



**AMMONIA ENERGY**  
ASSOCIATION

**Annual Conference - New Orleans,  
13<sup>th</sup> November 2024**

**HYAMTEC**

**Making Hydrogen Happen**  
**Ammonia Crackers for Industrial Applications**





# Who are we and what's our mission?

*Two Businesses, one vision*

 **AFC Energy**

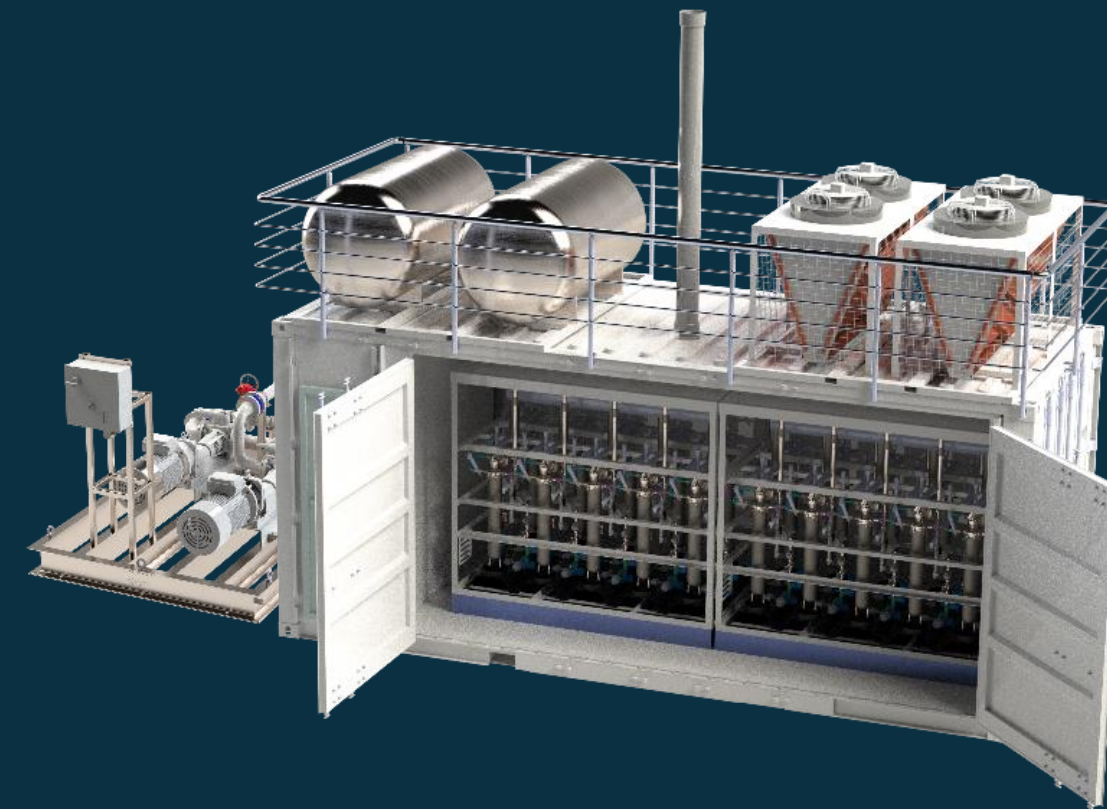
Hydrogen Fuel Cell  
Product Developer



- UK AIM Listed (LON:AFC),
- Fuel Cell modules from 10kW up to 500kW (Both Liquid & Air Cooled Systems)
- Diesel Generator Displacement markets, Focus on Construction

**HYAMTEC**

Ammonia Cracker Technology  
& Product Developer



- 100% Owned Subsidiary of AFC Energy PLC
- Ammonia to Hydrogen Systems developer
- Targeting Industrial, Combustion, Large scale Engine Conversions & Pure Hydrogen Generation




# The Problem

> 50% of global emissions come from hard to abate heavy industrial sectors.

Hydrogen is the obvious clean fuel solution to decarbonise heavy industry, but...

- It is difficult to store and transport in industrial quantities;
- It will take too long to install hydrogen pipelines;
- Making hydrogen on site from electrolysis requires a levels of power that the current grid cannot accommodate.

***Ammonia as a hydrogen carrier fuel coupled with modular Hyamtec's ammonia cracking technology will address all of these barriers.***

A photograph of a large industrial facility, likely a steel mill or refinery, with several tall smokestacks emitting dark smoke into a clear sky. The facility is composed of various metal structures, pipes, and tanks.

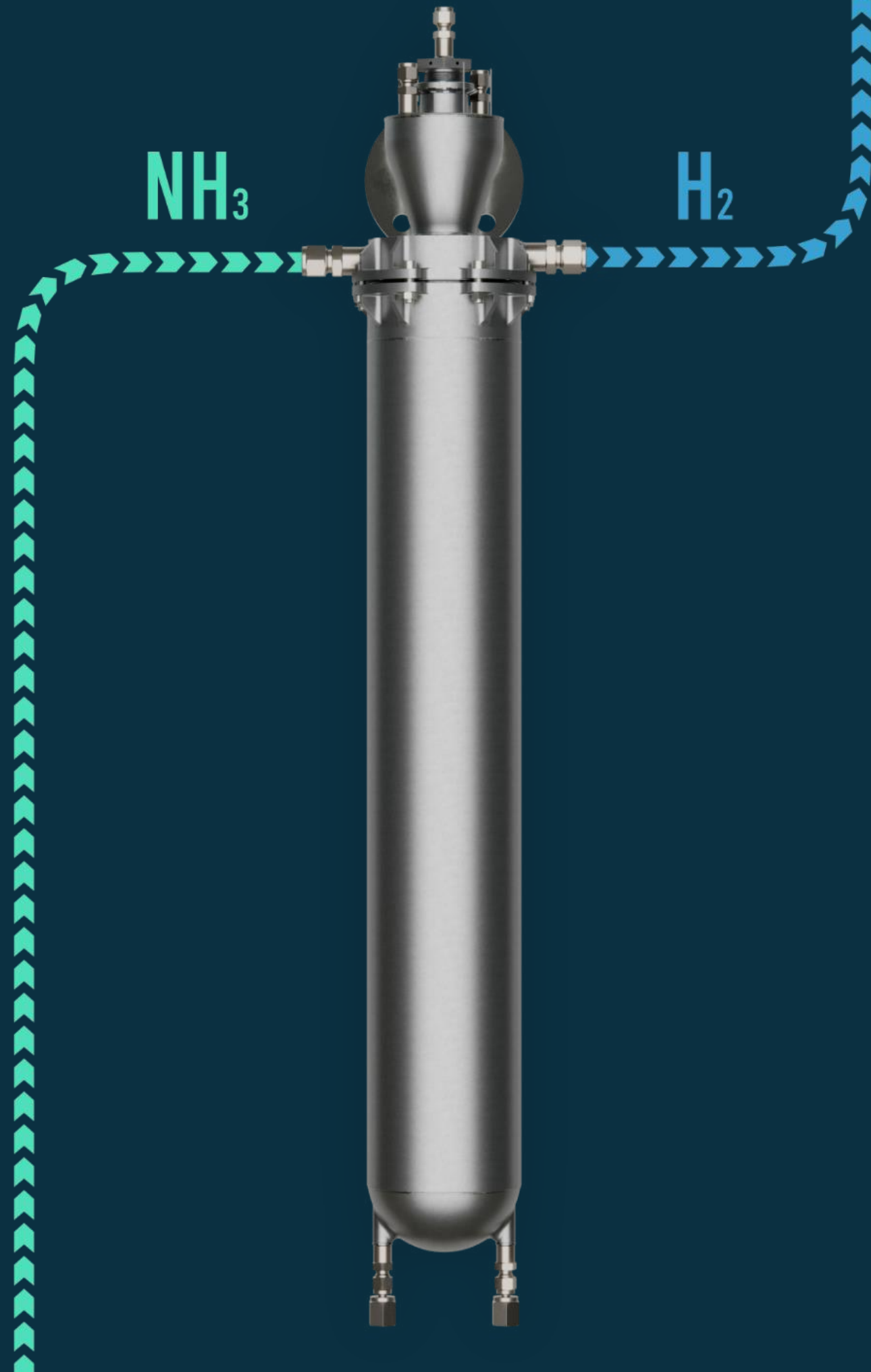
*Hydrogen should be the future fuel for heavy industry*

