Materials for Advanced Ultra-supercritical Steam Turbines - Advanced Ultra-supercritical Component Demonstration

DOE Contract Number DE-FE0025064

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Goals: The A-USC ComTest Project will lead to…

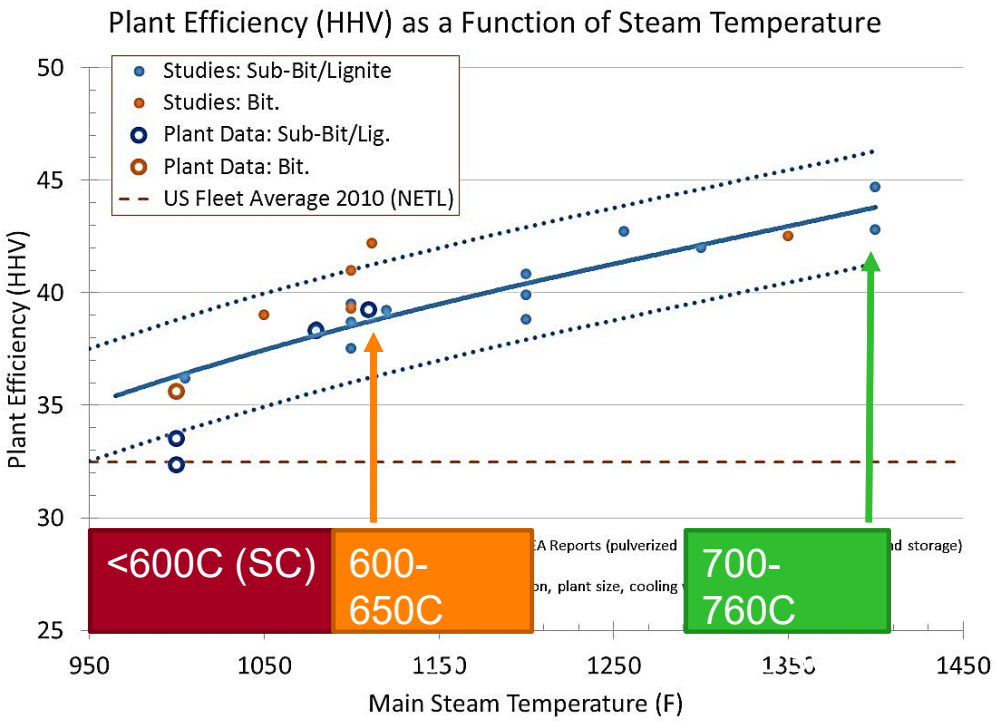
- **Higher efficiency** for new and existing fossil fuel plants
  - 10% above today's new state-of-the-art coal power plants, and
  - 25% above that of the average power plants in the U.S. existing fleet
- **Lower emissions** (NOx, SOx, CO_2)
- **Minimized risk** for utilities desiring to build A-USC plants
- Design of world's first integrated **A-USC steam turbine** at 760ºC
- Accelerated development of domestic **supply chain** for advanced materials and components
- **Validation of technology** applicable to multiple fossil, nuclear, and renewable power generation options, all targeted by the U.S. DOE NETL Cross-Cutting Research Technology Program

