RG360:
Opportunities and Challenges of Blending Hydrogen into the gas network

Mark Neller – Director - Arup

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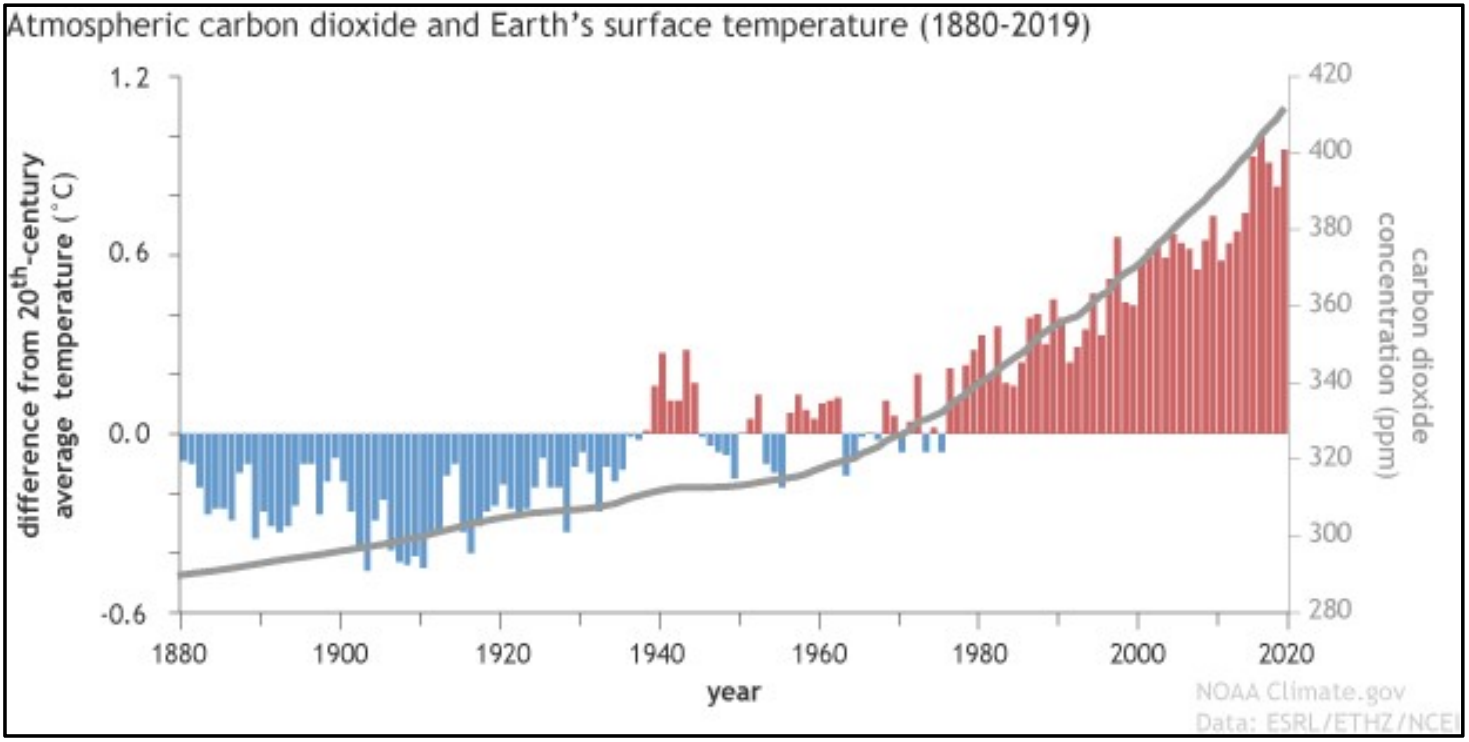
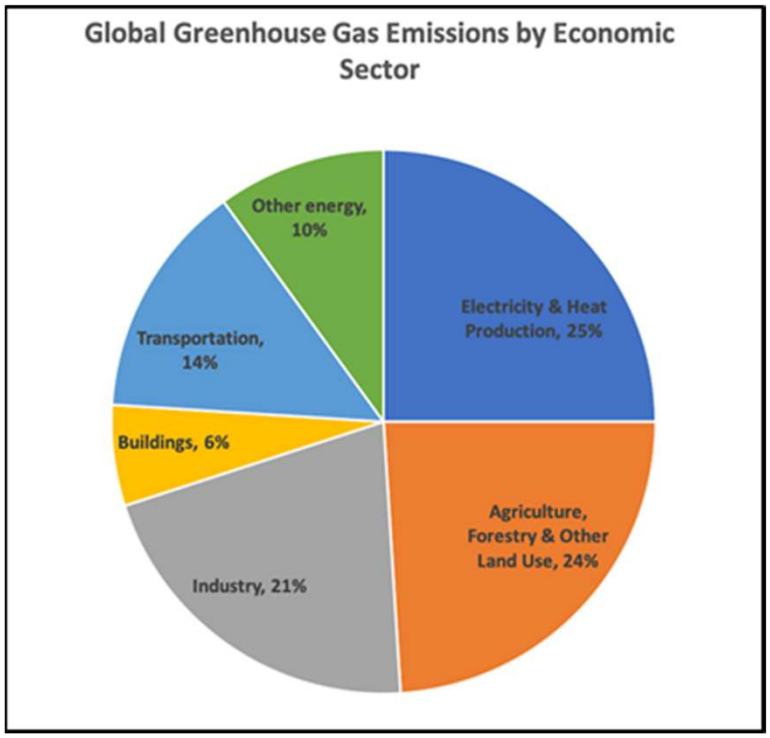
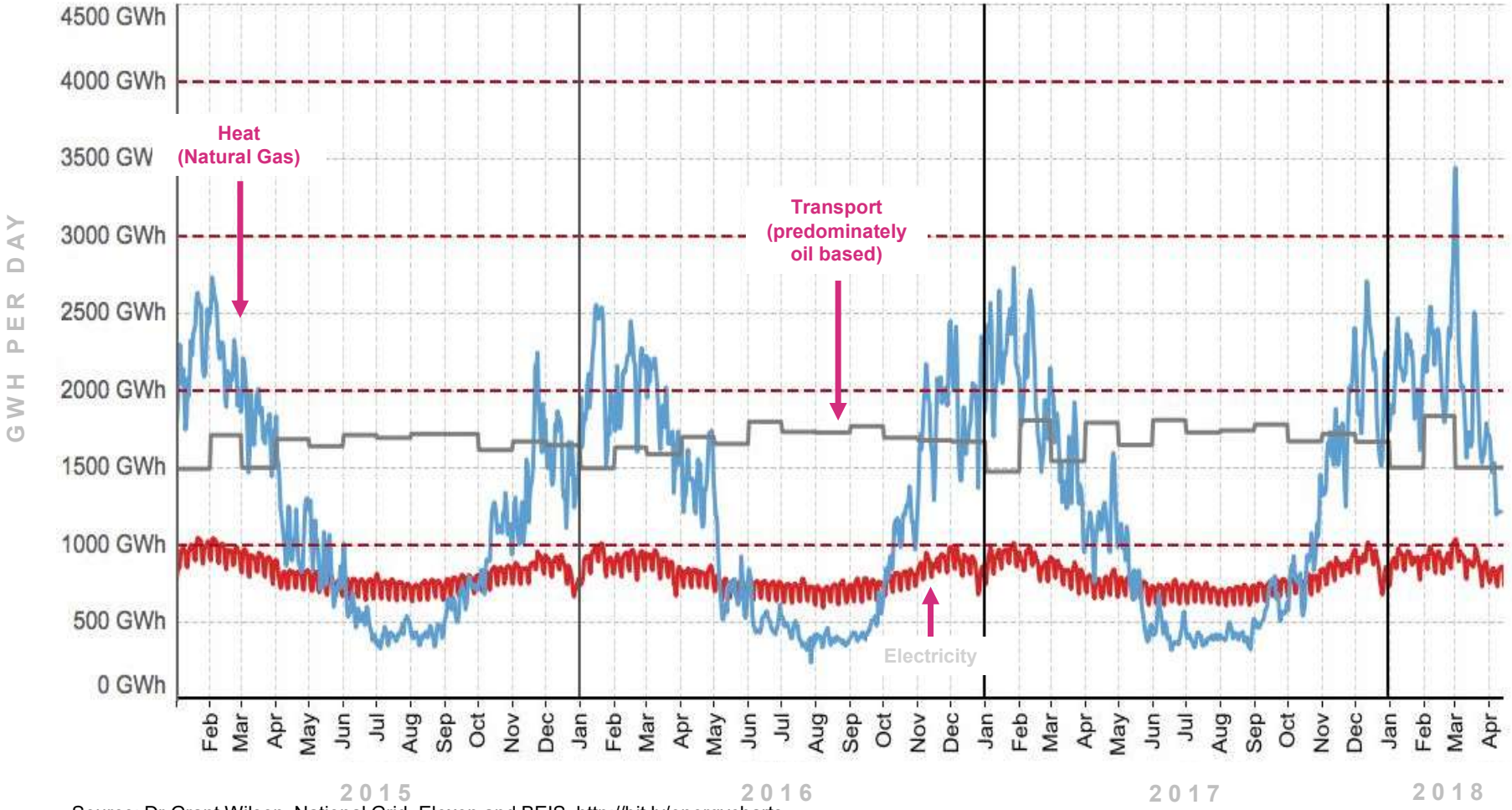

