

U.S. DOE



CHP  
TECHNICAL ASSISTANCE  
PARTNERSHIPS

# Port Arthur Steam Energy / Oxbow Corp.

## 5-MW Waste Heat to Power CHP System

### Site Description

Oxbow Corporation's coke plant began operation in 1935 and has the capacity to produce 700,000 short tons per year of calcined petroleum coke, used primarily in aluminum production.

Port Arthur Steam Energy LP (PASE) is a Waste Heat to Power (WHP) plant that uses otherwise-wasted heat from the coke production facility and converts it into five megawatts of electricity consumed on-site and sold to the grid, in addition to steam sold to the neighboring Valero petroleum refinery for crude oil processing.

By recovering heat from the flue gas and converting it into electricity and steam, the power and steam produced have no associated emissions, making PASE an extremely "green" project, earning it the EPA's 2010 Energy Star Award. Integral Power, LLC led the redevelopment and serves as the Managing Partner.

### Reasons for WHP

The Oxbow calcining plant sought to improve onsite energy efficiency and boost plant economics by capturing value for the kiln exhaust energy otherwise being wasted. The refinery sought to reduce natural gas consumption and associated emissions by receiving lower cost, emission-free steam. As a result of PASE, the need for the refinery boilers is offset, fuel consumption and emissions at the refinery are reduced, and the calcining plant receives revenue for high pressure steam from waste BTUs otherwise be vented to the atmosphere.

### Quick Facts

**LOCATION:** Port Arthur, TX  
**MARKET SECTOR:** Petroleum coke production, crude oil processing  
**EQUIPMENT:** Waste heat recovery boilers, back-pressure steam turbine  
**FLUE GAS TEMPERATURE:** 1800–2000°F  
**USE OF THERMAL ENERGY:** Steam and electricity generation  
**RECOVERED ENERGY:** 5 trillion BTUs per year  
**POWER PRODUCTION:** 5 megawatts (MW)  
**STEAM PRODUCTION:** 450,000 lbs/hr  
**TOTAL EFFICIENCY:** 90%  
**EMISSIONS:** None. Reduces facility's CO2 emissions by 159,000 tons per year  
**ACCOLADES:** 2010 Energy Star CHP Award  
**WHP IN OPERATION SINCE:** 2005

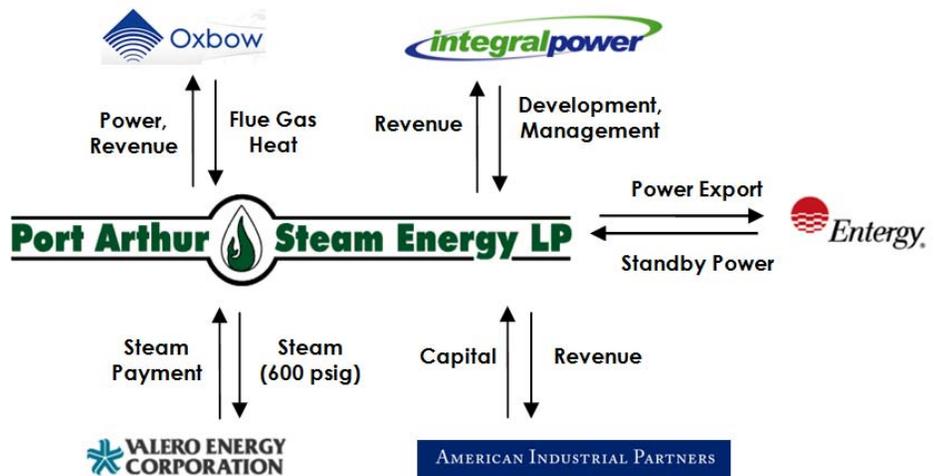


PASE's three waste heat recovery boilers (one at left) and its 6.5 MW back-pressure steam turbine (right) improve onsite energy efficiency and boost plant economics by capturing value for the kiln exhaust energy otherwise wasted.

PHOTOS COURTESY OF INTEGRAL POWER

## WHP Equipment & Configuration

PASE uses three Deltak waste heat recovery boilers rated at 210 kpph, 140 kpph, and 140 kpph. Each boiler is followed by a Process Equipment Multiclone Dust Collection System for additional particulate collection. (The multiclone system captures magnesium sulfate, the byproduct of neutralizing the fuel gas SO<sub>2</sub>, with magnesium hydroxide. It also captures unburned particulate remaining from the calcining process.) For electricity generation, the project has a General Electric 6.5 MW back-pressure steam turbine.



## WHP Operation

PASE captures and recovers 1800–2000°F heat from the fluegas from three petroleum coke calcining kilns at the Oxbow Corporation calcining facility, and uses it to produce approximately 450,000 pounds per hour of high pressure steam. A majority of the steam is sold to the neighboring Valero–Port Arthur refinery for process use, with the balance used to produce up to five megawatts (MW) of electricity. The power generated is used by Oxbow and PASE to serve internal load requirements, with any excess sold to the utility grid via Entergy.

The WHP system operates 24/7 and has no daily or seasonal fluctuations. The maintenance of the boilers and balance of plant equipment is performed by PASE in close coordination with the calcining plant. The typical availability of the calcining operation is around 90 percent. Excluding planned outages, the availability of the WHP is 99 percent or higher. The plant is operated and maintained by a full time staff of 15 at the plant. Major maintenance during planned outages is completed by local specialty contractors.

## Environmental Benefits

The steam and power are generated with no associated emissions. The project displaces fossil fuel that would otherwise be burned by typical on-site thermal generation and purchased electricity. Consequently, the WHP system effectively reduces CO<sub>2</sub> emissions by an EPA-estimated 159,000 tons per year. This reduction is equivalent to the emissions from more than 27,000 passenger vehicles. The project earned an EPA Energy Star Award in 2010.

## Lessons To Share

The interconnection process proved challenging and resulted in project delays. Sites should engage the utility early on with Texas's interconnection process, to ensure all technical and schedule requirements can be met in a timely manner. PASE ultimately filed as a Qualified Facility, requiring Entergy to purchase the export power at the utility's avoided cost.

"Through the recovery of otherwise-wasted heat to produce high pressure steam for crude oil processing, Port Arthur Steam Energy LLP has demonstrated exceptional leadership in energy use and management."  
— U.S. Environmental Protection Agency, in giving the 2010 Energy Star Award

## For More Information

U.S. DOE SOUTHWEST CHP  
TECHNICAL ASSISTANCE PARTNERSHIP  
Christine Brinker, Director  
720-939-8333, [cbrinker@swenergy.org](mailto:cbrinker@swenergy.org)

INTEGRAL POWER  
Ray Deyoe, Managing Director  
713-824-6851  
[rdeyoe@integralpower.com](mailto:rdeyoe@integralpower.com)

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