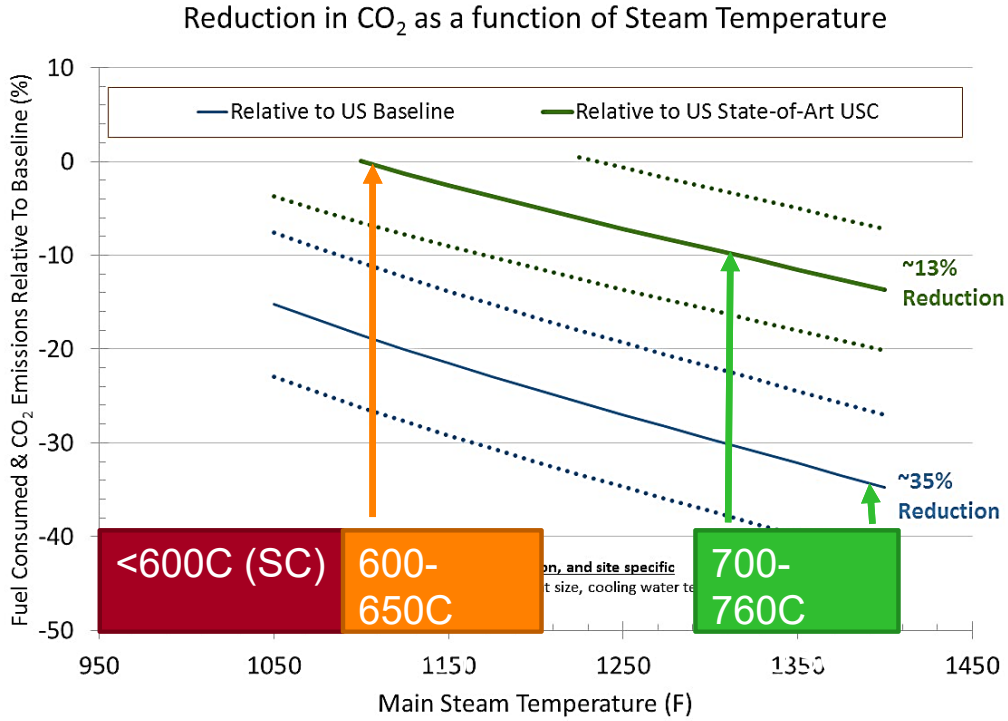
Presentation Outline

- Background
- Project Overview
- Accomplishments
- Future Work

Background

New A-USC Plant: Increasing Steam Conditions Dramatically Improve Efficiency and Reduce CO_2 Emissions





