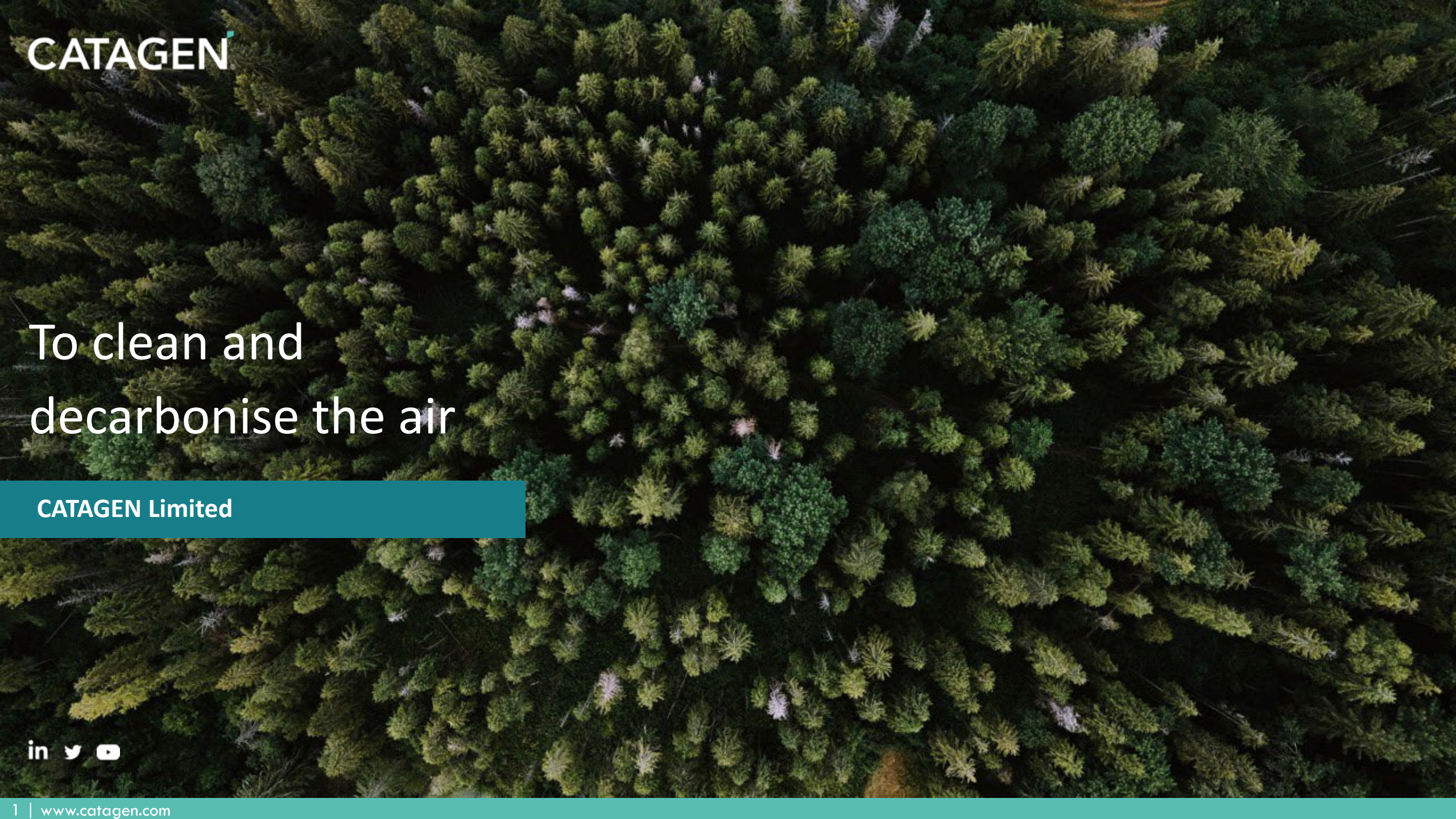

CATAGEN
To clean and
decarbonise the air
CATAGEN Limited

About us

WHO WE ARE

CATAGEN is a net zero technologies company providing independent emissions testing to global OEMs and industry leading data to transport policy makers.

CATAGEN Technologies:

CORE

Aftertreatment Ageing
Characterisation Performance Testing
Unique Aftertreatment Testing Offerings

IN DEVELOPMENT

Green Hydrogen Generator
Bio Hydrogen Generator
E-Fuel Generator
Carbon Capture from Air
Hydrogen Compression

CATAGEN Facility UK
Core Business – Catalyst Testing Services

Aftertreatment Testing

CERTIFICATION

We have supported OEMs with type approval for the US (EPA & CARB), Indian and Chinese regulators.

- *TUV Hessen – In Process*
- *UTAC – In Process*

Accredited by:

Applus IDIADA

CERTIFICATE No. GB21040018

IDIADA Homologation Technical Service CERTIFIES that :

Catagen Limited

5 Elmbank, Channel Commercial Park,
Titanic Quarter, Belfast, BT3 9DT

is able to perform in their facilities the tests regarding
Exhaust and Aftertreatment Hardware Accelerated Ageing
for projects of IDIADA according to the following directives and regulations:

Regulation (EC) 715/2007

Regulation (UN) 83 Type V, Catalyst Aging

In accordance with the requirements of IDIADA's qualification procedure IT-HO-901.
This certificate will be valid until 2 years after the date stated below.

James Eales
Projects Lead,
IDIADA UK

Richard Bailey
Homologation Manager,
IDIADA UK

GB21040018

Warwick, UK, 9th February 2021

Vehicle Certification Agency

APPROVED BY THE
VEHICLE CERTIFICATION AGENCY

This is to certify that the testing facilities of

Catagen
5 ELMBANK CHANNEL COMMERCIAL PARK, QUEEN'S ROAD, TITANIC QUARTER, BELFAST, BT3 9DT, NORTHERN IRELAND

*have been approved by VCA
for the purposes of testing to:*

'Accelerated Ageing of Exhaust Gas After treatment Hardware as per the World Harmonised Light Duty Procedure
Commission Regulation (EU) No 715/2007 and 692/2008 as last amended by 2018/1832

Signature:

D LAWLOR
Chief Technical and Statutory Operations Officer

By authority of
VCA Chief Executive

Date of approval: 16 JULY 2019

VCA
The United Kingdom Vehicle Approval Authority

This certificate is issued pursuant on the conditions shown below

Registration Number: FAB071

This certificate is issued by and is the property of the Vehicle Certification Agency,
1 The Eastgate Office Centre, Eastgate Road, Bristol, United Kingdom

