

Pipeline “Pumpdown” Compression

Barriers to implementation

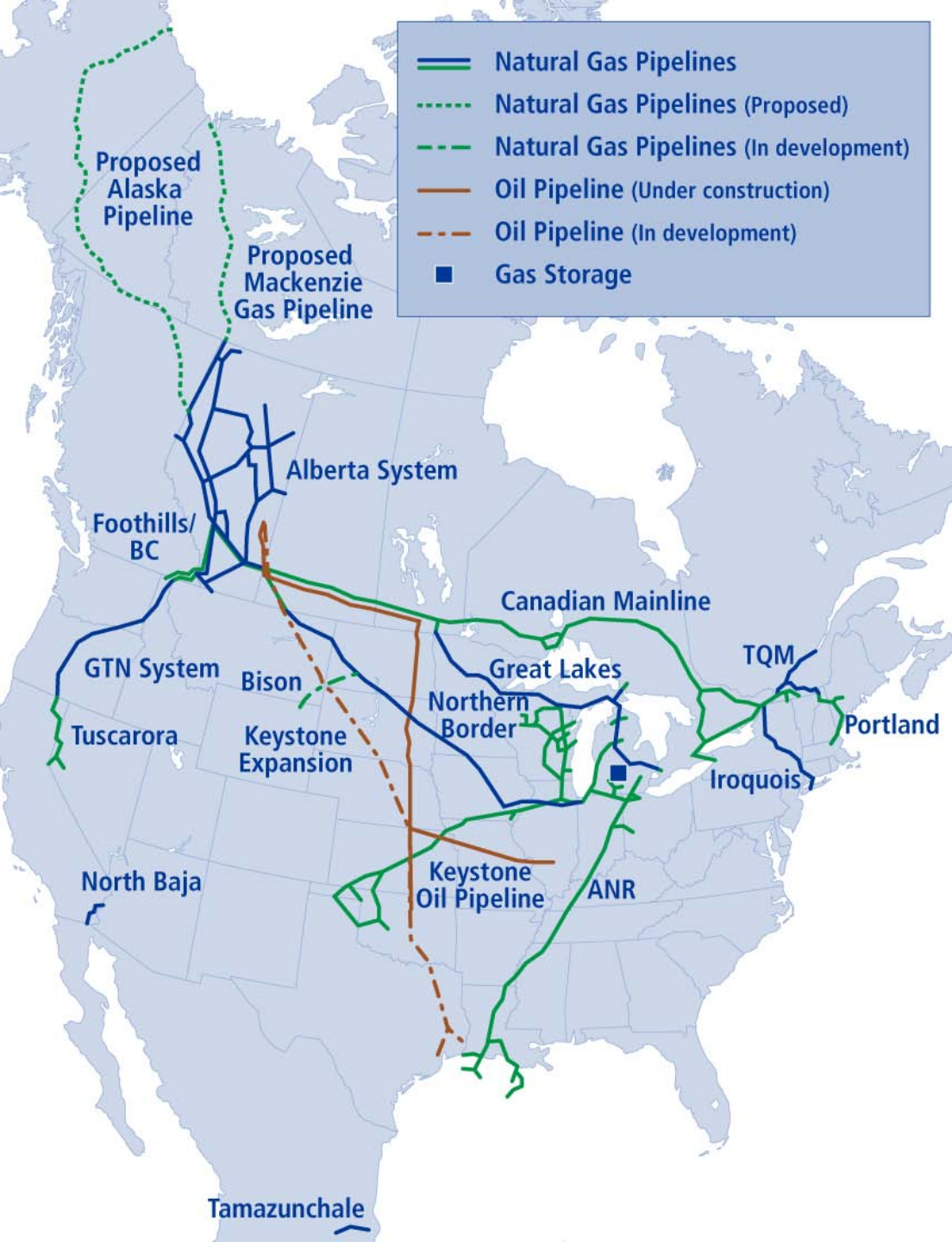
October 20, 2009

Jim Cormack

Pumpdown Compression - Agenda



- TransCanada's facilities
- What is "Pumpdown", or "Pulldown", or "Transfer Compression"
- Decision variables
- Opportunities and Challenges



