



SAFRAN AND THE CHALLENGE OF CLIMATE CHANGE

—
December, 2019



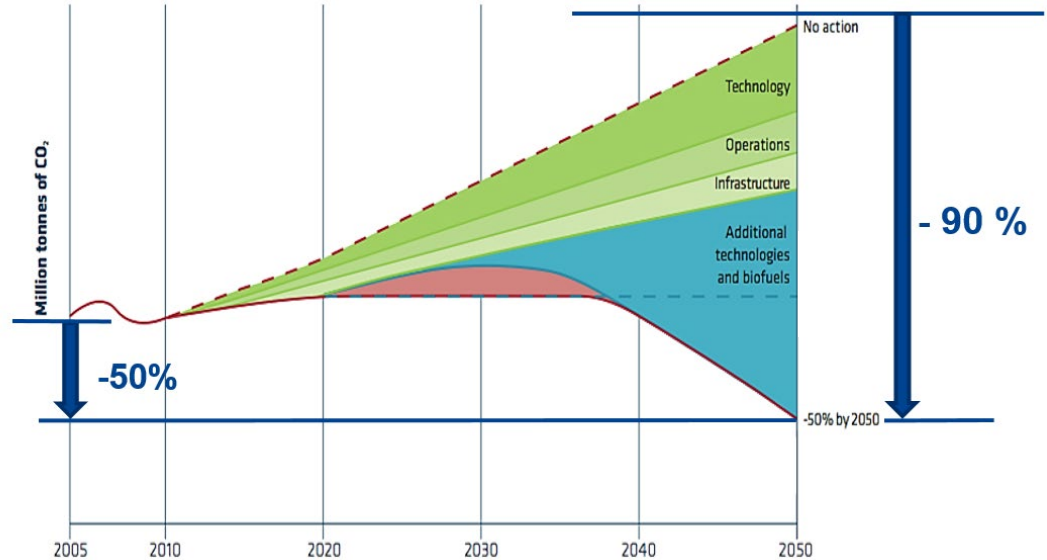
CONTEXT

- Safran has continually adapted and developed new know-how to meet the technological and economic challenges in its industry. **This places Safran at the forefront in addressing the environmental challenges relating to air transportation.**
- Safran is working voluntarily to reduce the carbon footprint of its processes (ie emissions related to the energy consumption of its sites (Scope 1 and 2) and is making a comprehensive commitment by implementing concrete measures to quickly cut emissions (targets will be disclosed in 2020)
- As a production of an aircraft accounts for a few % of its emissions over its life cycle, **Safran considers that its essential mission is the reduction of CO₂ emissions from its products** (mainly Scope 3).
- While the first direct means is to reduce the amount of fuel burned, successfully lowering aviation's environmental footprint will require pursuing **a range of measures that each present different advantages, challenges, and timelines.**
- **Safran's approach is to make progress in partnership with airframers, sharing its vision of different scenarios** with all stakeholders and positioning itself as a key player in the key technological components of the power equation
- **Research on breakthrough aircraft, low carbon aviation by 2030-2035 and carbon neutral by 2050***, is the key focus of Safran's strategy in response to the challenge of climate change.

