

# The Water Sector and Hydrogen: Green for Go

In the kNOW Webinar  
May 25, 2022



# The Team

## Speakers:



**Andrew McLeod,**  
Andrew McLeod, Bioresources  
Process Engineer, Jacobs



**Giulia Pizzagalli,**  
Innovation Projects Manager,  
Anglian Water



**Rebecca Zeitlin**  
Marketing Director,  
Levidian

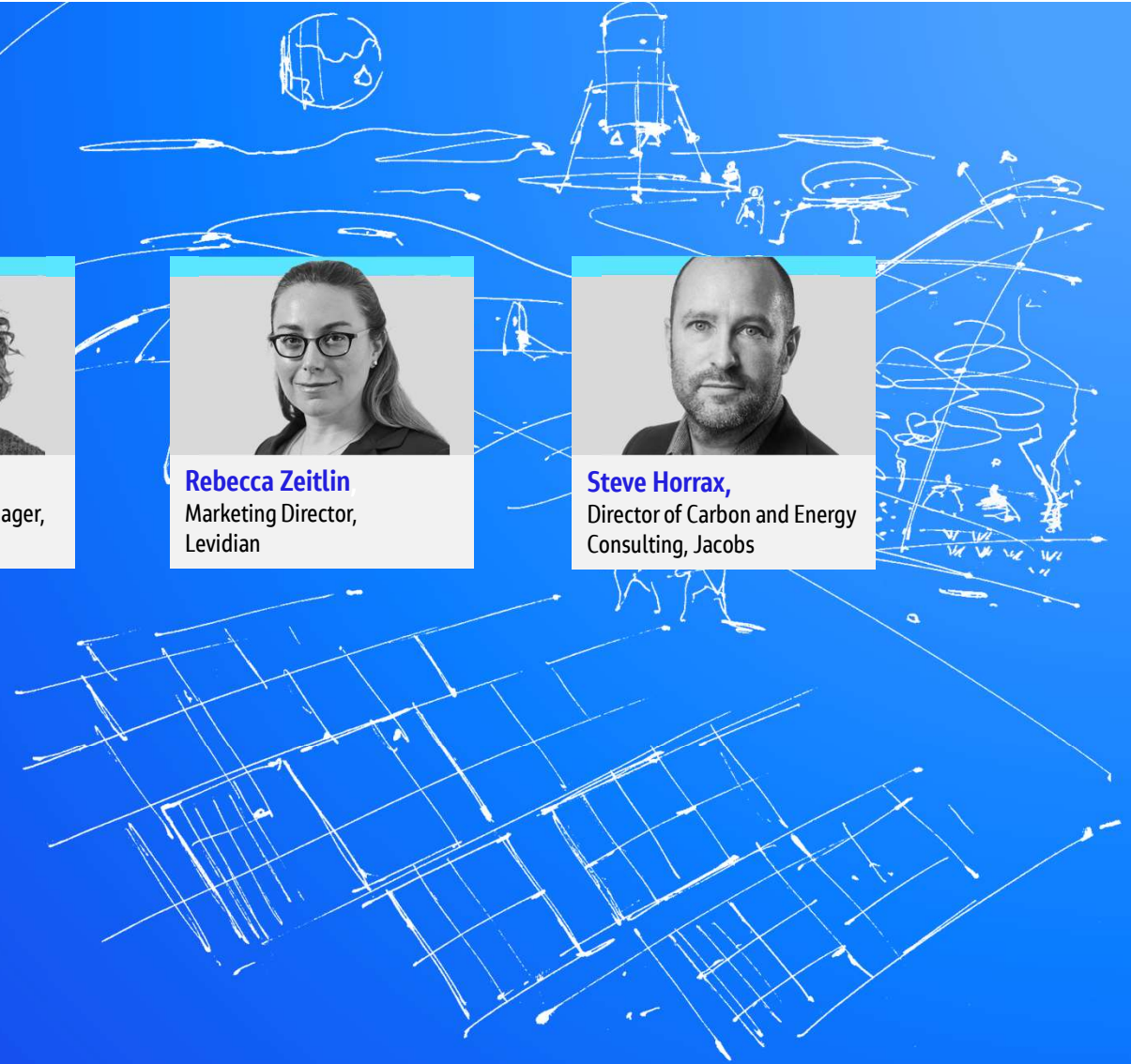


**Steve Horrax,**  
Director of Carbon and Energy  
Consulting, Jacobs

## Moderator:



**Amanda Lake,**  
Head of Carbon and Circular  
Economy – Water Europe, Jacobs



## Poll Question #1

- Hydrogen in the Water Sector is:
  - A. All about the hype!
  - B. Limited opportunities, but more of a distraction
  - C. Could play a good role in decarbonising the sector
  - D. A critical opportunity for enhancing services and reaching net zero
  - E. Absolutely, bring it on!

# The Water Sector & Hydrogen

Green for Go?  
Or H<sub>2</sub> - whoa?

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Andrew McLeod,  
Andrew McLeod, Bioresources  
Process Engineer, Jacobs



# Hydrogen and Net Zero - UK case study

## 2018

Climate Change Committee publish 'Hydrogen in a low-carbon economy'

## 2019

Many UK water companies pledge to be Net Zero by 2030

## 2020

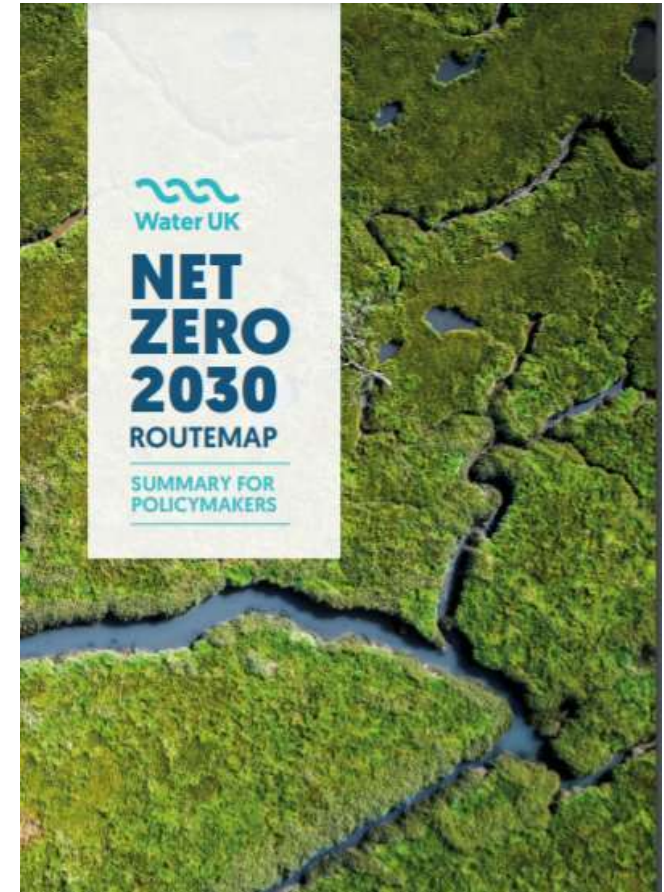
Water UK publish 'Net Zero 2030 Routemap'