A photograph of a long, large-diameter hydrogen pipeline stretching across a mountainous, hilly landscape. The pipeline is painted in alternating blue and green sections. The surrounding terrain is rugged with sparse vegetation and some buildings in the distance.

*Establishing a hydrogen pipeline network will take decades and £ billions*



# HYAMTEC



- We are focussing on the development of modular compact ammonia crackers
- Easily integrated into larger systems
  - *Designed to operate over a wide pressure range*
  - *Harmoniously operates with all purification technologies for Fuel Cell applications.*
  - *Compact size*
- Efficient operation
  - *Minimal thermal losses.*
  - *Can utilise multiple heat sources (including waste heat streams)*
- Optimised operating
  - *Fast Response time when operating*
  - *Very quick reactor architecture to start from cold (20 minutes)*

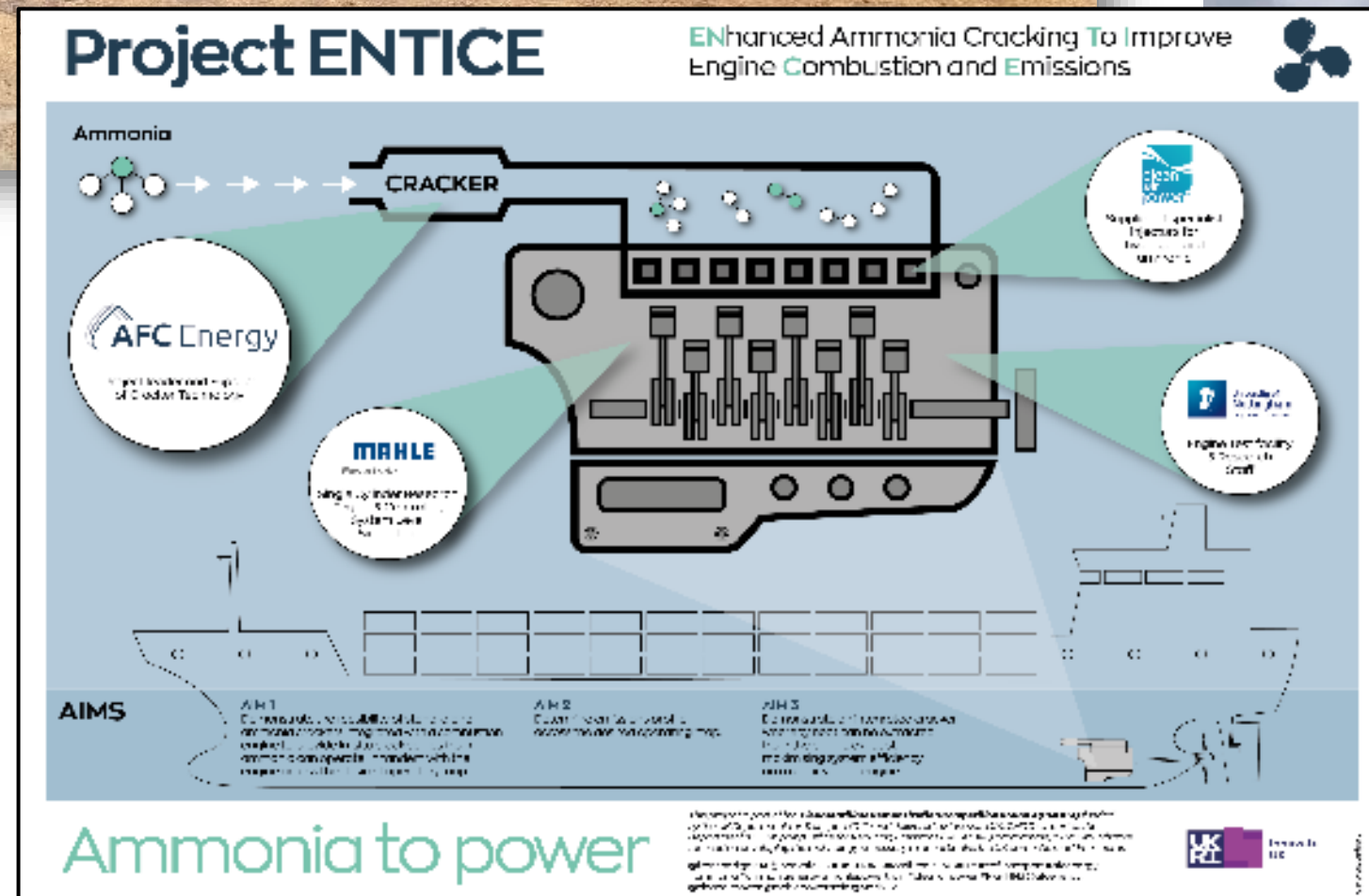


# Our Achievements

*Building on the back of extensive technical expertise*



- Direct operation of Ammonia Crackers and Fuel cells for ammonia to electricity production
- UK's largest pure hydrogen (from ammonia) pilot site achieving ISO 14687 Grade D up to 2.5 Tonnes/day ammonia throughput.
- Successful operation of our cracker technology with 4-stroke combustion engines as part of a UKRI Project
- Enviably on-site ammonia cracker test and evaluation facilities.
- Building IP Portfolio

