

How do cargo capacity, refuelling time, and hurdle rates impact the decarbonisation of trucks in Ireland?

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- ❑ **Transport sector is responsible for 34% of energy-related CO₂ emissions**
- ❑ **CO₂ emissions during 1990 to 2021 have risen by 115%**
- ❑ **Trucks make up 5% of total road vehicle stock**
- ❑ **Trucks generate 20% of transport emissions**
- ❑ **The overall freight demand is expected to double by 2050 (source: ESRI)**

Decarbonising trucks

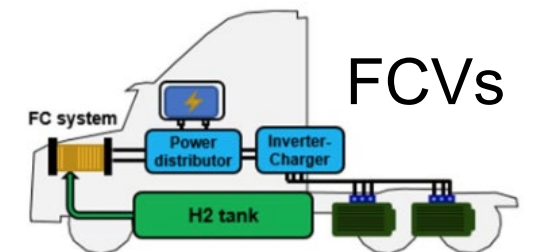
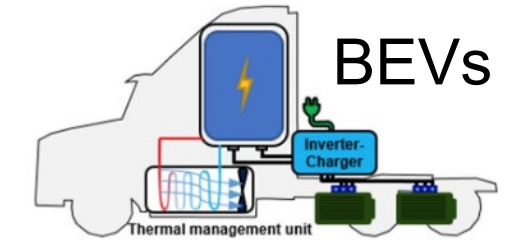
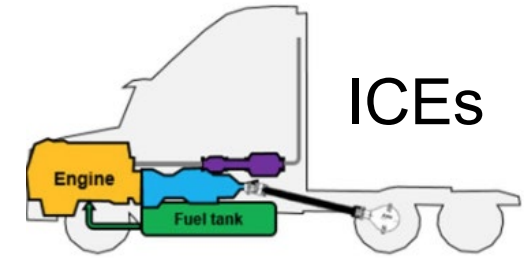


□ Barriers

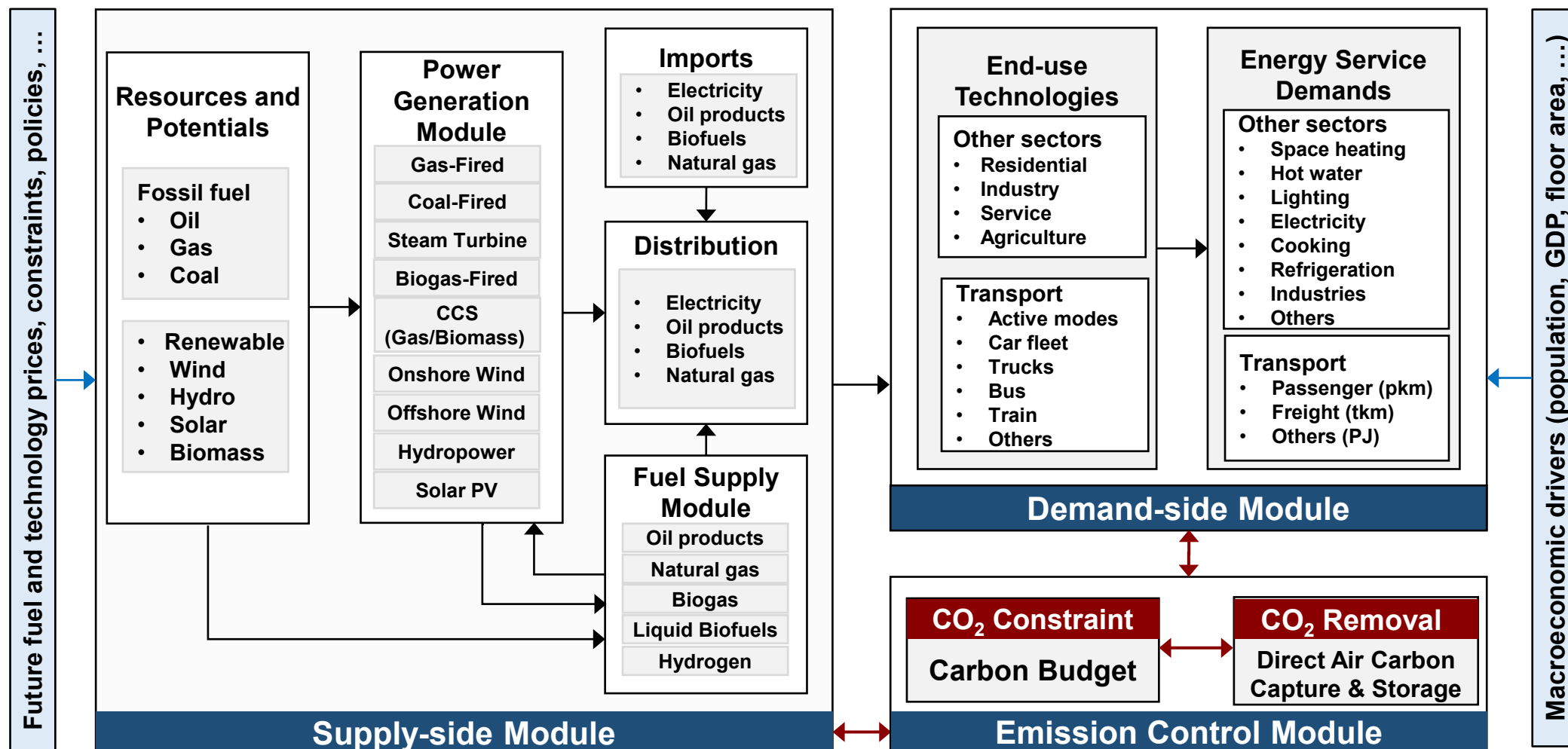
- Alternative fuel availability
- Recharging/refuelling time
- Decreased cargo capacity
- Capital-intensive infrastructures (e.g. ELC & H2 supply)
- Well-to-wheel emissions
- Less commercialised technologies
- Hesitancy to invest in a less mature technology



