An Energy Efficiency Workshop & Exposition

Palm Springs, California

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An Energy Efficiency Workshop & Exposition

Palm Springs, California

Measurement and Verification; A Case Study and Partnership

Select Energy

The Southeast Utilities System

Presenters

- Sharon Parshley
  Energy Manager
  Portsmouth Naval Shipyard (PNS)

- Britta I. MacIntosh, P.E.
  Director, Business Development
  Select Energy Services, Inc. (SESI)

Portsmouth Naval Shipyard
Kittery, Maine

- Mission: Nuclear Subs
- Island, Historical, Defense
- 297 Acres, 316 Buildings, 297 Housing Units
- Distribution Piping: 7 miles steam, 4 miles condensate, 6 miles hot water return and supply
- Controlled Industrial Area (CIA)
- Drydocks, Nuclear Facilities, Cranes
- Boiler / Central Power Plant
- Total Facilities Budget: $35 Million
- Utilities Budget: $12 Million

Getting Involved with ESPC

Pre-Dec 97 PNS performs efficiency upgrades using DSM

Dec 97 U.S. Navy SmartBase program introduces PNS to ESPC

Dec 97 PNS holds 2-day Site Survey / Presentations Meeting

- 3 ESCOs
- Tour of Shipyard together
- Presentation of Qualifications
- Briefing to PNS of findings by ESCO

Jun 98 ACOE & PNS Selection of ESCO

Oct 98 ACOE & PNS Sign MOA

A Program on a Mission

Dec 98 ESPC Kick Off Meeting

Mar 99 Site Survey Report Presentation / Meeting

- 10 year project, fully financed
- No cost avoidance claim allowed
- No maintenance savings claim allowed

May 99 Pre-Proposal Audit Presentation Meeting

Jun 99 Final Proposal Presentation

Aug 99 Task Order Award

Project Snapshot

- **$10.9 Million Investment**
- **$2.1 Million Annual Energy Savings**
  - **Power Plant Upgrade**
  - **Steam Trap Maintenance Program**
  - **Hot Water / Steam Distribution System Upgrade**
- **Sep 99– 00 Construction in Progress**
- **Dec 00 – Installation Complete / Government Acceptance**

Portsmouth Naval Shipyard Gas Turbine Ribbon Cutting
(22 Feb 2001)

ECSM-1 Power Plant Upgrade

- Scope of Work
  - (1) 5.2 MW gas turbine generator w / HRSG
  - Retain steam TGs #5 & #7, TG #6 out of service
  - Operate gas turbine year round
  - Shut down 600# boilers in summer months
  - Operate all turbines in winter months

ECSM-1 Savings

- Savings result from:
  - Increased electric generation efficiency due to the cogeneration system (gas turbine with HRSG)
  - Increased efficiency of generating steam at 200 psi versus 600 psi
  - Increased electric generation
  - Ongoing maintenance of new and existing equipment

ECSM-2 Steam and Hot Water System Improvements

- Scope of Work
  - Shut down 2,575 feet of steam and condensate piping
  - Install individual boilers in 5 buildings
  - Replace / maintain steam traps
  - Modify hot water pumping systems, VFD control

ECSM-2 Savings

- Savings result from:
  - Improved boiler plant efficiency
  - Reduced steam distribution losses
  - Reduction in lost condensate
  - Reduction of steam leaks
  - Repair or replacement of a large quantity of improperly functioning steam traps
  - Improved hot water pumping efficiency

An M&V Plan is Kind of Like a Pre-Nuptial Agreement

- No one really likes to talk about it, but it lays out a plan for how to deal with the unexpected
- What's at stake?
  - Savings guarantee
  - Contractor payment
  - Integrity of system performance
  - Your relationship

Business Issues Related to the M&V Plan

- Realizing Savings = Contractor Payment
- How complex is your plan?
  - Financier's view on savings stream
  - Dollars saved vs. dollars spent
  - Accuracy vs. Precision
- Operations & Maintenance
  - Trade-offs with M&V

