

Impact of Standby Tariffs on Economics for a CHP System at Turning Stone Casino

Standby Rates Workshop

NYS Public Service Commission - Albany

December 8, 2004



OAK RIDGE NATIONAL LABORATORY

Hugh I Henderson, Jr. P.E.

CDH Energy Corp.

www.cdhenergy.com



Study of CHP at Turning Stone Complex

- Facility had 6 MW load...expected to grow to 11 MW in five years
- Significant year-round thermal loads
 - Used most in multiple hot water boilers distributed around the facility
- About to revamp chiller plant & other infrastructure as part of major expansion

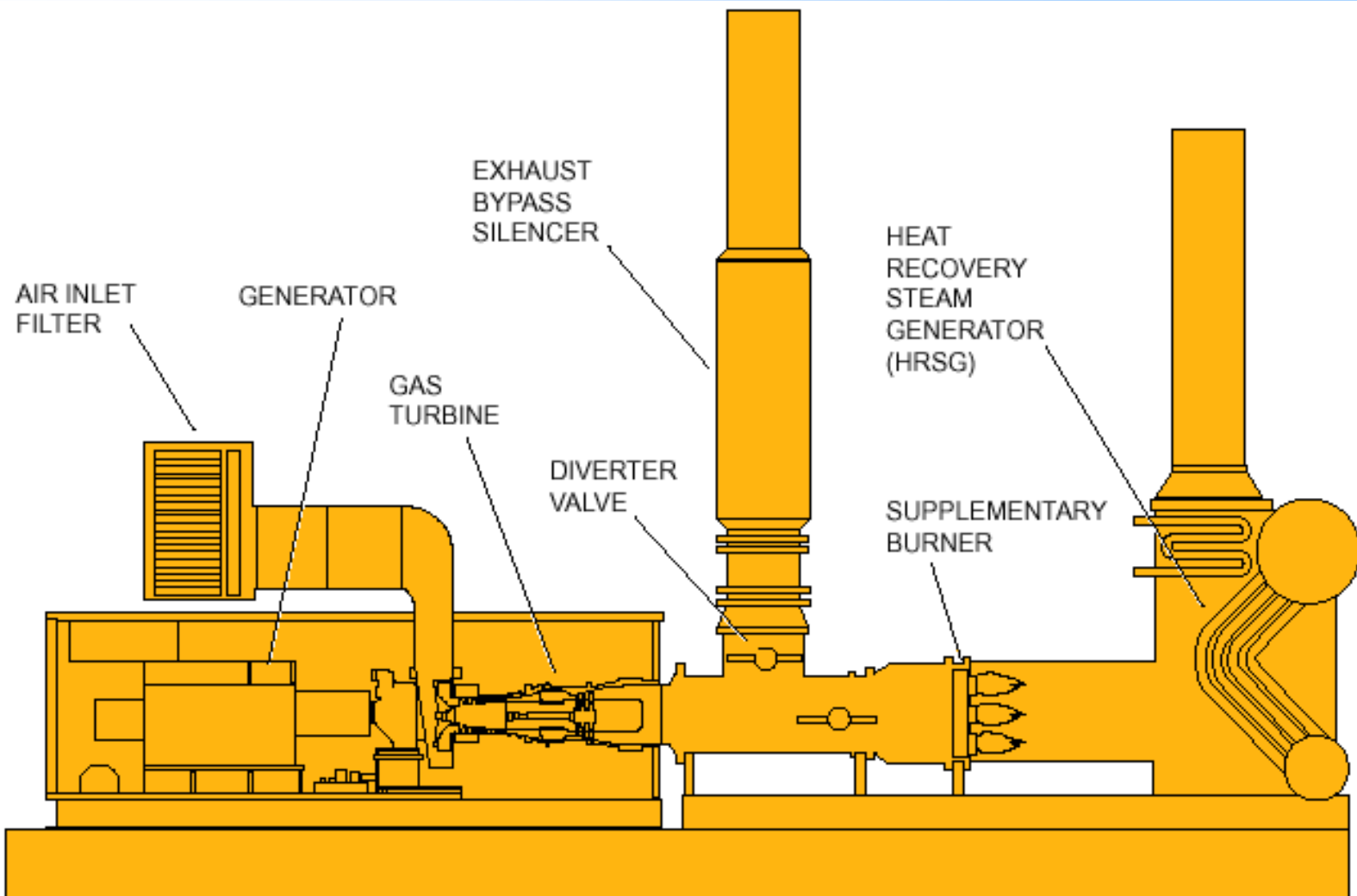
Why Make Power Onsite?

