Assessing the Economic Potential of IGCC with Liquid Sparing

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Presentation Overview

- Study objective
- Problem definition / background
- Approach
- Results
- Concussion

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Study Objective

- Examine the potential for revenue Enhancement of an IGCC using a spare gasifier train
  - Maximize asset productivity
  - Meet 85 – 90% power plant availability
  - Generate liquid fuel when spare gasifier train capacity is not for power production

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Problem Definition / Background

- Electric power sector facing a number of uncertainties while they are forced to make investment decisions to meet future demand:
  - Volatile natural gas prices
  - Looming environmental regulations -- Complex legal issues
  - Changes in fuel market
  - Market deregulation

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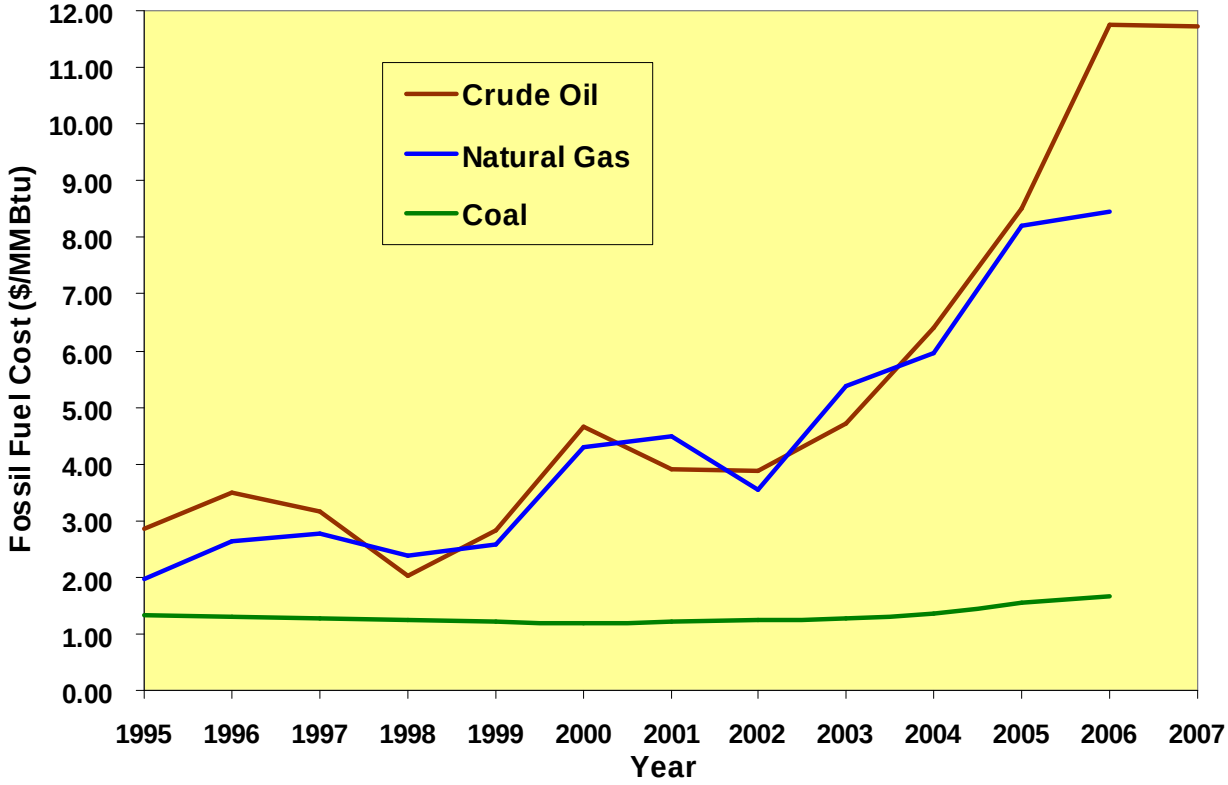
Problem Definition / Background



All prices are annual average delivered prices to U.S. generating facilities except for crude oil which is the U.S. annual average well head price. Source: Table 9.10, Monthly Energy Review, June 2006, EIA and Annual Average U.S. Wellhead Prices, USDOE.

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Problem Definition / Background

- Low, stable coal prices
- Domestically available -- transportation / Jones Act
- New coal generation options
- Project sponsors are considering coal again

Whether new investments are in traditional pulverized coal or next Generation advanced technologies could have enormous implications for the nation's environmental and security future.

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Problem Definition / Background

- Why IGCC?
  - Allows production of power, chemicals, and liquid fuels.
  - Could offset petroleum consumption in the transportation sector.
  - Provides the most technologically robust and cost-effective process for capturing and collecting CO_2.
  - Gasification has matured and IGCC is maturing.

