Translating Risks to Reality

How Risk Quantification can influence decision-making

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Date: **24 JAN 2018**

Meeting Agenda

1

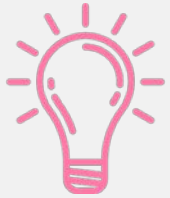
Understand the meaning of risk, return, and risk preferences.

2

Building a Strong Deterministic Model

3

Scenario Analysis – Portfolio Optimization



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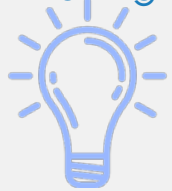
How Risk Appetite affects Decision-Making



1

Understand the meaning of risk, return, and risk preferences.

Risk and Return Fundamentals

- **Risk** is a measure of the uncertainty surrounding the return that an investment will earn or, more formally, the variability of returns associated with a given asset.

- **Return** is the total gain or loss experienced on an investment over a given period of time; calculated by dividing the asset's cash distributions during the period, plus change in value, by its beginning-of-period investment value.

Risk and Return Fundamentals: Risk Preferences

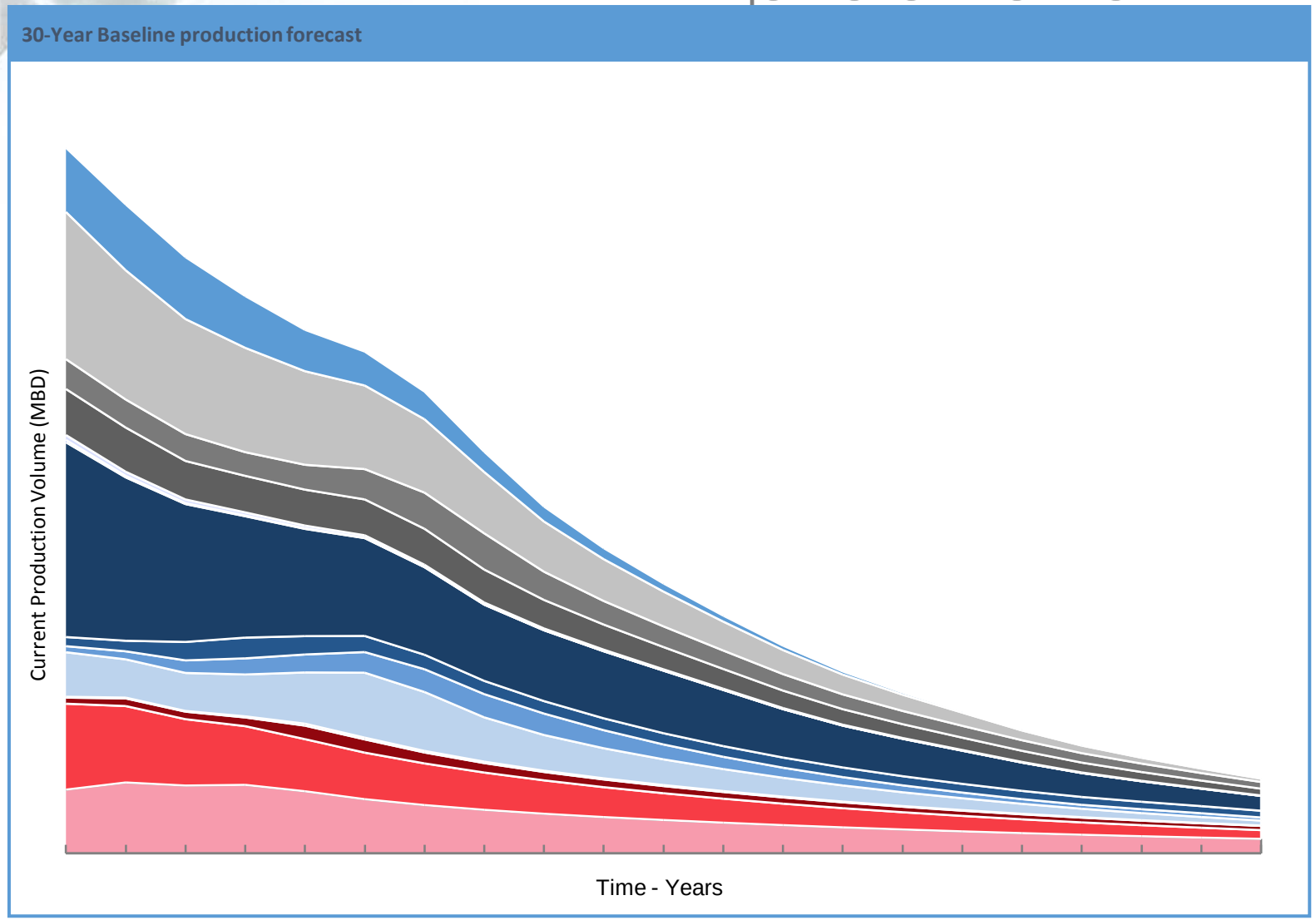
Economists use three categories to describe how investors respond to risk.

