Strategy and lessons learned to build a Measures, monitoring and verification plan for an Offshore depleted field

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Shell Aramis CCS project

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Shell's net-Zero Emissions Target

Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and Net Carbon Intensity (NCI) targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target and 2035 NCI target, as these targets are currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

Forward Looking Non-GAAP measures

This presentation may contain certain forward-looking non-GAAP measures such as cash capital expenditure and divestments. We are unable to provide a reconciliation of these forward-looking Non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those Non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements.

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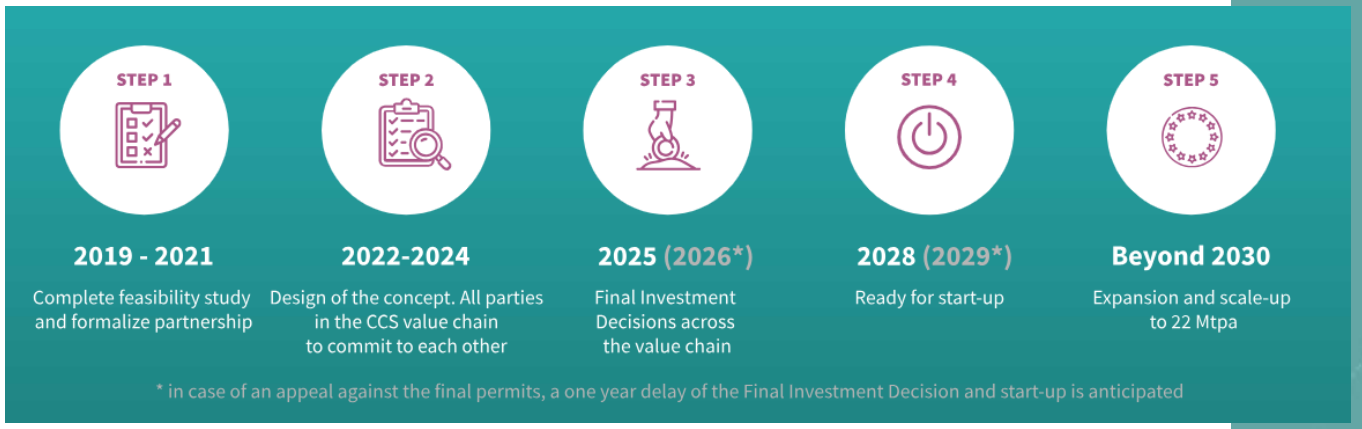
The Aramis CCS project

Largest planned Shell operated CCS project

Develop a cost-effective solution for Shell's and third parties' emissions in Europe

Initial setup is 5 Mtpa split between TotalEnergies and Shell



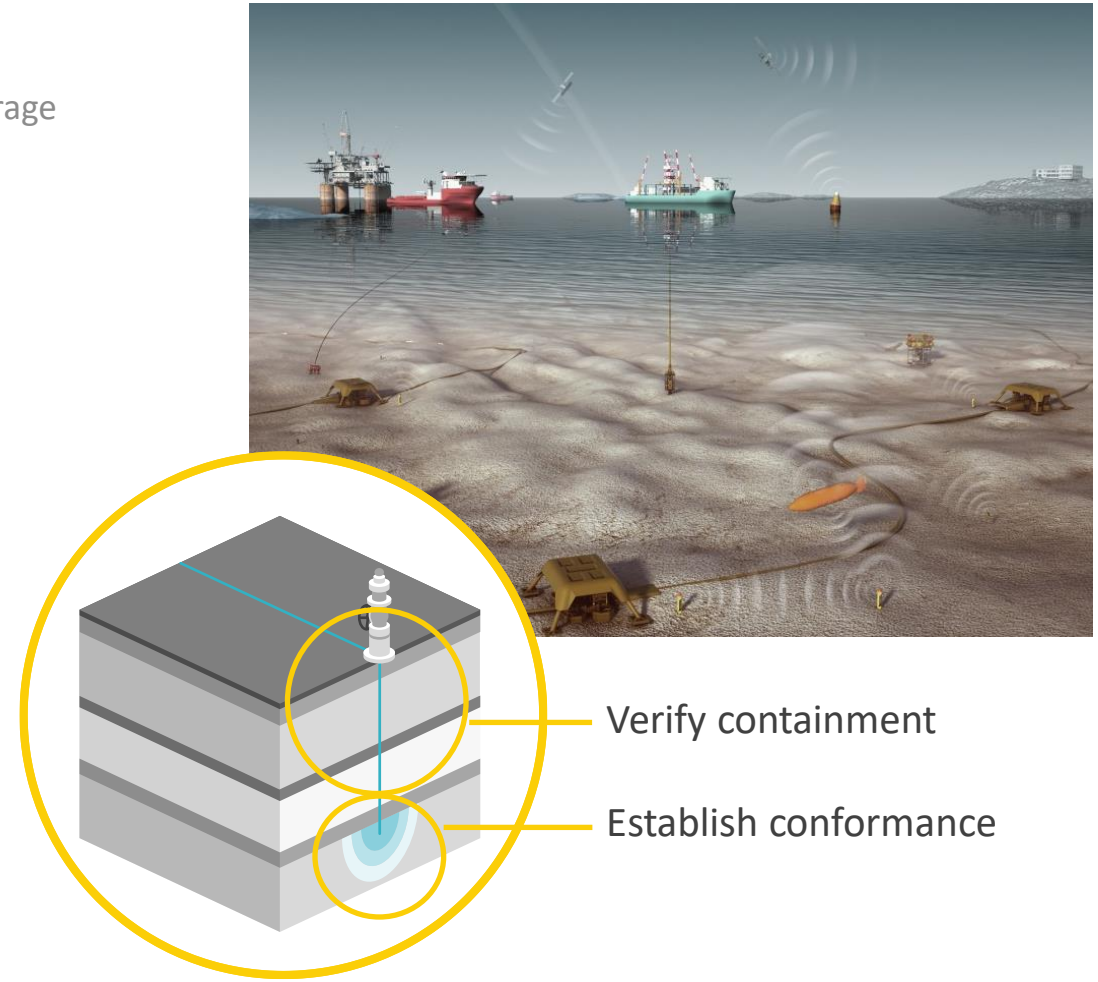
What is Measures, Monitoring and Verification?