- Reduce electric costs
 - average costs were 8.3¢/kWh in 2001/2002
- Facility owned by sovereign Oneida Indian Nation
 - interested in energy independence
 - environmental stewardship
- Niagara Mohawks punitive “Rule 12” was being phased out in July 2002!
 - penalty for self generation had been ~5¢/kWh

CHP System Concept

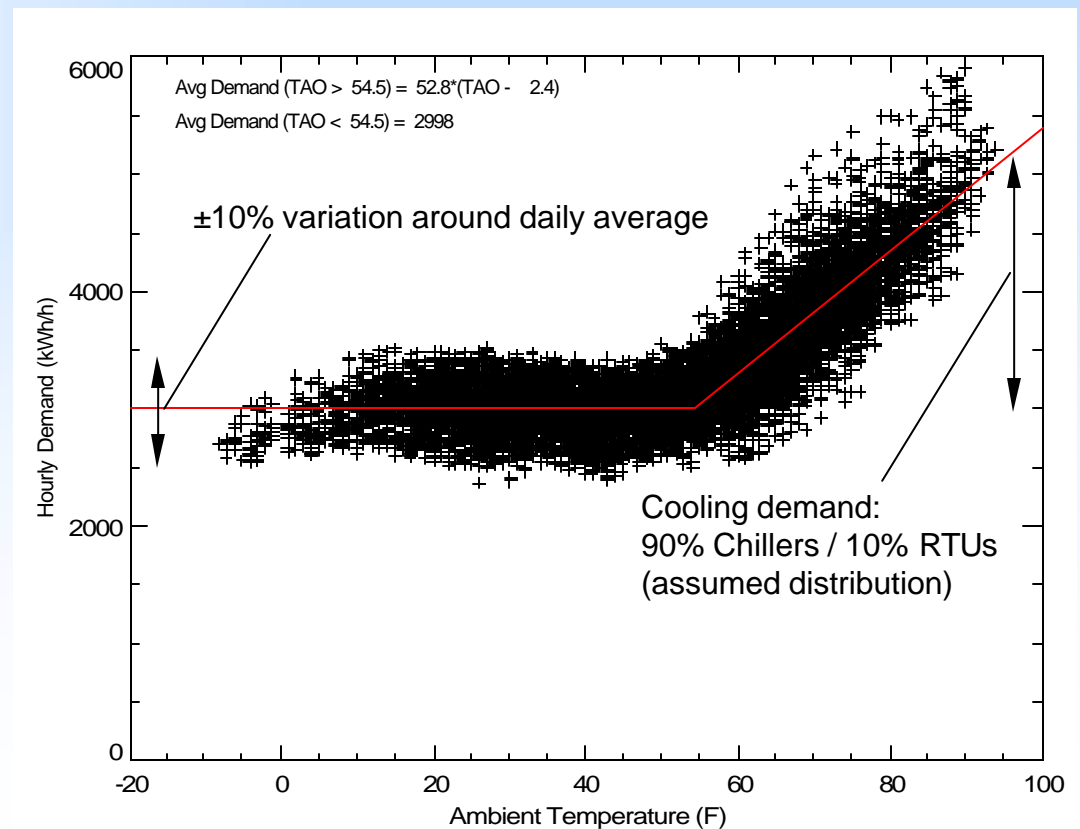
- Use established technologies
 - 3-11 MW system
 - need steam to meet diverse hot water loads
 - use steam in double-effect chillers to provide cooling
- Questions
 - Should facility go off grid?
 - Size for thermal needs?
 - How much redundancy?
 - Can all thermal loads be met?