- **Risk averse** is the attitude toward risk in which investors would require an increased return as compensation for an increase in risk.
- **Risk-neutral** is the attitude toward risk in which investors choose the investment with the higher return regardless of its risk.
- **Risk-seeking** is the attitude toward risk in which investors prefer investments with greater risk even if they have lower expected returns.

2

Building a Strong Deterministic Model

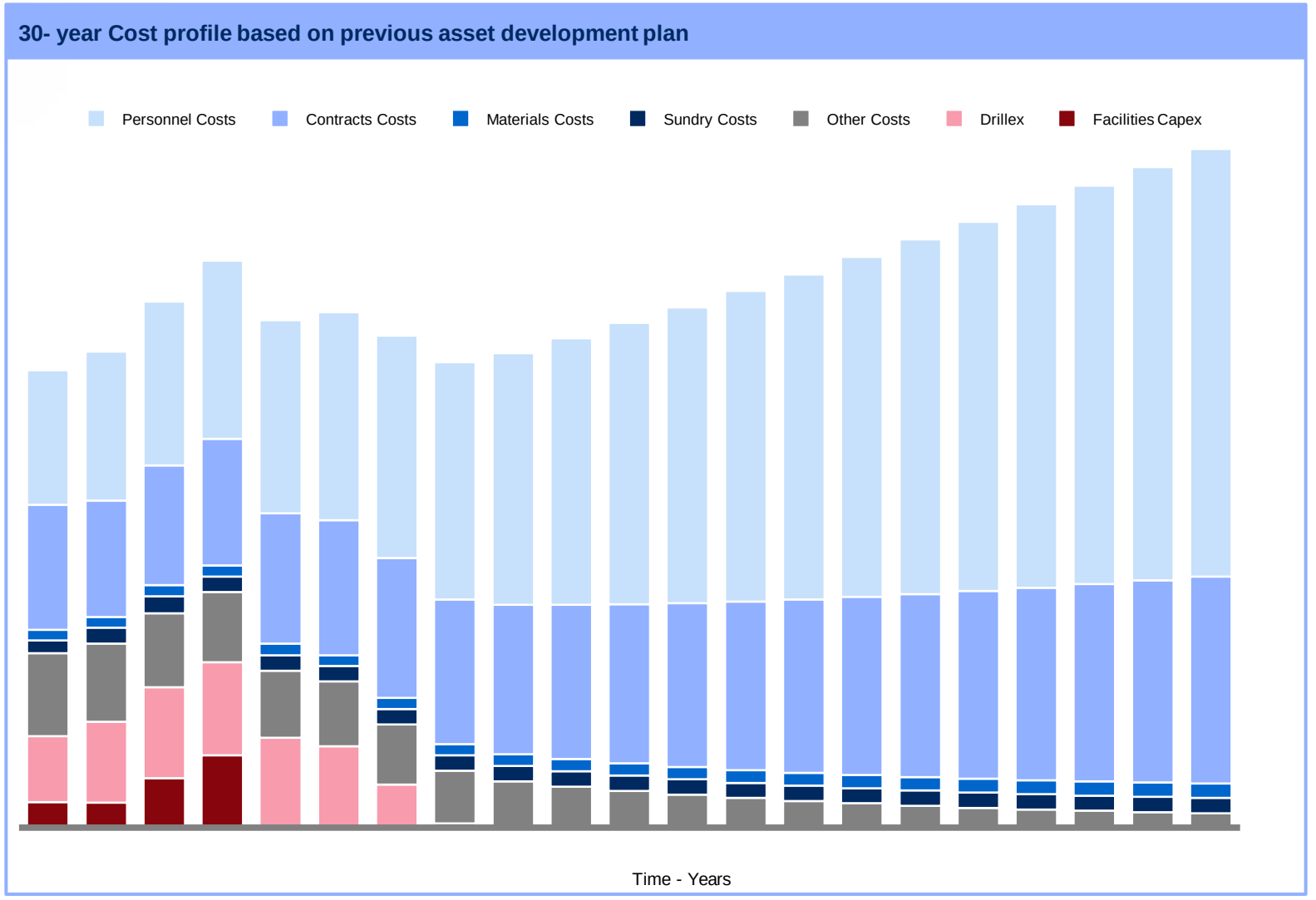
Building a strong deterministic model: Current production



