

# **The Path to a Sustainable Future Meets Reality**

**Penn States Conversion from Coal to Natural Gas**

February 2017

Presenters:

Paul Moser, PE – Penn State University

David Goetz, PE – Burns & McDonnell



**PennState**

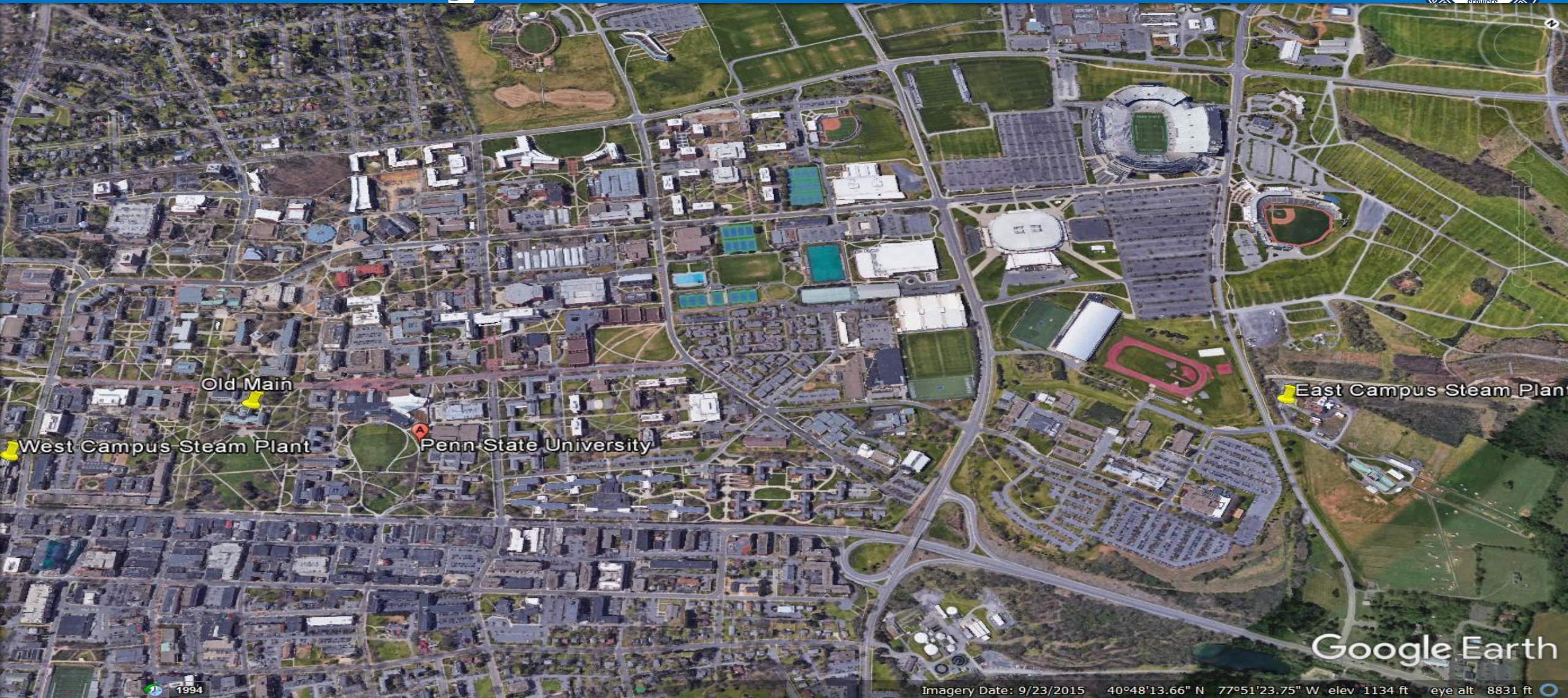
**BURNS**  **MCDONNELL**

# Where we started





# University Park



Imagery Date: 9/23/2015 40°48'13.66" N 77°51'23.75" W elev 1134 ft eye alt 8831 ft





# University Park Numbers

Campus

CHP System



West Campus Steam Plant

Old Main

Image Landsat / Copernicus  
Image NOAA

Google Earth

1994

Imagery Date: 9/23/2015 40°47'44.50" N 77°51'51.18" W elev 1162 ft eye alt 2065 ft



