

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 696004. The views expressed in this report are the sole responsibility of the authors and do not necessarily reflect those of the sponsor, the ET Risk consortium members, nor those of the review committee members. The authors are solely responsible for any errors.

# If you only have one minute

## Key conclusions

### **Climate and energy transition risks need to be included in company analysis and valuation, as:**

1. A large share of traditional indices are exposed to energy- and climate-related risks that are not all accounted for by the market, as traditional company- and portfolio-level assessments may fail to grasp them.
2. The assessment feeds into an increasing number of disclosure recommendations and requirements, e.g. the FSB Task Force on Climate-related Financial Disclosures and Article 173 of the French energy transition law.

### **Climate-related risks tend not to be fully captured and priced in by current financial models, analyses, or recommendations.**

Based on the research reports of 150 analysts, we conclude that:

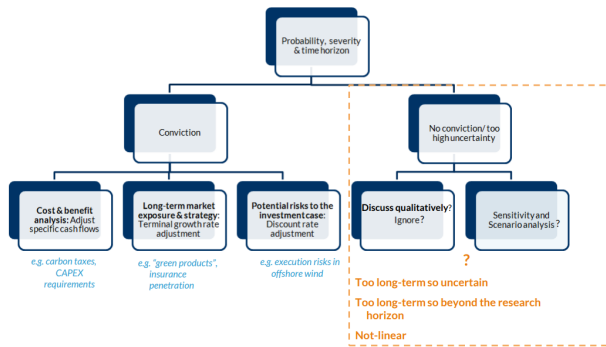
1. Transition-related themes, including policy, legal, technology, market, and reputational issues linked to climate change, are discussed unevenly across sectors and are often seen more as a market opportunity than as a risk.
2. Risks and opportunities beyond a 2-5 year horizon are often not quantified, even though they could be financially material.
3. When performed by financial analysts, scenario analysis tends to incorporate only selected parameters, such as carbon prices, and ignores systemic effects.

As part of the Energy Risk Transition project, we build on The CO-Firm's scenario assessment models and a growing body of research that explores scenario analysis as a tool to assess countries', sectors' and companies' exposure to climate transition risk. **In particular, we suggest ideas (and provide tools) as to how scenario analysis could be performed and integrated into company valuations and responsible investment strategies.**

This is the first in a series of five reports focused on the methodological and conceptual underpinnings of scenario analysis. Subsequent reports will apply these insights to selected companies and sectors, starting with the utilities sector (see *Transition risks for electric utilities*).

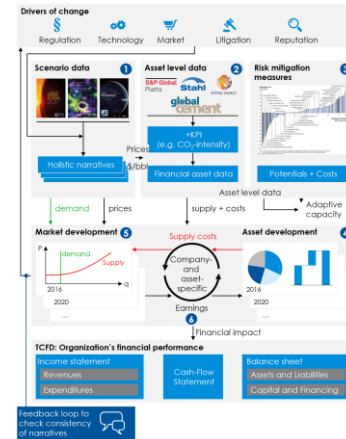
# Scenario analysis in six charts

Chart 1: Scenario analysis as a tool to deal with uncertainty



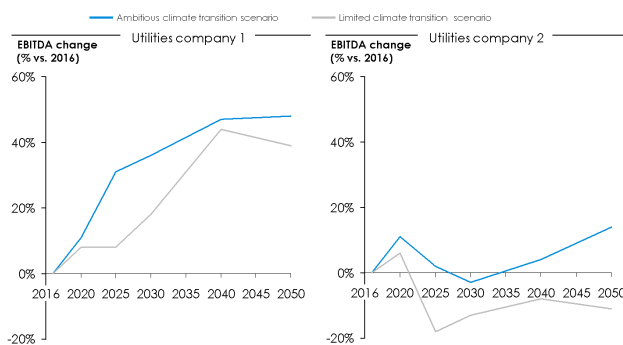
Source: Kepler Cheuvreux

Chart 2: Six steps involved in bottom-up modelling of climate risks



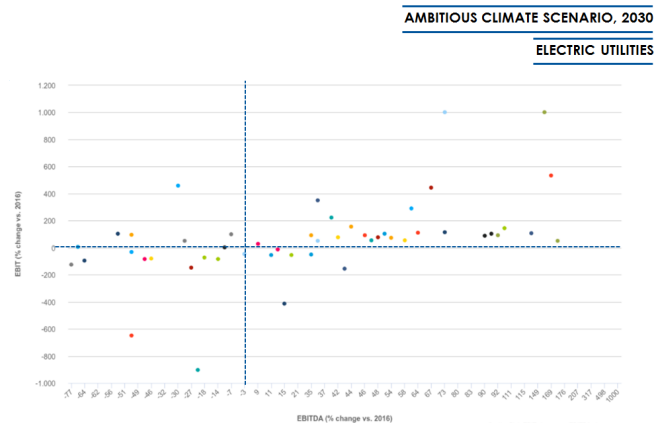
Source: CO-Firm

Chart 3: Assessing financial risks based on scenarios



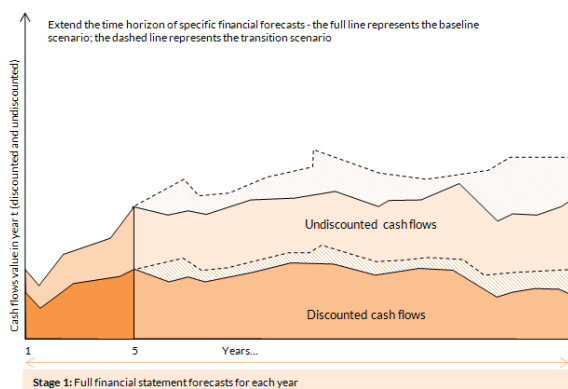
Source: The CO-Firm

Chart 4: Scenario analysis and stock picking: benchmarking



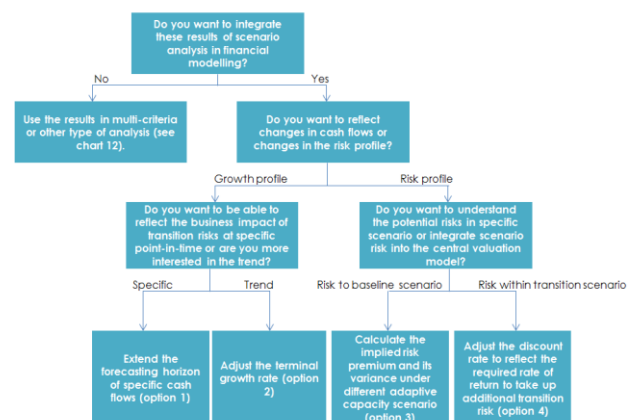
Source: The CO-Firm

Chart 5: DCF models are better adapted than multiple-based models



Source: Kepler Cheuvreux

Chart 6: How to integrate scenario analysis into company valuations?



Source: Kepler Cheuvreux

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# The Energy Transition Risk Project

The ET Risk Consortium, which is funded by the European Commission, aims to develop key analytical building blocks for Energy Transition risk assessment and bring them to the market.

1. **Transition scenarios:** The consortium will develop and publicly release two transition risk scenarios, the first representing a limited transition that extends current and planned policies and technological trends (e.g. IEA ETP RTS trajectory), and a second that represents an ambitious scenario that expands on the data from the International Energy Agency's Energy Technology Perspectives 2°C scenario (IEA ETP 2DS).
2. **Company & asset data:** Oxford Smith School and the 2° Investing Initiative will jointly consolidate and analyse asset-level information across six energy-relevant sectors (power, automotive, steel, cement, aircraft, and shipping), including an assessment of committed emissions and the ability to potentially "unlock" such emissions (e.g. reducing load factors).
3. **Valuation and risk models:**
  - a. The climateXcellence model: The CO-Firm's scenario risk model covers physical assets and products and determines asset-, company-, country-, and sector-level climate transition risks and opportunities under a variety of climate scenarios. Effects on margins, EBITDA, and capital expenditure are illustrated under different adaptive capacity assumptions.
  - b. Valuation models – Kepler Cheuvreux (KECH): The above impact on climate- and energy-related changes to company margins, cashflows, and capex can be used to feed financial analysts' discounted cash flow and other valuation models. KECHE will pilot this application as part of its equity research.
  - c. Credit risk rating models – S&P Global: The results of the project will be used by S&P Global to determine whether there is a material impact on a company's creditworthiness.
  - d. Assumptions on required sector-level technology portfolio changes are aligned with the Sustainable Energy Investment (SEI) Metrics ([link](#)), which developed a technology exposure-based climate performance framework and related investment products that measure the financial portfolio alignment



## Acknowledgements

For sharing their insights, and providing feedback in the writing of this report, we wish to thank the following IIGCC members ([link](#)):

- Vicki Bakhshi, Director, Governance and Sustainable Investment Team, BMO Global Asset Management (EMEA).
- Nathalie van Toren, Senior Advisor Sustainability, NN Group N.V.
- Johan Vanderlugt, Senior ESG Specialist, Responsible Investments, NN Investment Partners.

## Objectives and readers' guide

This report aims to build on scenario assessment pilots and a growing body of research that explores scenario analysis as a tool to assess assets', countries', sectors' and companies' exposure to potentially mispriced climate-related risks. We define scenario analysis as a way to "evaluate a range of hypothetical outcomes by considering a variety of alternative plausible future states under a given set of assumptions and constraints" ([link](#)).

The first in a series of five reports, this report focuses on the **methodological and conceptual** underpinnings of scenario analysis.

**We suggest ideas (and provide tools) as to how scenario analysis can be performed and integrated into company valuations and responsible investment strategies to measure and overcome the potential mispricing of climate-related risks.**

Upcoming reports will explore the **applicability** of these ideas and tools to various sectors.

Our main audience consists of ESG and financial analysts who wish to gain a better understanding of the more **technical aspects** of scenario analysis. This report is meant to contribute to an ongoing conversation about these themes.

We build heavily on a report published by 2° Investing Initiative, entitled *Transition Risk Toolbox – Scenarios, data and models* ([link](#)) and the Task Force on Climate-related financial Disclosures' supplement on scenario analysis ([link](#)). In this report, we also highlight additional reading.

**Table 1: What can you find in this report?**

Chapter	Description
<b>Chapter 1:</b> Why assess transition risks?	Significance of transition risks and evolution of investors' disclosure requirements/recommendations.
<b>Chapter 2:</b> How is it different from what we already do as a part of traditional financial analysis?	Climate and energy transition themes are only discussed and partially integrated into financial valuations, due to a lack of visibility on these risks and opportunities, their uncertain nature, probability and magnitude, as well as the inadequacy of traditional valuation models and tools.
<b>Chapter 3:</b> Is scenario analysis the new holy grail?	Scenario analysis can be a useful tool to investigate the potential business and financial impact of uncertain and longer-term risks and opportunities. It can be applied at multiple levels and in many types of analysis.
<b>Chapter 4:</b> How to assess the business impact of different transition scenarios?	Drawing on its climateXcellence model, The CO-Firm details the six steps that are required to analyse the impact of different transition scenarios on companies' financials (revenue, cost, capex), with a specific focus on their capacity to adapt.
<b>Chapter 5:</b> How to assess the valuation impact of different transition scenarios?	Drawing on their analysts' insights as well as previous literature and research, Kepler Cheuvreux investigates the different options that analysts have if they wish to integrate the results of scenario analysis in their valuation models, with a specific emphasis on discounted cash flows (DCF).
<b>Chapter 6:</b> Outlook	This section points out specific areas for future research.

Source: The CO-Firm & Kepler Cheuvreux



## Mini glossary of key terms

- **Adaptive capacity:** The capacity to respond to climate change-related risks and opportunities.
- **Climate-Related Risks and Opportunities:** The potential negative or positive impacts of climate change on an organisation.
- **Forecasting:** Forecasting is based on past and present data and analysis of trends. Often it takes the form of predicting a single, most probable trend for and into the future.
- **Physical risks (subset of climate-related risks):** Physical risks emanating from climate change can be event-driven (acute) such as increased severity of extreme weather events (e.g. cyclones, droughts, floods, and fires). They can also relate to longer-term shifts (chronic) in precipitation and temperature and increased variability in weather patterns (e.g. rising sea levels).
- **Scenario analysis:** The method used to assess the impact of plausible future states and pathways in the event of highly uncertain/long-term impacts. Scenario analysis differs from techniques such as sensitivity analysis, forecasting, value at risk (VaR), or stress-testing, as developed by financial regulatory authorities, which assesses financial stability based on adverse market scenarios or extreme shocks.

A critical aspect of scenario analysis is the selection of a set of scenarios (not just one, as sensitivity analysis with e.g. carbon prices) that covers a reasonable variety of future outcomes, both favourable and unfavourable. In this regard, the task force recommends organisations use a 2°C or lower scenario in addition to two or three other scenarios most relevant to their circumstances, such as scenarios related to Nationally Determined Contributions (NDCs), physical climate-related scenarios, or other challenging scenarios.

In jurisdictions where NDCs are a commonly accepted guide for an energy and/or emissions pathway, NDCs may constitute particularly useful scenarios to include in an organisation's suite of scenarios for conducting climate-related scenario analysis.

- **Sensitivity analysis:** the process of recalculating outcomes under alternative assumptions to determine the impact of a particular variable.
- **Transition risks (subset of climate-related risks):** Transitioning to a lower-carbon economy may entail extensive changes to address mitigation and adaptation requirements related to climate change, of which most common relate to policy and legal actions, technology changes, market responses, and reputational considerations.
- **Value at risk:** This measures the loss a portfolio may experience, within a given timeframe, at a particular probability level.  
**Source:** TCFD.

