Changing Course

10th May
Aviva Head Office
London

UNEP FINANCE INITIATIVE

Welcome

Angela Darlington

CEO of UK Insurance, Aviva

Key Note

Sarah Breeden

Executive Director, International Banks Supervision
Prudential Regulation Authority
Bank of England

Key Note: ‘The Global Impacts and Risks of Climate Change’

Christopher Hope
Emeritus Reader in Policy Modelling
University of Cambridge

Cambridge Judge Business School

THE GLOBAL IMPACTS AND RISKS OF CLIMATE CHANGE

Prepared by

Dr Chris Hope

Emeritus Reader in Policy Modelling

c.hope@jbs.cam.ac.uk

@cwhope

for the UNEP finance initiative launch event

10 May 2019

A sense of urgency about climate change

Source: https://www.desmog.co.uk/2019/05/01/climate-emergency-extinction-rebellion-language-urgency-parliament-labour-motion-ccc-net-zero

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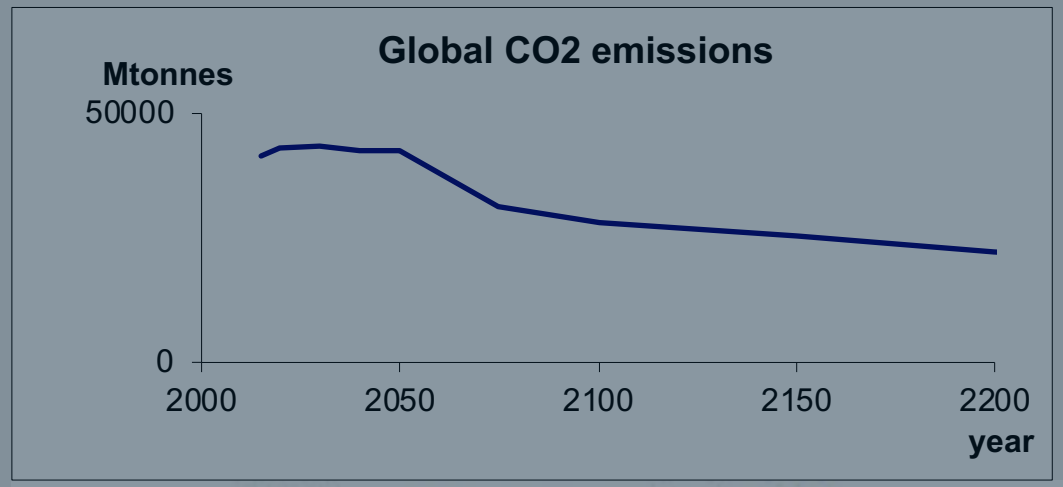
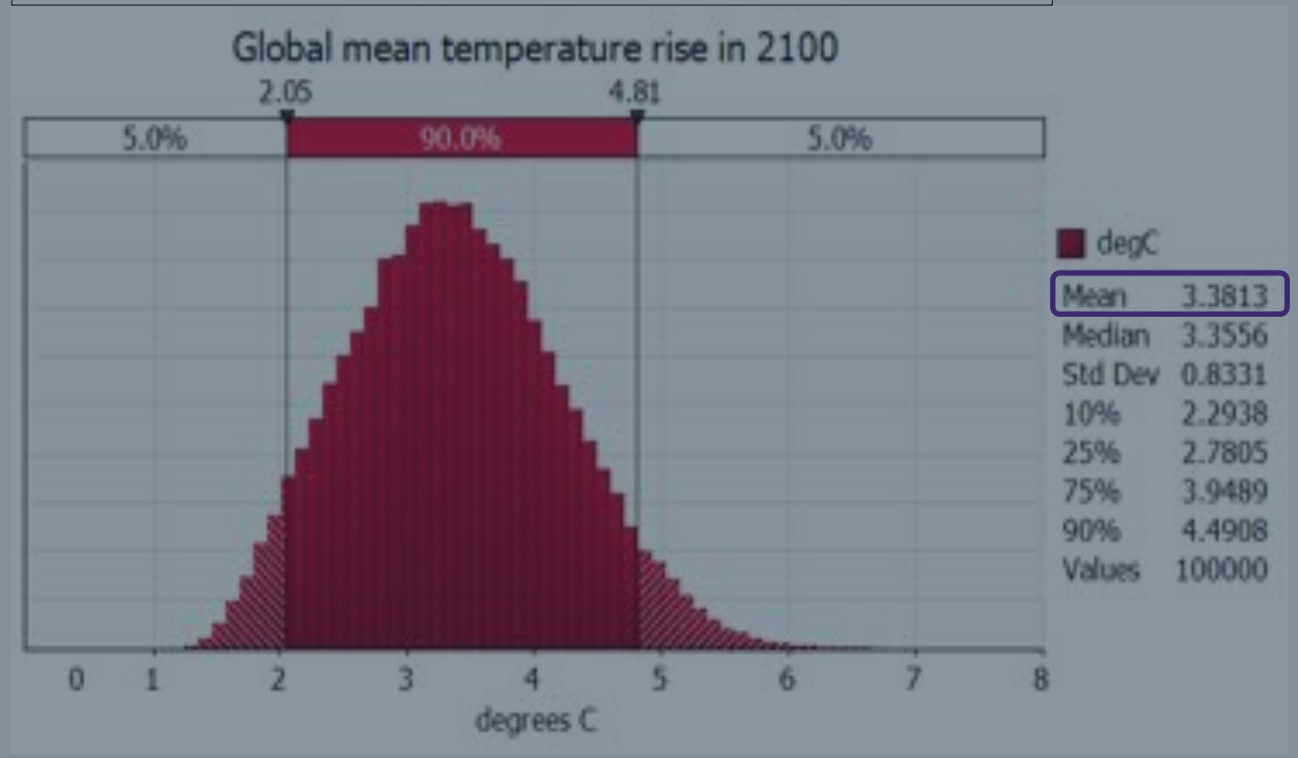
Present commitments





Source: 100,000 runs of the PAGE-ICE model

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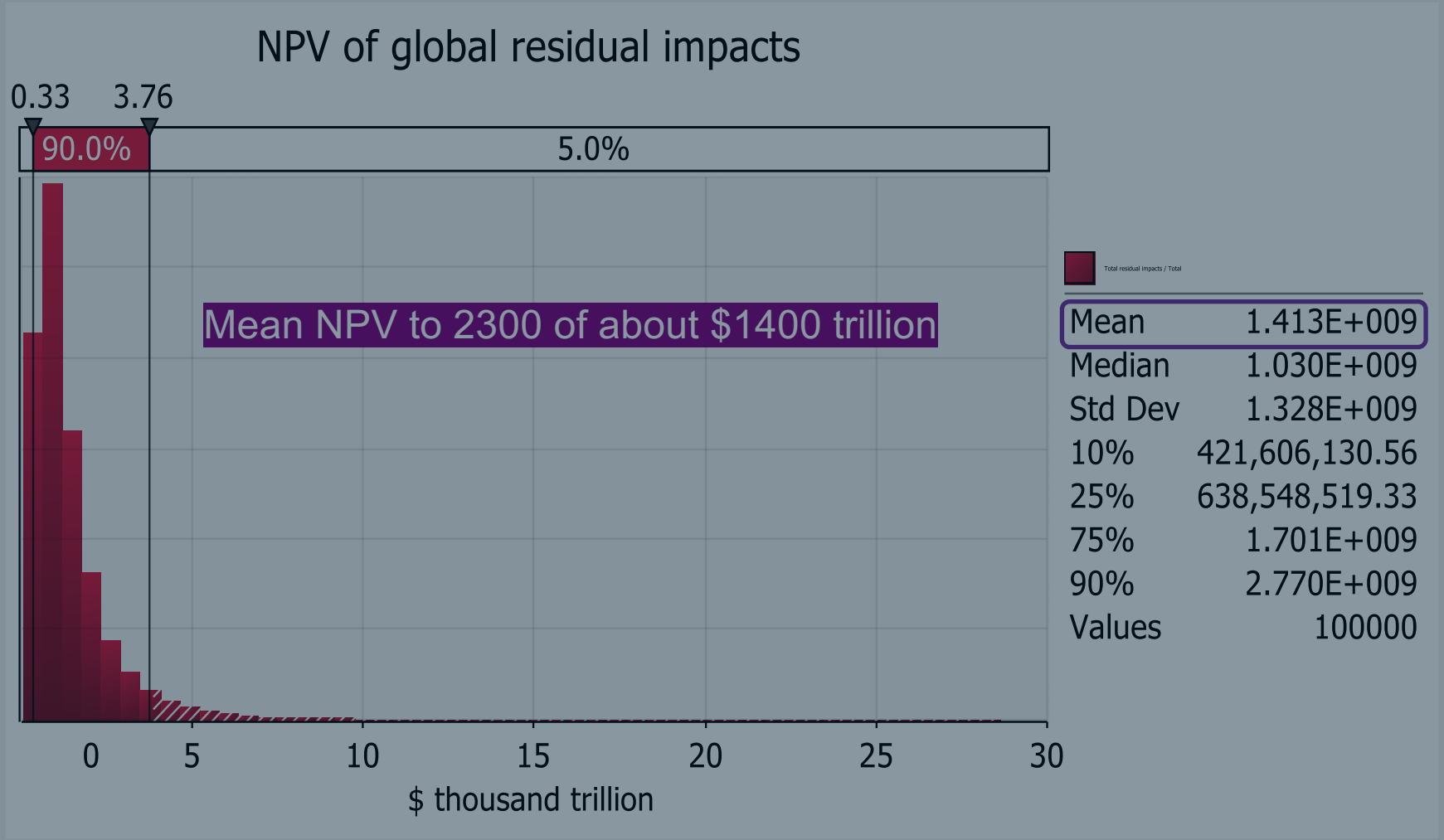
Climate impacts under present commitments



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Source: 100,000 runs of the PAGE-ICE model

nature COMMUNICATIONS

Article | OPEN | Published: 23 April 2019

Climate policy implications of nonlinear decline of Arctic land permafrost and other cryosphere elements

Dmitry Yumashev, Chris Hope, Kevin Schaefer, Kathrin Riemann-Campe, Fernando Iglesias-Suarez, Elchin Jafarov, Eleanor J. Burke, Paul J. Young, Yasin Elshorbany & Gail Whiteman

Nature Communications **10**, Article number: 1900 (2019) | Download Citation

Climate change tax to internalise the impacts under present commitments

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Source: 100,000 runs of the PAGE-ICE model

What does a climate change tax of $310 per tonne of CO_2 imply?

