



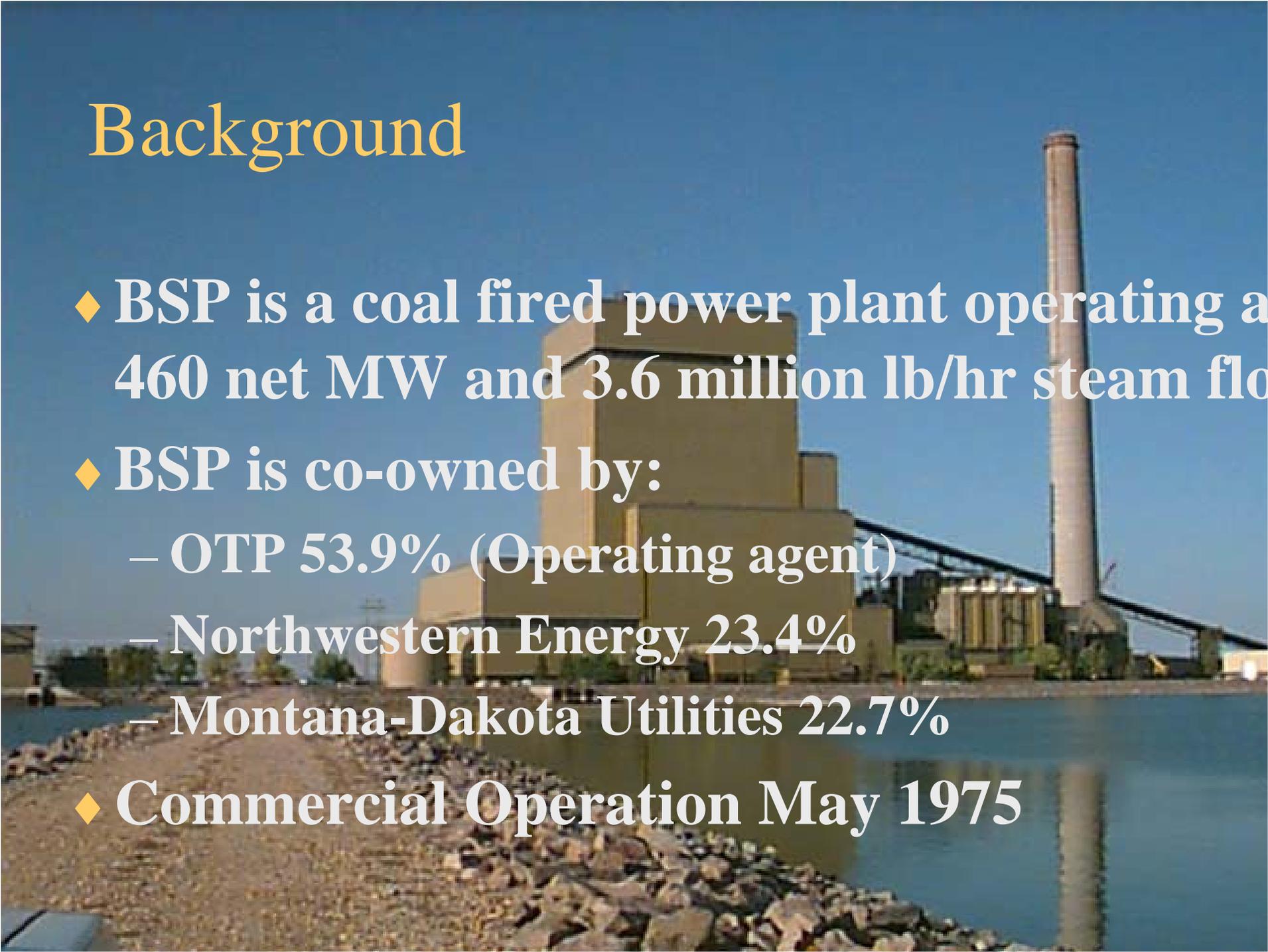
Big Stone Power Plant Efficiency Improvements

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Plant Manager

Background

A photograph of a large industrial power plant facility. The plant consists of several large, tan-colored rectangular buildings and a tall, slender smokestack. The facility is situated near a body of water, with a rocky shoreline in the foreground. The sky is clear and blue.