*Scenario analysis differs from techniques such as sensitivity analysis, forecasting, value at risk (VaR), or stress-testing*

## Why assess “transition” risks?

Restricting global warming to 2°C above pre-industrial levels will require a change in the fundamental structure of the economy, including energy, production, building, transportation and agricultural systems. These transformations create potential risks for companies and therefore investors that do not plan and adapt adequately.

Broadly speaking, one can distinguish between transition and physical risks. The former relate to the risks (and opportunities) from the realignment of our economic system towards low-carbon or carbon-positive solutions (e.g. via regulations or market forces), while the latter relate to the physical impacts of climate change (e.g. changing precipitation patterns)

As part of this report, we focus on transition risks within the context of an increasing focus on these topics, triggered by high-profile speeches and analysis, such as the *Tragedy of the horizon* speech made by the Governor of the Bank of England, Mark Carney, in 2015.

### Because transformation is on the horizon

In this report, we mainly focus on climate transition risks. In its recommendations, the FSB TCFD lays out a taxonomy of climate-related risks that distinguishes between transition and physical risks.

**Table 2: Transition versus physical risks – selected examples**

	Type	Climate-related risks	Potential financial impacts
Transition risks	Policy and legal	Increased pricing of GHG emissions; enhanced emissions-reporting obligations; exposure to litigation	Increased operating costs/reduced demand for products and services results from higher compliance costs/fines and judgement
	Technology	Substitution of existing products and services for lower emissions options; unsuccessful investments in new technology; costs to transition to lower-emissions technology	Write-offs and early retirements of existing assets; capital investment in technology development
	Market	Changing customer behaviour; increased cost of raw materials	Reduced demand for goods and services; increased production costs due to changing input prices (e.g. energy and water)
	Reputation	Stigmatisation of sector; increased stakeholder concern or negative stakeholder feedback	Reduced revenue from decreased demand for goods and services; decreased production capacity (e.g. delayed planning approvals)
Physical risks	Acute	Increased severity of extreme weather events like cyclones and floods	Reduced revenues from decreased production capacity (e.g. transport difficulties, supply chain interruptions); damage to property
	Chronic	Changes in precipitation patterns and extreme variability in weather patterns; rising mean temperatures; rising sea levels	Increased capital costs (damage to facilities); reduced revenues from lower sales/output

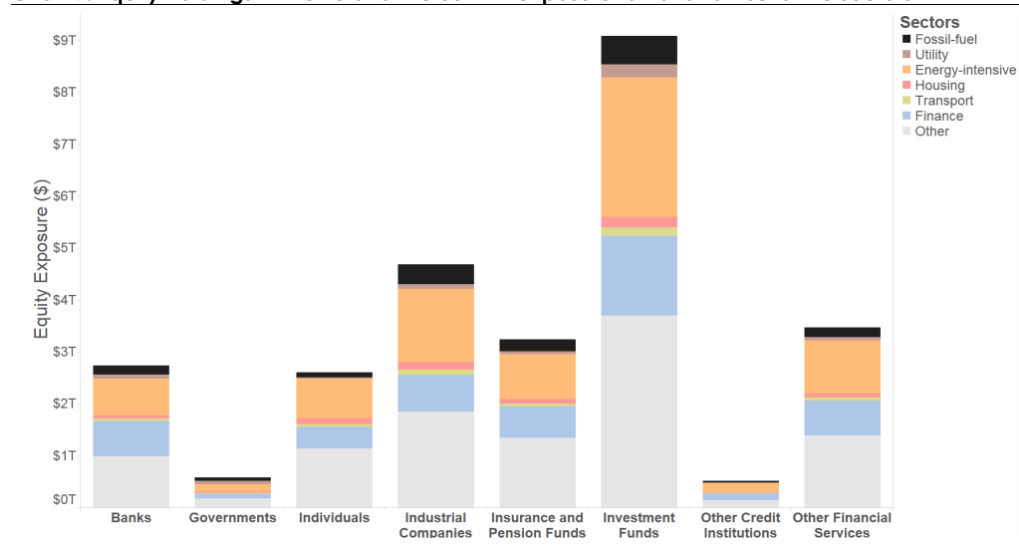
Source: TCFD ([link](#)). For alternative categorisation of risks, please refer to the “Transition Risk-O-Meter; Reference Scenarios for Financial Analysis” ([link](#))



## Because the financial sector could be very exposed

Research has shown that while all financial investor types' equity portfolio exposure to the fossil sector is limited (4-13%), the *combined exposure* to sectors that could be affected by the climate and energy transition through trends like the shift to renewables or electric vehicles is large (45-47% across types).

**Chart 7: Equity holdings in the EU and the US with exposure to transition-sensitive sectors**



Source: Battiston et al, 2017

Exposure to a 100% first-round (direct) shock in the fossil fuel and utilities sectors would *only* lead to a 4% equity loss for the top EU banks, and 10% when taking into account second-round losses through the interbank lending network ([link](#)).

The scenario analysis conducted by the Bank of England found that if energy stocks' dividends began to fall by 5% a year (from 2020), the affected firms' equities would lose c. 40%, equivalent to a fall of c. 11% in global equity market capitalisation ([link](#)).

These figures ignore the large exposure to non-energy sectors that could potentially be significantly affected by the transition and to which the financial sector holds significant exposure (e.g. buildings and transport).

Does exposure to sectors that could be affected by the transition necessarily imply a financial impact? It does if this risk is not properly priced in by financial markets.

Landmark speeches by the Governor of the Bank of England and Chairman of the Financial Stability Board (FSB), Marc Carney, stressed the significance of this threat for capital markets: *"The speed at which such re-pricing occurs is uncertain and could be decisive for financial stability. There have already been a few high profile examples of jump-to-distress pricing because of shifts in environmental policy or performance."*

## Long-term transition risks may materialise sooner than expected

In a series of reports, Kepler Cheuvreux's Head of Utilities, Ingo Becker, took a closer look at the technological revolution underway in the utilities sector and the pressure on older assets in a broader context. The decline in European utilities' (e.g. EDF, RWE, or EON) share prices, along with the business challenges deriving from both policy and technological setbacks, suggest that long-term transition risks could end up materialising sooner than expected. Ingo predicts transition risks will eat into conventional business in three phases: 1) conventional generation, which largely happened in the first half of the decade (that he anticipated in January 2009 in his Welcome to the Jungle note); 2) retail, where the next crash could happen (The story of light, March 2016), indeed, it started last year and is set to continue; and 3) networks, which is too early to model but that Ingo has been repeatedly flagging for two years.

"Transition" risk analysis places the emphasis on both future policy and technological scenarios that could occur sooner than predicted by both market and many companies.

## Because of increasing disclosure recommendations

In this context, new international and national mandatory and voluntary disclosure schemes on transition risks have emerged. While we do not provide an exhaustive list, we highlight some recent developments:

- Article 173 of the French Energy Transition Law requires that certain institutional investors disclose elements on transition and physical risks, on a comply-or-explain basis ([link](#)). Talks are underway in other jurisdictions about implementing similar requirements (e.g. Sweden) ([link](#)).
- The Swiss and German governments have both investigated the potential stability risks arising from the transition to a low-carbon economy. A survey undertaken by the Swiss government authorities earlier this year found that local pension funds and insurers were largely misaligned with the 2°C objective.
- The Task Force on Climate-related Financial Disclosure (TCFD), formed after Mark Carney's speech at Lloyd's of London in 2015, released the final version of its climate-related disclosure recommendations in four key areas in June 2017.

*The decline in European utilities' (e.g. EDF, RWE, or EON) share prices, along with the business challenges deriving from both policy and technology setbacks, suggest that long-term issues may come sooner than many in the market predicted (see our Head of Utilities, Ingo Becker' series of reports that anticipated the challenges of their conventional business)*

**Chart 8: TCFD disclosure recommendations**

Governance	Strategy	Risk Management	Metrics and Targets
Disclose the organization's governance around climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.
Recommended Disclosures	Recommended Disclosures	Recommended Disclosures	Recommended Disclosures
a) Describe the board's oversight of climate-related risks and opportunities.	a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	a) Describe the organization's processes for identifying and assessing climate-related risks.	a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
b) Describe management's role in assessing and managing climate-related risks and opportunities.	b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning.	b) Describe the organization's processes for managing climate-related risks.	b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.
	c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Source: TCFD, 2017

- The European Commission's High-Level Expert Group on Sustainable Finance (HLEG) set up in December 2016 considers a whole range of potential tightening policy actions in areas such as taxonomies for sustainable assets or climate change-related disclosures in line with the TCFD framework (e.g. for credit rating agencies, insurance companies in relation to prudential regulation, and more broadly for EU listed companies in relation to a classification of "green" assets; [link to the interim report](#)).
- In terms of soft law, the proposed ISO 14097 standard ("Framework and principles for assessing and reporting investments and financing activities related to climate change") explores several options and metrics associated with the assessment of investors' contribution to climate goals and exposure to climate-related risks ([link](#)).

**In summary, restricting global warming to 2°C above pre-industrial levels will require a change in the fundamental structure of the economy that could create potential risks for companies, and therefore investors, that do not plan and adapt adequately.**

**Broadly speaking, one can distinguish between transition and physical risks. Here, we focus on to the risks (and opportunities) triggered by a realignment of our economic system towards low-carbon or carbon-positive solutions (e.g. through regulation or market forces).**

**Our short review shows that the financial sector exposure and mispricing potential of transition risks could be significant. The challenge is thus to**

facilitate the orderly repricing of carbon-intensive assets by increasing transparency to avoid brutal shifts and losses in value across several sectors simultaneously.

In that context, we observe that the discussion has shifted progressively from simple qualitative review and carbon foot-printing towards value-at-risk and scenario analysis, especially within the context of the TCFD's recommendations.

## Is it different from fundamental analysis?

Certain specific transition risks and opportunities are discussed in equity analysts' reports, alongside other types of risks and opportunities, such as currencies and political issues, meaning that analysts do "consider" and price at least some of them.

However, we find that the results of these analyses are only partly integrated into valuation models, due to their long-term, uncertain and "breakthrough" nature as well as a lack of visibility and tools to assess them. Yet, these risks could have tangible impacts today, for example through current R&D spending and capital expenditures (capex).

Thus, scenario analysis may prove to be a useful tool to complement traditional financial accounting, valuation and investment recommendations.

This section builds on published research:

- *The responsible investor playbook*, Kepler Cheuvreux (Julie Raynaud, November 2016, [link](#)).
- *All swans are black in the dark*, 2° Investing Initiative and Generation Foundation (February 2017, [link](#)).
- *Climate change analysis: first aid kit*, Kepler Cheuvreux, (Julie Raynaud, March 2017, [link](#)).

### Integration into equity analysis: state of play

**Do financial analysts integrate these themes into their analysis?** The underlying assumption of the literature and disclosure recommendations on transition risks is that they are mispriced by financial markets. One of the reasons often highlighted is that financial analysts fail to integrate them into their valuation models and investment recommendations.

#### Certain transition risks and opportunities are discussed...

While each financial analyst is unique, we wanted to test this hypothesis on a sample of research. To do so, we scanned Kepler Cheuvreux analysts' research reports (360s, Q&As, and Espressos) from August 2016 to February 2017 to identify any comments or analyses of climate-related topics (energy, climate and greenhouse gas and air pollution).

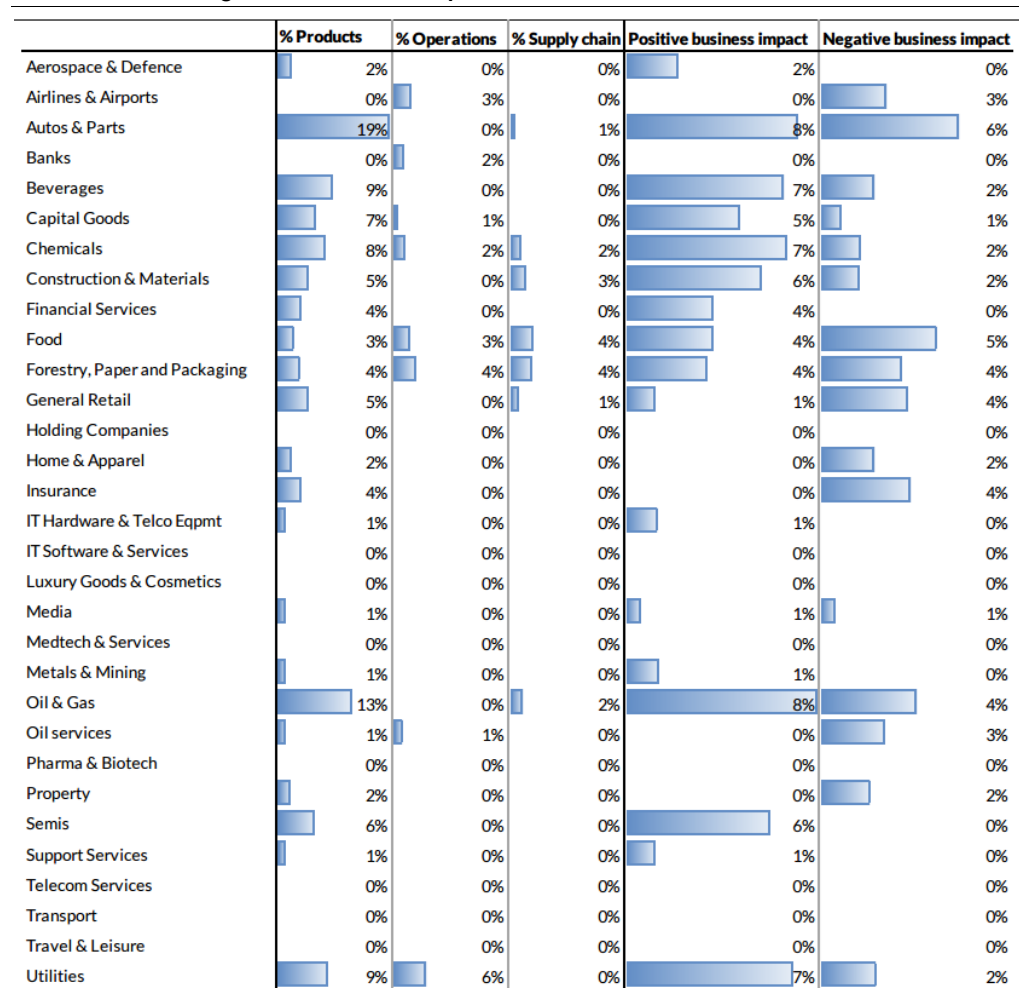
We collected around 150 pieces of analysis across 31 sectors and 100 companies. Key insights include:

- Apart from the food, insurance, oil services and property sectors, these topics are discussed across the board, more often from a positive (opportunistic) rather than negative (risk-oriented) perspective. This is also a key finding of the report by Kepler Cheuvreux analyst, Samuel Mary, *Scouting 2° opportunities* ([link](#)).