- 50 pence on a litre of petrol

  Typical retail price 130 p/litre

- 4 p/kwh on gas

  Typical retail price 5 p/kwh

- 15 p/kwh on electricity from coal
- 6 p/kwh on electricity from gas

  Typical retail price 15 p/kwh

- £150 on a return air ticket from London to Barcelona

  Typical retail price ???

UK Revenue from a climate change tax of $310 per tonne of CO_2

•From CO_2	£ 90 billion
•UK share of International Air Travel:	£ 10 billion
•Other greenhouse gases:	£ 15 billion
•**Potential revenue in first year:**	**£ 115 billion**
•**Revenue in 2030:**	**£ 105 billion**

(Tax rate increases by 30%, emissions reduce by 30%)

•Total UK tax revenues	£ 500 billion

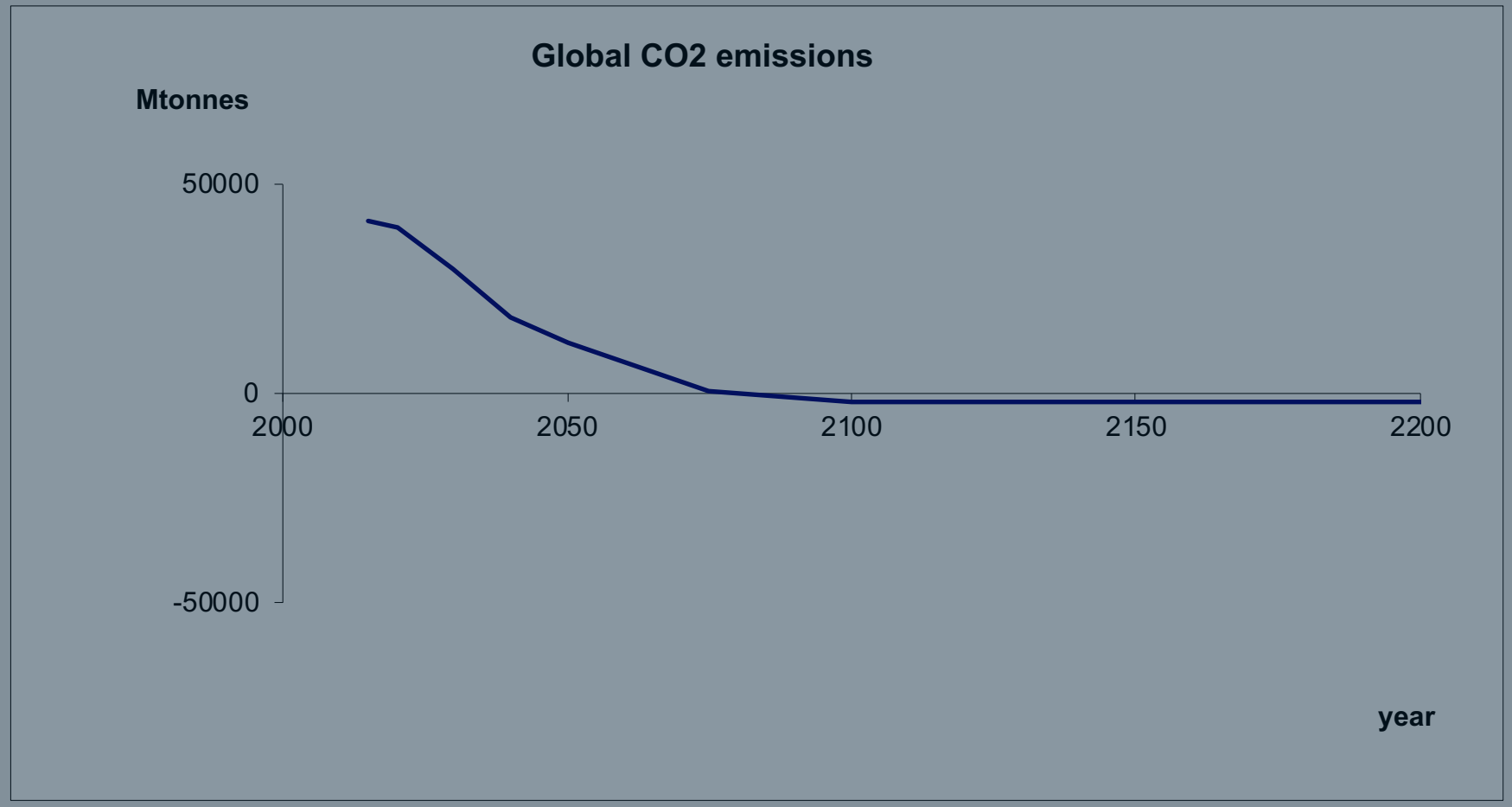
Source: Author's calculations

Potential uses of £115 billion per year climate change tax revenue

Fiscal neutrality is important for public acceptance

- Reduce basic rate income tax from 20% to 10% £ 40 billion
- Reduce VAT from 20% to 12% £ 40 billion
- Protect poor and elderly from energy price increases £ 20 billion
- Support R&D, information campaigns etc £ 15 billion

Cutting emissions to have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100



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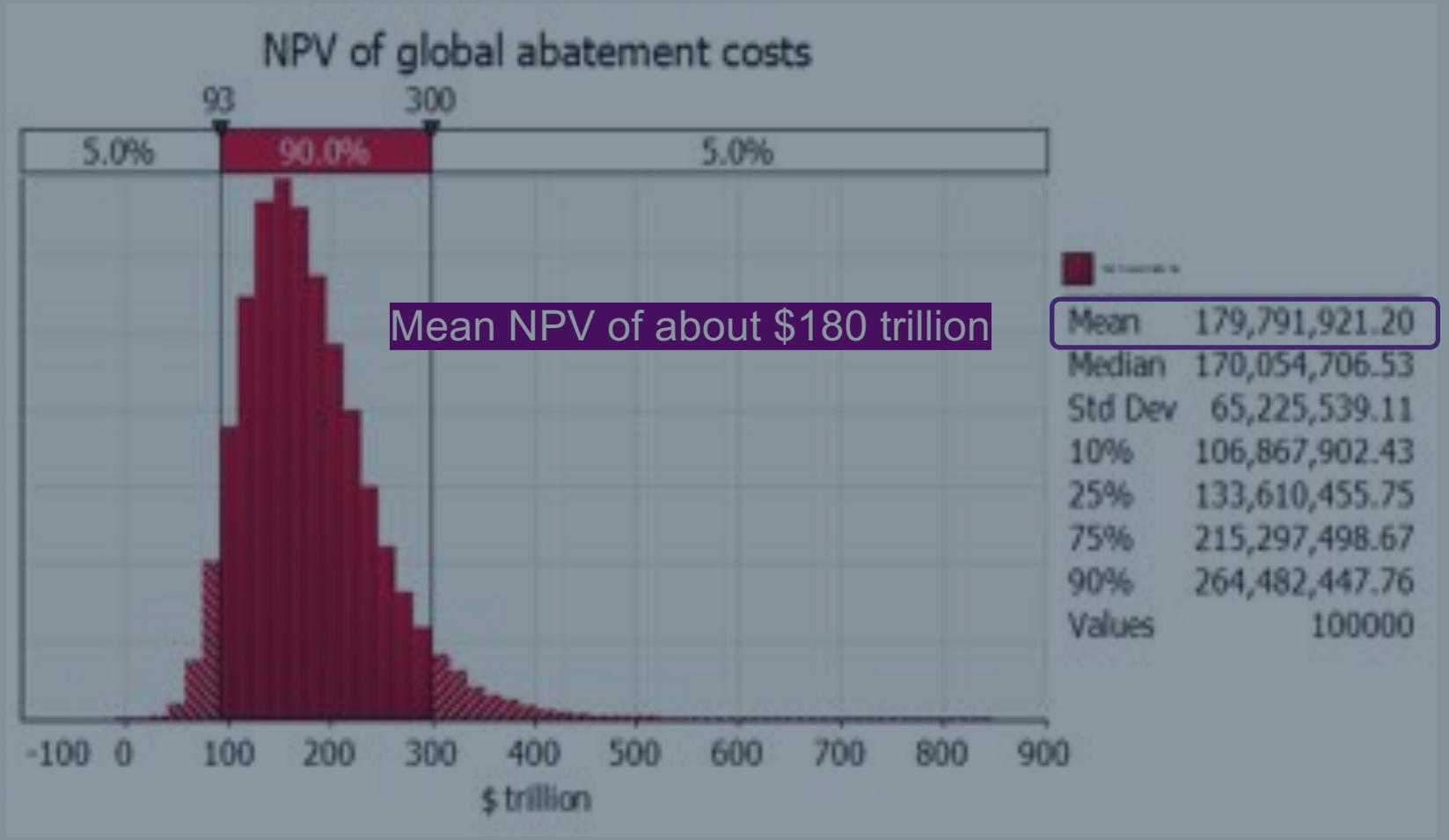
Abatement costs to have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100