## 2021

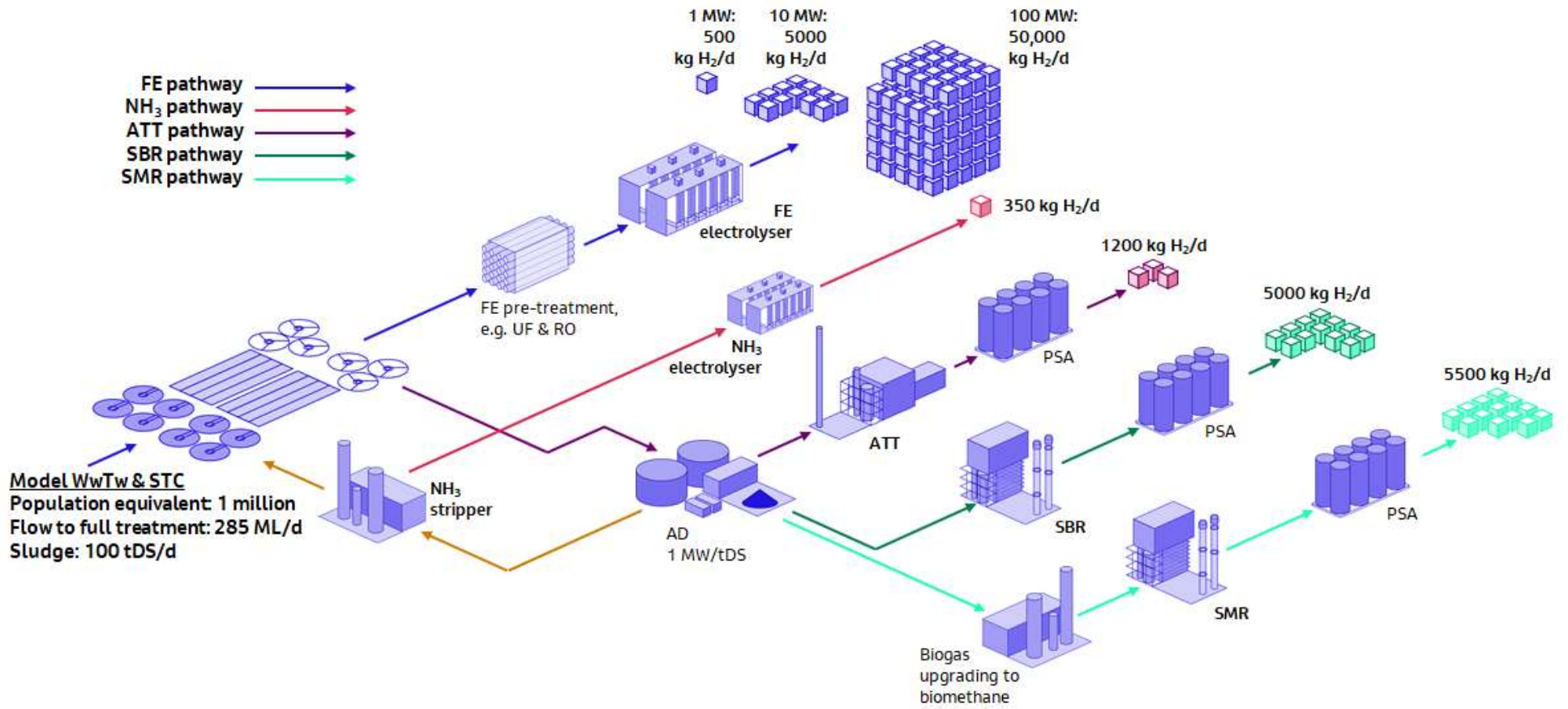
UK Gov publish Hydrogen & Net Zero Strategies – 5 GW by 2030

