

Innovation takes off: towards the de-carbonisation of aviation

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Clean Sky*

*Aviation Forum
Vienna Austria*

17 October 2019



Clean Sky 2: tackling key environmental challenges

Environmental Objectives*



TO -20%
-30%



TO -20%
-30%



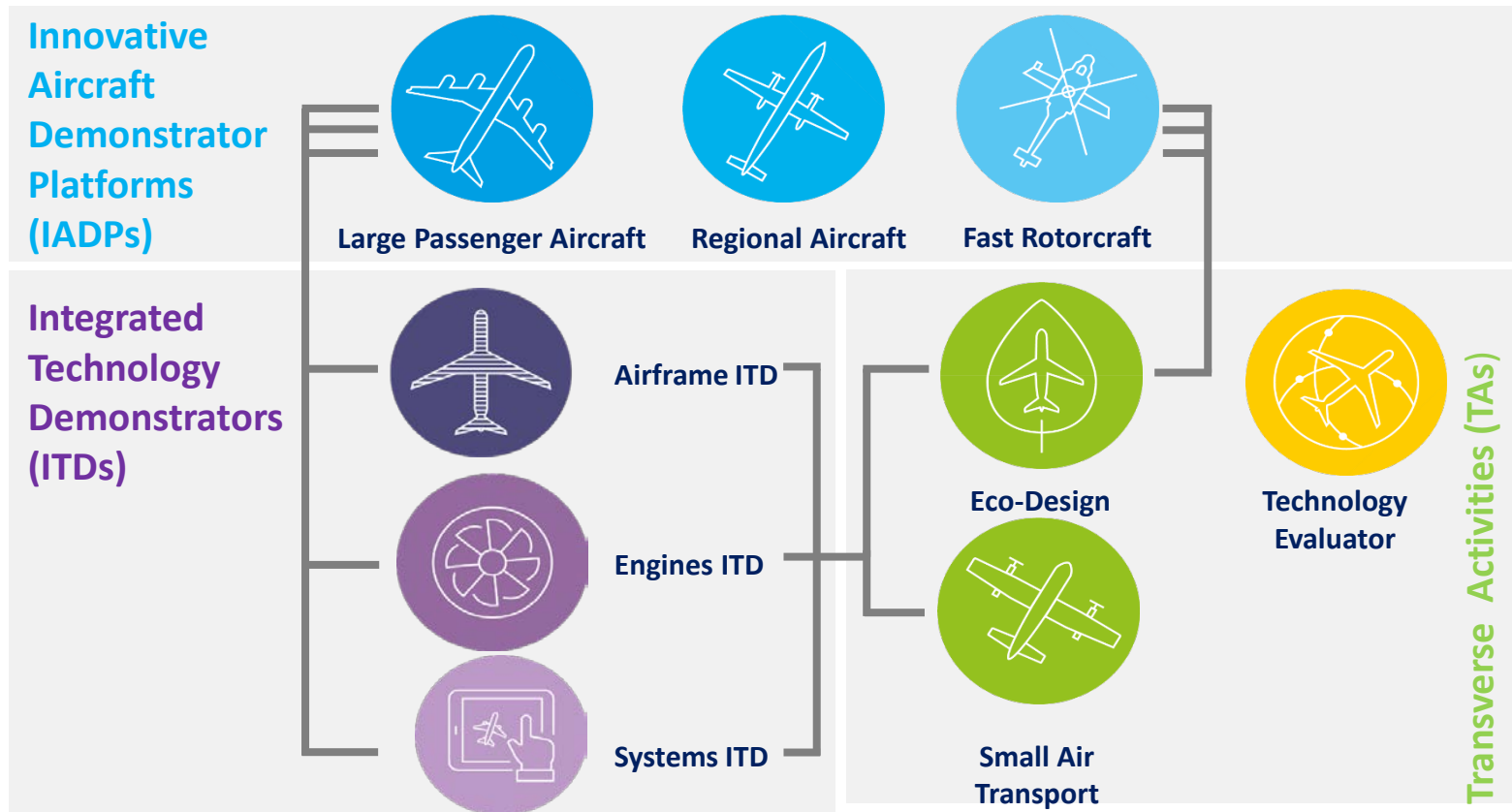
TO -20%
-30%

* vs today's best aircraft



...while building industrial leadership and ensuring mobility

CS2: an integrated programmatic approach



CS2: an impressive ecosystem in place



334

INDUSTRY MEMBERS



420

SMEs



373

RESEARCH CENTRES



350

UNIVERSITIES



28

COUNTRIES



110

REGIONS



466

GRANTS

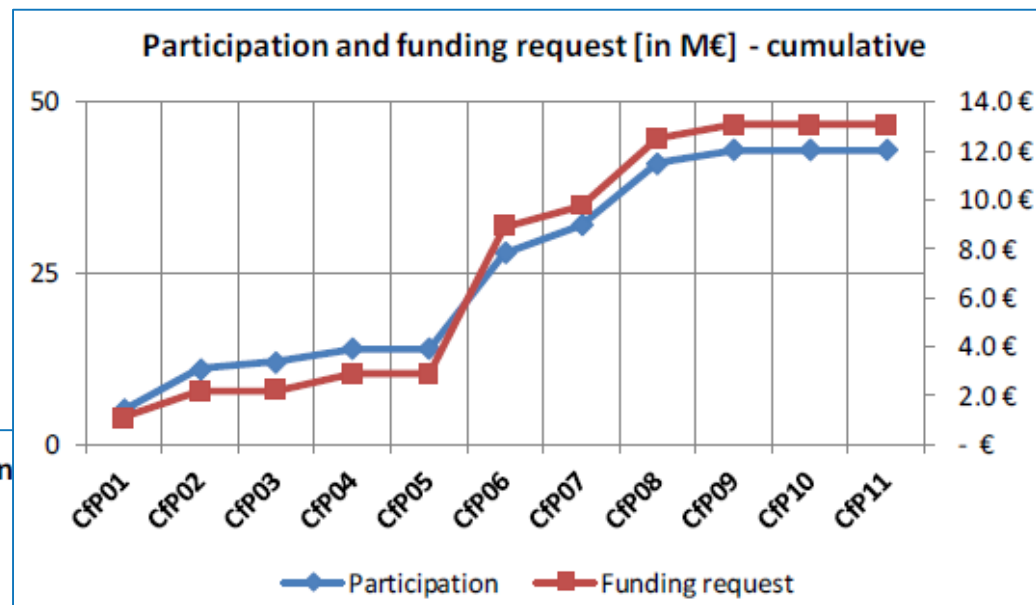
CS2: major demonstrators

Breakthroughs in Propulsion Efficiency	Advances in Wings and Aerodynamics	Innovative Structures and Production Systems	Future Cockpit and Flight Guidance Systems	More Electric Aircraft & Systems
<div>  <p>Very High Bypass Ratio (VHBR) Large Turbofan TRL 6 - 2023</p> </div> <div>  <p>Ultra-High Propulsive Efficiency (UHPE) TRL 5+ - mid-2022</p> </div> <div>  <p>Advanced Geared Engine Configuration (HPC and LPT technology demonstration) TRL 5 - 2023</p> </div> <div>  <p>Business aviation / short range Regional Turbo-prop TRL 5 - 2022</p> </div> <div>  <p>Light weight and efficient Jet-fuel reciprocating engine [Small Aero-Engine] TRL 6 - 2019</p> </div> <div>  <p>Reliable and more efficient operation of small turbine engines [Small Aero-Engine] TRL 6 - 2019</p> </div> <div>  <p>Hybrid Propulsion Ground Test Bench 2020</p> </div> <div>  <p>Novel Aircraft Configuration & Scaled Flight Test 2021</p> </div>	<div>  <p>Adaptive Wing Integrated Demonstrator Flying Test Bed 2022</p> </div> <div>  <p>Integrated Wing Technologies Flying Test Bed 2020 & 2023</p> </div> <div>  <p>Advanced Laminar Flow on Wings and Empennage</p> </div> <div>  <p>Laminar Nacelle Virtual TRL 5 - 2019</p> </div>	<div>  <p>Advanced Rear End Demonstrator 