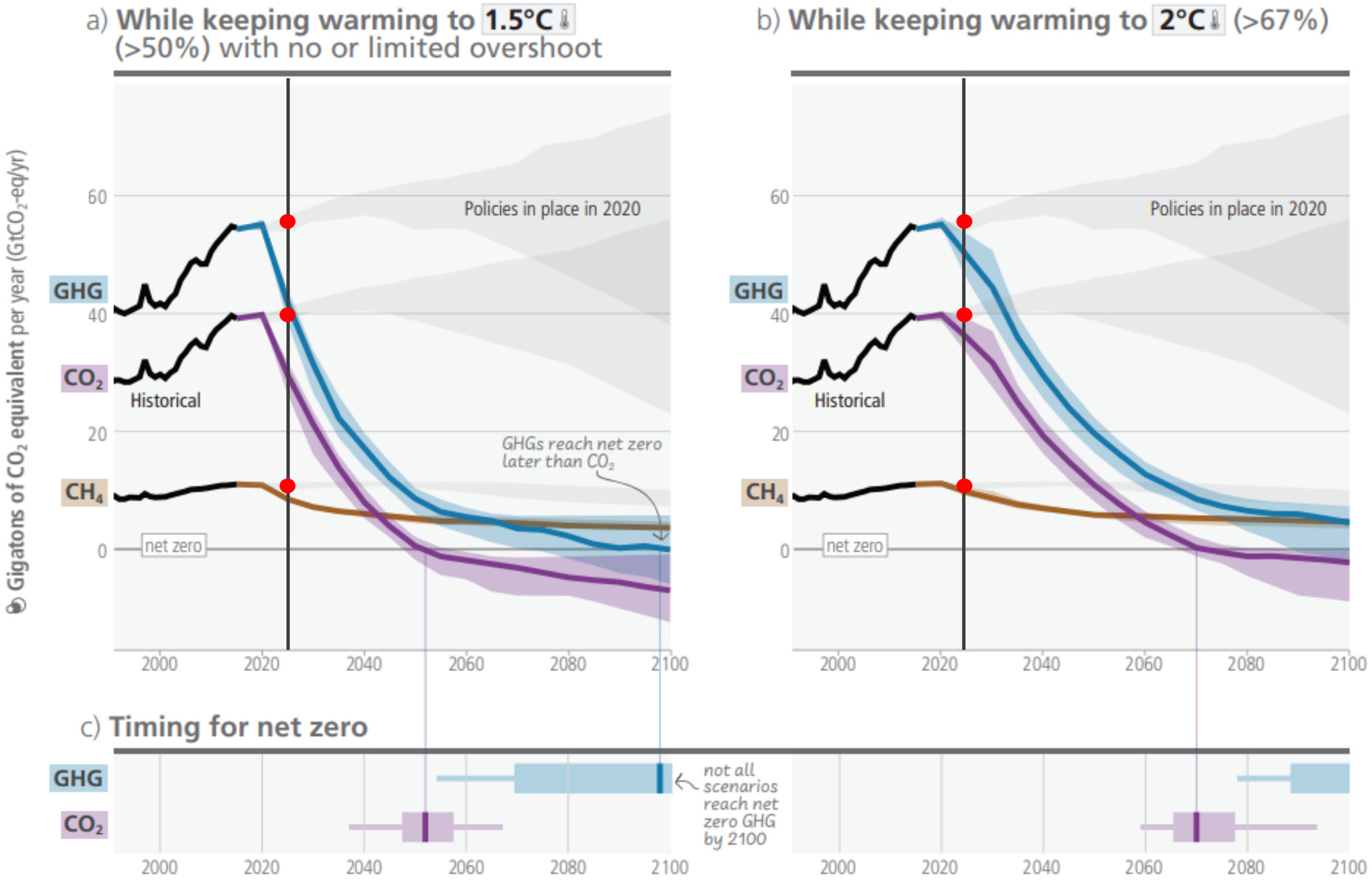
SSE Thermal

Daniel Mullen – Low Carbon Technology Engineer

March 2024

Agenda

- Context
- SSE Background
- SSE Projects & R&D
- CCS & AI


a) While keeping warming to 1.5°C (>50%) with no or limited overshoot
b) While keeping warming to 2°C (>67%)
Gigatons of CO2 equivalent per year (GtCO2-eq/yr)
60
40
20
0
GHG
CO2
CH4
Historical
Policies in place in 2020
GHGs reach net zero later than CO2
net zero
2000
2020
2040
2060
2080
2100
c) Timing for net zero
not all scenarios reach net zero GHG by 2100

SSE plc

Powering sustainable change

Purpose

To provide energy needed today, while building a better world of energy for tomorrow.