Pipeline Assets



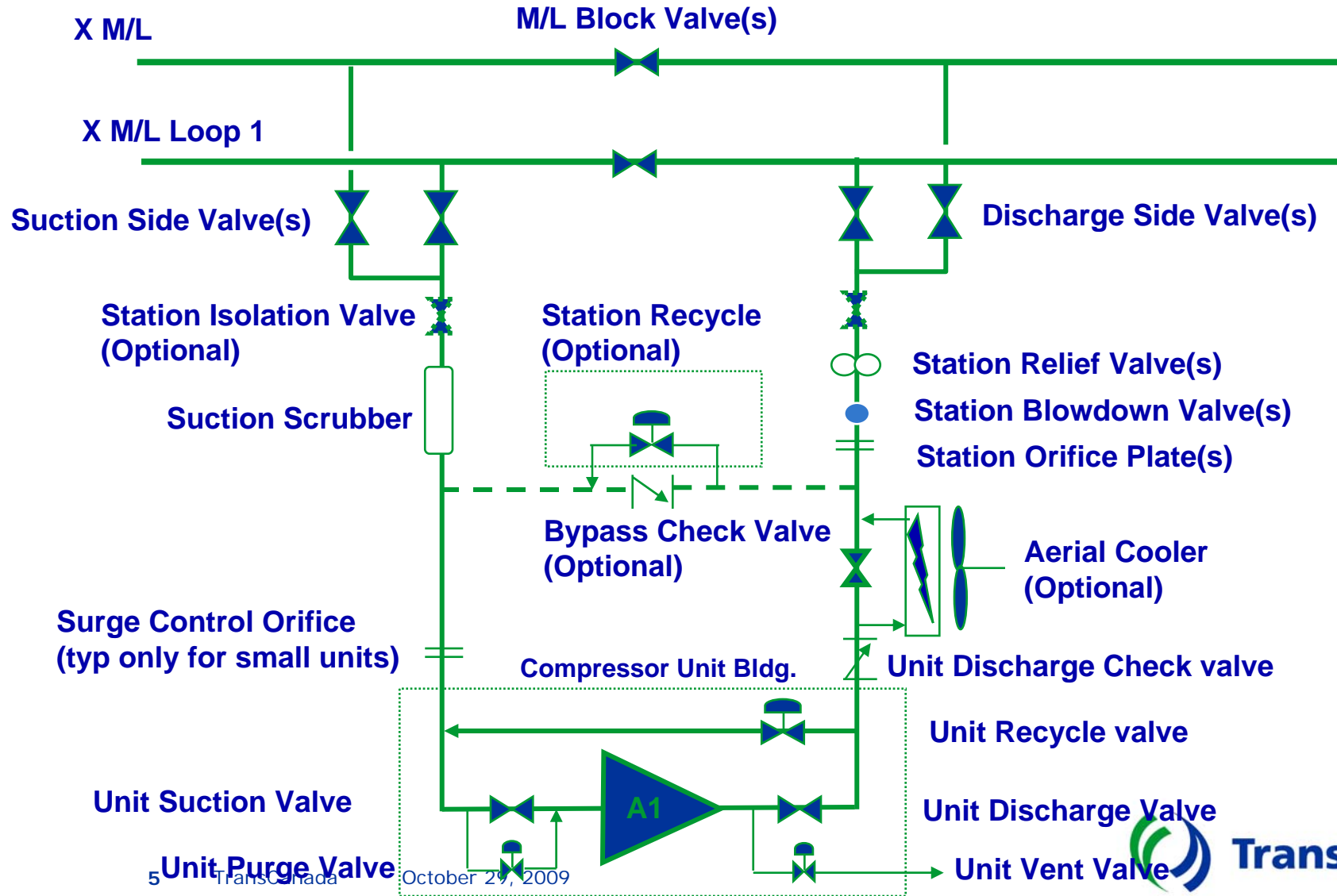
- 35,500 miles of wholly owned natural gas pipeline
- Interests in an additional 4,800 mi of natural gas pipeline
- 370 Bcf of natural gas storage capacity
- >250 Compressor Stations
- Average daily volume of approximately 15 Bcf
- Keystone oil pipeline 1.1 million Bbl/d

