Shell Catalysts & Technologies

Affordable CCS

Shell CANSOLV® CO_2 Capture Process

Srihari Kannan
Licensing Technology Manager

CAUTIONARY NOTE

The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this presentation "Shell", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. "Subsidiaries", "Shell subsidiaries" and "Shell companies" as used in this presentation refer to entities over which Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as "joint ventures" and "joint operations", respectively. "Joint ventures" and "joint operations" are collectively referred to as "joint arrangements". Entities over which Shell has significant influence but neither control nor joint control are referred to as "associates". The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

FORWARD-LOOKING STATEMENTS: This presentation contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim", "ambition", "anticipate", "believe", "could", "estimate", "expect", "goals", "intend", "may", "milestones", "objectives", "outlook", "plan", "probably", "project", "risks", "schedule", "seek", "should", "target", "will" and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this presentation, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, judicial, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. The contents of websites referred to in this presentation do not form part of this presentation. All forward-looking statements contained in this presentation are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Shell plc's Form 20-F for the year ended December 31, 2021 (available at www.shell.com/investor and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this presentation and should be considered by the reader. Each forward-looking statement speaks only as of the date of this presentation, JUNE 22 2023. Neither Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this presentation.

SHELL'S NET CARBON FOOTPRINT: Also, in this presentation we may refer to Shell's "Net Carbon Footprint" or "Net Carbon Intensity", which include Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions. The use of the term Shell's "Net Carbon Footprint" or "Net Carbon Intensity" are for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries.

SHELL'S NET-ZERO EMISSIONS TARGET: Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and Net Carbon Footprint (NCF) targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target and 2035 NCF target, as these targets are currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

FORWARD LOOKING NON-GAAP MEASURES: This presentation may contain certain forward-looking non-GAAP measures such as cash capital expenditure and divestments. We are unable to provide a reconciliation of these forward-looking Non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those Non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements. The contents of websites referred to in this presentation do not form part of this presentation. We may have used certain terms, such as resources, in this presentation that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

Biography

Srihari Kannan
Senior Licensing Technology Manager

Leads technology commercialization for gas processing technologies in Asia Pacific region.
Global focal point for Shell's refining bottom of barrel portfolio comprising distillation, thermal conversion and residue gasification.
23 years experience in a variety of roles including site operations, technology assurance, project concept development, engineering design and account management.
Focused on solving customer's energy transition challenges.

AGENDA

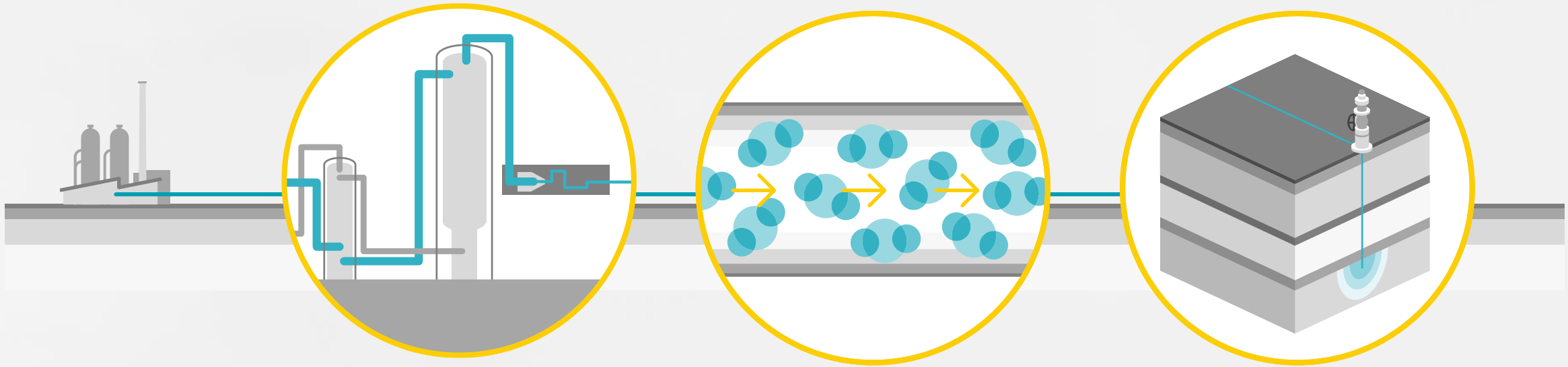
- Our changing world: The need for a lower carbon energy system
- The range of decarbonisation technologies needed for net zero
- Changed landscape enabling CCS
- Shell CO_2 Capture Technologies
- How to make post-combustion capture affordable
- Key takeaways

THE NEED FOR A LOWER CARBON ENERGY SYSTEM

2017		2050
7.6bn	Population increases by around a third	9.8bn
	Energy demand increases by around a third	
CO_2 32Gt (net CO_2e emissions)	CO_2 emissions need to be reduced by around half	18.4Gt (net CO_2e emissions) CO_2

2017–2050: Moving to a lower carbon energy system

WHAT IS CCS AND HOW DOES IT WORK?



