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### New Barrier Materials with Low CO<sub>2</sub> Footprint

TotalEnergies

ConocoPhillips







Global Cement Produced in 2022 4100 Million tons!

# **2600 Million tons CO<sub>2</sub>!**

Global CO<sub>2</sub> emission per year, 6-8% !

![](_page_2_Picture_3.jpeg)

# **GEOPOLYMERS**

![](_page_3_Picture_1.jpeg)

![](_page_4_Picture_0.jpeg)

![](_page_5_Figure_0.jpeg)

![](_page_5_Picture_1.jpeg)

## **Notable Milestones Achieved**

![](_page_6_Figure_1.jpeg)

**Geopolymer + Expansive Agent** 

![](_page_6_Picture_3.jpeg)

![](_page_6_Picture_4.jpeg)

# **Durable Geopolymers**

#### Granite-based Geopolymers (One-Part System) Exposed to Brine

![](_page_8_Picture_1.jpeg)

![](_page_8_Picture_2.jpeg)

![](_page_8_Picture_3.jpeg)

#### Main findings

University of Stavange

- Improved stability in the presence of brine, even with significant thermal shocks, independent of brine composition.
- Long-term stability in the presence of CO<sub>2</sub>saturated water.

![](_page_9_Picture_3.jpeg)

#### Granite-based Geopolymers (Two-Part System) Exposed to H<sub>2</sub>S

#### **Exposure details**

100 °C, 10 bar
H<sub>2</sub>S gas (0.5 %) dissolved in nitrogen
5000 ppm H<sub>2</sub>S in lab vs. <50 ppm at NCS</li>

![](_page_10_Figure_3.jpeg)

![](_page_10_Picture_4.jpeg)

![](_page_10_Picture_5.jpeg)

![](_page_10_Picture_6.jpeg)

Granite-based Geopolymers (Two-Part System)

![](_page_11_Figure_1.jpeg)

![](_page_11_Picture_2.jpeg)

#### The Way Forward

![](_page_12_Picture_1.jpeg)

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Research Develop Deploy
Current TRL

From medium-scale to field-test Brazil for field testing and globalization purposes Offshore Norway (e.g., dry well)

![](_page_12_Picture_4.jpeg)