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Problem Definition / Background

- 85+% availability of the gasifier is the major uncertainty – refractory replacement.
- 3 train gasifier (2 + 1 Spare) system can drive availability for power generation to 85+% while assuming 2 year refractory life and 5% plant forced outage.
  - 96+% availability with spare gasifier.
  - 92% availability with single train.

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Approach

- 3 train gasifier IGCC
- Nominal 500 MWe
- F-T technology
- Used NETL Gasification Plant Cost and Performance Optimization Study to develop cost estimates
- Compared costs with other published data -- Polk, Southern Co. IGCC project, Mesaba IGCC project
- Evaluated various project financing structures

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Design Basis

Plant Type	PC Plant	IGCC	IGCC with Spare
Design Capacity, MWe	550	577	627
Auxiliary Power, MWe	55	66	75
Net Capacity, MWe	495	511	552
Liquid Fuel Production, bpd	0	0	3,766
Sulfur Production, tpd	0	118	199
Coal Consumption, tpd	5,467	4,793	7,189
Average Plant Efficiency, %	34	40	42
Number of Boilers/Gasifiers	1	2	3

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Economic Assumptions

Financing Structure	IPP	Leveraged	GenCo	IOU	MOU
Interest on Debt, %	8	6	6	6	5
Term, Year	15	15	15	30	30
Debt Service Reserve	6 months	None	None	None	None
Interest on Debt Service Reserve, %	5	None	None	None	None
Debt, % total capital	70	80	35	47	100
Equity, % total capital	30	20	65	53	0
Plant Life, year	20	20	20	30	30
Depreciation, Year/ Method	20/ Straight Line	20/ Straight Line	20/ Straight Line	6/ Accelerated	6/ Accelerated
Income Tax	38%	38%	38%	38%	None
Inflation	None	None	None	None	None
IRR (Equity), %	12	12	12	None	None
Annual Return on Stock					
Preferred Stock	None	None	None	5.50%	None
Common Stock	None	None	None	9.00%	None

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Capital Costs

Plant Type	PC Plant		IGCC		IGCC with Spare	
Financing Structure	IPP	Leveraged, GenCo, IOU, and MOU	IPP	Leveraged, GenCo, IOU, and MOU	IPP	Leveraged, GenCo, IOU, and MOU
EPC Cost, $/kW	1, 258	1, 258	1, 673	1, 673	1, 977	1, 977
Soft Costs, $/kW	278	88	348	119	409	141
Interest During Construction, $/kW	162	129	208	170	245	201
Total Capital Costs, $/kW	1, 698	1, 475	2, 229	1, 962	2, 631	2, 319

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Operating Costs

Plant Type	PC	IGCC	IGCC With Spare
Power/Liquid Production Availability, %	88 / Zero	88 / Zero	88 / 85
Fixed O&M Costs, $/MWh	7. 36	10. 87	13. 20
Variable (excluding coal) O&M Costs, $/MWh	1. 57	1. 2	1. 15
Liquid Fuel/Sulfur Credit, $/MWh	0	(0. 38)	(11. 02)
Net Variable O&M Cost, $/MWh	1. 57	0. 82	(9. 87)
Coal Cost, $/MWh	11. 50	9. 77	13. 41
Total Variable O&M Cost, $/MWh	13. 07	10. 59	3. 54

