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Lifecycle Energy Modeling
Input into Upstream Design Process

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CO_2 Summit: Technology and Opportunity

6-10 June 2010, Vail CO USA

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Agenda

Background	energy usage profile of upstream industry upstream conceptual design process typical conceptual design case generation
Design input	production profile valuation methods
Comparison	energy intensity vs. production CO_2 emissions vs. production availability model output
Conclusion	net savings achieved – life cycle net savings achieved – totals questions

Background
Energy usage profile of upstream industry

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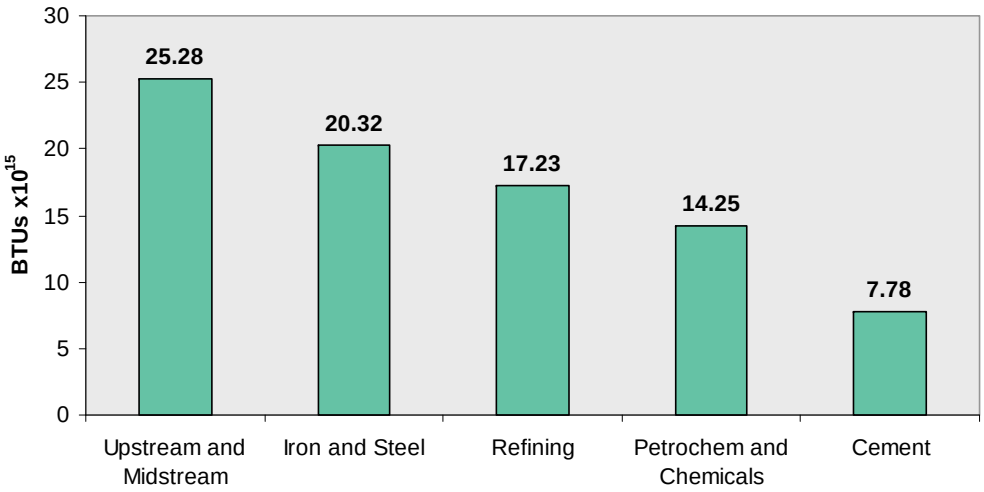
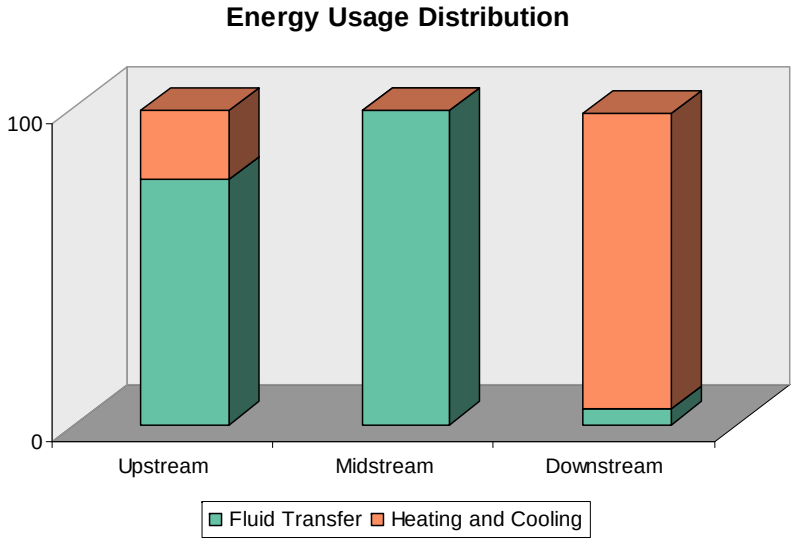


