POLK POWER STATION

IGCC OPERATION -LESSONS LEARNED

DOE CLEAN COAL ROUNDTABLE

JULY 29, 2004

TECO ENERGY

POLK POWER STATION

- **UNIT 1 IGCC, DOE CCT Round 3 Award**

  Gasifier, Texaco oxygen blown, coal slurry fed

  Combined cycle, GE 7F CT, GE D11 ST 315 MW

  Dual fuel, Syngas/Distillate Oil

  Design began April 1993

  Site work began August 1994

  In commerical service September 1996

- **UNIT 2 & 3 Simple Cycle CT, Peaking**

  Simple cycle GE 7FA+E, 7241 165 MW each

  Dual fuel, Natural gas/Distillate Oil

  Unit 2 In service 2000, Unit 3 in service 2002

IGCC DRIVER:

LOW EMISSIONS FROM LOW COST FEEDSTOCKS FOR LOW COST ELECTRICITY

POLK POWER STATION IGCC

FUEL FLEXIBILITY

Over 20 to Date:

Coals

Coal Blends

Coal/Pet Coke Blends

Coal/Coke/Biomass Blends

POLK POWER STATION IGCC

LOW AIR EMISSIONS

SO_2

NO_x

Particulates

LESSONS LEARNED

SITING/PERMITTING

- COMMUNITY INVOLVED IN PROCESS SITING TASK FORCE FORMED
- INLAND SITE LOCATION CHOSEN – PREVIOUSLY MINED LAND
- AGREED TO SITE RECLAMATION
- ENSURE PERMIT FITS TECHNOLOGY

LESSONS LEARNED

TECHNICAL ISSUES - 1

- PLANT WAS A 2X SCALE UP
- DEMONSTRATED NEW TECHNOLOGIES (ACID GAS REMOVAL APPLICATION, GAS/GAS EXCHANGERS, FIRE TUBE CSC'S)
- INTEGRATING TECHNOLOGIES FROM VARIOUS VENDORS WAS DIFFICULT

LESSONS LEARNED

TECHNICAL ISSUES - 2

KEY CHALLENGES:

- **Carbon Conversion (efficiency & slag disposal)**
- **Gas/Gas Heat Exchangers – removed**
- **Convective Syngas Cooler Plugging**
- **Slag/Fines Handling Corrosion/Erosion**
- **Distillate Oil Back-up Fuel Reliability**
-

LESSONS LEARNED

TECHNICAL ISSUES - 3

- **HEAT RATE (EFFICIENCY)**

Polk Heat Rate is good, but still not at design

Key issues:

1. **Carbon conversion low – Polk specific issue**
2. **Heat exchangers removed – for reliability**
3. **Steam requirement for sulfur removal higher than expected**
4. **Internal power consumption during startup and shutdown is significant**

LESSONS LEARNED
TECHNICAL ISSUES - 4

- POLK 1 IGCC is operating at 95% overall availability (including back-up fuel). Gasifier availability is at 82%.
- This overall availability is superior to all other coal technologies.
- Gasifier availability will improve with next generation plants. This will reduce fuel costs, but will not increase the reliability of power generation. IGCC is already superior to others.

LESSONS LEARNED

ENVIRONMENTAL

- ADDED COS HYDROLOSIS TO REDUCE SULFUR EMISSIONS
- NOx BACT LIMIT OF 15ppm MET WITH SYNGAS SATURATION – PERFORMING WELL
- SLAG PRODUCTION NOW GOING TO BENEFICAL REUSE (carbon recycled)

LESSONS LEARNED

COMMERCIAL

- POLK AS BUILT WAS OVER $2000/KW
- WITH ALL LESSONS LEARNED – REPLICATING POLK WOULD BE $1650/KW
- INCORPORATING ECONOMIES OF SCALE IN 500 MW SIZE WOULD BE ~ $1300/KW

(Economic evaluation is included in final DOE report)

LESSONS LEARNED

STAFFING

- HIGH PERFORMANCE SELECTION PROCESS
- HIRED ONLY EXPERIENCED JOUNEYMEN
- SELF-DIRECTED TEAM ENVIRONMENT
- CRAFTSMEN HAD NO PREVIOUS GASIFICATION EXPERIENCE
- ALL CRAFTSMEN TRAINED AS OPERATORS
- OPERATIONS TRAINING VIA PLANT SIMULATOR

IGCC RISK STUDY

- HIGHEST RISK AREAS ARE RATED AS CAPITAL COST, EXCESSIVE DOWNTIME, LACK OF STANDARDIZATION

- LESSONS LEARNED FROM FIRST GEN IGCC PLANTS AND OTHERS HAVE BEEN WELL DOCUMENTED AND WILL REDUCE EACH OF THESE THESE RISKS

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