

Power Electronics Innovation Opportunities for the UK

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Automotive Council UK roadmaps 2024

Two System-level Roadmaps

Mobility of People



- Private
- Shared

Mobility of Goods



- Localised
- Long-haul
- Off-highway (including NRMM)

Six Technology Roadmaps

Hydrogen Fuel Cell and Storage



H₂ Fuel Cell H₂ storage

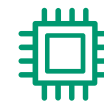
Internal Combustion Engines



Lightweight Vehicle and Powertrain Structures



Power Electronics



Electric Machines



Electrical Energy Storage

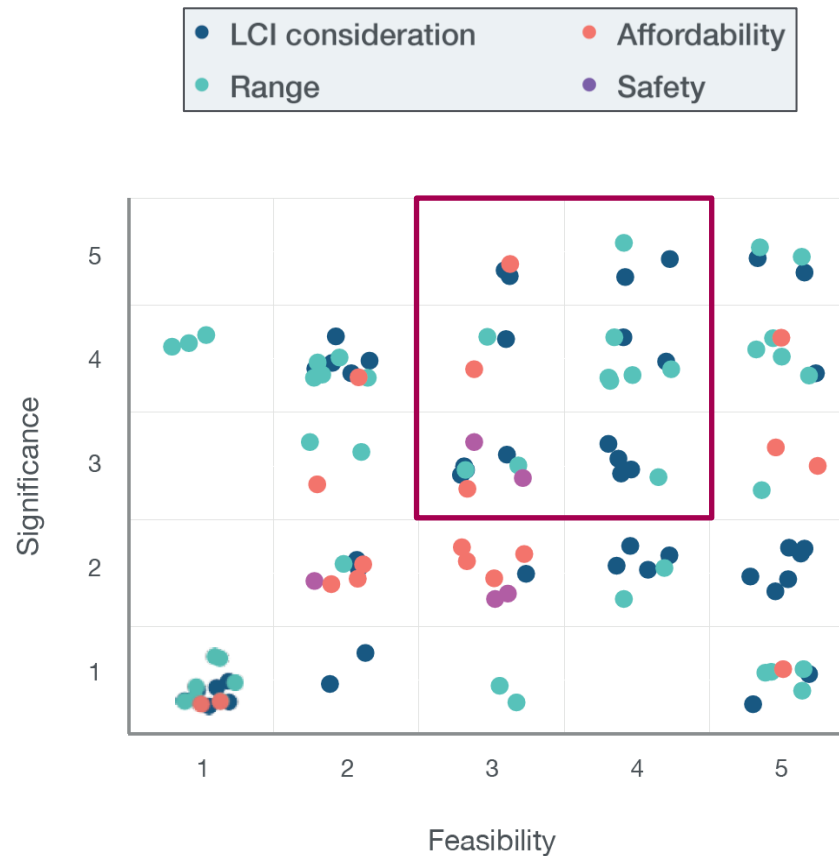
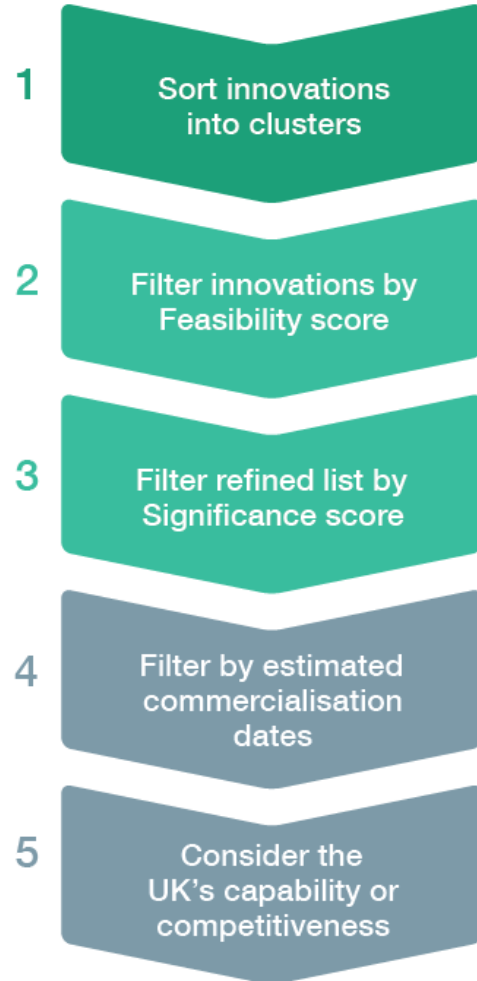