Oil and gas is top industrial energy user

Upstream use primarily in pumping/compression



Background
Typical facility conceptual design process

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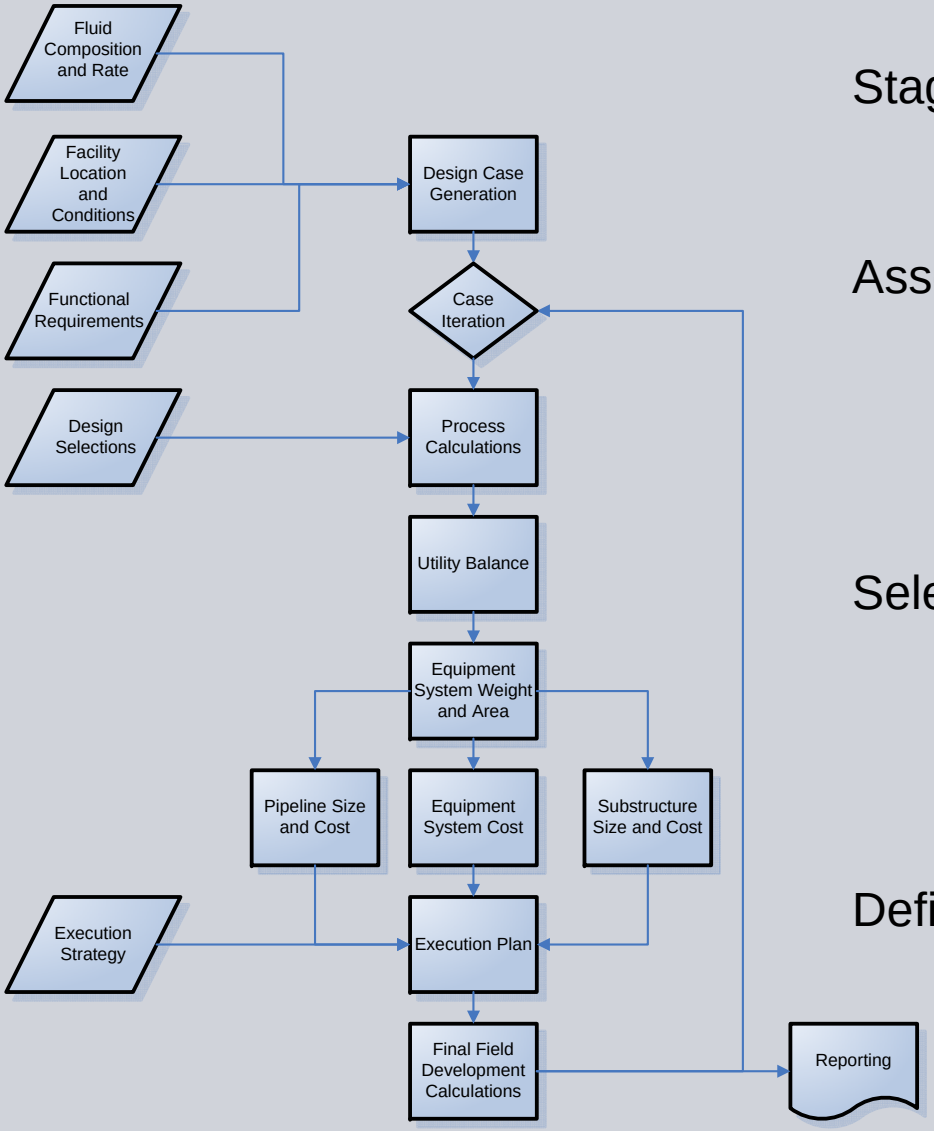

Stage gate process

method of capital appropriation

Assess phase (0.1% of project capital)

develop concept design cases
generate high level definition
target +/-50% cost estimate

Select phase (1% of project capital)

refine and select base case
front end engineering work
target +/-30% cost estimate