Aftertreatment Testing

SERVICES

Catalyst Ageing

- Standard Bench Cycle (SBC)
- Lean Spike / Fuel Cut Cycle
- ZDAKW Cycle
- GMBC
- Diesel Ageing
- High Temp. OBD Limit Ageing
- Custom Ageing Cycles

Characterisation Performance

- Oxygen Storage Capacity
- NH3 Storage Capacity
- Light Off Test
- NH3 Ratio Test
- Lambda / Air Fuel Ratio Sweep
- Drive Cycle Tests

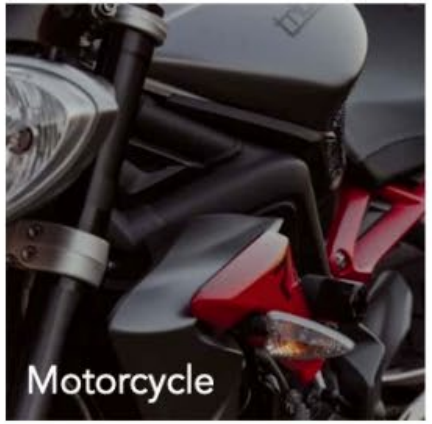
Knowledge-Based Advanced Offering

- 'Golden Catalyst Replication' (Cloning)
- Virtual Modelling Services
- PGM Optimisation
- Catalyst Poisoning
- Bespoke Test Design
- Collaborative R&D Projects