Type of CHP System Considered



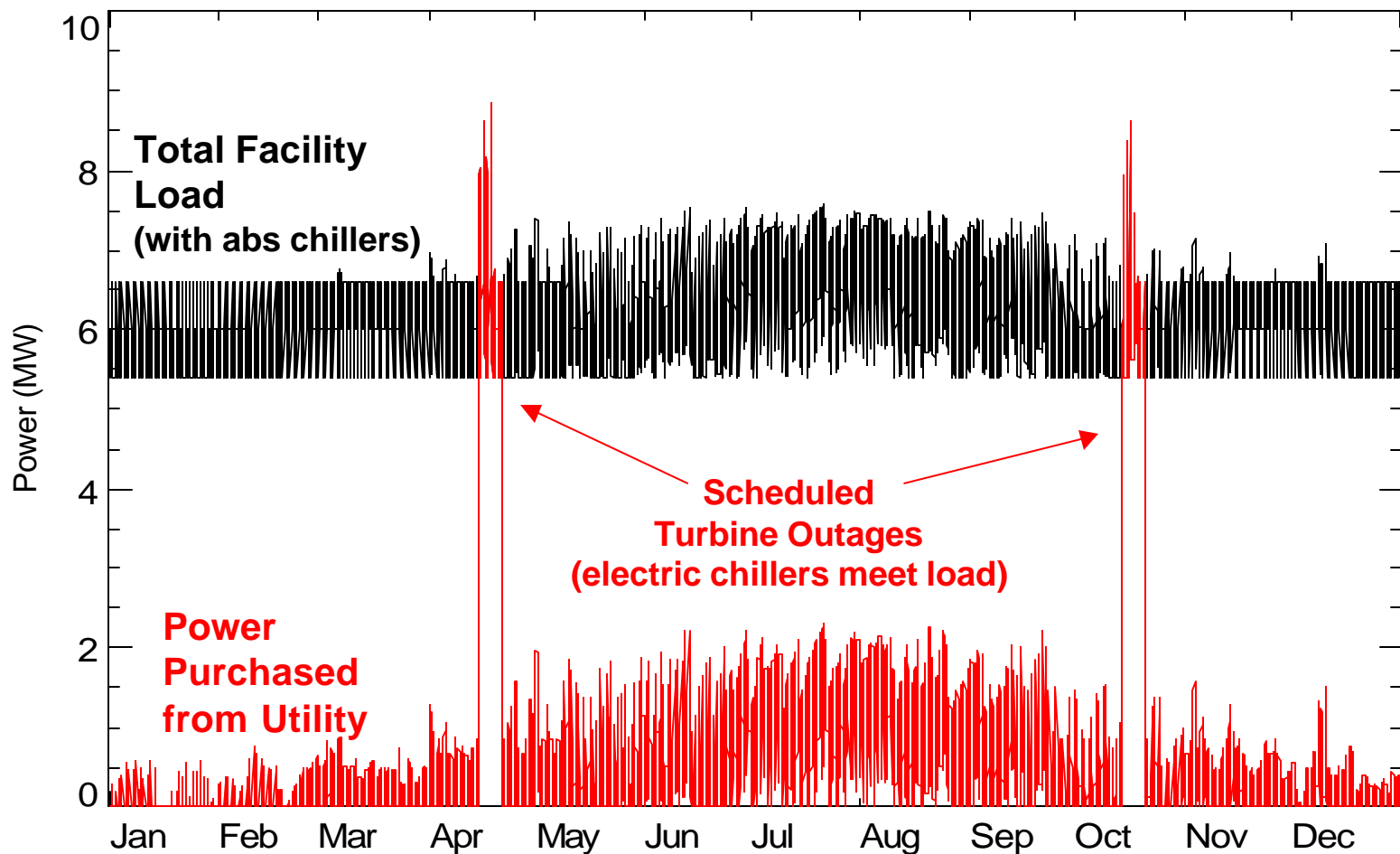
CHP Analysis Procedure

- Develop hour-by-hour models of electric and thermal loads (driven by TMY data)
- Performance curves and assumptions about CHP equipment performance
- Detailed utility rate calculations
- Consider impact of various scheduling scenarios, outages, etc.