## 2022

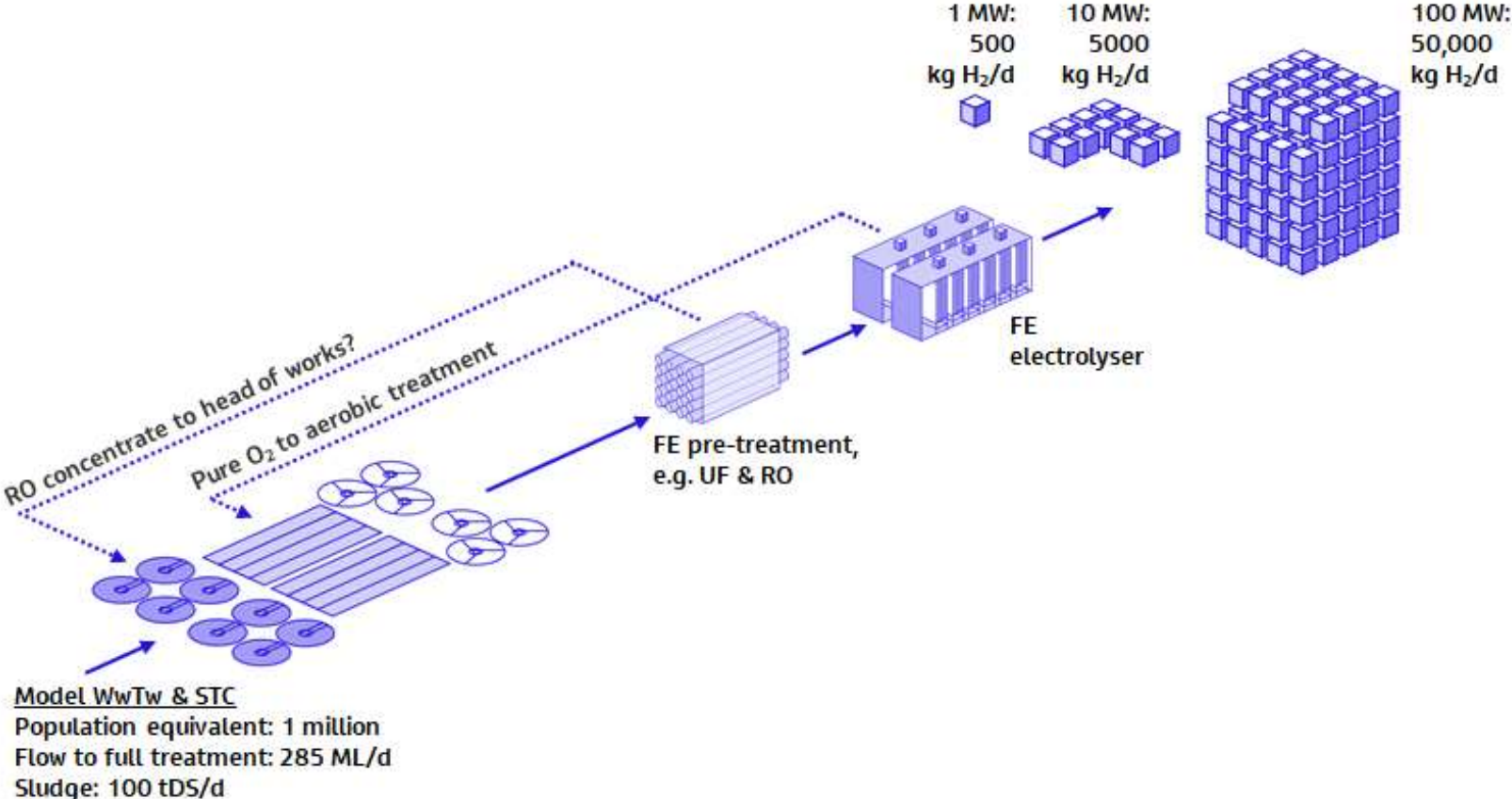
UK Gov publish Energy Security Strategy – 10 GW by 2030



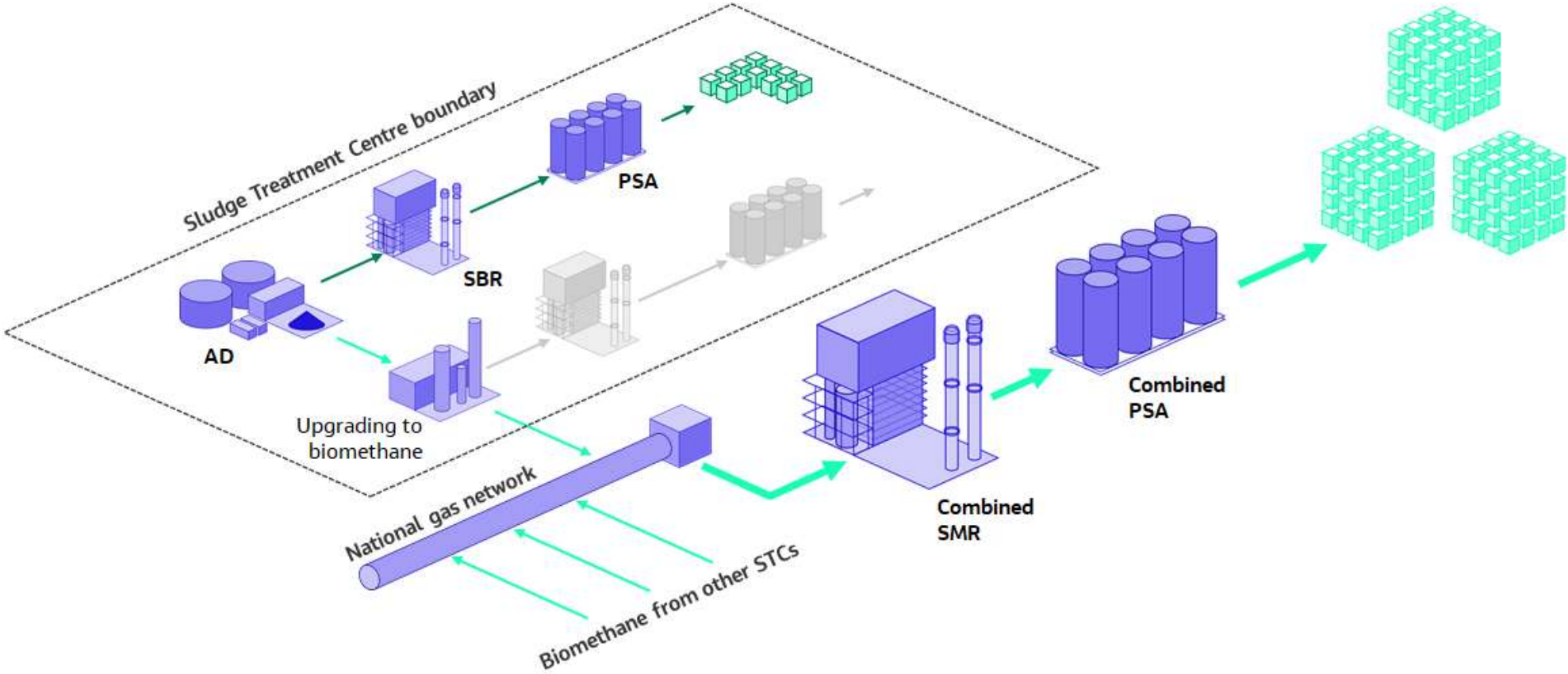
# Hydrogen Production Pathways



# Synergies & Conflicts – Final Effluent (FE) Pathway



# Centralisation & Strategic Location





# Jacobs' Thought leadership Series



<https://www.jacobs.com/newsroom/news/how-can-water-sector-engage-future-hydrogen-economy>

## Poll Question #2

- Do you think water companies are more likely to...
  - A. Build and operate their own hydrogen production plants
  - B. Generate and supply renewable feedstocks for 3<sup>rd</sup> party producers

# Triple Carbon Reduction

Hydrogen, GHG emissions and energy efficiency

Giulia Pizzagalli

Innovation Projects Manager, Anglian Water



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## Project partners



# Who we are

Anglian Water is the largest water and water recycling company in England and Wales by geographic area. We supply water and water recycling services to more than six million customers in the East of England and Hartlepool.

