

Steam Coal vs. Pet Coke Updates and Usage Comparison

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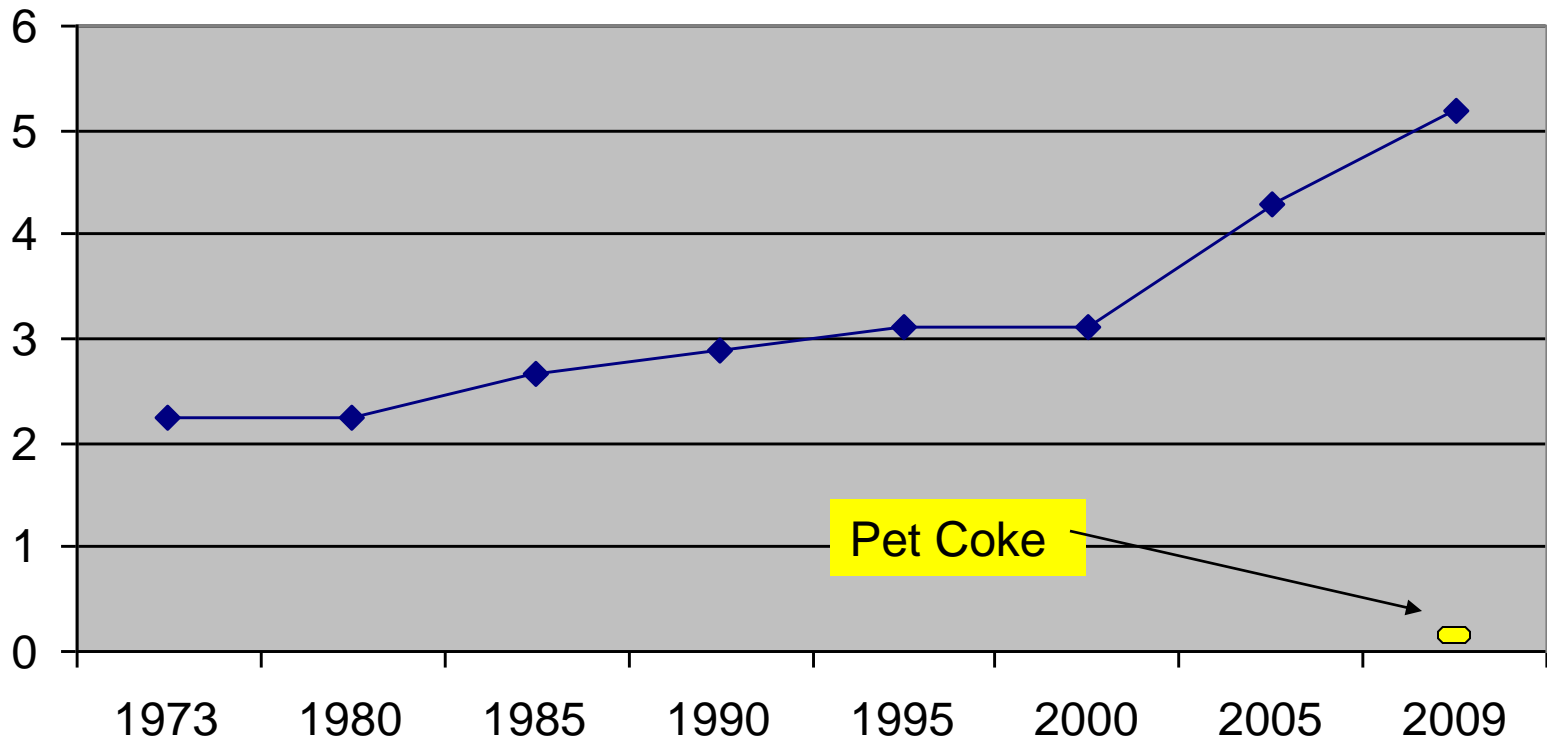
Steam Coal vs. Pet Coke Updates and Usage Comparison

Updates: 2009 steam coal production, consumption and trade (from the 2010 IEA Coal Information book for 2009 Coal Data)

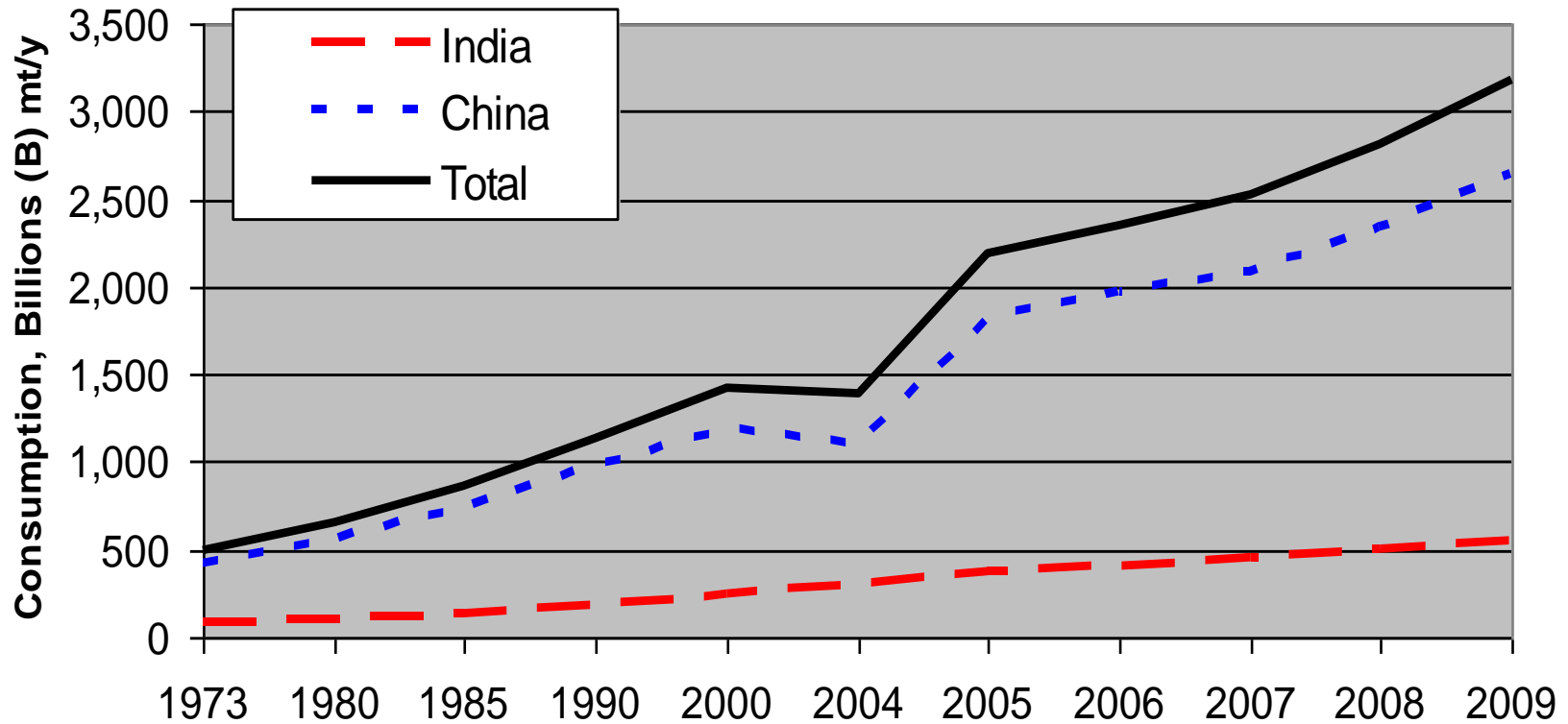
Usage: Power Plant's Decision on Buying Pet Coke to Blend with Coal



