# Initial assessment of categories & duty cycles provides four main commercial/off-highway vehicle classifications:

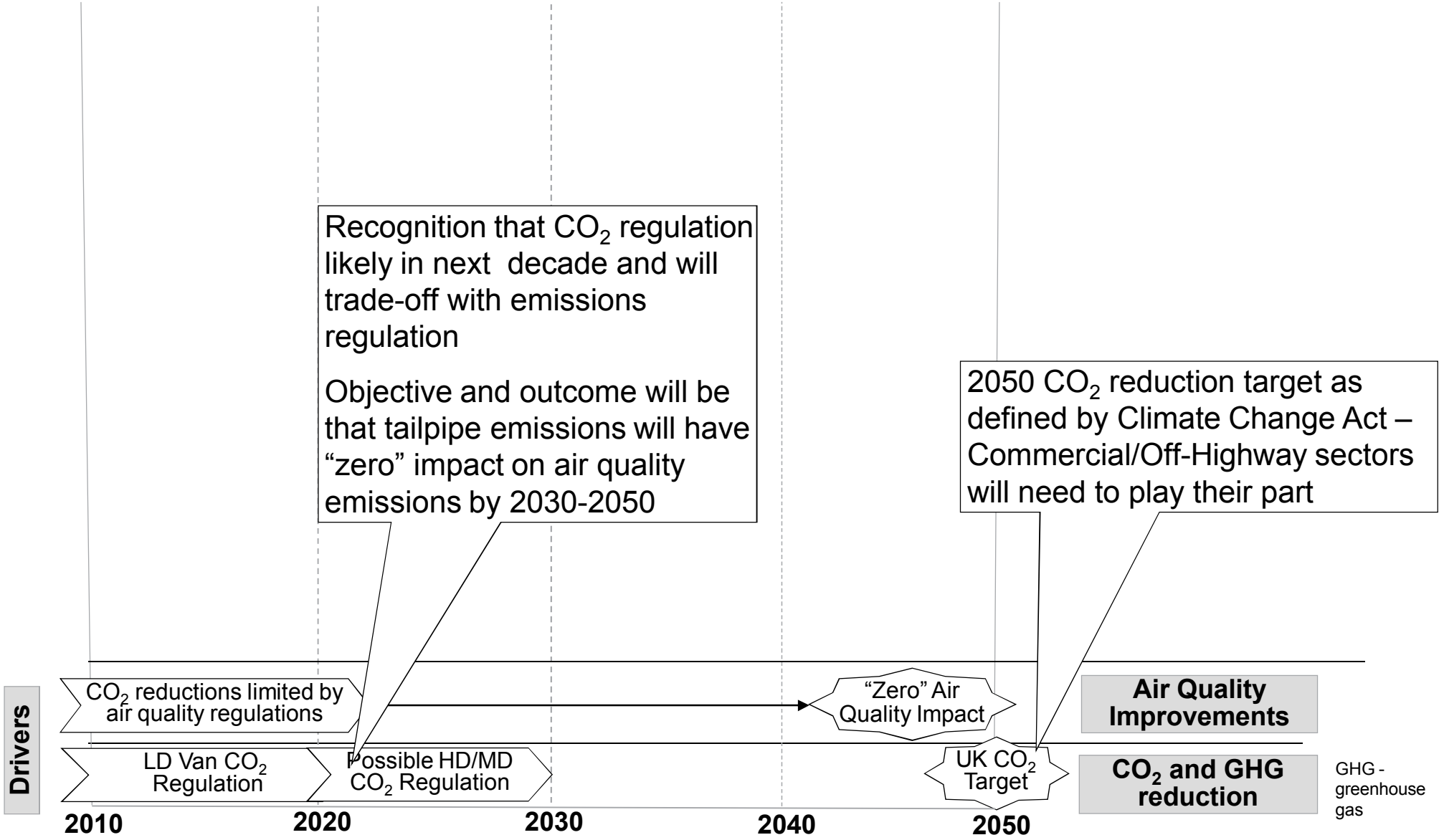
automotive council UK

**Duty Cycle and classifications are a function of application rather than vehicle or product**
**However, typical applications and characteristics are listed below:**