MMV Goals

- Ensure Containment to demonstrate the safety of geologic storage
- Ensure Conformance to indicate long-term effectiveness of geologic storage
- Generate evidence of containment for stakeholders (Confidence)
- Satisfy regulatory requirements
- Support storage transfer of long-term liabilities

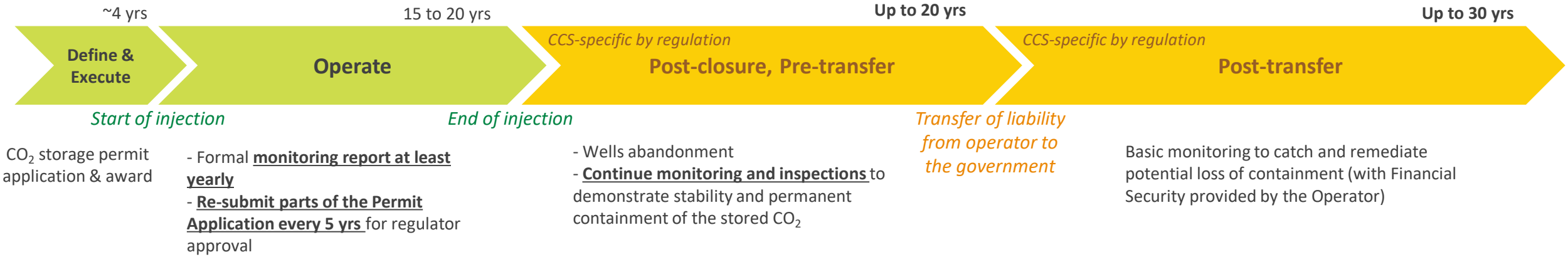
MMV approach

- Risk-based: Bowtie risk framework, mitigating threats with monitoring as active barriers
- Comprehensive: Covering all domains and phases of storage operation
- Adaptable: Based on updated risk assessments as storage operation evolves



MMV is crucial to gain and maintain License to Operate

MMV ensures successful and earlier transfer of liability



- Monitoring and escalation activities are pre-committed to the regulator (CO_2 storage permit application)
- Liability transfer conditions create an incentive towards proactive monitoring (EU Directive for CO_2 storage)