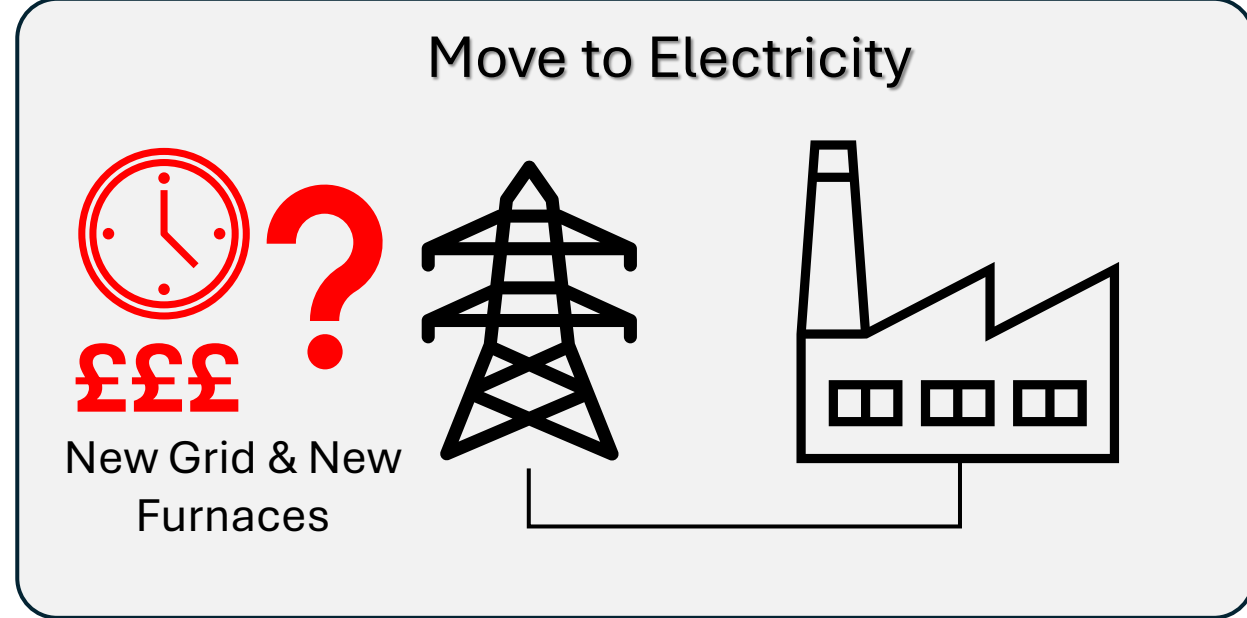
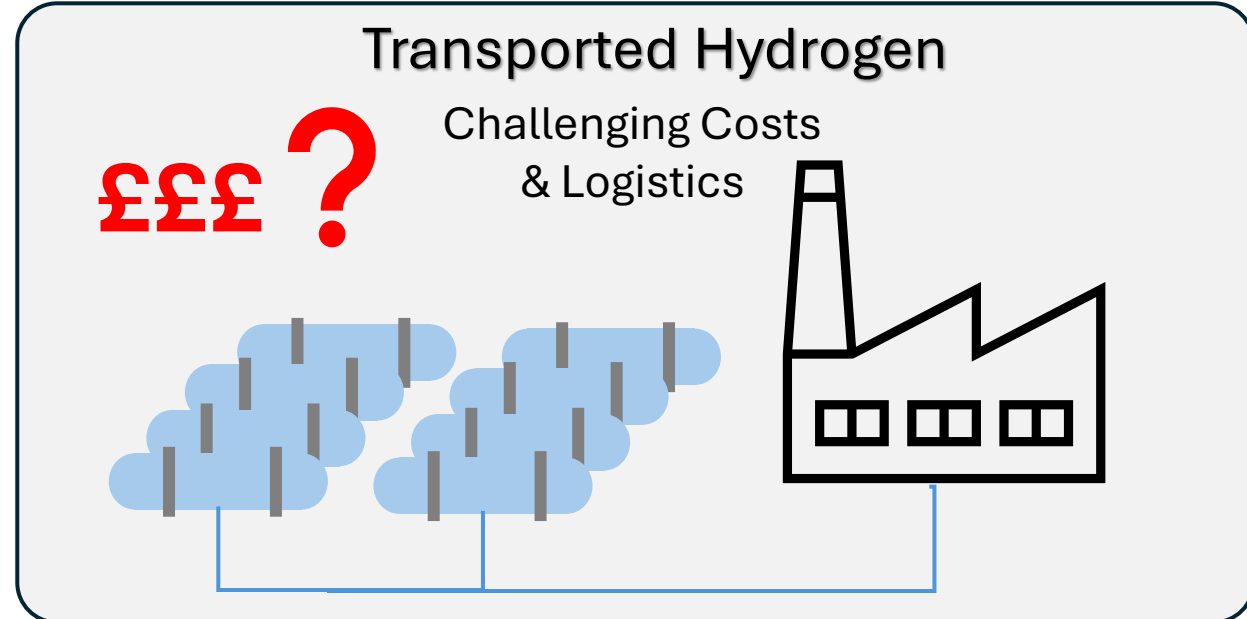
