2024 Energy and Turbomachinery Network (ETN) Annual General Meeting and Workshop
Low Carbon Solutions Parallel Session
21 March 2024
Leiden, Netherlands

Uniper's Power CCS Developments in the United Kingdom

Jon Runyon, Gas Turbine Combustion Engineer

Roger Brandwood, General Project Manager - Grain Carbon Capture

Uniper 2030: Flexible, balanced, bespoke – Providing what the energy system needs

Uniper 2030

Leveraging interlinkage of power and gas in core markets[1]

Investing >€8bn 2023-2030 in growth and transformation

Coal phase out by 2029[2] as first step on path to carbon neutrality by 2040[3]

Independent and stand-alone investment grade rated company as well as attractive employer

Customer

- ~1000 municipal and industrial customers as well as grid operators
- Securing sustainable energy supplies for customers
- Developing bespoke energy solutions to support our customers' decarbonization

Green & Flexible Power

- 15-20 GW capacity
- Thereof >80% green
- Green power sales portfolio
- Security of supply (e.g. ancillary services)
- Decarbonization solutions

Green Gases

- >200 TWh gas sales
- >1 GW electrolyzer capacity
- Security of supply based on an increasing share of green gases

Optimization

- Balancing sales with supply
- Originating and trading energy products to optimize the energy system

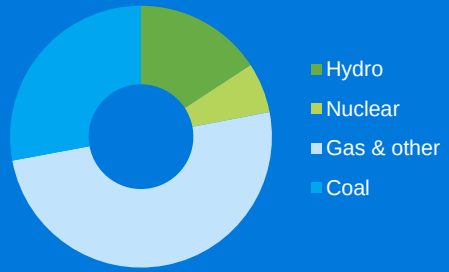
1 Core markets: Germany, UK, Sweden, Netherlands
2 Disposal of Datteln 4 acc. to conditions from EU COM remedies assumed
3 Referring to greenhouse gas scope 1-3 accounting rules

Green & Flexible Power: Closing the critical gap in the energy transition

Today

22.4 GW
of generating capacity (2023)

20% green



The way ahead

Grow green power

- Phase out coal by 2029[1].
- Grow wind and solar assets and renewable PPAs.
- Optimize value of hydro and nuclear.
- Pursue selective growth in hydro.

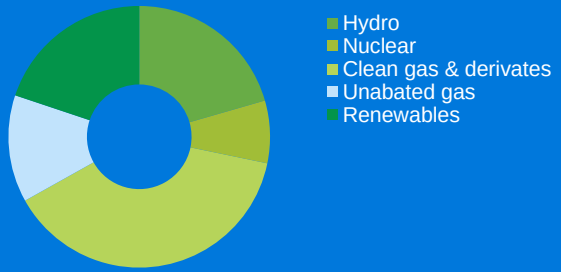
Grow flexible power

- **Decarbonize existing gas plants.**
- **Invest in new flexible generation with net-zero capability.**
- Grow in battery energy storage systems.

