



GTEN 2019 Symposium

October 21-23, 2019 | Banff, Alberta

19-GTEN-306 Project Case Study: T-South Reliability and Expansion (TSRE)

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Enbridge BC Pipeline

- Natural Gas transmission from Fort Nelson, BC to Huntingdon/Sumas, BC at the Canada/USA border
- First placed into service in 1957.
- Canada's first "big inch" pipeline.
- Federally regulated by the Canada Energy Regulator (CER).



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- Supplies 75% of the natural gas pipeline capacity to BC Lower Mainland and Pacific Northwest.
- Divided into two zones:
 - Transmission North (T-North)
 - Transmission South (T-South)
- 2,900 km of 30", 36", and 42" pipeline carrying up to 3.4 billion cubic feet of gas
- T-South extends from Chetwynd, BC to Huntington/Sumas, BC.

Source: Enbridge BC Pipeline [1]





Introduction to TSRE

- Collection of compression facilities and reliability improvement projects on T-South.
- Adds essential compressor station and system reliability through replacement of aging equipment.
 - Cooper-Coberra (Spey) replaced by BHGE PGT25+ turbine (LM2500+) with PCL802 compressor.
- Accommodates additional 190 MMSCFD of firm capacity.



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Source: TSRE Website [2]



T-South Reliability

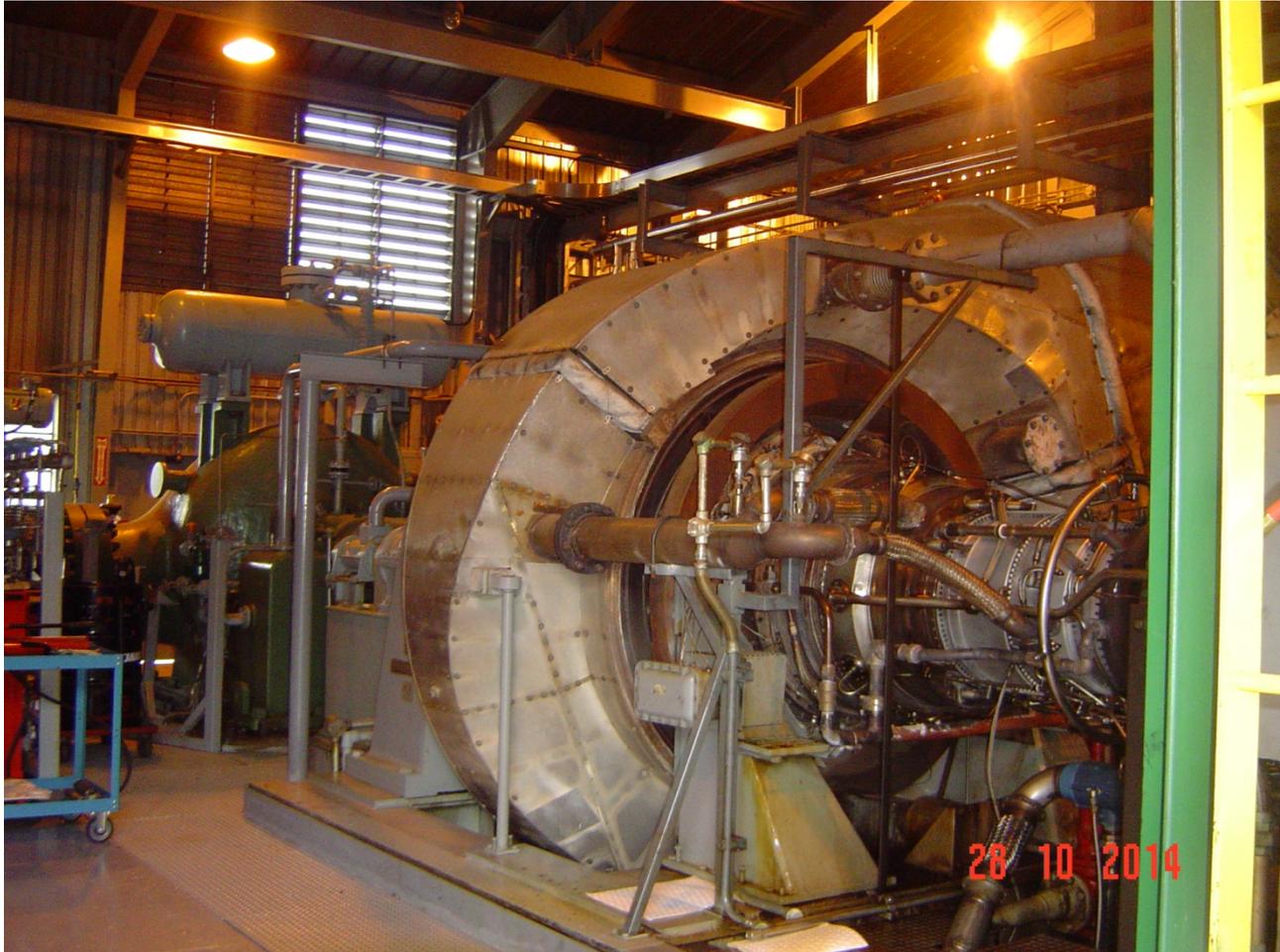
- A fundamental demand shift in 2013/2014
 - Increased utilization of aging units leading to increased unplanned repairs.
 - Increased shipper impacts during maintenance outages.
- Advances Enbridge's Compressor Fleet Replacement Strategy.