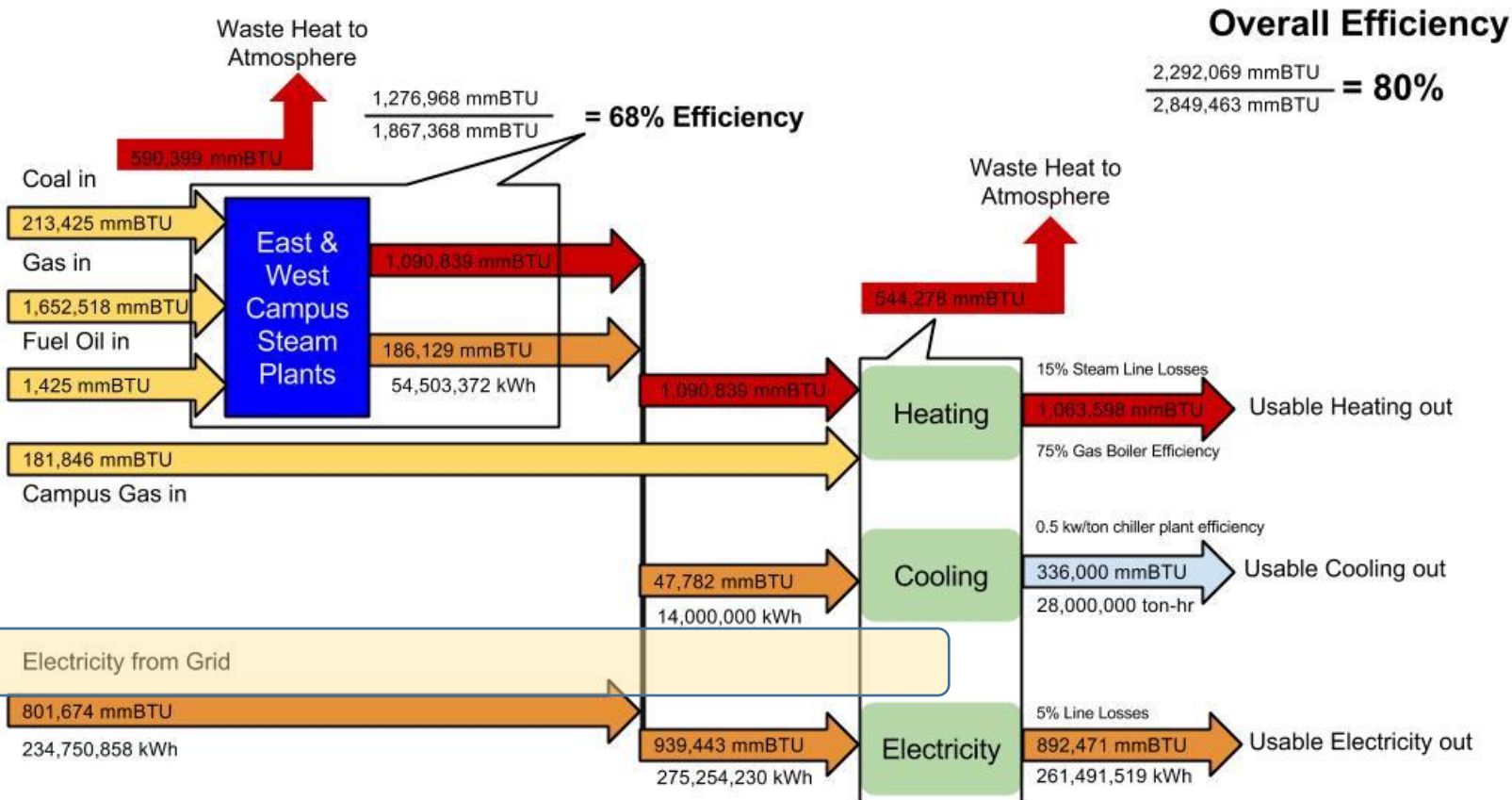
# More Numbers



## Plant Locations

- WCSP - Corner
- ECSP - Porter

## Penn State University Park Energy Flow Diagram FY 15/16



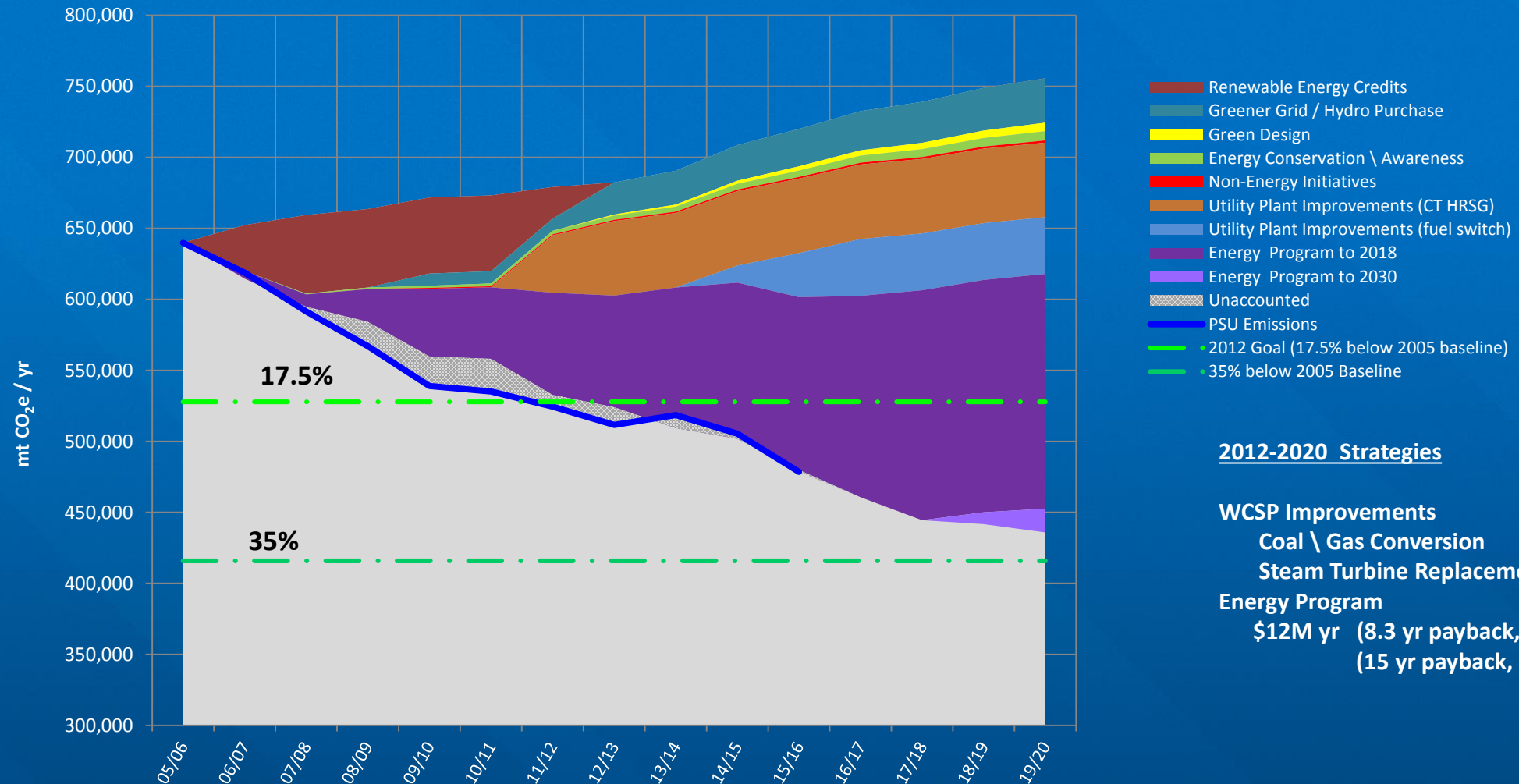


# Carbon Reductions



## GHG Emissions Reduction Strategies

Penn State University



### 2012-2020 Strategies

#### WCSP Improvements

Coal \ Gas Conversion

Steam Turbine Replacements

#### Energy Program

\$12M yr (8.3 yr payback, yrs 1-3)

(15 yr payback, yrs 4-6)