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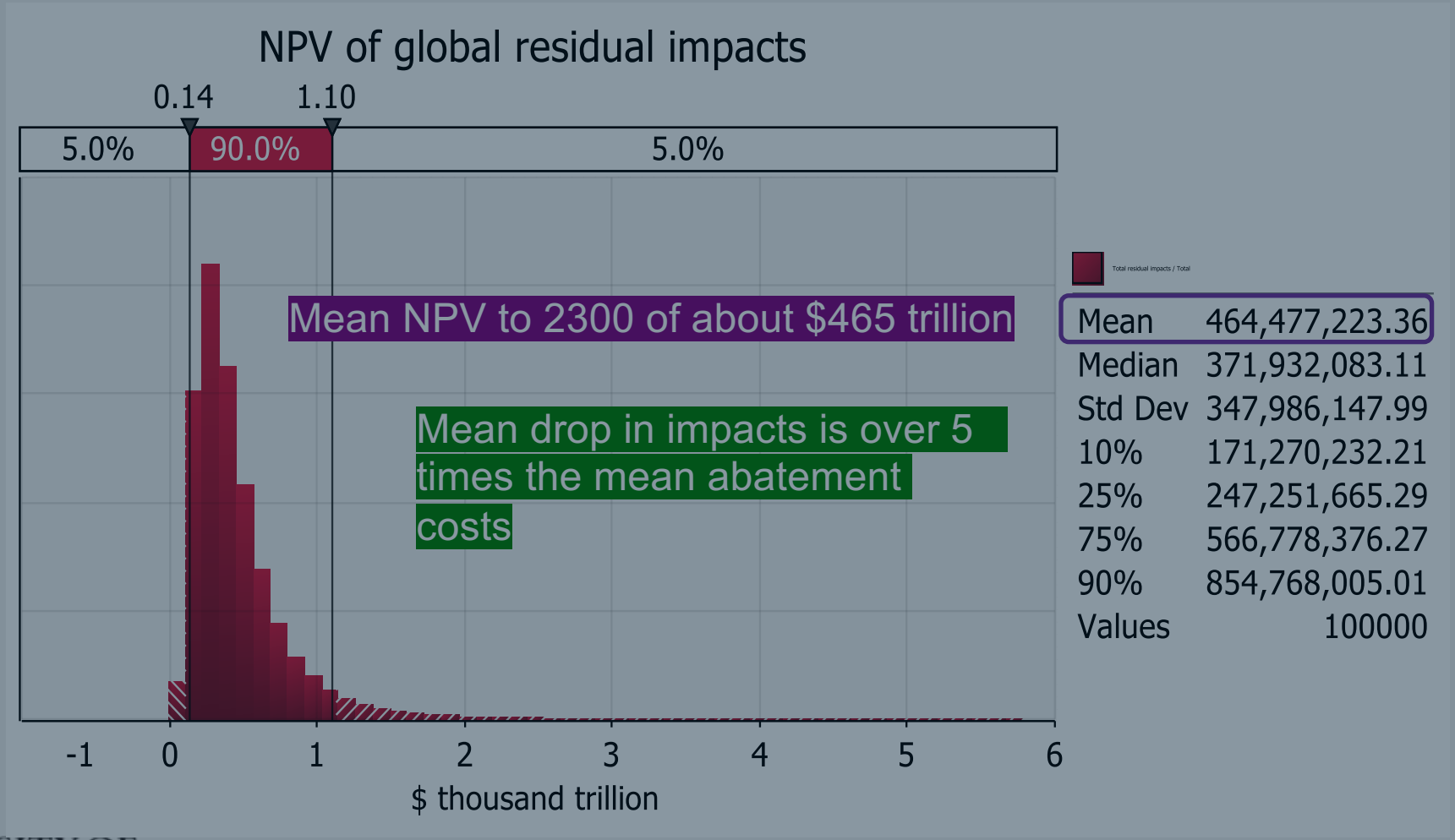
Source: 100,000 runs of the PAGE-ICE model

Climate impacts under policies that have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100



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Source: 100,000 runs of the PAGE-ICE model

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ADDENDA CAPITAL
AVIVA
Bentall Kennedy
CDPQ
citibanamex Afore
City Developments Limited
Desjardins
DNB Asset Management
investa
klp
La Française investing together
LaSalle
領展 LINK
M&G Real Estate
Manulife
Nordea
Norges Bank Investment Management
Rockefeller Asset Management
storebrand
TD Asset Management

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Changing Course

The UNEP FI TCFD Investor Pilot Report

Remco Fischer

Climate Lead, UNEP FI

#TCFDRecs

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The ‘Changing Course’ Report

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Länsförsäkringar
NN
Swiss Re
Munich RE
AXA
intact INSURANCE
Allianz
GENERALI
iag
ICEA LION GROUP
MAPFRE
MS&AD
Sompo Japan Nipponkoa
QBE
storebrand
the co-operators A Better Place For You
TOKIO MARINE

ADDENDA CAPITAL
AVIVA
Bentall Kennedy
CDPQ
citibanamex Afore
CITY DEVELOPMENTS LIMITED
Desjardins
DNB Asset Management
investa
xlp
LA FRANÇAISE
LaSalle
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M&G REAL ESTATE
Manulife
Nordea
NORGES BANK INVESTMENT MANAGEMENT
ROCKEFELLER ASSET MANAGEMENT
storebrand
TD
TD Asset Management

citi
DNB
Itaú
nab
Rabobank
RBC
Santander
SOCIETE GENERALE
Standard Chartered
TD
UBS

25

ACCLIMATISE building climate resilience
OLIVER WYMAN
CARBON DELTA the environmental fintech
vivid economics
PIK
IIASA

The ‘Changing Course’ Report

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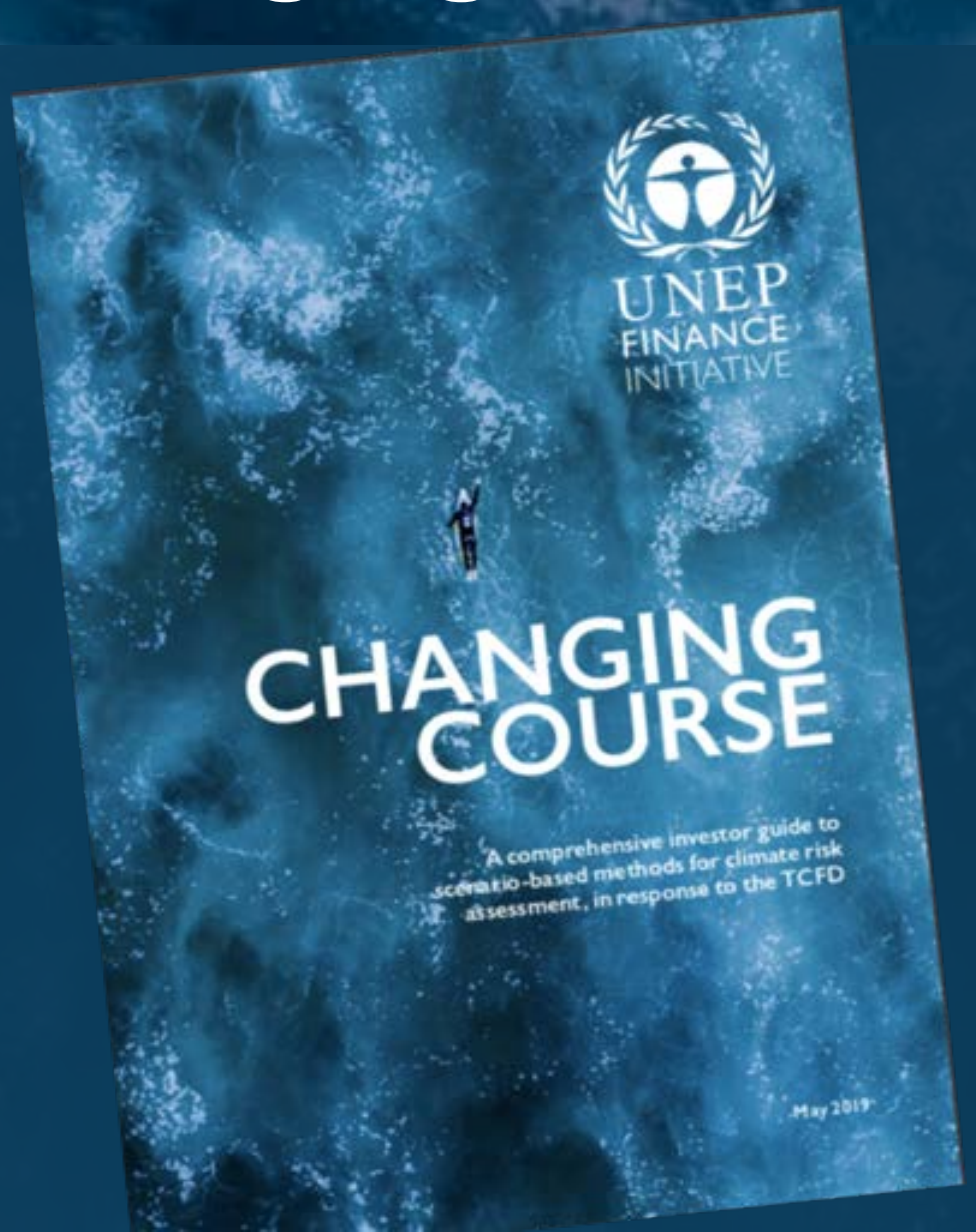

The ‘Changing Course’ Report

1. A comprehensive mapping
2. Step-by-step detail on the piloted methodology
3. Real investor experiences

The ‘Changing Course’ Report

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From Risk Assessment to Aligning Portfolios

