Top-down & bottom-up integration of climate models

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From insight to action

- Ortec Finance Climate Scenarios have successfully raised awareness of climate change as a financial risk driver
- Our top-down scenarios provide insight into systemic impacts across different climate narratives
- However, translating these insights into concrete investment decisions remains a key challenge for clients
- The real value of scenario analysis lies in its decision usefulness: informing choices, not just insights

Ortec Finance Climate Scenarios

Overview of scenario pathways

Net-Zero

Explores **risks/opportunities** under a highly ambitious but **orderly net-zero** scenario

1.6°C

Delayed Net-Zero

Explores **disruption** from a delayed transition with a step-up in policy action from 2030

1.9°C

Limited Action

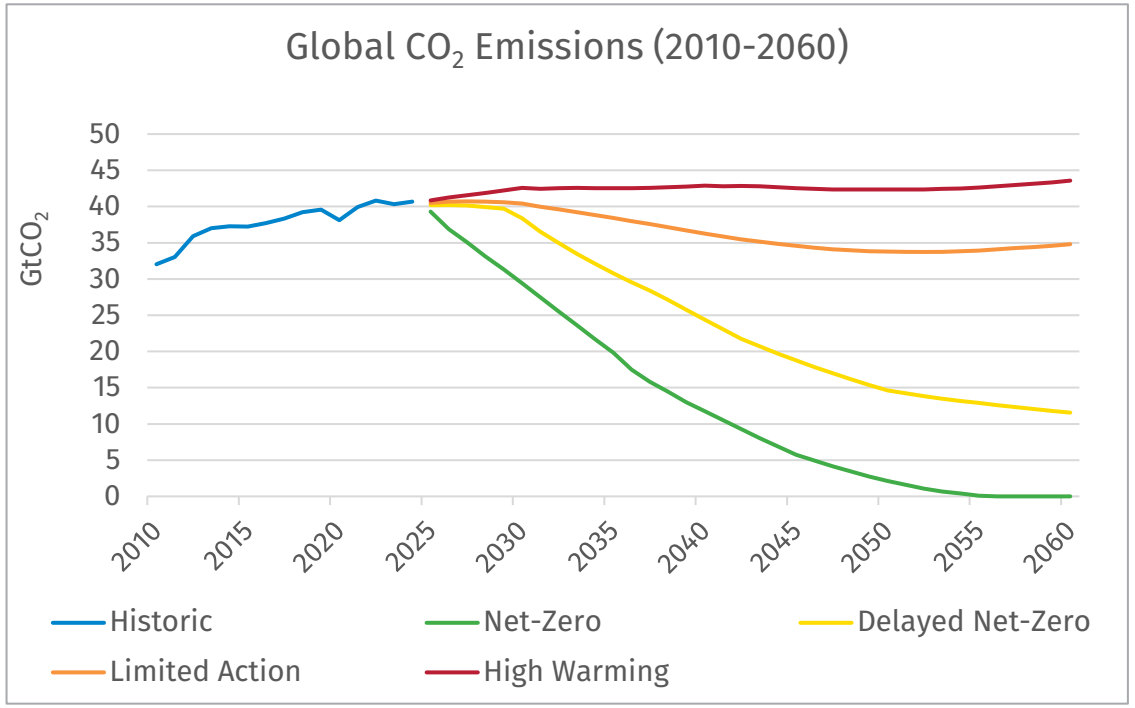
Explores **falling short of meeting emissions targets** and high exposure to physical risks

