Financial Innovation to Unlock Private Capital for Resilience and Adaptation

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Agenda

- **Investment Challenges in Adaptation and Resilience Projects**
- Real Options Analysis can Help to Address These Challenges
- Application 1: Valuing Resiliency in Public Health Infrastructure
- Application 2: Optimizing Loan Guarantees to Lower Borrowing Costs for Solar Power Projects
- Key takeaways
- Discussion and Q&A

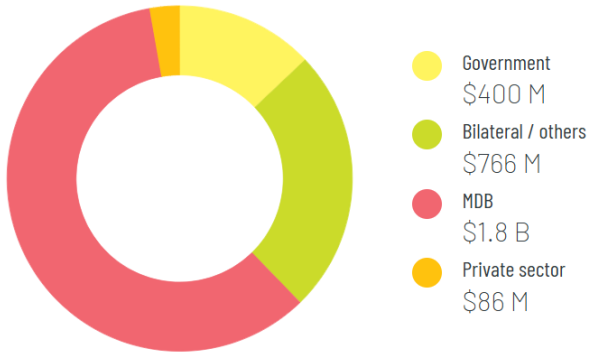
The Persistent A&R Investment Gap

The Challenge:

- Despite multiple appeals and compelling arguments, A&R projects attract very limited investment
- The share of private sector capital remains exceptionally small

Climate Investment Funds
Pilot Program for Climate Resilience (PPCR)

SOURCES OF EXPECTED CO-FINANCING



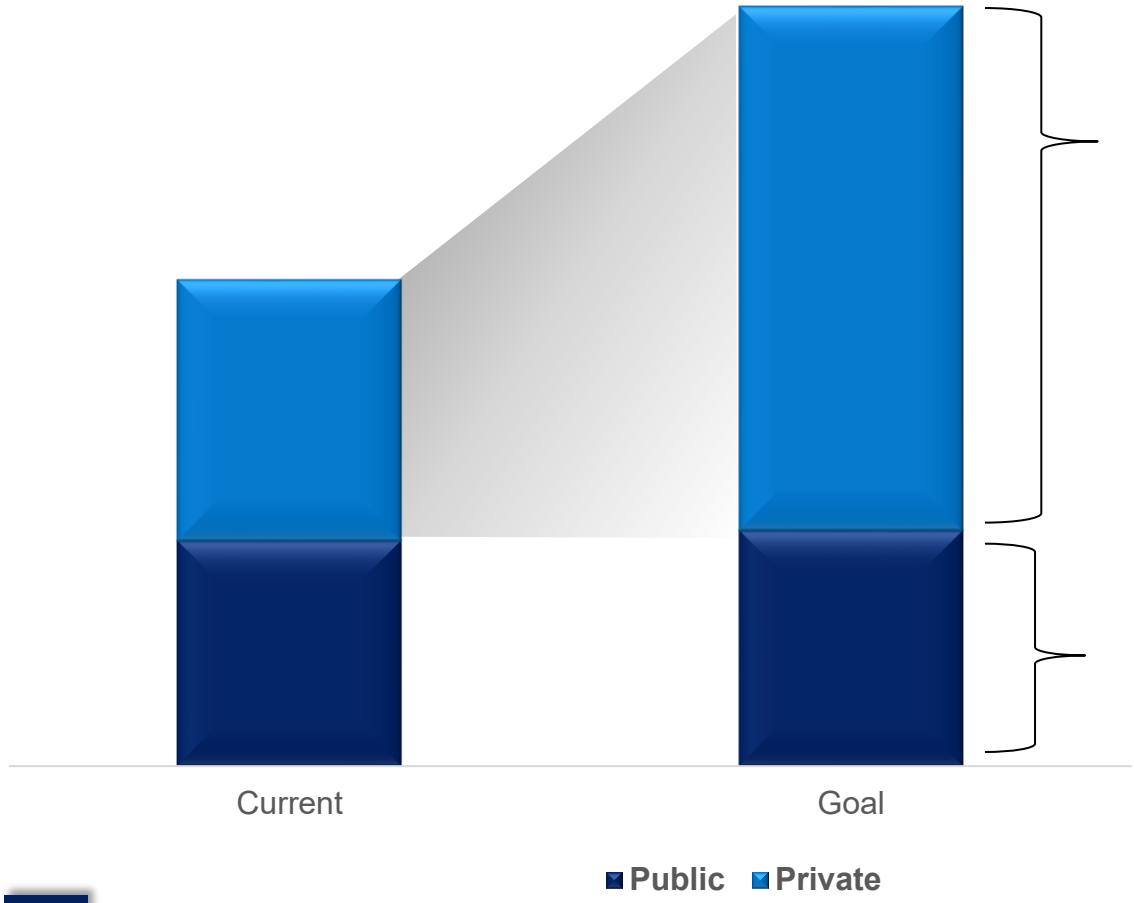
Why Private Investors Stay Away:

- **Uncertain Financial Results**: Expected gains are difficult to forecast with confidence, creating valuation challenges
- **Elevated Return Requirements**: Perceived risks drive demand for significantly higher Required Rates of Return (RRRs) that project economics often cannot support

The Bottom Line:

- Private investors operating within traditional frameworks view A&R projects as relatively unattractive investment propositions
- This holds regardless of the projects' social, environmental, or long-term economic benefits

The Challenges of Scaling up Private Investment in A&R Projects



How to better

- **Demonstrate that A&R projects are value-creating and will deliver a risk-adjusted rate of return.**

How to better

- **Leverage public funding by successfully derisking more A&R projects and reducing the RRRs.**

Achieving Resilience and Adaptation by Building Contingent Capabilities

- **Contingent organizational capabilities** are an organization's collective competencies, skills, resources, and capacities that enable it to perform tasks and achieve objectives while facing contingencies/risks.
- **Contingency plans** can be effective and efficient only if they involve applying pre-positioned contingent capabilities to mitigate the impact of emerging risks.
- Building **proactive resilience** requires developing contingency plans alongside investing in contingent capabilities.

Resilience:

ability to promptly, effectively, and efficiently overcome present threats (Resilience) and take advantage of present opportunities.

Reactive Resilience:

mobilize resources and marshal responses to opportunities and threats when they emerge

Proactive Resilience:

pre-planning responses and pre-positioning of contingent capabilities for prompt, effective, and efficient action

Contingent Capabilities – Fundamental Utility Challenge

- Essential during risk events
- Staying idle under base case scenarios

Contingent vs. Operational Investments: Different Valuation Needs

- Upfront costs versus uncertain future benefits
- Needed methodology for credible valuation of resilience and adaptation
- Valuing and optimizing R&A project to attract long-term private investment

Investment Characteristics	Investments in Operations	Investments in Resilience and Adaptation
Required Investment	Upfront	Upfront
Supported Activities	Ongoing and predictable	Ongoing and predictable
Timing of the Benefit	Accrue as scheduled	Accrue only if risk occurs
Scale of the Benefit	Accrue within a limited range	Unknown, depending on the frequency and severity of the risks
Likelihood of Benefits	High level of certainty	Highly uncertain
Assessment of Value	Correctly valued through current tools (NPV)	**Need new approach!**

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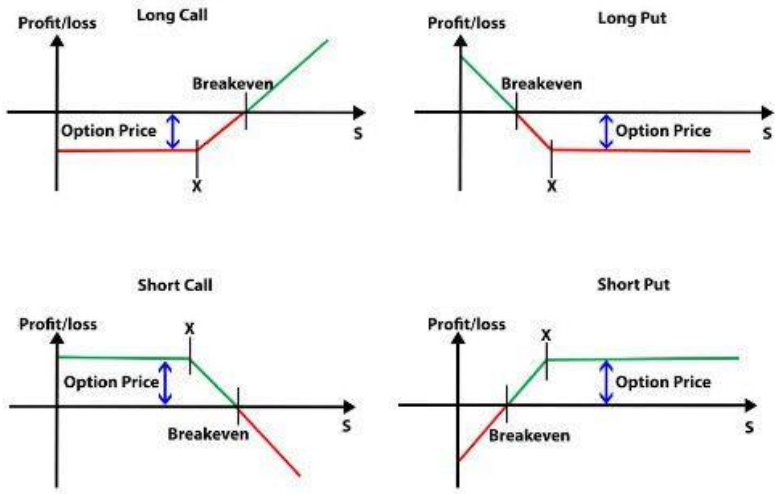
The Use of Options in Financial Markets for Hedging and Leverage



Definition: Financial options are contracts that give the holder the right, but not the obligation, to buy or sell an asset at a set price within a specified time.