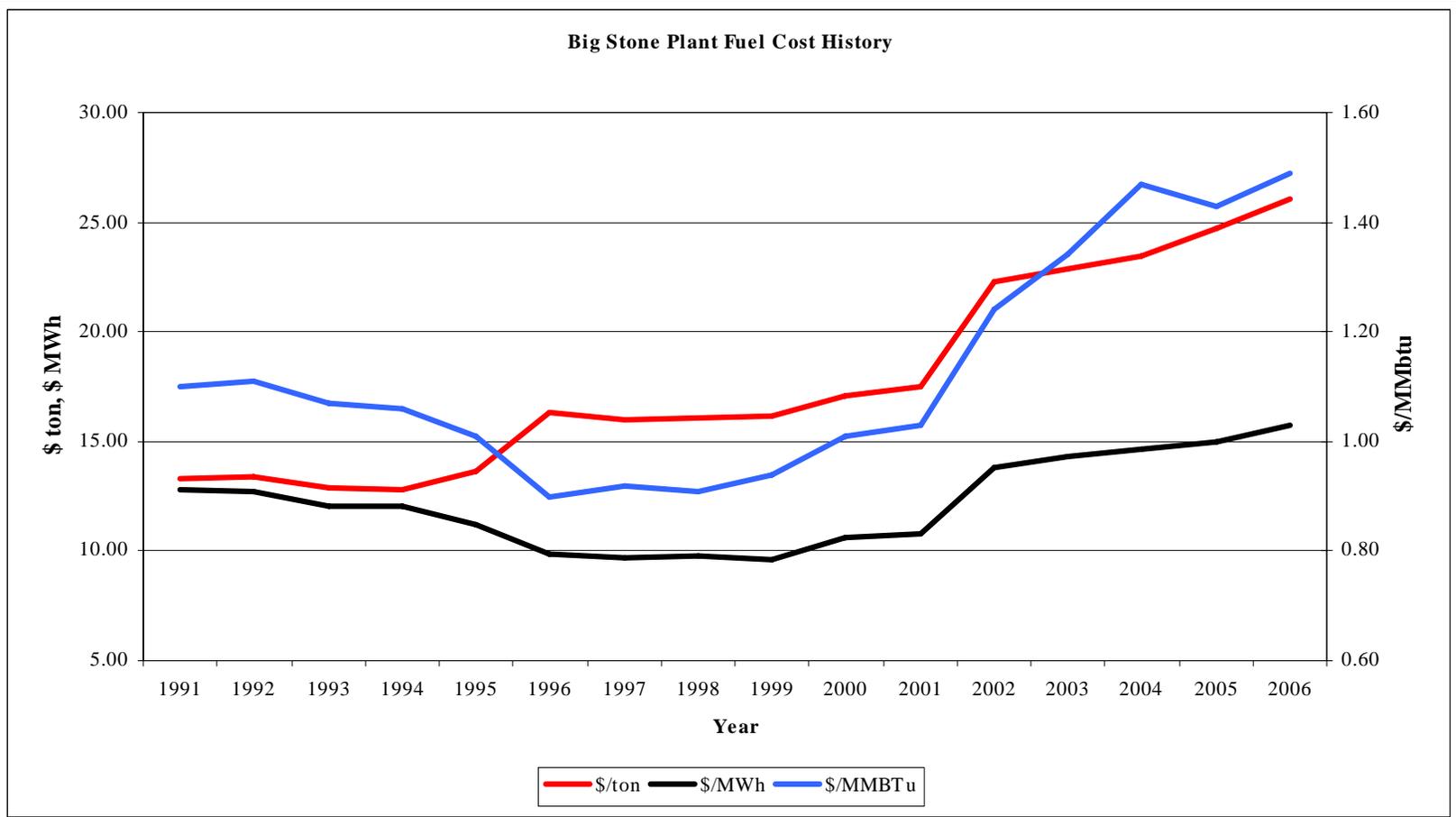
- ◆ BSP is a coal fired power plant operating at 460 net MW and 3.6 million lb/hr steam flow
- ◆ BSP is co-owned by:
 - OTP 53.9% (Operating agent)
 - Northwestern Energy 23.4%
 - Montana-Dakota Utilities 22.7%
- ◆ Commercial Operation May 1975



