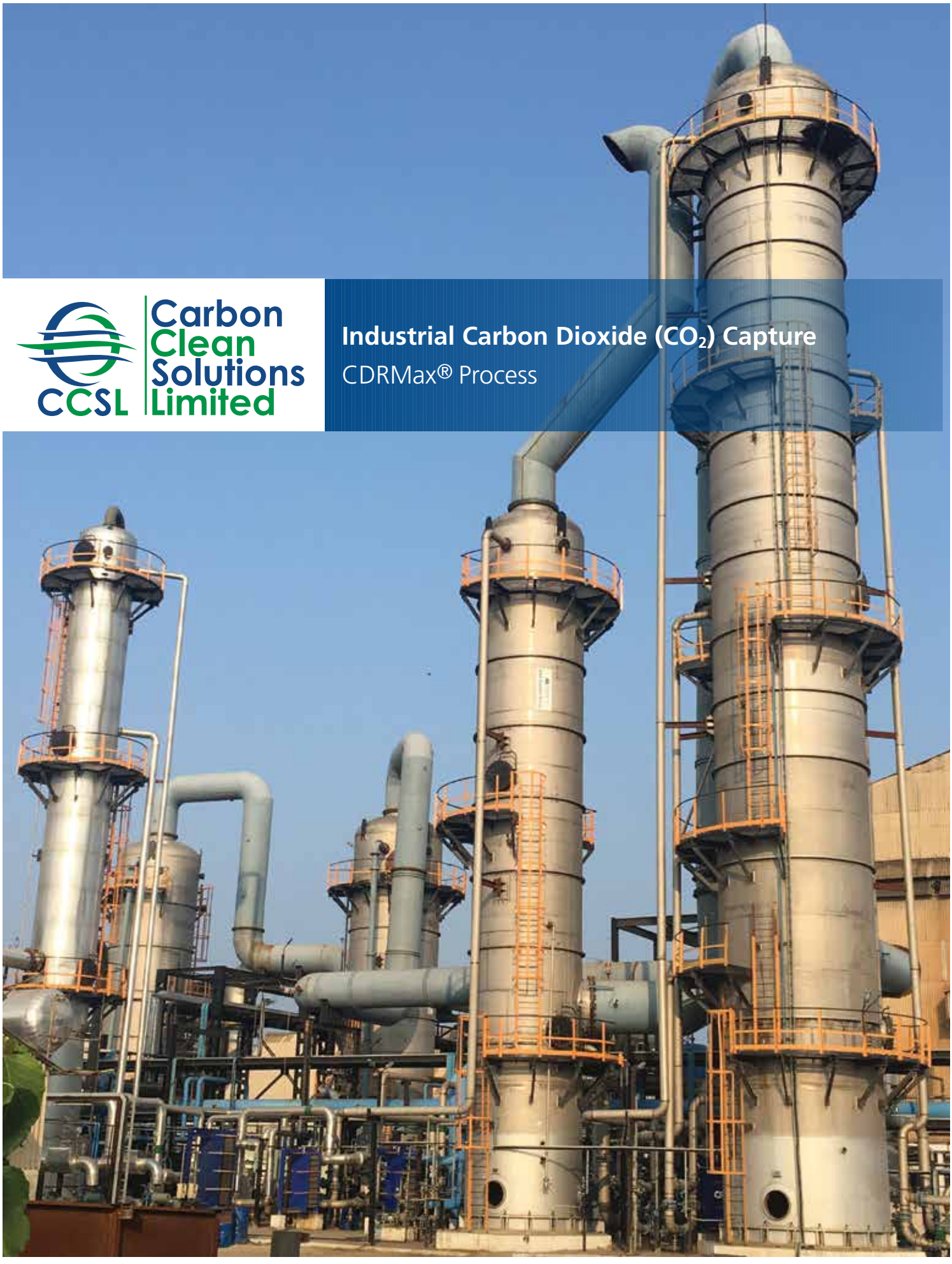
Carbon Clean Solutions Limited

CCSL

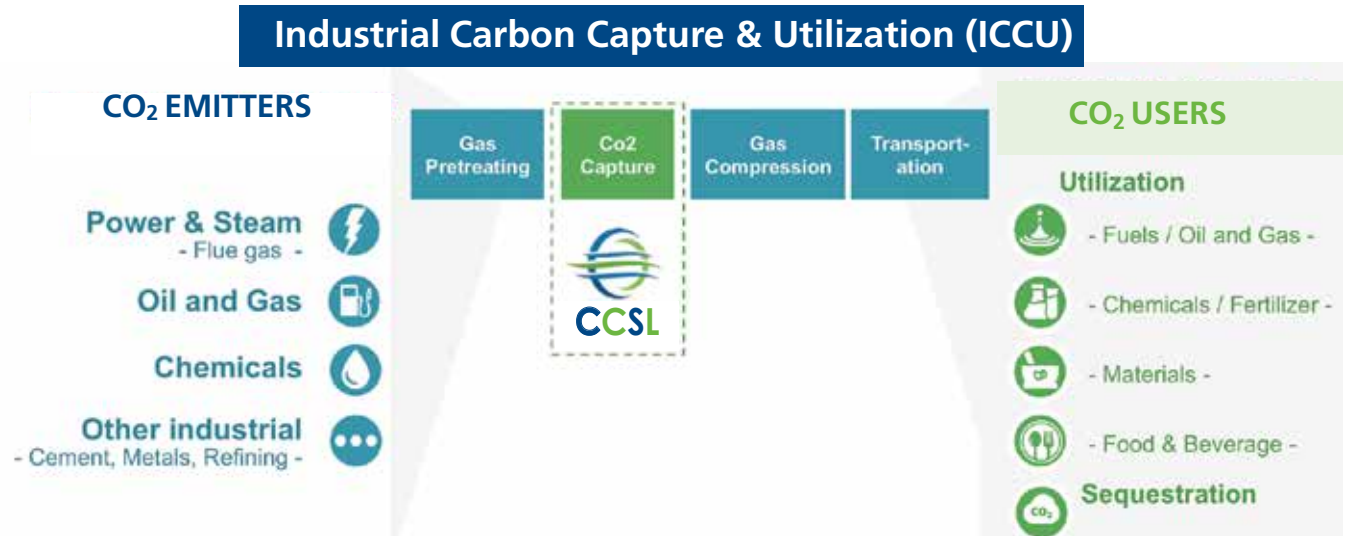
Industrial Carbon Dioxide (CO_2) Capture

CDRMax® Process



The CDRMax® Process

The CDRMax® process captures carbon dioxide (CO_2) from industrial flue gases or off-gases emitted from power plants, boilers, kilns and chemical facilities. The technology removes from 50 to 95% of the CO_2 from natural gas, coal, and petroleum-fired processes to produce industrial grade CO_2. The process is applicable from mid-scale *(100s of metric tons per day)* to large-scale *(1,000s of metric tons per day)* capacities for industrial carbon capture and utilization *(ICCU)* applications.



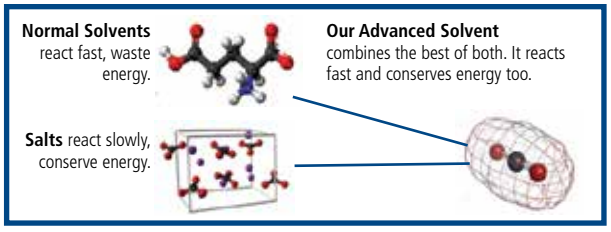
Technology Benefits

CDRMax® operates at atmospheric pressure to capture and purify CO_2 from low pressure flue gas and off-gas streams like kilns. The technology can be flexed to manage CO_2 concentrations in the source gas from 3% to 25% and produce CO_2 with purities between 95-99%.

Reduced Life-Cycle Costs

The CDRMax® process captures more CO_2 with smaller equipment and lower operating costs. CAPEX can be reduced by 20% and OPEX by 40% when compared to conventional MEA-based absorption. The process uses a proprietary solvent that:

- **Increases CO_2 loading to reduce pump sizing & circulation**
- **Reduces heat/power duties by 20-40%**
- **Minimizes corrosion thereby extending equipment life**
- **Requires no anti-foaming and anti-corrosion additives**
- **Keeps working — resists solvent degradation and foaming**
- **Lowers solvent emissions and waste-disposal costs**



For either greenfield plants or as drop-in replacements at brownfield sites, the APBS-CDRMax® solvent will reduce costs and extend plant life without major equipment changes.