Capture

CO_2 is separated from other components, treated, and compressed

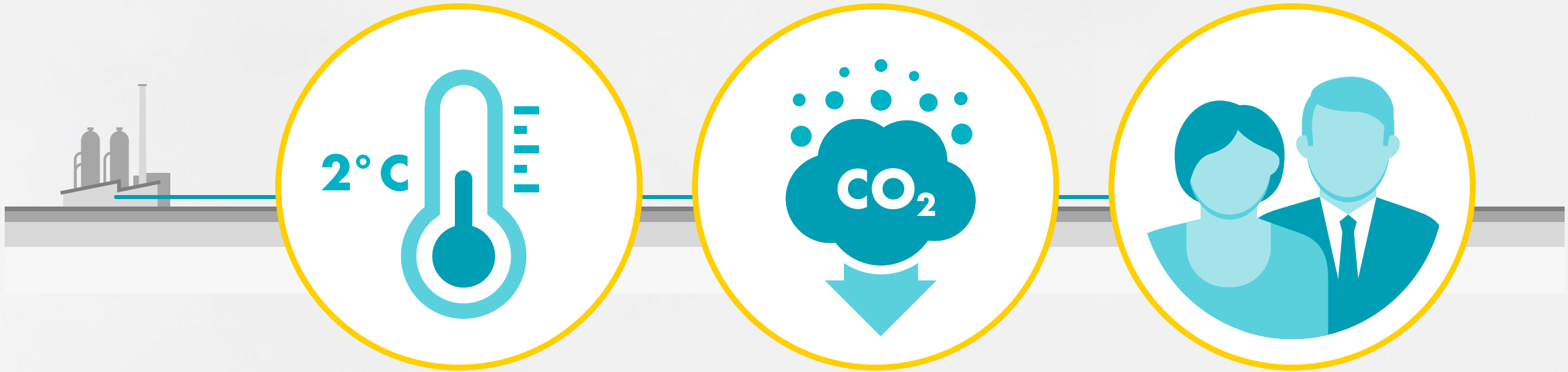
Transport

CO_2 is transported via pipeline or by ship to a storage site

Storage

CO_2 is injected deep underground where it remains

WHY IS CCS NEEDED?

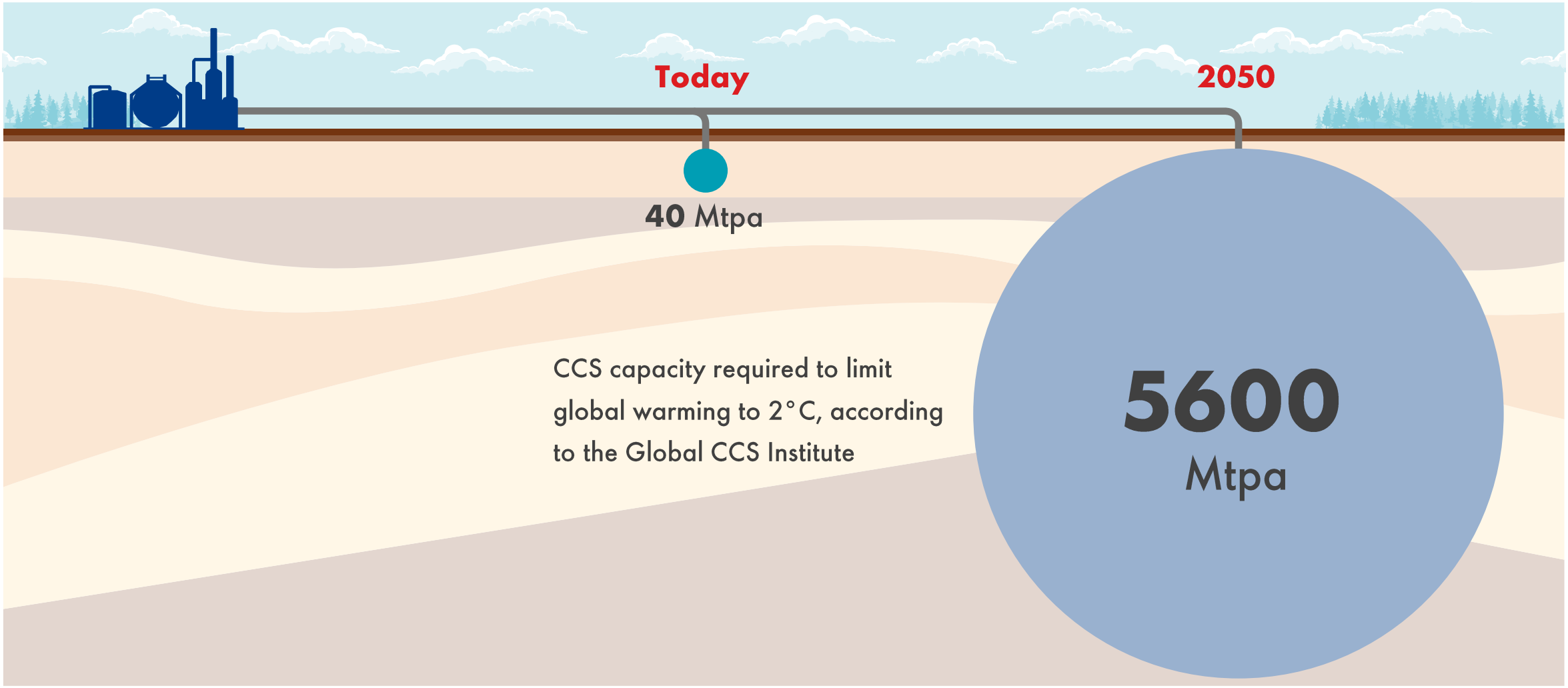


Most scenarios exploring how society can reach the goals of the Paris Agreement (e.g. IEA, IPCC and Shell scenarios) include use of CCS

