



**PACECCS**

# Emerging CCS technologies

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# Introduction

2017, London



2019, Kuala Lumpur



2022, Houston



Matt Healey is the Managing Director of Pace CCS and a member of ISO TC265, responsible for standards related to carbon dioxide capture, transportation, and geological storage

Pace CCS is a specialist CCS engineering consultancy.

- 60+ CCS projects to date
- UK, EU, USA, Australia, SE & E Asia, Middle East
- London, KL, Houston offices

## Services

- CCS full-chain design
- Third-party review for CCS projects
- CCS training course
- CCS full-chain digital twin



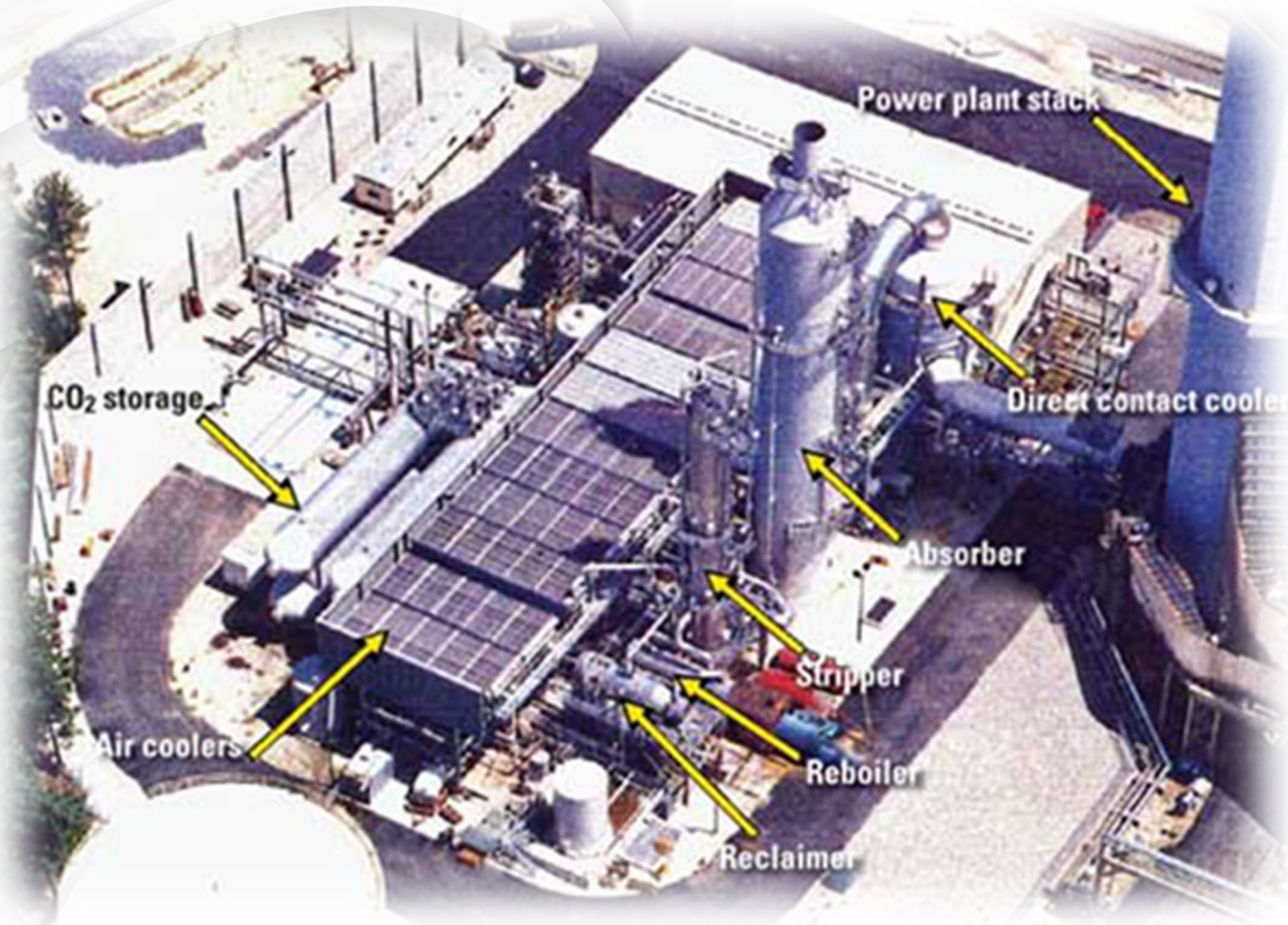
# CCS technology today

CCS technology is mostly oil & gas technology.

In many ways it is not fit for purpose.

- Low pressure CO<sub>2</sub> capture means big units.
- Amine capture is size-limited and power hungry.
- Capture is not considered in design of industrial processes.
- Software is not designed for CO<sub>2</sub> with impurities.

Many technologies will be out-competed by emerging CCS-specific tech.



This unit in NE USA is capturing about 0.25 MTPA CO<sub>2</sub>.



# The first CCS hubs

There are no CCS industrial hubs in operation today.

But there are 50 or so in design, some in very early concept, some under construction.