Changing Course Report Highlights

Jason Eis

Executive Director, Vivid Economics

Forward looking scenario-based assessments of climate related risks and opportunities are core to the TCFD recommendations

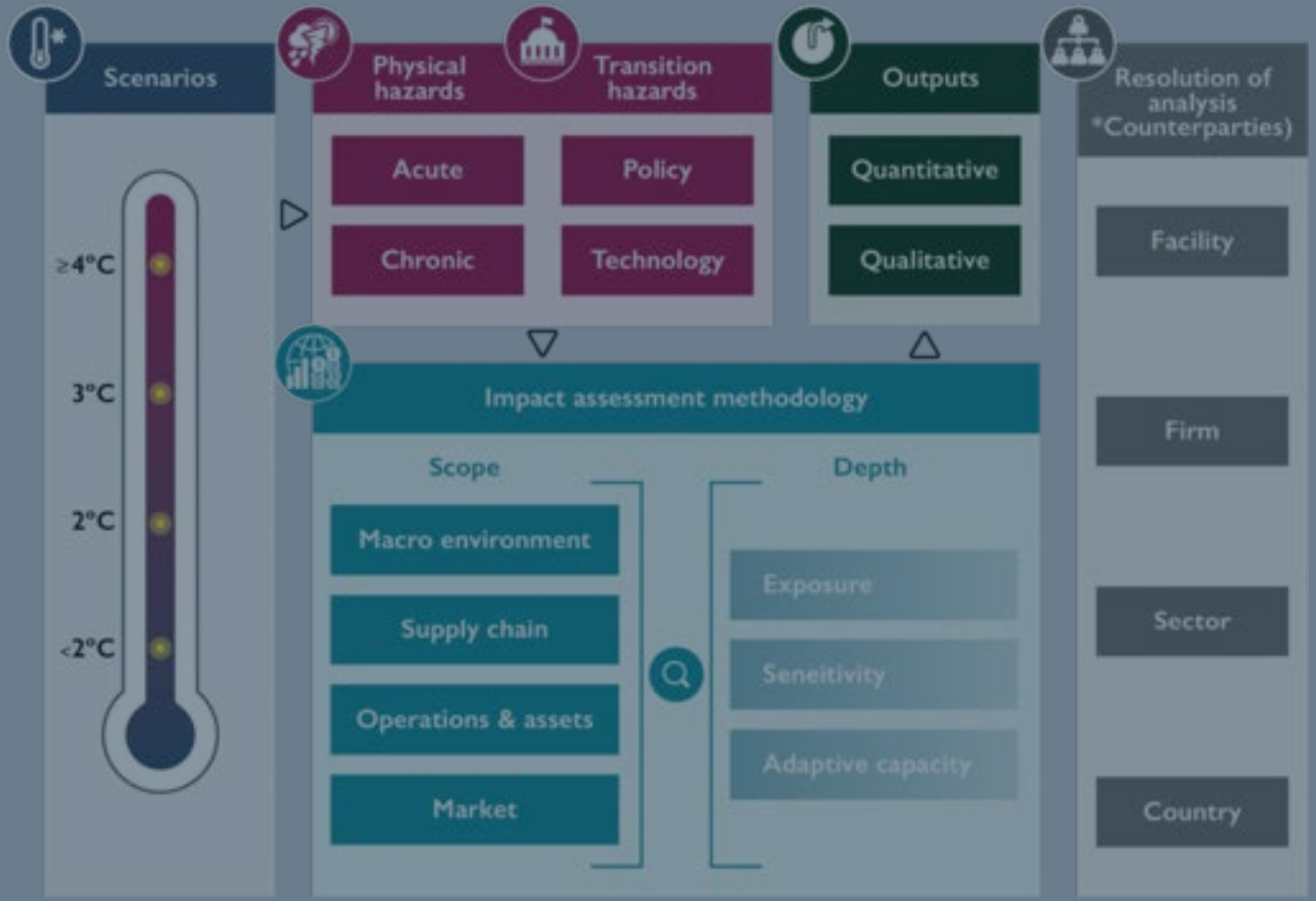
Why scenario analysis?

The timing, magnitude and nature of climate change impacts on companies' business models, strategies and financial performance is uncertain – to appropriately incorporate these potential impacts in strategic decisions investors need analyse the potential risks and opportunities under various possible states of the world, exploring a wide variety of sensitivities.

There are a large number of scenario analysis methodologies and providers that offer diverse and continually improving analyses

- We reviewed **methodologies from publicly published examples** of scenario analysis for investors
- The review found **a vibrant market of service providers** to support TCFD-compliant scenario analysis – this included 14 different providers, and that list is not necessarily exhaustive
- **Many providers share common core methodological elements**, drawing on similar datasets, modelling components and methods for financial valuation
- **However, significant diversity exists, with providers offering different (and sometimes complementary) methodologies** for assessing climate-related financial risks and opportunities across various asset classes, scenarios and output formats
- As a result, there is already a large set of methodologies to choose from, depending on desired scope, depth and focus of analysis.

Analytical elements of scenario-based impact assessments



Framework for analysis of TRANSITION approaches

Transition Risk Impact Assessment			
	Exposure	**Sensitivity**	**Adaptive capacity**
Macro environment	Economic diversification, political climate	Dependence on emmissions-intensive sectors	Fiscal and monetary and political flexibility, development level
Supply chain	Location (carbon pricing) of suppliers	Supplier emissions intensity and ability to pass through costs	Producer capacity to shift to low-carbon suppliers or inputs
Operations and assets	Location (carbon pricing) of facilities	Producer emissions intensity	Producer abatement potential
Market	Location (carbon pricing) of sales	Preference shifts, price reaction, consumption emissions intensity	Producer capacity to shift customer base or pass through cost

Scope of assessment

Depth of assessment

Framework for analysis of PHYSICAL approaches

Physical Risk Impact Assessment			
	Exposure	**Sensitivity**	**Adaptive capacity**
Macro environment	Economic diversification, location	Economic dependence on climate-exposed sectors	Fiscal and monetary flexibility, development level
Supply chain	Location of suppliers	Supplier natiral resource intensity and shock resilience	Producer capacity to shift supply chains
Operations and assets	Location of facilities	Sectoral/facility type resource and capital intensity	Resilience of individual facilities
Market	Location of sales	Market sensitivity to weather events and price shocks	Producer capacity to shift customer base or pass through cost

Scope of assessment

Depth of assessment

	Transition risk impact assessment																							
	Scenarios				Risks		Macro			Supply chain			Operations			Market			Output		Counterparties			
Provider	<2C	2C	3C	>4C	Policy	Technology	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Quantitative	Qualitative	Facility	Firm	Sector	Country
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C4		✔	✔		✔	✔					✔			✔	✔		✔			✔		✔	✔	
CD	✔	✔	✔		✔	✔							✔	✔		✔	✔	✔	✔	✔	✔	✔	✔	✔
CT	✔	✔			✔	✔							✔			✔	✔		✔		✔	✔	✔	
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MIS			✔		✔	✔	✔	✔	✔										✔					✔
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VE 2		✔		✔	✔	✔				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	

		Physical risk impact assessment																						
		Scenarios				Risks		Macro			Supply chain			Operations			Market			Output		Counterparties			
		<°2C	2°C	3°C	≤°4C	Policy	Technology	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Exposure	Sensitivity	Adaptive capacity	Quantitative	Qualitative	Facility	Firm	Sector	Country
Provider	427				✔	✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	✔			✔	✔	✔	✔	✔
	Acc 1		✔		✔	✔	✔				✔	✔		✔	✔		✔	✔		✔			✔	✔	
	Acc 2				✔	✔	✔							✔	✔						✔	✔			
	C4		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	✔			✔	✔	✔	✔	✔
	CD				✔	✔	✔							✔	✔					✔		✔	✔	✔	✔
	CW		✔		✔	✔								✔	✔	✔				✔		✔		✔	✔
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	MIS			(✔)		✔		✔	✔	✔											✔				✔
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Where gaps remain (a.k.a. what are the emerging advances)?

Scope of methodologies

- **Currently do not cover the entire value chain** of counterparties from suppliers to markets
- **Currently don't extend across the range of asset classes** with a consistent level of bottom-up detail
- **Do not include risks such as legal and reputational risk**

Depth of methodologies

- **Remain inadequate in their examination of 'adaptive capacity'**, and hence don't fully account for dynamic responses to climate risks and opportunities
- **For physical risk in particular, methodologies do not sufficiently consider the opportunities created**

Integration of methodologies

- **Do not integrate macroeconomic (top-down) and microeconomic (bottom-up) analysis in a consistent, holistic way**
- **Rarely consider physical and transition risk together**, and the potential trade-offs that arise

There is a clear need for better disclosure of climate-related data from investee companies, particularly including a company's individual sensitivity and adaptive capacity. The more granular the data disclosed by investee companies, the more informative scenario-based analysis can be for investors. This includes data on individual facilities, such as production sites and real estate.

Caveat emptor

- While scenario analysis can be a useful tool to explore and disclose the potential impacts of an uncertain future, it is not a precise prediction of the future

- The purpose of scenario analysis is to explore several plausible ‘what-if’ scenarios, rather than to precisely forecast the future or to evaluate the correctness of current market pricing

- There are some critical underlying complexities in the relationships between, for example:
  - Atmospheric GHG concentrations and the climate system
  - The climate system and the economy
  - Emissions reduction policies, technological innovation and market behaviours

- This means that any numbers derived from such methodologies should be used with caution and fully evaluated in the context of the scenario’s and model’s underlying assumptions

Pilot Project Methodology

David Lunsford

Co-Founder, Carbon Delta

Thank you UNEPFI and Investor Group!