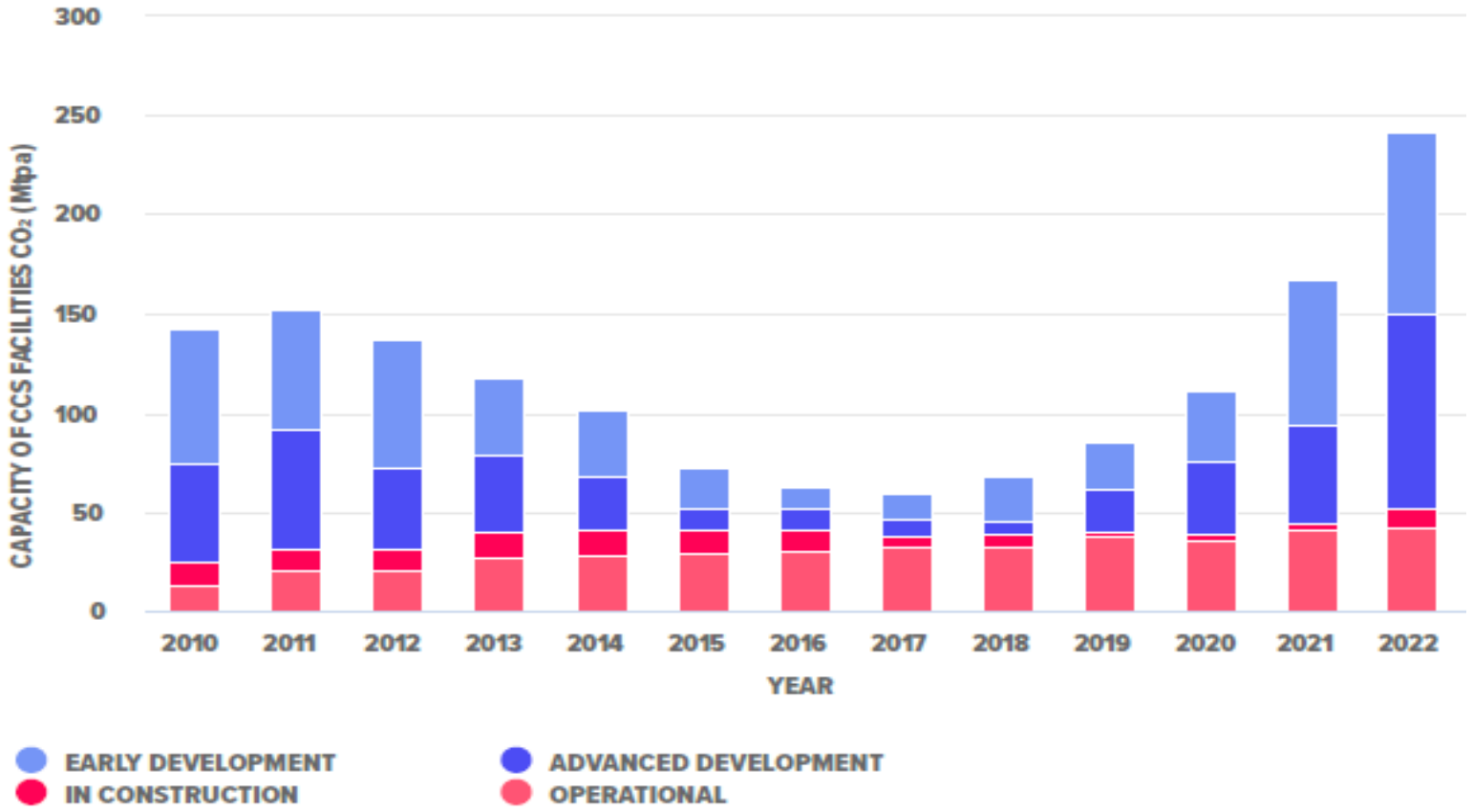
For certain sectors, such as heavy industry, CCS is one of the only technically feasible routes to deep decarbonisation

CCS leads to job creation and retention through development of new value chains

NET ZERO WILL BE VIRTUALLY IMPOSSIBLE WITHOUT CCS, BUT A HUGE INCREASE IN CAPACITY WILL BE REQUIRED



PIPELINE OF COMMERCIAL CCS FACILITIES * MOVE FROM AMBITION TO ACTION *



Source: Global status of CCS 2022 issued by Global CCS Institute

ACHIEVING YOUR NET ZERO EMISSIONS AMBITIONS WILL REQUIRE A WIDE RANGE OF DECARBONISATION TECHNOLOGIES

Decarbonisation pathways

INCREASE ENERGY EFFICIENCY	MAKE LOWER-CARBON ENERGY PRODUCTS	STORE THE REMAINING EMISSIONS
Improving energy efficiency in the facilities that bring energy products to customers	Reducing greenhouse gas emissions from products' end use	Mitigating emissions with carbon sinks

