Potential advantages for combining DACCS with amine post-combustion capture plants – CoDACCS - and ways to make new plants CoDACCS-ready

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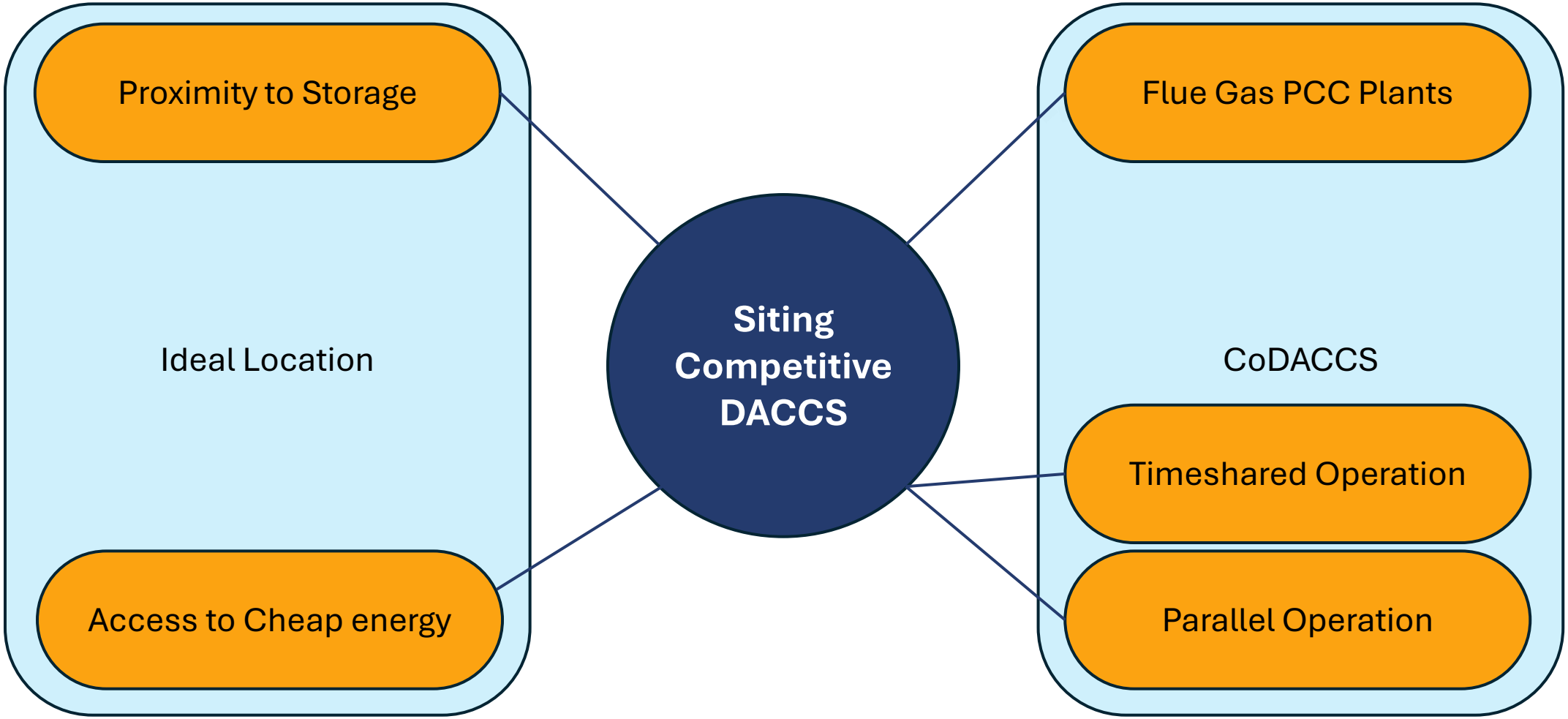
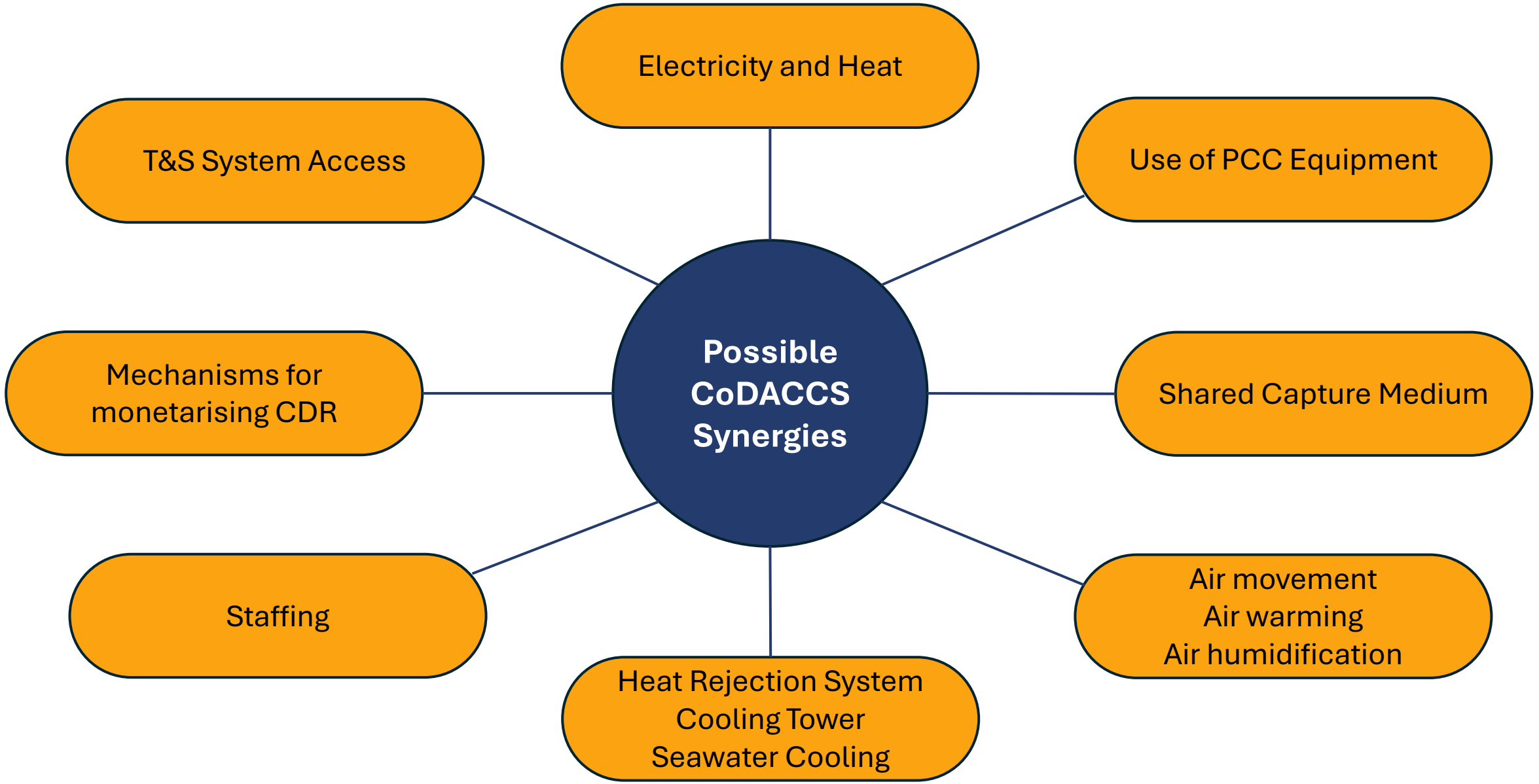
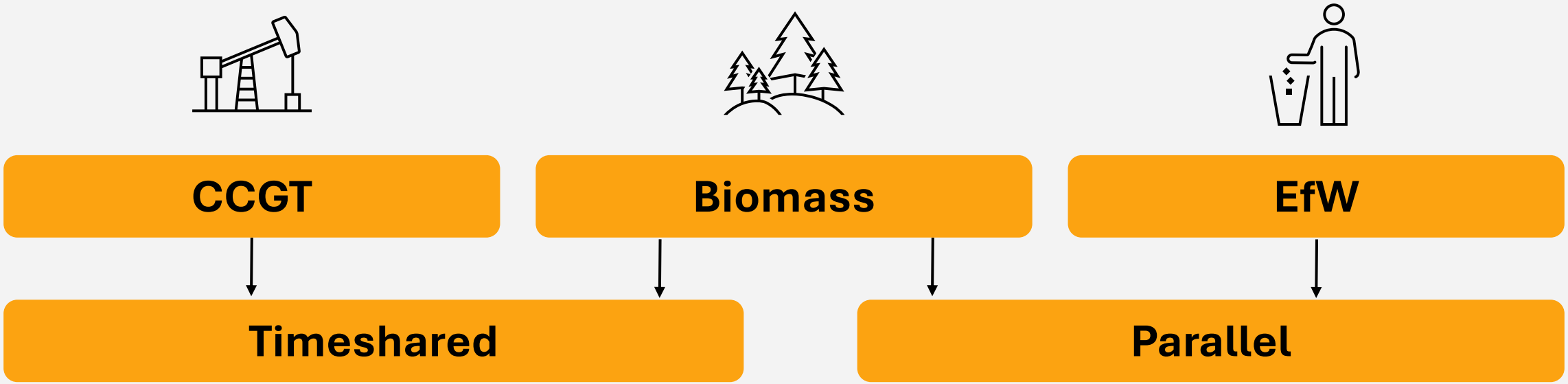
University of Sheffield