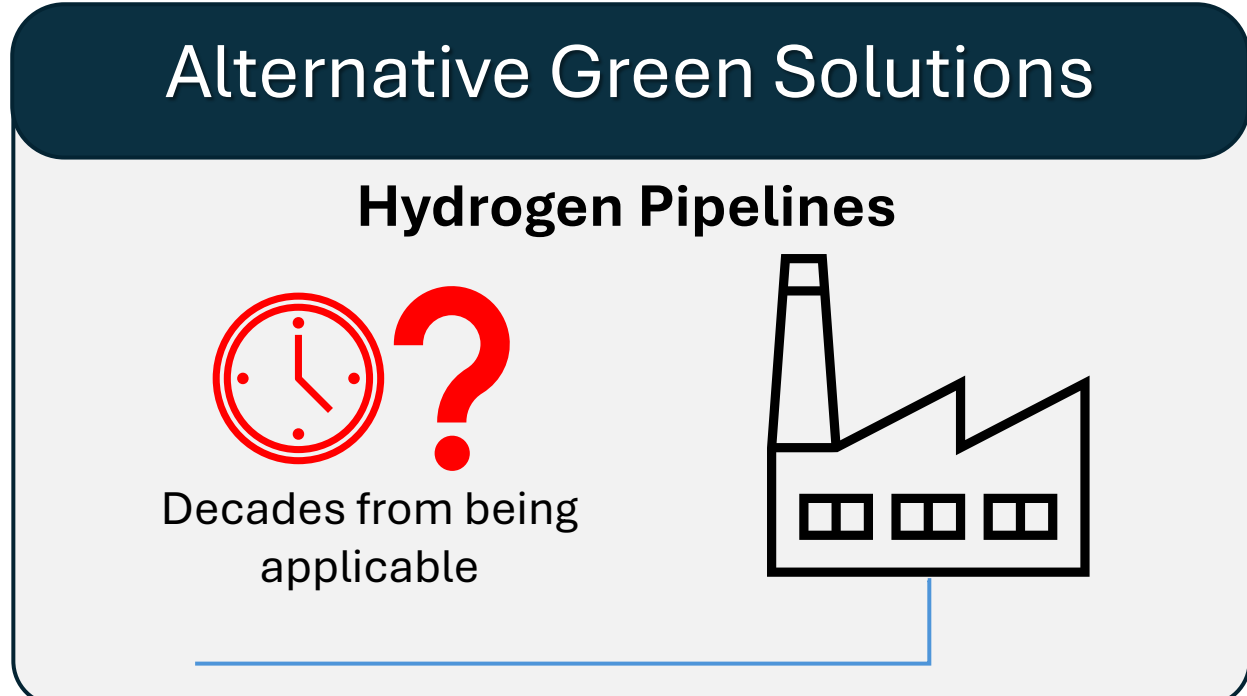
