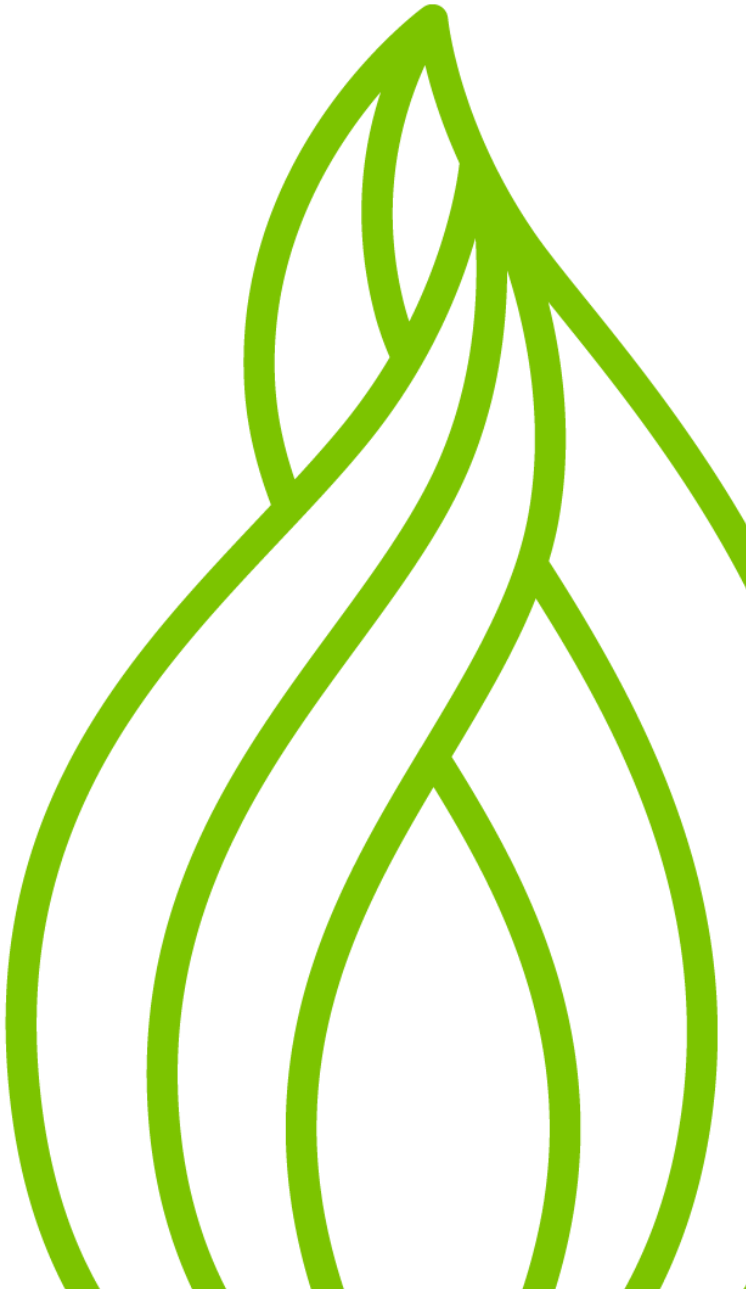
national gas transmission

Variable Envelope Compressor

Value Tracking Case Study



Variable Envelope Compressor

Background

Pipeline compressors can be put in two categories based on their prime movers; gas turbine driven and electric driven. The gas turbine driven compressor comprises a gas turbine prime mover, the gas turbine, which drives a de-coupled power turbine and process compressor (the “gas compressor”). The electric driven compressor comprises a variable speed electric motor directly coupled to the gas compressor.

National Gas Transmission’s fleet of gas compressor trains feature predominantly single stage, centrifugal compressors that do not include any additional technology for varying the envelope of operation besides speed control.

Compressors are designed to operate within limits known as the “envelope” of operation. When gas flows are stable or predictable, they operate comfortable within these limits. The National Transmission System (NTS) has begun seeing increasing short term changes in gas supply and demand patterns. Hence, some compressors due to their location on the NTS frequently operate around those limits.

A requirement for the gas compressor to operate around or outside one or more of its limits has traditionally been met by either a re-wheel (changing out the compressor impeller) or by installing a more adequately sized machine (driver plus compressor). Requirements for compressor unit re-wheels have been identified in a few NTS compressor stations in recent years. However, due to the high capital cost, equipment downtime required and the risk posed by supply / demand volatility few gas compressors have undergone re-wheeling.

The consequence of running the compressor around the limits of its envelope is highly unstable or inefficient operation in which could result in:

1. Increased fuel utilization
2. Reduced Machine Life due to vibration.
3. Increased risk of equipment breakdown.
4. Difficulty in commissioning and operating new compressor installations.

This research and feasibility project investigates the technical and commercial feasibility of installing gas compressors which are capable of varying their performance envelopes to allow efficient and stable operation in response to swings in gas supply and demand.

What’s new?

The research project provided an overview of this approach and the constraints of unit operation. All outputs were documented in the final report with proposed further work to take this from feasibility to implementation.

The benefits

- Improved understanding of asset usage.
- Possible cost avoidance in improving asset performance and reduced maintenance.

Financial savings

No financial benefits realised but follow on work has the potential to avoid building new compressors if existing assets are not fit for purpose due to incorrect usage.

Implementation

Proposed follow on project work on hold and to be re-visited based on stakeholder input.