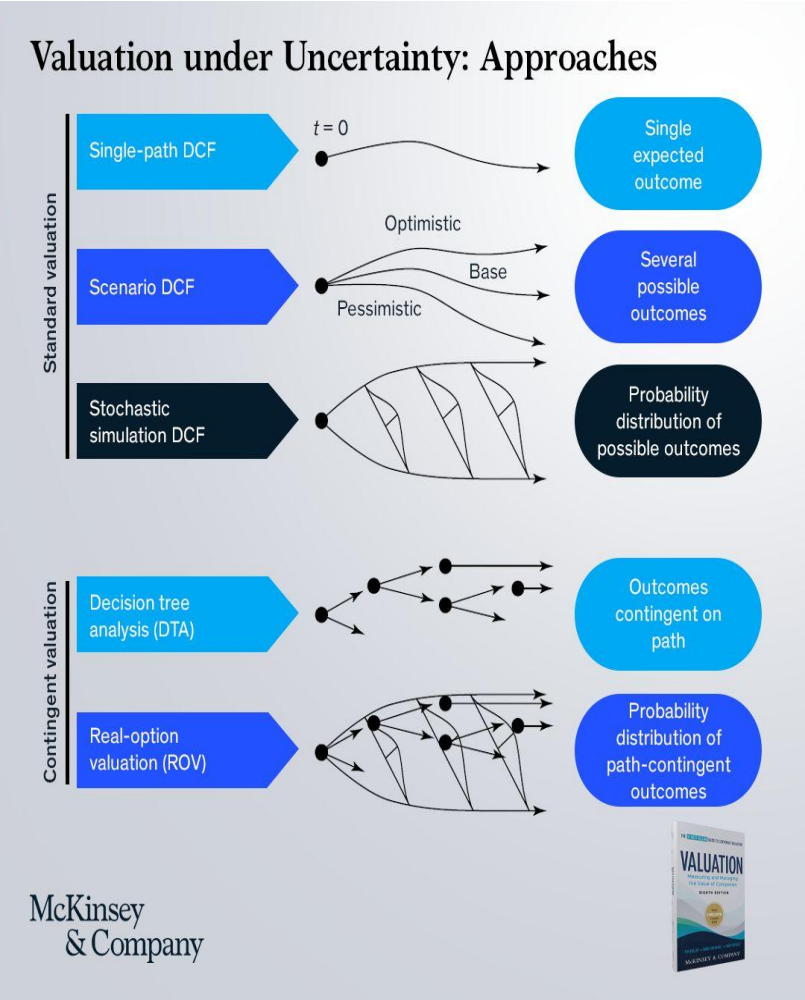
Key Types:

- **Call Option:** Gives the right to buy the asset for a predetermined price.
- **Put Option:** Provides the right to sell the asset for a predetermined price.

Hedging: Options and other derivatives serve as risk management tools, allowing investors to hedge against price fluctuations.

Leverage: Traders use options for speculation, leveraging their capital for potentially higher returns.

Real Options – A Financial Innovation



What are Real Options?

- **Real Options** represent the flexibility to take specific future actions that enhance or protect value.
- **Real Options Valuation** is a decision-support methodology used to quantify the value of these flexibilities.

Invention and Development:

- Real options were **first formally introduced** in the late 20th century, with the seminal work of academics such as **Stewart Myers** from MIT. They gained **prominence in finance and economics as a means of evaluating** investments in uncertain environments.

Different from Financial Options:

- **Unlike financial options,** which involve the right to buy or sell financial assets at a predetermined **price, real options apply to tangible (real) assets or projects**.
- Financial options are traded on markets, whereas **real options are created within the context of specific investment projects**.

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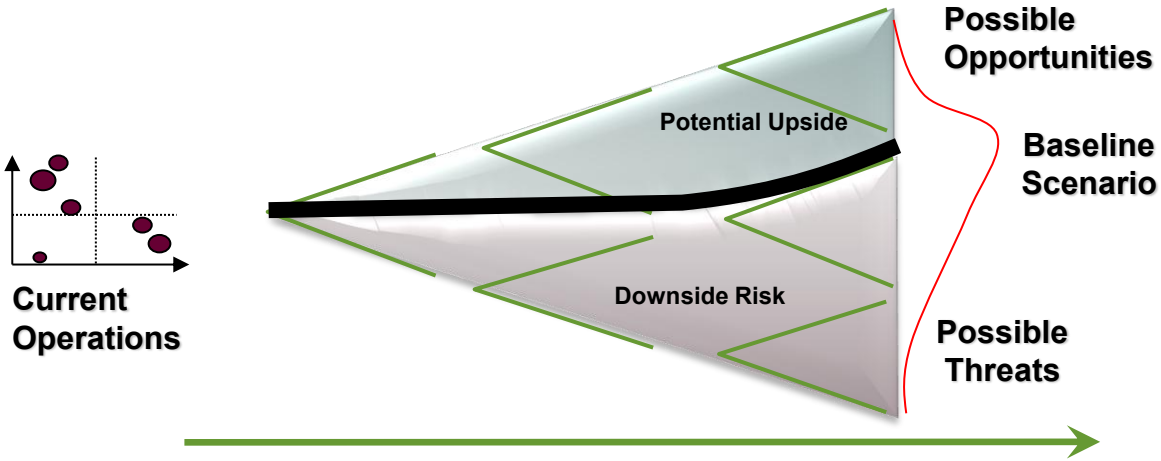
Agility Adjusted Value - Full Value

- To assess a project's full expected value requires accounting for its expected profitability as well as its upside potential and downside risk.

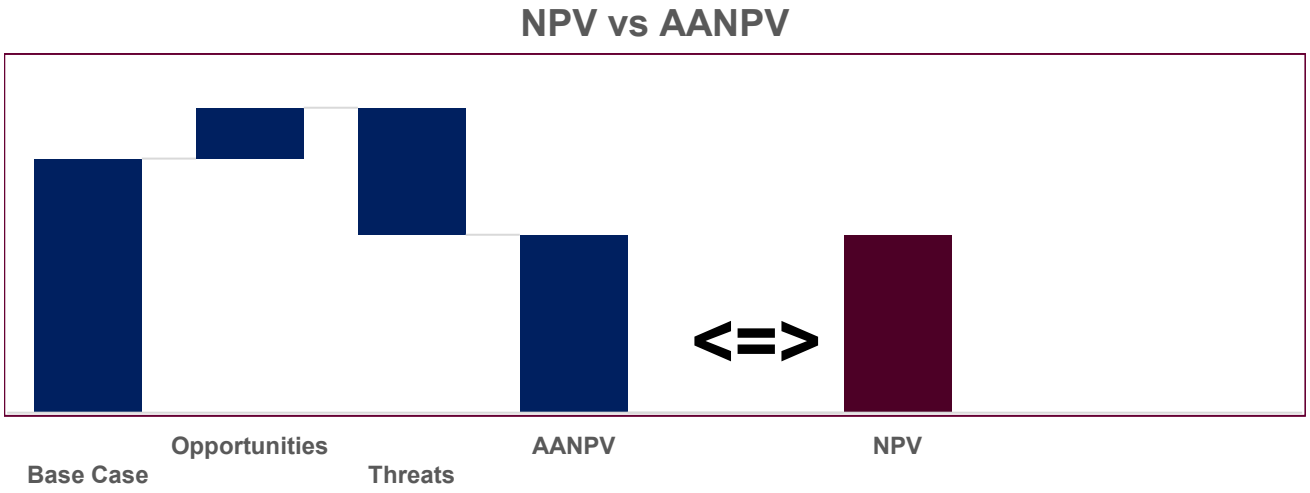
- Since upside potential adds value and downside risk subtracts value, the full expected value can be assessed as follows:

$$\boldsymbol{Agility\ Adjusted\ NPV = ExPr + Up - DownRisk}$$



AANPV – Meeting the Requirements to Value Contingent Capabilities

- Valuation methodology similar to the NPV approach.
- Able to explicitly and accurately capture the impacts of potential threats and opportunities on project value.
- Provides a single positive or negative valuation to support a clear go/no-go decision.
- The Agility Adjusted Net Present Value (AANPV) meets these requirements.



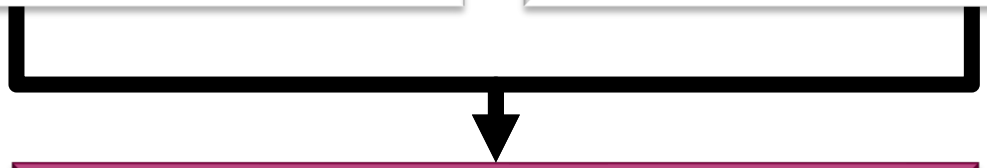
Real Options Analysis to Optimize Resilience

Reductive Real Options Valuation

- Resilience Value of existing risk mitigating controls:
  - Assess the negative option value **without existing controls**
  - Assess the reduced negative option value **with existing controls**
  - The difference is the Resilience Value

Accretive Real Options Valuation

- Resilience Value of incremental risk mitigating controls:
  - Assess the negative option value **with existing controls**
  - Assess the reduced negative option value **with existing and incremental controls**
  - The difference is the Resilience Value

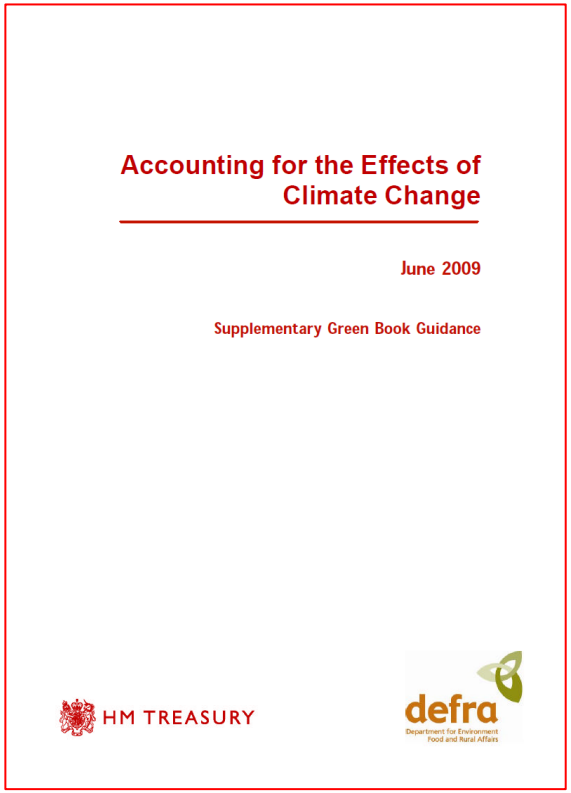


Resilience Optimization

- Resilience Value of existing and incremental risk mitigating controls:
  - Assess the negative option value **without existing controls**
  - Assess the reduced negative option value with **optimal existing and incremental controls**
  - The difference is the Resilience Value

HM Treasury Recommendation to use Real Option Analysis for Evaluating Policies, Programs and Projects

- UK Environment Agency's Thames Estuary 2100 (TE2100) project developed a strategy for tidal flood risk management to the year 2100 using Real Options Analysis.