Increased Efficiency is a Least Regret Strategy for CO_2 Reduction

Studies show A-USC = 10-35% reduction in CO_2 compared to current plants

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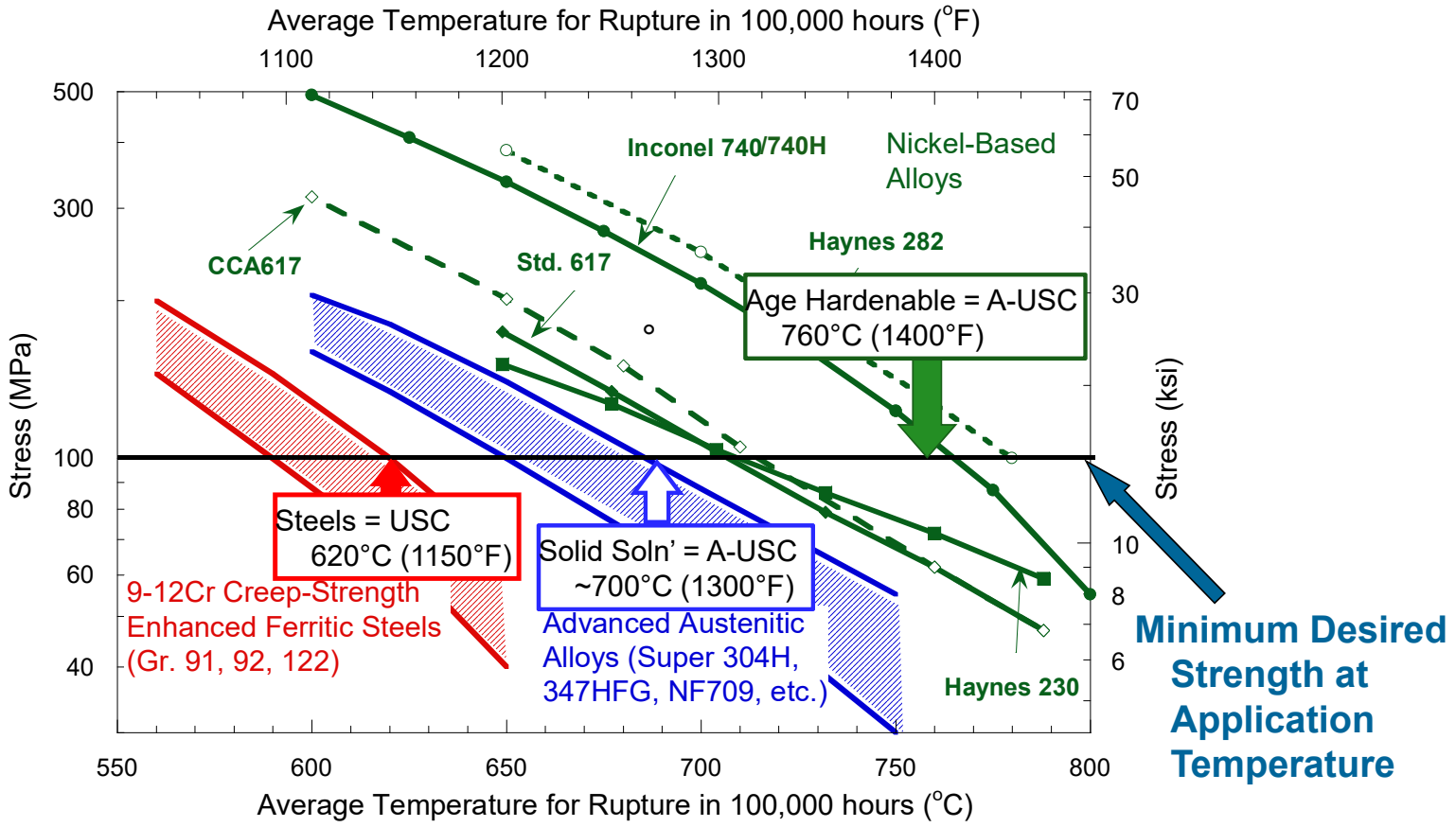
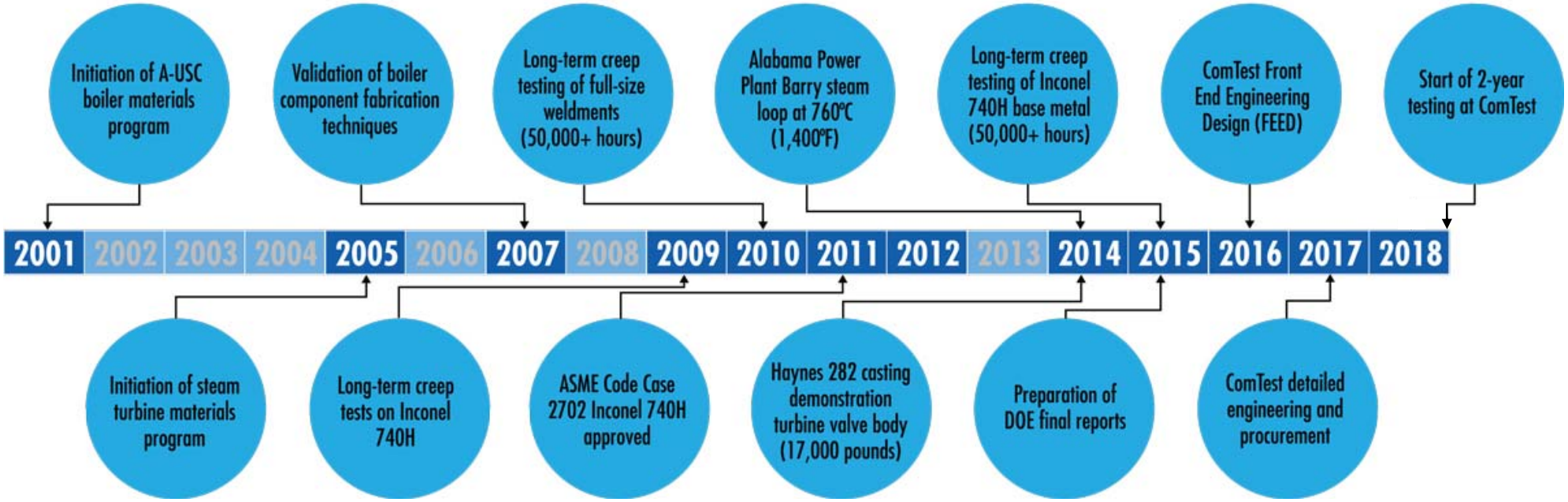
Materials Limit the Current Technology:

Today's State-of-the-Art (USC) Coal-Fired Power Plants are defined by steel technology



History of A-USC Materials Programs in U.S. ComTest is the Next Step for A-USC Technology