Vision

To be a leading company in a net zero world.

Strategy

To create value for shareholders and society in a sustainable way by **developing, building, operating and investing** in the electricity infrastructure and businesses needed in the transition to net zero.

sse Thermal

SSE Thermal

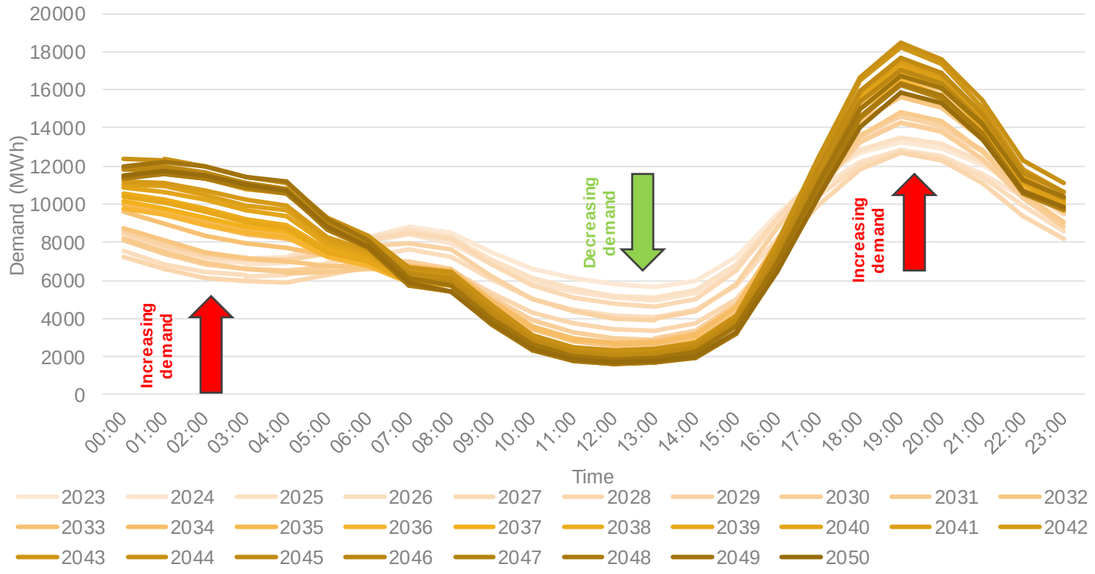
sse Thermal

GB Need for Dispatchable Power

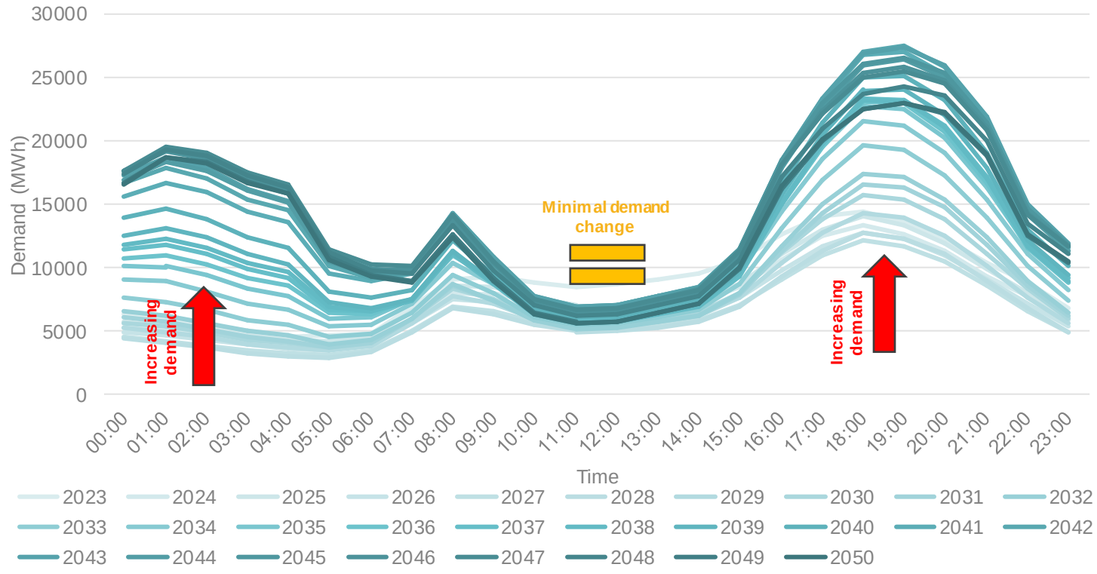
The changing shape of within day demand will have a significant impact on flexible capacity