*To what extent do financial analysts embed these transitions into their valuation models?*

- These topics are most often discussed within the autos & parts, oil & gas and utilities sectors, followed by the beverage, chemicals, and cap goods sectors.
- Most often, climate change is discussed in relation to the offering of products and services (corresponding to Scope 3 products in use).
- These themes are most often discussed from a short-term perspective. Longer-term risks and opportunities (e.g. over five years) are not discussed as often, let alone integrated into valuation models.
- Very few research reports focus primarily on these themes.

**Chart 9: Percentage of Kepler Cheuvreux publications that mention climate change-related themes between August 2016 and February 2017**



Source: Kepler Cheuvreux

### ...but discussion does not necessarily mean integration

Discussion does not mean integration. When transition risks and opportunities are discussed, this does not necessarily mean they are integrated into valuation models and/or investment recommendations.



We distinguish between different cases here and investigate why this might be the case in the next section on page 17.

- **Case 1:** These risks and opportunities are *not* integrated *quantitatively* into valuation models and investment cases, and only discussed *qualitatively*.
- **Case 2:** These risks and opportunities are (mostly partially) integrated quantitatively into valuation models and investment cases.

Whether specific risks and opportunities are integrated into models depends on the “ripeness” and timing of potential impacts as well as the analysts’ sensitivity to the theme.

We see that market opportunities and threats are most often integrated into models of specific cash flow growth and in some cases through adjustments to the terminal growth rate. Additional costs or capex requirements to grasp these opportunities are seldom modelled.

Risks are mostly integrated through the discount rate. When analysts adjust this variable, it is often to reflect the *overall risk* of the company (because of supply chain structure and pricing power, for instance), rather than transition-specific risks. This means that transition risks are only taken into account partially, at best.

## What are the key obstacles to integration?

According to research from 2° Investing Initiative and Generation Investment, obstacles to further integration of transition risks and opportunities in financial modelling can be mapped alongside two main axes: demand/supply and tools/frameworks availability (see Chart 10).

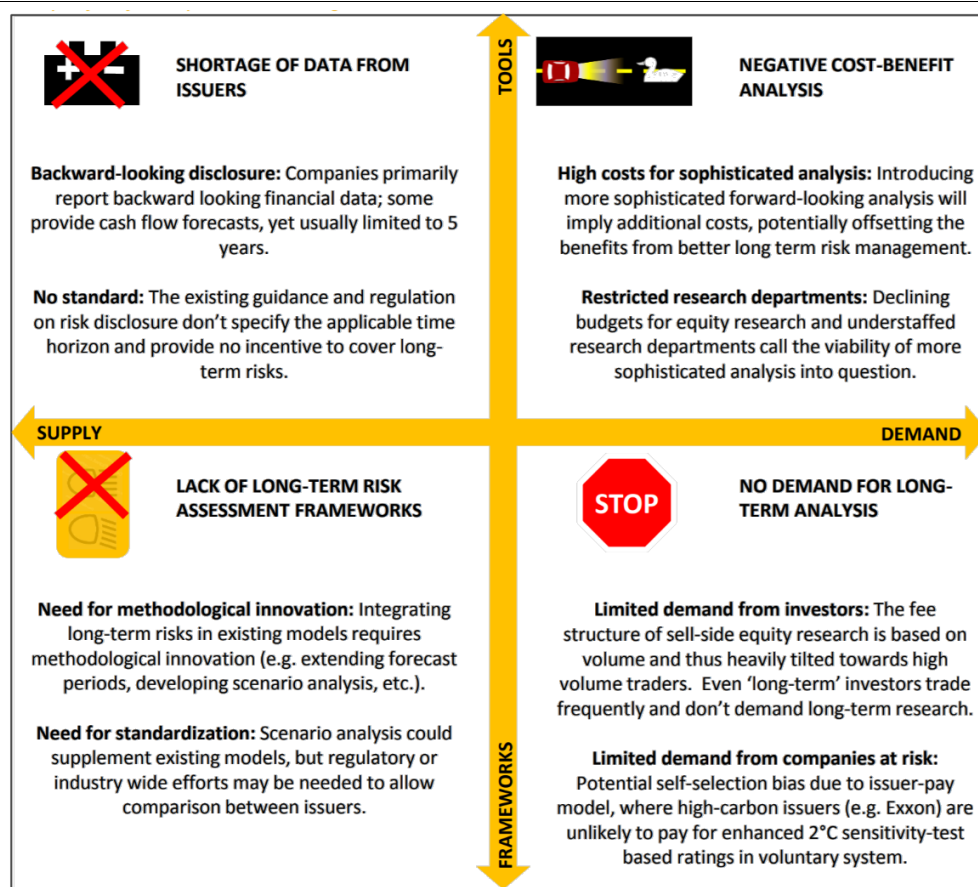
Target prices are not designed to represent the longer term but rather the next 12-18 months – hence the focus on the 3-5 year horizon by financial analysts. In our view, this is the single most important reason for the lack of integration of these risks in valuation models and recommendations.

Importantly, as underlined earlier, certain risks and opportunities that will materialise after 3-5 years might be relevant in the short term, however, for instance through increased capex and expenditures. One other example besides the utilities sector mentioned previously is the auto industry, where the forecast shift to e-mobility in 2020-30 has short-term capex and R&D implications impacting today’s share price.

Therefore, if an analyst wanted to investigate the longer-term impact of the energy transition on their valuation, either to understand the short-term implications, if any, or derive a target price that goes beyond the 12-18 month horizon, what would be the key obstacles?

*Certain risks and opportunities that will materialise after 3-5 years might be relevant in the short term*

Chart 10: Why do financial markets only partly consider transition risk?



Source: 2° Investing Initiative and Generation Investment, 2017 ([link](#))

## A lack of tools?

In addition, we believe that traditional valuation tools such as discounted cash flow models are ill-suited for this type of analysis:

- Mid- and long-term risks and opportunities are perceived as uncertain and not significantly contributing to the overall valuation due to discounting. We find, however, that "longer-term" cash flows (beyond the 3-5 year horizon) contribute significantly to share value (see page 42).
- Cash flow impacts from non-linear risks, such as new regulation or a technological disruption, are hard to model due to uncertainty around their timing and magnitude.
- While a higher discount rate leads to a lower target price, we also note that the higher the discount rate, the more weight is given to short-term cash flows and hence short-term drivers rather than long-term trends.
- Large risks over a longer time period (tail risks) may be better modelled using a probabilistic approach, which is not often the case. This method consists of assessing the financial impact of different scenarios and assigning a probability to each outcome

in order to derive the final result. This is, however, very time-intensive.

### A lack of information?

Among the most important challenges, in our view, is a lack of visibility on certain key risks and opportunities that could radically change the landscape in which companies and investors operate in the mid- to long-run. This lack of visibility is related to low disclosure levels, long-term data and the very nature of potentially disruptive transition-related risks.

We argue that this creates uncertainty and a lack of conviction on how these themes may impact companies.

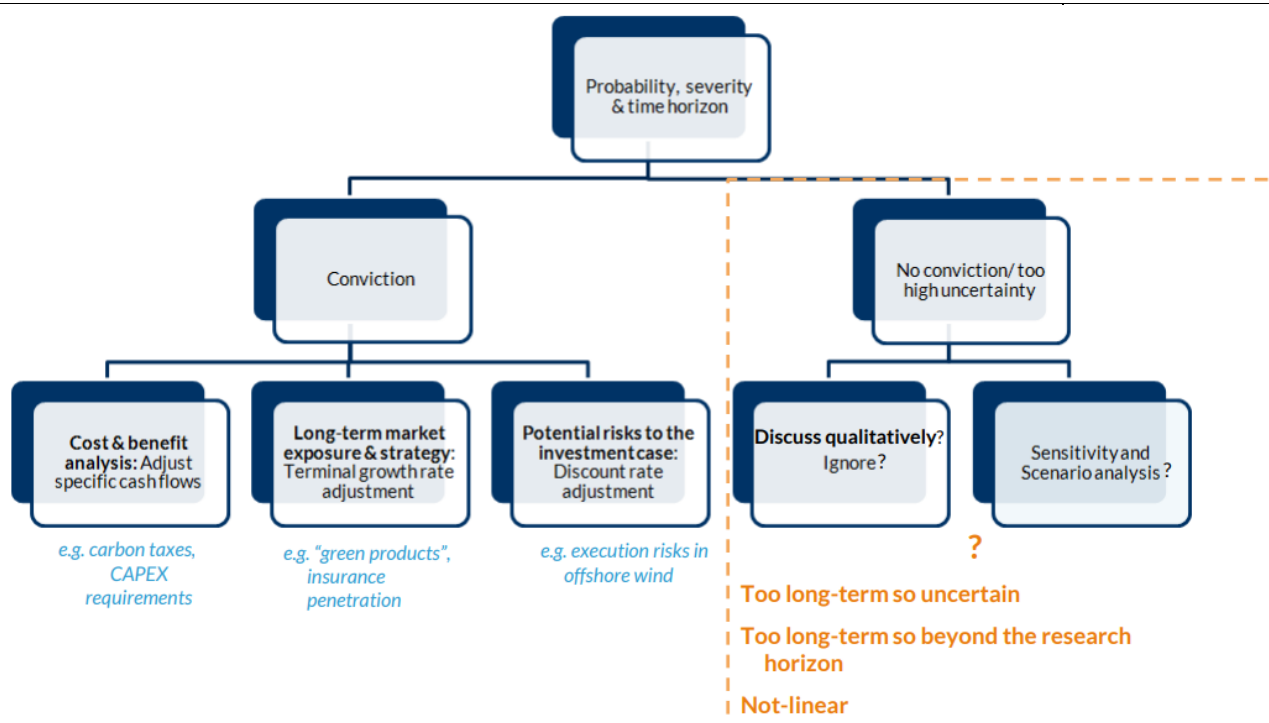
### How do financial analysts deal with uncertainty?

#### From qualitative assessments to scenario analysis...

Financial analysts have recourse to different techniques to deal with uncertainty in the context of the energy transition, from qualitative assessments to sensitivity and scenario analysis. Table 3 highlights a range of examples from our research showing how our analysts' deal with uncertainty, especially relating to transition risks.

*Financial analysts have recourse to different techniques to deal with uncertainty in the context of the energy transition, from qualitative assessments to sensitivity and scenario analysis*

Chart 11: Why do analysts only partially include transition risks in their valuation models and investment case?