Emissions testing

INDUSTRIES

CATAGEN



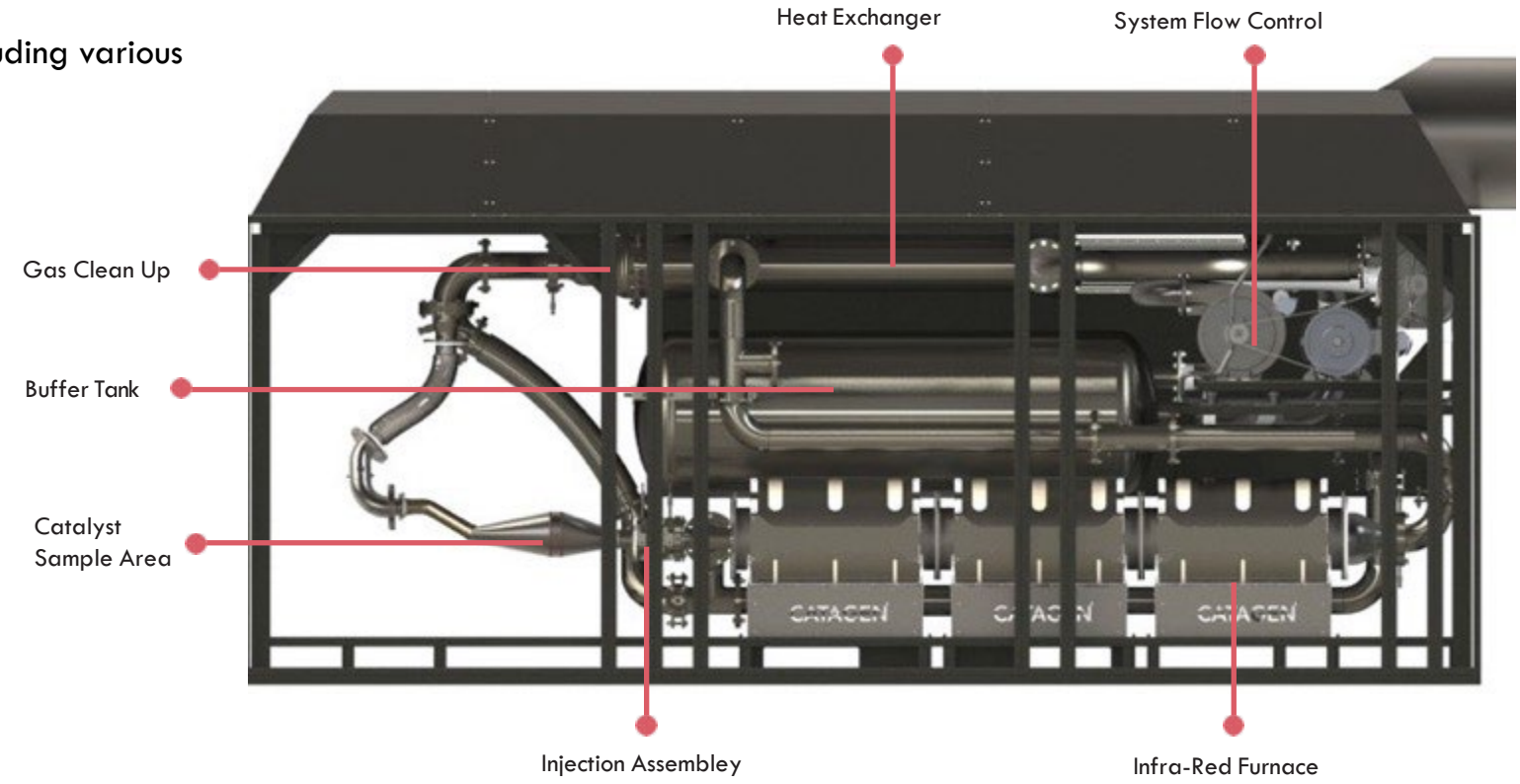
CATAGEN Test Reactor

OMEGA

OMEGA Reactor offers accurate control of key aftertreatment testing parameters -

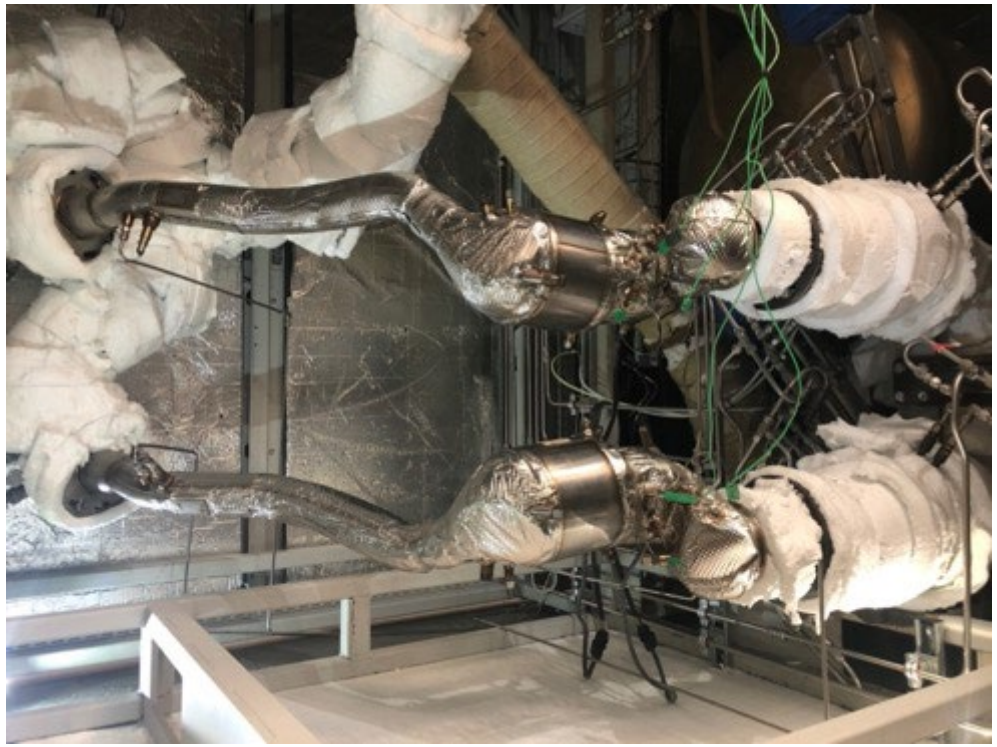
Temperature, flow rate and synthetic exhaust gas composition including various aftertreatment poisons

Capability	Ageing	Characterisation
Inlet Catalyst Temp. (°C)	**200 - 1000**	**50 - 800**
Flow Rates	**10 -120g/s (+)**	**5 – 60g/s**
Gas Compositions	Synthetic **Fully Customizable** Incl. Ammonia, & Poisons	Synthetic **Fully Customizable**
Sample Size	Single Brick to Full System (TWC, GPF, SCR, DOC)	Single Brick to Full System (Catalyst, GPF,SCR, DOC)

