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®

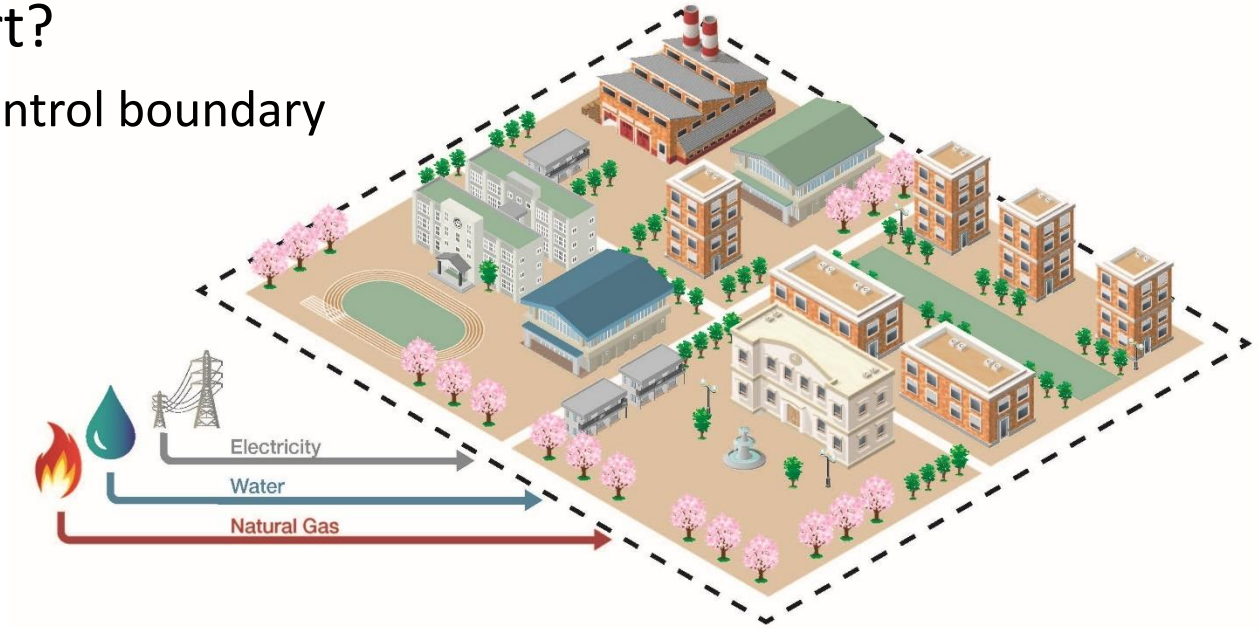
Energy Master Plan Perspectives

- 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

FEMP Federal Energy Management Program DUKE ENERGY®

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

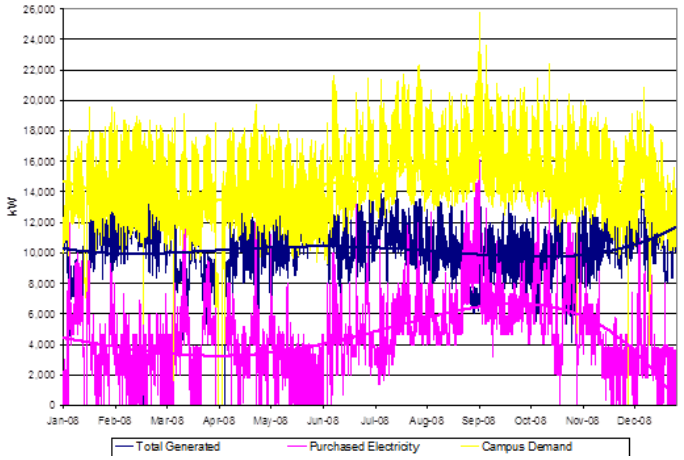
- Determine Goals and Expectations
  - Level of Detail
  - Time Window
  - Biases/Political issues

