



# Recycled Energy from Petroleum Coke Calcining Kilns

## Site Description

Port Arthur Steam Energy LP (PASE) was built to capture waste heat from one facility and use it to generate electricity and steam for use by other facilities. PASE recovers 2000°F kiln waste heat from Oxbow Corporation. It first uses the waste heat to generate steam for neighboring Valero-Port Arthur refinery and then uses the leftover steam to generate electricity, some of which it uses on-site, some it sells back to Oxbow, and the rest it delivers to Entergy Gulf States, the local electric utility. This process would be classified as recycled energy in Colorado.



### Facts at a Glance

- **Project:** Port Arthur Steam Energy LP (PASE), developed and managed by Integral Power, LLC
- **Collaborators:** Oxbow Corporation (Oxbow), Integral Power, LLC, Valero, Entergy Gulf States (EGS)
- **Location:** Port Arthur, Texas
- **Waste Heat Source:** 1800–2000°F kiln exhaust heat
- **Capacity:** 5 MW electricity + 450,000 pounds per hour process steam
- **Annual Electric Output:** 32,000 MWh per year
- **Annual Steam Output:** 3,600,000 MMBTU per year
- **Commercial Operation:** 2005
- **Financial Benefit:** \$2.5 to \$5 million per year
- **Awards:** 2010 EPA Energy Star Award
- **Other Applications:** Any heat intensive process such as those at refineries, steel mills and cement plants that use high temperature kilns, ovens and furnaces

### Key benefits

- The project improves on-site energy efficiency, plant economics and carbon footprint
- Saves up to \$5 million per year in electric and natural gas costs
- Avoids the burning of 36,422,400 therms of natural gas per year (~3.6 trillion BTUs per year)
- 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
- Can operate in island mode when incoming utility power is interrupted
- Supports 15 full time jobs



## Project Details

In PASE's system, nearly 5 trillion BTUs per year of waste heat is recovered from three petroleum coke calcining kilns owned by Oxbow and used by PASE to make up to 450,000 pounds per hour of high pressure steam. Most of the steam is sold to the neighboring Valero-Port Arthur refinery and the balance is used to generate up to 5 MW electricity, a portion of which is consumed on-site and the rest delivered to Oxbow and EGS. Utility resistance and interconnection processes led PASE to file as a Qualified Facility under the Public Utility Regulatory Policies Act (PURPA) which required EGS to purchase export power at avoided cost.

The system includes three Deltak waste heat recovery boilers, Multiclone Dust Collection System, GE 6.5 MW back-pressure steam turbine, 1000gpm water demineralization system, and a 2.5 mile steam pipeline.

The recycled energy system operates 24 hours a day, seven days a week and has no daily or seasonal fluctuations. Excluding planned outages, the availability of the recycled energy system is over 99 percent.

## Reasons for Installing Recycled Energy

- Generates power and steam without emissions, displacing natural gas that would otherwise be needed to fuel refinery boilers to generate electricity
- The steam turbine-generator can operate in island mode, generating steam and electricity for critical processes when incoming utility power is interrupted
- The project is mutually beneficial: Oxbow Corporation sells its waste heat, Valero-Port Arthur Refinery receives a steady supply of high pressure steam produced at lower cost and with no incremental emissions, Oxbow and PASE receive reliable power generated on-site, and EGS distributes electricity generated without emissions



## About Recycled Energy in Colorado

Recycled energy systems use waste heat from industrial processes to generate electricity with no additional fuel, combustion or emissions. Recycled energy does not include energy produced by any system that uses waste heat from a process whose primary purpose is the generation of electricity. Power generated from recycled energy systems in Colorado can be used to help utilities meet their renewable energy standard obligations.



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