Define phase (10% of project capital)

detailed engineering
target +/-10% cost estimate

Background
Typical concept design case generation

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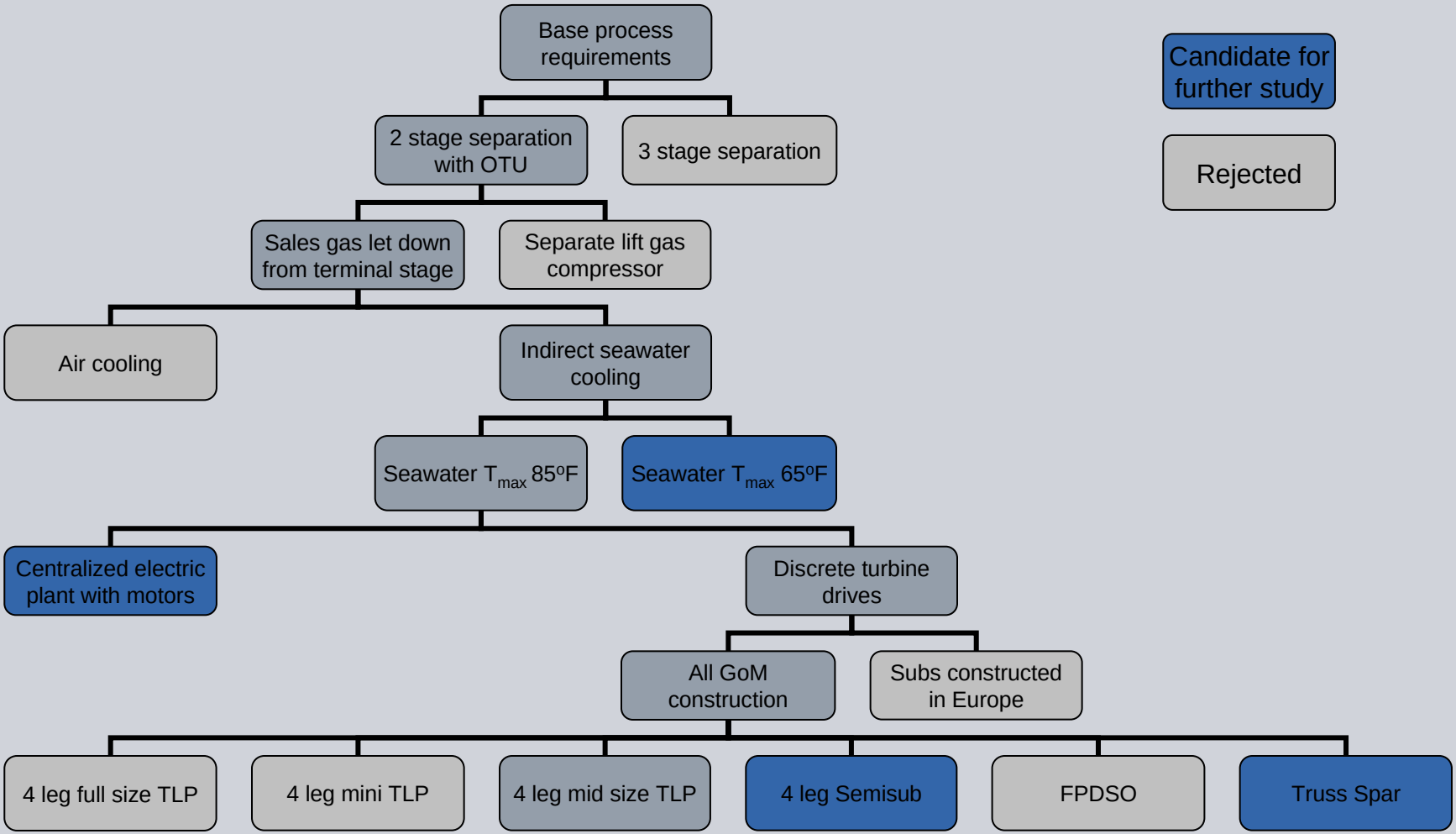

