Mot de Bienvenue

Marie Luchet, Responsible France & Programme Francophone, PRI
David Simon, Directeur Finances - Investissements et Risques, et membre du Comité Exécutif - AG2R LA MONDIALE
Keynote

Mark Lewis, Head of Research, Carbon Tracker
Unburnable Carbon Revisited

Mark C. Lewis
Head of Research, Carbon Tracker Initiative
PRI Paris Workshop, 10 July, 2018
mlewis@carbontracker.org
Who are we?

Identity: Carbon Tracker is an independent non-profit financial think tank funded by EU and US foundations interested in climate.

Vision: To enable a climate secure global energy market by aligning the capital markets with climate reality.

Mission: Mapping the transition for the fossil fuel industry to stay within a two degree budget.

Strategy:
- Empower *investors* to identify and switch off capital to the highest cost, highest carbon projects.
- Engage with *companies* to re-assess both the viability of such projects and of their business model.
- Educate mainstream *financial markets* and *policy-makers* over the risk of a disorderly transition.
- Work with *financial regulators* to bring transparency on carbon and stranded asset risk and the fossil fuel risk premium.
We can’t burn all our fossil fuels and have a healthy planet.

We won’t burn all our fossil fuels because renewables are increasingly cheaper than fossils.

So there will be an energy transition from fossil to renewables.

Transitions impact incumbents when (or just before) demand starts to fall.

We have already seen plenty of energy demand peaks, and the peak for all fossil fuels will be in 2022.

This peak will create falling energy prices and trillions of dollars of stranded assets.

The world already has $1,300bn of uneconomic fossil fuel assets, and we are spending $370bn a year on assets that are not needed under two degrees.

We can calculate by sector and stock where a lot of these assets are held.

The energy transition also creates spectacular new growth opportunities which provide very fertile ground for stock-pickers.

Summary
Based on IPCC data, the energy sector can release 700 Gt of CO2 from 2018 to give the world a 66% chance to avoid global warming of over 2 degrees.

Meanwhile, the energy sector released 32 Gt of Co2 in 2016, and this has been rising.

So, if nothing changes, we will use up the budget within 20 years.

To have a chance of hitting the budget, we need to start to reduce CO2 emissions immediately, and get them to a quarter of current levels by 2050.

There is a carbon budget for a two degree world
The world has a huge fossil fuel surplus

- Taking BP reserves data, the world has 1 trillion toe of oil, gas and coal reserves, and 13 times as much resources.
- Locked up in the reserves alone are 3,500 Gt tonnes of carbon dioxide.
- The total budget for CO2 is 700 Gt in a two degrees world.
- If we take the IEA apportionment of the budget by fuel, we already have two times too much gas and three times too much oil reserves.

![Graph showing the ratio of reserves to 2 degree budget](Source: IEA, BP)

![Graph showing carbon reserves in Gt CO2](Source: IEA, BP)
The OECD calculates that outdoor air pollution kills 2.9 million people a year, the fourth largest cause of death globally.

Under business as usual, deaths would increase to 6.1 million by 2060.

Until 2030, the costs of outdoor air pollution exceed those of global warming.

The problem is considerably worse in China and India because of their high levels of population density.

<table>
<thead>
<tr>
<th>Country</th>
<th>Deaths pa from outdoor air pollution (m)</th>
<th>Pollution t per square km 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0.5</td>
<td>5.0</td>
</tr>
<tr>
<td>EU 4</td>
<td>1.0</td>
<td>10.0</td>
</tr>
<tr>
<td>India</td>
<td>1.5</td>
<td>15.0</td>
</tr>
<tr>
<td>China</td>
<td>2.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Source: OECD

Source: IEA, Carbon Tracker estimates for the main area of habitation.
Although the US is increasingly energy independent, China, India and Europe are not.

On IEA projections, the oil import dependency of China and India will increase significantly.

Dependency upon foreign oil imports across global sea lanes dominated by US fleets is incompatible with a wholly independent foreign policy.
Since 2010, European utilities have written down $150bn of assets, mostly in fossil fuel generation. The drivers were a combination of regulation, renewables subsidy, excess capacity, and the falling costs of alternatives.

Renewables costs in Europe are about to break through the operating cost of existing plants. This is likely to lead to a new round of asset write-downs.
After decades of uninterrupted growth, the European utility sector was looking forward to more of the same in 2007.

What they got was stagnant demand and stranded assets as the renewables sector pushed out fossil fuel generation.

Wholesale electricity prices fell as a result of the overcapacity.

Since 2010, the European electricity sector has written down $150bn of assets.

Sector capitalisation has fallen by over half.
Europe still has 447 GW of fossil fuel generation capacity which is under threat from the transition.

We calculate that half the coal plants in Europe are loss-making at an operating level today. And they will almost all be loss-making by 2030.

We can identify the highest cost coal assets in Europe as well as companies with the largest amount of coal assets.
It is possible to consider energy in terms of its three main areas of supply – fossils, fast-growing renewables (solar and wind), and the slow growing non-fossils – nuclear, biomass and hydro.

In 2016, global electricity demand was 25,000 TWh.