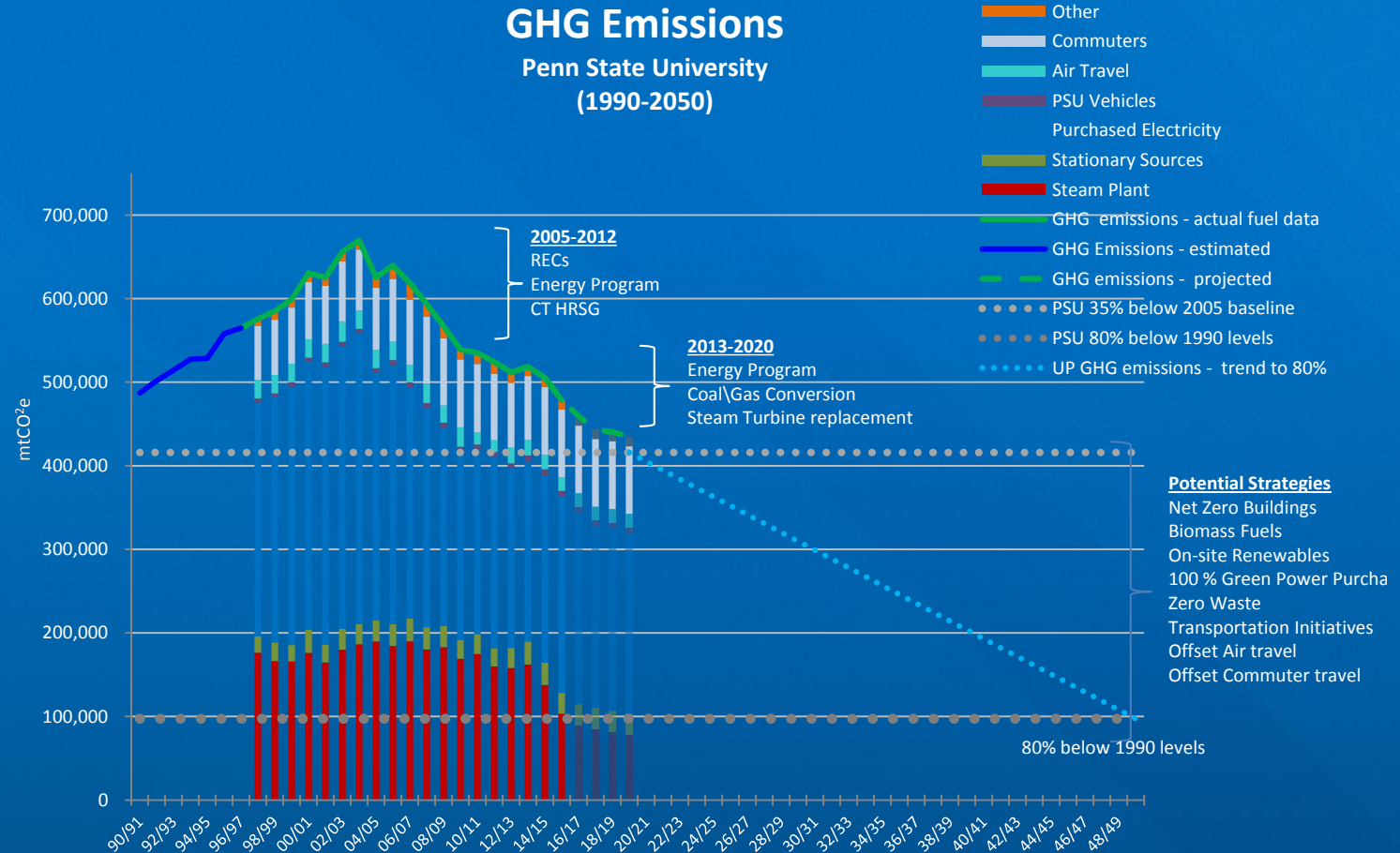




# Path to a Sustainable Future



- Plant Conversions to Natural Gas
- The reasons for Fuel Conversion
  - Climate Commitment
  - Build a plant for the next 50 years
  - Boiler MACT
- The affects of Fuel Conversion
  - Natural Gas Supply
  - Major changes while plant is operating
- Stakeholder Involvement

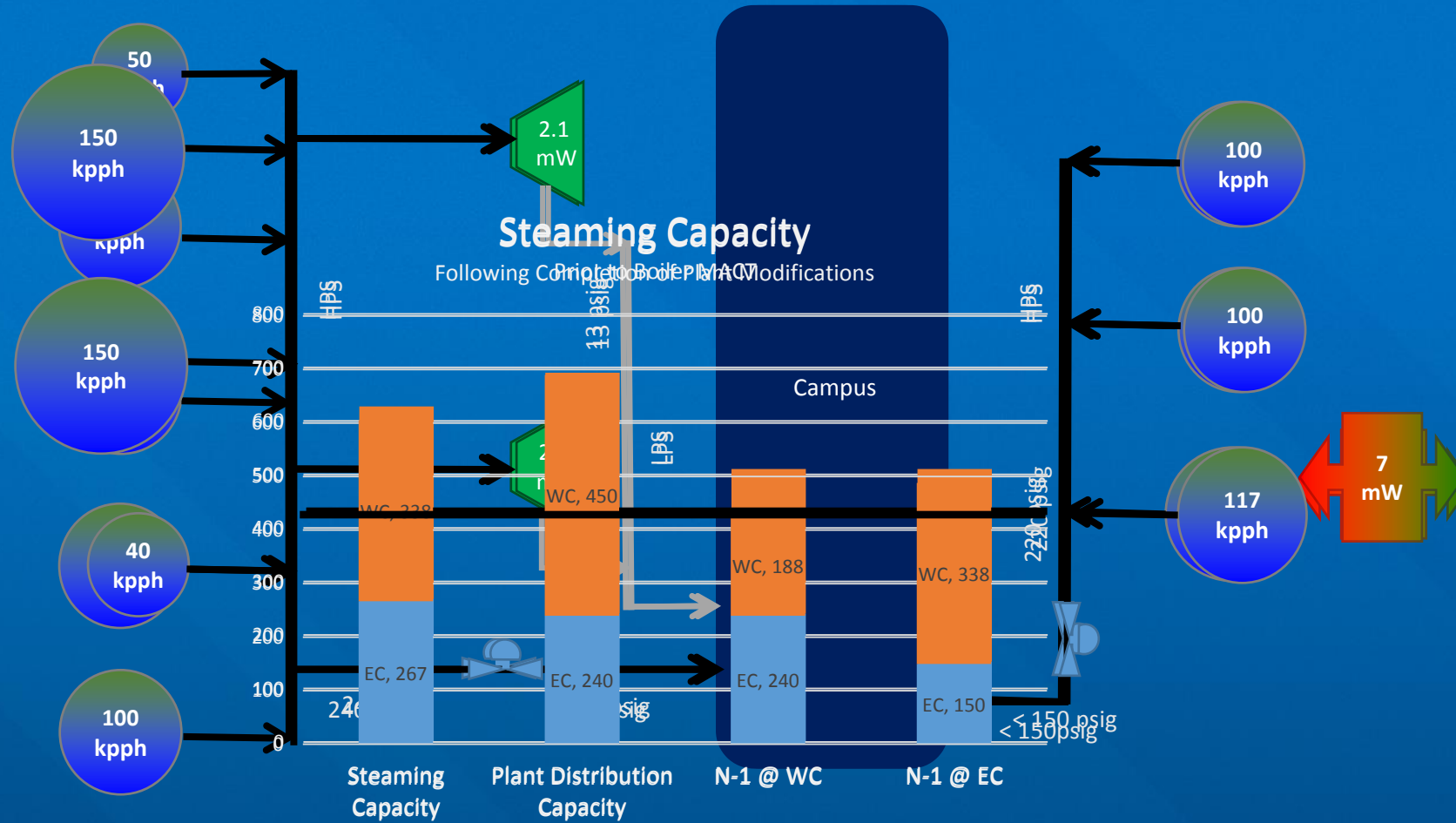


Penn State GHG Emissions include stationary sources, purchased electricity, OPP & Fleet vehicles and estimated commuter miles, air travel, waste, refrigerants and animal husbandry.



