An Update from Innovate UK

FCH2 Technical Conference
1st June 2017

Harsh Pershad
Senior Innovation Lead
(Energy & Infrastructure Systems)

Harsh.Pershad@innovateuk.gov.uk

Innovate UK

Outline

- Introducing Innovate UK
- Current Funding Competitions
- The #UKHFC Roadmap – six months on

Energy Catalyst Round 5

- **Competition opened:** Monday 24 April 2017
- **Registration closes:** Wednesday 21 June 2017 12:00pm

- The Department for International Development (DFID), the Department for Business, Energy & Industrial Strategy (BEIS) and the Engineering and Physical Sciences Research Council (EPSRC) are to invest up to £13 million in innovation projects to address the global need for clean, affordable and secure energy.
- The aim of the Energy Catalyst competition is to support highly innovative, market-focused energy solutions in any technology or sector or international market.
- Proposals must address all 3 elements of the energy trilemma: cost, emissions, security of supply
- The competition is open to any UK organisation and may also include international partners. You should apply into the stream most closely aligned with your project. Universities and small and medium-sized enterprises (SMEs) are encouraged to apply. Research organisations may lead early-stage feasibility projects.
- There are 3 options to apply into this competition. These are referred to as streams and will be run in parallel. The streams are dependent on the stage your project is at:
- **Early-stage competition stream**These are technical feasibility projects. Projects can last up to 1 year, with total costs ranging from £50,000 to £300,000. Research organisations may lead early-stage projects, in partnership with at least one UK business. UK SMEs can lead early-stage projects with or without partners.
- **Mid-stage competition stream**These are industrial research projects. Projects can last up to 3 years, with total costs ranging from £50,000 to £1.5 million. Mid-stage projects must be collaborative and led by a UK business.
- **Late-stage competition stream**These are experimental development projects. Projects can last up to 3 years, with total costs ranging from £50,000 to £10 million. Late-stage projects must be collaborative and led by a UK business.

Jiangsu-UK industrial challenge programme

- UK businesses can apply for a share of £5 million to carry out projects with partners from Jiangsu province, People's Republic of China.
- **Competition opens:** Monday 10 April 2017
- **Registration closes:** Wednesday 21 June 2017 12:00pm

- **Open priority** Open to transformational or disruptive innovations leading to new products, processes or services drawn from any technology, engineering or industrial area. Projects should lead to a significant return on investment and have a clear impact on business growth.
- **Infrastructure systems priorities** Solutions for smarter, integrated and intelligent infrastructure incorporating digital technologies. This includes adding a layer of intelligence to and improving links between:energy systems: matching energy supply and demand, improving affordability, security and value proposition
- connected transport: balancing transport infrastructure and vehicles at peak demand, connecting people and goods, optimising transport network efficiencies. This is to enable benefits in capacity, operational costs and effectiveness for accessible, safe and sustainable transport. Mobility as a service and enabling the UK to be a world class trading nation are some of the national priorities for connected transport

Investment accelerator pilot

- UK businesses can apply for a share of £8.5 million to fund feasibility studies in infrastructure systems or health and life sciences.
- Eligibility:The competition is open to single small and medium-sized enterprises (SMEs) who are looking for early stage grant funding and who wish to establish an equity relationship with a UK venture capital firm.
- Opens:8 May 2017
- Closes:5 July 2017
- This is a pilot programme for Innovate UK. It provides simultaneous grant funding and venture capital investment for early stage projects led by UK companies.
- We expect projects to have total costs of up to £150,000. The programme will provide 100% of project costs. Projects should last between 3 and 12 months.

Investment accelerator pilot (Scope)

- **Energy supply and systems**Innovations that improve value proposition, energy affordability and security, and reduce carbon emissions. These could include:
- energy supply solutions, such as carbon abatement, renewable energy technologies, nuclear power and **hydrogen and fuel cells**
- solutions that flexibly match energy supply and demand, such as storage, grid balancing and integration of micro-energy generation
- solutions that optimise performance across different energy vectors (the competition is not limited to electricity)
- Other areas in scope are health and life sciences, connected transport, smart infrastructure, and urban living.