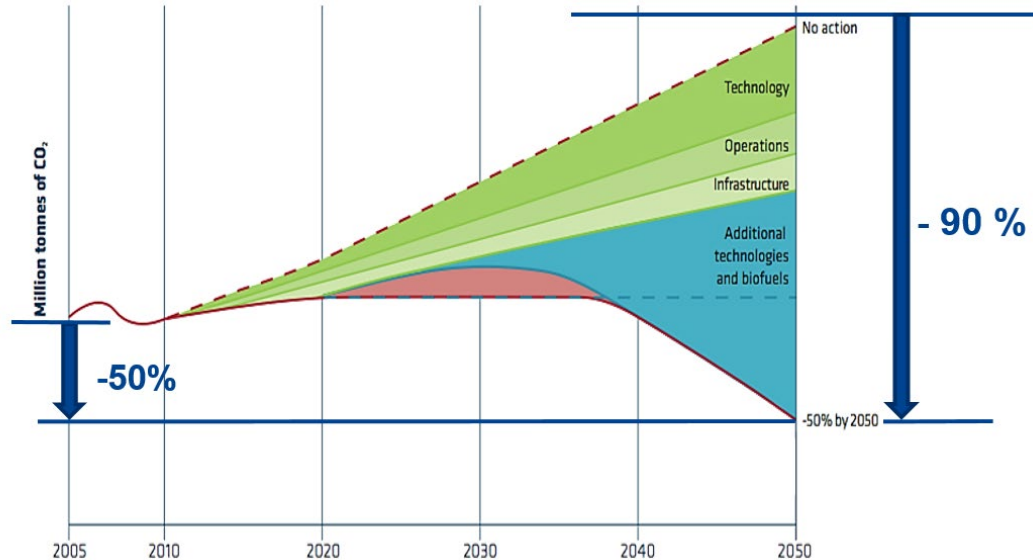


TOP PRIORITY: REDUCE AVIATION'S CARBON FOOTPRINT

- Aviation today accounts for 2% to 3% of CO₂ emissions
- In 2008, the Air Transport Action Group (ATAG) set an ambitious objective of reducing CO₂ emissions by 50% in 2050 in relation to 2005
- With forecast air traffic growth of 4%/year (= a 3.5-fold increase by 2050), meeting this goal means a 90% improvement in average emissions per passenger/kilometer (2015 fleet)



SEVERAL DRIVERS NEEDED TO REACH THIS GOAL



1. Renew global fleet with new-generation aircraft and achieve incremental improvements

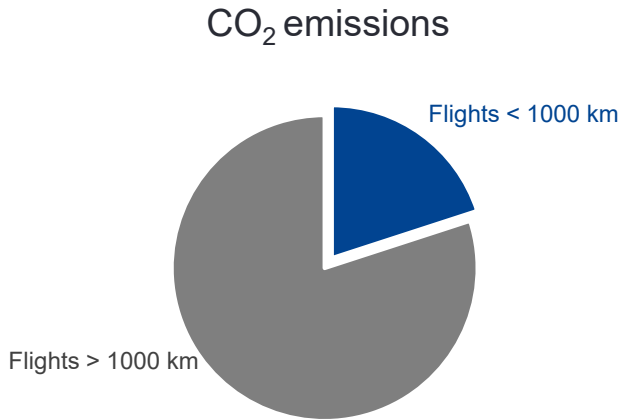
2. Improve air traffic operations and management

3. Introduce disruptive technologies

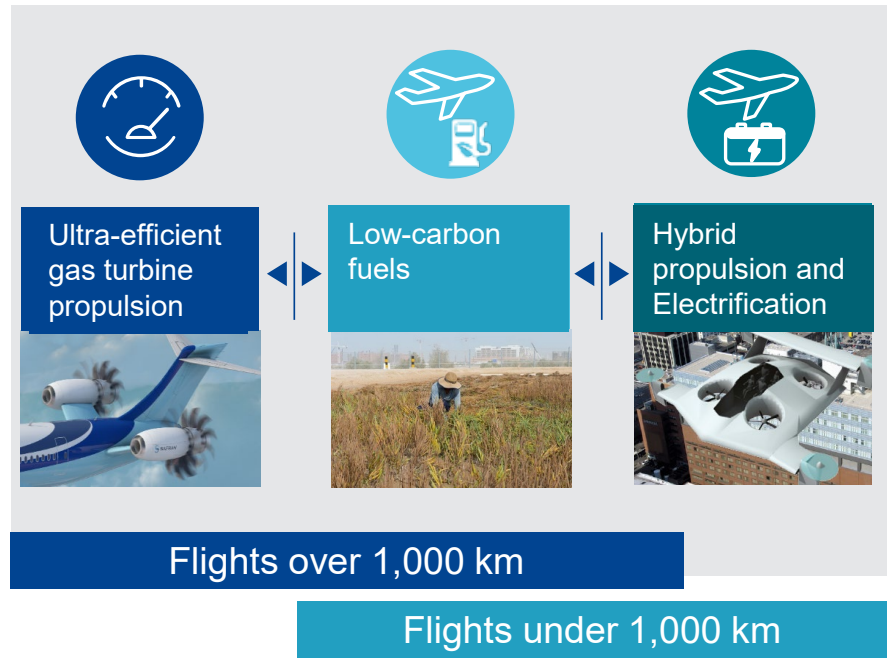
4. Replace existing jet

... while also reducing other pollution (noise, NO_x, particles, etc.)