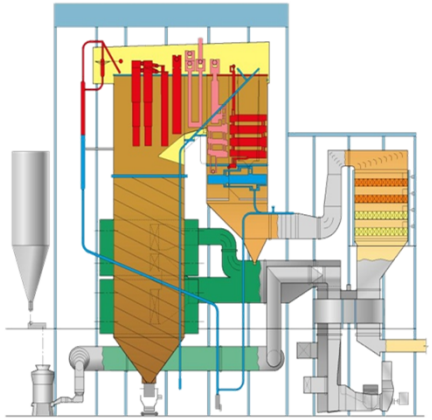


Background of A-USC Materials Programs

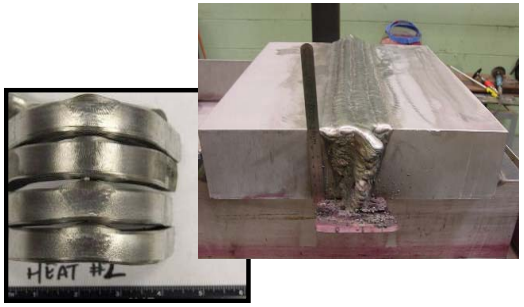
- Present work builds upon 15-year effort supported by U.S. Department of Energy, Ohio Coal Development Office, and industry participants
  - Boiler Materials for Advanced Ultra-supercritical Coal Power Plant
    - DOE Contract: DE-FG26-01NT41175
    - OCDO Grant: CDO-D-05-02(A)
  - Materials for Advanced Ultra-supercritical Steam Turbines
    - DOE Contract: DE-FE0000234
    - OCDO Grant: CDO-D-05-02(B)

Tasks Completed in A-USC Materials Programs

General design studies show favorable economics



Steam-Side Oxidation



Welding Technology Developments

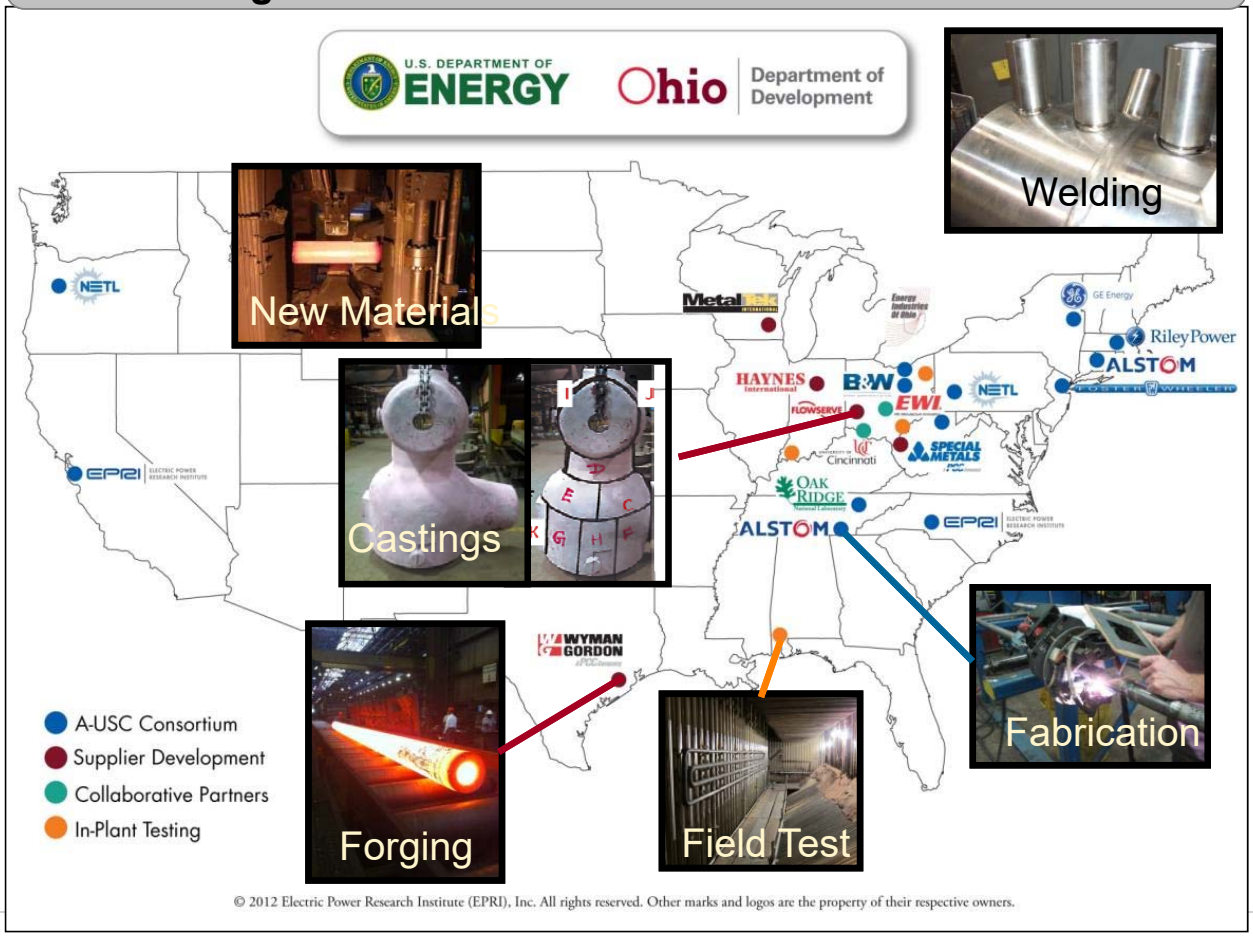
Fireside Corrosion (High-Sulfur Coal & In-Plant Testing)