Atmospheric carbon dioxide and Earth's surface temperature (1880-2019)
difference from 20th-century average temperature (°C)
1.2
0.6
0.0
-0.6
1880
1900
1920
1940
1960
1980
2000
2020
year
carbon dioxide concentration (ppm)
420
400
380
360
340
320
300
280
NOAA Climate.gov
Data: ESRL/ETHZ/NCEI


Global Greenhouse Gas Emissions by Economic Sector
Other energy, 10%
Electricity & Heat Production, 25%
Transportation, 14%
Buildings, 6%
Agriculture, Forestry & Other Land Use, 24%
Industry, 21%

The decarbonisation challenge

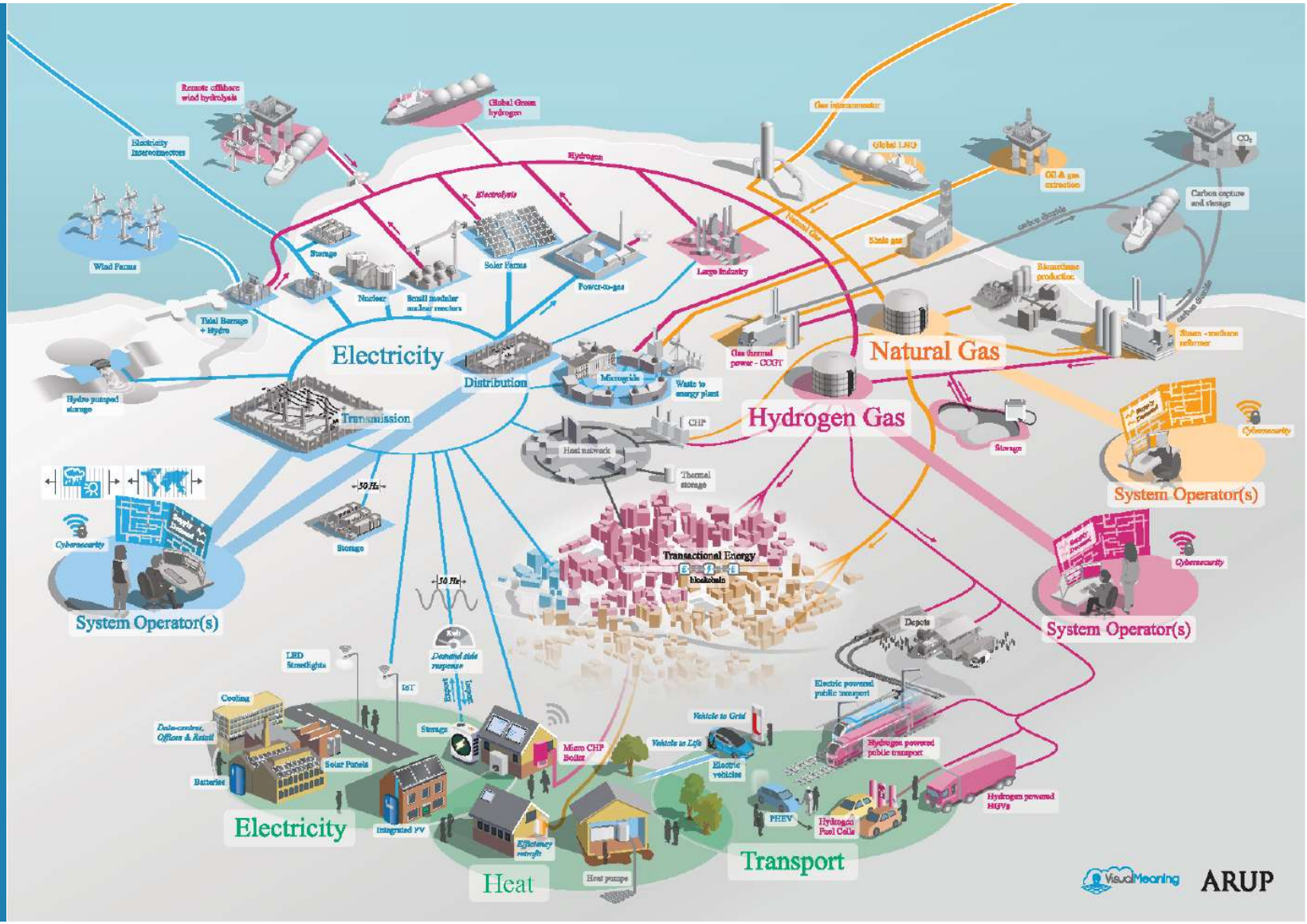


Source: Dr Grant Wilson, National Grid, Elexon and BEIS, http://bit.ly/energycharts

Why hydrogen?