Selecting the Appropriate Level of Verification Effort

Energy Measure	Investment	Projected Annual Savings	Annual M&V Cost	Annual O&M Cost
ECSM-1 Power Plant Upgrade	$9.941.217	$1.789.842	$23.630	$236.068
ECSM-2 Measure	$1.026.480	$330.737	$12.734	$81.595
Total	$10.967.697	$2.120.579	$36.364	$317.663

ECSM-2 Measure Breakdown	Projected Annual Savings	Annual M&V Cost	Annual O&M Cost
Boiler Decentralization	$48.282	$2.678	$1.451
HW Pumping Upgrades	$9.958	$2.168	$795
Steam Traps	$272.497	$7.888	$79.349

ECSM-1 M&V Protocol

- Uses a combination of FEMP Guidelines, where SESI verifies *equipment performance* and *availability*
  - Option A involves stipulated values derived from engineering models and verification of the equipment's potential to perform
  - Option B involves procedures for verifying equipment performance through engineering calculations and long-term metering by end use

Year 1 - System Availability

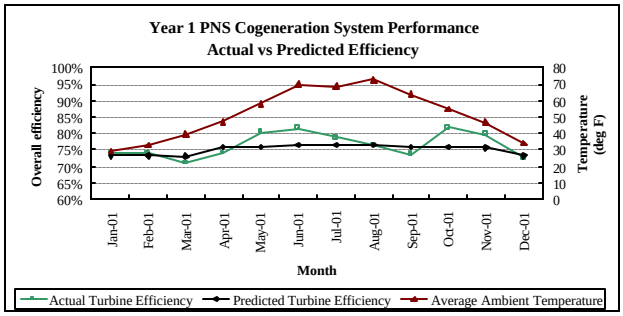
- Cogeneration system will be available a minimum of 85% of the time annually for electricity and steam production

Month	Total Monthly Hours	Actual Equipment Availability (Hours)	Equipment Unavailability Due to SESI Responsibility (Hours)	Equipment Run-Time (Hours)	Hours Equipment Not Operated by PNS
Dec 2000 – Nov 2001	8,016	7,853	162	6,875	979
Dec 2001	744	460	284	460	0
Year 1 Totals	**8,760**	**8,313**	**446**	**7,335**	**979**
Year 1 %	**N/A**	**94.9%**	**5.1%**	**83.7%**	**11.2%**

Year 1 – System Efficiency

Month	Average Ambient Temperature (°F)	Actual System Efficiency	Predicted Efficiency
Jan 2001	29.3	73.9%	73.3%
Feb 2001	32.7	73.8%	73.2%
Mar 2001	39.4	71.0%	73.0%
Apr 2001	47.1	74.0%	75.8%
May 2001	58.2	80.4%	75.8%
Jun 2001	69.8	81.6%	76.4%
Jul 2001	68.8	78.8%	76.3%
Aug 2001	72.5	76.6%	76.3%
Sep 2001	63.7	73.6%	76.0%
Oct 2001	55.0	81.8%	75.8%
Nov 2001	46.7	79.8%	75.7%
Dec 2001	34.4	72.6%	73.1%
Annual Averages	**51.4**	**76.5%**	**75.1%**

ECSM-1 Cogeneration System Performance



Please note that the cogeneration system efficiency varies with ambient temperature, equipment loading, and duct burner operation.

ECSM-2 M&V Protocol

- Boiler Decentralization Protocol (Option A)
  - This measure includes the installation of 5 new, decentralized no. 2 fuel oil fired boiler plants
  - Protocol verifies that the boilers are well maintained on an annual basis
- Hot Water Pumping Protocol (Option A)
  - This measure includes the installation of a variable speed drive on Pump #2 located in the boiler plant
  - Protocol verifies equipment performance through annual inspections