- Electrification of heat, transport and industry is expected to change the shape of within-day demand, impacting the requirement for flexible capacity.
- Electric vehicles and heat pumps will increase demand in the evenings, while residential solar capacity will reduce demand during the day.
- Low carbon flexible generation will continue to play a critical role in the transition to a net zero future

Development of average daily demand - Summer

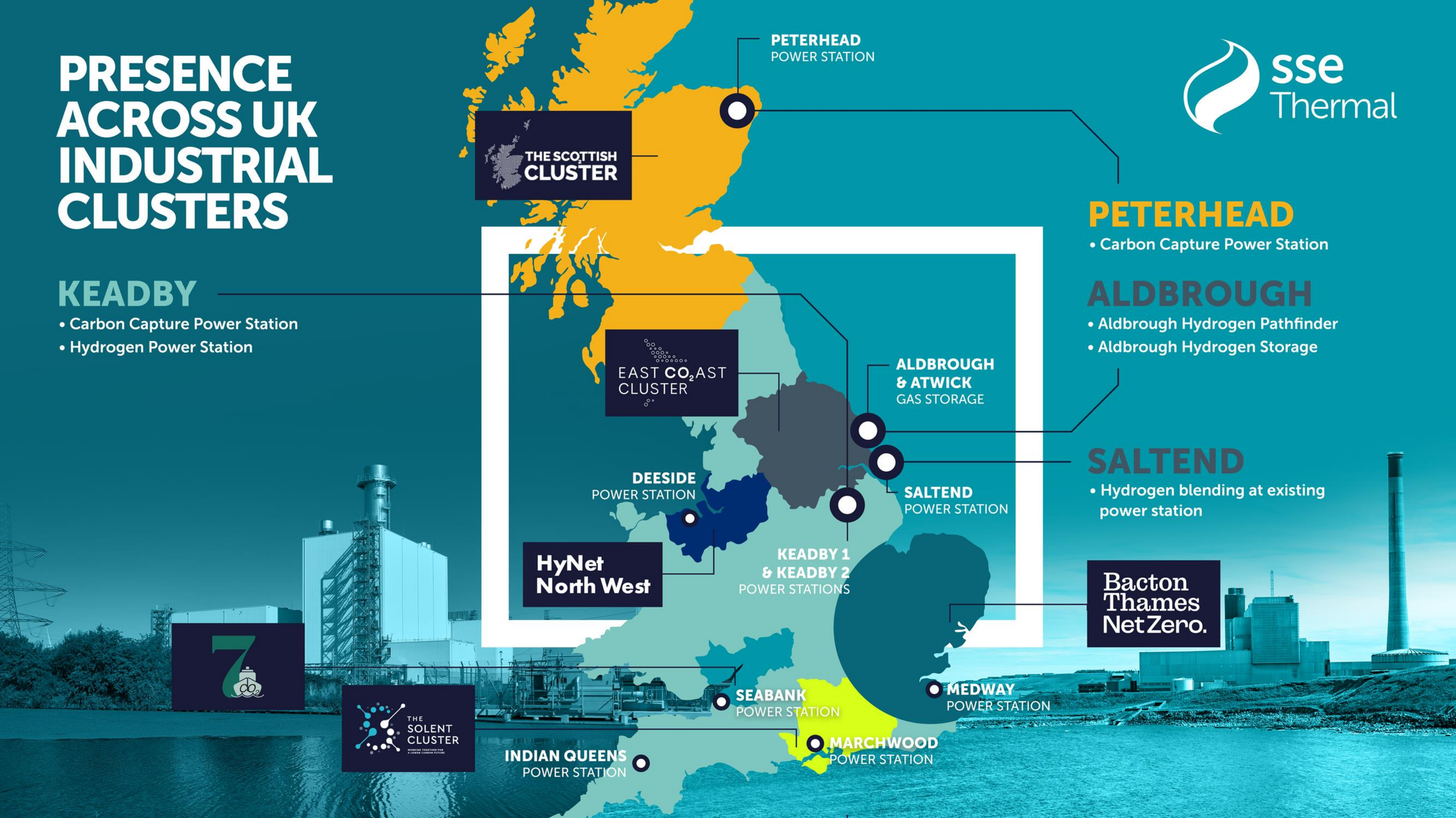


Development of average daily demand - Winter



PRESENCE ACROSS UK INDUSTRIAL CLUSTERS

sse Thermal



PETERHEAD

- Carbon Capture Power Station

KEADBY

- Carbon Capture Power Station
- Hydrogen Power Station

ALDBROUGH

- Aldbrough Hydrogen Pathfinder
