



combined heat & power in industrial parks

“Baytown Industrial Park” “830 MW Combined-Cycle Application”

Project Profile

Quick Facts

SITE LOCATION: Baytown, TX
SITE SIZE: 1500 acres and is 35% developed.
CHP EQUIPMENT: 3 Nat. Gas-fired Combustion Turbines operated in combined cycle with steam turbine
FUEL: Natural Gas
ENVIRONMENTAL BENEFITS: Potential NO_x reductions of 7,000 tons/yr; 13,000 tons/yr of SO₂; and 2.9 million tons/yr of CO₂.
CHP IN OPERATION SINCE: June 2002

Project Overview

The Baytown Industrial Park is the flagship site for Bayer MaterialScience LLC, which is the polymers manufacturing arm of Bayer AG in the U.S. Due to variety of utility and emissions reduction needs, a Combined Heat and Power plant was installed and operated by Calpine Corporation. The system includes combined-cycle cogeneration of 700 MW of base load power through out the year with 130 MW of peak power during summer months. The CHP plant enabled Calpine to produce electricity with 90% fewer NO_x emissions and 45% fewer CO₂ emissions than an average fossil fuel generation facility in Texas. To summarize, careful selection of a CHP project can result in a number of benefits, including cost reduction, compliance with regulations, and increased reliability.

Plant Description

The Baytown Industrial Park is the flagship site for Bayer MaterialScience LLC in the NAFTA region. Bayer MaterialScience is the polymers manufacturing arm of Bayer AG in the U.S. The Park sits on 1500 acres in Chambers County near Baytown and is partially developed. The site is home to 4 Bayer MaterialScience business groups: Polycarbonate, CAS (Coatings, Adhesives and Sealants), Polyurethane, (IBC) Inorganic Basic Chemicals. The site has grown more than 10-fold since 1971, when the first polyurethane unit started up. Today, the site is a thriving industrial park site anchored by Bayer MaterialScience LLC. The site also hosts Bayer Corporate and Business Services, LANXESS Corporation, Borden Chemical, El Dorado Nitrogen, First Chemical Texas, Texas Brine, and the Calpine Baytown Energy Center.

Reasons for CHP

The State of Texas faces a significant environmental challenge along the Texas Gulf Coast, specifically in the Houston/Galveston area, a designated non-attainment area under the Clean Air Act. The State Implementation Plan (SIP) adopted in 2002 for the Houston/Galveston area requires reductions in emissions of nitrogen oxides of 80% from a baseline value by 2007. The project began in the late '90s, when Bayer started considering how to address a variety of utility and emission reduction needs at its Baytown Industrial Park site. The project started with identification of the following situations:

- Baytown Industrial Park's steam and electricity costs were significant.
- Existing power contracts were about to expire.
- The site had four aging boilers, which created reliability concerns.
- Need to replace/upgrade aging boilers.
- At least two of the boilers were grandfathered under permits that were facing sunset.
- The company's strategy called for eliminating non-core competencies.

A number of solutions were examined including a Combined Heat and Power (CHP) plant. Key pieces of economic justification included:

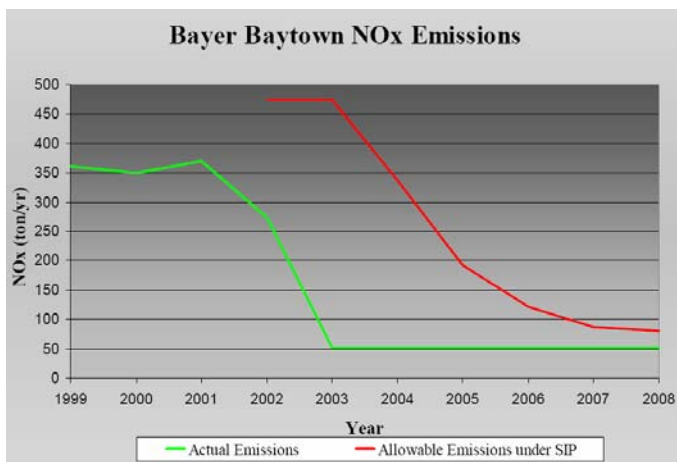
- Long term pricing agreements on steam and electricity
- Avoidance of capital costs
- Avoidance of extensive emission control technology
- Elimination of NOx compliance costs.

CHP Technology

- The Calpine facility uses three natural gas-fired combustion turbines and then recovers thermal energy from the hot combustion exhaust to create steam. The steam is used to generate additional electricity in a steam turbine.
- This combined-cycle operation enables the Calpine facility to produce electricity with 30% less fuel than the average fossil fuel-fired plant in Texas.
- This combined-cycle cogeneration facility has a base capacity of up to 700 MW throughout the year plus an additional 130 MW of “peaking” power during the summer months. The Calpine facility provides Bayer MaterialScience with all of its electrical and most of its steam needs under a long-term contract.
- The cogeneration approach improves Calpine’s efficiency by another 10%.
- To reduce NOx emissions, Calpine uses a combination of low-NOx combustion systems and selective catalytic (SCR) technology. These technologies enable Calpine to produce electricity with 90% fewer NOx emissions and 45% fewer CO₂ emissions than the average fossil fuel-fired generation facility in Texas.
- Extending this comparison to annual performance, the Calpine plant represents potential emissions reductions of 7,000 tons of NOx, 13,000 tons of SO₂, and 2.9 million tons of CO₂. These figures do not include the NOx emission reductions from the shut-down of the aging boilers at the Bayer site.

Conclusions

The project resulted in the shut down of the five steam boilers. The site-wide NOx emissions fell below the level needed to meet the SIP requirements for the Bayer site. In fact, Bayer was able to use the NOx reductions to comply with the SIP, hold some credits in reserve and provide Calpine with some of the credits needed to permit the new facility. Figure 1 shows Bayer’s allowable emissions under the SIP and the site’s actual emissions. The actual emissions are for Bayer MaterialScience only. As of 2003, Bayer was in compliance with the site’s 2008 emission limits (based on current SIP requirements). Although exact cost savings are confidential, Bayer reports that this site constituted its largest energy user of its U.S. sites. In 2000, Bayer spent more than \$200 million on energy in the U.S.



(Actual emissions in future years are estimated at 2003 actual levels)

For more information –

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**Economics
of CHP are
site specific.**

**Bayer is
seeing cost
saving in
their energy
expenditures**

**In 2003
itself, Bayer
was in
compliance
with sites
2008
emission
limits.**



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