

Supercritical CO₂ WG meeting

5 May 2026, online

Meeting agenda

- Opening – reminder of the last meeting @ ETN's AGM & Workshop (March 2026)
- Supply chain gap analysis
- CAPEX estimation for an sCO₂ power cycle
- Possible new activities
 - Study on available sCO₂ test rigs
 - Lessons learnt from sCO₂ demo projects
- Next episode of sCO₂ webinar

Summary of the sCO₂ roundtable

During the ETN AGM & Workshop

- Need for a consolidated view of **pilot and prototype learnings**
 - lessons learned: what worked, what did not
 - current sCO₂ test rigs and technologies, both direct- and indirect-fired
- Strong interest in further detail on **direct-fired sCO₂ cycles**
 - system-level design details
 - TEA/sensitivity work to clarify pathways to financial viability
- Open question around the **“China effect”**
 - proof of viability, or mainly a deployment exercise?
- Additional discussion centered on
 - the most effective system configuration, temperature ranges and post-combustion approaches

Supply chain gap analysis

Why This Work Matters

sCO₂ cycles offer compelling efficiency gains — but enthusiasm is outpacing supply chain reality.

1

Is sCO₂ ready for scale-up?

Technology is advancing, but pilot milestones do not equal commercial readiness. Gap analysis separates signal from noise.

2

Where are the critical gaps?

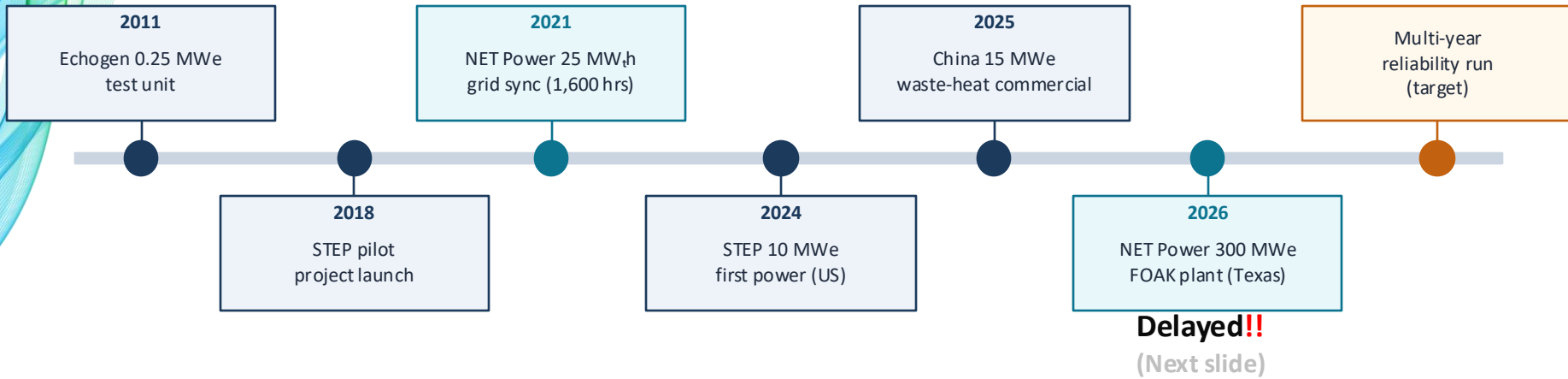
Five supply chain bottlenecks—spanning heat exchangers, turbomachinery, materials, sub-components, and manufacturing—constrain repeatable deployment.

3

Which path deserves focus?

Two architectures are in play. Understanding their relative maturity shapes where capital and development effort should be directed near-term.

Where the Technology Stands Today



Delayed!!
(Next slide)

- Indirect (Brayton)
- Direct (Allam-Fetvedt)
- Both / Target

↗ *First power has been generated — but no system has yet proven multi-year commercial operation.*

Technology Is Moving — Supply Chain Is Lagging

TECHNOLOGY READINESS

- 10 MWe pilot successfully generated power (2024)
- Direct cycle logged >1,600 operating hours
- Turbine design validated at 27,000 RPM
- Multiple developers actively advancing designs