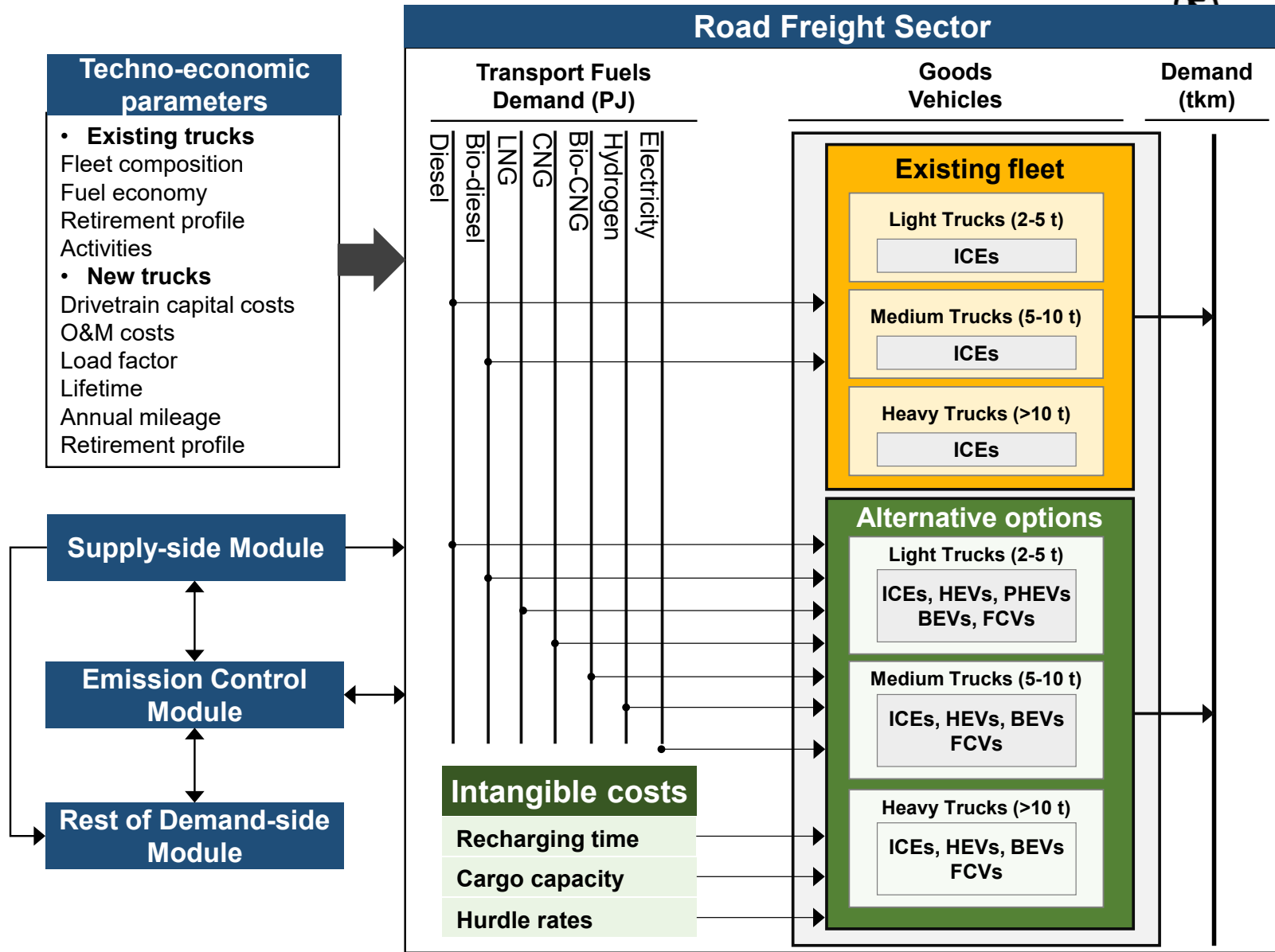
Need for a comprehensive Energy System Analysis