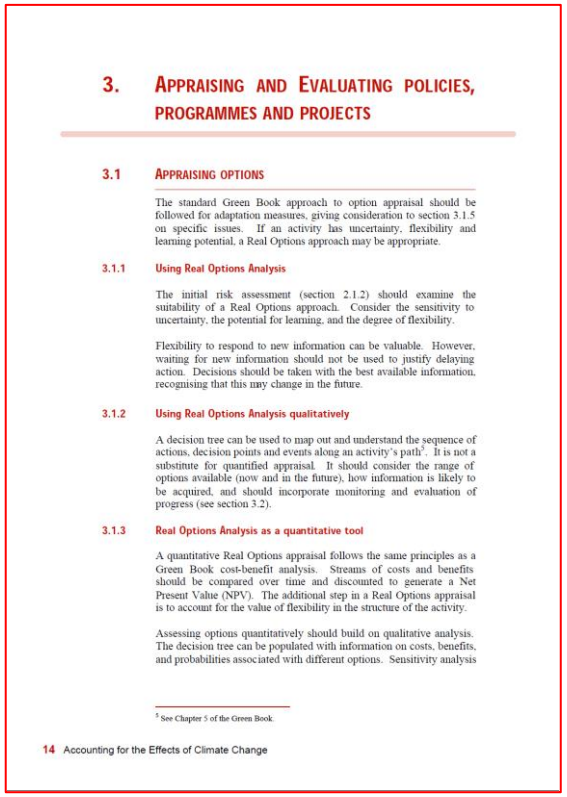
Accounting for the Effects of Climate Change

June 2009

Supplementary Green Book Guidance

HM TREASURY

defra
Department for Environment Food and Rural Affairs



3. APPRAISING AND EVALUATING POLICIES, PROGRAMMES AND PROJECTS

3.1 APPRAISING OPTIONS

The standard Green Book approach to option appraisal should be followed for adaptation measures, giving consideration to section 3.1.5 on specific issues. If an activity has uncertainty, flexibility and learning potential, a Real Options approach may be appropriate.

3.1.1 Using Real Options Analysis

The initial risk assessment (section 2.1.2) should examine the suitability of a Real Options approach. Consider the sensitivity to uncertainty, the potential for learning, and the degree of flexibility.

Flexibility to respond to new information can be valuable. However, waiting for new information should not be used to justify delaying action. Decisions should be taken with the best available information, recognising that this may change in the future.

3.1.2 Using Real Options Analysis qualitatively

A decision tree can be used to map out and understand the sequence of actions, decision points and events along an activity's path[5]. It is not a substitute for quantified appraisal. It should consider the range of options available (now and in the future), how information is likely to be acquired, and should incorporate monitoring and evaluation of progress (see section 3.2).

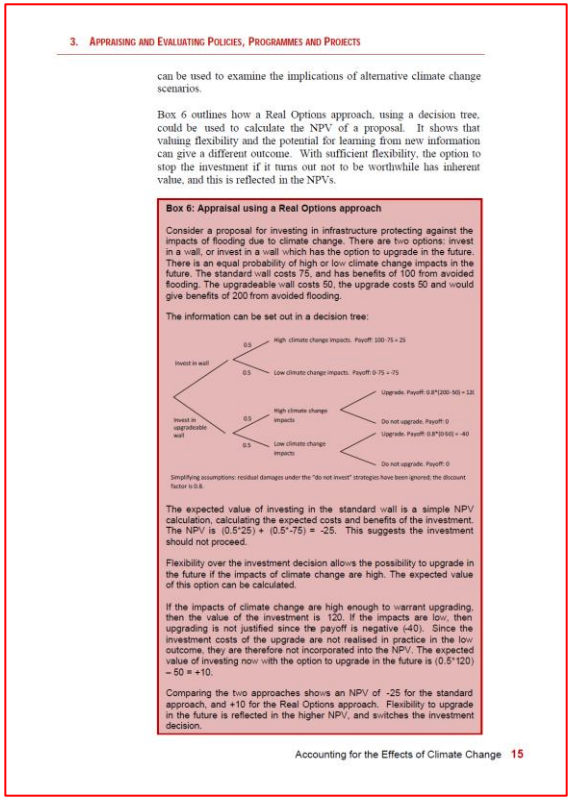
3.1.3 Real Options Analysis as a quantitative tool

A quantitative Real Options appraisal follows the same principles as a Green Book cost-benefit analysis. Streams of costs and benefits should be compared over time and discounted to generate a Net Present Value (NPV). The additional step in a Real Options appraisal is to account for the value of flexibility in the structure of the activity.

Assessing options quantitatively should build on qualitative analysis. The decision tree can be populated with information on costs, benefits, and probabilities associated with different options. Sensitivity analysis

[5] See Chapter 5 of the Green Book.

14 Accounting for the Effects of Climate Change



3. APPRAISING AND EVALUATING POLICIES, PROGRAMMES AND PROJECTS

can be used to examine the implications of alternative climate change scenarios.

Box 6 outlines how a Real Options approach, using a decision tree, could be used to calculate the NPV of a proposal. It shows that valuing flexibility and the potential for learning from new information can give a different outcome. With sufficient flexibility, the option to stop the investment if it turns out not to be worthwhile has inherent value, and this is reflected in the NPVs.

Box 6: Appraisal using a Real Options approach

Consider a proposal for investing in infrastructure protecting against the impacts of flooding due to climate change. There are two options: invest in a wall, or invest in a wall which has the option to upgrade in the future. There is an equal probability of high or low climate change impacts in the future. The standard wall costs 75, and has benefits of 100 from avoided flooding. The upgradeable wall costs 50, the upgrade costs 50 and would give benefits of 200 from avoided flooding.

The information can be set out in a decision tree:

The expected value of investing in the standard wall is a simple NPV calculation, calculating the expected costs and benefits of the investment. The NPV is (0.5*25) + (0.5*-75) = -25. This suggests the investment should not proceed.

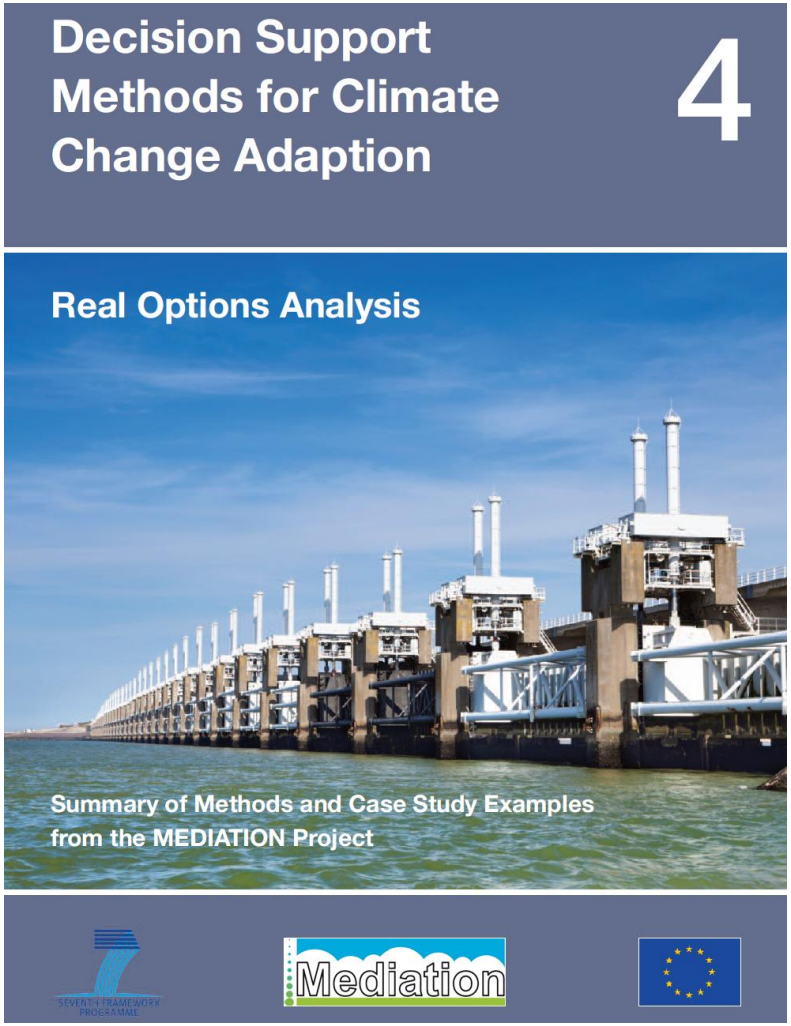
Flexibility over the investment decision allows the possibility to upgrade in the future if the impacts of climate change are high. The expected value of this option can be calculated.

If the impacts of climate change are high enough to warrant upgrading, then the value of the investment is 120. If the impacts are low, then upgrading is not justified since the payoff is negative (-40). Since the investment costs of the upgrade are not realised in practice in the low outcome, they are therefore not incorporated into the NPV. The expected value of investing now with the option to upgrade in the future is (0.5*120) – 50 = +10.

Comparing the two approaches shows an NPV of -25 for the standard approach, and +10 for the Real Options approach. Flexibility to upgrade in the future is reflected in the higher NPV, and switches the investment decision.