TRL 6–7

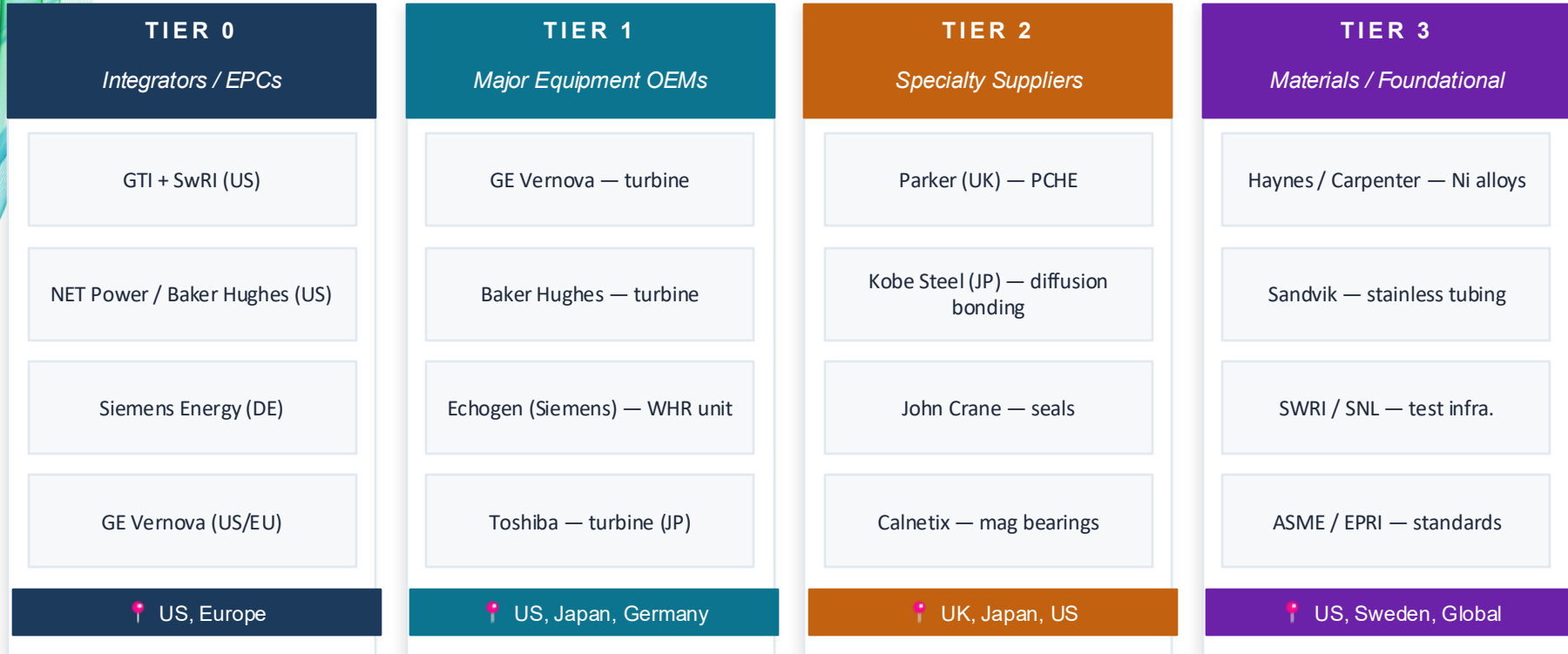
SUPPLY CHAIN READINESS

- No standardized, off-the-shelf component catalog
- Turbomachinery: only one-off, bespoke units built
- Materials qualification incomplete under ASME code
- No multi-year operational data to support warranties

SCL 2–3

➤ *The gap between TRL and supply chain readiness is a high risk of sCO₂ scale-up.*

Supply Chain Map: Four Tiers, High Regional Concentration



CAPEX estimation for an sCO₂ power cycle

Update May 2026

Main criticalities

No end-user's
involvement so far

Missing WHRU team member

- Insufficient information on environmental data from real cases
- Lack of directive to properly address the technical studies to meet End User's needs
- Missing crucial data on size and costs of direct exchange

At the AGM...

- **End User Involvement – Equinor** supports to give the right approach to boundaries and needed plus/cons of the technology
- **Identified potential supplier of WHRU** with some expertise in the field – in progress preparation of MR based on defined cycle

End User's Involvement – First Up

- **Weight and Size is a priority vs Efficiency**
- **Include auxiliary systems and size them appropriately** (on a traditional steam cycle, weight and size of water and condensate treatment can be half size of the power train)
- Take into account that **Steam will be needed anyway on an Offshore Facility** (so, cut only additional auxiliaries needed for Steam Power Cycle)
- Make comparisons between **interconnecting piping** between traditional steam cycle and SCO2 cycle
- **Use P&Id** to define differences
- Include strategies **for first fillings and fluid management (offshore)**
- **Ramp up time** can be a critical factor, and management of trips and shut-downs

Next Steps

- **Re-shape Workgroup meetings:** maximising involvement of participants concentrating the meeting focus on specific topics
- **Identify a potential «case» with End Users** to have the proper input data to direct properly the technical effort

Possible new activities

Study on available sCO₂ test rigs

- **Objective:** to create an overview of available sCO₂ test rigs
- No survey is intended, **publicly available information** sources only
- **Task force team** is yet to be defined → call for volunteers!

Lessons learnt from past sCO₂ demo projects

- **Objectives:** analyse the known sCO₂ demo projects
 - Project objectives vs. achieved reality
 - Implementation challenges
 - Success/failure factors (what assumptions turned wrong?)
 - Financial aspect (costs vs. value)
 - Scalability/replicability
 - Transferable lessons learnt
- **Task force team** is yet to be defined → call for volunteers!

Next episode of the sCO₂ webinar

E11 – Techno-economic analysis of an oxy-combustion cycle

- The topic was decided based on the discussion with ETN members during the AGM & Workshop event (March 2026)
- Speakers yet to be confirmed
 - ISOP project
 - Politecnico di Milano
 - End-user?

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Thank you for your attention