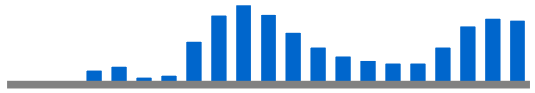
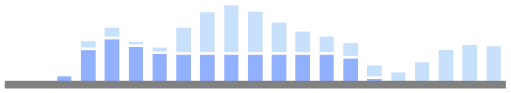
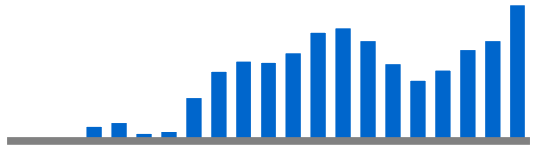
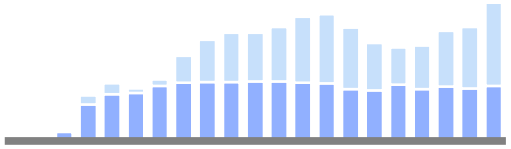
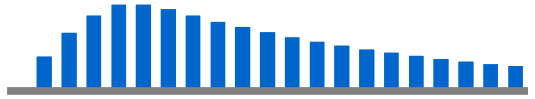
This example Asset Development Plan assumes that the corporation will continue with current levels of operations without any additional investments in production opportunities

Defining your existing portfolio and assessing its long-term sustainability is the foundation stone upon which all options will be base upon

Building a strong deterministic model: Cost



Assess opportunities to increase recovery across existing reservoirs

Reservoir	Opportunity	Additional oil production profile[1] MBD	Additional cost profile[1] Million $
1 Reservoir 1	Steam flooding Stage I		
2 Reservoir 2	Water flooding		
3 Reservoir 3	Increased recovery using water flooding using Polymer pilot		
4 Reservoir 4	Water injection		
5 Reservoir 5	Water flooding		
		Time - Years	Time - Years

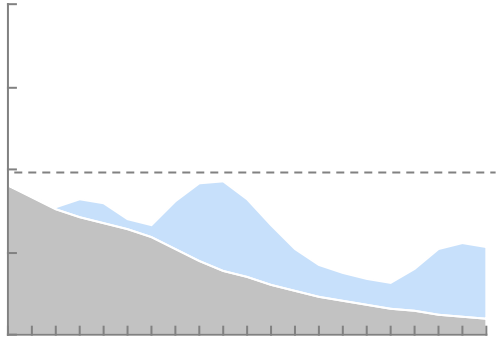
Building a strong deterministic model: Scenario Analysis

Additional production

Baseline production

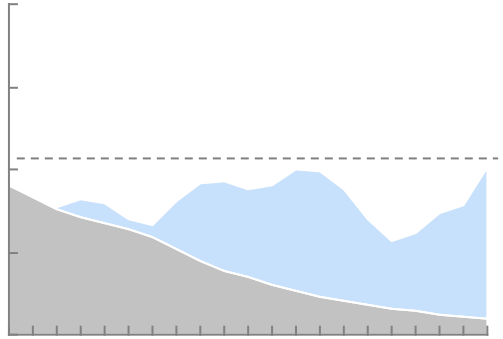
Scenario 1: Steam flooding and aggressive infill drilling