- Replacements have been prioritized based on:
 - Lack of availability of original equipment manufacturer (OEM) parts, service, and technical support;
 - Lack of competitive service providers;
 - Emerging environmental regulations affecting aging equipment; and
 - Expected run time.



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Source: Jitendra
Luthra (TSRE
Eng. Manager)
[3]

Cooper Coberra (Spey) 3045 gas turbines coupled to DeLeval PV30x30 compressor



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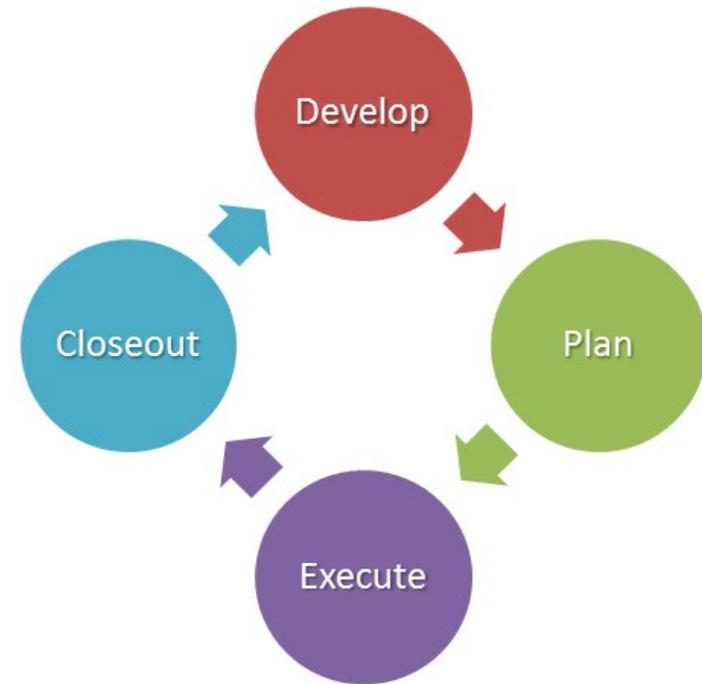
BHGE PGT25+ Turbine (LM2500+) with PCL802 Compressor

Source: Aaron Shimek, Enbridge [4]



The Project Lifecycle

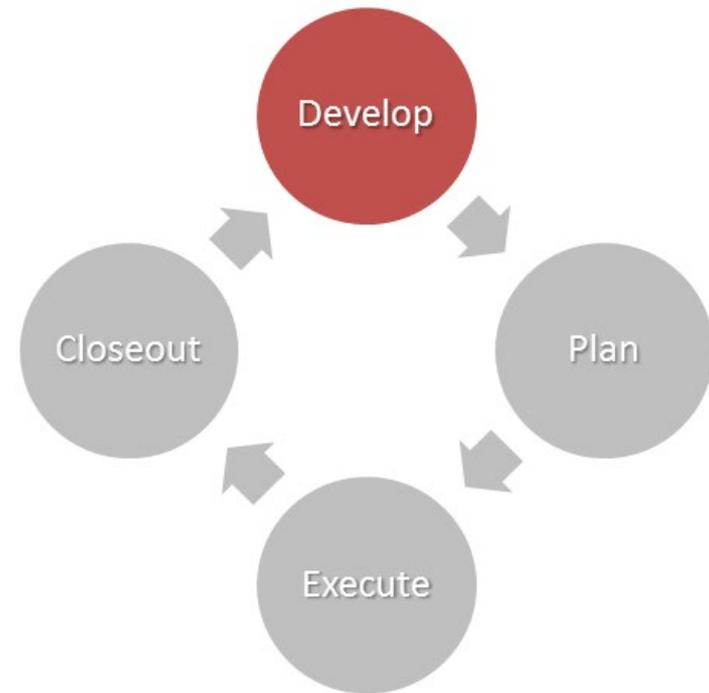
- 4 Key Phases:
 - Development
 - Planning
 - Execution
 - Close Out
- Controlled by Phase Gates





Project Development

- Typically driven by commercial or operational requirements.
- Feasibility Assessments
- Scoping
- Initial field investigations, if required.