Design input
Production profile

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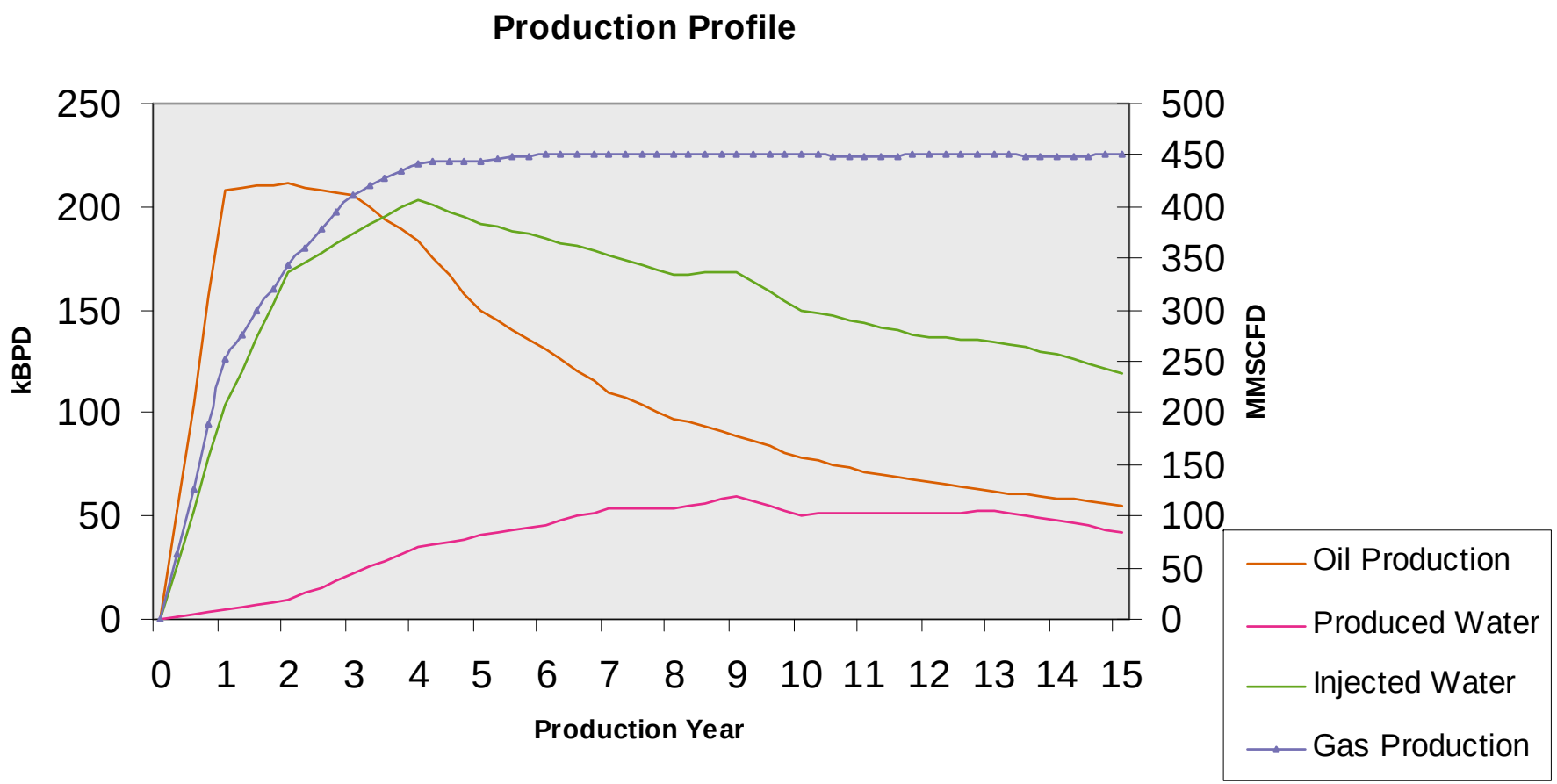

Design input
Valuation methods

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Fuel usage	cost avoidance of fines associated with flaring discounted NPV assuming future local gas market average pricing for recent gas sales or fraction thereof 2009 average wellhead gas price $3.71/kscf
CO_2 emissions	primarily cost avoidance of emissions taxes possible offsets market for international companies discounted NPV for countries with future requirements EUA December 2010 contract was €15.10/ton CO2 (5/28/2010)
Availability	calculate actual production time out of service use production pricing and profile for value compare NPV for base output and for increased availability NPV difference is value of deferred production Brent spot was $72.40/bbl (5/28/2010)
Inflation	2.5% annually