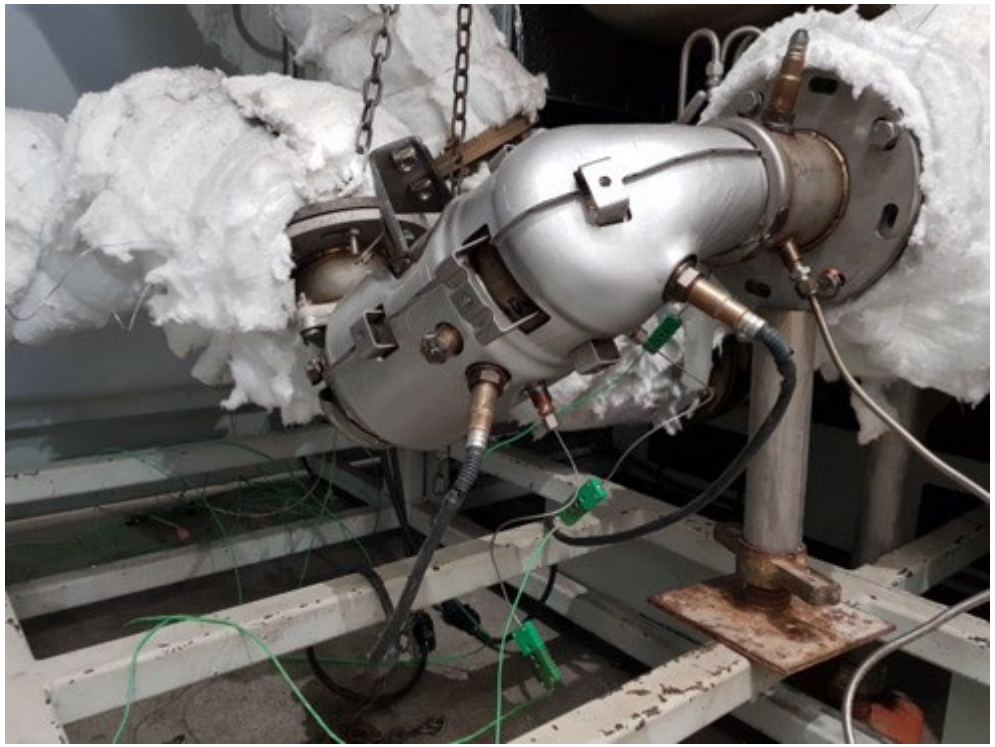


Light-Duty Passenger Vehicle

Installation – Fuel Formulations



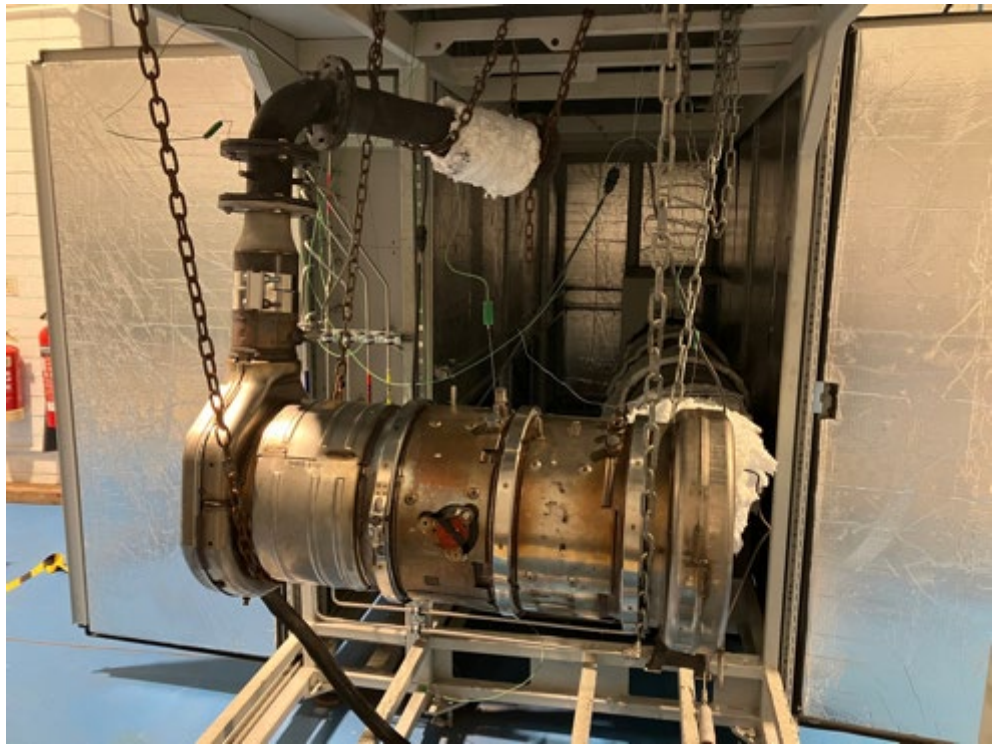
Dual TWC System



1.5 L Gasoline TWC

Heavy Duty On-Road

Installation

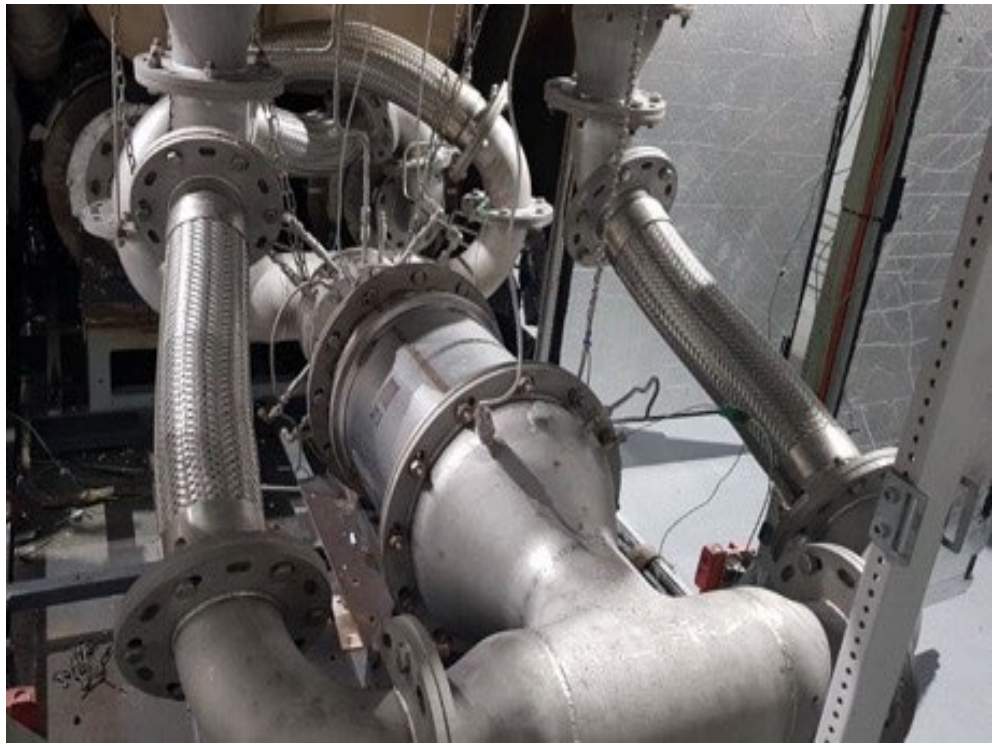


SCR System

SCR System

Heavy-Duty & Off-Road

Installation

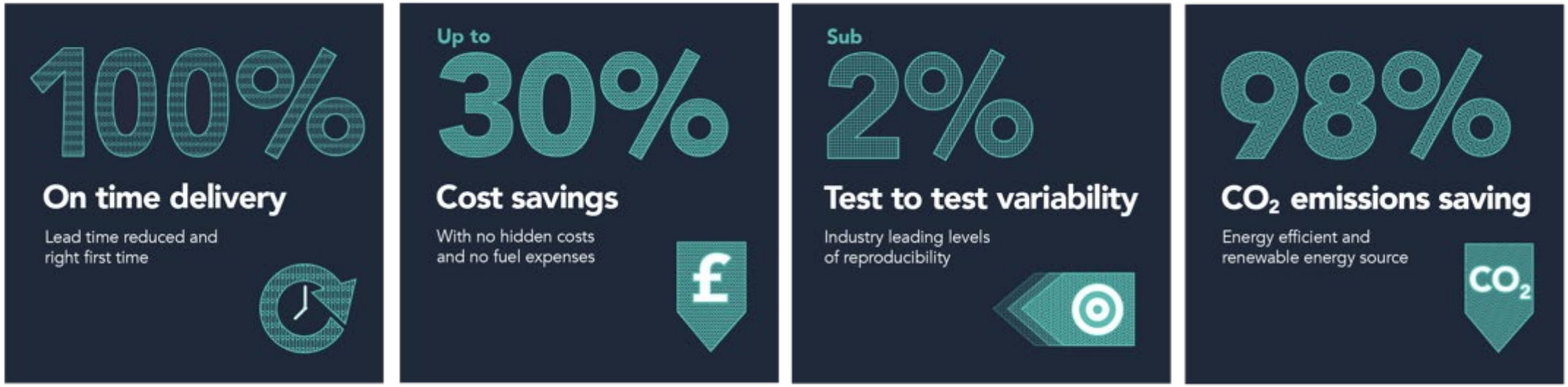


Heavy-Duty

Forklift TWC

Aftertreatment Testing

BENEFITS



Accelerated Aftertreatment Ageing

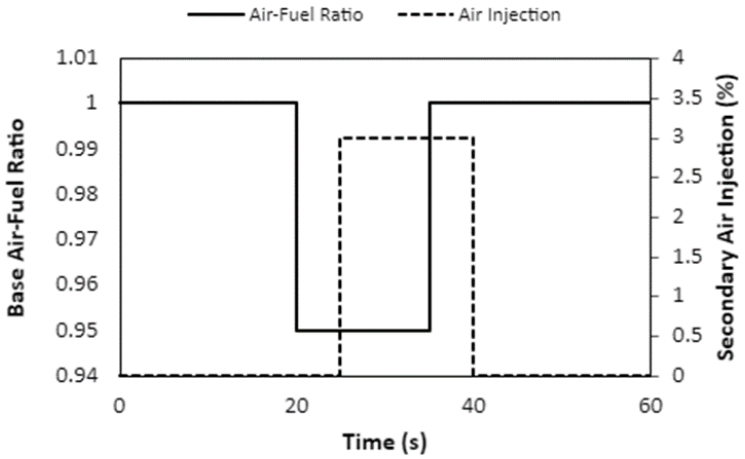
Legislative Ageing

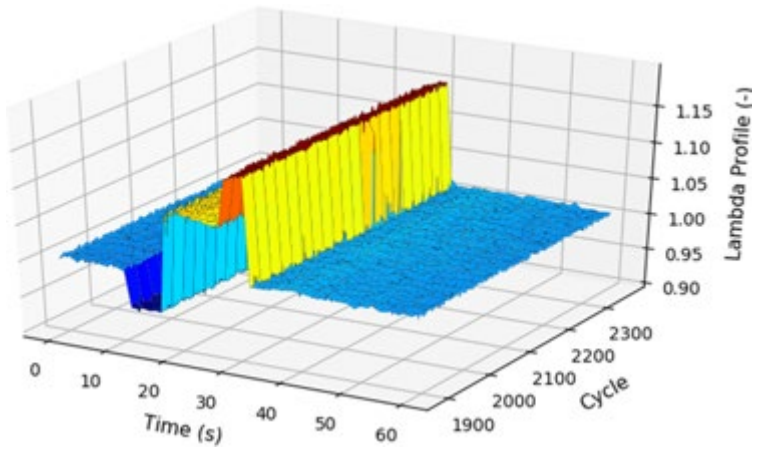
