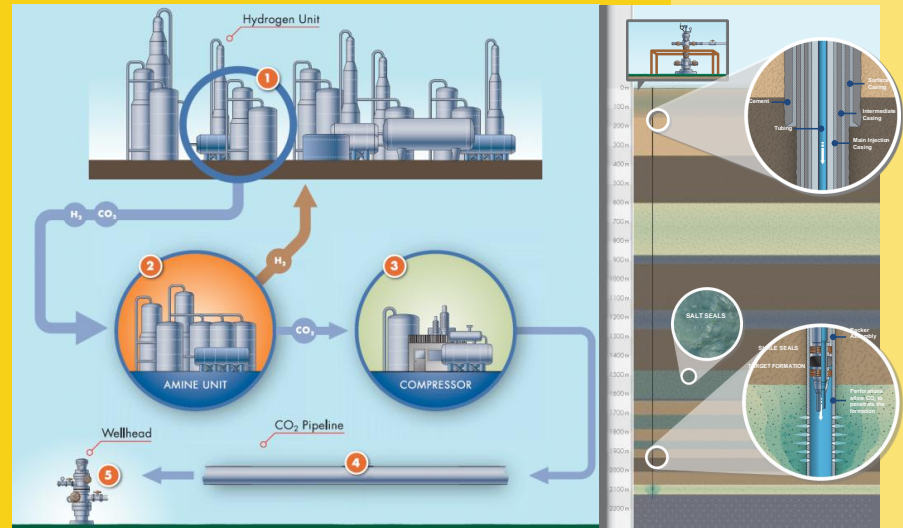




QUEST CCS PROJECT

CSLF Workshop
Strategies and Technologies for
Carbon Capture Cost Reduction
Bergen, June 2012



Len Heckel – Quest Business Opportunity Manager

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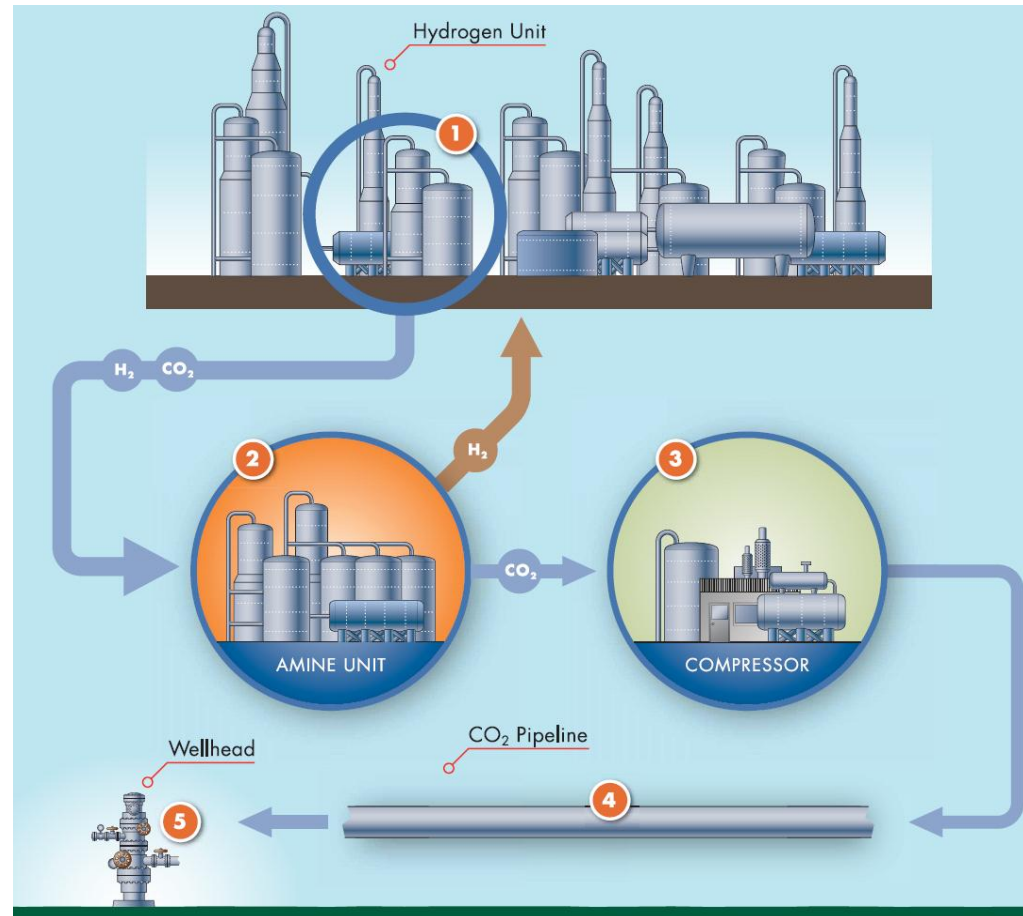
The United States Securities and Exchange Commission (SEC) permits oil and gas companies, in their filings with the SEC, to disclose only proved reserves that a company has demonstrated by actual production or conclusive formation tests to be economically and legally producible under existing economic and operating conditions. We use certain terms in this presentation, such as resources and oil in place, that SEC’s guidelines strictly prohibit us from including in filings with the SEC. U.S. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov. You can also obtain these forms from the SEC by calling 1-800-SEC-0330.

