

**Industry:** Petroleum Coke Calcining

**Project:** Port Arthur Steam Energy LP (PASE)

**Developer and Manager:** Integral Power, LLC

**Heat Supplier:** Oxbow Corporation

**Customers:** Oxbow Corporation & Valero Energy

**Location:** Port Arthur, Texas

**Waste Heat Source:** 1800-2000°F Kiln exhaust heat

**Capacity:** 5 megawatts (MW) + 450,000 pounds per hour (pph) process steam

**Average Capacity Factor:** ~92%

**Annual Electric Output:** 32,000 MWh per year

**Annual Steam Output:** 3,600,000 MMBTU per year

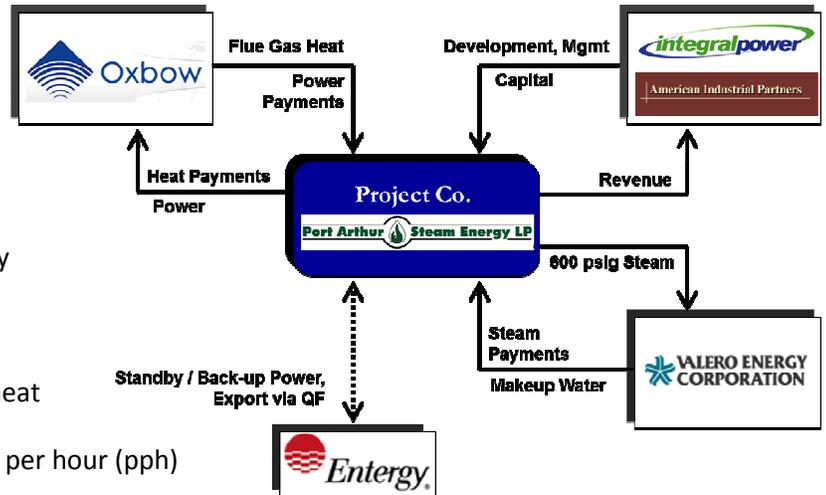
**Use of Electrical Energy:** On-site consumption, excess sold back to grid via Qualified Facility (QF) agreement

**Major Equipment:** Three Deltak waste heat recovery boilers rated at 210 kpph, 140 kpph, and 140 kpph, Multiclone Dust Collection System, GE 6.5 MW back-pressure steam turbine, 1000gpm water demineralization system, 2.5 mile steam pipeline

**Commercial Operation:** 2005

**Savings:** \$2.5 to \$5 million per year

**Challenges:** Re-development of an existing brownfield facility ruled out debt financing (funding procured through the private equity firm American Industrial Partners). Utility resistance and interconnect processes led PASE to ultimately file as a Qualified Facility under PURPA which required Entergy to purchase export power at avoided cost.



*The project improved on-site energy efficiency and plant economics by capturing value for the kiln exhaust energy that was being wasted (vented to atmosphere). PASE uses Oxbow's waste heat to generate emission free power and steam. Oxbow and PASE use some of the power and the rest is sold to the grid. Valero uses the steam, thereby reducing natural gas consumption and associated emissions.*



The Heat is Power Association is the trade association of the Waste Heat to Power (WHP) industry. The not-for-profit organization is committed to educating decision makers and the public about the characteristics of waste heat to power as a source for emission-free electricity and an economic driver for global competitiveness. The Heat is Power Association promotes the efficient, industrial use of emission-free electricity generated through WHP processes. To learn more, visit [www.heatispower.org](http://www.heatispower.org).

## Project Description

Port Arthur Steam Energy LP (PASE) captures waste heat from three petroleum coke calcining kilns owned by Oxbow Corporation and uses it to make steam, most of which it sells to the neighboring Valero-Port Arthur refinery. The balance of the steam is used to produce up to 5 MW of electricity that is consumed on-site and sold to the grid. The WHP system operates 24 hours a day, seven days a week and has no daily or seasonal fluctuations. Excluding planned outages, the availability of the WHP system is over 99 percent.

The project is capable of recovering nearly 5 trillion BTUs per year to produce up to 450,000 pounds per hour of high pressure steam, displacing natural gas that would otherwise fuel refinery boilers and generate electricity. By capturing and using the 1800-2000°F kiln flue gas waste heat, the power and steam produced have no associated emissions.

## Operational Benefits

- Uses an on-site waste heat that would otherwise be vented to the atmosphere
- Oxbow Corporation benefits from selling its waste heat, Valero-Port Arthur Refinery benefits from a steady supply of high pressure steam generated at lower cost and with no incremental emissions, Oxbow and PASE benefit from on-site power with no incremental emissions, and the grid (via Entergy) benefits from the generation of emission-free power
- The steam turbine-generator is capable of operating in island mode and has self-supported both the PASE and Oxbow plants on a number of occasions during interruptions of incoming utility power. PASE, Oxbow and Valero have all benefited from this feature

## Economic Benefits

- At capacity, the plant saves all parties a total of about \$5 million per year in electric and natural gas costs
- The WHP facility supports 15 full time jobs

## Environmental Benefits

- Uses an energy source (1800-2000°F heat), that would otherwise be wasted through the kiln stacks, to produce power with no associated emissions and no additional fuel
- Avoids the burning of 36,422,400 therms of Natural Gas per year (~3.6 trillion BTUs per year)
- Displaces fossil fuel that would otherwise be burned by typical on-site gas fired steam generation and purchased electricity
- Reduces CO<sub>2</sub> emissions by an EPA estimated 159,000 tons per year, equivalent to the emissions from more than 27,000 passenger vehicles

**Awards:** 2010 EPA Energy Star Award



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