2030 – Highlights

15-20 GW
generation capacity installed

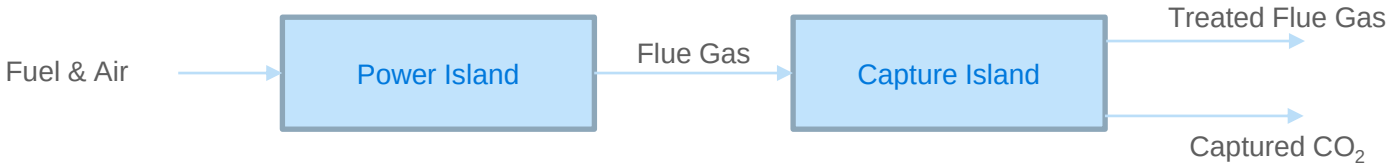
>80% green



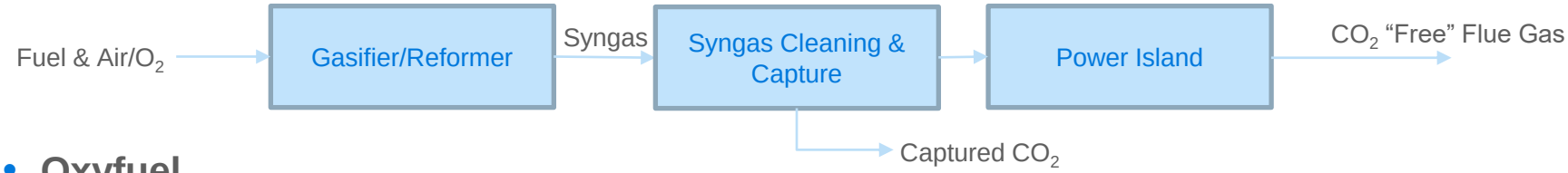
[1] Disposal of Datteln 4 acc. to conditions from EU COM remedies assumed