Learnings – Understand the risk perception of your stakeholders

Engage early with stakeholders during the permitting process

Learnings - Find the right balance

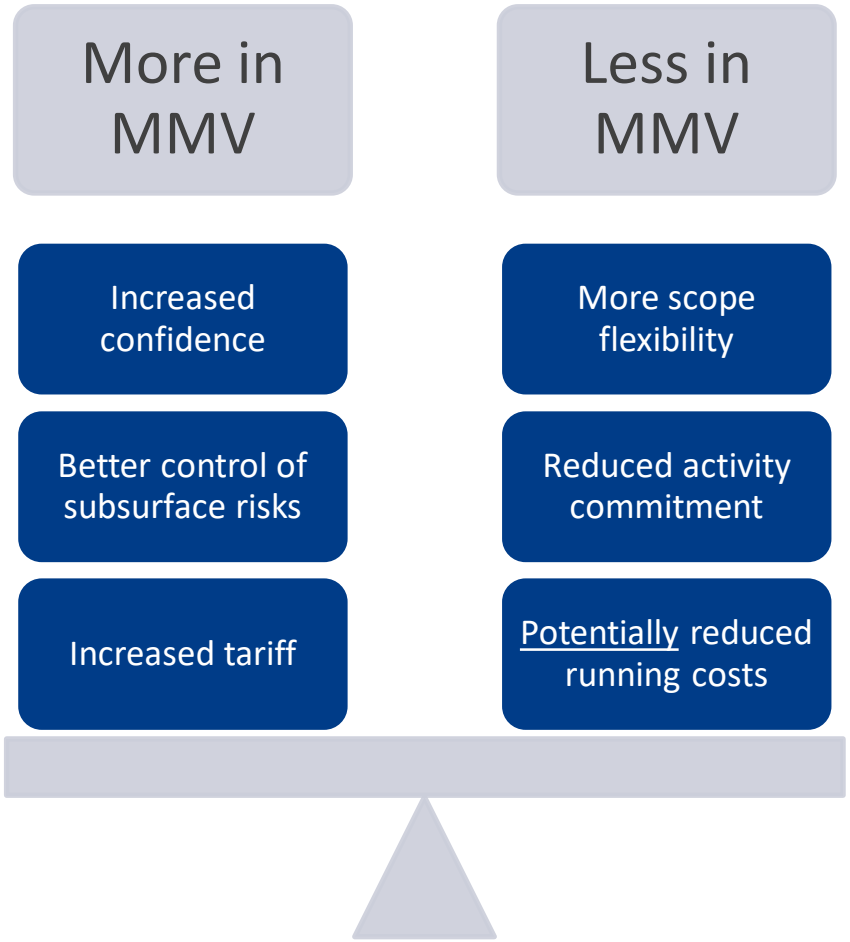


Table 1: Possible Requirements in a Transfer Report

Evidence for complete and permanent storage	Required documentation from the operator
Conformity with Models	1) For at least a continuous five year period immediately before the transfer, there has been no need to significantly change the 3D static geological model assumptions for the characteristics of the storage complex during history matching exercises incorporating monitored parameters from monitoring taking place over regular intervals. 2) Results of the backcasting with the final model are within or close to the confidence interval of the monitored parameters over the entire life of the project.
Absence of Any Detectable Leakage	For at least a continuous 10 year period immediately before transfer, show that: 1) Integrity of all wells (monitoring and injection) remains in a good shape without any leaks or unexpected deterioration or damage 2) Regular and periodically monitored data based on the approved monitoring plan indicates that the CO_2 plume has remained within the storage complex, i.e., there are no leakages 3) Regular and periodic geochemical analyses indicate that all measured and imputed data is consistent with the geochemical modeling
Evolution towards Long Term Stability	1) Show that the final models run out into the future project an eventual stability of CO2 plume within the storage complex. 2) The monitored parameters have moved close to the expected stable values, as determined by modelling (e.g., by providing a table or graph of differences between the monitored and stable values) 3) Graphs and tables showing that the rate of change in the monitored parameters is small and declining.

EU_GD3 - Criteria for Transfer of Responsibility to the Competent Authority.pdf (shell.com)

Learnings – Integration with operations and asset design is crucial

Project deliveries are developed alongside the MMV and should support the MMV commitments