- Aldbrough Hydrogen Storage

SALTEND

- Hydrogen blending at existing power station

Power CCS

- Keadby 3 is located in the Humber cluster, while Peterhead is on the east coast of Scotland.
- World's largest Power CCS plants once completed
- CCGT with amine-based post-combustion CO_2 carbon capture to be developed by SSE and Equinor
- Each with a generating capacity of up to 910MW and the capture of 1.5MT of CO_2 per year
- Keadby 3 - FEED Consortium consisting of Aker Solutions, Siemens Energy and Altrad Babcock
- Peterhead 2 - FEED Consortium consisting of Mitsubishi, Worley and Técnicas Reunidas.

Keadby 3

Peterhead 2

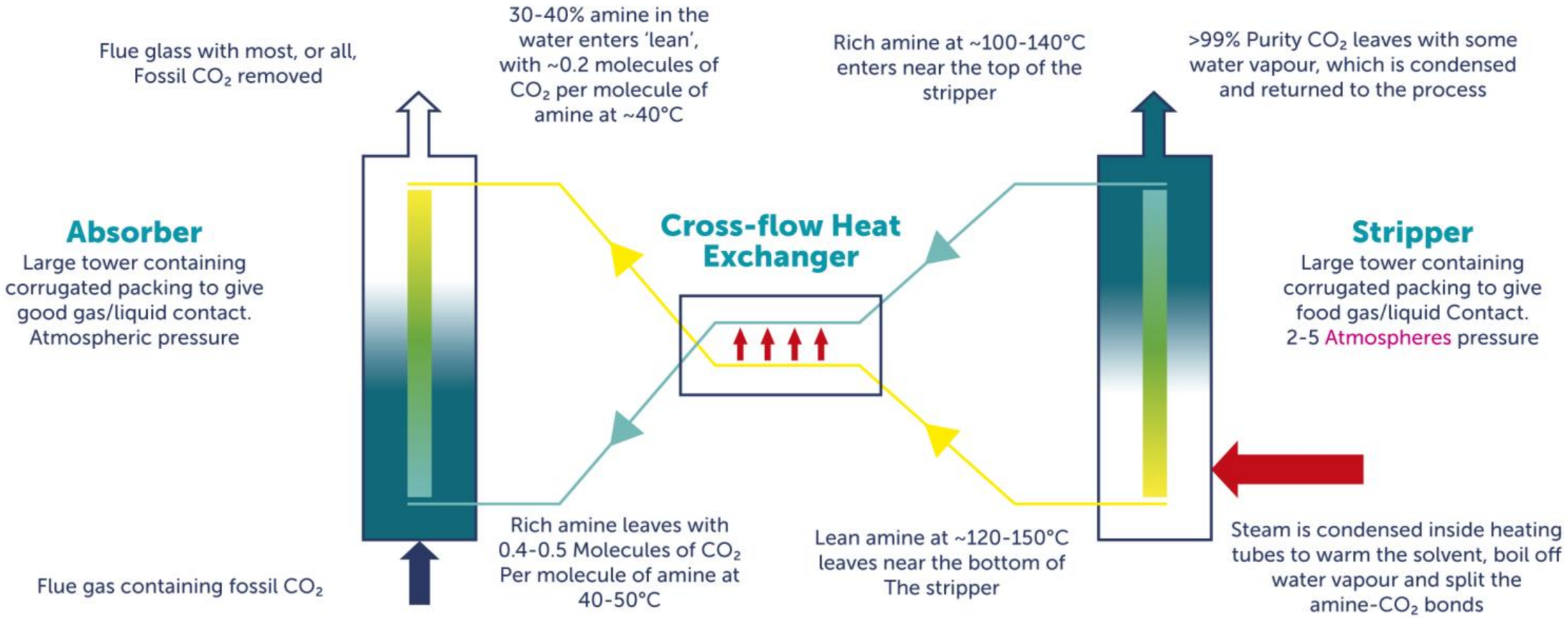
FOCUSS (FLEXIBLY OPERATED CAPTURE USING SOLVENT STORAGE)

