





SFW Carbon Capture Solutions



SFW Oxy+

SFW's Circulating Fluidized Bed (CFB) technology is operated in an oxygen-rich environment allowing the highly efficient recovery of heat and power. This produces a concentrated and readily available CO₂ stream, instead of emitting flue gases into the atmosphere. By replacing air in typical combustion units with oxygen and recirculated CO, rich product gas, capturing CO₂ becomes part of the integrated energy productionprocess. This leads to a reduction in the energy penalty that is typically associated with capturing CO₂.



SFW Oxy+ can be applied as a retrofit in existing plants or as a greenfield project. In both scenarios, the efficient combustion performance leads to lower emissions per unit of energy and can increase the gross production of energy from the industrial unit.

The technology allows sector coupling and industrial symbiosis, whereas by-product oxygen from hydrogen-producing electrolyzers enable the reduction capture cost and further synthesis for green chemicals, fuels and materials.

Project

The technology was demonstrated at the scale of 30 MWth at the Fundacion Ciudad de la Energia (CIUDEN), Spain in 2012.

designs.

Featured project

30 MWth SFW Oxy+ plant in Ponferrada, Spain: Carbon capture and storage demonstration plant with Endesa and CIUDEN during 2009-2017. Design for a full scale 300 MWe plant was developed as part of the project.



This was followed by commercial development with partners to complete the complete the FEED (Front End Engineering Design) activities and develop a readily available 300 MWe SFW Oxy+ power plant design. SFW's R&D and engineering experts continue to develop the solution and adapt innovations linked into our existing

SFW Oxy+ key features:

- Wide fuel range (up to full CFB range)

- SFW Oxy+ allows higher fuel capacity in similar sized air-fired combustion units

 Operational flexibility between air and oxy (or capture) mode

 New builds for optimized SFW Oxy+ performance reduce equipment sizing

 No variable OPEX related to solvent procurement and waste disposal

- Commercially available, scalable and costeffective components





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SFW CaL+



Featured project

Calcium Looping 1.7 MW demo plant Completed in La Pereda, Spain. The pilot plant was commissioned in 2012 with demonstrated capture efficiency of over 90%.

High-quality Calcium Looping with SFW CaL+

SFW CaL+ is a cutting edge Calcium Looping technology for the post-compustion capture of CO₂. It is built on the company's decades-long experience on delivering over 500 Circulating Fluidized Bed reactors (CFBs).

As a carbon capture solution, SFW CaL+ is not only scalable and retrofittable but also cost-efficient, environmentally effective and highly adaptable for capturing CO₂ emissions from multiple industries.

The technology captures and releases high purity CO₂ with the help of a natural and non-toxic sorbent, Calcium. The capture process gets its energy from sustainably sourced bio-residues and waste streams that are supplied to it via oxycombustion.

In SFW CaL+, carbon capture is powered by highly available and affordable oxygen that is produced as a by-product in green hydrogen plants. This synergy reduces capture costs significantly and leads to the efficient synthesis of carbon negative fuels and materials. SFW CaL+ has been tested and piloted since 2012 under industrial operating conditions at the La Pareda power plant in Spain. SFW has also demonstrated the technology with partners from industry and academy in two EU funded projects, CaLby2030 and HERCCULES. With the help of the SFW CaL + technology, the projects concretize a robust solution for the decarbonization of hard-to-abate sectors, such as the iron, steel, cement and power industries

SFW CaL+ key features:

- Additional revenue streams in the form of decarbonized power and lime
- CO₂ capture efficiency of over 90%

Figure. 1 Calcium Looping process concept



Captures other acid gases present in flue gas

System can handle challenging flue gas conditions (high temperature and levels of impurities)

Commercially available, scalable and costeffective components

Can be integrated to emission source, reducing the energy penalty

Sector coupling and oxygen synergy with green hydrogen synthesis



aCO₃ + heat

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SFW HPC+

Taking the most out of Hot Potassium Carbonate

SFW's modular carbon capture plant solution achieves captures rates of over 90 % by employing the Hot Potassium Carbonate (SFW HPC+) process.

The SFW HPC+ solution utilizes Potassium Carbonate. a compound that is widely used in the food, detergent, glass, and fertilizer industries. It is a safe, environmentally friendly, cost-efficient, flexible and well-proven solvent that is commonly used in hundreds of carbon capture plants.

The carbon removal solution includes Capsol Technologies' EoPTM End-Of-Pipe Carbon Capture technology. It lowers the energy consumption in the capture process, allows implementing carbon capture systems into existing plants and also recovers latent heat from flue gases that can be used as energy for district heating.



In the SFW HPC+ process, Potassium Carbonate (K2C0₂) captures CO₂ from cooled and compressed flue gases in an absorber. It reacts with the CO₂ and water, forming Potassium Bicarbonate (2KHCO₂).

This reaction is reversible; Potassium Bicarbonate can be regenerated back into Potassium Carbonate, CO, and water in a desorber, allowing the efficient capture and release of CO₂:

$K2CO_3 + CO_2 + H_2O \leftrightarrow 2KHCO_3$

Compression energy is recovered of the CO₂ depleted flue gases in an expander. This energy is used in the capture system itself and the remaining heat can be exported to a district heating network.

"The SFW HPC+ system covers the two approaches of carbon capture; Storage (CCS) and Utilization (CCU). Whether you want to compress and store or recycle and reuse we've got you!"

SFW HPC+ Key features:

The process has clear benefits for plant operators:

SFW HPC+ is a wellproven carbon capture process with hundreds of references and decades of operational experience in the Chemical, Oil and Gas industries

Figure. 2 The SFW HPC+ process



The SFW HPC+ process can be powered flexibly by electricity and/ or steam

Potassium Carbonate is a highly available, oxygen-resistant, non-toxic, nonvolatile and noncarcinogenic material

The Hot Potassium Carbonate solvent is affordable and reduces the solvent management costs of the carbon capture plant

The Hot Potassium Carbonate solvent facilitates permitting, as it does not pose any risks to the environment or health.



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Powering a decarbonized world for everyone



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Since 1891, Sumitomo SHI FW have developed and delivered the highest quality technology solutions within the everchanging energy market. Now the transition to a net zero world is reshaping industries and economies to improve our impact on our environment.

We work in partnership with our customers, cultivating a deep understanding of their businesses, to deliver integrated energy solutions. We want to be a life-cycle partner, bringing complementary expertise and working closely with our customers across the entire process. This is from customer value creation to design, scope, installation, execution, maintenance, and operations.

We partner with a diverse array of experts to meet rapidly evolving customer needs. With our unique knowledge, proven expertise, leading technology, and global reach, we go further, together. By working closely with our customers, we enhance customer value and can reach decarbonization goals faster.

Whatever the customer challenge, we endeavor to find the solutions.

Powering a decarbonized world for everyone.