BSP Mission Statement

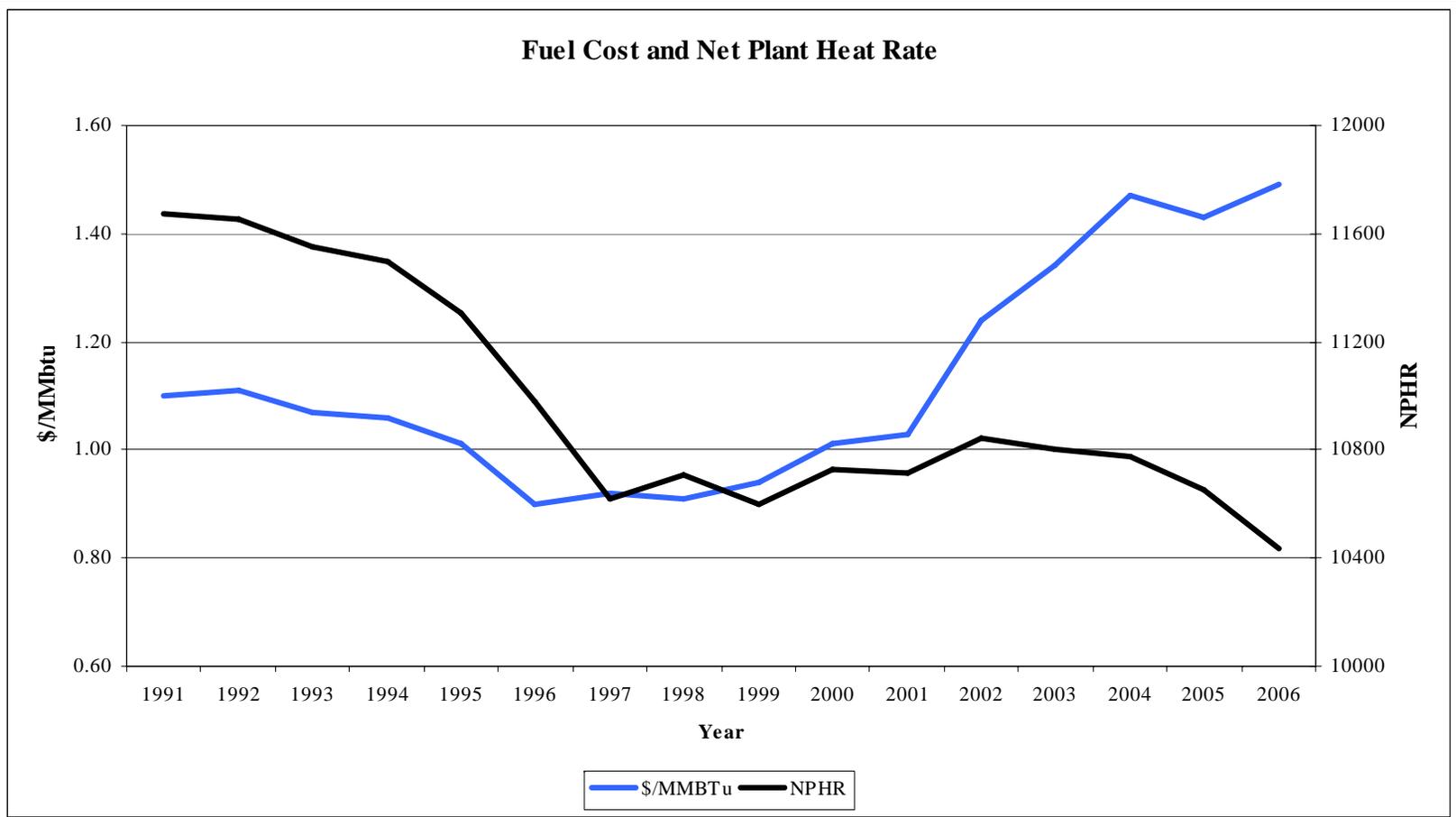
- ◆ The Big Stone Plant exists to safely generate electricity reliably, economically, and in an environmentally responsible manner.