Predicted Electric Load with CHP

Abs. Chiller Reduces Peak Demand in Summer



Predicted Costs with CHP – 115kV

5.5 MW turbine, HRSG, Abs. Chillers

Date	Total Facility		Purchased from Utility		Contract Demand (kW)	Sum of "As-Used" Demand (kW-day)	Monthly Account Charge	Contract Demand Charge	As-Used Demand Charge	Commodity Energy Charges	Total Costs
	Energy Use (kWh)	Demand (kW)	Energy Use (kWh)	Demand (kW)							
Jan	4,461,673	6,596.4	55,943	579.8	11,100.0	7,053	\$13,112	\$12,432	\$3,364	\$3,634	\$32,543
Feb	4,029,799	6,596.4	63,543	758.1	11,100.0	7,633	\$13,112	\$12,432	\$3,641	\$3,250	\$32,435
Mar	4,463,352	6,751.3	100,531	886.8	11,100.0	11,771	\$13,112	\$12,432	\$5,615	\$5,171	\$36,330
Apr	4,408,853	8,854.2	1,220,522	8,854.2	11,100.0	53,107	\$13,112	\$12,432	\$25,332	\$58,234	\$109,110
May	4,592,488	7,390.0	389,617	1,971.0	11,100.0	30,974	\$13,112	\$12,432	\$14,774	\$22,655	\$62,974
Jun	4,566,570	7,528.8	551,819	2,216.0	11,100.0	35,561	\$13,112	\$12,432	\$16,963	\$29,161	\$71,667
Jul	4,790,365	7,583.8	685,471	2,305.7	11,100.0	40,553	\$13,112	\$12,432	\$19,344	\$35,335	\$80,223
Aug	4,773,317	7,491.5	676,259	2,272.1	11,100.0	42,774	\$13,112	\$12,432	\$20,403	\$58,232	\$104,179
Sep	4,517,125	7,474.1	494,312	2,198.2	11,100.0	30,777	\$13,112	\$12,432	\$14,681	\$27,672	\$67,896
Oct	4,551,978	8,624.5	1,252,432	8,624.5	11,100.0	56,237	\$13,112	\$12,432	\$26,825	\$75,885	\$128,255
Nov	4,331,856	7,132.2	150,540	1,590.5	11,100.0	15,466	\$13,112	\$12,432	\$7,377	\$9,199	\$42,120
Dec	4,469,595	7,079.7	98,973	1,500.9	11,100.0	9,348	\$13,112	\$12,432	\$4,459	\$7,549	\$37,552
Year	53,956,968		5,739,959				\$157,344	\$149,184	\$162,778	\$335,978	\$805,284
							20%	19%	20%	42%	100%

Notes:

SC7 Utility charges for service over 60kV, Zone E:

Monthly Customer Charges: \$3,172 DD and \$9,940.03 CT

Contract Demand Charges (per kW): \$0.27 DD and \$0.85 CT

"As-Used" Daily Demand Charges (per each daily on-peak kW): \$0.1154 DD and \$0.0.3616 CT

DD - Distribution Delivery, CT - Competitive Transition

Predicted Costs with CHP – 13.2kV

5.5 MW turbine, HRSG, Abs. Chillers

Date	Total Facility		Purchased from Utility		Contract Demand (kW)	Sum of "As-Used" Demand (kW-day)	Monthly Account Charge	Contract Demand Charge	As-Used Demand Charge	Commodity Energy Charges	Total Costs
	Energy Use (kWh)	Demand (kW)	Energy Use (kWh)	Demand (kW)							
Jan	4,461,673	6,596.4	55,943	579.8	11,100.0	7,053	\$1,515	\$58,164	\$3,213	\$3,634	\$66,527
Feb	4,029,799	6,596.4	63,543	758.1	11,100.0	7,633	\$1,515	\$58,164	\$3,478	\$3,250	\$66,406
Mar	4,463,352	6,751.3	100,531	886.8	11,100.0	11,771	\$1,515	\$58,164	\$5,363	\$5,171	\$70,213
Apr	4,408,853	8,854.2	1,220,522	8,854.2	11,100.0	53,107	\$1,515	\$58,164	\$24,195	\$58,234	\$142,108
May	4,592,488	7,390.0	389,617	1,971.0	11,100.0	30,974	\$1,515	\$58,164	\$14,112	\$22,655	\$96,446
Jun	4,566,570	7,528.8	551,819	2,216.0	11,100.0	35,561	\$1,515	\$58,164	\$16,202	\$29,161	\$105,041
Jul	4,790,365	7,583.8	685,471	2,305.7	11,100.0	40,553	\$1,515	\$58,164	\$18,476	\$35,335	\$113,490
Aug	4,773,317	7,491.5	676,259	2,272.1	11,100.0	42,774	\$1,515	\$58,164	\$19,488	\$58,232	\$137,399
Sep	4,517,125	7,474.1	494,312	2,198.2	11,100.0	30,777	\$1,515	\$58,164	\$14,022	\$27,672	\$101,373
Oct	4,551,978	8,624.5	1,252,432	8,624.5	11,100.0	56,237	\$1,515	\$58,164	\$25,622	\$75,885	\$161,186
Nov	4,331,856	7,132.2	150,540	1,590.5	11,100.0	15,466	\$1,515	\$58,164	\$7,046	\$9,199	\$75,924
Dec	4,469,595	7,079.7	98,973	1,500.9	11,100.0	9,348	\$1,515	\$58,164	\$4,259	\$7,549	\$71,487
Year	53,956,968		5,739,959				\$18,176	\$697,968	\$155,475	\$335,978	\$1,207,598
							2%	58%	13%	28%	100%