2.9°C

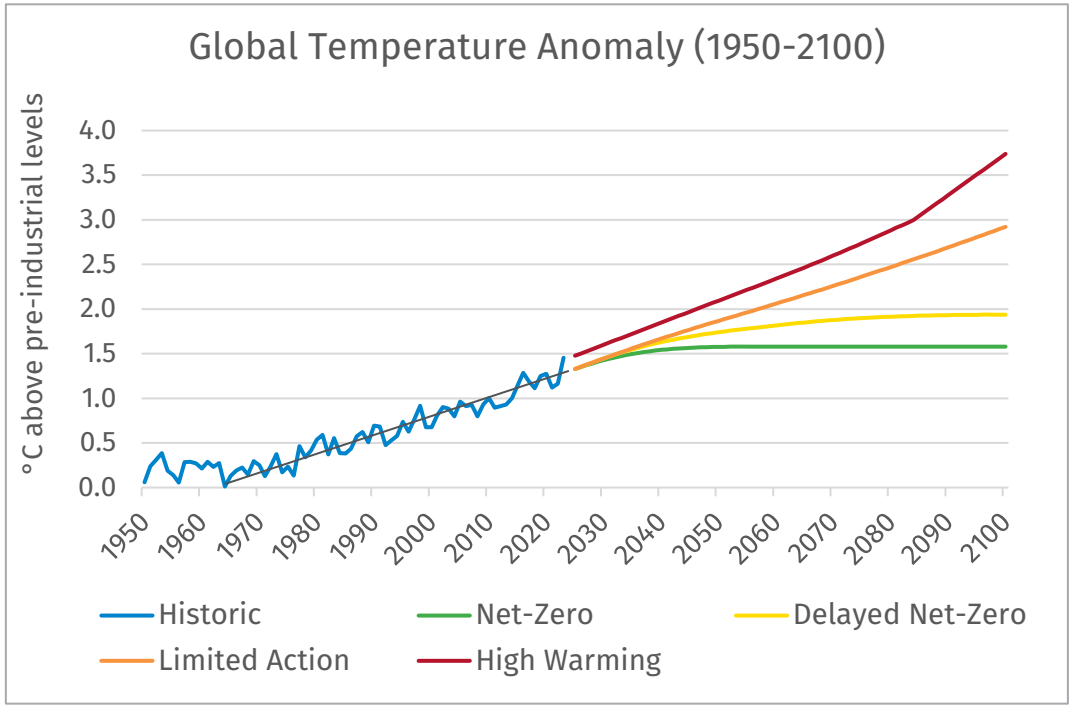
High Warming

Explores **severe physical** risks under current policies

3.7°C



Source: EDGAR, Ortec Finance Climate Scenarios 2025



Source: Berkeley Earth, Ortec Finance Climate Scenarios 2025

OF Climate Scenarios – Methodology overview

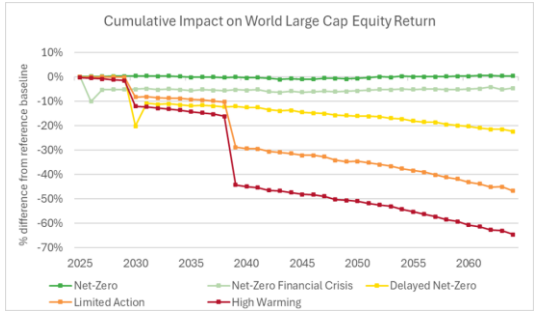
Transition Impacts
Cambridge Econometrics' E3ME macro-econometric model models impact on GDP and CPI per country and sector

Chronic Physical Impacts
Damage function relates temperature to GDP and CPI per country

Acute Physical Impacts
Project frequency of extreme weather events using ClimatePREDICT, models impacts on GDP per country

CLIMATE MAPS

GDP and CPI impacts per country are translated to over 600 financial variables (yields, spreads and asset class returns).



Climate Scenario Narratives

Net-Zero Financial Crisis	Net-Zero	Delayed Net-Zero	Limited Action	High Warming
1.6°C	1.6°C	1.9°C	2.9°C	3.7°C

Shocks to corporate revenues

Sectors covered

- ✓ Energy
- ✓ Materials
- ✓ Industrials
- ✓ Consumer Discretionary
- ✓ Consumer Staples
- ✓ Health Care
- ✓ Financials
- ✓ Information Technology
- ✓ Communications
- ✓ Utilities
- ✓ Real Estate

