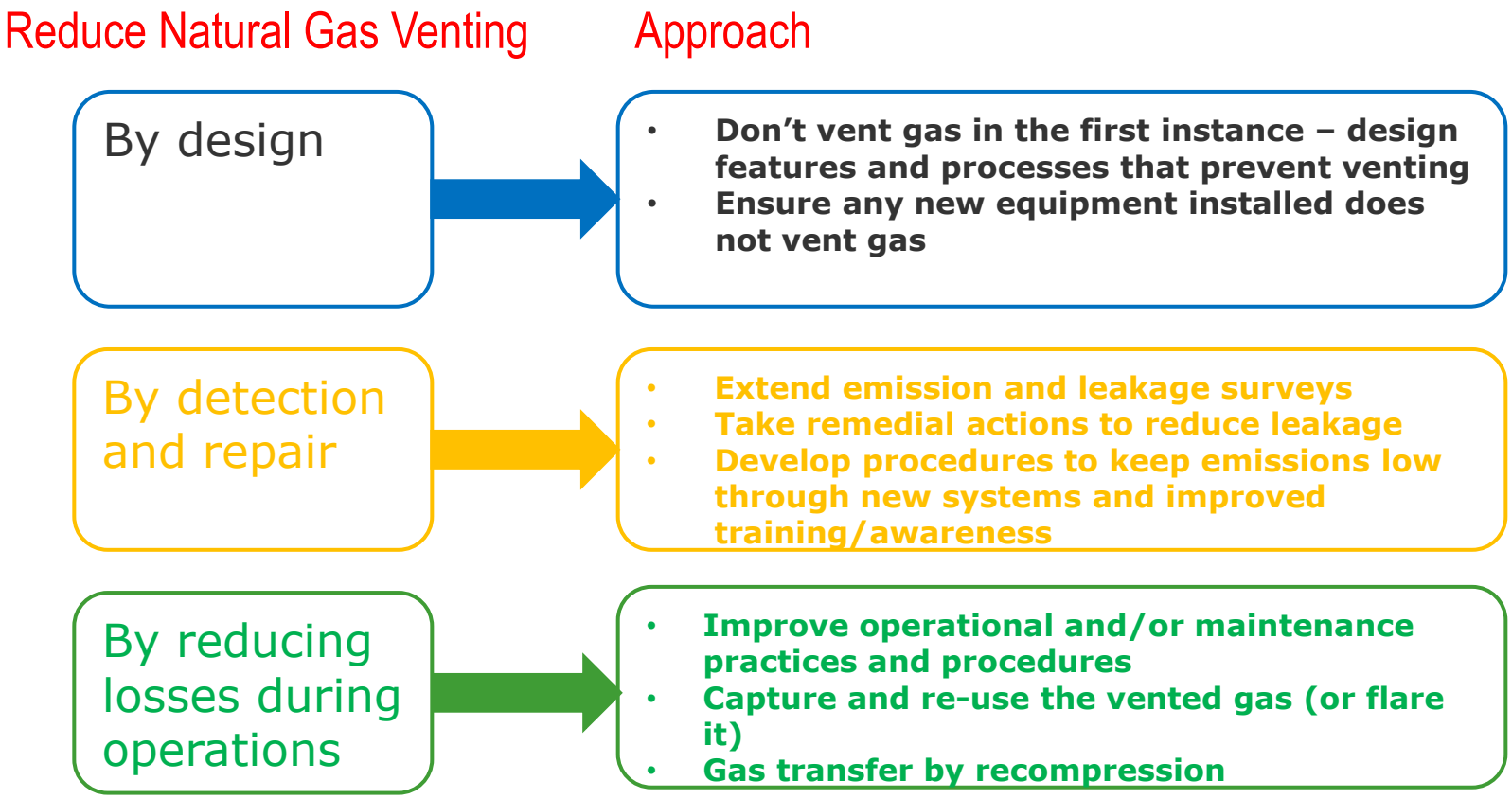
Alternatives to Venting of Natural Gas – ANG gas capture to reduce emissions

Categories of emission or venting

- **Natural gas emissions to the atmosphere result from several on-shore gas industry processes and operations, but can be categorised by four general types. These are:**
  - **Fugitive emission (unplanned and uncontrolled)**
  - **Process venting (planned, function of system operation)**
  - **Venting from maintenance work (planned and controlled)**
  - **Emergency vents (unplanned but controlled)**