Source: Kepler Cheuvreux

**Table 3: Non-exhaustive list of examples from Kepler Cheuvreux research**

Study	Description	Type
Chemicals history 101, 2017, Christian Faltz and Martin Roediger	Providing a subjective long-term view based on a simple scoring of which companies are best prepared for the future based on megatrends such as the growth in e-mobility, resource and energy consumption and population growth.	<b>Qualitative scoring</b>
Money for absolutely nothing at all: will the EU ETS survive, 2016, Ingo Becker	Disaggregating the carbon layer in the DCF and understanding its contribution to the valuation.	<b>Sensitivity analysis</b>
Beyond the Horizon, 2016, Jacques-Henri Gaulard	Calculating the net present value (NPV) of energy transition for banks; NPV impact too low to be significant under the assumptions and scope taken (Oil & Gas divestments and ROI differentials with renewable energy).	<b>Scenario analysis</b> on a limited set of variables

Source: Kepler Cheuvreux

**Case study on French banks:** For example, in January 2016 our head of banks Jacques-Henri Gaulard tested the potential impact of the energy transition on French banks' energy financing policy using the following scenario:

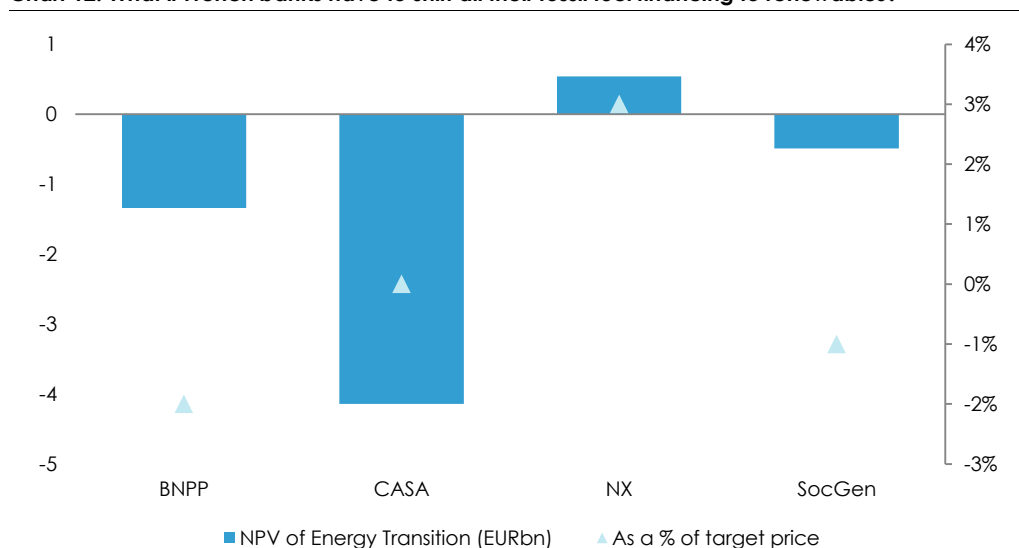
*What would it mean financially if French banks had to give up all their fossil fuel financing (including oil) over a 20-year period and substitute oil & gas financing with renewable energies?*

To do so, he looked at the various analyses of the banks' fossil fuel commitments and exposures by groups such as Rainforest Action Network, BankTrack and Profundo. He found that the negative net present value (NPV) impact of this scenario ranges between -EUR0.5bn for SocGen and -EUR4.1bn for CASA, but he expects the latter to become a global leader with a long-term ROE of 14% and profits in energy finance potentially reaching EUR2.5-3.0bn beyond the usual horizon.

Further analysis could involve testing the impact on each bank of various additional factors, including their exposure to other sectors that could be impacted by the energy transition but also the evolving cost of risk and margins for O&G, coal and renewables.

*Our head of banks Jacques-Henri Gaulard tested the potential impact of the energy transition on French banks' energy financing policy*

Chart 12: What if French banks have to shift all their fossil fuel financing to renewables?



Source: Kepler Cheuvreux

### ...with room for improvement in the context of transition risks

While analysts often *qualitatively* assess the risks to their investment conclusions and sometimes perform bull- and bear-scenario analyses, full-blown transition-related scenario analysis is seldom done over the mid- to long-term horizon and often focuses on a single criterion.

However, we find that in many cases climate transition risks are modelled on single factors, such as carbon prices or market penetration of electric vehicles.

While this partial perspective is useful, the results of the Paris climate negotiations have increased the probability of a full-system change including a drastic decrease in fossil fuel use, technological changes and a new regulatory environment. This possibility of a full-system change is seldom analysed by financial analysts.

*We find that in many cases climate transition risks are modelled on single factors, such as carbon prices or market penetration of electric vehicles*

### Engagement questions for your equity analyst and PM

- What type of valuation models do you use? Do you use discounted cash flows (DCF) models?
- In your DFC model, for how many years do you model specific cash flows before applying the second-stage growth/perpetuity formula?
- Over the period of time during which you model specific cash flows, do you estimate separately variables that could be impacted by the energy transition (e.g. are CO<sub>2</sub>-related costs separated from overall COGS modelling)?
- If you estimate variables separately, what method do you use? For what time horizon do you attempt to forecast specifically variables such as CO<sub>2</sub> prices or oil prices (i.e. before applying an average growth rate or leaving it flat)?

- Do you change the second-stage growth rate or discount rate based on transition-related specific risks or opportunities (e.g. higher terminal growth rate for business divisions positively impacted by the transition)?
- Do you test for the sensitivity of your investment case and valuation to different variables? If so, how do you choose the variables on which to base your sensitivity analysis? Have the results of sensitivity analysis ever led to a change in the central valuation case?
- Do you perform scenario analysis? If so, how many variables do you take into account? How do you determine the parameter value (e.g. level of CO<sub>2</sub> prices) within each model? Have the results of scenario analysis ever led to a change in the central valuation case?

**In summary, certain specific transition-related themes (such as changes in carbon taxes or the rise of renewables) are discussed in equity research, albeit unevenly, across sectors. This is most often done from a market-opportunity (e.g. green products and services) rather than a supply-chain, operational or market-risk perspective.**

**Discussion does not mean integration. Risks and opportunities beyond 2-5 years are most often not specifically quantified. Why is this?**

**Notwithstanding a lack of demand for this type of analysis, longer-term transition trends are not integrated because of their uncertain nature, probability and magnitude, leading to a lack of conviction and adequate tools and frameworks.**

**Scenario analysis may be a satisfactory intermediate solution to extend our view beyond the analytical “horizon” and complement short-term forecasts with insights that might then be integrated into valuation models and recommendations.**

**Forward-looking, full-blown scenario analysis on the positive and negative valuation effects of the energy transition is seldom done. Indeed, most scenario analysis performed in equity research tends to focus only on selected parameters, such as carbon prices. Accordingly, interactions between different risks may not be fully considered.**

**We therefore need tools and frameworks that allow us to go one step further.**



## Is scenario analysis the new holy grail?

Scenario analysis has been in the spotlight recently, particularly due to the TCFD's recommendations. We have already seen how sensitivity or scenario analyses on specific parameters or assumptions are already part of the toolbox that analysts use in the face of uncertainty. A full-blown scenario analysis could complement this further.

But let us take a step back. How can scenario analysis change the picture, if at all? Scenario analysis encompasses a wide range of techniques, and we believe it is essential to balance costs and resources against the expected results and use-cases when choosing how to use it.

This section builds on research published in:

- *The transition risk-o-meter: reference scenarios for financial analysis* (2° Investing Initiative, The CO-Firm, June 2017, [link](#)).
- *Developing an asset owner climate change strategy*, UN Principles for Sustainable Investment (January 2016, [link](#)).
- *Feeling the heat: An investors' guide to measuring business risk from carbon and energy regulation*, University of Cambridge Institute for Sustainability Leadership (CISL) (May 2016, [link](#)).
- *Environmental risk analysis by financial institutions: a review of global practice*, Cambridge Institute for Sustainability Leadership (CISL) (September 2016, [link](#)).
- *G20 green finance synthesis report*, G20 Green Finance Study Group (July 2017, [link](#)).
- *Climate change analysis: first aid kit*, Kepler Cheuvreux, (Julie Raynaud, March 2017, [link](#)).
- *Technical supplement: the use of scenario analysis in disclosure of climate-related risks and opportunities*, TCFD (June 2017, [link](#)).

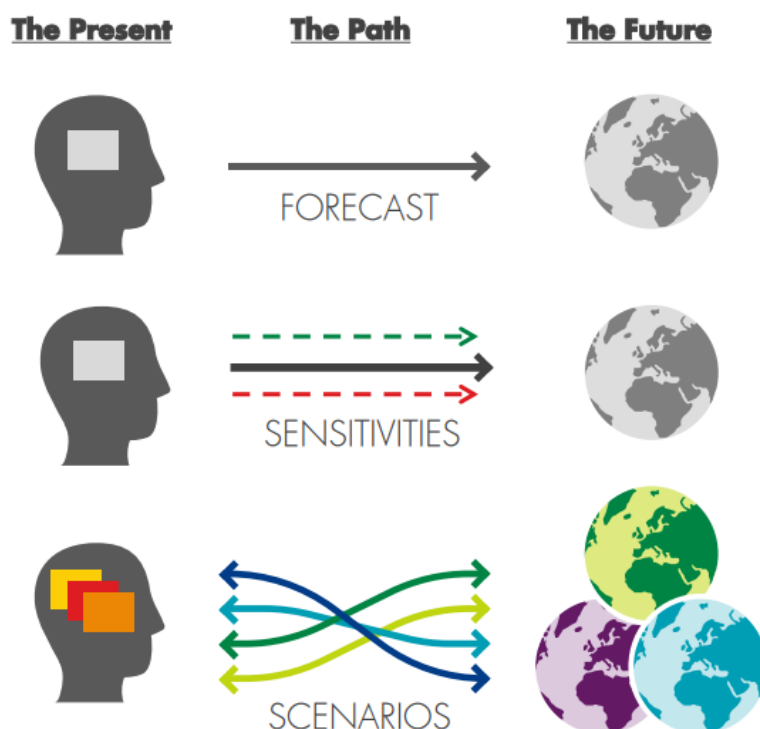
### What is a scenario? A coherent parallel world

Different types of scenarios exist. For the purpose of starting to assess transition-related risks, climate target-oriented scenarios tend to be the most insightful. These scenarios describe a plausible development path leading to a specific global warming target/carbon particle concentration, often building on least-cost assumptions.

The way a future pathway unfolds is often described by central indicators, i.e. embedded in economic and population growth assumptions and illustrated by sector- or country-specific CO<sub>2</sub>-emissions, technology pathways, or commodity price assumptions for specific points in time. The elements described need to be plausible, consistent, transparent about their assumptions and meaningful (note: for a detailed explanation of scenarios, please refer to the "[Transition-Risk-o-Meter](#)"; for a practical illustration and application of scenarios please refer to the upcoming utilities guide).

Climate scenarios describe a plausible development path leading to a specific global warming target/carbon particle concentration, often building on lowest-cost assumptions

Chart 13: What is a scenario?



Source: Shell

## Uses and abuses of scenario analysis

### A useful tool indeed...

According to the TCFD, scenario analysis "evaluates a range of hypothetical outcomes by considering a variety of alternative plausible future states under a given set of assumptions and constraints" ([link](#)).

The TCFD highlights the use of scenario analysis to "describe the resilience of the organizations" strategies as part of its recommended climate-related disclosures, under the "strategy" section. Companies should disclose the scenario used, methodology and timeframes, and information on the resiliency of the organisation.

Scenario analysis is useful when:

- Modelling a variety of effects (under one common scenario) that can be interrelated and interact positively or negatively with one another.
- Possible outcomes are highly uncertain, will play out over the medium to longer term, and the potential disruptive effects are substantial.
- Historical trends and datasets are not a good predictor of future trends (e.g. accelerating or disruptive change).
- The potential results are meaningful and allow for mitigation actions.

## Key nuances with other concepts

Thus, scenario analysis is not sensitivity analysis. While sensitivity analysis tests for the potential impact of one parameter (e.g. carbon prices), scenario analysis tests for the net effect of interactions between several parameters (e.g. carbon and electricity prices or energy consumption). We believe this allows us to develop a stronger understanding and story; however, it makes the interpretation of the results more complicated and requires thorough explanations.

Also, it is not stress-testing as developed by financial regulatory authorities, which assesses financial stability based on adverse market scenarios or extreme shocks. As underlined by the International Actuarial Association: "A scenario describes a consistent future state of the world over time, resulting from a plausible and possibly adverse set of events or sequences of events. A stress test provides an assessment of an extreme scenario, usually with a severe impact on the firm, reflecting the inter-relations between its significant risks." ([link](#)).

An example is the BOE's analysis of potential bank losses based on a range of economic variables such as GDP, unemployment, and the exchange rate. Another is the European Insurance and Occupational Pensions Authority's (EIOPA) analysis of the insurance sector, which looks at the impact of a sudden rise in risk premiums coupled with a sustained low-yield environment.

As it looks at both negative and positive impacts in a holistic manner and with a range of situations, scenario analysis also differs from Value At Risk (VaR), which assesses the "amount of potential loss, the probability of occurrence for the amount of loss and the time frame". In that sense, scenario analysis provides the basis for VaR analyses, i.e., the next step of assessing probabilities and integrating them into a holistic risk judgement call.

Further, it is not forecasting. As TCFD puts it in its Technical supplement ([link](#)), "forecasting is based on past and present data and analysis of trends. Often it takes the form of predicting a single, most probable trend for and into the future."

## Explored by several companies...

When companies have performed scenario analysis, analysts may want to make sure to understand better the key hypotheses, results and process. We provide below a non-exhaustive list of engagement questions:

- Do you perform scenario analysis?
- Are you able to provide transparency on the narrative, the parameters used and their value (e.g. what CO2 prices over different timeframes)?
- Which are your key risk drivers?
- Would you have adequate strategic responses to mitigate risks and capture opportunities?

*Scenario analysis differs from sensitivity analysis, value-at-risk analysis, and forecasting*

- How is the internal process around scenario analysis organised? Who performs it? Are the results presented to the board? Have strategic decisions been taken on the back of such analysis?

Our review of companies' existing disclosure on scenario analysis suggests that they are overall heterogeneous (use of proprietary scenarios, and oil & gas and metals & mining sectors more advanced than utilities), elusive (e.g. lack of company specific comments), still skewed towards qualitative data (lack of financial data), positive (emphasis on companies portfolio robustness), orientated towards internal rather than external users (to drive portfolio-shaping decisions or scenarios planning process), and partial (e.g. ENEL's physical impact focus). In parallel, in terms of sensitivity analysis, we note a trend among companies to foster their ambition when setting an internal carbon pricing mechanism from both a use case and carbon price level perspective, e.g. DSM's use of EUR50/tCO<sub>2</sub>e for its current operations and future investments.