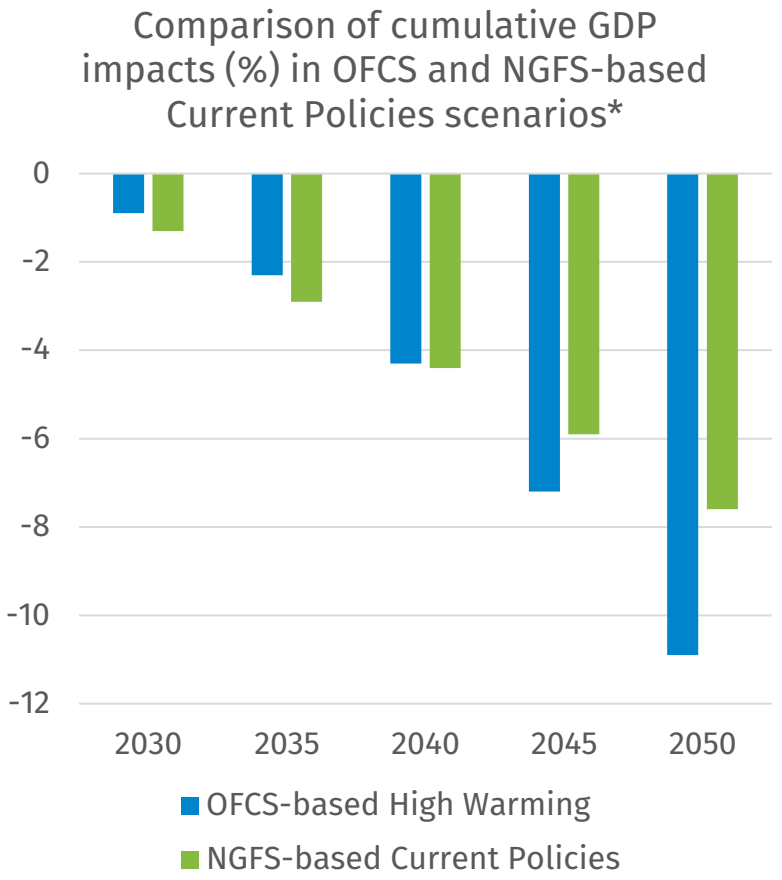
Regions covered

- ✓ Australia
- ✓ Brazil
- ✓ Canada
- ✓ China
- ✓ Denmark
- ✓ EM
- ✓ Europe
- ✓ Finland
- ✓ France
- ✓ Germany
- ✓ India
- ✓ Indonesia
- ✓ Italy
- ✓ Japan
- ✓ Malaysia
- ✓ Netherlands
- ✓ New Zealand
- ✓ Norway
- ✓ Philippines
- ✓ Russia
- ✓ Singapore
- ✓ South Korea
- ✓ Spain
- ✓ Sweden
- ✓ Switzerland
- ✓ Taiwan
- ✓ Thailand
- ✓ UK
- ✓ US
- ✓ World

OF Climate Scenarios – Physical risk modeling

Overview of approach and high-level results

	OFCS scenarios	**NGFS long-term scenarios**
Climate uncertainty	Makes assumptions around tipping points and temperature sensitivity to emissions.	Does not reflect key uncertainties, such as tipping points.
Chronic risks	Highly non-linear damage function.	Quadratic damage function.
Acute risks	Highly non-linear.	Not included.
Global scenario results	Catastrophic outcomes under HW scenario in long term (negative GDP growth rate in second half of the century).	More linear approach leads to limited GDP impacts in the long term.