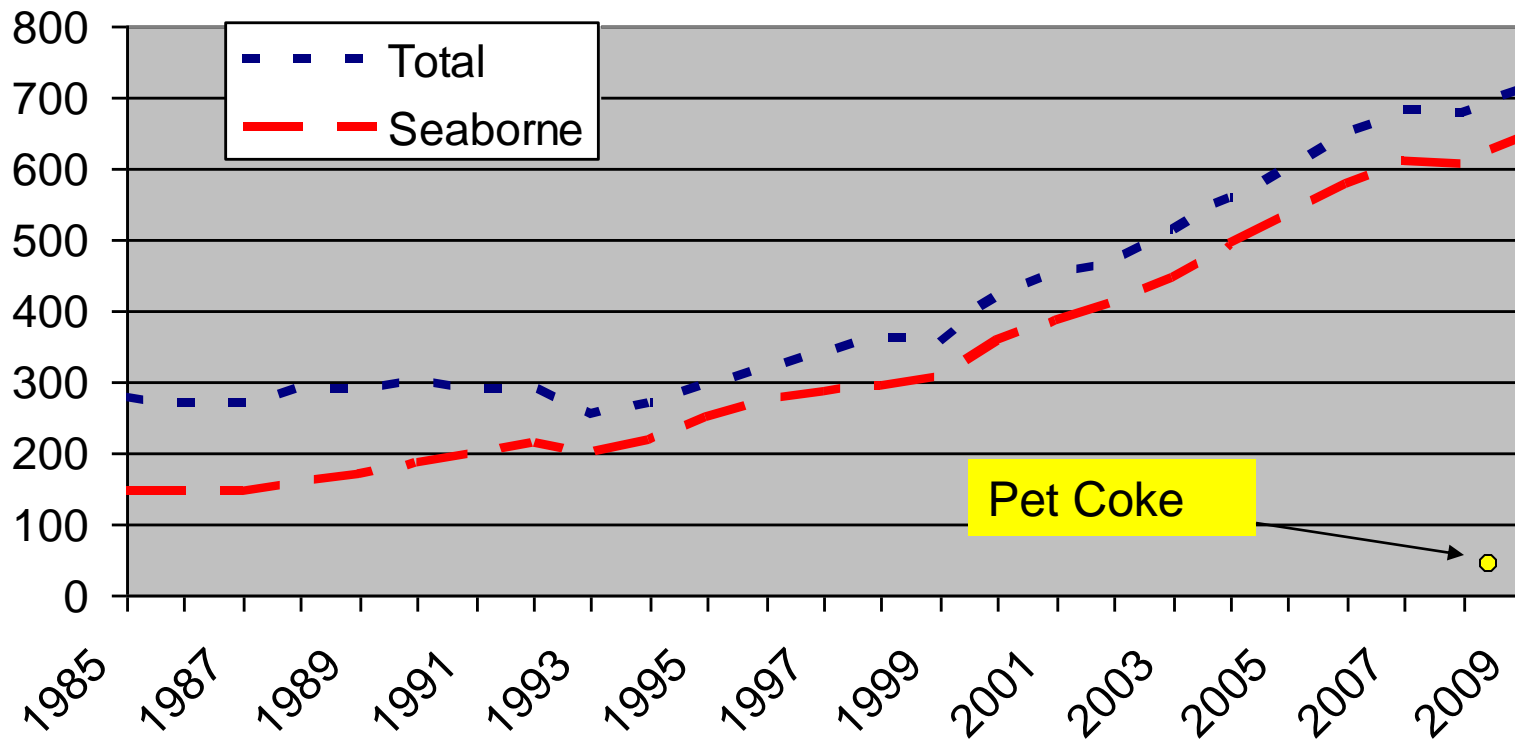
World Steam Coal Production B MT/y 1973-2009



China and India Steam Coal Consumption, 1973-2009



Global Steam Coal Trade, MM mt/y 1985-2009



Steam Coal vs. Pet Coke

Major Trade Pattern Changes, 2008 vs 2009 mm t/y

Importers:

- **China** Was 23 export, now 81 import, change of 104
- **India** Was 29 import, now 97 import, change of 68

Exporters:

- **Indonesia** Was 143 export, now 200 export, change of 57
- **Russia** Was 46 export, now 83 export, change of 37
- **Australia** Was 115 export, now 136 export, change of 21

Largest Steam Coal Producers

MM met tons

Memo: World
production = 5,196
MM met tons in
2009

	2008	2009	Change
China	2350	2560	210
USA	950	872	-78
India	463	440	-23
So Africa	250	246	-5
Indonesia	185	234	49
Australia	185	205	19
Russia	168	173	5
Eur (IEA)	111	106	-5
Kazakhstan	91	84	-7
Colombia	73	72	-1
Ukraine	39	37	-3
Vietnam	39	42	-3
DPR Korea	25	29	3
Subtotal	4930	5097	167