Quest Overview - Location



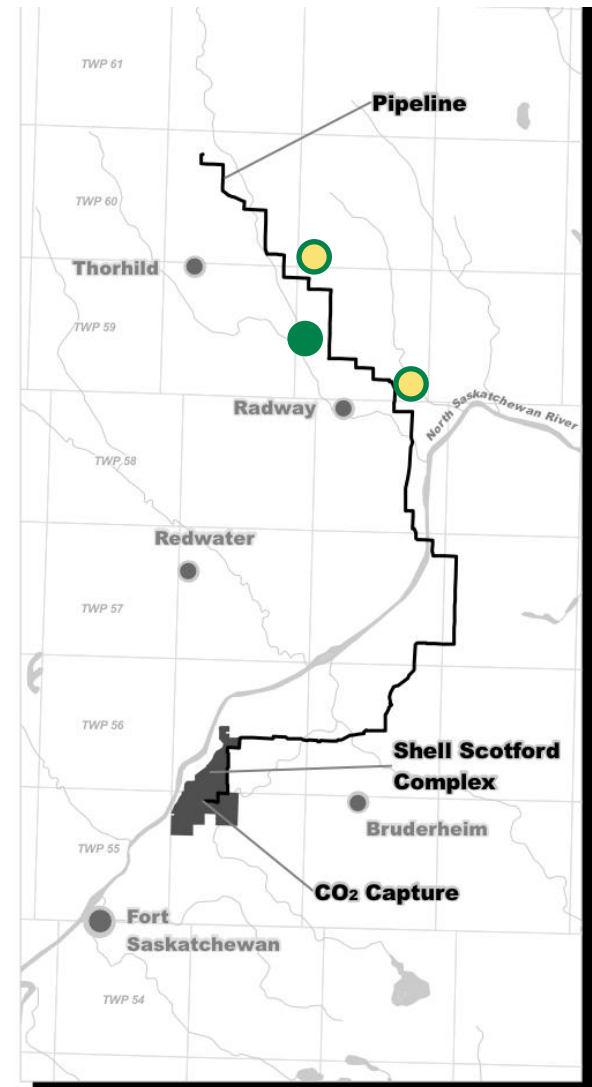
Quest Overview – General Features

- Quest CCS Project - fully integrated CCS (capture, transport & storage)
- JV among Shell (60%); Chevron (20%); and Marathon (20%)
- Located at Scotford Upgrader Complex
- 35% reduction of Upgrader CO₂ emissions
- Uses existing technology
- Capacity to capture over one million tonnes of CO₂ per year for 25 years
- Equiv to emissions from 175,000 cars



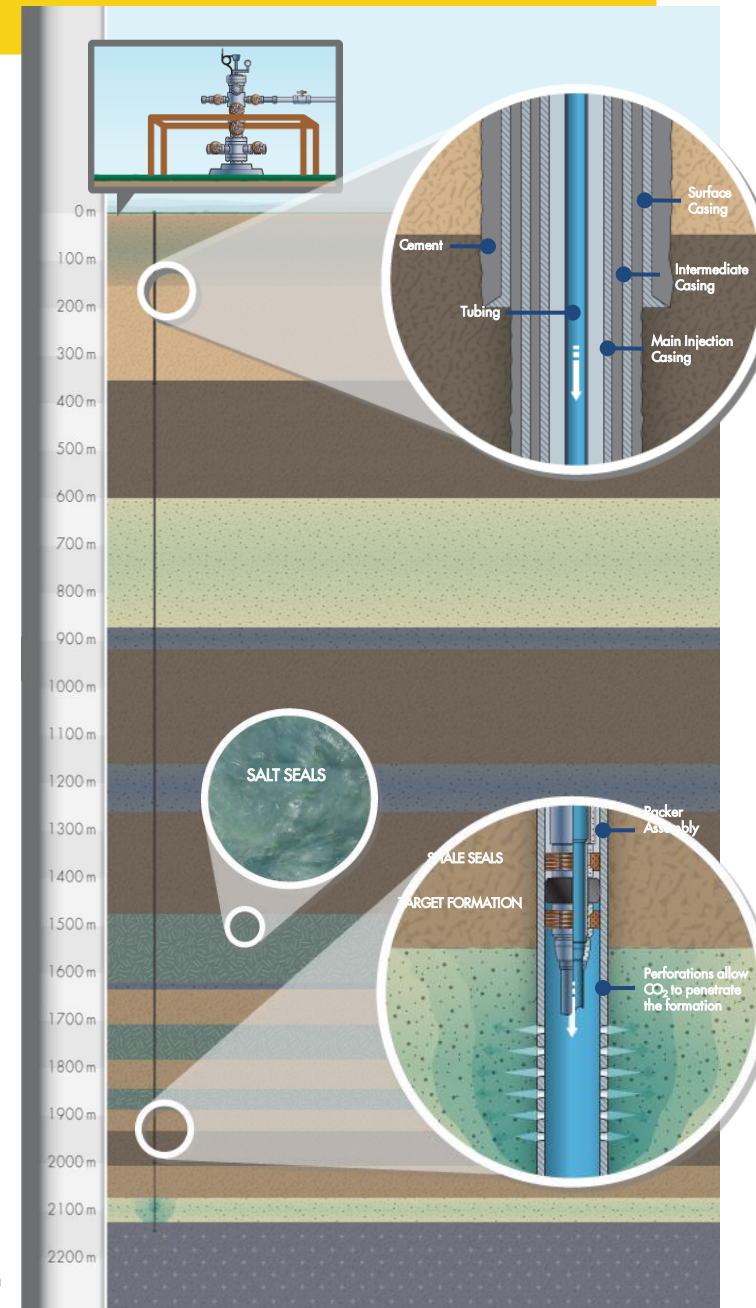
Quest Overview – Hardware

- Quest CCS Project CO₂ capture plant located in Fort Saskatchewan, approx 50 km N.E. of Edmonton, Alberta
- Capture at the Scotford Upgrader from 3 Hydrogen Units (SMR), Amine system ADIP-X
- CO₂ transported by 12 inch pipeline to storage
- The pipeline will travel approx. 65 km north of the Scotford Upgrader to the chosen injection locations
- 3 injection wells

