Future Challenges for the ICE

November 2018 **SIG Group**

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Engineering and Physical Sciences Research Council





University of Brighton

Advanced Engineering Centre

Advanced Engineering Centre



- Large group 4 professors, 16 academic and research staff
- Diverse mix of applied and fundamental experimental and modelling research
- Strong industrial links

2017 Roadmaps

Major refresh of the 2008 auto council roadmaps

- The product roadmaps were industry lead
- The technology roadmaps were an industrial academic collaboration lead by the APC spokes
- The roadmaps cover the prime technological pathways and not highly disruptive technologies that may arise from fundamental research!

Get your guide to future innovation

The report delves into each vehicle sector and technology area, offering organisations guidance on the innovation opportunities in the automotive industry.



DOWNLOAD HERE

Passenger car, especially inner city transportation

PASSENGER CAR





1 chevron = some uncertainty around timing of mass market adoption or phase out 2 chevrons = considerable uncertainty around timing of mass market adoption or phase out

Commercial vehicles, especially trans continental freight

COMMERCIAL AND OFF HIGHWAY VEHICLE



Driver set Driver predicted

Solid bar represents >1% global marked adoption and is preceded by significant product and process R&D 1 chevron = some uncertainty around timing of mass market adoption or phase out 2 chevrons = considerable uncertainty around timing of mass market adoption or phase out

Divergence in approach between vehicle applications is expected around 2030



Transition to zero carbon fuels will impact engine configuration

Demand from different sectors for scarce resource









'Electro fuels'Designed fuelEfficiency will be critical

Biofuels Some local variation Efficiency will be important

Recycled fuels

Large variations in quality!

Stobart Contraction of the second sec



Reflections on potential disruptors to the current view



Changes in how mobility is accessed:

- If you can order a car specific to your journey, do you need long range EV's and full hybrid?
- Opportunity to customise the vehicle for the application
- Highly efficient clean ICE's for intercity transport?



Autonomous Vehicles

- Higher 'hotel load' on vehicle
- May drive continued use of ICE for longer journeys



Societal cost

- High capital spend will be required to deploy
- Minimising whole system costs may become very important

Reflections on future needs for road transport

- Is Euro 6d good enough?
- I.e. no more combustion research!
- •Or do we need a genuine zero emissions engine?
- Lots more combustion research!
- Is the fuel flexibility of the internal combustion engine the critical attribute that secures the future of the engine?
- Fuel tolerance at low emissions is critical
- When the whole energy system is considered, do electrofuels become the buffer for the powergrid and the future sustainable fuel?
- Efficiency is critical

The Recuperated Split Cycle Engine – a new low emission engine architecture

- Precise control of the temperature at the start of combustion is achieved through the separation the compression and expansion processes and air pre-heating
- High efficiency is achieved through reducing compression work through isothermal compression and intra cycle waste heat recovery



Towards zero emission engines through the adoption of combustionlead engine design realised using a split cycle topology

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The Recuperated Split Cycle - Experimental Combustion Data from a Single Cylinder Test Rig 2017-24-0169 The APC technology roadmaps can be found at:

https://www.apcuk.co.uk/app/uploads/2018/06/roadmap-report-26-6-18.pdf

What the APC spoke is doing:

- White paper to put an evidence based message on the current and future potential of low emissions engines
- Day event in London on the future of low emissions engines
- In discussion with APC for a follow event as part of the future of technology series

These activities are in the planning stage and we welcome

comments and your support!