Background: Pipeline Pumpdown



- Process in which gas is evacuated from a segment of pipeline about to undergo maintenance
 - Move gas to downstream in-service segment instead of blowing to atmosphere
- Most applicable to large pipelines operating at high pressures
- Use in-line compressors to pull down the pressure to minimum suction pressure
- Use portable compressor to pull down pressure further
- About 90 percent of gas previously vented is usually recoverable
- Cost is often justified by value of gas savings
- Numerous internal and external barriers to implementation

Compressor Station Layout



Nova 1 Transfer Compressor Unit



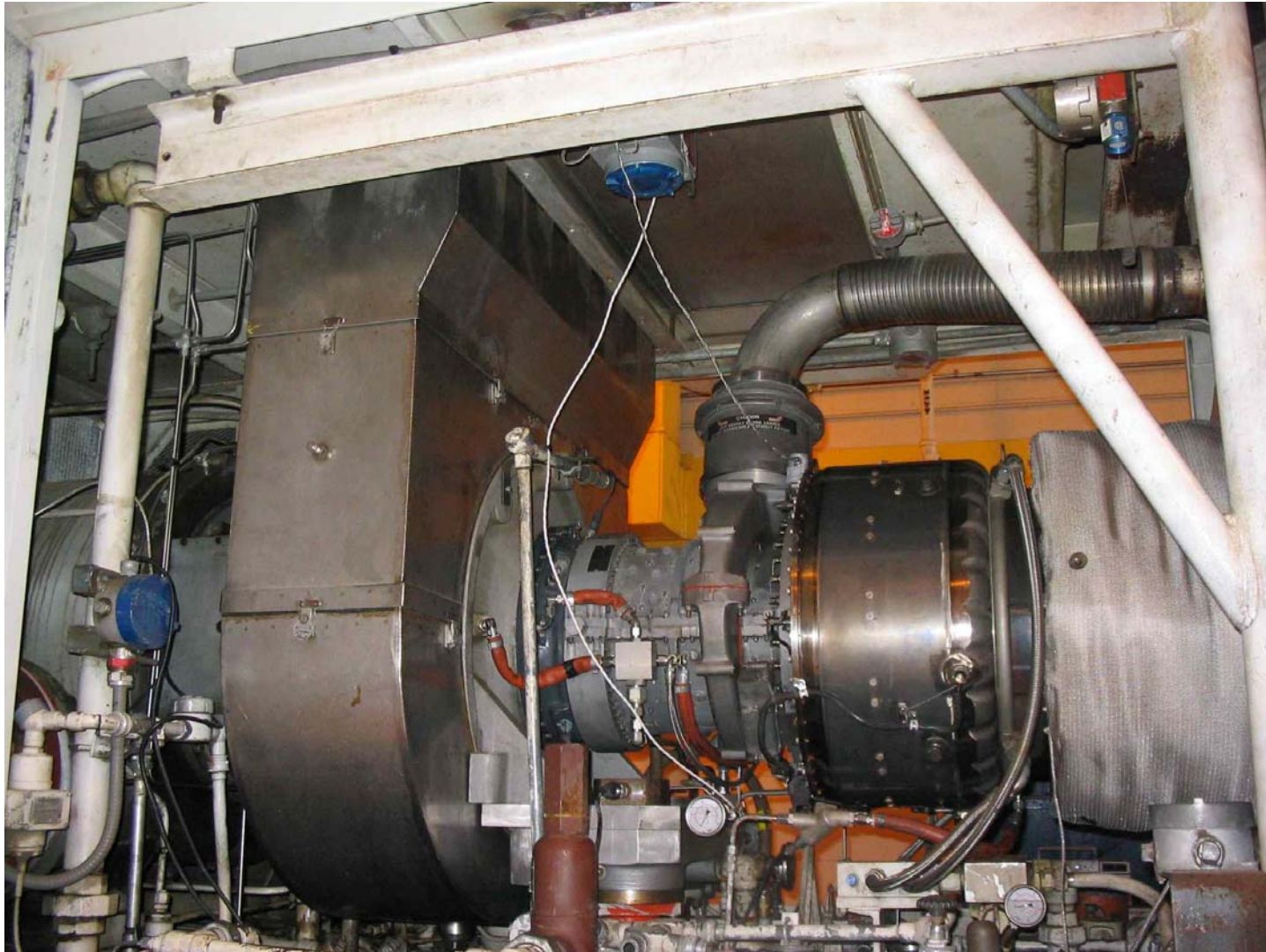
Nova 1 Transfer Compressor Unit



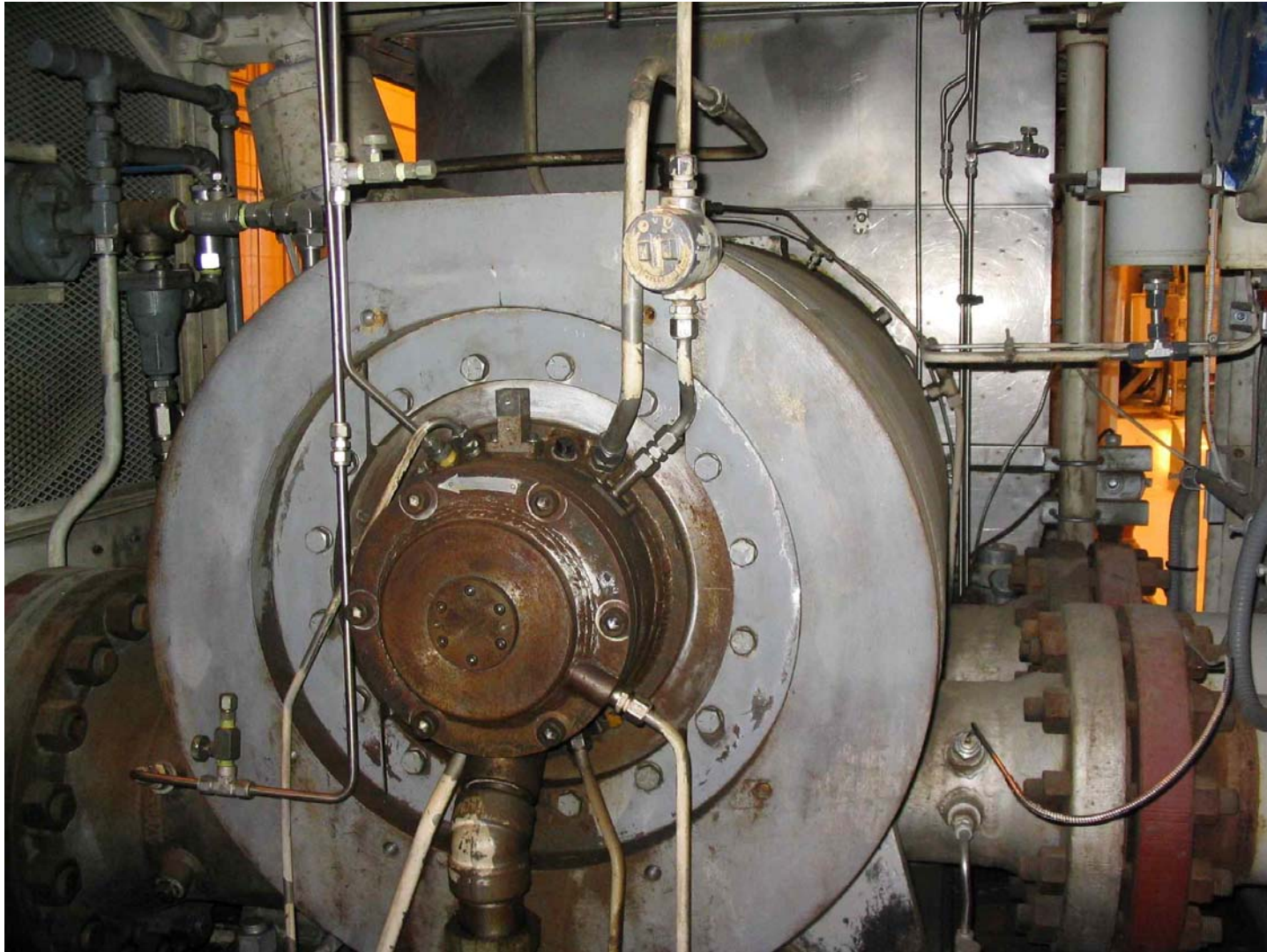
Nova 1 Transfer Compressor Unit