Coal = $25/ton; Liquid Fuel = $38/bbl; S = $40/ton

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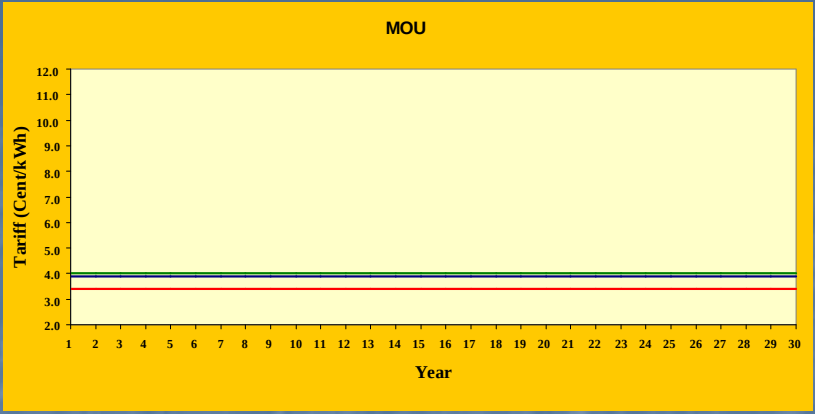
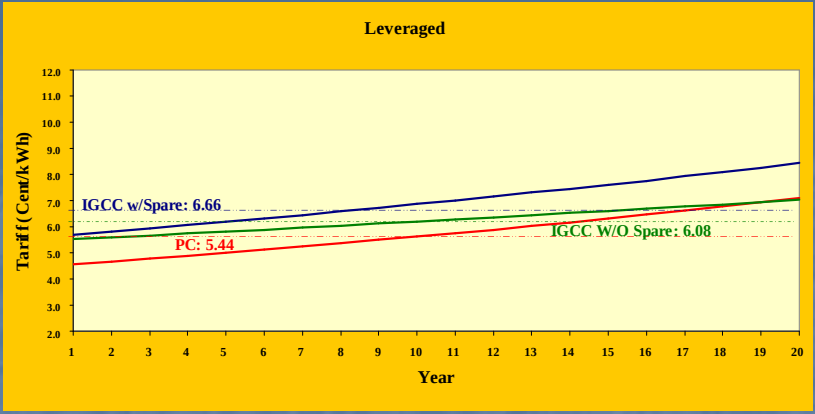
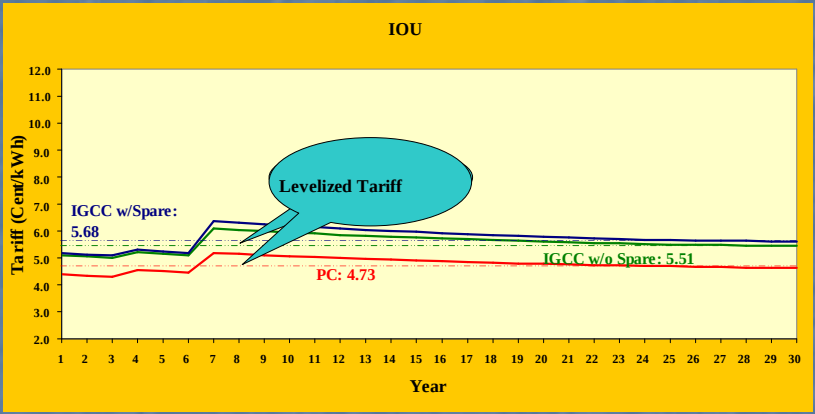
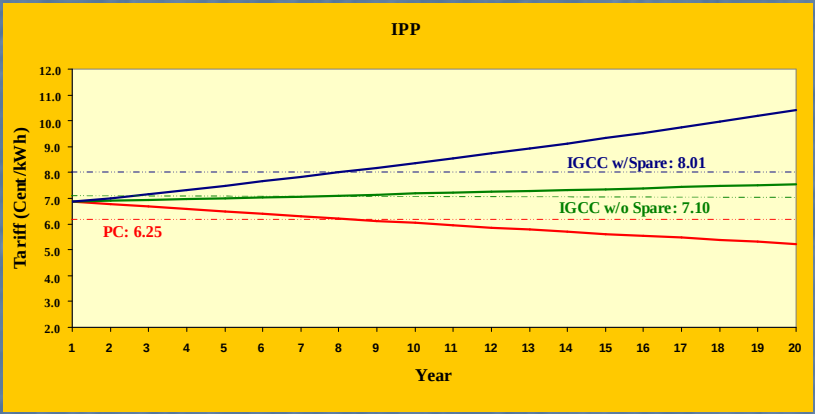
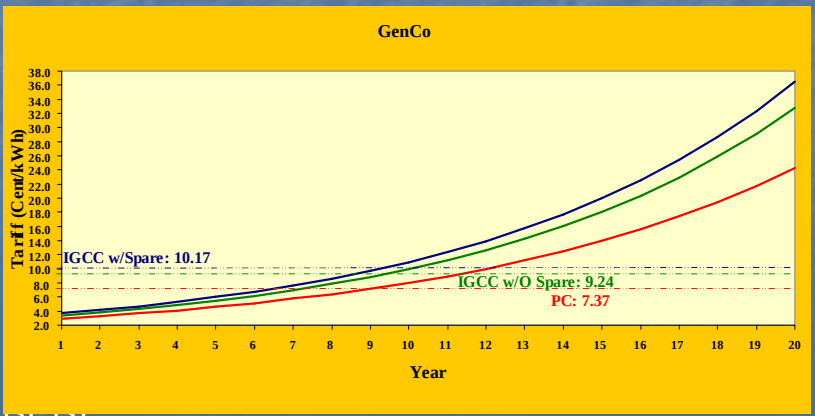
Required Tariff