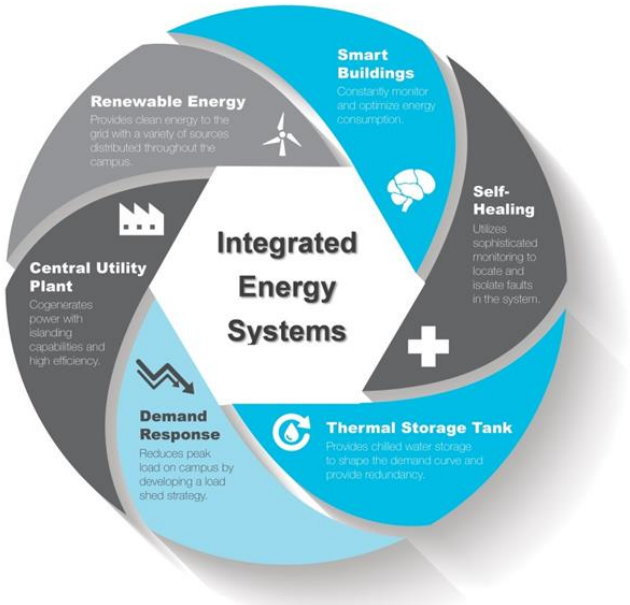
Ensure Energy Systems Meet Mission Needs and Addresses Deferred Maintenance	Improve Energy Reliability & Redundancy	Reduce GHG Emissions & Operating Costs

Planning Methodology – Digging In

- Data Gathering
  - Interviews
  - Documents
  - Walkdowns

- Data Review
  - Temperatures, flows, BTUs, KWH, Etc.
  - Gaps and Assumptions
  - Service Life
  - **Understand interdependencies**

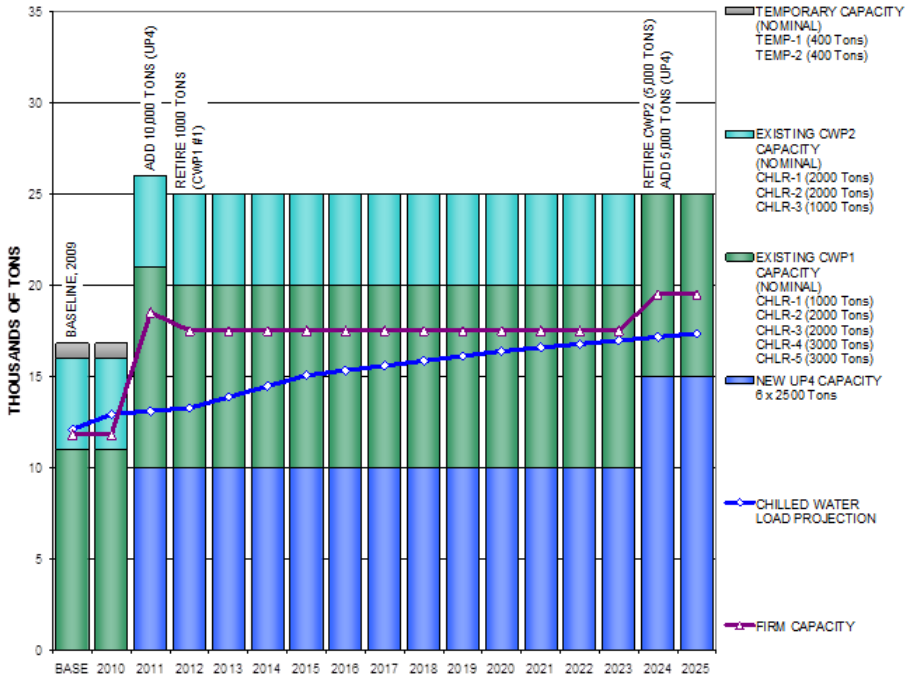




FEMP Federal Energy Management Program
DUKE ENERGY®

Planning Methodology – Analysis

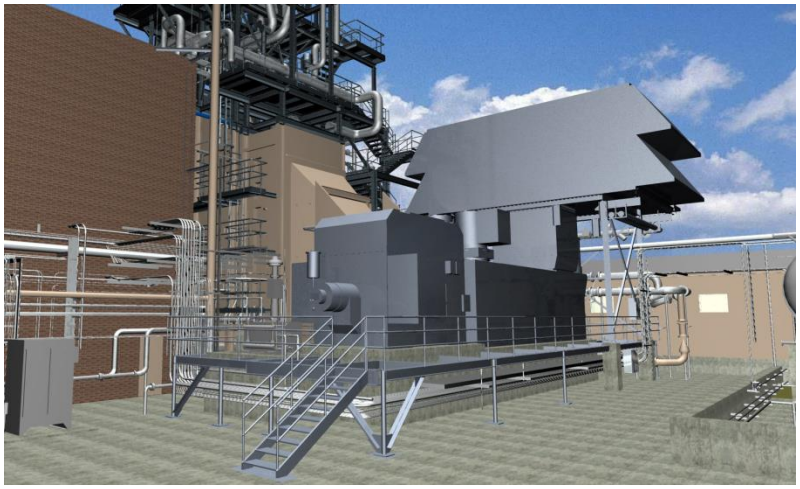
- Develop assumptions
  - How to handle unknowns?
  - Load growth projections
  - Redundancy requirements
- Primary Analysis
  - Modeling/Evaluation Baseline
  - Options Analysis
  - Develop Alternatives
  - Project Siting