DIFFERENT APPROACHES FOR DIFFERENT TYPES OF AIRCRAFT

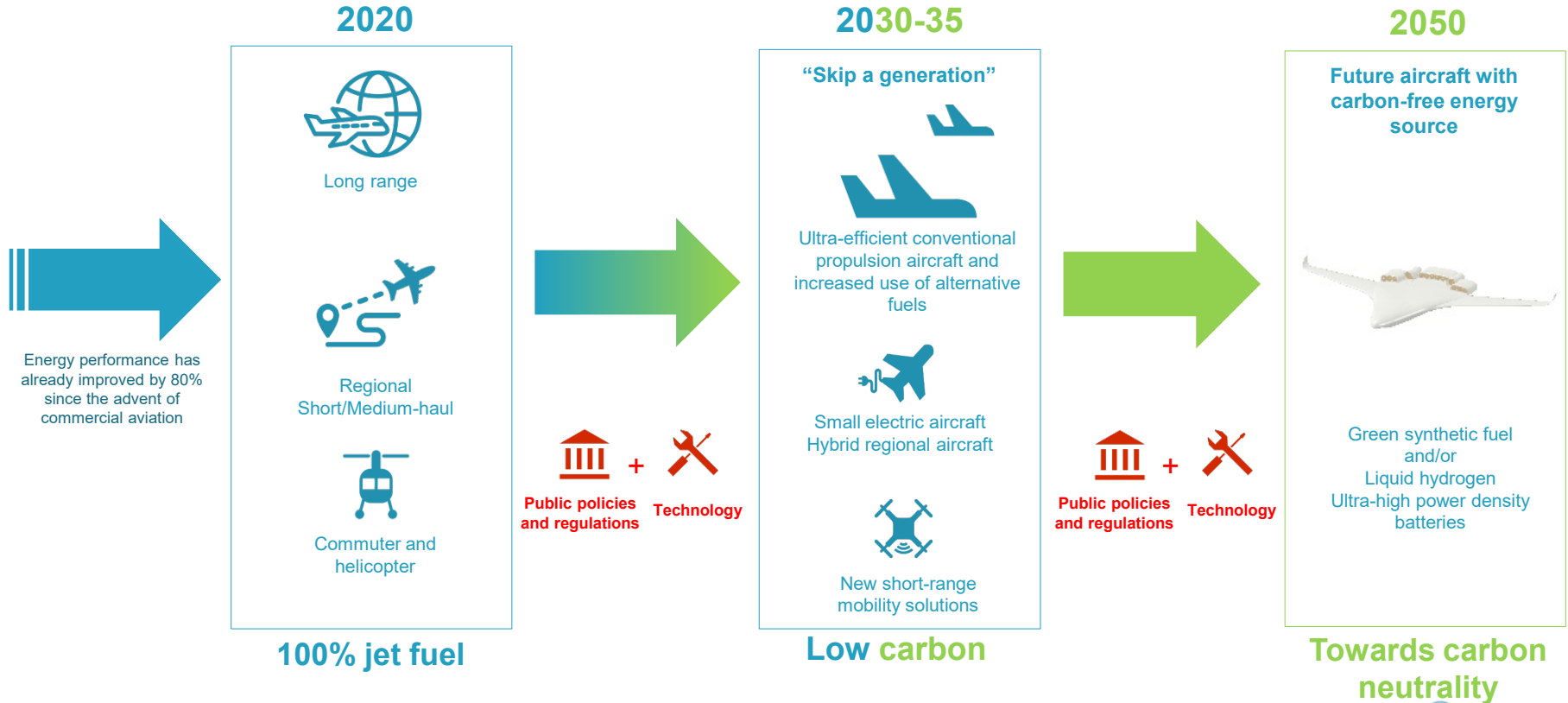


Source : DLR/ Sabre 2014



⇒ **Flights accounting for 80% of CO₂ emissions will largely continue to use combustion propulsion systems until at least 2040.**

TRANSITION TO DECARBONIZATION



SUSTAINABLE ALTERNATIVE FUELS



Biofuels
Using conventional resources
(biomass, waste, algae, etc.)