Future of Energy: Energy System 2035

Report



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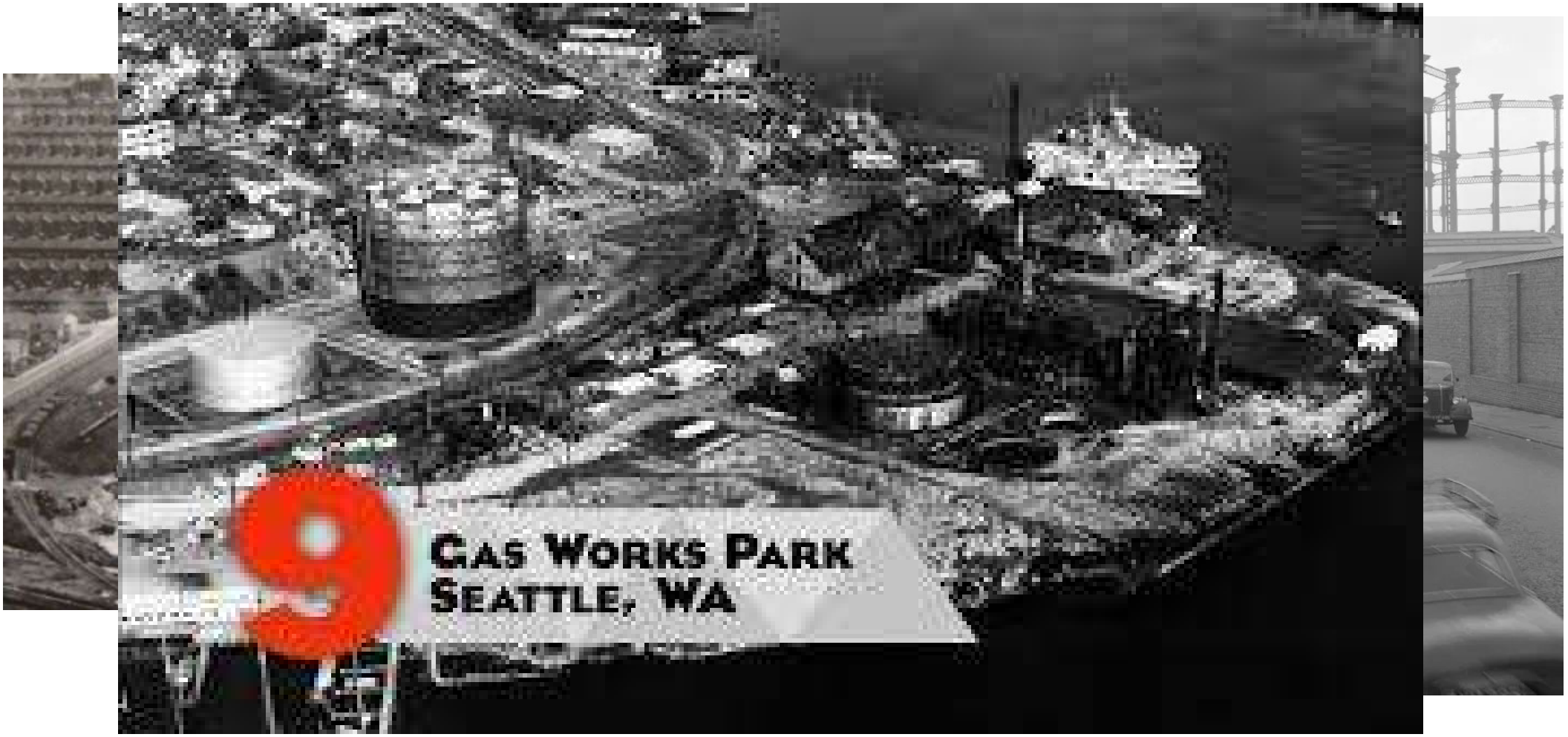
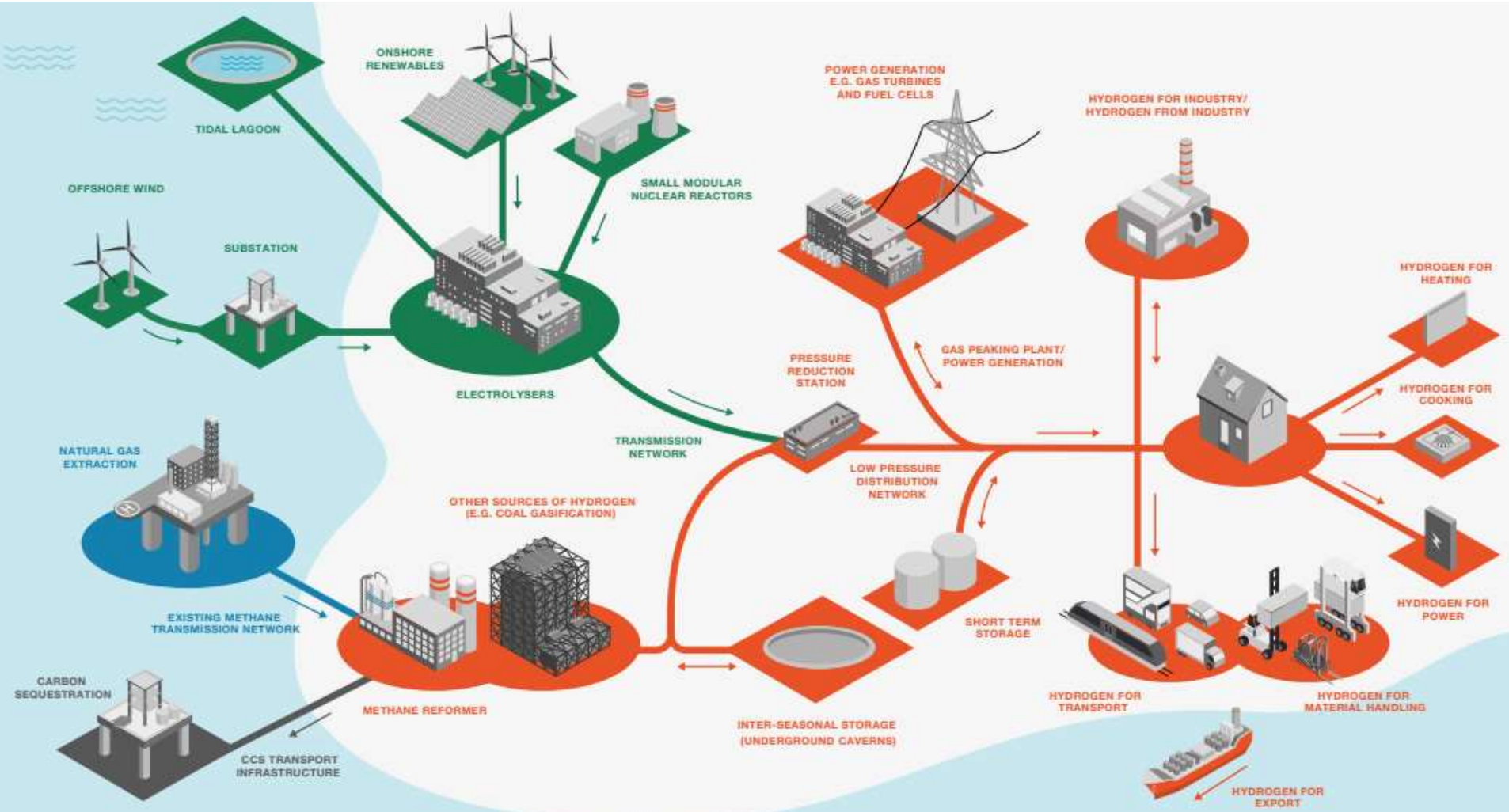
Hydrogen: Back to the future?





