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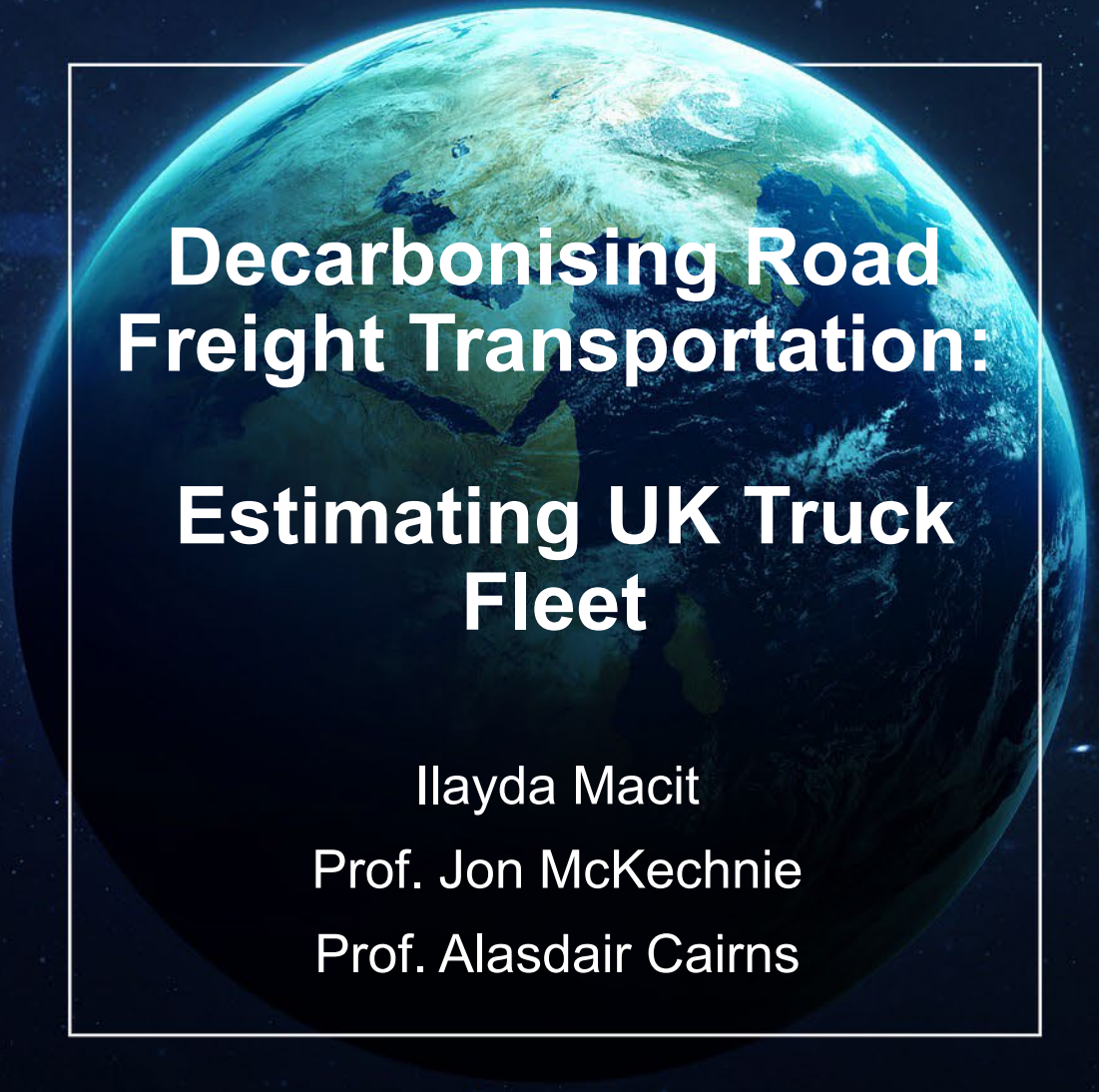

Decarbonising Road Freight Transportation:

Estimating UK Truck Fleet

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Contents

1. Introduction

- UK Zero Emission Vehicle (ZEV) Mandate
- Phase out dates for non-zero emission Heavy Goods Vehicles (HGVs)

- Mix of different truck technologies:
  - Battery Electric Vehicles (BEVs)
  - Fuel Cells
  - Alternative Fuels

Research Question:

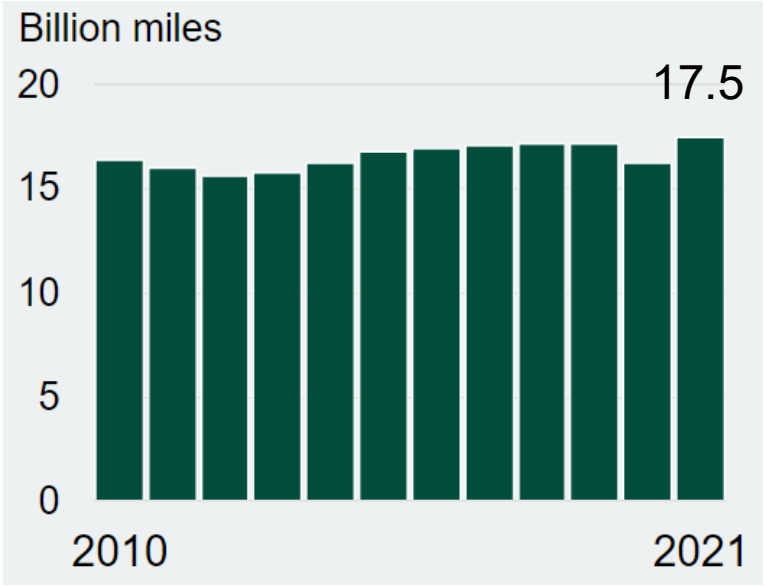
How will the UK truck fleet dynamics change over time?

1. Introduction

- Freight moved around the UK:

Trucks made up 80% of the 200 billion tonne kilometres in 2022.

