

New frontiers in CCUS

Baker Hughes

Gianluca Di Federico

CCUS Market Demand Generation Leader

1 April 2022

Agenda

Introduction

Our positioning in the CCUS value chain

- Capture
- Transportation
- Sequestration
- Utilization

Collaboration to foster CCUS deployment

CCUS is critical to energy decarbonization

CCUS capacity is needed to meet the Paris Agreement climate goals.

Baker Hughes is accelerating technology development—from consultation and project design to compression and monitoring—to help the industry's path to net zero.

New frontiers in CCUS

Technology



Acquisition of Compact Carbon Capture, a pioneering technology development company specializing in compact carbon capture solutions



Exclusive license agreement with SRI to use the Mixed Salt Process (MSP) to expand BH carbon capture portfolio



Investment in a bio-methanation technology company to expand BH portfolio with Power-to-Gas solutions



Acquisition of Industrial Climate Solutions, developer of compact gas-liquid absorption technology for pre- and post-combustion CO₂ capture

Partnerships



MoU to form a strategic and collaborative relationship to develop commercial models and integrate technologies for CO₂ solutions

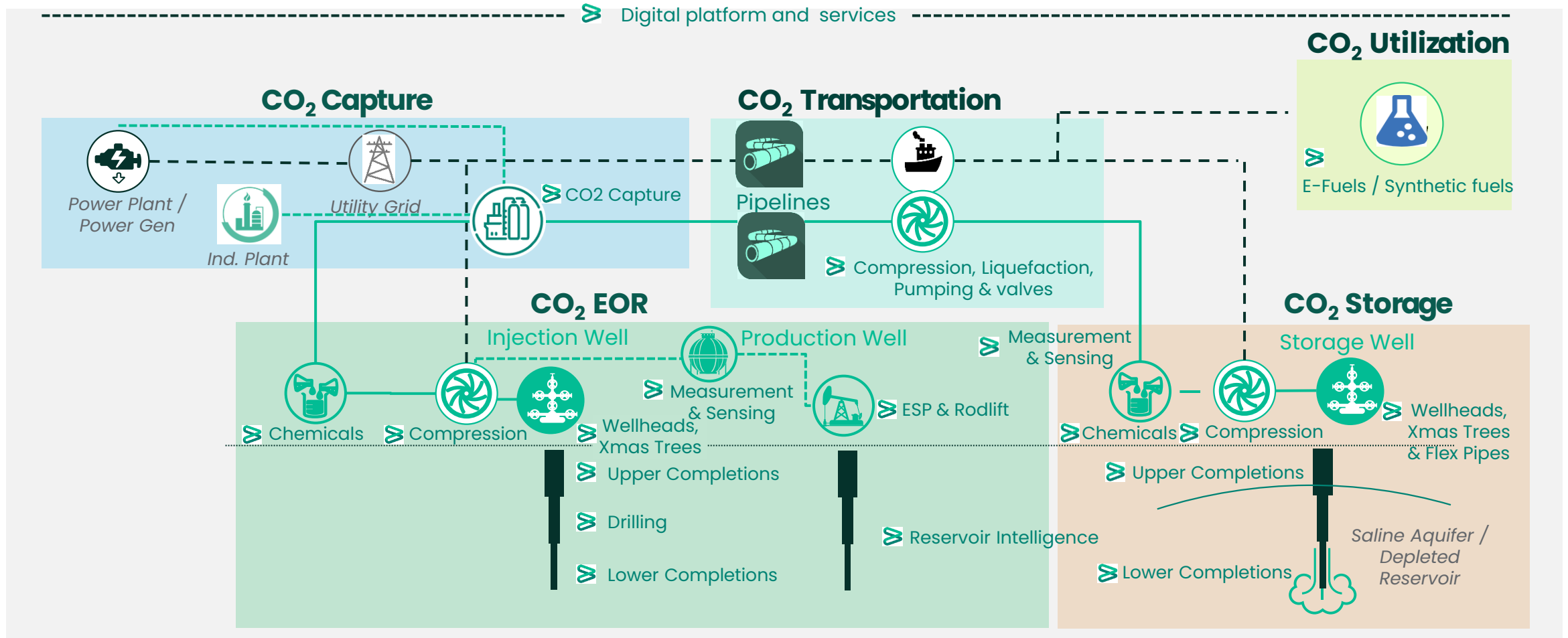


MoU to develop a hub for the decarbonization of industrial sites in the Viken region of Norway – expected to capture 0.6 million tonnes of CO₂