2023</p> </div> <div>  <p>Functional Cabin & Cargo Demonstrator of new integrated systems</p> </div> <div>  <p>Next Generation Multifunctional Fuselage Demonstrator automated cabin assembly & structure integration</p> </div> <div>  <p>Advanced Lower Center Fuselage Demonstrator</p> </div> <div>  <p>Regional Aircraft Fuselage / Pax Cabin Integrated Demonstrator</p> </div> <div>  <p>Affordable aerostructures for Small Air Transport</p> </div> <div>  <p>Advanced Small Aircraft Wing Box in Out-of-Autoclave CFRP 2020</p> </div>	<div>  <p>Disruptive Cockpit Demonstrator (Function preparation test) 2023</p> </div> <div>  <p>Active Regional Cockpit 2020</p> </div> <div>  <p>BizJet Enhanced Cockpit Concept 2022</p> </div> <div>  <p>Avionics for Extended Cockpit Demonstrator - 2020</p> </div> <div>  <p>Affordable SESAR Compliant cockpit for Small Aircraft</p> </div>	<div>  <p>Regional Aircraft 'Iron Bird' Systems Integration - 2021</p> </div> <div>  <p>Innovative Electrical Wing - 2021</p> </div> <div>  <p>Electric Drive Landing Gear System [E-LDG]</p> </div> <div>  <p>Advanced Electrical Environmental Control System [E-ECS] Demonstrator</p> </div> <div>  <p>Full Chain demonstration: Electrical power generation, distribution and usage</p> </div>
<div> <h3>Novel Aircraft Configurations</h3> </div> <div>  <p>NextGenCTR demonstrator - Next Generation Civil</p> </div> <div>  <p>RACER - Rapid And Cost-Effective Rotorcraft</p> </div>	<div> <h3>Optimal Passenger Environment</h3> </div> <div>  <p>Full Scale Mock-up of Business Jet Office Centered Cabin 2021</p> </div> <div>  <p>Innovative Cabin & Cargo Systems Technologies 2021</p> </div>			

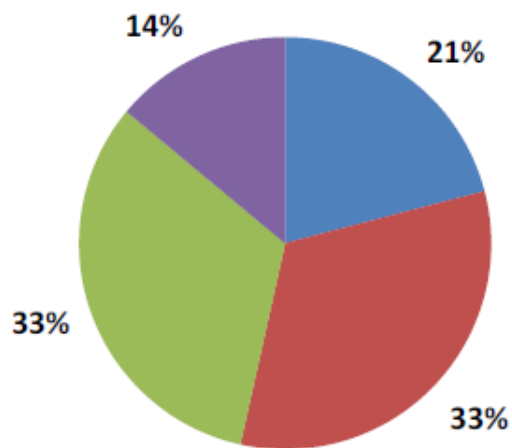


CS2: Austrian participation

- Currently 8th in participation and 10th in funding requests

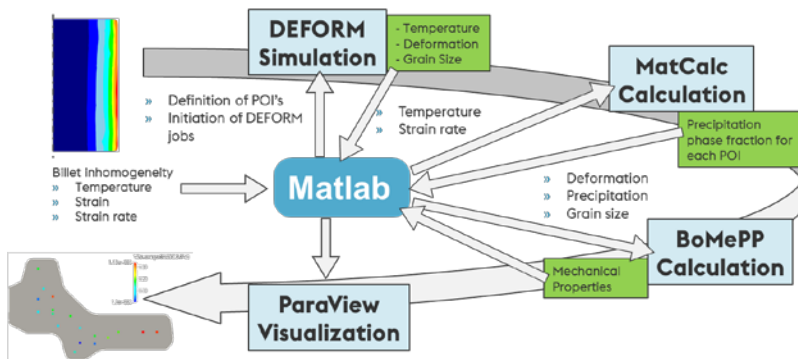


Participation as Partner per type of organisation



■ IND
■ SME
■ RES
■ UNI

Examples of Austrian participation (1/3)



