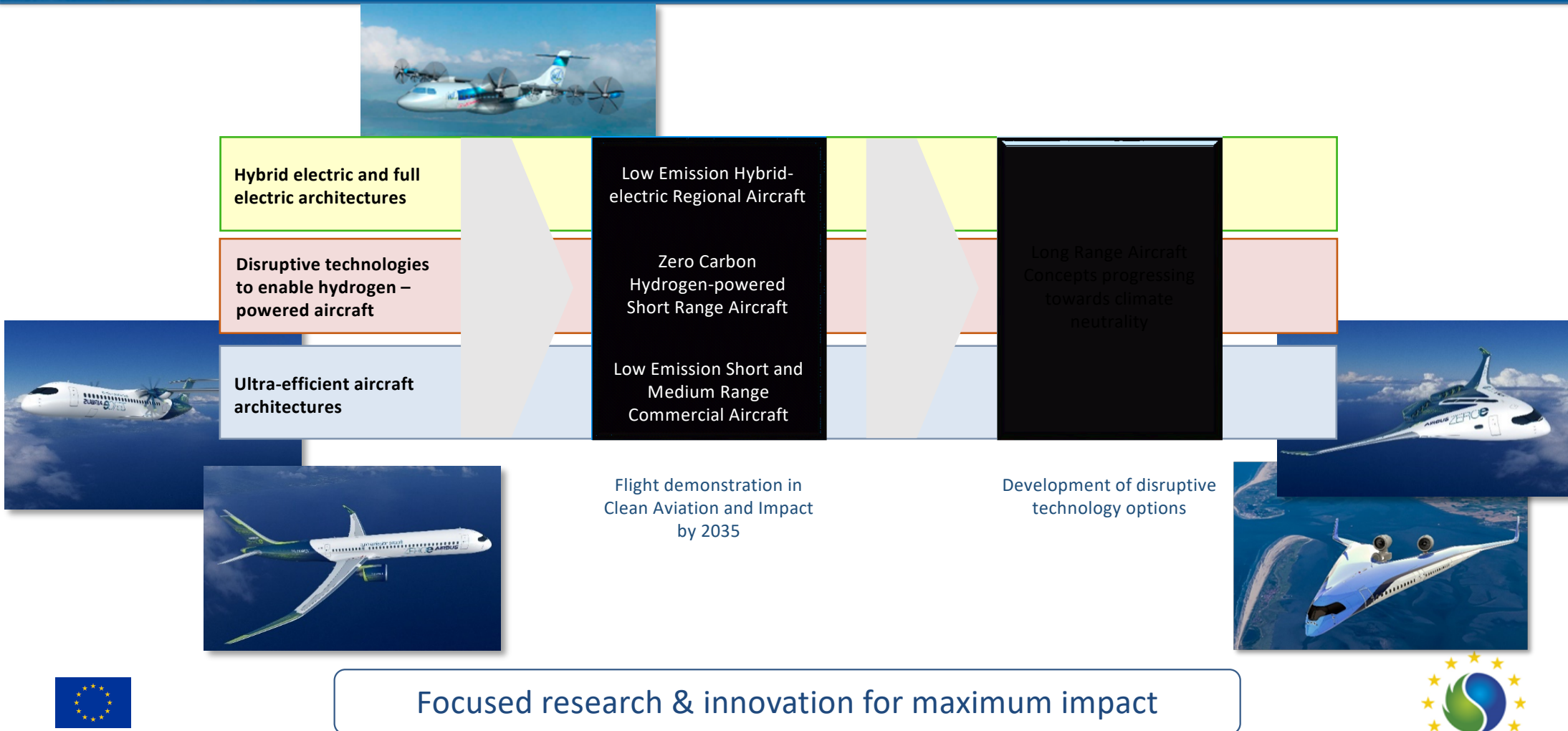
Worldwide CO₂ reduction targets and change drivers