Cost Information





Plant Performance





Improvements

- ◆ Improvements are made to minimize costs for our customers
- ◆ Operational practices
 - Fuel switch
 - Cleaning outages
- ◆ Capital improvement projects
 - Turbine replacements
 - Boiler modifications
 - Control system replacement
 - Other replacements



Operational Practices

Fuel Switch, 1995

- ◆ Big Stone Plant designed to burn ND lignite
 - Low Btu, high sulfur
 - Load limiting (boiler fouling)
 - 20 year contract plus makeup tons
- ◆ Western subbituminous, August 1995
 - Montana, Wyoming sources
 - Montana minimized beginning January, 2000



Fuel Switch, continued

- ◆ 5 percent efficiency improvement
- ◆ SO₂ emissions greatly reduced
- ◆ NO_x emissions slightly increased, began control in 1998
- ◆ Reduced steam temperatures prompted primary superheater replacement
- ◆ Gas recirculation fan resizing
- ◆ Rebuilt coal dumper to accommodate aluminum cars



Operational Practices

- ◆ Boiler high-pressure water wash
- ◆ Air preheater high-pressure water wash
- ◆ Condenser tube cleaning
 - High-pressure water
 - Chemical



Capital Improvement Projects

Turbine Replacements

- ◆ 1996 Low Pressure Turbine
 - \$5,000,000 capital project
 - 2 percent plant efficiency improvement
- ◆ 2005 High/Intermediate Pressure Turbine
 - \$9,000,000 capital project
 - 2 percent plant efficiency improvement
 - More possible with boiler redesign

