Oklahoma State University’s New Central Plant
From Master Plan to Completion

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Introductions

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Overview

- Why a new Central Plant?
- Program Summary
- Design Review
- Commissioning
- Pre Construction Services
- Utility Distribution Construction
- Central Plant Construction
- Successes and Challenges
- Next Steps
- Q&A
Why a new plant?

- **Central Plant Replacement Necessities**
  - Wind power agreement
  - Utility production capacity
  - Power plant condition
  - Power plant location

- **Central Plant Replacement Opportunities**
  - Tie to education
  - Energy Efficiency
  - Consolidation of Energy Services
Program Summary

- **Utility Master Plan**
  - Plan for correcting existing deficiencies
  - 5-year plans for steam, chilled water, and electrical
  - 20-year plans for steam, chilled water, and electrical

- **Campus Planning Tools**
  - KY Pipe steam and chilled water models
  - SKM Power Tools electrical model
  - Utility Geographic Information System (GIS)

- **New Central Plant**
- **Electrical Distribution**
  - New substation
  - Voltage upgrade
  - Power distribution center
Program Schedule

- PRIVATIZATION STUDY
- UTILITIES MASTER PLAN
- DESIGN
- CM@RISK
- PLANT CONSTRUCTION
- LONG LEAD TIME EQUIPMENT
- SUBSTATION CONSTRUCTION
- DISTRIBUTION CONSTRUCTION
- PLANT COMMISSIONING
- VOLTAGE UPGRADE DESIGN
- VOLT. UPGRADE CONSTRUCTION
- SUBSTATION DEMOLITION
- POWER PLANT DEMOLITION

Status timeline:

- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
Central Plant Design Summary

- **Cooling**
  - 12,000 tons expandable to 16,000 tons
  - 3900 HP of pumps with VFDs
  - 750 HP of cooling tower fans with VFDs

- **Heating**
  - 220,000 lbs/hr expandable to 280,000 lbs/hr
  - Heating water loop to serve buildings near plant
  - Stack gas economizers

- **Education**
  - 80 seat classroom
  - Public observation room
Electrical Distribution

NEW OG&E UNIVERSITY SUBSTATION
- 2 X 20MVA TRANSFORMERS
- 1 X 20 MVA FUTURE

ELECTRICAL DISTRIBUTION UPGRADES
- 8027 LF DUCTBANK
- 21 VAULTS

NEW CENTRAL PLANT
Steam and Chilled Water Distribution

- Over 12,000 total LF of steam, condensate return, and chilled water
- Design considerations
  - Direct buried vs. walkable tunnel
  - Open cut vs. trenchless installation
- Pre-insulated Class A piping system
- Separate steam mains leaving plant
- Variety of complex construction methods required
Steam and Chilled Water Distribution

Four vaults for steam traps, valves, and expansion joints

- Replace/interface with existing tunnel
- Robust design
- Access, safety, and maintainability is critical
Pre-Functional Checklists

- PFCs for major mechanical and electrical equipment reviewed prior to startup
- Incomplete tasks were identified and corrected prior to scheduling startup activities

Functional Tests

- Spurred great conversations on the controls sequences and resolved some issues early
Regular site visits

- Adequate budget to perform regular site visits
- Visits coupled with weekly Cx and startup meetings helped keep the team on track, coordinated, and gave visibility to project issues.

Involvement from the plant operations staff

- Plant ops spent a good deal of time onsite
- Witnessed portions of the functional testing
- Provide early look at plant operations
- Time for questions and input in the process
- Budgets for each phase
- Bid Package breakdown for best value
- Allowances
- Fast track – get started building while design finishes

