

Case note

ACS 1000 variable speed drive replaces steam turbine in the petrochemical industry

Repsol YPF replaced a steam turbine, which was driving a blower (3 MW), with an induction motor and an ACS 1000 variable speed drive from ABB.

The replacement resulted in an improved Energy Intensity Index, better process control and reduced maintenance costs.



View of motor driven by ACS 1000; ACS 1000 in converter building; Converter building and three-winding input isolation transformer.

Background

The Repsol YPF La Plata Refinery is located 60 km from Buenos Aires City, on the banks of the Río de la Plata.

With a nominal processing capacity of 31,000 m³/d (200,000 bbl/d) it is one of the biggest refineries within the Repsol YPF organization. It has 35 different process units on an area of 750 acres.

Challenge

The refinery has a large number of drive applications powered by steam turbines. At the time of installation this was the best technology to obtain the speed and/or the power required for the different applications. However, it has the following disadvantages:

- The cost of steam is higher than that of electric power
- Turbines have higher maintenance costs than electric drives
- Higher operating costs due to large amount of coolant water circulating through the surface condensers

Highlights

- Savings projected for the first year covered 33% of project costs
- Reduced maintenance costs
- Full operation even during power supply disturbances
- Improved process control
- Lower impact on electrical network
- User-friendly operation
- Fully redundant operation since the unit operates with both steam and electric energy supplies

Solution

In this situation Repsol YPF decided to analyze the feasibility of replacing steam turbines with variable speed electric drive systems. The technology that has become available in recent years made variable speed electric drive systems an interesting and competitive alternative for applications in the medium power range, even with speeds greater than 3,000 rpm (maximum speed of an electric motor driven at a frequency of 50 Hz).

Blower application

Fluid Catalytic Cracking Unit "A" has three blowers. Depending on production conditions it can operate with two, and requires at least one to prevent shutdown. Blowers were driven by 2,970 kW steam turbines at 4,100 rpm.

One of them was replaced with an electric drive system consisting of an ABB KTMP 4400 double secondary transformer, an ACS 1000 converter and an AMB 560 L2L motor.

Benefits

Efficient use of power

Asynchronous electric motor and frequency converter assemblies have proved to be a viable alternative for driving process units in which the necessary adjustment can be obtained with variable speed. Variable speed control of flow implies a more efficient use of power.

Control of motor torque

The ACS 1000 controls the motor torque throughout the speed range. Because of the smooth output waveform, a torque analysis is not necessary in most applications.

Improved power index

"The Energy Intensity Index (EII) of the FCC unit improved by 10.5 percent within one year by replacing one steam turbine with an electric drive", states Eng. Marcelo Ruiz, Manager of the FCC units at Repsol YPF La Plata refinery.

Faster return to operating conditions

After a shutdown, the drive system returns to operating conditions much faster than the steam-driven blowers (several minutes vs. two hours). "Having blowers supplied by different kinds of energy (steam & electricity) gives us operational flexibility. With this feature we can keep unobstructed air lines during a failure in one of the energy systems, minimizing the time to be back in operation", comments Eng. Ruiz.

Low impact of power supply disturbances

Due to its RideThrough function, the drive system is able to withstand disturbances in power supply. According to Eng. Ruiz measurements, made by Repsol YPF, have shown that the drive continued to operate during 600 ms micro power cuts.

Savings

Savings regarding energy, cooling water, maintenance and flow variations, projected for the first year covered 33 percent of the project cost.

Customer satisfaction

Eng. Daniel Remorini, Energy Maintenance Manager at the Repsol YPF La Plata refinery, states:

"When we selected the first important frequency converter application back in 1995, namely the replacement of a steam turbine with an electric variable speed drive (VSD), we made our decision considering mainly energy savings. Years later, having confirmed the excellent performance of an ABB SamiStar drive, we decided to repeat the experience in one of our most important production units, replacing one 4,000 HP, 4,100 rpm steam turbine with an ACS 1000 drive system. Once again, energy savings were our main considerations. Today, with both applications running, we realize that our estimations were exceeded as we have reached operating results that widen the scene for the development of new applications. The main benefits are:

- Operation flexibility having electric and steam energy to run the process.
- Almost immediate availability of the units after energy outages.
- VSDs provide additional benefits to those normally considered; these benefits are difficult to evaluate during the feasibility phase, but are of great help to the end user when the systems are in operation."

ACS 1000 key data

Inverter type	Three-level Voltage Source Inverter (VSI)
Power range	Air cooling: 315 kW - 2 MW Water cooling: 1.8 MW - 5 MW
Output voltage	2.3 kV, 3.3 kV, 4.0 kV, 4.16 kV (optional: 6.0 kV - 6.6 kV with step-up transformer)
Maximum output frequency	66 Hz (optional: 82.5 Hz)
Converter efficiency	Typically > 98%
Type of motor	Induction motor

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