FEMP Federal Energy Management Program DUKE ENERGY®

Planning Methodology – Evaluations

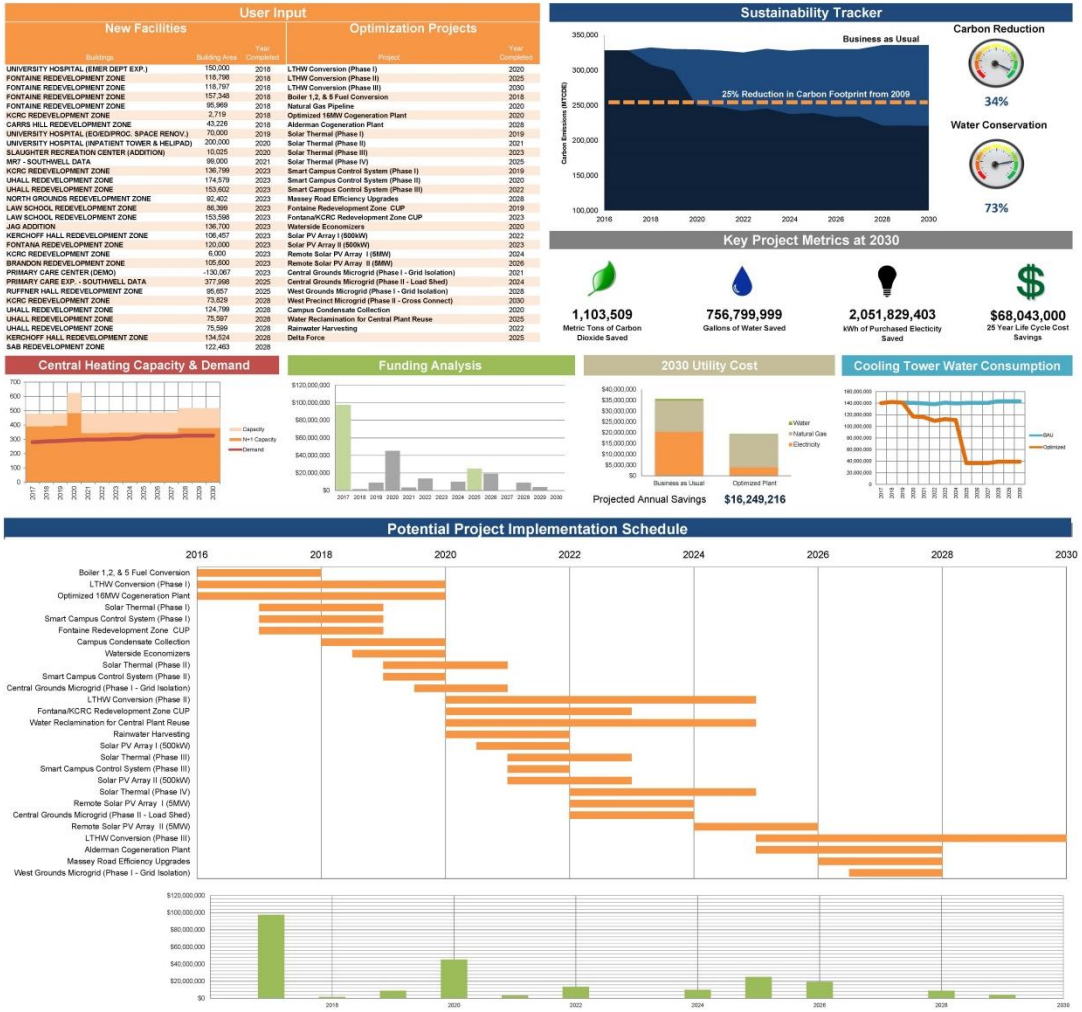
- Cost Estimates
- Economic Analysis
  - Economic factors
  - LCC with IRR
  - Integrate with GHG emissions
  - Sensitivity Analysis



FEMP Federal Energy Management Program DUKE ENERGY®

Planning Methodology – The Plan

- Finalize Recommendations
- Funding Plan
  - Discrete Project List
  - Cost Loaded Schedule
- Communication Tool
  - Consider Audience
  - Consider Living Report



