



## CASE STUDY

# Maintaining Strict Voltage Compliance with Impacting Regenerative Loads

### The Situation

Industrial environments with rapidly changing loads often rely on static synchronous compensators (STATCOMs) in power systems to stabilize voltage with both inductive and capacitive reactive power (VARs). However, an industrial customer recently contacted Powerside upon experiencing an operating environment that was far more complex.

The customer's system included a regenerative load driven by an active front-end (AFE) source inverter. Unlike typical loads, this system both consumed and returned power, creating rapid and continuous voltage swings that would rise during regeneration and drop during load draw. At the same time, the system was grappling with a weak electrical network with low X/R ratio ( $X = \text{reactance}$ ,  $R = \text{resistance}$ ), meaning it was extremely sensitive to both real and reactive power.

With a strict voltage excursion compliance criteria, the customer found themselves in a high-stakes scenario where non-compliance would result in a loss of interconnection permitting.

### Challenge

Voltage stability

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### Project Type

Utility noncompliance

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### Diagnostic Tools

PQube® 3, advanced system modeling, real-time simulations



## The Challenge

The customer's load was on a weak system that resulted in significant systemic voltage impacts, leading to a much stricter voltage excursion criteria:

- Maximum 1% voltage excursion allowed
- Each dip and rise must be under 0.5%

### Compliance was required at two separate locations:

- The point of common coupling (PCC)
- A utility substation 9,000 feet away

Maintaining voltage within such tight tolerances across two points—each with different X/R ratios—made for a significantly complex challenge. Additionally, the utility had other customers connected to the same substation, requiring careful coordination to avoid unintended impacts upstream.

The client's initial solution to their bi-directional voltage excursions was to provide real power compensation at each of their sites—but at a whopping \$4 million per site, they needed expert help for precise voltage control, without the large-scale cost.

Powerside was brought in to help.

## The Solution

Powerside approached the problem through advanced system modeling and real-time simulations, testing how different compensation strategies would perform under real-world conditions. By adjusting the STATCOM and real power input variables, Powerside identified an optimized solution.

We deployed a 0.78 MVar-sized STATCOM to provide targeted reactive power compensation, successfully meeting the power requirements at both the PCC and connected substation. By using an advanced [PQube® 3 power quality analyzer](#) at both the PCC and substation, our engineers could observe system behavior in real time and fine-tune the STATCOM's response to ensure strict utility requirements were met.

**Ultimately, this approach eliminated the need for multi-million-dollar real power compensation systems, delivering a significantly more cost-effective path forward while preserving system stability.**



When electrical issues challenge you beyond standard solutions, Powerside brings innovative power quality expertise to deliver precise results.

Reach out to us today to learn more about how Powerside can help you solve your most complex power challenges.

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