Materials and manufacturing round 3

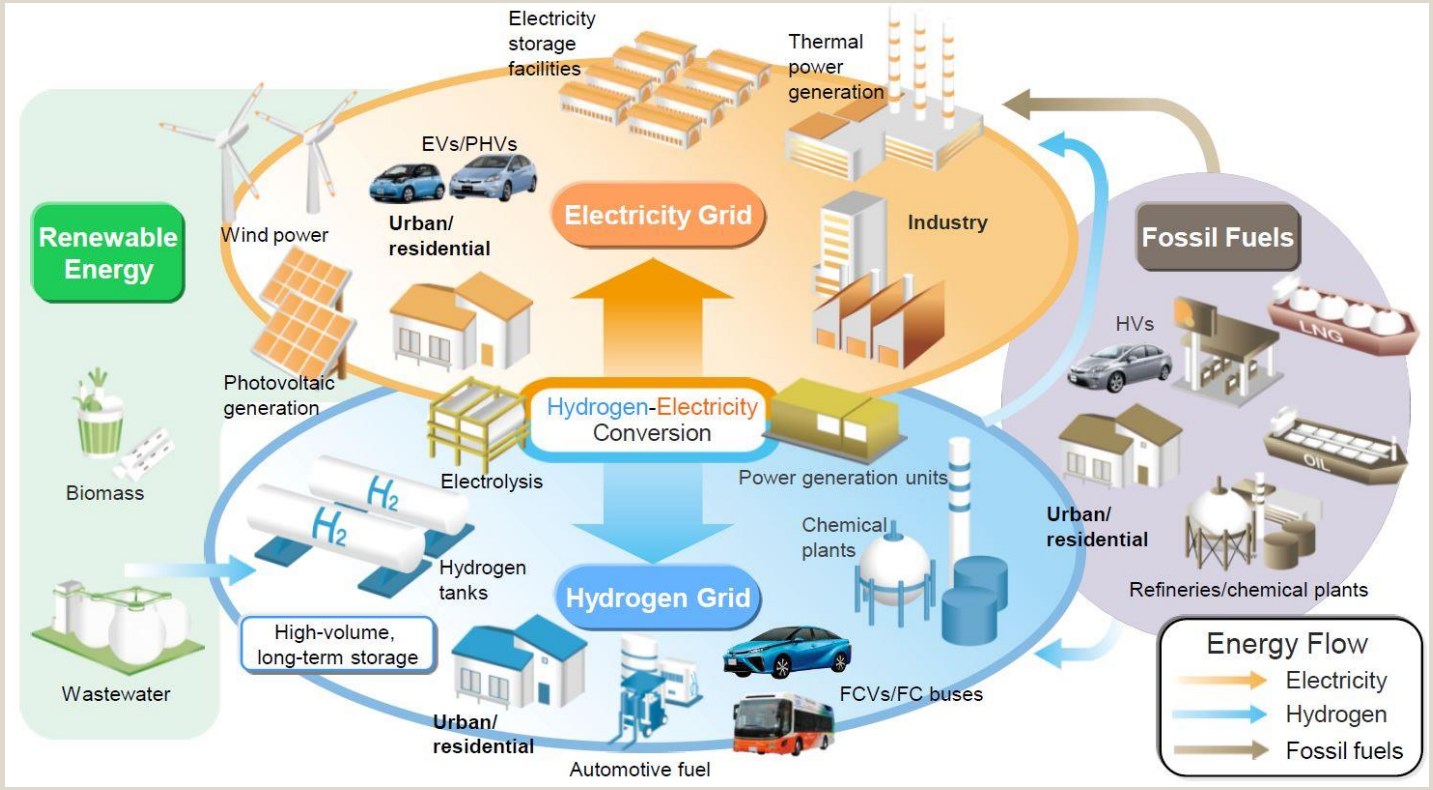
- UK businesses can apply for a share of up to £15 million to work on innovation projects in manufacturing and/or materials
- **Competition opens:** Monday 8 May 2017
- **Competition closes:** Wednesday 12 July 2017 12:00pm

- A project must cover at least one, from either of the following areas:
- innovation in a manufacturing system, technology, process or business model. For example, in process engineering, additive manufacturing, industrial biotechnology, mechanical conversion processes, coatings, surface engineering, textiles, supply chain management, new product introduction processes or re-manufacture, or application of digital technology to manufacturing approach
- innovation in materials development, properties, integration or reuse. For example, materials for light-weighting, energy generation and storage (heat and electricity), electronics/sensors, bonding and joining technologies, or operation in demanding environments. Also, the use of digital technologies to reduce time for material development, evaluation and assurance

Connected and autonomous vehicles test bed

- Businesses and research organisations can apply for a share of up to £55 million to create the world's most effective CAV testing ecosystem.
- **Competition opens:** Monday 3 April 2017
- **Registration closes:** Wednesday 12 July 2017 12:00pm
- The Centre for Connected and Autonomous Vehicles (CCAV) has a £100 million fund to invest in CAV test bed infrastructure. This competition is for up to £55 million in projects to develop connected and autonomous vehicle (CAV) testing infrastructure.
- The aim is to create the world's most effective CAV testing ecosystem. Proposals should integrate existing proving grounds and public road test sites across the UK's existing automotive and technology heartlands. They should improve current capabilities and create new ones.
- CCAV is expecting to invest up to £7 million to £18 million per project, depending on the competition stream. It expects to support up to 4 projects. Preference will be given to projects that can deliver operational facilities and be open for business within 12 to 18 months.