Three options typically considered for capturing CO_2

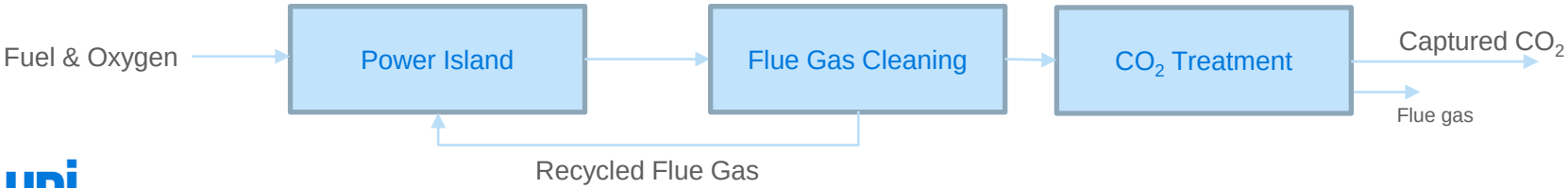
- **Post-combustion**



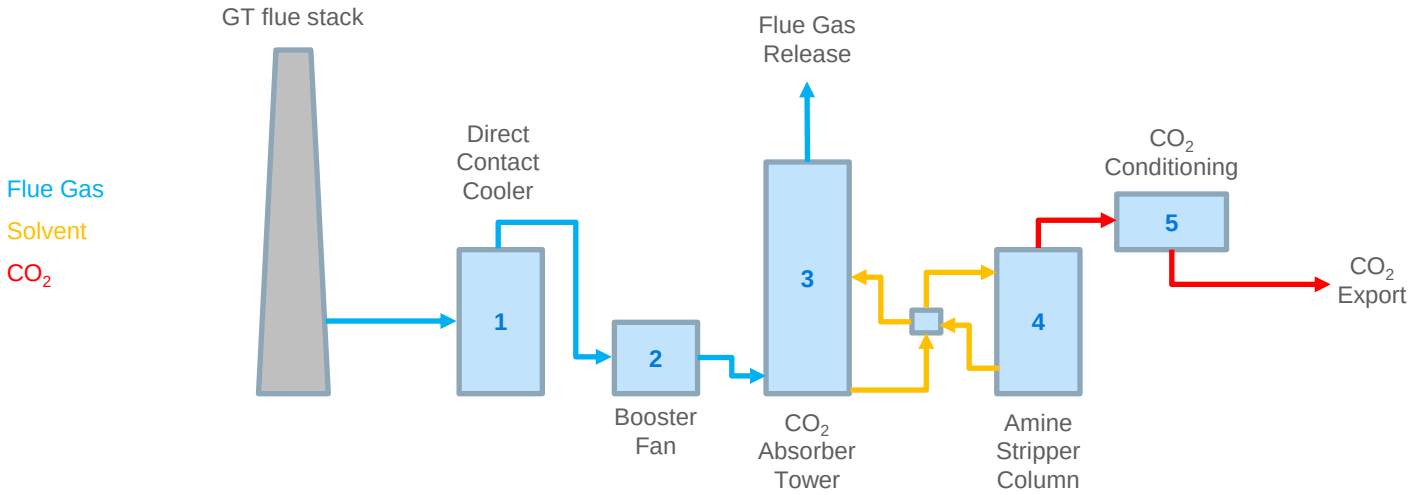
- **Pre-combustion / “Blue” hydrogen**



- **Oxyfuel**



What's in a post-combustion capture plant?



- Implementation of a CO_2 capture plant involves the addition of significant plant items to a CCGT. For example, the CO_2 absorber tower could be >100 m tall. The plant requires power, steam, cooling water, demin water, etc.
- The CO_2 is captured by a recirculating solvent (e.g., amine), and then the solvent is regenerated, with the CO_2 then being sent for compression, conditioning and transport. The solvent is reused.

UK Cluster Sequencing and Dispatchable Power Agreement

UK's initial CO_2 storage ambitions: 20-30MtCO_2/year by 2030[1]

Cluster Sequencing Process - a series of competitions to select CCS projects via business model support.

Track 1 T&S (Pipeline only): HyNet and East Coast Cluster
Track 1 Emitters (2027 deployment): 1x Power CCS project (NZT Power)
Track 1 Emitters (2030 deployment): Competition ongoing

Track 2 T&S (Pipeline and non-pipeline): Viking CCS and Acorn
Track 2 Emitters: Anchor projects competition expected in 2024

For Power CCS, the **Dispatchable Power Agreement (DPA)** sets out the business model support for retrofit or new build of carbon capture plant for power generation (excluding BECCS).[1]

UK government ambition for 10 GW of Power CCS by 2035.[1]

1 https://assets.publishing.service.gov.uk/media/62de67378fa8f56496f81ef8/power-ccus-call-for-evidence.pdf

Uniper UK Power CCS Recent News

Grain Retrofit Power CCS[1]

14 February 2024

Uniper awards design study contracts for Grain Carbon Capture project

Connah's Quay Low Carbon Power[2]

15 February 2024

Public engagement programme launched for new low carbon power station project at Uniper's Connah's Quay site

1 https://www.uniper.energy/united-kingdom/news/uniper-awards-design-study-contracts-for-grain-carbon-capture-project/
2 https://www.uniper.energy/united-kingdom/news/public-engagement-programme-launched-for-new-low-carbon-power-station-project-at-unipers-connahs-quay-site/

UK CCS Project Portfolio

Killingholme Humber H_2ub

- 720MW_{th} CCS-enabled hydrogen production facility, being developed
- CO_2 storage in southern North Sea via pipeline
- Potential offtakers include heavy industry, transport, and gas blending
- Pre-FEED study complete
- Commercial Operation Date (COD) 2030

Connah's Quay Low Carbon Power

- Low carbon replacement strategy
- Direct pipeline export of CO_2 to HyNet cluster
- New build CCGT with post-combustion CCS: ~550MW up to 1.2Mt/yr of CO_2 captured
- 2nd unit designed for later deployment
- Pre-FEED study complete
- Consenting process commenced
- Commercial Operation Date (COD) 2030 (for 1st unit)