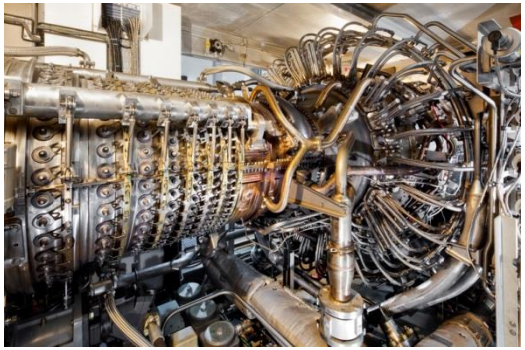
FEMP Federal Energy Management Program

DUKE ENERGY®


Case Study
The University of Texas at Austin

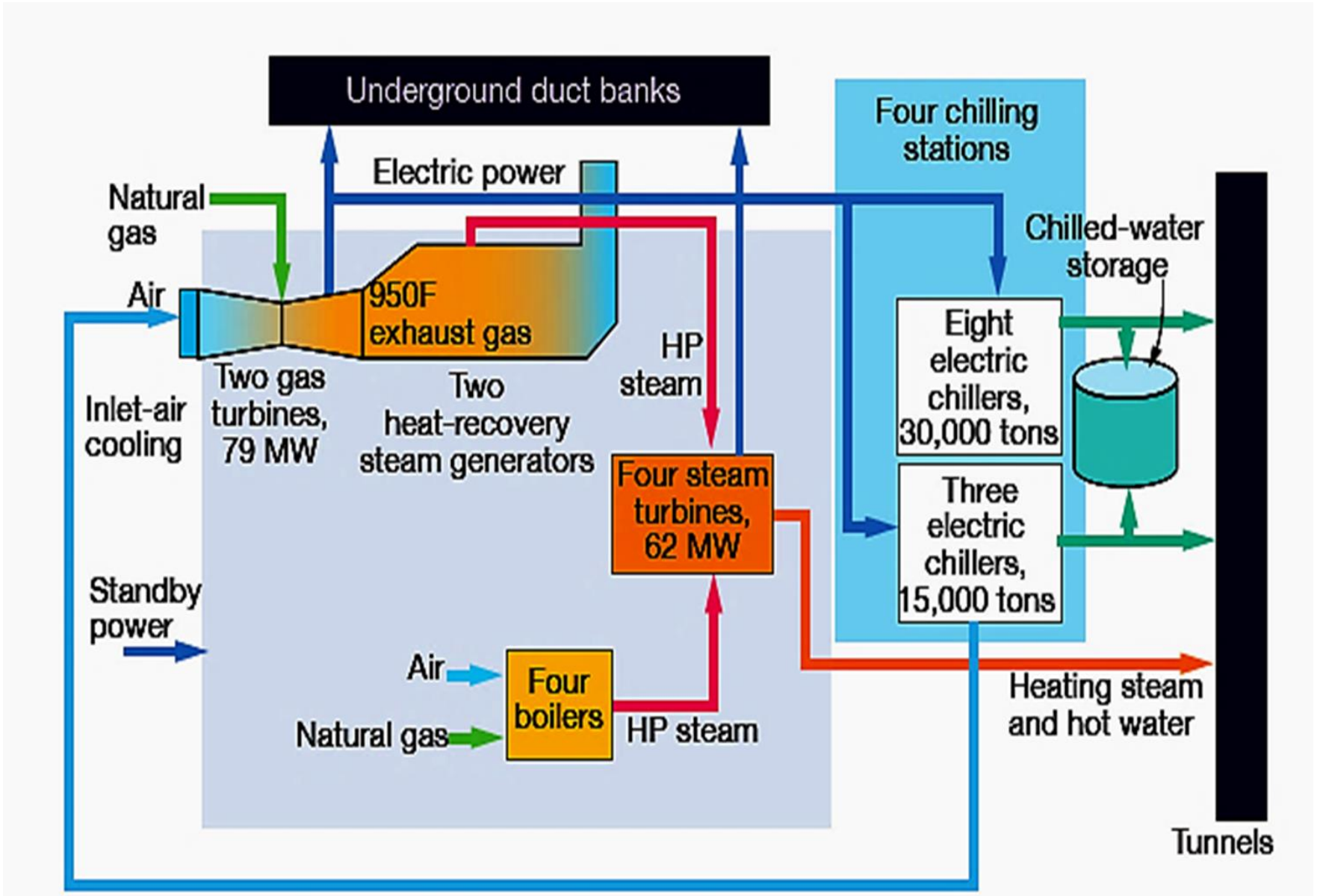