UK Hydrogen and Fuel Cell Roadmap

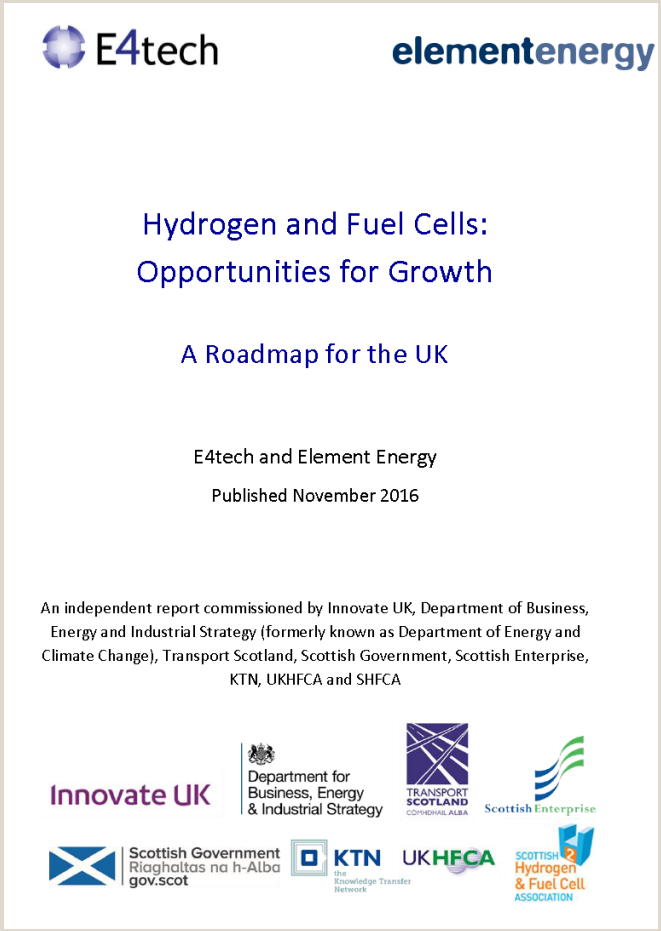


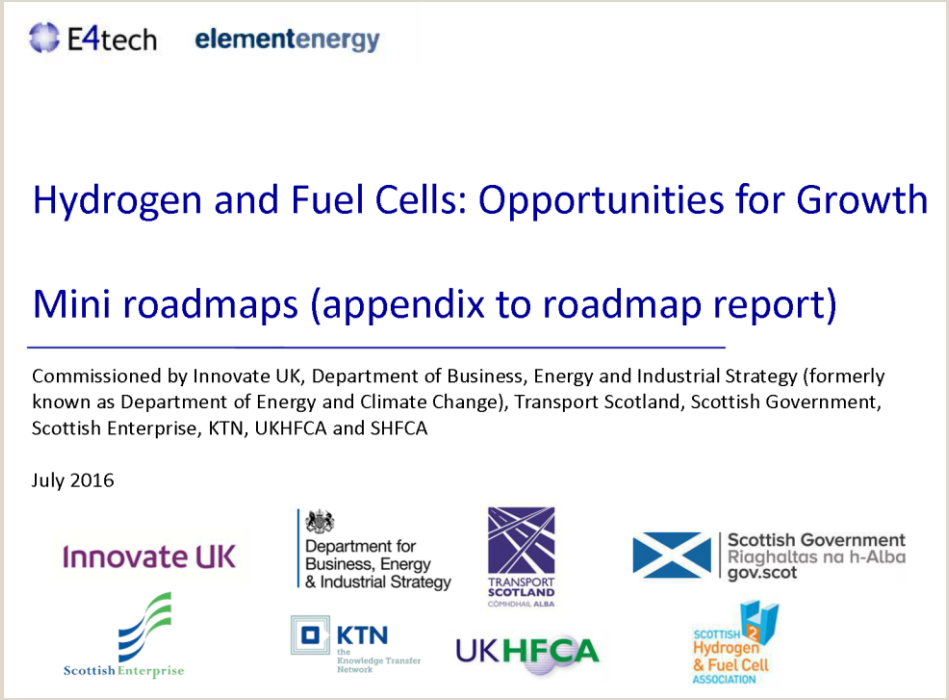
Many possibilities – where should stakeholders align activities to maximise benefits for the UK?

This project aims to drive sustainable economic growth in the UK H2FC industry in the period to 2025 and beyond

- **Public-private project** steered by Innovate UK, the Department of Energy and Climate Change (DECC), now BEIS, Transport Scotland, Scottish Government, Scottish Enterprise, Scottish Hydrogen and Fuel Cell Association (SHFCA), UK Hydrogen and Fuel Cell Association (UKHFCA), and the Knowledge Transfer Network (KTN)
- **Delivered by E4tech and Element Energy**, in consultation with the Steering Board and 200 stakeholders from 150 organisations.
- Launched in January 2016 and published in November 2016.
- Roadmap available at
- http://www.e4tech.com/e4tech-delivers-a-roadmap-for-hydrogen-and-fuel-cells-in-the-uk/