- PROSIT project: integration of a property simulation tool for virtual design and manufacturing of forged disks for aero engine applications
 - Coordinator: Voestalpine Böhler Aerospace GmbH & Co KG



- NO-ICE ROTOR project: an innovative lightweight heatable coating technology that will enable tilt-rotorcraft to operate safely in icy weather
 - Coordinator: Villinger GmbH

Examples of Austrian participation ^(2/3)



- TiAlCracks project: crack growth threshold analysis in TiAl alloys
 - Coordinator: Materials Center Leoben Forschung GmbH

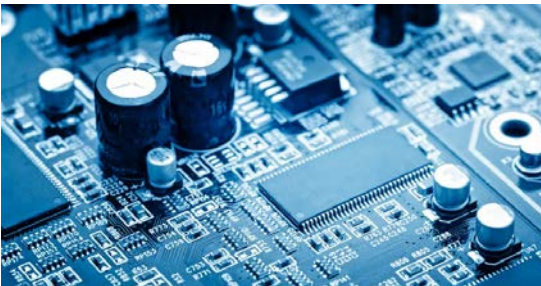


- HAIRMATE project: a lighter seating structure for an airplane consisting of one polymer (polyurethane) to simplify the recycling process
 - Beneficiary: Alpex Technologies GmbH

Examples of Austrian participation ^(3/3)



- NEWTEAM project: developing alloys by Powder Bed Additive Manufacturing processes, for the next generation of low pressure turbine blades production
 - Beneficiary: Montanuniversität Leoben (MUL)



- ICOPPE project: Innovative COoling system for embedded Power Electronics
 - Beneficiary: Schunk Hoffmann Carbon Technology AG

But we know this is not nearly enough !

