John W. Turk, Jr. Power Plant

American Electric Power / Southwestern Electric Power Co.
Turk Plant location
Turk Project Milestones

- Project Announced - Aug 9, 2006
- Received Permit to Install - Nov. 5, 2008
- EPC Full Notice to Proceed - Dec. 8, 2008
- 1st Fire Gas Igniters – Aug. 21, 2012
- 1st Fire on Coal – Oct. 27, 2012
- Initial Synch to Power Grid – Nov. 8, 2012
  - Has operated at high capacity factors
- Performance Tests – Feb. 12, 2013
  - Met capacity and heat rate expectations
Turk Plant Information

- 600 MW output
- The first ultra-supercritical cycle deployed in the United States since the late 1950’s (AEP’s Philo 6 and Philadelphia Eddystone Unit 1 demonstration projects)
- Utilizes Powder River Basin sub-bituminous pulverized coal in balanced draft steam generator
The Basic Heat Cycle Evolution

- **Critical Point** – 3208psia/705°F: water vapor and liquid water are indistinguishable.

- **Sub-Critical Steam Cycles**: Water boiling to steam with pressures below ‘critical point’.

- **Super-Critical Steam Cycles**: Water to steam without boiling. Pressure above ‘critical point’.

- **Ultra-Supercritical Steam Cycles**: Steam temperatures above 1100°F as defined by Electric Power Research Institute (EPRI).
  - Modern chrome and nickel-based super alloys in the steam generator, steam turbine, and piping systems can withstand prolonged exposure to this high temperature steam.

*Higher pressures & temperatures increase the cycle efficiency*
AEP J.W. Turk, Jr. Power Plant
Ultra-Supercritical Design Conditions

- B&W Pulverized Coal-fired Benson Cycle, Spiral-wound Furnace, Balanced Draft Boiler
- Alstom Power, Inc. Single Reheat Tandem Compound Steam Turbine
- Main Steam: 3675 psig (@ 5% Overpressure)/1115°F
- Reheat Steam: 1125°F
- PRB Coal (8300 Btu/lb, 0.4% Sulfur, 5.5% Ash, 31% H2O)
- Cycle efficiency in range of 39%
• Plant emissions controls using the best available control technologies:
  – NOx Control - Overfire air, Low NOx burners and Selective catalytic reduction (SCR) system.
  – SO2 Control - Spray-dryer Flue Gas Desulfurization system
  – Particulate Control - Pulse-jet fabric filter baghouse
  – Mercury control - Activated Carbon Injection (ACI)
Typical USC Arrangement (PRB Fuel)
Ultra-Supercritical Advantage

Higher efficiency has many benefits versus conventional subcritical technology

- 180,000 tons ($6 million) less coal per year, based on $2/MMBtu
  - 1,500 fewer coal train cars per year
  - 12 fewer coal trains per year or 480 trains over the life of plant

- 1,600 tons ($120k) less lime per year
  - 16 fewer lime train cars per year
  - FGD waste is reduced by 3,600 tons per year

- 14,000 tons total ash + FGD waste is reduced by per year
  - 540,000 tons reduction over the life of plant
  - Reduction in landfill size by 5-10 acres

Based on 600 MW Unit, 85% Capacity Factor
Ultra-Supercritical Advantage

• 1 million gallons less water usage per day
• 320,000 tons less CO$_2$ emitted per year
• 150 tons less SO$_2$ emitted per year
• 100 tons less NOx emitted per year
• 25 tons less PM-10 (filterable) emitted per year
• Steam generator is smaller, structural steel is reduced
Unit Operation after COD

• Unit declared commercial on Dec 20, 2012
• 110 plant employees
• Heat Rate of 8,700 Btu/kWh
• Has operated at high loads with very few forced outages
Conclusion

• Ultra-supercritical Pulverized Coal Technology
  • Higher Temperatures = Better Efficiency
  • Better Efficiency = Less Emissions & Less Carbon Dioxide
  • Metallurgy Currently Available for Temperatures above 1100°F
  • Equipment Suppliers Can Guarantee Performance & Reliability
  • Successful Turk Plant Start-up & Operation proves the reliability & efficiency of this technology advancement
• Received the 2013 EEI Edison Award
• Turk is providing low-cost, baseload electricity for SWEPCO customers
Turk in Operation