

SULZER

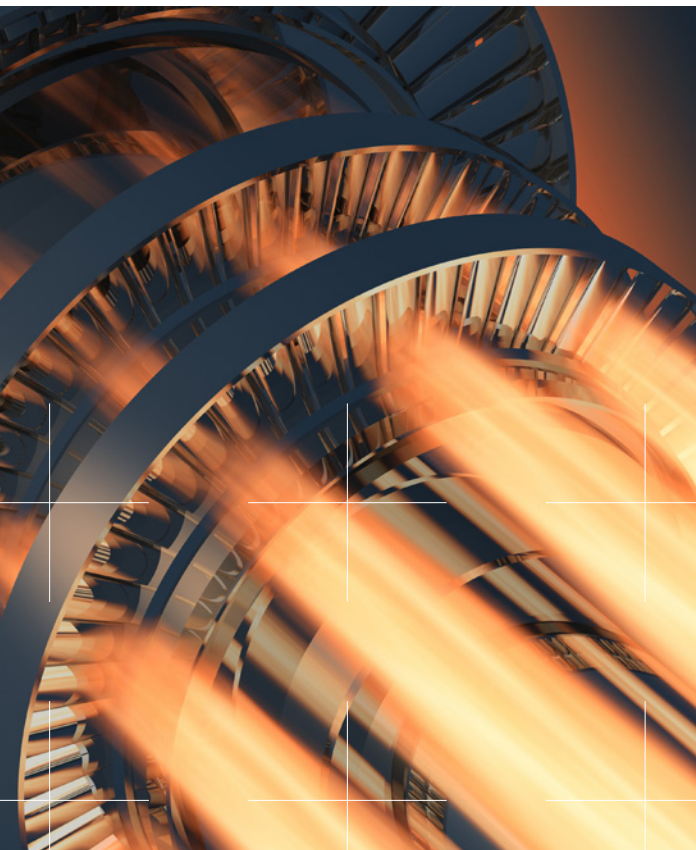
Proprietary CATS reduces gas turbine NOx emissions by 120 tonnes a year

CUSTOMER 500 MW combined cycle powerplant

LOCATION Tongzhou, China

INDUSTRY Power Generation

- KEY SERVICES
1. Sulzer CATS
 2. Research & development
 3. System integration



Meeting a new NOx emissions standard



In 2021, Jiangsu Province in China announced its “Stationary Gas Turbine Air Pollutant Emission Standard”, which stipulated that by 1 Jan 2023, all gas turbines in the area will have to attain a nitrogen oxide (NOx) emission limit of 30 mg/m³. The customer in question realized that to meet the new emissions standard, the gas turbine required a retrofit solution. Ideally, this needed to be achieved without a large capital expenditure (CAPEX) or annual operating expenditure (OPEX).

- The Siemens V94.2 gas turbine was emitting between 35 and 45 mg/m³ of NOx
- Flue gas denitration would cost operators a CAPEX of USD 2 million and an OPEX of USD 685'000
- A low NOx burner cartridge replacement through a dry low emission solution would require a USD 342'000 CAPEX and an annual USD 137'000 OPEX
- The aforementioned solutions would incur extended downtime due to long lead times, a situation which operators wanted to avoid, given the revenue impact
- The power plant needed an expert independent service provider (ISP) with a suitable solution for reducing the NOx emissions of the legacy turbine



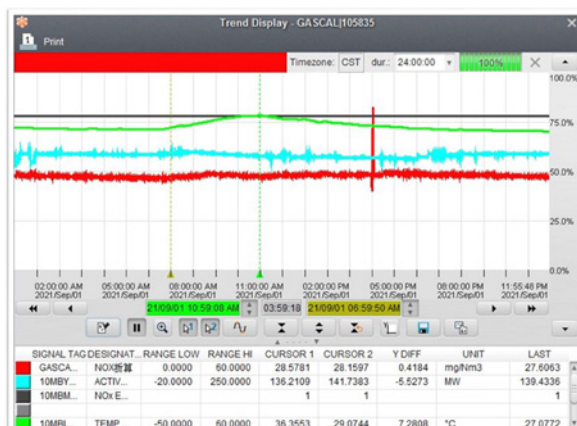
THE SOLUTION

Bespoke closed-loop combustion auto-tuning solution (CATS)

Having established an excellent track record of supporting the power plant for various overhauls and its reputation as one of the leading global independent service providers (ISP) with a strong engineering heritage, the customer turned to Sulzer for a viable solution.