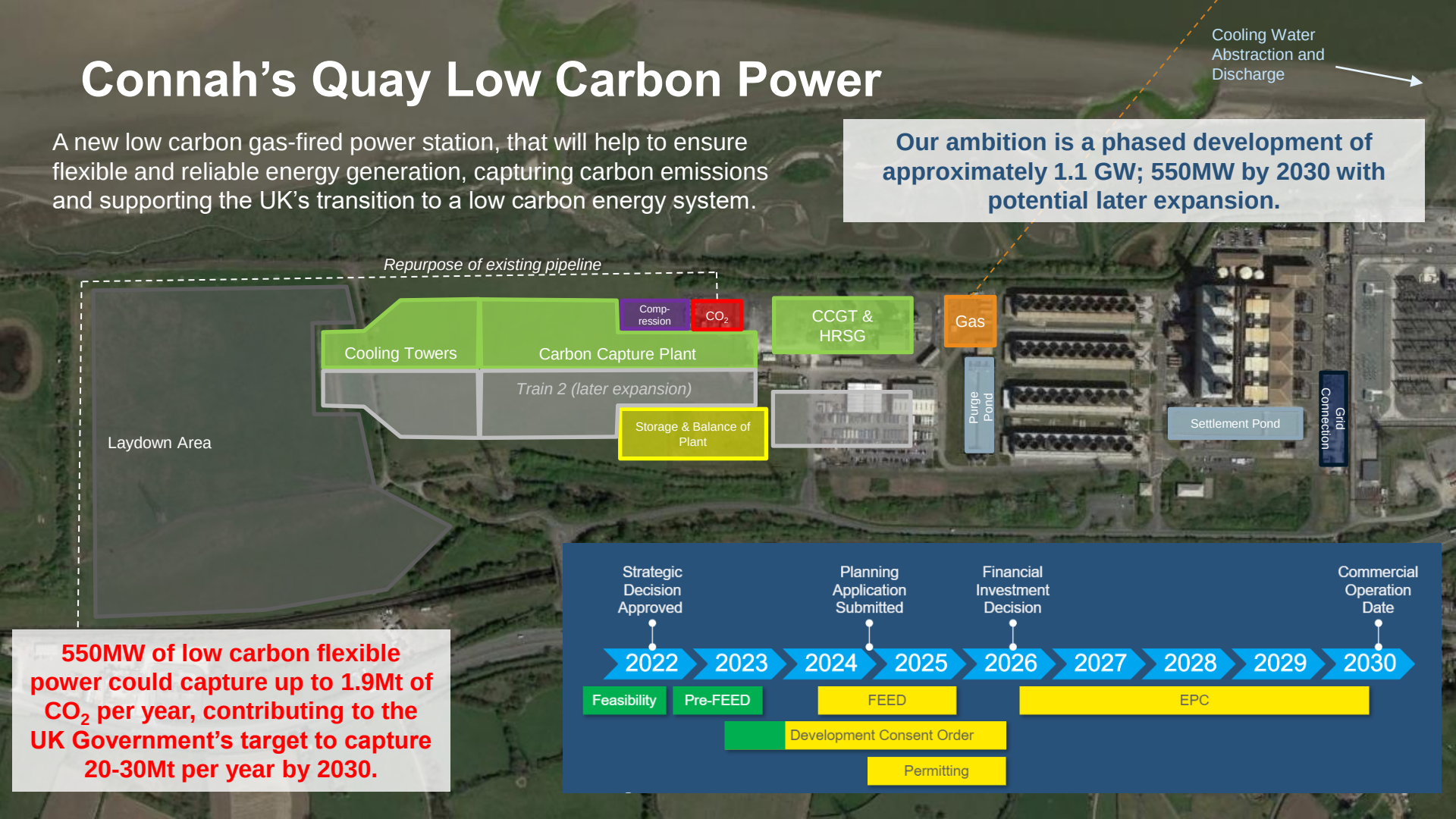
Grain Retrofit Power CCS

- Decarbonisation of existing assets
- Shipped CO_2 solution to a storage cluster
- Retrofit of post-combustion carbon capture to 1 to 3 CCGT units.
- Per unit: ~365MW, up to 750kt/yr of CO_2 captured
- Pre-FEED study complete,
- PDP in progress
- Consenting/permitting ongoing
- COD 2029 to 2030 (across three units)

Connah's Quay Low Carbon Power

A new low carbon gas-fired power station, that will help to ensure flexible and reliable energy generation, capturing carbon emissions and supporting the UK's transition to a low carbon energy system.