- **Funding:** DESNZ Carbon Capture, Usage and Storage (CCUS) Innovation 2.0 competition (£20million)
- **Budget:** £670K
- **Schedule:** May 2022 to September 2024
- **Aim:** Demonstrate a cost-effective method to achieve high capture levels during plant start-up, shutdown, and other transients using innovative technologies and world-leading pilot facilitates.
- **Video:** FOCUSS Overview

sse Thermal

FOCUSS Start-up concept

Steady state post combustion CCS operation



FOCUSS (FLEXIBLY OPERATED CAPTURE USING SOLVENT STORAGE)

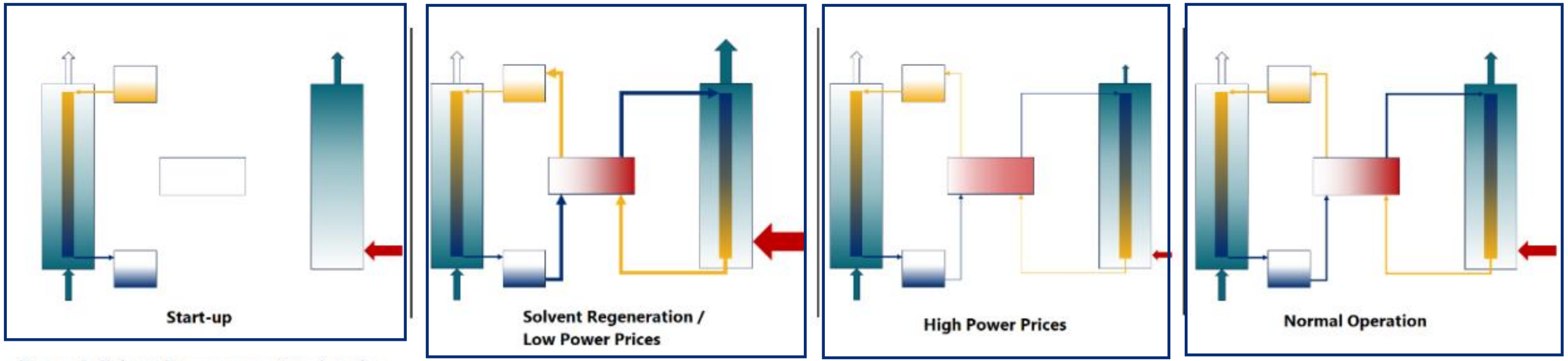
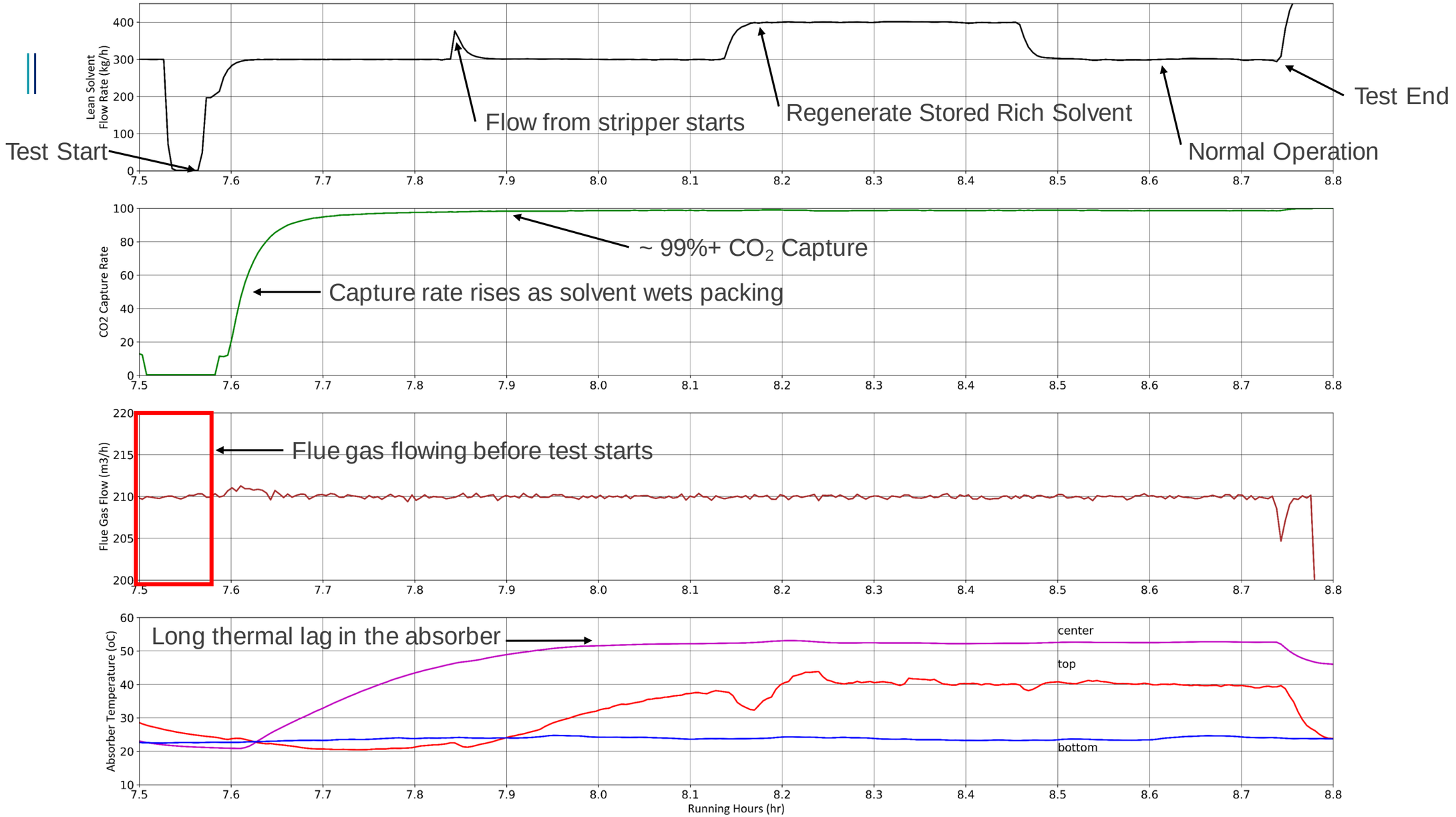