MBD **Additional CAPEX[1]:** +400%



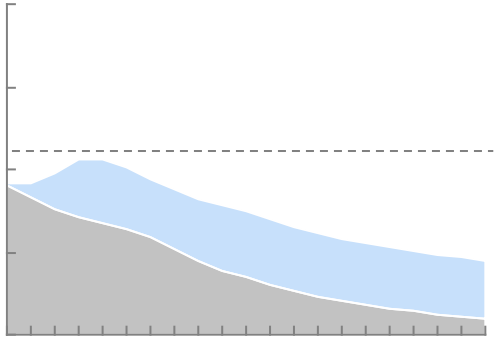
Scenario 2: Steam flooding and aggressive infill drilling – Different reservoir development selection

MBD **Additional CAPEX[1]:** +550%



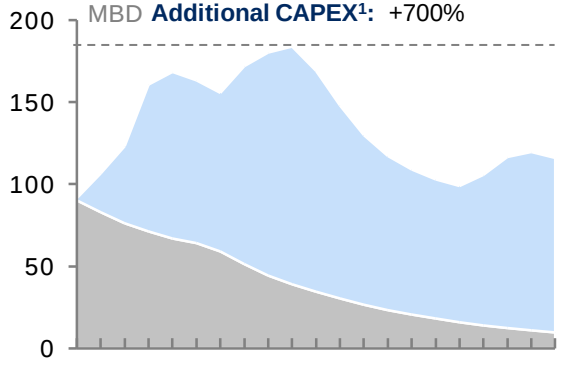
Scenario 3: Increased recovery through infill drilling of reservoirs

MBD **Additional CAPEX[1]:** +200%



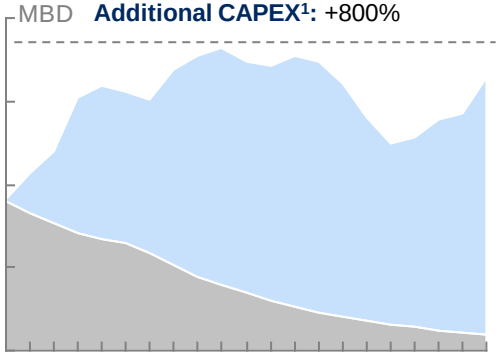
Scenario 4: Steam flooding and water flooding

MBD **Additional CAPEX[1]:** +700%



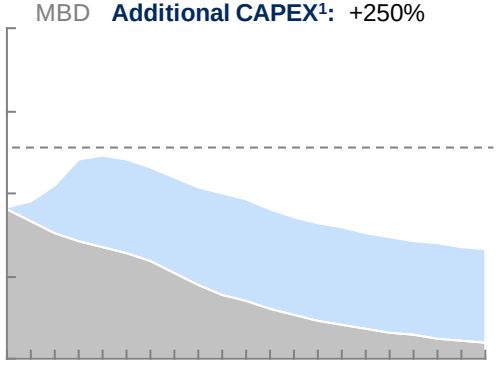
Scenario 5: Minimum cost per barrel[2]

MBD **Additional CAPEX[1]:** +800%



Scenario 6: Maximum Risk-Adjusted Return on Capital

MBD **Additional CAPEX[1]:** +250%



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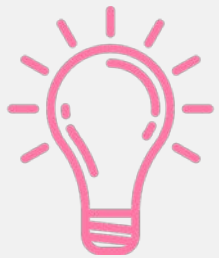
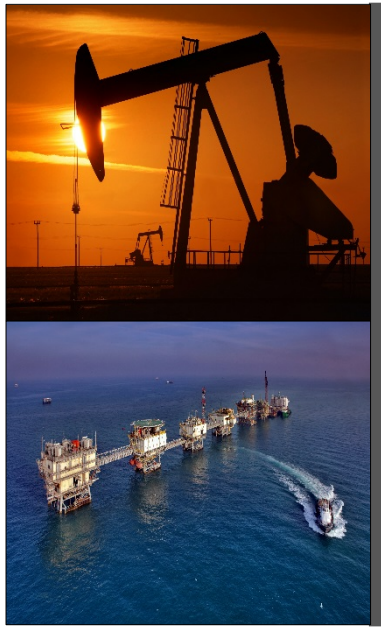
Scenario Analysis – Portfolio Optimization



