Operating experience with MGT6000 Gas Turbines

MAN Energy Solutions
Future in the making

SAIC Volkswagen
Combined Heat and Power Plant in Shanghai

Authors

Christian Steinbach,
Feng Liu,
Andreas Spiegel,
Thorsten Pöhler
(all MAN Energy Solutions)

Contents

Introduction 3
Plant Layout 4
Installation and Commissioning 5
Operating Experience / Availability 6-7
Summary and Outlook 8

Operating experience with MGT6000 Gas Turbines

at SAIC Volkswagen Combined Heat and Power Plant in Shanghai

SAIC Volkswagen (SVW) and MAN Energy Solutions are fully committed to protecting the environment. For this reason, both companies joined forces in 2015 to modernize the SVW power plant in Shanghai with a gas driven turbine combined heat and power plant (CHP plant). The new CHP plant has achieved an overall efficiency of >82% and reduces the CO_2 emissions by approximately 40%, compared to the former coal fired power plant.

After five operational years of supplying electricity and heat to the local corporate grid with high load fluctuations, we would like to share with you how we have managed to both improve the availability of the gas turbines and significantly reduce the number of protective shutdowns. Although the installed MGT6000 gas turbines were produced within the prototype series, the first machine will soon be reaching the nominal service interval for hot gas area inspection. A recent borescope inspection has shown the machine is in an overall good condition.

Plant Layout

The SAIC Volkswagen combined heat and power plant consists of four MGT6000 gas turbine packages with exhaust heat recovery boilers. The gas turbines power the generators using a load gear, and the generated electrical power is then directly fed to SAIC Volkswagen's company grid.

A local Chinese EPC company designed and erected the power plant. Picture 1 shows the plant layout with the MGT6000 gas turbine packages (yellow) delivered by MAN Energy Solutions. The oil cooling system (red) and exhaust heat recovery system (blue) were delivered by the local EPC.

At the time of installation, the serial production of the MGT6000 had just started. After running a comprehensive full scale engine testing at full load conditions, the prototype engines were released to the customer for operation.

Picture 1: Schematic of the SVW CHP Plant

Picture 2: Installation of the gas turbine packages on site in Shanghai

Installation and Commissioning

The first MGT6000 packages were delivered at the end of 2015 (Picture 2).
After having been commissioned by a joint team of Chinese and German engineers, the customer took over the MGT6000 packages on February 4, 2016 (Picture 3).

MAN Energy Solutions' objective is to localize the customer support and service for their products to a great extent. Therefore, local engineers were trained during commissioning to provide service and customer support for operation of the plant. Furthermore, they can rely on the support of our specialists from our headquarter for detailed data analysis and monitoring.