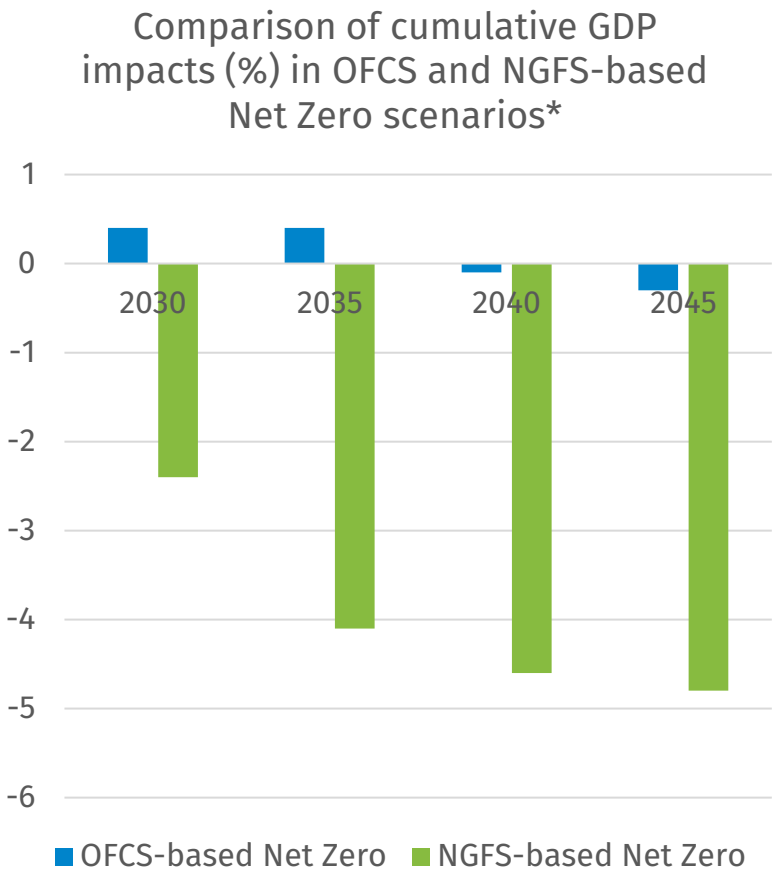


**Results presented relative to OF reference baseline*

OF Climate Scenarios – Transition modeling

Overview of approach and high-level results

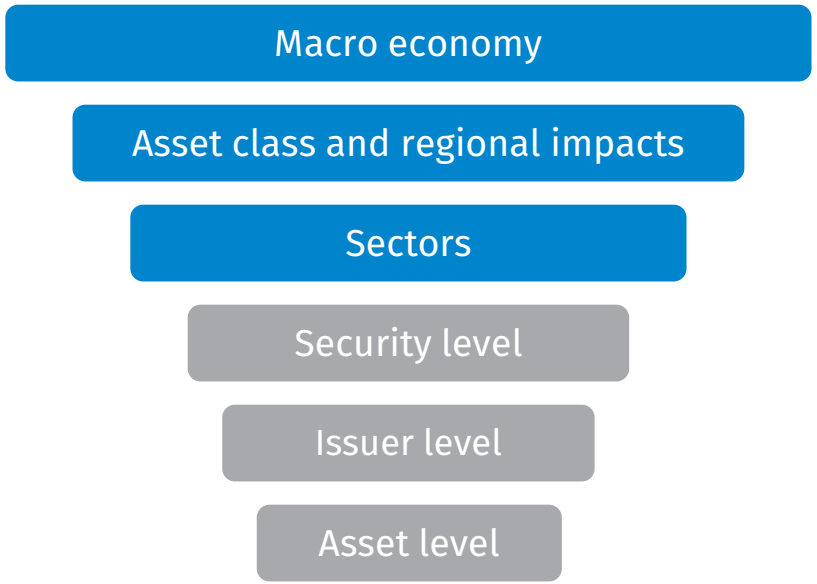
	OFCS scenarios, drawing on non-equilibrium modeling approach (E3ME)	**NGFS scenarios, drawing on equilibrium modeling approach** (NiGEM)
Core Assumption	Economy in disequilibrium	Economy operates in optimal state
Money Supply	Endogenous	Fixed and exogenous
Policy Impact	Policies can stimulate underutilised capacity	Policies seen as distortions from optimal baseline
Innovation & Tech	Modelling of technology adoption and learning	Limited representation of technology diffusion
Global scenario results	Transition policy drives small economic benefits at a global level in short-term due to investment stimulus effect	Transition policy drives economic costs due to deviation from long-run optimum



**Results presented relative to OF reference baseline*

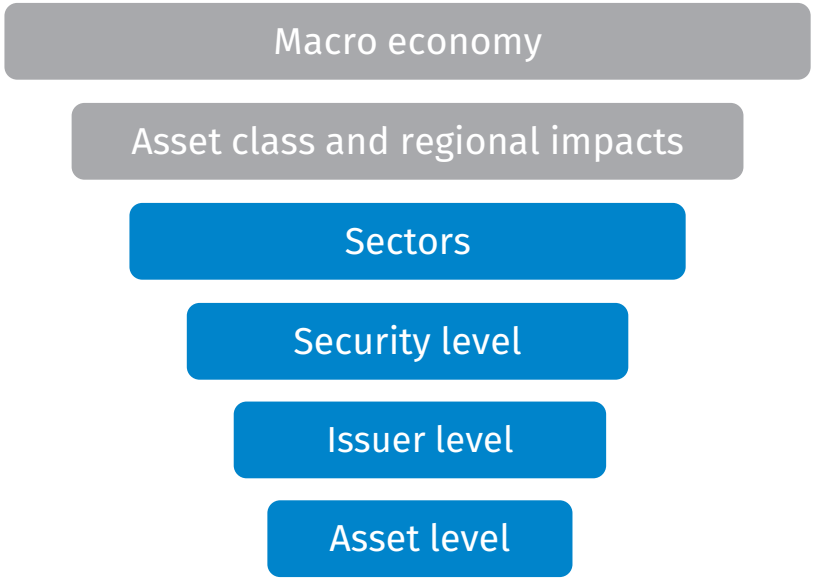
Different models for different use cases