Fabrication Processes

Turbine Component Scale-up

Next Step… Building Upon Prior Work

Federal – State – National Laboratory – Non Profit – For Profit Cost Sharing Consortium



15 Years

ComTest

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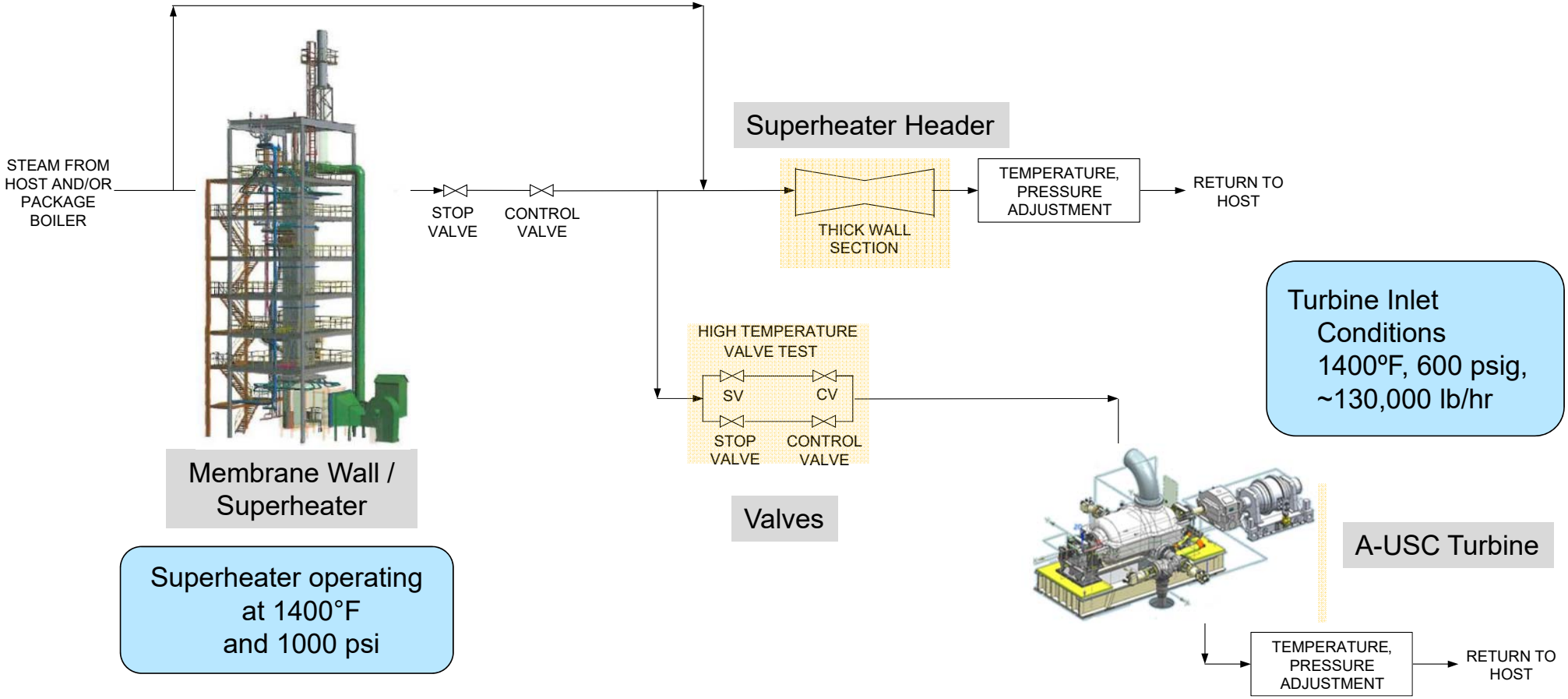
ComTest Project Overview

Schematic of ComTest Pilot Plant Vision



ComTest Project Team

Team Member	Funder	Role
US DOE NETL	✓	Funder
OCDO (Ohio)	✓	Funder
EIO		Prime Contractor & Administration
EPRI	✓	Technical Lead
GE	✓	Supply of Main Components
AECOM		EPC Contractor
Youngstown Thermal		Host Site Owner (Primary)
Southern Company		Host Site Owner (Alternate)

