

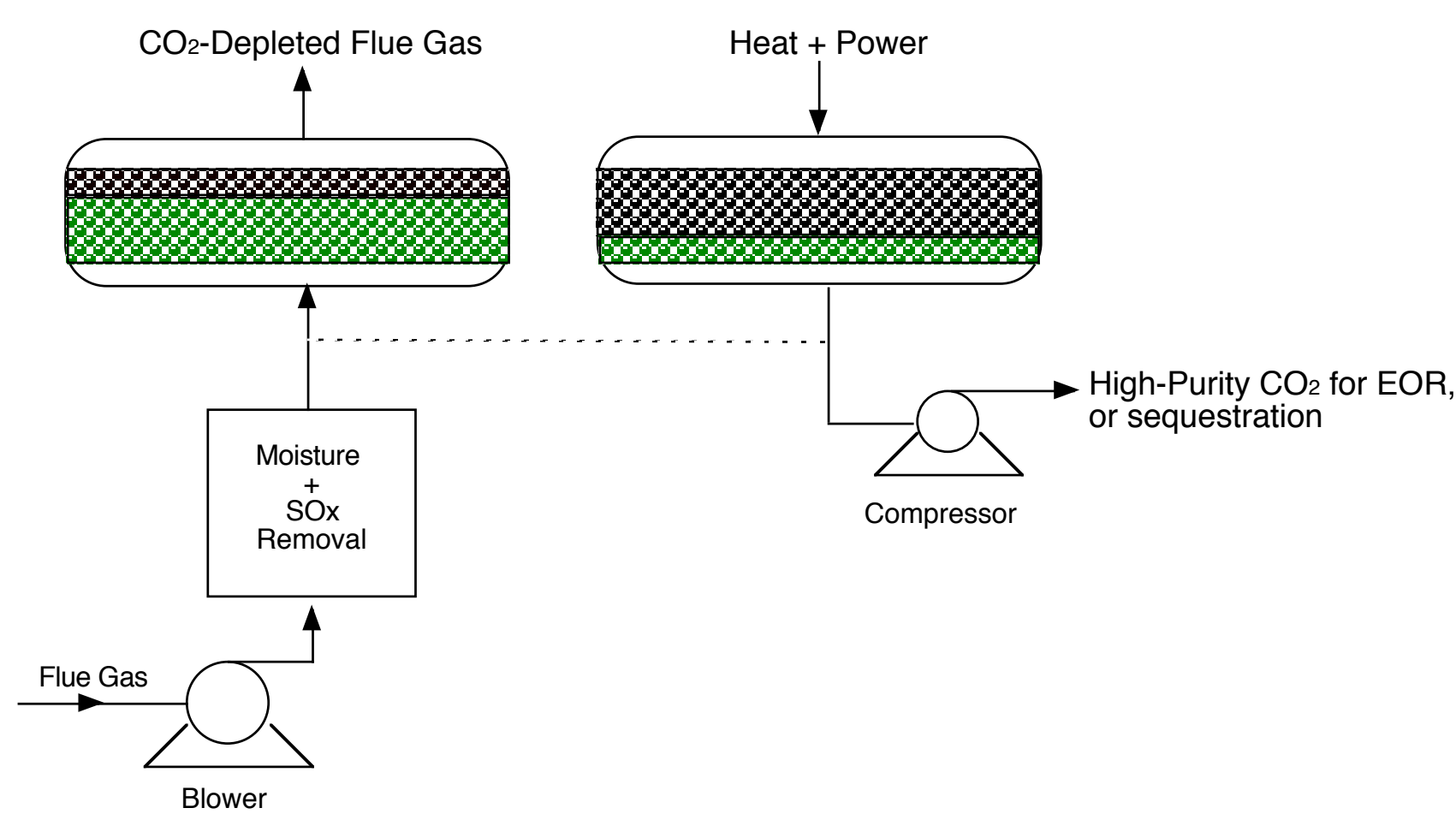
Inno₂Sepra

Transformational Sorbent-Based Process for a Substantial Reduction in the Capture Cost (FE31722)

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InnoSepra CO₂ Capture Process

- Physical sorbents with low heat of adsorption (0.8 GJ/MT), >98% purity, >95% recovery



- 1.4-1.6 GJ/MT thermal energy required at 110°C, >60% reduction in power lost due to steam extraction compared to Shell Cansolv, <15% of a SCPC plant's output for CO₂ capture and compression
- A capture cost of <\$25/MT based on lab and TCM field tests and a detailed TEA**, at least 40% lower than Shell Cansolv
- <4% loss in plant's power output with the use of a gas turbine to replace lost power output
- Lab testing, process simulation and preliminary TEA during Phase I
- Pilot plant fabrication, testing at TCM, detailed process design and a final TEA, EH&S Risk Analysis, and Technology Gap Analysis during Phase II
- Total project funding of about \$5.07 MM (about \$1.06 MM in cost share with significant TCM contribution), Project Manager: Mariah Young