Our positioning in the CCUS value chain

Baker Hughes positioning in the CCUS value chain

A broad portfolio of technologies and expertise to unlock the CCUS market leveraging innovative solutions and business models across all or parts of its value chain



Baker Hughes solvent-based solutions

Technology

Readiness level

Key features

Chilled Ammonia Process (CAP)

Solvent: ammonia-based



1 2 3 4 5 6 7 8 9

Releasing CO₂ at high pressure:

- Reducing compression needs
- Allows for direct liquefaction

Mixed Salt Process (MSP)

Solvent: potassium-based with ammonia



1 2 3 4 5 6 7 8 9

Sustainable solvent:

- Widely available/commodity
- No thermal and oxidative degradation
- Environmentally friendly effluents

Controllable emissions to atmosphere and tolerant to flue-gas contaminants (NO_x, O₂, etc.)

Compact Carbon Capture (CCC)

Solvent agnostic (tested with MEA)

Rotating beds to intensify mass-transfer



1 2 3 4 5 6 7 8 9

More efficient mass-transfer:

- Shorter absorber columns
- Compact regeneration system
- Smaller solvent inventory

Modular and scalable configuration:

- 75% reduction in footprint
- Retrofittable for brownfield applications
- Enabling offshore carbon capture

Industrial Climate Solutions (ICS)

Pulsing froth gas-liquid absorber

Compact size with no moving parts



1 2 3 4 5 6 7 8 9

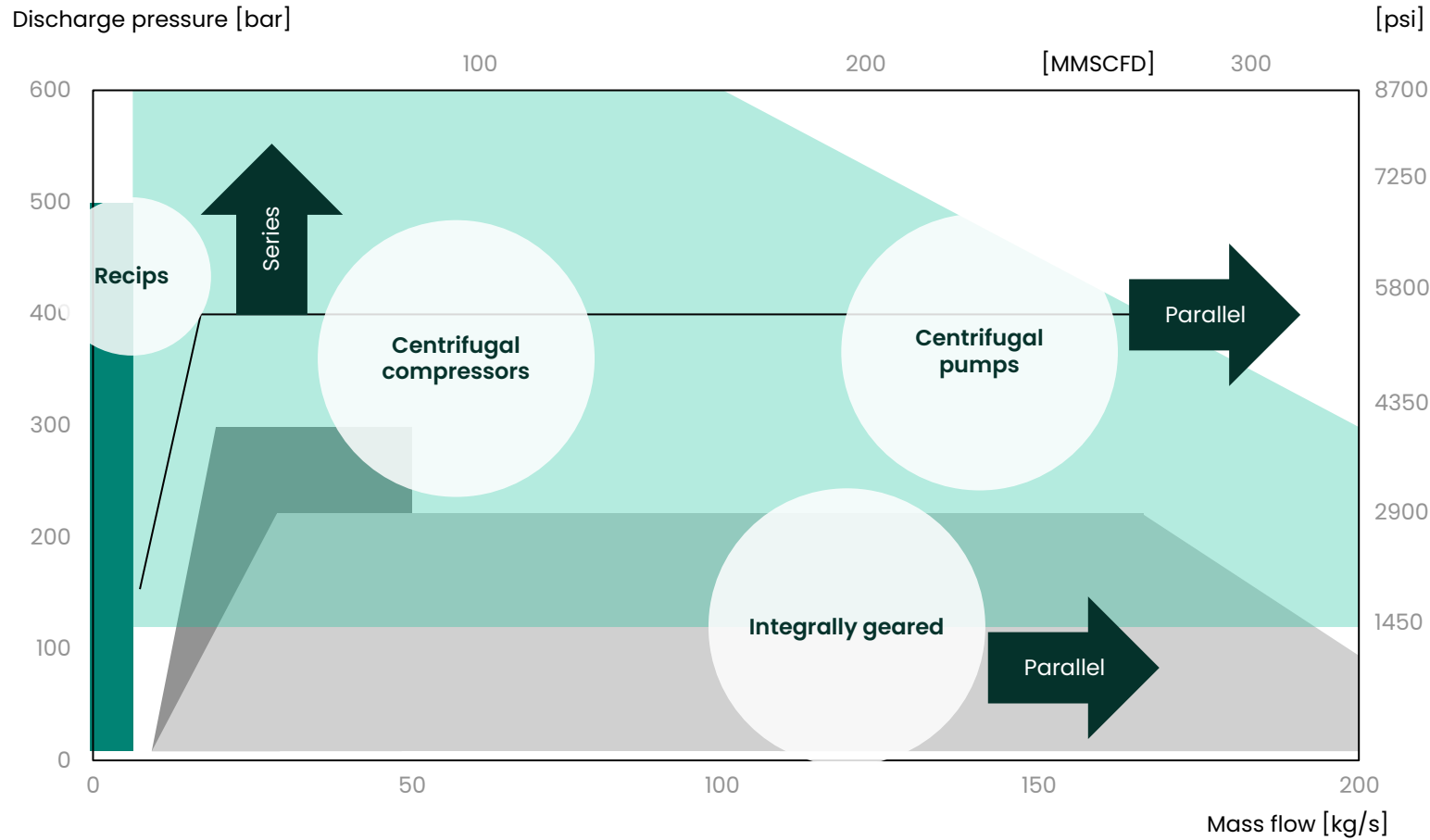
More efficient mass-transfer:

- Reduced column diameter
- Reduced bed depth

Versatile for challenging applications

- Pre- or Post-combustion capture
- Self-cleaning for high-solids processes
- Capture/scrubbing or 2- or 3-phase reactors

Compression & pumping



Centrifugal Pumps

- Design pressure 670bar (API 6A 10000), discharge pressure 540bar
- 10+ kg/s flowrate

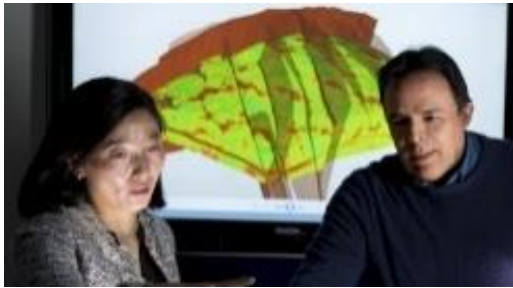


Centrifugal Compressors

- Since 1968, 90+ urea plants, 13Mio operating hours
- Discharge pressure up to 280bar and up to 18MW, inlet flow 300,000+ Nm³/h

Injection & storage capabilities

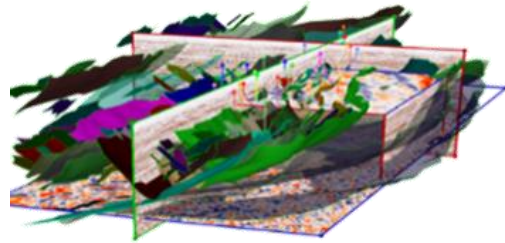
Project development



Storage characterization

- Assess the feasibility of our customer's assets for storage capacity and integrity
- Conduct pre-FEED and FEED studies for storage leveraging our capabilities in geo-mechanical modeling, subsurface engineering and completions design
- Assist with the injection site permit application

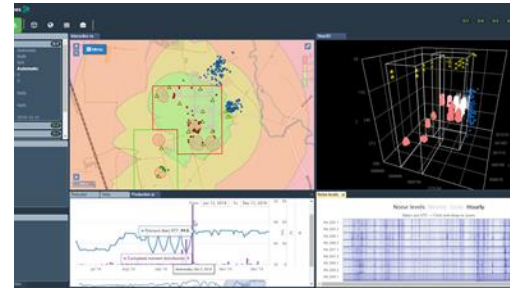
Subsurface storage



Installation optimization

- Provide integrated well services and project management to ensure regulatory compliance, third-party management and timely delivery
- Deliver an optimized injection and monitoring philosophy tailored specifically to project needs
- Customize well designs and service integration to assist each storage project's unique requirements

Asset integrity



Compliance assurance

- Ensure containment across the lifetime of the asset to comply with local and regional regulations
- Provide near-wellbore and formation monitoring services to verify the integrity of the wellbore, the stability of the reservoir and its regional seal
- Real-time monitoring services to reduce risk and number of resources required to manage the long-term injection project