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ADDENDA CAPITAL
AVIVA
Bentall Kennedy
CDPQ
citibanamex Afore
City Developments Limited
Desjardins
DNB Asset Management
investa
klp
La Française investing together
LaSalle
領展 LINK
M&G Real Estate
Manulife
Nordea
Norges Bank Investment Management
Rockefeller Asset Management
storebrand
TD Asset Management

Impact of Climate Change on Company's Profitability

Russia – heat wave 2010

- ***Carlsberg: 13% loss*** *in quarterly profits reported by in Q2 2011*

California – wildfires 2018

- ***PG&E (Californian utility):*** *filed for bankruptcy due to hundreds of lawsuits from victims of fire*

California – Clean Energy and Pollution Act – 50% Renewables by 2030

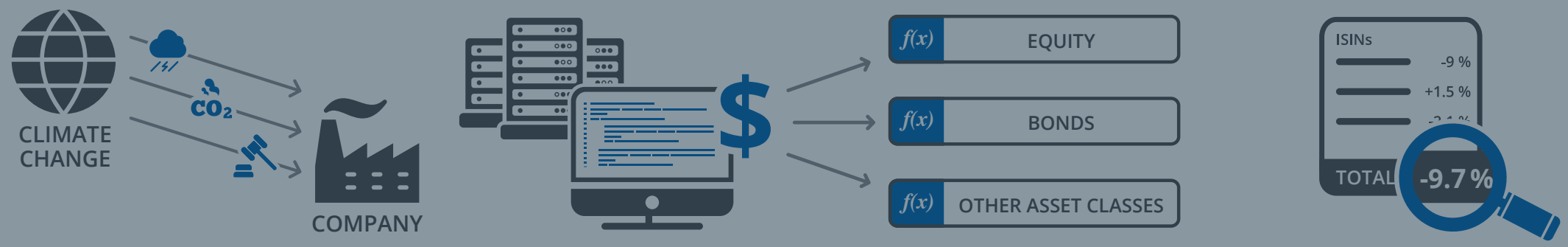
- ***Sunrun: 1000% revenue growth***
- ***Vivint Solar: 4000% revenue growth***

India – 100% electric vehicles by 2030

- ***Tata Motors: 5% in electric vehicle development, Net Income is forecast to accelerate by 35% for 2020/2021***

A Hybrid Approach is Necessary Due to Data Limitations

The Carbon Delta Modelling Process



Impact Modelling → Cost / Profit Calculations → Security Valuation → Portfolio Level

UNEPFI Project Components

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Methodologies

Financial Modelling

Real Estate

Online Tool

Climate Change Analysis Pillars

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Transition Risks & Opportunities

Physical Risks & Opportunities

Policy

15 years+

- ✓ 1.5°C-Scenario
- ✓ 2°C-Scenario
- ✓ 3°C-Scenario / NDC

+

Technology

15 years +

- ✓ 1.5°C-Scenario
- ✓ 2°C-Scenario
- ✓ 3°C-Scenario / NDC

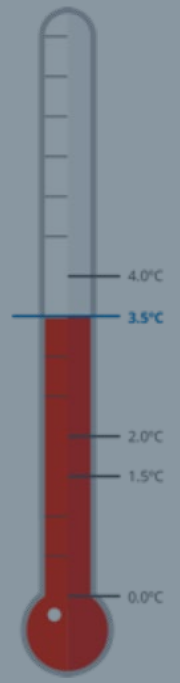
+

Physical

15 years +

- ✓ Average RCP 8.5

= **Climate VaR**



Climate Change Analysis Pillars

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Transition Risks & Opportunities

