FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR
May 18-19, 2016
Cincinnati, OH

Energy Master Planning Perspectives and Best Practices

Hosted by:

FEMP
Federal Energy Management Program

Duke Energy
Energy Master Plan Perspectives

• Why is an Energy Master Plan important?
  – Identify and coalesce around goals and drivers
  – Address critical infrastructure needs
  – Prepare for growth
  – Develop an actionable strategy

• The Goal:
  – Provide a roadmap for an efficient, practical, cost effective and robust energy infrastructure system
Energy Master Plan Approach

• Where do I start?
  – Define your control boundary

• What should I address?
  – Energy Consumption/Demand
  – Energy Production/Conversion
  – Energy Distribution
Common Planning Components

- Condition Assessment
- Infrastructure Renewal
- Load Growth Projections
- Energy Conservation Improvements
- Self-Generation/Fuel Diversity
- Distribution Analysis
- Environmental Compliance Strategies
- New Plant/Infrastructure Siting
- Reliability Improvements
- Cost Estimating
- Economic Evaluation
- Funding/Phasing/Scheduling Plans
Planning Methodology – The Start

- Follow Architectural Master Plan
  - “Living” Document

- Determine Goals and Expectations
  - Level of Detail
  - Time Window
  - Biases/Political issues

Ensure Energy Systems Meet Mission Needs and Addresses Deferred Maintenance

Improve Energy Reliability & Redundancy

Reduce GHG Emissions & Operating Costs
Planning Methodology – Digging In

• Data Gathering
  – Interviews
  – Documents
  – Walkdowns

• Data Review
  – Temperatures, flows, BTUs, KWH, Etc.
  – Gaps and Assumptions
  – Service Life
  – Understand interdependencies
Planning Methodology – Analysis

• Develop assumptions
  – How to handle unknowns?
  – Load growth projections
  – Redundancy requirements

• Primary Analysis
  – Modeling/Evaluation Baseline
  – Options Analysis
  – Develop Alternatives
  – Project Siting
Planning Methodology – Evaluations

• Cost Estimates

• Economic Analysis
  – Economic factors
  – LCC with IRR
  – Integrate with GHG emissions
  – Sensitivity Analysis
Planning Methodology – The Plan

- Finalize Recommendations
- Funding Plan
  - Discrete Project List
  - Cost Loaded Schedule
- Communication Tool
  - Consider Audience
  - Consider Living Report
Case Study
The University of Texas at Austin
UT Austin - By the Numbers

• 50,000 students
• 18 million SF, 485 acres
• $580M+ Annual Research
• Largest University Utility in US
  – Boiler Plant Commissioned - 1910
  – Power Plant Commissioned - 1928
• Generation Capacity - 134 MW
  – 59 MW Peak Load
• Electrical Duct Banks - 32 Miles
• Steam/CHW Tunnels - 9 Miles
• Campus-Wide Blackouts
  – 4 in 54 years
Energy Supply to Campus

Diagram showing the energy supply system:
- Underground duct banks
- Electric power
- 950°F exhaust gas
- Two gas turbines, 79 MW
- Two heat-recovery steam generators
- Four steam turbines, 62 MW
- Natural gas
- Inlet-air cooling
- Standby power
- Air
- Four boilers
- Natural gas
- HP steam
- Healing steam and hot water
- Tunnels
- Four chilling stations
- Eight electric chillers, 30,000 tons
- Three electric chillers, 15,000 tons
- Chilled-water storage
Challenge – New Master Plans

Federal Utility Partnership Working Group
May 18-19, 2016    Cincinnati, OH
Natural Gas Projection

Fuel Gas Forecast (MMBTU)

FY2010 forecast, escalated at 2%

4,118,000

4,500,752

4,960,135

5,486,393

5,657,421

Federal Utility Partnership Working Group
May 18-19, 2016    Cincinnati, OH
Challenge – New Medical School

- 2M+ SF new teaching and research hospital facilities
Campus Energy Initiatives

• Energy Procurement
• Demand Side Management
  – Retro-commissioning
  – Smart metering
  – Seed money and self-funding
• Plant Efficiency Upgrades
  – Chase every Btu – Optimize!
  – $150M investment
  – Address interdependencies
• Water Conservation
  – Buildings
  – Plants
  – Landscaping
Natural Gas Projection

Fuel Gas Forecast (MMBTU)

FY2010 forecast, escalated at 2%

Actual volumes
FY2016 forecast, escalated at 2%

Federal Utility Partnership Working Group
May 18-19, 2016    Cincinnati, OH
Goal - offset growth with Side Demand Conservation

Federal Utility Partnership Working Group
May 18-19, 2016  Cincinnati, OH
Net Benefit

CUMULATIVE AVOIDED GAS
SINCE 1996

15,670,000 MMBTU

Without Improvements

Space Growth

Return to 1976 Fuel Levels
9 million sf vs. 17.9 million sf
184 million kWh vs 337 million kWh
Questions?

Contact
Kevin Fox, P.E., CEM
Principal - Energy & Power Solutions, Jacobs
kevin.fox@jacobs.com