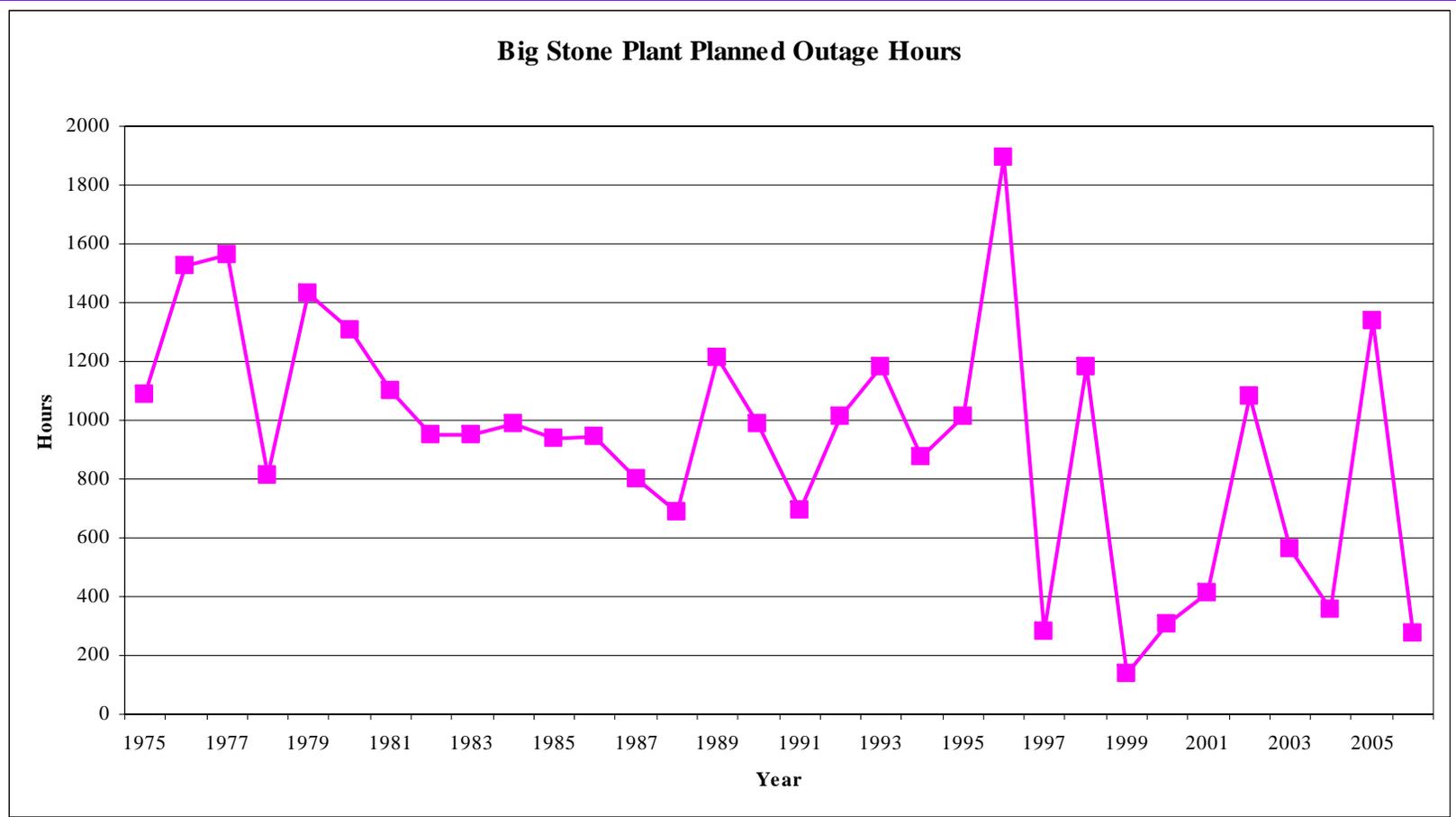


Capital Improvement Projects Other Projects

- ◆ 1996 control system replacement
 - Improved reliability
 - Minor heat rate improvement due to increased stability
- ◆ Feedwater heater replacements (4)
- ◆ Condenser retubing
- ◆ Predry system removal