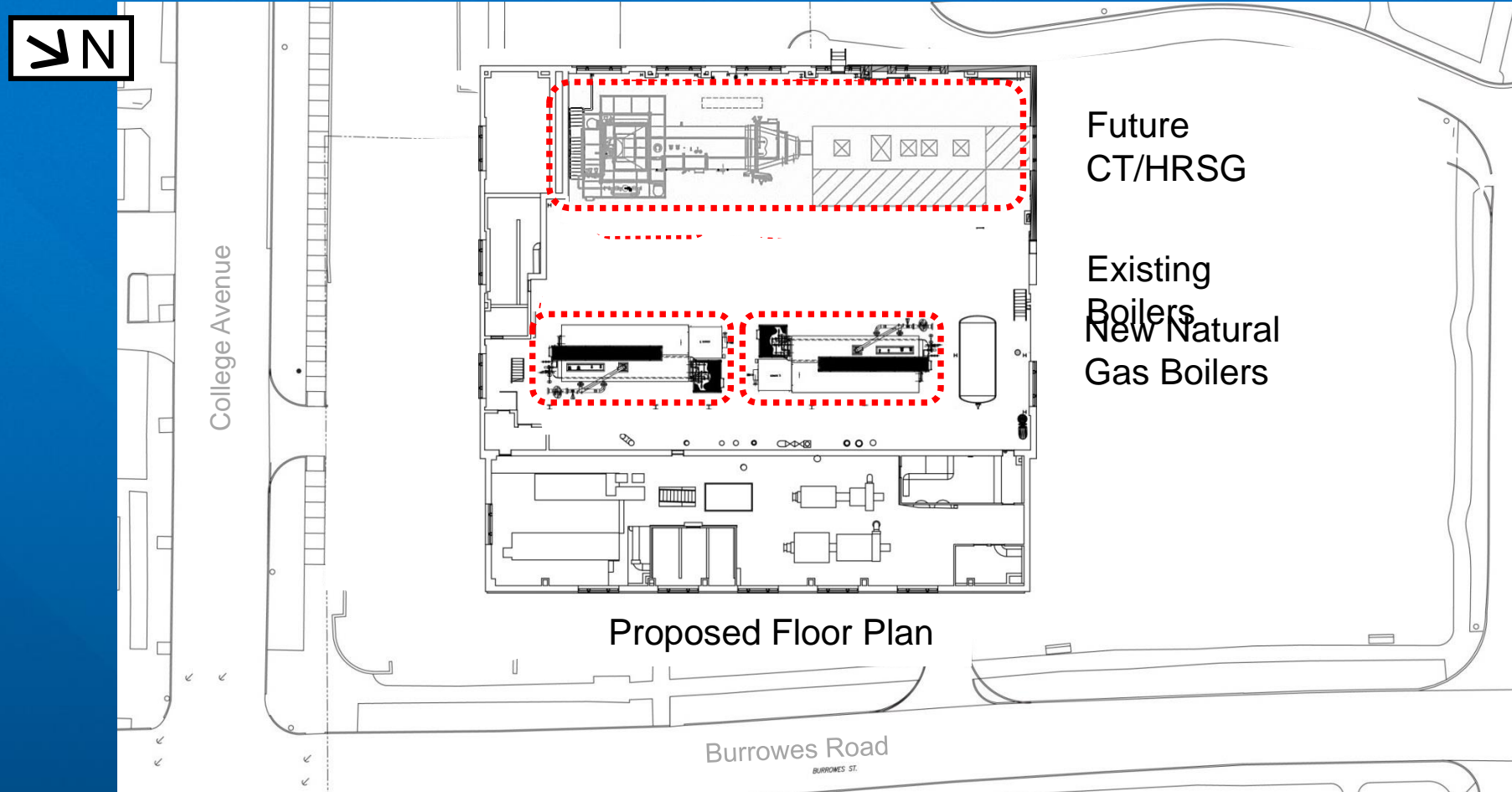


# CHP – Penn State





# West Campus Steam Plant – First Floor Plan

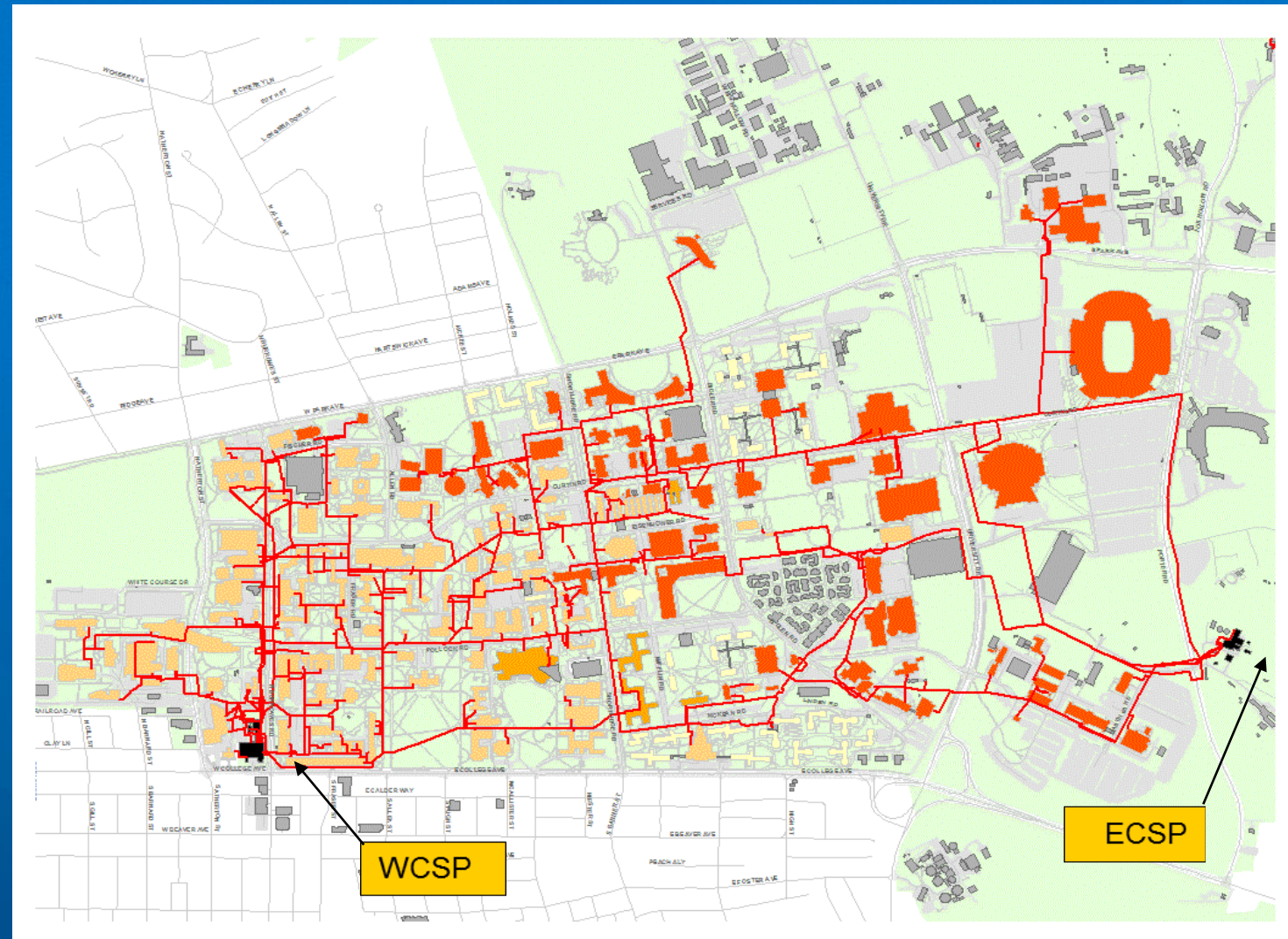




# Changing Landscape

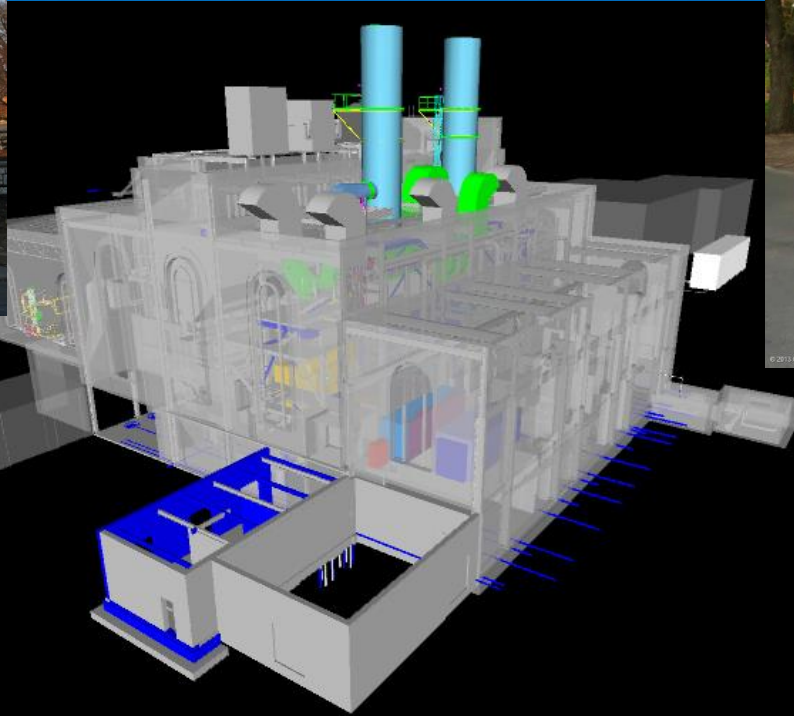


- Boiler MACT
  - Options for refurbishing, converting, and replacing existing equipment
- University Drivers
  - Sustainability
  - Efficiency
  - Reliability
  - Meeting Campus Growth





