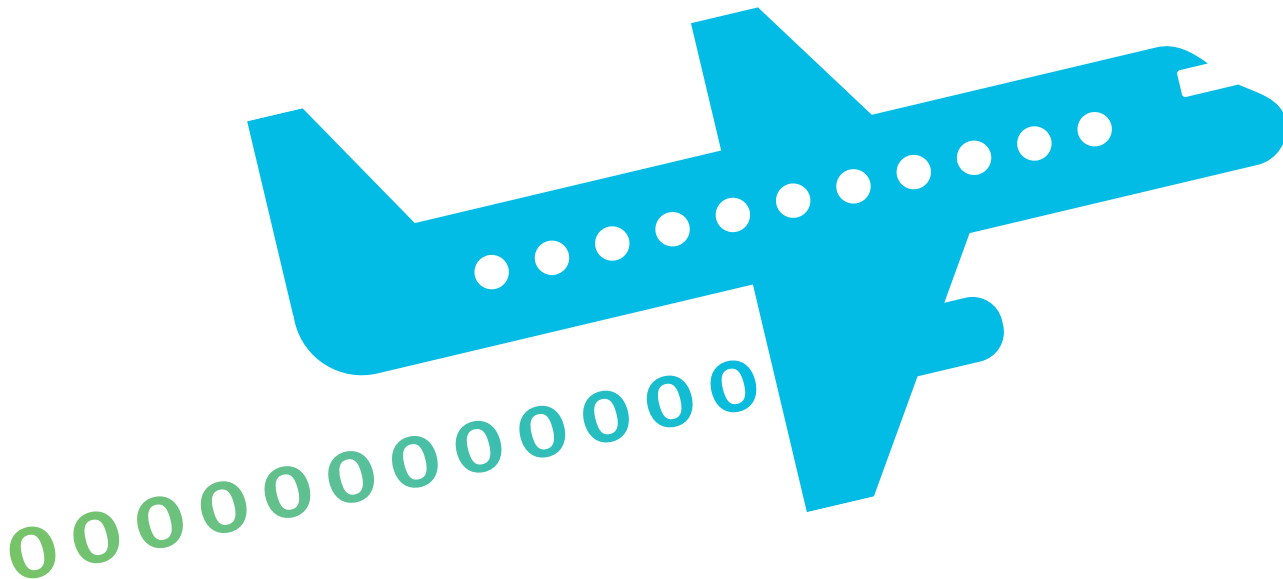


# The sky's the limit

The role of zero emission flight  
in reaching net zero

“green  
alliance...”



