xstream
a datacor product

CASE STUDY

Castlelost Flexgen Gas Transient Analysis

PLATINUM PIPE AWARD WINNER

CHALLENGE

Castlelost Flexgen is developing a 275 MW OCGT peaking plant (Kiltotan, Oldtown, and Rochfortbridge, ~ 85 km west of Dublin) designed for rapid response to grid demands. Such fast load variations produce transient pressure fluctuations across the gas supply system. The Gas Networks Ireland (GNI) regulator requires up to 5 seconds to react to shifts in flow, which can cause pressure spikes, dips, or gas supply interruption. This introduces risks of turbine alarms, shutdowns, or even triggering of the GNI slam-shut valve.

Maintaining stable turbine inlet pressure near 33 barg is therefore essential under various dynamic operating scenarios.

SOLUTION

Fingleton White conducted a high-fidelity transient gas system analysis using xStream. xStream employs the Method of Characteristics (MOC) to solve the transient equations of gas flow. The fundamentals mass, momentum, and energy equations are solved for each pipe to accurately represent the propagation of transient waves throughout the system.

The full pipeline system—from the GNI regulator through the header down to each Siemens turbine—was modelled for both 5-turbine and 7-turbine operation. The study evaluated steady-state performance and four transient scenarios in each configuration: (1) all turbines tripping simultaneously, (2) all turbines ramping up at the steepest point of startup, (3) a single turbine trip with all turbines running, and (4) a turbine trip with only two turbines running.

Fingleton White

- **Industry:** Power Generation
- **Region:** Ireland
- **Focus:** Engineering a new gas power plant

The model incorporated regulator response curves, buffer volume calculations, alarm thresholds, turbine operational requirements, and worst-case boundary conditions to validate system robustness.

RESULTS

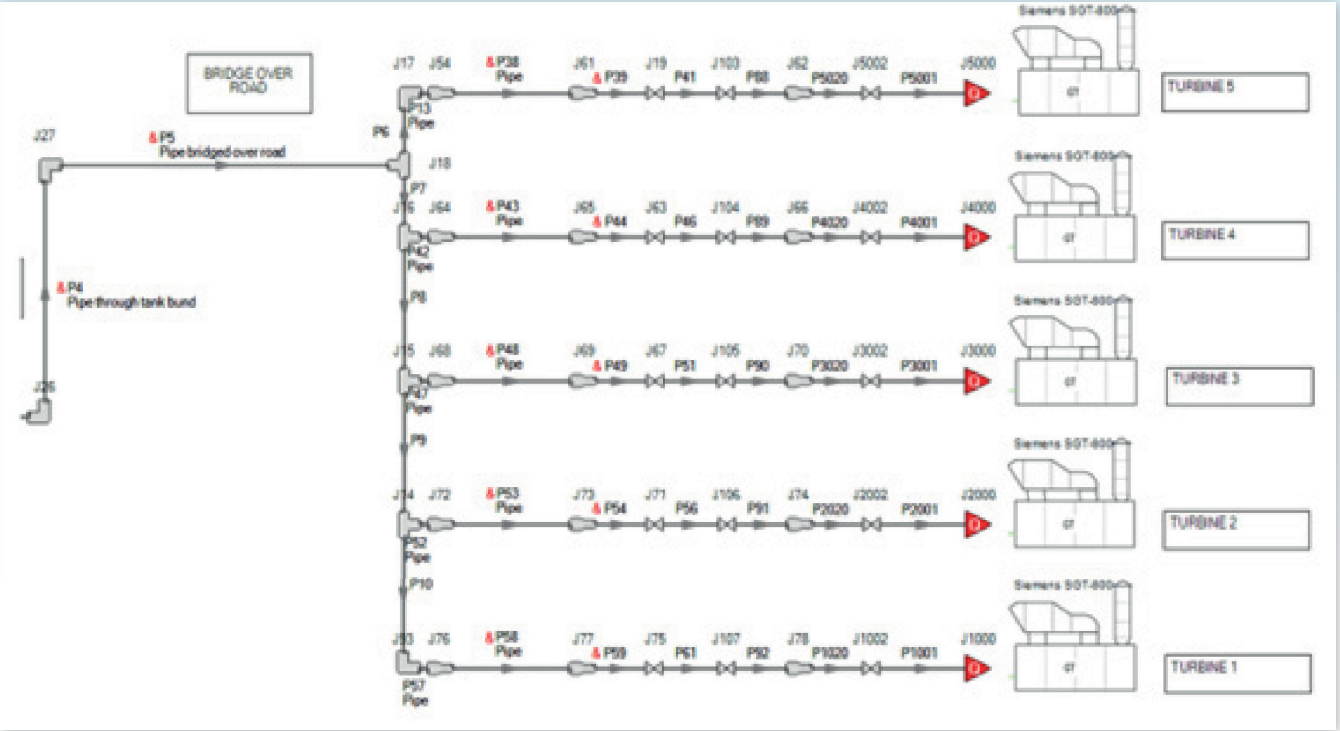
The analysis demonstrated that the system meets all operational, regulatory, and OEM requirements for both 5-turbine and 7-turbine configurations. No transient event exceeded the GNI slam-shut limit of 38.01 barg. Pressure drops during ramp-ups stayed above the turbine low-pressure alarm threshold of 29 barg. Pressure variations in all trip scenarios were within the allowable transient limit of 1.5 bar.