Largest Steam Coal Consumers

MM met tons

Memo: World steam
coal consumption =
5,163 MM mt in
2009

	2008	2009	Change
China	2327	2640	313
US	937	842	-95
India	492	536	45
Eur (IEA)	273	248	-25
So Africa	173	179	6
Japan	128	112	-16
Russia	122	90	-32
Korea (So)	81	86	5
Australia	70	68	-2
Kazakhstan	64	62	-2
Taiwan	60	57	-3
Indonesia	42	34	-8
Ukraine	36	36	0
DPR Korea	26	26	0
Total	4830	5015	186

Largest Changes In GPC Exports from US

K MT

Country	2008	2009	change
Mexico	4,980	2,024	-2,956
Japan	3,143	3,109	-34
Brazil	2,543	1,795	-748
Spain	2,202	1,990	-212
Italy	2,038	1,724	-314
Canada	1,942	1,661	-281
Morocco	798	539	-259
Turkey	734	1,574	840
Netherlands	637	351	-286
Australia	595	592	-3
India	569	1,819	1,250
Portugal	464	374	-90
France	444	429	-15
UK	417	409	-8
Chile	355	430	75
China	352	2,391	2,039
Totals	22,213	21,211	-1,002

Steam Coal vs. Pet Coke

Updates Summary

- Coal demand lower everywhere except in India and China
- Coal supply increasing from Indonesia, Australia, shrinking from US
- Result is shifting trade patterns towards Asia Pacific and away from Atlantic
- USGC pet coke trade patterns also shifting towards Asia Pacific
- Expect pattern to continue unless China/India stop growing or adopt the climate change fervor

Changes in Steam Coal Exports and (Imports) MM met tons

	2008	2009	More exports	Less exports	Less Imports	More imports
Exporters:						
So Africa	78	66		11		
Russia	46	83	37			
Kazakstan	27	22		5		
Indonesia	143	200	57			
Colombia	73	69		4		
USA	13	30	17			
Australia	115	136	21			
Importers:						
India	-29	-97				67
Japan	-128	-112			16	
Eur (IEA)	-162	-142			20	
Exp to Imp: China					23	81

Steam Coal vs. Pet Coke: What do I buy?

A look at a Power Plant's decision
process

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Steam Coal vs. Pet Coke

The choices for my plant

90/10 blend:

- 60k mt USGC 4 % S Pet Coke
- 540 k mt So African Steam Coal (RB1)

vs.

100% So African Steam Coal (RB1)

- 600k mt RB1 (adjusted for MW-Hr)

What are savings in MM \$ for the 90/10 blend?



Steam Coal vs. Pet Coke

Do a plant test burn first!

- **Heat Rate effects of a blend**
 - Better: higher pet coke BTU lowers HR
 - or
 - Worse: Loss On Ignition –LOI raises HR
- **Sulfur removal costs**
 - Reduced SO₂ credits,
 - more limestone, NH₃, power
- **CO₂ Penalties**
- **Ash Value effects**
 - Better: Lime (CaO) makes it more valuable
 - or
 - Worse : carbon carryover makes it harder to sell



Steam Coal vs. Pet Coke

After the test burn

- **Run calculations using current coal, coke prices and freight of each**
- **If savings, is it enough to cover the “intangibles”**



Steam Coal vs. Pet Coke

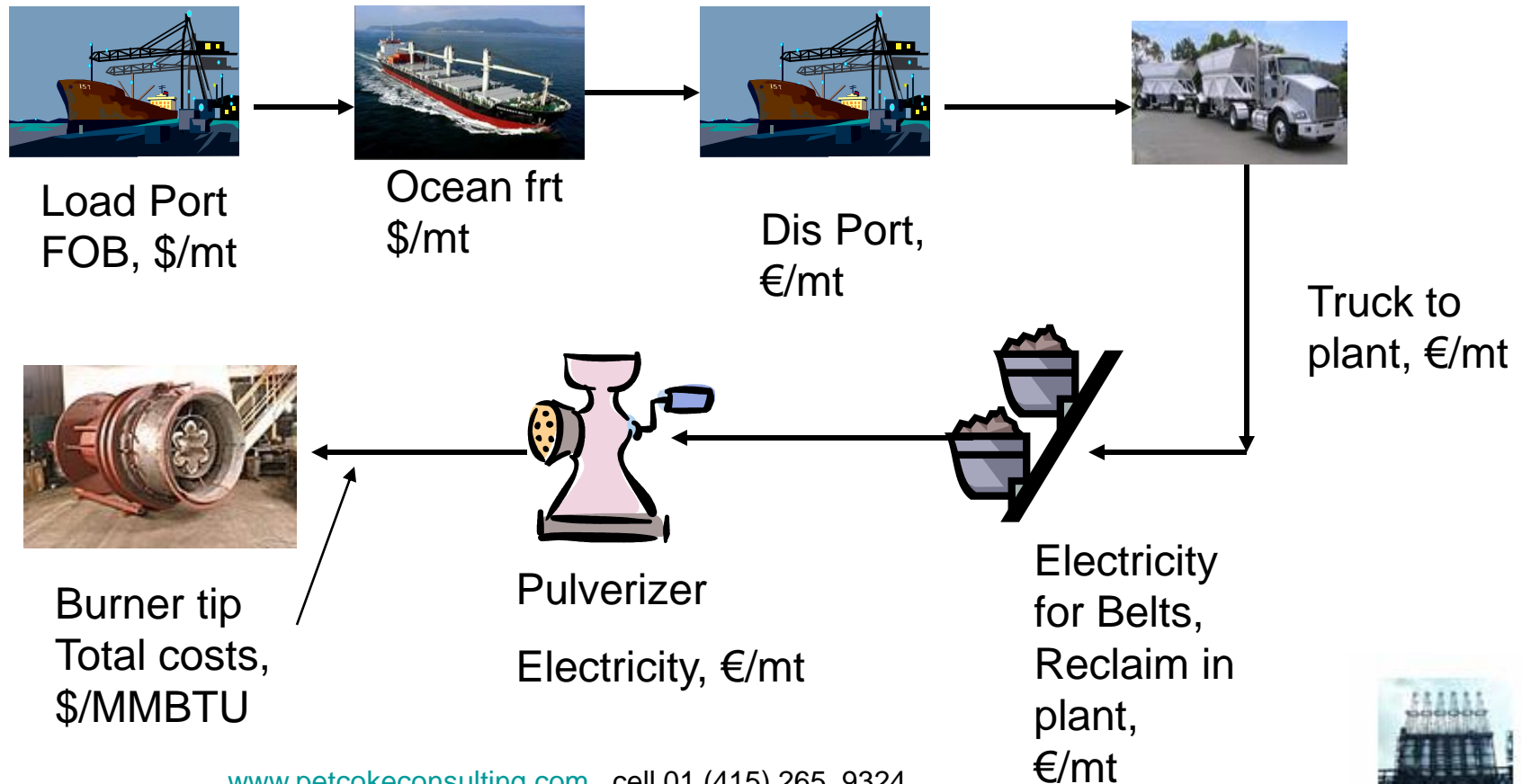
Power Plant Major Assumptions:

- Northern Europe (near an ARAGT terminal)
- Truck both from terminal to plant
- Conventional PC boiler designed for RB1 that can burn 10% pet coke (with some associated LOI)
- Assumed effects for the Blend are:
 - Heat Rate increases (boiler efficiency drops)
 - CO2 Penalty for pet coke incurred
 - Ash value decreases
 - Sulfur Removal costs increase



Steam Coal vs. Pet Coke

First Calculation: Cost to burner tip



Steam Coal vs. Pet Coke

Fuel Comparison, CIF at Disport

	So African Steam Coal RB1	USGC pet Coke
FOB Price, \$/MT	80	85
Ocean freight, \$/mt	20	15
Calorific, BTU/lb, AR	10,800	14,200
Calorific, KG/kcal, AR	6,000	7,889
Sulfur, %	1	4
Ash, %	15	0.5
HGI	60	40
Memo CIF price to dis port, \$/MMBTU	\$4.20	\$2.91
Memo % of CIF at Disport on \$/MMBTU basis	69.0 %	



Steam Coal vs. Pet Coke

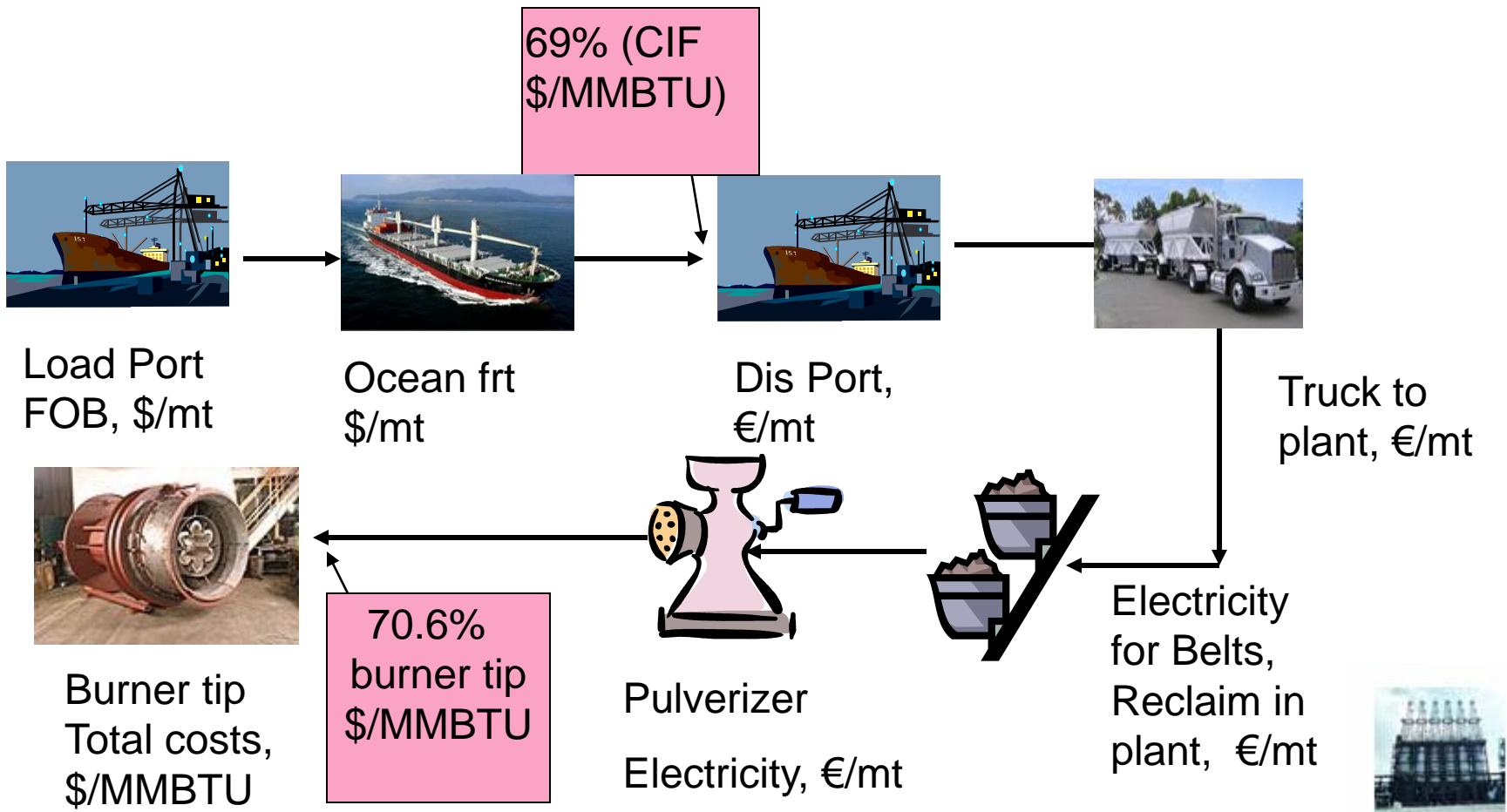
Fuel Comparison, Disport to Burner Tip

	So African Steam Coal RB1	USGC pet Coke
Terminal In/Out	€10/mt	€10/mt
Truck to Terminal	€3/mt	€3/mt
Electricity for Belts in yard	€0.50/mt	€0.50/mt
Electricity for Pulverizer	€0.50/mt	€1.00/mt
Exchange rate, € to \$	1.25	1.25
Cost to Burner tip, \$/MM BTU	\$4.93	\$3.49
Memo % to burner tip	70.6%	