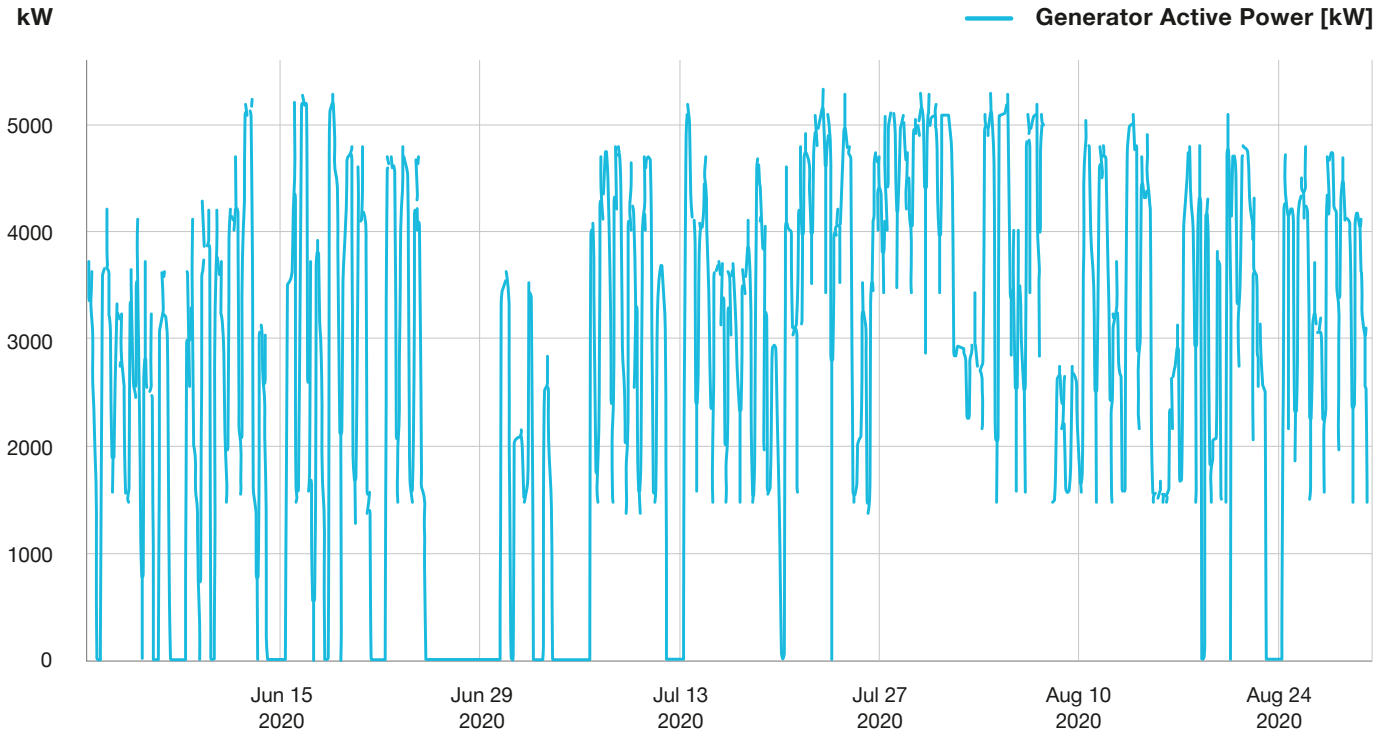
Picture 3 : MGT6000 package installed at SVW site in Shanghai

Operating Experience / Availability

The MGT6000 is equipped with MAN Energy Solutions' PrimeServ assist monitoring system. This system allows MAN experts to remotely monitor the operator's data for anomalies and transmit notifications onto the MAN CEON platform. This enables the operator to monitor and ensure the availability of the machinery. Furthermore, MAN experts are able to analyze current component conditions and evaluate the remaining lifetime which leads to optimized maintenance planning.

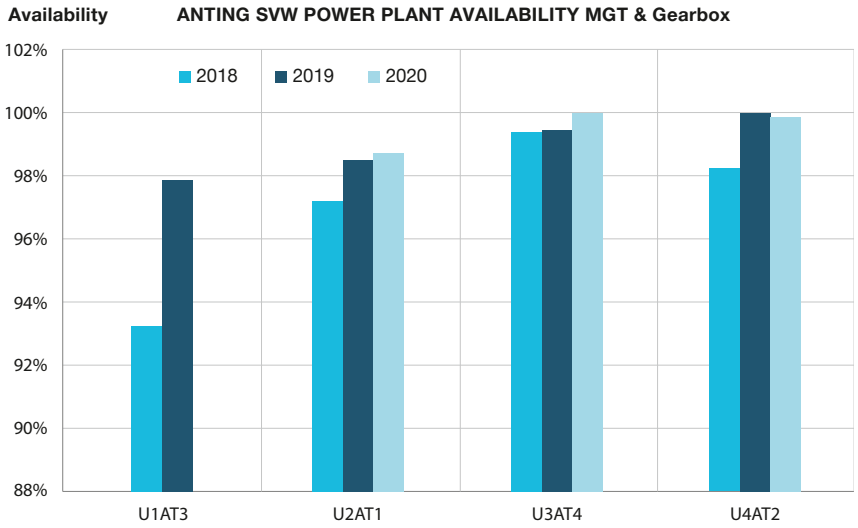
Since these machines were prototypes, they were equipped with additional prototype measurement sensors for measuring temperature and pressure. In addition, the auxiliary system and shutdown thresholds were set at a very high safety setting. Obviously, this led to a higher number of protective shutdowns at the start of the operation. After increased operating experience, the additional equipment was reduced and the gas turbine protection optimized for more reliable operation.