# Where we're headed





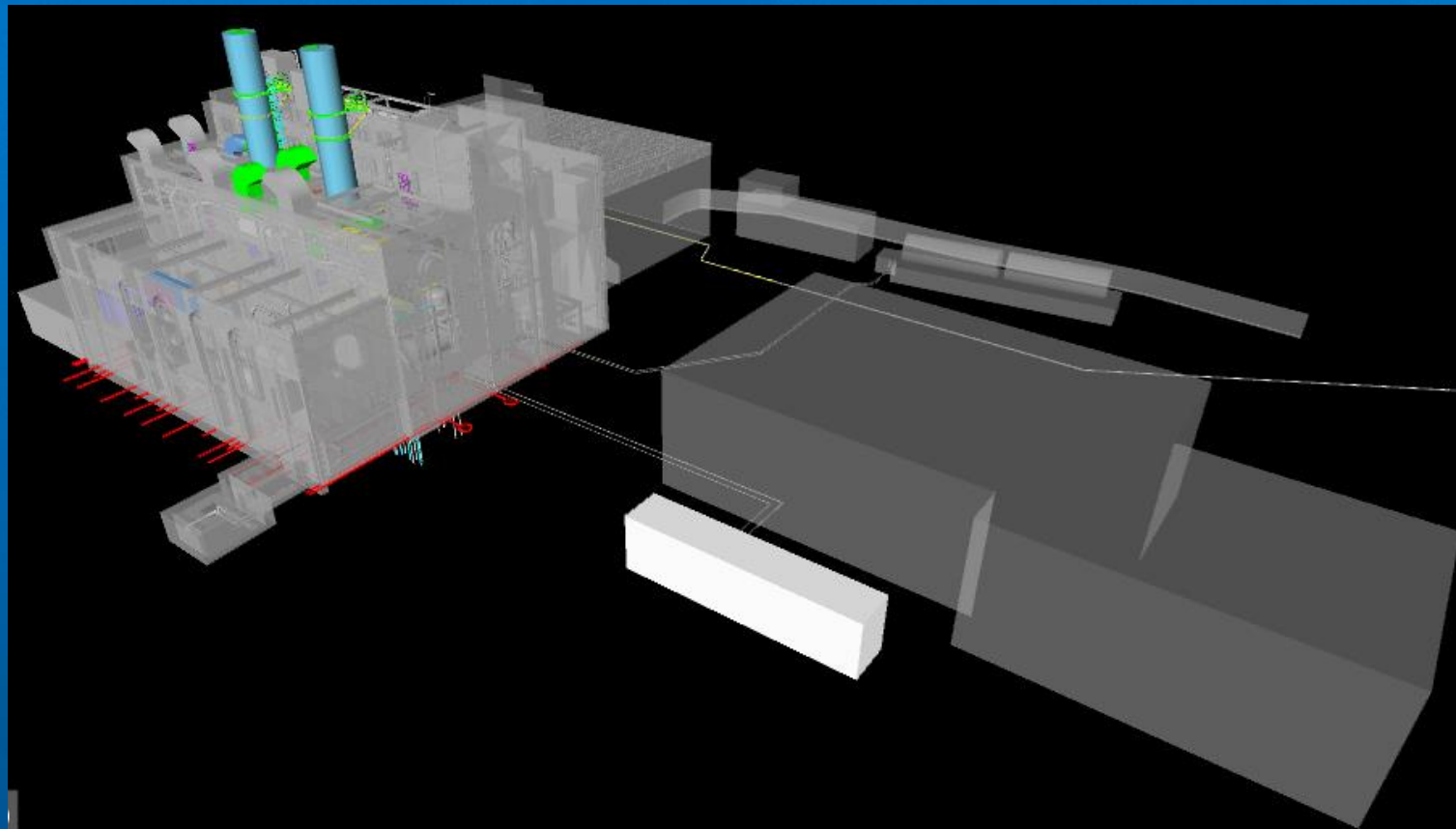
# Where we're headed





# Putting Plans to Paper

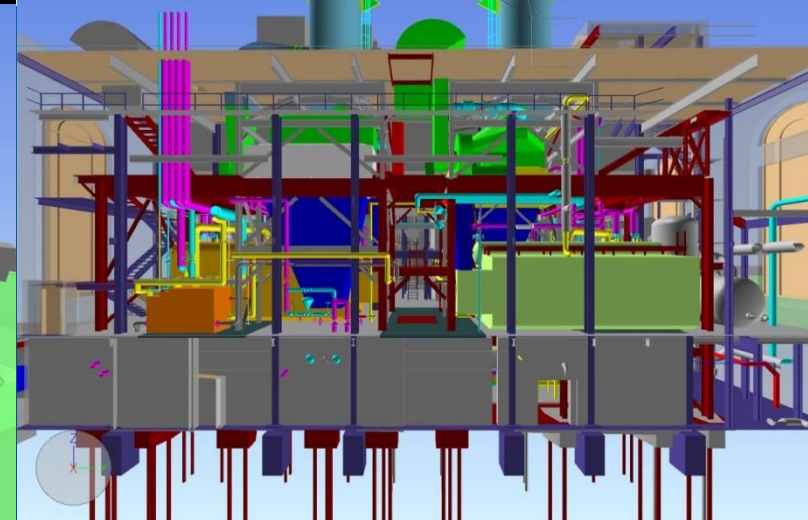
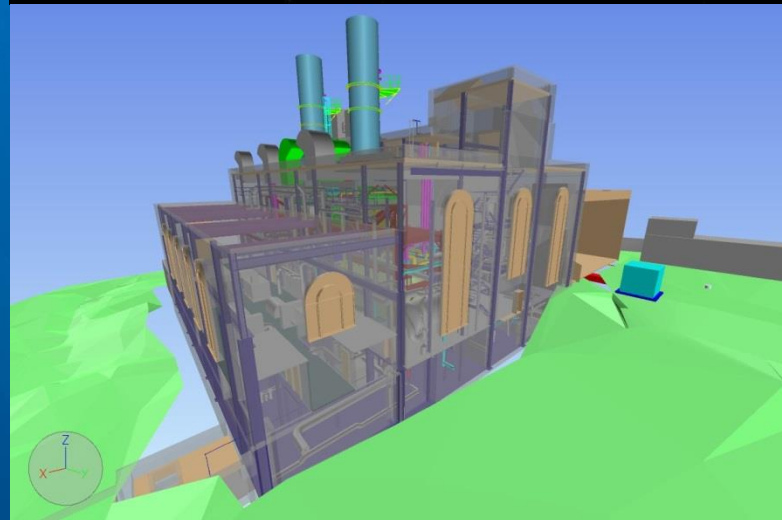
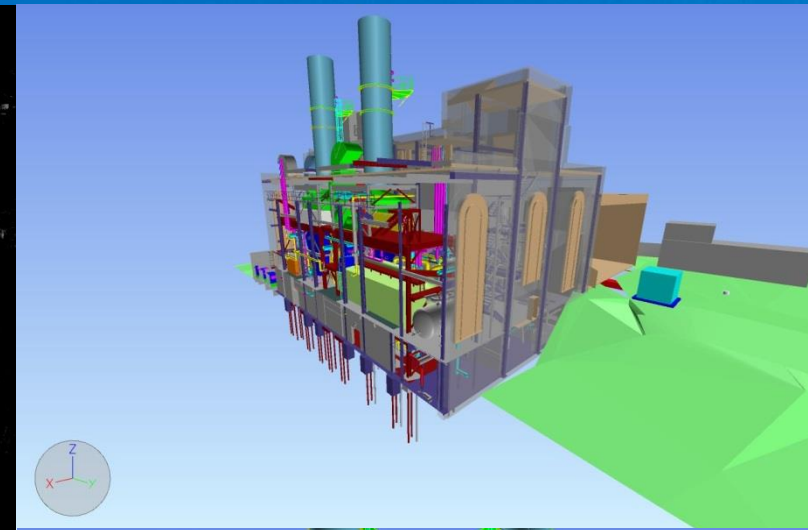
- Planning and Focused Studies
- Laser Scan / 3D Model
- Supplementing Existing Documentation
- Equipment Procurement
- Bringing on the CM
- Construction Documents
- Multiple Packages/Multiple Funding Sources
  - (IFB, IFC, Cx)