Two documents





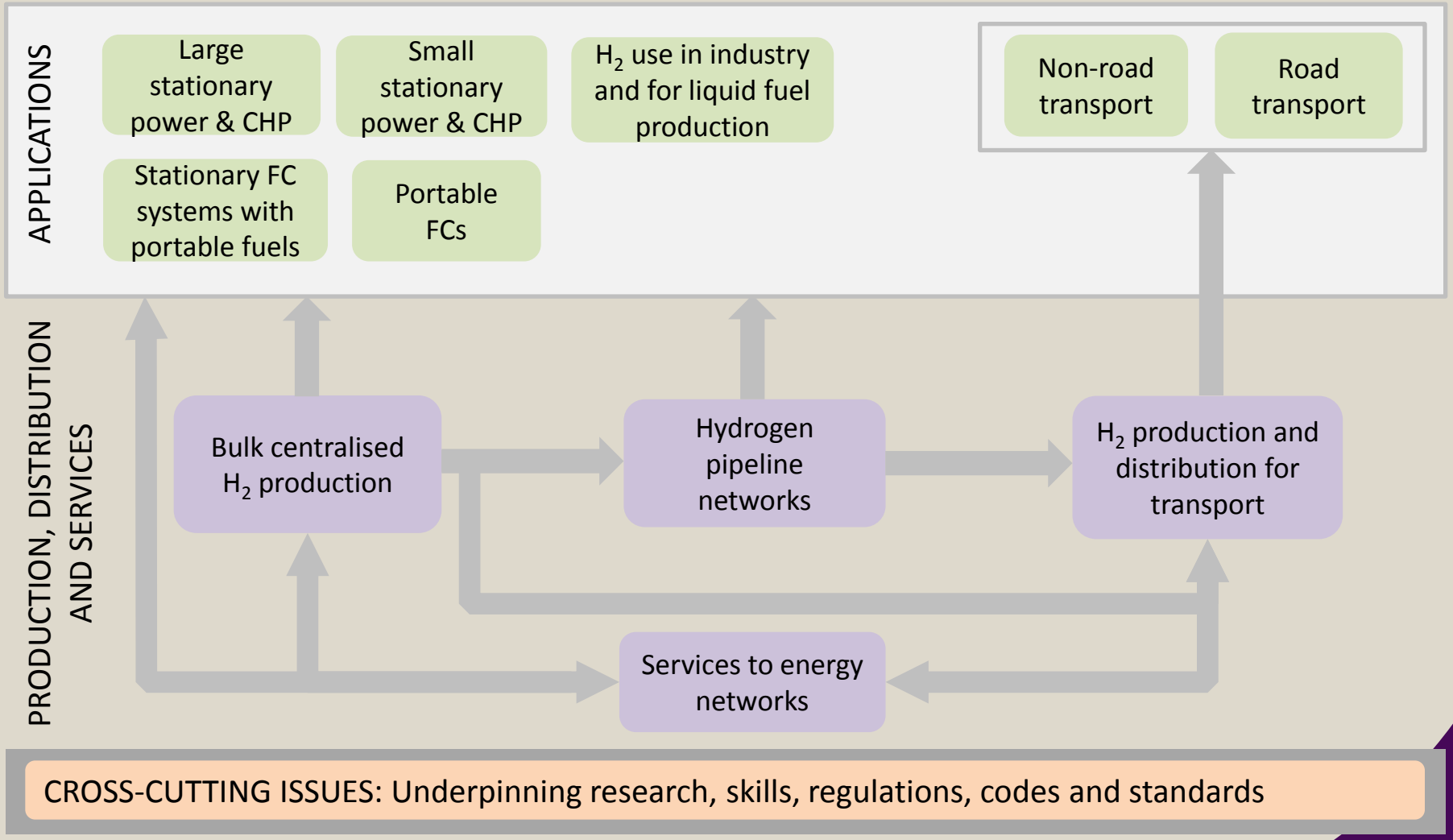
Main report (national priorities, aimed at non-specialists)

H2FC sector experts should consult key segments in the appendix.

Stakeholders are using the roadmap to inform and influence policymaking

- OLEV (£23m), BEIS (£25m), Innovate UK, EPSRC, and Scottish funding announcements
- Hydrogen and Fuel Cell opportunities are now explicitly referenced in Scottish draft Energy and Climate Action Plans and UK Industrial Strategy Green Paper
- Industry responses for recent UK and Scottish Government Consultations, and recent H2FC Supergen Hub White Papers reference the roadmap
- Stronger working relationships and trust established
- H2FC project proposals aligning with the roadmap priorities
- Clearer understanding for those in other countries or at the periphery of the sector on UK strengths and investment opportunities.

