Lightweight Vehicle and Powertrain Structures

Technology Roadmap

2024

automotive council UK

ADVANCED PROPULSION CENTRE UK

Produced by the Advanced Propulsion Centre UK on behalf of the Automotive Council UK
Information correct at time of publication

Introduction to the technology roadmap

The 2024 technology roadmaps provide a view of technology adoption in the automotive industry. These roadmaps help academia, industry and policy-makers understand where research and development (R&D) efforts are likely to be focussed, highlight key milestones in technology adoption, and through the supporting documents explore challenges and opportunities.

The documents available for each roadmap are as follows:

The executive roadmap

The executive roadmap provides a high-level view of forecast mass adoption of technology within the automotive industry. Mass adoption requires technology, supply-chain, manufacturing and market readiness and in some instances, regulatory readiness.

The narrative report

The narrative report supports the executive roadmap by providing the context behind the technologies on the roadmap. The narrative considers regulatory and market drivers alongside the work required to develop individual technologies and their supply chain.

The innovation opportunities report

The innovation opportunities report is intended to take a deeper dive in to the R&D steps required to enable technologies on the roadmap.

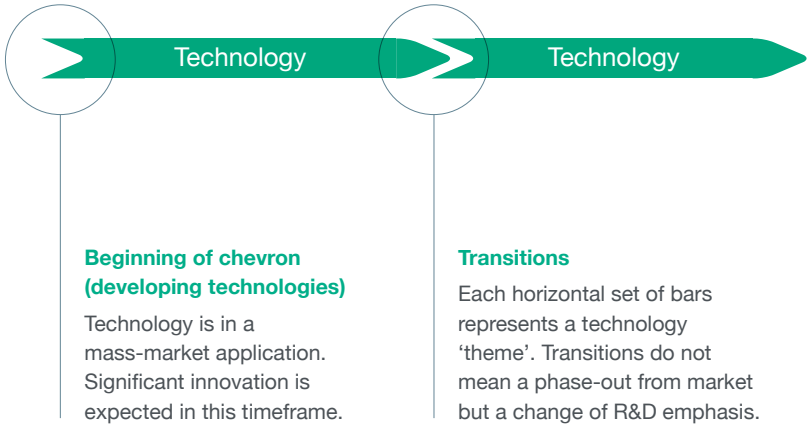
Technology roadmap

Narrative report

Introduction to the technology roadmap

This technology roadmap represents a snapshot-in-time view of the global automotive industry propulsion technology forecast for mass-market adoption.

- Chevrons with text describing a technology indicate when a technology is expected to reach mass-market adoption in the automotive industry.
- Technology adoption will vary from region to region, this is recognised and discussed in the narrative report that accompanies this executive roadmap.
- Technology adoption varies within different sectors of the automotive industry and, where appropriate, this is indicated on the roadmap and discussed in the accompanying narrative report.
- Some technologies may be feasible before appearing on the roadmap, many technologies that do not appear until later are technically feasible now. However, the roadmap considers not just technology maturity but also market, supply chain and regulatory impacts. These are discussed in the accompanying narrative report.
- Some chevrons appear to start on the 2025 line, this is considered as equivalent to a technology being available now.



Beginning of chevron (developing technologies)

Technology is in a mass-market application. Significant innovation is expected in this timeframe.

Transitions

Each horizontal set of bars represents a technology ‘theme’. Transitions do not mean a phase-out from market but a change of R&D emphasis.

Opportunities for vehicle mass reduction*

These technology indicators represent opportunities to reduce mass across vehicle sub-systems with the recognition that this is part of managing a weight budget, and that trade-offs are made across the vehicle, depending on the application, performance needs, cost budget, and addition of new features.

Overall vehicle mass may increase to meet performance, cost and life cycle targets.