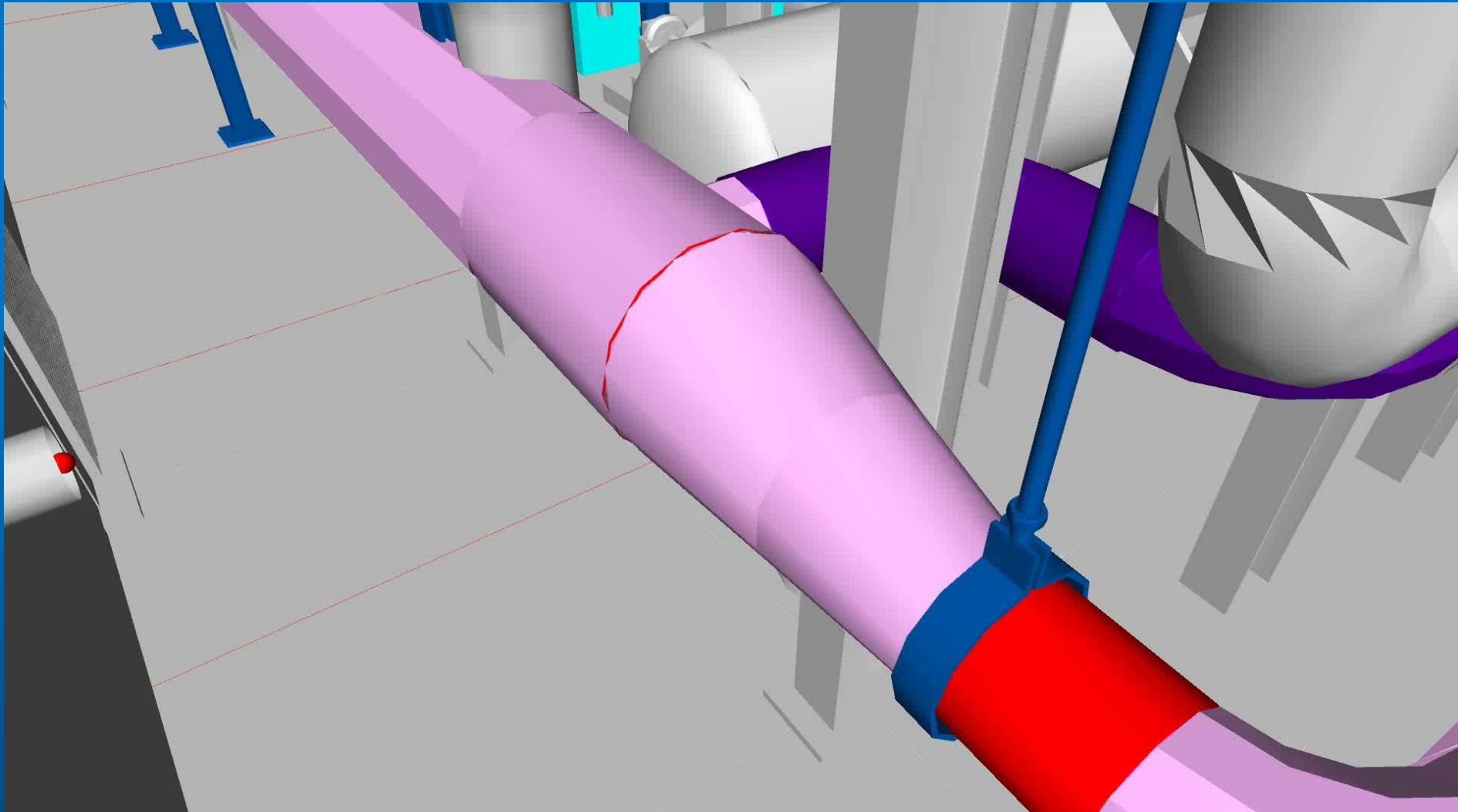
# Drivers for Equipment Selection

- Convert or Replace
- Equipment Sizing
- Existing Building
- Reliability
- Efficiency
- Cost