These projects are different from CO<sub>2</sub> injection projects currently in operation

- The operator of the disposal network is not the body creating CO<sub>2</sub>
- The disposal network must be always online (or else \$\$\$\$)

Operating experience: none



A blower: from flue gas to amine contactor



# Second generation capture

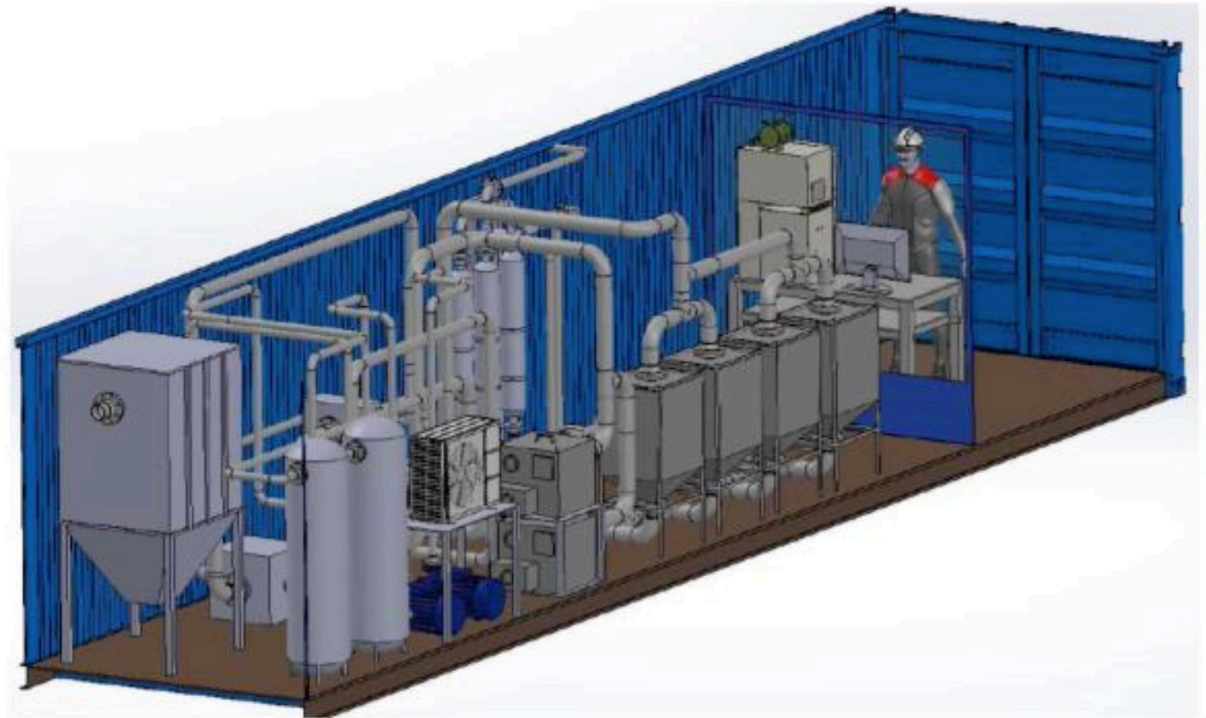
Amines are on the way out.

Second-generation CCS capture technologies are cheaper, smaller and less energy intensive.

Claimed costs are as low as 50% of traditional amine capture.

Technologies like KC8 are competing for a space in what is forecast to be a trillion dollar market.

