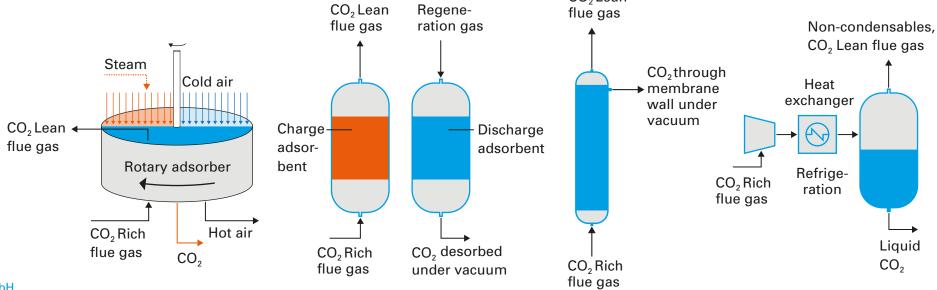
## **CCUS technologies – Adsorption based & others**





CO<sub>2</sub>Lean

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	TSA – temperature swing adsorption and desorption	VSA – vacuum swing adsorption and desorption	Selective membrane separation	Cryogenic CO <sub>2</sub> liquefaction
Separation principle	Adsorption	Adsorption	Membrane	Physical (phase separation)
Specific energy demand	1.5 GJ/t <sub>CO2</sub> (mostly waste heat)	1.7 GJ/t <sub>CO2</sub> (mostly power)	1.20 GJ/t <sub>CO2</sub> (mostly power)	n.a. (mostly power)
Typical temperature	40-60°C	<40°C	30-50°C	-50°C
Typical pressure	Ambient	Cycling between moderate	Moderate pressure flue gas,	20-50 bar <sub>g</sub>
		pressure and vacuum	CO <sub>2</sub> under vacuum	
Typical CO <sub>2</sub> removal	90% (target)	<90%	<80%	>99% (with CO <sub>2</sub> feed >50%)
Typical CO <sub>2</sub> purity	95% (target)	<95%	95%	>99% (with CO <sub>2</sub> feed >50%)
Typically combined with	Standalone	Cryogenic Liquefaction	Amine wash,	VSA,
			Cryogenic Liquefaction	Membrane (eg Cryocap)
Typical plant size (tonnes	200 – 2,000,000	1,000 – 500,000	10,000 – 1,000,000	>100,000
per year CO <sub>2</sub> removal)				
Technology maturity level	Pilot / Commercial, eg Husky	Demonstration / Commercial, eg	Demonstration / Commercial	Demonstration / Commercial,
	Energy SK, Lafarge Holcim	Air Products Port Arthur SMRs,		eg Air Liquide Cryocap at Port-
	Cement, BC	USA		Jérôme SMR, France