Appendix V
EPRI IGCC Presentations

ELECTRIC POWER RESEARCH INSTITUTE

IGCC Air Emissions and Recent Permit Data

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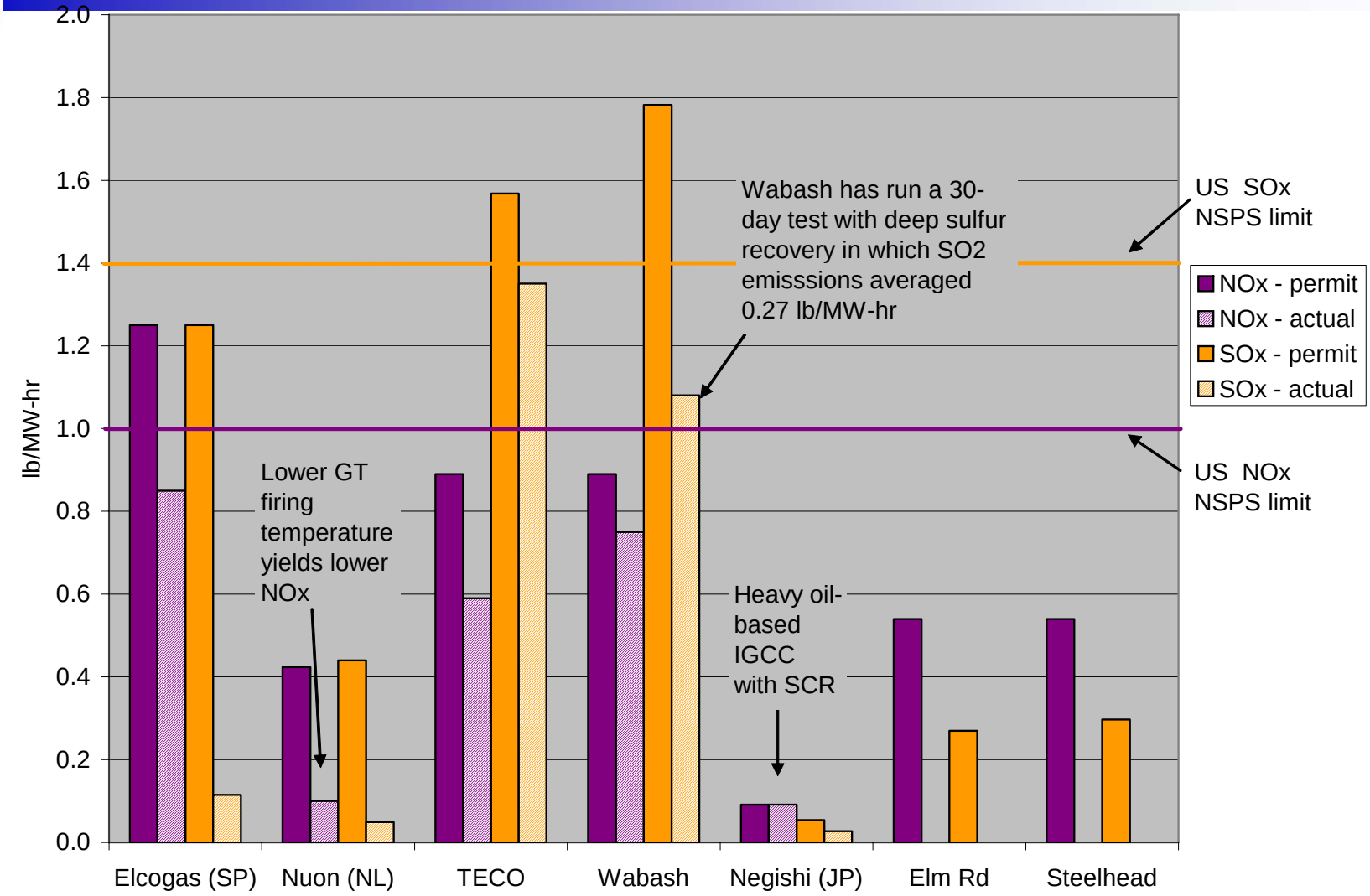
IGCC Permitted & Actual NOx, SOx Emissions