Decarbonisation technology examples:

Energy efficiency studies	Biofuel technologies including HVO and co-processing	Carbon capture and storage
Heat integration		
	Blue and green hydrogen	

INDUSTRY REQUIRES PROVEN COMPETITIVE TECHNOLOGIES TODAY

DRIVING SHARP INCREASE IN DEMAND FOR SHELL'S CANSOLV TECHNOLOGY

Standalone:

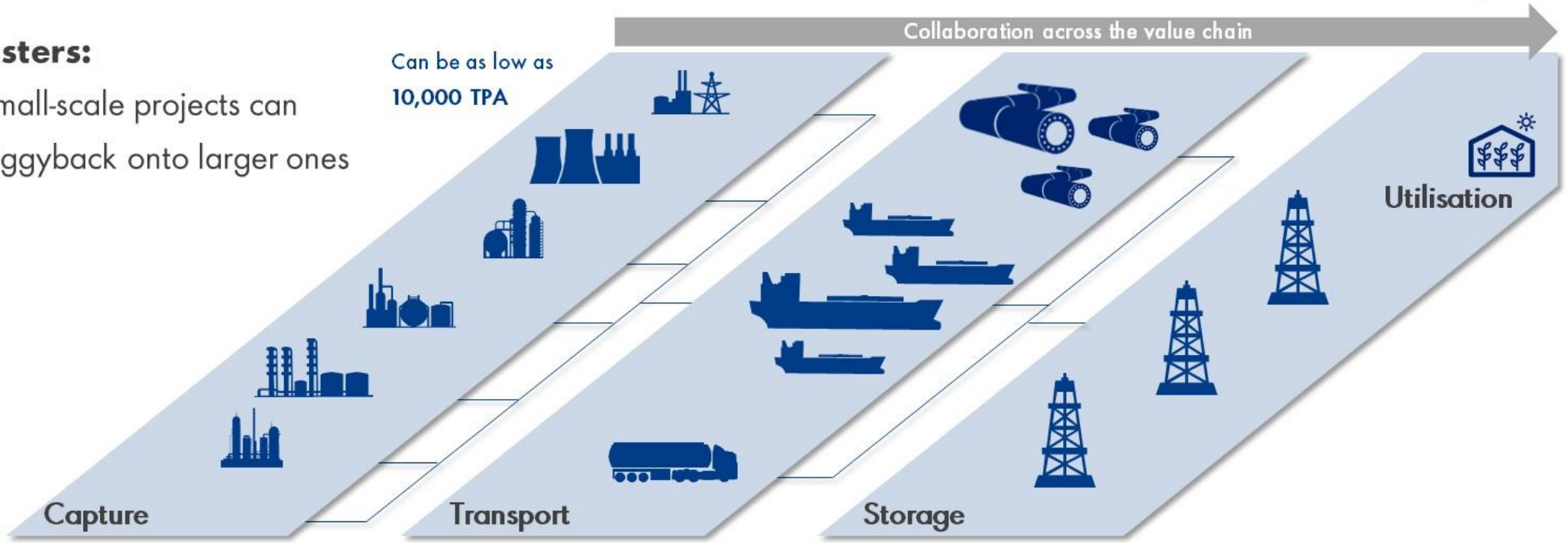
- Scale is required to be cost-effective

Typically
>1,000,000 TPA

Clusters:

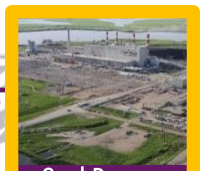
- Small-scale projects can piggyback onto larger ones

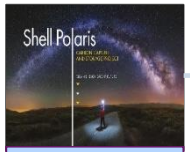
Can be as low as
10,000 TPA



GLOBAL SHELL INVOLVEMENT IN CCS PROJECTS


Serafina Energy


SaskPower Boundary Dam

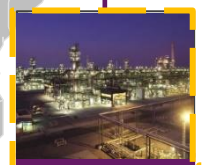

Shell Polaris


Shell Deer Park


Calpine Deer Park

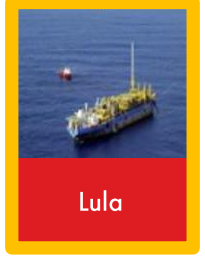

Northern Lights


Fortum Oslo Varmes


Middle East Conf


Middle East Conf


Shell QUEST


Lula


Test Centre Mongstat


Peterhead (cancelled)