Notes:

SC7 Utility charges for Primary service under 15kV, Zone E:
 Monthly Customer Charges: \$902 DD and \$612.74 CT
 Contract Demand Charges (per kW): \$3.12 DD and \$2.12 CT
 "As-Used" Daily Demand Charges (per each daily on-peak kW): \$0.2713 DD and \$0.0.143 CT
 DD - Distribution Delivery, CT - Competitive Transition

The SC7 Standby Rate

- Customer pays for standby or backup services provided by utility
 - eliminates the need for special backup equipment or redundancy
- Tariff includes normal “As-Used” demand and “Contract” demand charge
 - “as used” same as normal demand charges
 - “contract” demand charge for standby service
- But...how is contract demand determined?
 - not generator size, but max load!

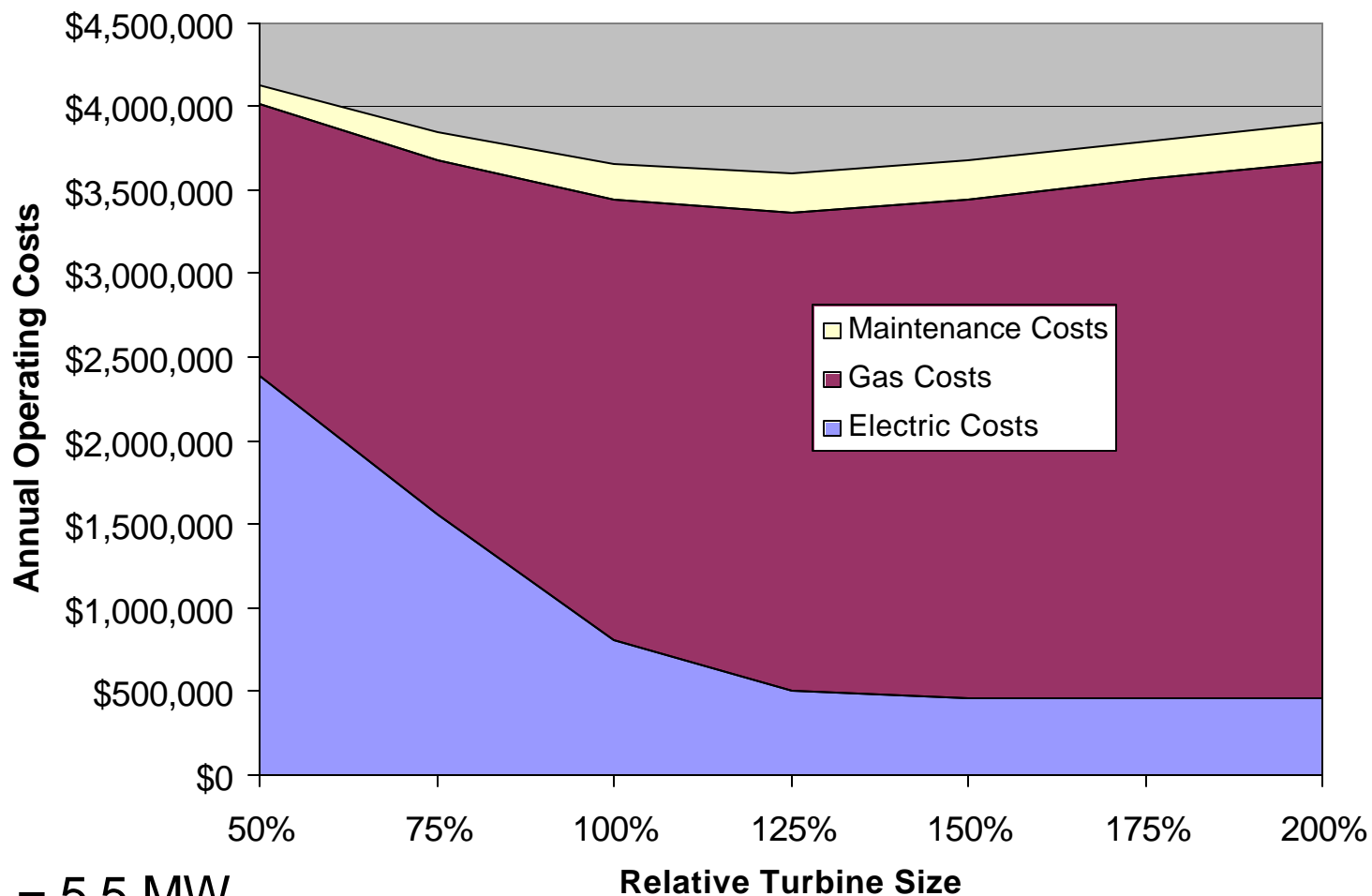
How Punitive are Standby Rates?