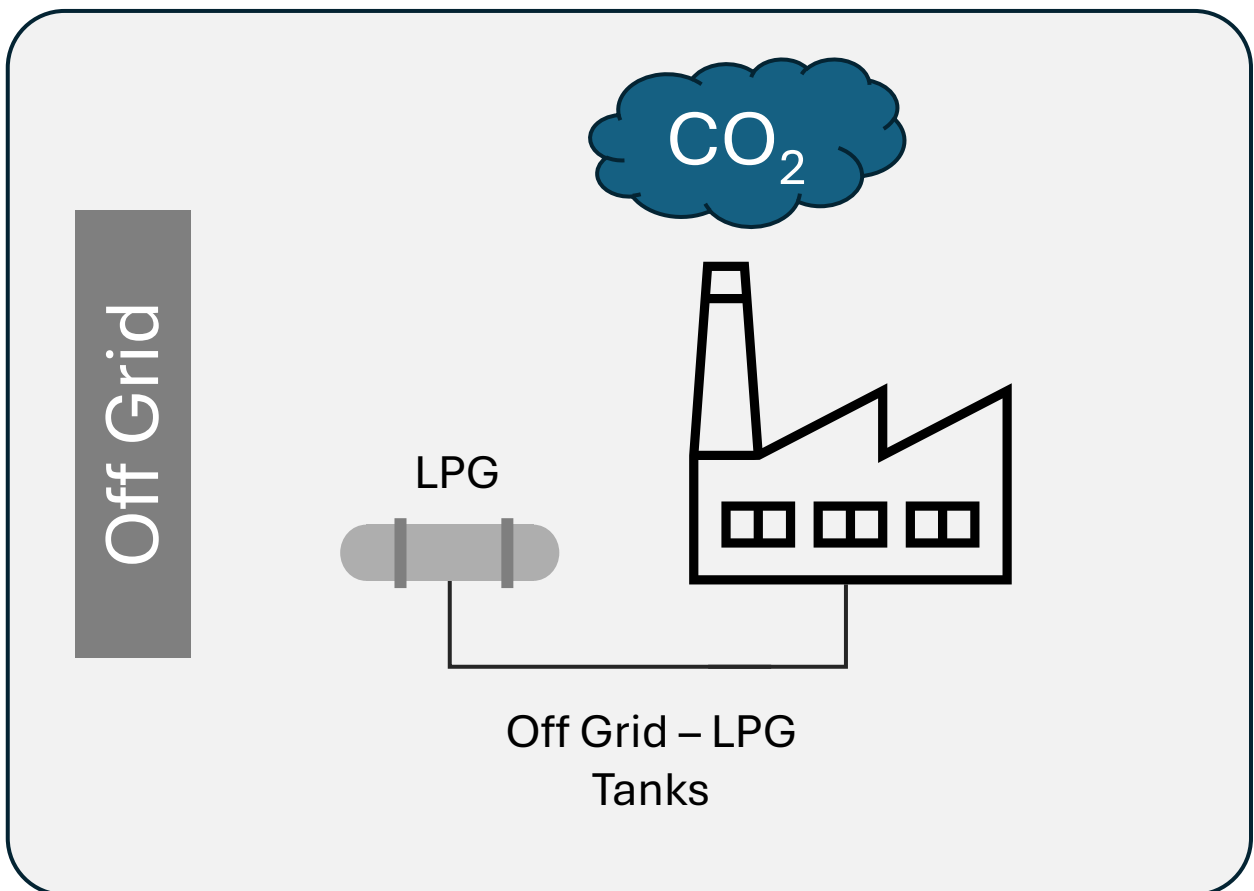
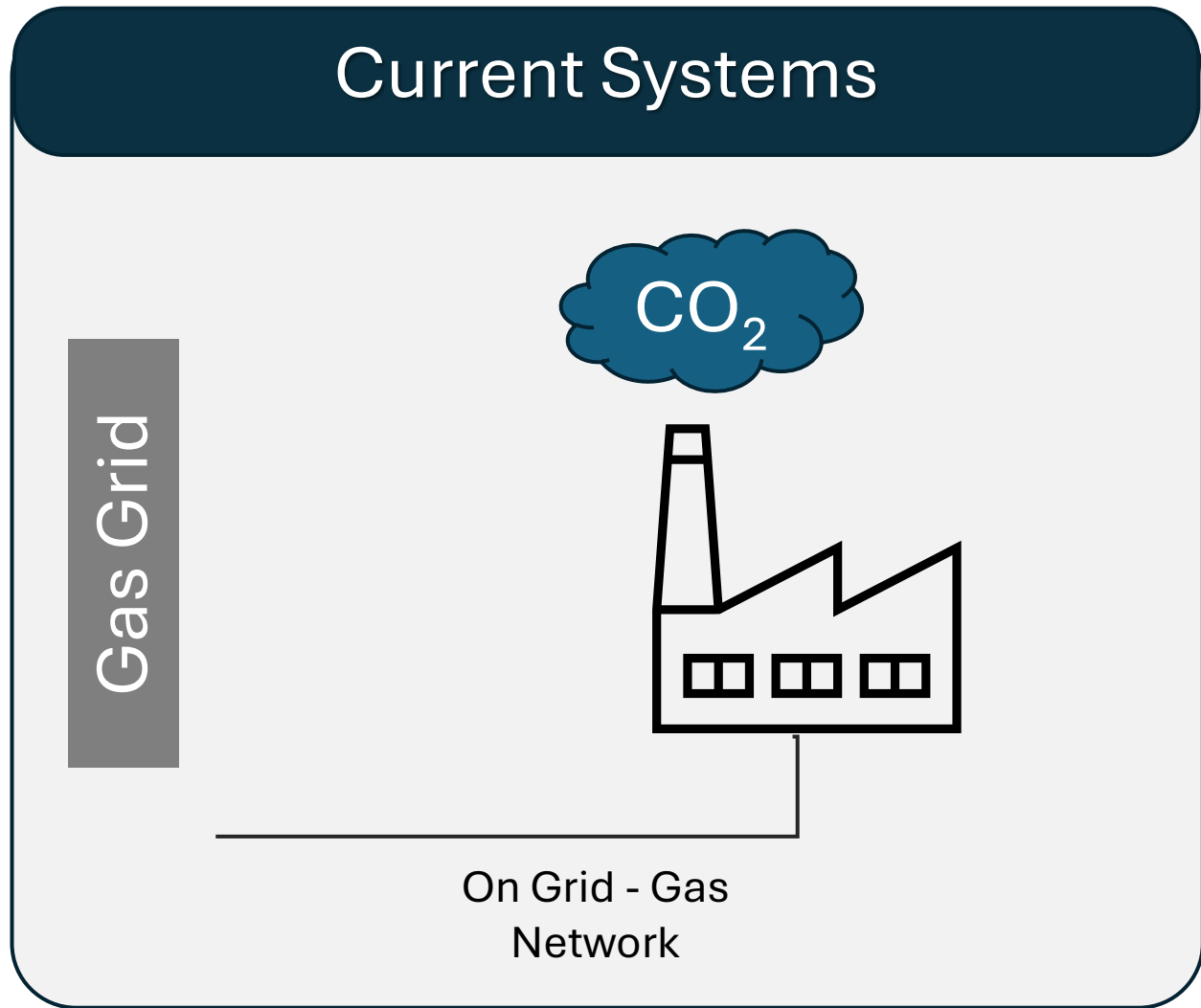