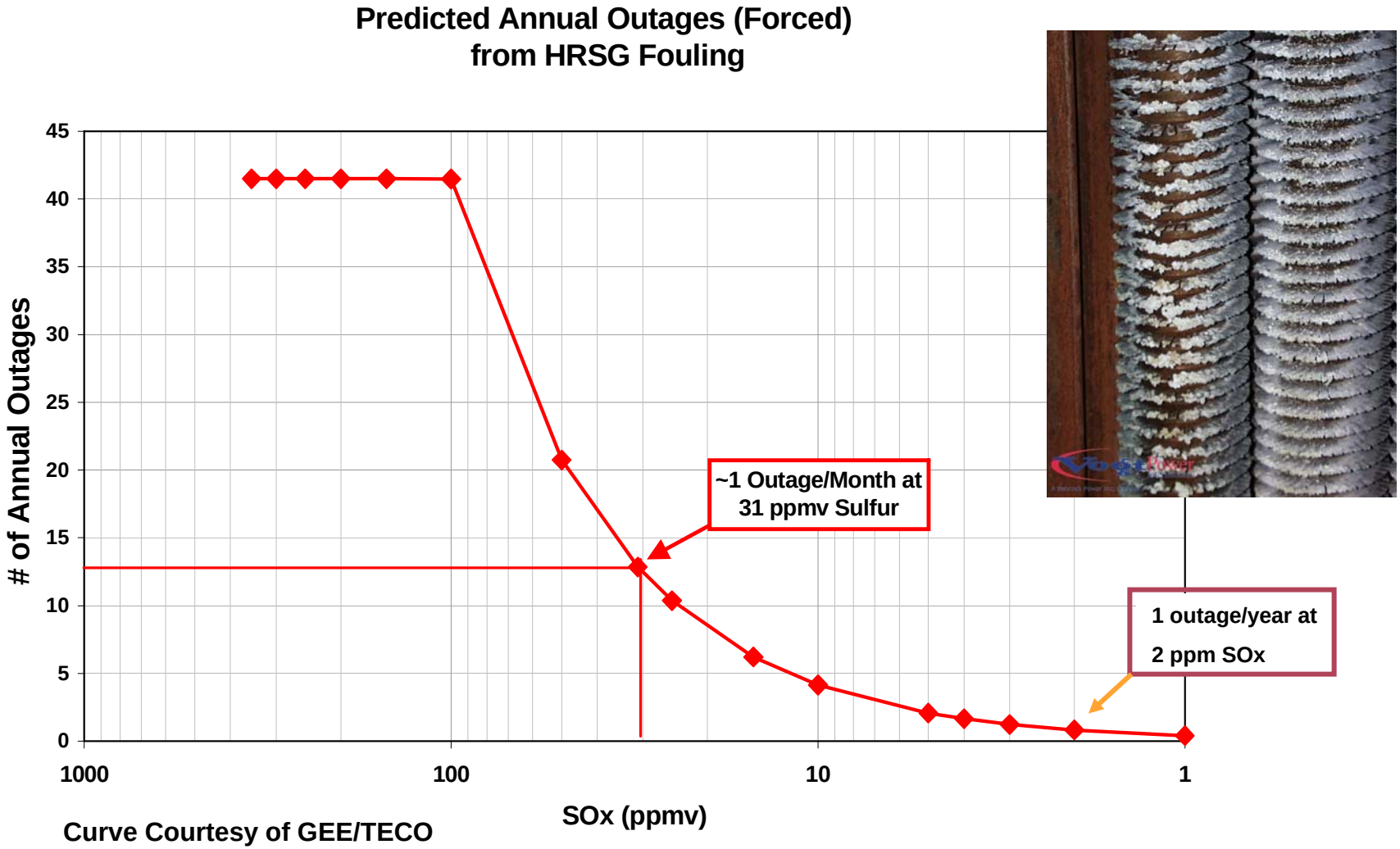
(Emissions for HRSG Stack ONLY)



Design 2 with SCR Revised SG Btus & PM
(Design values – NOT recommended permit levels)

Air Emissions 630 MW net IGCC	lbs/hr/CT	ppmv	lbs/MM Btu HHV to the Gasifiers @ 5,500 MMBtu/hr HHV Gasifier Heat Input	lbs/MMBtu HHV to the CTs @ 4,200 MMBtu/hr HHV CT Heat Input	lbs/Gross MWh @ 788 MW gross output
NOx [12]	38	3.5 dry	0.014	0.018	0.096
SO_2 [12]	16	2 wet	0.006	0.008	0.041
PM (filterable – front half of sampling train)	18	-	0.007	0.009	0.046
Total PM (including condensibles – back half of sampling train)	35.5	-	0.013	0.017	0.090
CO [10]	98	25 dry	0.036	0.047	0.249
UHC as CH_4	16	7 wet	0.006	0.008	0.041
VOC [12]	3.3	1.4 wet	0.001	0.002	0.008
Mercury (Hg)			No more than 10% of the Hg in the gasifier feed will become an air emission	No more than 10% of the Hg in the gasifier feed will become an air emission	No more than 10% of the Hg in the gasifier feed will become an air emission
Ammonia slip [12]		5.0	-	--	-

SCR - Prediction Annual HRSG Washings



Permit Margining for H2SO4 Acid Mist

Acid Mist from an IGCC is well below the 2 ppmv SO3 threshold for a visible "Blue Plume". The UDBS Design 2 with SCR recognizes Acid Mist as being partially or wholly converted to ammonium sulfate and ammonium bi-sulfate

- UDBS Design 2 design basis uses 2.4 lbs/hr/combustion turbine of acid mist based PM based on 15 ppmvd H_2S and COS in the syngas prior to any humidification or dilution and SO_2 to SO_3 conversion rates for the combustion turbine of 5% and 1% for the SCR.
- TECO Energy's suspended Polk Unit 6 IGCC PSD Application discussed this issue for their proposed SCR with a low NOx reduction rate of 40%, concluding that acid mist would be produced at 12.8 lbs/hr/combustion turbine for BACT. This was based on margining the syngas sulfur to 40 ppm and margining the SO_3 conversion rates 40/15 x 2.4 = 6.4 lbs/hr.

  When using the margined 6.4 lbs/hr syngas sulfur conversion then adding a presumed 12 percent rate for assumed SO_3 conversion rate, the result would have a margined level of about 12.8 lb/hr/combustion turbine of acid mist.

Navigating to the IGCC Permits Database

The hard way…..

www.myepri.com
(log in with your EPRI User ID/password)

–My Research Areas
  –Program 66B
    –In the Spotlight – List All
      –Advanced Coal Technologies Knowledge Base B
        –IGCC Permits Database

Navigating to the IGCC Permits Database

The easy way…..

