What are gas hydrates?

Gas hydrates are in the family of unconventional gas resources, along with shale gas, tight gas, and coalbed methane. Gas hydrates are chemical compounds resembling ice, which form a solid lattice around a molecule of gas. They require high pressures or low temperatures and sufficient quantities of gas to form and remain stable. Historically, gas hydrates have mostly been viewed as a threat to oil and gas operations.

Gas hydrates form primarily within permafrost and below the seafloor. They can be hosted in sands, clay, or grow as seafloor mounds.

Exploration
Notable exploration campaigns have already occurred around the world. Sand-rich sediments stand out as the most feasible source in the near term. Gas hydrate resources in sand sediments are plentiful.

Production
There are four main ways to produce gas hydrates:
- **Depressurization**
- **Thermal stimulation**
- **CO₂ / Methane exchange**
- **Chemical injection**

Depressurization is the most efficient method for sand-rich reservoirs. Impact on geomechanical stability from prolonged production is still unknown. Short duration production tests have been carried out in the North American arctic and offshore Japan. Challenges to production include (secondary) reformation of hydrates during extraction and high levels of by-products (sand and water).

The man-made production of gas hydrates is not expected to impact naturally occurring gas hydrate emissions, which occur independently. Climate change-driven methane emissions should be long-term rather than explosive, as was once assumed.

Economics
Economics for production is still highly speculative and will be impacted by certain key factors:
- Well spacing requirements
- Production profiles
- Recovery factors

Prolonged production tests (6-12 months) will help refine assumptions and factors in economic models. Early commercial production is likely to come from Asia, where drivers are favourable:
- Less natural gas availability (vs North America)
- Higher gas prices

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Gas hydrate blockage

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Exploitation techniques
- **Injection of inhibitors**
- **CO₂ injection**
- **Thermal stimulation**
- **CSEM²**
- **Pressure coring**
- **Natural gas transportation**
- **Acoustic logging**
- **Nuclear magnetic resonance**
- **Resource development strategies¹**
- **CO₂ sequestration & disposal**
- **Microwave heating**

Industrial use of gas hydrates
- **Gas hydrate blockage**
- **Desalination**
- **Sour-gas separation**
- **Natural gas transportation**
- **CO₂ sequestration & disposal**
- **Microwave heating**

Operations
- **Injection of inhibitors**
- **CO₂ injection**
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