TANGIBLE BENEFITS ACHIEVED

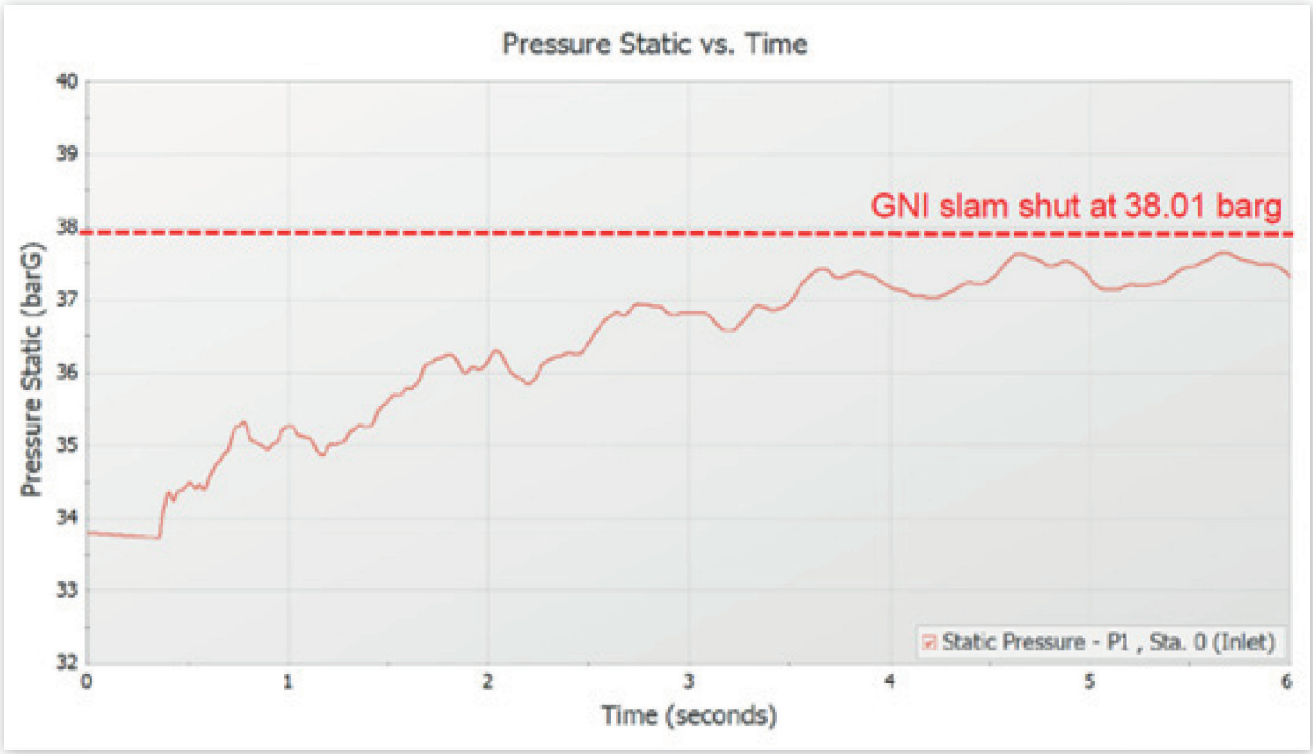
- **Operational security confirmed:** no risk of gas supply interruption even in extreme trip events.
- **Avoidance of turbine shutdowns:** no scenario produced pressures capable of triggering alarms.
- **Verified pipeline buffer volume adequacy:** for both 5- and 7-turbine configurations.
- **Proven compliance** with GNI and Siemens requirements.
- **Reduced commissioning and operational risk:** by validating expected behaviour in worst-case conditions.
- **Confirmed readiness for future expansion:** to 7 turbines without major pipeline redesign.

TURBINE KEY FINDINGS

CATEGORY	KEY RESULT
Steady State	~32.58–32.59 barg delivery pressure; stable and within turbine requirements.
Buffer Volume	16.63 m^3 total pipe buffer; sufficient to absorb all modeled transients.
Scenario 1: All Turbines Trip	Peak pressure 37.82 barg (below 38.01 barg slam shut); no system risk.
Scenario 2: All Turbines Ramp Up	Minimum pressure 32.03 barg; remains well above 29 barg low pressure alarm.
Scenario 3: One Turbine Trips (All Running)	Peak at neighbour turbine: 34.28 barg; pressure variation <1.5 bar; no alarms.
Scenario 4: One Turbine Trips (Two Running)	Peak 33.7 barg; variation <1.4 bar; all within alarm limits.
Overall Finding	All scenarios meet GNI and Siemens limits; no risk of trips, alarms, or supply interruption.



xStream Model of 5 Turbine Configuration



Transient Analysis of Pressure Build-Up When 5 Turbines Trip