Comparative analysis between Scenarios – Deterministic versus Risk-based

Building a strategically comprehensive risk model



Oil & Gas Industry

Natural owner	Not natural owner
Delay risks	Market risks (Oil price volatility, Exchange rate risk)
Operational risks	
Technology risk	Political risk
OPEX Uncertainty	Financing risk

Building a strategically comprehensive risk model

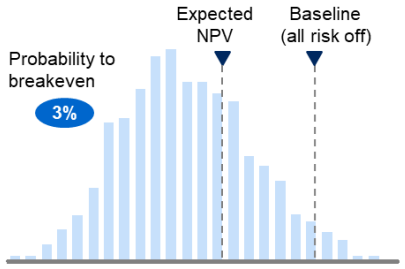
Risk Categories	Key Risks
Stakeholder Risk	Reputational Risk
Project Risk	Domestic Political Influence
	Execution Delay
Market / Financial Risk	Crude price volatility
	Correlation of crude and gas prices
	Crude and refining margin volatility
	Interest rate volatility
	Charter rates
	Petrochemical price volatility
	Retain margin volatility
	Counterparty risk
	Exchange rate risk
Operational Risk	Operational risk
	HSSE
Portfolio / Business Risk	Technology Risk

Risk-Based Comparative Scenario Analysis

Scenario 1

		Baseline	Expected
Capex, mn $		X +	X + 200%
IRR, %		a%	Negative
Return on capital	NPV/I, %	-32%	-55%
	RAROC[1], %		-35%
NPVaR[2], KD mn			X+

Minimum oil price to achieve >95% break-even[3], $/bbl: 141.86

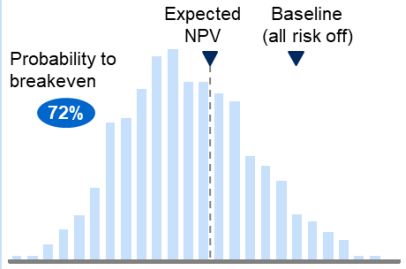


NPV, million $

Scenario 2

		Baseline	Expected
Capex, mn $		X +	X + 170%
IRR, %		a%	a - 3%
Return on capital	NPV/I, %	46%	18%
	RAROC[1], %		11%
NPVaR[2], KD mn			50%X

Minimum oil price to achieve >95% break-even[3], $/bbl: 111.43

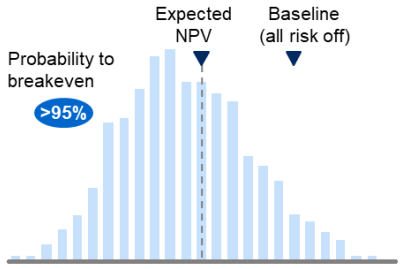


NPV, million $

Scenario 3

		Baseline	Expected
Capex, mn $		X	X+20%
IRR, %		2a%	2a-2%
Return on capital	NPV/I, %	198%	164%
	RAROC[1], %		75%
NPVaR[2], KD mn			0.5X

Minimum oil price to achieve >95% break-even[3], $/bbl: 91.99

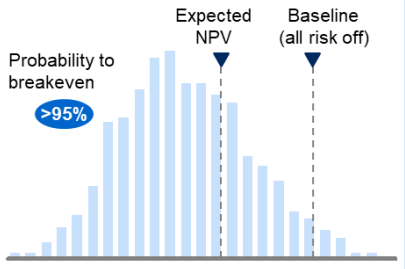


NPV, million $

Scenario 4

		Baseline	Expected
Capex, mn $		3X	3.2X
IRR, %		26.0%	23.1%
Return on capital	NPV/I, %	115%	95%
	RAROC[1], %		61%
NPVaR[2], KD mn			X