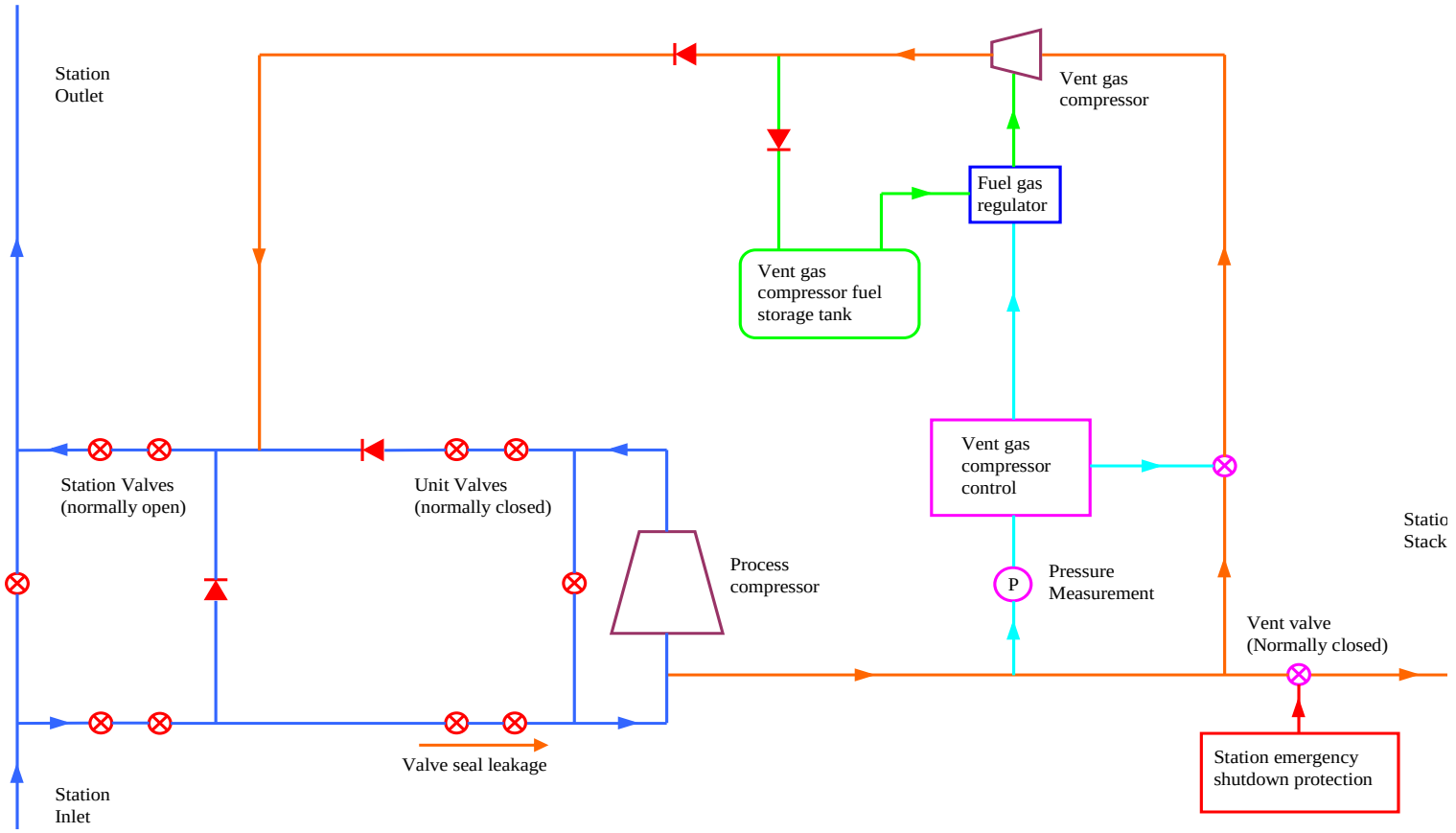
Natural Gas Venting Reduction



Key objectives of this study

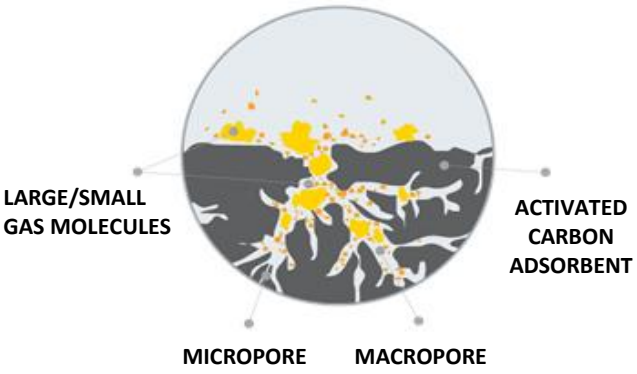
- To find technological solutions to reduce the gas vented volumes :
  - Prevent the methane emission in the first place (new processes, technologies or equipment)
  - Capture the methane emission (and then use the gas somewhere else or return it to the network)
  - Flare the gas to convert it to CO_2
- Feasibility Study to evaluate options, develop solutions and focus on cost and environmental benefit view-point. Three aspects highlighted:
  - Recompression – gas transfer from an isolated section to a "live section"
  - Capture the gas that would be vented (using specific technology eg. ANG) then re-use it
  - Flare the gas rather than vent it.
- Main project: **Undertake a series of field trials of selected technologies to raise awareness and provide validation data**

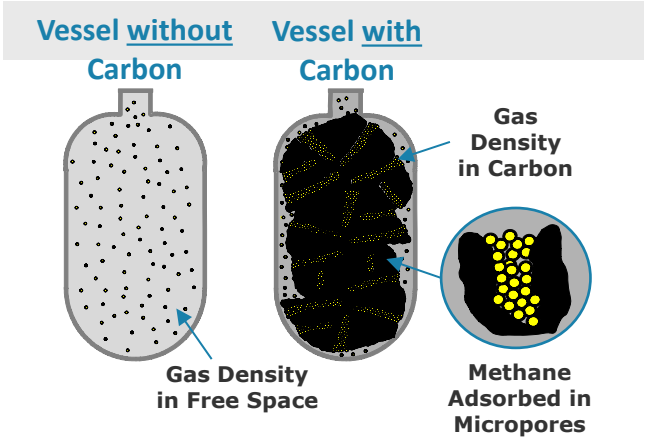
Concept of gas capture at a Compressor Station



Introduction to ANG Technology

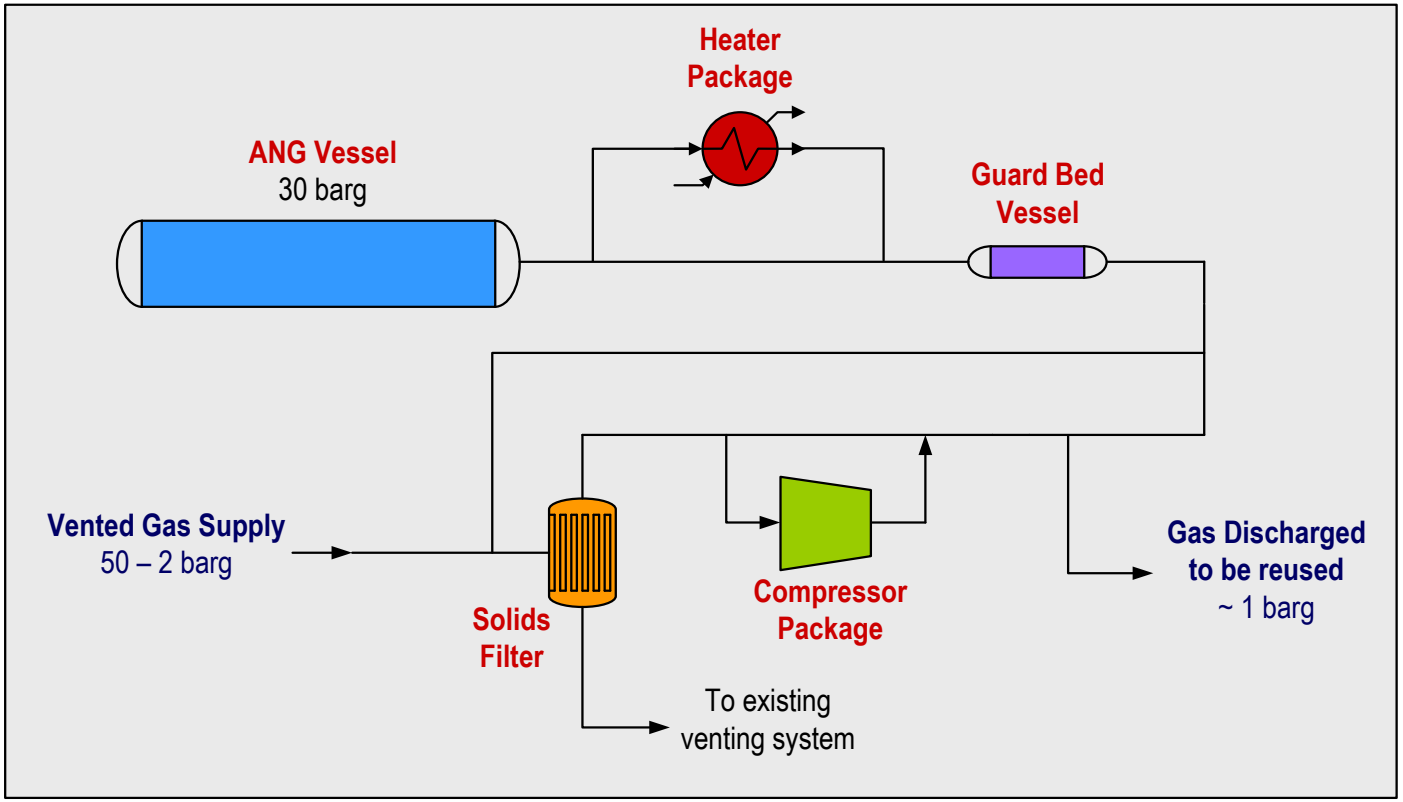
- Adsorption of natural gas onto adsorbent at low or intermediate pressure ranging from 5 to 50 bar.
- Adsorbent has a high porosity to achieve maximum storage capacity.
- Greater energy density than Compressed Natural Gas (CNG) at same pressure.