# Construction Highlights





# Plans meet Reality

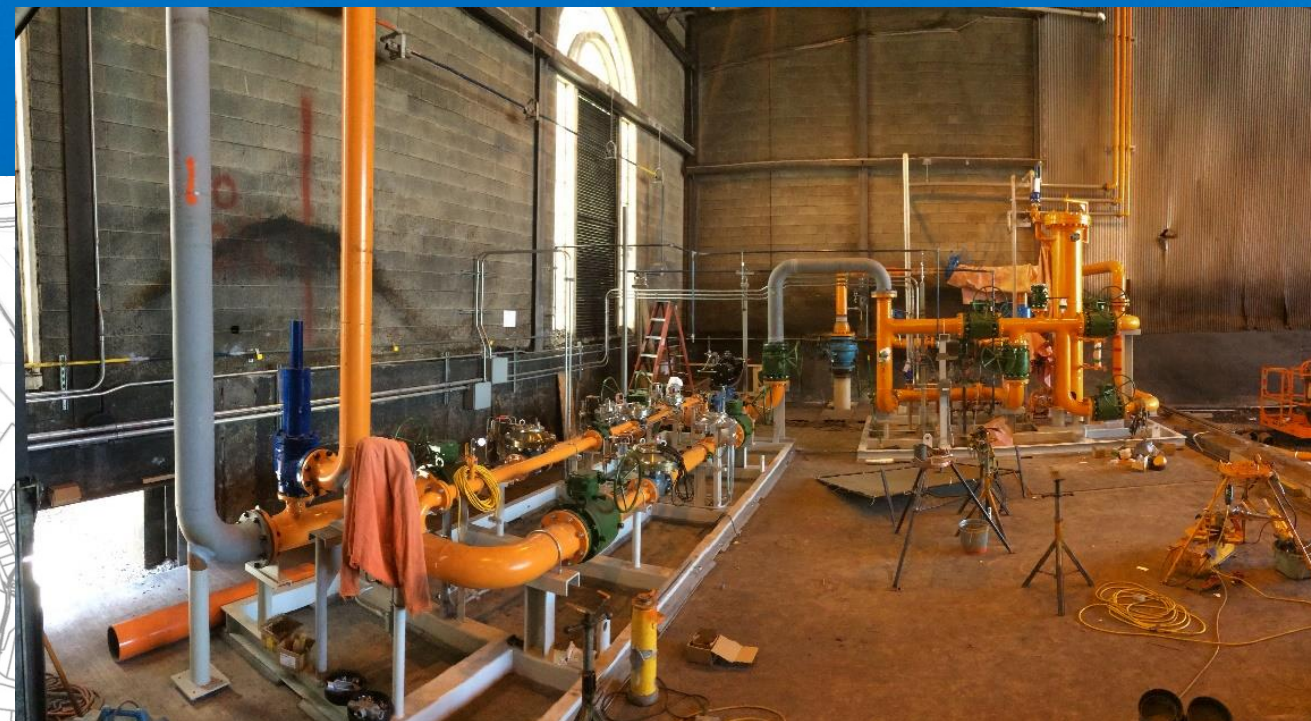
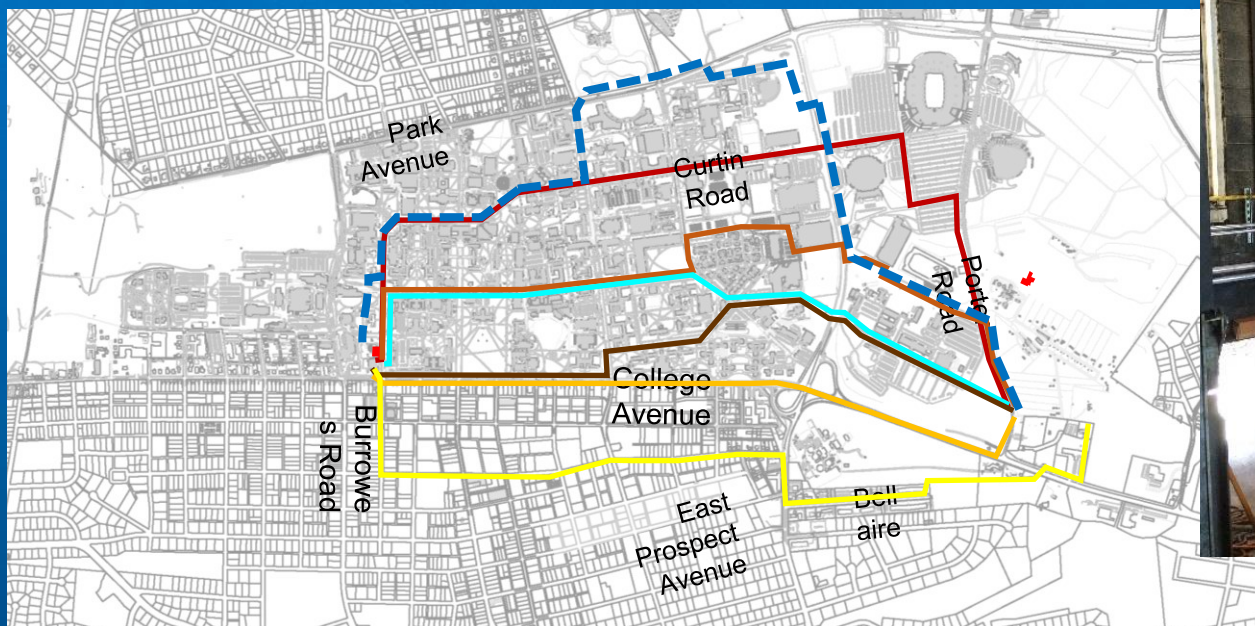
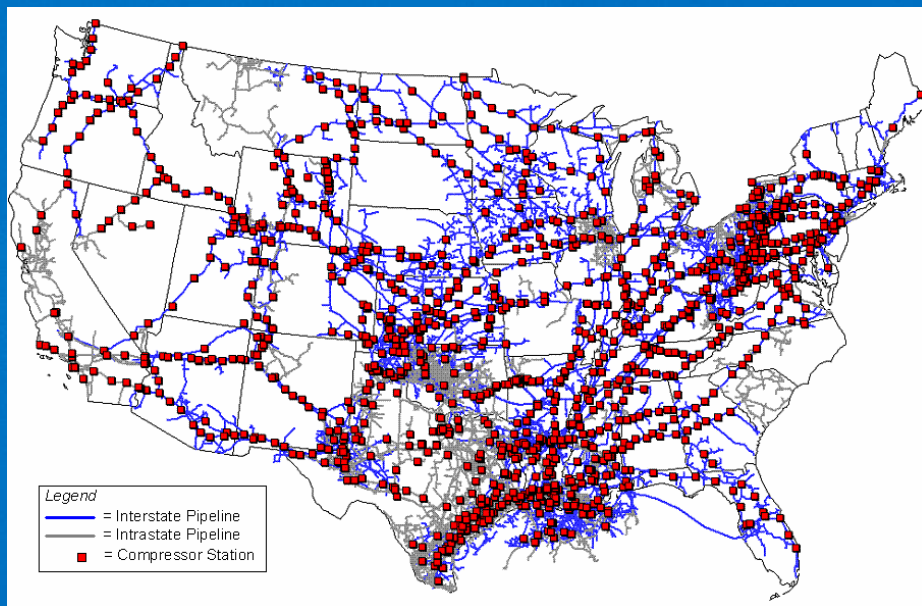
- Boilers
  - InDeck 2 x 150 kpph
  - Zeeco Burners
- Turbines
  - Siemens SST-060
    - 2.1 mW
    - 2.8 mW
- 2MW Diesel Generator, CAT
- Natural Gas Service
- 2 Above Gnd 25K Gallon ULSD Storage Tanks
- Water Softeners. Marlow
- Condensate Polishers. Marlow
- New Plant Electrical
- Plant Security System
- New Chilled Water Supply
- New LEED Steam Services Building





# Fuel Supply

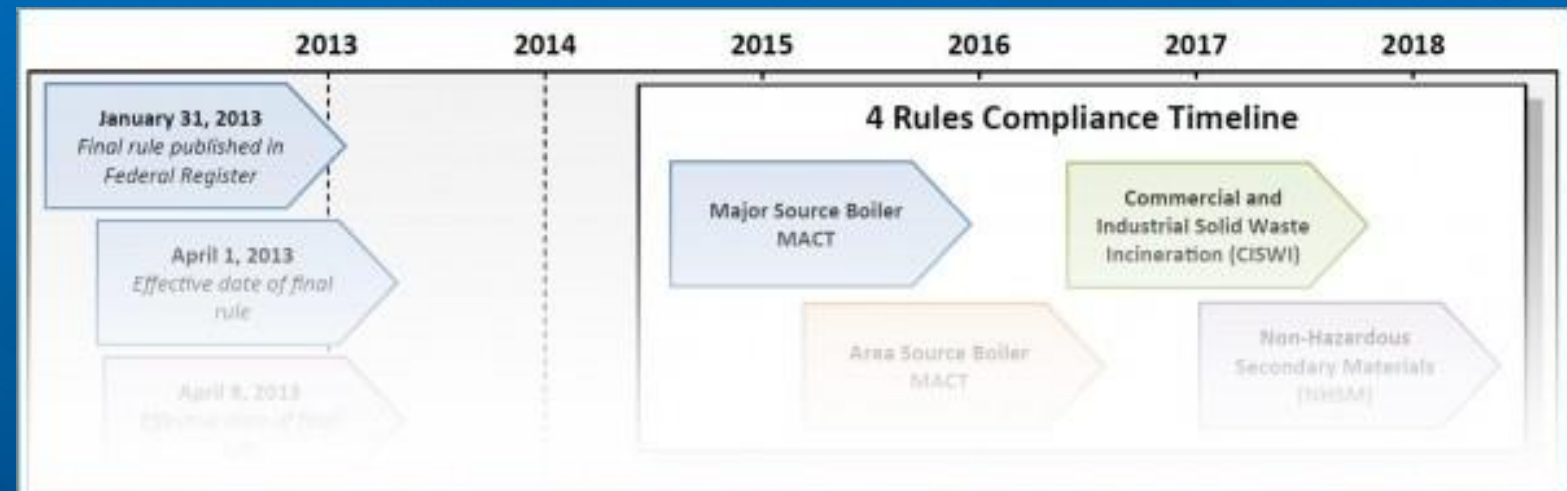
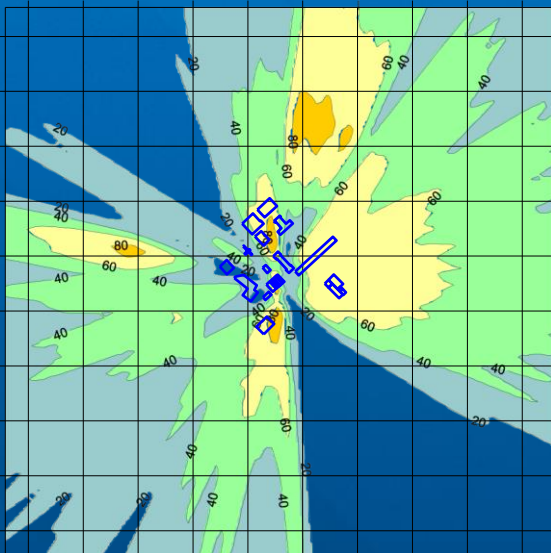
- Natural Gas Contract
- Natural Gas Line Route