Accounting for the Effects of Climate Change 15

European Union Recommendation to Use Real Option Analysis for Climate Change Adaptation



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Further Reading and Reference Sources

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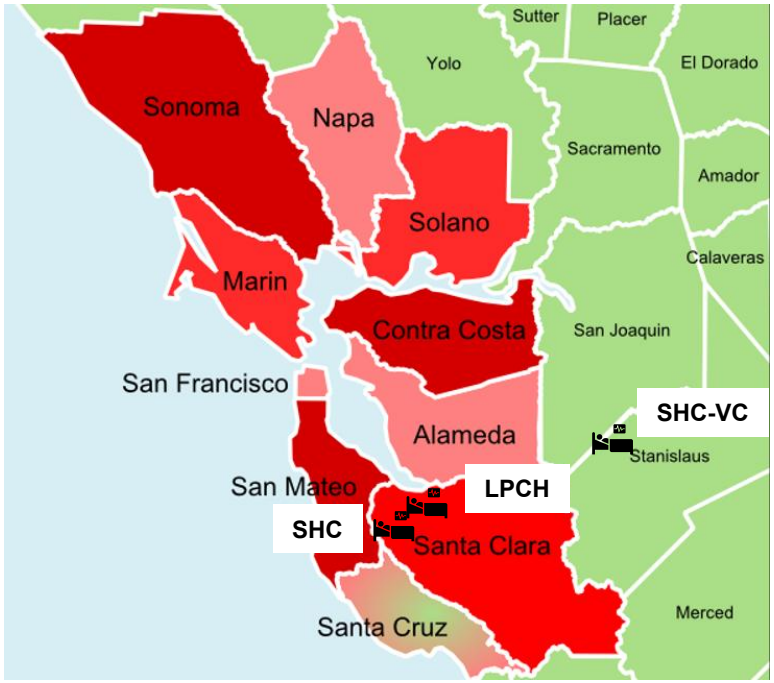
Stanford Medical Network of Care

Three Hospitals:
- Stanford Health Care
- Lucile Packard Children's Hospital Stanford
- Stanford Health Care – ValleyCare

~60 clinics and Medical Office Buildings including:
- Emeryville
- Cancer Center South Bay
- Redwood City

Consistently Ranked as top hospitals in the country



Real Options Analysis to Optimize Resilience

PPE Shortages Impact on Operations

- As COVID19 spread in mid-March 2020, cities and counties began shutting down the economy
- Health systems relying on Just In Time (JIT) medical supply deliveries were very short on PPE
  - Reuse PPE
  - N95 mask re-processing (cleaning)
  - PPE Conservation

Elective procedures have been postponed

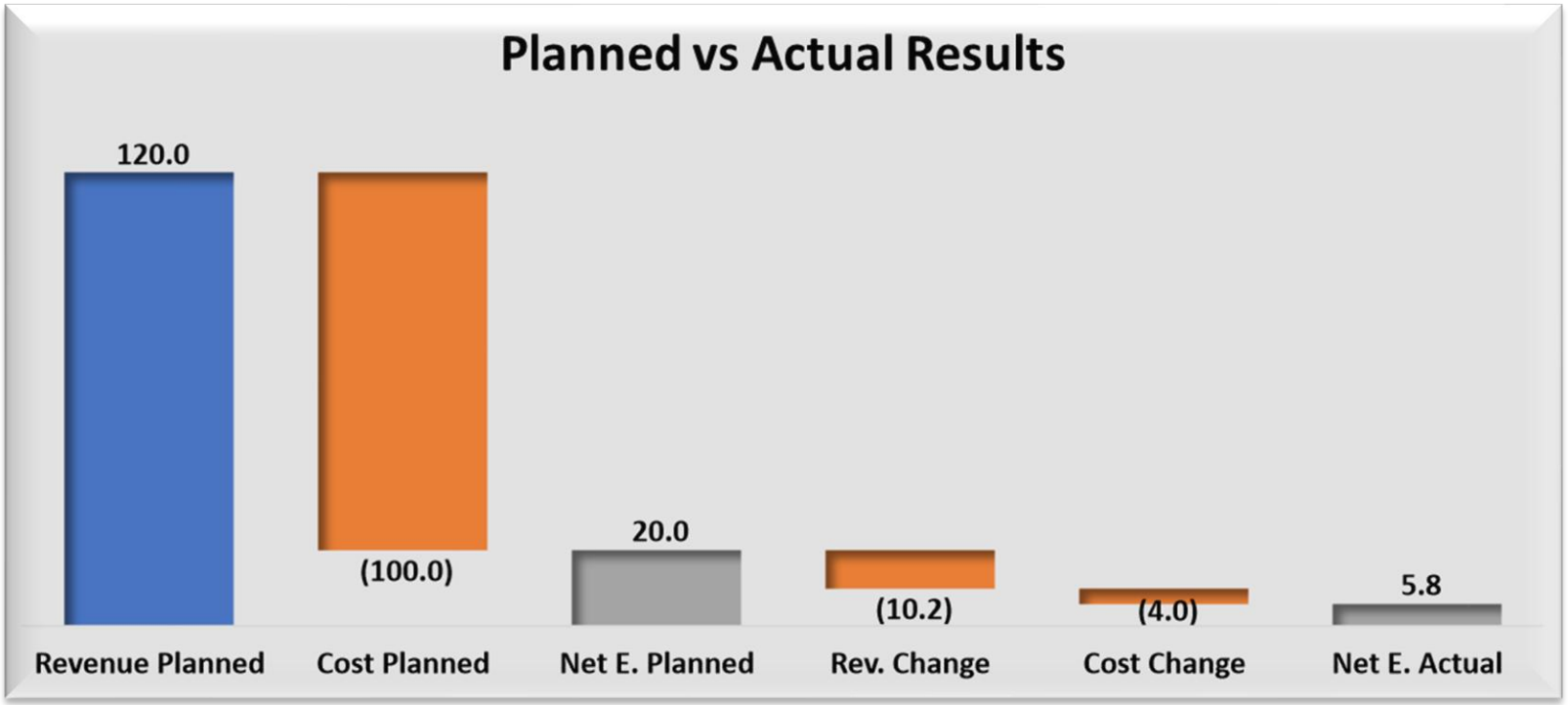
PPE Fraud and Price Gouging

- Multiple press reports of PPE fraud
- FDA and OSHA regulate various levels of PPE
- Regulations based on water penetration rates, filtration particle size, etc.
- Price gouging – what cost $5 was selling for $50 – 10x price increase

We bought less PPE, but our expenses went up

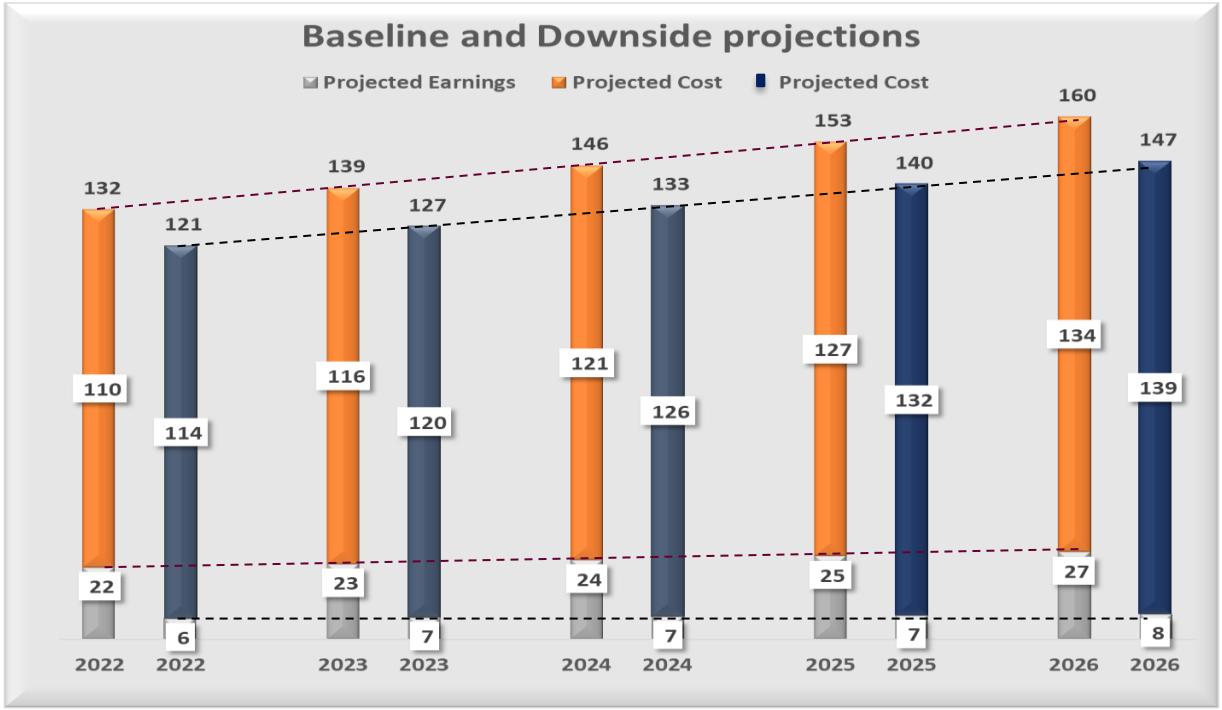
Impact on Net Earnings

- Revenue fell by 8.5% compared to plan
- Costs increased by 4% compared to plan



Baseline and Downside Projections 2022-2026

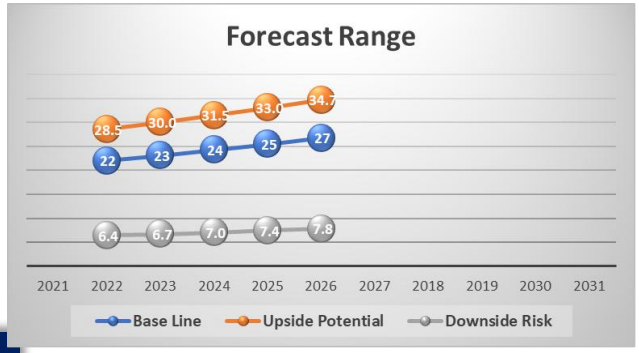
- Baseline projection: Revenues and costs grow at 5% annual
- Downside projection: Revenue drops by 8.5% and Costs increase by 4%

