Ocean GeoLoop

Technology Update

July 2025

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A proven Norwegian carbon capture system with no harmful chemicals without need for heat

Challenges & Triggers

Global industries emit nearly **38 billion tonnes of CO_2 annually**, with record atmospheric CO_2 concentrations hitting ~422 ppm—underscoring the urgent scale of the challenge

Without effective solutions, industries face mounting regulatory pressures, rising costs, and reputational risks that threaten long-term competitiveness

The **growing momentum** among governments and industries to **reduce carbon emissions and embrace circular economies** rapidly accelerates the demand for CO_2 reduction technologies and solutions

Solution

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OGL delivers a **chemical-free, low-energy and fully electric** carbon capture solution. It is robust to real-world pollutants, **integrates easily with existing operations, and does not rely on residual heat** - making it ideal for hard-to-abate sectors. OGL enables clean, efficient decarbonization across key industries such as **lime, cement, and waste-to-energy** - helping decarbonize global value chains

Advantages of OGL's technology across the CCUS value chain

Value chain overview and impact from OGL technology

CO_2 emission plant

The emitting plant can be a **quicklime producer, cement plant, pulp and paper mill, smelter, WtE facility, ammonia plant or any other CO_2-emitting industrial facility**

Advantages:
- Excellent HSE
- Little impact on running production
- Handles complex flue-gas variations
- Lower need for environmental permits
- Easy integration

Carbon capture technology

Ocean GeoLoop's solution is designed to be **flexible and applicable across a wide range of hard-to-abate sectors**

Advantages:
- Autonomous and robust process
- Low energy consumption
- Energy flexibility
- Potential for energy production

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EPC

Ocean GeoLoop will **lead the selection of an independent EPC provider**, either directly or through its own network of partners

Advantages:
- Standardized equipment
- Robust process
- Modular design
- Replicability

Operations & maintenance

The client **may operate the system independently** or choose a **third-party provider**

Ocean GeoLoop may provide O&M services as well, either themselves or through affiliates

Advantages:
- Handles complex flue-gas variations
- Autonomous and robust process
- Low staffing needs
- Self-optimized system

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Transport

The **high-purity CO_2 output** from Ocean GeoLoop's technology can either be utilized directly on-site or **transported via truck, ship, or other means**, depending on the intended use or storage solution

Advantages:
- No residual amines
- NO_X and SO_X is handled inherently in the solution and does not flow with the CO_2 for transport, minimizing downstream technological risks as e.g. pipeline corrosion

Utilisation or storage

Captured CO_2 can be **stored** in geological formations like saline aquifers and basalts, or **used** in feed, building materials, e-fuels, and other industrial products

Advantages:
- High-purity CO_2 output
- Stable, dry gas stream, ready for compression or conversion
- No amines leading to fewer impurities and less downstream contamination

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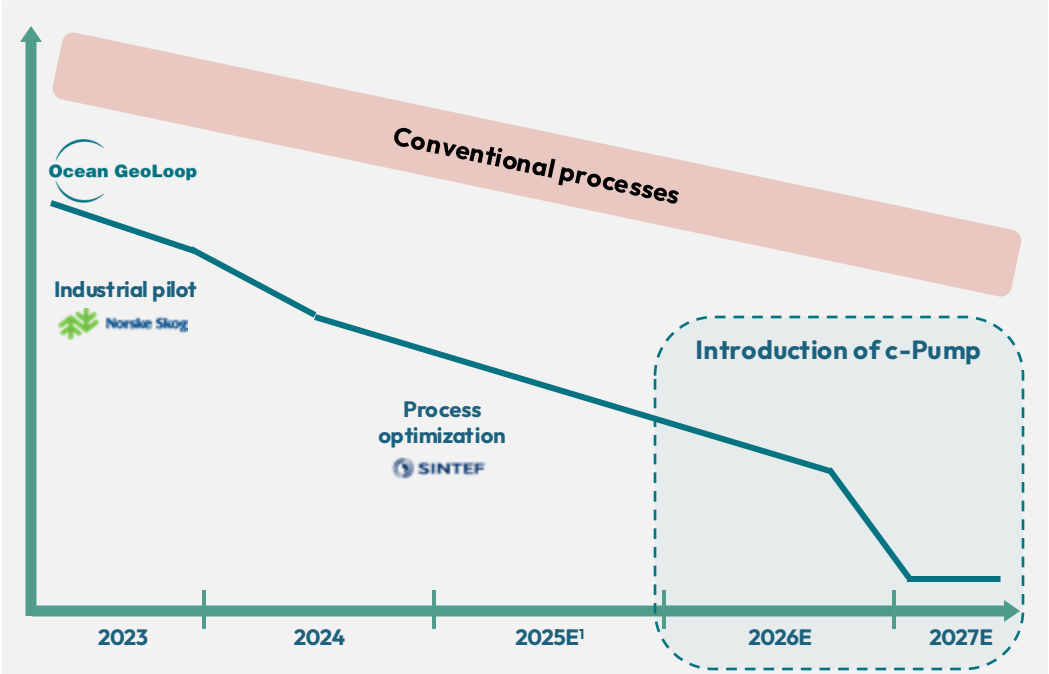
Proven technology with clear roadmap to best-in-class capture cost