Brother Chemical CISA


Porthos / Aramis


Gorgon CCS

ACORN Hub

Net Zero Teesside

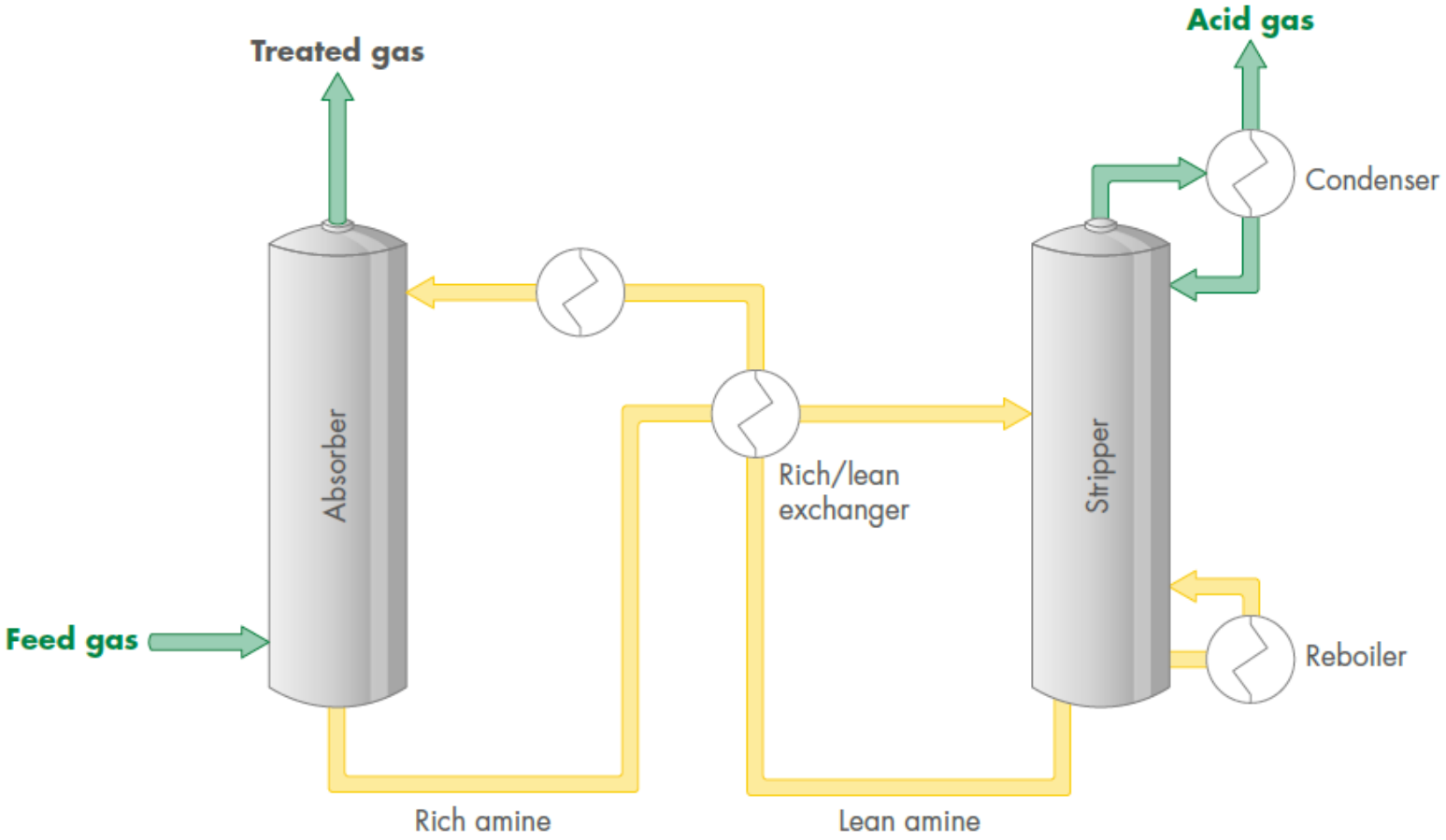
Phillips66


VPI

Industry leader in CCS

- Large scale projects – Shell equity
- 3rd party projects – No Shell equity
- CCS projects under construction/planning
- CCS projects – Completed FEED
- Operating

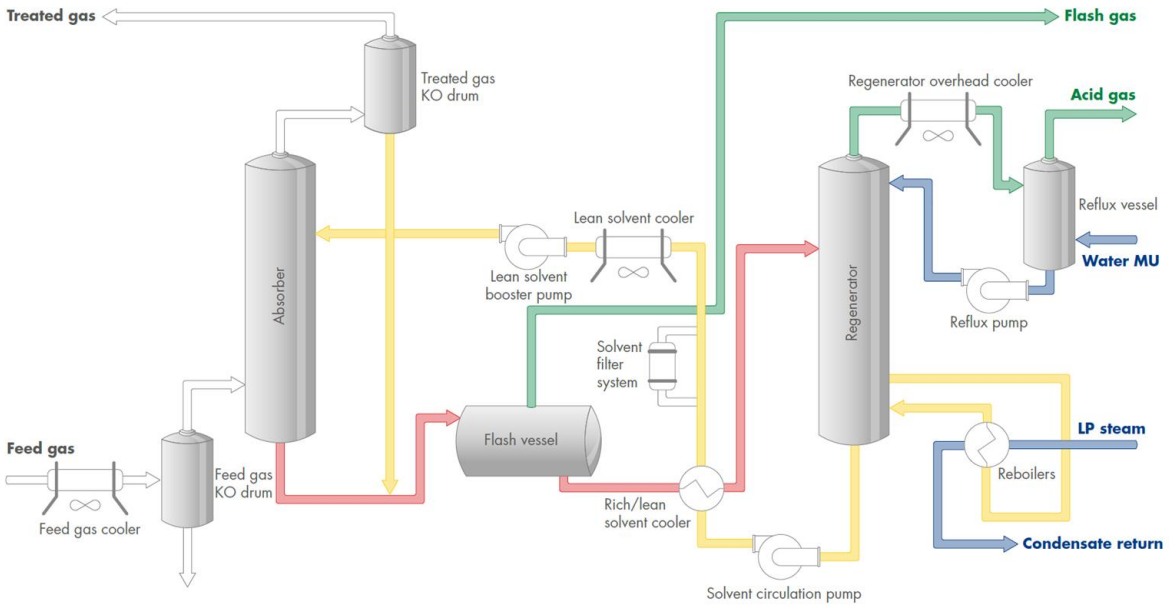
INTRODUCTION: AMINE-BASED CAPTURE SYSTEMS