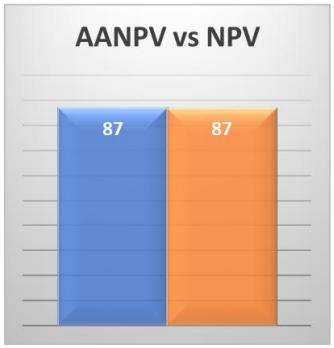


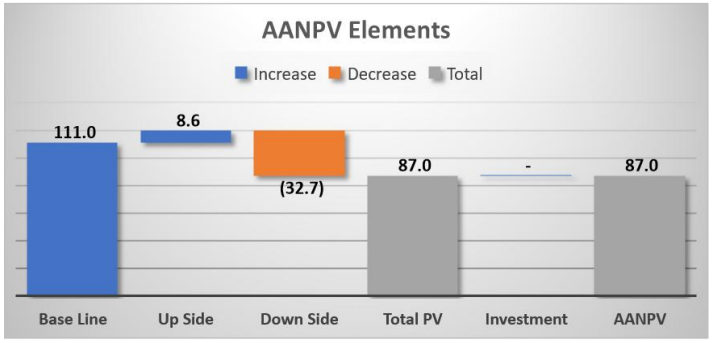
NPV vs. AANPV

- NPV values operations by discounting baseline cash flows at the cost of capital
- AANPV incorporates multiple performance scenarios for more correct valuation

Year	Growth	2021	2022	2023	2024	2025	2026
Upside Potential			28.5	30.0	31.5	33.0	34.7
Base Line			22.0	23.1	24.3	25.5	26.7
Downside Risk			6.4	6.7	7.0	7.4	7.8
Initial Investment		0					
Additional Investment							
Investment Total		0					







Proposed Resilience-Building Project

- To prepare for future possible contagious epidemic emergencies, the organization considers setting up a warehouse with PPE reserves
- A business case details the expected financial impact of the project if undertaken

Set Warehouse and store PPE reserves

- As Just-in-Time PPE procurement proved ineffective
- Resiliency became a key focus for management
- To ensure operations continuity during future emergencies, we propose setting up a warehouse and storing PPE reserves

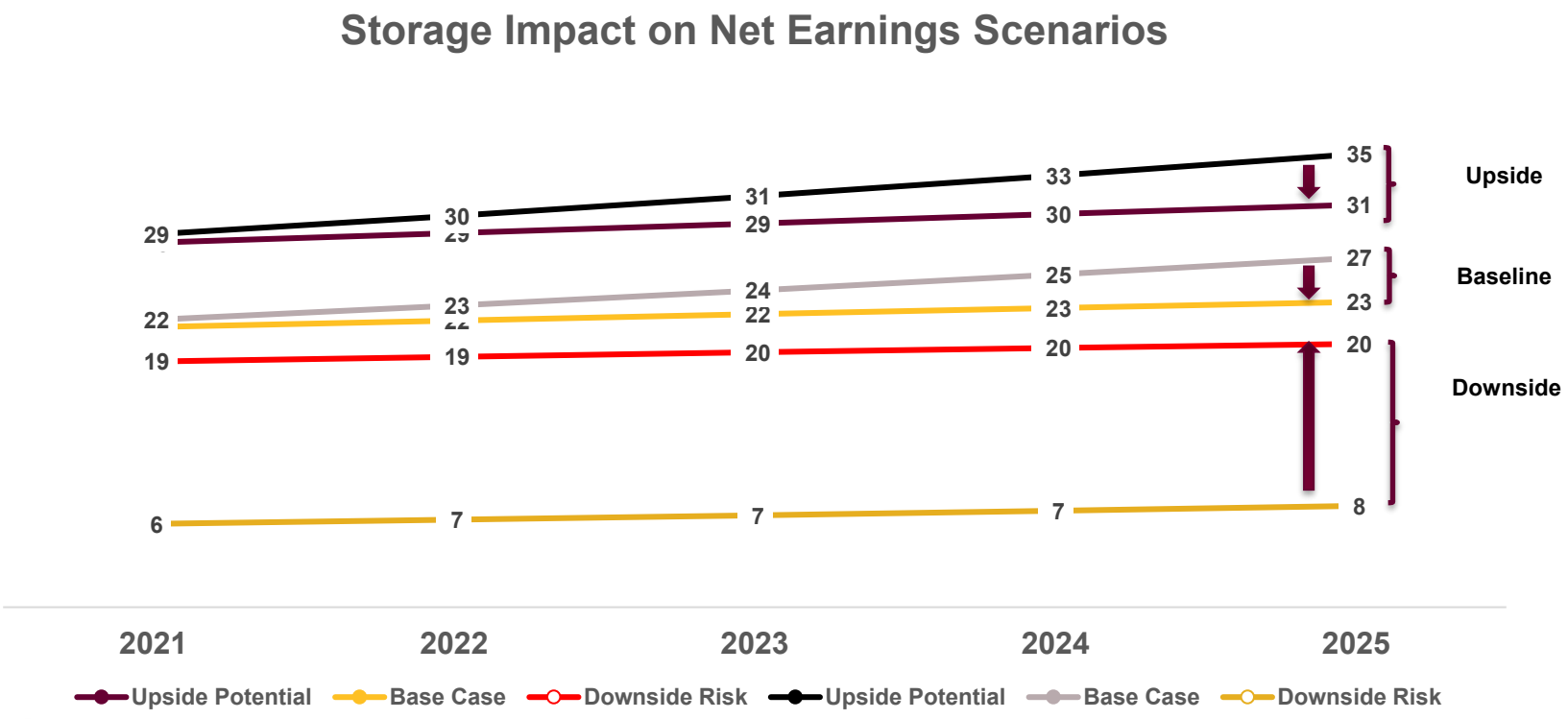
Warehouse's Economics

- Invested Capital: - 10 million
- Baseline: Cost will grow at 5.2% annually vs. 5% baseline
- Downside Revenue would drop by 2% vs 8.5% baseline
- Downside Cost would increase by 0% vs 4% baseline

Project's Impact on the Net Earnings Scenarios

- The project lowers the baseline and the upside projections due to additional costs to maintain the storage facility

- The project improves downside outcomes by reducing revenue loss and eliminating cost increases under the downside risk scenario

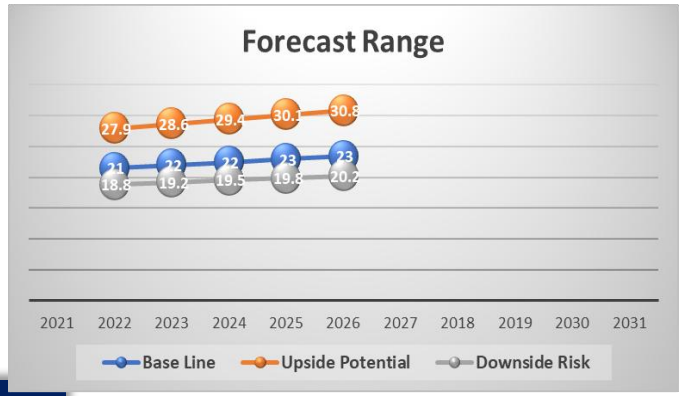


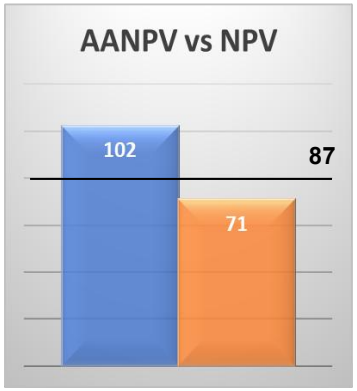
NPV vs AANPV Project Impact

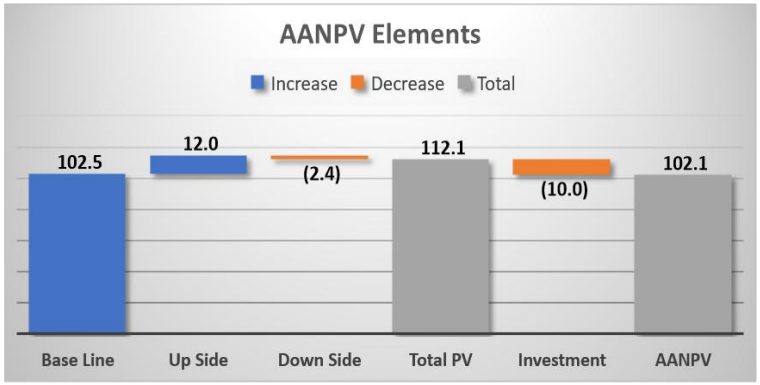
- NPV discounts the new baseline cash flow and the additional investment at the cost of capital

- AANPV reflects multiple performance scenarios and the additional investment

Year	Growth	2021	2022	2023	2024	2025	2026
Upside Potential			27.9	28.6	29.4	30.1	30.8
Base Line			21.5	21.9	22.4	22.9	23.4
Downside Risk			18.8	19.2	19.5	19.8	20.2
Initial Investment		0					
Additional Investment		-10					
Investment Total		-10					