Proximity to Storage
Ideal Location
Access to Cheap energy
Siting Competitive DACCS
Flue Gas PCC Plants
CoDACCS
Timeshared Operation
Parallel Operation

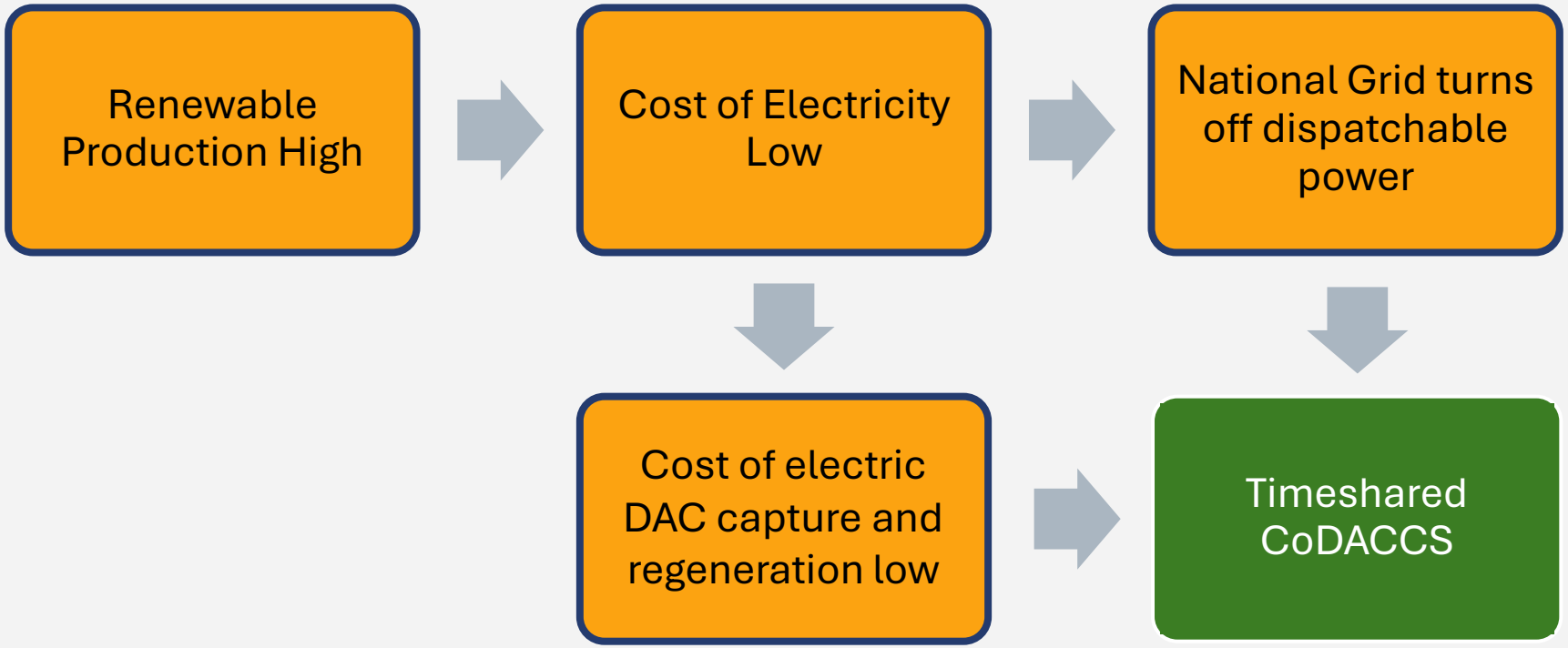

Electricity and Heat
T&S System Access
Use of PCC Equipment
Possible CoDACCS Synergies
Mechanisms for monetarising CDR
Shared Capture Medium
Staffing
Air movement
Air warming
Air humidification
Heat Rejection System
Cooling Tower
Seawater Cooling


