POLK POWER STATION IGCC

The Second DOE/UN International Conference and Workshop on Hybrid Power Systems

Charlotte NC - April 2002

TECO ENERGY

POLK POWER STATION - IGCC

The plant is one of the first-of-its-kind combination of two leading technologies:

- "Coal gasification" which uses coal to create clean-burning gas
- "Combined cycle" which uses waste heat to increase efficiency

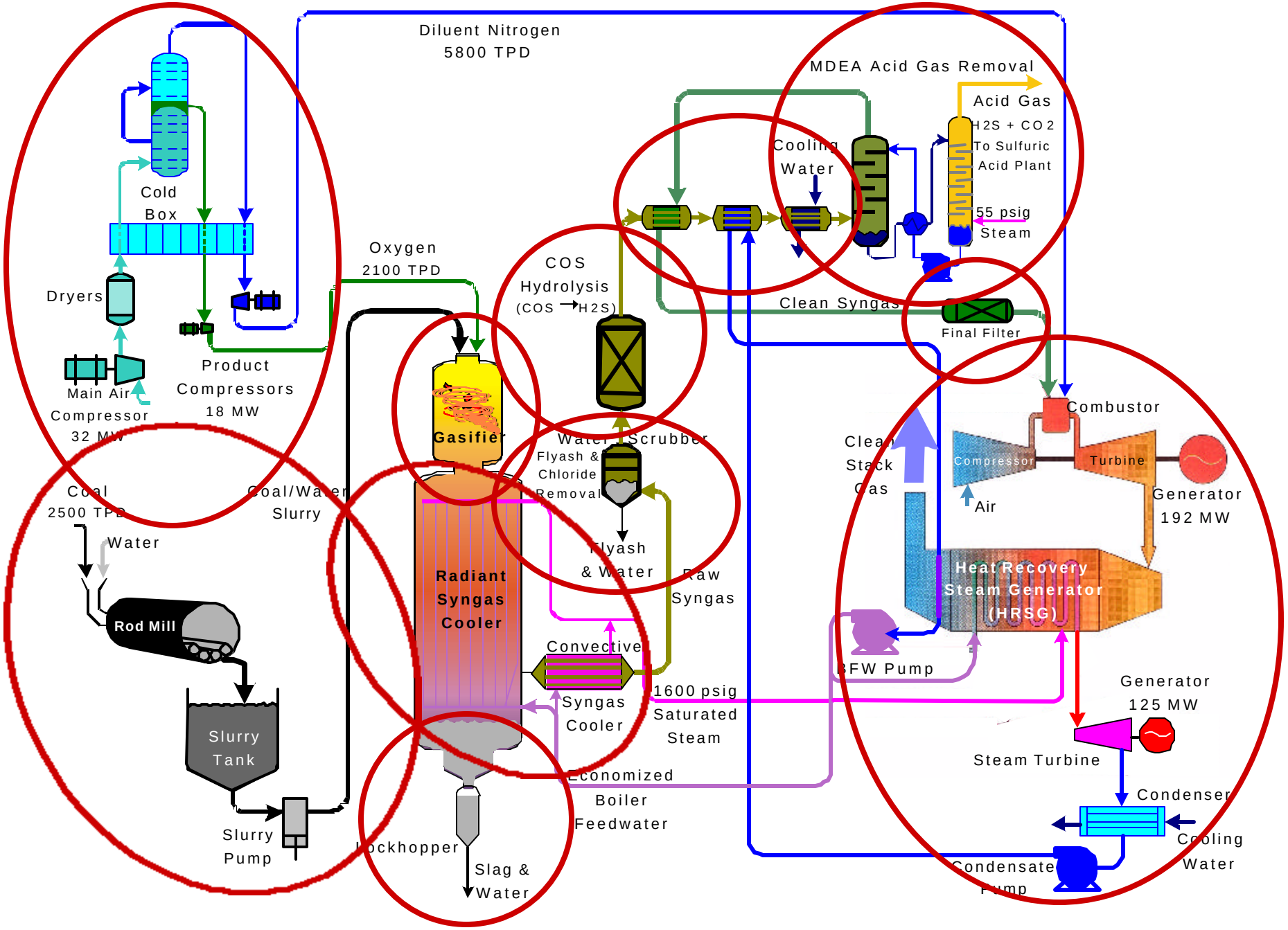
Department of Energy Clean Coal Technology Program Round III demonstration project.