- Heavy Good Vehicles (HGV):
  - less than **6% of road traffic**
  - released **18%** of the total **UK road transport emissions** (National Grid, 2022)

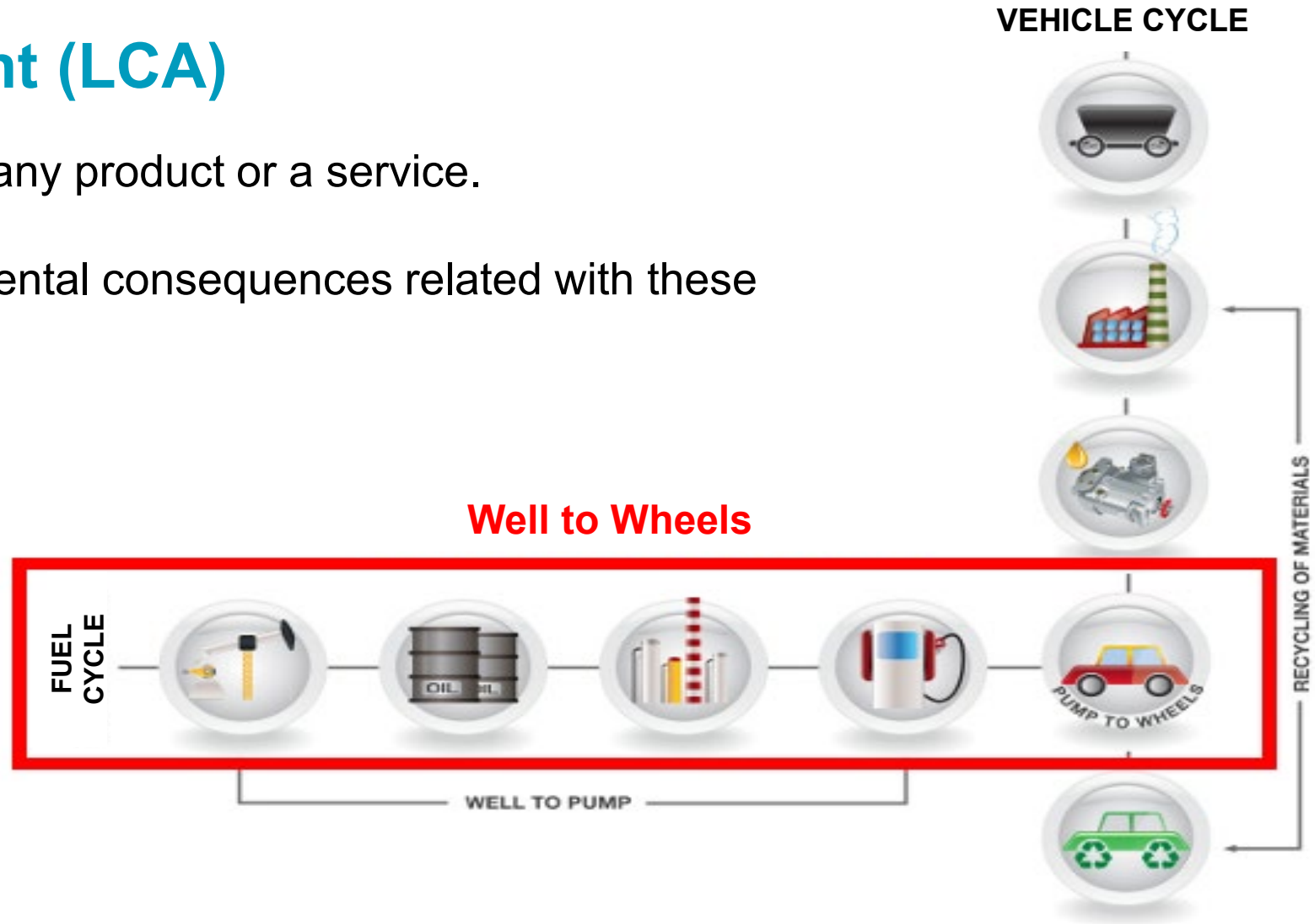


Road Traffic Statistics UK (2022)

2.Methodology

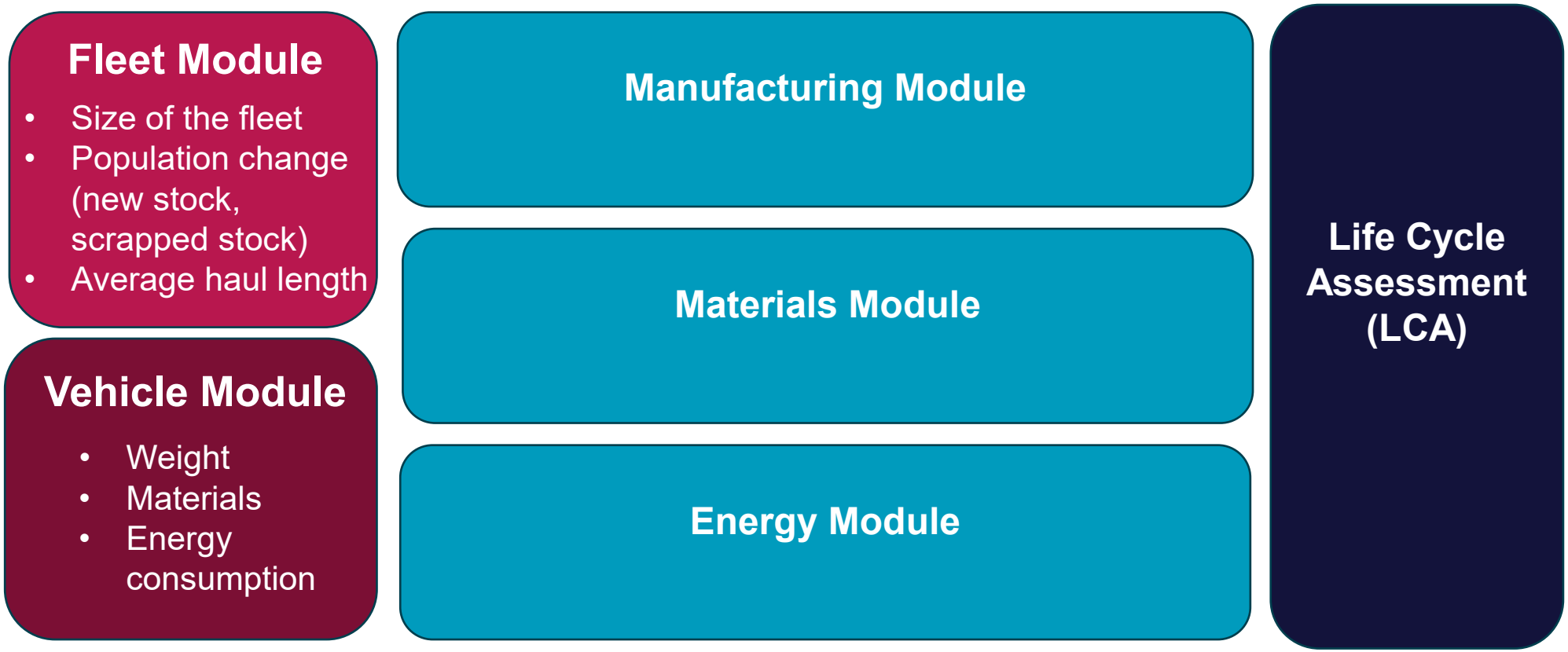
Life Cycle Assessment (LCA)