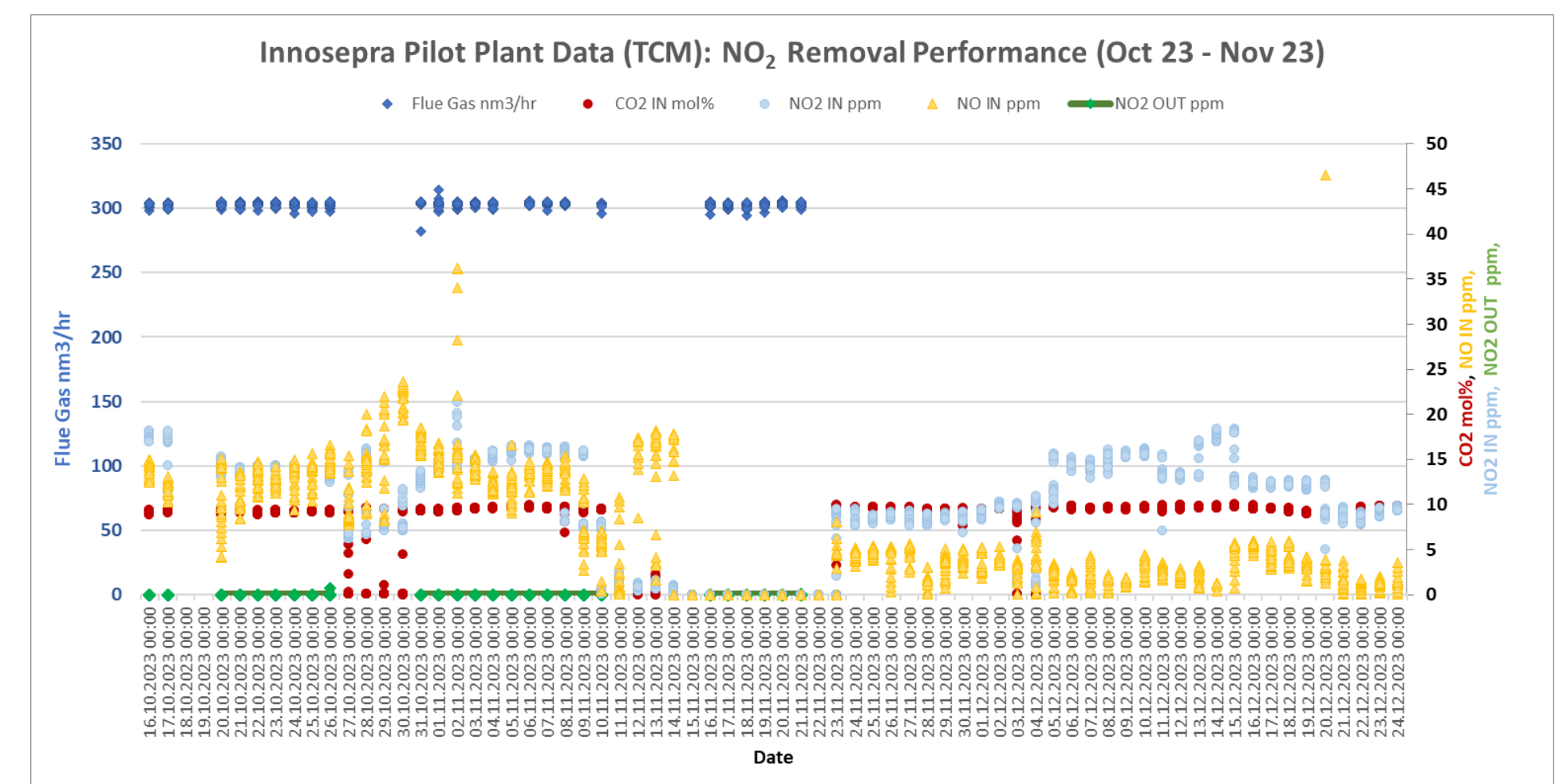
TCM Pilot Plant



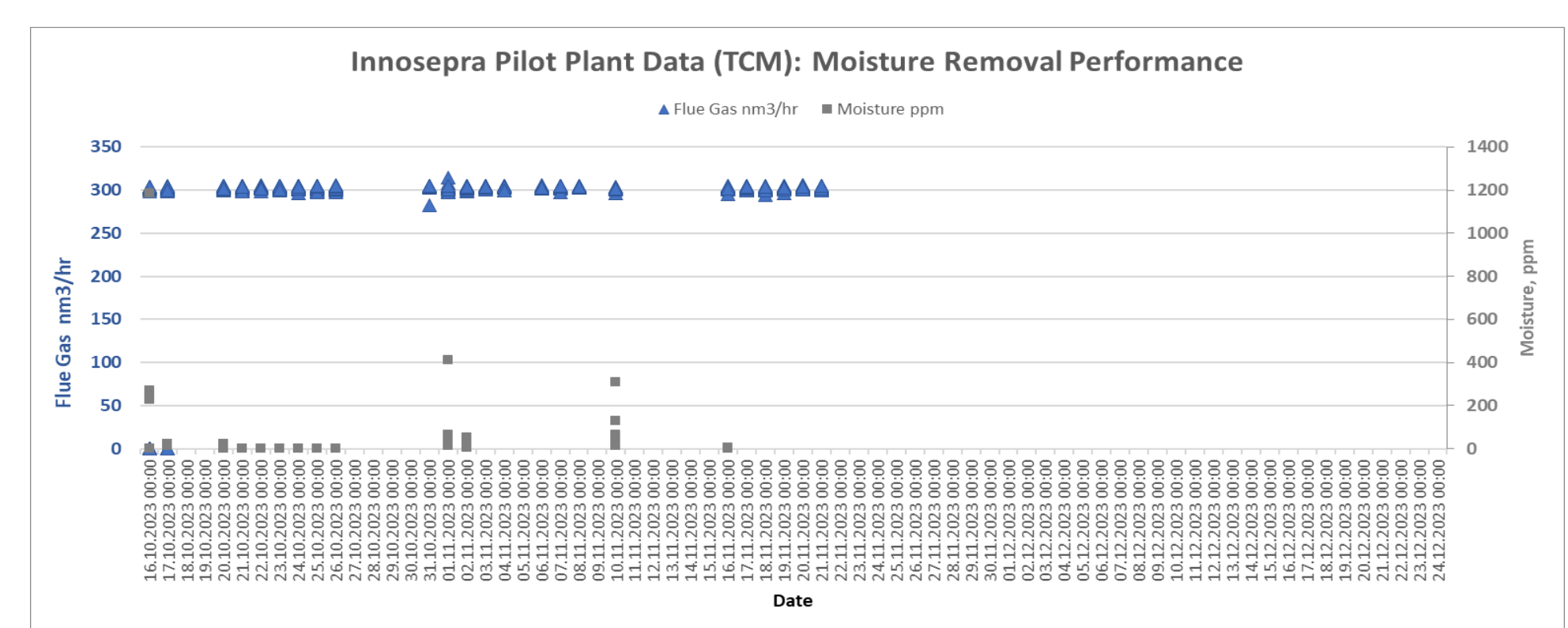
- Pilot plant consists of three skids
 - A flue gas purification, feed compression and cooling, and the feed drying skid
 - A 4-bed CO₂ capture skid for continuous operation
 - A vacuum pump and the regeneration skid

Pilot Scale Testing at TCM

- More than 800 hours of flue gas purification testing (300-500 nm³/hr), nearly 100% removal of NO₂



- Potential for >80% reduction in emissions, and >75% reduction in solvent replacement cost**
- >300 hours of flue gas drying, <5-ppm moisture



- >15 breakthrough tests, 8-12-wt% CO₂ capacity
- >10 regeneration experiments, <1.4 GJ/MT thermal energy needed
- Additional lab tests to confirm >90% recovery, >98% purity

Process Simulation and the TEA

- ASPEN Plus simulation based on a 650 MWnet (Case B12A, 2019 Baseline Report) indicates
 - 99.5% purity, 95% recovery, 1.6 GJ/MT thermal energy requirement at 110°C
 - 91.6 MW total power loss, 14% of plant output**
- TEA for the InnoSepra Process indicates
 - A \$600 MM increase in TASC over the base power plant for CO₂ capture, and **a breakeven CO₂ capture cost of \$25/MT**
 - Additional cases to reduce the loss of power output through use of a gas turbine evaluated

	Case B12A	Case B12B-Derate	Case B12C-Inno	Case B12D-Inno
Total As Spent Cost, \$MM	1,937	2,956	2,625	2,804
Total Annual Cost, \$MM	312	420	396	437
LCOE*, \$/MWH	64.4	112.4	95.4	92.8
Breakeven CO ₂ capture cost (no T&S), \$/MT	-	46.0	25.1	36.9
CO ₂ Sales Price for no Increase in Power Cost, \$/MT	-	-	38.1	39.4
Net Power Output, MWh	650	502	558.4	632.0