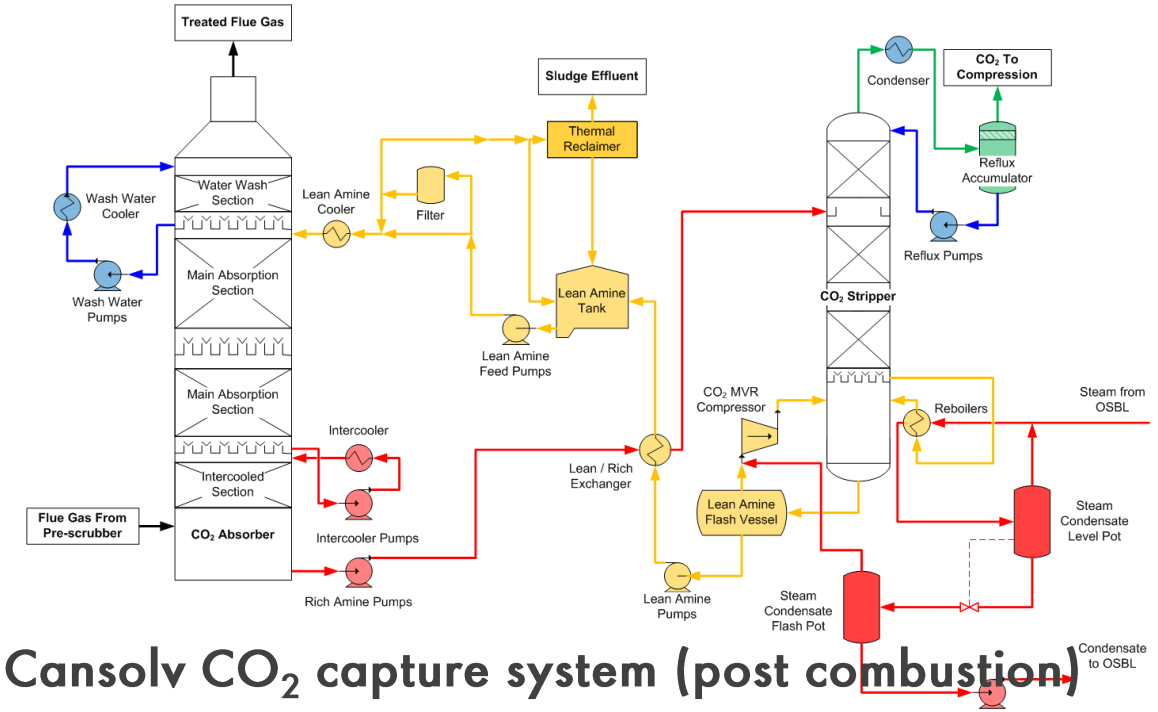
IDENTIFY PRE AND POST COMBUSTION APPLICATIONS…

Parameter	Pre-combustion capture	Post-combustion capture
Applications	Shifted syngas Natural Gas processing	Stack gases
Gas composition		
Presence of Oxygen	No/ Low	Yes/ High
Hydrocarbon rich	Yes	No
Temperature	Low/ ambient	High
Pressure	High	Low/ Atmospheric