Nova 1 Transfer Compressor Unit



Nova 1 Transfer Compressor Unit



Specifications



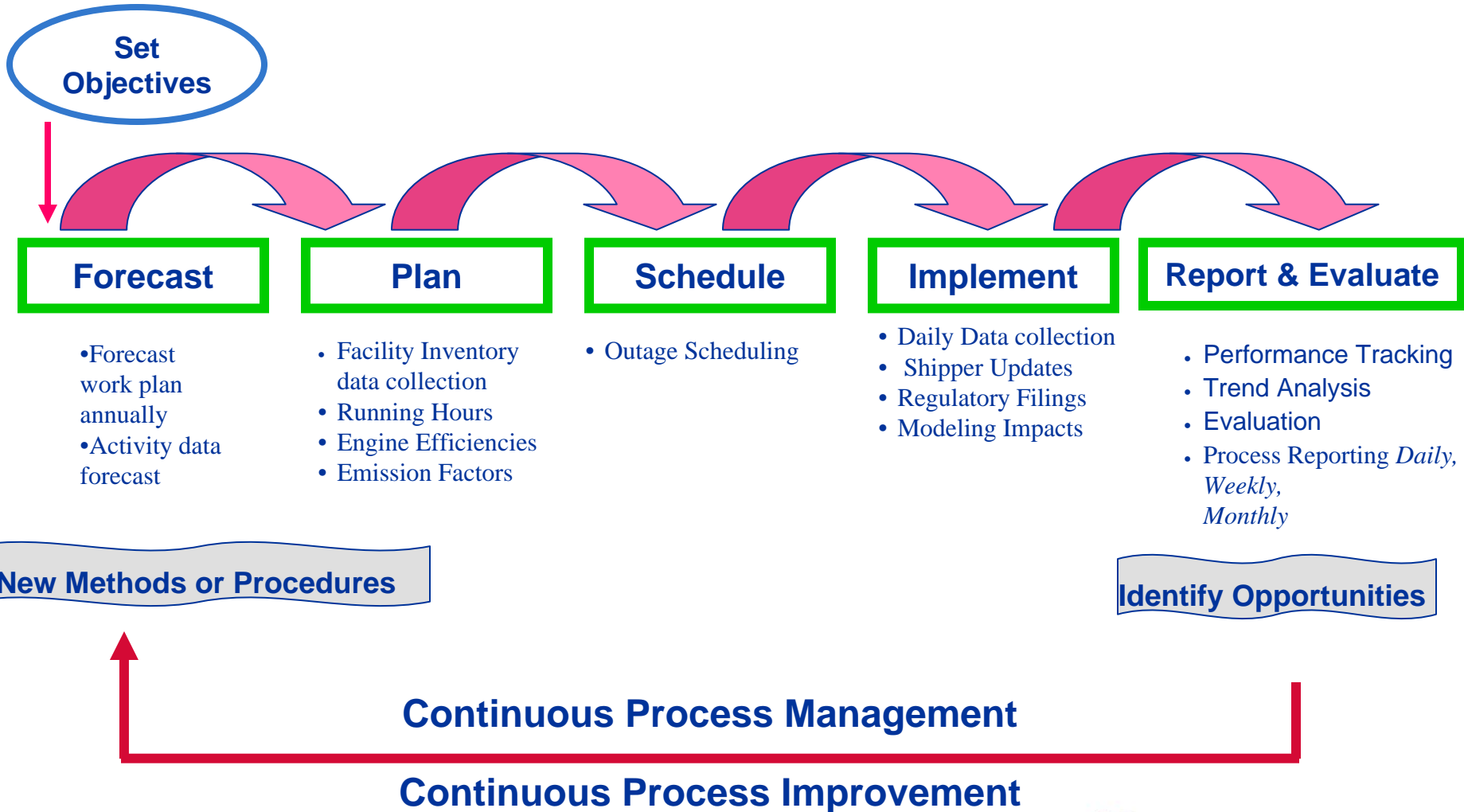
- Nova 1 is a portable 8 staged, inter & after cooled natural gas transfer compressor.
- Allied Signal ASE 40 3.5 MW Gas Generator & Power Turbine Driver (Natural Gas)
- Norwalk TC40 Centrifugal Compressor
- CAT / Olympic Gen-set (Auxiliary Power Unit)
 - 75 kWA (Diesel)
 - 480 V AC output