Physical Risks & Opportunities

Policy

15 years+

- ✓1.5°C-Scenario
- ✓2°C-Scenario
- ✓3°C-Scenario / NDC

✓6 x 2˚C Scenario

+

Technology

15 years +

- ✓1.5°C-Scenario
- ✓2°C-Scenario
- ✓3°C-Scenario / NDC

✓6 x 2˚C Scenario

+

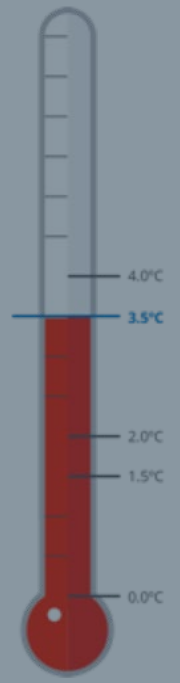
Physical

15 years +

- ✓Average RCP 8.5

✓ Worst Case RCP 8.5

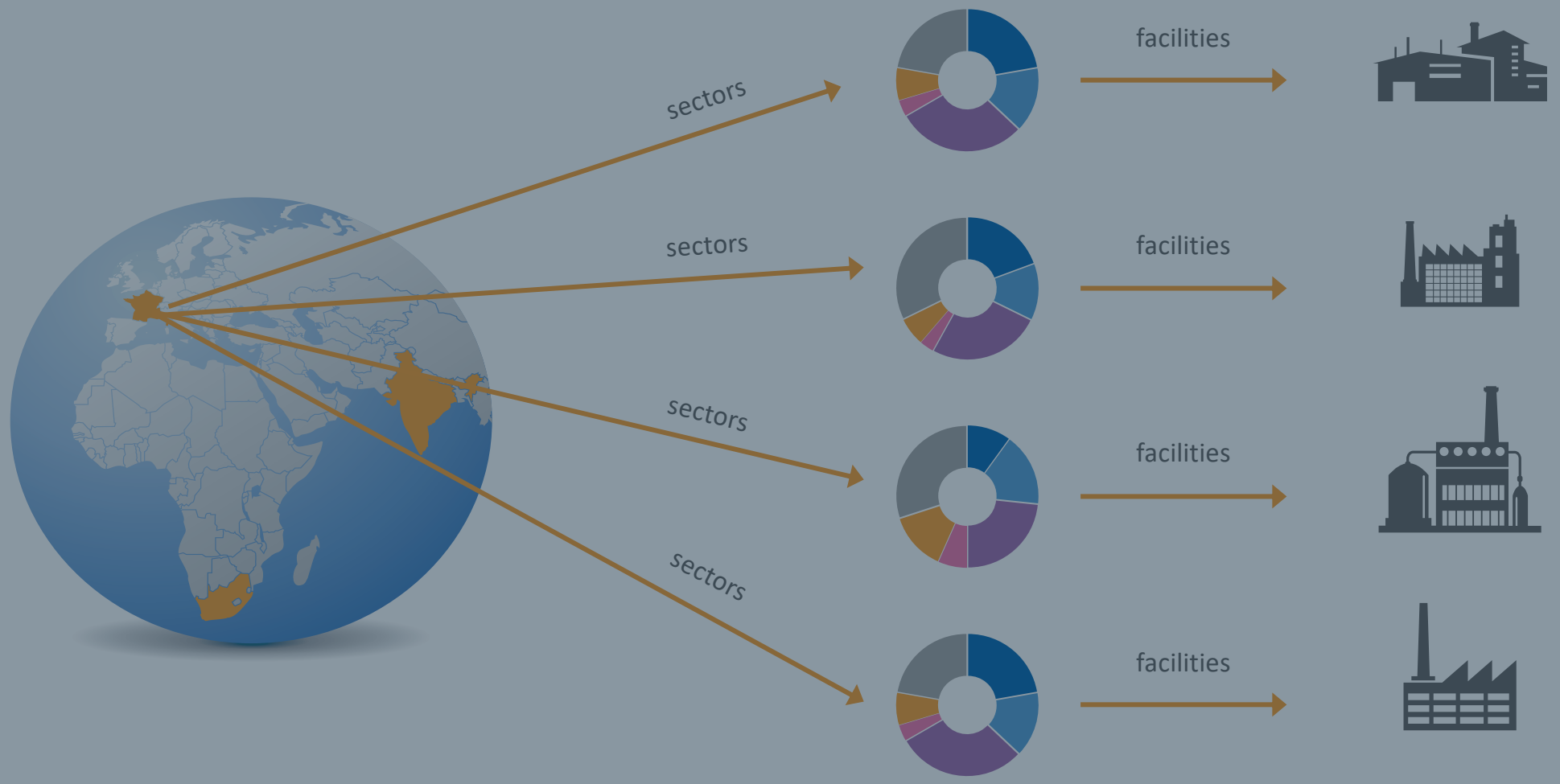
= **Climate VaR**



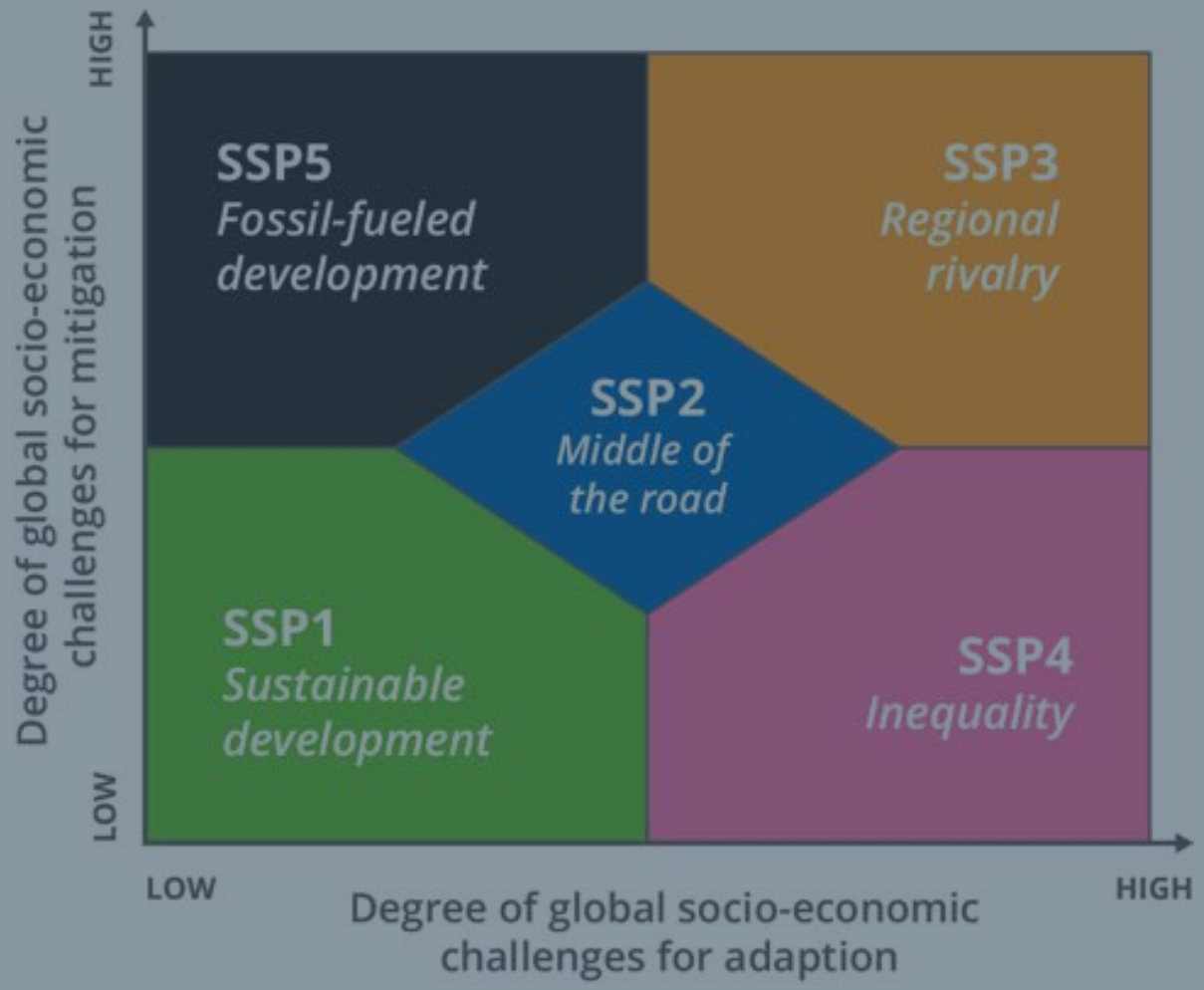
Climate VaR – Transition Risks

The Methodology

Methodology – Transition Risks

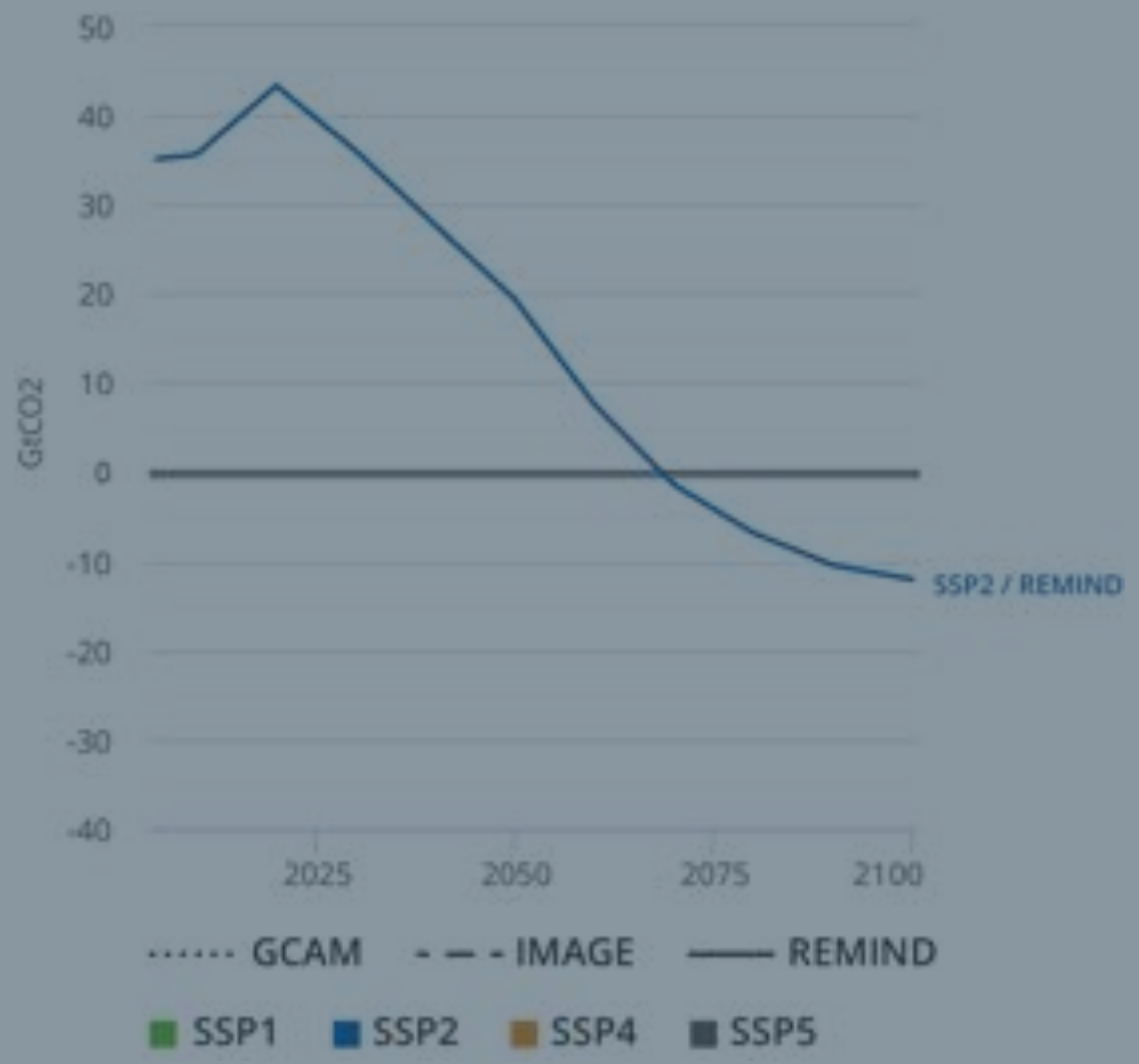


Shared Socioeconomic Pathways (SSPs)