Environmental Objectives^{1,2}



TO -20%
-30%



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1 vs. today's best aircraft



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11



ATAGX AIR TRANSPORT ACTION GROUP

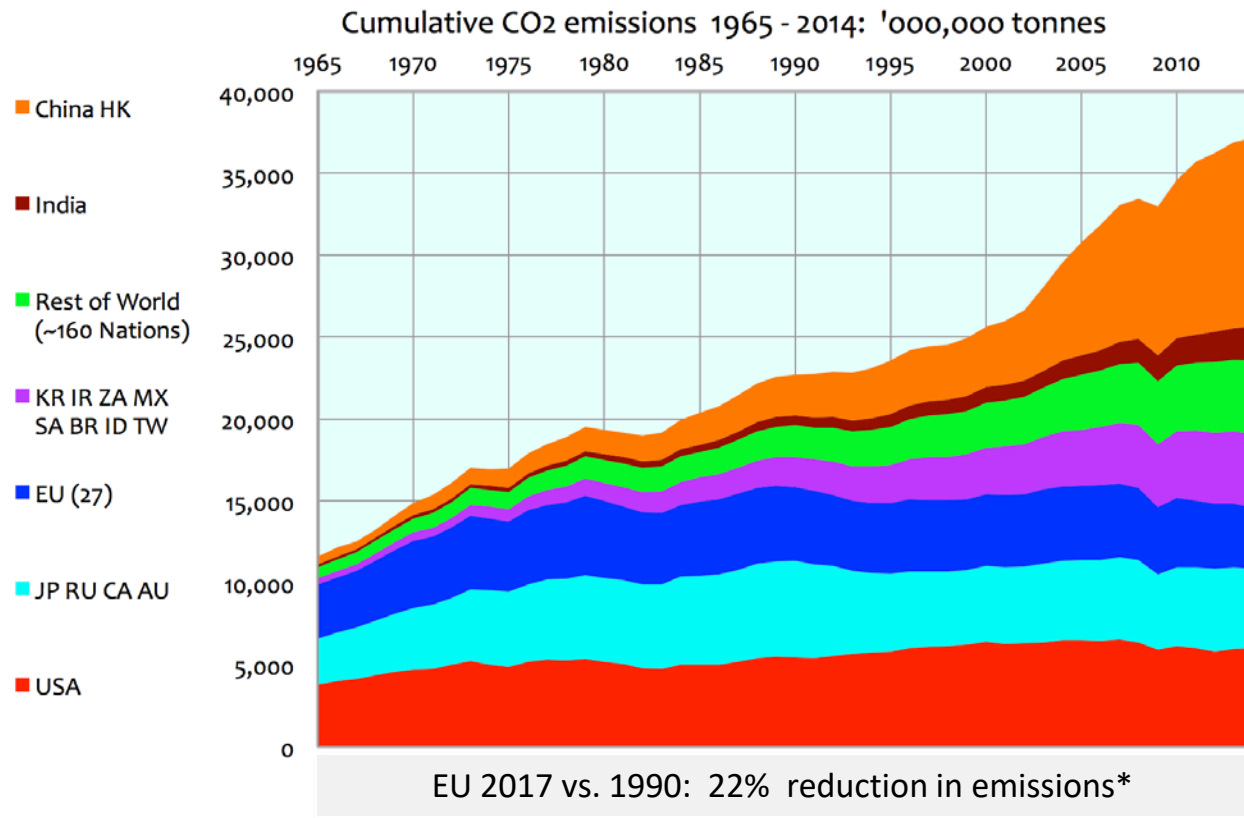


Our vision: Climate neutral Europe by 2050
#EU2050 #COP24

icct
THE INTERNATIONAL COUNCIL
ON CLEAN TRANSPORTATION

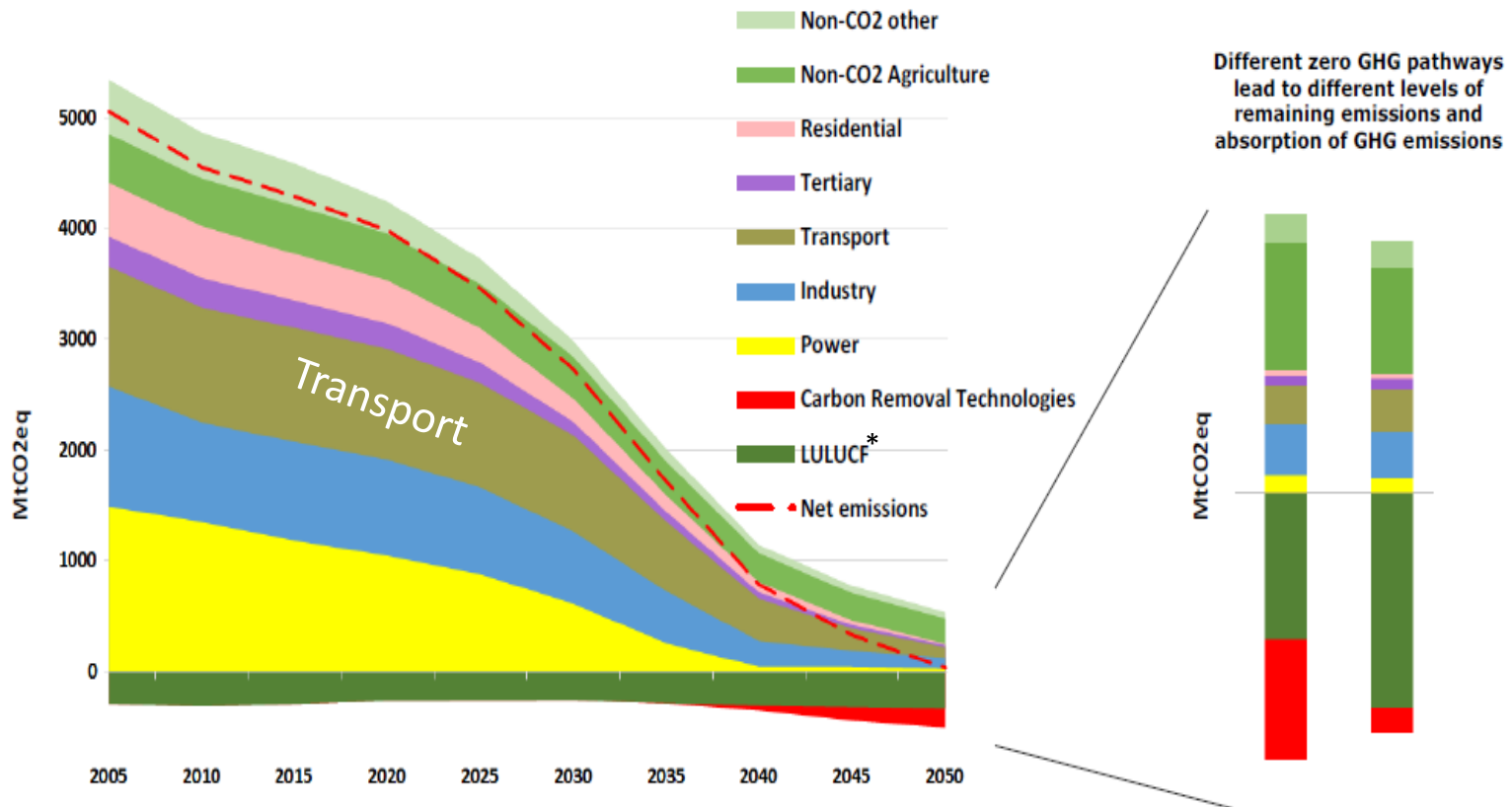
2....while building industrial leadership and ensuring mobility

Global CO₂ emissions 1965 - 2017



* Figure excludes maritime and aviation; EU aviation emissions tripled in this period....

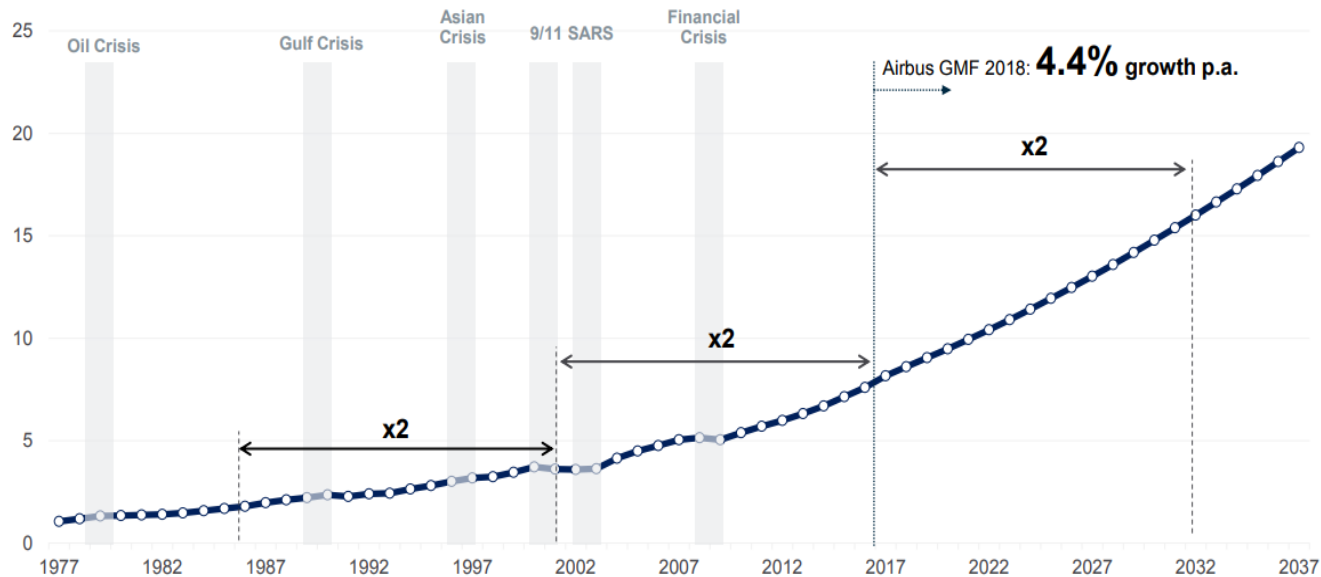
Europe's GHG Emissions Trajectory



*LULUCF : Land use, land use change and forestry

Aviation is widely expected to continue growing

World annual traffic (trillion RPKs)