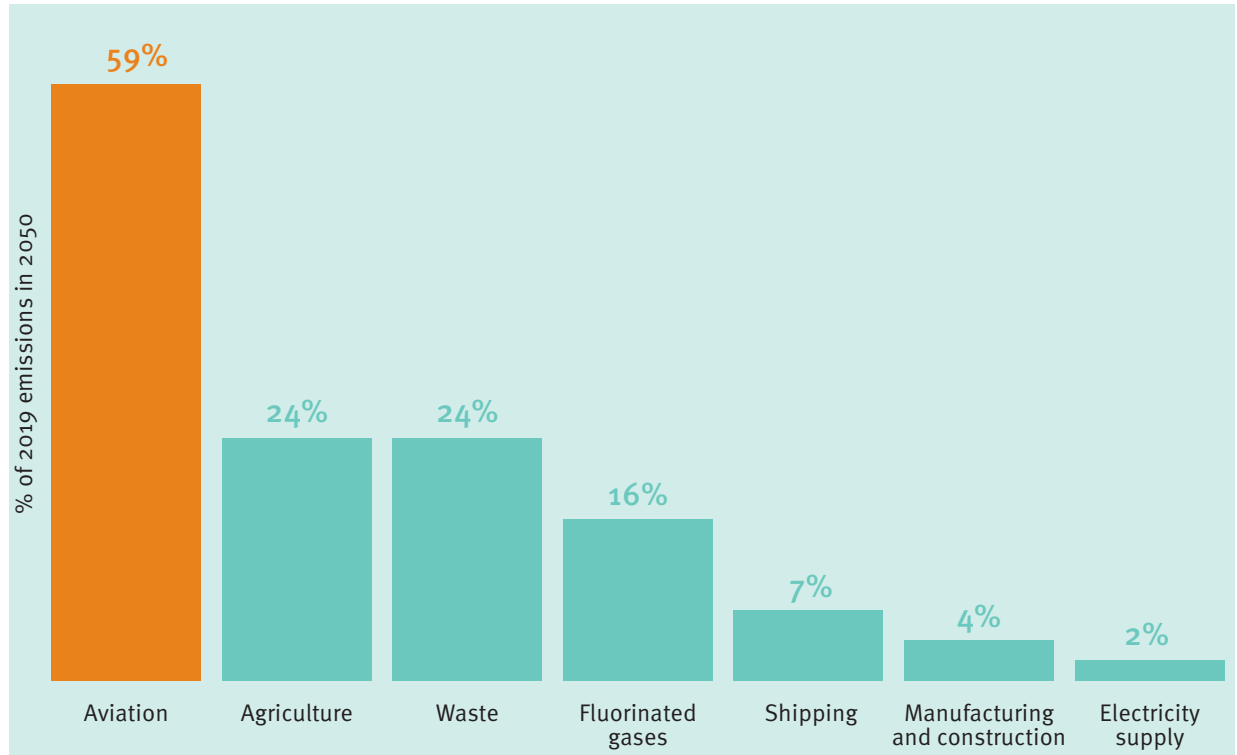
# Introduction

Aviation will be one of the only sectors still emitting carbon in 2050. On current projections, it is unlikely to make any significant decarbonisation progress until the 2040s.

The UK government's current approach to cutting the climate impact of aviation is not a complete solution. In particular, the route to zero emission flights (ZEF) has not been strategically formulated.

Here, we outline the potential of ZEF, its importance in reaching a net zero carbon economy, and what is needed to commercialise it.

# Aviation is the sector that will make the least progress in cutting greenhouse gas emissions by 2050



Source: Climate Change Committee, 2020, *Sixth carbon budget*

# What is zero emission flight?



## Conventional aircraft

Jet fuel is stored in the wings and aircraft design is optimised for kerosene.



## Sustainable aviation fuelled (SAF) aircraft

Jet fuel is directly substituted for SAF. No changes are made to the aircraft.



## Zero emission

### Hydrogen powered aircraft

Propulsion occurs through hydrogen combustion (where hydrogen is burned as fuel) or hydrogen fuel cells (where hydrogen powers batteries). New aircraft and refuelling systems are needed.

### Battery electric aircraft

A dense, high power battery system propels an electric motor, typically in smaller and lighter aircraft.

# What role could zero emission flight play in government strategy?

Three approaches combined can help aviation reach net zero

## Demand management

Reducing how much we fly will cut emissions, but there are few plans to address demand.

The Department for Transport (DfT) predicts passenger demand will rise by 70 per cent by 2050, hugely exceeding the 25 per cent increase recommended in the Climate Change Committee's advice to the government.

## Sustainable aviation fuel (SAF)

Using SAF does not eliminate emissions burned in the atmosphere but it can reduce lifecycle emissions.

It does not address non-CO<sub>2</sub> emissions which account for a significant proportion of aviation's global warming impact.

Some feedstocks will be difficult to scale up due to limited supply or the need for them elsewhere in the energy system.

Some SAF feedstocks could cause issues, like encouraging the creation of waste for fuel.