| | Light duty vehicle, up to and including 3.5t GVW | Medium duty vehicle, From 3.5 – 26t GVW Rigid & drawbar | Bus/Coach – Heavy Duty engine but lighter duty cycle | Heavy duty vehicle, From ~ 26 – 44t GVW Rigid & drawbar |
|---|---|---|---|---|
| | Up to ~120 kW | From ~ 90-200 kW | From ~ 180+ kW | From ~ 180+ kW |
| **Typical Engine Disp.** | **1.5 – 3 litres** | **4 – 7 litres** | **4 – 12 litres** | **7 – 16 litres** |
| **Sample Off-Highway Applications** |  **Light duty delivery** |  **Medium duty truck** |  **Bus** |  **Heavy duty truck** |
| |  **Skid Steer Loaders/Excavators** |  **Backhoe Loaders** |  **Mobile Cranes** |  **Crawler Excavators** |
| |  **Fork lifts & Telehandlers** |  **Compact Wheel Loaders** |  **Tractors – Utility & 4WD** |  **Wheel / Track Bulldozers** |

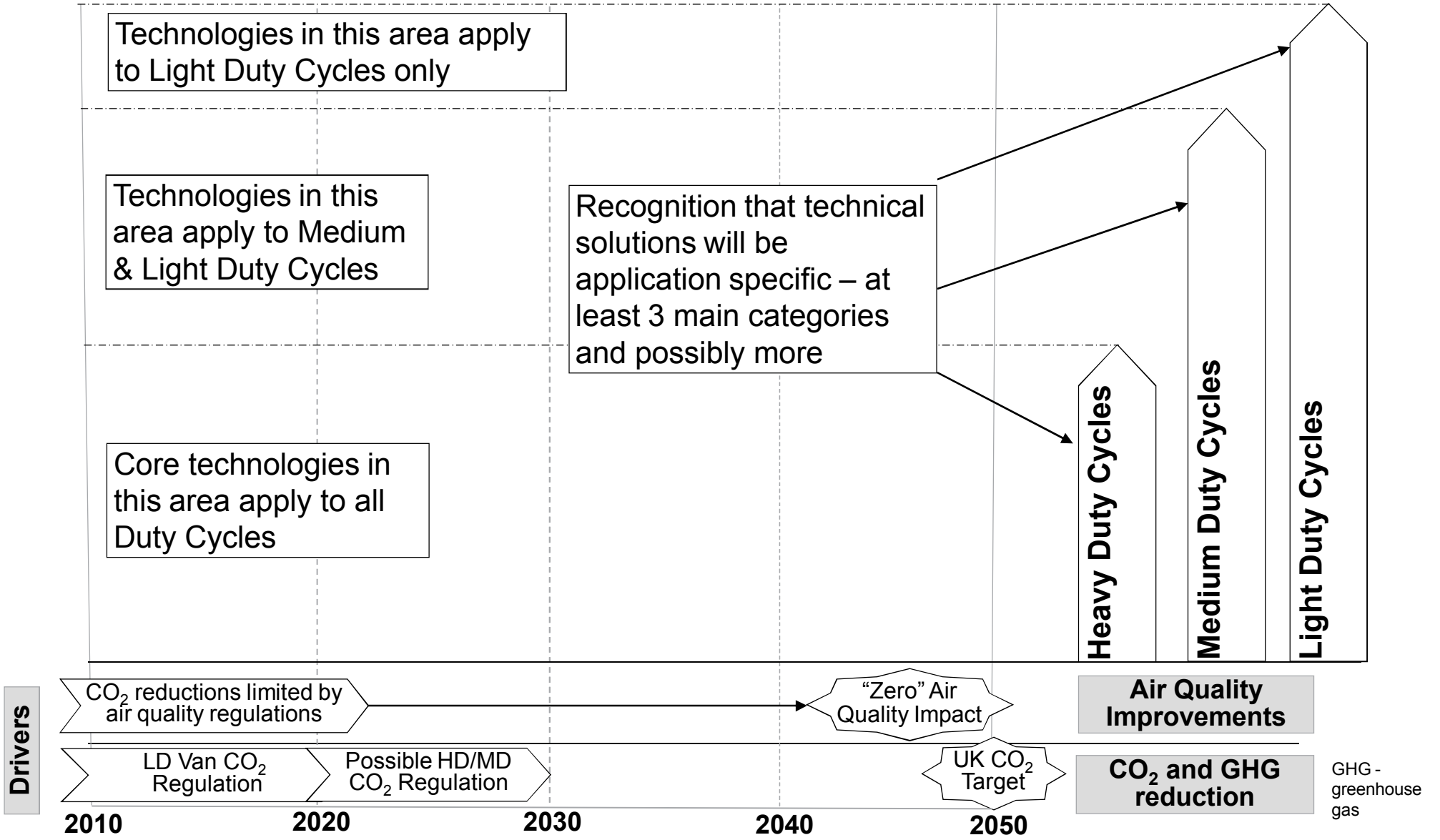
# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK



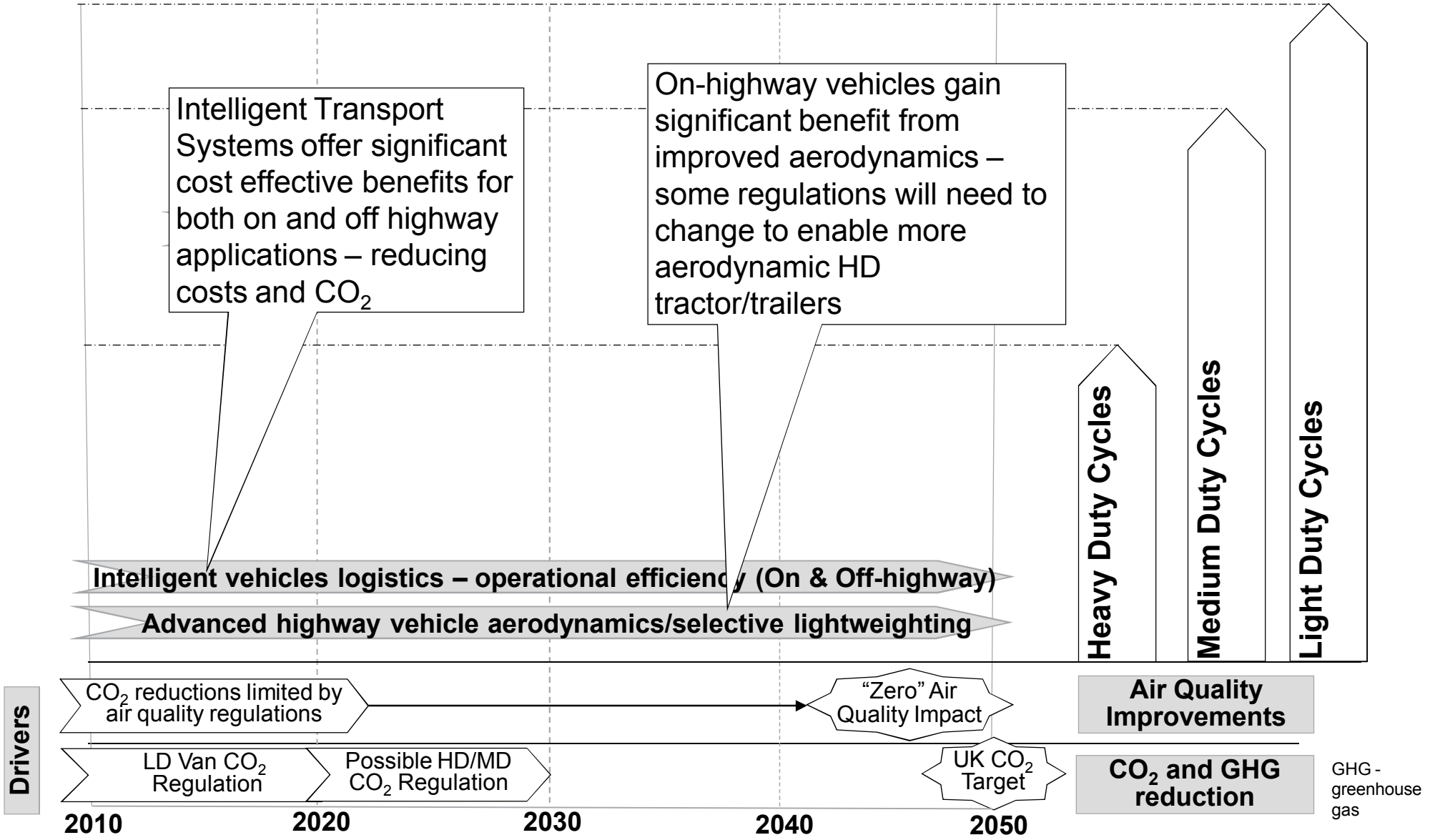

GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle



# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

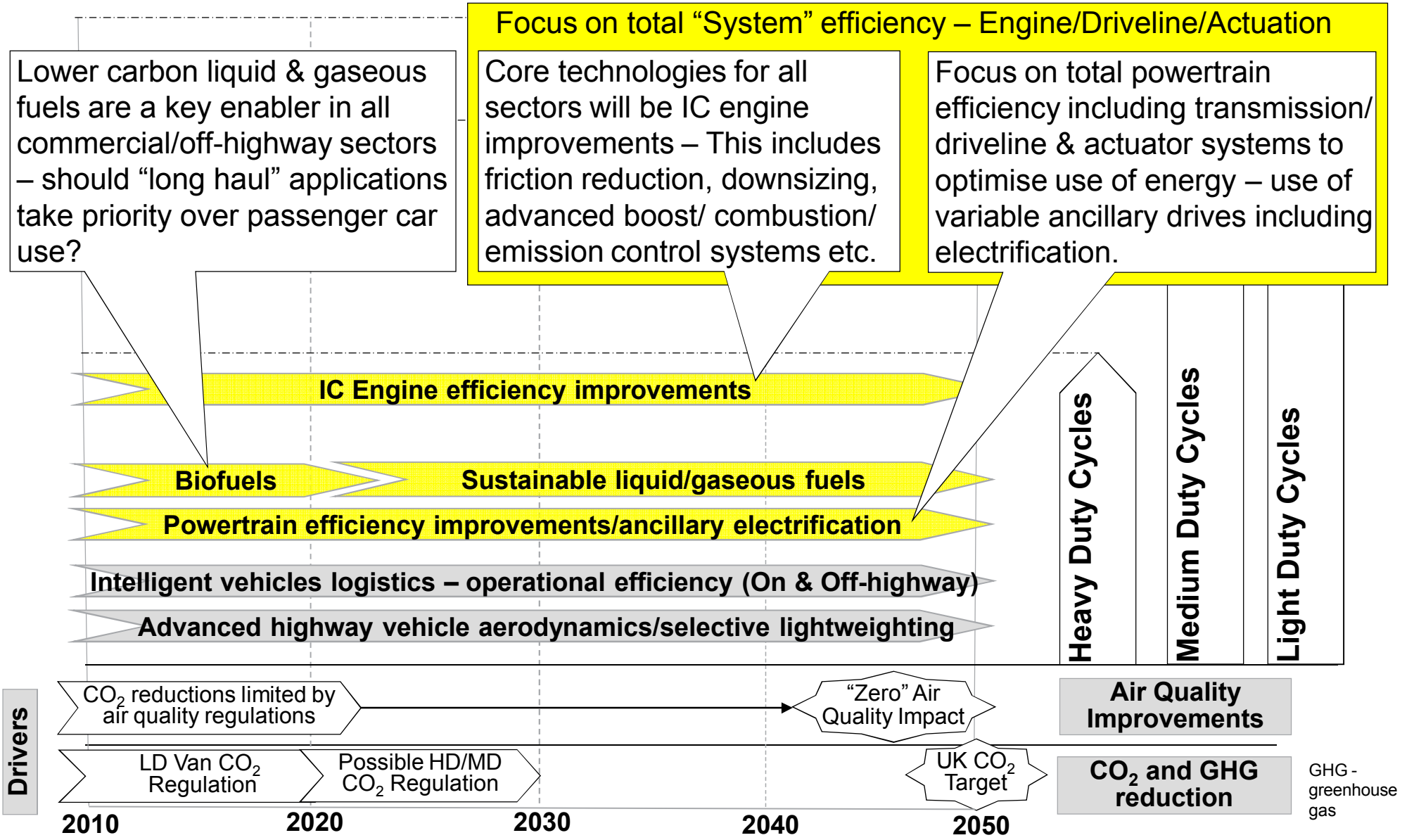
automotive council UK




GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

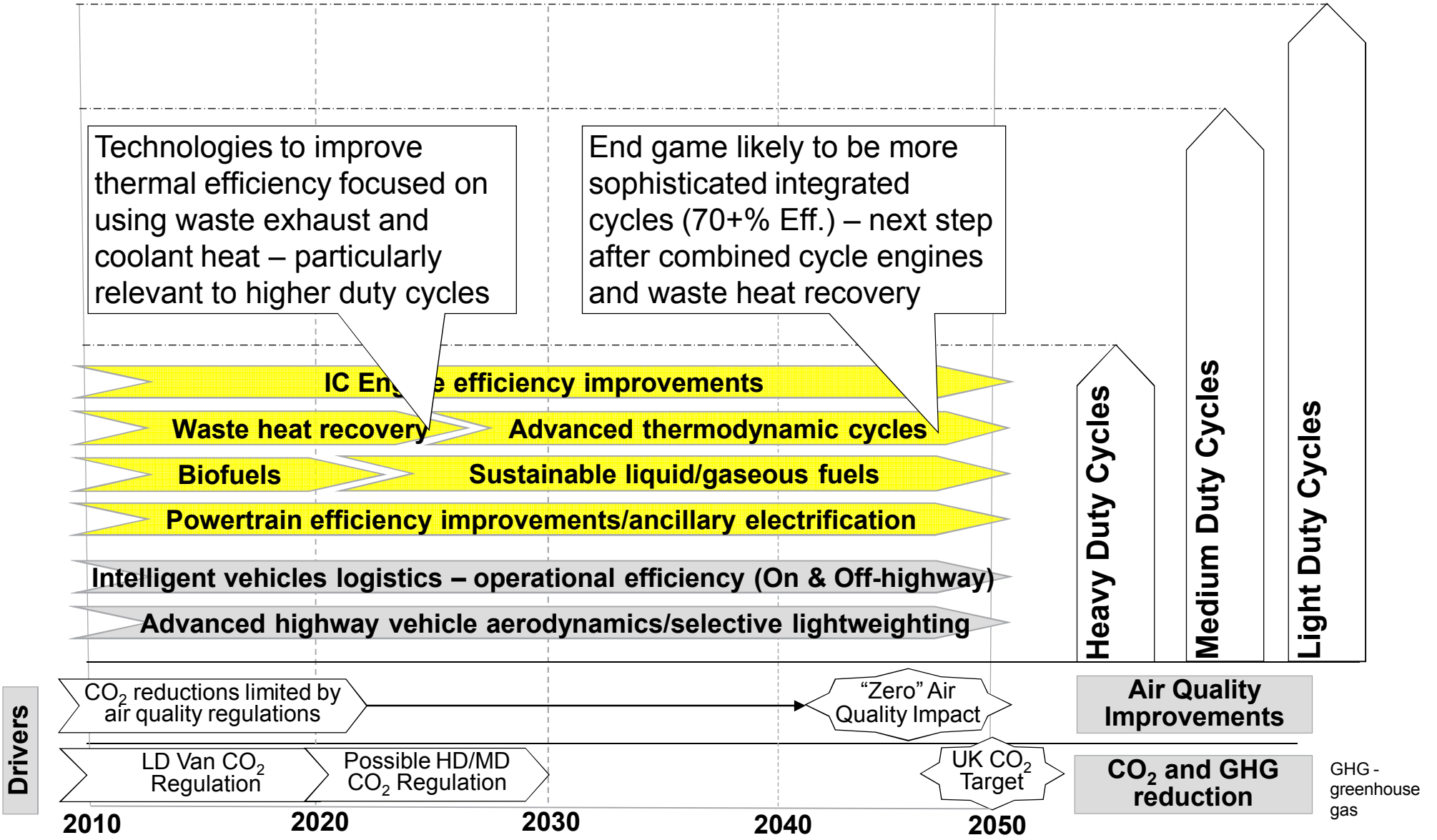
automotive council UK




GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK




GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK

***Breakthrough*** in energy storage

Cost effective energy storage critical for commercial applications – breakthrough required for mass market penetration

Some plug-in applications possible but depends on duty – Utility and mixed duty cycle looks most likely

Demos

**Plug in hybrid**

**Full hybrid**

**Micro/Mild hybrid**

Hybridisation for medium duty applications where stop/start accel/decel predominates for both on and off-highway – Penetration dependent on infrastructure and battery technology and lags light duty introduction