UT Austin - By the Numbers

- 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



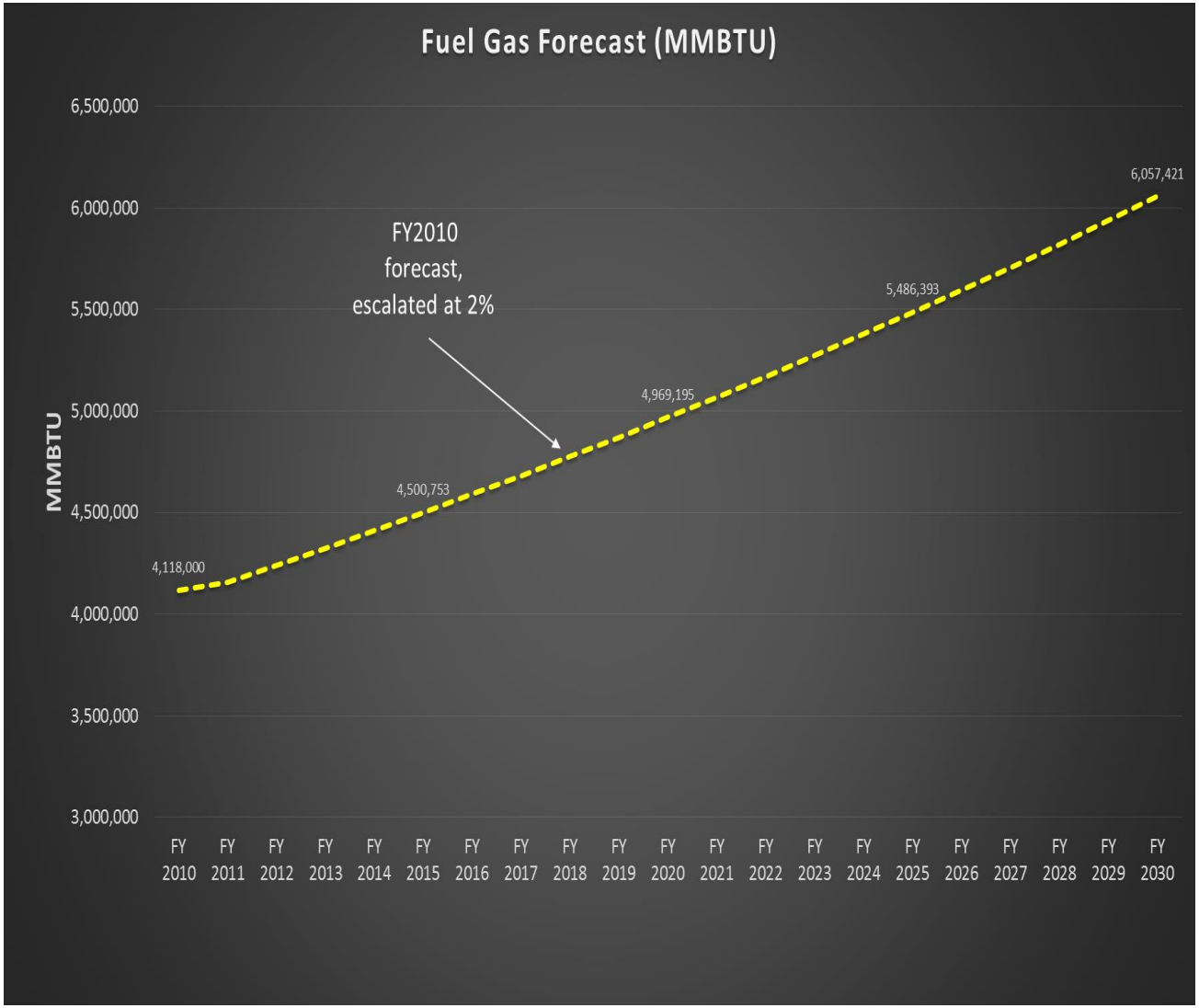
FEMP Federal Energy Management Program DUKE ENERGY®

