

Hydrogen from Natural Gas

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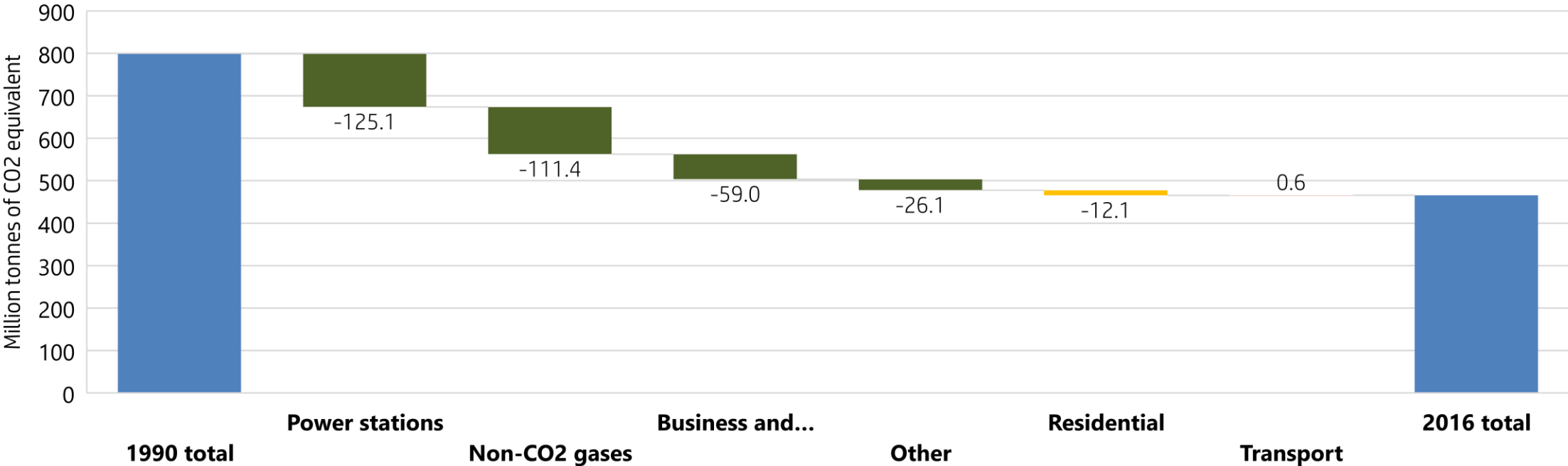
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Securing our energy future



UK decarbonisation context

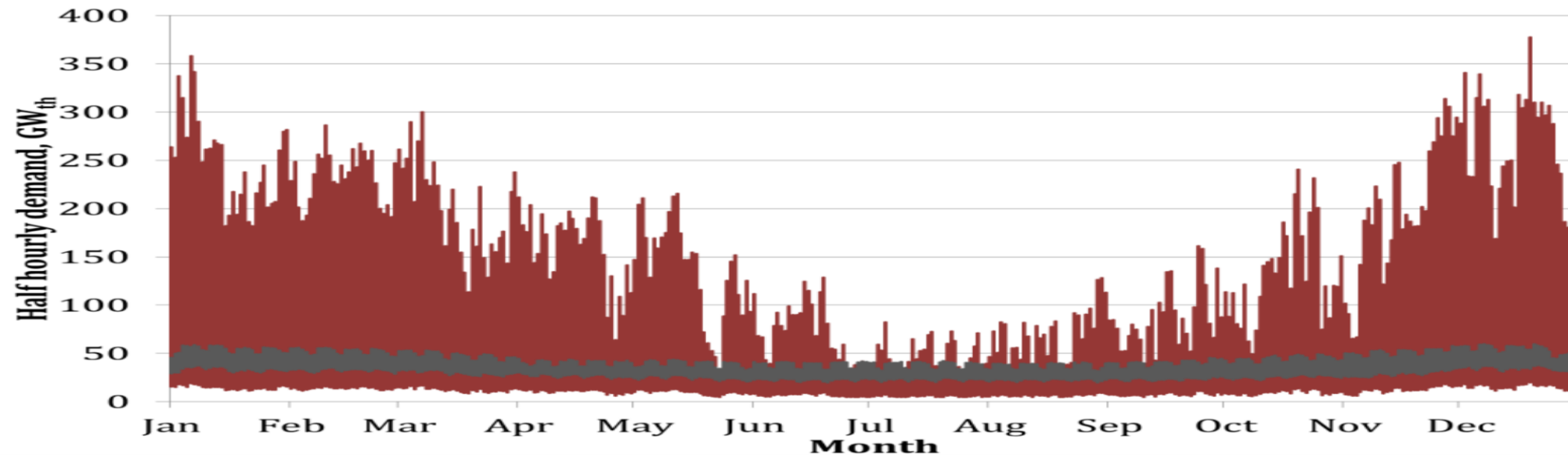
- UK has cut green house emissions by 42% since 1990 baseline – halfway to 2050 target (Paris Treaty)
- But little progress on heating and transport, air quality is still a big problem

UK greenhouse gas emission progress: 1990-2016



The UK's heating system relies on gas

- 80% of the UK's 26 million homes are heated by gas (2018)
- Homes not connected to Gas Grid are 1.5 times more likely to be fuel poor than national average.
- Currently 1.5 million new gas boilers are installed in the UK each year.