STANDARD BENCH TEST (SBC)

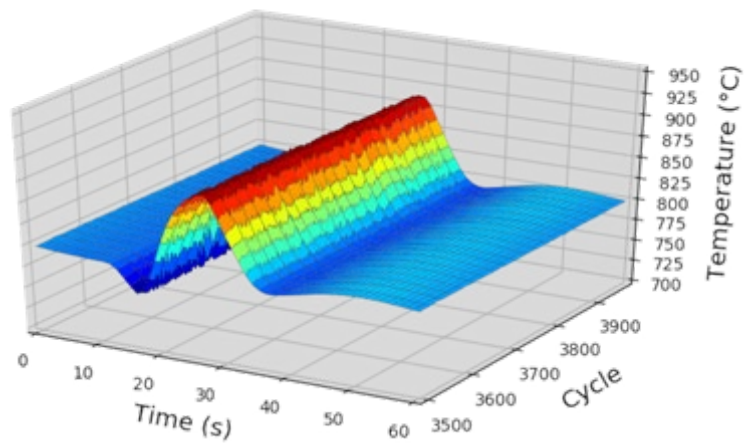
Bench ageing carried out as per the EPA SBC specification.

Four sections:

- 40 second with stoichiometric bulk flow (Stoic, λ = 1.00).
- 5 second with rich bulk flow (Rich Spike, λ = 0.95).
- 10 second rich with secondary air injection (Lean Spike 1, λ = 1.1).
- 5 second stoichiometric with secondary air injection (Lean Spike 1, λ = 1.15).







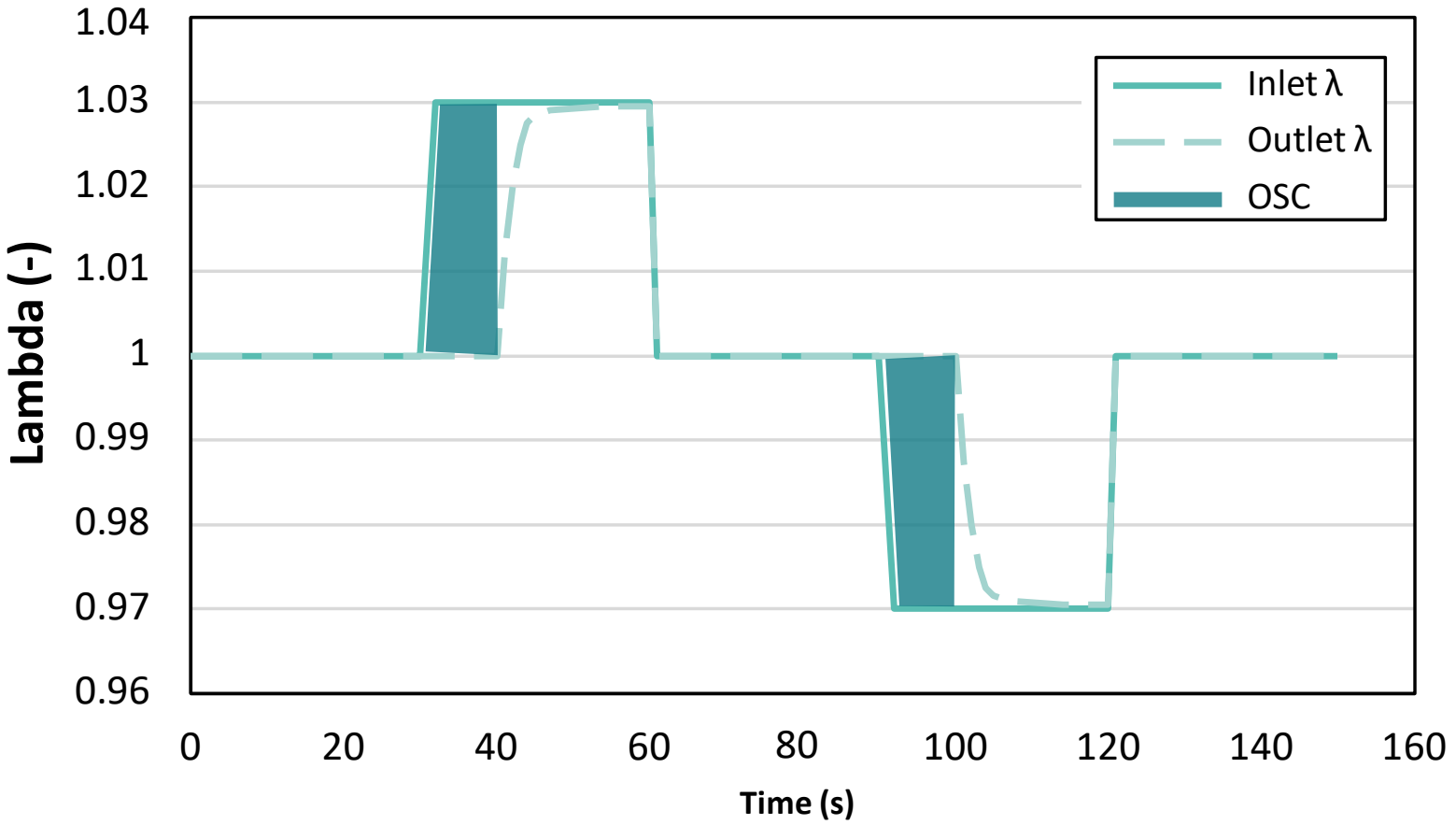
8 hour sample of data highlighting repeatability and reproducibility