- Determine by comparing to “normal utility rates” with remaining load
- “Penalty” depends on service voltage
 - at normal distribution voltages penalty is about 23% of total savings (\$436k of \$1.9M).
 - At transmission voltages penalty drops to 6% of total savings (\$128k of \$2.3M)

Assumed Load Growth	Utility Service Voltage	Utility Costs – Normal Rate	Utility Costs – Standby Rate	Difference
2x loads (11.1 MW)	13.2 kV Service	\$771,937	\$1,207,597	\$435,660
	115 kV Service	\$677,666	\$805,284	\$127,617
2.4x loads (13.3 MW)	13.2 kV Service	\$1,635,559	\$2,016,379	\$380,780
	115 kV Service	\$1,471,272	\$1,513,014	\$41,742

Analyzed Various Sizing Options

Most cost effective to meet part of facility load



100% = 5.5 MW

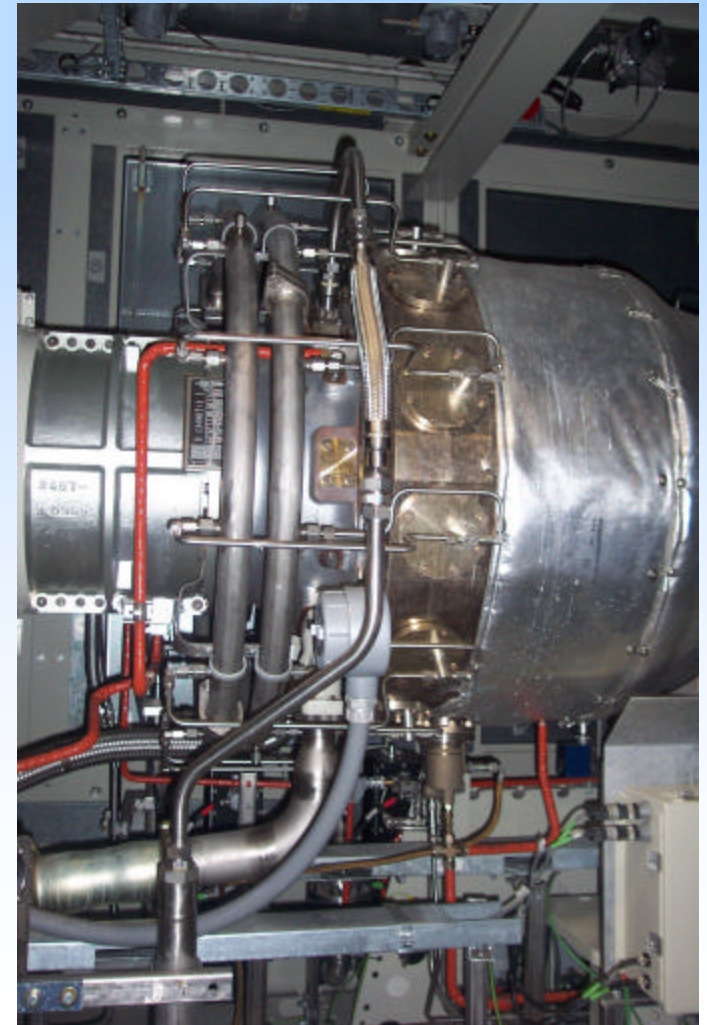
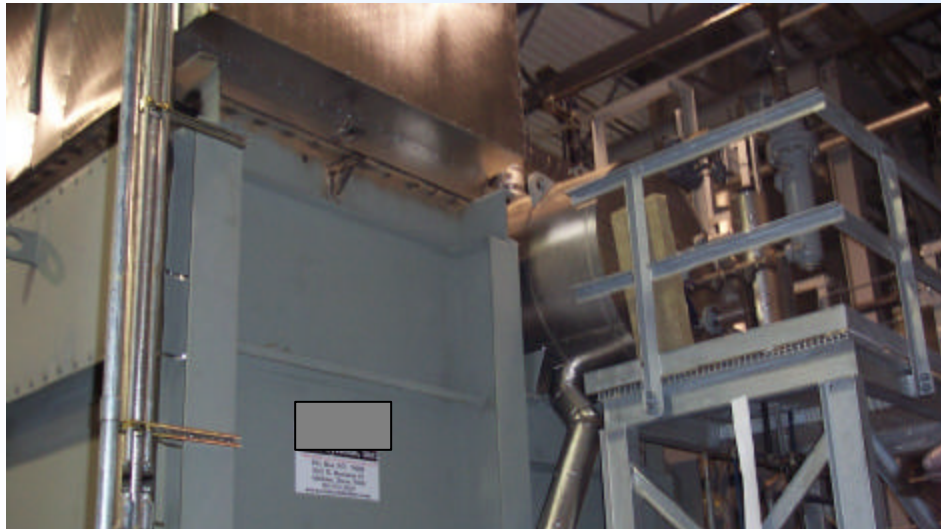
Made Sense to Buy Substation!

- Facility had option to buy substation in utility service agreement
- Structure of standby rates made it very advantageous
- Substation is on major 115kV line



CHP System was Built

- Integrated into new chiller & boiler plant in Spring '04
- Grid parallel operation began in November 2004