- Our region is the driest and lowest lying in the UK, more vulnerable than most to the effects of climate change - it's vital we look after the water we've got and plan for future resilience of water resources.
- Our population is growing - we run more water and water recycling treatment works than elsewhere and we need to operate them to target efficiency.
- For many years we have been at the forefront of the industry in carbon reduction. By 2020, we reduced capital carbon by 61% from our original baseline in 2010 and reduced operational emissions by 34% (from 2014-2015).

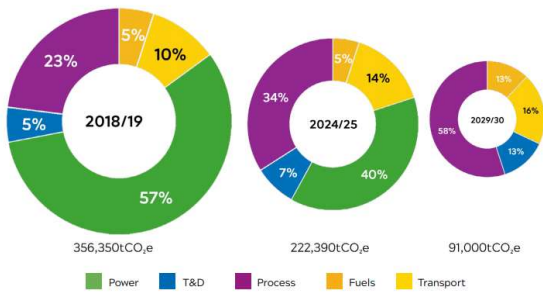


# Net Zero by 2030



HM Government

## UK Hydrogen Strategy



### 2030 Imagined: our transition to net zero

Expert analysis and consultation with stakeholders confirms there is no single solution that achieves net zero on its own so it's clear that a broad combination of approaches and collaboration between water companies, policymakers and the supply chain will be needed.

By 2030 we aim to see:

- 1. Low emissions vehicles**  
100% of fleet passenger vehicles are electrified and 80% of commercial vehicles (LGVs and HGVs) converted to alternative fuels to cut carbon and air pollution.
- 2. Water and energy saving**  
New strategies to tackle leakage and help customers save water, alongside smarter and more efficient networks and catchments.
- 3. Process emissions**  
Targeting a reduction of up to 60% from our 2018-19 baseline by 2030, with monitoring of emissions to inform research and detailed pathways ahead of PR24.
- 4. Renewable power**  
Up to 3GW of new solar and wind power coupled with energy efficiency measures and suitable storage to provide up to 80% of sector demand, relieve pressure on grid generators, and minimise the need for offsets.
- 5. Green gas**  
Biomethane from sewage waste is injected into the grid to heat up to 150,000 homes, use in hard to decarbonise sectors, or to generate low-carbon power when generation from renewables is low.



Anglian Water, 2021



# Ofwat Innovation Fund

- £200m over five years – paid for by water customers in England and Wales;
- Designed to ensure long term value and incentivise collaboration within the water sector and open it to other sectors;

Objective of the fund is that the sector can better **meet needs of, and create long term value for customers, society and the environment through innovation**

Accelerating the creation and roll-out of innovative products, services and concepts

Growing the capacity and capability of the sector to innovate

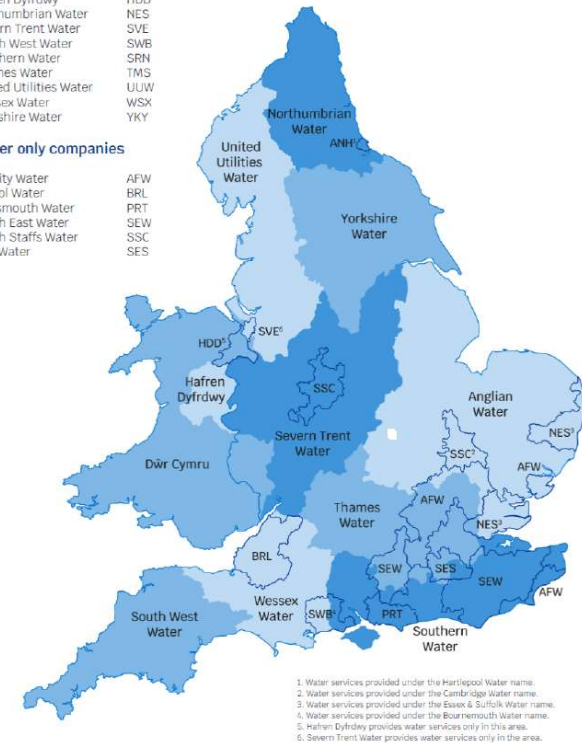
Embedding a culture that values, encourages and supports innovation

## Water and wastewater companies

Anglian Water	ANH
Dŵr Cymru	WSH
Hafren Dyfrdwy	HDD
Northumbrian Water	NES
Severn Trent Water	SVE
South West Water	SWB
Southern Water	SRN
Thames Water	TMS
United Utilities Water	UUW
Wessex Water	WSX
Yorkshire Water	YKY

## Water only companies

Affinity Water	AFW
Bristol Water	BRL
Portsmouth Water	PRT
South East Water	SEW
South Staffs Water	SSC
SES Water	SES