TSRE Development

- Rigorous and Iterative scoping process.
 - Ultimately chose additional compression option.
 - Cost effectively met both project goals of increased reliability and additional volumes.
- Preliminary Field Work
 - Environment, Archaeological, Survey
- Pre-FEED Engineering



Pipeline Looping vs Added Compression

- There are three ways to add expansion volume to a gas transmission system:
 - Pipeline Looping- reduction of pressure drop due to gas velocity.
 - Added Compression- increased flowrate results in increased pressure drop. Extra horsepower is needed to boost pressure.
 - Combination of Loop and Compression.

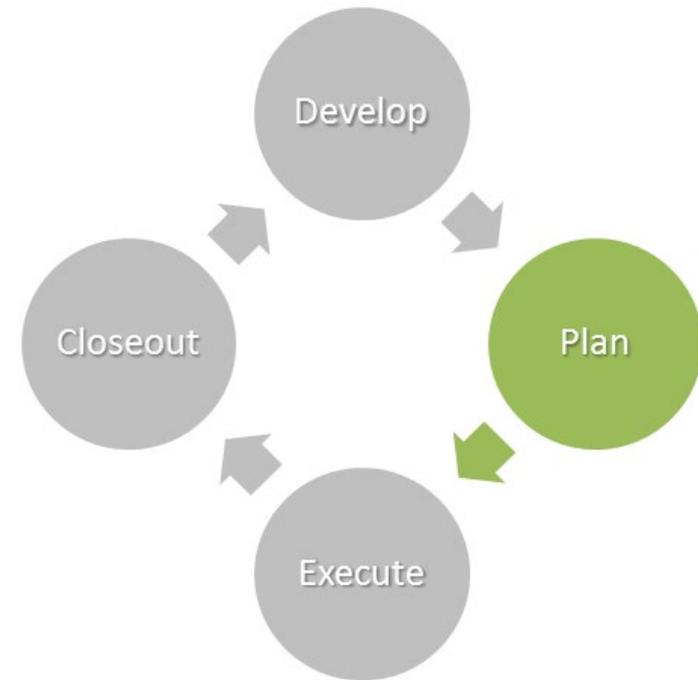


- TSRE chose a compression only option.
- The added compression only option provides other operational benefits:
 - Additional Operational Flexibility
 - Optimized Inventory
 - Staffing Flexibility
 - Support Agreements.



Project Planning

- Scope is further defined and refined.
- Team members are identified.
- Project Execution Plan (PEP) developed, Baseline scheduling.
- FEED Engineering
- Regulatory submissions.





TSRE Planning

- Planning kicked off in October 2017.
- FEED Engineering began and additional field work took place.
- Procurement of long lead materials and equipment.
- Regulatory applications to the NEB, now CER, took place in July and August 2018.



Compressor Procurement

- Consistency across T-South was an important consideration during unit selection.
- After a sourcing process, TSRE purchased five BHGE PGT25+ compressor packages.
- Why?
 - Horsepower.
 - Operational flexibility through optimization of HP.
 - Expansion volume.