Top-down



- Captures the **systemic nature** of climate change and climate risks
- Useful for **strategic decision-making** and risk management across sectors/ regions/ asset classes

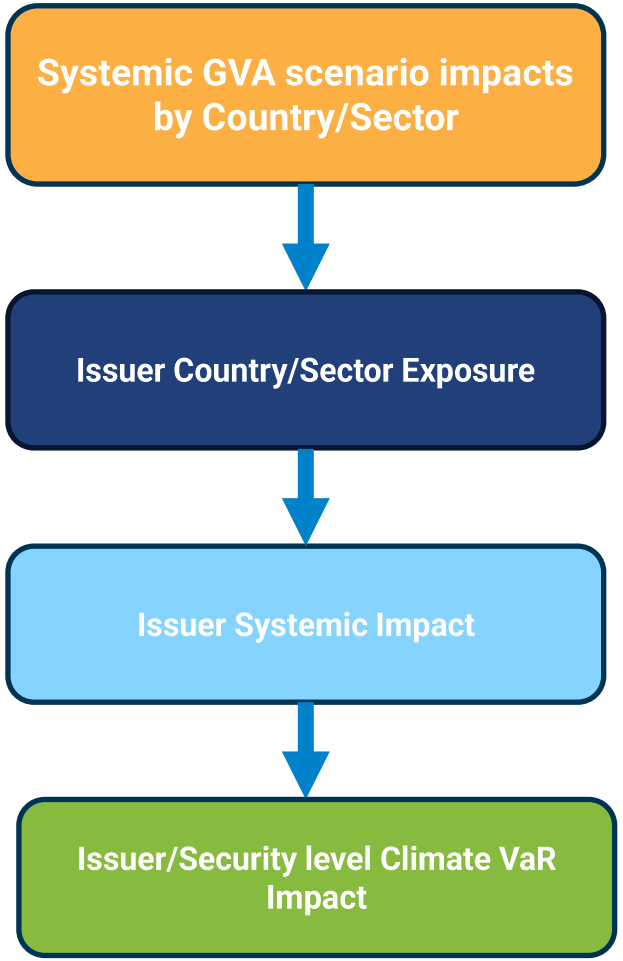
Bottom-up



- Captures **firm-level insights** on company assets, revenues, costs and business model
- Useful to implement strategic decision-making and align objectives

MSCI Climate VaR Methodology – 4 step methodology

Translating systemic impacts into issuer level risk



Time series of GVA scenario impacts by ClimateMAPS regions/sectors for split by transition, physical and combined risks.

MSCI GeoSpatial exposure data expressed as estimated output by country and NACE sector.

Estimated loss in output by country/sector based on exposure and GVA impact.

Leveraging MSCI's Climate VaR financial modeling. Issuer level CVaR and PDs along with security level outputs.

ORTEC FINANCE MSCI

Step 1: Systemic GVA Scenario Impacts

Scenario-specific GVA Impact time series by country and sector

Step 1 of 4

What this step does

ORTEC Finance Climate Scenarios provide the systemic GVA Impact time series for each combination of scenario (s), country (c), and year (t).

Risk types

- Transition risk
- Physical risk
- Combined risk

Key Variable

$GVA\ Impact_{s,c,t}$

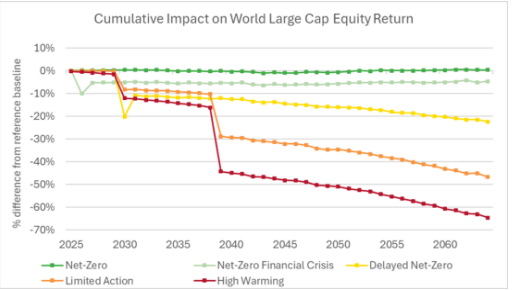
Annual growth terms by scenario (s), country (c), time (t)

OFCS Scenarios

- Net Zero 2050
- Delayed Net Zero
- Limited Action
- High Warming

CLIMATE MAPS

GDP, GVA and CPI impacts per country are translated to over 600 financial variables (yields, spreads and asset class returns).



ORTEC FINANCE MSCI

Step 2: Issuer Country/Sector Exposure

Mapping Exxon Mobil's output to geographic and sector exposures

Step 2 of 4

What this step does

MSCI GeoSpatial data maps Exxon's output to country/sector weights.