### Pre-Construction Services

| Description                      | Total Project | Base Bid | NOC Utility | Extension | Bid Package 4 | &6B | Bid Package #6C | Bid Package #5 | Bid Package #6A | and Basement Backfill | Bid Package #3 | Bid Package #2 | Division 2 - Existing Conditions | Division 3 - Concrete | Division 4 - Masonry | Division 5 - Metals | Division 6 - Wood & Plastics | Division 7 - Thermal & Moisture Protection | Division 8 - Doors & Windows | Division 9 - Finishes | Division 10 - Specialties | Division 11 - Equipment | Division 12 - Furnishings | Division 13 - Special Construction | Division 14 - Elevators | Division 21 - Fire Suppression | Division 22 & 23 - Mechanical | Division 26 - Electrical | Division 27 - Communications | Division 28 - Electronic Safety & Security | Division 31 - Earthwork | Division 32 - Exterior Improvements | Division 33 - Utilities | Division 41 - Material Handling Equipment |
|----------------------------------|---------------|----------|-------------|-----------|---------------|-----|----------------|----------------|----------------|---------------------|----------------|----------------|------------------------------------------|-------------------|-----------------|----------------|----------------|----------------|-----------------------------------|-------------------|----------------|----------------|----------------|----------------|-------------------------------|-------------------|----------------|----------------|----------------|
|                                  | $56,033,538   | $1,108,557| $9,155,863  | $340,063  | $5,135,746    | $5,755,779 | $24,553,720   | $6,123,740     |                |                     |                |                | Division 2 - Existing Conditions: 220,000 | Division 3 - Concrete: 6,843,604 | Division 4 - Masonry: 1,537,000 | Division 5 - Metals: 2,841,500 | Division 6 - Wood & Plastics: 249,346 | Division 7 - Thermal & Moisture Protection: 1,073,570 | Division 8 - Doors & Windows: 549,294 | Division 9 - Finishes: 1,672,067 | Division 10 - Specialties: 116,127 | Division 11 - Equipment: 15,000 | Division 12 - Furnishings: 40,000 | Division 13 - Special Construction: 0 | Division 14 - Elevators: 256,875 | Division 21 - Fire Suppression: 345,500 | Division 22 & 23 - Mechanical: 14,118,091 | Division 26 - Electrical: 7,918,626 | Division 27 - Communications: 49,857 | Division 28 - Electronic Safety & Security: 107,413 | Division 31 - Earthwork: 8,005,400 | Division 32 - Exterior Improvements: 120,000 | Division 33 - Utilities: 4,923,510  |
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**Contractor’s Contingency**: 1,057,894

**Owner’s/Architect’s Contingency**: 899,187

**Performance & Payment Bond**: 508,460

**Subcontractor Default Insurance**: 798,565

**Builders Risk**: 166,966

**General Liability**: 205,496

**Direct Construction Cost**: $56,033,538

**Professional Services**: General Conditions 3,998,154

**Lithco GC Reduction Fee**: (178,908)

**Professional Services Total**: $8,021,465

**MEP Allowance**: 1,000,000

**BP #5 Allowance**: 100,000

**Project Subtotal**: $65,155,003
- Over 12,000 total LF of steam, condensate return, and chilled water
- Two Construction Phases
  - 6a
  - 6b
- Non-Closable Roads
- Campus Schedule Critical Completion Dates
- Washington Street Stadium Access
- Hall of Fame
Utility Distribution BP#6a

- Campus Schedule Critical
  - Football Gameday
- Innovative Construction Methods
Existing Utilities in Close Proximity

- ATT duct bank
- Campus Chilled Water
You Can’t Close Hall of Fame!

- Considerations
  - Direct buried vs. walkable tunnel
  - Open cut vs. trenchless installation
  - There is a TREE there
Electrical Distribution – BP#5

- Understanding Existing Utilities
  - Hydro-Excavation

- Communication
  - Campus updates
  - Direct Communication with Major Stakeholders

- Western and Hall of Fame Intersection
  - 48” RCP
  - Coordination with Paving Contractor
OSU Central Plant– BP#1

- Excavation
  - 75,500 cu yds
- Shoring
- Dewatering
OSU Central Plant – BP#2

- Concrete
- Structural Steel
  - 40 Ton Bridge Crane
OSU Central Plant – BP#3 & 4

- Cooling Tower Structure
- MEP
- Architectural
- Underground Utilities
OSU Central Plant – BP#3 & 4

Architectural
Successes

- Aggressive timeline
  - Master plan start to plant completion in less than 5 years
- Tie to educational mission of University
- Involvement of plant operators in design, construction, and Cx
- Team approach of University, CMAR, A&Es, and CxA
- BIM coordination
- 50-year vision
- Integration into campus Architecture
Challenges

- Timing of OFCI equipment purchases
- Closing non-closable streets
- Transition of steam service from existing plant to new plant
- What to do with 70,000 gallons of fuel oil
Next Steps

- Completion of Heating Water Loop Phase I
- Completion of Voltage Upgrade and Power Distribution Center
- Steam & Chilled Water Distribution Upgrades
- SCADA System

Low Voltage Upgrades:

- Phase 1
- Phase 2
Q&A Period