Specifications

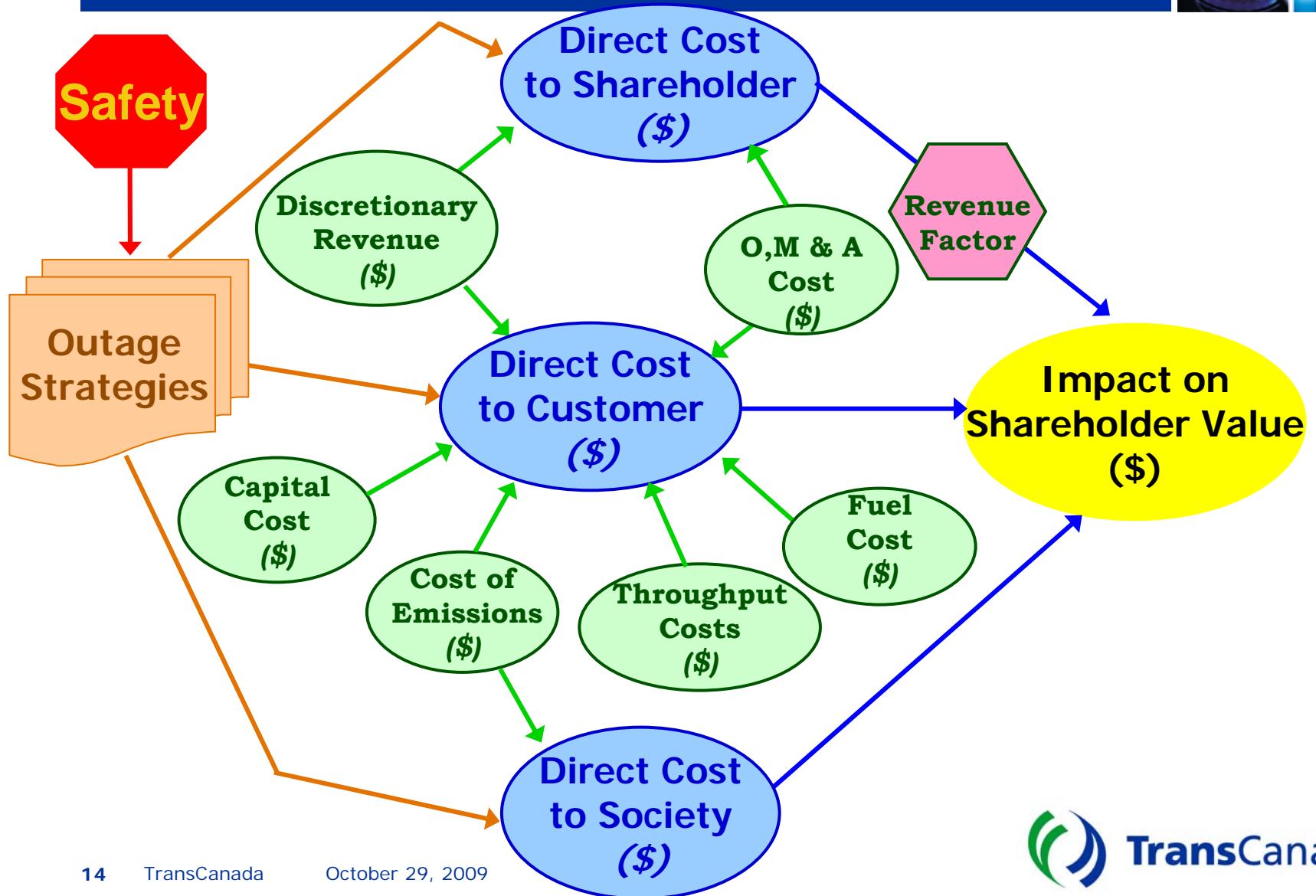


- Nova 1 is a stand alone operation require no external electrical interconnections.
- Suction & Discharge piping is connected to the pipeline with temporary portable natural gas piping.
- Fuel Gas is drawn off the Discharge side gas.
- All piping & pressure vessels is ASME B31.8 & 31.3
- All electrical currently is certified to CSA standards

Management Operating System – The Process



Outage Decision Model – The Variables



TransCanada Experience: Economics



- Several variables affect the beneficial use of portable pumpdown compressors:
 - Additional fuel use from downstream compressors can be large
 - Fuel use by portable compressor
 - Extra manpower and maintenance issues
- TransCanada uses its "Outage Decision Model" to evaluate these variables and decide the economic feasibility of pumpdowns
- Other Considerations:
 - The time variable is very important, especially if service disruptions are a potential from the line being out of service
 - The extra fuel consumed by inline compression due to increased friction loss is usually the critical variable

Key Points for Pipeline facilities in a GHG constrained world



Little scope for emission reductions:

- Combustion emission reductions from existing facilities is extremely expensive
- Existing Facility options are:
 - Pipe vs compression for new projects
 - Efficiency improvements
 - Electrification in isolated instances
 - Reduction in fugitive emissions

Pipeline Options for GHG Reductions



- Physical
 - Efficiency upgrades (already being considered)
 - Replace drivers with electric motors (limited situations)
 - Replace compression with pipe (very expensive)
 - Reduce throughput/output (counter-productive)
 - Waste Heat recovery/cogeneration (limited situations)
 - Capital stock turnover (small efficiency gains)
 - Carbon Capture & Sequestration (extremely expensive on gas combustion)
- Contractual
 - Purchase GHG credits/offsets/allocations
 - Invest in “technology”

Challenges



- Shipper (customer) concerns not aligned with emission reduction objectives – more education needed
- Costs – this is how the world works
- Challenges
 - Unclear regulation
 - Unclear application of regulation
 - Stringent and time consuming reporting requirements
 - Capacity of current employee base
 - Competing regulatory objectives