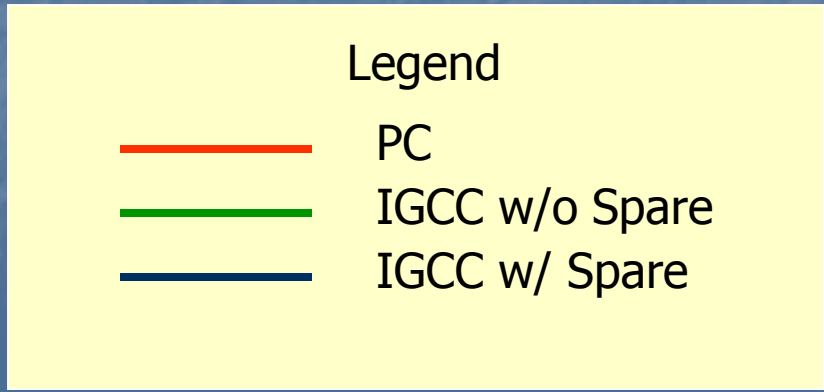












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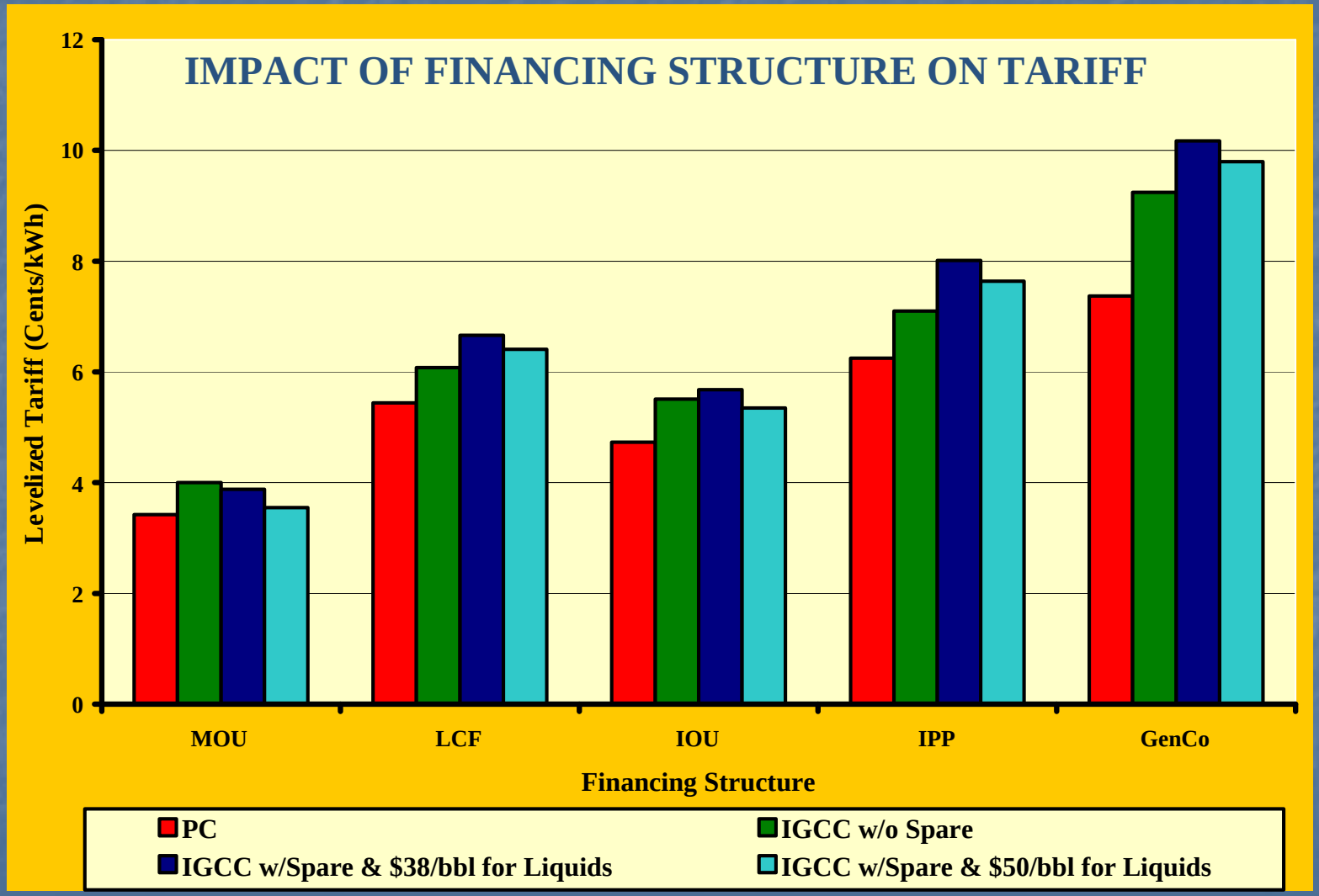