Post-injection care & closure



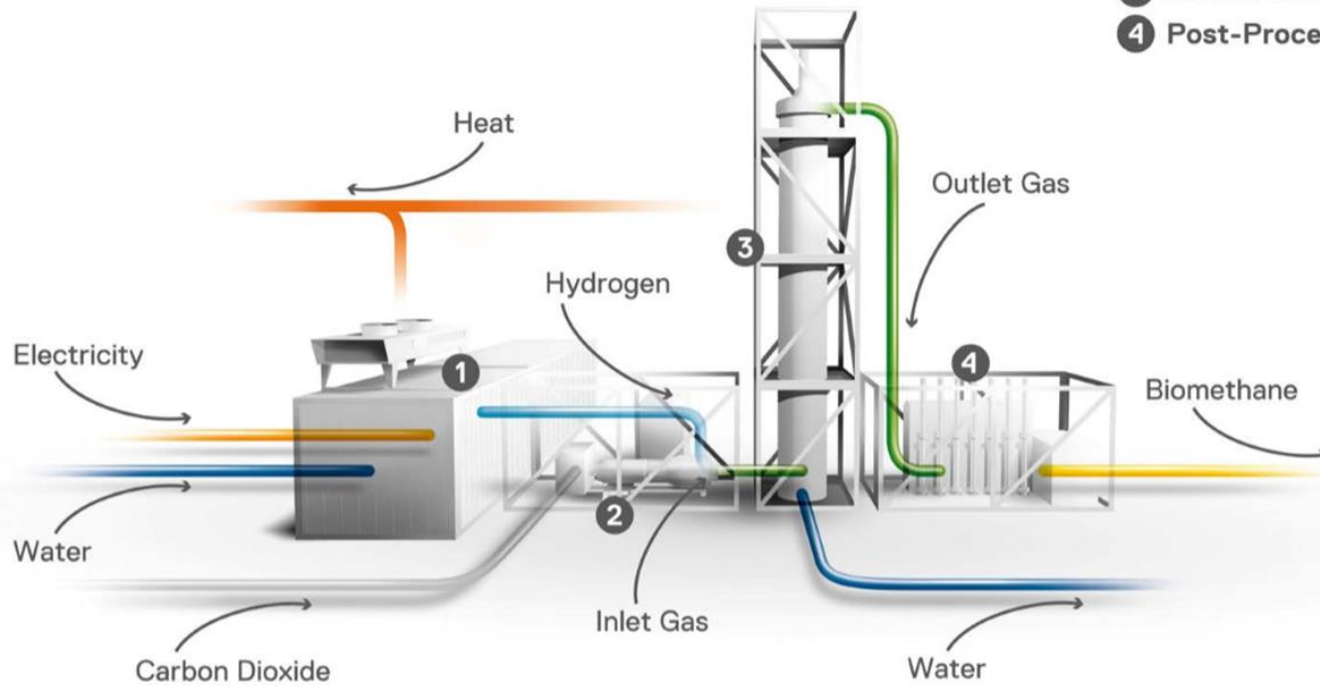
Long-term asset protection

- Assist with site closure through optimized plug and abandonment operations
- Continue asset monitoring with our robust solutions designed to reduce OPEX spend and additional field-based activities
- Continue to assist our customers with long-term regulatory compliance to reduce overall project risk

Converting CO₂ and H₂ into synthetic methane



- 1 Electrolyzer
- 2 Pre-Processing
- 3 BioCat Reactor
- 4 Post-Processing



0.7MWe	
Gas Grid Injection	
Solothurn, Switzerland May 2019	

1MWe	
Gas Grid Injection	
Avedøre, Denmark April 2016	

Energy stored in the methane molecule, to be used whenever needed

Summary

A woman with long blonde hair, wearing a green Baker Hughes work jacket, is looking upwards and to the right. She is standing in an industrial environment with blue and green structural elements. The background is slightly blurred, showing industrial equipment and lighting.

Investing today in the sustainable solutions of tomorrow

- Investing in technology and partnerships
- Innovative processes and equipment
- Compact solutions
- Holistic carbon management
- Enabling renewable energy storage

Baker Hughes 