http://igccdb.epri.com

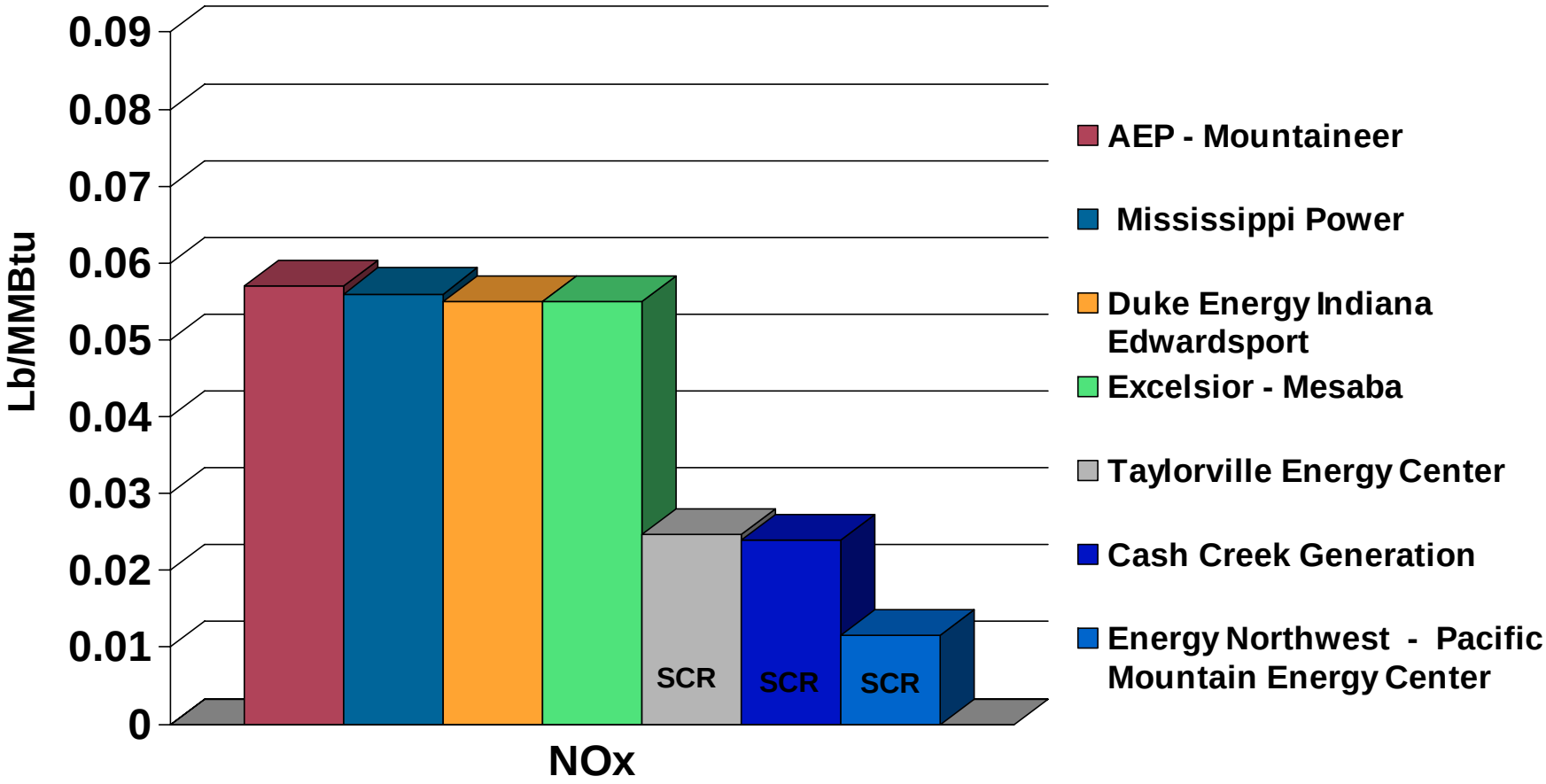
(log in with your EPRI User ID/password)