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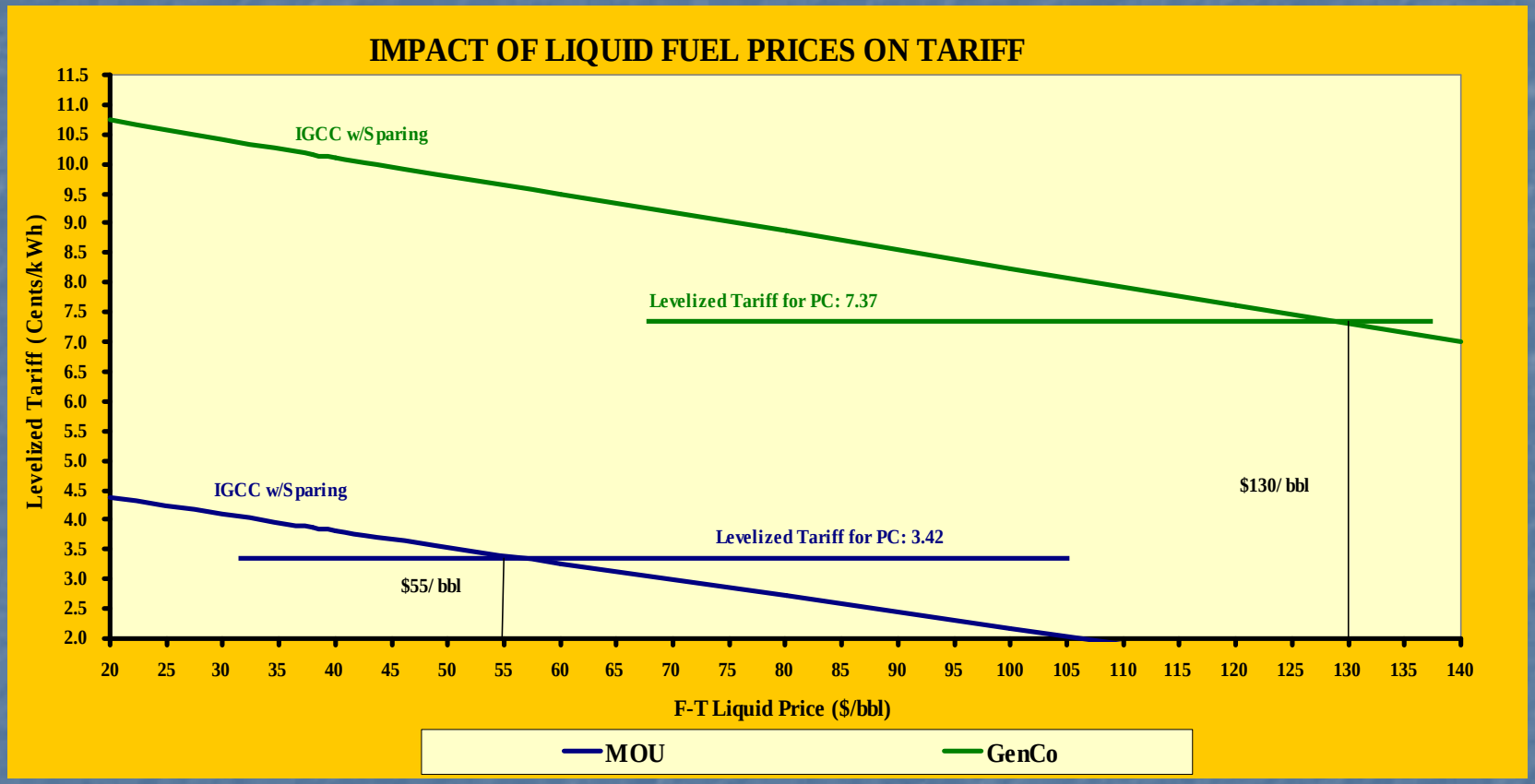