KC8



A 1 tpd second-gen capture pilot being designed by Pace CCS

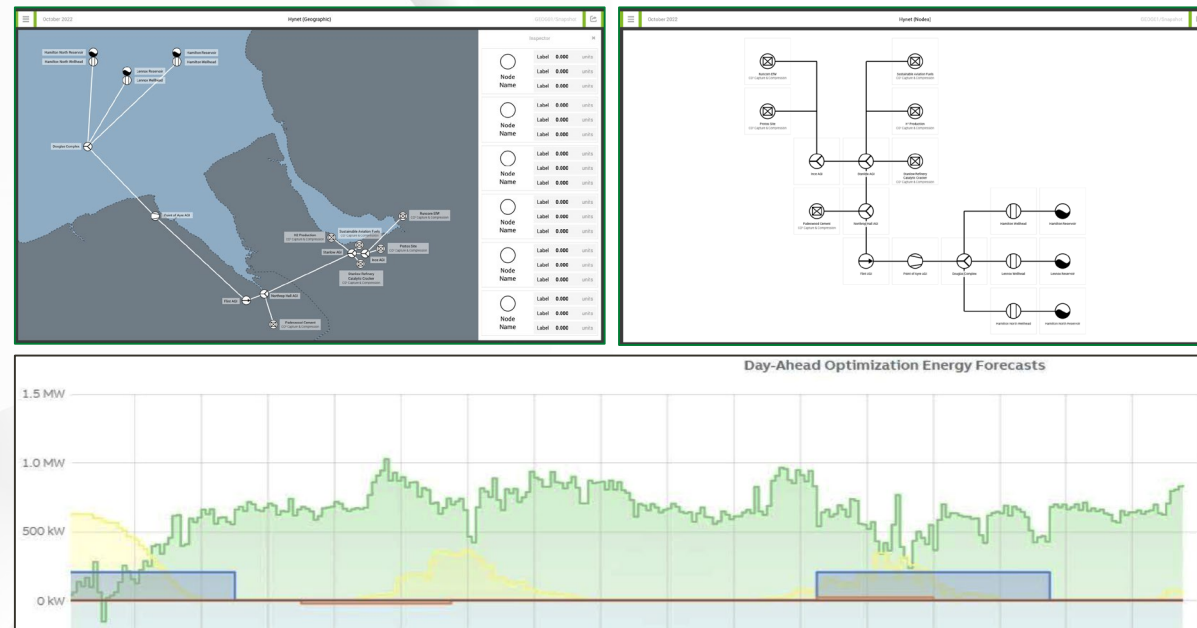


# Software

Oil & gas software – widely used – is not fit for purpose.

- Poor thermodynamic models
- Slow and error-prone
- (They are designed for 20,000 components, not 7.)

Big knowledge gaps around two-phase flow, chemical reactions, corrosion, liquefaction...



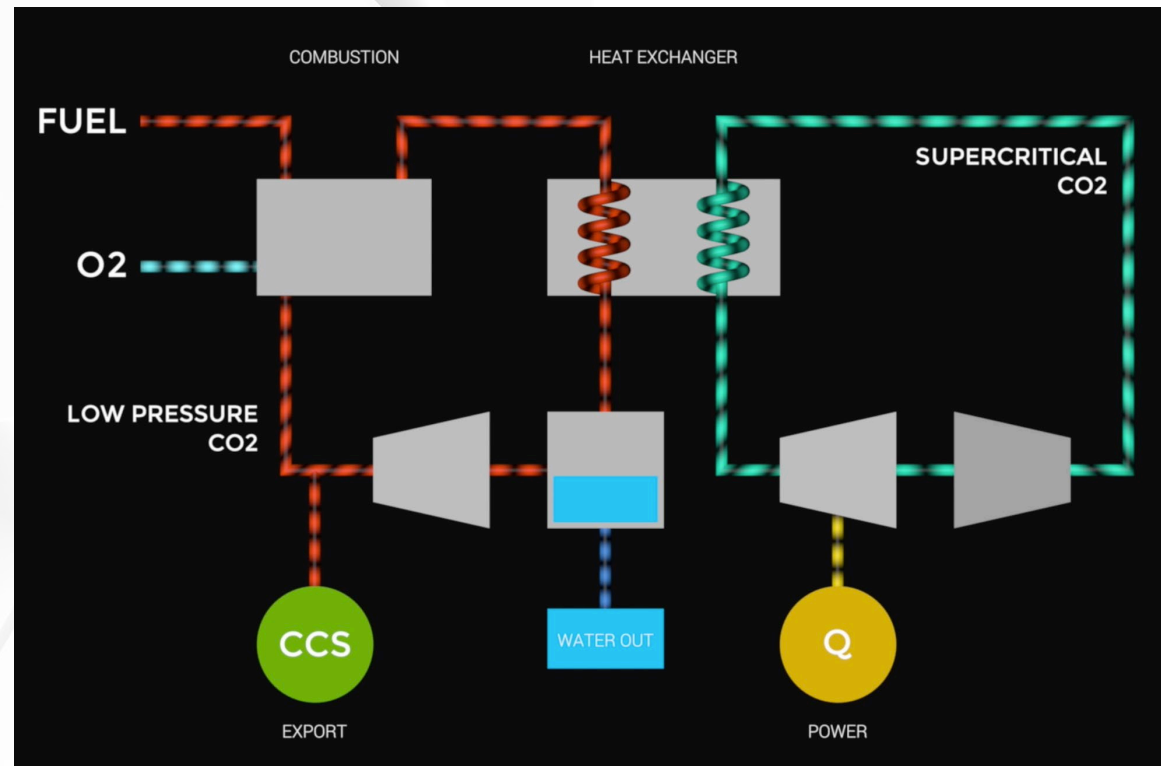
Pace CCS – ABB “Balance of Operations”, a digital twin for CCS projects



# Blue power

New thermodynamic cycles produce power & high-quality pressurized CO<sub>2</sub>, ready for CCS.

- Cheaper & more efficient than powergen plus capture.
- About 5% of the size of a traditional gas turbine
- Ceox and Netpower are the two technologies in this space
- Netpower are listing on the NYSE in Q2 at a presumed value of US\$1.5b



The Ceox thermodynamic cycle



# Crystal ball time

CCS does three things that renewable energy cannot

- CCS decarbonises existing industry
- CCS (with biofuels or DAC) is carbon negative
- CCS required to decarbonize cement

The cost of decarbonising cement creates a practical floor for the price CO<sub>2</sub>.  
(We can't reach net zero unless we decarbonise cement with CCS.)

So:

- Emerging technology will reduce the cost of CCS.
- Existing technology risks being unprofitable as the floor price of CO<sub>2</sub> falls.





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**Thank You**

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