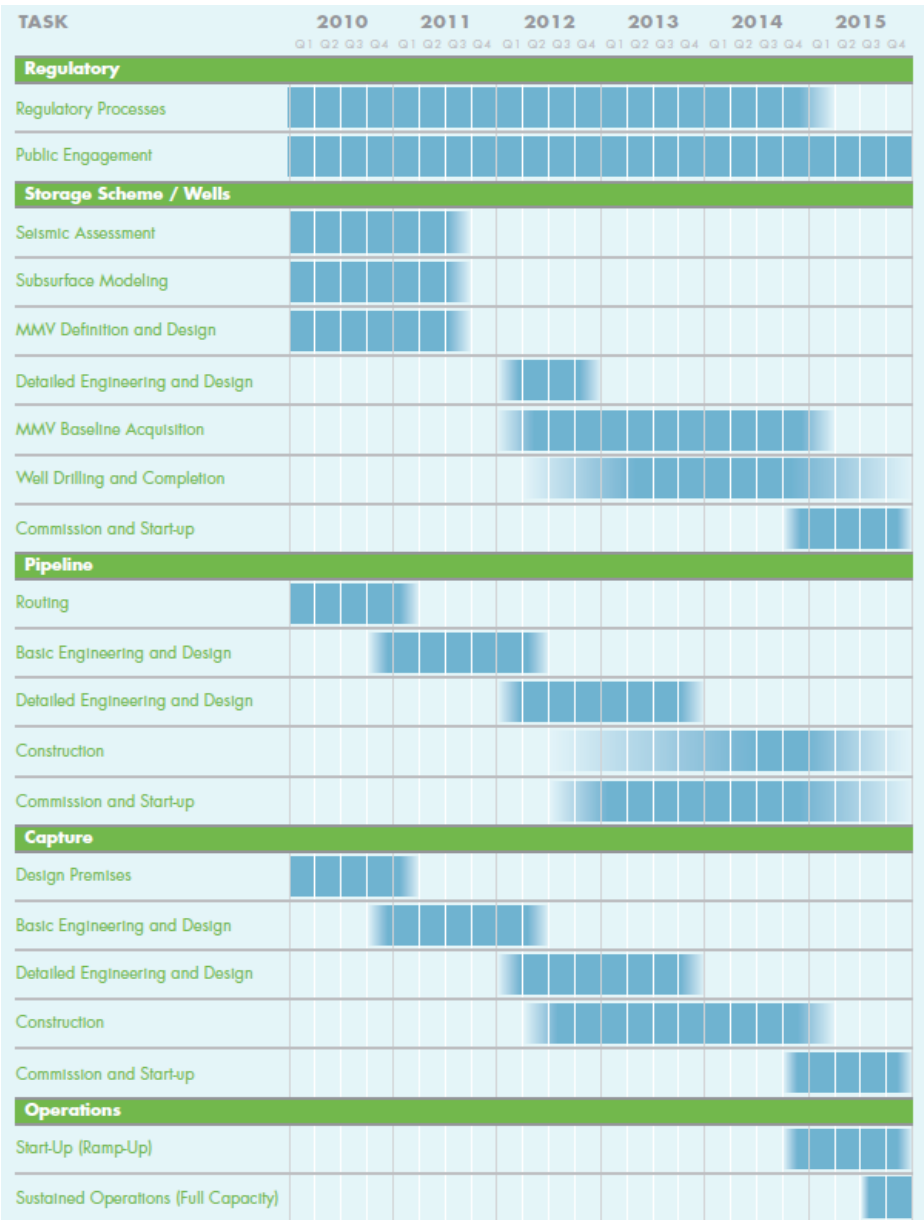


Quest Overview – Storage

- Saline aquifer storage
- Basal Cambrian Sands (BCS) selected
 - Storage zone is a formation called Basal Cambrian Sands (BCS) 2,300 m, Prairies deepest sandstone
 - Multiple caprock and salt seal layers, no significant faulting visible from wells or seismic
 - The BCS is well below hydrocarbon bearing formations and potable water zones in the region
 - Relatively few wells drilled into the BCS, none within 10 km of the proposed storage site
- Wells and Drilling
 - 3 well plan, 5 more if required
 - Conventional drilling methods
 - Multiple steel casings for wells, 3 in freshwater zone, all cemented to surface

