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Trigeneration

Case History

Hongqiao CBD (Phase I) Power Station,
Shanghai

Where:

Hongqiao CBD, Shanghai

Supply:

Eight Cummins Power Generation gas generator sets (C1400N5C), with a rated power of 1400 kW each.

Purpose:

The Combined Cooling, Heating and Power (CCHP) system is designed to provide a standard power supply for offices, conferences and exhibitions, hotels, businesses, retail stores and recreational facilities, whilst also being capable of supplying chilled water, hot water and winter heating.

Primary choice factors:

Cummins gas generator sets maximize energy efficiency through an effective cascade use of energy. This is the most direct low-carbon measure to systematically optimize energy right from the supply end to reduce energy consumption and CO₂ emissions for higher energy utilization and lower energy consumption. Efficient energy use and low-carbon emissions in Hongqiao CBD (Phase I) can thus be achieved.

“New Energy” serves the CBD low-carbon practice area of the Yangtze River Delta

Shanghai, China - Hongqiao Business District is located in the west of Shanghai, covering an area of about 86 km², of which its core area (Phase I) covers 1.43 km². As a key development area in Shanghai during the “12th Five-Year Plan”, it will be built into a low-carbon practice area integrating ecology, industry and landscaping, serving as a new platform for Shanghai International Trade Center and as a high-end business center of the Yangtze River Delta. A total of RMB850 million is to be invested in the energy center of Hongqiao CBD (Phase I), and it is a landmark low-carbon project of the business district. In the project, Cummins gas generator sets will use



Cummins Power Generation C1400N5C gas generator sets along with acoustic enclosures.



Cummins Power Generation C1400N5C gas generator sets with exhaust gas heat exchangers.

natural gas to generate electricity and recover heat to satisfy the local demand of cooling, heating and power, helping shape the image of a low-carbon Hongqiao.

The district's centralized energy supply system has been led by a distributed energy supply system with a total installed generating capacity of 12 MW, which is connected to the grid and capable of exporting to the grid. The balance part that exceeds the capability of CCHP is supplemented by electric chiller equipment and gas boilers. The south station of the energy center covers a floor area of 11,220 m², and a building area of 11,553 m². Its north station is a structure consisting of one underground floor and two floors above ground, covering a floor area of 7,922 m², and a building area of about 9,864 m².

To satisfy the overall local demand for cooling, heating and power, the project investors chose "Gas reciprocating internal combustion engines and Absorption chillers", in conjunction with other water-cooled screw chillers and gas boilers peaking modular energy solutions to build a combined cooling, heating and power station. It is by this combined cooling, heating and power model that the entire cooling and heating load of the district, and part of its electrical load, will be met.

The Cummins service team has provided a complete power solution for this project, including gas generator sets, silencers, sound attenuated enclosures, absorption chiller, load management control system, gas trains and full support covering system installation. The high-quality products and excellent service system have undoubtedly provided a firm guarantee for the business district's power, cooling and heating supply.

Cummins service team has provided a complete power solution for this project.

A flexible and stable overall energy service solution

The customer chose eight silenced Cummins Power Generation lean-burn gas generator sets (C1400N5C), with a power of 1400 kW each, as the core of the system. Each power station can produce 5.6 MW (11.2 MW with the north and south stations combined) electricity, and simultaneously output 13.3 MW for chilled water for air conditioning (7°C) or 13.6 MW for hot water for heating (95°C) through heat recovered from the generator set. The output, chilled water for air conditioning and hot water connected to the pipe network of the cooling and heating system respectively. The one-time heat utilization rate of natural gas fuel reaches 83.6% (cooling) and 86% (heating) respectively through the cascade use of gas energy.

Operational tests have proven that the combined heating and power system has played a positive role in improving the safety of the power supply system, reducing the pressure of power plant, transmission and distribution network infrastructure investments, and supplying complementary electricity by peak shaving as well as reducing carbon emission.



Power Generation

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Cummins C1400N5C gas generator set is equipped with a QSK60 gas engine and the latest PCC3.3 (PowerCommand Controller) system, and is able to achieve generator set system control including automatic remote start/stop, precise frequency and voltage adjustment, output electrical parameter display and automatic stop in case of fault occurred to ensure the safe and steady running of the system.

Highly efficient energy use, low carbon emissions

All the power provided by Cummins gas generator sets are directly connected into the grid of the business district in the mode of “being connected to the grid and being exported to the grid”, and is sold by the investors. The sale prices of cooling and heating are all calculated in kilowatt hours of energy, equivalent to RMB0.55/kWh; 30% of the basic consumption will be charged as set forth in the contract; fees will be charged according to the actual situation if the figure exceeds 30%.

“Generally, the energy utilization rate is only 40% in power generation by natural gas, with the remaining 60% being transformed into high-temperature exhaust gas and heat. The 1400 kW of power for each set of lean-burn gas equipment in combination with the appropriately-designed CCHP system is able to boost the utilization rate of natural gas up to more than 80%.”

Zhu Yu, Project Manager of Hongqiao Project
Department, Jardine Engineering Corporation

Cummins gas generator sets in combination with waste heat cooling and heating systems ensure safe and reliable energy supply for the business district. Continuous and steady operation can remarkably reduce staff maintenance costs and maximize economic benefits, while keeping operating costs to the minimum. Compared with a conventional solution of mains and split air conditioning, it is the most direct low-carbon measure to systematically optimize energy right from the supply side to reduce consumption and CO₂ emissions for higher overall utilization and lower energy consumption.

The centralized energy supply system in Hongqiao CBD (Phase I), Shanghai is of a high technical level and has demonstrative value in urban sustainable development, low-carbon practice, ecological construction, green architecture, information technology and scientific management. It fully reflects the frontier of international technology, having realized high energy efficiency and low-carbon emissions in the locality.

For more information about trigeneration and other energy solutions please contact your local Cummins Power Generation distributor or visit power.cummins.com.



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