		2025	2030	2040
Light-Duty Vehicles	Body (% change)	BASELINE	-15 to 0	-35 to -10
	Chassis (% change)	BASELINE	-10 to 0	-25 to -10
	Interior (% change)	BASELINE	-5 to 0	-15 to -5
	ICE powertrain (% change)	BASELINE	-5 to 0	-10 to -5
	BEV powertrain (% change)	BASELINE	-10 to +10	-20 to -10

Notes:
- Represents percentage mass change at equal affordability
- Affordability based on material lifetime cost including end-of-life (EOL)
- Assuming equal performance (crash, NVH, durability, reliability and recyclability)
- Opportunities to reduce mass will vary depending upon vehicle type and design requirements

		2025	2030	2040
Heavy-Duty Vehicles	Body (% change)	BASELINE	-10 to 0	-20 to -5
	Chassis (% change)	BASELINE	-5 to 0	-10 to -5
	Interior (% change)	BASELINE	-5 to 0	-10 to -5
	ICE powertrain (% change)	BASELINE	-3 to 0	-5 to 0
	BEV powertrain (% change)	BASELINE	-5 to +10	-15 to 0

Notes:
- Represents percentage mass change at equal affordability
- Affordability based on total cost of ownership (TCO)
- Baseline 3-axle lorry (maximum tonnage of 18-26 tonnes)
- Assuming equal performance (crash, NVH, durability, reliability and recyclability)

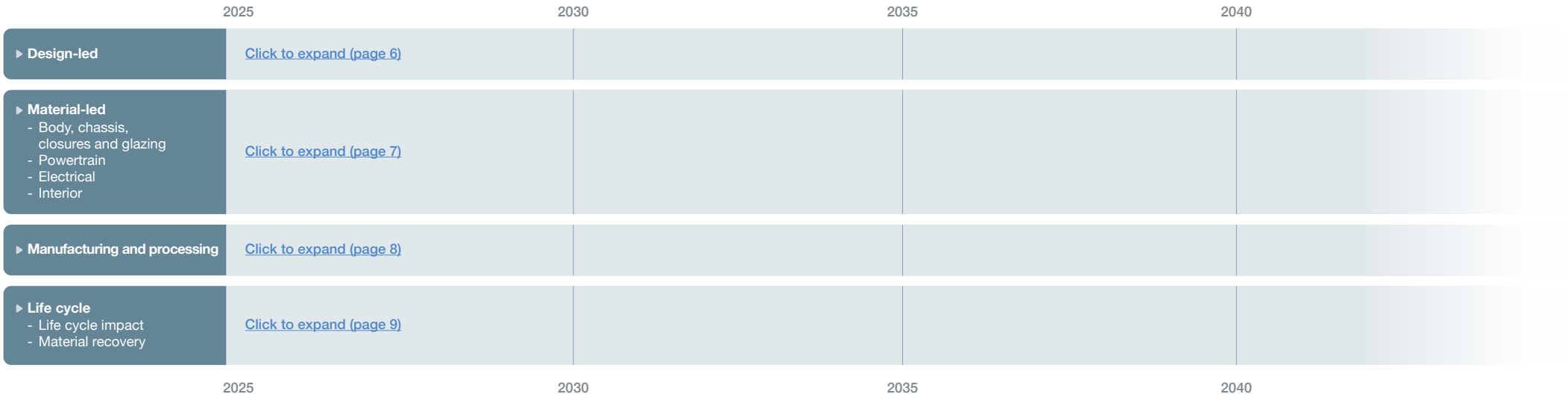
Manufacturing emissions targets

Indicators representing CO_2-eq reduction targets for vehicle manufacturing (Scopes 1 and 2), these targets do not include vehicle use or end-of-life.

	2025	2030	2035	2040
Manufacturing emissions targets	BASELINE	> 20% reduction	> 50% reduction	> 90% reduction

* Industry consensus, from application to application there could be significant deviation
** Fuel cell powertrain not included due to relative maturity compared to BEV and ICE powertrains