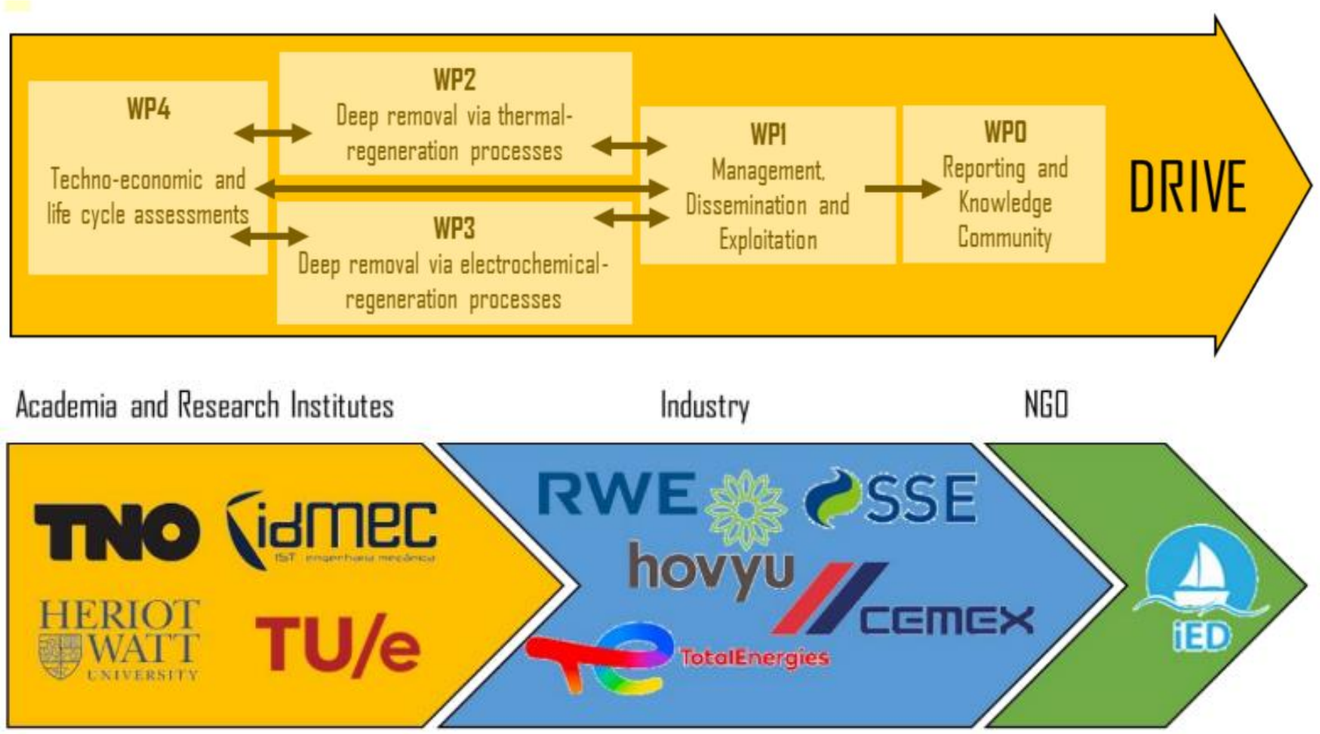
Figure 1: Solvent Storage operational modes

sse Thermal


Lean Solvent Flow Rate (kg/h)
Test Start
Flow from stripper starts
Regenerate Stored Rich Solvent
Normal Operation
Test End
CO2 Capture Rate
~ 99%+ CO_2 Capture
Capture rate rises as solvent wets packing
Flue Gas Flow (m3/h)
Flue gas flowing before test starts
Absorber Temperature (oC)
Long thermal lag in the absorber
center
top
bottom
Running Hours (hr)