Two thirds of supply came from fossil fuels, and 29% from hydro, nuclear, and biomass.

Solar and wind provided just 1,300 TWh or 5% of supply.
However, the picture is very different when we look at incremental supply. In 2016, incremental electricity supply was 601 TWh.

Solar and wind were the largest contributor of incremental supply, adding up 35% of incremental energy supply and 208 TWh.

Fossil fuels added a third of incremental supply, 206 TWh.

This fits into a consistent pattern. Nuclear, hydro and biomass grow at around 2% a year, solar and wind grow at around 20%, and fossil fuels are the residual.
So it is possible to work out the date of peak demand for fossil fuels for electricity generation with regard to just two primary variables – the growth rate of total electricity demand and the growth rate of wind and solar. Assuming total electricity demand growth of 2% (the IEA forecast) and a solar and wind growth rate of 20%, the peak year is 2019. At a 15% solar and wind growth rate (which is pretty much guaranteed), the peak year is 2021.

We observe therefore that at reasonable growth rates the world will see peak demand for fossil fuels for electricity by 2021.

<table>
<thead>
<tr>
<th>Growth rate of solar and wind</th>
<th>1.50%</th>
<th>2%</th>
<th>2.50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>2023</td>
<td>2029</td>
<td>2040</td>
</tr>
<tr>
<td>15%</td>
<td>2019</td>
<td>2021</td>
<td>2024</td>
</tr>
<tr>
<td>20%</td>
<td>2018</td>
<td>2019</td>
<td>2021</td>
</tr>
<tr>
<td>25%</td>
<td>2018</td>
<td>2018</td>
<td>2019</td>
</tr>
</tbody>
</table>

Source: Carbon Tracker

![Incremental electricity supply in the future](carbon_tracker_graph.png)
In 2016, energy for the generation of electricity made up 42% of all global energy demand.

Energy for electricity made up 80% of incremental demand for all energy.

The disproportionate importance of electricity is because of the ongoing electrification of transport and heating. The share of electricity in total energy demand increases by around 2-3% per decade.

Once solar and wind account for all incremental electricity supply, they will make up almost all total incremental energy supply.
The energy sector in 2016

- In 2016, fossil fuels made up 86% of global energy supply, while solar and wind were just 2% of the total.
- Fossil fuels have been dominant in the energy supply for a very long time.

Source: BP
• The incremental supply picture is, however, very different.
• Solar and wind made up a quarter of incremental energy supply in 2016.
• Hydro, nuclear, biomass were a further quarter.
• Fossil fuels were just half of incremental supply of energy in 2016.
We can thus calculate when fossil fuel demand will peak, based on total energy demand growth and the growth rate of solar and wind supply.

Future demand for energy is projected by the IEA to grow at 1% a year. Meanwhile solar and wind are growing at 15-20% a year. The crossover point is between 2020 and 2025 at current growth rates. At 1% growth in energy demand and 17% for solar and wind, we will see peak global fossil fuel demand in 2022.
How we see the world of energy

- Global demand for fossil fuels is about to peak.
- This overall peak will be preceded and followed by demand peaks for each region and commodity.
- Investors should see the peaks as an aspect of a wider transition, not as a series of discrete events.
- Investors in incumbents start to lose money even before the peak comes.
- This energy transition will therefore have a huge impact on equity markets.
The choice for emerging markets: the old

- Railway
- Coal mine
- Port
- Power station
- Distribution
- Consumers
The new choice: clean energy
The energy transition and demand peaks

Global fossil fuel demand total

2022

2021

Global fossil fuel demand for electricity

Global demand for new oil cars

2021

VW

2007

European fossil fuel demand for electricity

RWE

2005

EU gas demand

Gazprom

2014

Global coal demand

Peabody

2011

Global gas turbine demand

GE

2005

EU gas demand

Gazprom

2020s

Global oil demand

2030s

Global gas demand

VW

Victims of the peak

RWE

Gazprom
For more information please visit:

www.carbontracker.org

@CarbonBubble
L’engagement actionnarial et la coalition Climate Action 100+

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- **Laetitia Tankwe**, Conseillère du Président, Ircantec
Les enjeux sociaux des changements climatiques

- **Nick Robins**, Professor in Practice - Sustainable Finance, Grantham Research Institute on Climate Change and the Environment, London School of Economics
- **Bertille Presta Knuckey**, Portfolio Manager – Head of Sustainable & Responsible Investment, Sycomore Asset Management
Investir dans une transition juste

Nick Robins, Professor in Practice
The Investing in a Just Transition initiative

- Co-designed by Grantham Research Institute at LSE and Initiative for Responsible Investment at Harvard
- In partnership with Principles for Responsible Investment & International Trade Union Confederation
- Supported by an international advisory committee
- Key goals
  - Develop a case for investor action on the Just Transition
  - Generate draft guidance for investors
  - Identify policy reforms to support the investor role
  - Deliver by COP24 in December 2018
- First discussion paper just released
What is the Just Transition?