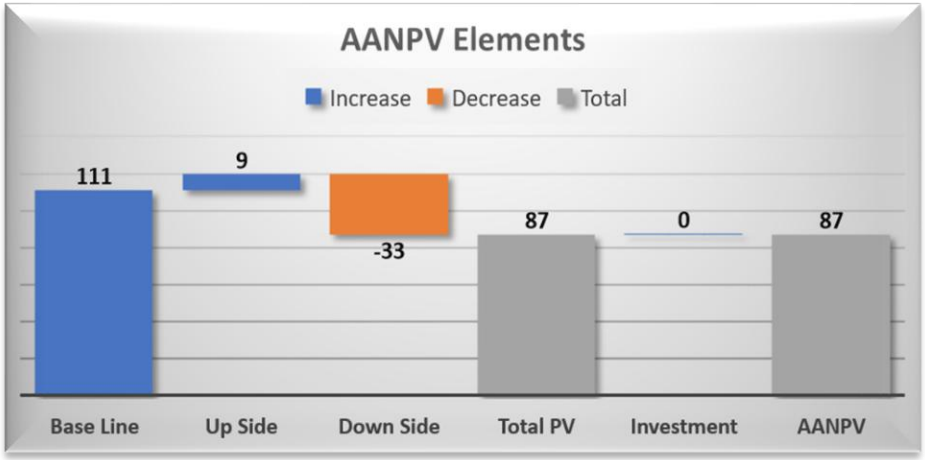


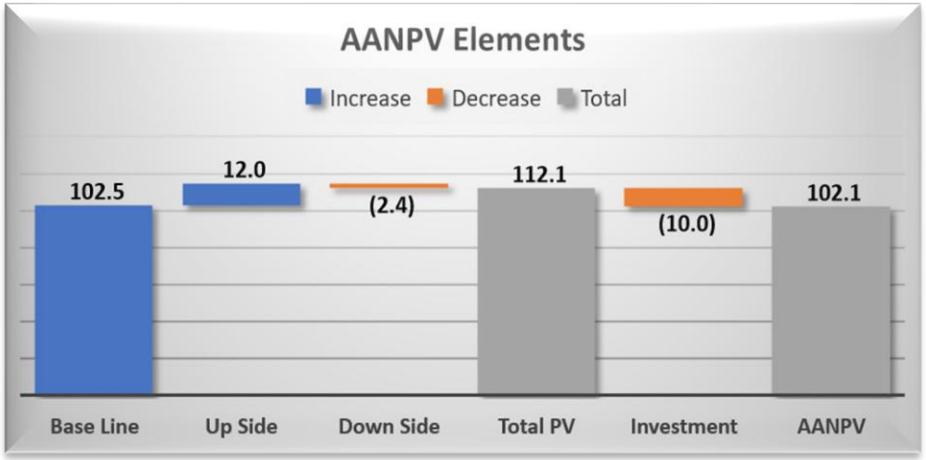


Change in the AANPV Elements

- The additional costs reduce the Baseline from 111 to 102.5
- Upside increases from 9 to 12 as the value of Baseline is reduced
- The negative value of the Downside is reduced dramatically from -33 to -2.4
- There is an additional investment of -10

- As a result, the AANPV increases from 87 to 102 despite the additional costs and investment





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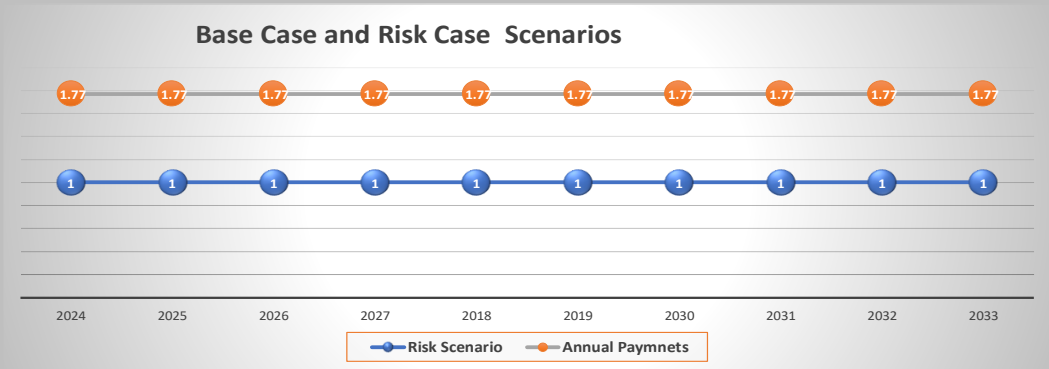
Evaluating a Loan Guarantee – Illustrative Example

- An Investor is considering taking a $10 million loan for a clean energy project.
- A local bank requires 12% annual interest.
- At a 12% interest rate, the required annual payments are $1.77million, totaling $17.7million over the loan's term.
- Multilateral Development Bank (MDB) is considering offering a full loan guarantee.
- MDB must evaluate the default risk of the loan and assess the guarantee's value for price negotiations with the potential Investor.

Developing Risk Scenarios

- Default risk can be assessed by developing a risk scenario alongside the base case repayment scenario.
- The risk scenario assumes a 10% probability that actual repayments could be $1 million or lower.
- This scenario then helps to generate all intermediary scenarios between $1 million and $ 1.77 million.

Key Assumptions	
Loan Amount	10
Repayment Periods	10
Initial Discount Rate	12%
Risk Free Rate	4%
Probability of Risk Scenario	10%



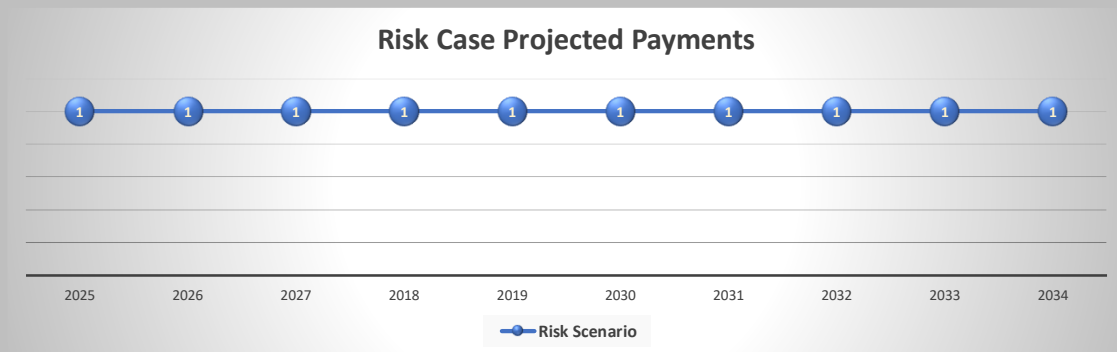
Valuing the Sovereign Guarantees

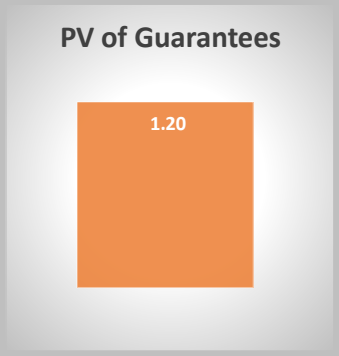
- Real Options Analysis enables the correct valuation of the loan guarantee at $1.2 million despite uncertain cash flows

- The MDB can use this methodology to value different partial loan guarantees and optimize its offer

Repayment Periods	**10**
Risk Free Rate	**4%**

Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
Base Case Payments		1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
Risk Case Projected Payments		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Initial Investment											

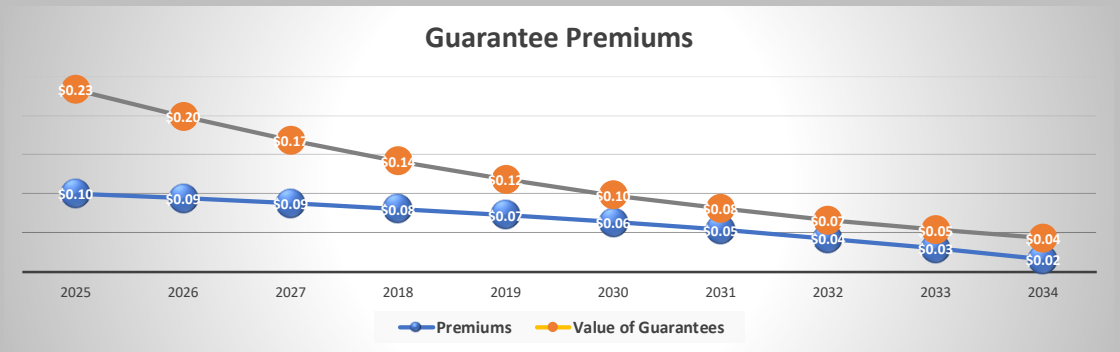


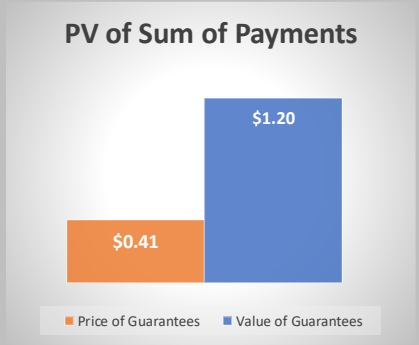


Loan Guarantees Value vs Premiums

- Annual guarantee premiums are set at 1% of the remaining principal with a Present Value of $0.41 million.
- The guarantee's value exceeds the premium each year, resulting in an incremental Present Value of $0.79 million.
- The $0.79 million represents a price discount offered by the MDB to the borrower

Initial Discount Rate	12%										
Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
Loan Principal	$10.00	$9.43	$8.79	$8.08	$7.28	$6.38	$5.38	$4.25	$2.99	$1.58	$0.00
Price of the Guarantee	$0.10	$0.09	$0.09	$0.08	$0.07	$0.06	$0.05	$0.04	$0.03	$0.02	
Value of Guarantees	$0.23	$0.20	$0.17	$0.14	$0.12	$0.10	$0.08	$0.07	$0.05	$0.04	

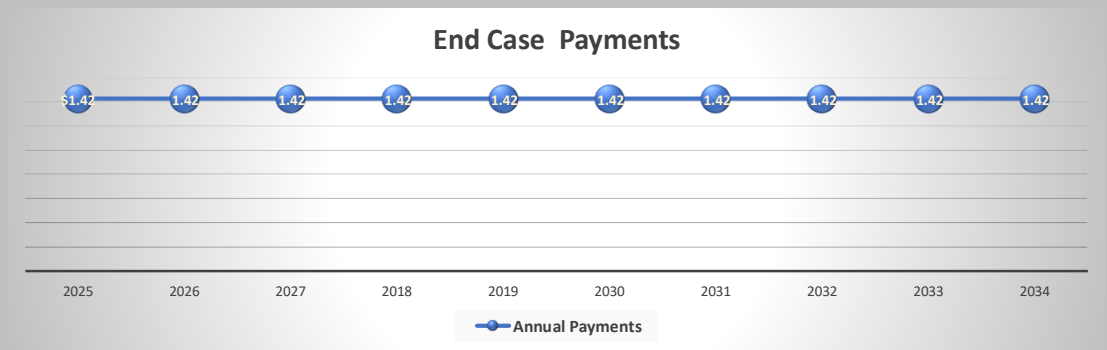


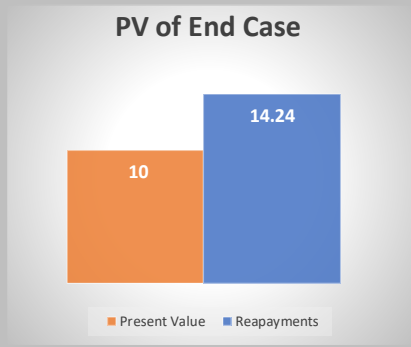


Reducing Default Risk and the Interest Rate of the Loan

- With the guarantee, the bank reduces its default risk and can offer a 7% interest rate.
- At 7%, annual payments are $1.42 million, totaling $14.24 million over the loan term.