CCGT
Biomass
EfW
Timeshared
Parallel

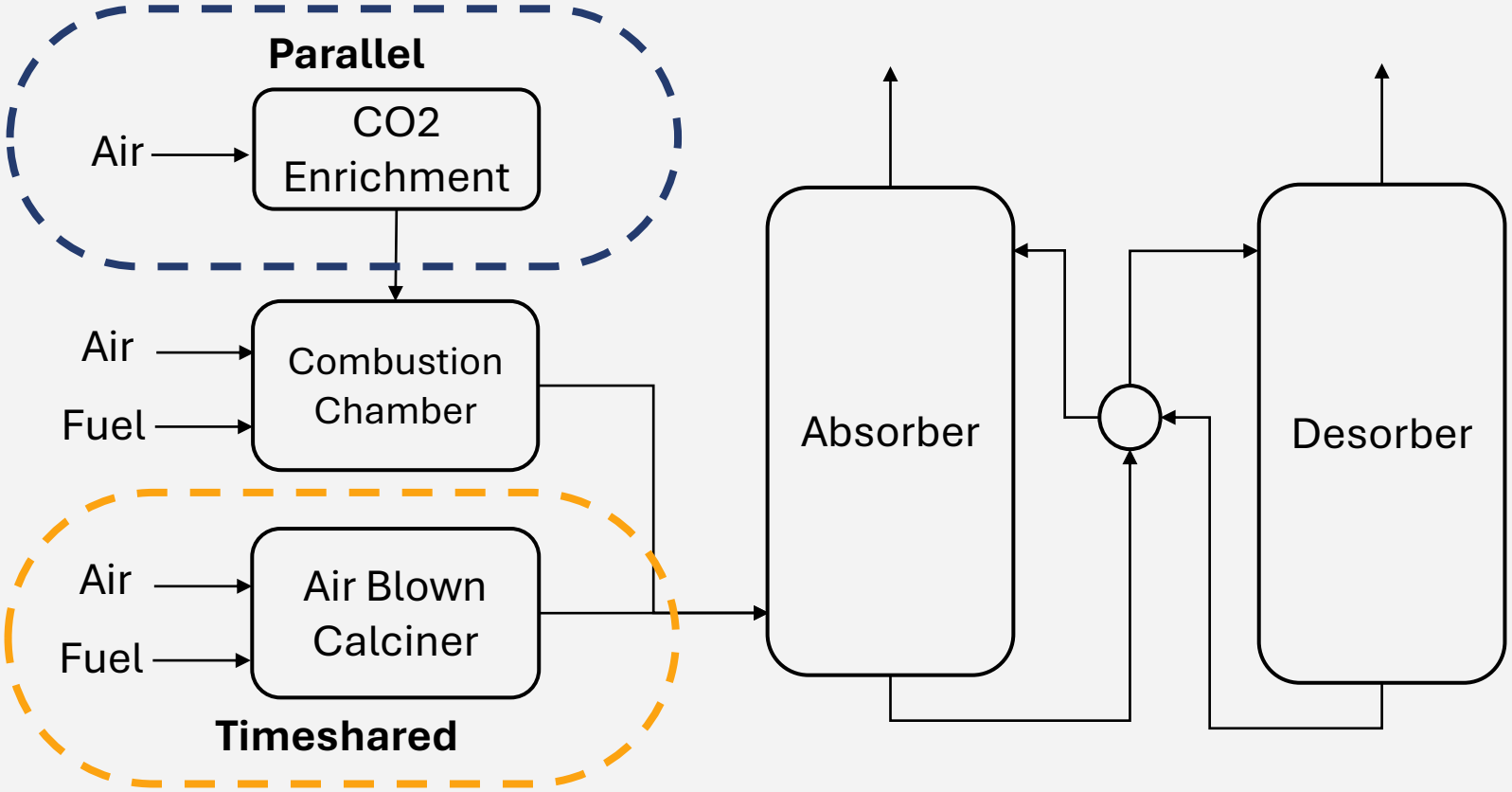
What Facilities and Utilities are available?