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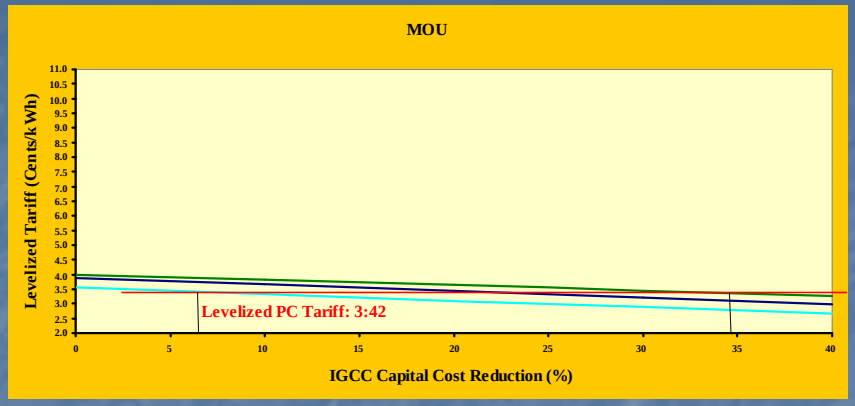
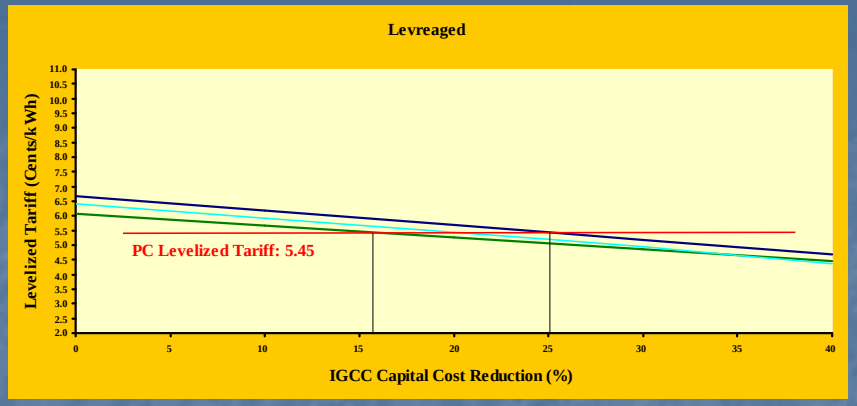
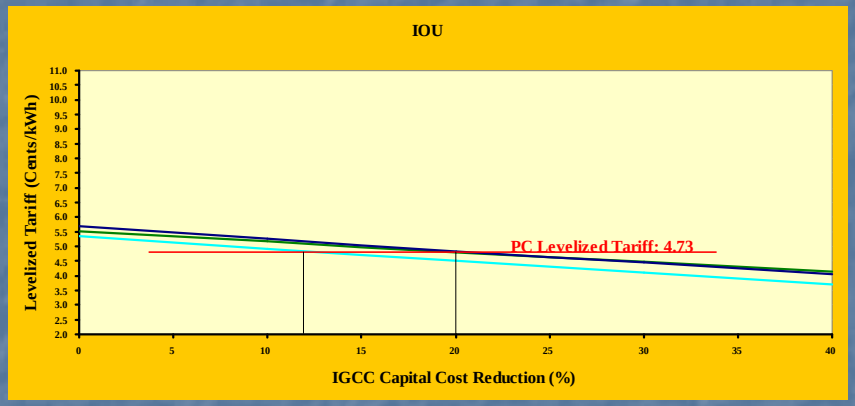
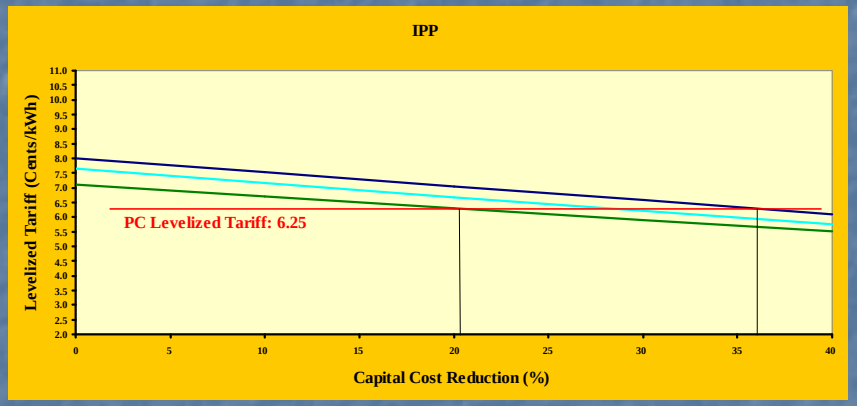
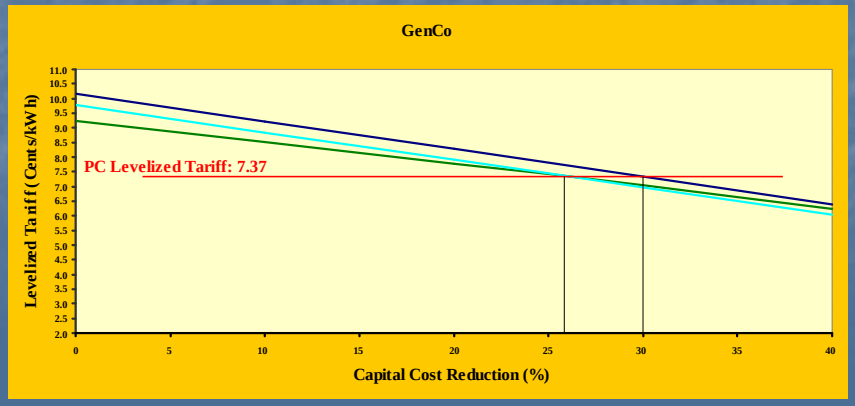
Capital Cost Reductions Required

