Powering Up Steel Production

From Voltage Instability to Enhanced Productivity

Southern States

Case Study

The Problem

Our customer is a steel company with the capability to manufacture 1,930 tons of steel bars and rods. Their production facilities include one Electric Arc Furnace, one Ladle Furnace, and a Rolling Mill.

The company's industrial processes were causing voltage fluctuations that played havoc not only with their operations but also with the grid itself. Hence, the utility required compliance with power factor, harmonics, and flicker limits.

PARAMETER	VALUE
Harmonics (TDD)	9.15%
Harmonics (2nd h. content)	3.5%
Flicker (Pst95)	2.09
Power Factor	60% of the time, this facility absorbs reactive power from the grid, while 30% of the time it delivers a large amount of reactive power back to the grid causing voltage oscilations.

The Analysis

The customer's reactive power strategy for the Electric Arc Furnace and rolling mill consisted of fixed harmonic filters as shown below:

EAF circuit (34.5 kV):

- 2nd Harmonic filter
- 3rd Harmonic filter
- 4th Harmonic filter

Rolling mill and services (13.8 kV circuit):

- 7th Harmonic filter

This design met the customer's needs; however, the excessive delivery of reactive power to the grid and the flicker generated by the Electric Arc Furnace (EAF) remained significant concerns for both the utility and adjacent loads.

To mitigate flicker and provide effective reactive power compensation, dynamic compensation was deemed necessary.

Upon extensive analysis, the optimal solution emerged as a **Hybrid STATCOM**. Although the potential utilization of the customer's existing harmonic filters was considered, the limitations posed by available space and the remaining service life of the equipment ultimately swayed the decision towards a complete replacement.

The Solution

With passive compensation alone, it was impossible to comply the required limits, especially for 2nd harmonic and flicker (Pst and Plt).

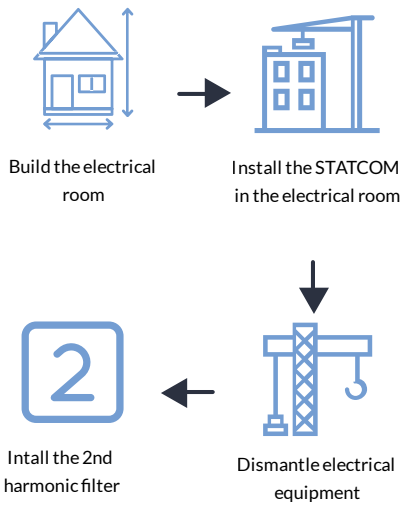
After power flow analysis, a 100 Mvar STATCOM was specified. ±80 Mvar SVG + 20 Mvar 2nd harmonic filter.

- A Hybrid STATCOM solution enhanced the performance and reduced investment requirements.
- The main challenge was to install the equipment in a small footprint where actual harmonic filters were installed without affecting production.

The Implementation

Following the completion of the electrical design, the next challenge involved carefully planning the installation stages, with a primary focus on ensuring the uninterrupted operation of the EAF.

The project had to be broken down into 2 phases to keep the EAF running at optimized power.



The construction phase of the project presented significant challenges, attributed not only to the irregular landscape but also to the presence of the pre-existing harmonic filters essential for EAF operation

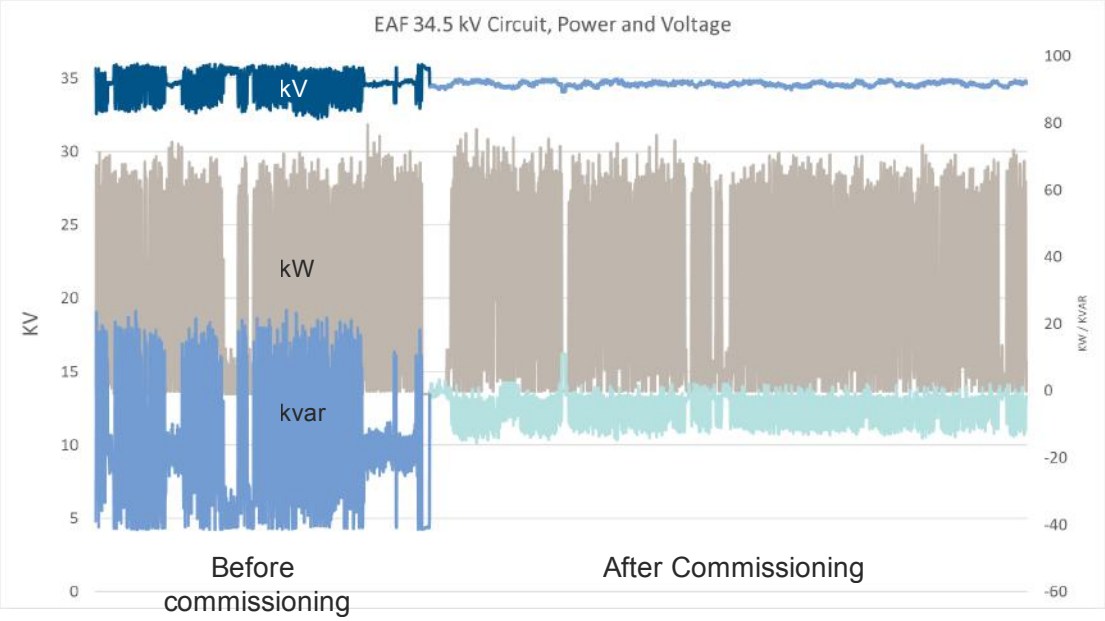
Aerial view: Highlighted in blue is the available space for the STATCOM solution with the previous harmonic filters.

The Results

With great logistics and coordination with the customer, the project was implemented on time with the following power quality results:

PARAMETER	BEFORE	AFTER
Harmonics (TDD)	9.15%	3.34%
Harmonics (2nd h. content)	3.5%	2.05%
Flicker (Pst95)	2.09	0.97
Power Factor	Absorbing and delivering excess reactive power, causing voltage fluctuations.	97% of the time between 97% lagging and 100%.

Apart from achieving grid connection compliance, additional benefits were derived from improved voltage regulation in the EAF circuit. Productivity was increased by having more stable voltage and more active power available, hence Power On time of the furnace was decreased.

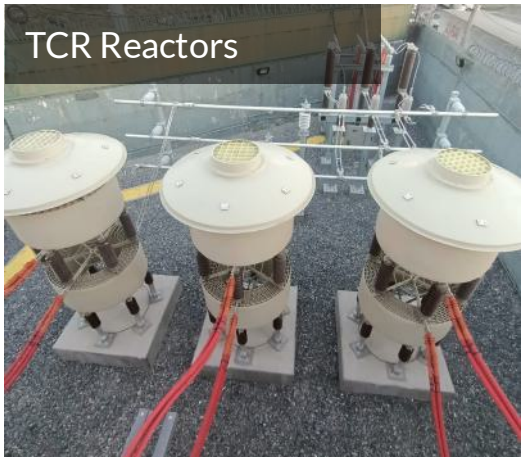


Project Gallery

Power Units

Electrical room

TCR Reactors



2nd harmonic filter

2nd harmonic reactors

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