Establishing a Hydrogen Economy:

The future of energy 2035

Report

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Challenges to be overcome

Cost

Policy Enablers

Legal barriers

Technical challenges

Public perception

Coordination

Evidence gathering

Is it safe?

Do we have all the technology needed?

How will it be done?

Is it cheaper and better value than other net zero technologies?

Will consumers choose it over other net zero technologies?

What problems is it really the right answer for?

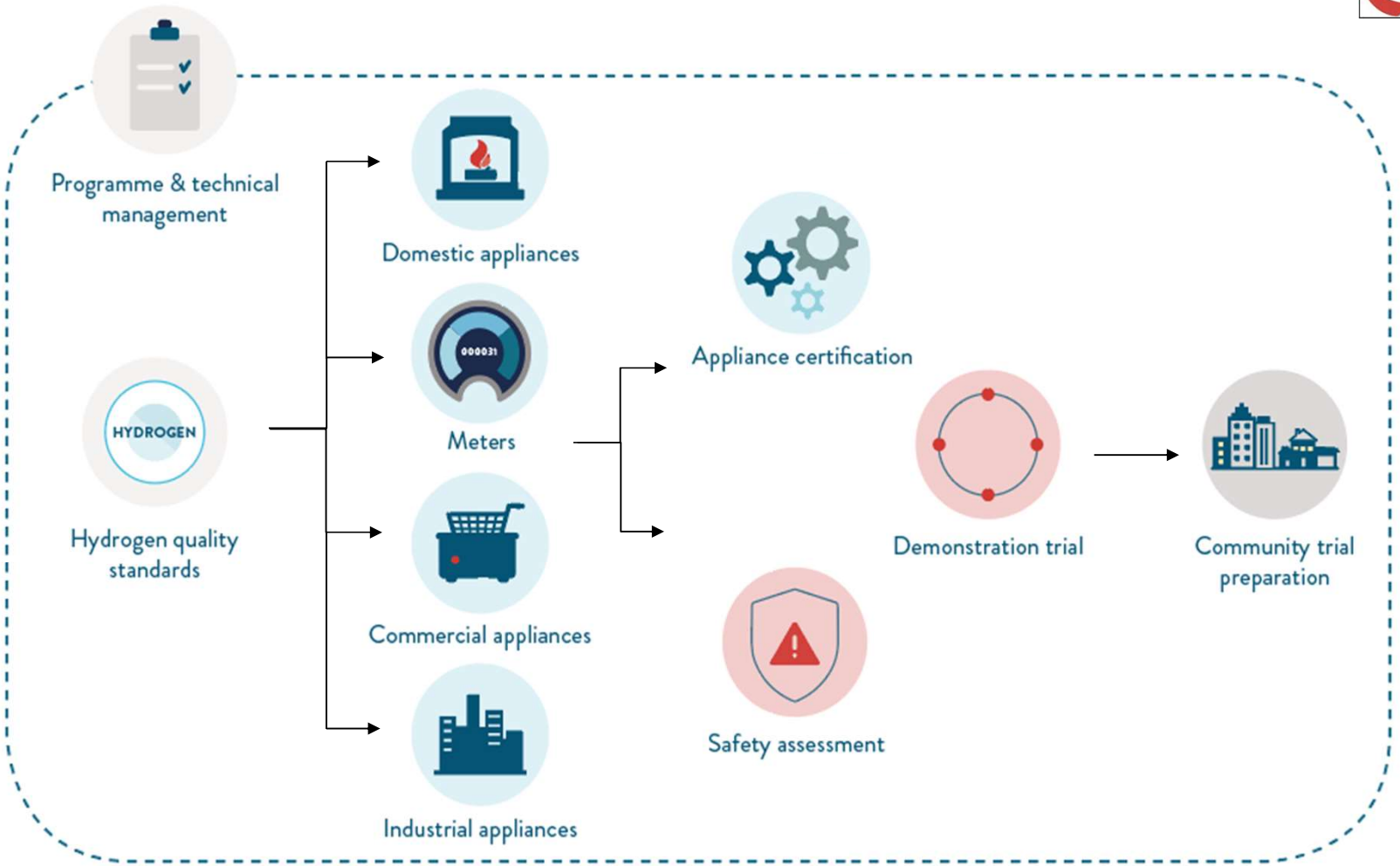
Hy4Heat

£25m BEIS funded programme

To establish if it is technically possible, safe and convenient to replace natural gas (methane) with hydrogen in residential and commercial buildings and gas appliances.

This will help enable the government to determine whether to proceed to a community trial of hydrogen.

Hy4Heat

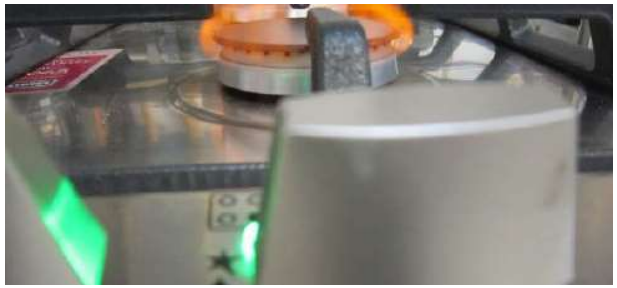

Programme & technical management
Domestic appliances
Meters
Commercial appliances
Industrial appliances
HYDROGEN
Hydrogen quality standards
Appliance certification
Safety assessment
Demonstration trial
Community trial preparation

Hydrogen Appliances: Boilers

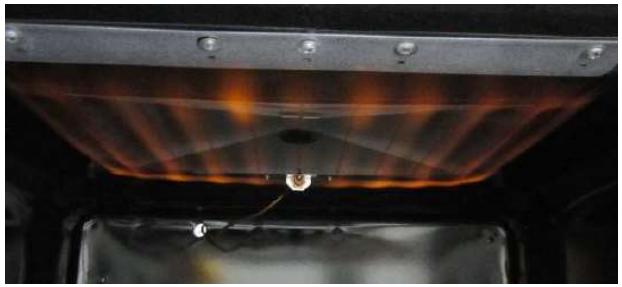
Hydrogen Appliances: Fires

Clean Burner Systems

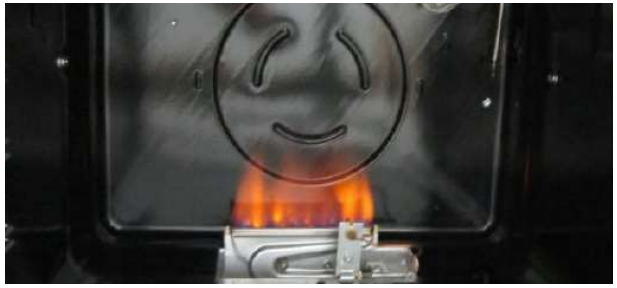
Hydrogen Appliances: Cookers



Hob



Grill



Oven

Hy4Heat

Fife and H100

SGN
Your gas. Our network.