- Material and energy flows to any product or a service.
- LCA addresses the environmental consequences related with these flows.

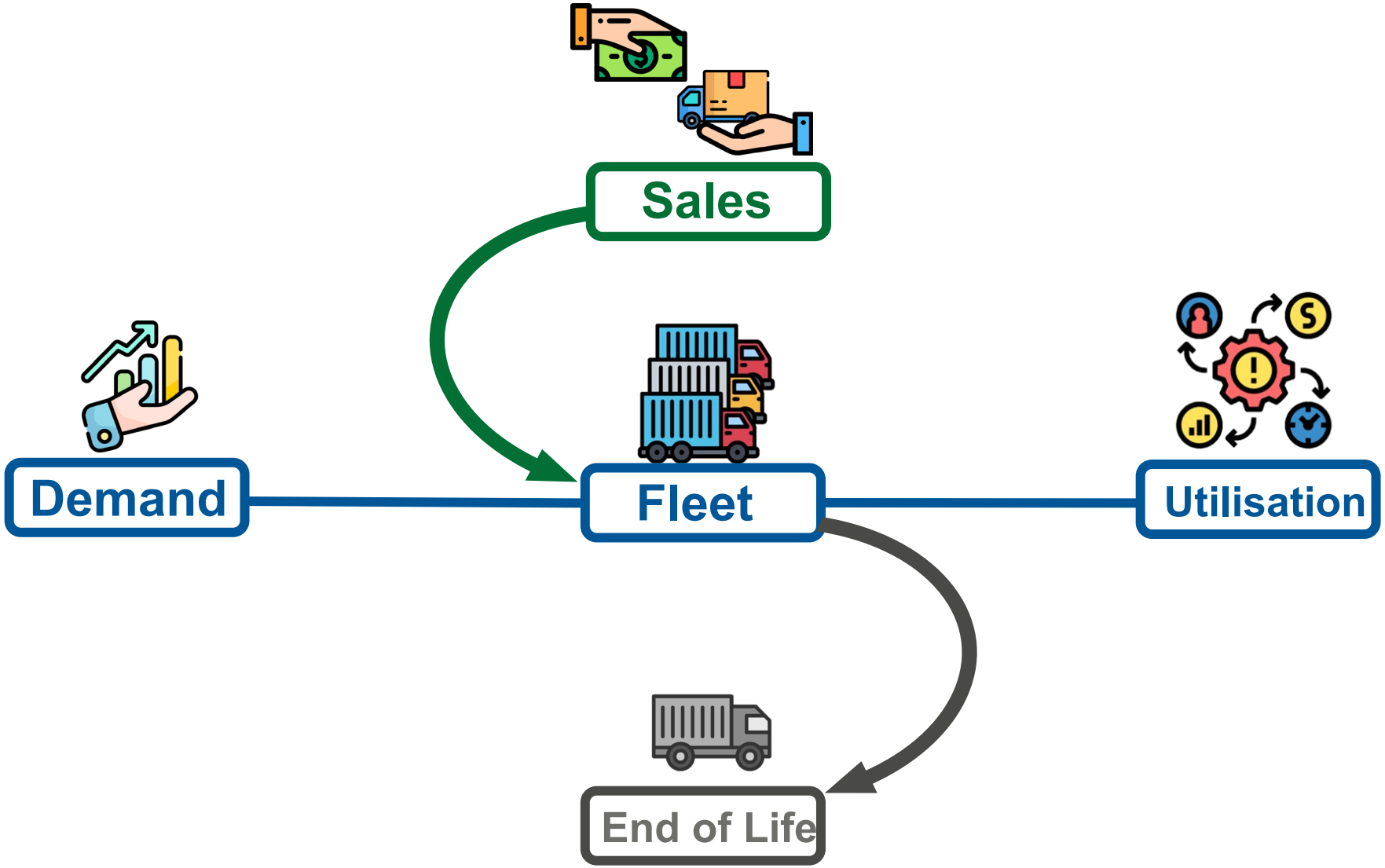


2.Methodology

FLAME (Fleet Life Cycle Assessment and Material-Flow Estimation)