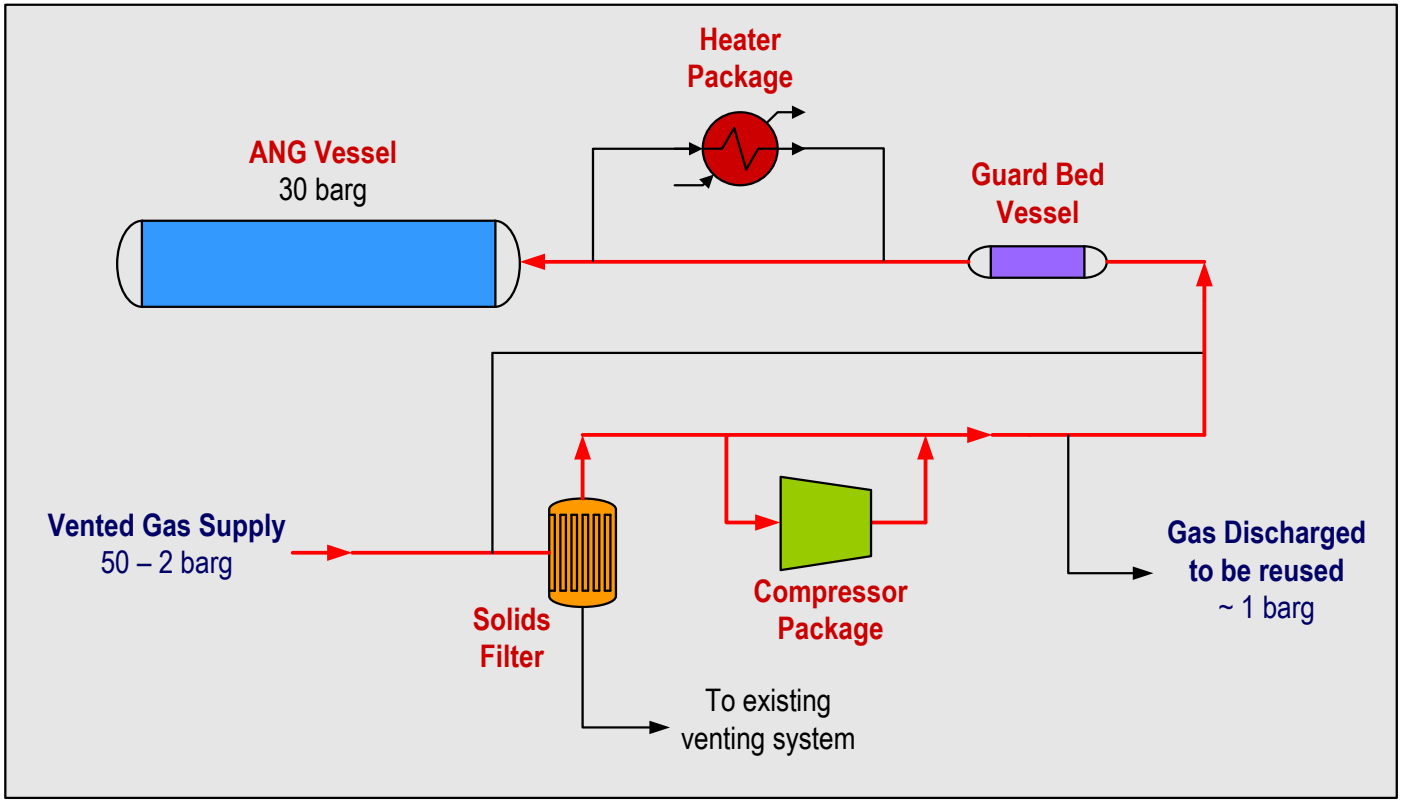
ANG Process Overview

- Simplified process flow diagram for ANG



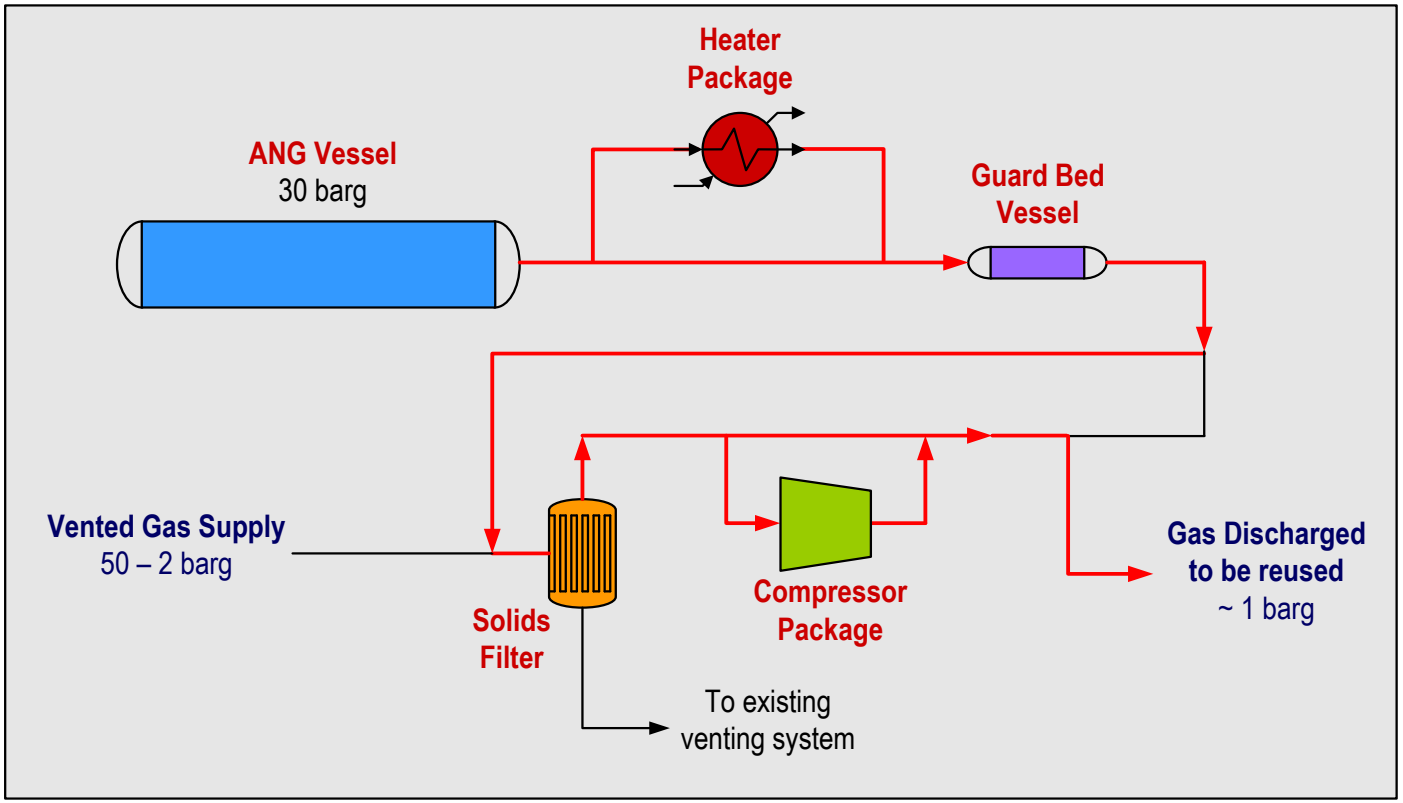
ANG Process Overview

- Charging Phase