Appendix structured into 11 market segments that represent shared Steering Board priorities



End-use roadmap | Supply chain roadmap

Information available in the roadmap appendix

- UK market segment sizes
- Benchmark cost and performance data
- Key players and projects
- Shared, plausible growth scenarios for the period to 2025 and beyond
  - Economic, energy and environmental impacts
  - Actions to reach the most ambitious scenarios
- Co-ordination needs with differentiated priorities
  - For government (central, local)
  - For Industry
  - For Academia

Thank You

For more details on competitions please email
support@innovateuk.gov.uk

For details on the H2FC Roadmapping Exercise please e-mail
Harsh.Pershad@innovateuk.gov..uk

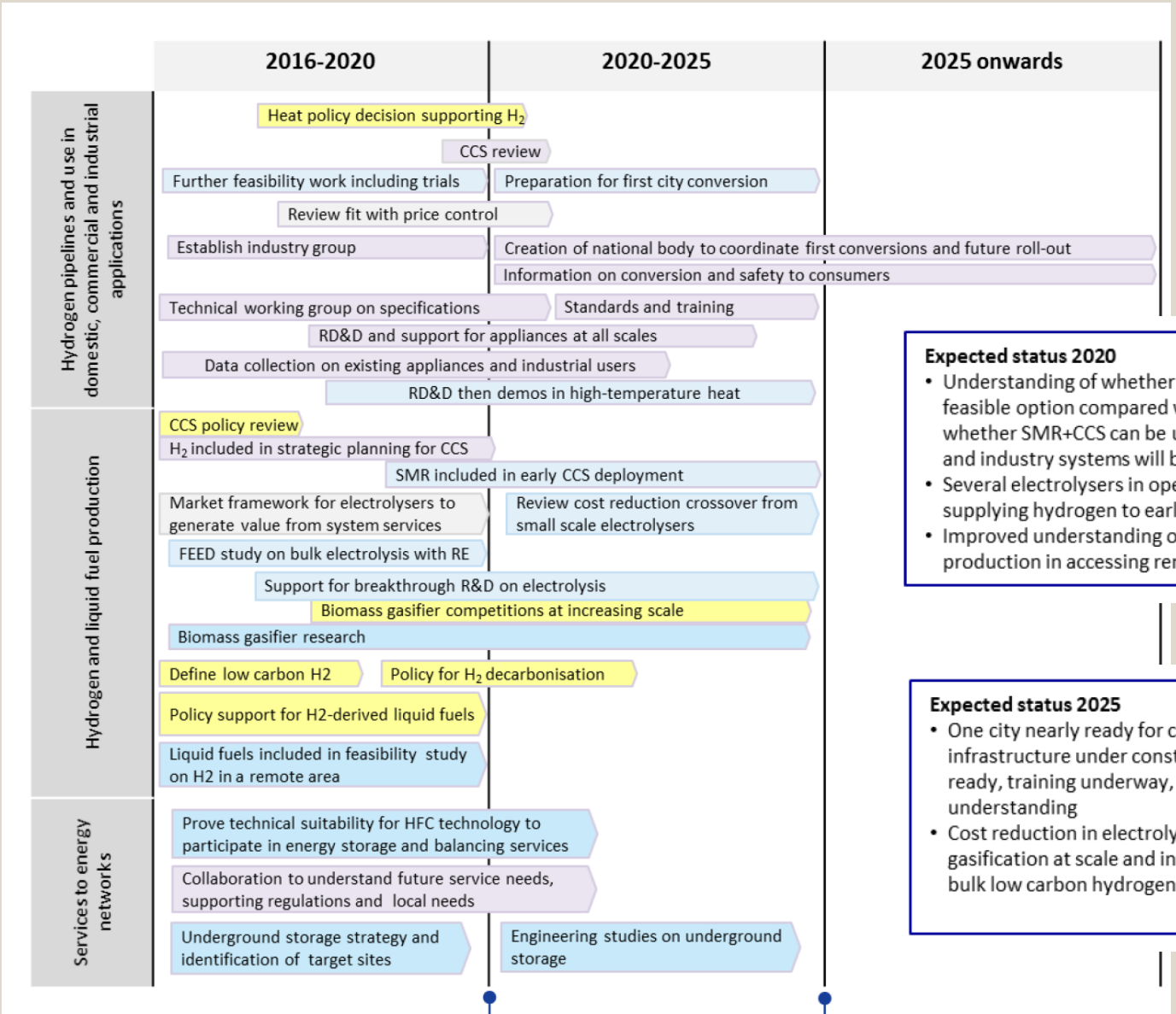
Innovate UK

North Star House, North Star Avenue, Swindon SN2 1UE
Tel: +44 (0)1793 442 700
Email: support@innovateuk.gov.uk
www.innovateuk.gov.uk