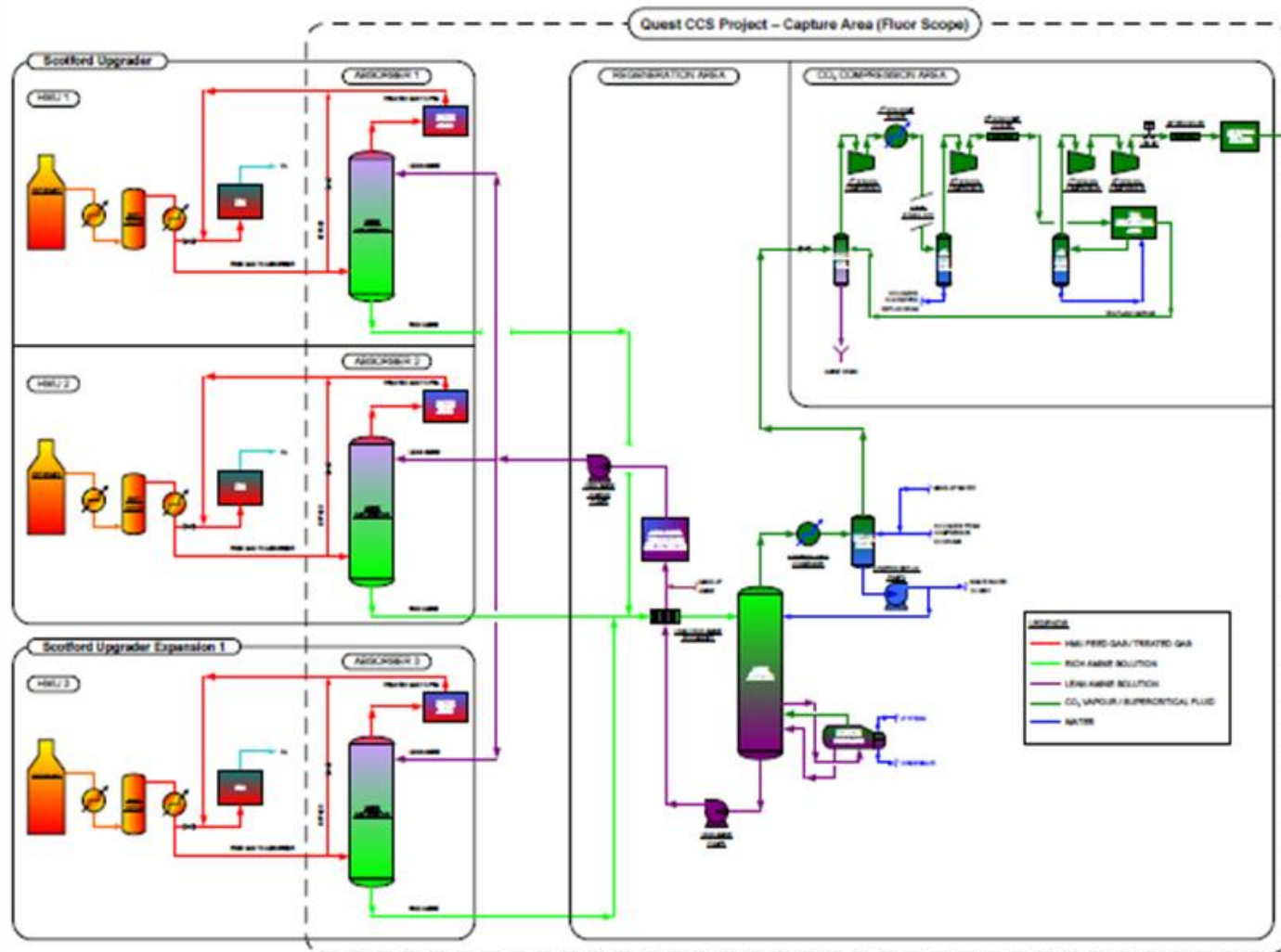


Quest Overview - Timeline



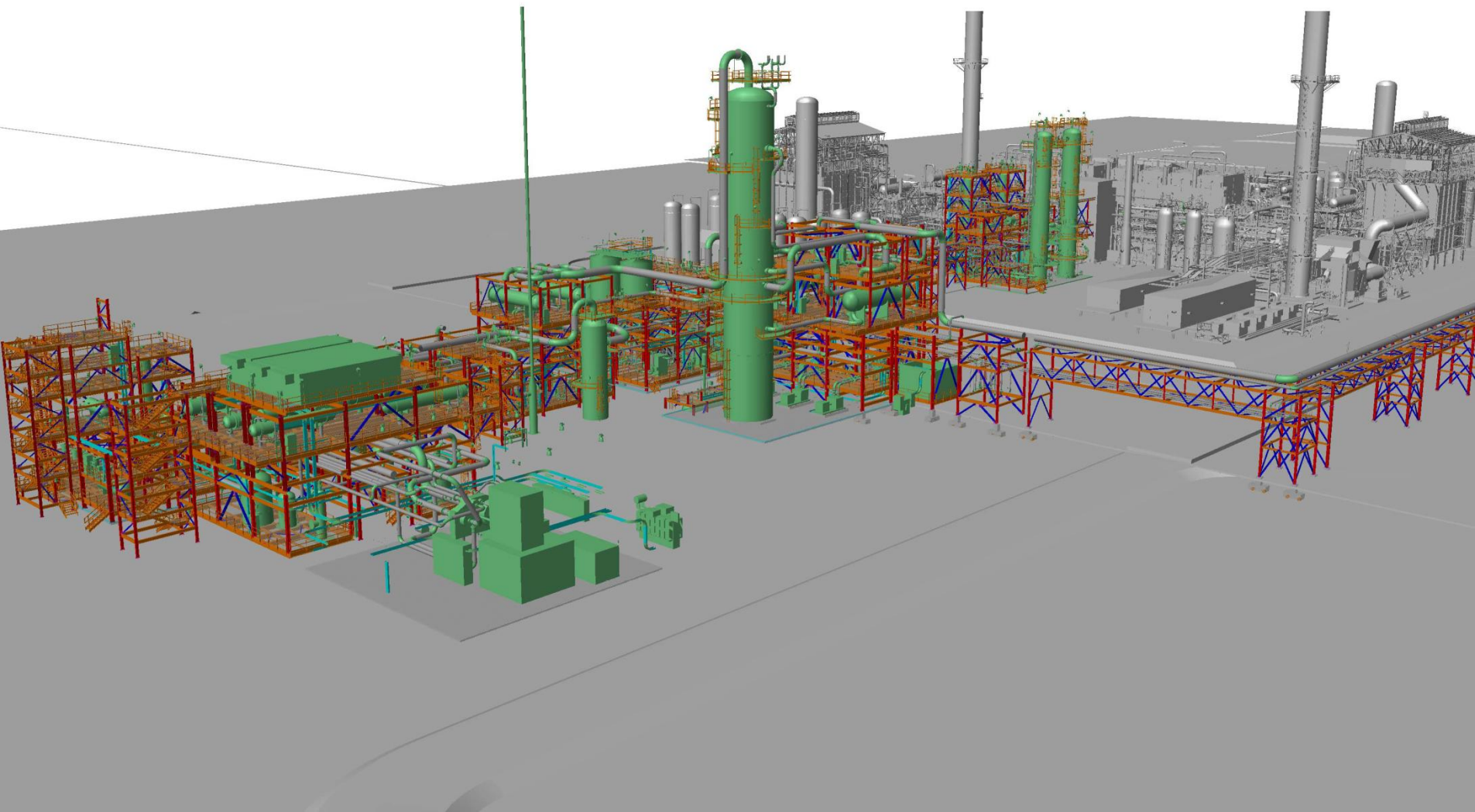
- Regulatory Hearing March 2012
 - Approvals expected June 2012
- FID planned Q3 2012
- Well Program Q4 2012
 - 2 additional injection wells
 - Associated deep monitoring and groundwater wells
- Capture & Pipeline in Execute phase
 - Capture at 30% model review stage
 - Early construction Q2 2012
 - Capture construction start end 2012, pipeline Q3 2013
- Operations Handover Q2 2015
 - Full production Q3 2015

Quest Capture Process Design



- Shell ADIP-X Amine process (99%+ pure CO₂), 1.2 MTPa capacity
- Multistage centrifugal compressor to 8.5 Mpa (supercritical state)
- TEG dehydration unit

Capture 3D Model – HEMU 1 & 2



Capture cost savings concepts

- Integration with base facility (upgrader SMR and cogen) in technology selection
- Process simplification
- Constructability
- Physicality (plot plan spacing)
- Utilities integration

