COMBINED HEAT AND POWER

Lessons Learned from the Implementation of Projects Across the Country

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Background

• Perspective from:
  – Designing and implementing systems over 15+ years
  – Successes
  – Bumps and bruises
  – Failures to launch
• Not a CHP 101 discussion
• Addressed toward privately-owned CHP, not utility side
• Names changed to protect the innocent
Lesson #1

CHP is not for everyone!
CHP is *not* for everyone

**Big Idea**

- Understand *your* project drivers
- Accept that the right answer might be:
  - Yes!
  - Maybe later
  - No
  - Never!
CHP is not:

• A means to beat your utility at their own game
  – Frustration with your utility is a poor motivator
  – The utility will always win, one way or another
    • Incentives
    • Standby charges
    • Departing load charges
    • Interconnection fees
    • Time (they dictate this)

• Always the cleanest form of electricity
  – Comparisons can be confusing
CHP is not:

- A universal solution
  - Every system is unique
  - Beware of peer pressure

- The California Highway Patrol
  - Understand your audience
  - Understand their motivation
    - How much?
    - What’s the benefit?

- Fast, cheap or easy!
  - See remaining lessons...
CHP might be right when:

• Coincident thermal and electrical demands
• Consistent thermal demand baseline
• Electricity is expensive, fuel is cheap
• Resiliency is in play
• Financial and policy incentives exist
• Sustainability is a goal
  – GHG goals
  – Eliminate coal
Application

Case Studies

• The “load follower”
• The “grow into it”
• The “free study said it’s a go”

Application

• Understand project drivers, opportunities
• Seek qualified assistance to advance development
• Apply Lesson #2
Lesson #2

CHP projects require intense due diligence!
CHP projects require intense due diligence

**Big Idea**

- EARLY is when to do the project right
- Do your homework
- Ask the right questions
- Consider every step of development
- Be realistic with input and results
Invest in a rigorous and detailed study

- Detailed thermodynamic model
  - Quality (hourly, metered) data
  - Caution re: future projections
  - Mindful of parasitic loads
  - Explore and optimize:
    - Economizers
    - Inlet air cooling
    - Condensate pre-heaters
    - Low grade heat recovery
    - Water usage
Invest in a rigorous and detailed study

• Understand requirements of CFO & Finance

• Sensitivities

• Value for carbon/GHG?

• Full project cost
  – Construction
  – Permitting
  – Utility interconnect
  – Design
  – Existing conditions
  – Permits
  – Owner
  – Owner contingency
  – Commissioning
  – Training
  – Project
  – Project management
Application

Case Study

– University of Minnesota
  • LCC Savings – $94M
  • GHG Savings – 35,700 tons annually

Application

– Understand financial metrics necessary for approval
– Growing into a project is risky
– A screening does not a project make
Lesson #3

CHP projects take time. Lots of time. Longer than you expect. Plus more.
CHP projects take time

Big Idea

– Understand the steps of developing a CHP opportunity
– Have reasonable expectations
– Create schedule margin
– You are not always in control
Application

Case Studies

- EPA permitting = 9-12 months
- ISO permitting = 9-12 months (before paralleling)
- Equipment procurement = 12+ months
- Set realistic expectations for all stakeholders
- Time = $$$
- Beware of project fatigue
Steps in Development

- Idea
- Approval
- Design
- Construction
- Closeout
Lesson #4
Consider safety in design and operations.
Plant safety

Big Idea
- Take safety seriously
- Safety is a cultural topic
- Take a leadership role

OSHA Guidance
- 29 CFR 1910.269
- 29 CFR 1926 Subpart V
Design tips

Safety Hazards in a Power Plant

- Electrical safety
- Machine safety
- Working at elevation
- Excavation work
- Lifting operations
- Confined spaces
- Chemical hazards
- High temperature piping and ductwork
- Vehicle movement
- Control of contractors
Application

**Case Study**
- Jacobs project
  - 11 employees killed

**Application**
- Evaluate ALL risks
- Create a culture that values safety, transparency and accountability
- Don’t let a tragedy serve as the stimulus
Lesson #5

CHP plants don’t have to be ugly. But don’t make them pretty first.
Plant Aesthetics

Big Idea

– Design from inside to out
– The engineer gets to drive!
– PFDs yield systems to plan around
– Consider O&M and traffic flow
– Plan around noise, drift and emissions
Design Tips

• CHP = Engineered System
  – Start with PFD, not rendering
  – Engineering led
  – Architecturally supported

• Design from the inside out
  – Plan around largest equipment
  – Stacks, air intakes, vents and rooftop equipment
  – Electrical gear
    • Single source
Application

Case Study
– University of Oklahoma
– University of Minnesota

Application
– Engineering first
– Safe and functional
– Aesthetics third
Parting Shots:

6. **Natural gas compressors.** You don’t want one.

7. **Project delivery; choose wisely.**

8. **Permitting: Go local, start early.**

9. **Don’t forget Cx – later in this broadcast...**