O'Neill, Kriegler et al., Global Env. Change 42: 169-180, 2017

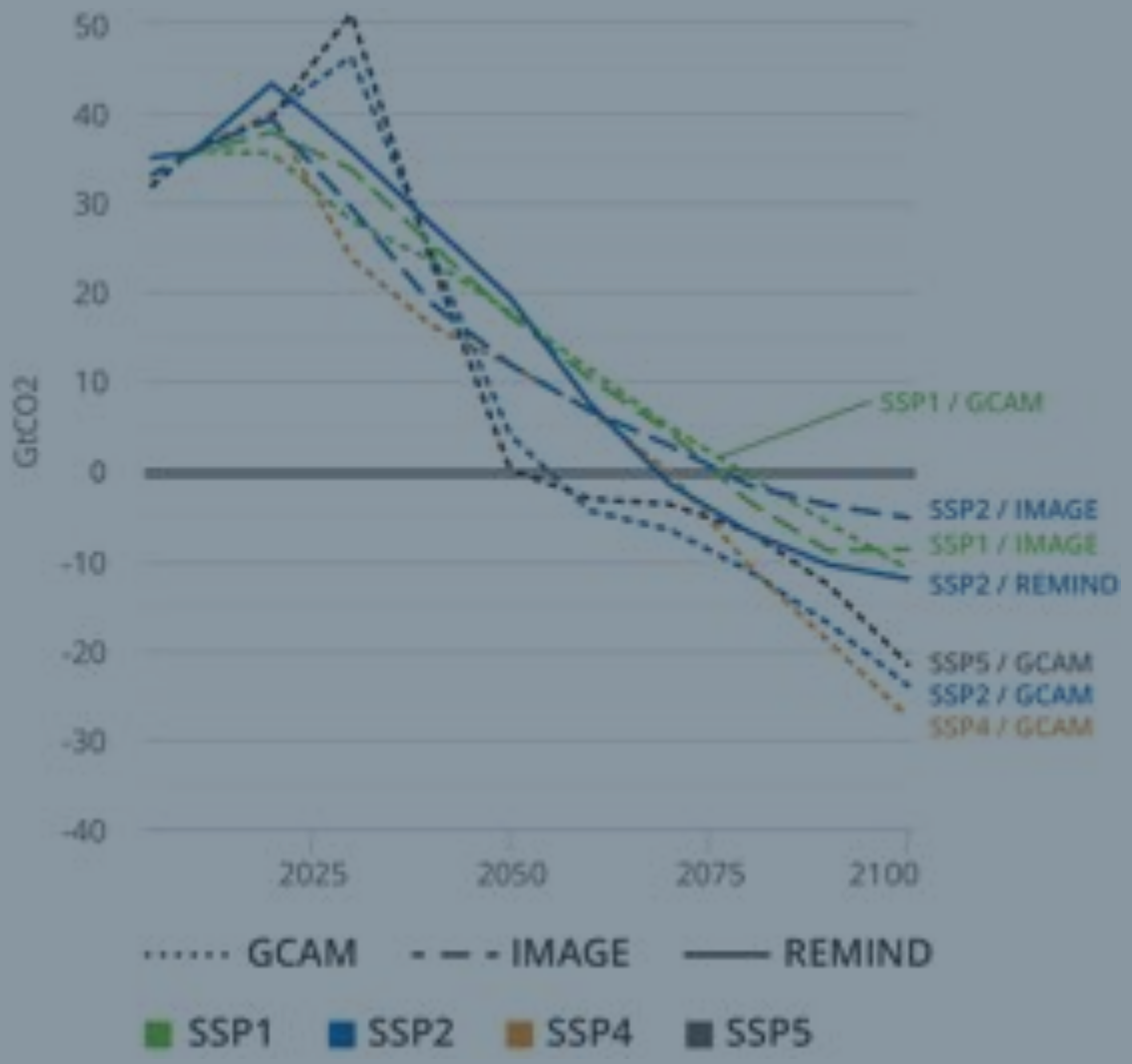
2˚C Scenario CO_2 Emissions



2˚C Scenario CO_2 Emissions

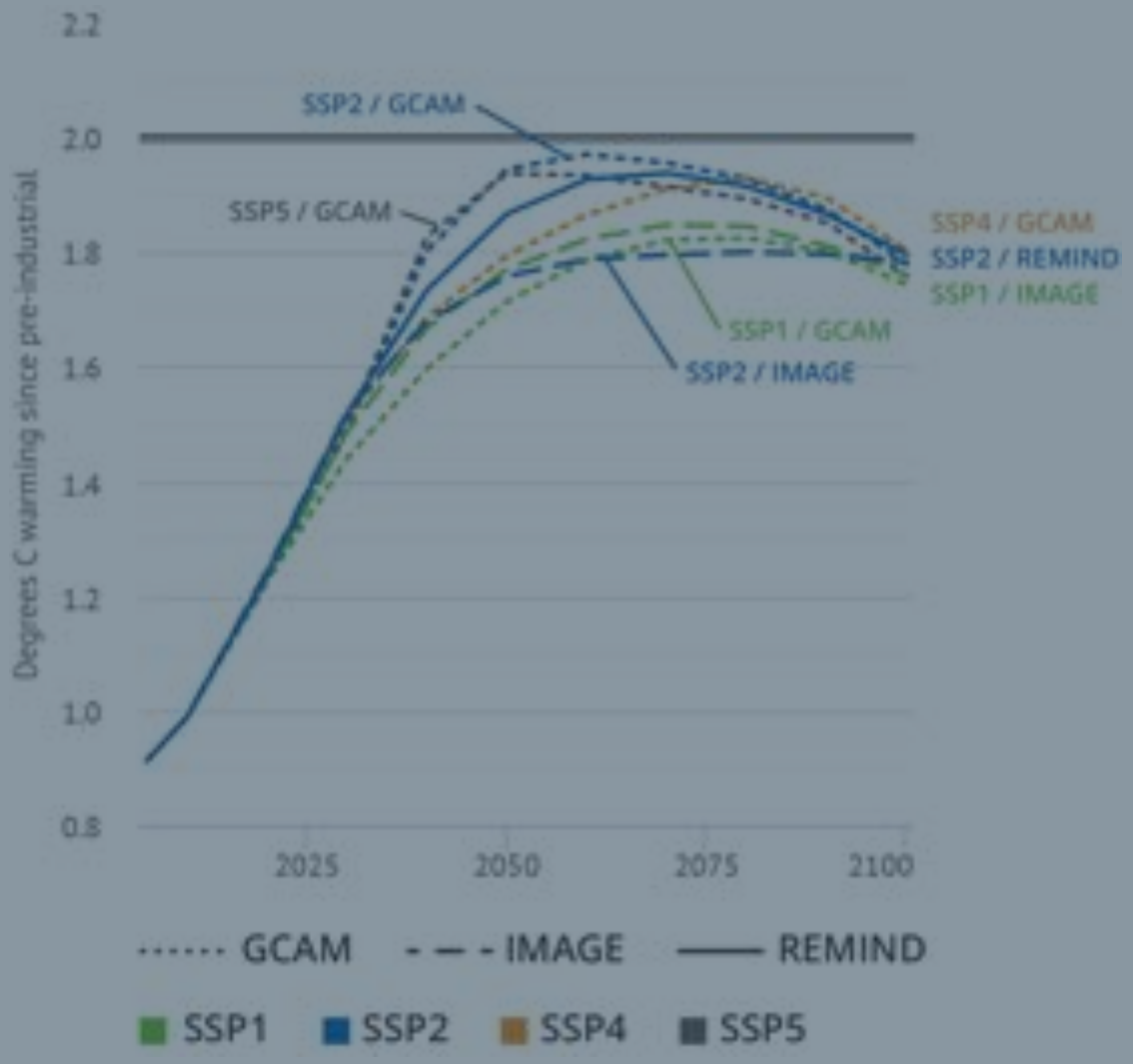
GCAM4
Joint Global Change Research Institute Pacific Northwest National Laboratory & University of Maryland

IMAGE
PBL Netherlands Environmental Assessment Agency



2˚C Scenario Global Temperature Change

2˚C Scenario Global Temperature Change



Climate VaR – Technology Opportunites

The Methodology

Low carbon patent examples (1)

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Composite Binders at Heidelberg

- Alternative binder in the cement production
- Reduces the CO_2 footprint of cement production

Patent: 20150304EP2842925A1, CALCIUM SULFOALUMINATE COMPOSITE BINDERS

Smart Grids at Siemens

- Improves the electricity network
- Saves overall energy and makes the society more efficient

Patent: 20140912WO2014137655A1, DEMAND SHAPING IN AN ELECTRICAL POWER GRID

Low carbon patent examples (2)

Nuclear Fusion at Lockheed Martin

- Small and compact nuclear fusion reactors
- Ready for market in 5-10Y.

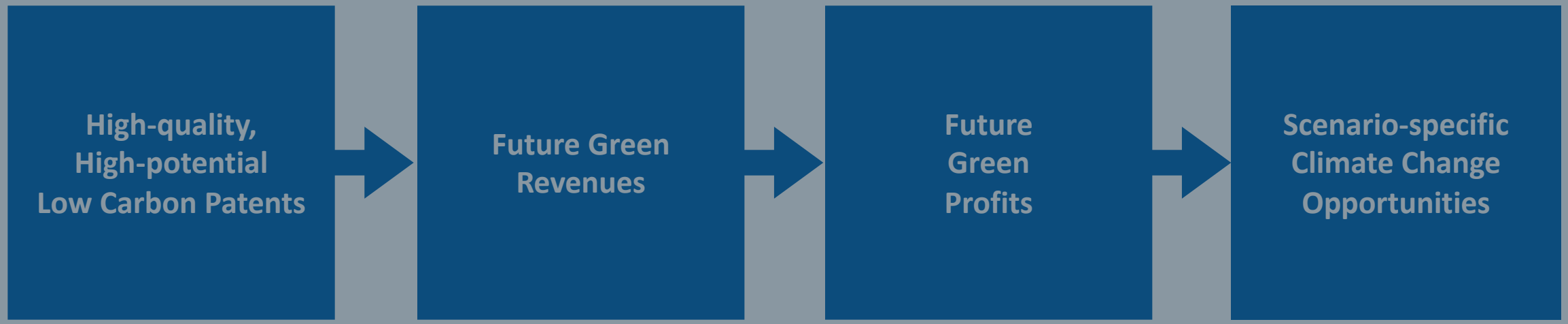
Patent: 20141009CA2908480A1, MAGNETIC FIELD PLASMA CONFINEMENT FOR COMPACT FUSION REACTOR

Biotechnology at Novartis

- Improves the production of chemicals
- Saves general amounts of used materials, heat with biocatalysis.

Patent: 20150115CA2916905A1, MULTIPLE PROTEASES DEFICIENT FILAMENTOUS FUNGAL CELLS AND METHODS OF USE THEREOF

Methodology – Transition Opportunities

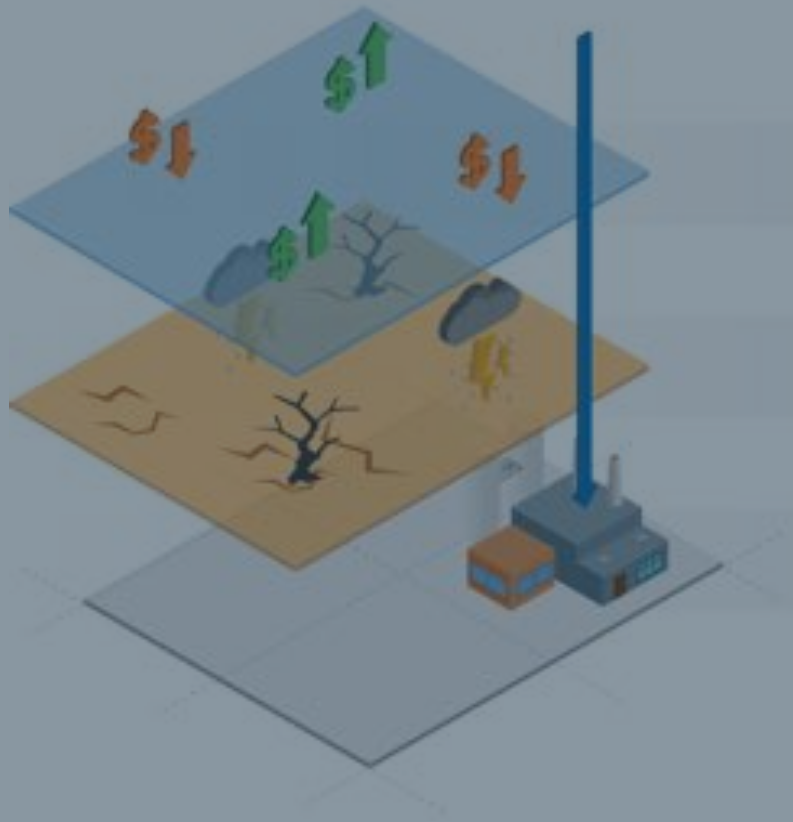


Climate VaR – Physical Risks

The Methodology

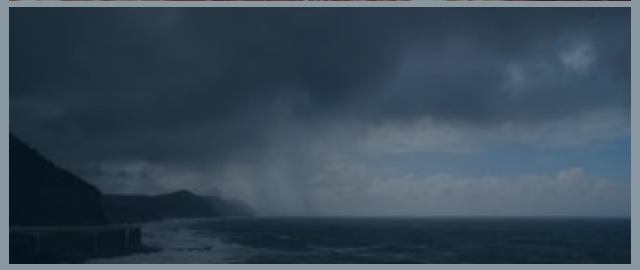
Methodology – Physical Climate Risks & Opportunities