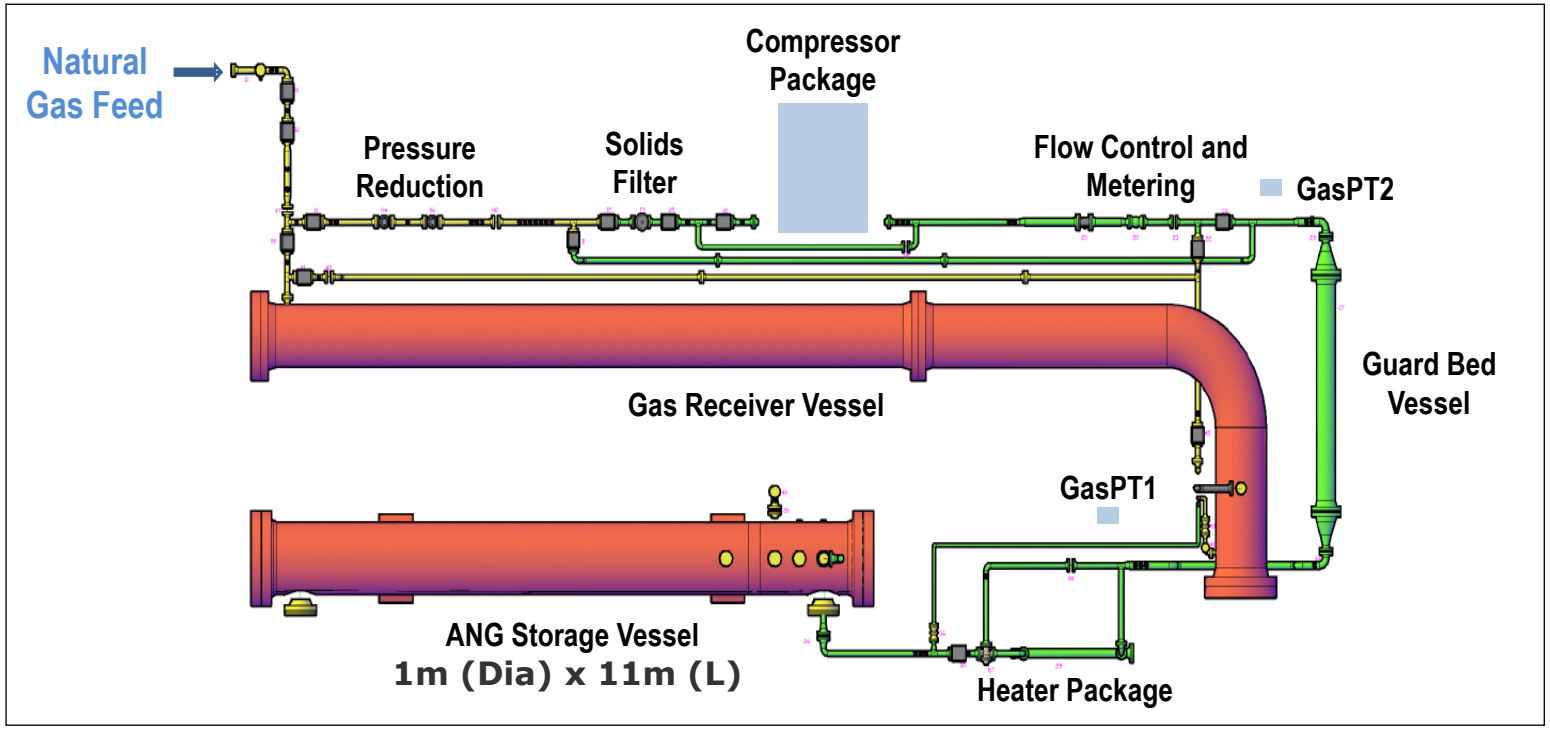
ANG Process Overview

- Discharge Phase



Layout of Test Facility

- To capture approximately 400 kg of natural gas.
- Footprint of test rig is 14 m x 22 m = Area of 308 m^2