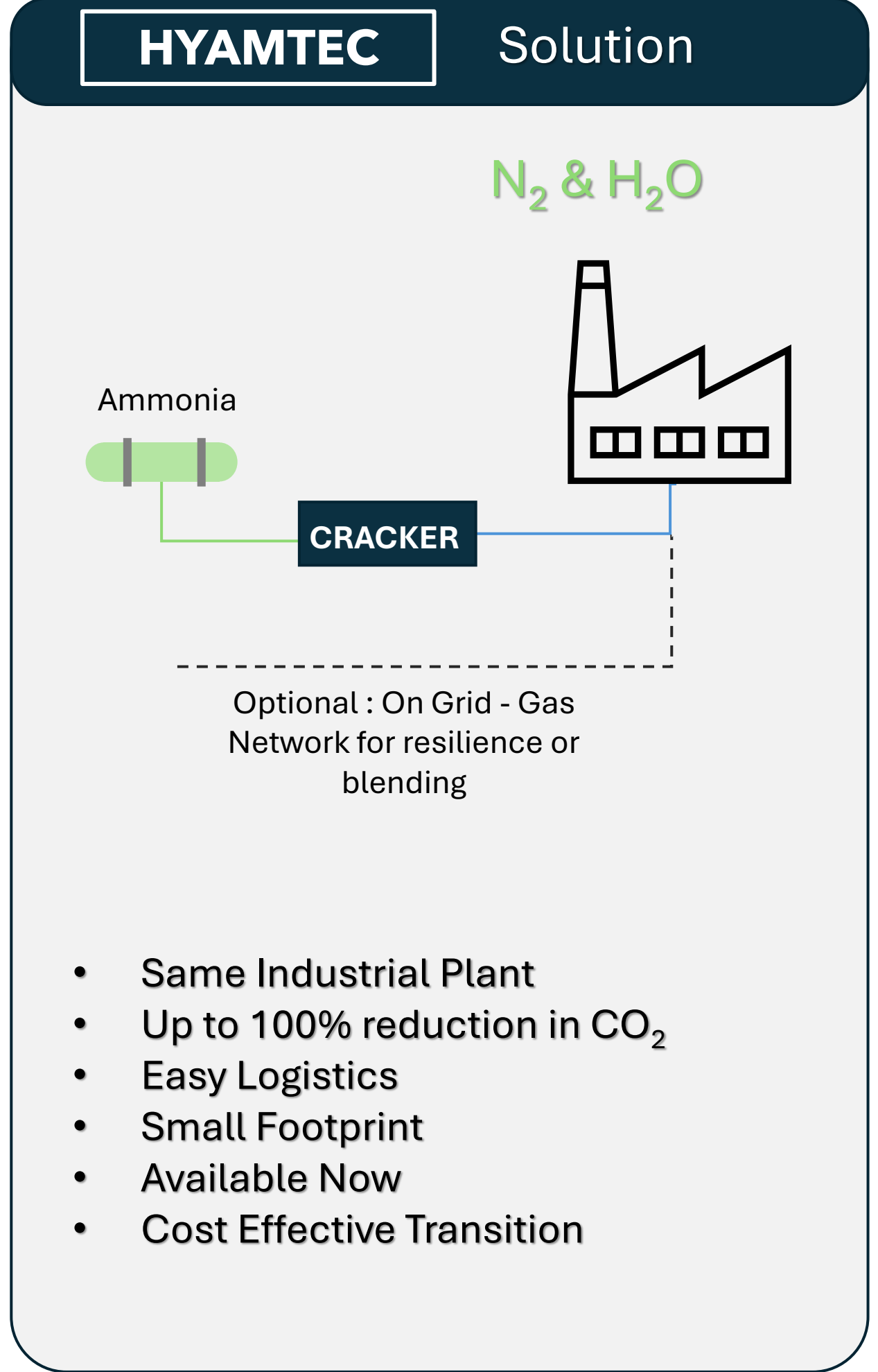
# Decarbonisation of Industry

How ammonia cracking could simplify the move to hydrogen fuel

**HYAMTEC**



Or





# Decarbonisation of Industry

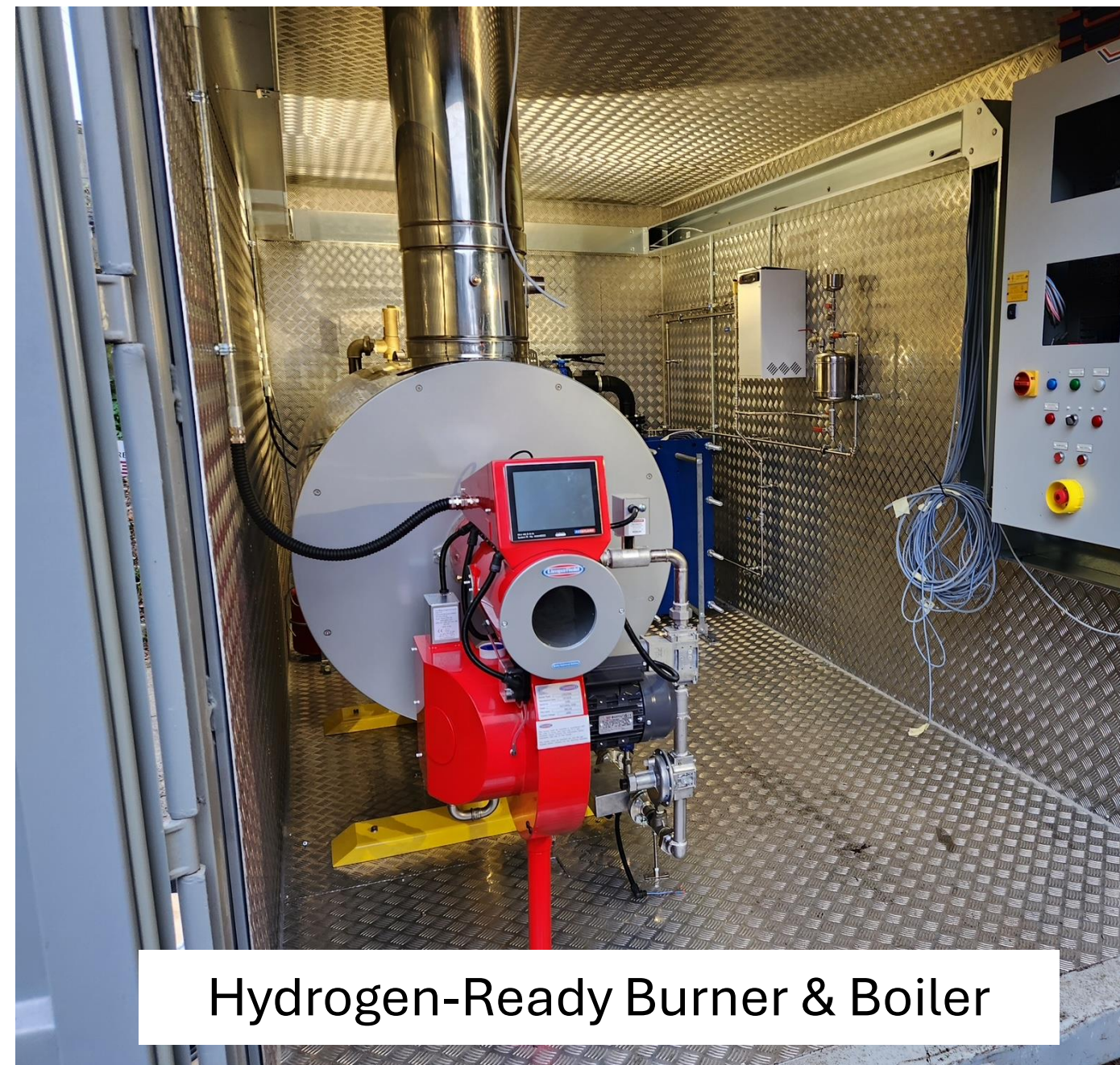
*Demonstration Projects – Cracked gas as a fuel*

**HYAMTEC**

- Rapidly deployable Cracker Tower, burner & Boiler for Industrial Demonstrations.
- Set-up and operational within 2 hrs.
- Full turn-key operations