Comparison
Energy intensity vs. production

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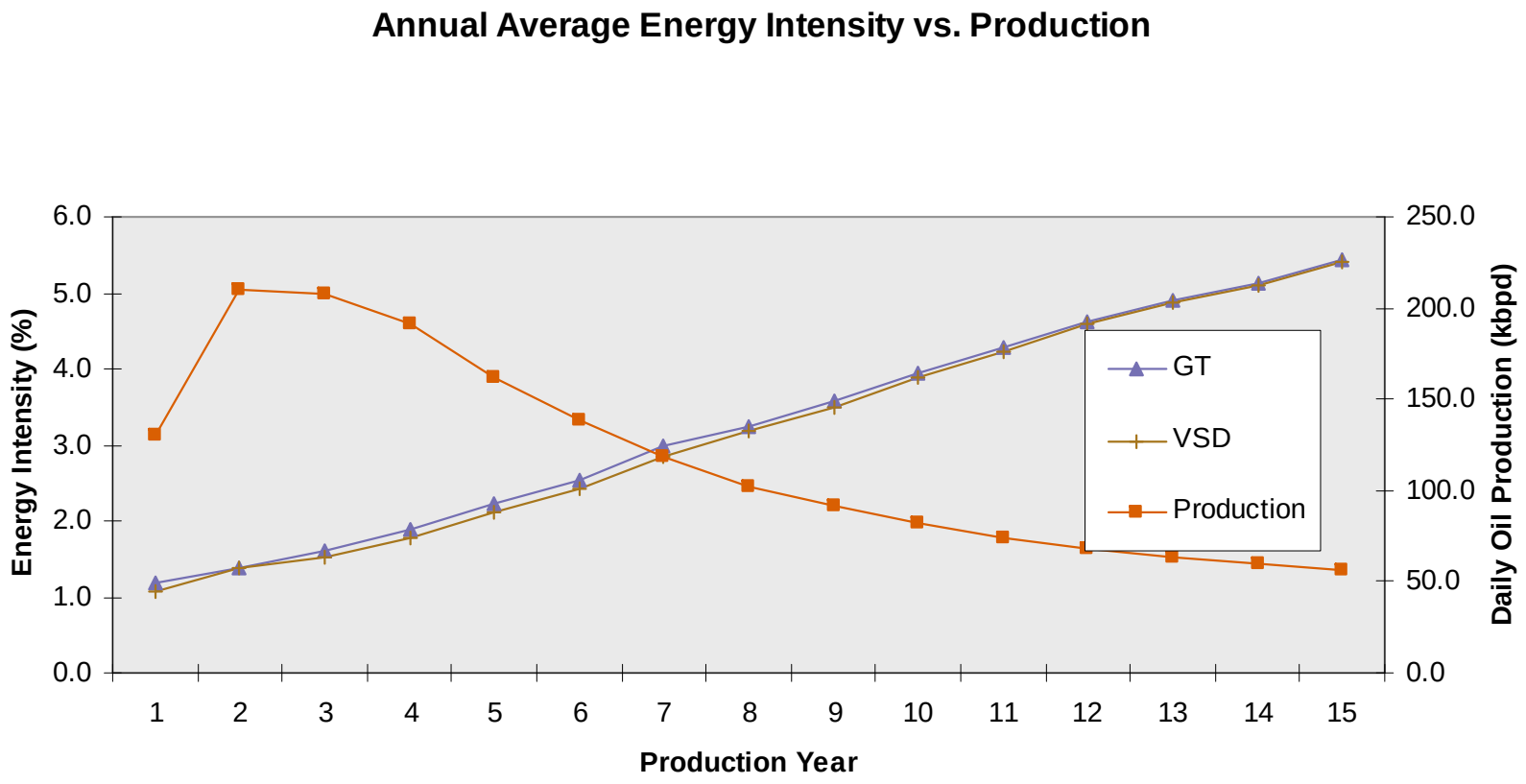