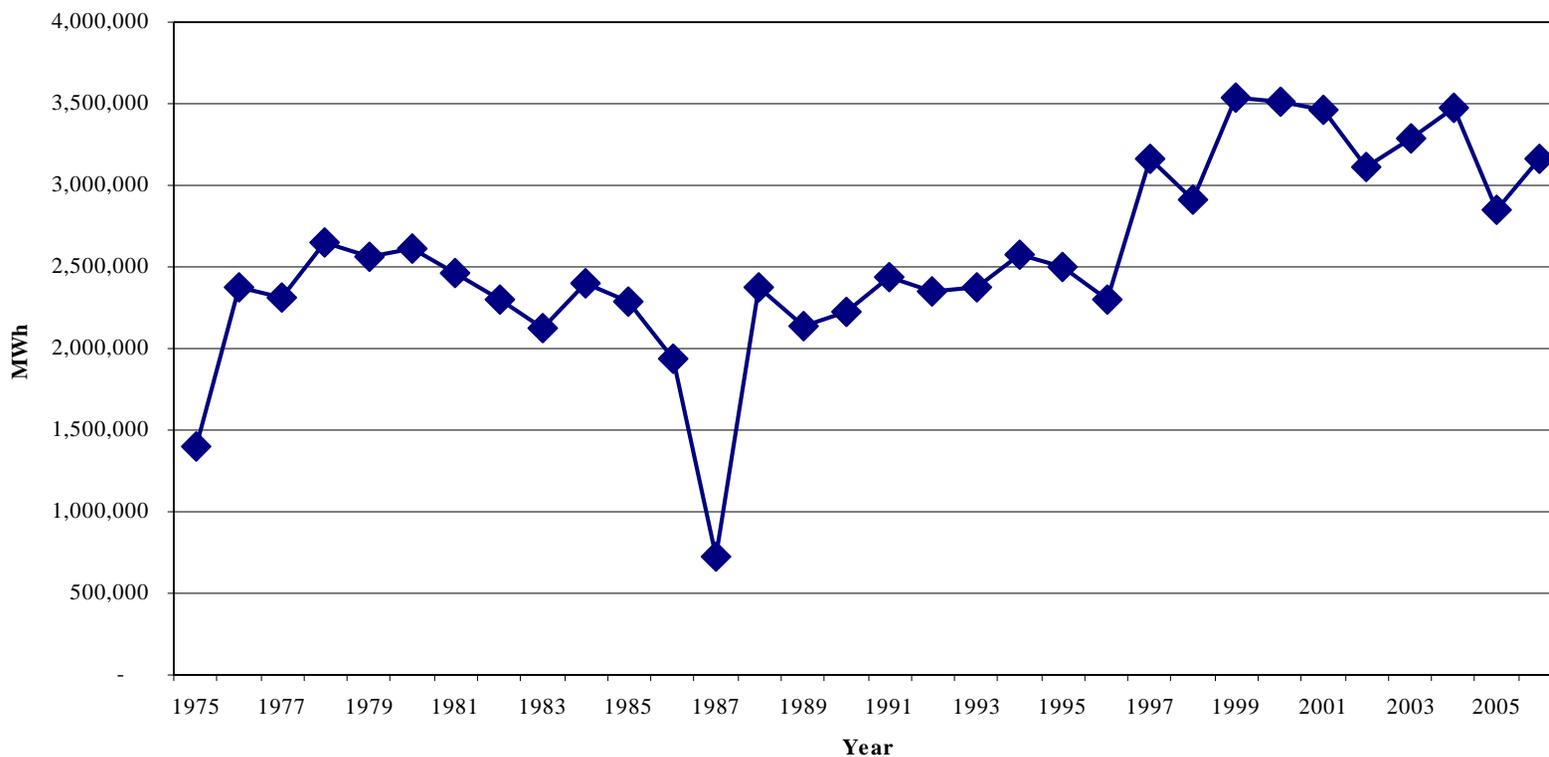
Planned Outage Hours



Plant Annual Generation



Big Stone Plant Net Generation





Generation Levels

- ◆ 1975-1995 limited to 400 net MW cruise by fuel characteristics
 - Twice yearly cleaning
 - Additional boiler maintenance
- ◆ 1987 generation low due to generator failure
- ◆ 1996-2004 limited to 430-450 net MW cruise by turbine limits
- ◆ 2005-present limited to 460 net MW cruise by new turbine limits