Technology roadmap



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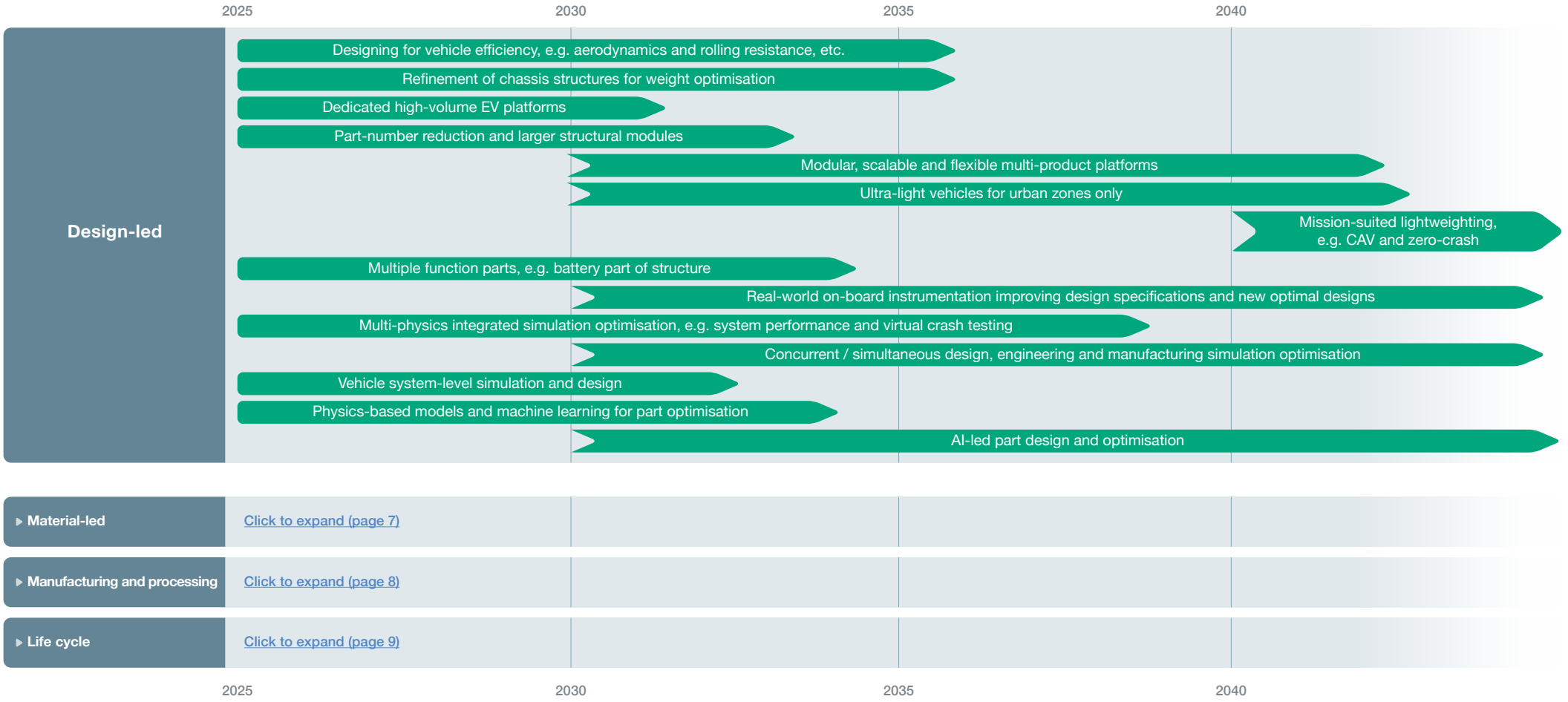
Fluid timings: these technologies have less consensus on when they will occur on the timeline, and may be implemented earlier or later than they appear. They may be adopted in niche vehicle applications.

This roadmap represents a snapshot-in-time view of the global automotive industry propulsion technology forecast for mass market adoption.
Specific application-tailored technologies will vary from region to region.