## Zero emission flight (ZEF)

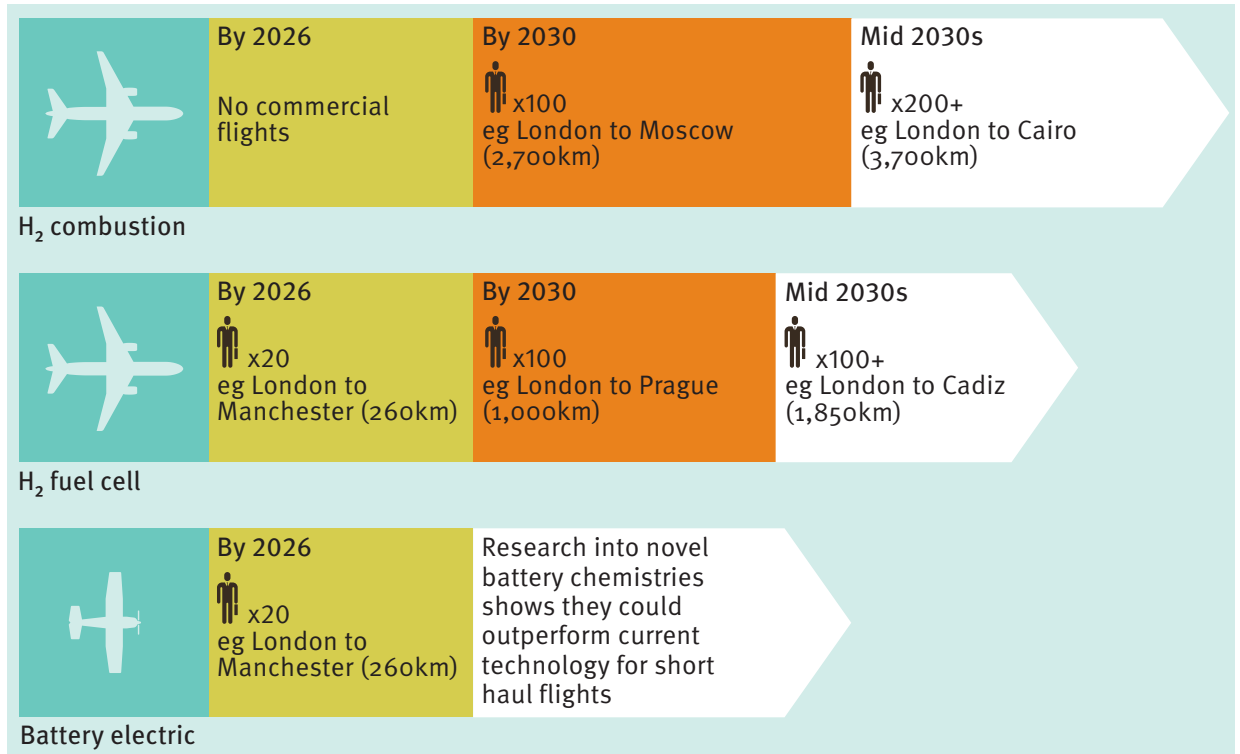
ZEF is an opportunity to mitigate aviation's significant climate impact and move the sector closer to net zero.

As an emerging technology, the UK could gain a competitive advantage and become a world leader in the industry.

Current strategy lacks a concrete pathway to facilitate its rapid scale-up.