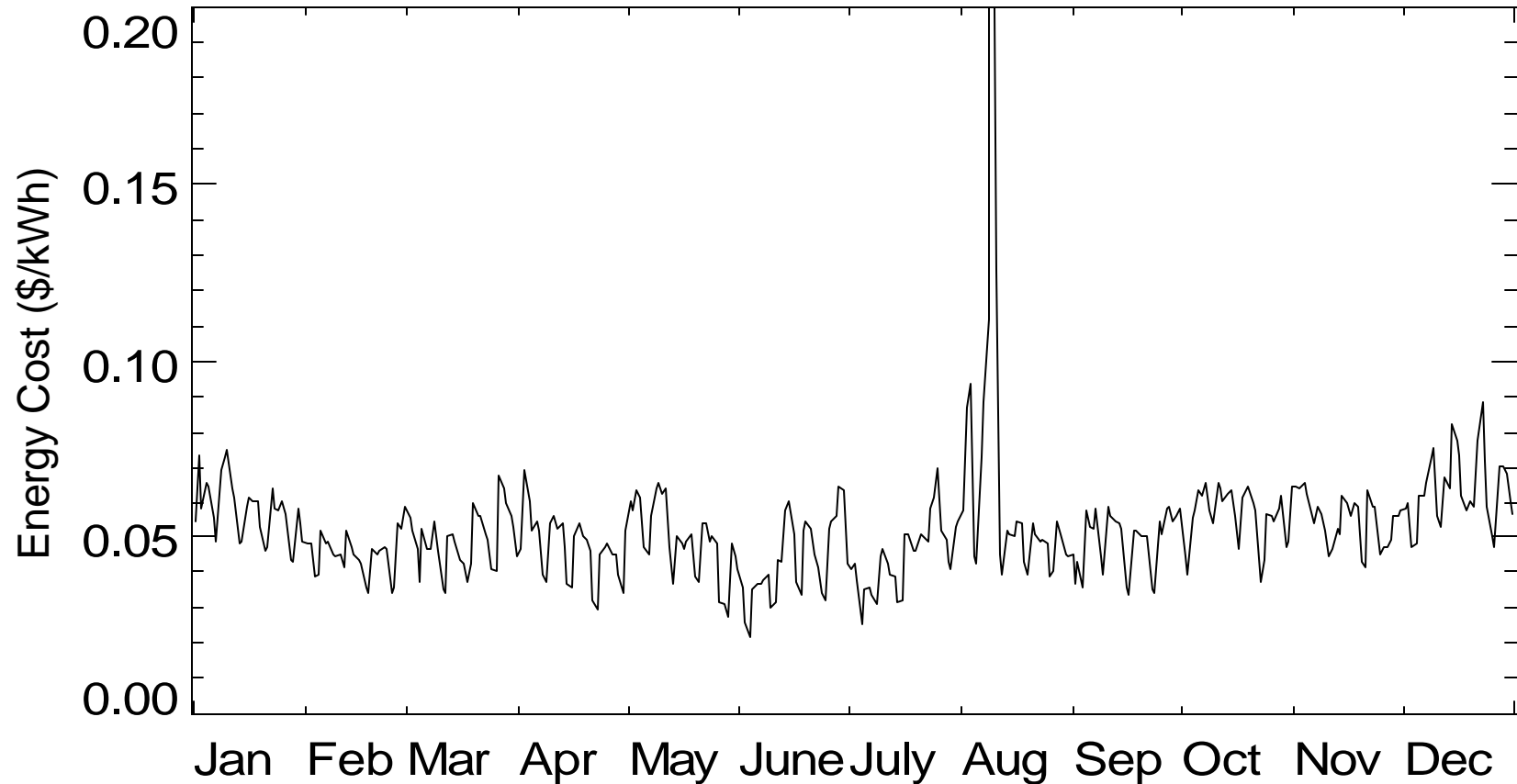
Summary

- Standby rates not as punitive as in past
 - At least in compared to Rule 12
 - Penalties depend strongly on service voltage details
- Big issue in NYS is definition of contract demand
 - Should it be generator size or total facility load?
 - Makes small systems impractical
 - Some utilities have exceptions for small systems (under 15% of facility peak load)

backup slides...

NYISO Commodity Electric Prices

Corresponding to Oct 2000 to Sep 2001



Detailed Costs at Various Sizes

	% of Possible HR	Purchased Electric Costs (\$/yr)	Purchased Gas Costs (\$/yr)	Turbine Mainten. Costs (\$/yr)	Total Operating Costs (\$/yr)	Annual Savings (\$/yr)	Total Installed Cost (\$ Million)	Simple Payback (yrs)