Community Demonstration

Phase 1: Demonstration Facility & 300 Homes

Phase 2: 1000 Homes

Phase 3: Industrial & Commercial

Phase 4: Transport

Phase 5: Whole Systems & Hydrogen Coast

Project Cavendish

Hydrogen for London and the South-East

Project Cavendish

- Where is Project Cavendish?

Project Cavendish

- Where is Project Cavendish?
- What is Project Cavendish?

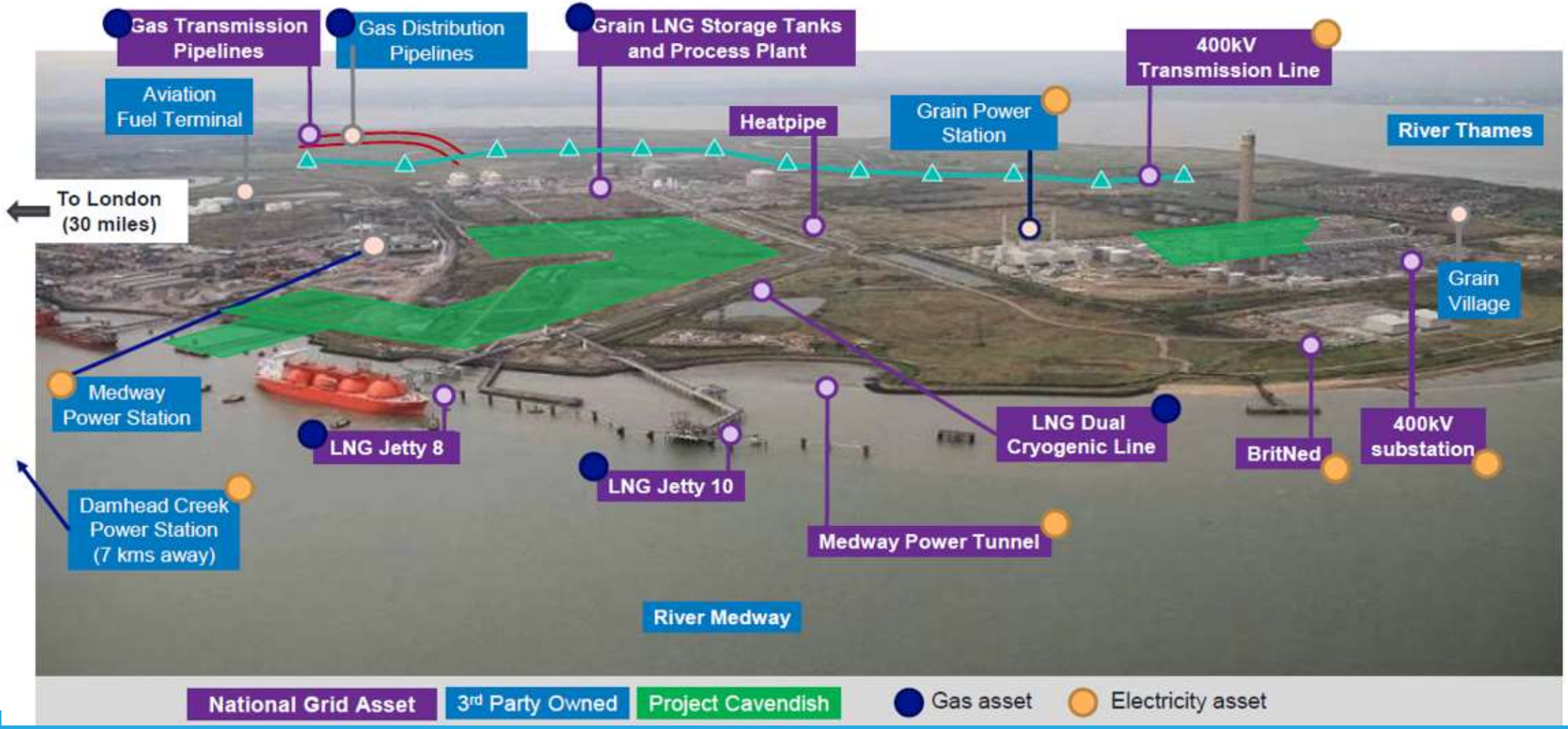
Project Cavendish

- Where is Project Cavendish?
- What is Project Cavendish?
- Who is Project Cavendish?

