

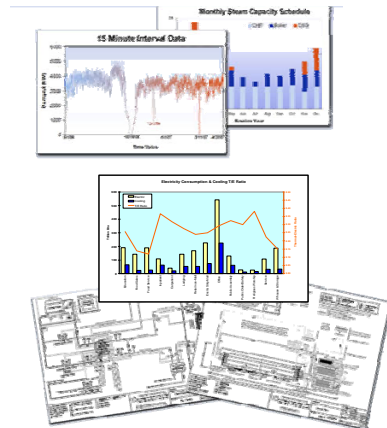


CHP, Waste Heat & District Energy

Module 4: CHP Qualifiers & Considerations

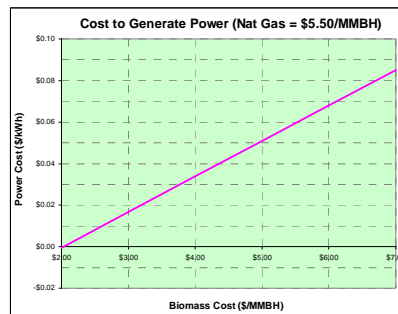
Module 4 Topics

- **Goals**
- **Qualifiers**
 - Size/Energy Costs
- **Considerations**
 - Space
 - Distribution Systems
 - Interconnection, Etc.
- **Permitting**
- **Schedule**



CHP Project Goals

- Increase Energy Efficiency
- Reduce Energy Costs
 - High Thermal Load Factor
- Minimize Operational Risk
- Reduce Carbon Footprint
- Other Issues
 - Reliability, Expansion, etc.



Qualifiers

- Substantial Energy Costs – Thermal & Electric
 - > \$100K p.a. to Self Perform (small project)
 - > \$500K p.a. for 3rd Party Option (still small project)
 - > \$2M p.a. for medium projects
- Substantial Operating Hours
 - > 5,000 hours per year system operation at Full Load
- Coincident Thermal & Electric Loads
 - Thermal Distribution System required
 - Thermal Loads must be 'Addressable'
- Corporate Willingness & Desire for Benefits

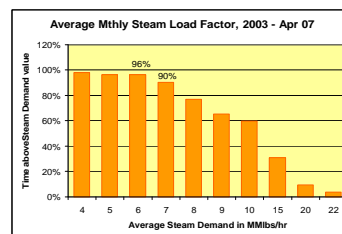
Qualifiers

- **Industrial Users**
 - > 1 MW peak demand with process thermal loads
- **Commercial Users**
 - Office Buildings over 50,000 SF
 - Enclosed Shopping Malls with central utilities
 - Hotels with over 100 rooms
- **Institutional Users**
 - Colleges over 5,000 full time students
 - Hospitals over 100 beds
 - Multifamily Residential over 100 units

* *Thermal distribution system required for all applications*

Considerations

- **Physical Location & Space Availability**
 - Fit equipment with service access
 - Adequate biomass handling/storage space
 - Fuel Transportation
 - Proximity to Switchgear & Thermal Loads is a Cost issue
- **Thermal Distribution System**
 - Type and Quality
 - Tie-in point at return line
 - Maximize load for all 12 months
 - Thermal Use all Operating Hours



Considerations

- **Electric Distribution System**

- Tie-in prior to distribution
- Only 1 Meter – Cannot back feed
- CHP output at 480 – 13,000 V
- Grid Interconnection – Parallel or Island Mode
- Parallel ⇒ No Power Export/Simpler Interconnection



- **Fuel Availability & Quality**

- Long term fuel supply necessary to cover at least the payback period
- Fuel quality can have significant impact

Considerations

- **Electric Issues**

- Facility Grid Reliability
- ‘Black Start’ Capability – Emergency Circuits/Block Loading Capability
- CHP System Parasitics

- **Emissions**

- EPA Title 5 or Local Authority
- Residue Disposal

Generator Emissions				
Emissions		Rate g/bhp-hr	Annual Total	Monthly Average
NO _x	Tons	0.15	5.7	0.5
NH ₃	Tons	0.04	1.5	0.1
CO	Tons	0.5	19.0	1.6
O ₂	%	9.4		