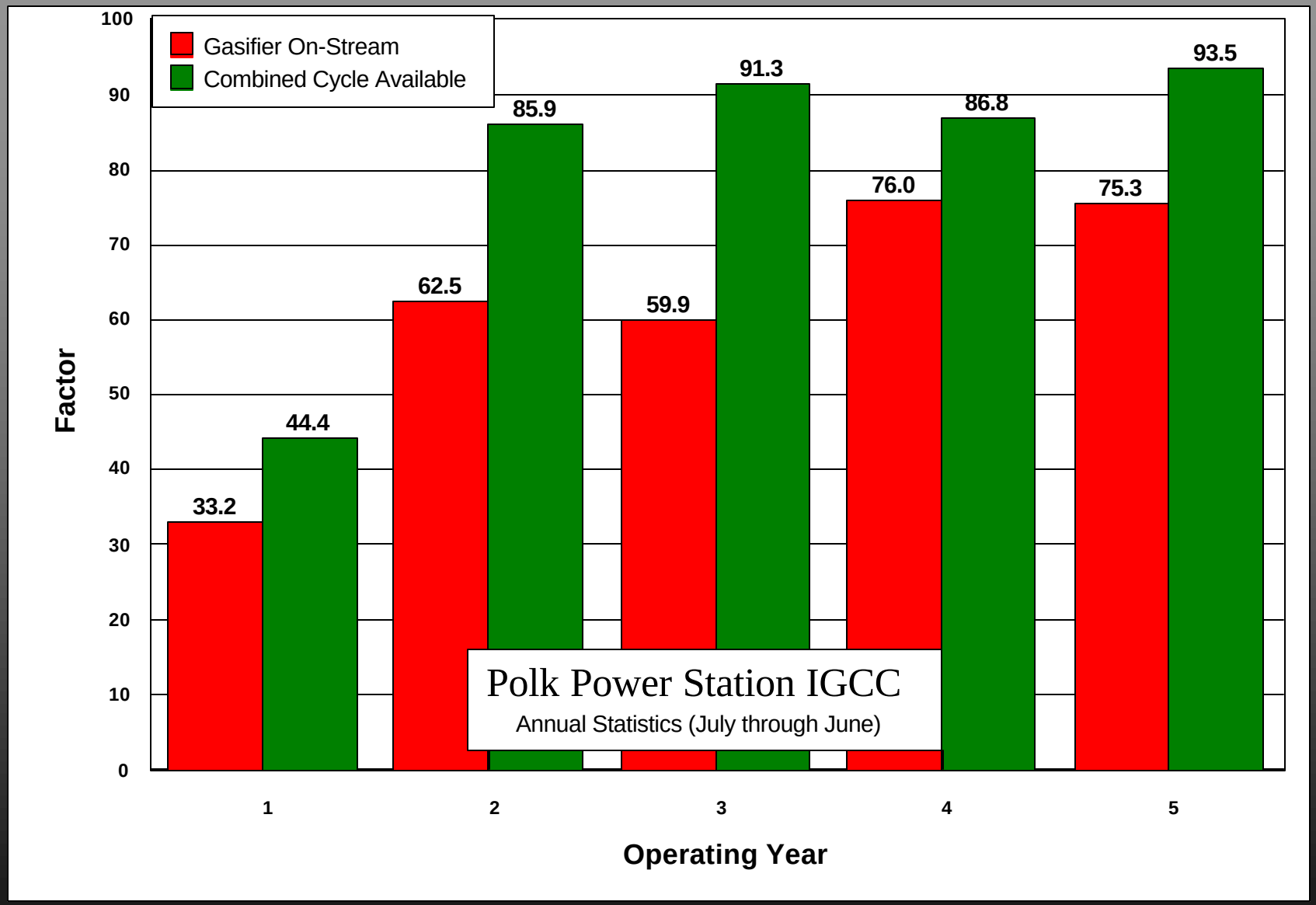
DOE co-funding of $142 M.