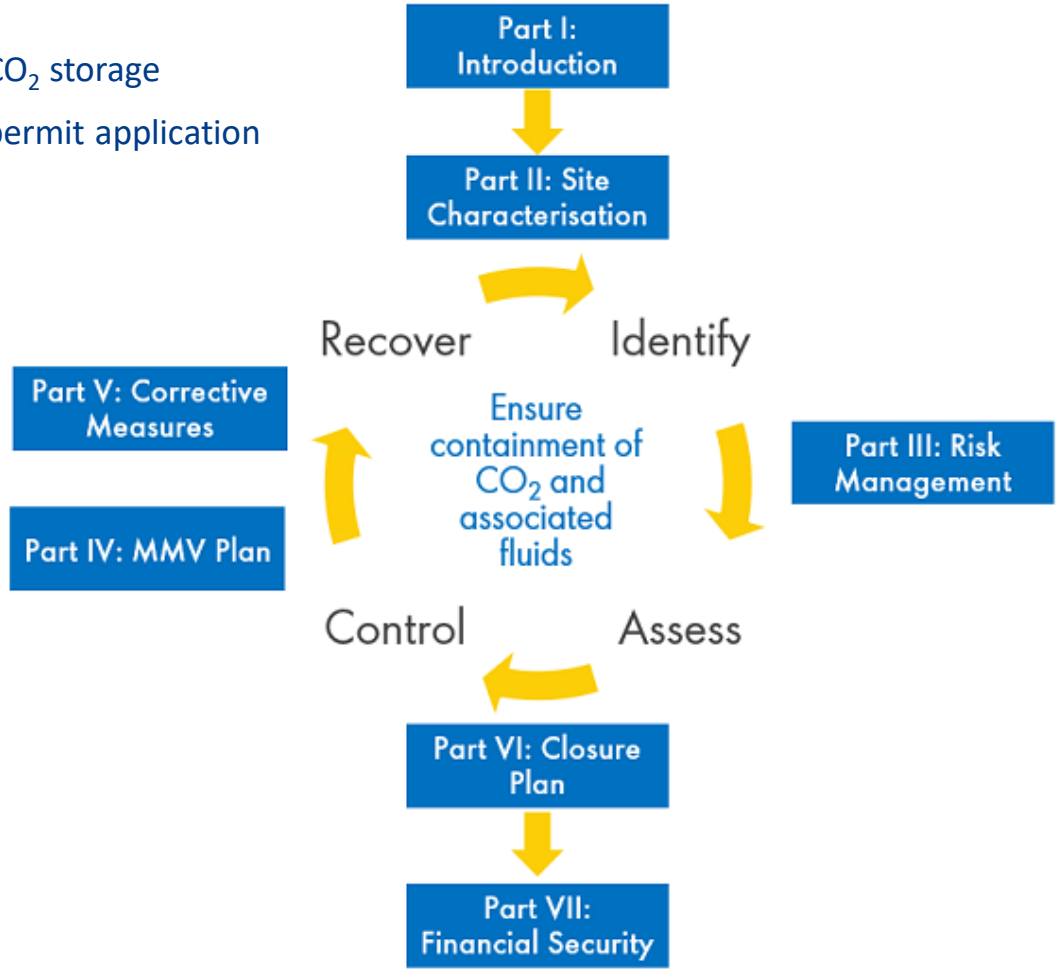
Operational project deliverables

- Operating & Maintenance philosophy
- Wells, Reservoirs, Facilities Management plan

Asset design project deliverables

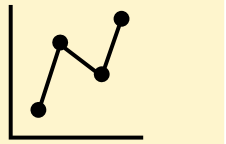
- Well Functional Specifications
- Platform Basis for Design
- Information and Digital Technology strategy
- Technology maturation plan

CO_2 storage permit application



Risk-based MMV for safe and cost-effective long-term CO_2 storage

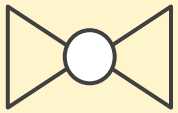
How can we reduce monitoring costs without compromising safety?



1. MMV Method

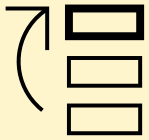
Baseline

- Seek acquisition synergies
- Make use of existing surveys/data and focus new acquisitions over high-risk areas



Risk-based

- Based on bowtie containment risk assessment
- Selective technologies deployed at key risk locations: injection well, legacy wells, faults, etc.



Triggered

- Tier 1 – address critical risks to loss of containment through direct, continuous monitoring (e.g., in-well, pressure/temp)
- Tier 2 – address risks to loss of containment through longer sample time or surveillance frequency (e.g., DAS VSP)
- Tier 3 – contingency monitoring triggered as a response to Tier 1 or Tier 2 monitoring activities (e.g., marine monitoring

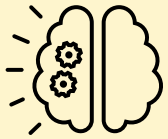
Risk-based MMV for safe and cost-effective long-term CO_2 storage

How can we reduce monitoring costs without compromising safety?

2. Technology choices

In-well focus, fibre optics and risk-based marine monitoring

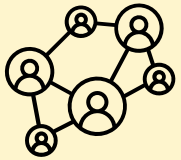
- Realise DTS, DAS microseismic, P-cable seismic and other low-cost seismic potential
- Active and passive acoustic marine monitoring at high-risk areas



3. Increase value

MMV data integration and automation

- Real-time comparison of different monitoring data streams to look for time correlations of anomalies
- Use data analytics tools to speed up processing and interpretation to enable real-time decision making



4. Stakeholders

- Regulators: Risk-based MMV as a tool to build trust enabling timely hand-over of liabilities
- Academia/Research Institutes: Collaborate to independently develop and verify performance of lower-cost monitoring technologies

Summary of key learnings