Comparison
CO_2 emissions vs. production

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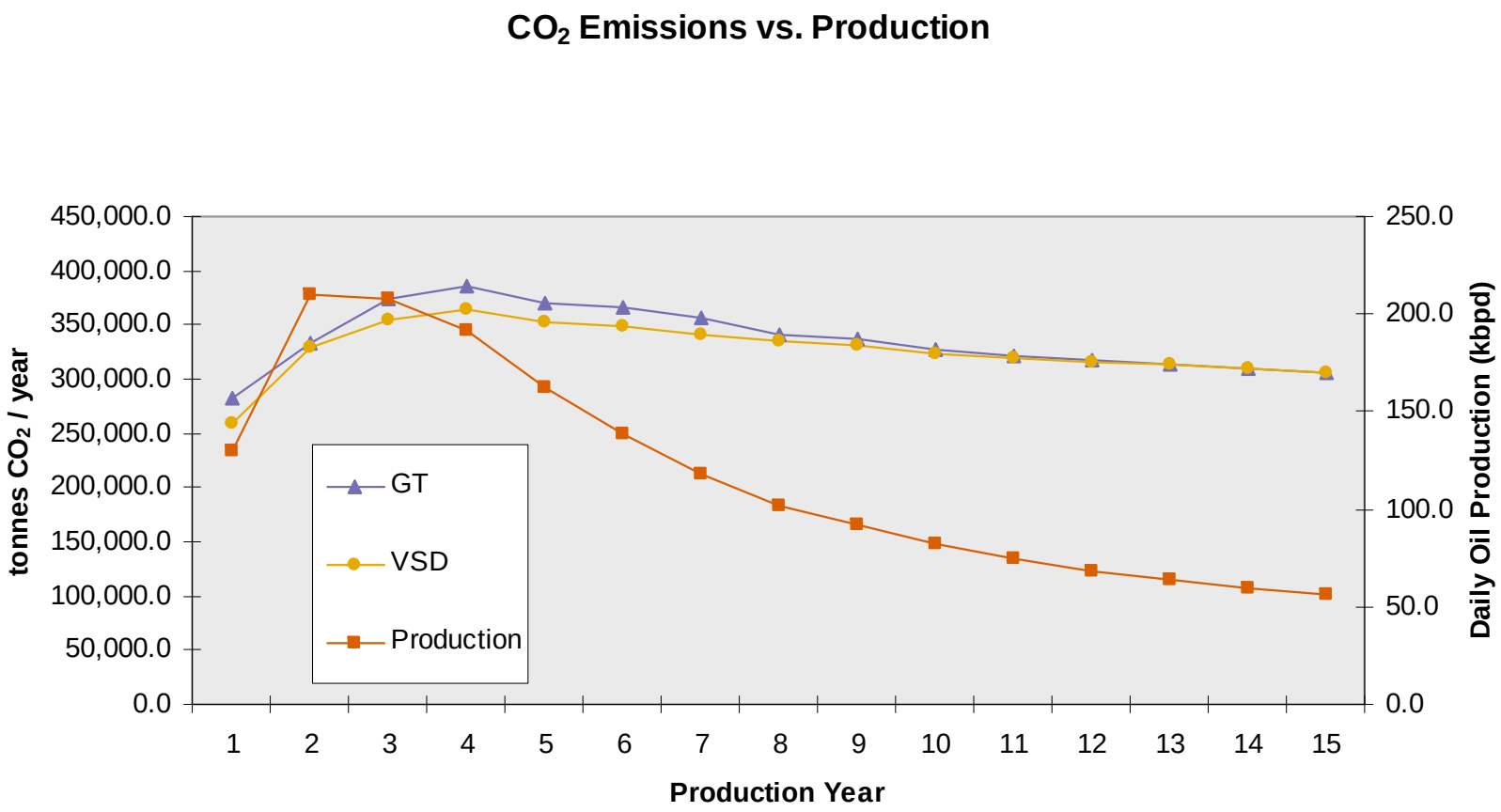