3.Fleet Module

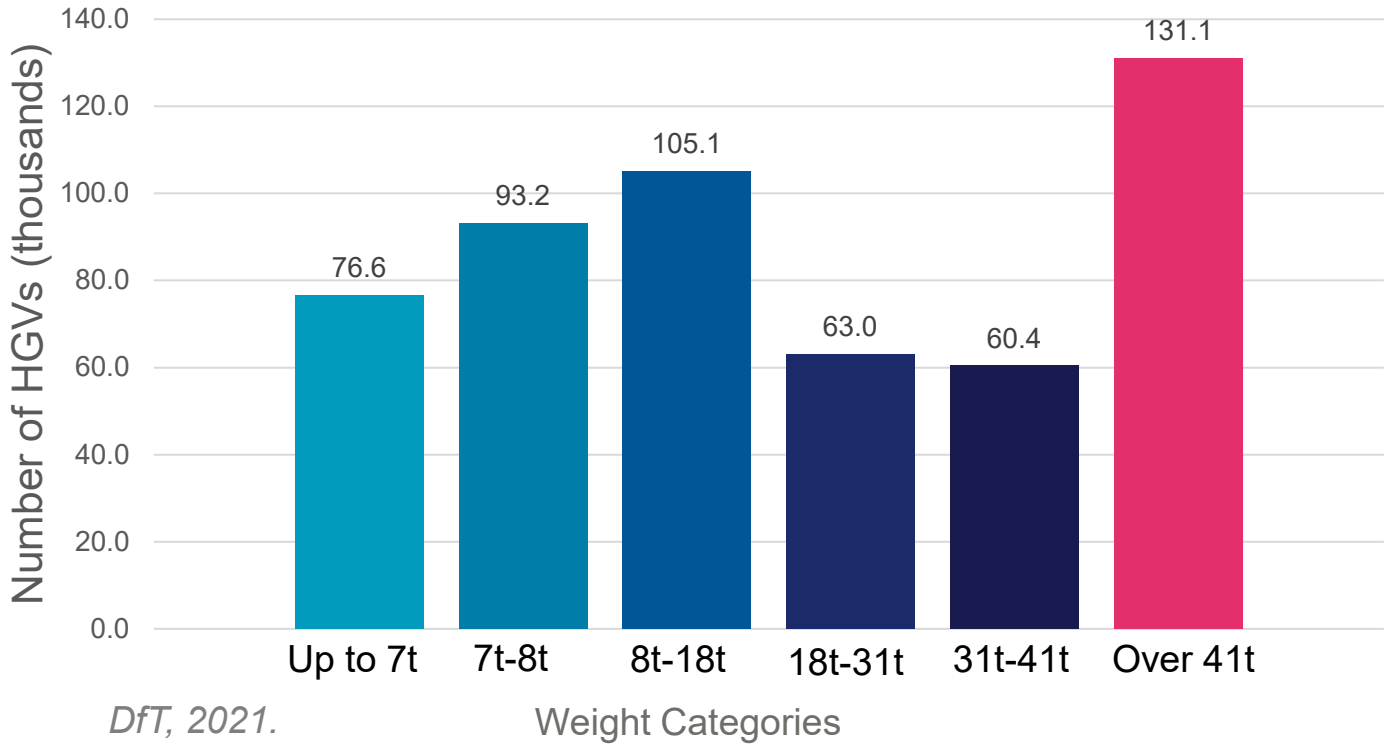


3.Fleet Module

Current HGV characteristics of the UK and Great Britain:

- As of 2021, there are total **529.4 thousand** licensed HGVs in UK (DfT, 2021).

Licensed heavy goods vehicles in UK at the end of 2021, by weight:

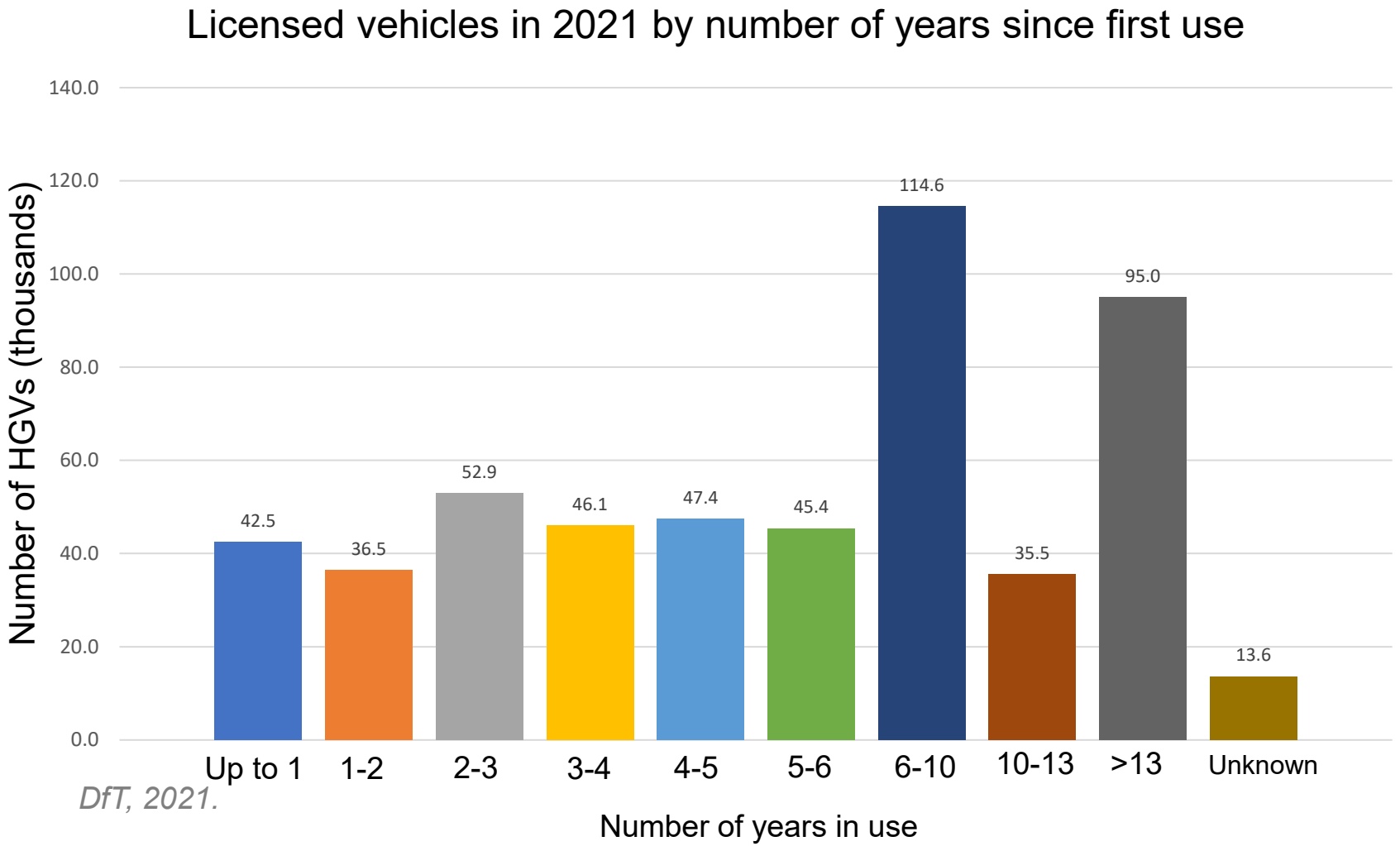


DfT, 2021.

- Average haul length for each journey for all vehicles is **108 kilometres**.
- Around 30% of all rigid and articulated vehicles are running empty.