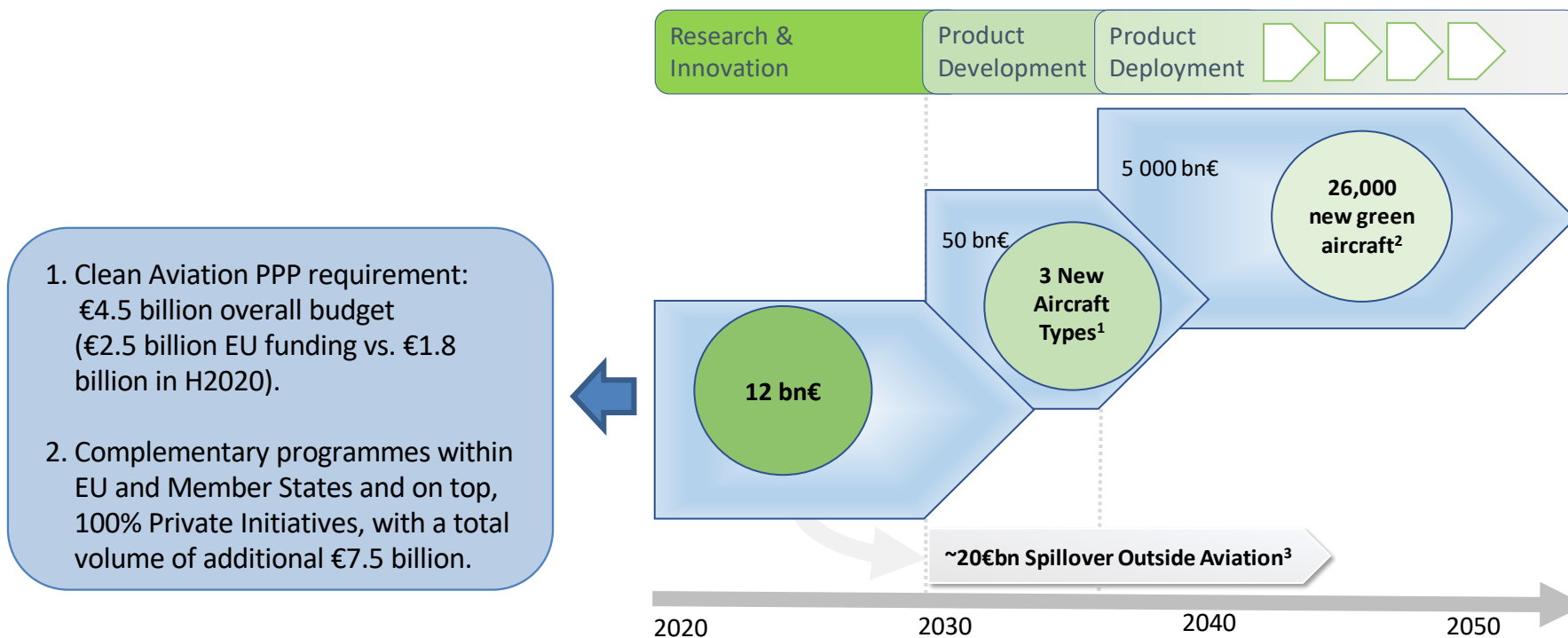
Target: climate-neutral aviation for Europe by 2050



Proposed Clean Aviation demonstration of disruptive aircraft concepts



Impact dimension of Clean Aviation



- 1 – Based on Aircraft Development 15bn€ per type
 2 – Estimated on basis of Airbus GMF 2028-2037: 37,400 new a/c scaled to 2035-2050 in order to reflect larger baseline in 2035. 50% market share assumed.
 3 – Estimate based on 12€bn investment in aviation R&T over 10 yrs. Value at 2020 NPV.



Research & innovation will trigger huge further investments



Clean Sky and Clean Aviation Partnerships

- Clean Sky: an efficient and high-performing EU-wide eco-system
- European Commission priorities for 2021-2027 (e.g. Green Deal, COVID-19 recovery)
- Clear and extremely ambitious sector-wide commitment to achieve a climate-neutral aviation in 2050, while ensuring EU's competitiveness
- Revolution in technology development and its fast and widespread deployment is mandatory
- A Clean Aviation PPP ensures teaming and brings research and policy together → **impact**
- Impact will assure European aviation is fit for the future and a global leader
- Effective regulations and an appropriate financial framework will enable synergies, setting global standards and secure EU's aviation strategy (window of opportunity!)





Engage with us!

Stay updated on www.cleansky.eu

Find us on:



Twitter



LinkedIn



Flickr



YouTube