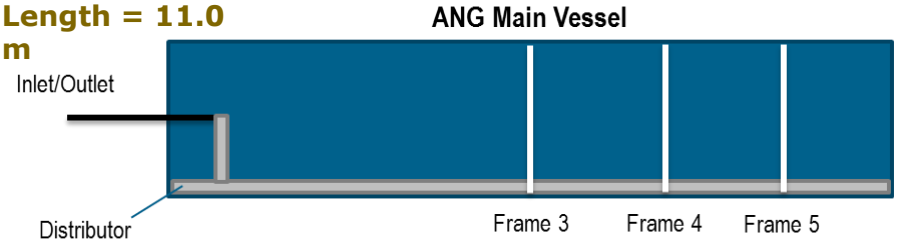
ANG Trial Objectives

- To evaluate the performance and capabilities of the ANG storage technology and carbon footprint.
  - To replicate venting scenario at National Grid Compressor Site
  - To evaluate and verify the capacity for the selected installation
  - To optimise the control of gas quality
  - To verify the carbon footprint reduction
  - To determine the time taken to capture and store gas
  - To demonstrate cyclic operation

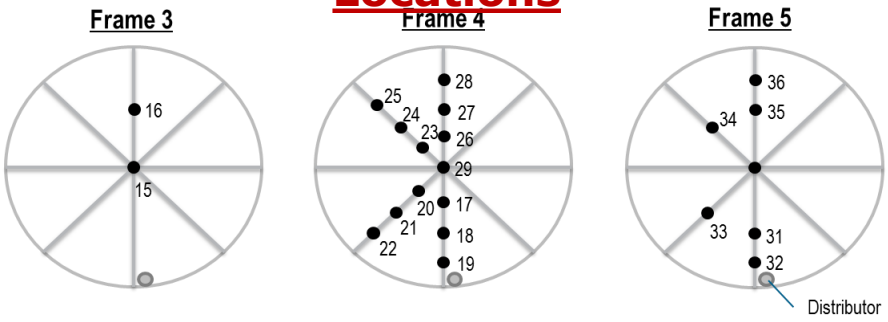
ANG Vessel Design

V = 9.8 m³
Diameter = 1.1 m
Length = 11.0 m

ANG Vessel Layout

