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The Economics of Carbon Capture and Storage (CCS): Learnings from Policymaking and Investment Analysis

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Disclaimer:
The views expressed in this presentation are solely the author's, and do not necessarily reflect the views of the Saudi Arabian Oil Company or its affiliates.

Objective

Demonstrate how to:

- Use the Social Cost of Carbon (SCC) as an input into the capital budgeting model for CCS projects;
- Treat systematic and diversifiable risk in Discounted Cash Flow (DCF) analysis;
- Measure the value of options embedded in the CCS project, such as the option to delay, expand or abandon the project.

Stylized assumptions (illustrative)

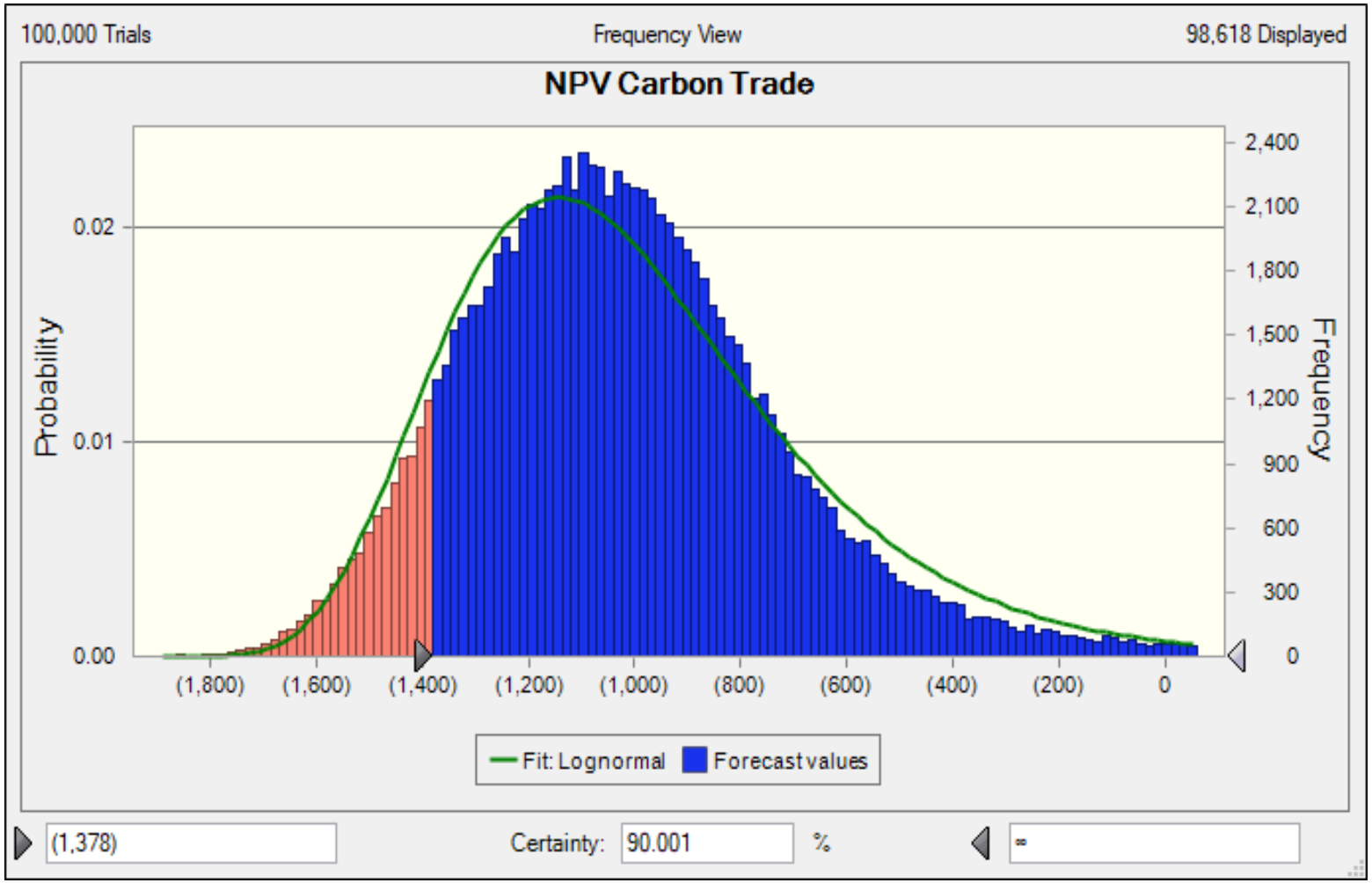
- Total capex: US$ 1.5 billion
- Opex: at 4% of capex
- Abatement: one million tons of CO_2-equivalent per annum
- Social cost of carbon (SCC):

Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
$ per ton	72	76	81	85	90	95	100	105	111	117	124	131	138	146	154	162	171	181	190	201	212	224	236	249	263	277

