



Converted turbine, new boilers and stacks: reliable, responsible, ready for growth

MIKE LARSON

University of Illinois at Urbana-Champaign
Director of Utilities Production

MIKE BREWER

Mechanical Engineer
Abbott Power Plant

MARCH 7, 2018



I

Illinois

at a Glance

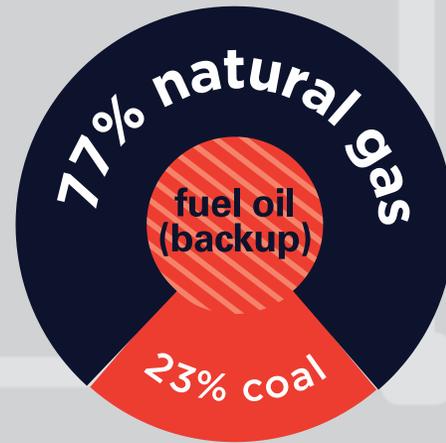
- **A leading research university**
- **One of original Big Ten schools**
- **Sits on 6,370 acres**
- **44,000+** undergrads and grad students
- **11,000+** faculty and staff



Abbott at a Glance

- **Primary** heat and electricity provider
- Constructed **1940**
- Has **always** used CHP
- Serves **19.4 million** sq ft of space, 260 buildings
- **84 MW** electric generation capacity
- **1,235,000 lb/hr** steam production capacity

Abbott and the Environment



For reliability & cost-effectiveness

Progressive: first JBR in North America

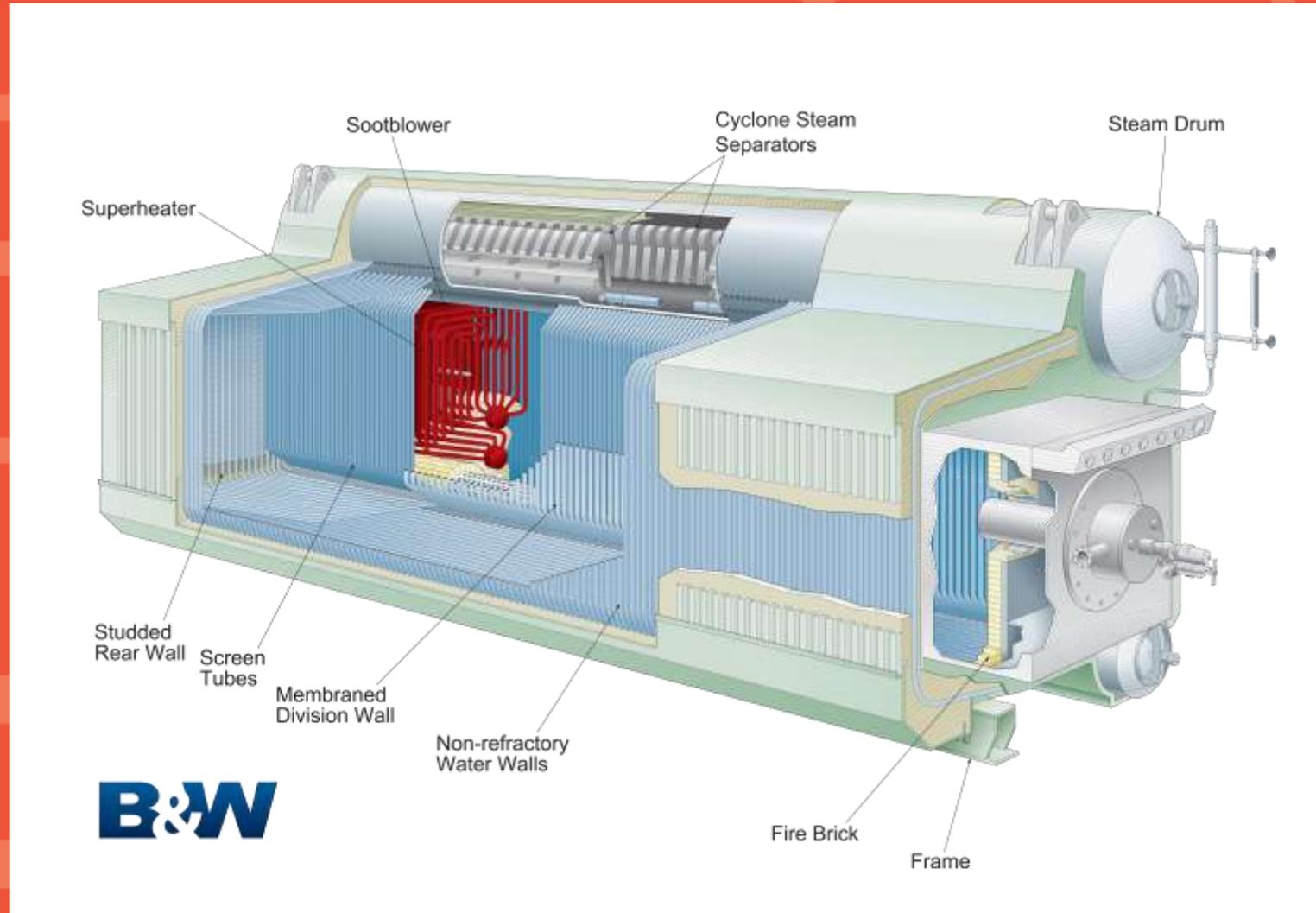
Beats proposed EPA emission limits for CO₂ NO_x Hg