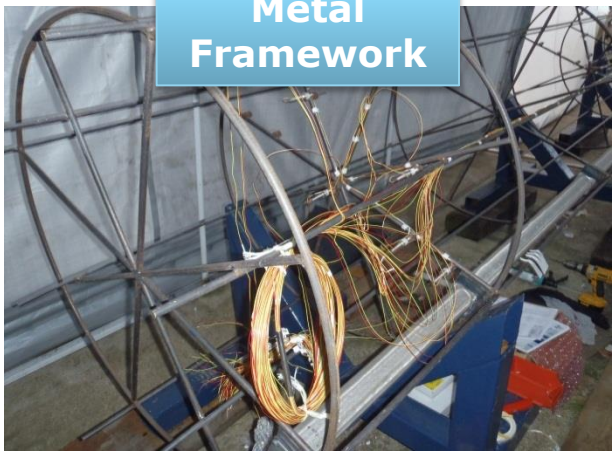


Thermocouple Locations



Existing 42 Inch Diameter Vessel

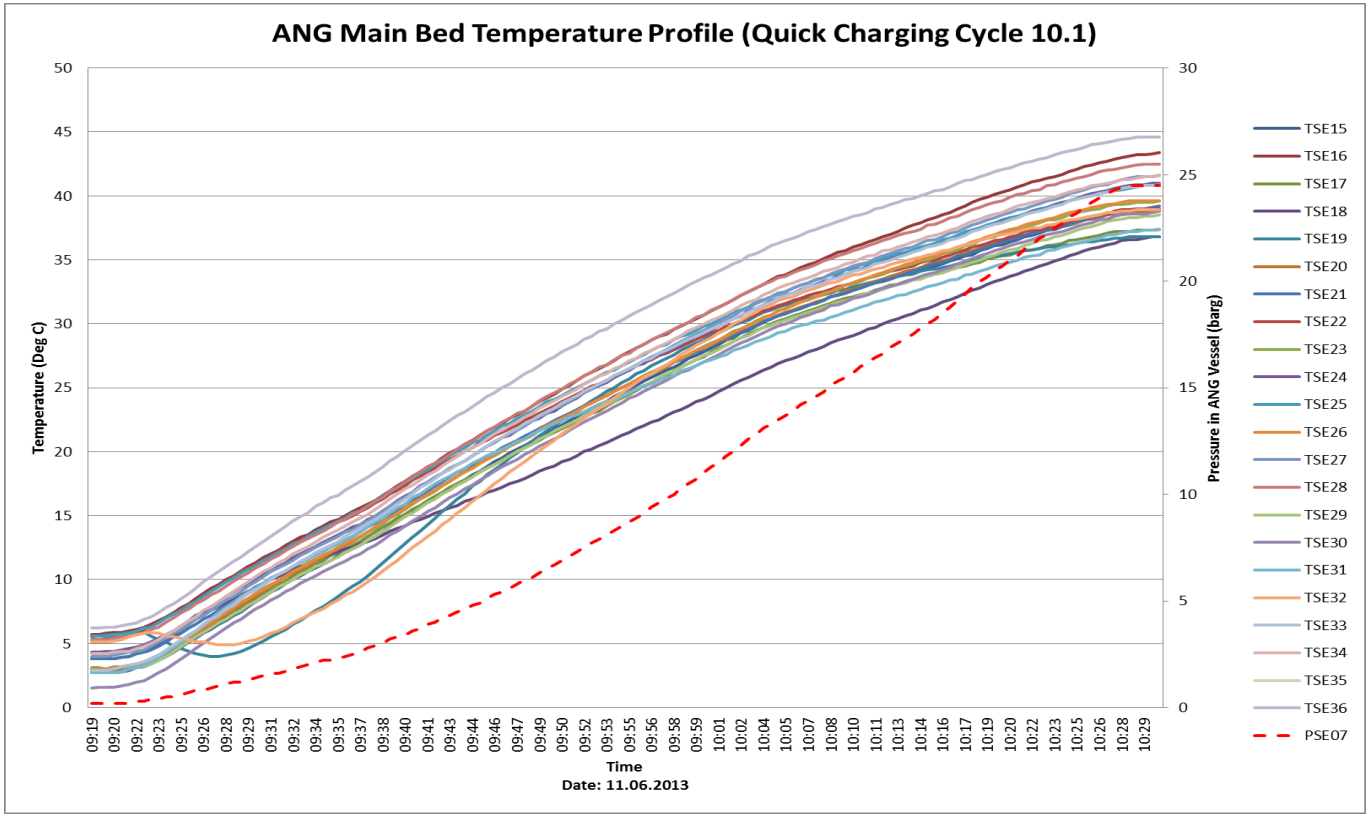
Metal Framework



GAS CAPTURE FIELD TRIAL RESULTS

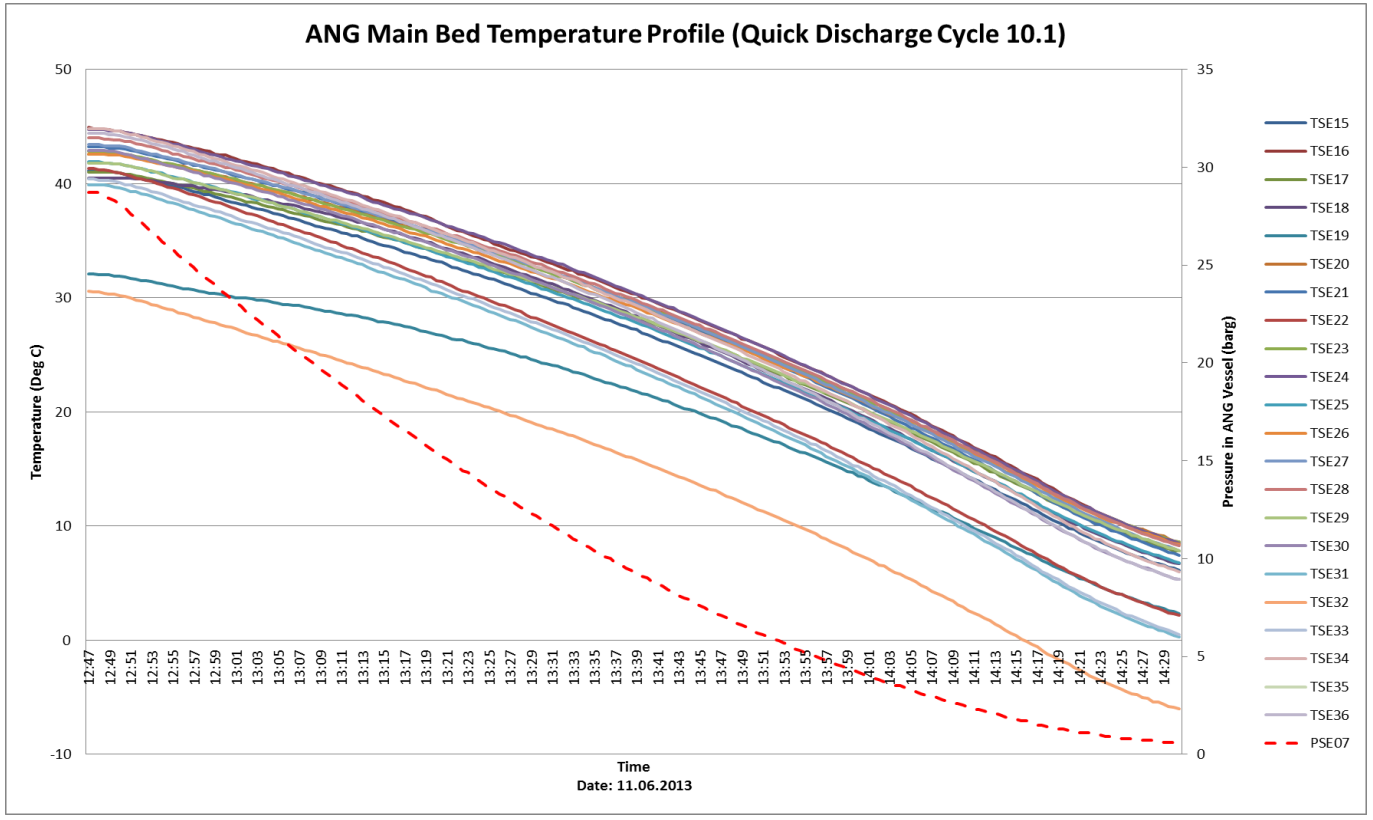
Adsorption Process

- Adsorption phase → Adsorbent bed heats up

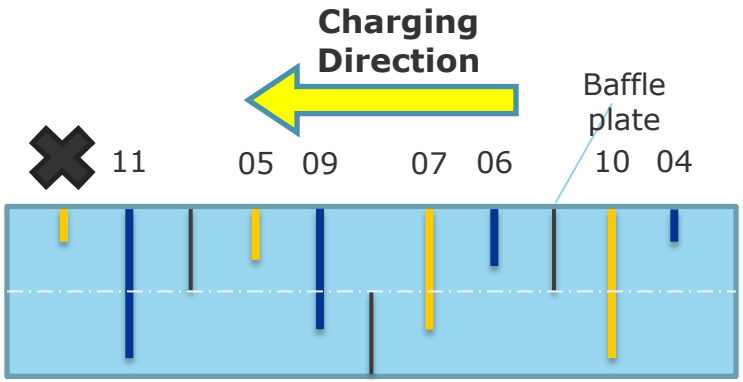


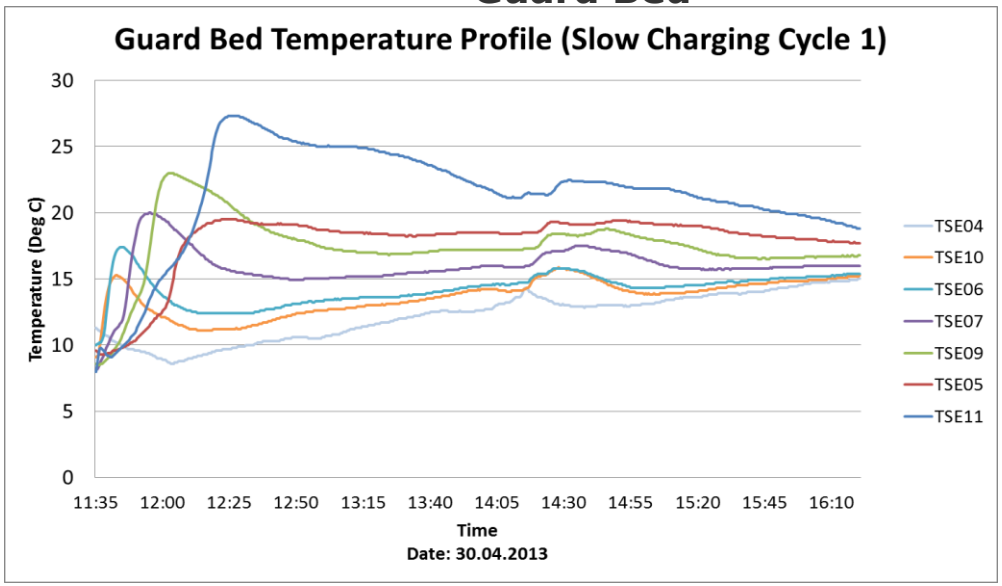
Desorption Process

- Desorption phase → Adsorbent bed cools down



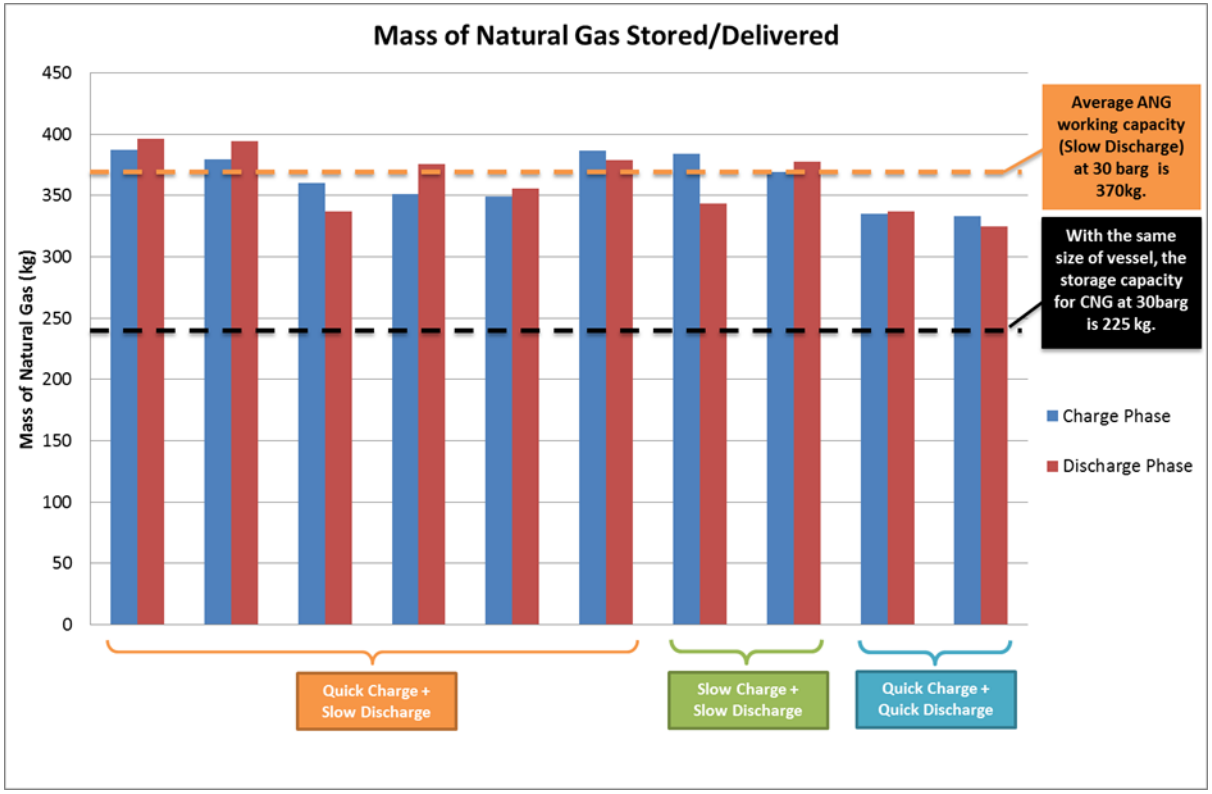
Guard Bed Temperature Profile





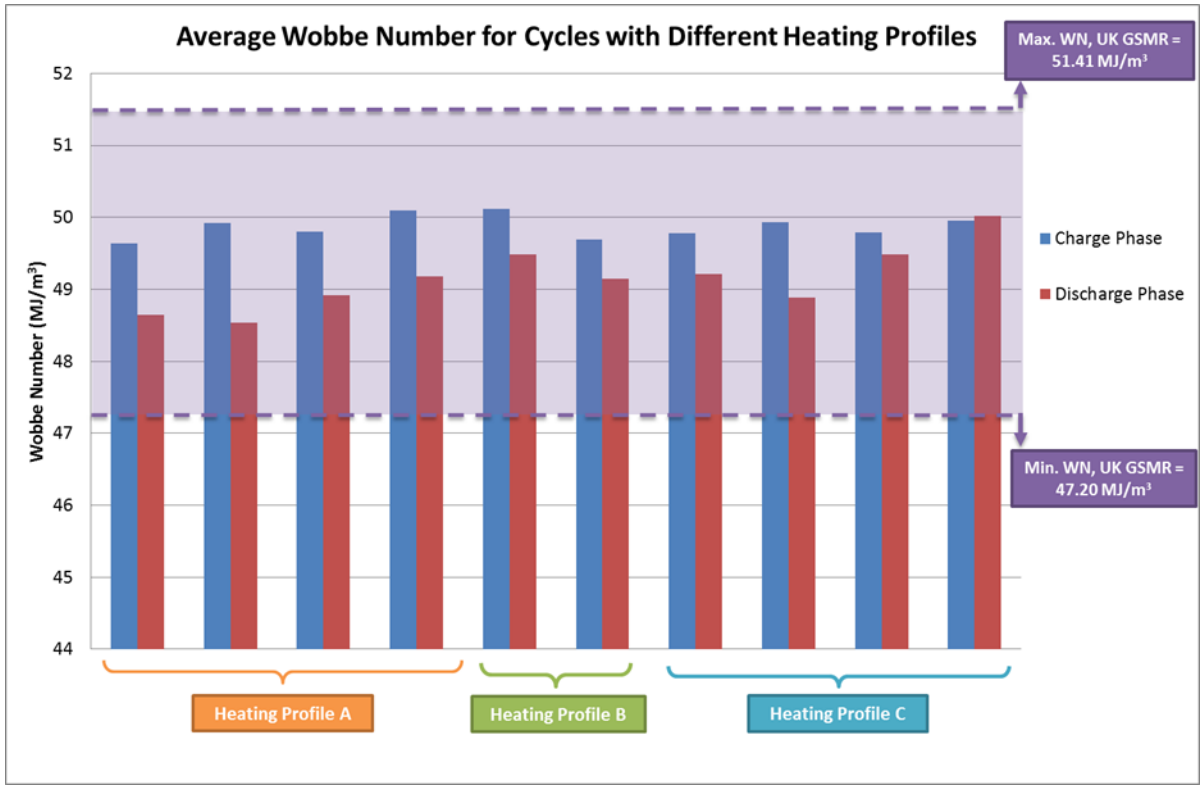
Storage & Delivered Capacity