**Heavy Duty Cycles**

**Medium Duty Cycles**

**Light Duty Cycles**

**Drivers**

$CO_2$ reductions limited by air quality regulations

"Zero" Air Quality Impact

**Air Quality Improvements**

LD Van $CO_2$ Regulation

Possible HD/MD $CO_2$ Regulation

UK $CO_2$ Target

**$CO_2$ and GHG reduction**

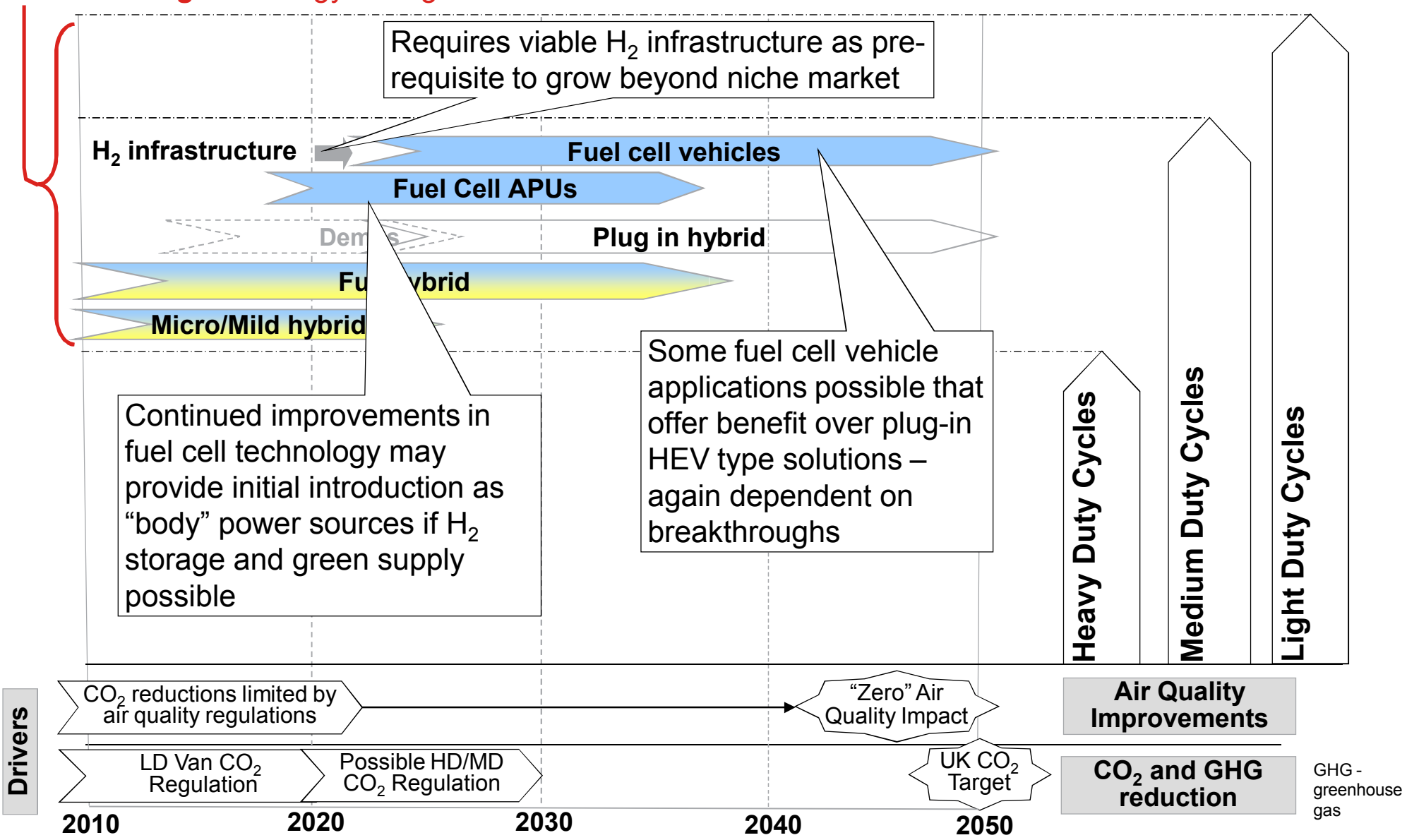
GHG - greenhouse gas

**2010** **2020** **2030** **2040** **2050**

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK

***Breakthrough*** in energy storage

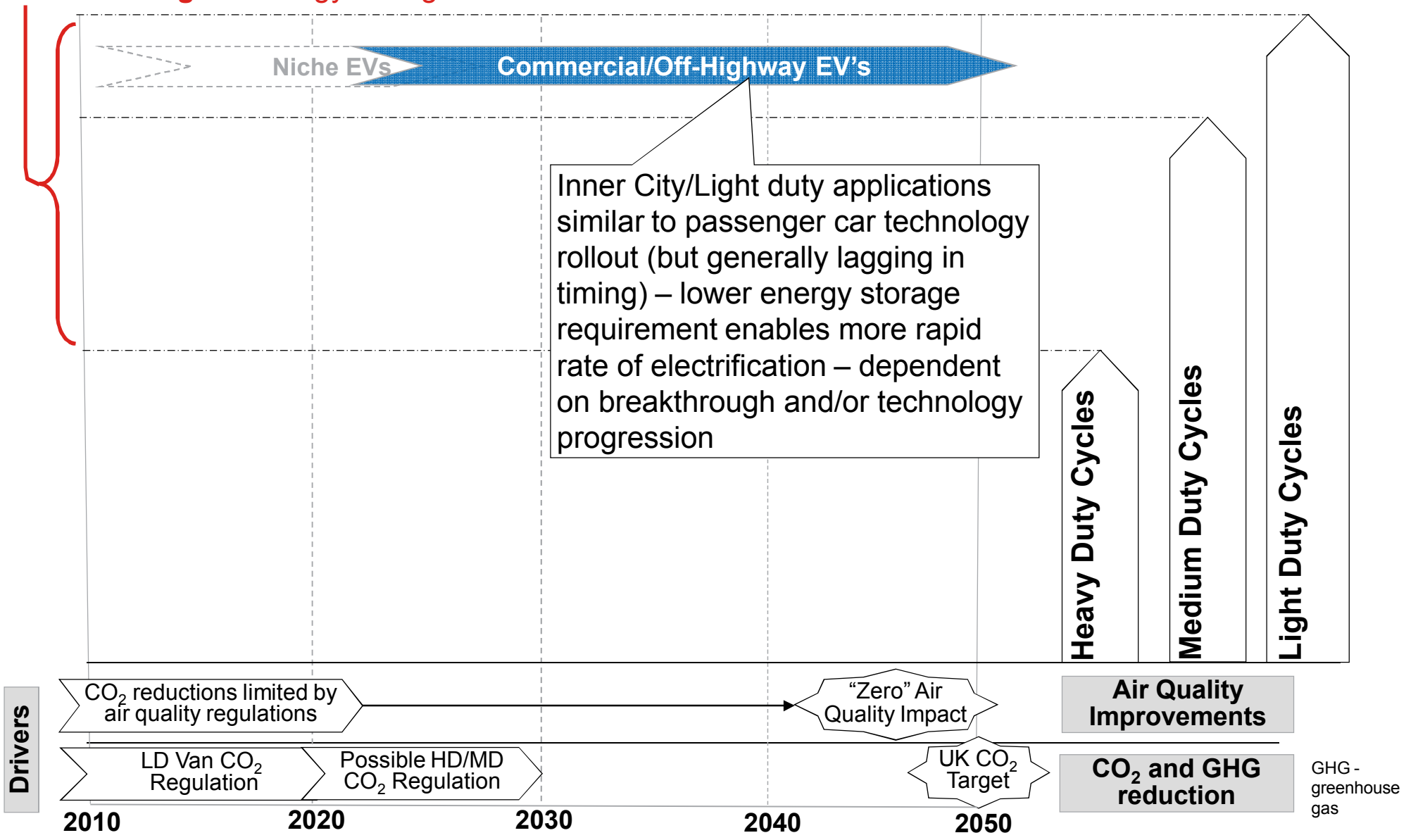



GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK

***Breakthrough*** in energy storage

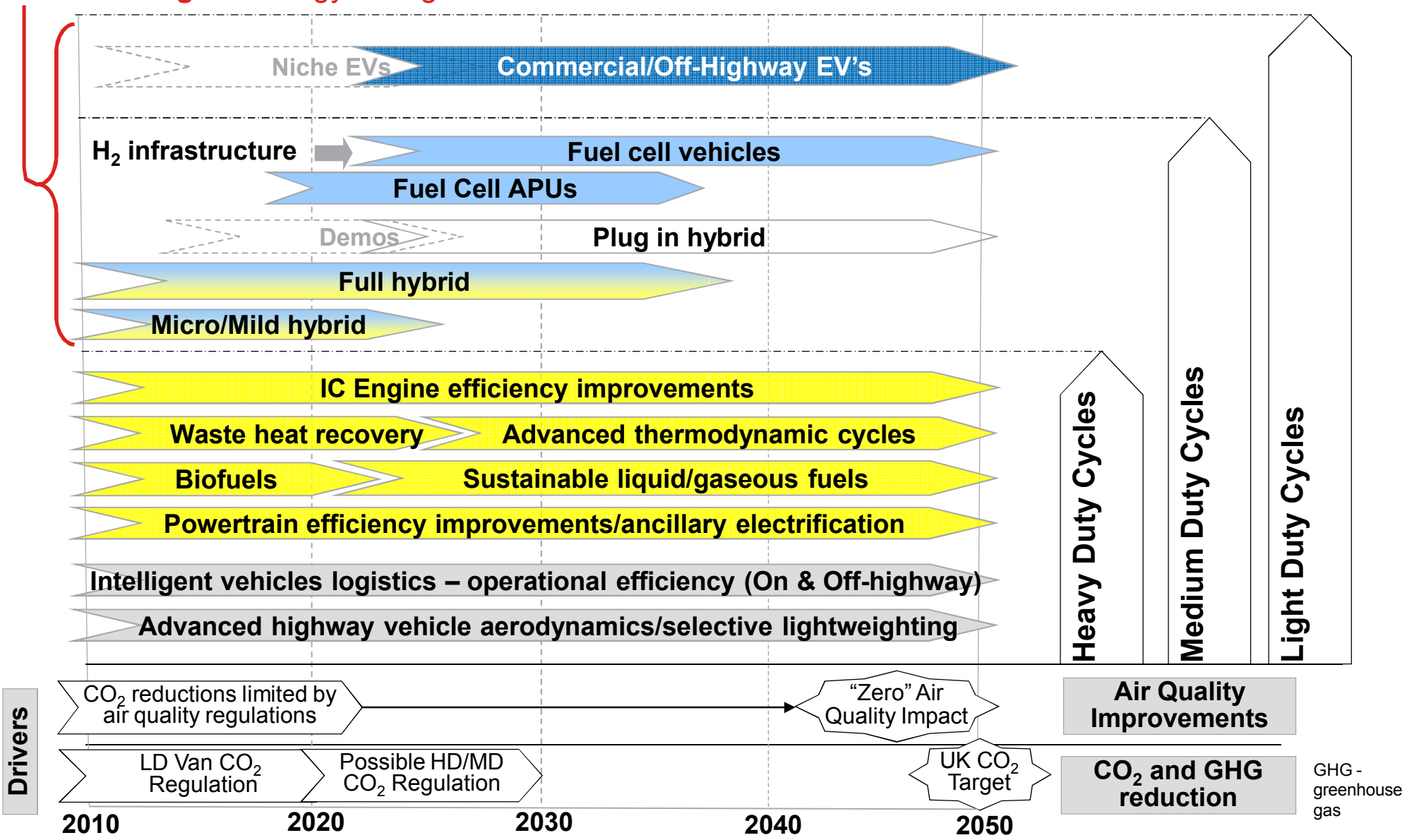



GHG - greenhouse gas

# Low carbon Commercial Vehicle & Off-highway roadmap has parallel technology streams depending on duty cycle

automotive council UK

***Breakthrough*** in energy storage




GHG - greenhouse gas

# Commercial Vehicle & Off-Highway share a similar future roadmap - $CO_2$ reductions require efficient combustion engines, low carbon liquid fuels & intelligent logistics

automotive council UK

**Key Points related to the low carbon Commercial & Off-Highway Vehicle roadmap**

- Whilst there are many common technologies shared between on and off-highway vehicles with similar technical and commercial barriers, the relevance to specific products will be based on many other factors such as:
  - Specific duty cycle & overall power requirements
  - Re-fuelling & range requirements – particularly for higher power & heavy duty cycles
  - Total cost of ownership
- Reducing $CO_2$ emissions for long haul vehicles & high power products in the foreseeable future will be dependent on improvements in conventional powertrains & transmissions
  - A key requirement will be affordable & sustainable low carbon liquid fuels
- The shift to alternative powertrains and transmissions such as electrification will be limited to light duty products and short range/endurance products but will benefit from technologies developed for the passenger car market
- Centrally re-fuelled vehicles and products may offer opportunities for the introduction of low carbon fuels or electrification where this can be cost effective
- There are clear opportunities & benefits available from an integrated approach and the introduction of “Intelligent Logistics” for both on-highway & off-highway vehicles