TIMES-Ireland Model (TIM)



Freight sector and main input



Cargo capacity and refuelling time



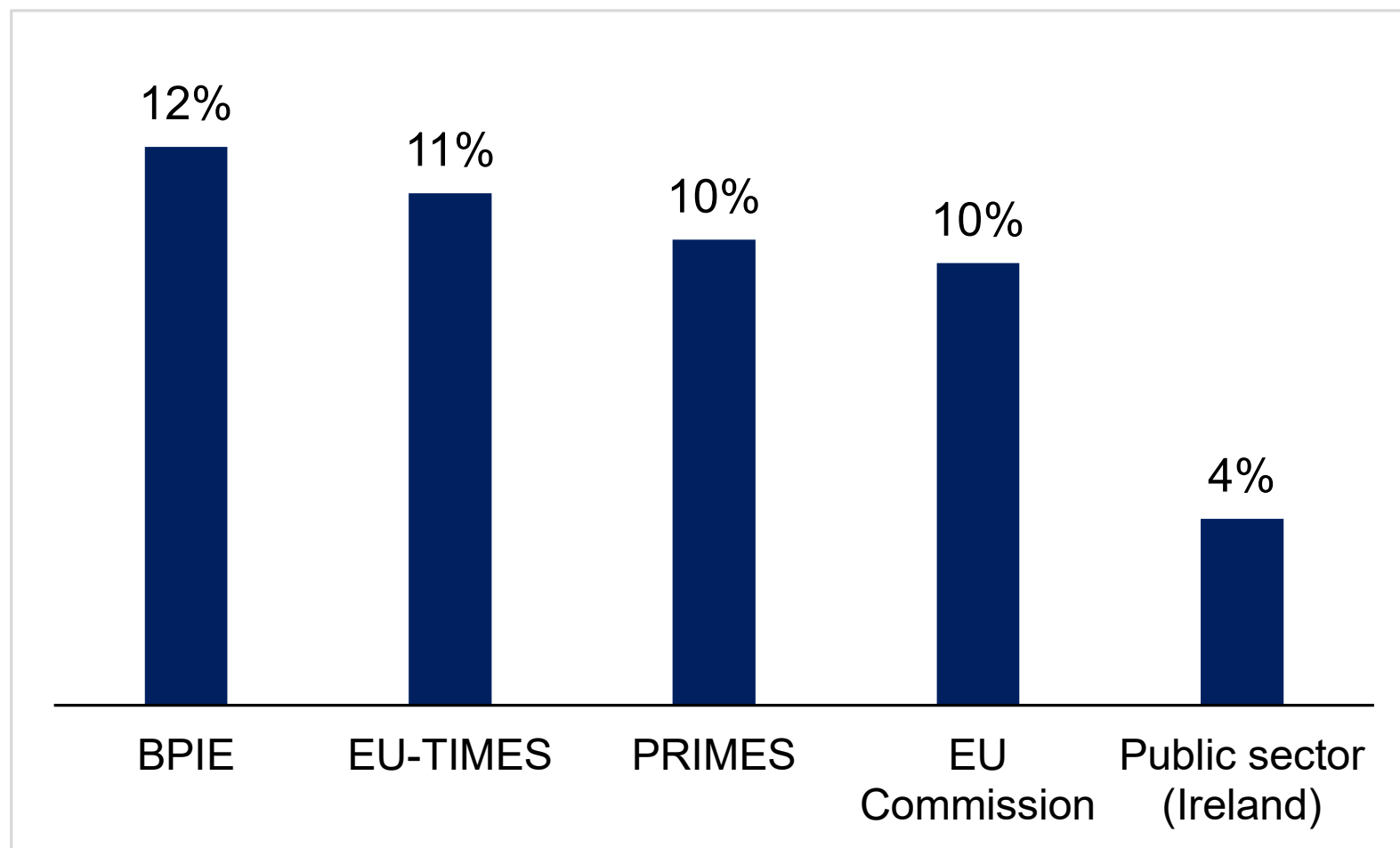
Technology	Cargo capacity relative to diesel ICE		Refueling time multipliers	
	2020	2050	2020	2050
ICEs (CNG)	0.99	0.99	1.2	1.1
BEVs	0.67	0.89	8	2
FCVs	0.9	0.96	1.2	1.1