Minimum oil price to achieve >95% break-even[3], $/bbl: 80.50

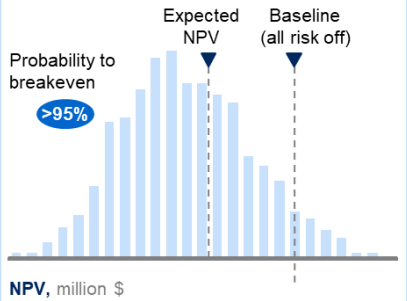


NPV, million $

Scenario 5

		Baseline	Expected
Capex, mn $		3.5X	3.9X
IRR, %		29.6%	26.8%
Return on capital	NPV/I, %	168%	144%
	RAROC[1], %		87%
NPVaR[2], KD mn			1/5X

Minimum oil price to achieve >95% break-even[3], $/bbl: 63.66

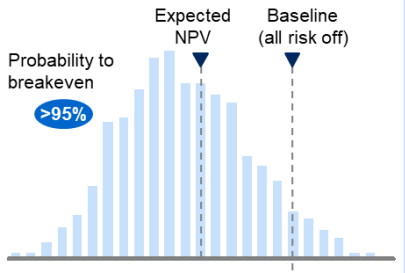


NPV, million $

Scenario 6

		Baseline	Expected
Capex, mn $		X	1.3X
IRR, %		31.0%	29.2%
Return on capital	NPV/I, %	269%	244%
	RAROC[1], %		122%
NPVaR[2], KD mn			0.7X

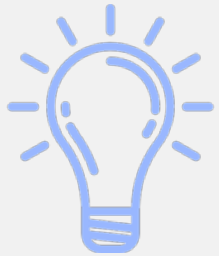
Minimum oil price to achieve >95% break-even[3], $/bbl: 58.13