Aftertreatment Characterisation

Industry leading characterisation

OXYGEN STORAGE CAPACITY

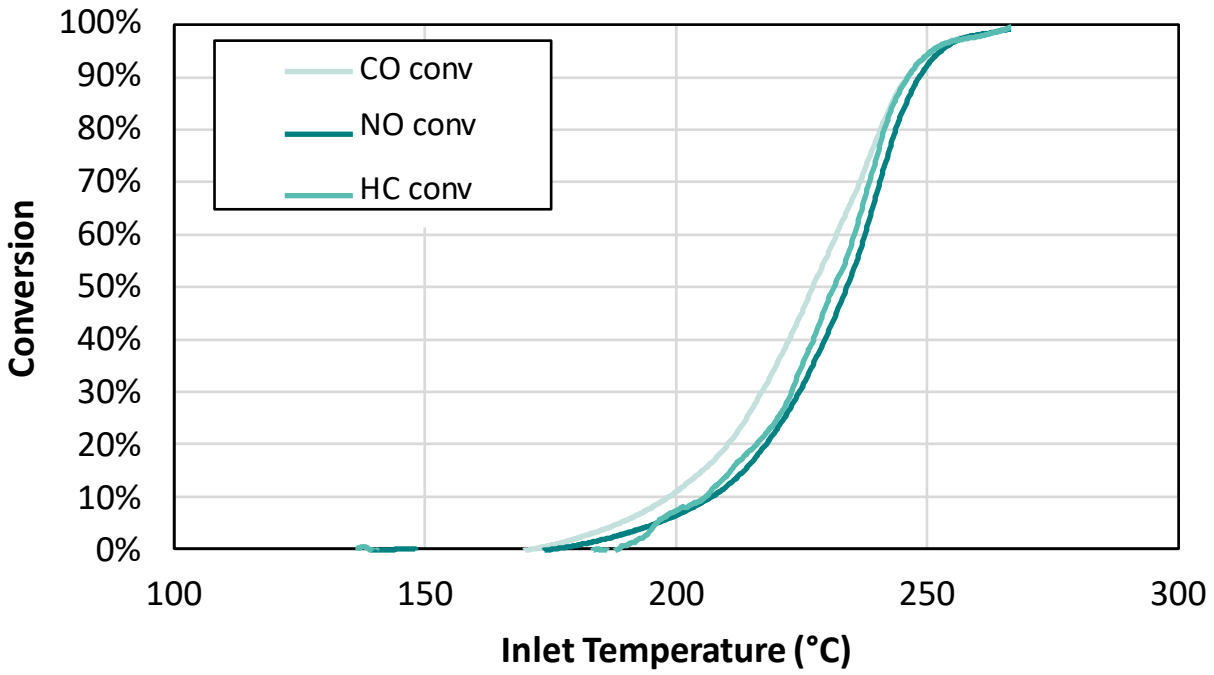
- Pure measurement of Oxygen Storage
- 6 x precision measurements <5% variance.
- Oxidation and reduction measured.
- Typical operating conditions of 500°C and 12g/s.
- Repeatability within ±3%



Industry leading characterisation

LIGHT-OFF

- Conversion of main harmful constituents measured
  – CO, HC and NOx.
- Ability to measure individual gas species or full mix on full scale aftertreatment systems.
- Repeatability within ± 1.5°C