3.Fleet Module

Current HGV characteristics of the UK and Great Britain:

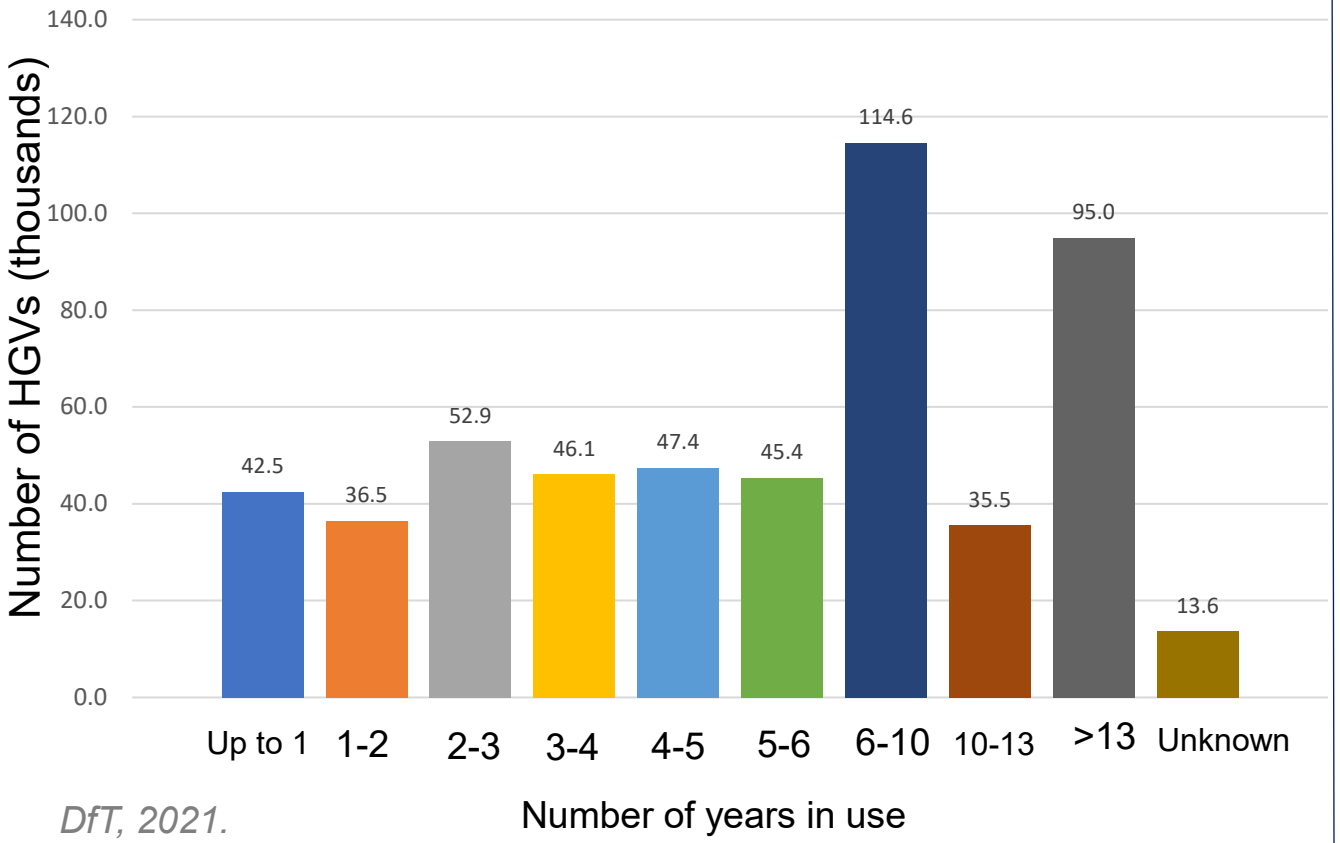


DfT, 2021.

3.Fleet Module

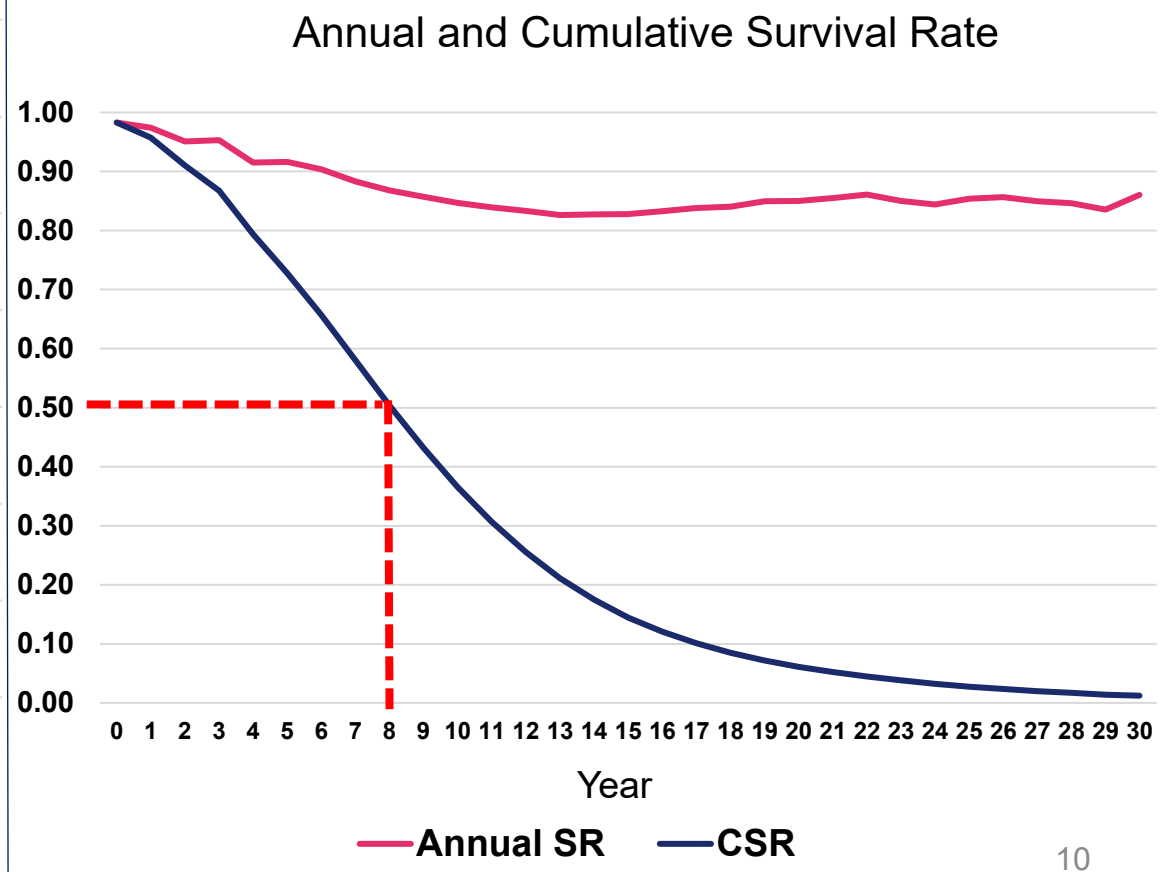
Current HGV characteristics of the UK and Great Britain:

Licensed vehicles in 2021 by number of years since first use



DfT, 2021.

Survival rate of the HGV Fleet:



3. Fleet Module

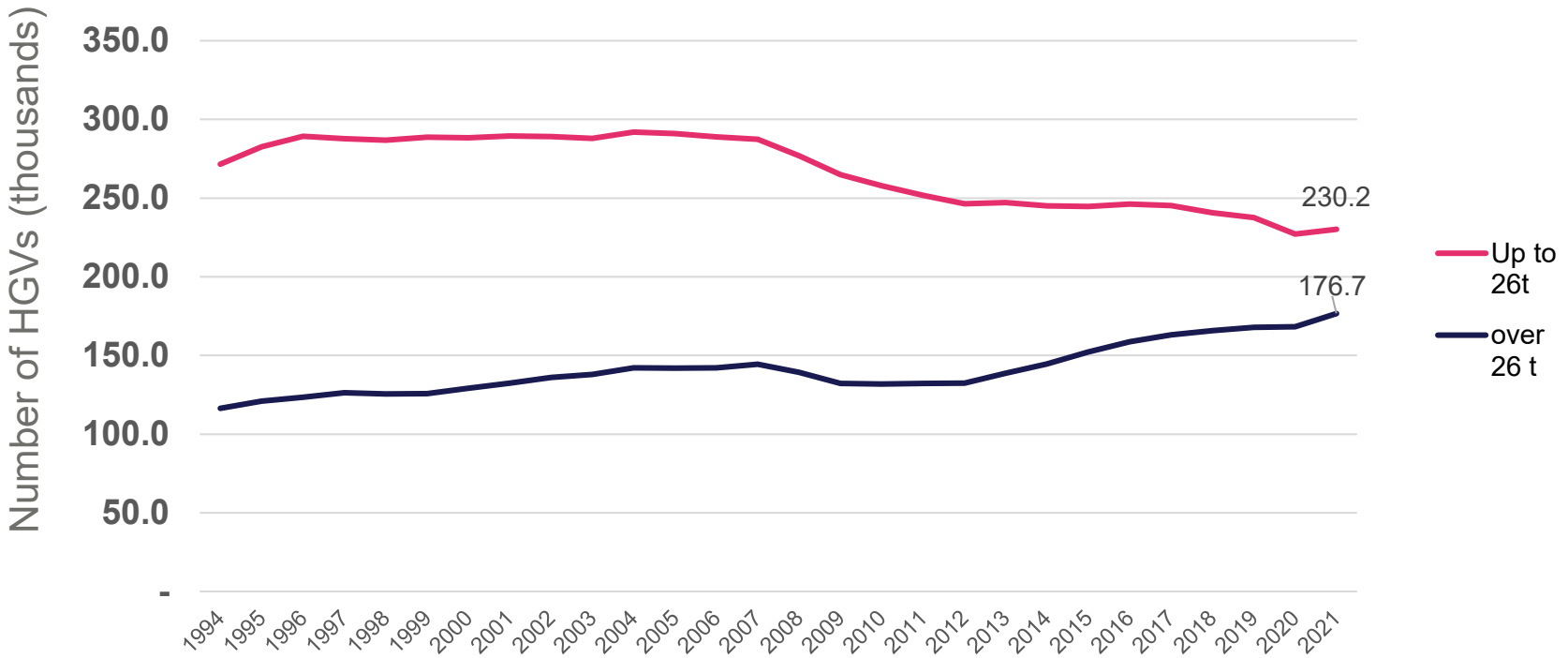
After

2035 → **New trucks <26 tonnes**

2040 → **New trucks >26 tonnes**

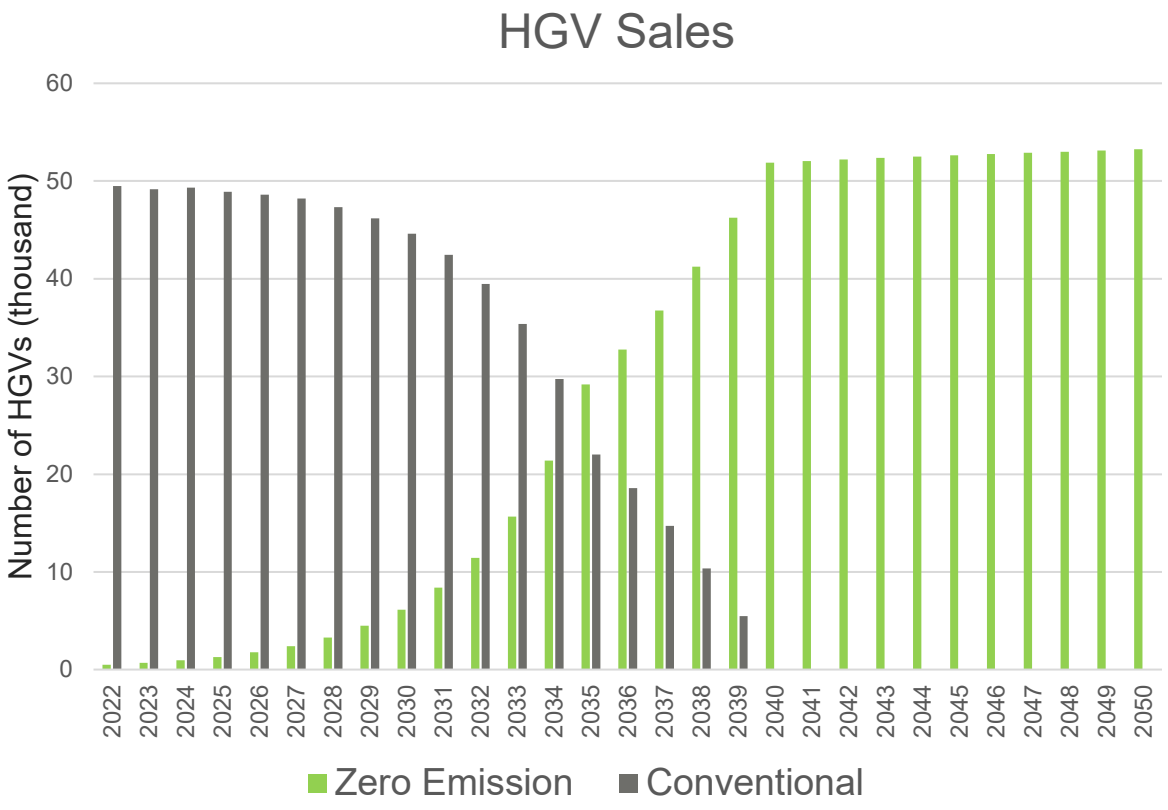
Have to be net-zero

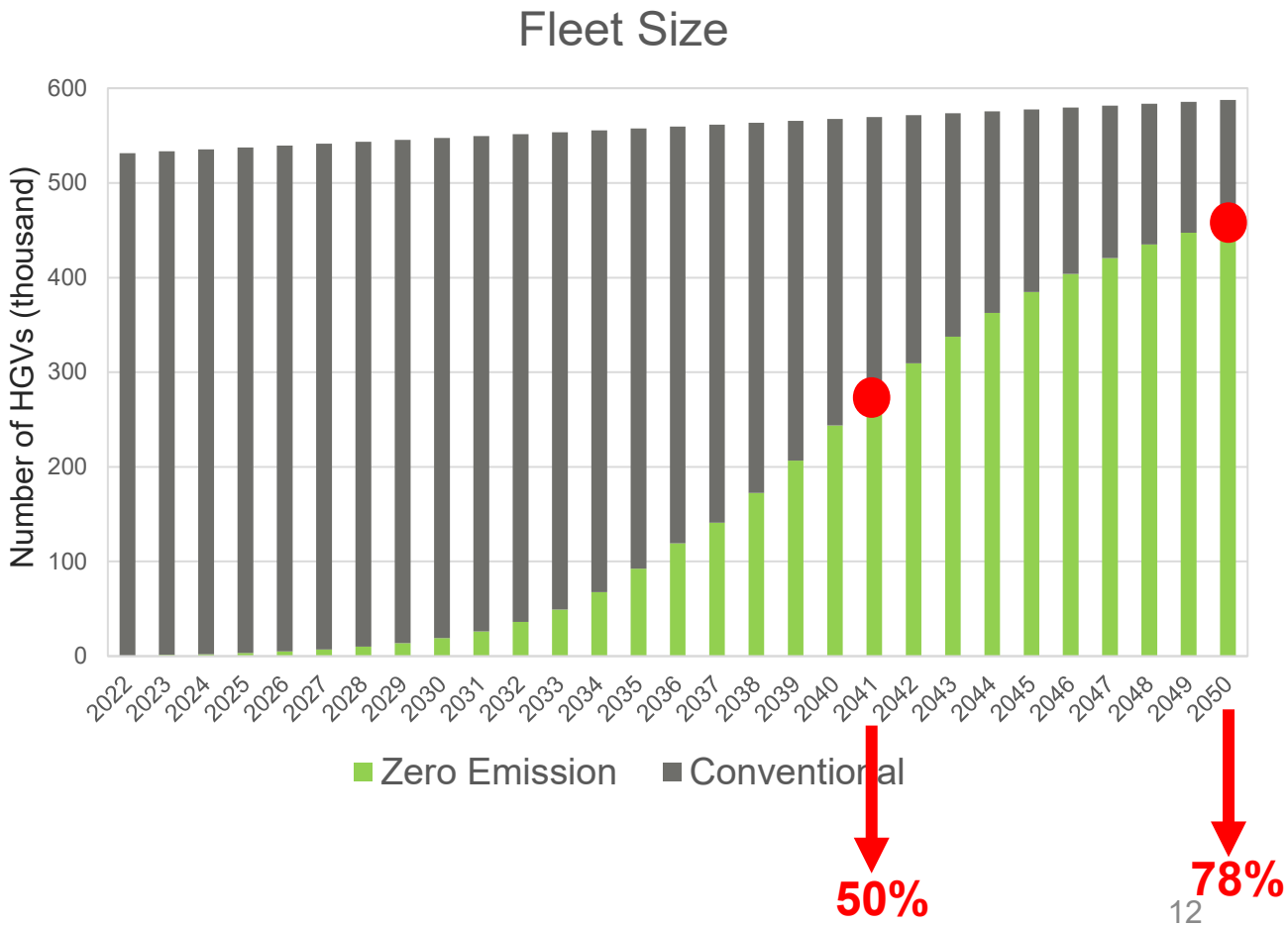
- The number of Battery Electric HGVs in the UK fleet at the end of 2021, was 520. **0.1% of the whole fleet**. At the end of September 2022 this number was 1019 (DfT, 2022).



3.Fleet Module

HGV Fleet Turnover & Initial Fleet Estimation





4.Vehicle Module

- 5% of the UK HGV fleet to use H_2 as a fuel *(National Grid (2022), UKRI (2021))*
- H_2 ICE trucks and infrastructure policies seems promising.
- E-fuels and biofuels, especially renewable diesel which can easily be used as a drop in fuel.