Digitalisation, software and control systems

Materials and manufacturing / circularity and life cycle impact

Energy and infrastructure

Innovation priority



Significance-feasibility matrix for power electronics innovations

System safety

Software and hardware innovations that detect, predict and manage faults

GaN-based systems

Use in OBC's as well as in multi-level inverters

Technologies that enable higher device yield

Larger wafers and higher voltage devices

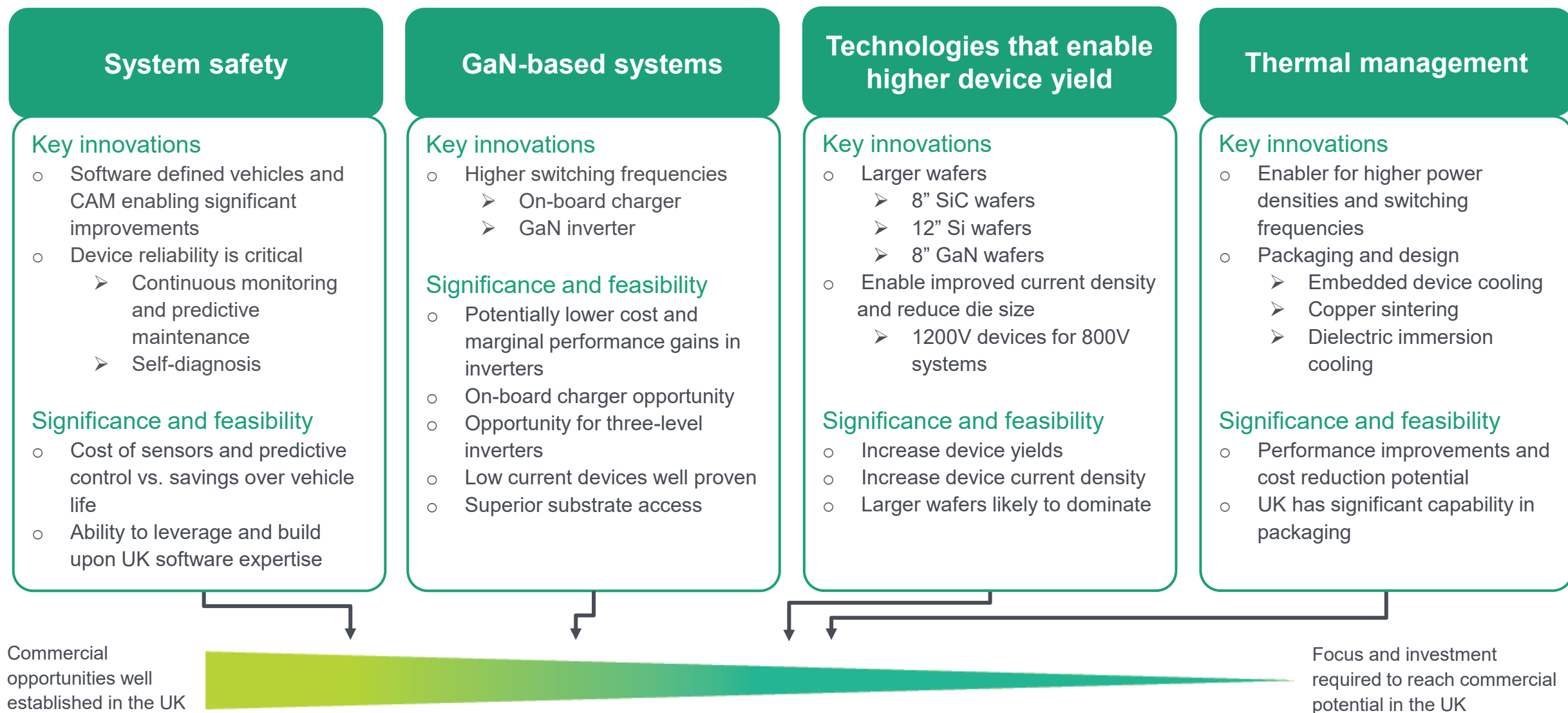
Thermal management

Cooling efficiency improvement and reduce system level costs

Special mentions

Inverter optimisation, integration, V2X and LCI considerations

Power electronics priority innovations for the UK



Special mentions

Inverter optimisation

- Reduce inverter cost and improve performance
- Leverages UK inverter manufacturing
 - Fusion inverters
 - In-wheel inverters
 - X-in-1 inverters

Integration

- Continued importance in reducing cost and weight
- Encompasses multiple “innovations”
 - Smaller and lighter converters
 - Smaller and cheaper subcomponents (e.g. modules)
 - Reduced component count
- One-size-fits-all solutions may not be optimal for all use cases

Vehicle-to-X

- Requires onboard power electronics systems
- Opportunity to leverage UK EV fleet for grid storage and balancing
 - Unlock revenue potential for EV owners
- Collaboration between relevant stakeholders needed

LCI considerations

- Critical in creating circular economy
- Broad consideration which cuts across all aspects of power electronics with multiple supporting innovations

Power electronics benefits and challenges

Innovation Theme	Benefits	Challenges