5

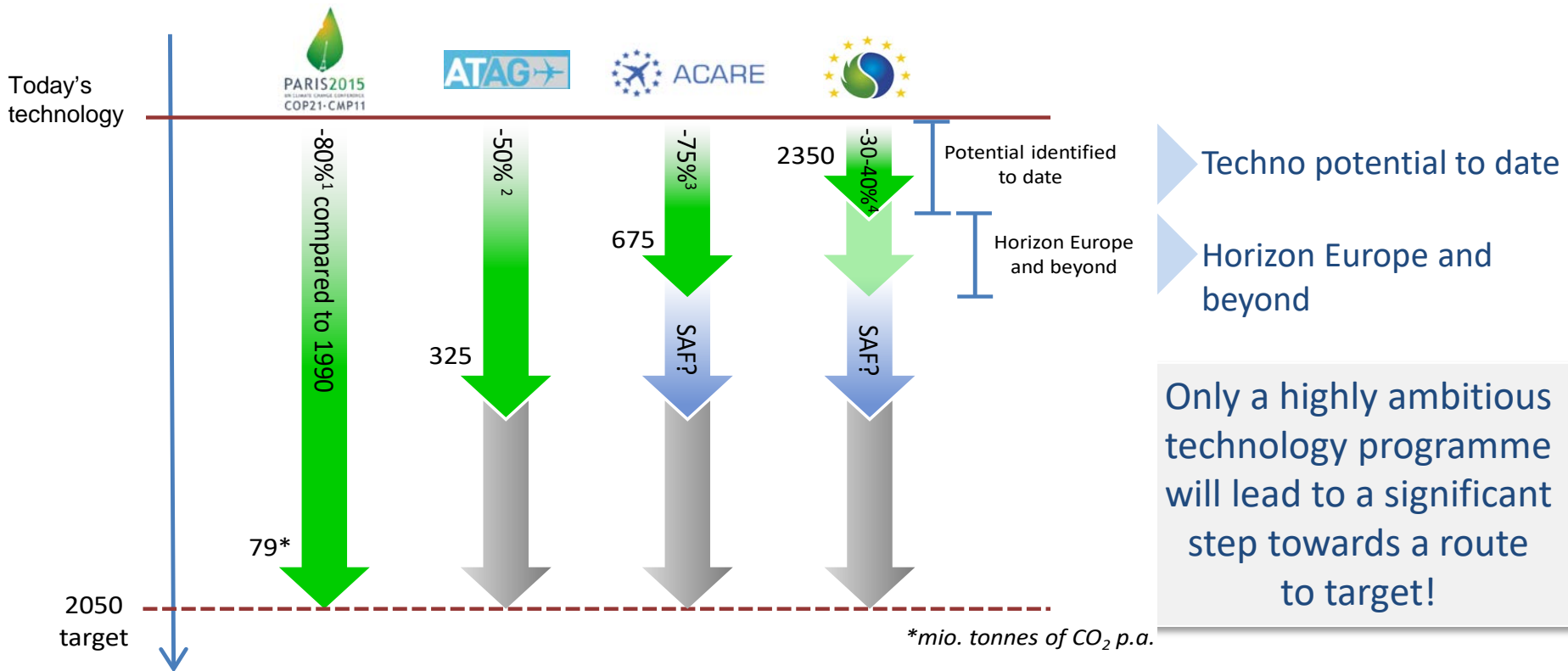
RPK = Revenue Passenger Kilometre
Source: ICAO, Airbus GMF 2018

AIRBUS

* Courtesy Airbus: GMF 2018 - 2037



CO₂ reduction targets (2050): still a long way to go



¹ to limit global warming to below 2°C; no specific aviation target; pro-rata 80% reduction of CO₂ emissions

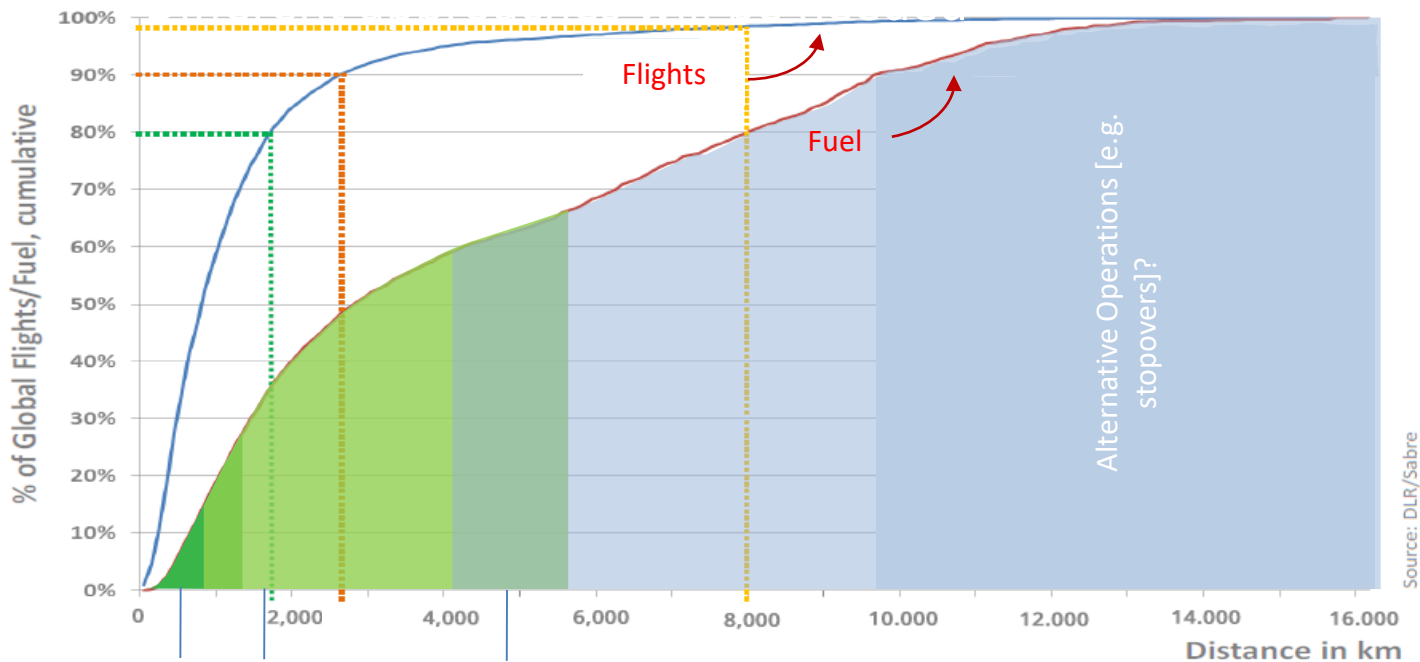
² compared to 2005; including reduction enabled by Sustainable Aviation Fuel (SAF)