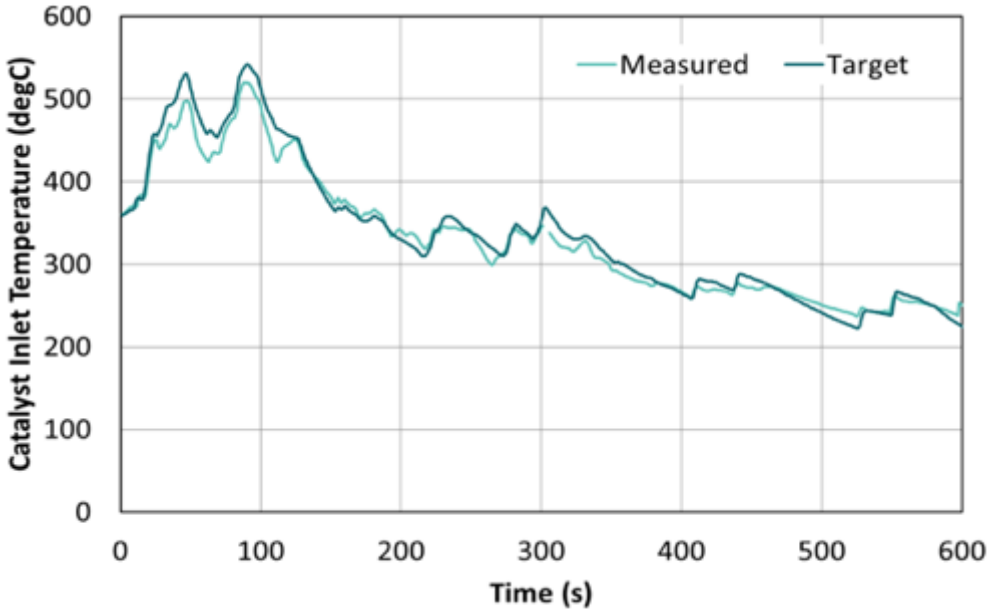


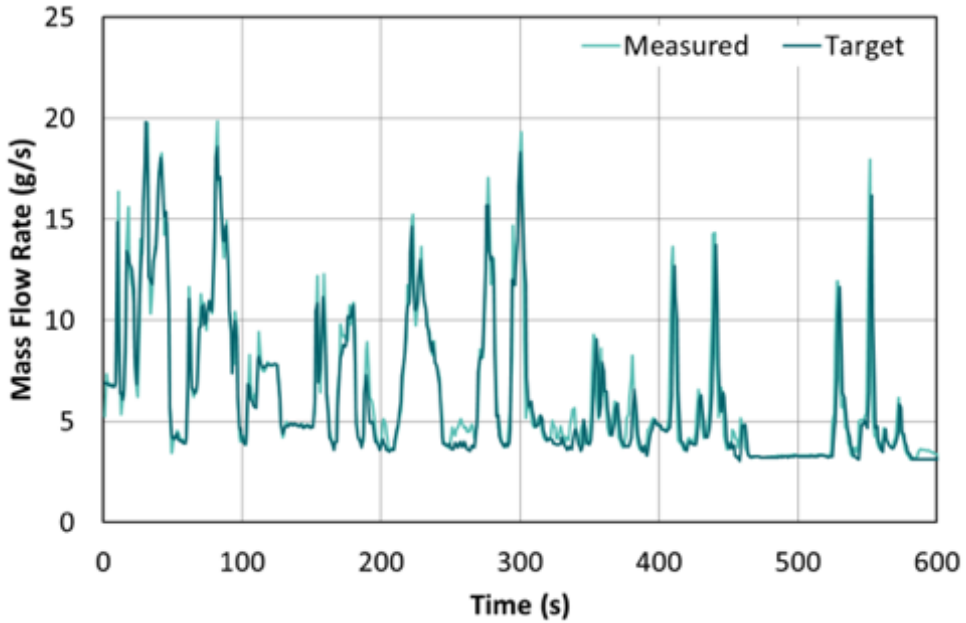
Parameter	Value
Flow rate	11gs $^{-1}$
Lambda	1
CO Concentration	6000 ppm
HC Concentration	400 ppm
NO Concentration	1200 ppm

Industry leading characterisation

DRIVE CYCLE

- Repeatable, reproducible drive cycle emulation.
- AI recreates catalyst inlet conditions from engine out measurements.
- Providing accurate, repeatable drive cycles for optimum aftertreatment development.






ClimaHtech™

CATAGEN has a vantage point for NET ZERO Markets and Technologies

Key Core Competencies:

- Emissions Data and Simulation
- Energy Efficient Chemical Reactor Technology
- IP & Knowledge

UK Science Minister Nusrat Ghani visits CATAGEN

catagen.com • 1 min read

She said:
"Technologies like green hydrogen which are being pioneered here at CATAGEN can help end our dependency on volatile and expensive fossil fuels, and support our transition to clean, affordable, home-grown energy. We are determined to support companies like these, creating high-skill jobs and fuelling economic growth across every part of the UK."
Department for Business, Energy and Industrial Strategy (BEIS)
#tocleananddecarbonisetheair #climatechange #netzero

GREEN HYDROGEN

Hydrogen is viewed as ‘A Fuel of the Future’

- Zero carbon emissions so viewed as clean and green
- Hydrogen combustion is being developed for heavy duty and off road
- Longer capacity without refuelling
- Not as heavy as EV batteries

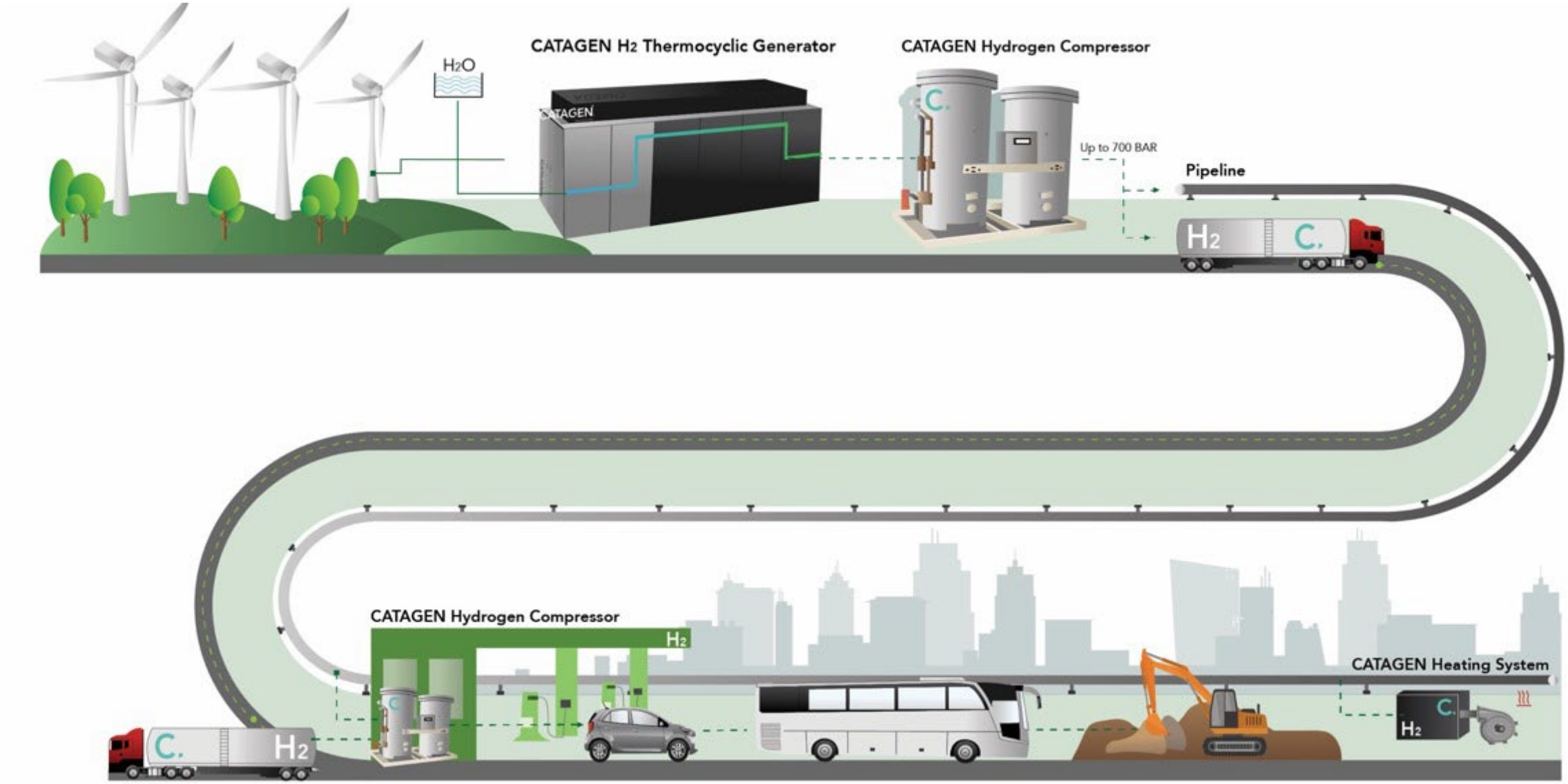
But there are important issues to resolve