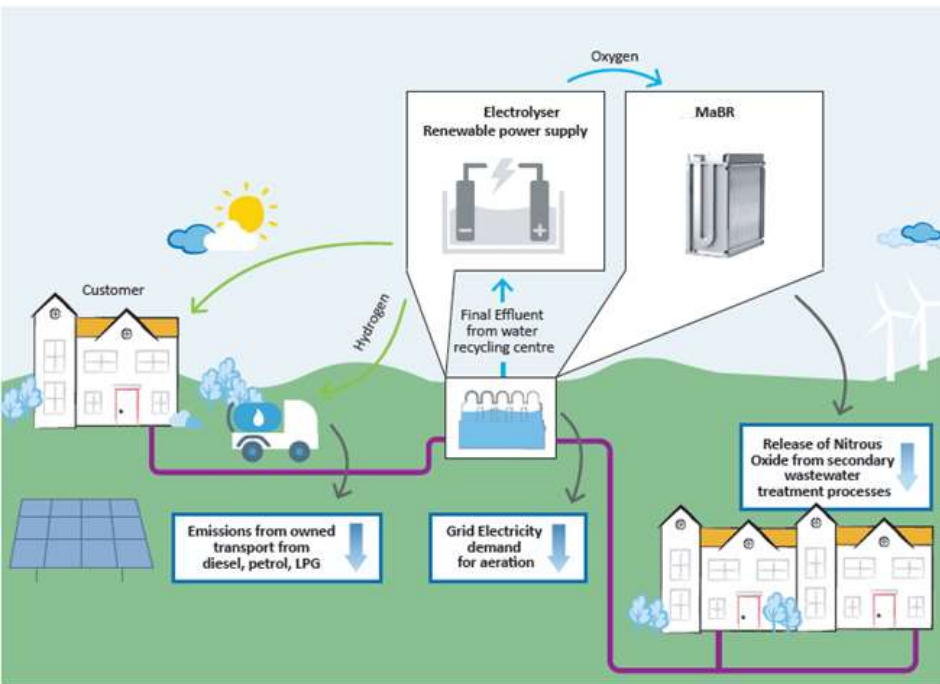
1. Water services provided under the Harlepool Water name.  
 2. Water services provided under the Cambridge Water name.  
 3. Water services provided under the Essex & Suffolk Water name.  
 4. Water services provided under the Bourne-mouth Water name.  
 5. Hafren Dyfrdwy provides water services only in this area.  
 6. Severn Trent Water provides water services only in this area.



# Triple Carbon Reduction



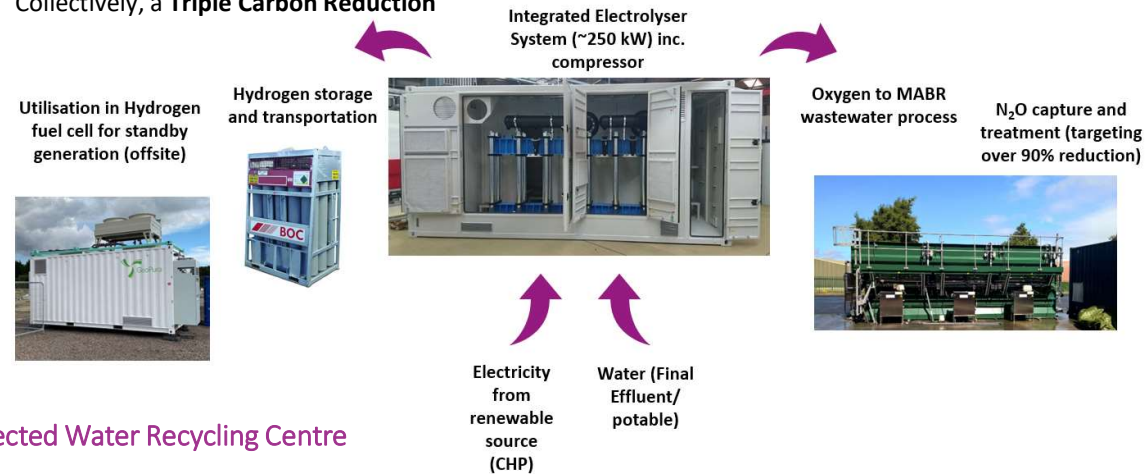
## Hydrogen, GHG emissions and energy efficiency



Demonstration plant at selected Water Recycling Centre

1. Generate oxygen via electrolysis of final effluent, to be utilised in the MABR process, and green hydrogen for use in applications that are currently challenging to decarbonise (i.e. diesel generators).
2. Demonstrate a viable alternative wastewater treatment process (MABR, Membrane Aerated Biofilm Reactor) targeting elimination of nitrous oxide (N<sub>2</sub>O) emissions from secondary treatment;
3. Achieve up to 85% reduction in energy consumption compared to conventional treatment processes currently in use (i.e. “activated sludge”);

Collectively, a Triple Carbon Reduction



# Powered by hydrogen Built on graphene

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Rebecca Zeitlin,  
Marketing Director, Levidian