³ compared to 2000; reduction per passenger-kilometre; assuming air traffic in 2050 = approx. 5-times 2005 level; excluding SAF

⁴ compared to 2000; combined CS1 and CS2 efforts

Different approaches per aircraft category needed

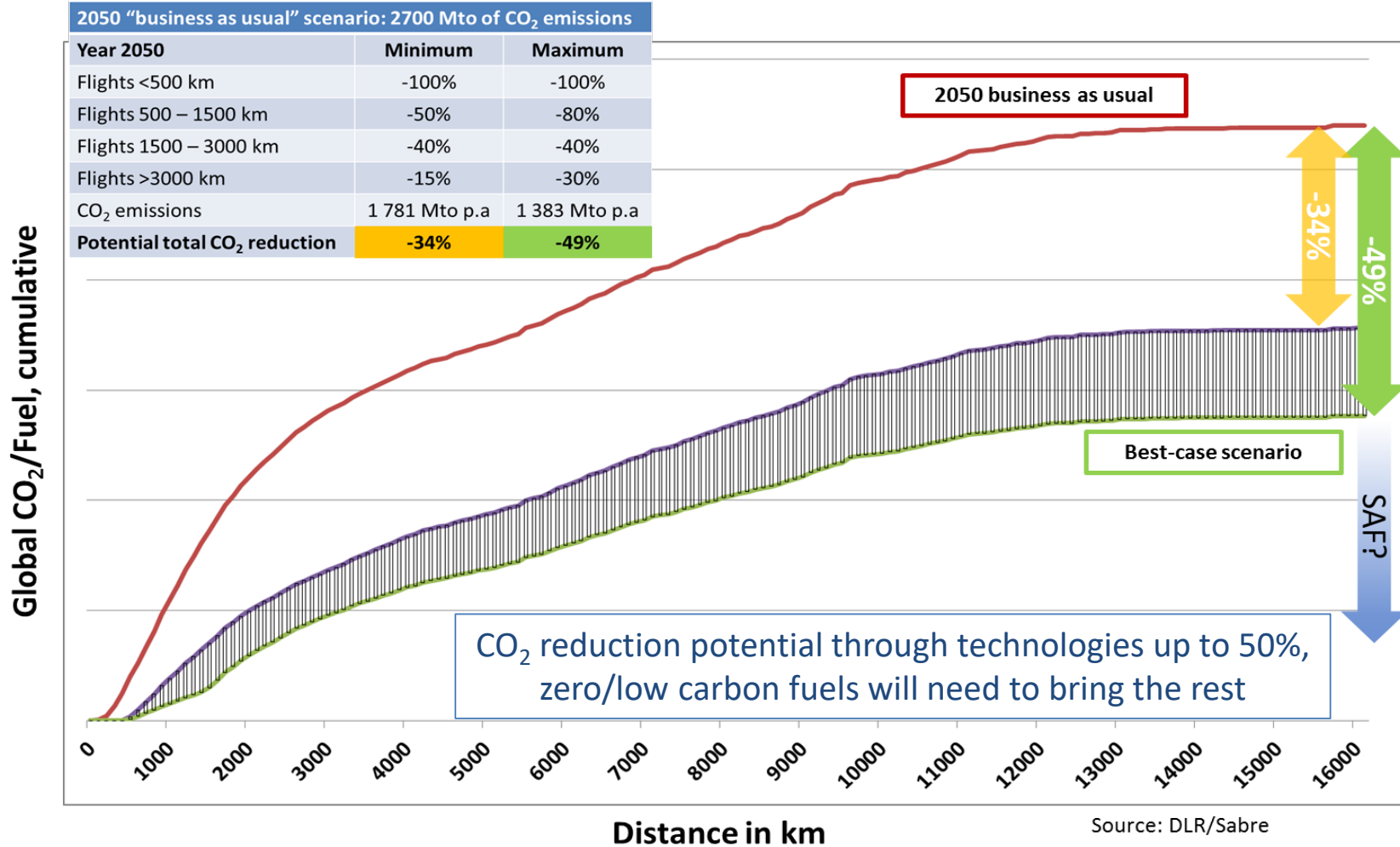
90% of flights: < 3000km, = 50% of fuel used
 10% of flights: > 3000km, = 50% of fuel used
 1% of flights: > 8000km, = 20% of fuel used