Comparison
Availability model

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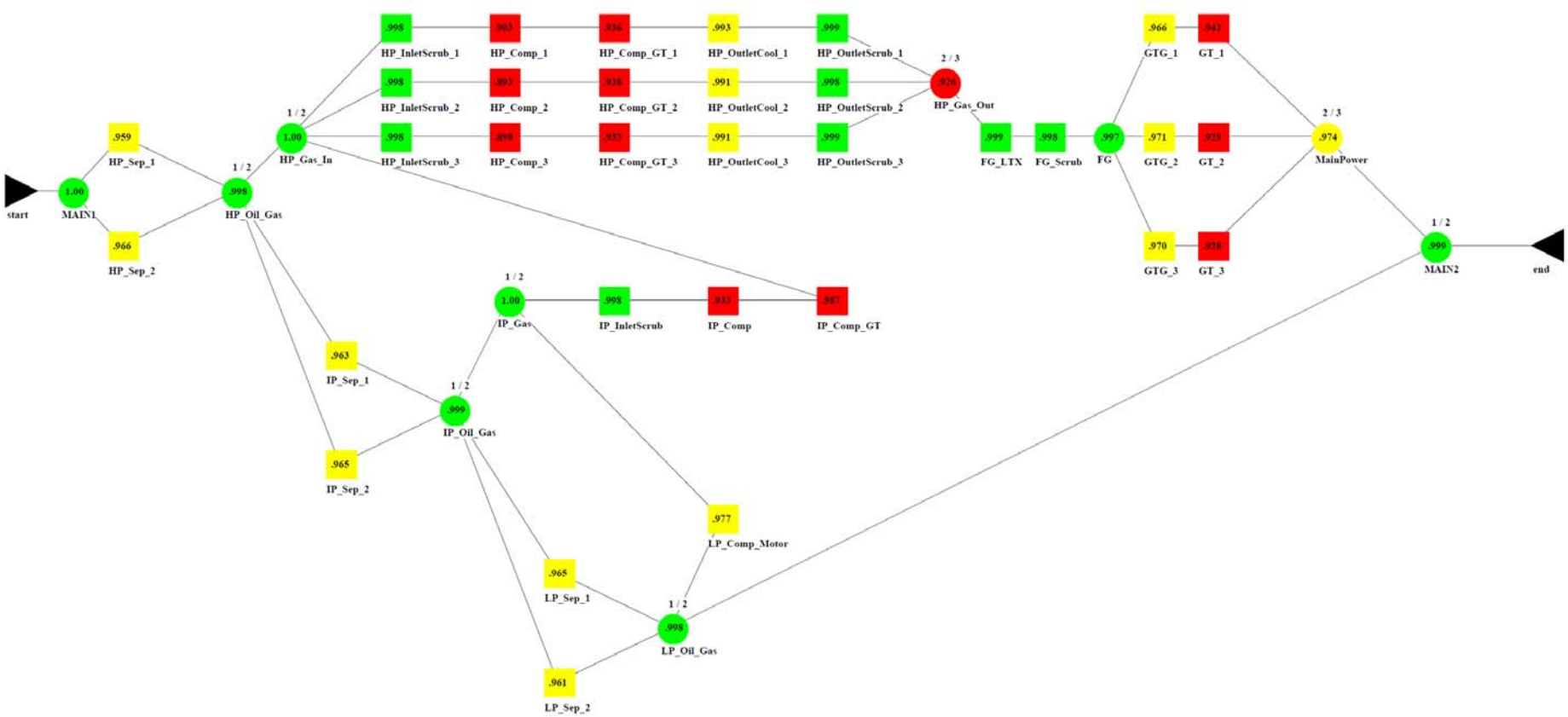