Appendix

Innovate UK

Hydrogen in the energy system

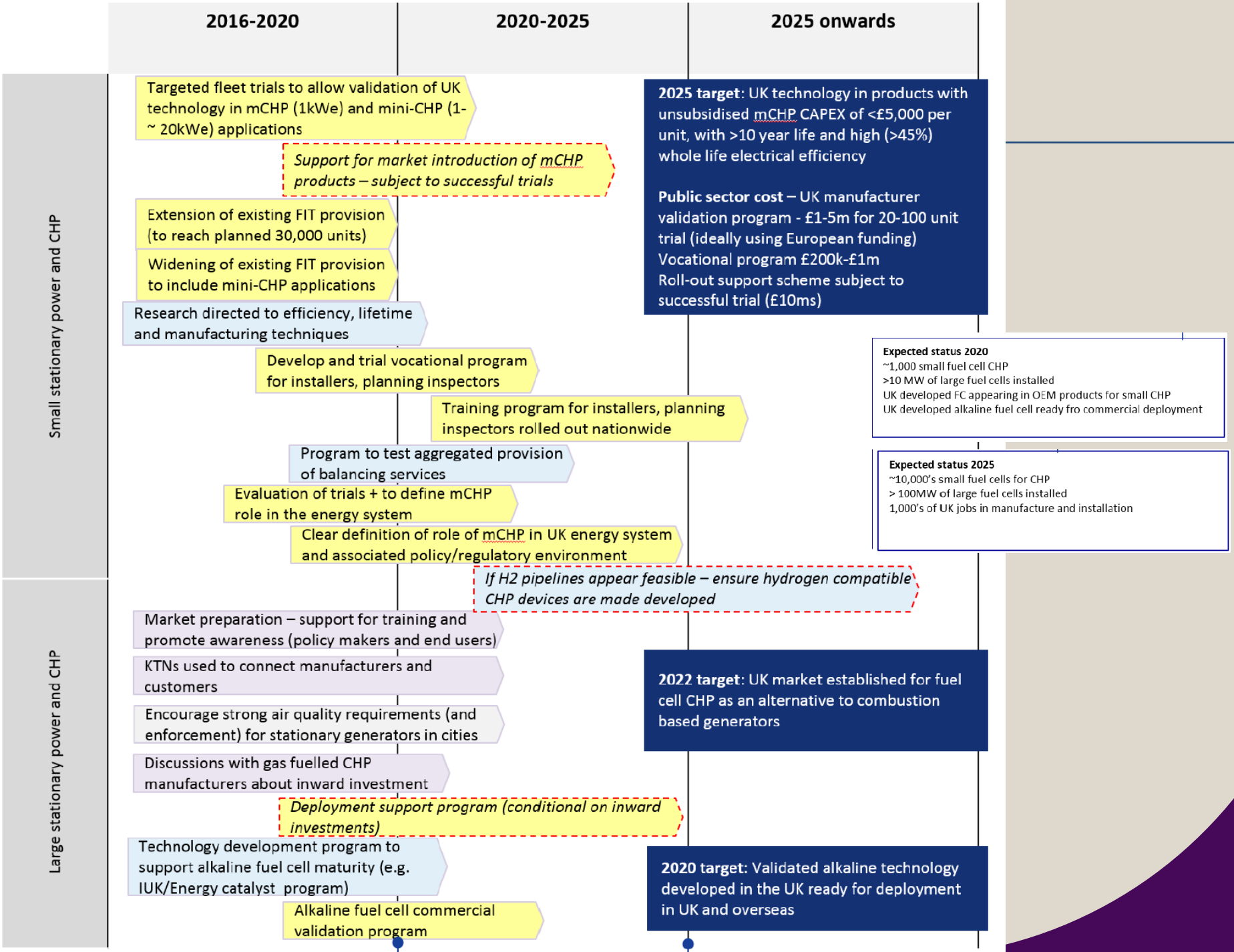


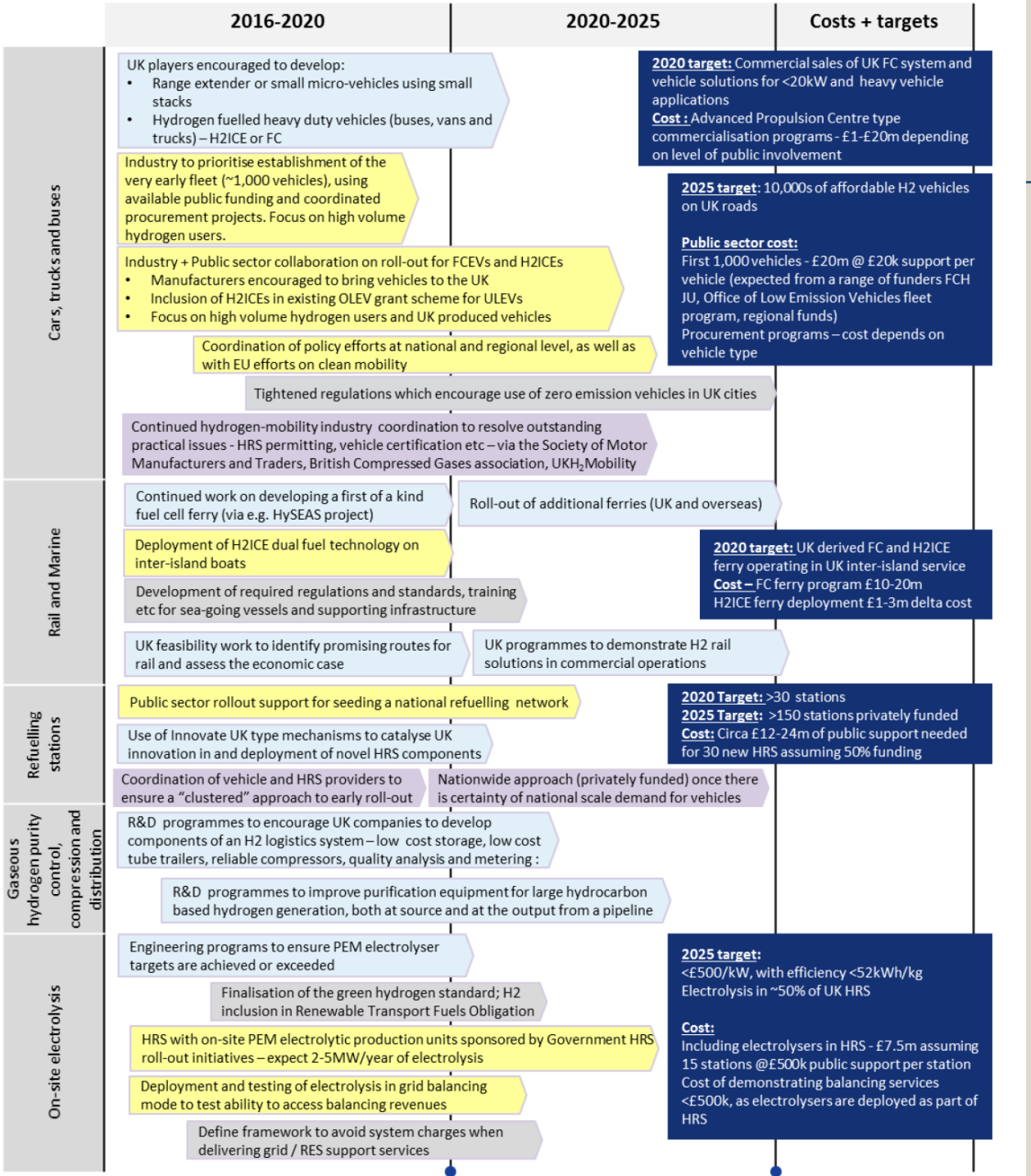
Expected status 2020

- Understanding of whether pipeline conversion in 2026 is a feasible option compared with other low carbon heating options, whether SMR+CCS can be used, and what types of appliances and industry systems will be needed
- Several electrolysers in operation providing systems services and supplying hydrogen to early transport applications
- Improved understanding of the role of electrolysis and liquid fuel production in accessing remote renewables

Expected status 2025

- One city nearly ready for conversion: hydrogen production and infrastructure under construction, diverse range of appliances ready, training underway, improved public and industry understanding
- Cost reduction in electrolysis, demonstration of biomass gasification at scale and integrated CCS systems give a range of bulk low carbon hydrogen options


2016-2020
2020-2025
2025 onwards
Small stationary power and CHP
Large stationary power and CHP
Targeted fleet trials to allow validation of UK technology in mCHP (1kWe) and mini-CHP (1-~ 20kWe) applications
Support for market introduction of mCHP products – subject to successful trials
Extension of existing FIT provision (to reach planned 30,000 units)
Widening of existing FIT provision to include mini-CHP applications
Research directed to efficiency, lifetime and manufacturing techniques
Develop and trial vocational program for installers, planning inspectors
Training program for installers, planning inspectors rolled out nationwide
Program to test aggregated provision of balancing services
Evaluation of trials + to define mCHP role in the energy system
Clear definition of role of mCHP in UK energy system and associated policy/regulatory environment
If H2 pipelines appear feasible – ensure hydrogen compatible CHP devices are made developed