Our ambition is a phased development of approximately 1.1 GW; 550MW by 2030 with potential later expansion.



550MW of low carbon flexible power could capture up to 1.9Mt of CO_2 per year, contributing to the UK Government's target to capture 20-30Mt per year by 2030.

Grain Retrofit Power CCS

Retrofit Combined Cycle Gas Turbine (GT26) with Post-Combustion Carbon Capture

A Power CCUS project is in development as a decarbonization solution for the three existing Grain CCGT power generation units.

This could contribute up to (per unit):
- **365MW of low carbon flexible power** to support the potential 10GW of Power CCUS government estimates needed by 2035
- **750ktpa of CO_2 captured** as part of government's ambition to capture 20-30Mtpa by 2030

If applied to 3 units, up to **1.1GW** of power and **2.25Mtpa** of CO_2

Today

Uniper has a clear mandate to decarbonise European Generation*

2025

CO_2 Transport & Storage Infrastructure

Acorn

2030

-80%

Power CCUS
CCGT with CCS (3 x ~365MW)

Existing Grain generating asset's current end of life is ~2050

2035

Net Zero

2050

uniper

* Uniper intends for 80% of its installed generating capacity to be zero-carbon by 2030. It will end coal-fired power generation by 2029 at the latest. Uniper intends for its Scope 1 to 3 emissions to be carbon-neutral by 2040, ten years earlier than previously planned. It plans to achieve group-wide carbon neutrality for its Scope 1 and 2 emissions by 2035.

Making Net Zero Probable

Grain Retrofit Power CCS

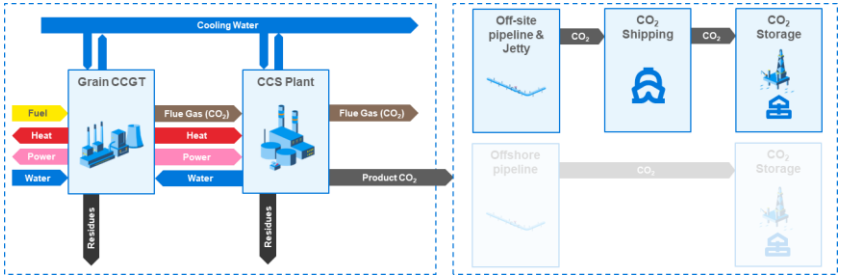
Retrofit Combined Cycle Gas Turbine (GT26) with Post Combustion Carbon Capture

Pre-FEED complete, consenting activities ongoing and competitive Process Design Package (PDP) in motion

365MW of low carbon flexible power

Capturing up to 750ktpa of CO_2

Later expansion up to 1.1GW and 2.3Mtpa of CO_2



- 95% capture rate
- Competitive Process Design Package process will enable technology selection of amine-based solvent technology
- CO_2 transport & storage solution in development, including liquified shipping
- All three units currently in scope, providing optionality on number of units converted and associated timelines