# Our strategy



**Build the world's best team and work with the best customers**

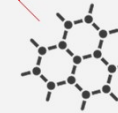
## **Hydrogen producer**

Provide on site hydrogen to customer sites



## **Gas decarboniser**

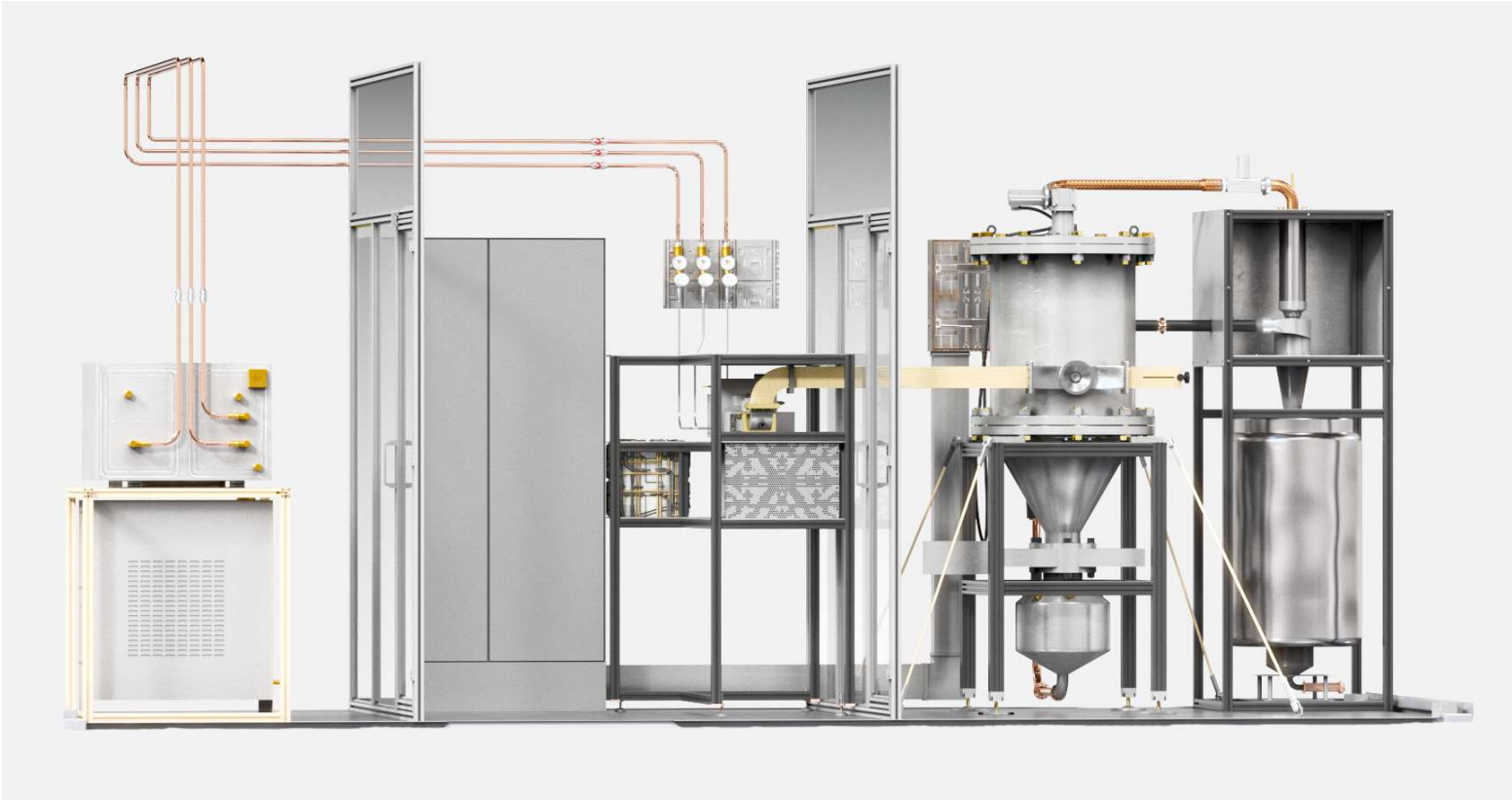
Provide on site gas decarbonisation services