NPV, million $

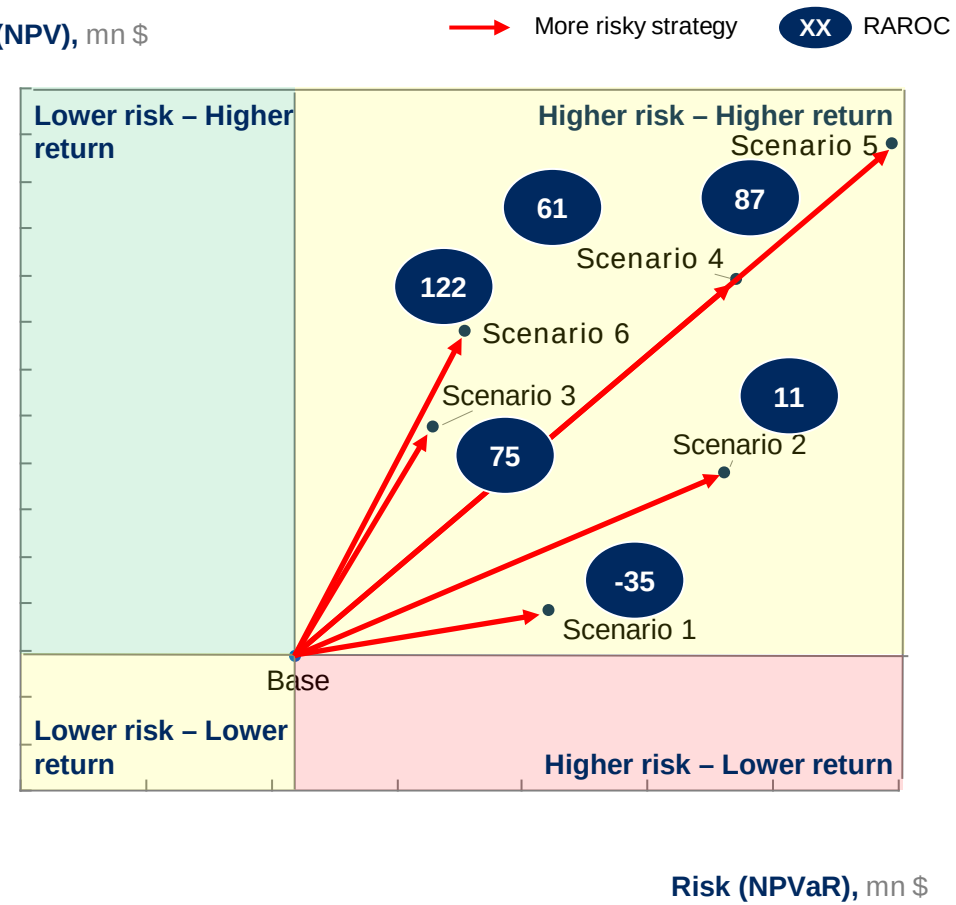
4

How Risk Appetite affects Decision-Making



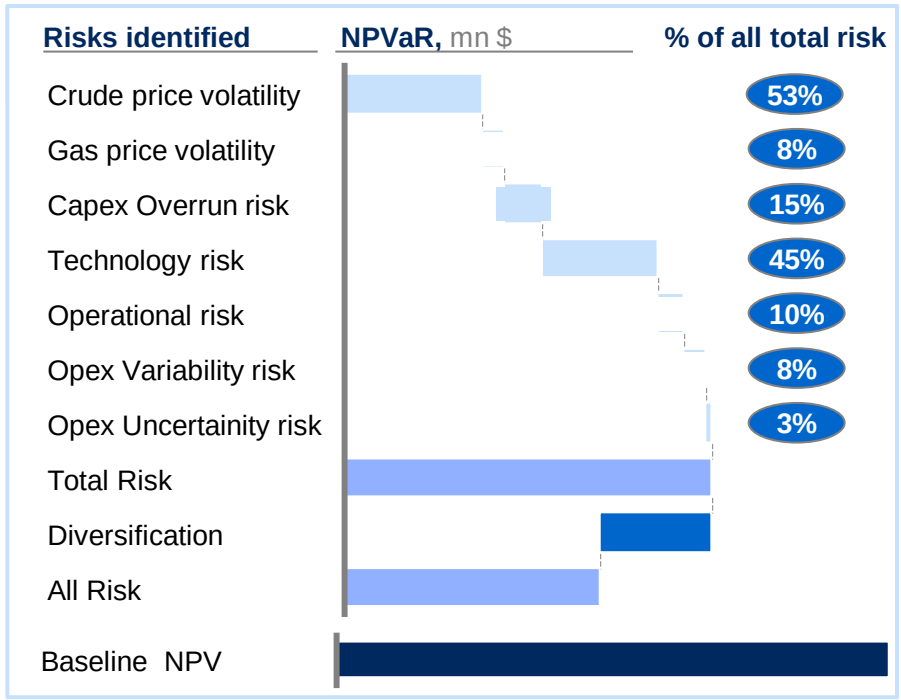
Risk-Based Comparative Scenario Analysis