Part of the Paris Agreement:
‘The imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities’

A strategic vision:
‘A just transition is an economy-wide process that produces the plans, policies and investments that lead to a future where all jobs are green and decent, emissions are at net zero, poverty is eradicated, and communities are thriving and resilient.’ (ITUC)
The European Dimension

High-Level Expert Group on Sustainable Finance

“Sustainable finance has a key role to play in delivering a “just transition”, and in making sure that the shift away from high-carbon, resource-intensive and polluting sectors produces net benefits for workers and communities.

This could be achieved, for example, by working with local authorities, communities and others to develop investable pipelines of green assets (such as property and infrastructure) in vulnerable regions.”
A multi-dimensional challenge

- **Positive & Negative:** green jobs & stranded workers
- **Global:** developed & developing; global value chains
- **Whole Economy:** all economic sectors, not only coal
- **Social and Spatial:** unevenly distributed; tied to place
- **Systemic:** linking climate & inequality as drivers of instability

For investors, the just transition connects the **E & the S**
Why should investors take part?

- **Materiality**: Value drivers (e.g., human capital management)
- **Norms**: Aligning with international law, norms and goals
- **Opportunities**: A lens for new investment opportunities
- **Beneficiaries**: Beneficiary interests and preferences
- **Systemic risk**: Extending the management of systemic risks
- **Collaboration**: A platform for blended finance strategies
What can investors do?

1. **Investment strategy:**
   - Including the social dimension in climate policy
   - Involving key stakeholders (e.g., beneficiaries)

2. **Investor engagement:**
   - TCFD implementation: strategy; governance; risk
   - Scenario planning
   - Sector priorities (e.g., coal phase out)
What can investors do?

3. Capital allocation
   • Labour and social standards in climate investments
   • Tailoring green bonds in affected regions
   • Linking social impact strategies with the transition

4. Policy dialogue:
   • International policy: G7, G20, ILO, UNFCCC
   • Sustainable Finance: spatial dimension in national roadmaps
   • Climate Plans: regional and national plans
Strategic Implications for Responsible Investors

• Rethinking ESG as a holistic strategy

• Exploring the spatial dimension of investment

• Tackling linkages in economic and financial systems

• Engaging more deeply with workers, communities, business, policymakers.
Key Questions

• How can the case for investor action be strengthened?

• What tools would be most useful for investors?

• How should investors engage in the broader agenda?
Next Steps

- 12-14 September: PRI in Person and Global Climate Action Summit, San Francisco – draft Investor Guidance

- 3-14 December: COP 24, Katowice – refined Investor Guidance

- 2019: piloting the guidance with investors and stakeholders
Find Out More

The Discussion Paper

https://bit.ly/2xMG7H4

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Point sur les recommandations TCFD

- Sagarika Chatterjee, Head of Climate Policy, PRI
CLIMATE CHANGE: WHY SHOULD INVESTORS CARE?
Three types of climate-related risk

Physical risk

Liability risk

Transition risk

Source: IPCC
The Taskforce on Climate related Disclosures (TCFD)

Core Elements of Recommended Climate-Related Financial Disclosures

- **Governance**
  The organization's governance around climate-related risks and opportunities

- **Strategy**
  The actual and potential impacts of climate-related risks and opportunities on the organization’s businesses, strategy, and financial planning

- **Risk Management**
  The processes used by the organization to identify, assess, and manage climate-related risks

- **Metrics and Targets**
  The metrics and targets used to assess and manage relevant climate-related risks and opportunities
The guide has been prepared for **asset owners looking to improve their practices** according to the Taskforce on Climate-related Financial Disclosures (TCFD) Recommendations.

To meet investors’ need for practical tools and guidance, this guide offers a **range of actions** allowing improvement across the four pillars of the TCFD framework (governance, strategy, risk management, and metrics and targets).

The guide highlights **near term actions** as well as setting out recommendations for **engaging with fund managers** on their management of climate-related issues.

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**TCFD: What are the benefits for asset owners?**

- Translates climate change into financial metrics
- Means to improve risk management
- Comparable, flexible framework
- Forward-looking approach
- Increase financial trust and respond to beneficiaries
IMPLEMENTING TCFD
A four step guide

Getting started
➢ Become familiar with the TCFD recommendations
➢ Investigate business case for TCFD & approach of peers
➢ Establish board level oversight
➢ Ask CIO, consultants & managers to consider climate-related risks
➢ Report against PRI’s climate risk indicators / in AR

Policy & process
➢ Establish implementation & monitoring plan
➢ Disclose strategy and governance approaches

Assess total portfolio exposure
➢ Analysis portfolio holdings
➢ Engage / assess your managers
➢ Undertake scenario analysis, identify metrics
➢ Disclose governance, strategy, risk mg & metrics

Implement risk mg strategy
➢ Identify responses, including tilt towards climate solutions
➢ Develop climate engagement programmes
➢ Report in AR and reassess annually
INVESTOR DISCLOSURE TO THE PRI
Climate risk indicators based on TCFD
Responses could either be public or private

Introduction in January 2018
INVESTOR DISCLOSURE TO THE PRI

480 signatories submitted responses, 190 will be public from the 2018 PRI Reporting Framework

Signatories reporting on Climate Change

These 480 investors have $42.4 trillion in AUM

56 French investors disclosed based on TCFD

In depth analysis of responses to the PRI climate risk indicators will be published in 2nd half of 2018
GUIDE TO INTEGRATING CLIMATE SCENARIOS

Getting started
- How can this help?
- Where do climate scenarios come from?
- TCFD’s three principles of climate scenario analysis
- What are the key assumptions?