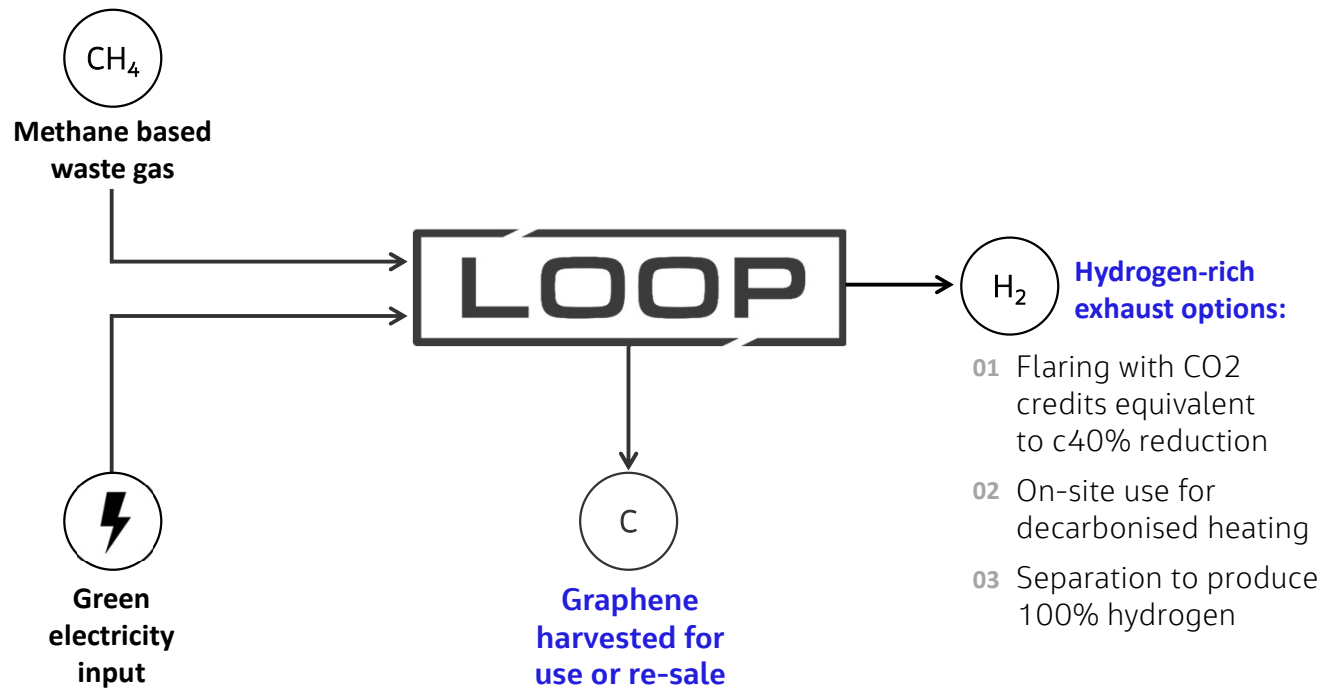
## **Graphene supplier**

Provide best in class graphene at scale for application into customer products

# The Levidian LOOP



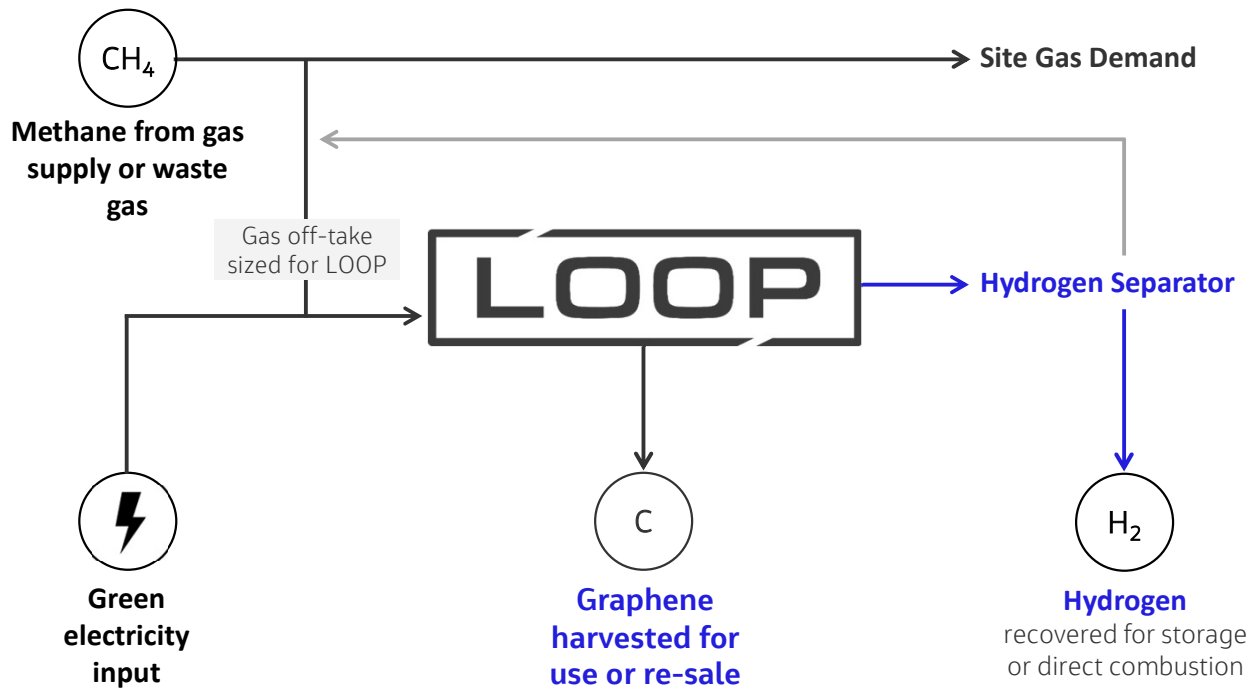
# LOOP: Decarbonisation configuration



## Configuration benefits

- ⊕ Instantly decarbonises gas by **40%**
- ⊕ Has option for **100% reduction** through addition of hydrogen separation
- ⊕ Produces **high quality graphene** at scale

# LOOP: Hydrogen configuration



## Configuration benefits

- ⊕ Convert part or all of existing sites gas usage to Hydrogen and Graphene
- ⊕ Hydrogen can be compressed and stored or used directly in suitable equipment for heat or power generation via a fuel cell or Hydrogen ready engine/turbine

# LOOP in the water industry

- Known ability to utilise biomethane
- Currently exploring utilisation of biogas
- UK water industry produces 490 million cubic metres of biogas per year
- LOOP could generate 49,341T<sub>e</sub> hydrogen/year
- This would reduce CO<sub>2</sub> emissions by 538ktCO<sub>2</sub> annually
- Potential to supply H<sub>2</sub> to other industries offers significant opportunity
- Carbon is captured in solid form

# Graphene: The facts

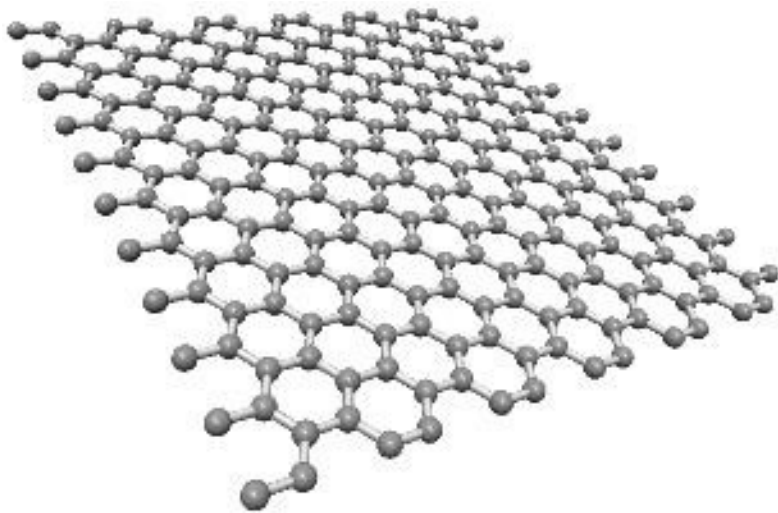
Flat sheets weigh

**0.001%**

compared to a sheet of  
paper of the same size

**40X**

stronger than diamond  
and 300 times stronger  
than A36 structural steel



## What makes it special?

- Strongest known material
- Stretchy
- Conducts heat and electricity
- Extremely lightweight
- Compatible with existing materials, from plastics to ceramics to metals

# Graphene use example

## Concrete

Only **0.03%** graphene addition:

Compressive strength increase by

**33%**

Flexural strength increase by

**60%**

Toughness increase by

**100%**



Controlling the nano-sized cracks and preventing formation of micro-sized cracks, making them more effective than conventional steel bar or fibre reinforcements.



Immediate application:  
Ultra-High Performance Concrete (UHPC) Advantages include lower lead times compared to steel. UHPC can cost in excess of \$500 per tonne.