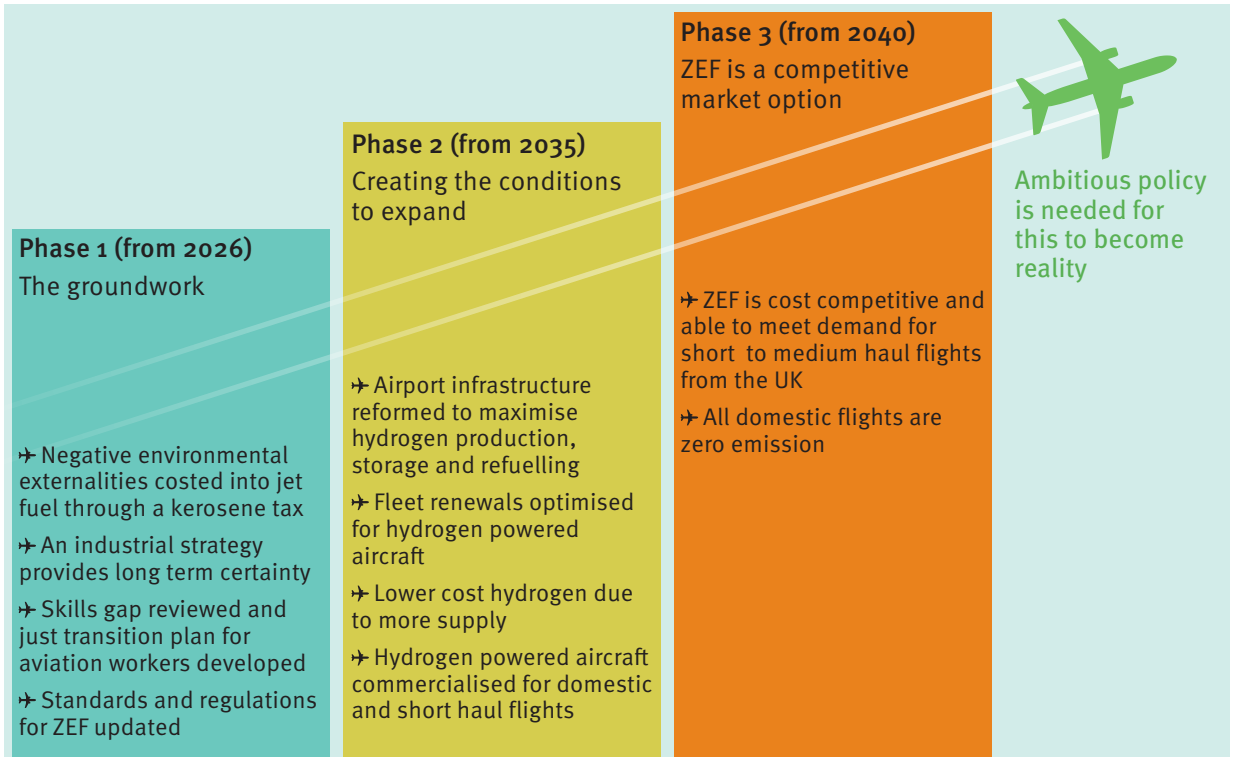
# The potential of zero emission flight



# Although a big improvement, zero emission flight still isn't 100% green

Technology	How green?		
Hydrogen fuel cell		<ul style="list-style-type: none"> <li>+ No in-flight CO<sub>2</sub> emissions and a total warming impact 75 to 90% lower than jet fuel</li> <li>+ No disproportionate demand on resources (providing the industry generates its own green hydrogen)</li> </ul>	<ul style="list-style-type: none"> <li>- Wastewater emitted during flight. (innovative wastewater recycling could reduce this)</li> </ul>
Hydrogen combustion		<ul style="list-style-type: none"> <li>+ No in-flight CO<sub>2</sub> emissions and a total warming impact 50 to 75% lower than jet fuel</li> <li>+ No disproportionate demand on resources (providing the industry generates its own green hydrogen)</li> </ul>	<ul style="list-style-type: none"> <li>- Wastewater emitted in flight (innovative wastewater recycling could reduce this)</li> <li>- Nitrous oxide (NOx) emitted in flight</li> </ul>
Battery electric		<ul style="list-style-type: none"> <li>+ No in-flight emissions and, as electricity goes greener, the lifecycle emissions of batteries will also decrease</li> </ul>	<ul style="list-style-type: none"> <li>- High demand for critical raw materials, which can have negative environmental impacts</li> </ul>
SAF		<ul style="list-style-type: none"> <li>+ Although CO<sub>2</sub> is emitted during flight, lifecycle emissions are lower than kerosene</li> </ul>	<ul style="list-style-type: none"> <li>- Other, non-CO<sub>2</sub> emissions are still emitted</li> <li>- Demand for feedstock risks encouraging waste or placing pressure on land that could be used for food</li> <li>- Low potential to scale up</li> </ul>

# A clear pathway to commercialise zero emission flight





## **The sky's the limit: the role of zero emission flight in reaching net zero**

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### **Green Alliance**

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