Introduction to Climate Value-at-Risk

Methodologies and Tools to Evaluate the Financial Impact of Climate-Related Risks and Opportunities

November 2019
Carbon Delta estimates the effect of climate change on a company’s bottom line

**POLICY RISKS**

**2019 South Africa Carbon Tax**

Minerals Council SA says the carbon tax could wipe out 6,000+ mining jobs each year

Eskom’s carbon tax liability is projected to be approximately R11.5 billion per year from 2023

**TECH OPPORTUNITIES**

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

Sunrun (Solar Installer): 1000% revenue growth

RWE (German Utility): Analyst-Revision -22.6%

**PHYSICAL RISKS**

**2015 South Indian floods**

Ford Motor Co., BMW AG and Renault SA halted production at their factories

TVS Motor Co.’s stock price dropped 4.9 per cent, saying rainfall adversely affected production and sales.
The climate innovation

**Scenario analysis**

1.5°C-Scenario

2°C Scenarios (7)
- 3 Integrated Assessment Models
- 5 Socioeconomic Pathways

3°C-Scenario / NDC

Average Scenario

Worst Case Scenario

**Physical Risks & Opportunities**

**Transition Risks & Opportunities**
What is Climate Value at Risk (CVaR)?

Climate VaR aims to assess the potential financial sensitivity to climate risks and opportunities, i.e. what would be the potential financial impact of different climate scenarios (1.5°, 2°, 3° of warming)?

Estimates of net-present-value impact of climate change on the security pricing

An aggregate Climate VaR can be broken down into:

- **Policy** (transition risks)
- **Technology opportunities** (transition opportunities)
- **Physical risks & opportunities**

Asset classes covered: listed equities, fixed income, real estate assets

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**Aggregated Climate VaR**

*2°C mid-range & average physical climate risk scenarios*

The bar chart illustrates how Enel SpA compares to its market peers in terms of the aggregated Climate Value-at-Risk. The Aggregated CVaR combines the Policy CVaR, the Technology CVaR, and the Physical CVaR into an overall Climate Value-at-Risk metric.

- CPFL Energia SA
- ELECTRICITE FRANCE SA
- CIA ENERGETICA DE MINAS GER
- Enel SpA

Source: Carbon Delta company report
Climate Value-at-Risk building blocks & risk metrics

**Transition Risks & Opportunities**
- **POLICY**
  - 15 years until 2100
  - Emission Reduction Requirements per year
  - Costs to comply with emission reduction targets

- **TECHNOLOGY**
  - 15 years until 2100
  - Patents deliver deep insights into R&D investments
  - 90 million patents
  - 10,000+ companies
  - > 400 groups of low carbon technologies

**Physical Risks & Opportunities**
- **PHYSICAL**
  - 15 years until 2100
  - Extreme Heat
  - Extreme Cold
  - Heavy Precipitation
  - Heavy Snowfall
  - Wind Gusts
  - Coastal Flooding
  - Tropical Cyclones

= Aggregated Climate VaR
How is Carbon Delta's CVaR calculated?
Nationally Determined Contributions (NDCs)

Pathway to Canada’s 2030 target

Emissions reductions to come from additional measures, such as investments into public transit, green infrastructure, clean technology and innovation, and stored carbon.

Source: Canada’s NDC, Page 4
Overview of Policy Risk Methodology
Aggregation Across Company Facilities
Calculate Cost Impact with Carbon Prices
Company-level Scenario Analysis

On a company level, we calculate:

- Current emission level
- Annual emission levels 15 years into the future
- Emission reduction requirements per year
- Costs to comply with emission reduction targets each year under BAU, 3°C, 2°C and 1.5°C scenarios
Tech Opportunity: Sector Breakdown of Patents

- E-Vehicles
- Wind
- Photovoltaic
- CCS
- Energy Supply
- Biofuels
- Combustion
- Smart Grids
- Health Care Equipment
- Waste

Weight x Patent Value

Low Carbon Patents

Other Patents
Overview of Physical Risk Methodology

EXPECTED COST = VULNERABILITY \times HAZARD \times EXPOSURE
Hazard: Extreme Weather Types

- Extreme heat and cold
  - Re-analysis

- Heavy precipitation and snowfall
  - Re-analysis

- Wind gusts
  - Re-analysis

- Wildfires
  - Re-analysis, development in progress

- Coastal flooding
  - Climate models

- Tropical cyclones
  - Probabilistic model – Climada

- Fluvial flooding
  - Climate models, development in progress
Exposure: Asset Level Database

- Asset location database with global coverage
- Growing number of enterprise assets (>500k assets)
- Data is obtained from
  - Company analysis
  - Crawling data
  - Industry databases

Example: European locations within MSCI ACWI and exposure to coastal flooding
Use cases

- Regulatory Compliance
  - CSR and TCFD reporting
- Risk Management
  - Shareholder engagement
- 2ºC Alignment
  - Sectoral & regional over- and underweights
- New Financial Products
  - Green Technology Opportunities for Alpha Creation
Carbon Delta’s existing clients

Carbon Delta has worked with the below organizations to measure and manage climate risk

- UNEP Finance Initiative
- Aviva
- Norges Bank Investment Management
- AXA
- Rockefeller Asset Management
- DNB
- Storebrand
- La Française
- Publica
- M&G Investments
- Nordea
- LaSalle
Which industries are most affected by climate risks?

CVaR spread by primary sectors of activity

Optimize the Climate VaR of a portfolio
Climate Risk Contribution

Portfolio CVaR contribution by security

- GLENCORE
- BP
- INTERNATIONAL CONSOLIDATE
- RIO TINTO
- CRH
- SSE
- UNITED UTILITIES GROUP
- SEVERN TRENT
- BHP GROUP PLC
- ANGLO AMERICAN

Transition risks • Physical risks
How aligned is a sample portfolio with the Paris Climate Target?

Top 5 High-Warming Potential Securities

<table>
<thead>
<tr>
<th>Security</th>
<th>Weight</th>
<th>Warming Potential</th>
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</thead>
<tbody>
<tr>
<td>CANOPY GROWTH CORP</td>
<td>0.03%</td>
<td>6.00°C</td>
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<tr>
<td>HeidelbergCement AG</td>
<td>0.03%</td>
<td>6.00°C</td>
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<tr>
<td>LafargeHolcim Ltd</td>
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<td>6.00°C</td>
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<tr>
<td>Melco Crown Entertainment Ltd</td>
<td>0.02%</td>
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<tr>
<td>CNMC Health PLC</td>
<td>0.01%</td>
<td>6.00°C</td>
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Top 5 Low-Warming Potential Securities

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<tr>
<td>Xerox Corp</td>
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</tr>
<tr>
<td>Tokyo Electron Ltd</td>
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<td>1.30°C</td>
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<tr>
<td>Smith &amp; Nephew PLC</td>
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</tr>
<tr>
<td>Skyworks Solutions Inc</td>
<td>0.04%</td>
<td>1.30°C</td>
</tr>
<tr>
<td>Seagate Technology PLC</td>
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