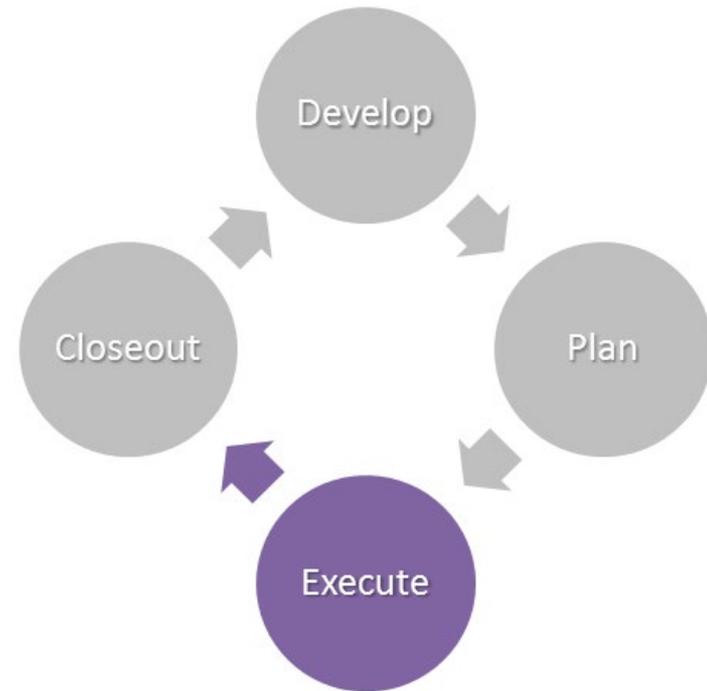
Integration with Existing Facilities

- Varying ages of existing equipment- 1970's through early 2000's.
- Single Station approach.
- Existing utilities matrix developed to understand what is currently in operation and what needs to be supplemented or replaced.
 - Substantial new load requirements with the additional unit.



Project Execution

- Detailed Engineering Design.
- Completion of material procurement and deliveries.
- Contracting.
- Regulatory approvals.
- Construction.





TSRE Execution

- Complete Detailed Design.
 - Receipt of IFC drawing packages.
- Construction Contracting.
- Material Deliveries.
- Regulatory approval received from the CER on September 26, 2019.
- General Construction to begin in March 2020.



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Transportation of LM2500+ en route to CS3

Source: Cristian Popa, TSRE Lead Engineer [5]



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Construction of new compressor addition at CS8A (2017)

Source: TSRE Project Factsheet [6]



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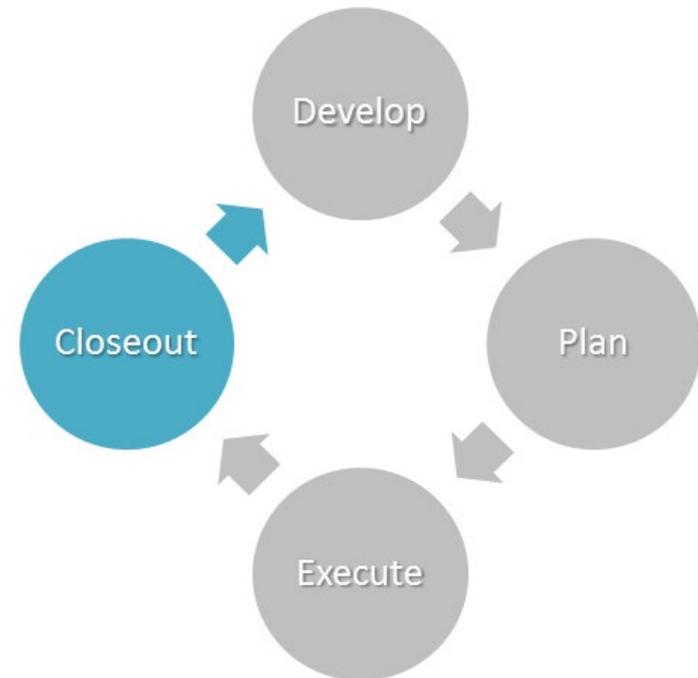
Completed Construction at CS8A (2017)

Source: T-South Regional Project Update for Winter 2019 [7]



Project Closeout

- Contractual obligations confirmed and contract closeout.
- Lessons Learned.
- Project documentation is finalized and filed.
- Project team disbands.





TSRE- What's Next?

- Construction Preparations
- Contracting
- General Construction Starting in March 2020
- Piping Tie-ins during Summer 2020
- Commissioning and In-Service in Q4 2021.
- Project closeout activities.



Acknowledgements

- Jitendra Luthra, P. Eng
- Dave Challoner, P. Eng



Sources

- [1] Enbridge Canadian Gas Transmission and Midstream: BC Pipeline. April 2019. <https://noms.wei-pipeline.com>
- [2] T-South Reliability and Expansion Program. June 2019. <https://www.enbridge.com/tsouth>
- [3] Photo Credit: Jitendra Luthra, 2014.
- [4] Photo Credit: Aaron Shimek, 2017.
- [5] Photo Credit: Cristian Popa, 2019.
- [6] T-South Reliability and Expansion Project Factsheet. Mailout to Communities, June 2018.
- [7] T-South Regional Project Update for Winter 2019. January 2019. <https://www.enbridge.com/tsouth>