Market preparation – support for training and promote awareness (policy makers and end users)
KTNs used to connect manufacturers and customers
Encourage strong air quality requirements (and enforcement) for stationary generators in cities
Discussions with gas fuelled CHP manufacturers about inward investment
Deployment support program (conditional on inward investments)
Technology development program to support alkaline fuel cell maturity (e.g. IUK/Energy catalyst program)
Alkaline fuel cell commercial validation program
2025 target: UK technology in products with unsubsidised mCHP CAPEX of <£5,000 per unit, with >10 year life and high (>45%) whole life electrical efficiency
Public sector cost – UK manufacturer validation program - £1-5m for 20-100 unit trial (ideally using European funding)
Vocational program £200k-£1m
Roll-out support scheme subject to successful trial (£10ms)
Expected status 2020
~1,000 small fuel cell CHP
>10 MW of large fuel cells installed
UK developed FC appearing in OEM products for small CHP
UK developed alkaline fuel cell ready fro commercial deployment
Expected status 2025
~10,000's small fuel cells for CHP
> 100MW of large fuel cells installed
1,000's of UK jobs in manufacture and installation
2022 target: UK market established for fuel cell CHP as an alternative to combustion based generators
2020 target: Validated alkaline technology developed in the UK ready for deployment in UK and overseas



Expected status 2020
~1,000 vehicles in the UK
>30 stations
>5 OEM FCEV models available
>5 small cars, range extenders, vans, trucks available with UK content
20-50% ownership cost premium versus conventional vehicle

Expected status 2025
>30,000s of vehicles in the UK
>150 stations
10's of OEM FCEV models available
Hydrogen vehicles in all large segments of the transport market
0-20% ownership cost premium versus conventional vehicle
Many 1,000's of new UK jobs