- The results show that at full scale and a pressure of 30 barg, ANG provides a 70% increase in working capacity compared to CNG.



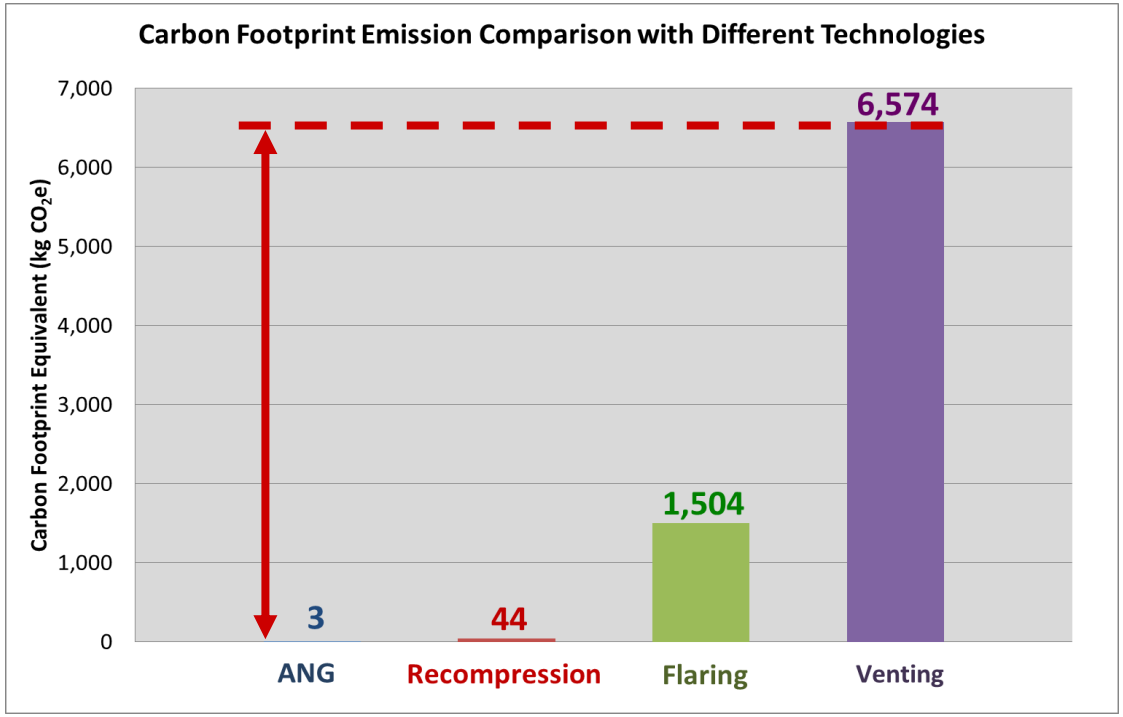
Gas Quality

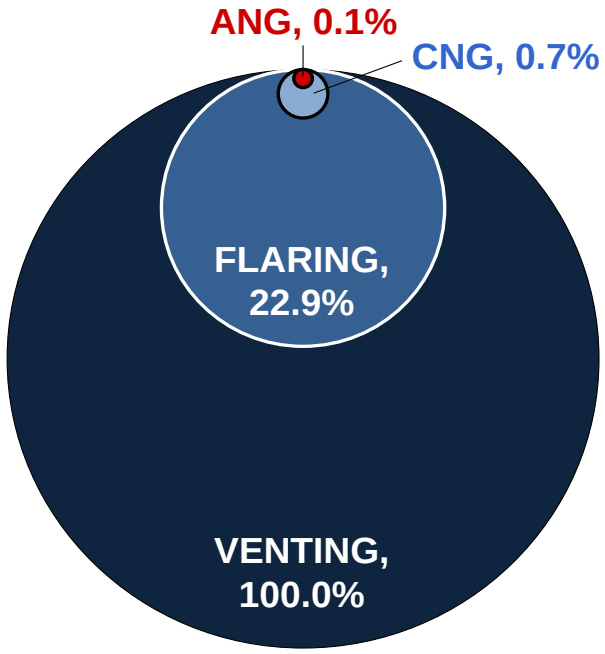
- The average WI of the charge and discharge phases were within the range set by GS(M)R.



Carbon Footprint Reductions

- Figure below shows the comparison of carbon footprint using different technologies as an alternatives to venting.





Achievements

- **“Full” scale demonstration** of ANG technology.
- The trial was successful and met all the objectives.
  - The trial and facility have been designed to mimic the expected venting and capture process at a compressor site.
  - The system installation can capture close to 400 kg of natural gas and showed the benefit of 70% storage enhancement compared to CNG.
  - For these scenarios, ANG technology gives the greatest carbon footprint reduction compared to recompression and flaring.
  - During the discharge phase, the gas delivered meets the transmission pipeline gas quality specification.
  - There is no evidence of carbon performance reduction from the cyclic operations.

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