- **Noise**

- Mitigated with Enclosures & Silencers

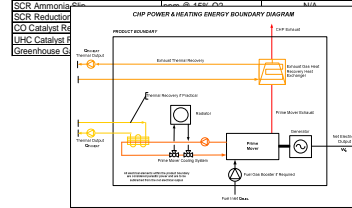
- **CHP System Control & Metering**

- Integrate with component controls, utility meters & BAS

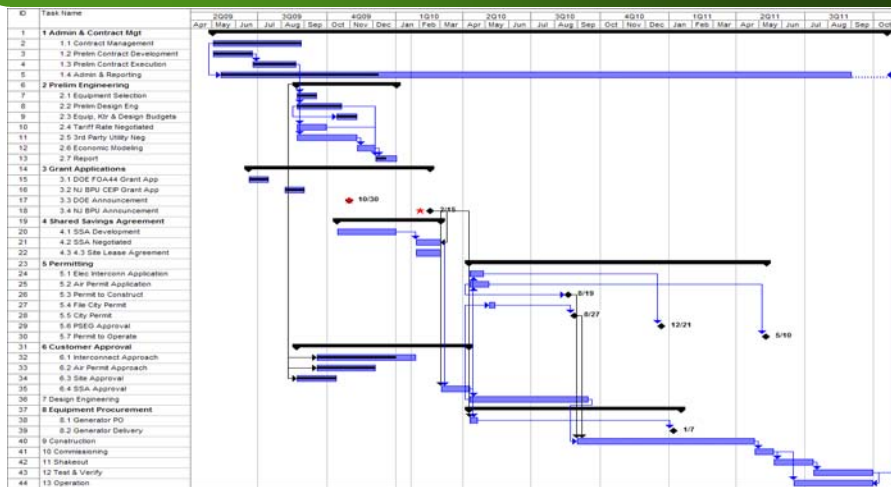
Permitting Issues

- Air Permits
- Electrical Interconnection
- City/State Construction Permits
 - Operating Personnel
- Grant Program Requirements
 - M&V

Exhaust Emissions At Stack			
NOx	ppm @ 15% O2	5	5
	lb/MMBtu, HHV	0.018	0.018
	lb/hr	0.6	0.6
CO	ppm @ 15% O2	10	10
	lb/MMBtu, HHV	0.022	0.022
	lb/hr	1.0	1.0
UHC	ppm @ 15% O2	4.3	4.3
	lb/MMBtu, HHV	10	10
	lb/hr	0.6	0.6
VOC	ppm @ 15% O2	1	1
	lb/MMBtu, HHV	0.003	0.003
	lb/hr	0.1	0.1
PM10	ppm @ 15% O2	0.2	0.2
	lb/MMBtu, HHV	1.3	1.3
	lb/hr	0.030	0.030
SO2	ppm @ 15% O2	5.8	5.8
	lb/MMBtu, HHV	0.2	0.2
	lb/hr	0.003	0.003



Project Schedule





U.S. DEPARTMENT OF ENERGY

Mid-Atlantic Clean Energy Application Center

Promoting CHP, District Energy, and Waste Heat Recovery

Larry Burton
Pennsylvania and West Virginia
PENN STATE UNIVERSITY
UNIVERSITY PARK, PA 16802
TEL: 814.360.9868
E-MAIL: lcb2@psu.edu



Gearoid Foley
New Jersey
50 WASHINGTON ROAD
PRINCETON JUNCTION, NJ 08550
TEL: 609.799.2340
E-MAIL: gfoley@maceac.psu.edu

James Freihaut, Director
Mid-Atlantic Clean Energy Application
Center

104 ENGINEERING UNIT A
UNIVERSITY PARK, PA 16802
TEL: 814.863.0083
E-MAIL: jdf11@psu.edu

Richard Sweetser
Virginia, DC and Maryland
12020 MEADOWVILLE COURT
HERNDON, VIRGINIA 20170
TEL: 703.707.0293
E-MAIL: rsweetser@maceac.psu.edu

Bill Valentine
Delaware
THE PHILADELPHIA NAVY YARD
4801 SOUTH BROAD STREET
PHILADELPHIA, PA 19112
TEL: 609.799.2340
E-MAIL: wjv3@psu.edu