End Discount Rate	7%										
Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
		-	-	-	-	-	-	-	-	-	-
End Case Payments		$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42



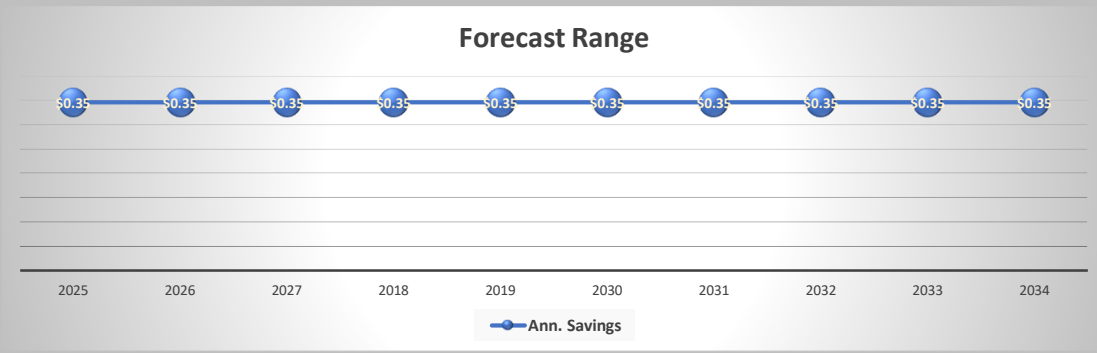


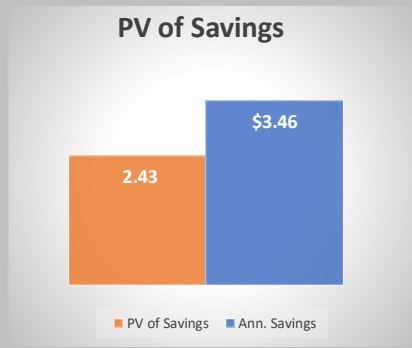
Reducing the Cost of Borrowing to the Investor

- Lower annual payments save the investor $0.35million per year
- Total savings over the loan's life are $3.46million, with a present value of $2.43million

End Discount Rate	7%

Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
Base Case Payments		$1.77	$1.77	$1.77	$1.77	$1.77	$1.77	$1.77	$1.77	$1.77	$1.77
End Case Payments		$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42	$1.42
Ann. Savings		$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35

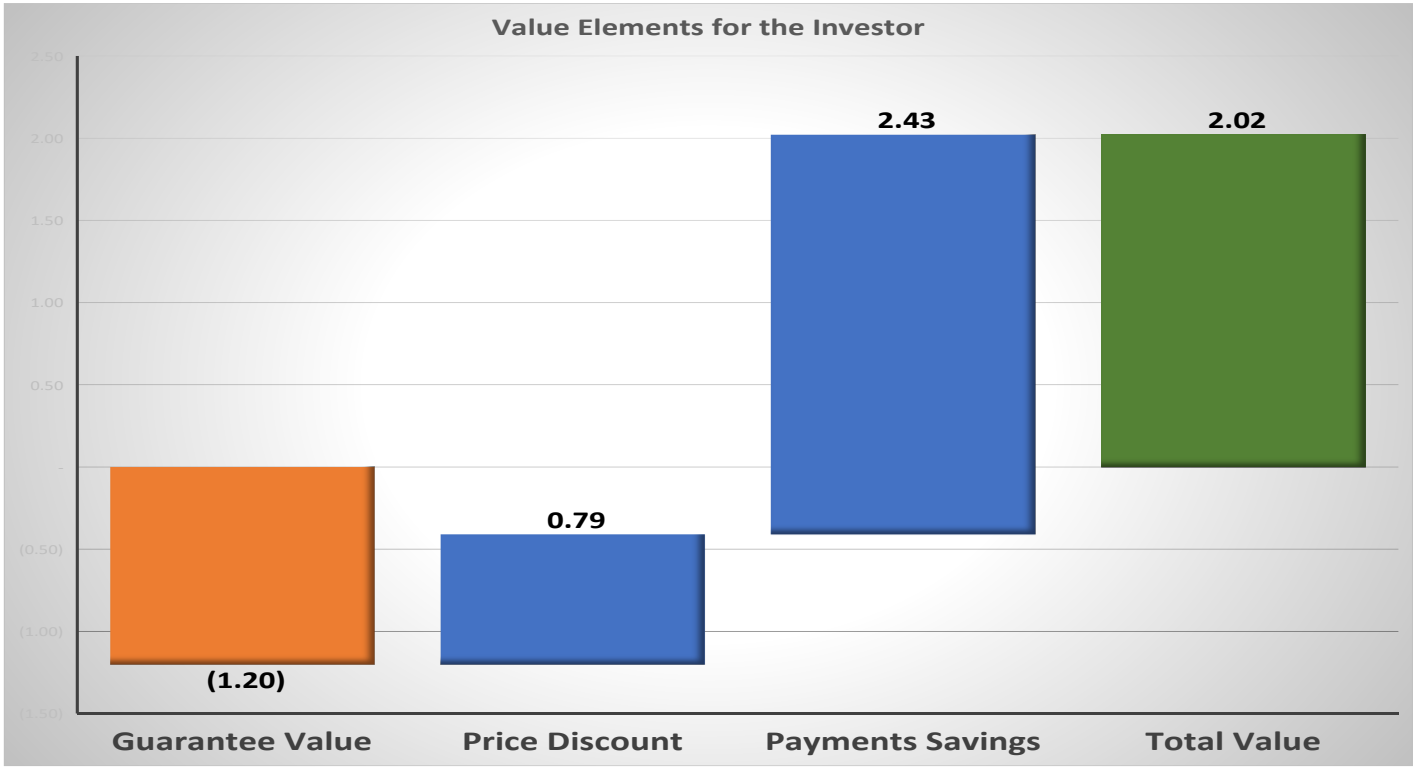




Value Added to the Investor Through the Loan Guarantee

The guarantee delivers $2,02 million of additional present value to the investor

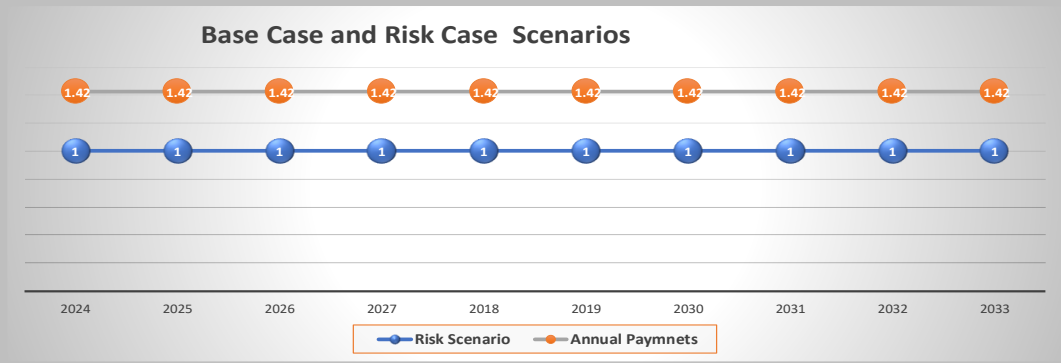
- Negative $1.2 million guarantee value/ full price
- $0.79 million in guarantee price discounts (investor pays only $0.41 million)
- $2.43 million in payment savings over the loan's life



Developing Risk Scenarios for the New Cost of Borrowing

- Annual loan payments are $1.42 million at 7% interest
- Risk scenario still assumes 10% probability that repayments could be $1 million or less
- This scenario then helps to generate all intermediary scenarios between $1 million and $ 1.42 million.