Cracked Gas Generator



Hydrogen-Ready Burner & Boiler

## Demonstrations



Chemical Plant



Asphalt Production



Large Scale Heat  
Deployment

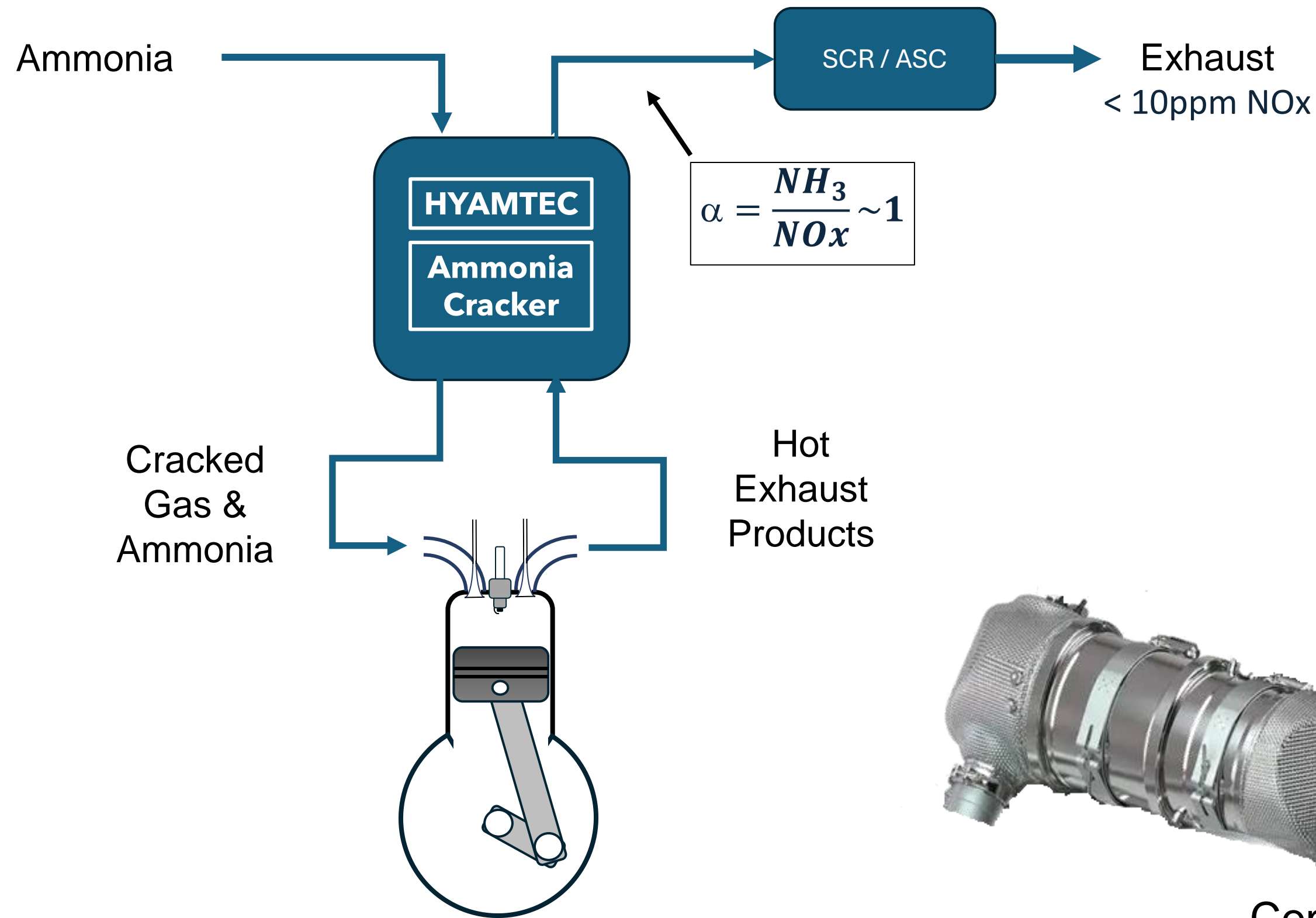


Power Generation

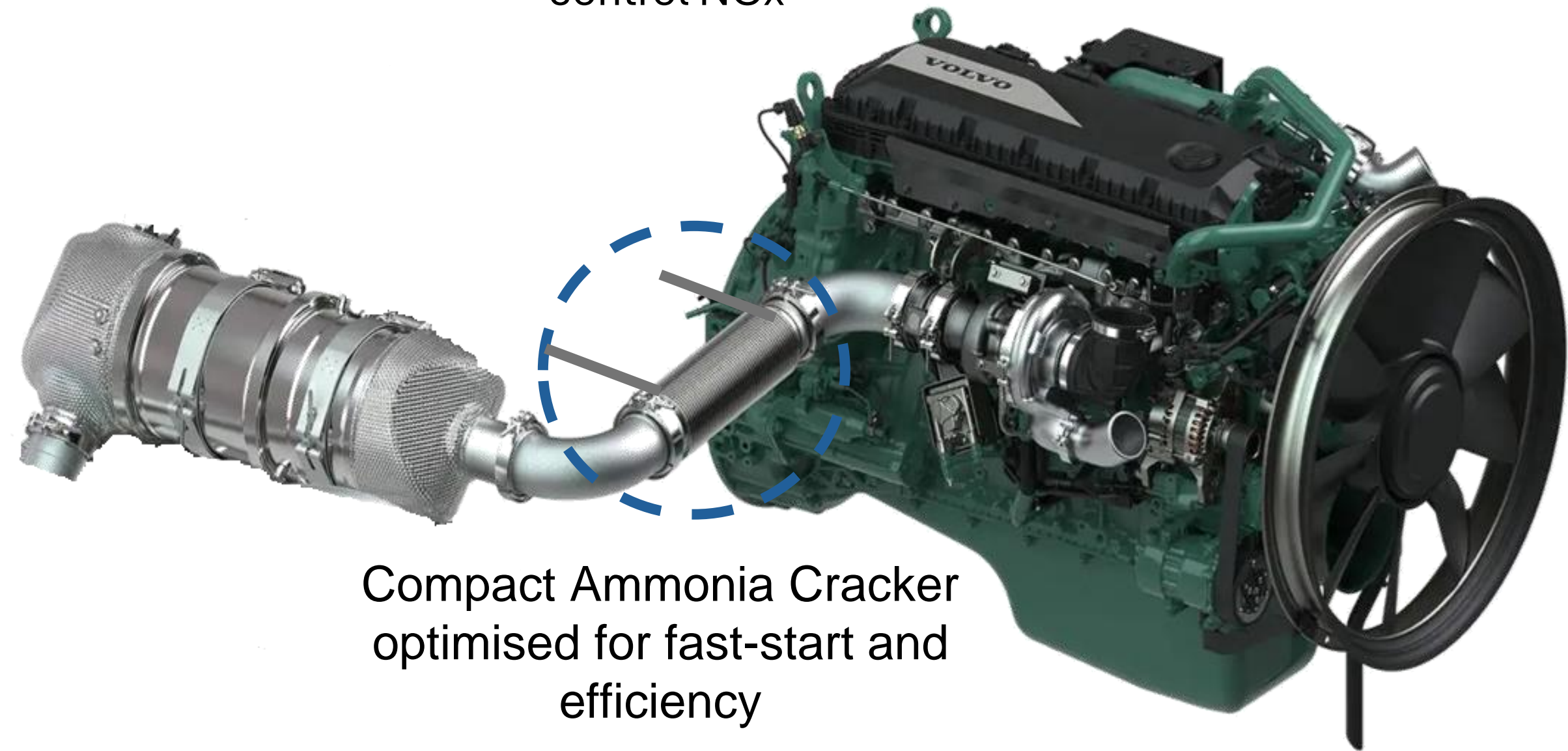


# Engine Integration

Use case : Large multi-MW 4-stroke combustion engines



- Highly Efficient Cracker designed to extract heat from the combustion engine exhaust to boost system efficiency
- Removes the need for carbon-based pilot fuels (Diesel, Petrol, Methanol) leading to zero carbon emissions and a single fuel inventory, No negative effects of additional N<sub>2</sub> in fuel stream
- Maintain unity ratio to utilise readily available after treatment technologies from the diesel industry to control NOx