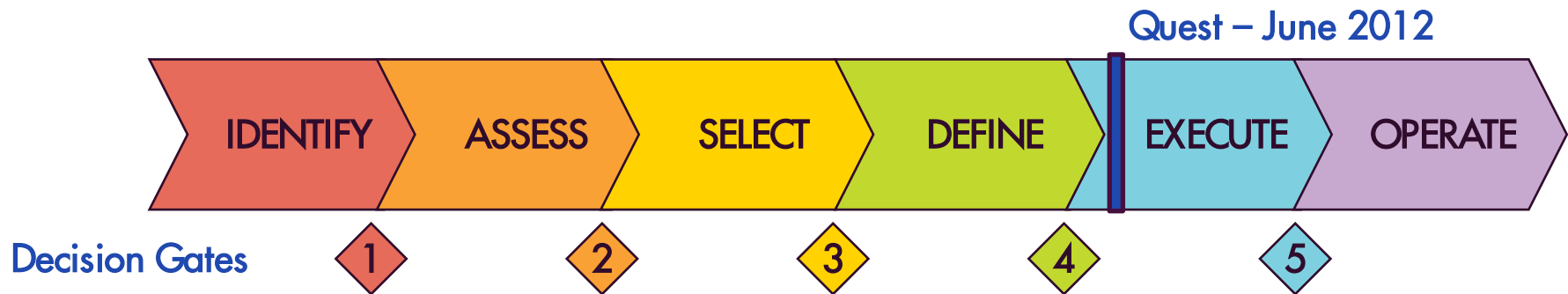
Comment

SALT SEALS

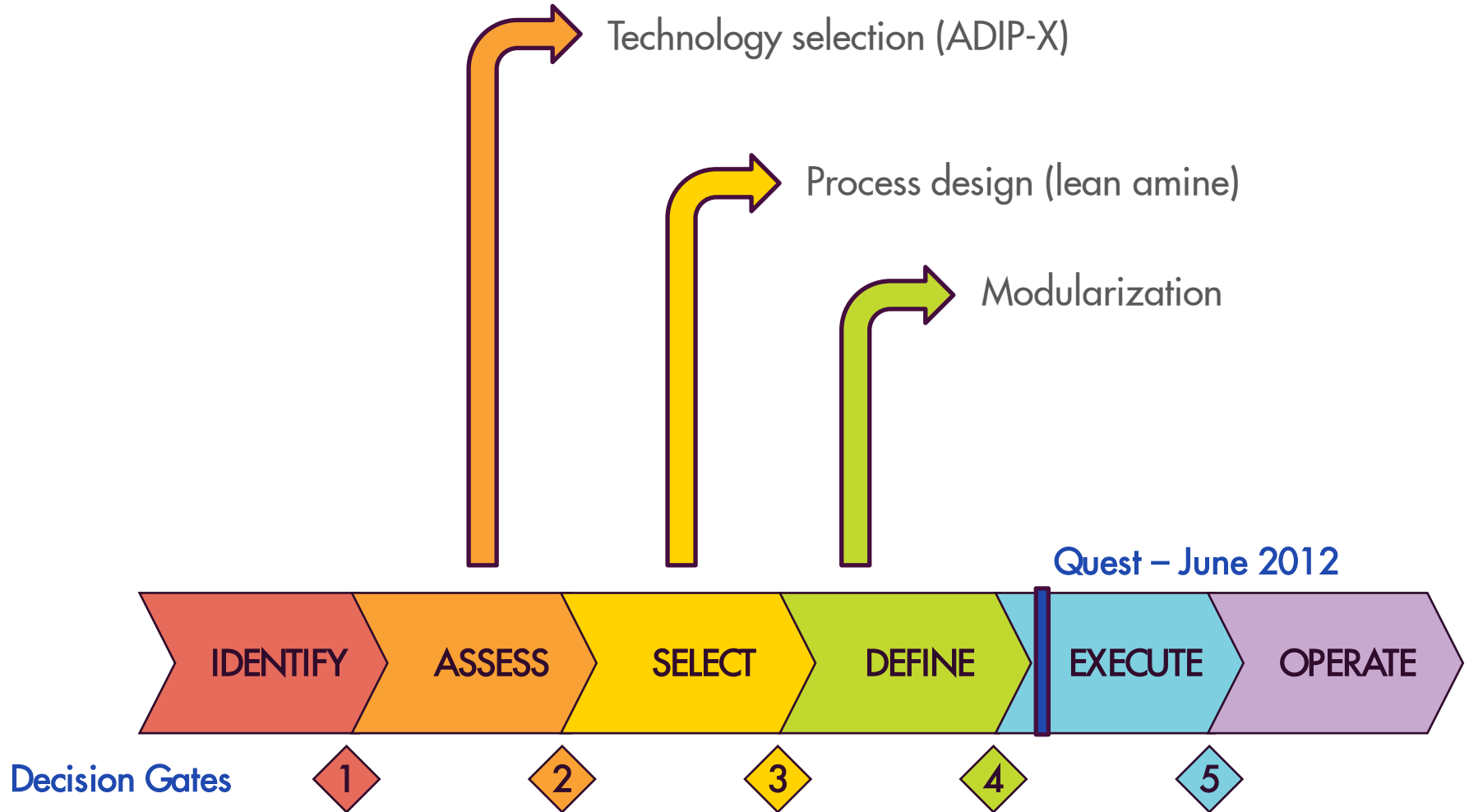
SHALE SEALS