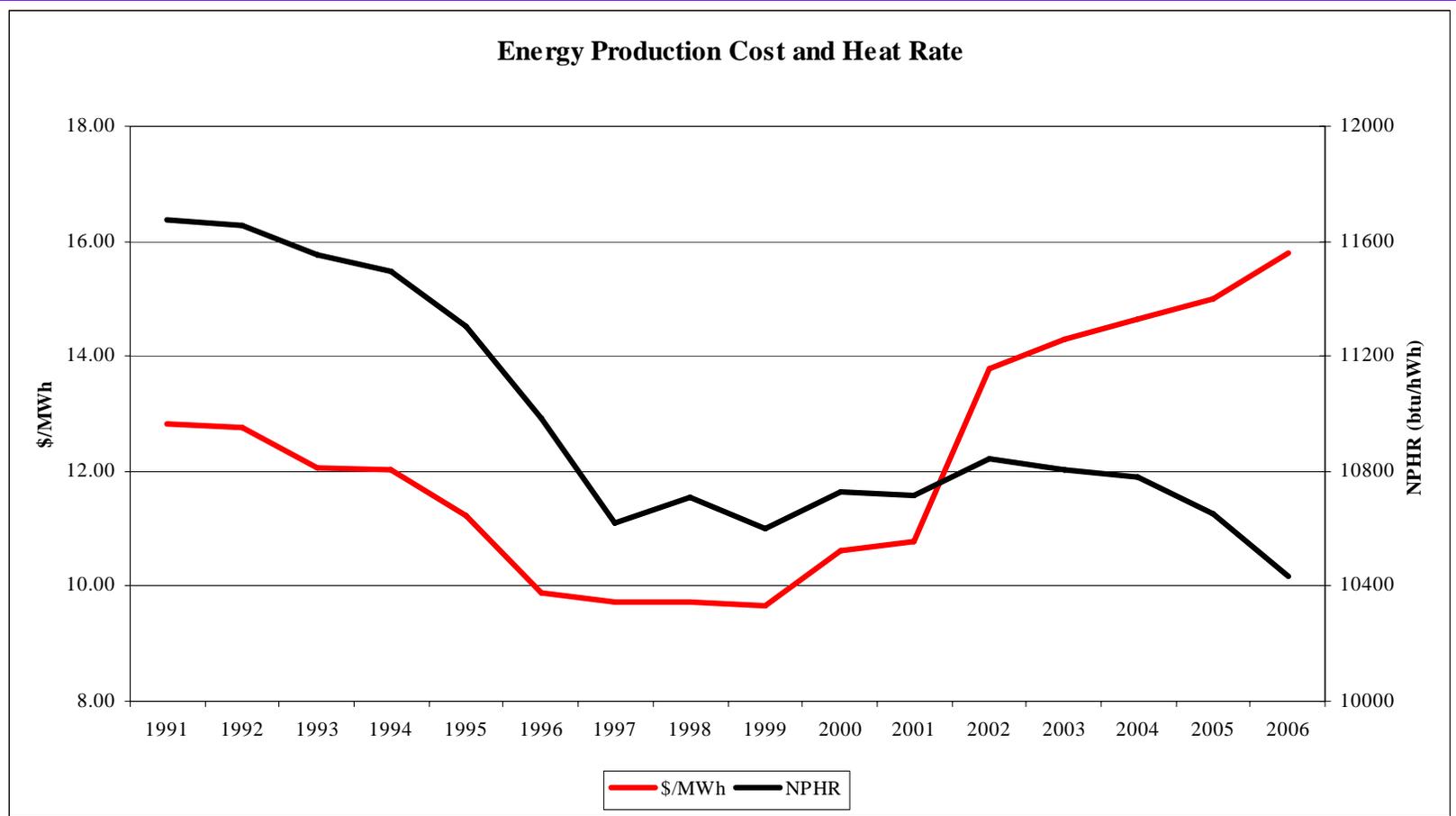


New Source Review (NSR) Concerns With Efficiency Projects

- ◆ Regulatory uncertainty
 - Ongoing litigations
 - Review by others
- ◆ Similar capital projects have been reviewed by other states and jurisdictions
- ◆ Big Stone Plant approaches efficiency improvement projects with NSR in mind



Energy Production Cost & Heat Rate





Otter Tail's Position on PURPA Standard 13

- ◆ The Commission should not adopt the Fossil Fuel Generation Efficiency Standard, as it is unnecessary.
- ◆ Otter Tail has demonstrated many voluntary cost effective examples of operational and capital investment measures used to improve Fossil Fuel Generation Efficiency



Are there any questions?