IGCC

The facility began commercial operation in fall 1996

POLK POWER STATION


Diluent Nitrogen
5800 TPD
MDEA Acid Gas Removal
Acid Gas
H2S + CO2
To Sulfuric
Acid Plant
Cooling
Water
55 psig
Steam
Cold
Box
Dryers
Oxygen
2100 TPD
COS
Hydrolysis
(COS → H2S)
Clean Syngas
Final Filter
Product
Compressors
18 MW
Main Air
Compressor
32 MW
Gasifier
Water Scrubber
Flyash &
Chloride
Removal
Combustor
Clean
Stack
Gas
Compressor
Turbine
Air
Generator
192 MW
Coal
2500 TPD
Coal/Water
Slurry
Water
Flyash
& Water
Raw
Syngas
Radiant
Syngas
Cooler
Heat Recovery
Steam Generator
(HRSG)
Rod Mill
Convective
Syngas
Cooler
BFW Pump
1600 psig
Saturated
Steam
Generator
125 MW
Slurry
Tank
Steam Turbine
Economized
Boiler
Feedwater
Condenser
Slurry
Pump
Lockhopper
Slag &
Water
Cooling
Water
Condensate
Pump


Gasifier On-Stream
Combined Cycle Available
Factor
100
90
80
70
60
50
40
30
20
10
0
33.2
44.4
62.5
85.9
59.9
91.3
76.0
86.8
75.3
93.5
1
2
3
4
5
Operating Year
Polk Power Station IGCC
Annual Statistics (July through June)

LOW EMISSIONS

Typical Emissions (Lb/MWH)

	PC	AFBC	Polk (Permit)	Polk (Steady State)
SO_2	2.2	3.3	1.4	1.0
NOx	3.6	1.8	0.9	0.7
Particulate	0.8	0.2	0.07	<.01

LOW SO_2 EMISSIONS

Sulfur Removal Factors

	Boiler		Polk
Sulfur Compound	SO2		H2S
Pressure at Removal Point (psig)	14.7		365
Partial Pressure of sulfur compound (psig)	0.02		14.0
Partial Pressure Ratio		193	
Gas Flow at Removal Point (KACFS)	6400		40
Flow Ratio		160	

LOW PARTICULATE EMISSIONS

Particulate Removal Factors

	Boiler	Polk
FILTRATION STEPS	1 Step	2 steps
Liquid Contact		
Limestone Slurry	2 Stages	0
Water	0	9 Stages
Water/MDEA	0	6-10 Stages
TOTAL LIQUID CONTACT	2 Stages	15-19 Stages
Gas Flow at Removal Point (KACFS)	6400	40
Flow Ratio	160	

POLK POWER STATION IGCC

FUEL FLEXIBILITY

Over 20 to date:

Coals

Coal Blends

Pet Coke Blends

Biomass Blend

Polk Power Station - Outages and Fuels in 2001

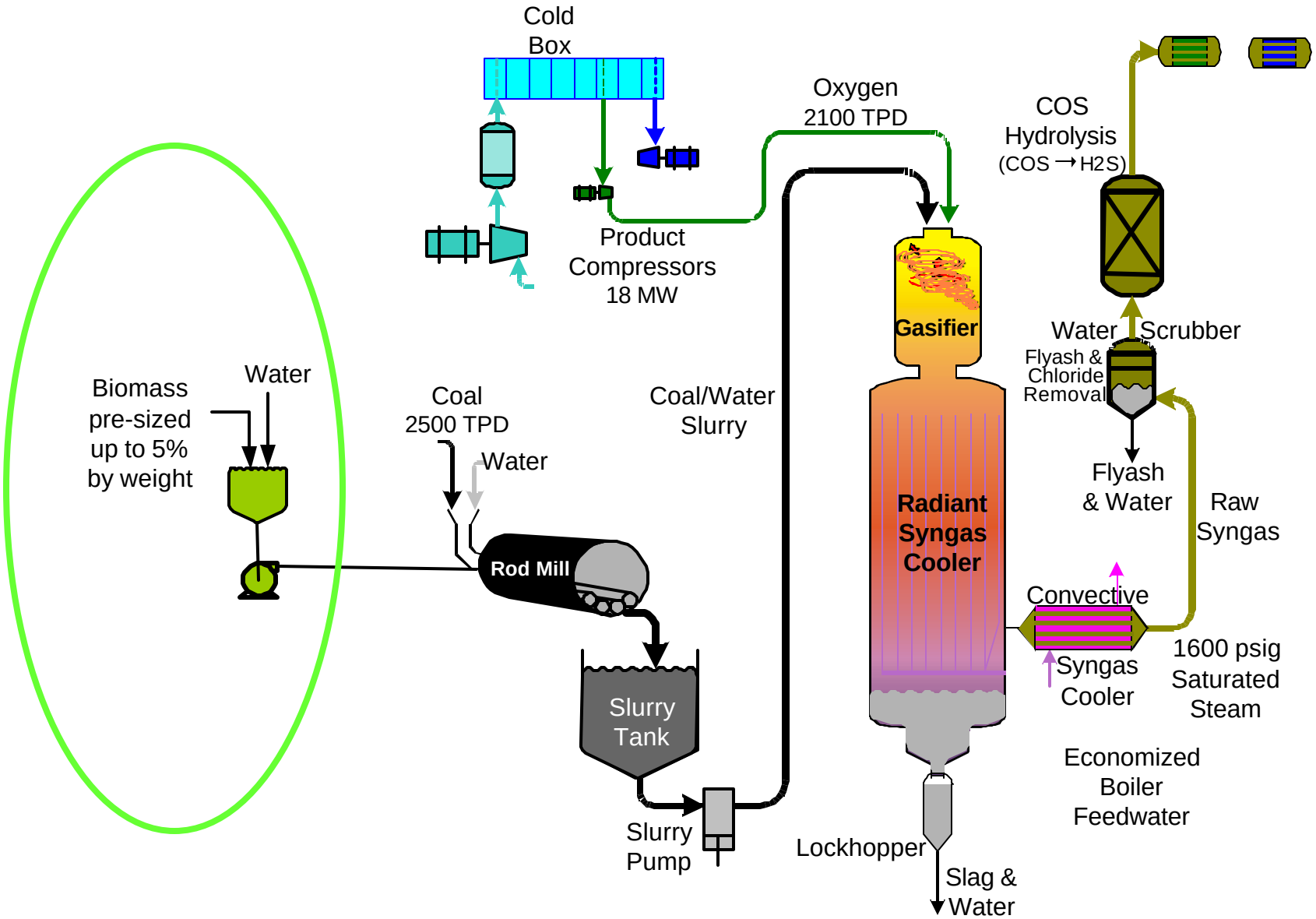
Sun	Mon	Tu	Wed	Thu	Fri	Sat	
	01/01	01/02	01/03	01/04	01/05	01/06	
01/07	01/08	01/09	01/10	01/11	01/12	01/13	MAC Discharge Vent I/P
01/14	01/15	01/16	01/17	01/18	01/19	01/20	
01/21	01/22	01/23	01/24	01/25	01/26	01/27	Seal Parts Plugged Crusher
01/28	01/29	01/30	01/31	02/01	02/02	02/03	
02/04	02/05	02/06	02/07	02/08	02/09	02/10	
02/11	02/12	02/13	02/14	02/15	02/16	02/17	
02/18	02/19	02/20	02/21	02/22	02/23	02/24	**Blend Ratio: 30/20/50**
02/25	02/26	02/27	02/28	03/01	03/02	03/03	CSC Plugging/Tube Leak
03/04	03/05	03/06	03/07	03/08	03/09	03/10	
03/11	03/12	03/13	03/14	03/15	03/16	03/17	Planned Outage: Refractory
03/18	03/19	03/20	03/21	03/22	03/23	03/24	
03/25	03/26	03/27	03/28	03/29	03/30	03/31	
04/01	04/02	04/03	04/04	04/05	04/06	04/07	
04/08	04/09	04/10	04/11	04/12	04/13	04/14	
04/15	04/16	04/17	04/18	04/19	04/20	04/21	
04/22	04/23	04/24	04/25	04/26	04/27	04/28	
04/29	04/30	05/01	05/02	05/03	05/04	05/05	
05/06	05/07	05/08	05/09	05/10	05/11	05/12	
05/13	05/14	05/15	05/16	05/17	05/18	05/19	
05/20	05/21	05/22	05/23	05/24	05/25	05/26	West RSC Exit Pluggage
05/27	05/28	05/29	05/30	05/31	06/01	06/02	MAC 4th Stage Vibration
06/03	06/04	06/05	06/06	06/07	06/08	06/09	
06/10	06/11	06/12	06/13	06/14	06/15	06/16	
06/17	06/18	06/19	06/20	06/21	06/22	06/23	
06/24	06/25	06/26	06/27	06/28	06/29	06/30	