**Table 4: Non-exhaustive list of companies that performed and reported publicly on scenario analysis**

Company	Sector	Scenarios	Financial indicator	Company-specific interpretation of their findings
BHP Billiton	Metals & Mining	Four scenarios: A New Gear (innovation delivers step-change growth in developed economies); Closed Doors (national self-interest drives economic policy leading to low growth); Global Accord (unified focus on limiting climate change i.e. 2°C scenario); Two Giants (US and China-led hubs drive technology-enabled growth).	20-year average EBITDA margin ranges, 20-year average business EBITDA contribution and EBITDA relative to FY 2016 in a 2°C world	The company is robust in a 2°C world due to portfolio diversification and diminishing contribution of fossil fuels as a proportion of its portfolio value over time, in comparison with other commodities
Conoco Phillips	Oil & Gas E&P	Four main corporate supply and demand scenarios, one of which represents a carbon constrained future (technology, legislation and regulation, and demand changes). Three scenarios follow the IPCC 2 degree trajectory.	n/a	n/a
ENEL	Utilities	Long Freeze, Medium and Go green (~2DS), with qualitative data regarding the impact on macro variables, energy and natural resources, energy and climate policy regulation and technology innovation. Specific project on Climate Change physical impacts	n/a	n/a
Glencore	Metals & Mining	Delayed Action (Glencore Central Scenario: IEA New policy scenario with delays), Committed Action (IEA New policy scenario), Ambitious Action (450ppm Scenario).	n/a	Portfolio Resilience Analysis shows the strength of the portfolio in a 2DS e.g. positive effect for copper and zinc
Royal Dutch Shell	Oil & Gas E&P	75 specific scenario-based inputs, considered by sector, carrier, energy source, and geography. Models for various drivers for demand: energy service needs, energy mix, oil demand context (e.g. aggressive EV scenario). "New Lens Scenario" means c. 2.5C of warming this century, with global emissions heading to net-zero by 2100.	n/a	Portfolio resilient, no plans to "move to a net-zero emissions portfolio over our investment horizon of 10–20 years".
Statoil	Oil & Gas E&P	Three scenarios. Key assumptions: GDP growth, energy intensity, total primary energy demand, sales of light-duty vehicles, energy and fuel mixes. The Renewal scenario focuses on developments that combine to deliver an energy-related CO2 trajectory that is consistent with a 50% probability of limiting global warming to 2°C.	Net present value for projects	Using IEA's 450 scenario shows a positive impact of c. 6% on net present value over the lifetime of all projects
Exxon	Oil & Gas	<b>Note: further to a shareholder proposal filing, Exxon committed this year to disclosing a report on "impacts of climate change policies".</b>		

Source: Kepler Cheuvreux

### ...and by several financial institutions

On the back of the TCFD recommendations, several pension funds and investors have committed to using scenario analysis.

- For now, the reference to scenarios among investors has been mostly confined to an assessment of the energy mix alignment with the IEA's goal of 450ppm by 2040, according to Novethic ([link](#)) based on a November 2017 review of 70 reports linked to the article among 100 financial institutions whose AUM exceeds EUR3trn.
- SEI Metrics' 2°C portfolio test (misalignment of activities based on future production by technology, and the technology portfolio requirements illustrated in IEA's scenarios) has been applied by over 200 investors.

- PGGM committed in its 2016 annual RI report to identifying “how and in which parts of the portfolio, investments can be affected by climate change and the measures implemented to counteract climate change based on developed climate models and scenarios” ([link](#)).
- CALSTRS provided results at the portfolio level, focusing on investment returns’ sensitivity to four scenarios in collaboration with Mercer ([link](#)). Risk factors included technology, resources, physical damages impact and policy.

### **But careful...**

When using scenario analysis, a few best practices apply:

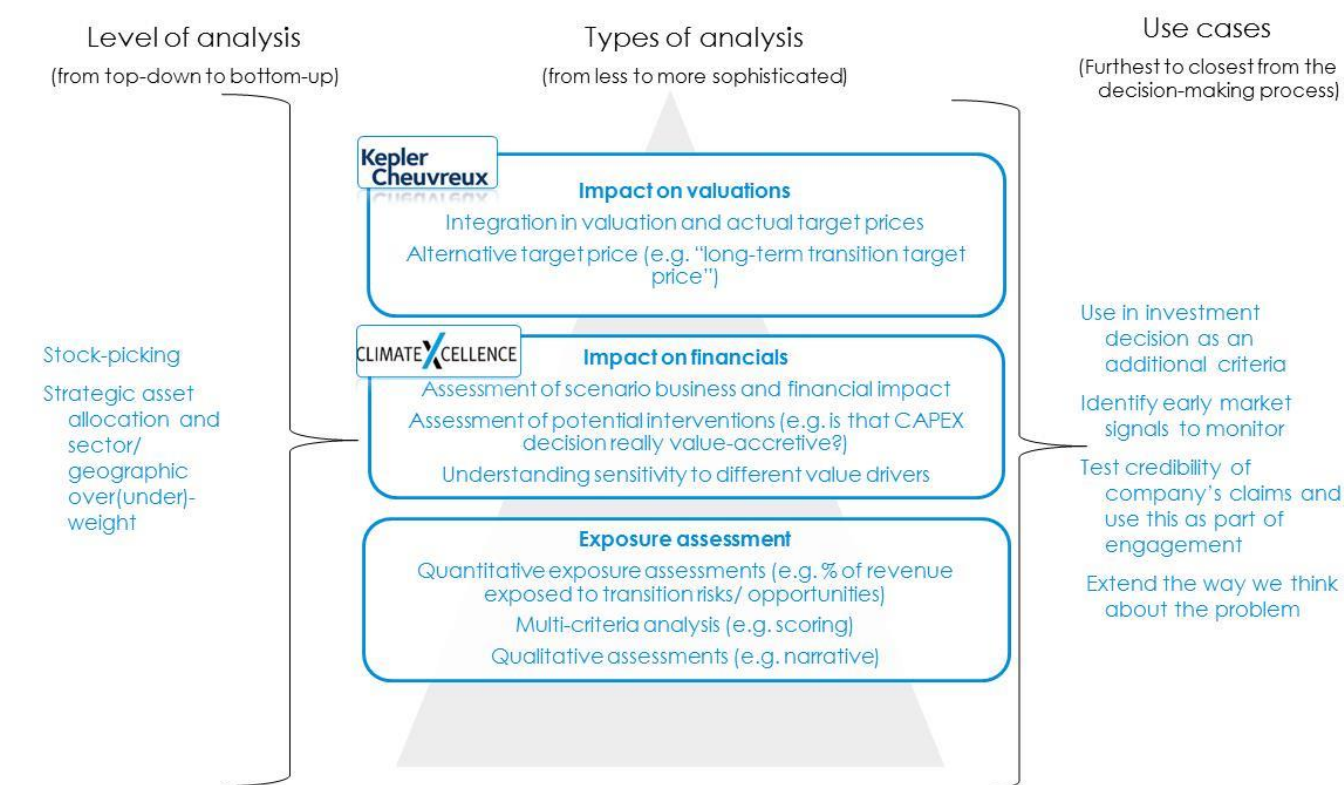
- Scenarios are not forecasts or predictions. Scenarios should not be associated with probabilities, but rather illustrate alternative future pathways on a system level.
- Performing well in one scenario does not necessarily ensure strategic resilience. As scenarios build on key assumptions, and several different future pathways towards the same global warming target exist, it is worth understanding the key assumptions made in different scenarios and testing strategic resilience, or better, financial performance after adaptive capacity, under the different assumptions and resulting pathways. Trade-offs could, for example, exist between updating new technologies and the rise of alternative fuels. Please refer to p.31 for more details around how to select scenarios.
- Interpreting the results requires understanding the key assumptions/narrative. Besides recommending using at least one 2°C scenario, the TCFD is in general not prescriptive as to which scenario it should be or what the key parameters’ value should be. While this safeguards flexibility, this renders like-for-like comparisons between different organisations’ results potentially difficult. We therefore recommend either testing against very transparent scenarios, or following a set of principles when developing proprietary scenarios. Please refer to p. 33. for a “how-to” step-by-step guide on selecting scenarios.



## Scenario analysis in the context of stock-picking and engagement

Scenario analysis can be performed at different levels, take many shapes and forms, and be used in different contexts.

Chart 14: Scenario analysis in the context of investment decision-making can take many shapes and forms



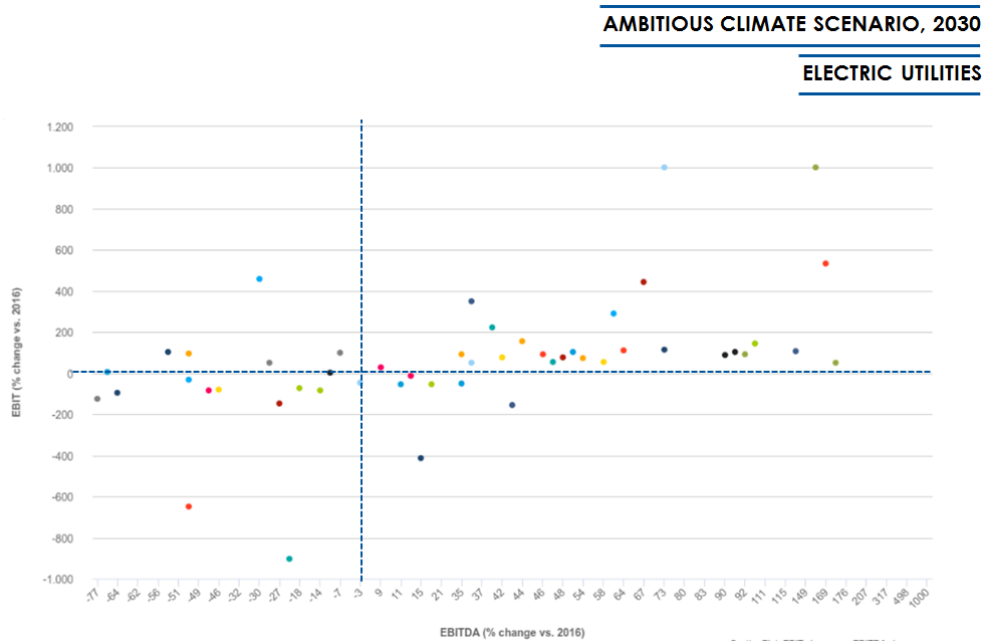
Source: Kepler Cheuvreux

- **Level of analysis:** Foremost, analysis can be conducted from a top-down perspective, starting with asset classes and sectors (this is the approach taken by Mercer, for example) and/or from a bottom-up perspective, from the physical assets/products of the company and sector. The latter is more suited for stock-picking strategies.
- **Type of analysis:** Furthermore, investors have different options for integrating scenario analysis results into their investment process. For instance, the results need not necessarily be integrated into valuation models. They could be used instead as an additional criterion in a multi-criteria analysis when evaluating an investment decision, or as engagement criteria.
- **Use-cases:** We identify a range of use-cases, from widening our view and analysis horizon, to use in an investment decision, and in company engagement. Scenario analysis can also be useful in quantifying the materiality of transition-related risks and identifying which early market signals should be monitored (to pre-empt announcement effects).

We provide an example use-case for stock-picking in the utilities sector below. This is fully illustrated, and implications for company engagement are derived in the utilities sector report (see *Electric utilities in climate transition*).

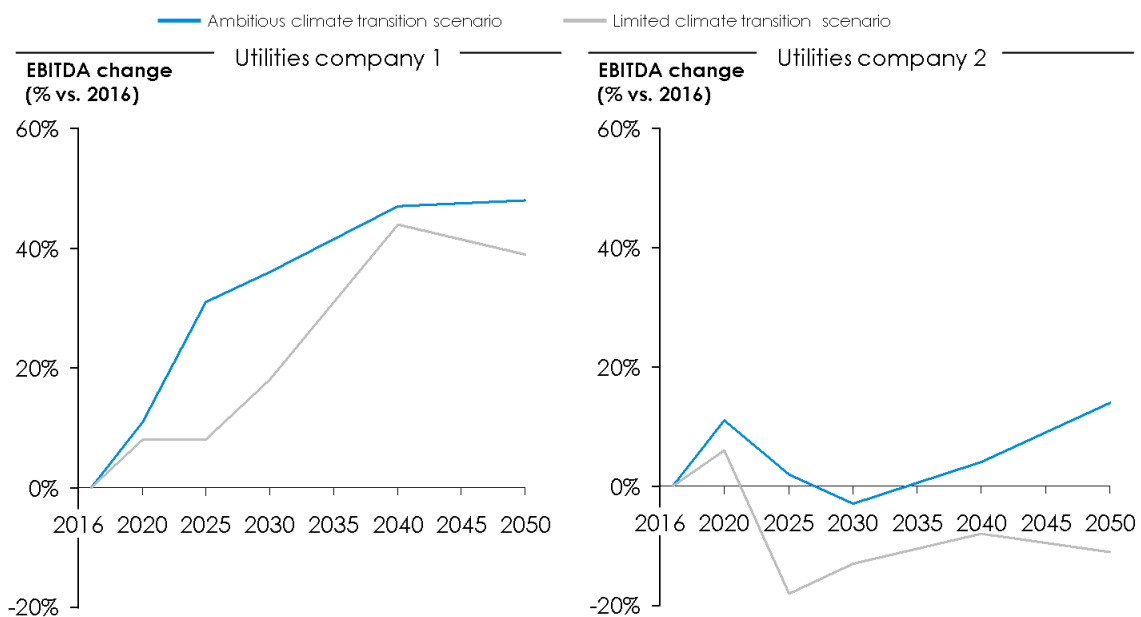
**Example from the utilities sector:** The results of scenario analysis can be used to compare the financial impact of one or more climate transition scenarios on individual companies to inform stock-picking.