Accomplishments

Accomplishments

- Evaluated multiple potential host sites
- Identified viable host sites (Ohio and Alabama)
- Completed Pre-FEED and FEED tasks
- Prepared preliminary capital cost estimates
- Worked with suppliers to develop supply chain
- Developed two-year test plan
- Started Detailed Engineering effort

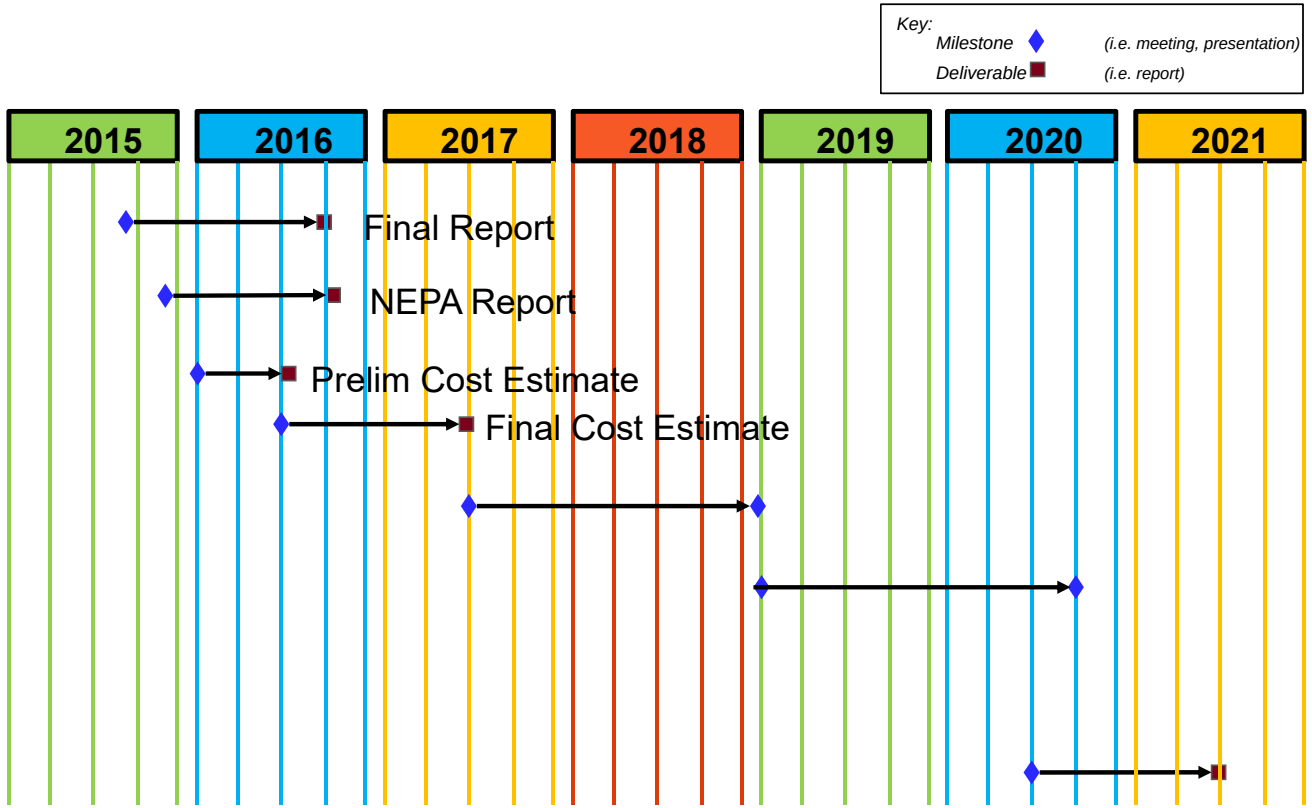
Future Work

Next Steps

- Confirm Phase 2 budgets – close budget gap
- Finalize testing scope and host site selection
- Identify funding sources for Phase 2 cost share
- Complete Detailed Engineering effort
- Develop procurement specifications for equipment
- Confirm supply chain and fabrication methods
- Construct ComTest components and facility
- Operate pilot plant for two years

A-USC ComTest Schedule

- Pre-FEED
- NEPA
- FEED
- Detailed Engineering
- Procurement & Construction
- Operation
  a. Membrane Wall & SH
  b. Cycling Header & Valves
  c. Steam Turbine
- Evaluation & Reporting



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