Key Assumptions	
Loan Amount	10
Repayment Periods	10
Initial Discount Rate	7%
Risk Free Rate	4%
Probability of Risk Scenario	10%
	90.0%

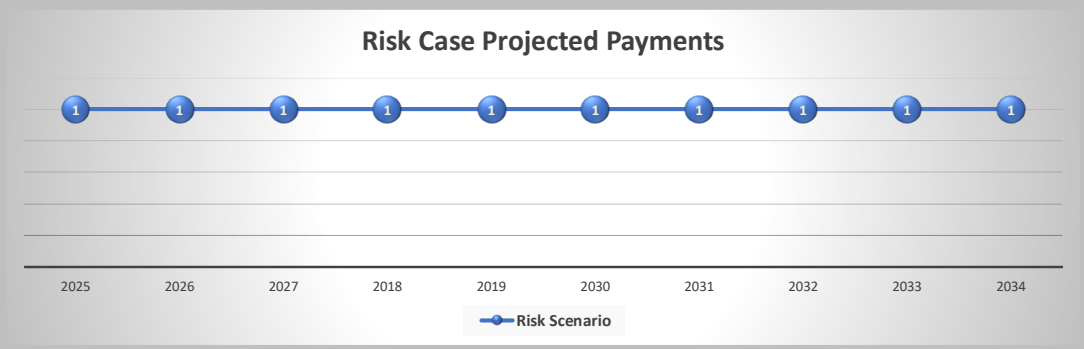


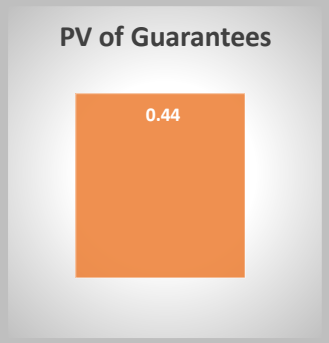
Valuing Loan Guarantees for the New Cost of Borrowing

- The reduced loan payments lower the potential loss for the guarantor
- Using Real Options Analysis, the loan guarantee is now valued at $0.44 million
- This represents a savings of $0.76 million compared to the initial guarantee value of $1.2 million

Repayment Periods	10
Risk Free Rate	4%

Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
Base Case Payments		1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Risk Case Projected Payments		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Initial Investment											





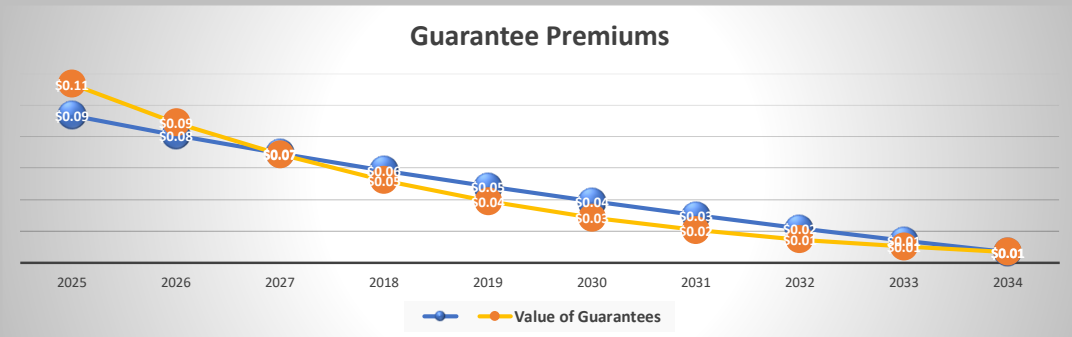
The New Loan Guarantees Value vs Premiums

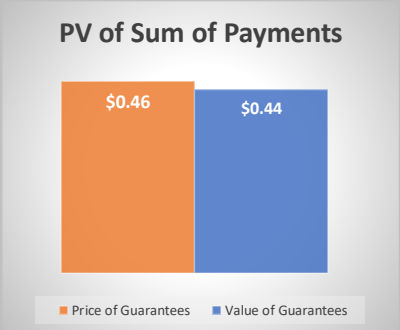
- In each period, the annual value of the guarantee closely aligns with the annual premium paid.

- Over the life of the loan, the total present value of the guarantee and the premiums are nearly equal.

Initial Discount Rate	7%

Year	2024	2025	2026	2027	2018	2019	2030	2031	2032	2033	2034
Loan Principal		$10.00	$9.28	$8.50	$7.67	$6.79	$5.84	$4.82	$3.74	$2.57	$1.33
Price of the Guarantee		$0.09	$0.08	$0.07	$0.06	$0.05	$0.04	$0.03	$0.02	$0.01	$0.01
Value of Guarantees		$0.11	$0.09	$0.07	$0.05	$0.04	$0.03	$0.02	$0.01	$0.01	$0.01

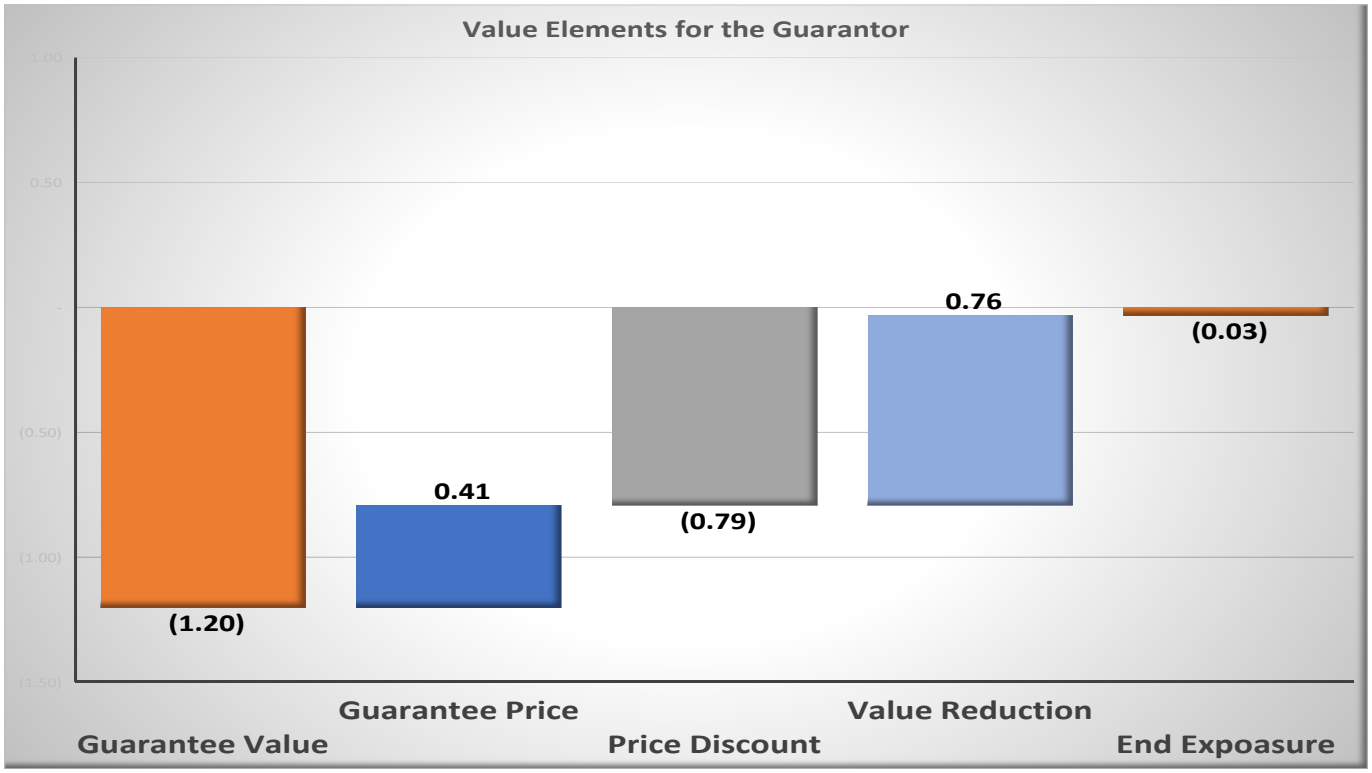




End Net Exposure of the Multilateral Development Bank

- Before the reduced borrowing cost, the MDB's Initial exposure is ($0.79) million due to the premium discount

- After the investor's borrowing costs are reduced, the guarantee value decreases by $0.76 million, resulting in only ($0.03) million net exposure for the MDB



Agenda

- Investment Challenges in Adaptation and Resilience Projects
- Real Options Analysis can Help to Address These Challenges
- Application 1: Valuing Resiliency in Public Health Infrastructure
- Application 2: Optimizing Loan Guarantees to Lower Borrowing Costs for Solar Power Projects
- **Key takeaways**
- Discussion and Q&A

Key takeaways

The Valuation Challenge:

- Resilience investments require substantial upfront costs but deliver benefits only during low-probability extreme events
- Traditional NPV undervalues resilience measures, leaving decision-makers without complete information on true economic value

Real Options Solution:

- Models the uncertainty of risk scenarios with ranges of impacts and probabilities
- Converts uncertain future benefits into present values with comparable metrics (NPV, ROI)
- Enables "apples-to-apples" comparison between resilience and operational projects

Implementation Opportunities:

- Integrates with existing capital budgeting processes to optimize timing and scale of investments
- Provides clear, defensible metrics for stakeholder communication
- Applicable across diverse resilience projects

Agenda

- Investment Challenges in Adaptation and Resilience Projects
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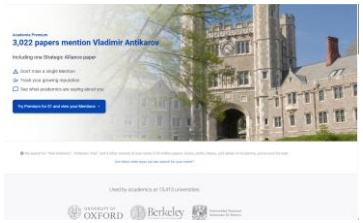
- Application 1: Valuing Resiliency in Public Health Infrastructure
- Application 2: Optimizing Loan Guarantees to Lower Borrowing Costs for Solar Power Projects
- Key takeaways
- **Discussion and Q&A**

About Us

Vladimir Antikarov is Principal at Verea Group LLC. With over 20 years of experience, Mr. Antikarov has served as a senior member of the corporate finance practice with the Monitor Group (1992-2005), now Monitor Deloitte, and as Senior Advisor to the CFO of Overseas Shipholding Group, Inc. (2005-2012). His client engagements have included work with AT&T, Merck, Lockheed Martin, Lucent/Avaya, Thomson Reuters, Philips, Roche, Valle, Votorantim, Telefonica, Axel Johnson, and The World Bank.

Mr. Antikarov is a co-author, with Tom Copeland, of the best-selling book, Real Options, A Practitioner's Guide, used by MIT, Harvard, The Wharton School, and many other business schools. The book has been published in six languages and was the number one business book on Amazon UK.



Mr. Antikarov has been cited more than 3400 times in the academic and professional literature.

PRMIA
The Professional Risk Managers' International Association

A member of numerous professional associations, most recently Mr. Antikarov has been elected by his professional colleagues as Regional Director of the Professional Risk Manager International Association (PRMIA) for the Washington DC area.

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