Energy Supply to Campus



Challenge – New Master Plans

Natural Gas Projection



FEMP Federal Energy Management Program

DUKE ENERGY®

Challenge – New Medical School

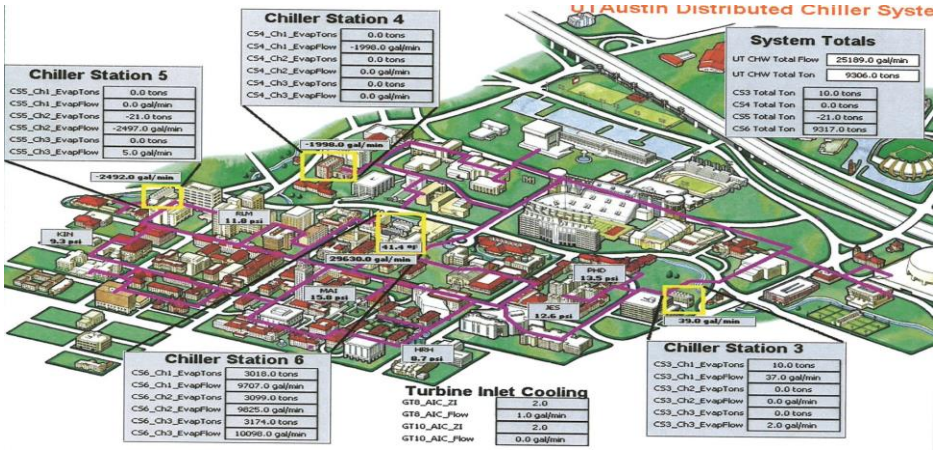
- 2M+ SF new teaching and research hospital facilities

FEMP Federal Energy Management Program

DUKE ENERGY®

Campus Energy Initiatives

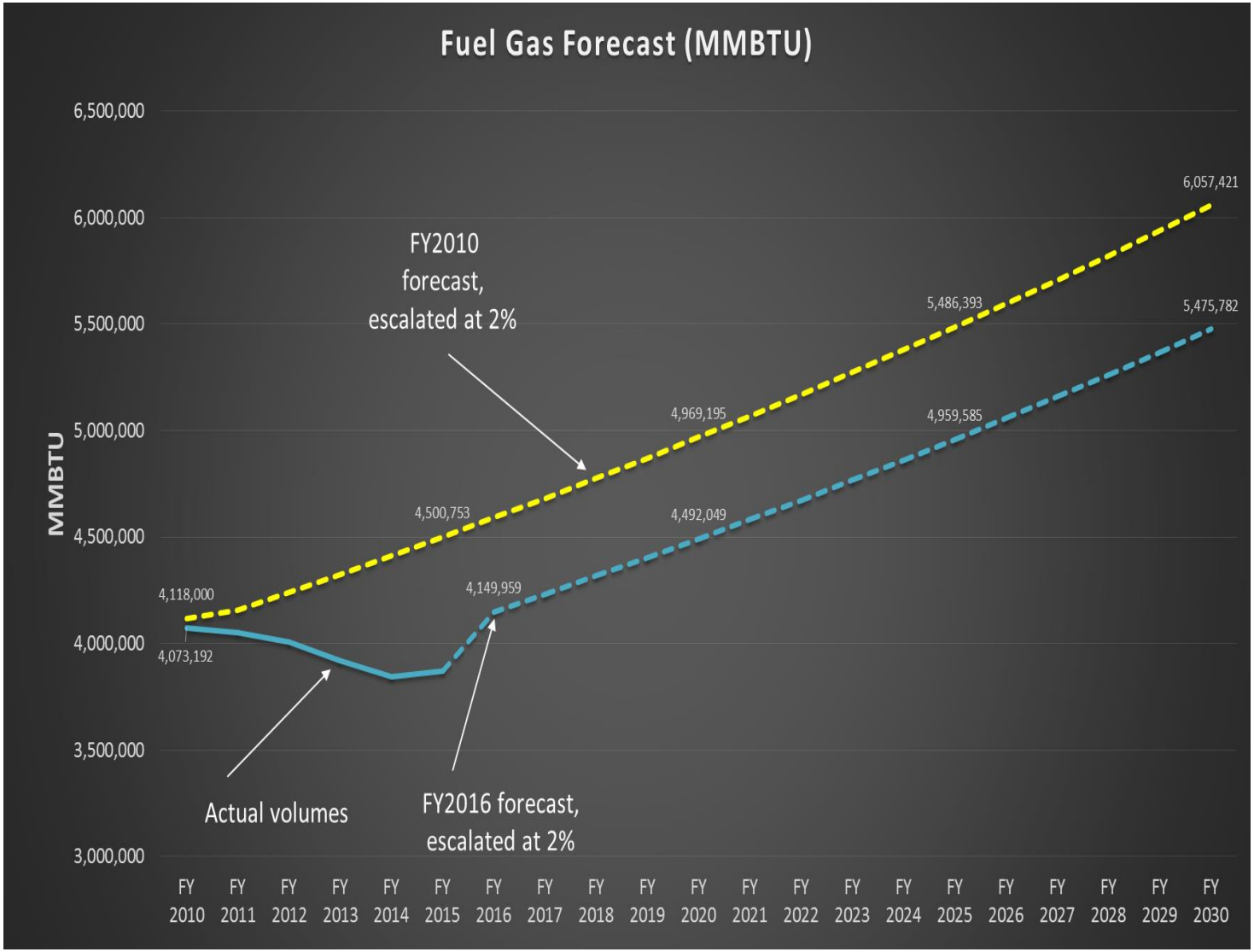
- Energy Procurement
- Demand Side Management
  - Retro-commissioning
  - Smart metering
  - Seed money and self-funding
- Plant Efficiency Upgrades
  - Chase every Btu – Optimize!
  - $150M investment
  - Address interdependencies
- Water Conservation
  - Buildings
  - Plants
  - Landscaping