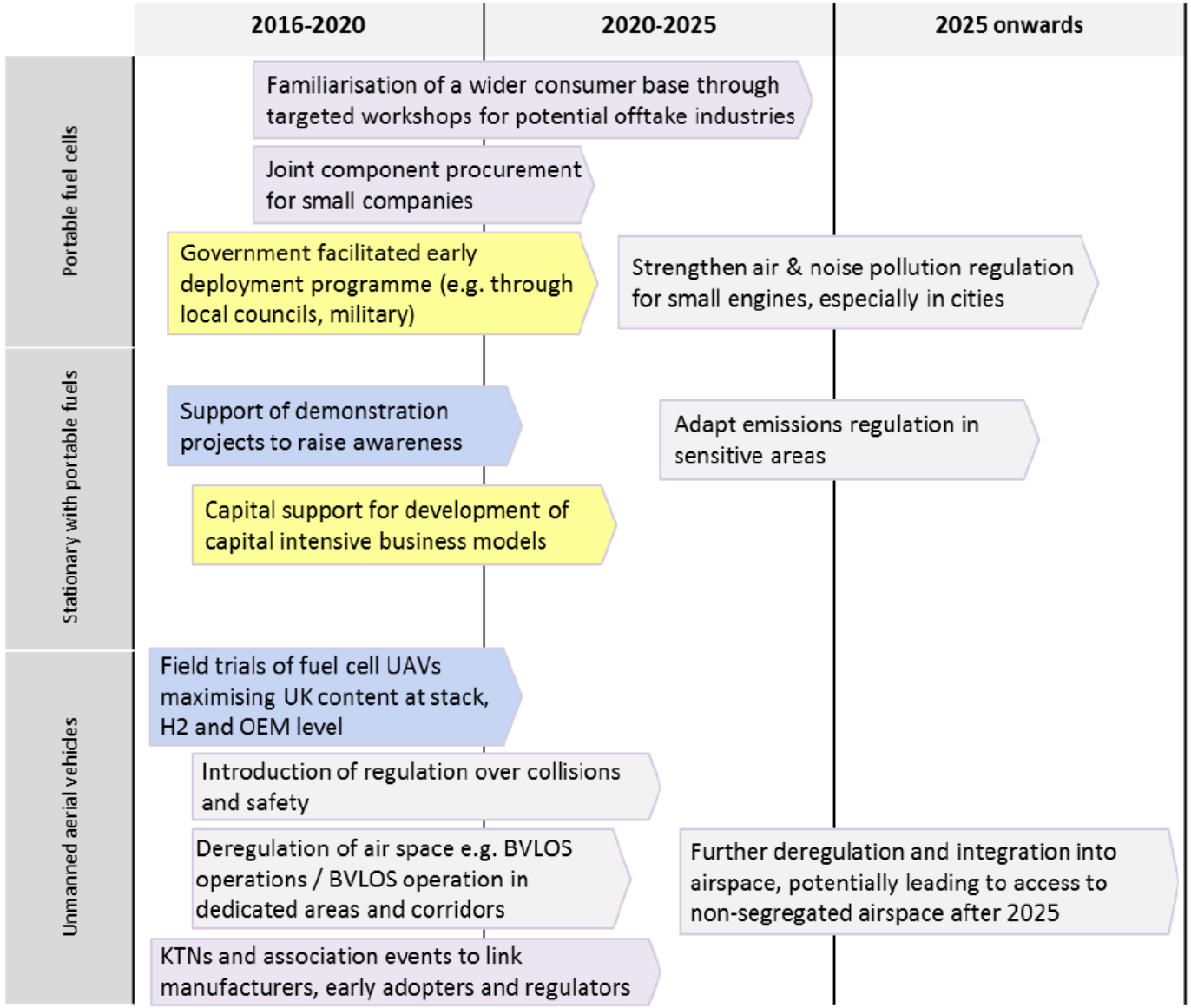


Figure 9 Roadmap for fuel cell products in portable and specialist applications. Key to chevron colours: grey – regulation, blue – RD&D, yellow – deployment support, purple – information provision and coordination

Areas for research highlighted in the roadmaps include:

- Stacks and tanks – hitting the cost targets at lower volume
- Hydrogen logistics – lower-cost systems for moving from centralised production to stations
- Electrolyser advances – going below the £500/kW and 55kWh/kg targets
- Biomass gasification - scale up
- Hydrogen appliances for heat – domestic and commercial, including in catering
- Implications of using hydrogen in the existing gas distribution systems
- Use of hydrogen in high temperature industrial applications
- Research work to improve efficiencies of electricity production from fuel cells and reduce cost of systems
- Developing strategies to ensure compatibility of PEM fuel cells for stationary and transport applications with the hydrogen purity expected from a pipeline. This could include purity tolerant stacks or systems to purify hydrogen at the point of use
- Collaborative funding programmes for prototyping and the first deployments in UAVs to speed deployment