DRIVE

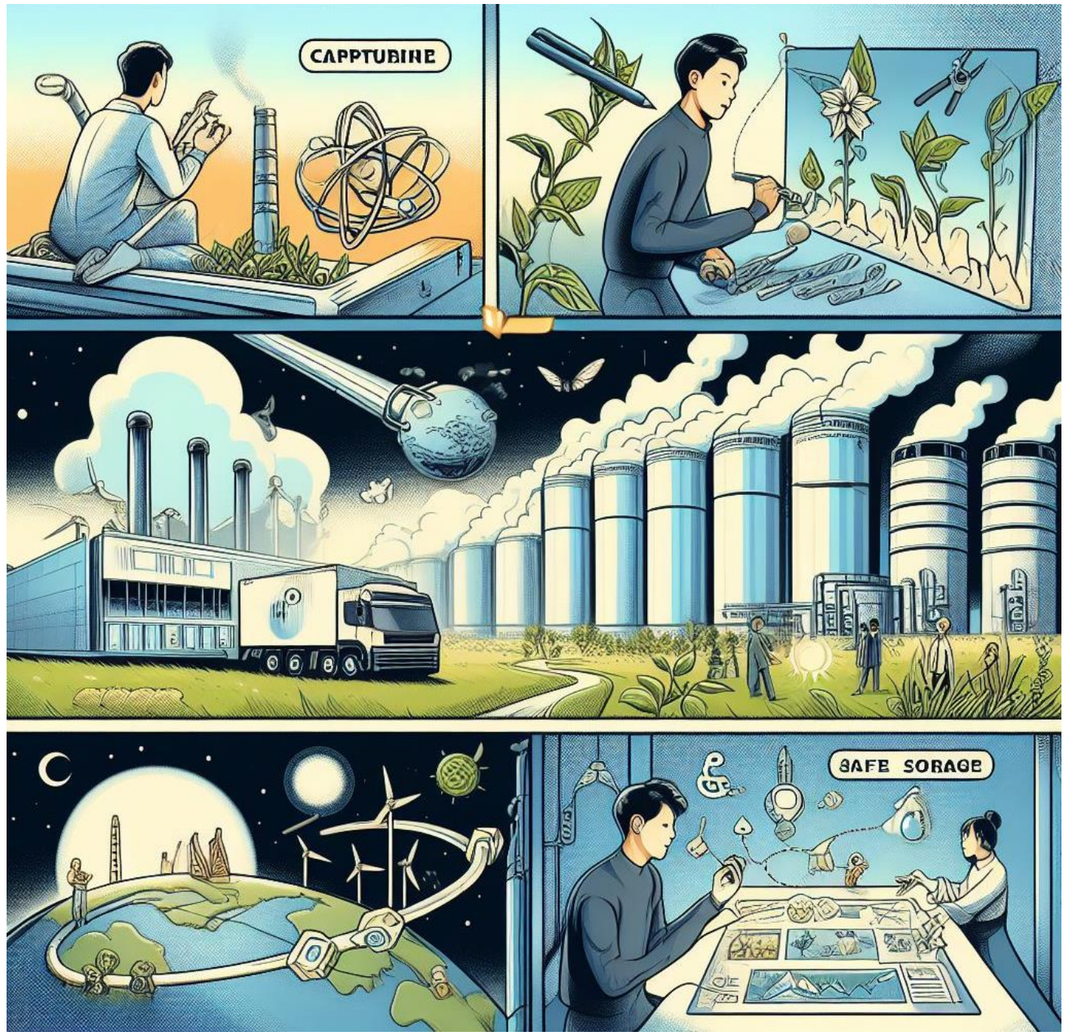
Deep Removal of CO2 & InnoVative Electrification concepts



- **Funding:** Clean Energy Transition Partnership
- **UK Partners:** HWU & SSE Thermal
- **Budget:** £3.3M
- **Schedule:** Dec 2023 to Dec 2026
- **Aim:** DRIVE technologies and methods will allow industries to minimize the costs of achieving carbon neutral or carbon negative operations at specific point sources, with a marginal cost of less than 200 €/tCO_2 set as a target for the technologies to be studied/developed

sse Thermal

AI and CCS



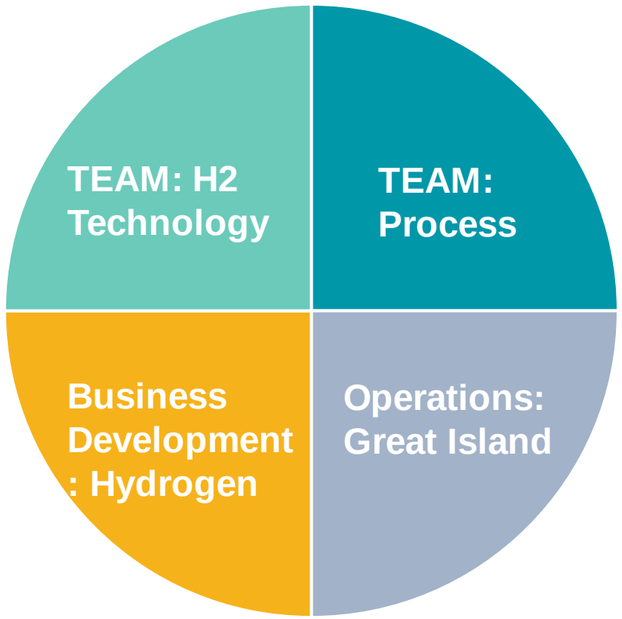
How can AI help with implementing large-scale CCS technologies?

Graduate Programme

Structure

4 x 6-Month Placements

- With 1 on-site placement
- Compromise of Business needs and personal preferences



SCAN ME

Placement Opportunities

Thermal Engineering & Asset Management	Operations	Commercial
Construction	Development	Business Development

sse Thermal

Get in touch:

Daniel Mullen, Low Carbon Technology Engineer

Daniel.Mullen2@sse.com