CASE STUDY: Fuel Supply Capability Expansion – Specification, Procurement, and Commissioning

Delivering High-Flow Natural Gas, Nitrogen Doping, and Propane Blending from Design to Operational Use

Project Snapshot

Industry: Aerospace / Combustion Test Facilities
Challenge: The test site needed higher natural-gas flow than the utility could supply, plus new capabilities for nitrogen doping and propane blending—none of which the existing infrastructure could support.
Result: A fully **specified, procured, and commissioned** multi-fuel supply solution (CNG + nitrogen + propane) that safely delivers the required flows and mixtures, after correcting critical sizing and specification gaps.

---

1. Opening Hook – The Challenge

A test site needed to run **higher-flow natural-gas tests** and explore **variable gas compositions** (nitrogen-diluted gas and propane-enriched fuel). The client had already invested in a **new million-dollar gas compressor**, expecting it to unlock the required capacity.

However, the tests still couldn't run at the desired conditions, and nitrogen doping or propane blending **weren't possible at all** with the existing infrastructure. The goal of this project was to **enable an entirely new fuel-supply capability** through complete **specification, procurement, and commissioning**.

---

2. Problem Definition

We started by establishing the true baseline:

- Existing **line sizes**, pressure ratings, and site layout.
- Utility constraints on **natural-gas feed** to the facility.

We then discovered a critical oversight:

- The limiting factor was not just the old compressor.

- The **incoming gas supply itself was capped by the provider**, so even the new compressor **couldn't deliver the target flow**.

At the same time, the customer needed:

1. **Additional natural-gas capacity** beyond pipeline limits.
2. **Nitrogen doping capability** to simulate different gas compositions.
3. **Propane blending** for specific test envelopes.

All of this had to be done with **correct sizing, safety, procurement, and commissioning** into the existing test environment.

---

3. Our Approach – Complete End-to-End Delivery

Phase 1: Specification and System Design (~3–6 Months)

1. Extending Natural Gas Capacity with CNG

To overcome the utility limit, we **specified** a **Compressed Natural Gas (CNG) trailer system**:

- **CNG trailers** for high-pressure storage.
- **Depressurization skid** (the critical enabler): multi-stage pressure reduction with **integrated heating** to prevent Joule–Thomson liquefaction.

2. Nitrogen Doping System

Jumbo nitrogen trailers paired with **correctly sized pressure regulators**, flex hoses, and rigid piping. We corrected a prior mis-specification where the regulator **couldn't deliver required flow**.

3. Propane Blending

Propane storage tank + vaporizer with **insulated, heat-traced vapor lines** to maintain gaseous state and prevent condensation.

Phase 2: Procurement (~3–6 Months)

We **procured all major equipment** per the specifications:

- **CNG trailers and depressurization skid** (multi-million-dollar scope).

- **Nitrogen trailers and regulators**.
- **Propane tanks, vaporizers, and heat-tracing systems**.
- **Piping, valves, and instrumentation** rated for site conditions.

Total investment: **several million dollars** across all systems.

Phase 3: Installation and Commissioning (~1–2 Months + 4–5 Weeks)

Installation took approximately **one year** total for design through physical setup. **Commissioning** of all three systems required **4–5 weeks** of rigorous validation:

- Functional flow and pressure checks.
- Control logic and safety interlock verification.
- **Propane commissioning on a robust test system** capable of 0–100 % propane (preventing damage to sensitive combustors).

This **safe commissioning strategy** was critical—wrong test fuels could have destroyed hardware worth hundreds of thousands.

---

4. Results and Impact

- **Natural-gas capability:**
  - Achieved target flow rates **beyond utility limits** using CNG + depressurization.
- **Nitrogen doping:**
  - Reliable, correctly sized system delivering precise nitrogen blending.
  - Fixed earlier regulator mis-specification.
- **Propane blending:**
  - Safe, controllable propane supply with proper vaporization and line conditioning.
- **Overall impact:**
  - The test site gained a **new multi-fuel, multi-composition capability**, enabling advanced combustion tests that were previously impossible.
  - **Proper specification, procurement, and commissioning** protected equipment, schedule, and investment, preventing costly mistakes.

---

5. Takeaway & Forward Value

This project underscores what **ProReady Engineering** brings to complex fuel-supply challenges:

- **End-to-end delivery**: Specification → procurement → commissioning.
- We look **beyond the obvious bottleneck** (the compressor) to find the true system constraints.
- We design solutions that combine **CNG, nitrogen, and propane** safely and correctly.
- We place heavy emphasis on **sizing, specification, and commissioning strategy**, because a single wrong regulator or test choice can waste millions.

By applying systems-level thinking and attention to detail, we transformed a constrained test site into a **flexible, future-ready fuel-supply platform** capable of supporting advanced combustion research for years to come.