Determining influencing factors
- Identify sectors at risk
- Establish key issues, uncertainties and influencing factors
- Develop indicators of change

Quantitative analysis
- Utilise specialist tools
- Evaluate results
- Identify responses
- Publish results
- Reassess annually
TWO TYPES OF SCENARIOS ANALYSIS

- Context exploring
- Decision making
WHERE DO CLIMATE SCENARIOS COME FROM?

Physical changes to the climate

- IPCC
- National Meteorological Agencies
- Met Office
- EUMETSAT

Energy System transition scenarios

- Current Policy Scenario
- New Policy Scenario
- Sustainable Development Scenario
- Beyond Two Degrees Scenario
- IRENA 2030
- Greenpeace Advance Energy Scenario
TCFD’S THREE PRINCIPLES OF SCENARIO ANALYSIS

I. Include at least one ≤2°C

II. Use a range of scenarios

III. Transparency. Use public reference scenarios
KEY ASSUMPTIONS IN REFERENCE SCENARIOS

- Technology choices
- Probability of outcome
- Frequency of update

Source: Cicero: Climate Scenarios Demystified, February 2018
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IDENTIFYING SECTORS AT RISK

Moody’s identified 11 sectors, $2 tr of rated debt, with exposure to transition risk.

Source: Moody’s Investor Service: incorporating environmental risk into credit analysis, March 2018
PHYSICAL CLIMATE RISK
Three elements to a taxonomy

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Exposure</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Extreme weather</td>
<td>• Real assets portfolio: in a climate hazard prone area?</td>
<td>• Adaptive capacity of cities / companies?</td>
</tr>
<tr>
<td>- Increase in flooding</td>
<td>• Extent of insurance coverage?</td>
<td>• Resilience of investments?</td>
</tr>
<tr>
<td>- Storms / hurricanes</td>
<td>• Supply chains: where are these located?</td>
<td>• Risk management systems in place?</td>
</tr>
<tr>
<td>- Droughts</td>
<td>• Investments in agri-business?</td>
<td></td>
</tr>
<tr>
<td>• Chronic risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sea level rise</td>
<td></td>
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<tr>
<td>- Crop yields</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Spread of pathogens</td>
<td></td>
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<tr>
<td>- Vector borne diseases</td>
<td></td>
<td></td>
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<tr>
<td>• System risks</td>
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<td></td>
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<tr>
<td>- Cascading risks</td>
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<tr>
<td>- Tipping points</td>
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PRI’s PARTNERS ON SCENARIO ANALYSIS
Publicly available tools and research on climate scenarios

More tools available from professional service providers...
SUMMARY OF SCENARIO ANALYSIS

- A tool for understanding potential impairment of corporate earnings as a result of climate-related risks

- The three TCFD principles for scenarios:
  - Include at least one \( \leq 2^0 \)
  - Assess a range of scenarios
  - Transparency. Use public reference scenarios

- The application to climate is still developing. Avoid a jump to probabilistic analysis.
Analyse de scénarios climatiques : évaluation des risques de transition et d’impact carbone des portefeuilles

- Laura Ramirez, Project Manager, 2° Investing Initiative
- Matthieu Maurin, Managing Director, Carbon4 Finance
PACTA 2.0
Outil d’analyse des scénarios climatiques en ligne

PRI Climate Forum
July 2018

2° Investing Initiative
OBJECTIFS
Aider les investisseurs à comprendre les risques liés à la transition

Questions clé:

1. Quelle exposition aux risques liés à la transition énergétique au sein des portefeuilles ?

2. Quelles variations au fil du temps ?

3. Comment se compare l’exposition entre les pairs et sur le marché ?
Feuilles de route technologiques

Compared with

renewable power capacity additions in

2017 2018 2019 2020 2021 2022

Global stock market
Global economy

Données d’actifs physiques & CAPEX / plans de production

ORIGINE DU PROJET
Recherche multipartite sur l'analyse financière climat

Consortium SEI Metrics (mené par 2°)

Partenariats académiques
APPROACH
Assurer une cohérence de l'analyse des scénarios dans toute la chaîne

Emetteurs
TCFD disclosure
Investisseurs / banques
TCFD disclosure
Autorités

Analyse de données d’actifs physiques
MISE EN APPLICATION
4 superviseurs et gouvernements

Premier « stress test » réalisé au niveau national pour déterminer le risque climatique lié aux investissements dans l'industrie de l'assurance

Analyse de 79 investisseurs couvrant environ 60% des fonds de pension suisses et 70% du marché de l'assurance suisse

Analyse pour un usage interne
ÉTAPE 1: CONSTRUIRE UNE BASE DE DONNÉES DE PRODUCTION PROSPECTIVE
Lier la production de l’économie réelle aux outils financiers