	CCGT	Biomass	EfW
Method	Timeshared	Hybrid	Parallel
‘Free’ Electricity	✗	✓	✓
Steam Available	✗	✓	✓
Spare PCC Infrastructure	✓	✓	✗

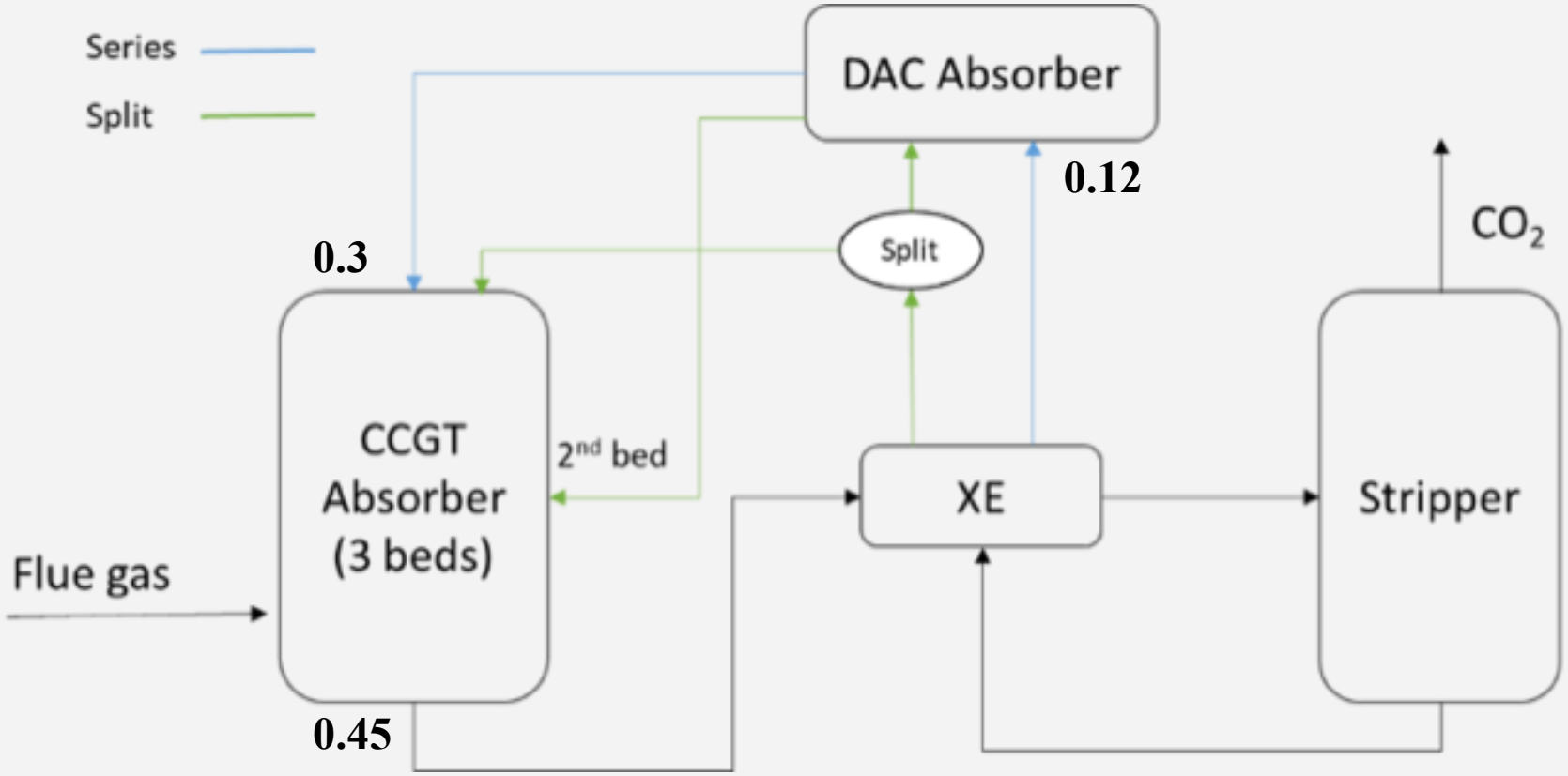
Timeshared Operation



Opportunities: Absorber

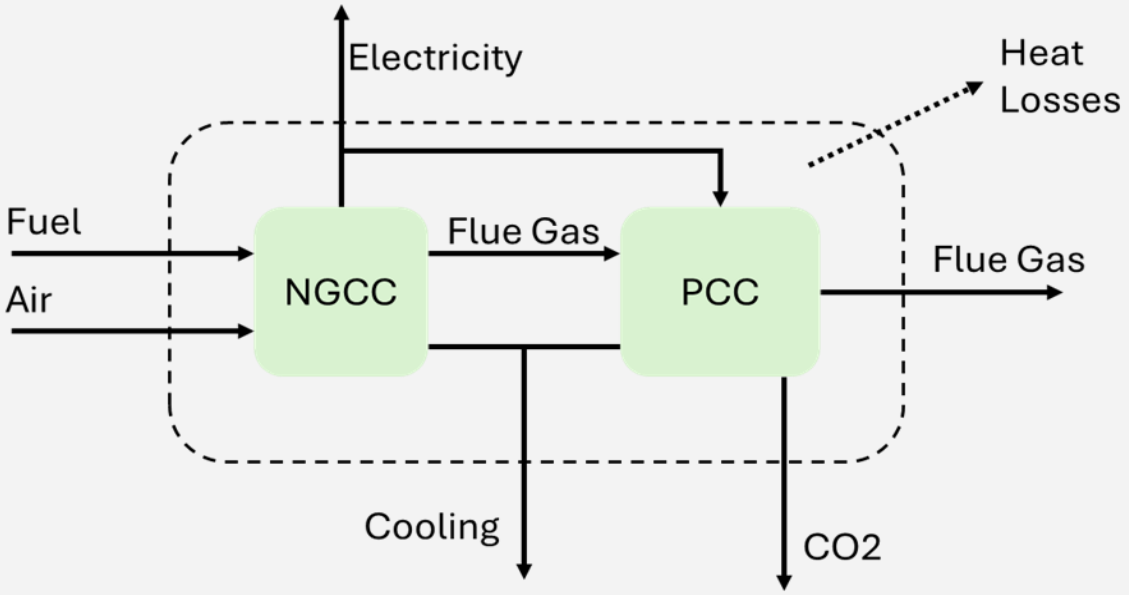


Opportunities: Absorber



Michailos et al., 2022, A performance modelling study of integrating a MEA direct air capture unit with a CCGT absorber, 16th International Conference on Greenhouse Gas Control Technologies, GHGT-16.