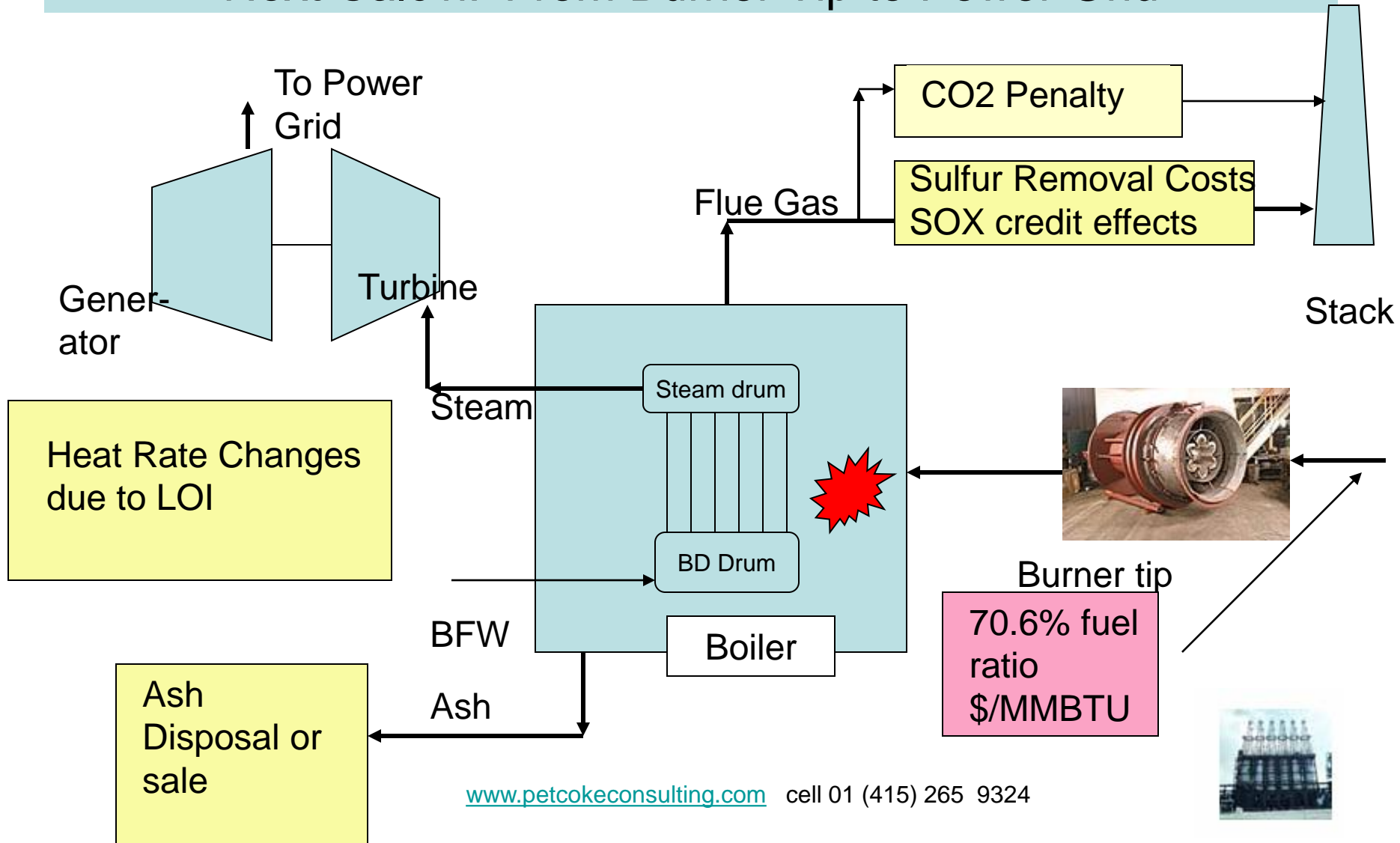
Steam Coal vs. Pet Coke

Fuel Cost Ratio at burner tip, \$/MMBTU



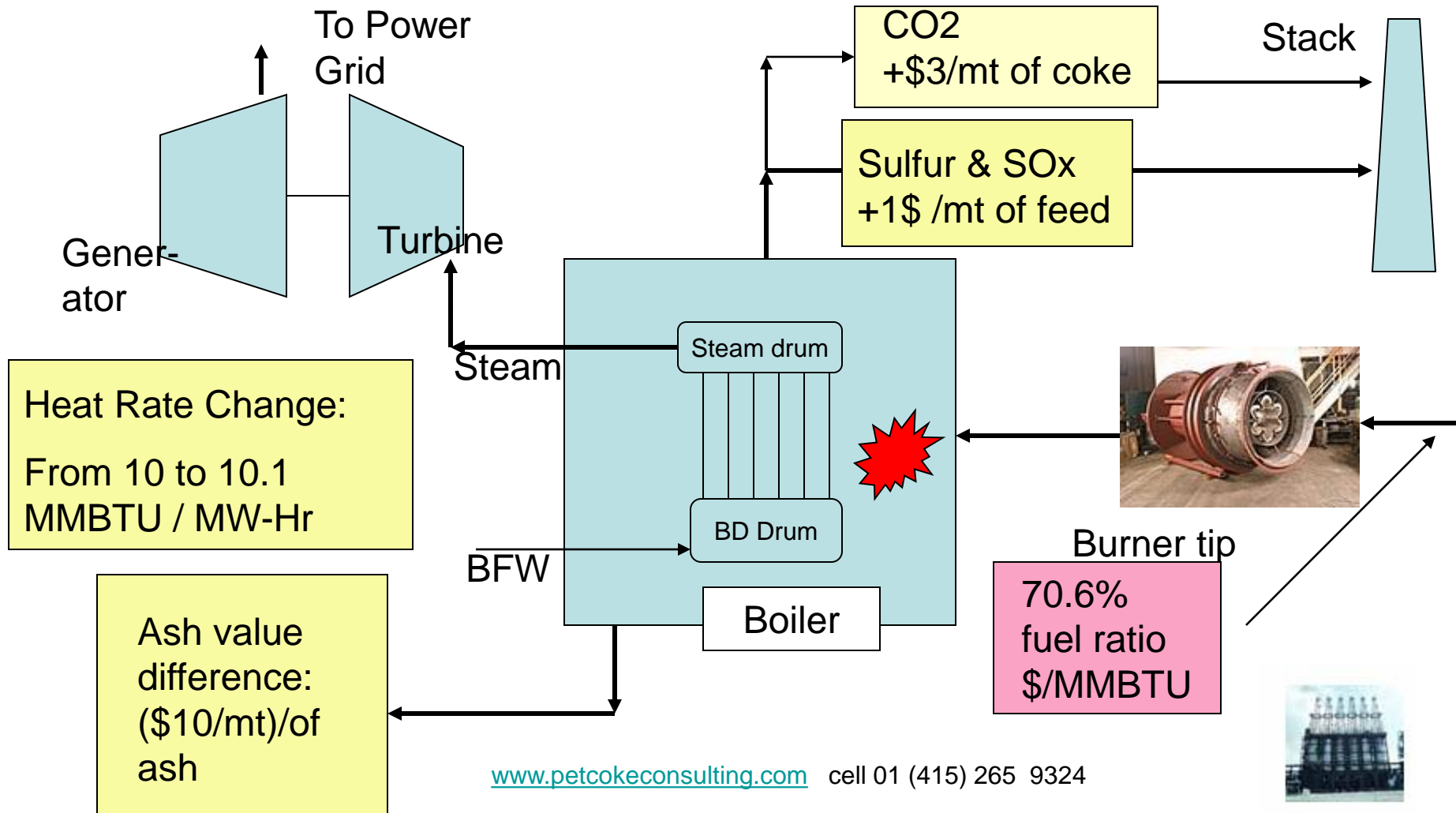
Steam Coal vs. Pet Coke

Next Calc'n: From Burner Tip to Power Grid



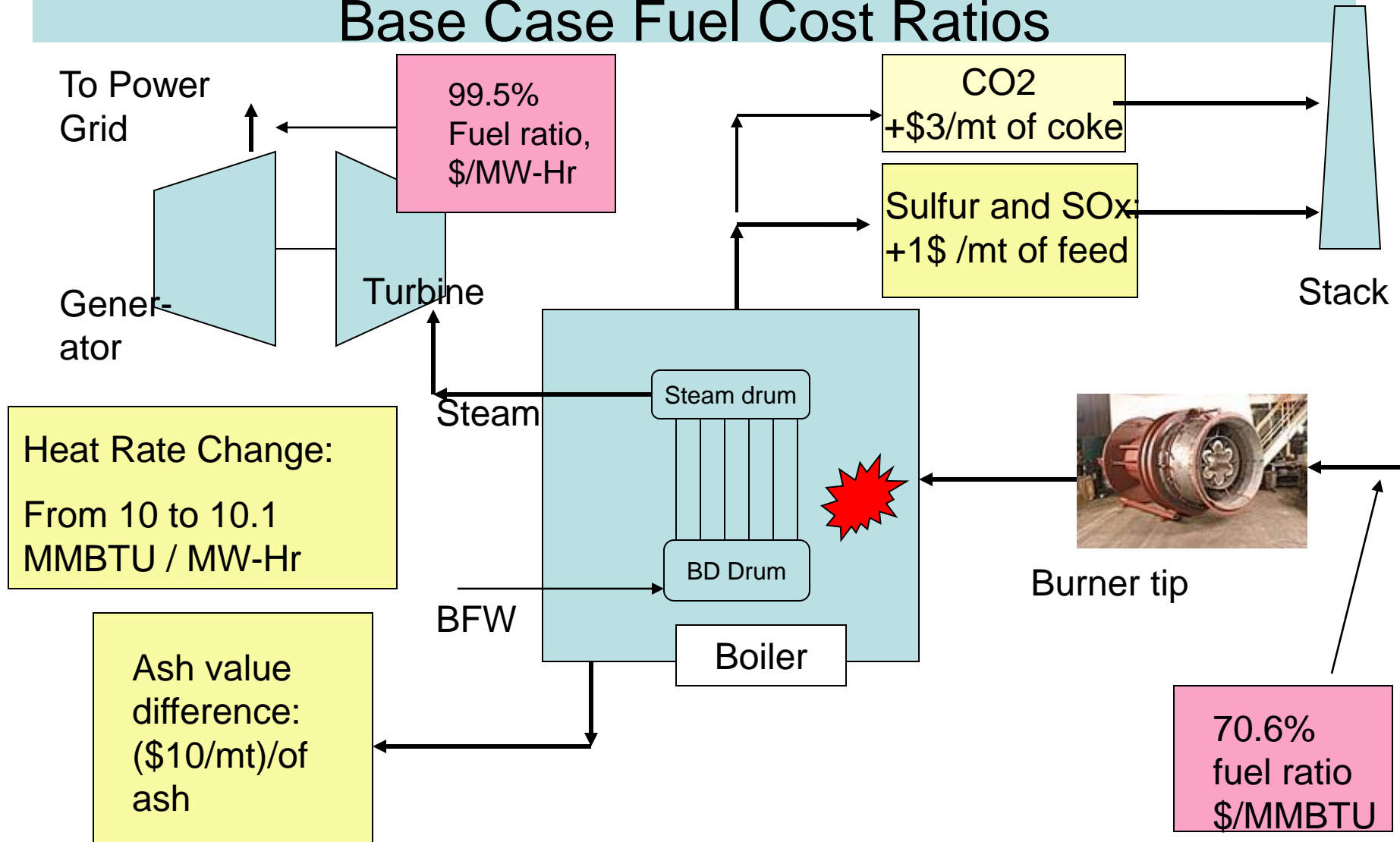
Steam Coal vs. Pet Coke

From Burner Tip to Power Grid, Base Case Parameters



Steam Coal vs. Pet Coke

From Burner Tip to Power Grid, Base Case Fuel Cost Ratios



Steam Coal vs. Pet Coke

Base Case Results

Base Case Savings **\$0.368 MM** at 99.5% final fuel ratio on \$/Mw-hr basis

OK, but is it enough to overcome “intangibles”:

- More training of operators to handle pet coke blend
- Manage one more supplier
- Stock accounting complexity
- “Blame Game” for any plant problem whether fuel related or not