Advantages of hydrogen

100% hydrogen in the gas grid

- Iron Mains Replacement Programme already halfway completed – programme is for safety reasons but polyethylene pipes are also able to transport hydrogen.
- New boilers/cookers will be needed, but not wholesale changes to central heating system – far lower cost and disruption to consumers.
- Town Gas was 50% hydrogen – wholesale conversion to natural gas in 1970s – The UK has done this before
- Hydrogen can be stored seasonally – batteries provide power for hours not months!

Hydrogen blending

- Blending at up to 20-30% likely to be possible without conversions to appliances
- Allows gas system to store excess renewable electricity through hydrogen

Key elements being demonstrated

Safety of hydrogen in the home:

- BEIS Hy4Heat programme – runs until 2021

100% hydrogen in the gas distribution network:

- Next phase of H21 Leeds project (Northern Gas Networks) – runs until 2020

Industrial hydrogen with gas grid blending:

- HyNet project (Cadent Gas) being developed in the North West of England
- Conclusions from HyDeploy project due in 2020

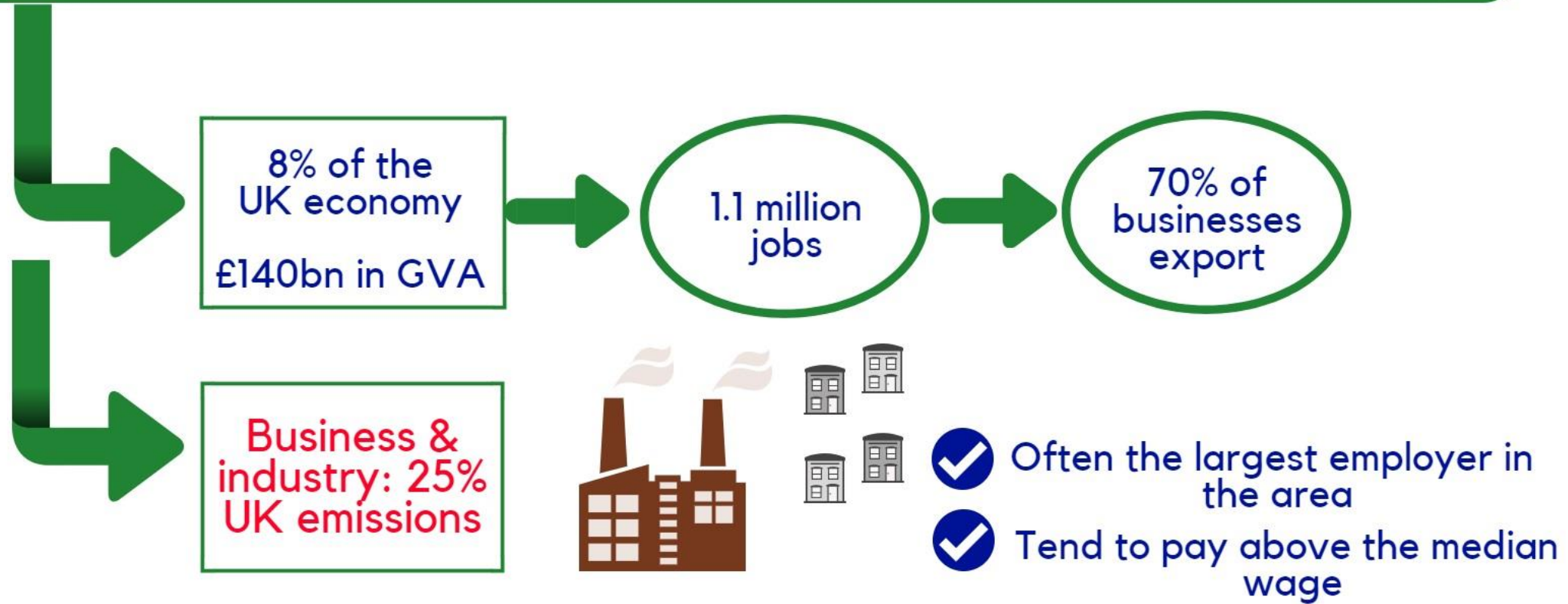
Producing low carbon hydrogen from gas

Focus on gas today, but electrolysis and bio-hydrogen are also important:

- Steam methane reformation produces half of global hydrogen – cheapest and most widely-used method
- SMRs in the UK e.g. Grangemouth, Teesside
- Hydrogen from methane with carbon capture essential:
 - Already proven in Texas, Canada, Japan, and Hong Kong.
 - Permanent CO₂ storage in Norway offshore since 1996
- UK offshore has more than 100 years of CO₂ storage and fields ready for decommissioning or CCS are near to industrial clusters
- Committee on Climate Change: CCS is vital for meeting the 2050 target – costs could be twice as high without CCS

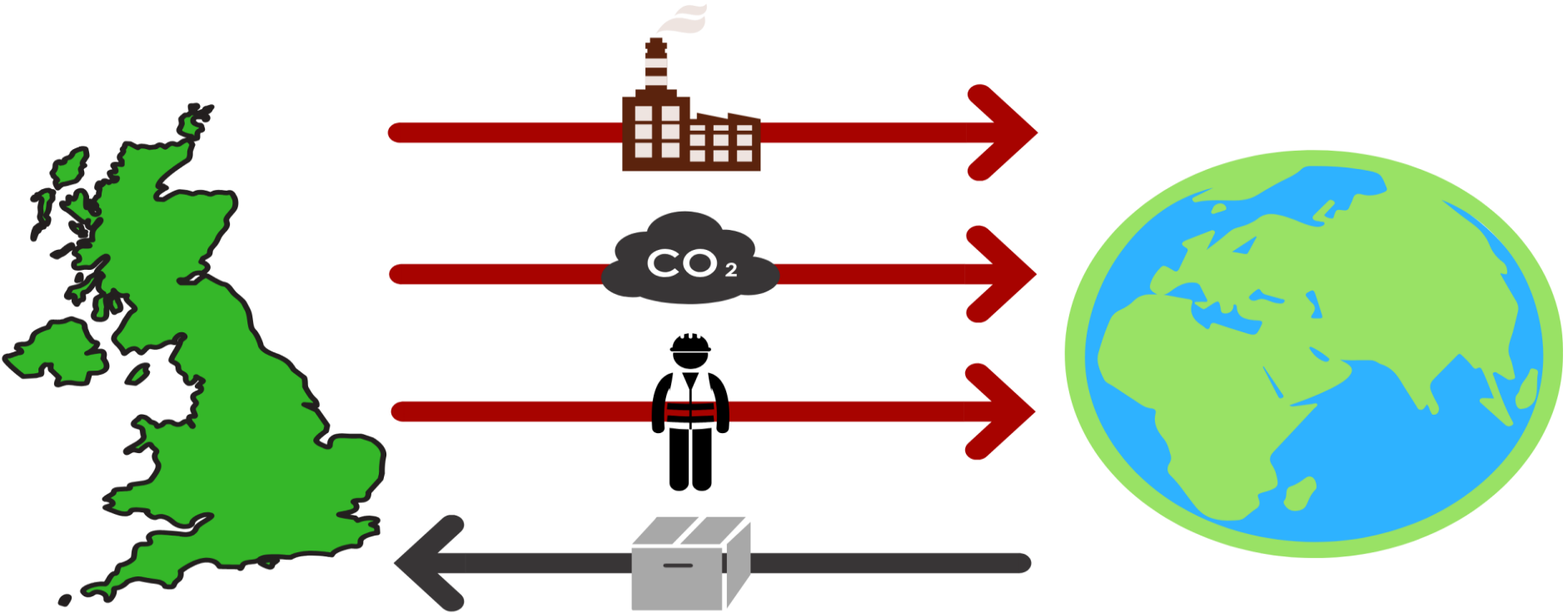
Tech. exists today: need to cut cost & increase CO₂ capture efficiency

Energy intensive industries are vital



Our big industrial challenge

We have seen too much decarbonisation through offshoring in recent decades...



Off-shoring emissions

Between 1997 and 2015:

Greenhouse gas emissions

UK production:  33%

UK consumption: 4% 

Carbon imports:  31%

Manufacturing share of GVA

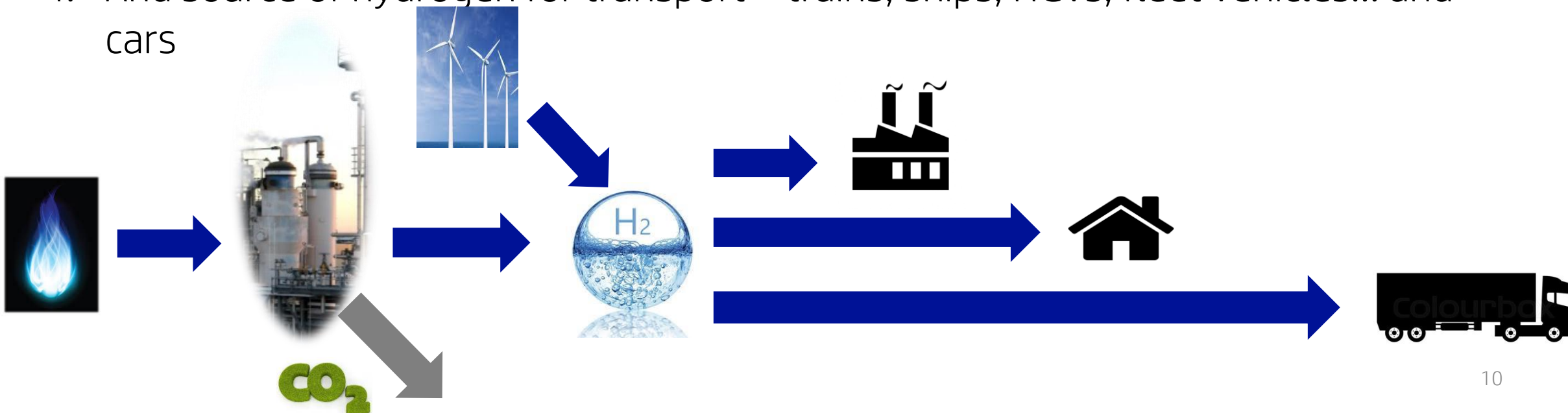
1997: 17%

2015: 10%

Closure of Redcar steelworks in late 2015 caused nearly half the fall in industrial emissions in 2016 – but 2,000 jobs lost! If we do nothing this pattern continues...

Re-shoring responsibility

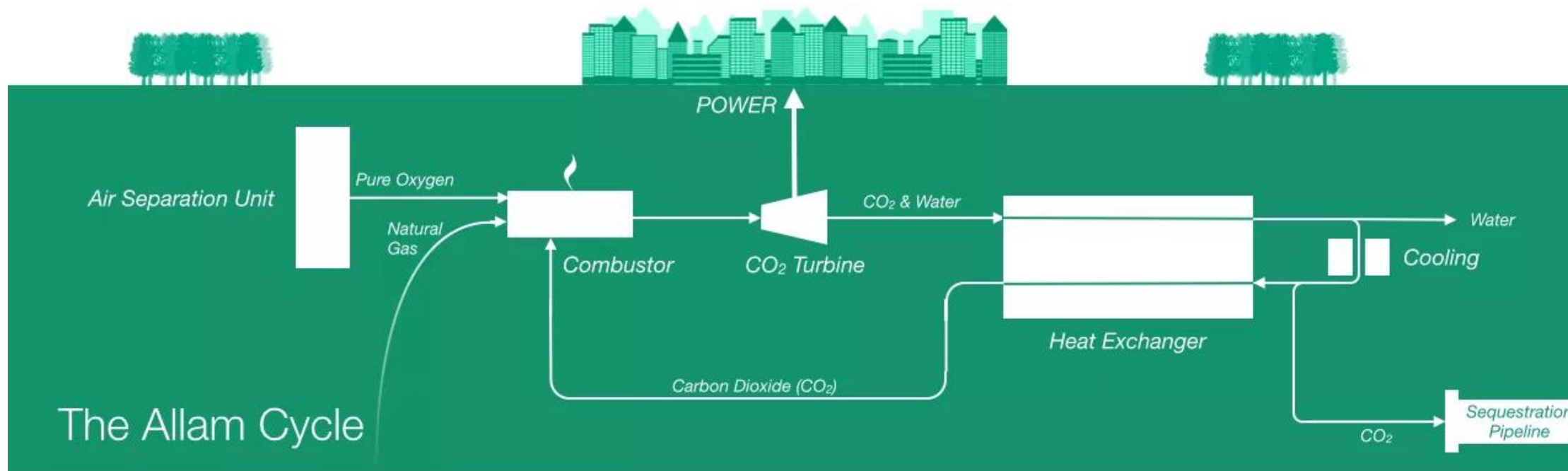
1. As domestic heat projects work through, opportunity to start using more hydrogen in industrial clusters
2. Tied into CCS development and linked to electricity system
3. With low carbon hydrogen production established, source of hydrogen for domestic heating and grid balancing
4. And source of hydrogen for transport – trains, ships, HGVs, fleet vehicles... and cars



And finally, let's not forget power!

- NetPower gas-fired power station with built-in CO₂ capture has just completed a 50MW demonstration in Texas.
- Short answer is – it works!

Could this be a route back for CCS in the power sector?



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