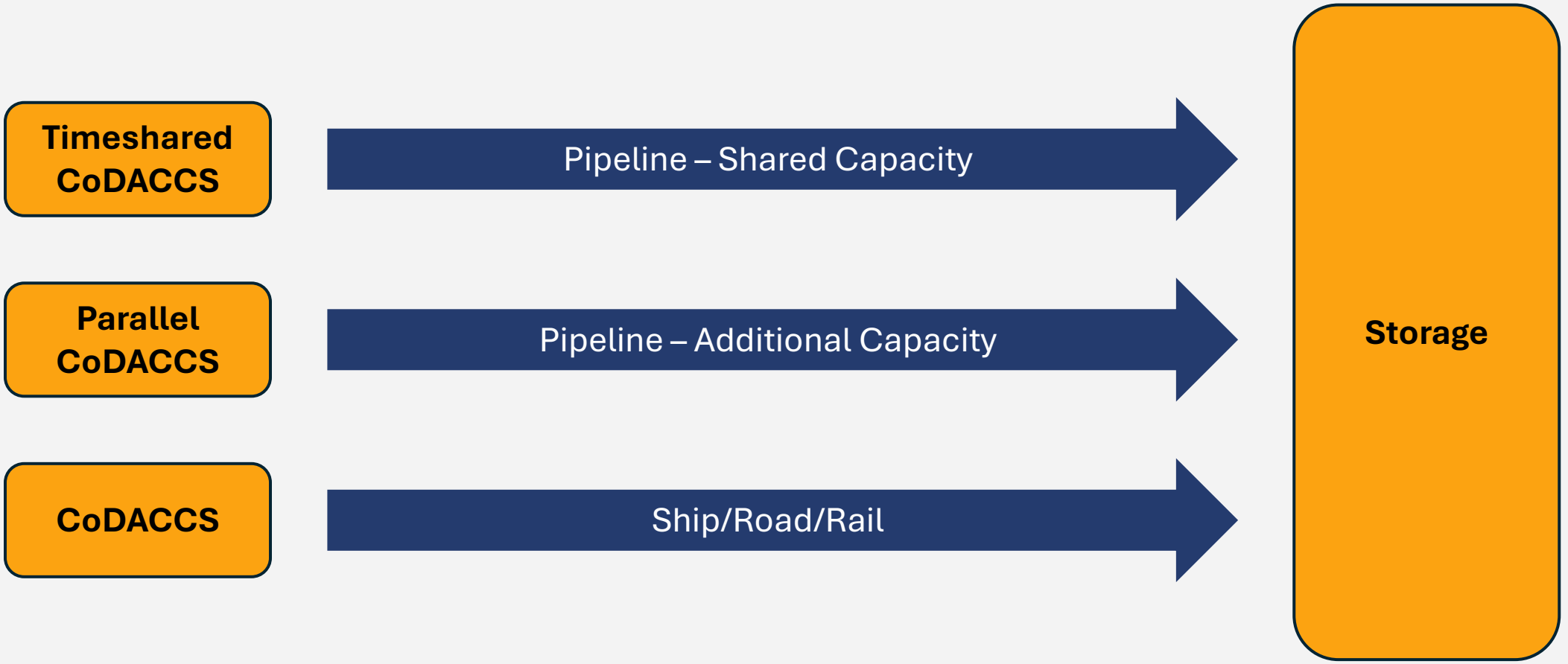
Opportunities: Dry Cooling Tower



Relative amount of CO2 captured from cooling tower compared with flue gas at 50% air capture

Air Temperature Increase	GGCT	Biomass	EfW
5K	37.8%	31.9%	32.5%
10K	18.9%	15.9%	16.3%
15K	12.6%	10.6%	10.8%

Opportunities: Transport and Storage



Recommendations: Parallel (EfW)

Feature	Preparation	Notes
• CO2 T&S	• Likely need to be oversized	• CoDACCS could help fill underused pipeline
• Heat	• Steam turbine operating in back pressure mode for maximum steam extraction • Tie ins and space for low grade heat recovery	• Steam extraction for other heat users is always useful
• Absorber + PCC Train	• Solvent flowrate increase to maintain capture rate with separate air absorbers or added flue gas	• Alternative absorber use of adding a CoDACCS 'flue gas' to main flue gas steam before absorber likely to be limited
• Solvent • Solvent management equipment • Desorber	• Using same solvent for DAC and PCC saves large amounts of energy but additional desorber capacity required	• Additional desorber capacity from oversizing absorber or from additional DAC units
• CO_2 compression and conditioning	• Extra capacity needed.	• Oversizing or additional units.
• Cooling towers	• Air cooled condensers/cooling towers modified to be able to add/incorporate CoDACCS absorbers	• Condensing steam flow to the air-cooled condenser may be reduced if additional steam is extracted • Fans can be used without the condenser in operation

Recommendations: Timeshared (CCGT)

Feature	Preparation	Notes
• CO_2 transport and storage	• No need to oversize	• Aim to size DACCS to match T&S capacity
• Absorber + PCC Train	• Flue gas tie-in • Absorber intercooling for higher or lower CO_2 concentrations than design	• Flue gas pretreatment (e.g. DCC for an air blown lime kiln)
• Solvent • Solvent management equipment • Desorber	• Solvent tie ins. • Electric-power regeneration options as built or able to be added later are advantageous	• Heat recovery available from cooling the flue gas • Main energy source imported electricity used in heat pumps
• Cooling towers and Cooling system	• Tie ins for cooling towers. • No cooling potential from air-cooled condenser, only air movement	• Fans in an air-cooled condenser may be used without the condenser in operation

Conclusions

- Electricity and Heat
- Use of PCC Equipment
- Shared Capture Medium
- Air movement
- Cooling tower
- Staffing
- CDR Mechanisms
- T&S System Access

DACCS

CoDACCS

University of Sheffield

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