Illustrative marginal cost of carbon capture (per tonne)



From industrial pilot until today and going forward

Improvements from industrial pilot until today

- Control system developed for safe, autonomous operations
- Optimized process kinetics through targeted process optimization and materials technologies

- **Digital tools:**
  - Data capture to cloud
  - On-demand visualization
  - Dashboard livestreaming KPIs

- **Introduction of energy recuperation tools:**
  - Francis turbine
  - Turboexpander

Anticipated further improvements going forward

- Continued optimization through materials and process technologies
- Optimization of energy recuperation methods
- Live automatic process optimization by enhanced control system
- Successful introduction of the c-Pump has potential to reduce net electricity consumption to close to zero if sufficient waste heat and cooling is available

(1) Estimated

Proven, 100% clean, autonomous and energy efficient carbon capture

Key benefits and differentiators

Non-toxic – non-amine
- no local emissions or chemical handling

Low staffing needs
- fully autonomous operation

Robust and suited for a broad range of emissions
– universal, versatile and scalable technology

Industrial pilot at Norske Skog Skogn, co-funded by Innovation Norway

Superior energy efficiency
– low energy needs with incorporated energy recuperation

No need for waste heat
- easily integrated electrically powered process

Energy flexibility
- optimization potential using thermal energy

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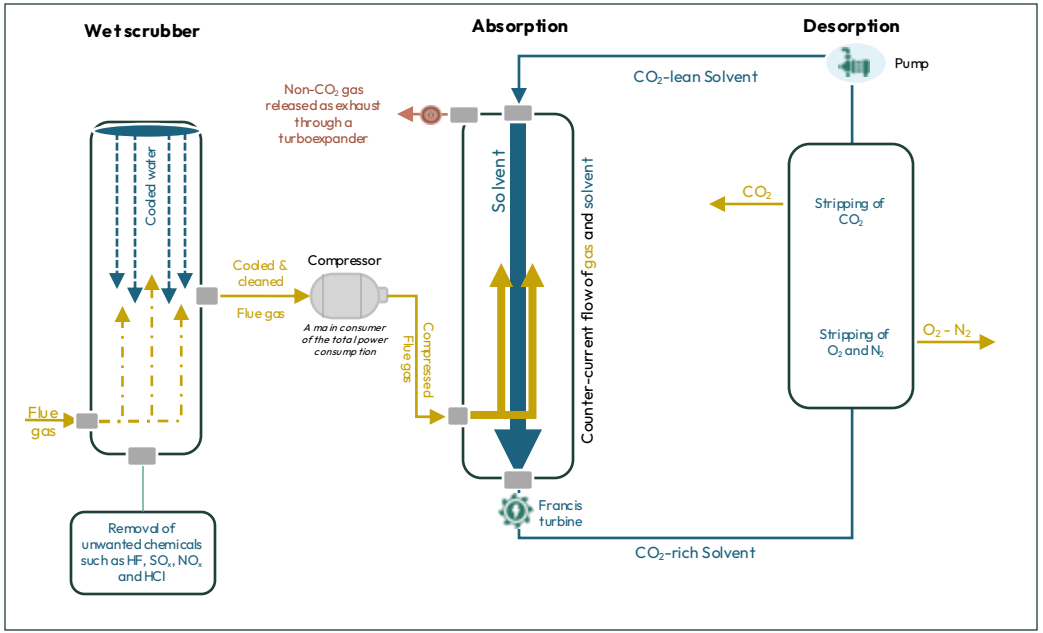
Innovative and energy efficient closed-loop water-based CO_2 capture process