# Environmental Permitting

- PADEP and PSU Dynamics
- Outside Influences
- Plant Stack(s)
- 18 Months for Air Permit



# Town and Gown Relationship

Issues Were

- No Pipeline In My Street
- No Fossil Fuels
- Plant Location

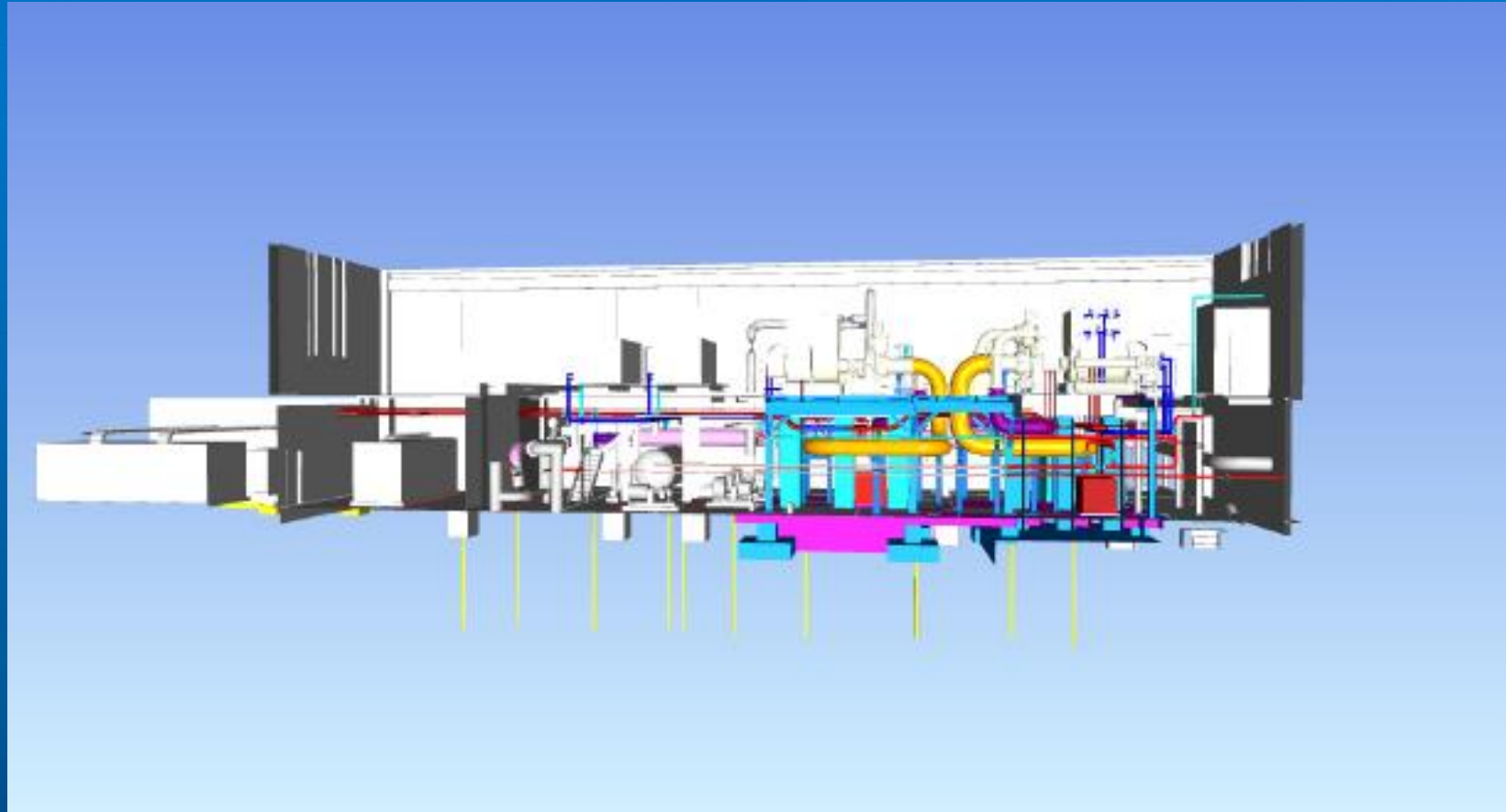




# Phased Implementation in an Operating Plant



- Meeting Campus Steam Needs – N-1 Commitment
- Projects at both Plants
  - Natural Gas Line
  - ECSP Boiler Retubes
  - ECSP Dist. Upgrade
  - WCSP Improvements
  - WC Steam/CHW Dist.
- Historic Facility



# The Right Team at the Right Time



- Engineering
- Boiler Maker / CM
- Plant Staff



PSU - West Campus Steam Plant

Boiler #1 - Upper Drum Install





# Construction Highlights





# Construction Highlights



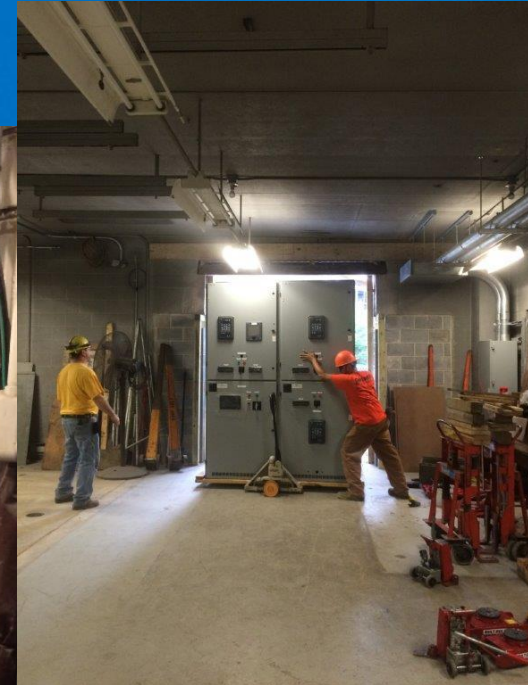


# Construction Highlights





# Construction Highlights





# Construction Highlights





# Hitting our Milestones



## Schedule

- Construction Begins 2014
- Plant On-line Throughout 3+ Year Phased Demolition and Construction
- Complete Electrical System Replacement Back On-line October 2015
- Boiler 2 Startup December 2015
- Boiler 1 Startup December 2016 for MACT Compliance
- Steam Turbines On-line February 2017
- Steam Services Building Complete December 2018

## Cost

- Gas Line - \$15M
- WCSP Improvements - \$36M
- Steam Turbine Replacement - \$9.5M







**PennState**

**BURNS  MCDONNELL<sup>SM</sup>**