Key Variables

Output Exposure $_{i,s,c}$

Weights at t=0

Exposure Growth $_{s,c,t}$

Change over time

	Coal and Manufactured fuels	Materials	Oil and Gas	Total
Australia	1%	0%	0%	1%
Brazil	1%	0%	0%	1%
Canada	16%	0%	0%	17%
China	4%	0%	0%	4%
Denmark	0%	0%	0%	0%
Germany	1%	0%	0%	1%
Indonesia	1%	0%	0%	1%
Japan	4%	0%	0%	4%
Singapore	1%	0%	0%	1%
Thailand	2%	0%	0%	2%
US	52%	4%	6%	62%
World	6%	0%	0%	6%
Total	88%	5%	6%	100%

Step 3: Undiscounted Costs Over Time

Combining exposure weights with GVA impacts to calculate undiscounted costs

Step 3 of 4

Core Formula

$$\textit{Undiscounted Cost}_{i,s,c,t} = (\textit{Output Exposure}_{i,s,c} \times \textit{Exposure Growth}_{s,c,t}) \times \textit{GVA Impact}_{s,c,t}$$

From Step 2

Output Exposure $_{i,s,c}$

Exxon's country/sector weights at t=0

From Step 2

Exposure Growth $_{s,c,t}$

How weights change over time

From Step 1

GVA Impact $_{s,c,t}$

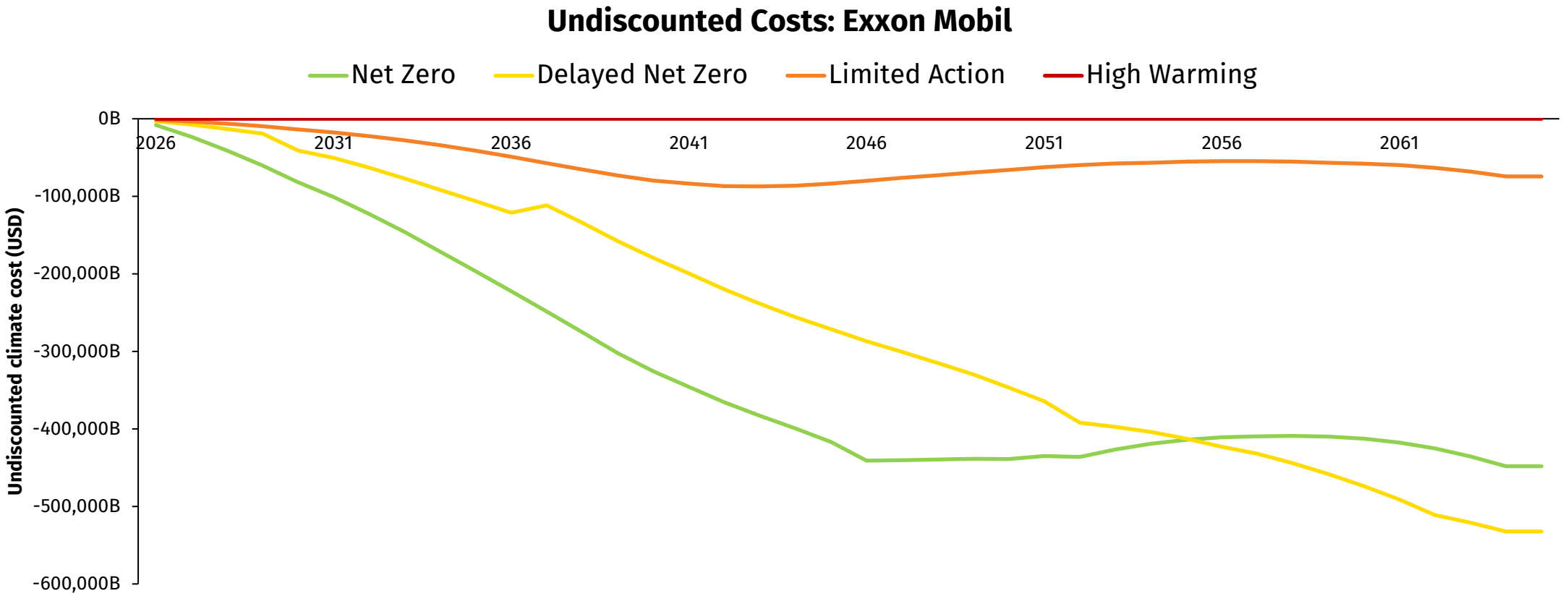
Macro scenario impact on sector GVA

Output: A time series of undiscounted costs for each issuer × scenario × country/sector combination. For Exxon, this produces cost curves across all exposure regions (US 62%, Canada 17%, etc.) over the projection horizon.