New boilers and stacks

Project criteria

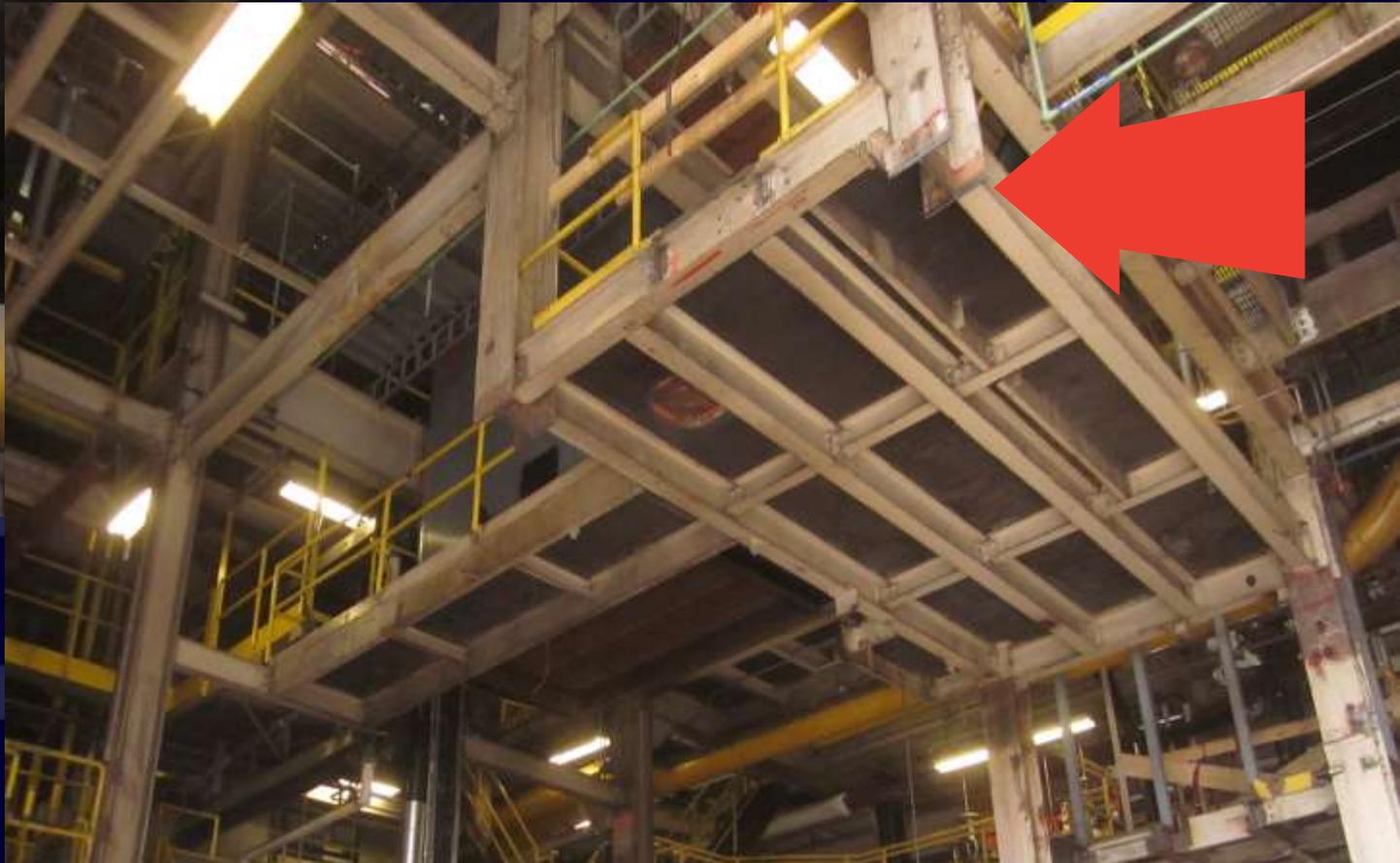
- increased reliability
- lower NOx emissions
- higher efficiency
- additional electric generating capacity
- the ability to run the plant 100% on natural gas
- redundancy for our JBR fan
- more plant flexibility