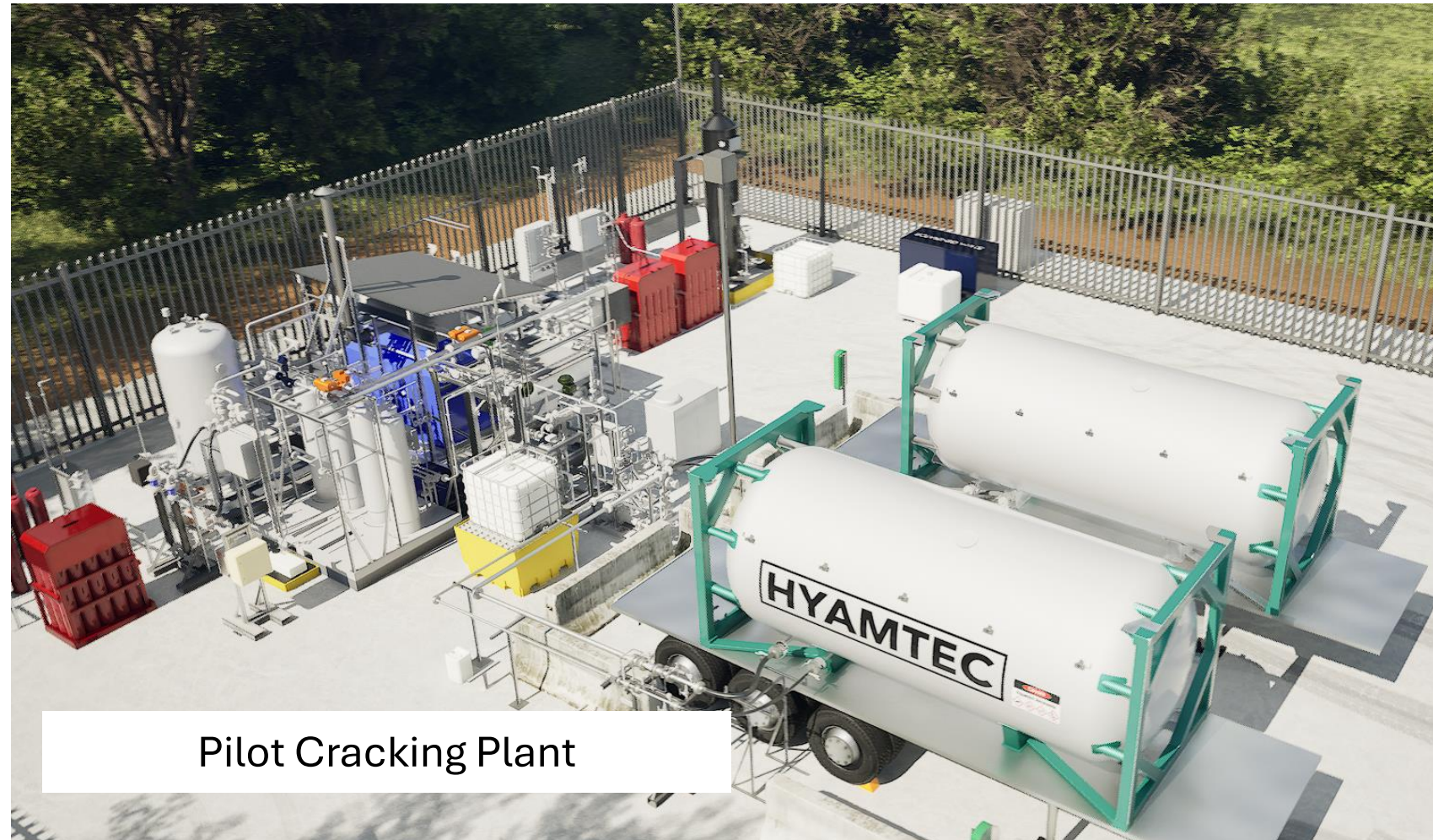




# Hydrogen Refuelling

Use case : Construction, Hub and spoke

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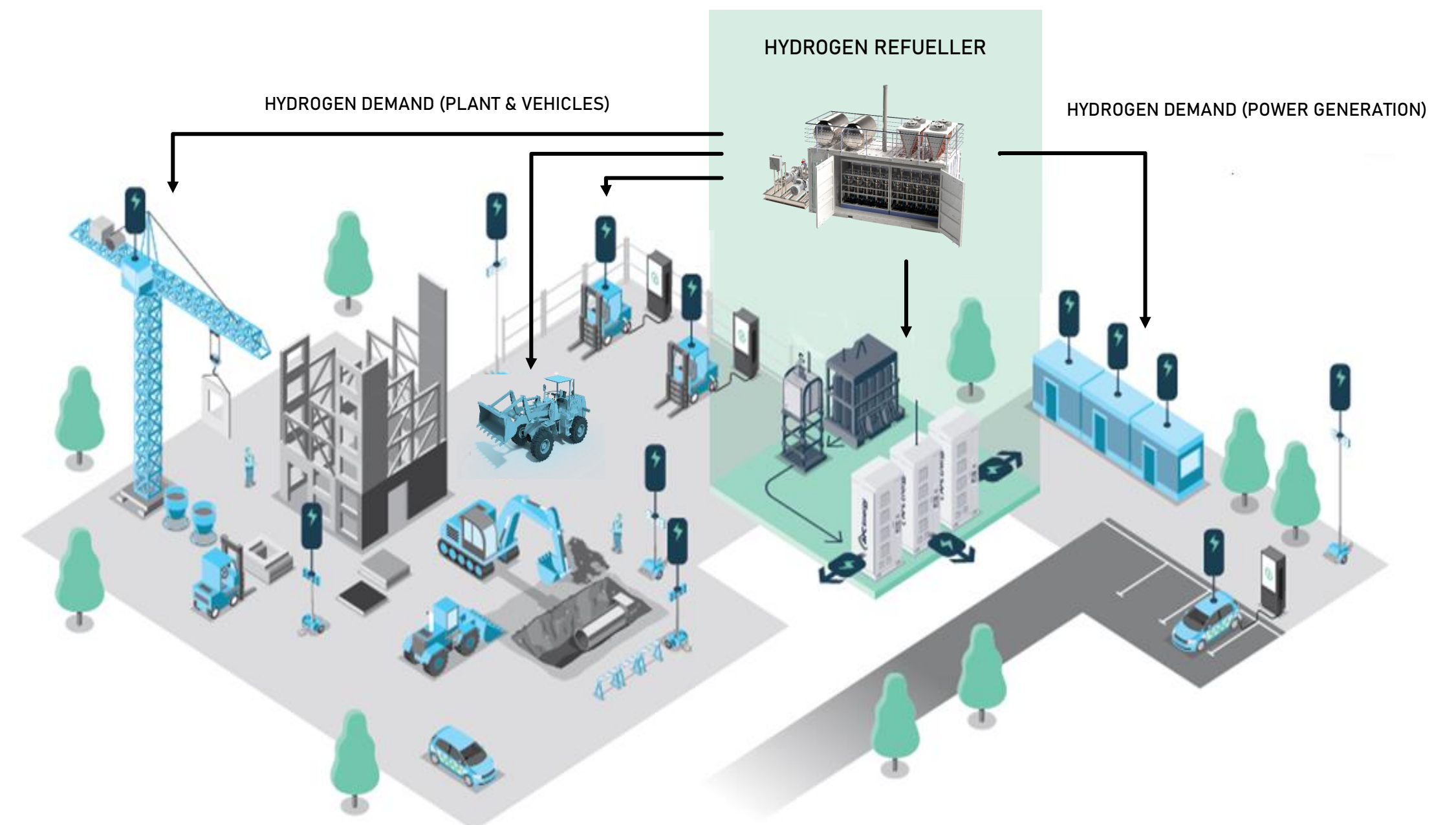


Pilot Cracking Plant



Hydrogen Tube-Trailer Filling

- 400Kg/day Hydrogen Production Pilot Plant operating, 16barg ISO14687 Grade D
- High Efficiency (0.6kW Electrical consumption), waste streams utilised for heat generation
- Compressed Hydrogen output (450 barg) for Tube Trailer Filling
- Now taking Learnings & repackaging for UK / EU Deployments







**MAKING HYDROGEN HAPPEN**



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