EXPECTED COST = VULNERABILITY x HAZARD x EXPOSURE



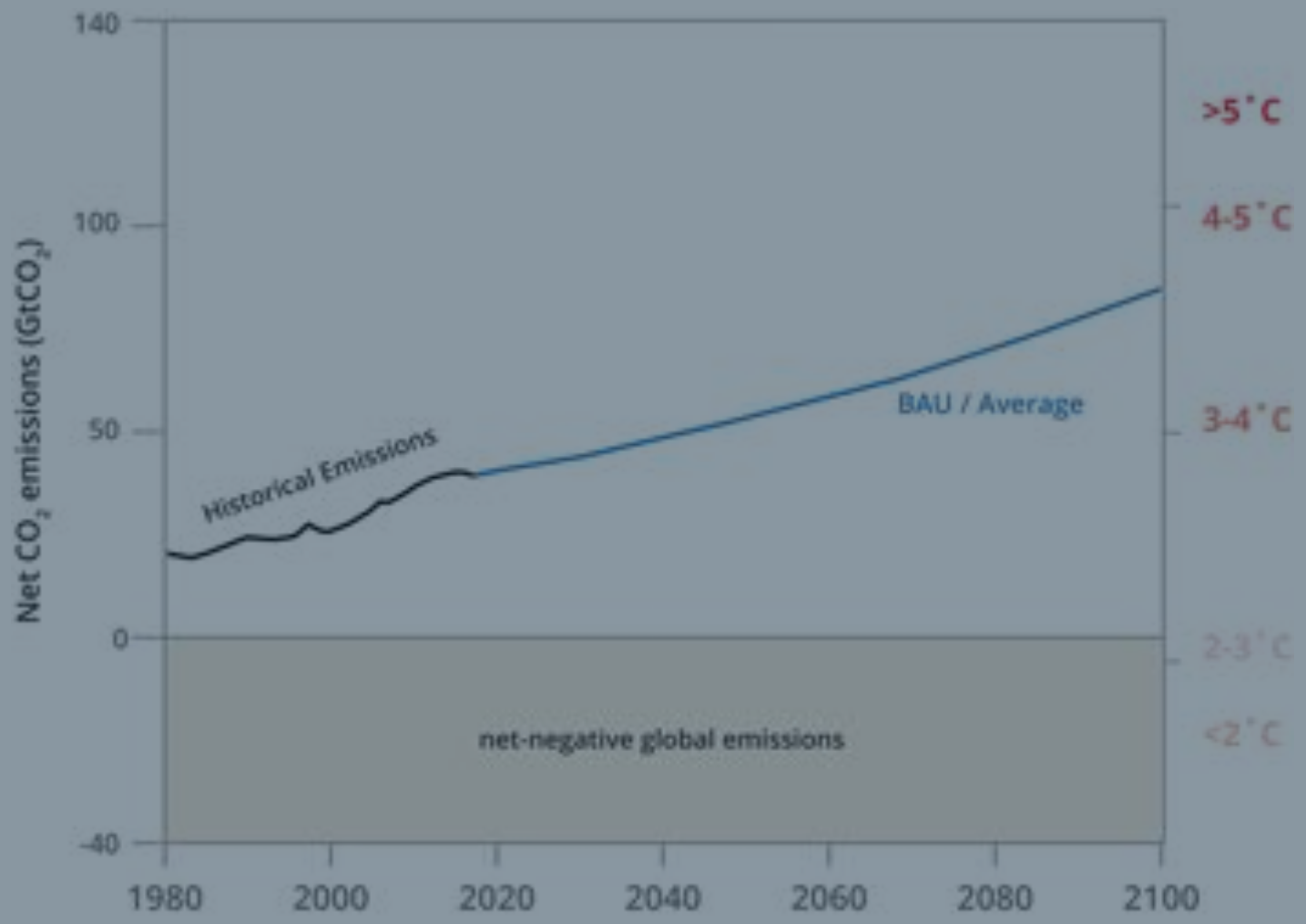
VULNERABILITY	*Cost Function*
HAZARD	*Extreme Weather*
EXPOSURE	*Company Facility*

Extreme Weather Hazards in the Model

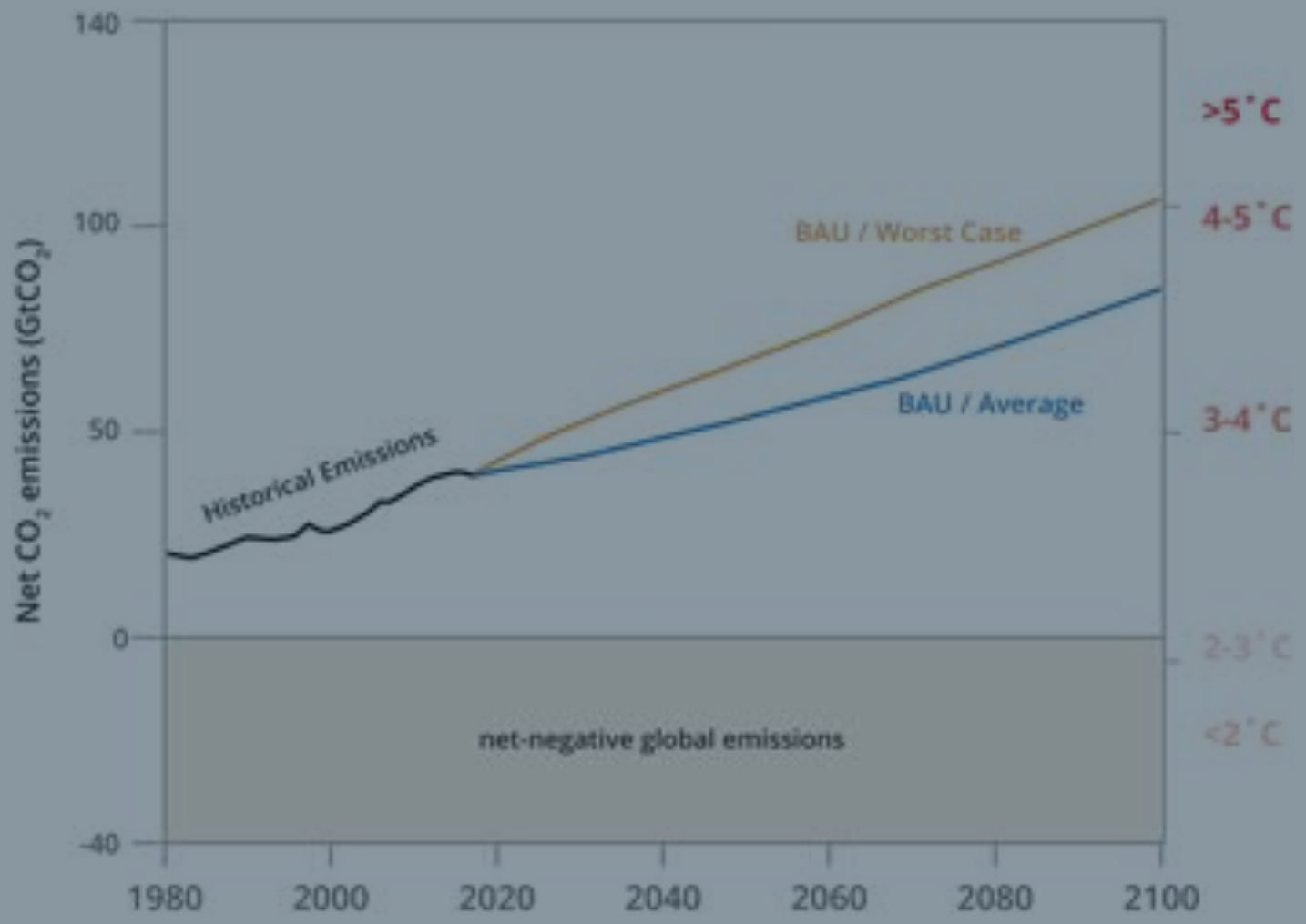


- Extreme Heat *(Re-Analysis)*
- Extreme Cold *(Re-Analysis)*
- Heavy Precipitation *(Re-Analysis)*
- Heavy Snowfall *(Re-Analysis)*
- Wind Gusts *(Re-Analysis)*
- Coastal Flooding *(Climate Models)*
- Tropical Cyclones *(Probabilistic Model - Climada)*

Methodology – Physical Climate Change (1)



Methodology – Physical Climate Change (2)



Climate Scenario Data Use Cases

Warming Potential for Fund Creation

Sectoral & regional over- and underweights

Green Technology Opportunities for Alpha Creation

Downside Risk Reduction

CSR and TCFD reporting

Shareholder engagement

Changing Course

Coffee Break
Next Session: 15:00

10th May
Aviva Head Office
London

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Tool Demonstration

Anja Ludzuweit

Director of Business Development, Carbon Delta

High-Level Panel

Margaret Kuhlow, *Climate Practice Lead, WWF*
Sasja Beslik, *Nordea Group Head of Sustainability*
Steve Waygood, *Chief Responsible Investment Officer, Aviva*
Willemijn Verdegaal, *Co-Head Climate & ESG Solutions, Ortec Finance*

Moderator: Elodie Feller, *UNEP FI*

Closing Intervention

Ed Baker

Senior Policy Officer, PRI

Thank you


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