Moving to higher pressure



New 850 psig gas boilers provide best payback to feed 850 psig and 325 psig turbine generators.

Site preparation – first boiler



Original one-phase schedule

	
Statement of work	Spring 2014
Design startup	January 2015
Contractors in place	September 2016
Old boiler shutdown	March 2017
Boiler delivery	August 2017
New boiler commissioning – December 2017	December 2017

Dismantling the old





Boiler removal

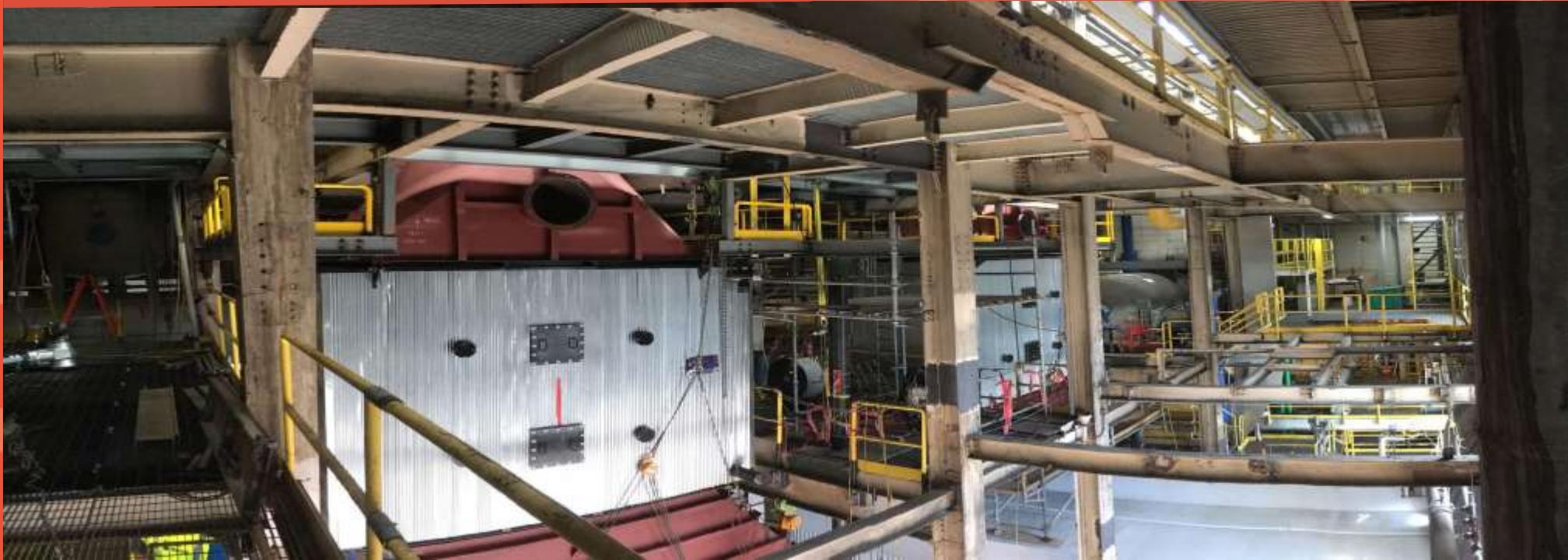


New boilers arrive





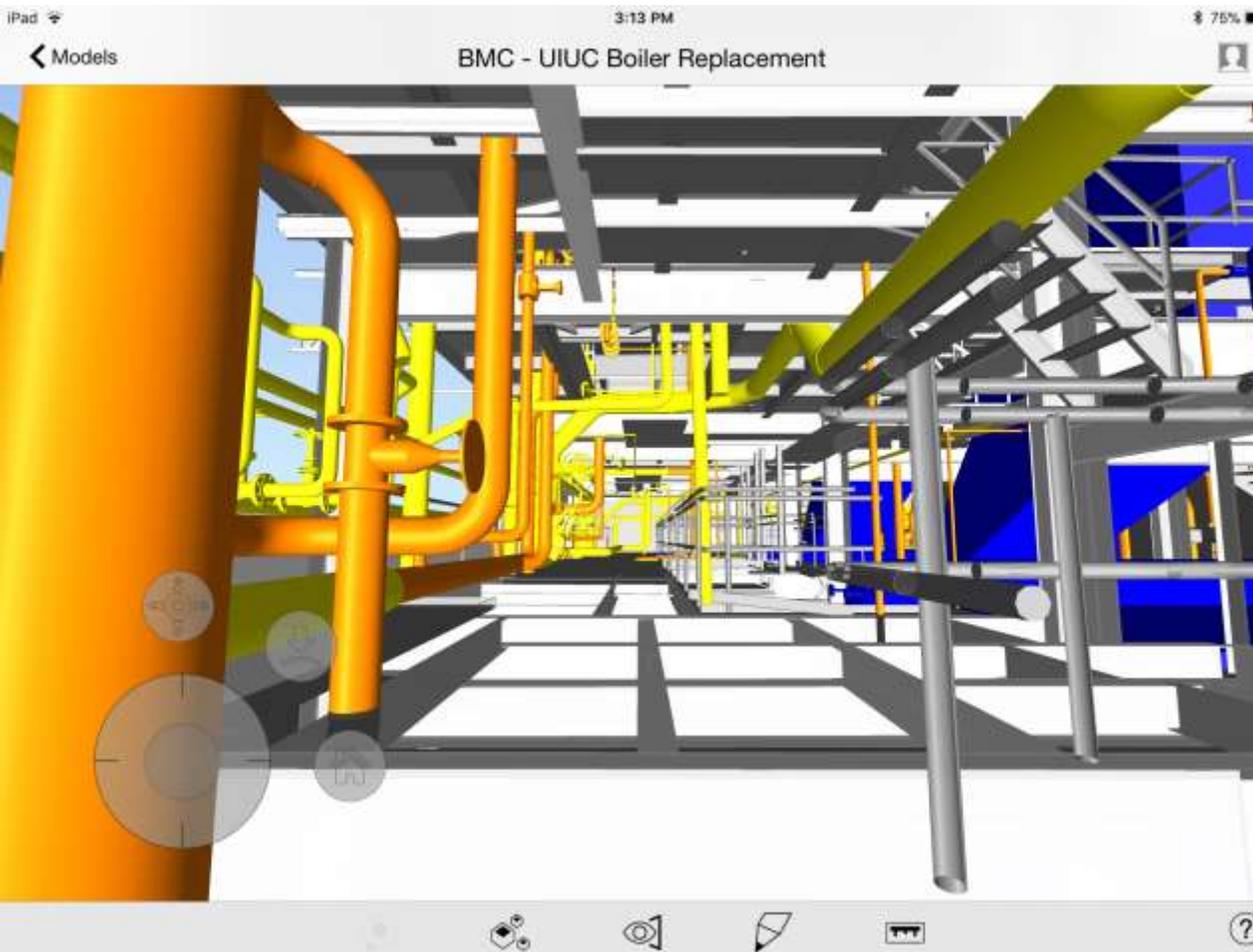
Steel fabrication workaround





**Two new stacks
in fall 2017**

Lessons learned: Precision modeling crucial



Lessons learned:
BIM 360
Glue tool helped



Lessons learned: Adopt two-phase design process

Phase 1:

- Process flow diagram
- Detailed lists
- Piping and instrumentation
- Existing plant
- Hazardous materials assessment and remediation plan
- Major equipment general arrangements
- Cost analysis and scope adjustment

Phase 2:

- Updated Phase 1 drawing set
- Demolition and new configuration
- Contract specification only for items not on drawings
- Where possible (not allowed in Illinois), complete as design-build so contractor engaged in planning and design

More lessons learned

- **Transfer responsibility for managing/updating model to coordinating contractor at bid award.**
- **Require contractor competence with 3D model, keeping refreshed with red lines for use by team.**
- **Complete updating, consolidating of our plant piping standards.**
- **Increase use of manufacturer model specific parts.**
- **Require more tailoring of standard details....**