Step 3: Undiscounted Costs — Exxon Mobil

Cumulative undiscounted transition costs by scenario (2026–2065)

Step 3 of 4



Step 4: Systemic Climate VaR

Discounting and aggregating costs across all exposures and time periods

Step 4 of 4

Final Aggregation

$$Systemic\ CVaR_{i,s} = \sum_{c} \sum_{t=0..T} Undiscounted\ Cost_{i,s,c,t} / (1+r)^{t}$$

Sum across all country/sector exposures (c) and discount each time period (t) back to present value

Exxon Mobil: Systemic CVaR Results by Scenario

Net Zero 2050
-43.7%
Transition: -42.0% | Physical: -1.7%

Delayed Net Zero
-36.8%
Transition: -31.5% | Physical: -5.3%

Limited Action
-20.8%
Transition: -12.9% | Physical: -7.9%

High Warming
-30.7%
Transition: 0% | Physical: -30.7%

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Transition Signals: Differentiating Leaders vs Laggards

Objective

Keep overall systemic signal intact while providing greater differentiation between companies.

Applies only to sectors with material transition risk (Energy, Utilities, Transport, Materials, Automotive, etc.)

Approach

Adjust systemic transition risk Climate VaR based on company-specific data:

- Carbon intensity
- Green revenues
- Low-carbon patents

Then renormalize within sector to preserve the overall systemic signal.