8 ton to 5.4 ton

50,000 km/yr to 36,000 km/yr

Source: Lajevardi SM, Axsen J, Crawford C. Simulating competition among heavy-duty zero-emissions vehicles under different infrastructure conditions. Transportation Research Part D: Transport and Environment. 2022 May 1;106:103254. <https://www.sciencedirect.com/science/article/pii/S1361920922000840?via%3Dihub#f0005>

Discount rate in freight sector



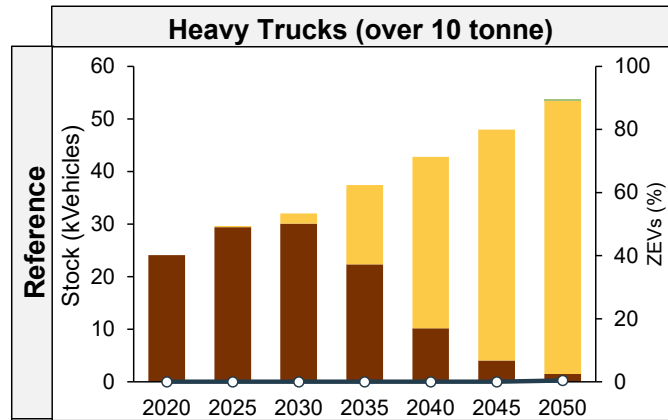
Scenario definition



- Reference
- Net zero by 2050
- Net zero + Intangible costs

Scenarios	BAU	Carbon budget constraint	Intangible costs		
			Recharging time	Cargo capacity	Hurdle rate (12%)
Reference	✓				
Mitigation	✓	✓			
Mitigation+ Intangible	✓	✓	✓	✓	✓