Conventional fuels	Fossil fuels	Diesel
		Gasoline
Alternative fuels	Fossil fuels	Liquefied Petroleum Gas (LPG)
		Liquefied Natural Gas (LNG)
		Compressed Natural Gas (CNG)
	Biofuels	Biodiesel
		Bioethanol
		Biogasoline
		Biomethane
		Hydrotreated Vegetable Oil (HVO)
	Electricity	
	Hydrogen	

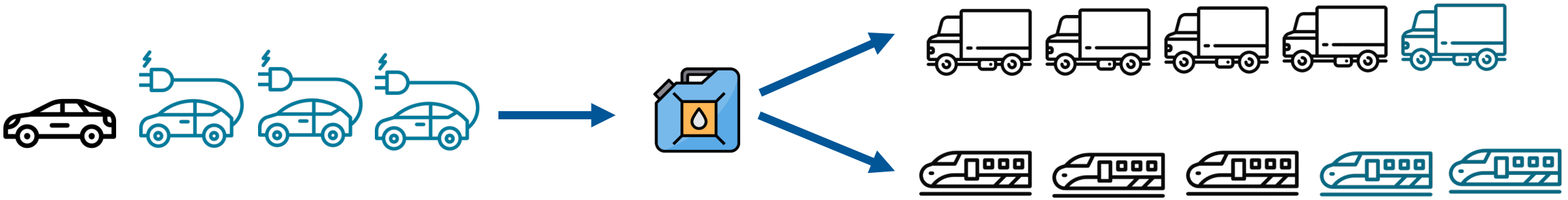
Fuels available for road transport (Navas-Anguita et al., 2019)

Rigid Trucks
- Small (12t)
- Medium (18t)

Articulated Trucks
- Over 40t

5.Future Work

- Estimating fuel use of the fleet and fuel prioritisation between modes.



- Fuel and technology mix scenarios development.

And for each scenario, quantifying life cycle GHG emissions of the HGV fleet.

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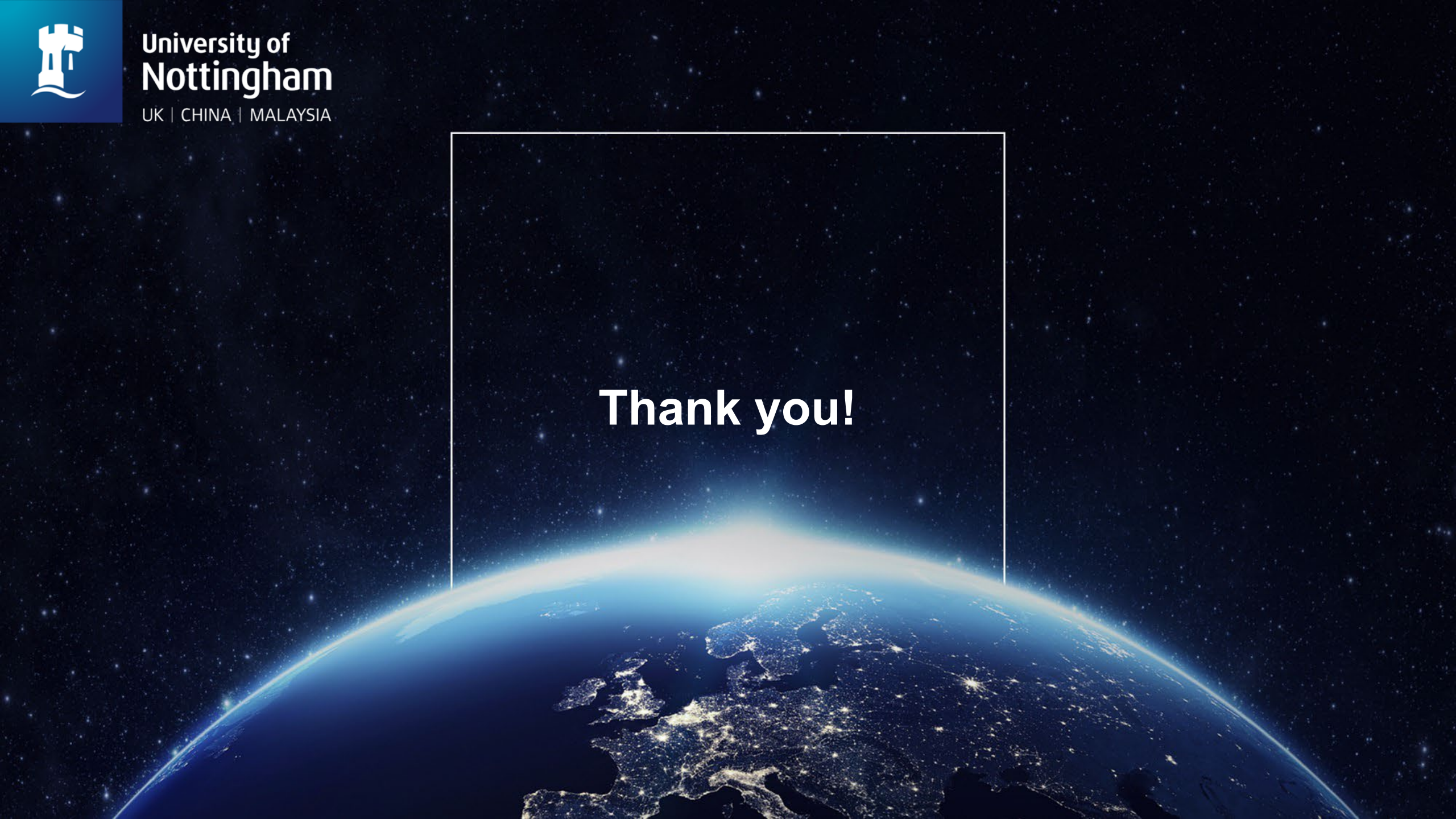

Equations

Survival rate of the HGV Fleet:

For Survival Rate, DfT's VEH1111 Table is used. It gives information on the number of licensed vehicles in Great Britain at the end of each year, by their respective first used years.

SR_a is the rate of which an HGV in its age "a" survives to become "a+1" of age.

CSR_a the cumulative survival rate of age "a" would be:

$$CSR_a = \prod_{0}^{a} SR_a$$

HGV Fleet Turnover:

Since there are no more than one technology option available, equation is updated as such:

$$Stock_y = Stock_{y-1} + In_y - Out_y$$

$$Out_y = \sum_{a=age} Out_{y,a}$$

$$Out_{y,a} = (1 - SR_a) * Stock_{y-1,a}$$

$Stock_y$ the on-road stock of vehicles in year "y",

In_y the new sales,

Out_y the outgoing vehicles (scrapped vehicles),

SR_a the survival rate of age "a"