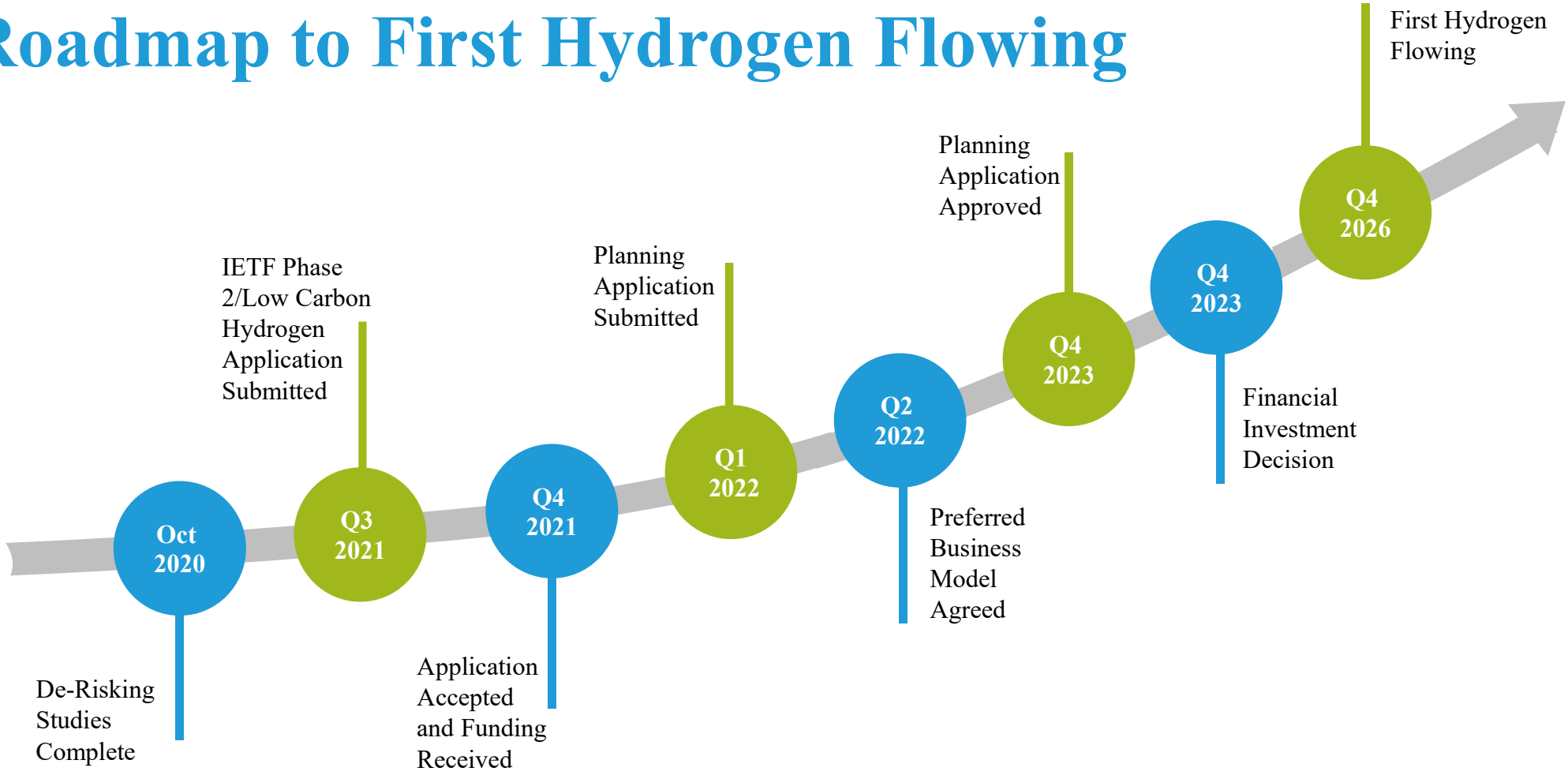
Project Cavendish

- Where is Project Cavendish?
- What is Project Cavendish?
- Who is Project Cavendish?
- Why Project Cavendish?

Prime Location



Roadmap to First Hydrogen Flowing



All subject to any applicable consenting and regulatory approvals

Project Cavendish

ARUP

Technical and Program Management support

Progress to Date

- 1- Review of SCG Hydrogen Efforts
- 2 – Demonstration Planning Activities
- 3 – Demonstration Project Work Packages
- 4 – Program-Wide Work Packages

5% Blending community demonstration project

Project Management and safety assessment support

Integrated Blending Programme

Program Management and strategic advise

A vision for hydrogen in New Zealand: Green Paper

National Hydrogen Strategy priorities & delivery (Australia)

UK Government to invest £4bn to create 250,000 new green jobs

Hydrogen in the EU's Economic Recovery Plans

A checklist for Policy Makers

- Collaboration environments
- Carbon emission targets.
- Whole Energy System scenarios.
- Road map based on mid-point scenarios
  - Value creation.
  - Just transition.
  - Resilience.
- Low regret / no regret short and medium term actions aligned with final outcome.
- Use of successful models from other transitions / locations.