IGCC Permits Database

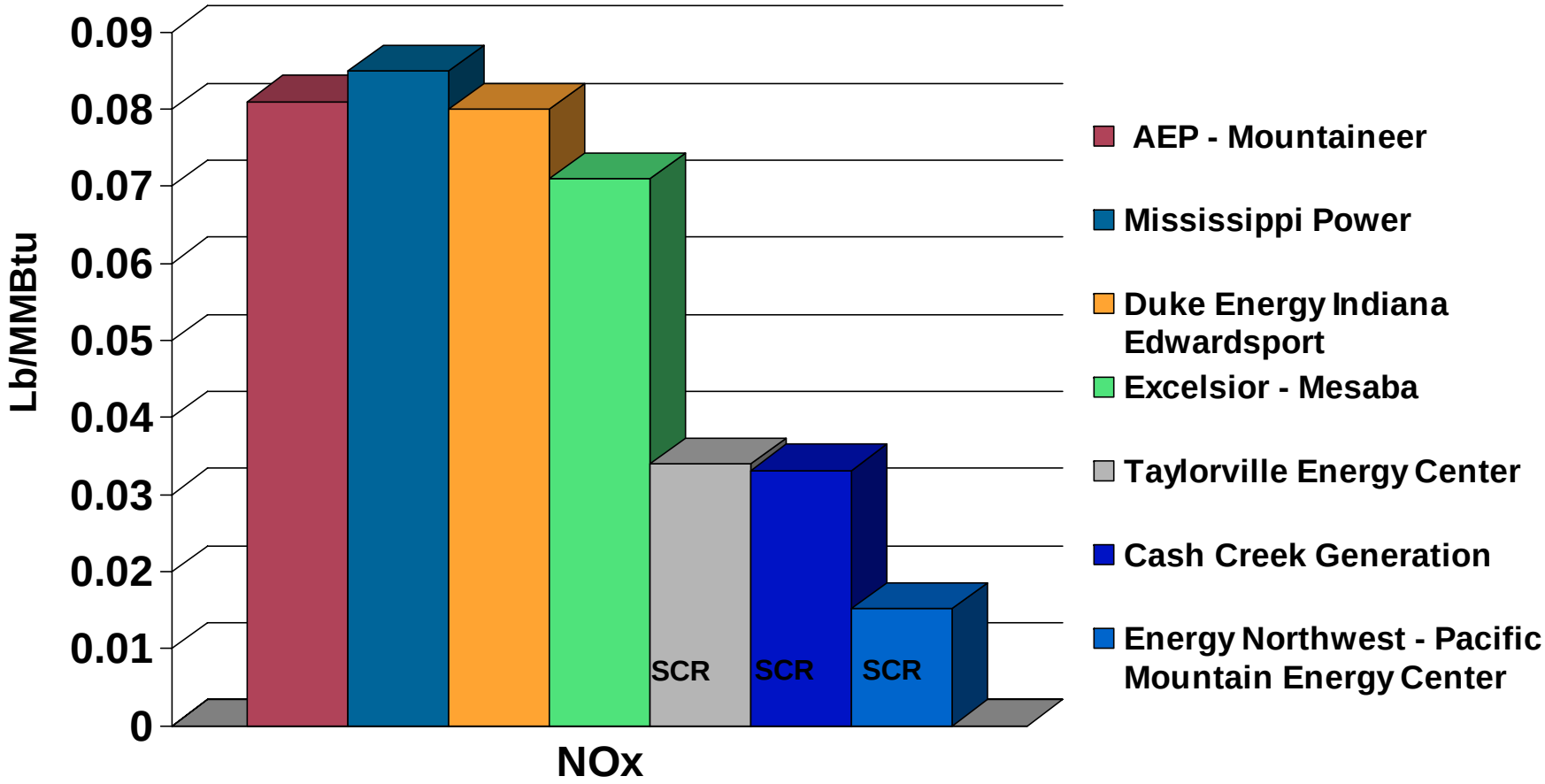
New in the IGCC Permits Database

Facility	Document	Document Date
Cash Creek Generation	Final air permit	January 17, 2008
Edwardsport	Final air permit	January 25, 2008
Hyperion Energy Center	Permit application	December 20, 2007
Mississippi IGCC	Permit application	December 2007
Wabash (Duke Power)	NPDES permit renewal	May 16, 2007

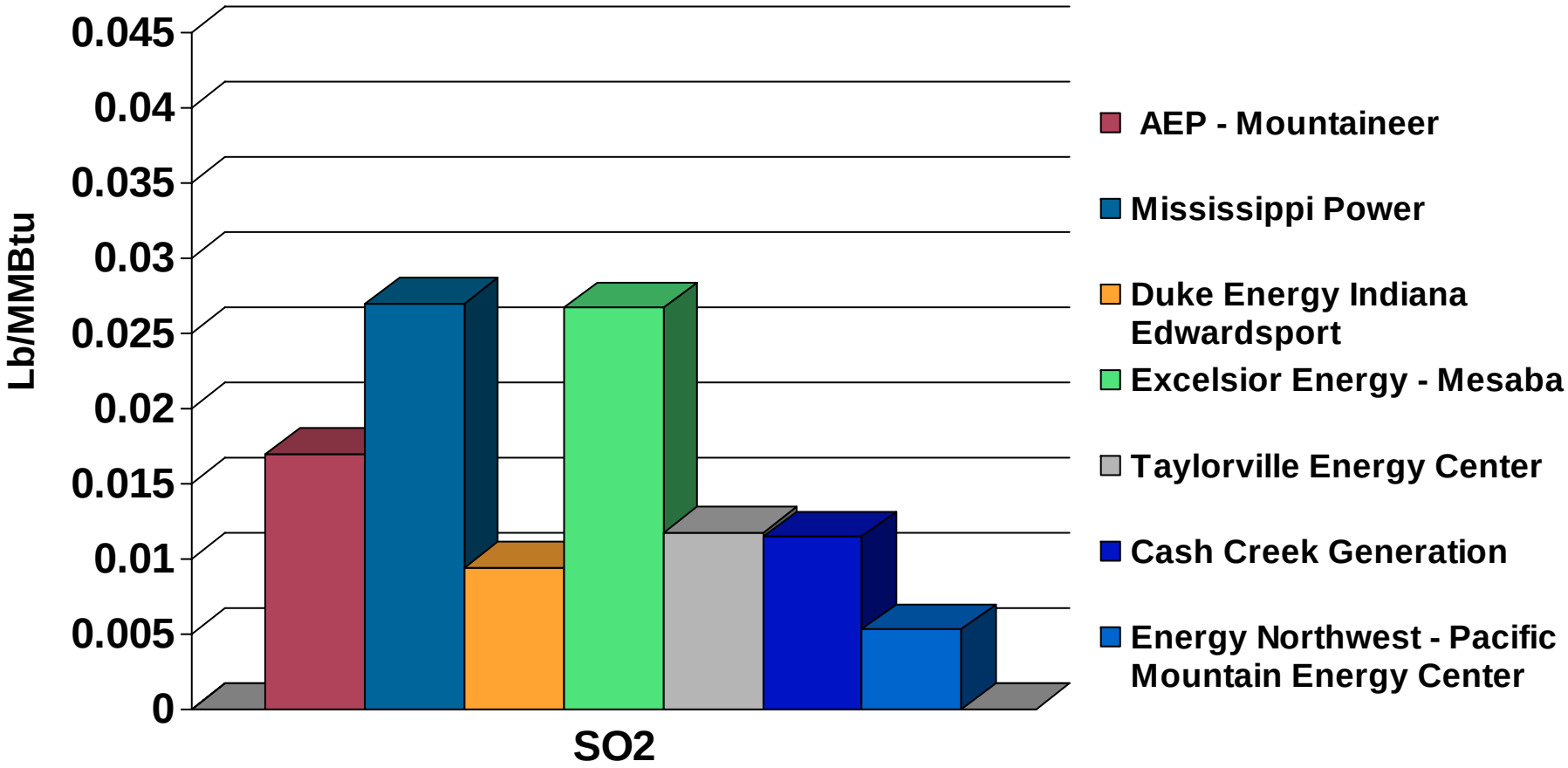
NO_X Emission Rate Comparison Gasifier Heat Input Basis