Results: Vehicle stock



ICEs

HEVs

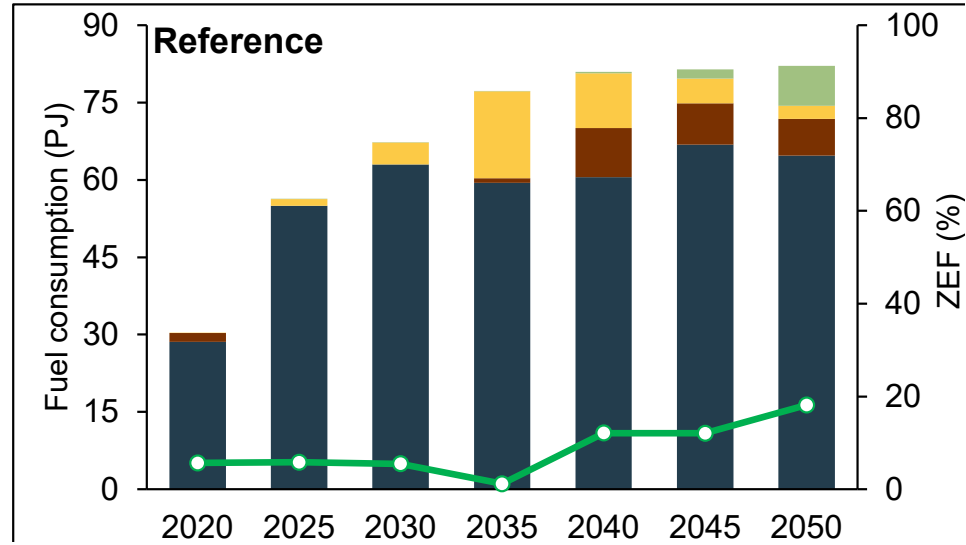
PHEVs

BEVs

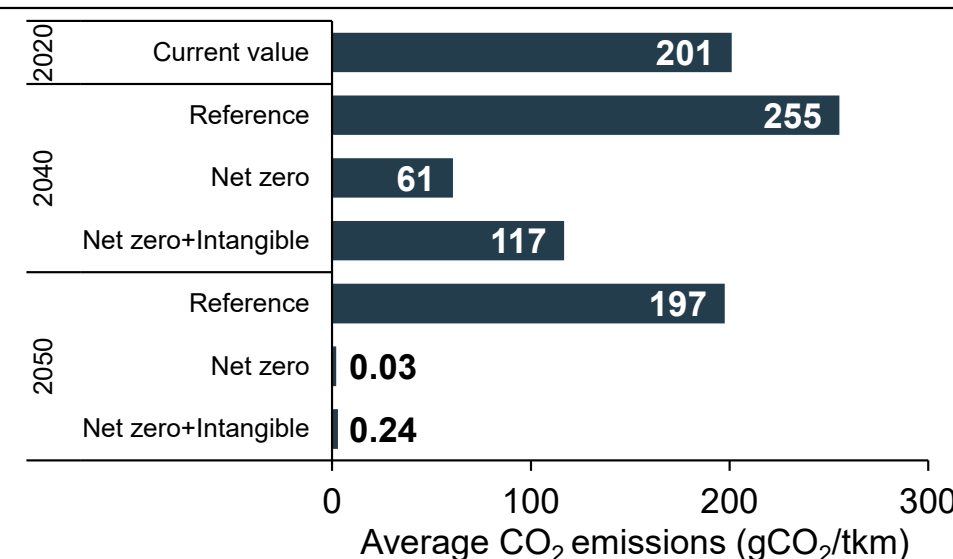
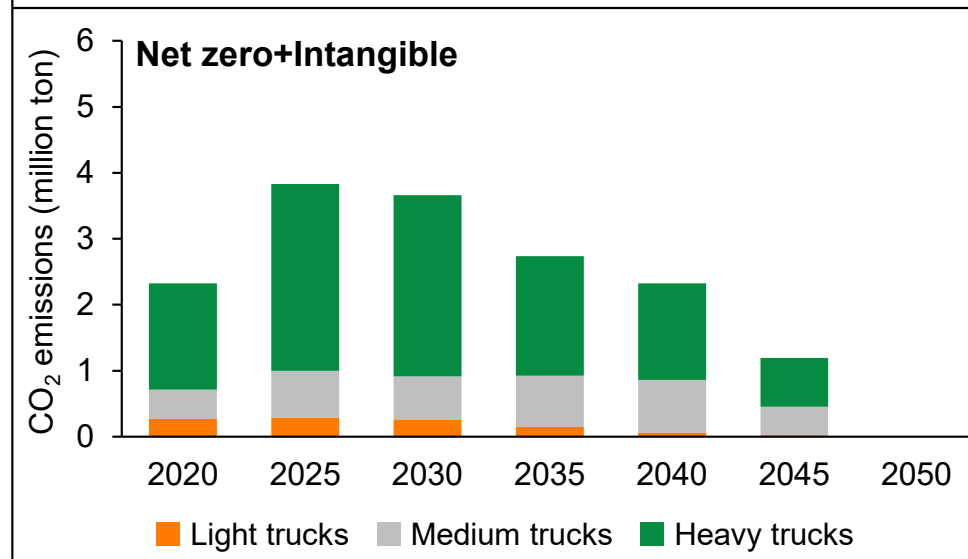
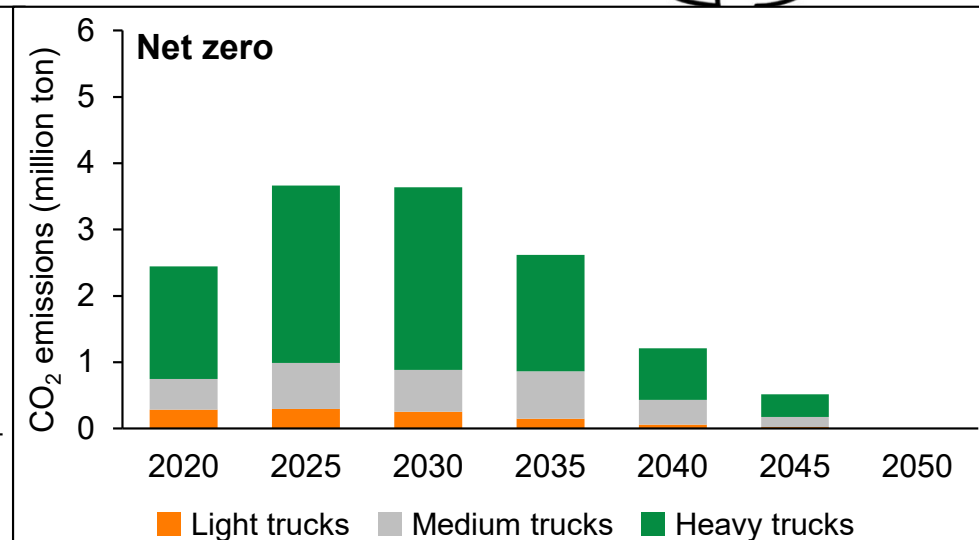
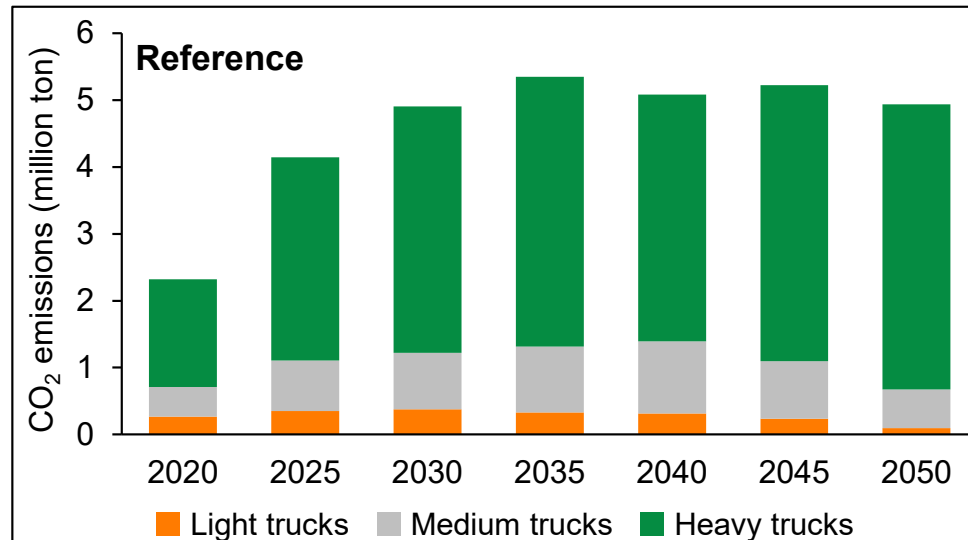
FCVs

ZEVs (%)

Fuel consumption



CO₂ emissions





- **Cargo capacity, refuelling time, and hurdle rates** can significantly change the results between **electrification & hydrogen FCV**
- **Intangible costs impact preference:**
 - Hydrogen FCV may be favoured for medium and heavy trucks
 - BEVs are preferred without considering intangible costs
- **Importance of holistic evaluation:** Policy makers and stakeholders should consider both **tangible & intangible factors** for effective decarbonisation strategies
- **Infrastructure considerations:** Availability of hydrogen supply and dispensers, as well as power generation and recharging stations, are crucial factors
- *Sensitivity analysis is planned to further refine results*

Thank you!

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