More lessons learned

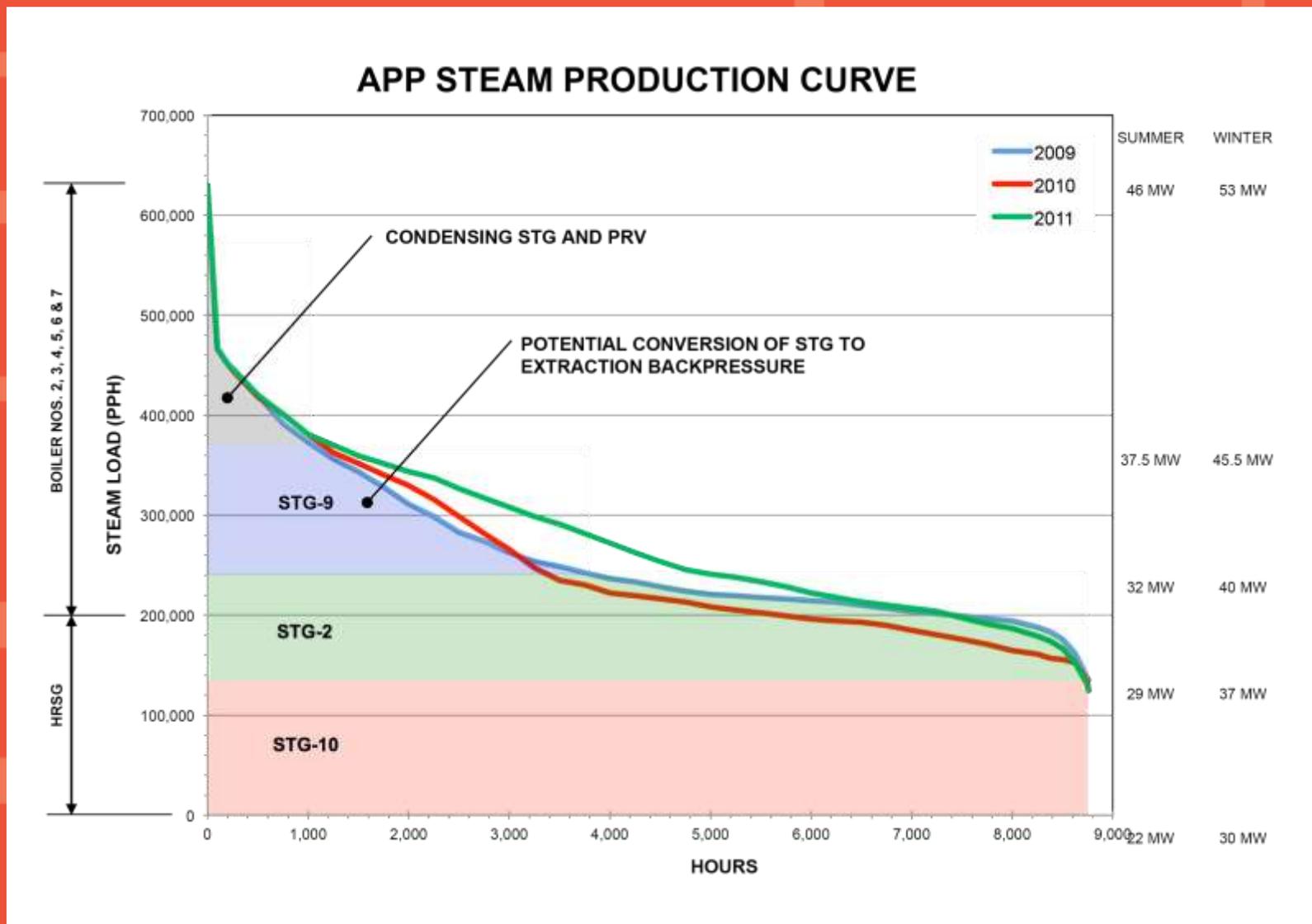
- Increase precision in configuration of structural and decking design; improve communications on expectations and capabilities.
- Continue requiring on-site time by the engineering team (mechanical, structural, electrical).
- More precisely define instrument field location in the model and/or drawings, model the route of large conduit.
- Continue daily, weekly on-site, face-to-face meetings of owner, contractor and engineer.
- Continue contractor commitment for site cleanliness.

Converted turbine

Goal:

Increased efficiency and
reduced costs

Abbott Power Plant load duration curve



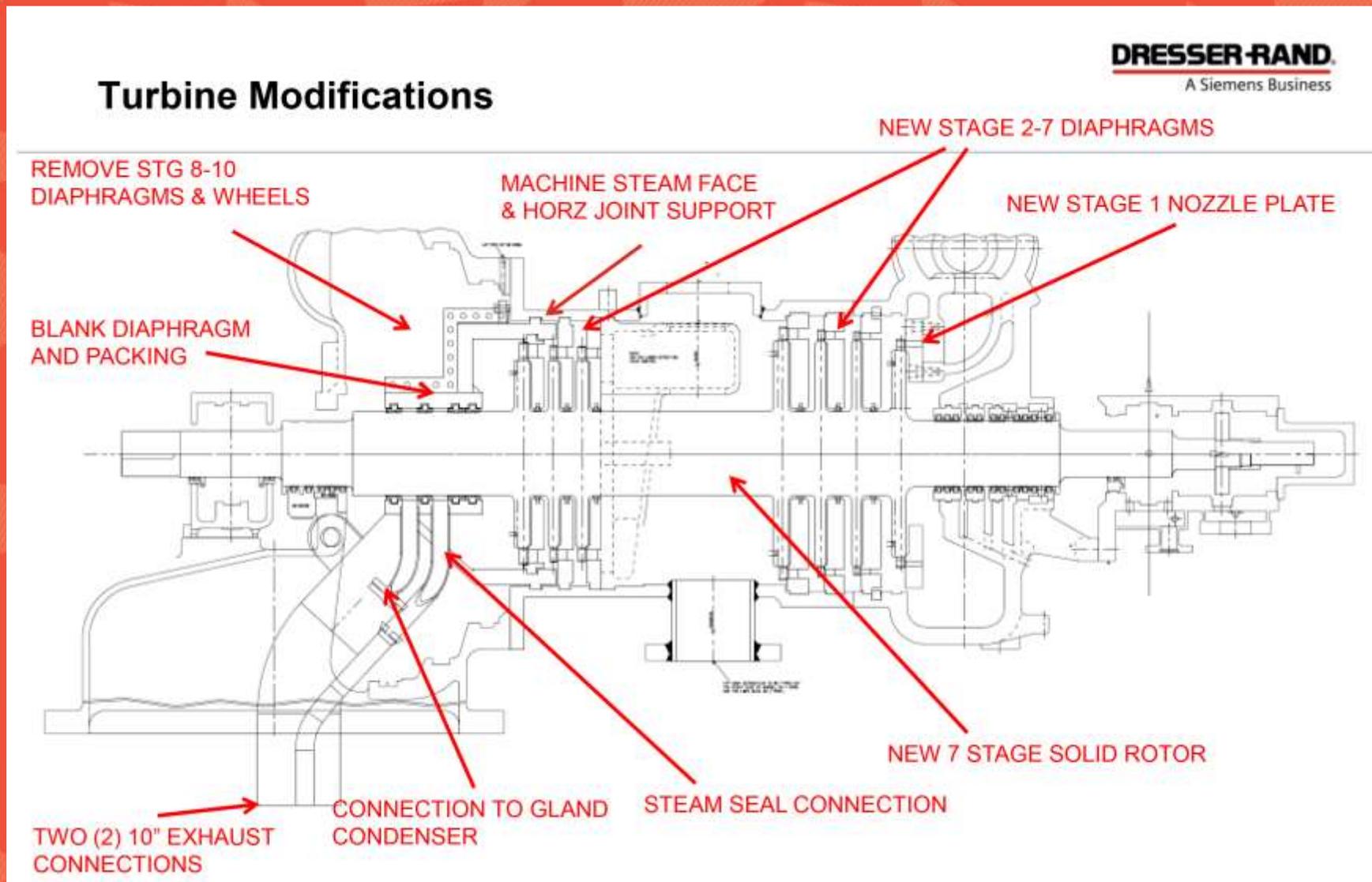
Project payback

< 5 years based on
\$2 per MWh production cost

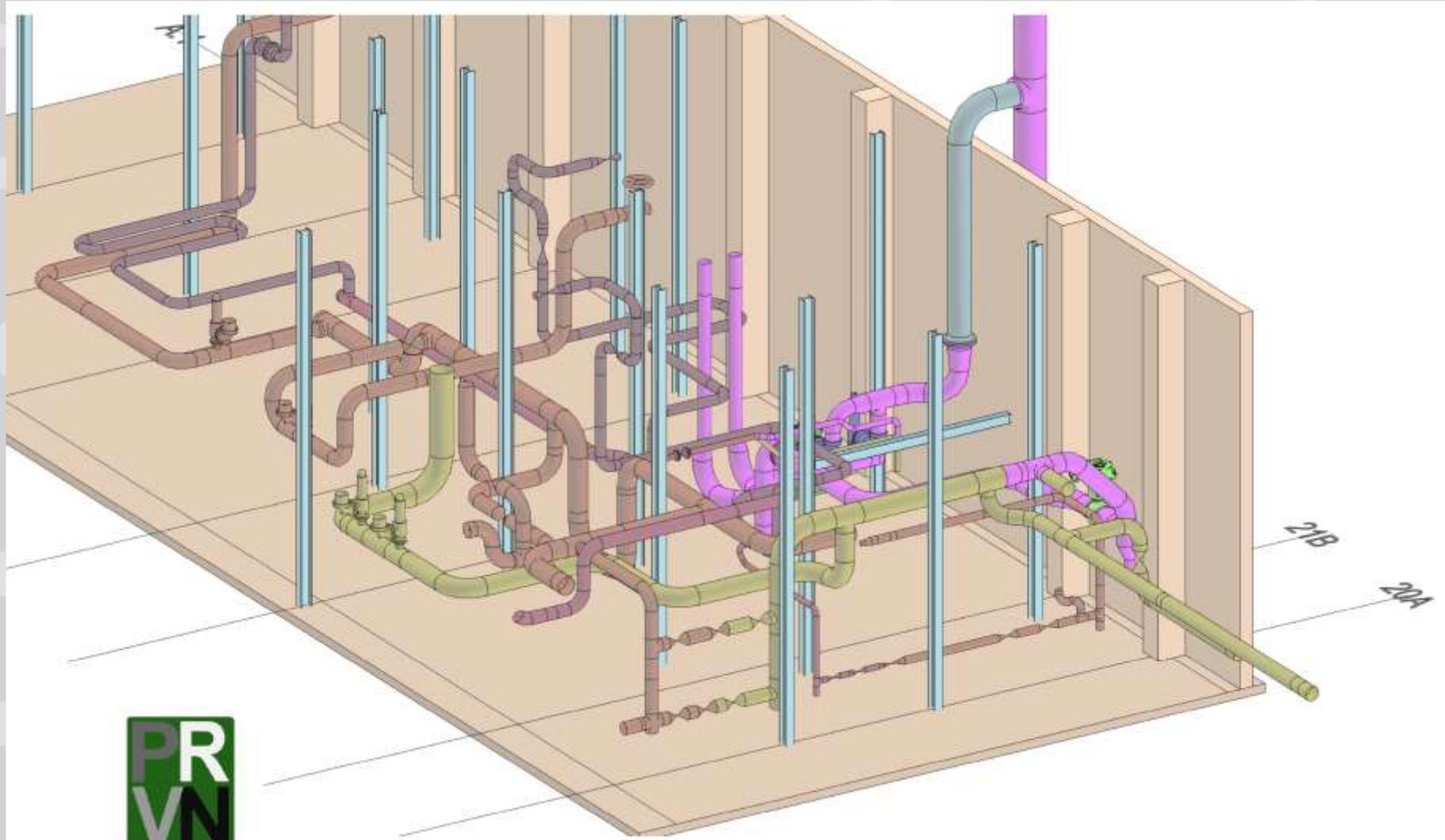
Moving forward

- **Purchase orders** – Fourth quarter 2016 - early 2017
- **Turbine conversion design completed** – April 2017
- **Turbine connected, piping configured** – September 2017 - December 2017
- **Turbine commissioned** – Early 2018

Modifications needed



Piping connections intricate



Converted turbine

Piping connections tightly secured during installation



Before and after

	Original Design	Post Modification
Inlet Pressure	840 psig	840 psig
Inlet Temperature	750° F	740° F
Inlet Flow	127,200 lb/hr	168,000 lb/hr
Extraction Pressure	160 psig	150 psig
Extraction Flow	0 - 100,000 lb/hr	0 - 28,000 lb/hr
Exhaust Pressure	not installed	50 psig
Exhaust Flow	not installed	0 - 140,000 lb/hr
Condenser Flow	27,000 - 127,000 lb/hr	NA
Output	12,500 kW	7,750 kW



**Converted turbine, new boilers
and stacks:
reliable, responsible, ready for
growth**

MIKE LARSON

Director of Utilities Production
University of Illinois at Urbana-Champaign
217.333.5139
mjlarso@illinois.edu

MIKE BREWER

Mechanical Engineer
Abbott Power Plant
217.333.7067
mkbrewer@illinois.edu

MARCH 7, 2018

**Abbott Power Plant thanks our vendors for
their participation.**