TARGET FORMATION

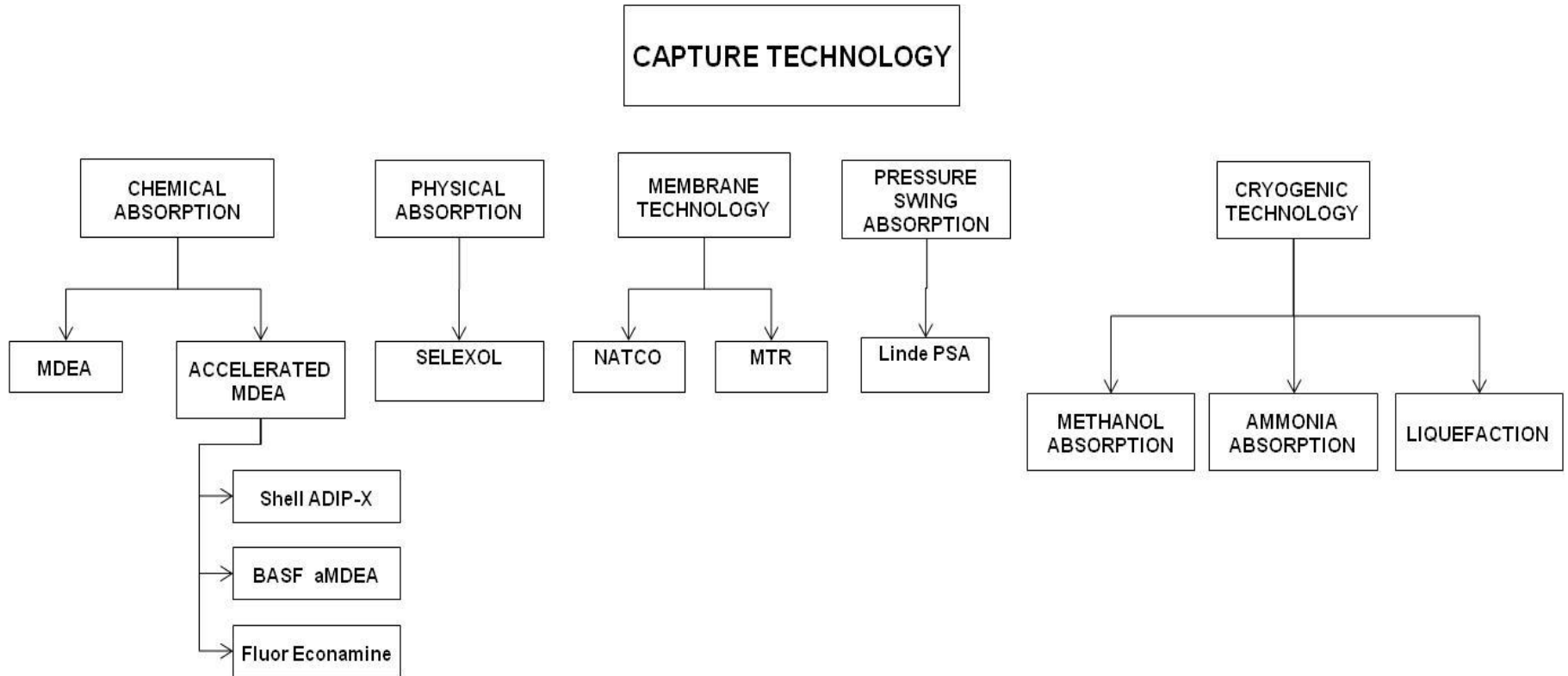
Capture cost initiatives during project lifecycle