Impact on Climate VaR

Leaders
More favorable Climate VaR values

Laggards
More negative Climate VaR values

Average
Minimal change in Climate VaR

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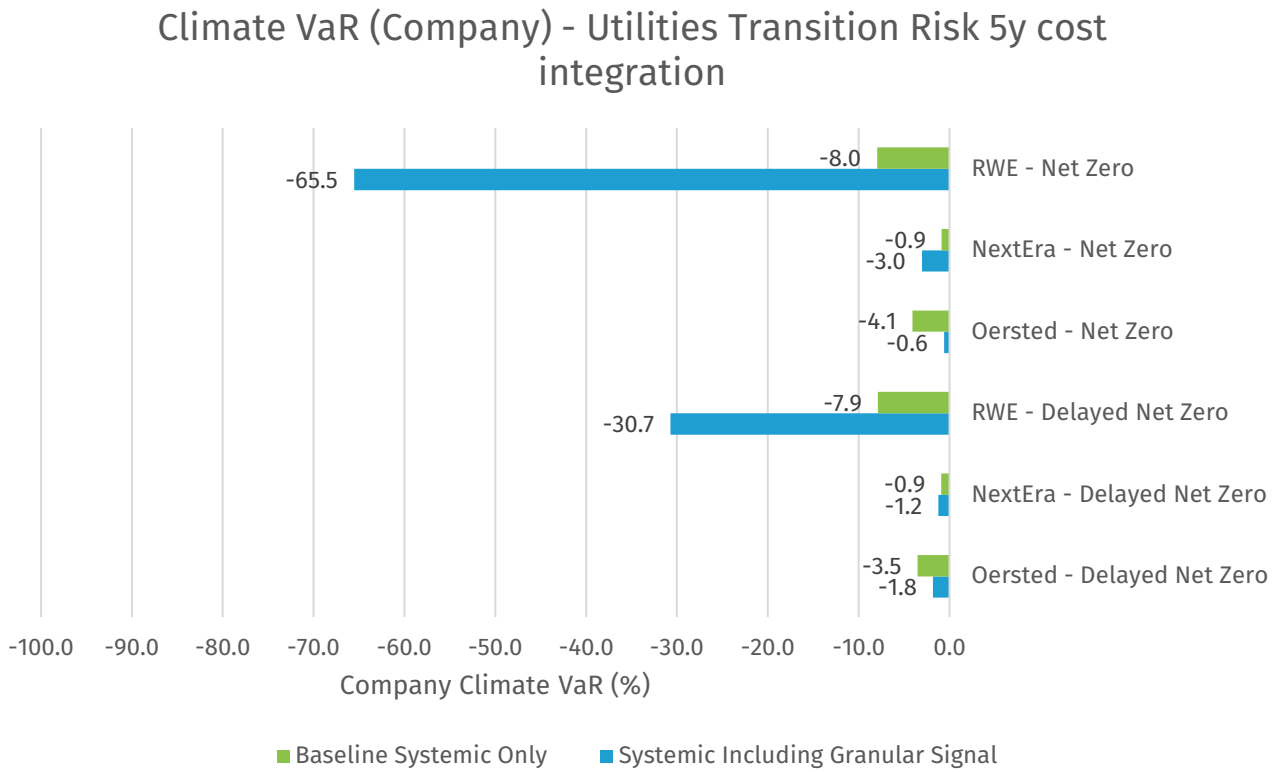
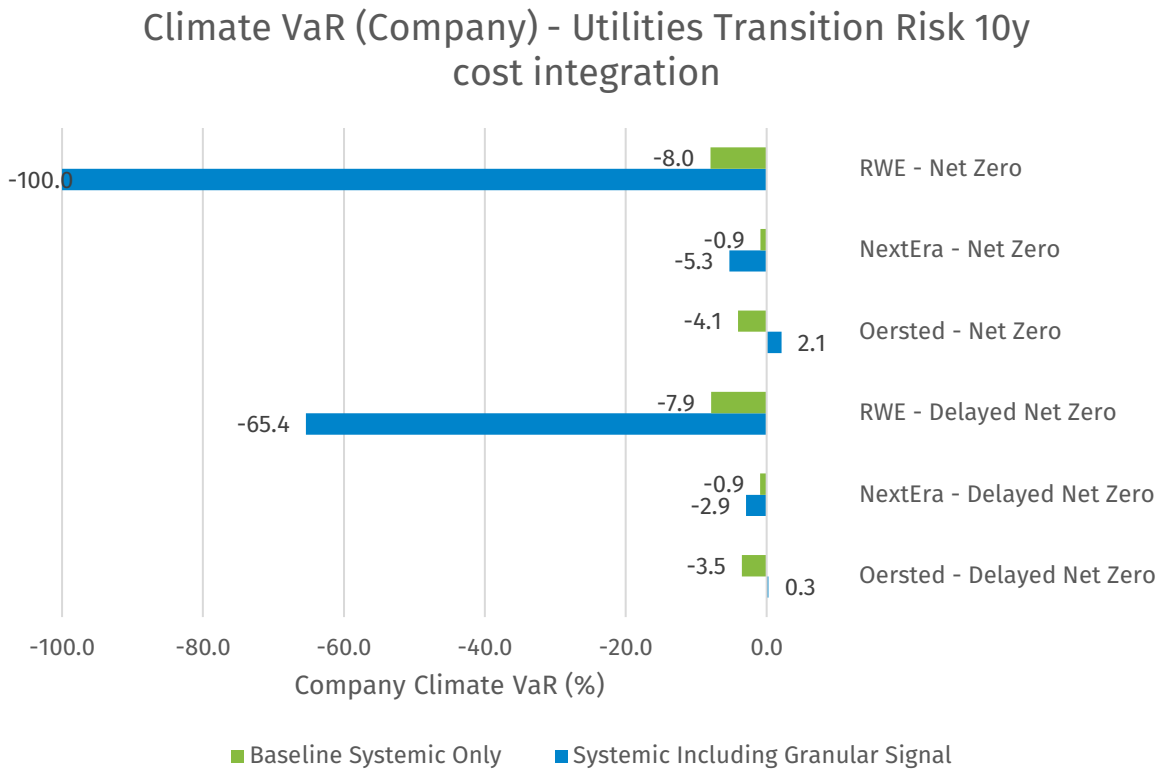
Granular Transition Signal Results

Systemic only versus including granular signal





Objective of top-down bottom-up integration

Provide consistent insights across different levels of the investment decision making process, based on similar sets of assumptions across narratives.

Strategic Asset Allocation

Focus on key objectives and relevant risk drivers

Portfolio/Benchmark Construction

Take into account specific ESG objectives, with a focus on sector-region dimension

Regulatory Reporting

Comprehensive coverage across all asset classes with sufficient granularity

Security Selection

Assess which companies show high/low exposure to transition and physical risk drivers, and their plans the manage these

Approach to innovation

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1. Explore | 2. Experiment | 3. Execute

Spark	Scoping	Stakeholder Alignment	Problem	Solution	Business	Pilot	Implement
Idea Approval	Client Ready Pitch	Client Interest	Right Problem	Right Solution	Concept Validated	Product Validated	

Contact me

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