**Chart 15: Comparing companies' EBITDA and EBIT performance relative to 2016: the spread can be large**



Source: The CO-Firm

**Chart 16: Change in EBITDA relative to 2016 for two utility companies in two climate transition scenarios**



Source: The CO-Firm

Following this bottom-up approach ensures consistency across the asset-/ product-, company- and geography-, and sector-level, enabling the development of a consistent strategy across the portfolio allocation, stock selection, and company engagement.

Should risks turn out to be material in a relevant timeframe, considering them in the company valuation merits consideration. This will be illustrated in section 5.

**In summary, we believe that scenario analysis is particularly well suited to modelling the net impact of a variety of interdependent drivers in an uncertain, non-linear environment. It is important to understand that scenario analysis is different from stress-testing, sensitivity and value-at-risk analysis.**

**Interpretation of the analysis results by external parties is greatly facilitated by using a set of transparent scenarios, or building on a common set of principles and analysis steps.**

**As part of the ET Risk Project, we explore how scenario analysis can be performed at the physical asset/product-, company-, country-, and sector-level. The objective is to show the potential margin, cash flow, and capex/depreciation under a specific set of long-term scenarios.**

**In the next two sections of this report, we highlight: 1) how to derive the impact of scenarios on the financials of a company; and 2) how to potentially include these insights in a bottom-up company valuation and financial models.**

**The upcoming series of reports will showcase how this type of analysis can be applied to different sectors and how material the results might be, starting with the utilities sector (see *Electric utilities in climate transition*).**

## How to perform scenario analysis?

In this section, we explore how to quantify the impact of transition scenarios on different business variables, including revenue, cost, depreciation and capex. We build on The CO-Firm's climateXcellence model. In the next section, we explore how these results can be integrated into financial modelling.

ClimateXcellence is a physical asset-/product- and country-based climate risk model which identifies company-, country- and sector-level risks and opportunities. Key modelling inputs and steps to assess how risk factors impact revenues, earnings and capex viability before and after company adaptation are illustrated below.

ClimateXcellence builds on modelling approaches that were co-developed with Allianz Global Investors, Allianz Climate Solutions, WWF Germany ([link](#)) and applied by the Investment Leaders Group, hosted by the University of Cambridge Institute for Sustainability Leadership.

This section builds on research published in:

- Developing an Asset Owner Climate Change Strategy, UN Principles for Sustainable Investment (January 2016, [link](#)).
- Feeling the heat: An investors' guide to measuring business risk from carbon and energy regulation, University of Cambridge Institute for Sustainability Leadership (CISL) (May 2016, [link](#)).
- Environmental risk analysis by financial institutions: a review of global practice, Cambridge Institute for Sustainability Leadership (CISL) (September 2016, [link](#)).
- G20 Green Finance Synthesis Report, G20 Green Finance Study Group (July 2017, [link](#)).
- The Transition Risk-o-Meter: Reference Scenarios for Financial Analysis (2° Investing Initiative, The CO-Firm, June 2017, [link](#)).
- Climate Change Analysis: First Aid Kit, Kepler Cheuvreux, (Julie Raynaud, March 2017, [link](#)).
- Changing Colors: Adaptive Capacity of Companies in the Context of the Transition to a Low Carbon Economy (2dii, The CO-Firm, Allianz, Allianz Global Investors, August 2017, [link](#)).
- Scouting 2° opportunities, Kepler Cheuvreux (Samuel Mary, November 2016, [link](#)).
- Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities, TCFD (June 2017, [link](#)).

This section complements the report "Transition Risk Toolbox" from the 2° Investing Initiative ([link](#)), which provides a higher-level discussion of the concepts and analysis steps described below.

## How to select scenarios?

### Ensuring the insight

A range of scenarios is needed to capture possible extremes and future worlds. This means not only selecting scenarios with a range of ambition levels (e.g. well-below 2°C, 2°C, business as usual), but also selecting different scenarios with the same ambition (e.g. 2°C scenarios from IEA, IAMC or Greenpeace). The FSB TCFD provides an overview for publicly available climate-related scenarios in its report.

Nations are also starting to formulate their own scenarios, which might be highly relevant to some companies acting in cross-regional markets. It is important to select multiple scenarios that are clearly different in their narrative and structure in order to depict a range of possible transition impacts and ensure strategic resilience in the long run. For an extended set of scenarios, see ([link](#)).

The following aspects should be taken into consideration:

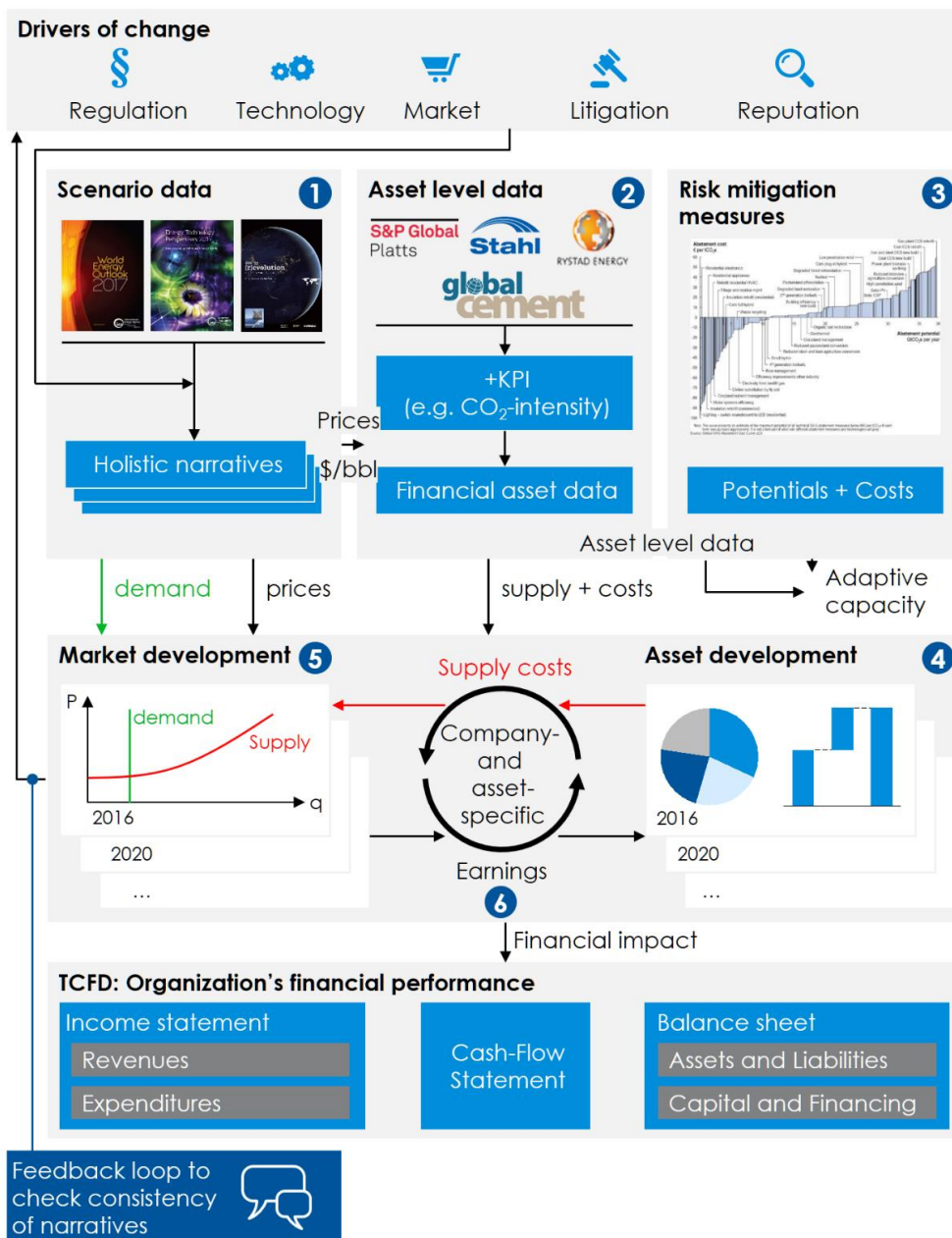
- **Level of ambition:** Usually, climate scenarios are consistent with a range of global warming projections, ranging from 1.5°C to 6°C or more. In order to be meaningful, the TCFD advises organisations to choose at least one 2°C or lower scenario, in addition to other scenarios most relevant to their circumstances, such as scenarios related to Nationally Determined Contributions (NDCs), physical climate-related scenarios, or other challenging scenarios ([link](#)).
- **Level of detail/granularity:** Scenarios differ in their level of granularity in terms of regional (e.g. global, regional, country-level), sectorial (e.g. cross-sector, sectorial (e.g. transport, industry, households) or sub-sectorial (e.g. steel industry), temporal (e.g. 2030, 2050 etc.) and technological detail (e.g. carbon capture and storage in industry and power generation or battery electric vehicles deployment). In general, scenarios with lots of detail regarding risk exposure should be preferred to allow for distinctive statements.
- **Consistency and physical plausibility:** Climate change scenarios encompass a large set of indicators in dynamic interaction with each other (e.g. CO<sub>2</sub> certificate prices and electricity prices). For a credible climate change scenario, parameter variations should be inherently consistent not only between the energy systems but between the regions: changes in one region should be consistent with global changes and vice versa.
- **Transparency:** In order to be verifiable, climate change scenarios should be transparent about their underlying assumptions and key drivers. High levels of transparency will facilitate a more informed discussion and will finally lead to more credible results.

## How to determine the business impact of scenarios?

### Six key analytical steps

The TCFD recommends analysing the financial impacts on the income, cash flow statement and balance sheet. The following provides an overview of a scenario-based, bottom-up market model underlying climateXcellence. While alternative routes are possible, we recommend taking six central steps to build bottom-up models (Chart 17, subsequent numbering is consistent with the chart).

Chart 17: Financial modelling of climate transition risks



Source: The CO-Firm



**Table 5: Six central steps to build bottom-up models**

Step	Why?	How?
1. Derive the key risk drivers based on the narrative behind a scenario	Scenarios typically present decarbonisation pathways for a specific sector (or national economy) e.g. changing technology trajectories (wind, coal etc.) or demand (e.g. rise/drop in electricity demand). However, scenarios are mostly unspecific about the drivers (e.g. CO <sub>2</sub> certificate prices, technology costs and their development over time, technology diffusion, command and control policies, etc.) that will lead to and explain such changes.	Backward induction approach to connect the dots between the transition drivers and scenario data, e.g. what battery prices are needed for cost parity and for consumers to switch from fossil fuel to electric cars (see step 5)
2. Built asset/product database based on relevant and meaningful information on individual physical assets/products for the risk and opportunity assessment	Since climate transition impacts companies' physical assets and product portfolios differently – even within the same sector – building (enhancing) an asset database that is relevant and meaningful for assessing climate-related risks and opportunities is central to the modelling. Having a sound asset database at hand allows differentiated financial impacts of climate transition on companies to be derived.	Commercially available databases holding technological information such as capacity, asset type and start-up year can be a viable basis but need to be extended by i.e. energy and carbon intensities and financial meaningful data
3. Techno-economic assessment of assets' adaptive capacities for risk mitigation	Financial modelling of climate risk must consider companies' ability to anticipate transition risks and develop mitigation strategies, as it impacts future asset development and companies' financial performance (see page 33). Adaptive capacity allows a true and fair view of risks and opportunities to be presented. Not considering it might overestimate climate risks.	Explore adaptive options such as product, business and technology switches (see page 33) GHG Marginal Abatement Cost Curves (MACC) can be a starting point to explore technological options. All options should be tested for economic soundness, i.e., the underlying business case for the adjustment.
4. Forecast companies' asset or product portfolio development with and without adaptive capacity under different scenarios.	Climate risk assessment is conducted over long time periods e.g. up to 20 or 30 years, over which companies develop and can change their market share, business strategy, product portfolio and production technologies. Outside effects like market-driven volume (e.g. more electricity demand) and price effects can further impact companies' line-up. Not anticipating companies' development might also overestimate climate risk.	The development of companies' asset base or product portfolio is basically a function of the demand development (see step 1), company's current assets (see step 2) its adaptive capacity (see step 3). Considering the inherent uncertainty, it can be helpful to analyse two or more pathways to derive impacts that result from different business strategies.
5. Forecast market development based on the demand and supply assumptions to derive prices and revenues in the scenarios	The different future worlds of climate scenarios will result in price and volume effects on markets. First, modelling product markets allows us to calculate market development consistent with the scenario. Second, it enables us to derive companies' future earnings and sales volumes considering their competitiveness. Third, it helps in backward induction missing scenario data such as CO <sub>2</sub> prices (see step 1.)	Markets in their simplest form can be modelled with supply and demand cost curves. The aggregation of companies' asset developments (see step 4) yields the supply cost curve and the scenario data (see step 1) serves as the inelastic demand curve for a given scenario. The price is settled where supply and demand intersect.
6. Mapping financial impacts on assets/products to companies	For assessing climate risk, companies can be perceived as superset of physical assets with technology and country combination. In the last step, the asset-specific risk needs to be mapped to the company's portfolio to derive total financial impacts.	Market modelling in step 5 provides country-asset-specific earnings based on price, volume and supply costs, while step 3 provides asset-specific changes in depreciation and capex. With the help of step 4, the country-asset-specific financial impact can be mapped to countries.