Capture cost initiatives during project lifecycle



Technology Selection

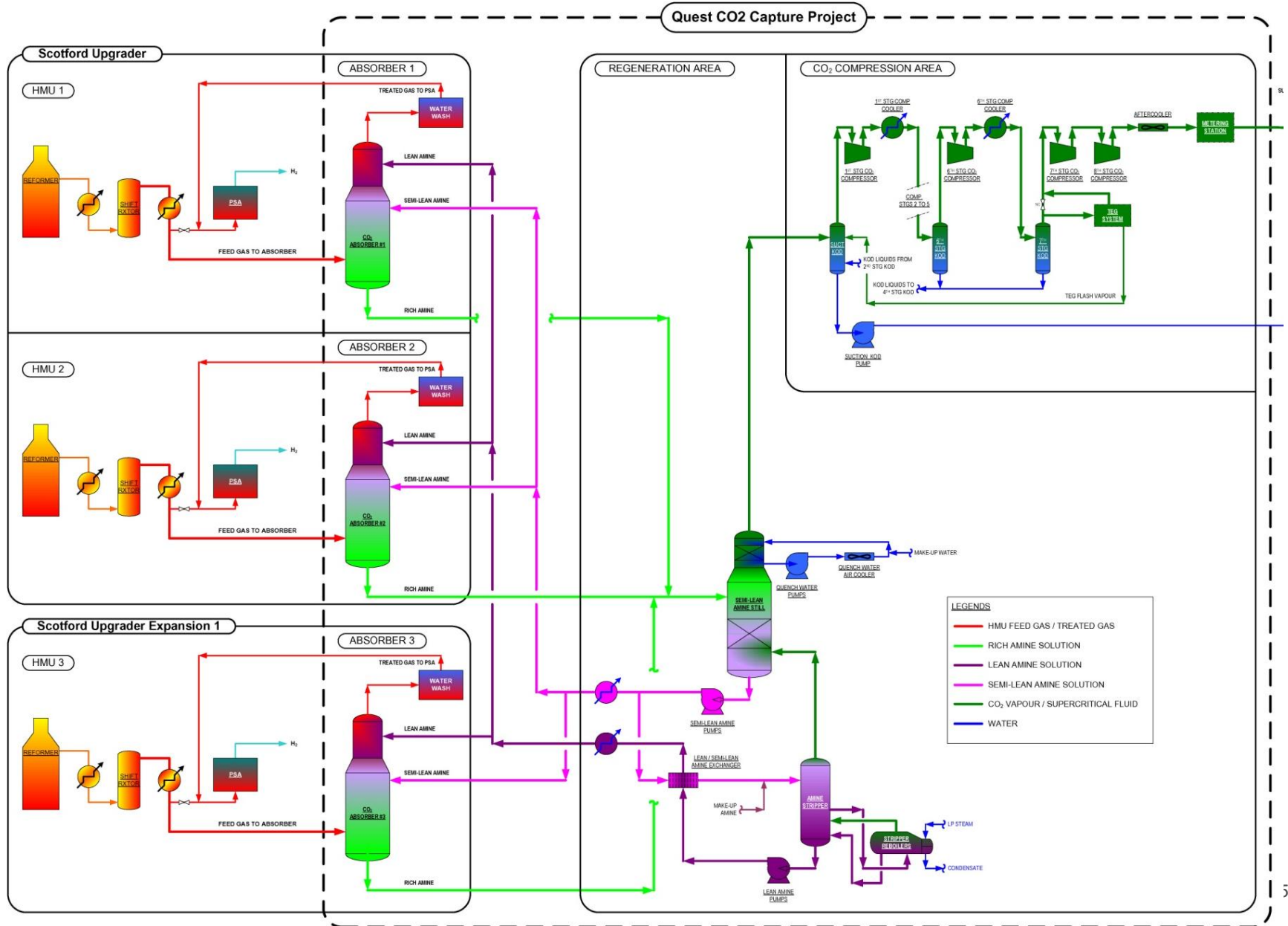


Technology Selection

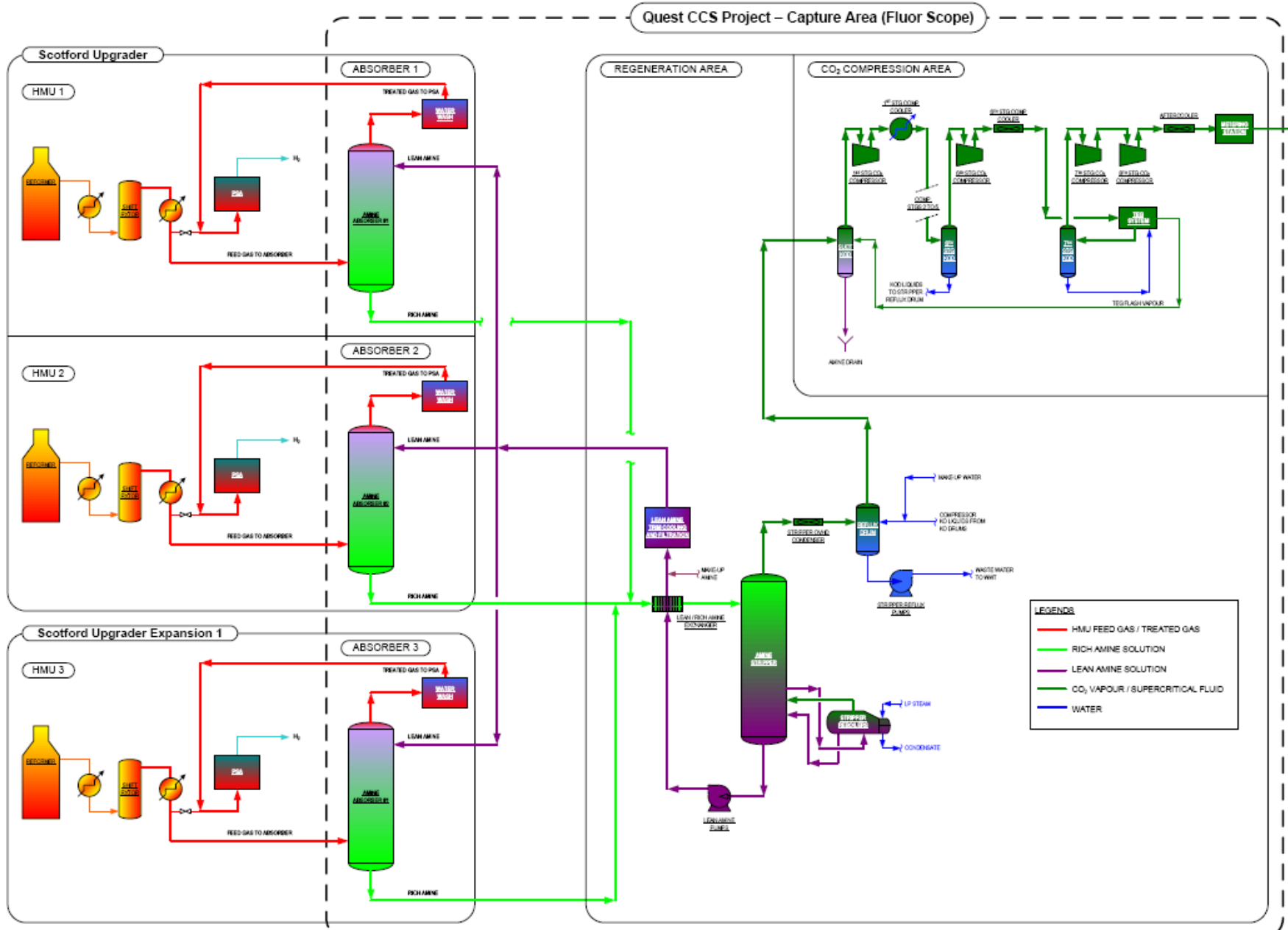
	ADIP-X	MDEA	PHYSICAL ADSORPTION SELEXOL	MEMBRANE TECHNOLOGY	LINDE PSA	METHANOL ABSRPN	AMMONIA ABSRPN	LIQUEFACTION
CRITERIA								
HSE RISKS	Green	Green	Yellow	Green	Green	Yellow	Yellow	Green
CAPEX	Green	Yellow	Yellow	Yellow	Yellow	Red	Yellow	Yellow
OPEX	Green	Green	Green	Red	Red	Red	Yellow	Green
IMPACT ON HMU Reliability	Green	Green	Red	Green	Green	Yellow	Green	Green
COMMERCIAL	Green	Green	Yellow	Red	Red	Green	Red	Red
CONSTRUCTABILITY	Green	Green	Red	Yellow	Yellow	Yellow	Yellow	Yellow

- Risk-based evaluation using key criteria to achieve lifecycle cost reduction

Process Design – Start of Select (Semi-Lean system)



Process Design – End of Select (Lean system)



Lean system SWOT analysis

Strengths

- Lean Amine process much simpler to operate.
- Site integration-substantial savings Capex /Opex.
- Equipment count and sizing reduced
- Constructability improved
- Unit now out of novelty range

Weakness

- Higher steam consumption.
- Bigger reboiler and O/H condenser

Opportunities Captured in PRE-FEED

- Improved steam integration - key factor in lean amine selection.
- Better CW Integration
- Low pressure steam and Cooling Water diverted to Quest

Threats

- Entirely dependent on Cogen and baseplant utilities

Capture Modularization

■ Modularization Benefits

- Smaller individual scope (efficiency, cost)
- Labour pool management
- Reduced on-site work in an operating facility

■ Modularization Risks (Planned Mitigations)

- High integration focus required (Integration Coordinator, ongoing group communication)
- Reliance on more third parties (High involvement from Shell for early warning signs)