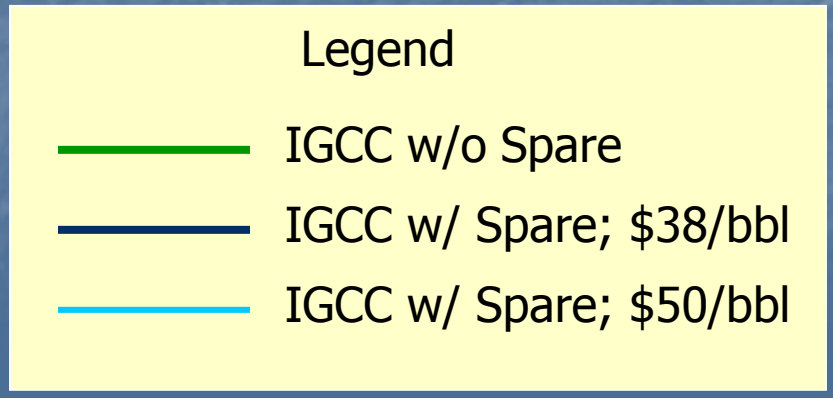












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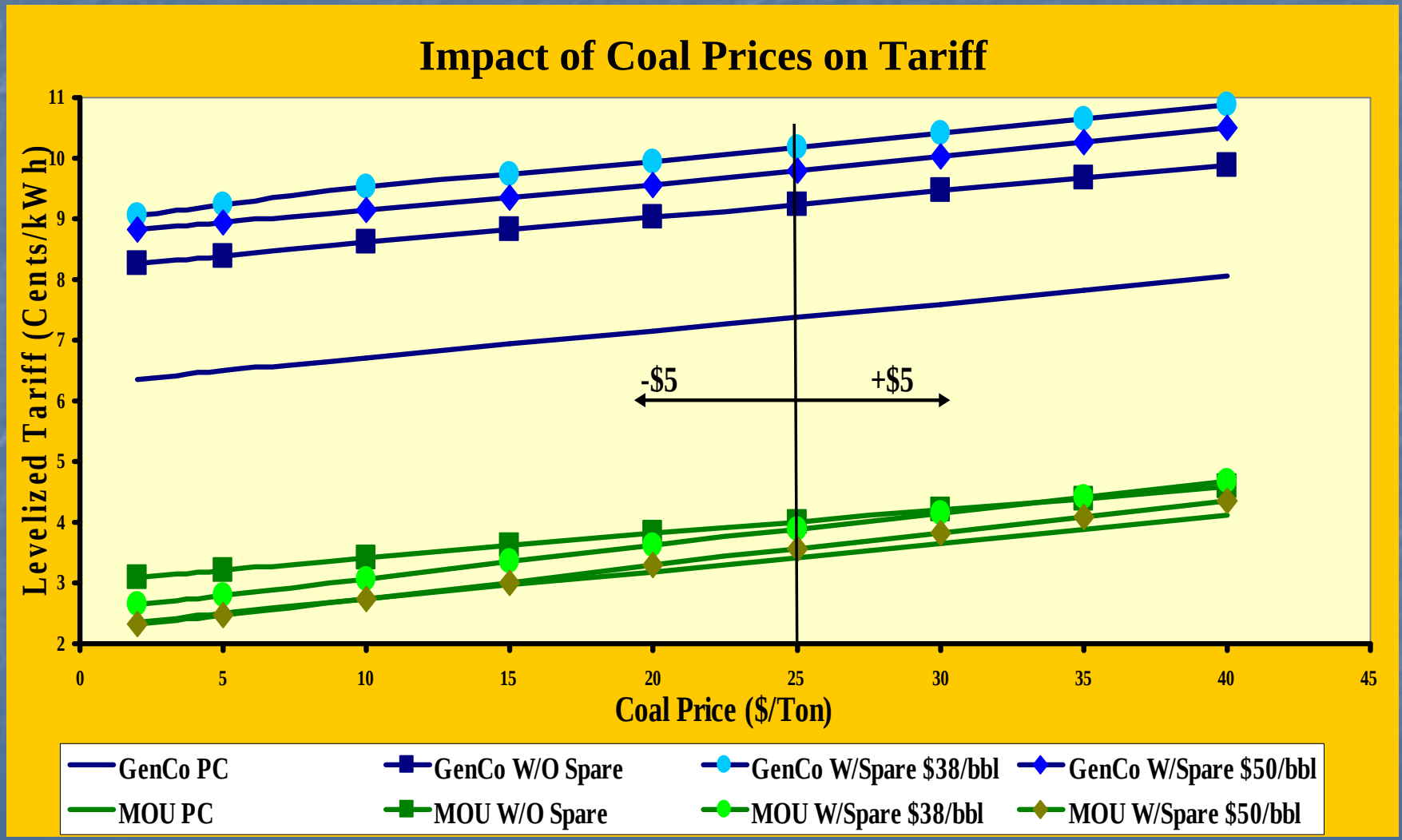