FEMP Federal Energy Management Program

DUKE ENERGY®

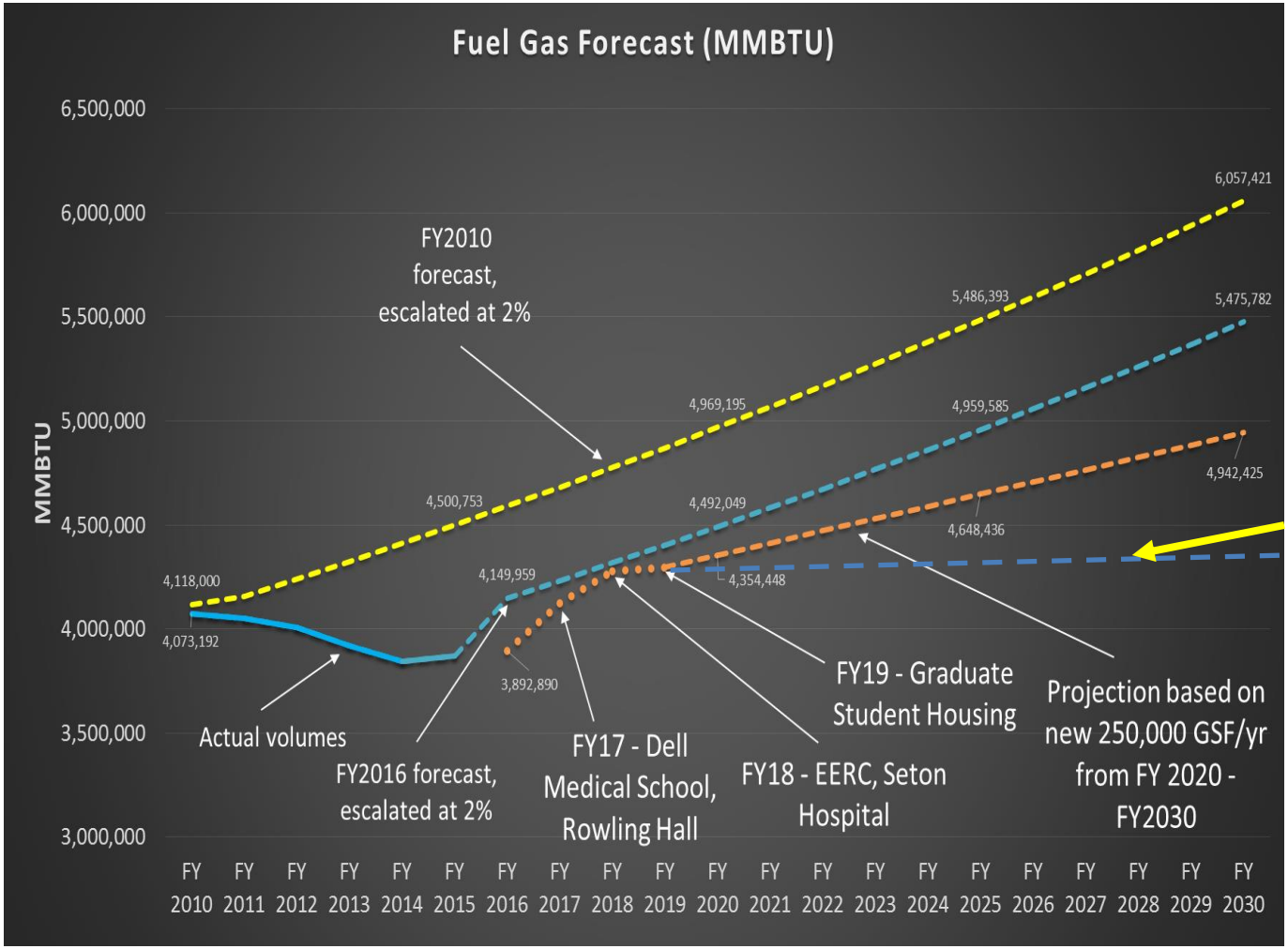
Natural Gas Projection



FEMP Federal Energy Management Program

DUKE ENERGY®

Natural Gas Projection

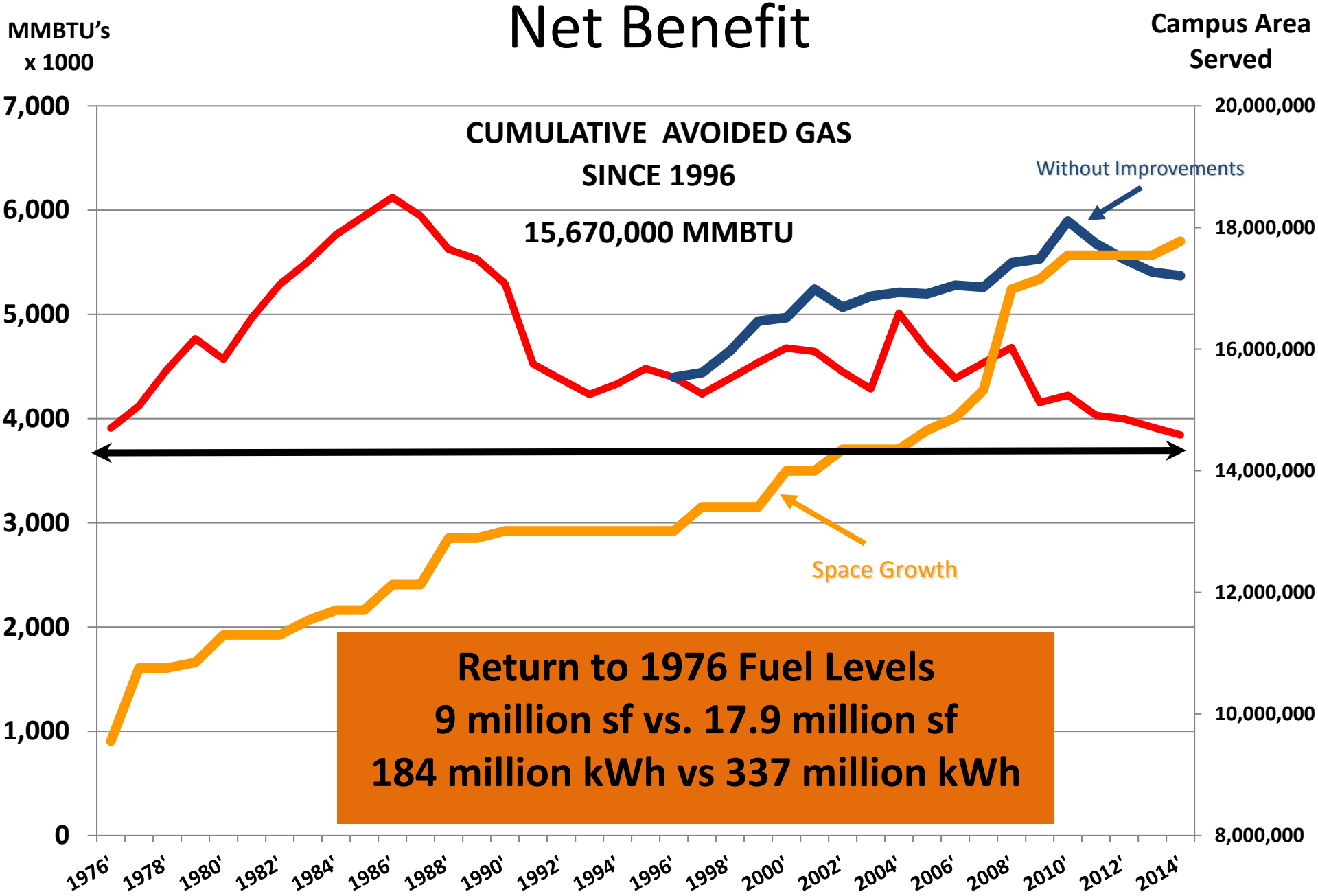


Goal - offset growth with Side Demand Conservation

FEMP Federal Energy Management Program

DUKE ENERGY®

Net Benefit


MMBTU's
x 1000
Campus Area
Served
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
20,000,000
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
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
1976'
1978'
1980'
1982'
1984'
1986'
1988'
1990'
1992'
1994'
1996'
1998'
2000'
2002'
2004'
2006'
2008'
2010'
2012'
2014'

Questions?

Contact

Kevin Fox, P.E., CEM

Principal - Energy & Power Solutions, Jacobs

kevin.fox@jacobs.com