Market Segment: Combined Cooling, Heating and Power (CCHP)

POWER PROFILE

Customer: ENN Energy Service (Shanghai) Co., Ltd.

Location:
Shanghai, China

Customer Business Issue:
Reliable power with low cost of operation

Solution:
Two Cat® G3520H gas generator sets

Cat® Dealer:
Lei Shing Hong Machinery (Shanghai) Co., Ltd.

The Shanghai Tencent Cloud Data Center (TCDC) is one of the most advanced service platforms for cloud computing and cloud storage infrastructures in the Asia-Pacific region.

POWER NEED

The Shanghai Tencent Cloud Data Center (TCDC) is one of the most advanced service platforms for cloud computing and cloud storage infrastructures in the Asia-Pacific region. TCDC uses the latest modular data center technologies and other advanced cloud computing technologies. It serves the needs of TCDC, while simultaneously providing cloud platform integrated services for third-party enterprises and domestic Internet users, and e-commerce services for the local government.

A total grid supply capacity of 40 MVA is provided to TCDC by the local state grid. However, this only supports Phase 1 and 2 of TCDC's operations. Phase 3 and 4 faced significant shortfall in terms of power, which then required an alternate source of reliable, steady and cost-effective power to simultaneously provide cooling load capacity.

TCDC has four independent data center blocks. Each block has two 10 kV bus bars connected to the grid with eight 2,500 kVA transformers at 50% load capacity. Each block also has five 2,000 kW diesel fueled generator sets providing standby power. This is coupled with a 7.5 MW uninterruptible power supply (UPS) system for emergency power. The load distribution includes 7 MW for the servers, 0.5 MW for the auxiliary equipment, and 2.5 MW for the HVAC, office and lighting systems. The total operational capacity is 10 MW.

ENN is the energy management company for the Shanghai TCDC. ENN specializes in using natural gas as the fuel for its distributed generation (DG) projects. ENN invests, designs, builds and operates its own DG sites throughout China. With gas engine generator sets as the basis for power generation, ENN recovers the waste heat (from both the jacket water and the exhaust) in the form of hot water and exhaust gas, which together feed into lithium bromide (LiBr) absorption chillers to produce chilled water as the heat recovery system. By recovering the waste heat while producing power, the CCHP system is able to simultaneously provide both power and chilled water to TCDC, meeting all power and cooling needs.

TCDC is one of the very first to use natural gas power CCHP systems for its power and cooling needs. The advanced natural gas based CCHP system provides clean, green, efficient and cost-effective solution for demanding data center requirements. The TCDC CCHP cascade energy utilization system is only possible with the use of an integrated energy management system incorporating advanced natural gas engine generator sets and LiBr absorption chiller technologies.

SOLUTION

The Shanghai TCDC natural gas distributed generation project has an installed capacity of 10 MW. For Phase 1, two Cat G3520H gas engine generator sets with a full load rating of 2,500 kW were installed. Commissioning was completed in August 2016. Their high reliability, efficiency and low cost of operation and maintenance deliver maximum benefits.

The gas generator sets are parallel to the municipal grid, connected with no injection mode. The produced power provides partial power to the data center, while the thermal energy from the high-temperature exhaust gas and hot jacket water is recovered in the absorption chiller to produce 7°C cooling water to meet the data center's cooling load demand. Additionally, the system is equipped with cold storage tanks used to improve cooling system reliability for peak shaving.

The Cat G3520H gas generator sets can operate with a variety of load conditions. They also can operate under island mode and with black start function, so they can start and operate without any external power supply. Island mode operation is designed for 200 hours annually.

The engine is capable of NOx emissions of 250 mg/Nm^3 (at 5% O_2) meeting the current local air emissions regulations. There is also reserved space for the installation of a de-NOx system, should it be necessary in the future. To further minimize environmental impact, the G3520H gas engine generator is housed in an acoustic attenuation enclosure, allowing compliance with local industrial environment sound/noise regulations.

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The adoption of a DG CCHP system not only secured the stability and reliability of the power supply for TCDC, but it also uses heat recovery to make possible a cost-effective chilled water supply. This highly efficient use of the natural gas or energy resource reduces the carbon footprint of the existing conventional utilities.

RESULTS

When compared to conventional coal-fired power plants of the same capacity, 3,470 tons of conventional coal burning is saved with a reduction of 23,300 tons of CO_2 emissions (or 48% reduction in CO_2 emissions), and also the eduction of 466 tons of SO_2 and 79 tons of NOx emissions (or a 60.8% reduction in NOx emissions).

This project provides both energy saving and emission reduction. Compared with conventional coal-burning energy systems, the adoption of DG CCHP systems has the potential to save more than 18% in overall energy. Emissions of various pollutions, such as PM2.5 particulates, were reduced by over 60% and the annual emission reduction of CO_2 is roughly 23,300 tons.

For more information, please visit cat.com/powergeneration

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LEXE1270-01 August 2017