System safety	<ul style="list-style-type: none"> Reduction in EV cost of ownership Plays to UK strengths in software Supports Automotive Council UK's CAM strategy 	<ul style="list-style-type: none"> Potentially high upfront-development cost Cybersecurity risk needs to be considered Limited data sharing between OEMs
GaN-based conversion systems	<ul style="list-style-type: none"> GaN is cheaper than SiC when grown on Si Higher switching frequency operation, enabling smaller and cheaper power converters UK has significant GaN expertise 	<ul style="list-style-type: none"> GaN-based power inverter technology is immature 800V inverters require three-level topology Potential risk associated with gallium supply
Technologies that enable higher device yield	<ul style="list-style-type: none"> Allows increased die yield and therefore reduced die cost Enables cost savings at the system level 	<ul style="list-style-type: none"> Limited existing WBG semiconductor manufacturing capabilities in the UK Significant upfront cost in building new capacity Significant competition on the global market
Thermal management	<ul style="list-style-type: none"> Operation at higher device temperatures, enabling higher power densities and switching frequencies Enable improved system performance 	<ul style="list-style-type: none"> As chips shrink, removing heat from hotspots is critical Cooling improvement, particularly at device level, is an enabler to optimize SiC and GaN devices



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DRIVE35



ENABLING TRANSFORMATION

Automotive Transformation Fund

ACCELERATING SCALE-UP

Scale-up Fund

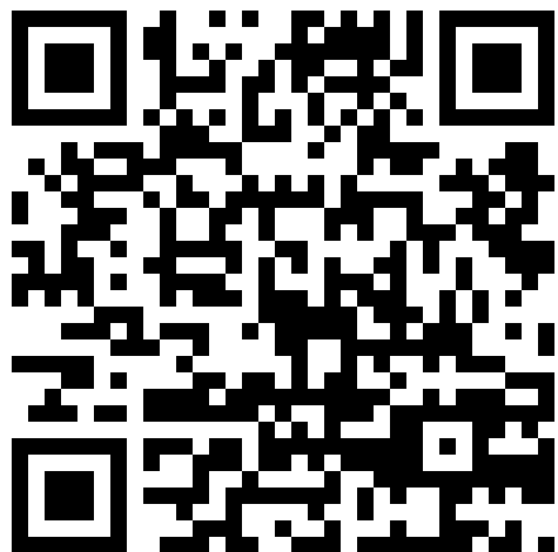
Feasibility Studies

SUPPORTING INNOVATION

Collaborate

Demonstrate

Mobilise



Thank you for listening

Check out our **Knowledge Base**

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