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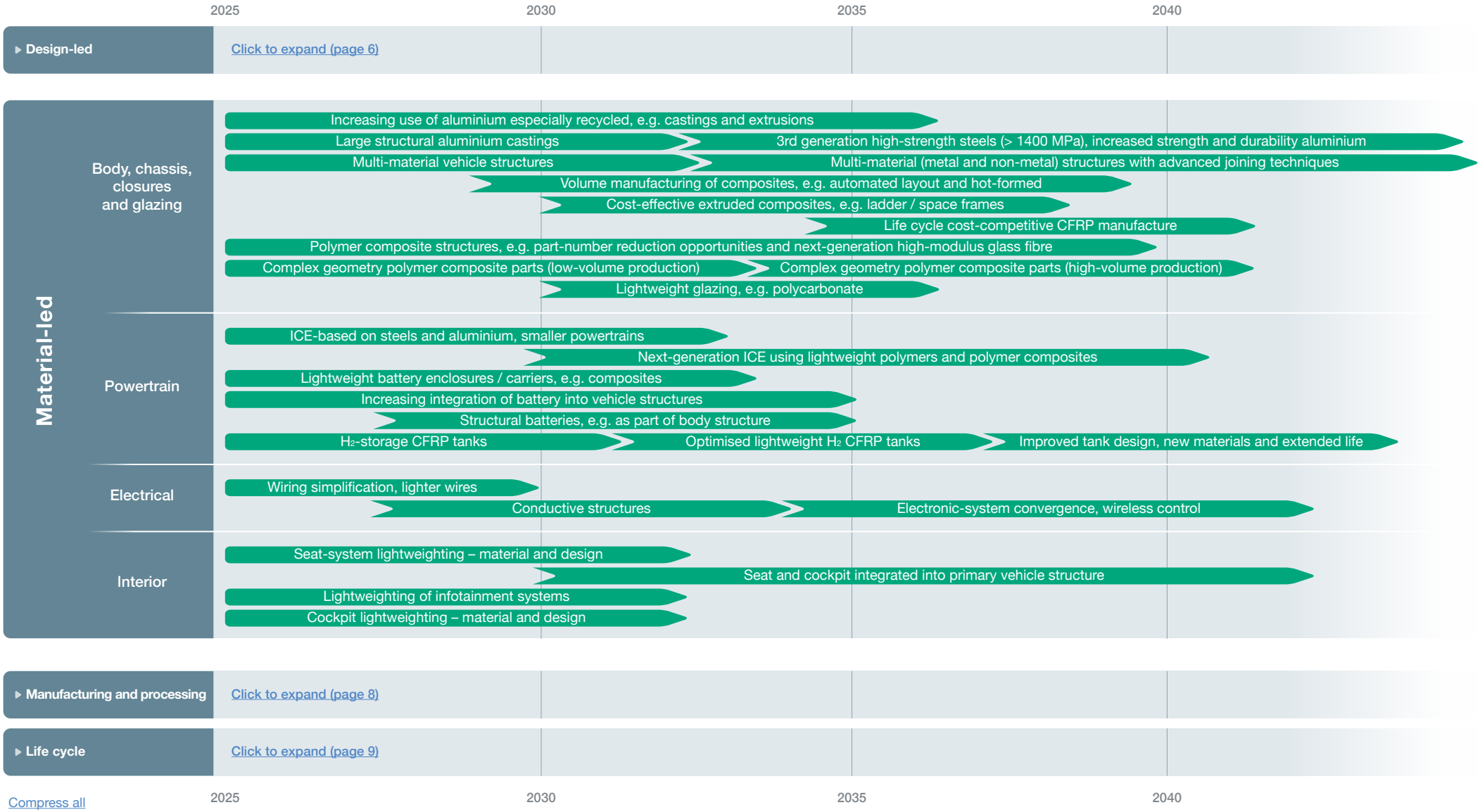