Sun	Mon	Tu	Wed	Thu	Fri	Sat	
07/01	07/02	07/03	07/04	07/05	07/06	07/07	
07/08	07/09	07/10	07/11	07/12	07/13	07/14	MAC Discharge Vent Valve Solenoid
07/15	07/16	07/17	07/18	07/19	07/20	07/21	
07/22	07/23	07/24	07/25	07/26	07/27	07/28	**Blend Ratio: 25/35/40**
07/29	07/30	07/31	08/01	08/02	08/03	08/04	COS Catalyst Plugging
08/05	08/06	08/07	08/08	08/09	08/10	08/11	
08/12	08/13	08/14	08/15	08/16	08/17	08/18	
08/19	08/20	08/21	08/22	08/23	08/24	08/25	
08/26	08/27	08/28	08/29	08/30	08/31	09/01	Scrubber B Pigtail Leak, O2 Vent Valve
09/02	09/03	09/04	09/05	09/06	09/07	09/08	
09/09	09/10	09/11	09/12	09/13	09/14	09/15	
09/16	09/17	09/18	09/19	09/20	09/21	09/22	Slag Disposal, Sootblower Removal
09/23	09/24	09/25	09/26	09/27	09/28	09/29	
09/30	10/01	10/02	10/03	10/04	10/05	10/06	
10/07	10/08	10/09	10/10	10/11	10/12	10/13	
10/14	10/15	10/16	10/17	10/18	10/19	10/20	LH Recirculation Line Fitting Failure
10/21	10/22	10/23	10/24	10/25	10/26	10/27	
10/28	10/29	10/30	10/31	11/01	11/02	11/03	Nozzle Scrubber A Barrel Crack
11/04	11/05	11/06	11/07	11/08	11/09	11/10	CSC Plugging
11/11	11/12	11/13	11/14	11/15	11/16	11/17	Failed Ell, syngas to Scrubber
11/18	11/19	11/20	11/21	11/22	11/23	11/24	
11/25	11/26	11/27	11/28	11/29	11/30	12/01	**Blend Ratio: 30/15/55**
12/02	12/03	12/04	12/05	12/06	12/07	12/08	
12/09	12/10	12/11	12/12	12/13	12/14	12/15	
12/16	12/17	12/18	12/19	12/20	12/21	12/22	
12/23	12/24	12/25	12/26	12/27	12/28	12/29	
12/30	12/31						

FUEL LEGEND:

- Cumberland Pittsburgh #8
- 60% Powhatan / 40% South American
- South American / Black Beauty / Pet Coke Blend
- Black Beauty
- Kentucky #9 - Peabody Patriot
- 1% Biomass in Pet Coke Blend

BIOMASS CO-UTILIZATION


Cold
Box
Oxygen
2100 TPD
COS
Hydrolysis
(COS → H2S)
Product
Compressors
18 MW
Gasifier
Water
Scrubber
Flyash &
Chloride
Removal
Biomass
pre-sized
up to 5%
by weight
Water
Coal
2500 TPD
Water
Coal/Water
Slurry
Flyash
& Water
Raw
Syngas
Rod Mill
Radiant
Syngas
Cooler
Convective
Syngas
Cooler
1600 psig
Saturated
Steam
Slurry
Tank
Economized
Boiler
Feedwater
Slurry
Pump
Lockhopper
Slag &
Water

SLURRY ON VIBRATING SCREEN

POLK POWER STATION BIOMASS CO-GASIFICATION

- **INITIAL BLEND MAX 5% BY WEIGHT (8 MW POWER PRODUCTION)**
- **TAX CREDIT FOR CLOSED LOOP BIOMASS FUEL USE**

SUMMARY -IGCC BENEFITS

- **FUEL FLEXIBILITY - OPPORTUNITY FUELS (COAL, PET COKE, BIOMASS)**
- **LOW EMISSIONS (SOx, NOx, PM)**
- **FACILITATES MERCURY AND CO2 REMOVAL**

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