Steam Coal vs. Pet Coke

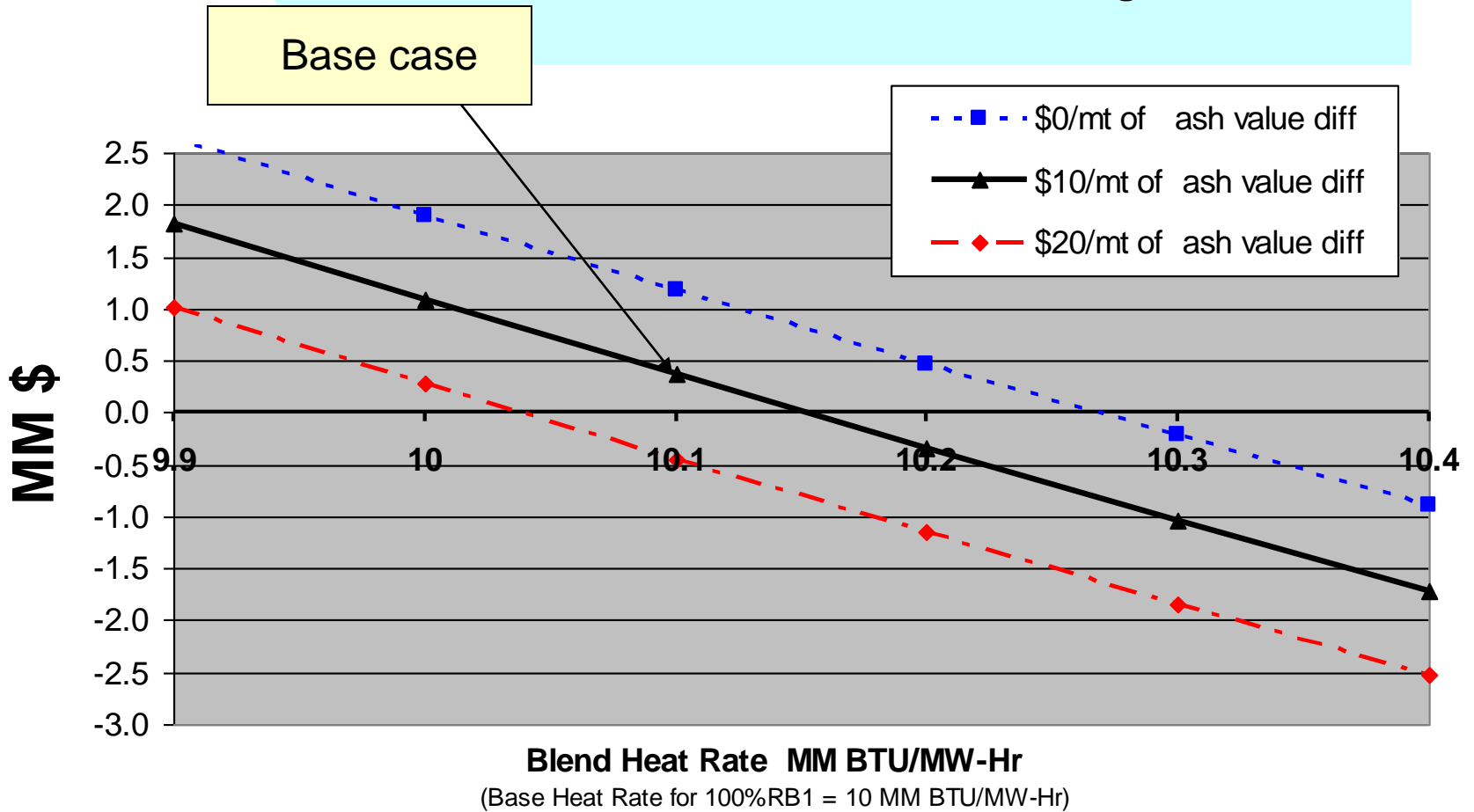
Sensitivity Cases

	90/10 Blend	Other cases
Ash Values		Another \$10 decrease ash reduction in value
Sulfur Removal Costs		Another \$1/mt of Blend increase in cost
CO2 Penalty		Another \$3/MT of pet coke
Heat Rate, MMBTU/Kw-Hr	9.9- 10.4	