Green synthetic fuels
(Power to Liquid)
from decarbonated hydrogen

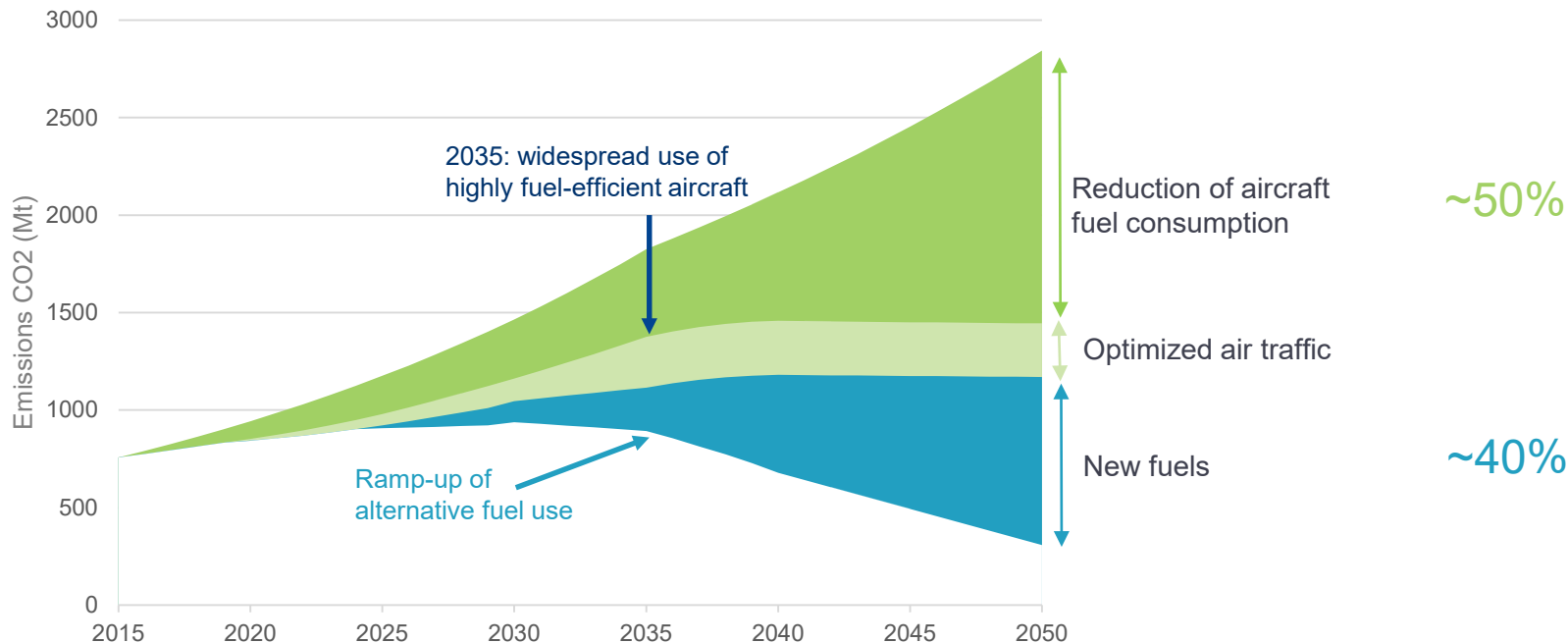


Liquid hydrogen

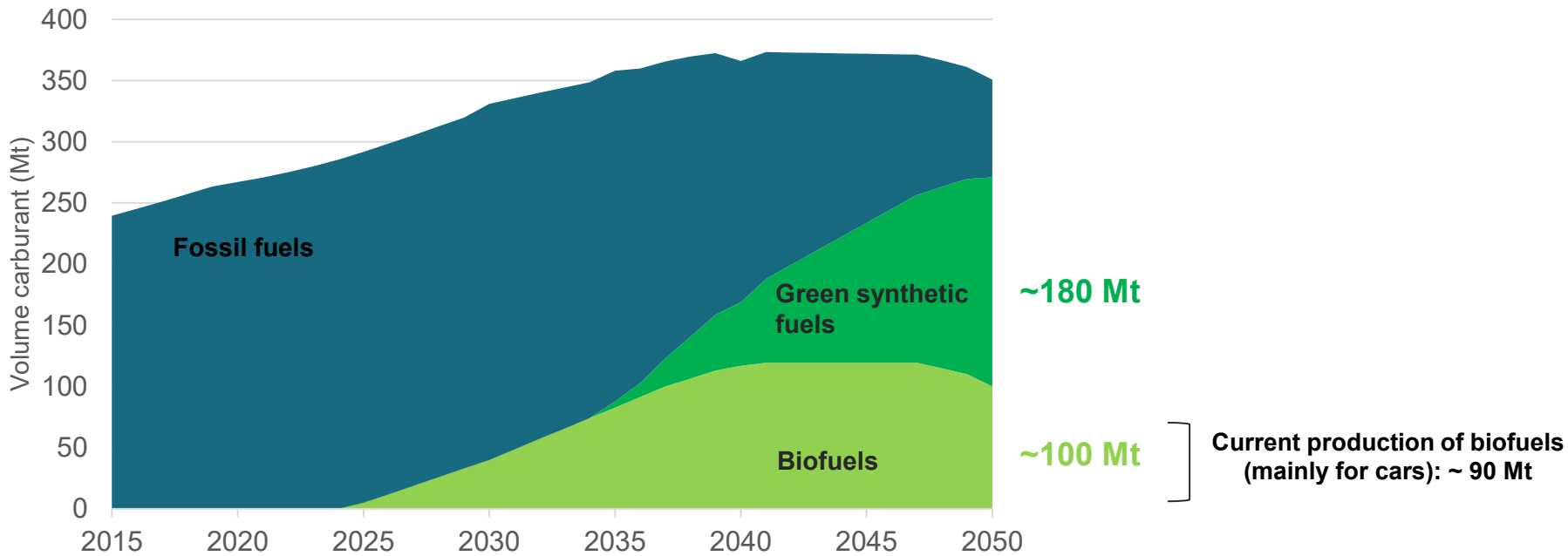
Existing aircraft and infrastructures

Disruptive aircraft, new infrastructures
→ Higher risk and longer term option

SAFRAN'S VISION OF A POSSIBLE AIR TRANSPORTATION DECARBONIZATION SCENARIO



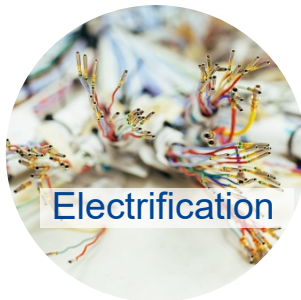
REASONABLE AMOUNTS OF SUSTAINABLE ALTERNATIVE FUELS



SAFRAN'S COMMITMENT TOWARDS CARBON NEUTRALITY

75%
of R&T
spending

on technologies aiming
directly or indirectly at
reducing the environmental
footprint of air transportation



SAFRAN'S VISION TOWARDS CARBON NEUTRALITY

- The goal for 2050 **can be reached**, solutions exist
- Meeting this objective demands a **shared vision** by all stakeholders worldwide (industry, airlines, public authorities, energy experts) and a **strong commitment** within their respective fields
- **Safran is a key player in any change**, because of its role in most aircraft systems, especially those involving energy systems
- **Safran's technology roadmap** specifies contributing to a disruptive aircraft towards 2030-35 that would reduce fuel consumption by **30 to 40% (including the substitution from existing jet fuel to sustainable fuels)**, to move towards "zero emissions" in flight in 2050





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