Source: The CO-Firm

## Zoom on step 3: assessing adaptive capacity

### Why consider adaptive capacity?

Analysing companies' respective adaptive capacities provides a view on the potential winners in a changing environment.

Adaptive capacity is the result of a company's set of capabilities, such as anticipating external trends, reconfiguring its asset base, gaining access

to third-party assets, etc. Adaptive capacity can be reflected by technology adjustments, changes in the product portfolio, business segments, means of commercial delivery, etc. ([link](#)). It is then put into practices by strategic changes.

### **Is a company willing and able to adapt?**

The willingness and capacity of a company to adapt not only depends on the change itself, but also internal factors such as corporate culture and market positioning. For example, in the automotive sector, BMW and Daimler, which are focused on large and luxury vehicles, could face a strategic disadvantage in a context of growing demand for small and medium cars.

How to structure our analysis including both quantitative data and qualitative insights? The tables below offer a framework for a bottom-up assessment of adaptive capacity, including governance, strategic capabilities, assets, P&L, etc. In the context of climate change, it is complemented by specific, partially technical factors relating to the potential for and business case behind upgrading a company's assets.

Table 6: Examples of criteria for assessing whether a utility is willing and able to adapt

Criteria	Details	Use case	Linkages with Climate analysis	TCFD	CDP
<b>Assets &amp; Liabilities</b>					
<b>1. Strength of the balance sheet</b>					
Credit rating	S&P, Moody's and Fitch ratings, views on the capital structure and outlook	What's liquidity and credit risk? How stretched is the balance sheet and what is the room to manoeuvre, access to capital?	Utility's generation mix, or contribution of activities by level of risks captured by e.g. Moody's	Yes	
Debt	Net debt, and Net debt to EBITDA	What's capital flexibility?	Shift to Renewables and low-carbon alternatives		Yes
Capital	Lock-in, requirement, increase likelihood	What's the potential to fund growth capex?	Shift to Renewables and low-carbon alternatives		
Decommissioning provisions	Decommissioning costs for nuclear generation installations	What's the impact on the debt and risk profile?	Nuclear decommissioning		
<b>2. Tangible assets</b>					
Capacity	Ownership structure, scale, average age, efficiency, forecasts based on assets lifespan, planned retirements	What's the expected portfolio transformation? Is there for example a timeline for the phase out of coal-fired power plants?	Shift to Renewables and low-carbon alternatives		
<b>3. Intangible assets</b>					
Human capital	Company culture (e.g. entrepreneurial drive, cohesion), appropriate staff including talent attraction and retention, labour dialogue	How agile is the organisation? How successful could it prove in developing and integrating new businesses?	Shift to Renewables and low-carbon alternatives		
Intellectual Capital	Innovation record, monetisation, R&D investments, incorporation of long-term risks factors	What's the company's innovation efforts and profile?	Shift to Renewables and low-carbon alternatives		Yes
Social & Relationship Capital (Customers relationship & Reputation)	Customer satisfaction, Complaints received per 100,000 customer accounts electricity suppliers	Does the company have a comprehensive client relationship management approach (e.g. regular client satisfaction measurement) and how does it perform?	Shift to a decentralised and more sustainable energy focused and energy efficient model	Yes (2016 in the UK)	
Social & Relationship Capital (Community relations & license to operate)	Policy and stakeholders engagement	What's the company's ability to influence / capture regulatory influence and the systemic relevance of institution? How well does it communicate to stakeholders?	Carbon regulation supportiveness		Yes (Influence Map analysis)
<b>4. P&amp;L</b>					
Revenues, earnings, and cash flows	Business model, product (regulatory regime, type of operations) and geographical diversity	What's the long-term momentum and volatility?	Shift to Renewables and low-carbon alternatives		
Costs	Opex	What are cost efficiency efforts and the opex reduction target and momentum? To what extent will affect the level to which future earning capacity?	Shift to Renewables and low-carbon alternatives	Yes	
Capital allocation	Capital expenditures (capex), including share allocated to Growth investments, M&A; capital allocation between capex and dividends; divestments	What's the expected portfolio transformation and impact on the cash equation?	Shift to Renewables and low-carbon alternatives		

Source: Kepler Cheuvreux

Table 7: Examples of criteria for assessing whether a utility is willing and able to adapt (cont'd)

Criteria	Details	Use case	Linkages with Climate analysis	TCFD	CDP
<b>5. Financial ratios</b>					
Various	Cash conversion ratio, Capital payback periods or ROCE, Dividend-payout, Net debt to EBITDA	What's the capital flexibility?	Shift to Renewables and low-carbon alternatives	Yes (ROCE)	
<b>6. Governance</b>					
Board	Expertise, quality and oversight	What's the Board ability to drive the company's transformation and adapt?	Identification of board-level climate experts	Yes	Yes
Management	Expertise, quality and oversight	What's the management ability to drive the company's transformation and adapt?	Specific targets for climate change in CEO remuneration	Yes	Yes
Shareholding structure	Shareholders breakdown by type	What challenges and opportunities do shareholders pose to the company's ability to transform and adapt (e.g. state's ownership)?	Shift to Renewables and low-carbon alternatives		
<b>7. Strategy</b>					
Strategy definition and agility	Roadmap, timing, planning, flexibility, optionality e.g. spin-off, divestment, capital allocation, refurbishment	What's the strategy's incorporation of long-term risks and opportunities, including climate change, and ability to evolve e.g. modify existing capital investments?	Acknowledgment of the renewables transition	Yes	In part
Alignment with structural trends	Shift from centralised to distributed generation e.g. rooftop solar business plans, Digitalisation, Energy efficiency and storage	What's the level of efforts to embrace and benefit from long-term trends?			
Portfolio test/scenario analysis	Strategy and portfolio stress-testing	What's the resilience of the company's strategy and portfolio? Does the company quantify the risk and disclose range of values that correspond to a possible asset acquisition?	Climate-related scenarios and associated time horizon(s) considered, use of an internal carbon price or range of prices	Yes	In part
Risk management	Processes, anticipation, crisis management, Hedged production	What's the company's ability to react to sudden and large market disruptions or policy shifts?	Climate-related scenarios and associated time horizon(s) considered	Yes	
Market positioning	Pricing power, supply chain / value chain positioning, type of customers, contracts	To what extent does the customers base and company specific market conditions affect its ability to transform and adapt?	Shift to Renewables and low-carbon alternatives	Yes	
<b>8. Disclosure of metrics and targets</b>					
Various climate-related KPIs	Energy/Fuel Mix, GHG emissions (emission intensity (tCO <sub>2</sub> /GWh) level, trend, including locked in emissions, and target, including carbon neutrality, science-based review, link with the 2°C scenario	Does the current and forecast level of emissions inform vulnerability to a significant decrease in future earning capacity?	Shift to Renewables and low-carbon alternatives	Yes	Yes

Source: Kepler Cheuvreux

## How can a company adapt?

Companies face a range of strategic options to adapt. These strategies can be framed as follows ([link](#)):

- **Product adjustment/switch:** Notable examples of this are likely to include automobile manufacturers (e.g. from diesel to electric vehicles) and electric utilities (e.g. from coal-fired to renewable power generation).
- **Production process/supply adjustment:** One example of this is the airline industry, which may have to adjust its purchasing decisions (e.g. from the current fleet to more fuel-efficient or zero-carbon alternatives). Another example is the steel sector, which will be required to adjust its plant portfolio.
- **Commercial adjustment:** Companies might also find ways to leverage their business context to avoid climate transition pressure. An example of this is the pass-through of CO2 prices to consumers in the steel sector ([link](#)).
- **Business segment switch:** Companies might realise that to sustain cash flow, they may need to shift to new business segments. This can happen relatively quickly. For example, diversified miners may sell or buy new business lines and fundamentally change their exposure in a short period of time, although this requires a certain degree of balance sheet strength and governance capacity to sell or buy "at the right point". Steel producers might choose to diversify away from steel. Individual mobility of the future might show increasing shares of car sharing, leading to a business segment that sells mobility rather than cars.

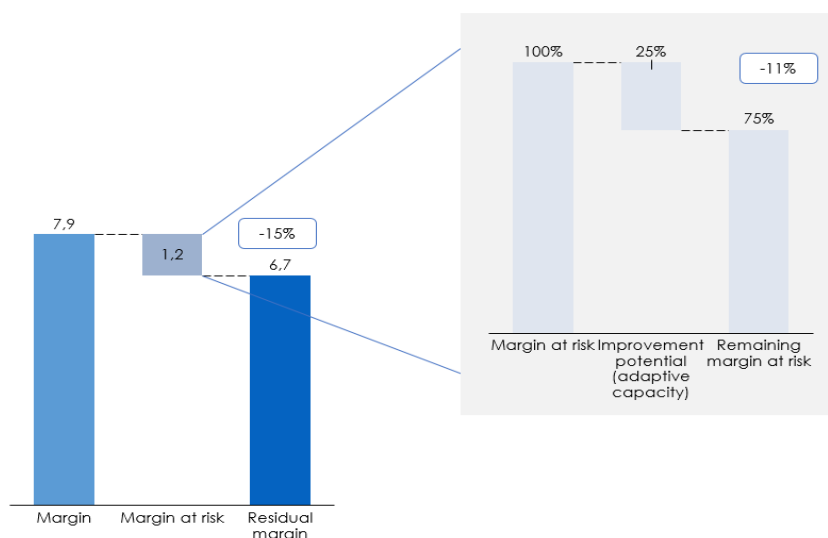
When assessing a company's adaptive capacity, potential measures should have a positive business case under the transition scenarios and ensure that the quality and quantity of the end product is not compromised ([link](#)).

One example illustrates the concept of adaptive capacity:

### Oil refineries: reducing margin risk by a quarter

Applying a EUR45 carbon price per ton of CO2 to oil refineries in the UK in 2020 implies a risk to their margins of 15%. Passing those costs fully through to customers is unlikely. However, if companies were to anticipate the increase in carbon prices, it could implement technological measures that satisfy their cost-benefit analysis when taking into account the new carbon price. This could, for example, include extended heat integration, implementation of co-generation, or unit-specific measures. Implementing these three measures reduces the expected risk by 25% to 11% ([link](#)).

Chart 18: Impact of a carbon price on oil refineries in the UK



Source: The CO-Firm

In summary, in order to understand potential extremes and “different worlds”, more than one scenario should be taken into consideration when determining the financial impacts of climate transition. Proper scenario selection involves four central elements: ambition, granularity, consistency and plausibility, and transparency.

Financial risk modelling consists of six central steps: 1) identifying the key drivers for scenarios; 2) building a meaningful asset/product portfolio database; 3) analysing companies’ adaptive capacity; 4) analysing companies’ asset base/product portfolios; 5) analysing markets to calculate prices and revenues; and 6) calculating the financial impacts for assets and companies.

# How to embed transition scenario results in company valuations?

By following the six steps described on page 33, analysts can estimate the impact on revenue, costs, capex, depreciation and other business variables for different transition scenarios.

As discussed on page 27, these results can be used directly in investment decision-making as part of a multi-criteria analysis. Analysts may also want to integrate them into financial valuation models.

In this section, we investigate whether the results of transition risk modelling can be used in bottom-up stock valuation, and if so, how?

This section builds on published research:

- **The Responsible Investor Playbook**, Kepler Cheuvreux (Julie Raynaud, November 2016, [link](#)).
- **All Swans are Black in the Dark**, 2° Investing Initiative and Generation Foundation (February 2017, [link](#)).

## What question do you wish to answer?

In our view, there are two main questions that investors can ask:

- **Question 1:** What should the target price of a company be under a defined 2°C scenario (build an alternative scenario)?
- **Question 2:** Can I use the results of Question 1 (insights into companies' misalignment with a 2°C scenario) to integrate climate-related transition risks that are currently not factored in into current valuation models (adjust the baseline scenario)?

This first question aims to analyse the gap between current valuations and what they could be under a 2°C scenario, thereby identifying the potential mispricing of a stock. The second uses key insights from answering the first question in order to better price current stocks and ponder actual changes to the target price.

## The choice of baseline

While we briefly discussed the question of the choice of baseline previously, we add a few points in the context of company valuation analysis. Answering the first question, ***“What should the target price of a company be under a pre-defined 2°C scenario?”***

If the aim of the analysis is to understand the potential mispricing of assets – we recommend using company valuations as baseline consensus, for example based on Bloomberg data. The consensus does not necessarily reflect long-term trends, given that most valuation models do not forecast the year-on-year cash flow impact of potential external changes in electricity or carbon prices after five years.



One may also choose another baseline that corresponds to a “central trajectory”, such as the IEA Reference Technology Scenario, which represents a world where countries implement their pledges, or nationally-determined-contributions, leading to a 2.7°C temperature rise. Therefore, it can be considered as a long-term dynamic baseline when used in comparison with the 2°C scenario.

## Can we use valuation models as they are built today?

We believe discounted cash flow models (DCF) are better suited to scenario analysis than multiple-based models, given the long-term nature of transition risks and opportunities, even if the use of this type of model requires additional assumptions and research.