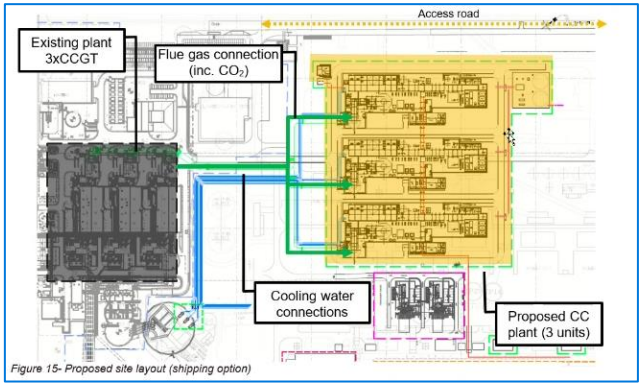
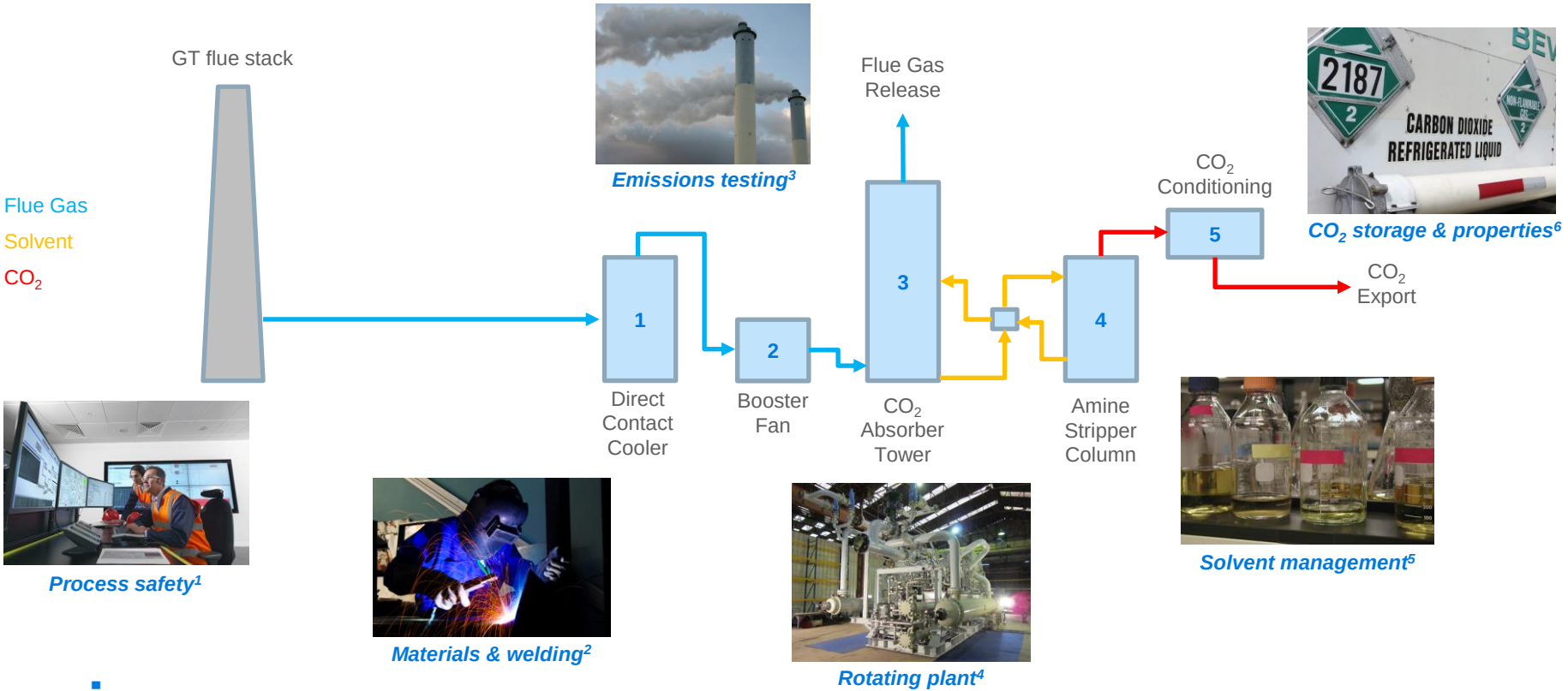


Figure 15- Proposed site layout (shipping option)

CCS technology requires new/adapted skill requirements for GT users



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Questions?

Uniper's Power CCS Developments in the United Kingdom

Jon Runyon – jon.runyon@uniper.energy

Roger Brandwood – roger.brandwood@uniper.energy

www.uniper.energy