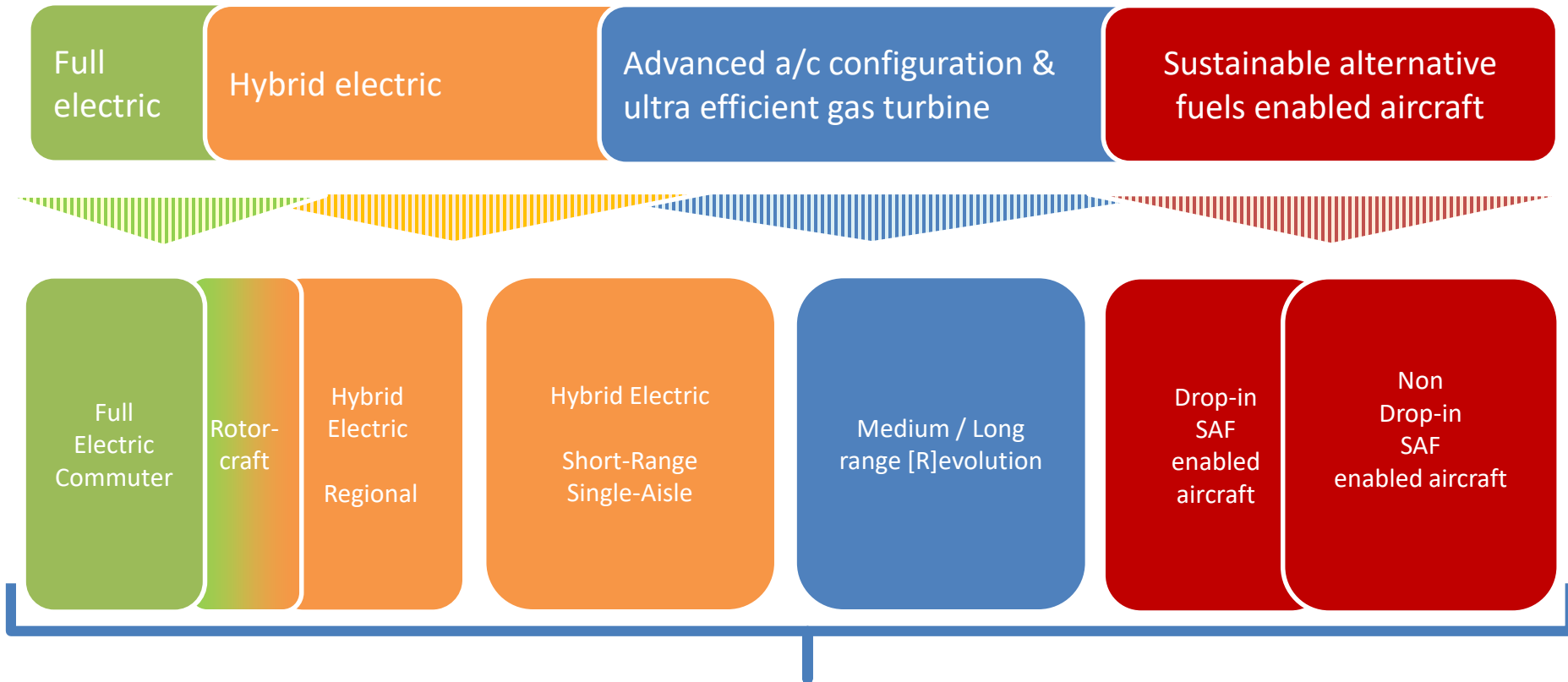
Source: DLR/Sabre



Potential CO₂ savings through technologies in 2050

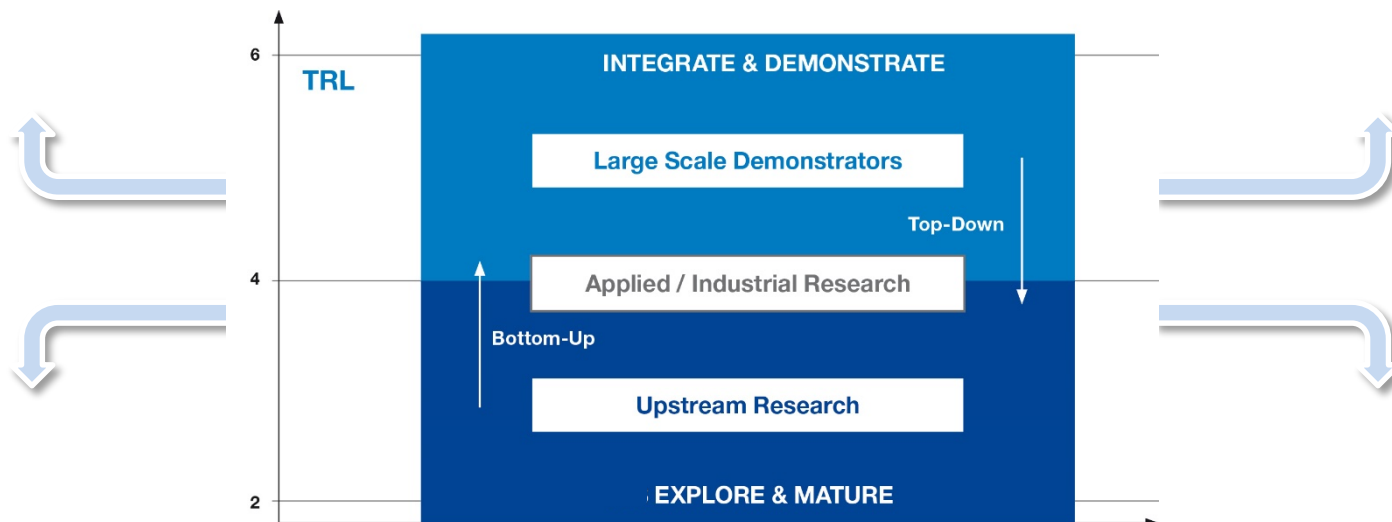
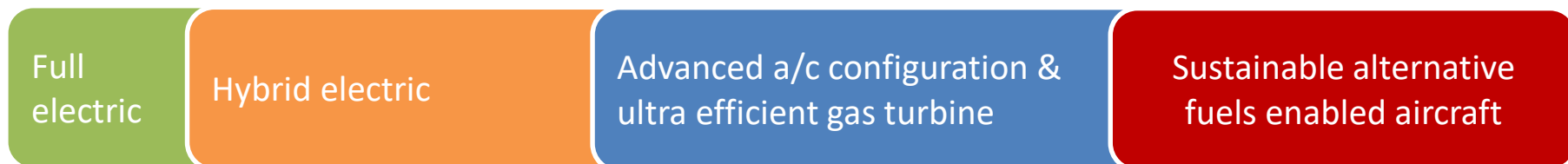