As the MGT6000 feeds the generated electrical power directly into the SVW factory grid, it is essential for it to handle strong load variations in the grid. These variations can reach up to 75% of the nominal power output of the MGT6000. The long-term operating experience has proven that the MGT6000 can master these load fluctuations reliably (Picture 4).



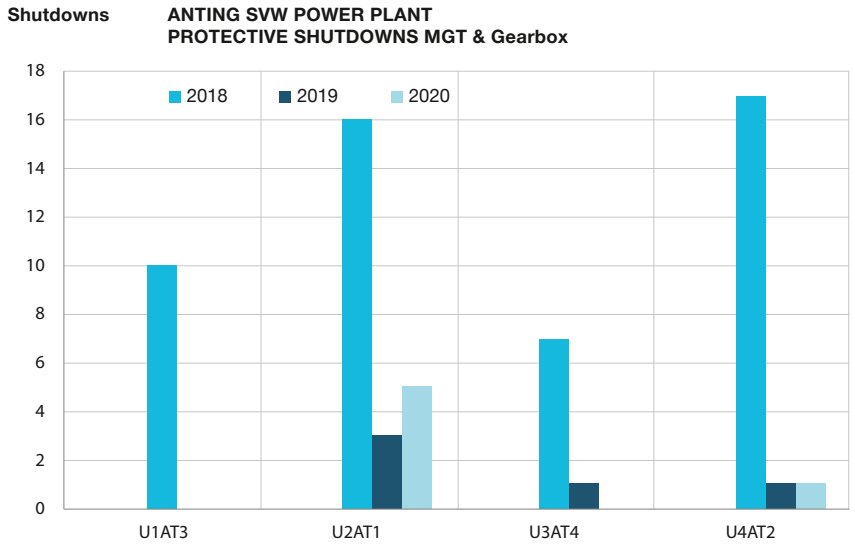
Picture 4: Example of the MGT6000 load profile in the SVW car factory in Anting

We were able to enhance operation of the MGT6000 by continuously optimizing and adapting the package to fulfill the SVW car factory requirements. Year by year, progress was made in improving both the availability and number of protective shutdowns. Since 2019 the availability of this MGT6000 gas turbine package has exceeded 98% (Picture 5). These are excellent values, especially when considering that the Anting MGT6000 gas turbines were originally from the prototype series.



Picture 5: Availability of the MGT6000 reaches >98% after three years of operation.

With increasing operational experience, we were able to remove additional protective instrumentation and consequently reduce the number of unnecessary protective shutdowns (Picture 6). The operational time of the MGT6000 has proven that the robust design of these machines is very reliable as well as durable. Furthermore, they offer an excellent operational flexibility, making it a perfect match with the customer's power demand for a local grid.



Picture 6: The number of protective shutdowns were significantly reduced by 2019

Summary and Outlook

The MGT6000 gas turbines have made a substantial contribution to reducing the SVW car plant emissions. MAN Energy Solutions is proud to support SVW in achieving their goals for environmental protection.

Three MGT6000 gas turbines are in ongoing operation. The front-runner successfully accumulated more than 37’100 equivalent operating hours in January 2021. As a recent borescope inspection has revealed, the machine’s conditions are up to standard. Therefore, it can continue to run until it reaches its regular inspection interval of 40’000 equivalent operating hours.

The experience gained from the MGT6000 gas turbines in operation at the SVW power plant in Shanghai is of great value for the entire MGT fleet. MAN Energy Solutions uses this experience for the ongoing improvement process to continuously increase the reliability of the MGT6000. This contributed to the MGT fleet achieving more than 200’000 OH while sustaining high reliability. Recent new orders for the MGT6000 in Germany have proven how more and more gas turbine operators are gaining trust in this modern heavy duty machine.

Picture 7: MGT6000 turbine inlet section after 37’100 equivalent operating hours (picture of borescope inspection on February 20, 2021)

MAN Energy Solutions
86224 Augsburg, Germany
P + 49 821 322-1750
F + 49 821 322-49 1750
info@man-es.com
www.man-es.com

MAN Energy Solutions
Gas turbine development
and production center
Steinbrinkstr. 1
46145 Oberhausen, Germany
P + 49 208 692-01
F + 49 208 669-021
turbomachinery@man-es.com
www.man-es.com

D02086101EN Printed in Germany 06210.5