Comments:

Wet scrubber (Preconditioning)
- Initial cooling and scrubbing of the flue gas to remove unwanted particles and chemicals
- Primarily based on standard wet scrubber technology
- Efficient handling of pollutants

Absorption
- A physical process of absorbing the CO_2 from the flue gas in a water-based liquid
- As the gas rises in the absorption column, it meets fresher liquid allowing for efficient uptake of the CO_2 component in the gas
- Relies on proprietary IPR to achieve continuous high CO_2 concentration and stable solvent absorption capacity

Desorption
- Through low-pressure stripping and proprietary OGL techniques, the CO_2-rich liquid phase is regenerated and reused for sustained CO_2 capture
- OGL's proprietary IPR facilitates rapid and cost-efficient CO_2 stripping, by improving the desorption kinetics (reducing the energy consumption), including the use of advanced materials technologies setting it apart from other physical methods
- Use of a proprietary control system to optimize the process, including handling of process variations

Energy recovery
- The CO_2-rich liquid is depressurized through a Francis turbine
- A turboexpander is used to convert pressure energy into mechanical work

Digital infrastructure
- The capture system is supported by a comprehensive digital infrastructure, including autonomous cloud-based operations
- Supported by real-time data integration Model Predictive Control is currently in development to enable self-optimizing operations and system performance

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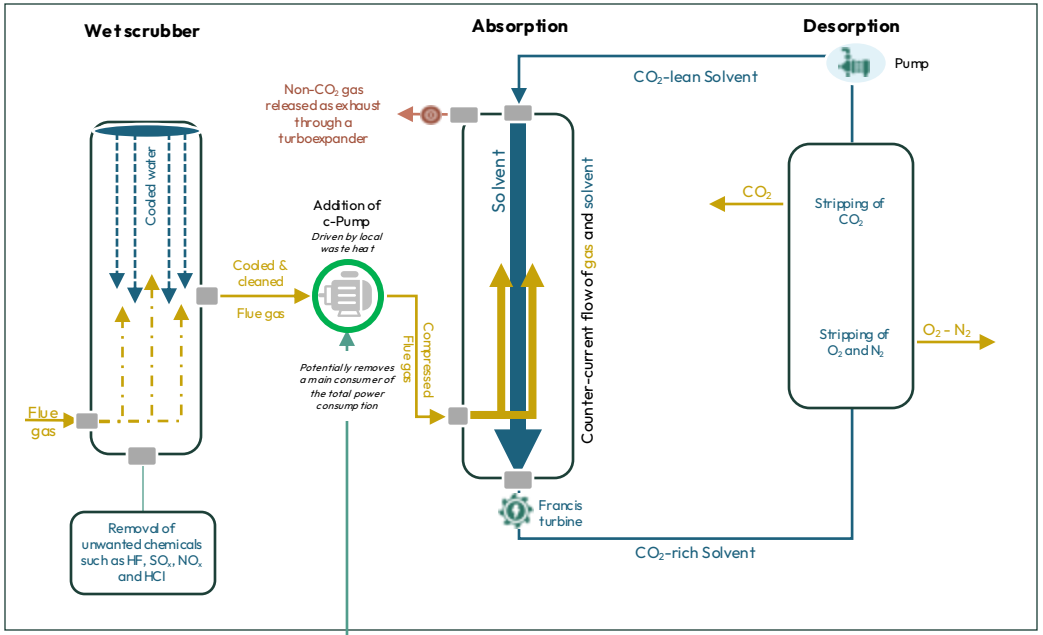
Addition of c-Pump can reduce net electricity demand by >80%



c-Pump
Relies on available thermal contrasts to produce mechanical or electrical energy

Comments:

- **If sufficient waste heat and cooling is available**, the c-Pump can be integrated in the facility by replacing the compressor, effectively reducing the net electricity demand to close to zero
- The c-Pump is a heat engine, utilizing heat differences, taking the waste heat and turning it into mechanical energy to compress the flue gas
- Facilities in areas with limited grid capacity can benefit from implementation of the c-Pump by significantly reducing their electricity need
- Could potentially connect a generator between the wet scrubber and the c-Pump to achieve the exact pressure needed for the c-Pump to generate sufficient mechanical energy, and generate electricity in the process
- The capex of the c-Pump is expected to be comparable to the capex of the compressor
- Building on our established commercial partnership with Herøya Industry park, we intend to jointly explore and initiate pilot testing activities on the c-Pump during 2026

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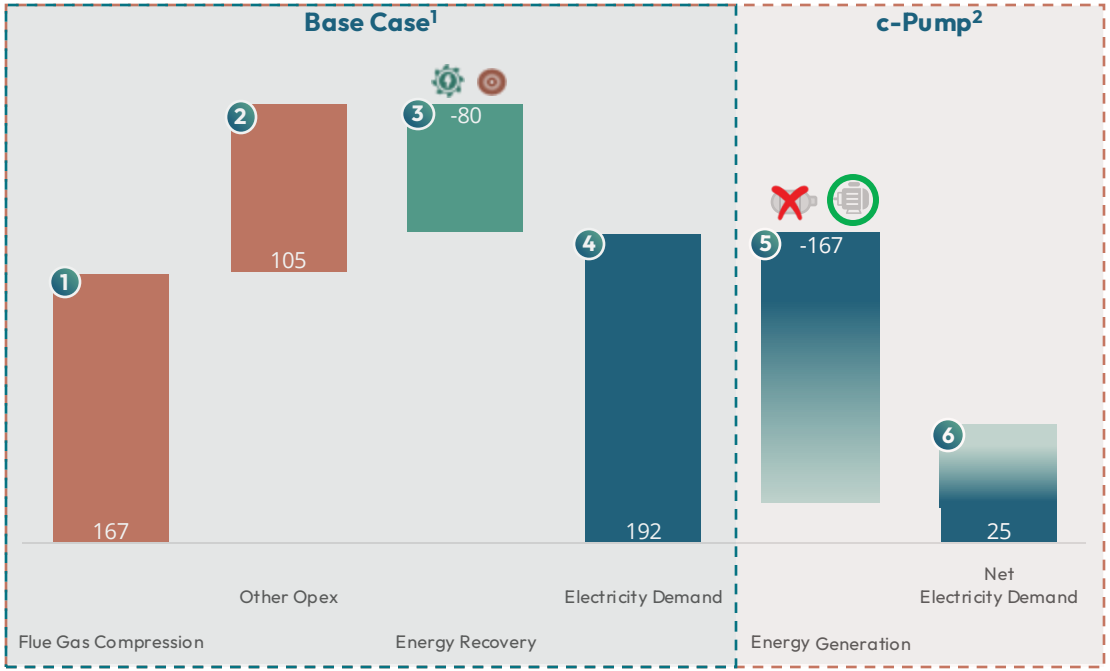
c-Pump: Can be used where excess waste heat and cooling is available

Net electricity demand (kWh/tonne CO_2 captured)



Comments

1. 167 kWh/tonne, or 61% of opex, stems from flue gas compression
2. 105 kWh/tonne, or 39% of opex, stems from other opex elements
3. Energy recovery of 80 kWh is a result of utilizing a Francis turbine and a turboexpander
4. Net electricity demand is in the size order of 200 kWh electric energy per tonne for flue gases with 25 % CO_2 concentration
5. The c-Pump has potential to reduce net electricity demand by >80% in plants with excess waste heat and cooling. The recovered energy could match the full 167 kWh currently consumed by compression, be slightly less, or potentially even exceed that amount depending on available waste heat and cooling
6. A full-scale plant with sufficient waste heat and cooling, will potentially have a net electricity demand of approximately 25 kWh per tonne, depending on the energy recovery from the c-Pump

(1) SINTEF Report 2024/01162: "Energy consumption in the OceanGeoLoop CO_2 Capture Process";
(2) SINTEF Report 2024/00619: «Analysis of the c-Pump system"

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