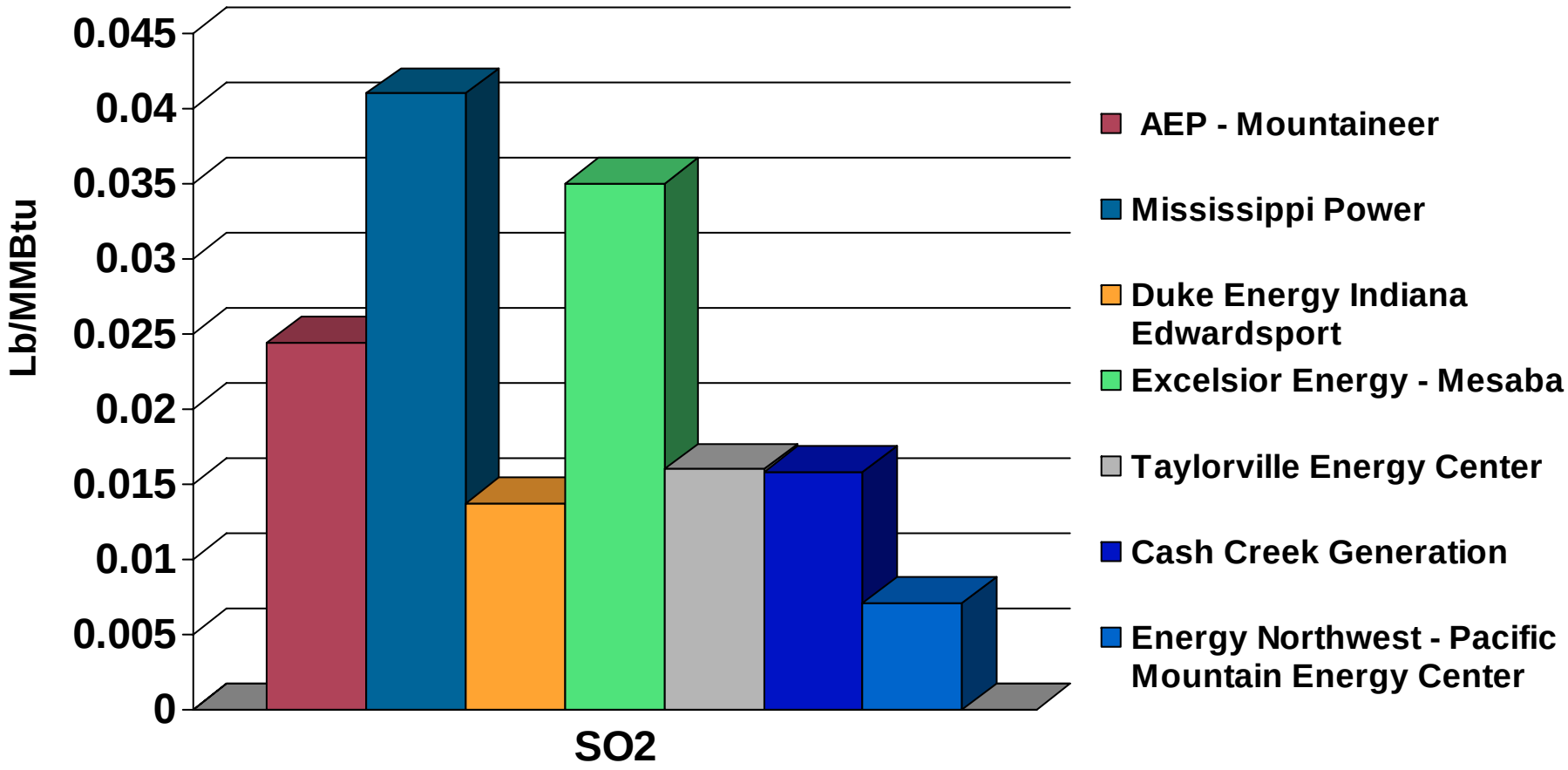
NO_X Emission Rate Comparison
Gas Turbine Heat Input Basis