Value creation of identified scenarios on a portfolio

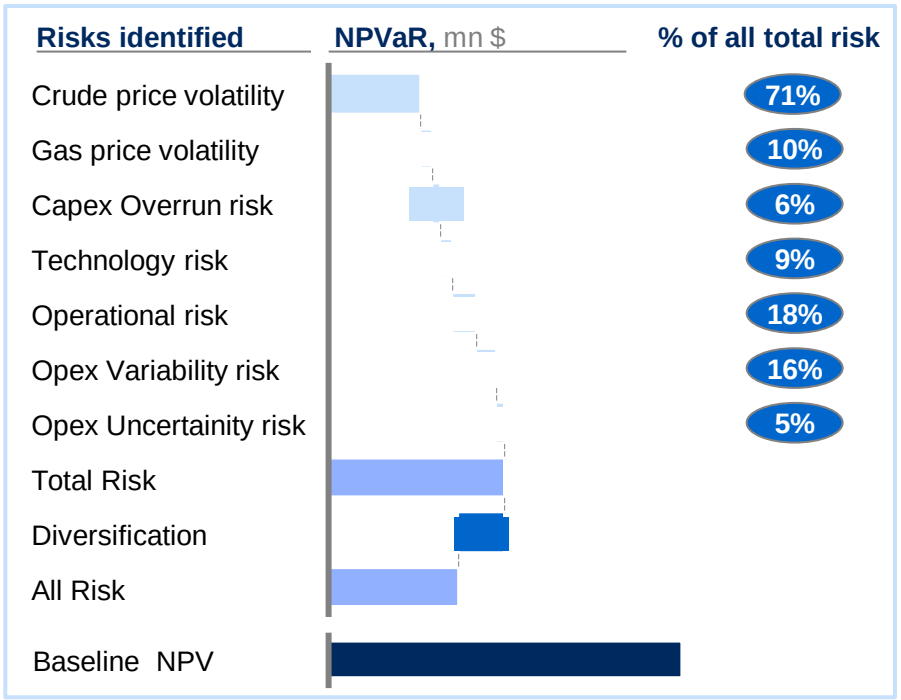


Risks Waterfall

Scenario 5: Minimum cost per barrel

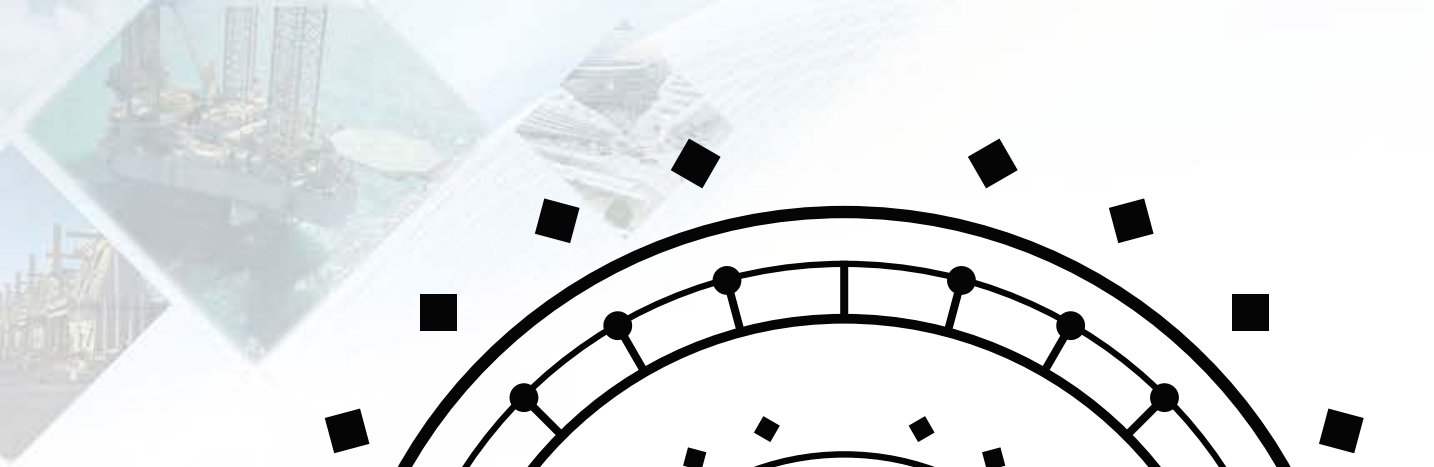


Scenario 6: Maximum Risk-Adjusted Return on Capital



Benefits of applying risk tools to support decision

	From ...	... To
Removing NPV bias	A deterministic approach providing scenario based estimates of key financial metrics with limited visibility on associated of prob-abilities and correlations	A stochastic approach removing the human bias (which could under-estimate both upside and downside e.g. oil price increase, cost overruns) towards a “most likely” scenario
Targeted mitigation planning	Providing a qualitative view on associated risks/value at stake, which could lead to a sub-optimal mitigation plan	Providing a quantified risk exposure for each type of uncertainty, which in turn enables targeted mitigation planning, i.e. being able to quantify how risk exposure can be reduced due to mitigation actions
Prioritization of portfolio choices	Prioritizing portfolio choices based on returns (NPV), unit cost and technology choices	Prioritizing portfolio choices based on risk-return profiles, unit costs and technology choices (scenarios 2 & 3 have similar return but widely different risk profiles)



Back-Up

Patron Speech