Données prospectives de production et capacité

- +100,000 power plants
- ~95 million cars produced
- ~22,000 oil and gas fields
- ~36,000 airplanes
- ~10,000 ships
- ~2,200 cement factories
- ~13,000 steel plants
- ~2,000 coal mines

Sources: Economic intelligence databases + financial databases

ACTIFS FINANCIERS

STRUCTURE DE L’ENTREPRISE

PROPRIÉTAIRES
ETAPE 2: ALLOUER LA PRODUCTION AUX PORTEFEUILLES
Selon les entreprises en portefeuille

Portefeuilles d’investissement en equity et revenu fixe

Allouer une portion de la production issue de l’économie réelle à chaque instrument financier du portefeuille

Méthodes:
1) Approche ownership
2) Approche portfolio weight

Resultats:
“profil de production envisagée” du portefeuille
ÉTAPE 3: APPLIQUER LES MODIFICATIONS PRÉVUES PAR LE SCÉNARIO

Générer un profil de production cohérent avec le scénario

Portefeuilles d’investissement en equity et revenu fixe

“PROFIL DE PRODUCTION ENVISAGÉE”

Résultat: un “profil de production alternatif” du portefeuille
Selon les scenario de l’AIE 1.75° / 4° / 6° / autres scenarios

Méthode: “proportionate share”

Feuilles de route technologiques
(Source: IEA, BNEF, Greenpeace, SBTI)
ÉTAPE 4: COMPARER AVEC LES OBJECTIFS/PAIRS/BENCHMARKS
Identifier le désalignement dans l’économie réelle, pour chaque technologie

- Portfolio vs Portfolio’s scenario target
  - Portfolio
  - COMPARE
    - MWs of renewable capacity
    - GWs of coal-fired capacity
    - number of hybrid vehicles
    - MMbbls of oil extracted
  - Portfolio’s 2° Target

- Portfolio vs Peer Portfolio
  - Portfolio
  - COMPARE
    - GWs, vehicles, MMbbls
  - Peer Portfolio

- Portfolio vs Market portfolio’s scenario target
  - Portfolio
  - COMPARE
    - GWs, vehicles, MMbbls
  - 2° Market Portfolio
PACTA 2.0
Outil d’analyse des scénarios climatiques en ligne
PACTA 2.0 OUTIL D’ANALYSE DES SCÉNARIOS CLIMATIQUES EN LIGNE

Télécharger un portefeuille

Terms and conditions

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Privacy

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If you have any questions about the use of your personal data and the process, please contact: info@pacta2.fr
PACTA 2.0 OUTIL D’ANALYSE DES SCÉNARIOS CLIMATIQUES EN LIGNE

Options disponibles

- Asset Class
- Graphs
- Sector/Technology
- Parameters

2° SCENARIO ANALYSIS

Current Exposure in the Power sector:

Power Sector: Current Global technology exposure

The graph shows the present relative weighting of each technology in the Power sector in your Equity.
PACTA 2.0 OUTIL D’ANALYSE DES SCÉNARIOS CLIMATIQUES EN LIGNE

Resultats

Current Exposure in the Power Sector

Future Exposure in the Power sector
Portfolio’s “alternative production profile” consistent with:

- **CPS – 6C**
- **NPS/RTS – 4C**
- **SDS – 2C**
- **B2DS – 1.75C**

... scenarios.

Amount of gas-fired power capacity allocated to the portfolio each year. “planned production profile”
Technology Breakdown of Power Companies within the fixed income portfolio

Country Exposure to renewable capacity within the equity portfolio
Physical risk analysis in investment portfolios

The CRIS methodology – PRI Conference

July 2018
Carbon4 Finance: who we are
A data provider specialized in metrics for the financial sector

Carbon4 Finance focuses on Climate Data Solutions for investors and lenders. The company’s clients are asset managers, asset owners, banks and index providers that wish to report their climate performance or develop climate investment tools and policies based on custom data solutions.

**OUR APPROACH**

- An innovative bottom-up methodology
- c.10 carbon data analysts specialized in different sectors
- Worldwide coverage (~1,850 largest corporates)

**OUR SERVICES**

- Climate data
- Scope 1, 2 & 3: induced emissions and emissions savings
- Asset vulnerability to physical risks
- Portfolio 2°C alignment

**A multi-sector approach**

- BUILDINGS
- ENERGY and MINING
- AGRICULTURE, FOOD and WATER
- TRANSPORT
- FOREST, PAPER and WASTE
- HEAVY INDUSTRY and MACHINERY
- FINANCIAL
## Selected credentials

### Banks

- Reference framework developed with partners
- Calculation of Induced Emissions of Credit and Asset Portfolios
- Physical and Transition Risk Analysis of Public, Private and Sovereign Issuers

### Securities portfolios

- Development of Carbon Impact Analytics to assess induced and avoided emissions for securities
- Development of Climate Risk Impact Screening to assess physical risks for securities
- Recast of Low Carbon 100, Euronext's low carbon index

### Real Assets

- Induced and avoided emissions
- Computing modules developed to evaluate 28 types of infrastructure projects throughout the life of the project
- Pre-investment due diligence
- Real Estate Portfolio review
Assessing physical risk in investment portfolios
Carbone 4 offers the financial sector a complete climate risk analysis package

“With better information as a foundation, we can build a virtuous circle of better understanding of tomorrow’s risks, better pricing for investors, better decisions by policymakers, and a smoother transition to a lower-carbon economy.”