<i>2,750 kW (50%)</i>	84.2%	\$2,390,023	\$1,621,776	\$112,064	\$4,123,863	\$1,863,901	\$7.58	4.07
<i>4,125 kW (75%)</i>	69.3%	\$1,562,435	\$2,122,596	\$168,095	\$3,853,127	\$2,134,637	\$9.23	4.32
<i>5,500 kW (100%)</i>	56.1%	\$805,284	\$2,634,786	\$216,977	\$3,657,047	\$2,330,717	\$10.88	4.67
<i>6,875 kW (125%)</i>	52.4%	\$497,059	\$2,867,442	\$232,007	\$3,596,508	\$2,391,256	\$12.53	5.24
<i>8,250 kW (150%)</i>	52.1%	\$457,325	\$2,991,578	\$233,210	\$3,682,113	\$2,305,651	\$14.18	6.15
<i>9,625 kW (175%)</i>	52.1%	\$457,325	\$3,105,888	\$233,210	\$3,796,423	\$2,191,341	\$15.83	7.22
<i>11,000 kW (200%)</i>	52.1%	\$457,325	\$3,210,656	\$233,210	\$3,901,191	\$2,086,573	\$17.48	8.38

Savings at Different Sizes

Impact of Turbine Size (100% = 5,500 kW)