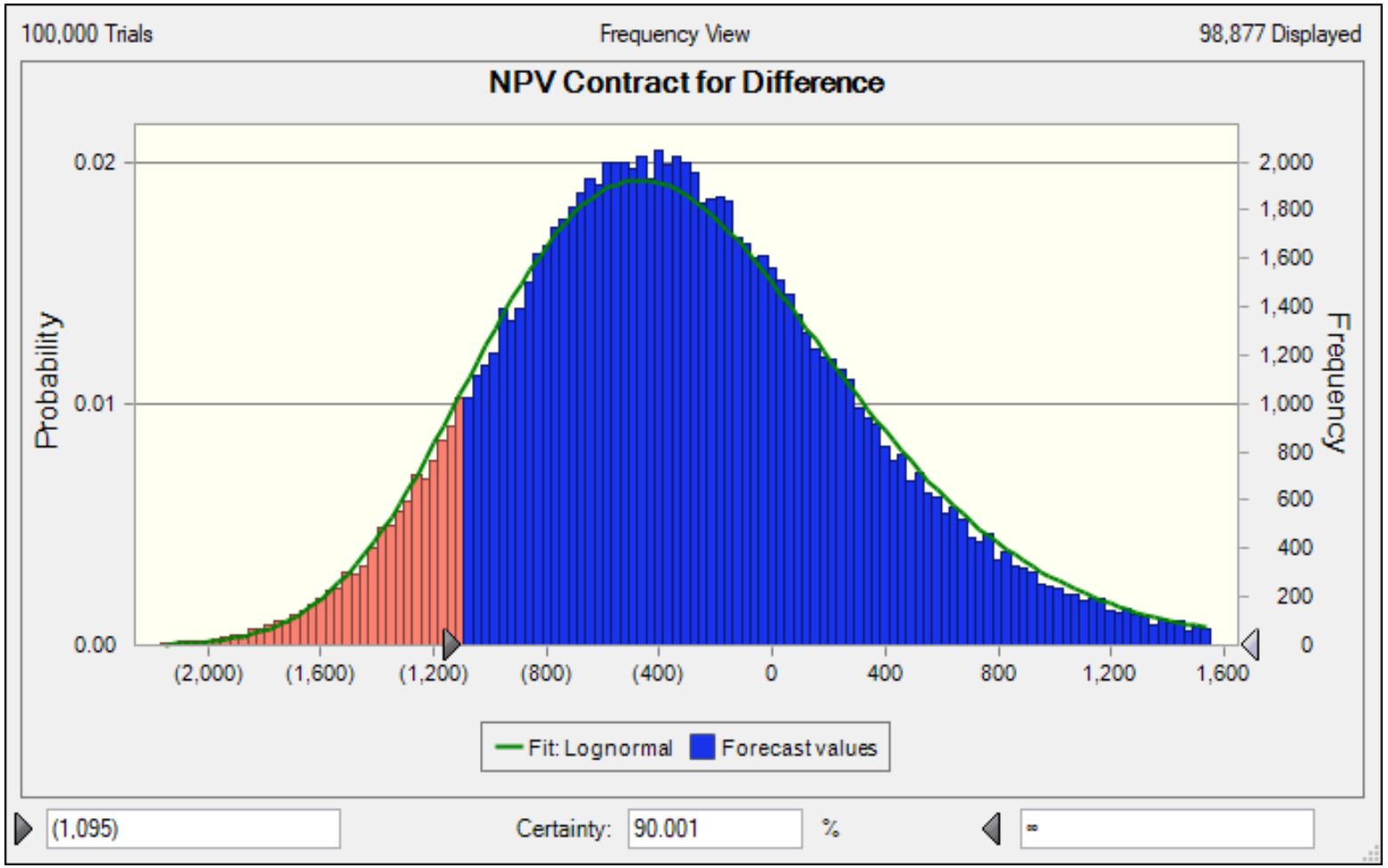
Source: Nordhaus, L. B. (2024). Policies, projections, and the social cost of carbon: Results from the DICE-2023 model. *PNAS*, 1-8.

- Statutory corporate income tax: 20%.
- Two cases: full exposure to carbon trading vs contract-for-differences

Results



Results



The value of flexibility

[Black Scholes Calculator]

Option		Stock		Market	
Strike	1500	Price	490	Interest Rate	4%
Expiration (years)	5	Volatility	30%	**Settings**	
		Dividend	0%	Precision	1

	European Call	European Put	Forward	Binary Call	Binary Put
Price	19.6	757.7	-738.1	0.0	-0.0
Delta	0.2	-0.8	1.0	0.0	-0.0
Gamma	0.0	0.0	0.0	0.0	-0.0
Vega	256.0	256.0	0.0	0.3	-0.3
Rho	270.7	-5869.8	6140.5	0.4	-4.5
Theta	9.8	-39.3	49.1	-0.1	0.1

Conclusion

- The output of the policymaker's analysis, namely an estimate of the SCC may guide the choice of a central input into the investor's analysis, i.e. the value of a ton of carbon abated.
- The distinction between idiosyncratic (diversifiable) and systematic risk remains crucially important.
- While the standard Capital Asset Pricing Model (CAPM) dominates estimation of the cost of capital on the investment side, the more general Consumption CAPM may be used for discounting in social cost-benefit analysis.
- The value of information and flexibility is real and needs to be taken into account.

Thank you!