SO_2 Emission Rate Comparison Gasifier Heat Input Basis



SO_2 Emission Rate Comparison
Gas Turbine Heat Input Basis



Water Usage and Waste Water Handling

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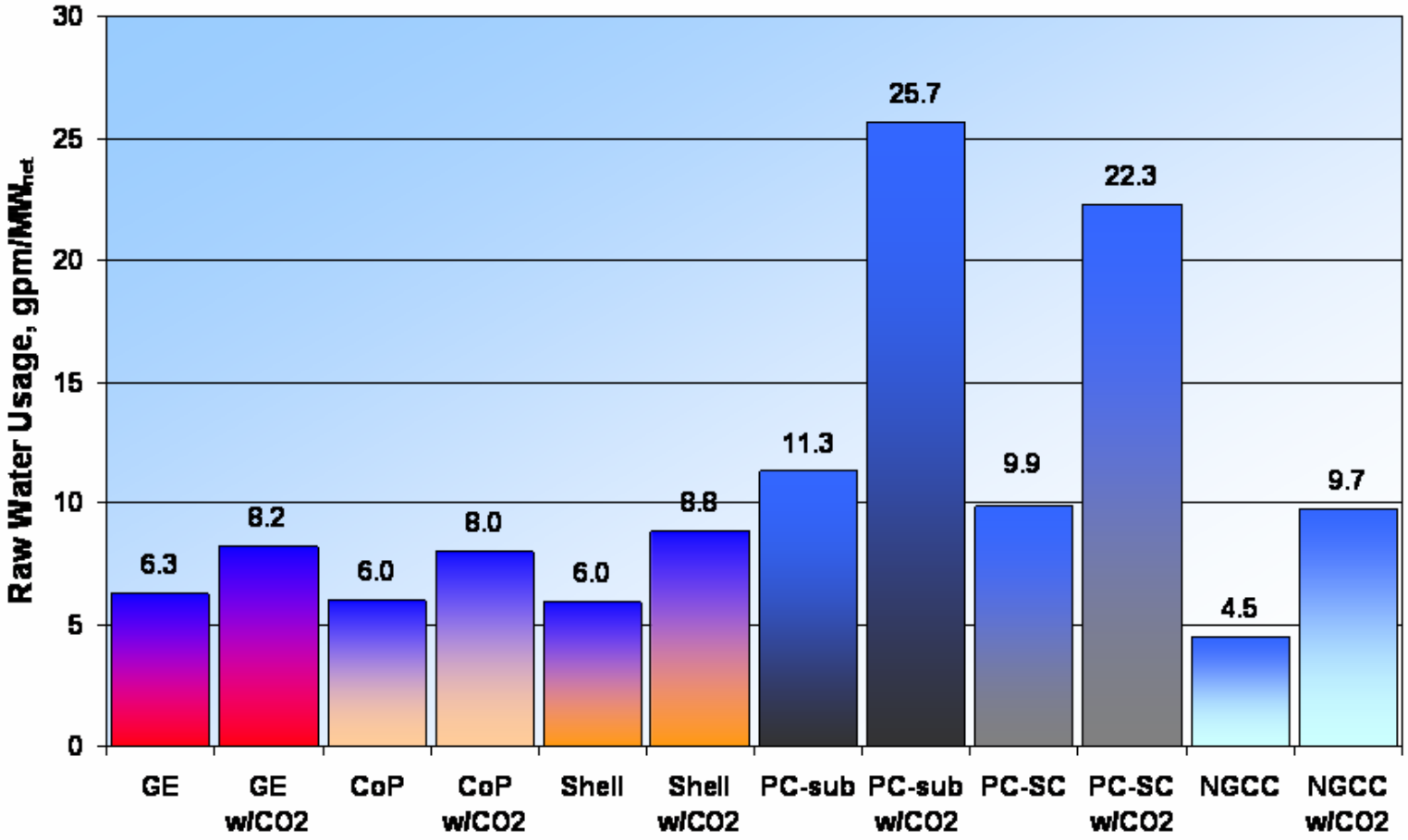
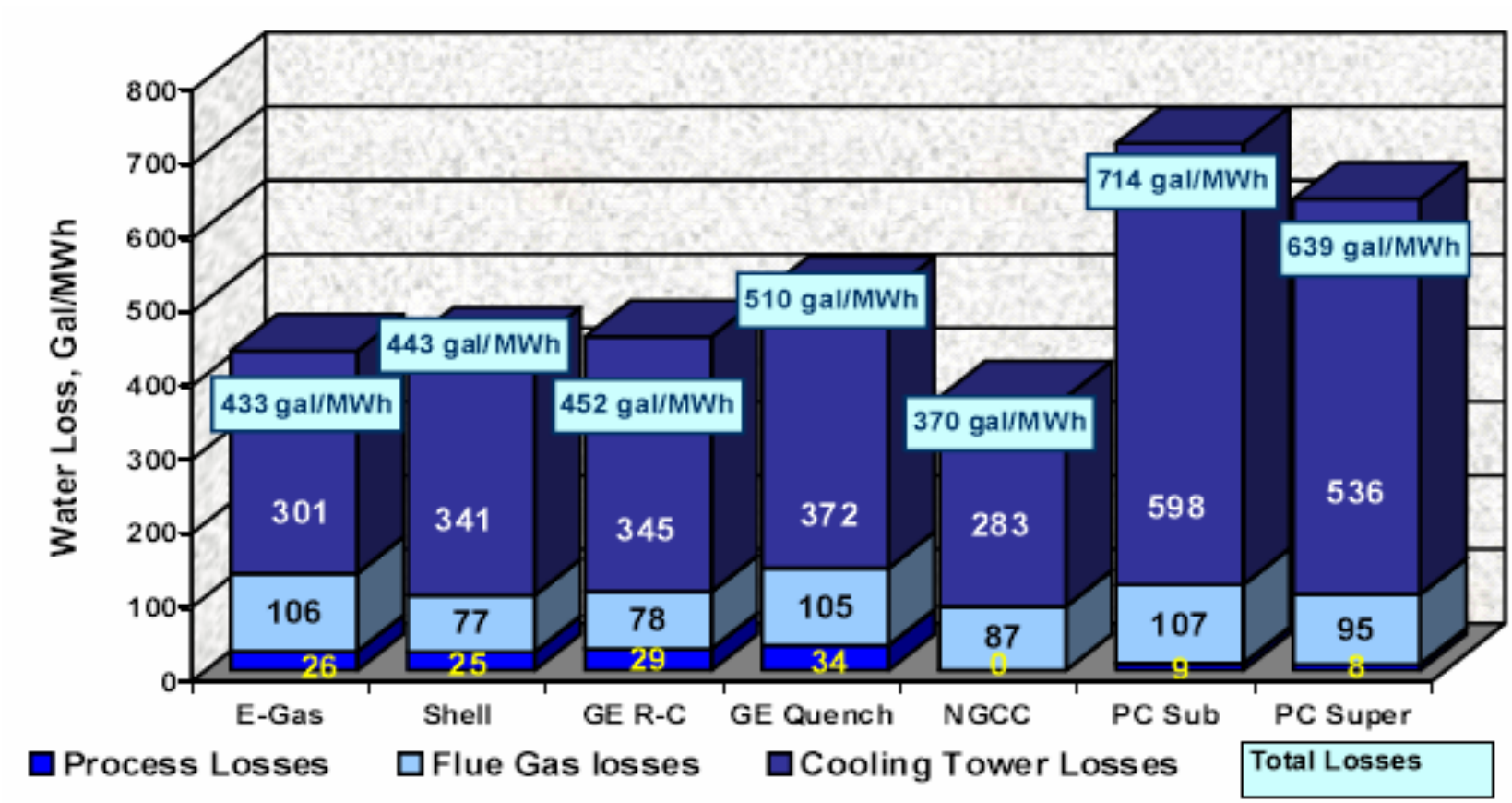
Water Usage w/o- w Capture (DOE May 07 Report – assumes water-cooled steam turbine condenser)