# Application in the wider hydrogen economy

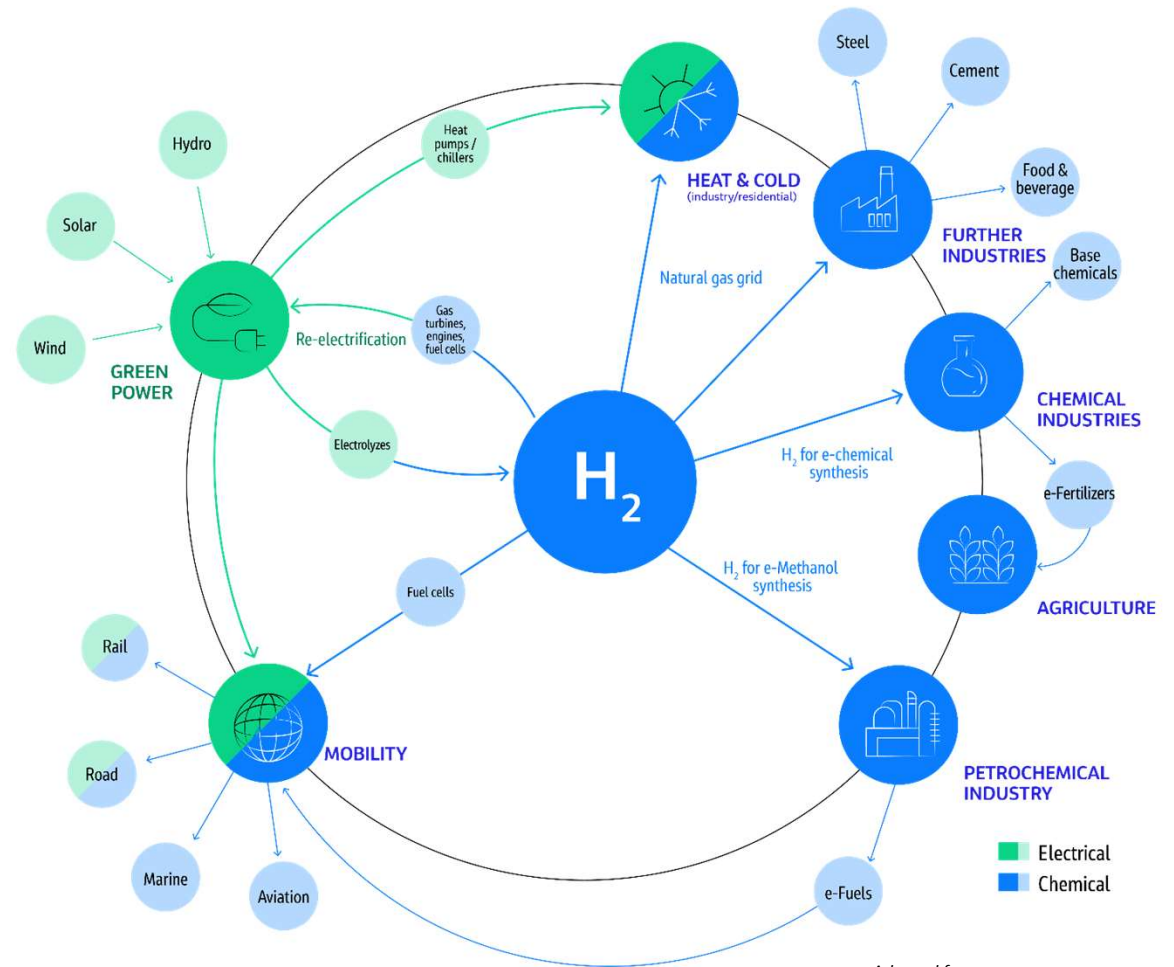
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Director of Carbon and Energy  
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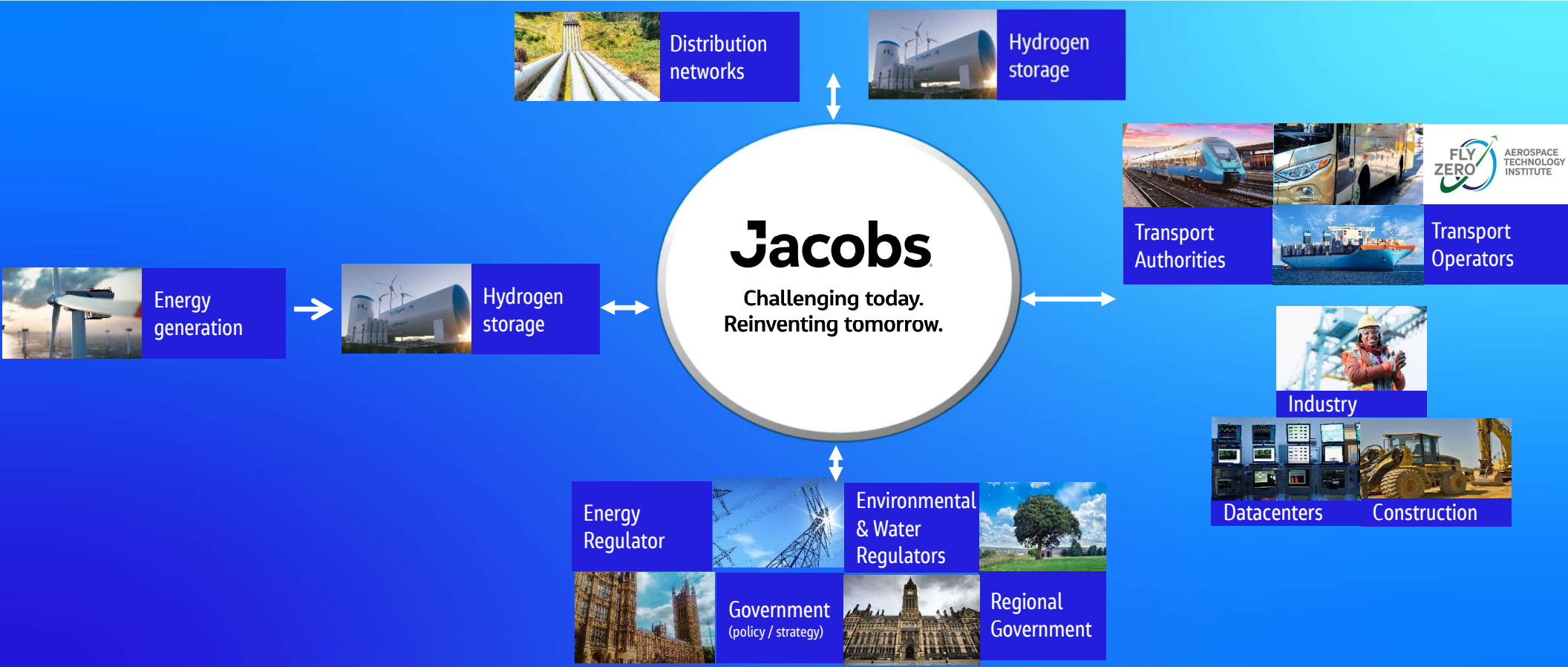
# The Hydrogen Value Chain

- Interest levels rising
- Complex picture
  - Politically
  - Technically
  - Economically
  - Geographically
- Meeting the needs of the water sector and being an integral player in the hydrogen economy
- No silver bullet!



Adapted from:  
*Power-to-X: The crucial business on the way to a carbon-free world: Siemens Energy*

# De-risking Growth Opportunities



# Thanks for listening

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