Working Principles *(Refer to Process Flow Diagram below.)*

Flue Gas Conditioning – Flue gas is conditioned by an SOx/NOx scrubber **(1)** and then cooled **(2)**.

Absorption – The conditioned gas enters an absorption column where it contacts the counter-current flow of our proprietary solvent for efficient CO_2 absorption.

Washing – The depleted flue gas exits the absorber column and passes through an integrated water washer **(3)** to minimize the loss of the solvent.

Stripping – The CO_2 rich solvent from the absorber bottom flows to the lean/rich heat exchanger **(4)**, where the rich solvent is heated before entering the stripper column. The lean solvent (low CO_2) flows to the reboiler, where it is heated by auxiliary steam (**5**). The steam from the reboiler enters the stripper tower **(6)** flowing upward, counter-current to the rich solution. The absorbed CO_2 is released from the rich solvent and flows to the top of the stripper tower **(7)**. The lean solvent is returned to the absorber column via the lean/rich heat exchanger for further flue gas processing.

The high purity CO_2 is directed to the end-use application. **(8)**

Savings

Regeneration energy
40% less than MEA

Lean solvent flow rate
40% less than MEA

New packing
30% less pump HP

Construction materials
30% less on stainless

Footprint
20% less area

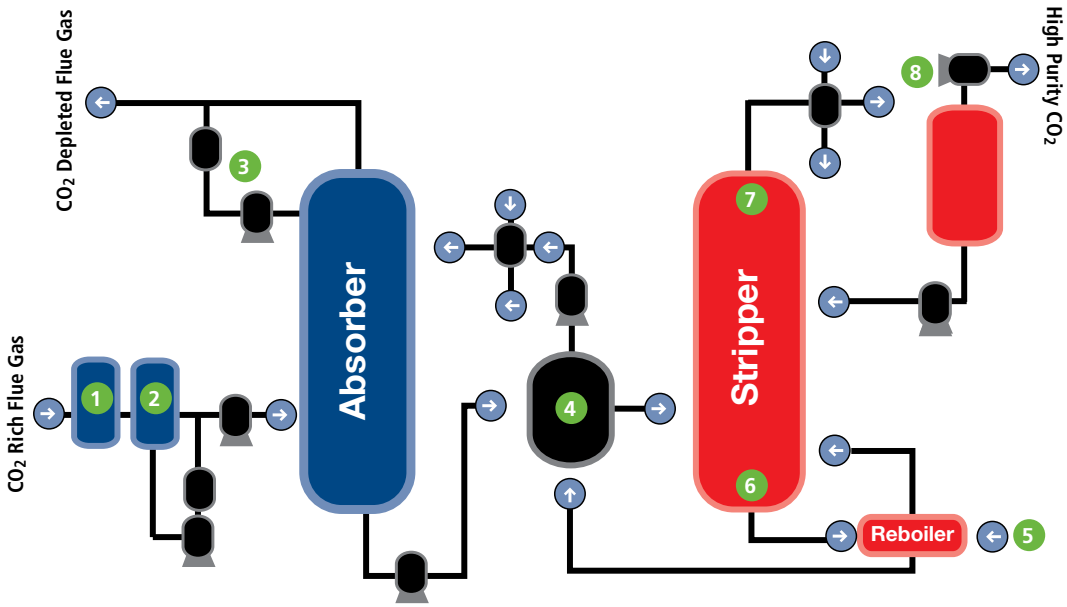
Patented design
10% less energy

Wash water emission
Non-aerosol, low ppb solvent level

Reclaimer
Ion exchange/thermal

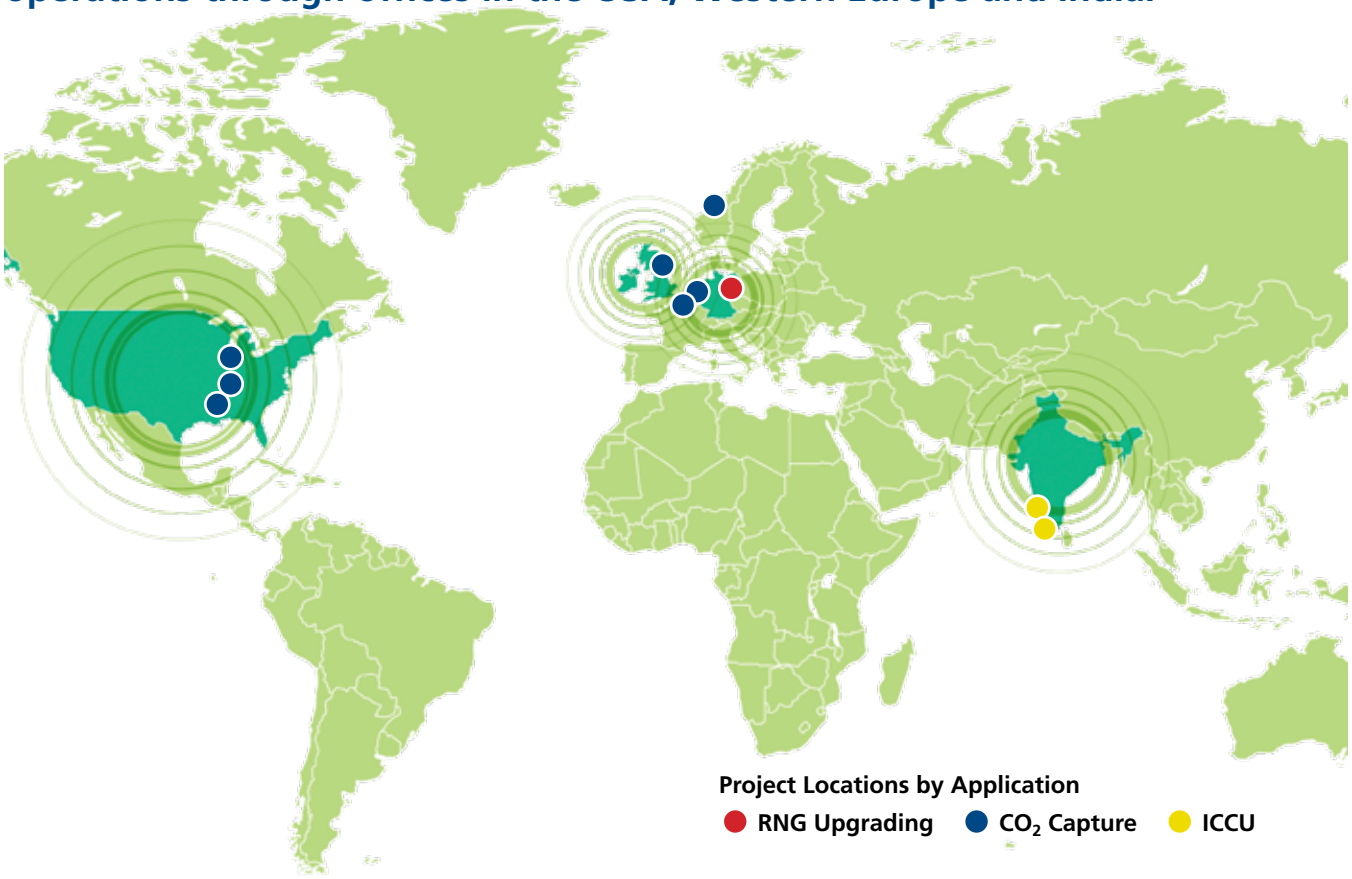
Health & Safety
REACH & GHS compliant

CDRMax® Process Flow Diagram



Presence and Experience

Carbon Clean Solutions maintains headquarters in the UK, and conducts operations through offices in the USA, Western Europe and India.



A Proven Track Record

CCSL is a recognized leader in CO_2 capture and reuse as demonstrated by > 30 plants now operating with our technology or solvent.

ADMINISTRATION

CORPORATE HEADQUARTERS **LONDON, UK**
SALES OFFICE **HAMBURG, DE**
SALES OFFICE **ALICANTE, ES**
SALES OFFICE **CHICAGO, USA**
RESEARCH CENTER **SHEFFIELD, UK**
ENGINEERING CENTER **MUMBAI, INDIA**

Carbon Clean Solutions Limited
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www.carboncleansolutions.com