Waste Heat to Power: A New Focus for CHP

By Jeff Duncan
Vice President
Carter & Burgess, Inc.

Overview

- Traditional CHP Focus
- Markets/Trends
- Current CHP Opportunities
- Technology
- Customer Challenges

Traditional Definition

- An Integrated System
- Located near a plant or facility
- Satisfy a portion of the facility electric load
- Utilize waste heat for heating, cooling or process

Markets for CHP

- University - District Energy Systems
- Industrial – Cogeneration Systems
- Light Industrial – Small Cogeneration
- Corp. Campus, Military Bases, etc.
- Office Buildings/Complex

CHP Trends

- Turn of the Century Origins
- 80’s & early 90’s - FERC Purpa - QF
- Today – On-site DG systems

Key Variables of CHP

- Cost of Energy (kw)
- Cost of Fuel
- Electricity / Thermal load growth
- Environmental

Should the Focus of CHP Change?

Drivers of CHP

Environmental:

- Global Warming
- Emissions Reduction

  - Nox
  - CO_2
  - SOX
  - P 10

Drivers of CHP

Economic:

- Historically High Natural Gas Pricing (Today / Future)
- National: Increase Cost of Electricity

Drivers of CHP

Technology:

- Higher Efficiencies of Prime Movers
- Improved Emission Control Technology
- Enhanced reliability/availabilities of system

Result

Today's CHP Systems are…

- Cleaner & more efficient
- Highly reliable
- Use / Reuse or No-use of fuel

Fuel Choices

- Natural Gas
- Renewables
  - digester gas
  - landfill gas
  - bio diesel / E85 ethanol
  - wood waste
  - animal waste blends
  - PV – solar combined cycle
- No Fuel: Waste Heat Recovery

Fuel Selection

Fuel of Choice:

- Natural gas

Problem:

- Historical high cost

Clean Energy Options

- Renewables
  - Wind PV
  - Bio Mass
- Nuclear
- Fuel Cells
- CHP

CHP Efficiencies

- Enhanced CTG / HRSG / STG Combined-Cycle Technologies
- Target Highest CHP efficiencies
- Also High Electric efficiencies

Today's Applications

- Goal serve annual average thermal loads (Heat / Cool)
- Use steam turbine for power production (floater)
- STG power used to:
  - off-set high cost electric power
  - drive high efficiency CRU (CW)

Current Technologies / Approaches CHP

- Combustion turbines & engine generators
- Fuel cells with waste heat recovery
- District Energy Systems (combined-cycle)
- Add Thermal energy storage (TES)
- Add STG to convert to combined-cycle (better use thermal + power)
- Off-grid combined-cycle / cogen
- Enhanced Operating Protocols

California Legislation

Energy Action Plan II (Priorities)

1. Energy efficiencies
2. Demand response
3. Renewables
4. CHP
5. Clean / efficient fossil generation
6. Reduce demand for natural gas

Key Limits for CHP Growth

- Legislative limbo
- No PUC direction for Utilities to buy CHP
- Concern for high/erratic natural gas prices
- Self Generation Incentive Program (SGIP)

  - Still small - up to 5 MW

  - Exemptions: standby charges, departing load charges & expanded net metering

  - Capital cost rebate (max $750k)

  - sunset 2007 (renewed annually)

Reference

- When / How to use CHP?
- What is available technology?
- Where to go for help / solutions?
  - DOE Distributed Energy Program
  - CHP Regional Application Center
  - Qualified Local Professional