– Mark Carney, Financial Stability Board (FSB) Chair and Governor of the Bank of England

Physical risks
Risks connected to the exposure of the physical consequences of climate change. (sea level rise, heatwaves, droughts, …)

Transition risks
Risks induced by the transition towards a low-carbon economy. (regulation evolutions, attenuation policies, markets, …)

Climate projections extracted from the latest IPCC report

Source: Global Carbon Project

Anthropic emissions
A strong growth in economic losses linked to climate-induced natural disasters

- Within the last 30 years, economic losses linked to natural disasters have tripled
- In 2017, natural disasters have entailed over $300 billion worth of costs
- Only 30% of these losses were insured
Physical risks materialize on assets, supply chain and revenues

The example of the 2011 Thailand floods

An economic cost estimated at more than $45bn whose only 22% were insured: 9,859 factories closed, 1,700 roads destroyed or paralysed, etc.

Direct and indirect impacts on:

<table>
<thead>
<tr>
<th>The automotive industry</th>
<th>The electronic industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,000 cars not produced each day in the Thai car factories</td>
<td>45% of hard drives in the world were produced in Thailand in 2011</td>
</tr>
<tr>
<td>67 M$ the cost incurred by Nissan to restore its production line</td>
<td>235 M$ the loss for the industrial company Western Digital</td>
</tr>
<tr>
<td>50% decrease in production of Honda’s factories in the US and Canada</td>
<td>x2 the increase in hard drive prices following the floods</td>
</tr>
</tbody>
</table>

Source: Riverside (2012)
Financial portfolios are impacted through their constituents

- Climate change exposes companies or infrastructures to several types of risks leading to drops in revenues and impairment losses.
- Their financial performance and their ability to repay debt can be impacted.
- Equity and bond portfolios are thus at risk.
- These impacts depend on each constituent’s activities: their location, vulnerabilities, their risk management…

Example of AXA’s Real Estate assets’ exposure to flood and extreme weather risks without climate change (historical)

| Floods and windstorms: potential losses of AXA Real Estate Portfolio potentially occurring once every 100 years |
|---|---|---|---|---|---|---|---|---|
|  | Germany | UK | Luxembourg | France | Switzerland | Belgium | USA |
| Floods | 6 960 | 798 | * | * | * | * | * |
| Windstorm | 1 946 | 3 205 | 52 | 5 149 | 5 778 | 2 598 | 668 |

Source: AXA 2018
Carbone 4 has developed CRIS – a methodology to assess physical risk exposure intended for financial institutions

A one-year development project

Climate Risk & Impact Screening (CRIS) is a service to evaluate corporate, infrastructure and sovereign investment portfolio exposure, to physical risks

Supported by major financial institutions

And international experts

© 2018 Carbone 4
Physical risk score result from Climate hazard and vulnerability matrix

Scores on physical risks for each financial asset (company, infrastructure, sovereign) and at the portfolio level.

- Lower Risk
- Moderate Risk
- Medium Risk
- High Risk
- Very High Risk

Climate risk

Climate Hazard

Depends on the geographical location of the asset.

Vulnerability

Depends on the asset and its sectoral activities.
A bottom-up analysis based on the geographic and sectoral breakdown of each company’s activities

- At the company level, for each climate hazard, risk is a combination of the risks of each country-sector coupling composing its business, weighted by the breakdown of its activity in each of these couples.

- The indicator used to understand the geographic breakdown depends on the capital intensity of the sector (CAPEX to revenue ratio): fixed assets for high capital intensity sectors, and revenue for low capital intensity sectors.
CRIS covers 7 direct climate hazards and 9 indirect hazards

**Direct climate hazards**
- Increase in average temperature
- Changes in the intensity or frequency of heatwaves
- Changes in drought extremes
- Changes in rainfall extremes
- Sea level rise
- Changes in the intensity or frequency of storms
- Changes in rainfall patterns

**Indirect climate hazards**
- Biodiversity migration and loss risks
- Air quality risks
- Urban heat island risks
- Water scarcity risks
- Wildfire risks
- Flood risks (river & groundwater flood)
- Landslide and mass movement risks
- Coastal flood risks
- Coastal erosion risks

Legend:
- **Acute hazards**
- **Chronic hazards**
Examples of results for increase in temperature

- **207 countries covered**
- The hazard rating is based on relative changes of one climate variable: **Mean of annual temperatures**

### Past: Historical mean temperature (historical averages 1961–1990)

In the past: 0°C is reached for -1.8°C in Greenland, 99°C is reached for +29°C in UAE.

### Future: Projected changes in 2046-2065 relative to 1961-1990 under the medium scenario

Future: 1°C is reached for +0.76°C in Tonga, 99°C is reached for +6.42°C in Canada.