SHELL CO_2 CAPTURE TECHNOLOGIES

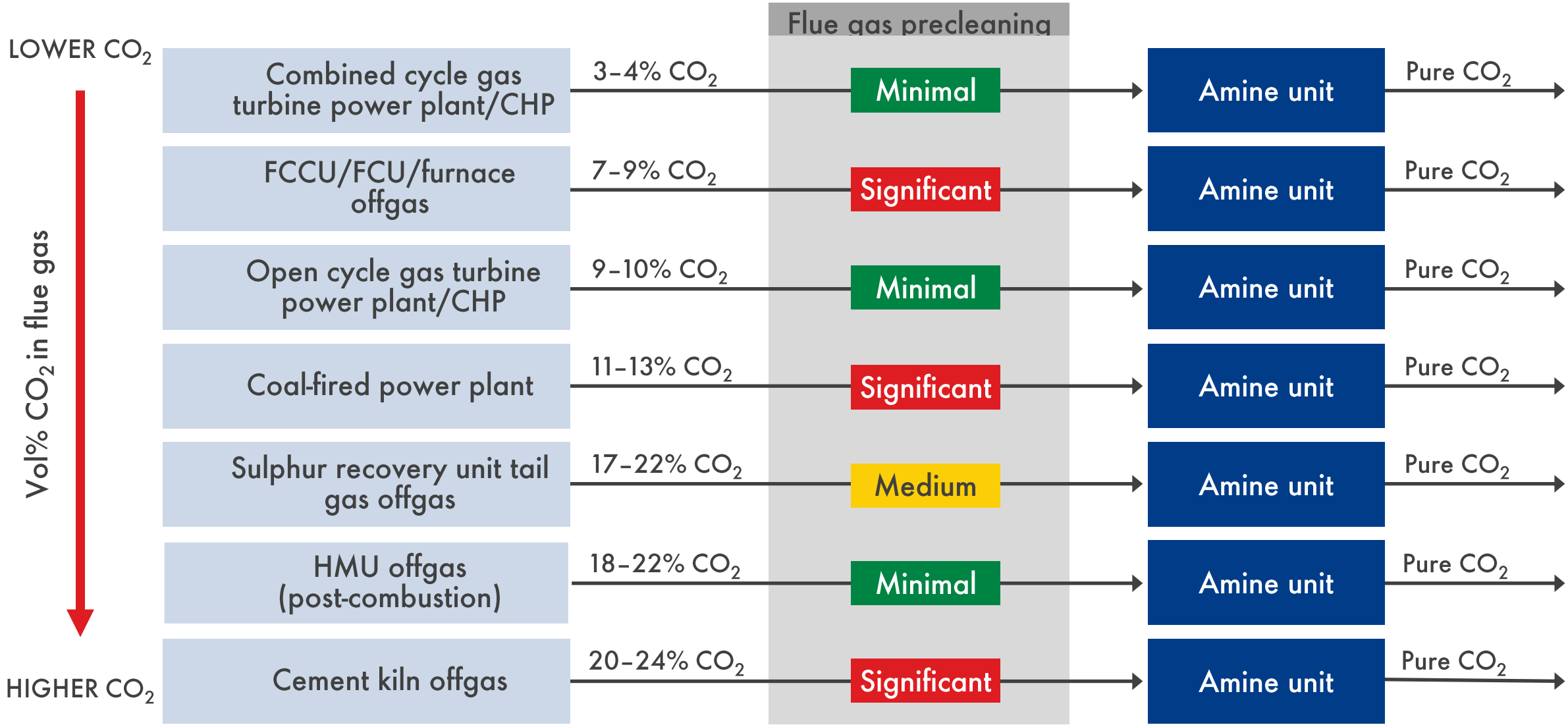


ADIP ULTRA (pre combustion capture)



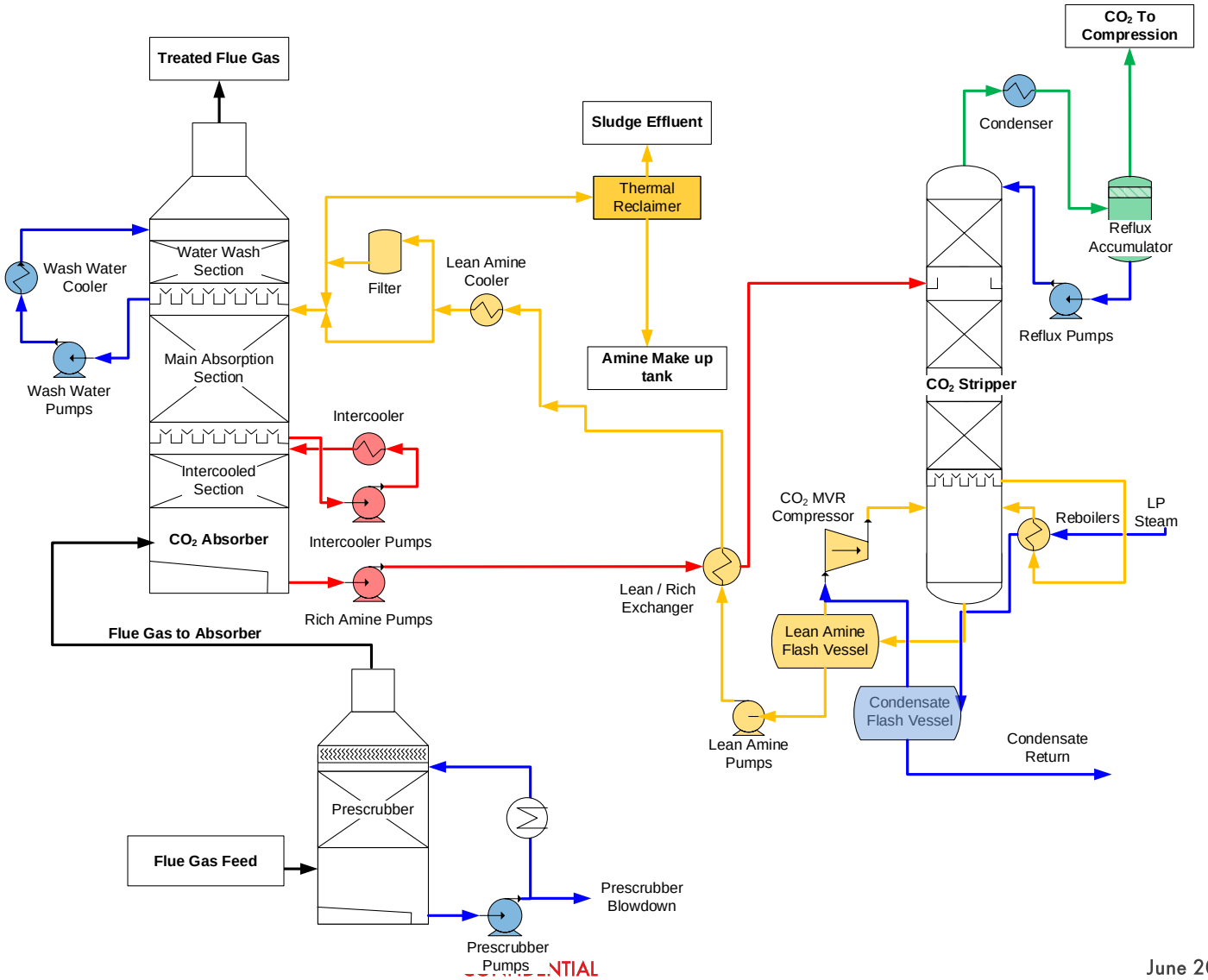
Cansolv CO_2 capture system (post combustion)