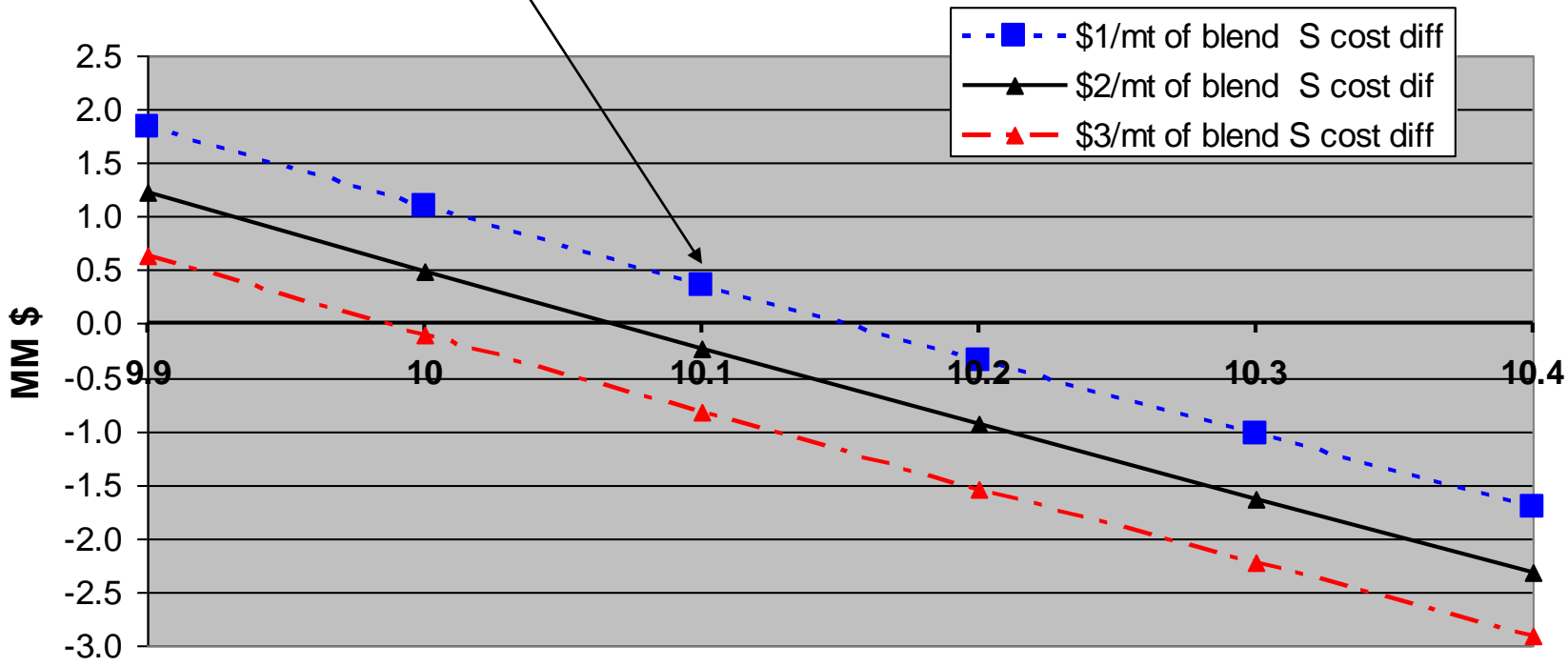
Ash Value Sensitivity

90/10 Pet Coke Blend Savings/(Loss) vs 100% RB1 Steam Coal for a 60 k mt Pet Coke USGC cargo



**Sulfur Removal Cost Sensitivity
90/10 Pet Coke Blend vs. 100% RB1 Steam Coal
for A 60k mt of USGC Pet Coke cargo**

Base Case



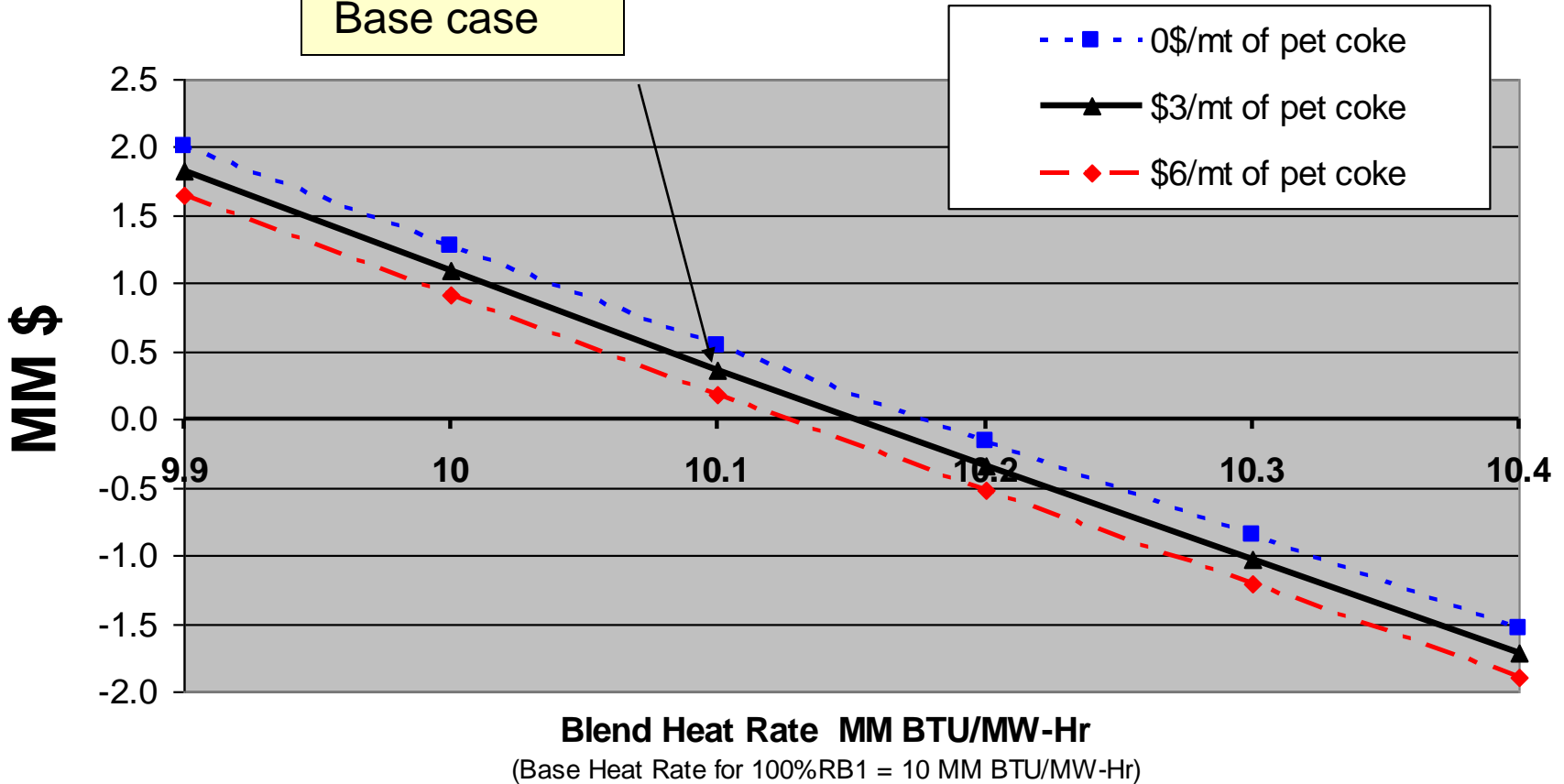
Blend Heat Rate in MM BTU/ MW-Hr

(Base Heat Rate for 100%RB1= 10 MM BTU/MW-Hr)

CO2 Penalty Sensitivity

90/10 Pet Coke Blend Savings/(Loss) vs 100% RB1 Steam Coal for a 60 k mt Pet Coke USGC cargo

Base case



Steam Coal vs. Pet Coke

Summary

- DO A PLAN TEST BURN FIRST!!!
- Likely need lower than 70% price ratio of fuel on CIF \$/MMBTU basis to make a 90/10 blend work
- Even then, LOI (ash value and Heat rate effects), CO2 Penalties and S removal costs can ruin the economics
- Even if economics OK, still are the “intangibles”