- Currently expensive to produce at scale, to transport and to store

E.g. Difficult to transport, typical fuel tanker can only carry 1 ton of Hydrogen (30 tons of diesel)

CATAGEN Green Hydrogen

Energy Vector




ClimaHtech
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HGEN
CATAGEN
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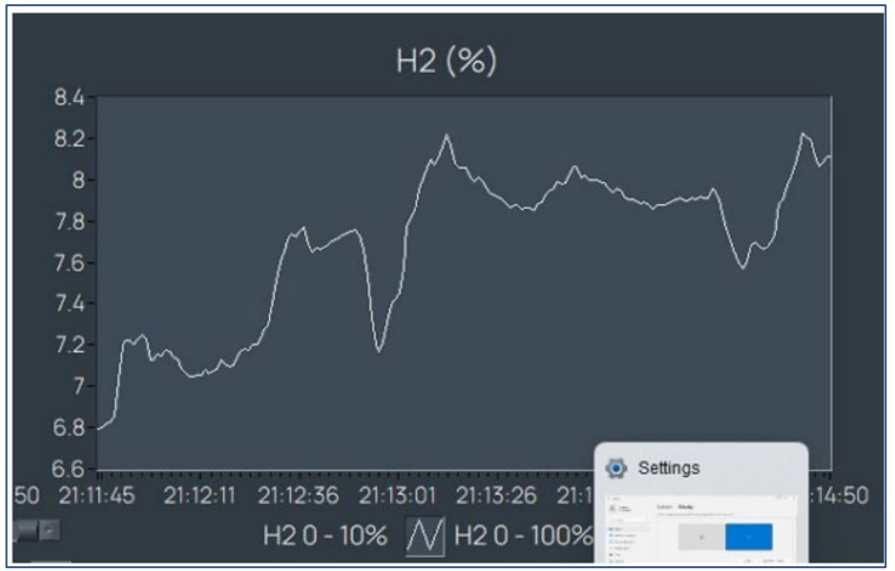
Green Hydrogen Reactor Results



E-FUELS HYDROGEN CARRIER

For Heavy Duty Diesel, Aviation and Marine

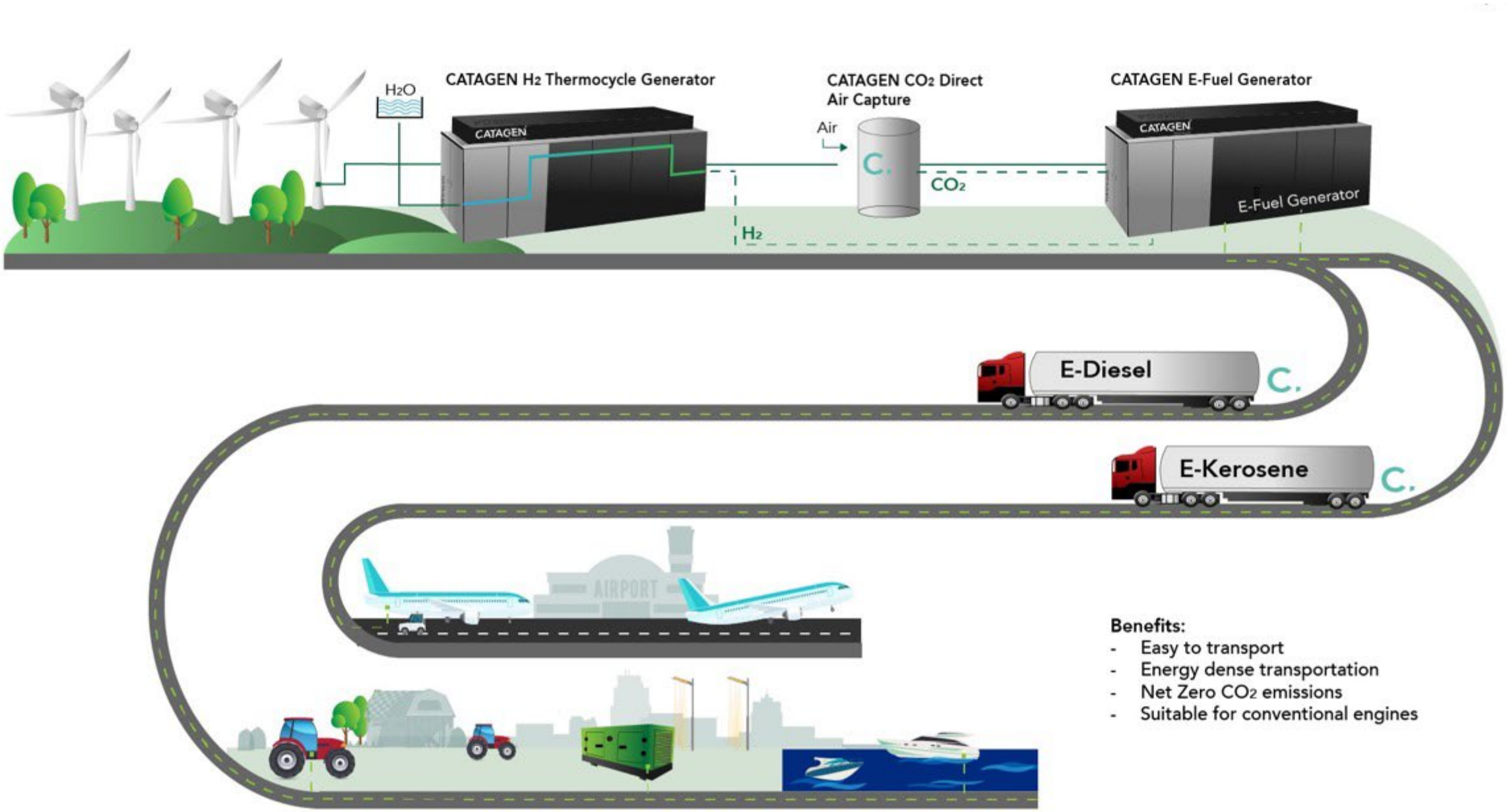
Part of the Ten Point Plan for a Green Industrial Revolution:

Point 6: Jet zero and green ships

Point 10: Green finance and innovation

CATAGEN E-Fuel

Energy Vector



Benefits:

- Easy to transport
- Energy dense transportation
- Net Zero CO_2 emissions
- Suitable for conventional engines

E-fuel Reactor – Lighter Hydrocarbons


CATAGEN
beyond now
Thank you