Key thrusts → demonstration strategy



No. and hierarchy of demonstration projects is currently being defined

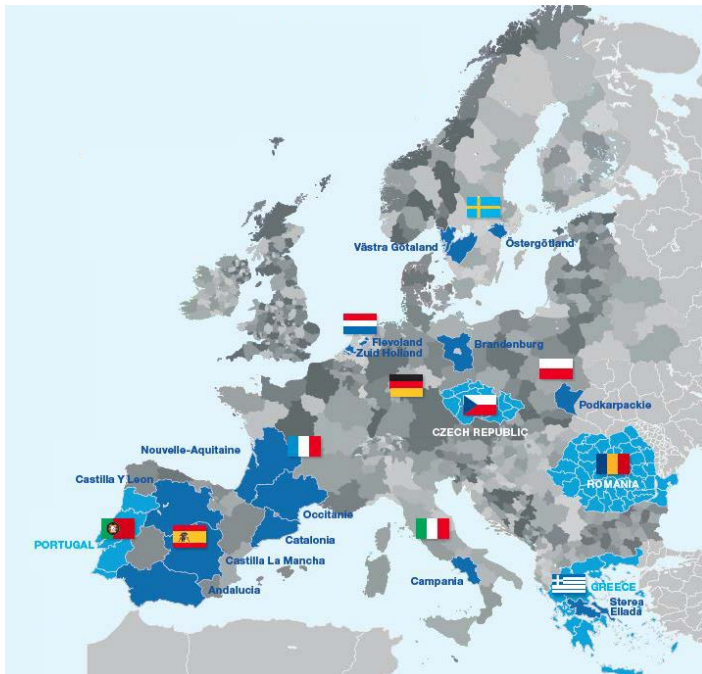
Getting the balance right in bottom-up v. top-down



- *Technologies and architectures towards zero-carbon aviation*
- *Methods and tools to ensure and accelerate the technology transition*
- *Creating the conditions for success (safety, security, mobility scenarios, climate science etc.)*

Clean Sky: creating and leveraging synergies across Europe

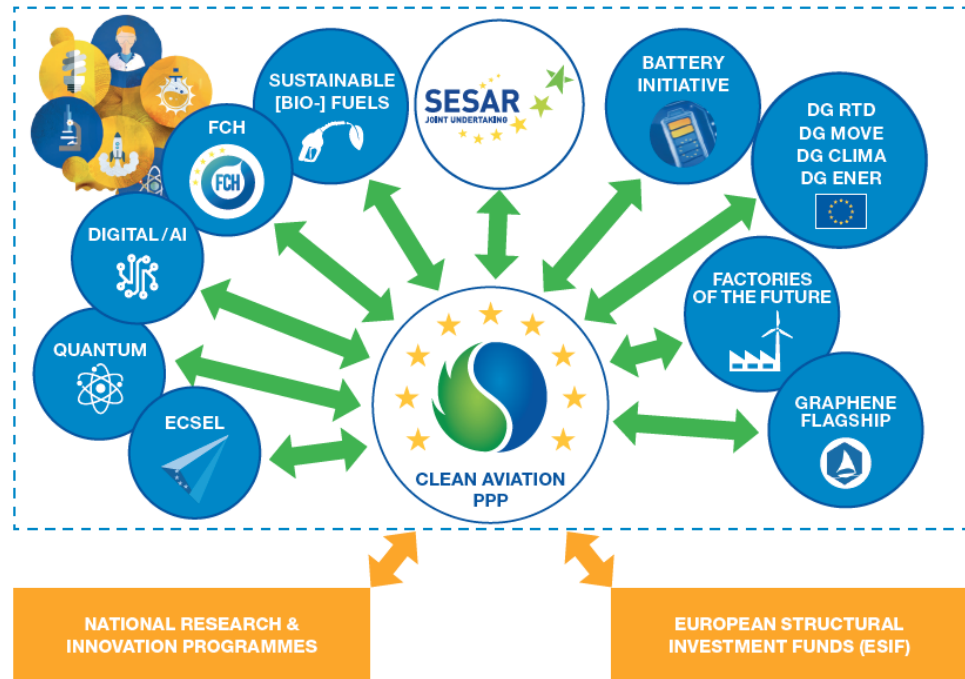
Horizon 2020



CS2 ESIF Synergies: ~ €50 Mil.
(plus projects at national level aligned via CS members)

x10

Horizon Europe



New Horizon Europe partnership synergies level of ambition: ~ €3000 Mil.
(via an Innovation Architecture)



Have your say on the future partnership

- The European Commission has launched the 2nd phase of the public consultation on the 'European Partnership for Clean Aviation' in support of the Impact Assessment on the proposal related to this proposed Partnership.
- The Partnership, envisaged under Horizon Europe, aims to enable aviation to transition towards a deep de-carbonisation, contributing to the EU's Climate and Energy goals, while ensuring the safety, security and European leadership in aviation.
- Stakeholders are invited to provide feedback via the Commission's consultation by 6 November 2019.
- <https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-4972457>



Clean Aviation iPPP: the way forward

- De-carbonisation is the *Grand Challenge* facing the sector
- We need a revolution in technology development !
- Low TRL *technology push* and high TRL *technology pull* in one programme
- Rapidly maturing, demonstrating and de-risking disruptive architectures
- Shared & joint technology roadmap bringing all actors together
- Teaming with the EU brings research and policy together → **impact**
- Impact will assure European aviation is fit for the future



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