Courtesy of DOE

Water Consumption Details – No CO_2 Capture Cases



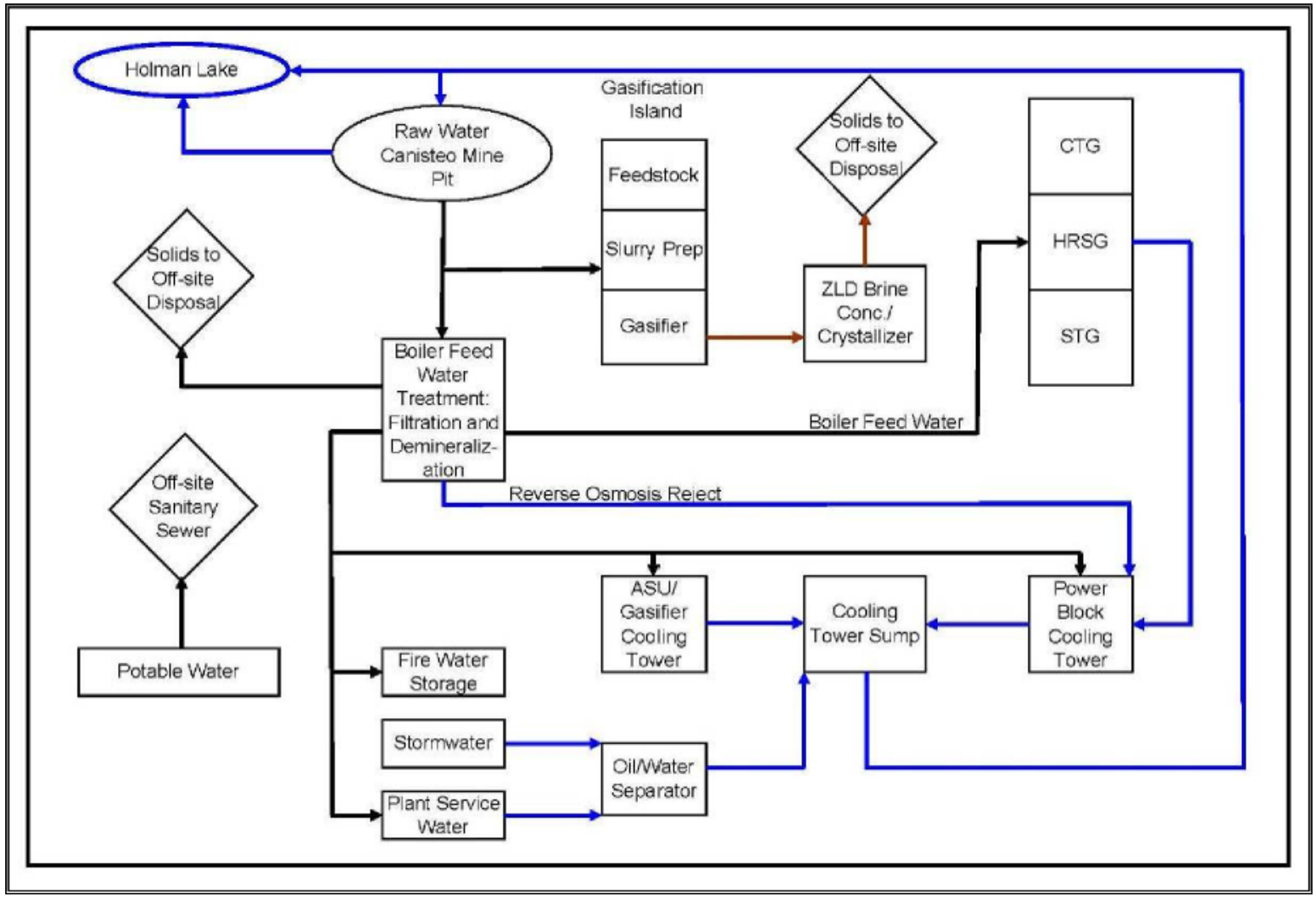
Water Use Quantities for Recent Permits

Table 5-24
Water Use Quantities Submitted in Permit Applications for Several IGCC Power Plants