ECSM-2 M&V Protocol

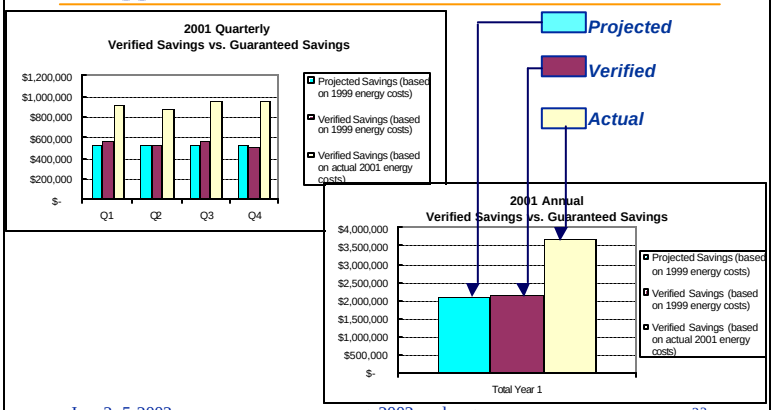
- Steam Trap Protocol (Option A and Option B)
  - Includes trap testing and repairs
  - 100% of steam traps (1162 building traps, 102 distribution traps, and 85 power plant traps) were tagged, tested initially and replaced or repaired as necessary
  - Created steam trap database documenting steam trap population, location, condition and repair action
  - Performance is demonstrated through annual inspections, testing, and maintenance conducted during the winter months.

ESPC Projected & Verified Energy Savings

Total Year 1	Power Plant Upgrade	Steam / HW System Improvements	Total Savings
Projected Energy Savings (Based on 1999 energy costs)			
	$1,789,842	$330,737	$2,120,579
Verified Energy Savings (Based on 1999 energy costs)			
	$1,836,667	$329,121 *	$2,165,788
Verified Energy Savings (Based on 2001 energy costs)			
	$2,821,571	$889,363 *	$3,710,934

* Verified Savings for Steam / HW Sys Improvements include a steam trap savings adjustment.

2001 ESPC Energy Savings



Purchased Electricity

	FY99 Before Deregulation		FY01 After Deregulation		
	Non-Winter Billing Months	Winter Billing Months	Winter	Off-Winter	Summer
	Apr – Nov	Dec - Mar	Dec - Mar	Apr, May, Sep, Oct, Nov	Jun - Aug
Demand Charge per kW					
On-Peak	$2.10	$10.95			
Shoulder	$0.36	$2.24			
Energy Charge per kWh					
On-Peak	0.047098	0.058710	0.1007	0.0939	0.1500
Shoulder	0.046670	0.055909	0.0991	0.0599	0.1497
Off-Peak	0.042242	0.047712	0.0605	0.0573	0.0668

Cost Comparisons

(Based on FY99 Energy Rates)

	FY01 Costs with ESPC 1	FY01 Costs without ESPC 1
Electricity Generated	40,635 MWH	10,080 MWH
Electricity Purchased	34,391 MWH	64,946 MWH
Purchased Electricity	$3,041,763	$6,115,336
Purchased Fuel	$9,158,088	$9,158,088
ESPC Payment	$2,106,494	$0
Electric Delivery Cost	$133.01 / MWH	$133.48 / MWH
Steam / Heat Delivery Cost	$30.65 / MBTU	$33.71 / MBTU

ESPC Project Benefits

- Paid through Energy Savings for 10 years
  - 10 year project, fully financed
  - No cost avoidance claim allowed
  - No maintenance savings claim allowed
- Contractor Owns and Maintains Equipment
- PNS Operates Equipment
- O&M and M&V are part of Annual Payment
- Significant reduction in future O&M costs

Was It All Roses?

- Commitment to a Partnership guided PNS and SESI through challenging issues
  - Utility Protest
  - Unexpected Shipyard-wide Power Failure
  - Rail strike and uncooperative State Highway Commissions during equipment delivery
  - Construction delays due to special Shipyard mission requirements

What's Next?

- Build on success of ESPC #1 with additional upgrades
  - Improve reliability / efficiency of Shipyard's generation capacity
  - Shipyard-wide lighting upgrades
  - Compressed Air System Maintenance Program
  - Decommissioning of Hot Water System

In Summary

- This is a long term deal
- Develop your M&V plan together
- Document, document, document
- Play nice: If majority of risk is borne unfairly by one party or the other, then there will sour grapes from the start
- Expect the unexpected

Question & Answer