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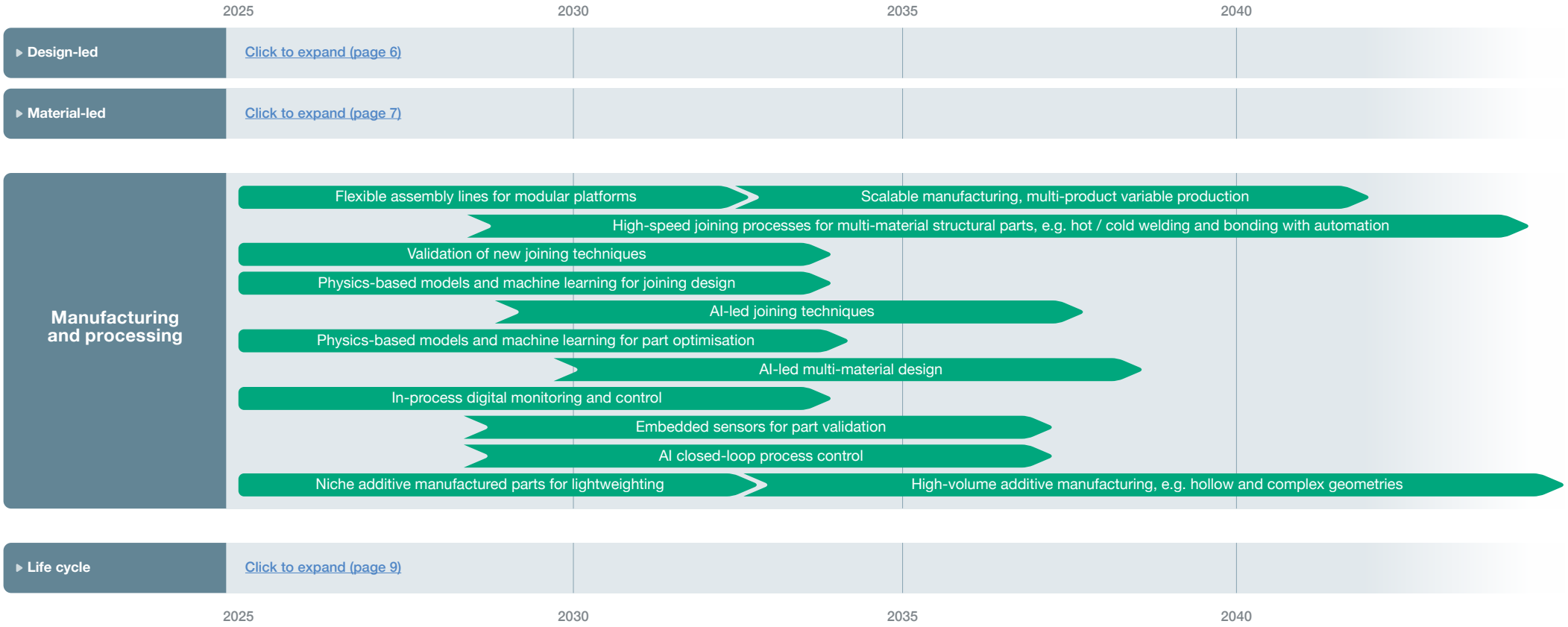

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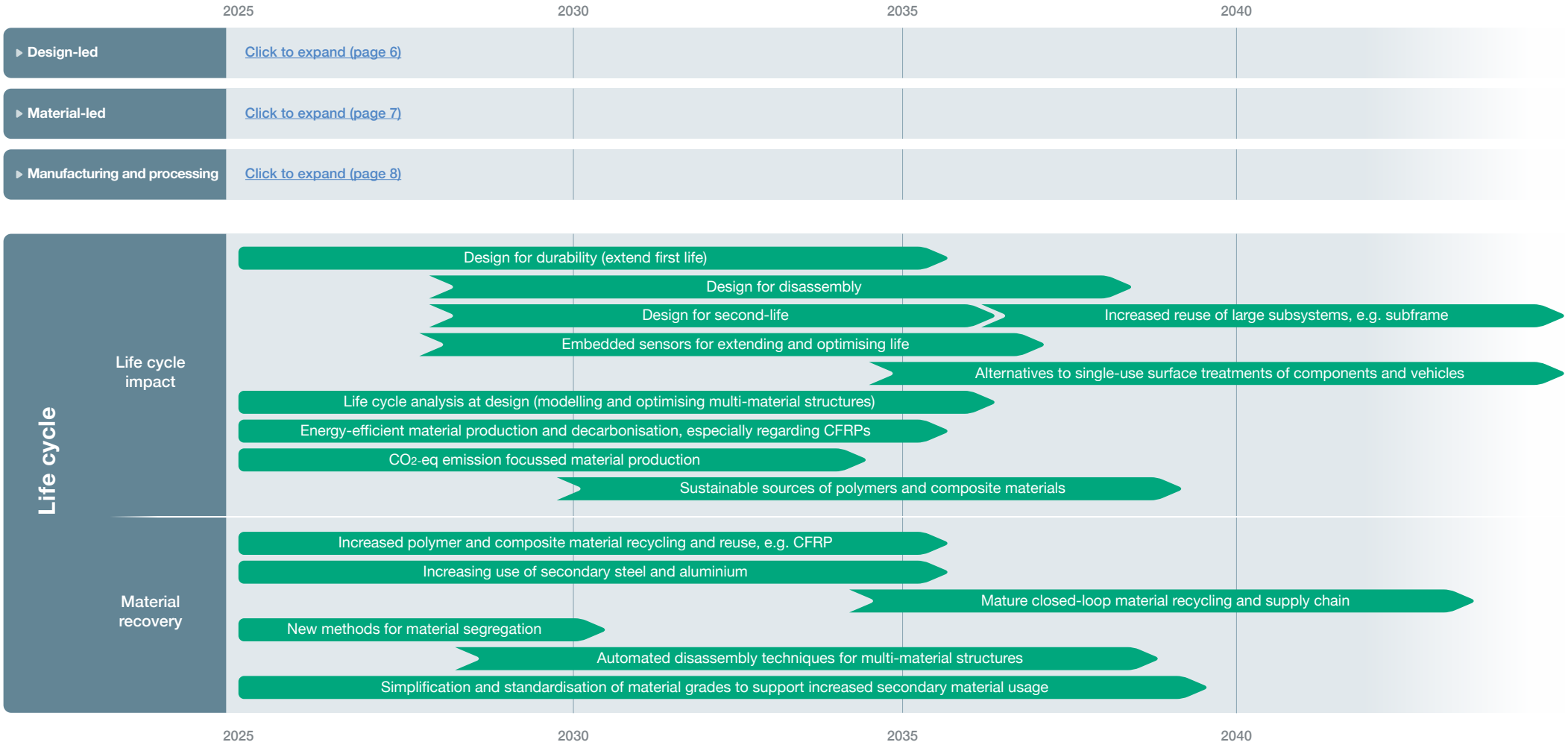