### Future: Projected changes in 2080-2100 relative to 1961-1990 under the high-emission scenario

Source: Carbone 4 processing based on IPCC and World Bank databases.
Our approach to capture credit risk vulnerability for corporate

Example with a (gradual or extreme) hazard and a sector

Free Cash Flow deterioration risks

Risks linked to increases in CAPEX

Increased CAPEX Risk

Risks linked to OPEX increases

Risks linked to a decrease in cash flow

Risks linked to decreased revenues

Potential maximum conceivable losses (scored from 0 to 99 with 99 = total destruction)

<table>
<thead>
<tr>
<th>Assets/CAPEX</th>
<th>Costs/OPEX</th>
<th>Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangible Assets</td>
<td>Raw material purchases</td>
<td>Change in sales volumes</td>
</tr>
<tr>
<td>Intangible Assets</td>
<td>Consumable purchases</td>
<td>Change in sales prices</td>
</tr>
<tr>
<td>Current Assets</td>
<td>Consumable supplies</td>
<td>New markets</td>
</tr>
<tr>
<td></td>
<td>Total payroll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintenance and repairs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Goods and employee transportation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hazard A</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>75</td>
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</tbody>
</table>
Our sectoral profiles are built upon 15 vulnerability factors

<table>
<thead>
<tr>
<th>Categories</th>
<th>Factors contributing to vulnerability</th>
</tr>
</thead>
</table>
| Upstream value chain| 1. Production depending on water availability  
2. Production depending on raw materials or on materials sensitive to climate variation  
3. Geographic concentration of suppliers/cluster tendency |
| Process             | 4. Production relying on long lived assets  
5. Production relying on highly specific and complex assets  
6. Weather sensitivity (other than cold) of production and operation process  
7. Need to cool processes and workplaces |
| Workforce           | 8. Workforce intensity of production  
9. Proportion of outdoor workers  
10. Need for cold chain |
| Logistics           | 11. Use of road and rail transportation  
12. Dependency to port facilities and operations |
| Demand              | 13. Market adaptability  
14. Weather sensitivity of price volatility  
15. Weather sensitivity of sales |

**Examples of sectors highly sensitive**

**IT industry:** collapse in hard drive production with the shut down of main factories in Thailand because of floods

**Petrochemical sector:** shut down of petrochemical plants because of sea level rise and increased storm surge height

**Manufacture sector:** reduced productivity of workers because of heatwaves and warming working conditions

**Oil and gas industry:** Disruption in port operations and access of tanker boats because of coastal flooding

**Food industry:** Rise in corn price volatility because of more severe hot conditions
The Top 12 most and least vulnerable sectors

- Utilities are very vulnerable. Non-material services are less vulnerable.

### Top 12 highly vulnerable sectors
1. Integrated conven. elec. services
2. Integrated ren. energy services
3. Durable household products with electronics
4. Special Mining and materials
5. Production of conven. elec.
6. Production of food products
7. Integrated services for diverse utilities
8. Pharmaceutical
10. Household products with specific natural raw materials
11. Integrated fossil energy services
12. Airport owner/manager

### Top 12 least vulnerable sectors
49. Marine transportation services
50. Road network owner/manager
51. Road transportation services
52. Insurance and Reinsurance
53. Public equipment owner/manager
54. Buildings construction
55. Heavy construction
56. Non-material services
57. Retail of household products
58. Holding & Development
59. Tertiary services in tourism
60. Tertiary services in Telecom
Establishing physical risk scoring that could be applied at portfolio and constituents levels

**Portfolio XXX**

<table>
<thead>
<tr>
<th>Risk rating</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>2050/medium scenario</td>
<td></td>
</tr>
</tbody>
</table>

**Top climate hazards:**
- Sea level rise: 43
- Storms: 42
- Rainfall extremes: 39

Breakdown of risk rating by climate hazard, using a medium-emission scenario for 2050

**Portfolio XXX**

<table>
<thead>
<tr>
<th>Risk rating</th>
<th>35</th>
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</thead>
<tbody>
<tr>
<td>2050/medium scenario</td>
<td></td>
</tr>
</tbody>
</table>

**Securities most at risk and their ratings**

| Securities at risk and their ratings |
|---|---|
| Alpha 1 - 51 |
| Alpha 2 - 49 |
| Alpha 3 - 46 |
| Alpha 4 - 44 |
| Alpha 5 - 43 |

Methodology:
The risk rating is a combination of location-specific climate hazards and industry-specific vulnerabilities, weighing the sectoral and geographical sensitivities of a company’s activities based on the following factors:
- Sectoral sensitivity
- Geographical sensitivities

Risk rating is calculated using a multi-hazard risk rating, which includes both location- and sector-specific factors. The multi-hazard risk rating is then adjusted to reflect the overall risk profile of the investment.
Case study n° 1: strong disparity within sectors and universe

- For corporates, Carbone 4 has analysed **1 765 companies** - covering most of the MSCI World’s constituents. Eventually, 10 000 entities will be analysed.

