

# Technology factsheet: Competitiveness of clean energy technology – Carbon Capture, Utilization and Storage

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## Key technologies

There are over 40 operational facilities, globally, capturing close to 50Mt per year. In most scenarios, some form of carbon capture is essential to meet climate targets.

### Liquid solvent

#### tech 1

Technological  
Readiness Level (TRL)  
2-3: Ionic liquids;  
Encapsulated solvents

#### tech 2

TRL 4-6: Amino  
acid-based solvent/  
Precipitating solvents;  
Phase change solvents;  
Water-lean solvent

#### tech 3

TRL 6-8: Chilled  
ammonia; Serically  
hindered amine

#### tech 4

TRL 9: Traditional  
amine solvents;  
Physical solvents;  
Benfield process

### Solid adsorbent

#### tech 1

TRL 1:  
Electrochemically  
mediated adsorption

#### tech 2

TRL 5-6: Sorbent-  
Enhanced Water  
Gas Shift; Enzyme  
catalysed adsorption

#### tech 3

TRL 7-9: Temperature  
Swing Adsorption; Pressure  
Swing Adsorption / Vacuum  
Swing Adsorption

## Membrane

### tech 1

TRL 2-4: Room Temperature Ionic Liquid; Polymeric membranes/Solvent hybrid

### tech 2

TRL 6-7: Polymeric membranes/Cryogenic separation hybrid; Electrochemical membrane integrated with MCFCs

### tech 3

TRL 9: Gas separation membranes for natural gas processing

## Other

### tech 1

TRL 5-7: Bioenergy with carbon capture and storage (BECCS); direct CO<sub>2</sub> separation; solid looping

### tech 2

TRL 5-9: Cryogenics

### tech 3

TRL 6-8: Oxyfuel combustion; Direct Air Capture (DAC)

## Key value chain figures

- **Global sector turnover:** EUR 2.7 billion (2020, and expected to increase to EUR 5.6 billion by 2027) – of which EUR 1.05 billion in USA and EUR 92 million in EU.
- **Global employment:** 4000 (direct) – of which 4 000 in USA and 200 in EU.



## Key facts

### Fact 1

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CCUS can contribute to decarbonizing multiple industries, including power generation and industrial processes, by generating negative emissions. This makes CCUS a versatile technology for addressing climate change.



### Fact 2

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Although several CCUS technologies are commercially available, there is still uncertainty about the large-scale CCUS deployment, with many projects in the very early stages of development and some technologies being tested. Returns on investment are not yet certain and, in addition, the industry faces challenges of societal acceptance.

### Fact 3

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Newer technologies and upscaling are expected to reduce costs in time.



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