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Probabilistic Analysis

Parameter	Range
Coal Price	$8 – $35/Ton
Coal Feed Rate	+30% to -2%
EPC Cost	± 25% for PC ± 30% for Others
Interest Rate	± 1.5 for MOU ± 2% for Others
Liquid Fuel Prices	

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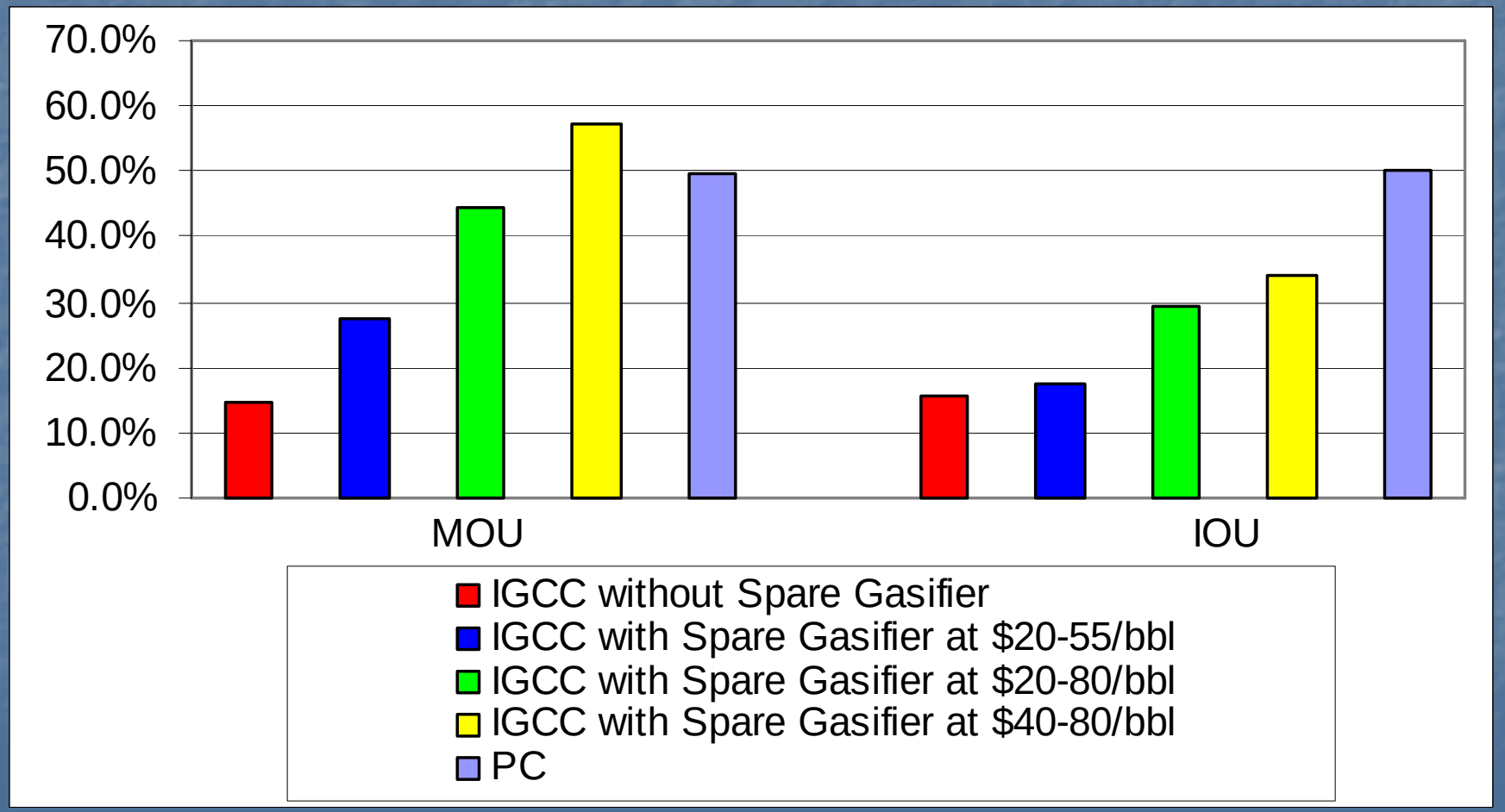
Probability of Meeting PC Tariff



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Conclusions

- IGCC with liquid sparing is competitive with PC at Liquid fuel prices of $50/bbl and higher
- MOU and IOU financing structures favor Liquid Sparing
- Liquid Sparing improves probability of success