- Results show a **strong inter-sector and intra-sector disparity in risk levels**, allowing for an active management of the risks (stock-picking, benchmarking, etc.).
Case study n° 2: a close game!

<table>
<thead>
<tr>
<th></th>
<th>All hazards in 2100 with high emission scenario</th>
<th>Heatwaves only</th>
<th>Sea Level rise only (includes coastal erosion, submersion etc.)</th>
<th>Heavy rainfall only (Includes floods, landslides etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>38</td>
<td>59</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>Belgium</td>
<td>40</td>
<td>57</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>UK</td>
<td>28</td>
<td>49</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Croatia</td>
<td>39</td>
<td>57</td>
<td>29</td>
<td>39</td>
</tr>
</tbody>
</table>
Main applications of CRIS physical risks indicators

**Extending climate reporting to adaptation and physical risks**

CRIS
- Provides access to a concise risk rating at the portfolio level
- Facilitates a comparison of ratings according to the climate change scenario and time horizon
- Enables the identification of which hazard is causing the most risk for your portfolio.

A global evaluation of the physical risks makes it possible to integrate the analysis into the company’s reporting in accordance with TCFD recommendations and existing regulations (e.g. Article 173).

**Risk management and dialogue engagement with the underlying assets**

In-depth evaluations, such as:
- The top 5 values most and least at-risk
- Risk ratings by underlying asset and comparisons with the sector,
- The identification of the geography and sector most at risk for the asset under review.

Allows enables investors to better manage climate risk and engage in a dialogue with the underlying companies.
Combining Transition and physical risks analysis for reporting and managing climate risks
Mapping the climate performance of a Portfolio for a reporting purpose

- **Portfolio A**: 1°C
- **Portfolio B**: 2°C
- **Portfolio C**: 3°C
- **Portfolio D**: 4°C

**Physical risk score 0-100**

Transition Risk intensity °C
Mapping the climate performance of a portfolio: the portfolio management perspective

Transition Risk intensity °C

Current state
Improved allocation
Forced 2°C scenario

Portfolio B
Portfolio A
Index N

Physical risk score 0-100

Forced 2°C scenario

4°C
3°C
2°C
1°C

20 40 60 80
Investing in the low carbon economy

- PRI guide to investing in the low carbon economy
- PRI briefing on collaboration between the upcoming Global Climate Action Summit and PRI in Person

- Sagarika Chatterjee, Associate Director, Head of Climate Policy, PRI
PRI Guide: How to invest in the low-carbon economy

Highlights investment strategies to align investment portfolios with a lower carbon, more climate-resilient economy

Practical guidance and investor examples on:

- Low carbon, climate-aligned investment opportunities including listed and unlisted
- Integration of climate-related risks and opportunities into investment decisions
- Phasing out investments in thermal coal

ASSET OWNER ACTIONS
- Add to investment committee agenda to identify and research opportunities.
- Ask consultants to identify and research opportunities.
- Ask fund managers what opportunities are available.
- Encourage fund manager integration efforts.

INVESTMENT MANAGER ACTIONS
- Consider developing new funds and products.
- Bolster integration into core processes.
- Engage with clients and potential investors on demand and needs.
- Build internal expertise.
- Bolster reporting metrics.
PRI collaboration with the Global Climate Action Summit

An opportunity to highlight and accelerate global investor action on climate change

Common objective of the Global Climate Action Summit and PRI

- Challenge investors to accelerate action to meet the Paris Agreement goals
- Inspire governments to implement The Paris Agreement
PRI collaboration with the Global Climate Action Summit

PRI and the Global Climate Action Summit are co-ordinated for maximum impact

Investors action on climate change will feature at the Global Climate Action Summit and PRI in Person

- “Transformative investments” is a key theme at the Global Climate Action Summit
- Climate change is a key topic at PRI in Person

How can you get involved?

- Participate in The Investor Agenda
- The Friday Finance Roundup, Friday September 14th, San Francisco Marriott Marquis
- [https://www.eventbrite.com/e/friday-finance-roundup-registration-46893057397](https://www.eventbrite.com/e/friday-finance-roundup-registration-46893057397)
Global investor platform showcasing investor climate action

- PRI encourages investor participation by 10th August ahead of the Global Climate Action Summit, PRI in Person, the One Planet Summit in New York and COP in Poland

Showcases investor action in:
- Investment: low carbon, integration and coal
- Corporate engagement: ClimateAction100+
- Investor disclosure: TCFD
- Policy advocacy: 2018 Global Investor Statement

To participate: www.theinvestoragenda.org
Investir dans l’économie bas carbone

- **Candice Brenet**, Managing Director, Ardian
- **Philippe Brossard**, Directeur Recherche, Développement et ISR, AG2R LA MONDIALE
- **Luisa Florez**, Head of SRI Research, La Banque Postale AM
- **Frederic Samama**, Co-Head of Institutional Clients Coverage, Amundi
- **Modérateur : Marie Luchet**, Responsable France & Programme Francophone, PRI
Conclusions

Philippe Desfossés, CEO, ERAFP
Marie Luchet, Responsable France & Programme Francophone, PRI