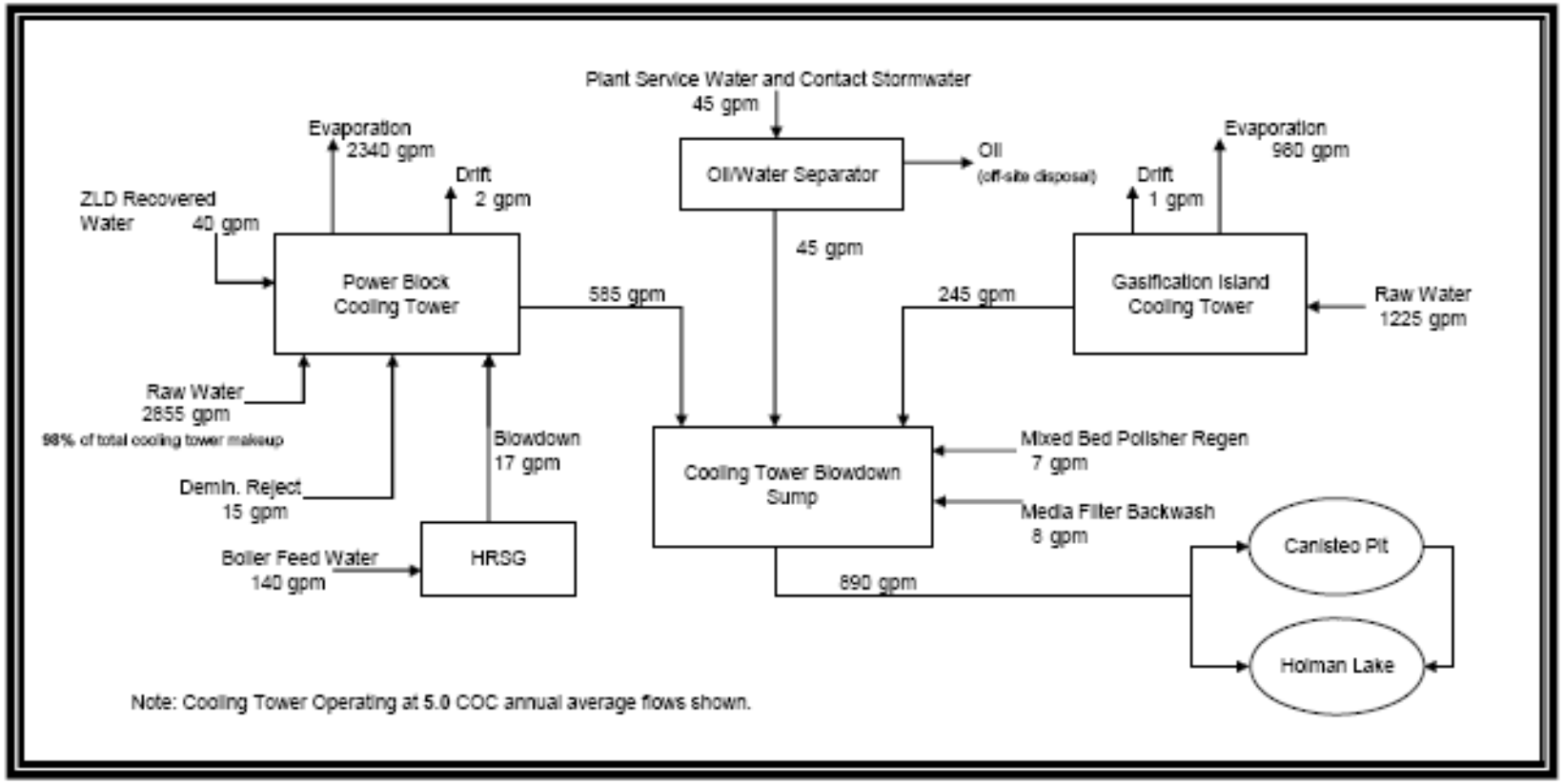
	Excelsior Mesaba	Orlando Utilities Commission Stanton Energy Unit	FutureGen (website)
	Additional detail below:, see page 5-70	*Additional detail below: see page 5-72*	
IGCC Type	CoP E-Gas	KBR Transport	Entrained Flow w/CCS
MW	600	285	275
Feedstock	PRB	PRB	Bit. Coal
Annual Water Use			
10^6 gal/day	6.48*	3.38	4.05
gpm	4000*	2347	2500
gpm/MW	6.67*	8.24	9.09
gal/MWh	450*	494	545
Max/Peak Water Use			
10^6 gal/day	10.53*		
gpm	6500*		
gpm/MW	10.8*		
gal/MWh	731*		

* Above for 8 cycles-of-concentration in gasification and combined cycle cooling towers
For cycles-of-concentration 5 use 1.10 factor over these numbers
For cycles-of-concentration 3 use 1.2875 factor

Mesaba IGCC – Proposed Water Use Flow Diagram (EPRI report 1013342)



Mesaba One: Water Uses Contributing to IGCC Power Station Discharge



Source: EPRI Report 1013342

Waste Water Disposal Options

- Zero Liquid Discharge
  - Produces solid waste product (salt)
- Discharged to surface waters after treatment
  - Typically at least 3 treatment steps before discharge
    - Stripping with steam to remove H2S and NH3
    - Flocculation/Sedimentation to remove solids and metals
    - Biological treatment to remove organics
- Deep Injection Wells
  - Follows EPA UIC protocol

Water Source/Disposal for Existing IGCCs

	Raw Water Source	Cooling Water Source	Waste Water Discharge
TECO Polk	On-site wells	Cooling pond	None, ZLD
WVPA Wabash River	?	River	None, ZLD
Nuon Buggenum	River	River	None, ZLD
Elcogas Puertollano	Lake	Evaporative Cooling Tower	River post treatment

Water Source/Disposal for Proposed IGCCs

	Raw Water Source	Cooling Water Source	Waste Water Discharge
Duke Edwardsport	On-site wells	Evaporative Cooling Tower	Deep Well Injection
Excelsior Energy Mesaba	Abandon Mine Pits	Evaporative Cooling Tower	ZLD, mine pit, lake
Nuon Magnum	Harbor/De-salination Unit	Harbor	Estuary post-treatment
Southern/OUC Stanton	On-site wells	Evaporative Cooling Tower	On-site ash landfill & WWT