Conclusion
Net savings achieved, life cycle

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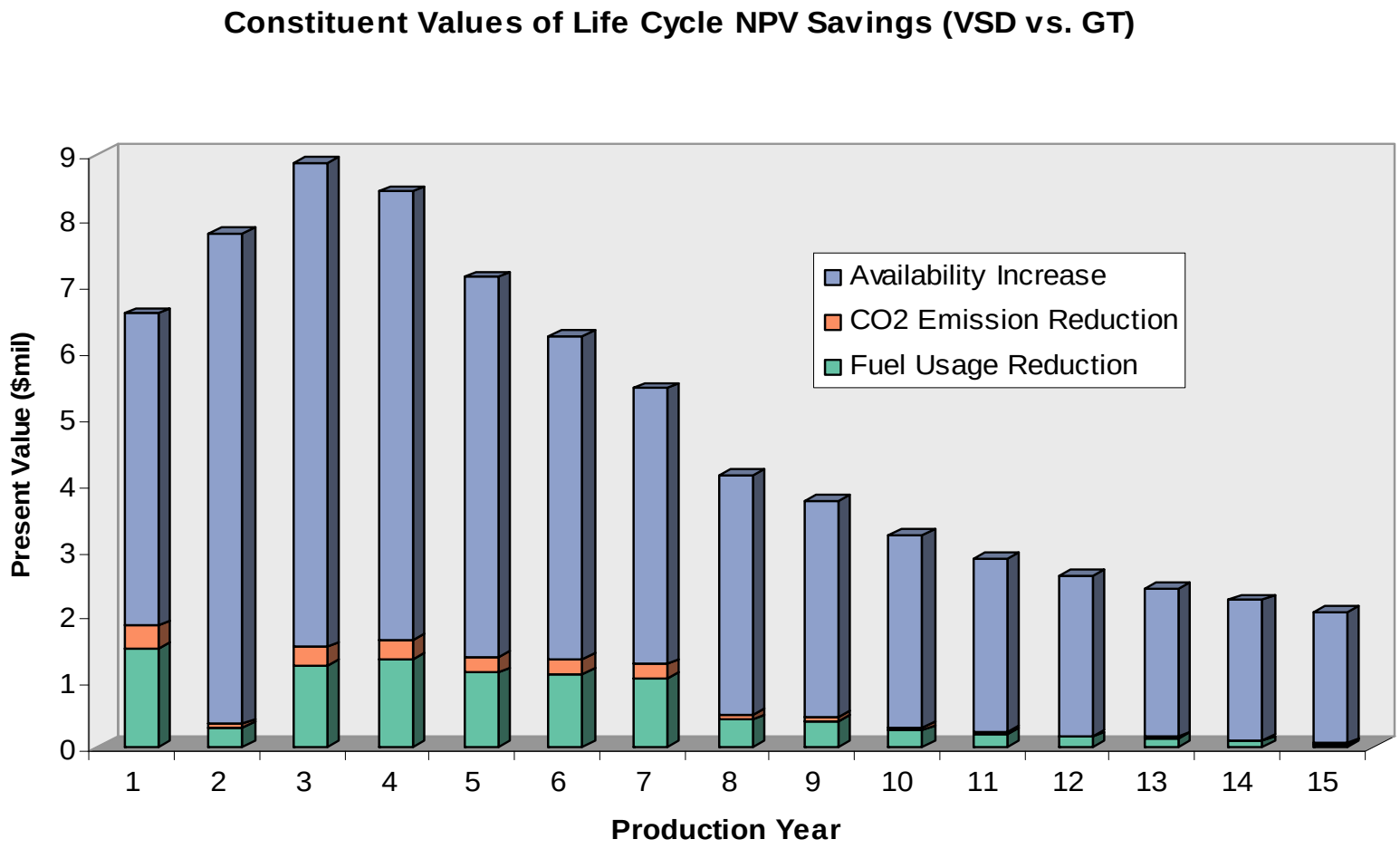

Conclusion
Net savings achieved, totals

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	GT	VSD
CAPEX (total platform installed cost)	1,149,163,400	1,183,251,600
		(34,088,200)

NPV OPEX savings for fuel gas	9,304,509
NPV OPEX savings for emissions	1,925,837
NPV OPEX savings for uptime	62,315,457
Total NPV savings	73,545,804

Overall savings	39,457,604

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Questions?