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Glossary

ADAS	Advanced driver-assistance system
AFP	Automated fibre placement
AI	Artificial intelligence
ALD	Analysis-led design
ATL	Automated tape laying
BEV	Battery electric vehicle
BIW	Body-in-white
CBAM	Carbon border adjustment mechanism
CFD	Computational fluid dynamics
CFRP	Carbon-fibre reinforced plastic
CNC	Computer numerical control
CO_2	Carbon dioxide
CO_2-eq	Carbon dioxide equivalent
DER	Distributed energy resource
DRI	Direct reduced iron
EAF	Electric arc furnace
ELV	End-of-life vehicle
EOL	End-of-life
EV	Electric vehicle
EU	European Union
FCEV	Fuel cell electric vehicle
FEA	Finite element analysis
GHG	Greenhouse gas
HDV	Heavy-duty vehicle
HP-RTM	High-pressure resin transfer moulding
HVAC	Heating, ventilation, and air conditioning
ICE	Internal combustion engine
IoT	Internet of things
LCA	Life cycle analysis / assessment
LDV	Light-duty vehicle
MBD	Multi-body dynamics
ML	Machine learning
NDT	Non-destructive testing
NRMM	Non-road mobile machinery
NVH	Noise, vibration, and harshness
OEM	Original equipment manufacturer
PAN	Polyacrylonitrile
PFA	Polyfurfuryl alcohol
PVD	Physical vapour deposition
R&D	Research and development
RTM	Resin transfer moulding
SMC	Sheet moulding compound
T_g	Glass transition temperature

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System-Level Roadmaps

- Mobility of People
- Mobility of Goods

Technology Roadmaps

- Electric Machines
- Power Electronics
- Electrical Energy Storage
- Lightweight Vehicle and Powertrain Structures
- Internal Combustion Engines
- Hydrogen Fuel Cell System and Storage

Find all the roadmaps at

www.apcuk.co.uk/technology-roadmaps

automotive council UK

ADVANCED PROPULSION CENTRE UK

Established in 2013, the Advanced Propulsion Centre UK (APC), with the backing of the UK Government's Department for Business and Trade (DBT), has facilitated funding for 304 low-carbon and zero-emission projects involving 538 partners. Working with companies of all sizes, this funding is estimated to have helped to create or safeguard over 59,000 jobs in the UK. The technologies and products that result from these projects are projected to save over 425 million tonnes of CO_2.

The APC would like to acknowledge the extensive support provided by industry and academia in developing and publishing the roadmaps.

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