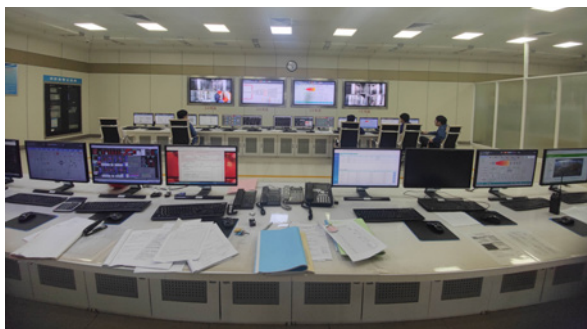
Sulzer's gas turbine experts evaluated conventional NOx control solutions and modelled the timeline and costs impact over the longer term. In a bid to meet the customer's goals with minimal impact to downtime and costs, the team went back to the drawing board. After an extensive research and development phase, Sulzer provided a bespoke CATS, which would control key combustion parameters to reduce NOx emissions while securing gas turbine efficiency. Sulzer developed the modular control system in-house, carrying out control strategy design, control logic configuration and simulation verification.

- CATS provides closed loop control, using feedback from sensor signal data to keep operational parameters within the desired thresholds. If any signal value exceeds the desired range, automatic dynamic adjustments are made to ensure that key parameters such as emissions, combustion dynamics, power output and efficiency are maintained
- Every gas turbine is unique, rigorous analysis of thousands of sets of operating data from combustion characteristics to NOx generation were done by Sulzer's experts for precise calibration of CATS, to achieve the desired automatic-tuning outcomes.



- A custom key data display was implemented, showing signal data from different parameters including NOx, humming, natural gas heat, humidity and temperature
- The bespoke control interface includes dedicated modules for auto-fuel adjustment, a combustion stability control, NOx emissions reduction, performance optimization control, fuel calorific value manual input function, function status display, alert alarm and a historical graph
- Using models to make predictions on burn stability in different conditions, the system can also take proactive actions to control the burn, an aspect that becomes more proficient as more data is collected
- Across a range of loads, gas calorific values, humidity and ambient temperatures, the CATS was able to deliver average emissions below the 30 mg/m³ standard

Pushing a legacy turbine to new efficiencies

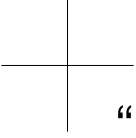


The CATS ensured that the turbine now meets the “Stationary Gas Turbine Air Pollutant Emission Standard” coming into effect in Jiangsu Province. During its first year of operation, emissions from the gas turbine have been greatly reduced. All this has been achieved without costly, lengthy modifications to the turbine itself.



- The highest instantaneous value of NOx emissions from the turbine is lower than 28.5 mg/m^3 since the CATS was installed, with an hourly average of just 27 mg/m^3 – 25% to 30% lower than the average NOx emission value in 2020
- CATS has provided the power plant with a one-off CAPEX saving of USD 1.4 million, while delivering OPEX savings of over USD 41'000 per turbine annually
- NOx emissions from the gas turbine have been reduced by 120 tonnes in its first year of operations, unlocking annual NOx emissions tax savings of nearly USD 44'000
- CATS was installed with minimal disturbance to power generation operations, helping to secure uptime
- The system is fully applicable to other selective Siemens, General Electric and Mitsubishi heavy duty gas turbine models





“Having monitored the performance of the solution’s impact, we’re pleased that it has yield cost savings on different fronts, from NOx emissions tax to CAPEX, while helping the customer in achieving its compliance and sustainability goals. On a project basis, Sulzer CAT’s impact for Tongzhou power plant is a testament to Sulzer’s multi-faceted technical expertise and customer-first approach.”

Dai Yun Fei, Deputy General Manager (Sulzer-Huadian JV) & Project Lead (Sulzer CATS)

PROJECT KEY FACTS

NOx EMISSIONS SAVED ANNUALLY

120 tonnes

NOx EMISSION REDUCTION WITH CATS

25-30%

CAPEX SAVING

USD 1.4 million

THE IMPACT

OPEX SAVING/TURBINE ANNUALLY

Over USD 41'000

Sulzer’s bespoke CATS solution allows power plants with legacy gas turbines to achieve stable combustion performance and reduced emissions reliably and cost-effectively.

NOx EMISSIONS TAX SAVINGS ANNUALLY

USD 44'000

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