Post-combustion CO_2 capture landscape



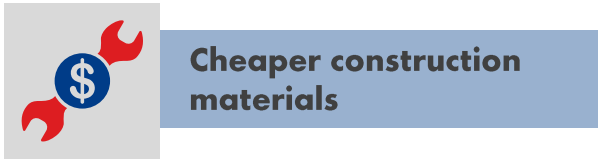
CANSOLV CO_2 capture overview

- Designed for low pressure environments (including post combustion CO_2 capture)
- Ability to manage oxidised environments, tolerant to SOx
- Systems can be guaranteed for bulk CO_2 removal up to 99%
- Highly adaptable to a wide variety of applications



IMPROVEMENTS COMBINE TO HAVE A SIGNIFICANT EFFECT ON A PROJECT'S ECONOMICS, PERFORMANCE AND VIABILITY

- Solvent
- Absorber
- Regenerator
- Emissions
- Overall plant



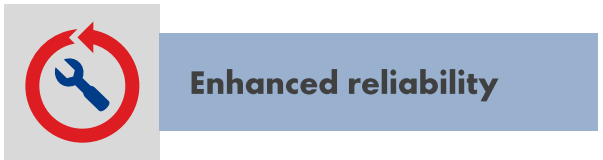
Cheaper construction materials

Lower energy use

Smaller equipment size

Tailored offshore designs

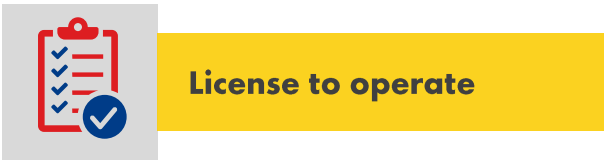
Improved environmental performance



Enhanced reliability

lower capital expenditure

Lower operating costs



License to operate

ALLIANCE WITH TECHNIP ENERGIES ALLIANCE PROVIDING TURNKEY. SINGLE POINT DELIVERY OF CO_2 CAPTURE SOLUTIONS


Fortum Oslo Varme's WtE plant, Norway

PILOT UNIT 1.5 kTA

- Standard 40' container-built turnkey solution
- Objective: validate a technology for a given flue gas/application

SMALL UNIT 10 kTA

- Standard 40' container-built turnkey solution
- For small scale emitters, local CO_2 utilisation or first step CCS implementation

MEDIUM UNIT 100 kTA

- Standard container-built turnkey solution (special built containers)
- For medium scale emitters (WtE, bio-incineration, cement, metal industry, GTs, etc)

LARGE UNIT 200 to 400 kTA

- Transportable on public roads through special convoy
- For relatively large scale emitters and applications such as cement manufacture, CHP, WtE…

LARGER UNIT 500 to 2000 kTA

- For large scale emitters and applications such as cement manufacture, CHP, WtE…

SHELL CO_2 CAPTURE TECHNOLOGIES - KEY TAKEAWAYS

Carbon Capture Technology using amines is a proven technology

- The post combustion piloting and technology development has started more than 30 years ago.
- Shell has developed world scale Carbon Capture projects (1MTPA each) and in operation for 6^+ years

however due to the limited number of opportunities there is still room for efficiency and life cycle cost improvement:

- **Shell continuously invest to improve the technology** through feed back from operations, piloting, process design efficiency and new solvents formulations
- **Partnering with EPC (T.EN)** to unlock value through modularization, standard solutions, value engineering and efficient execution