Indeed, in our view, multiple-based models are not well adapted to scenario analysis for several reasons:

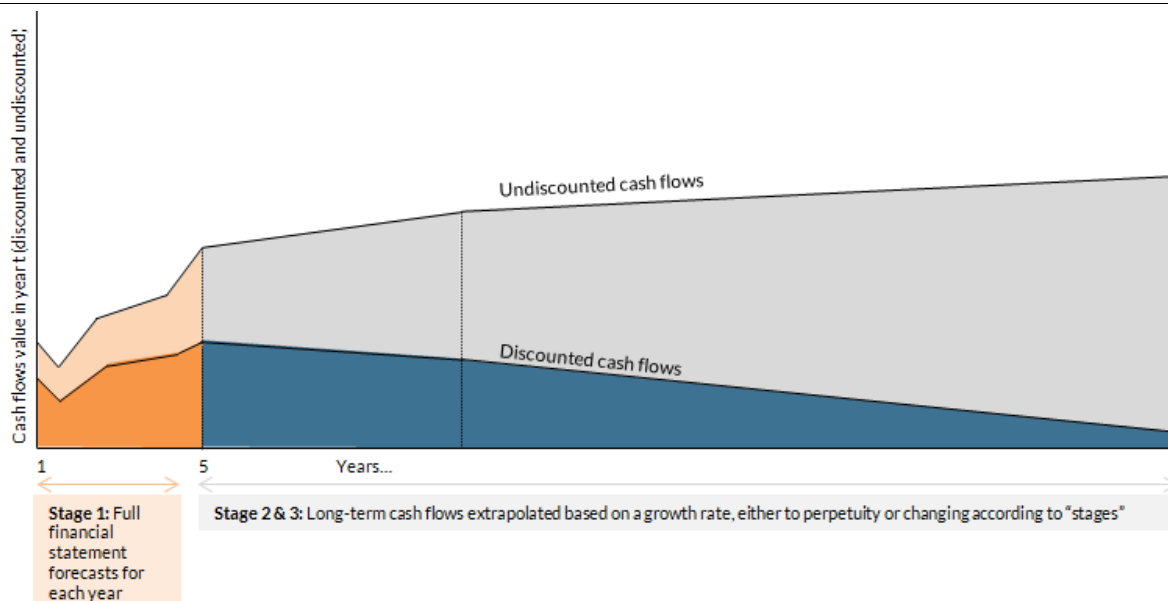
- They do not account for abrupt variations at any point in time or the timing and duration of specific impacts.
- Applying valuation multiples to 2030, 2050 or 2050 EBITDA would not make much analytical sense, as this method is inherently short-term oriented.
- Adjusting multiples to reflect sentiment on a company's long-term position within a specific transition scenario is subjective and hard to forecast.

Therefore, we focus our analysis on DCF models but highlight the importance of insightful qualitative data along with scenario analysis in the context of multiple models as an area for further research.

A typical discounted cash flow model is built using three main pieces: forecasts of the specific cash flows over a one- to ten-year period; an estimate of the long-term growth rate (which can be differentiated over different periods of time); and an estimate of the discount rate. Chart 19 provides a conceptual view.

*We believe discounted cash flow models (DCF) are better suited to scenario analysis than multiple-based models given the long-term nature of transition risks and opportunities*

Chart 19: Conceptual view of a DCF model



Source: Kepler Cheuvreux, based on 2° investing initiative

Whether we seek to answer Question 1 or Question 2 (see p. 39), the integration of transition scenario results into financial modelling can be done on both the growth potential and risk profile of specific stocks.

- The energy transition can affect the **long-term growth potential** of a specific country, sector or company. In the context of scenario analysis, analysts can either extend the time period over which **specific cash flows** are modelled YOY (i.e. extend Stage One and test for different scenarios), or change the **growth** rate used in the second stage or the perpetuity formula (Stages Two and Three).
- Transition pathways, as captured by scenarios, can also affect the **risk profile, or variability of cash flows**, of an asset. It is worth noting that the notion of risk in finance refers to the variability of an expected outcome, either positive or negative, even if in practice investors are more concerned about downside risks. This is captured by the discount rate.

## How to model scenarios' impact on the growth profile

According to research by the 2° Investing Initiative and Generation Investment, 75-90-% of company valuation comes from cash flows that are forecast more than five years into the future ([link](#)).

Yet these cash flows are estimated using a growth to perpetuity formula, usually based on economic growth. This is rarely company-specific and may not take into account the impact of the energy transition on company-specific or economy-wide growth.

Many scholars and research houses have investigated the impact of climate change on GDP. While the scope of impacts and scenarios (action

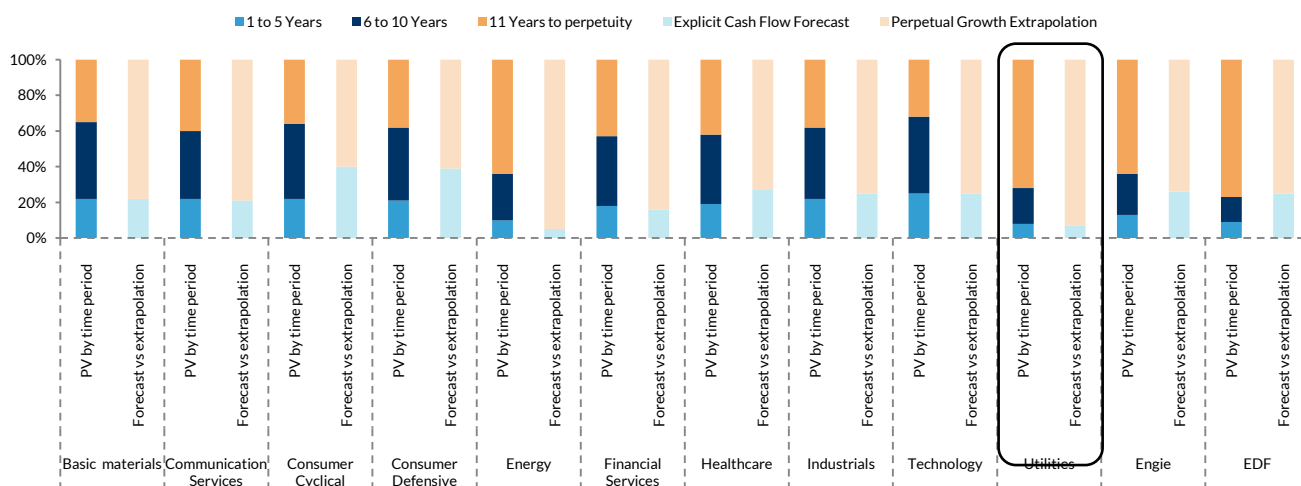
*The integration of a transition scenario results into financial modelling can be done on both the growth potential and risk profile of specific stocks*

*The impact of climate change on GDP can be used as a proxy to adjust the future growth rates used in modelling*

or no-action) and level of disaggregation (whole economy vs. sector/country view) vary, they can be used as a proxy to adjust the future growth rates used in modelling:

- Lord Stern estimated in 2006 that if left unchecked, climate change could lead to a global annual loss of 5% of GDP each year, or 11% when other externalities such as health and environmental effects are included in estimates.
- Other studies have been undertaken on the same topic, with results ranging from 0.9 to 6.4% of GDP for a temperature increase between 2.5°C and 5°C. The OECD published a report in 2015 that provides the percentage in GDP loss in 2060 from climate change at sector-level ([link](#)).

**Chart 20: Divergence between actual time horizon of analysts and the materiality window of underlying stocks**



Source: 2° Investing Initiative and The Generation Foundation, 2016, [link](#)  
Bloomberg issues a survey to equity research analysts on free cash flow estimates. The responses listed in their database tail off after five years of forecasts with 74% of analyst responses coming in the first three years, and 94% coming in the first five years.

Not only could the energy transition change our industry's growth rate forecasts, in addition a company's positioning in a specific market or ability to adapt and maintain higher returns than its industry may vary. In that context, can we use transition risks and opportunities analysis to derive a more-specific growth profile for each company within each scenario?

## Two options to adjust a company's growth profile

We suggest exploring two options:

- Extending the forecasting horizon of specific cash flows offers more precise scenario results and "what if" analysis. It is therefore better suited for testing the impact of tail risks (high magnitude, low probability) and non-linear risks.
- Adjusting the terminal growth rate to reflect the impact of different transition scenarios on the global economy and specific sectors,

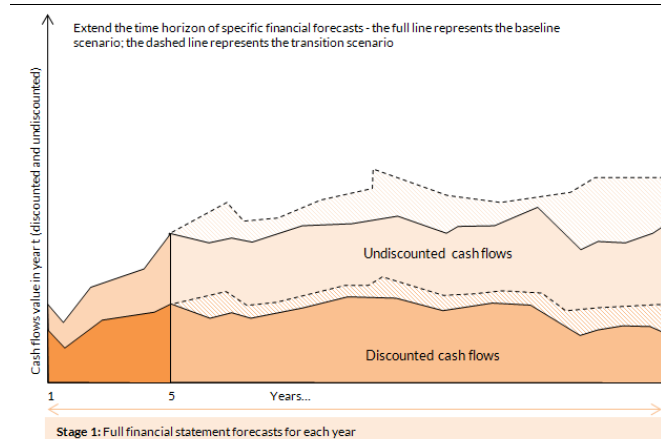
and/or the appetite and ability of a company to adapt. This option is easier to implement but is less specific than extending the forecasting horizon of cash flows.

**Table 8: Pros and cons of both options**

Options	✓	✗
Extend YOY-specific cash flows	<p>Appears to be the most "logical" option to tackle the time horizon issue</p> <p>Allows shocks and non-linear risks to be factored in</p> <p>Easier and less time-intensive</p>	<p>Time and resource-consuming</p> <p>Matching asset-level data with financial reporting and analysts' models can be challenging</p> <p>May need to extrapolate parameters that are not provided by scenario builders (e.g. human resources costs) leading to potential inconsistencies</p>
Adjust the growth rate	<p>Can reflect the potential of a company to maintain a long-term competitive advantage</p>	<p>Difficult to determine the range within which to change the terminal growth rate (which is typically between the historical inflation rate of 2-3% and the historical GDP growth rate of 4-5%).</p> <p>Does not take into account the timing and duration of impacts</p>

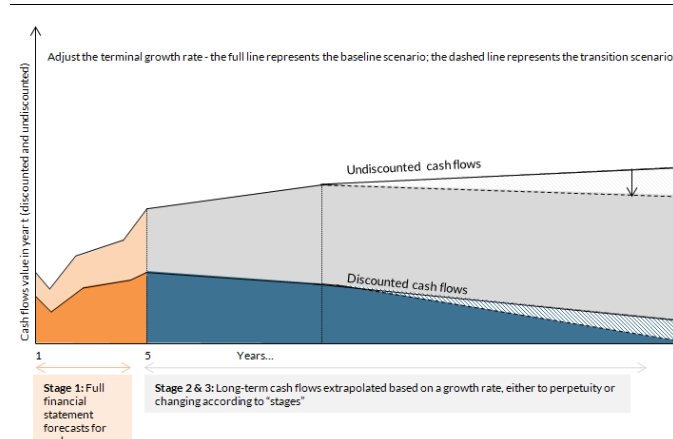
Source: Kepler Cheuvreux

**Chart 21: Extend specific cash flows**



Source: Kepler Cheuvreux

**Chart 22: Adjust the Stage Two and terminal growth rate**



Source: Kepler Cheuvreux

## From scenario analysis to integration into current valuations

When seeking to answer Question 1, "what should the target price of a company be under a defined 2°C scenario?", certain investors may want to modify assumptions about the company's growth profile using data that was calculated under that specific scenario, such as the EBITDA and capex data from CO-Firm's climateXcellence model or an equivalent model.

The percentage difference between the current target price and the 2°C scenario target price represents the potential mispricing of these 2°C risks as defined by the specific scenario and underlying parameters (carbon prices, energy consumption and the like).

In order to answer Question 2, "how do I use the results of the first question to integrate the 2°C transition risk into current valuation models?", analysts

may need to assign a probability to the results of specific scenarios in order to build a weighted average.

However, scenarios are not forecasts, and scenario builders do not assign probabilities to them. In addition, there is an infinite number of plausible 2°C pathways and a 2°C scenario represents only one of them.

We thus argue that unless we are able to build bull and bear scenarios that represent our view on the best and worst cases, it is very difficult to integrate the results of scenario analysis into current valuation models.

The main value of conducting scenario analysis is to understand the "hidden" influence of long-term impacts on target prices and seek to better understand the sensitivity of cash flows to specific parameters such as carbon prices and energy demand. This may in turn reinforce or conversely challenge our current positive or negative view on a stock based on the magnitude of this gap.

*Scenario analysis may in principle reinforce or conversely challenge our current positive or negative view on a stock*

## How to model scenarios' impact on the risk profile

The climate and energy transition may affect not just the growth profile of companies, but also the riskiness of their cash flows i.e. the likelihood that investors receive a return that is different (higher or lower) from what is expected. This is captured by the discount rate in a DCF model.

How can we change the discount rate in the context of scenario analysis? There are two sides to the equation if we use the Capital Asset Pricing Model (CAPM): the equity market risk premium and the beta (Chart 23). One can also change directly the cost of equity, or even the discount rate, without focussing on individual underlying variables.

How we modify the discount rate and through what variable depend on the story that we want to tell, i.e. whether we want to investigate the historical sensitivity of companies' stock prices to transition-related shocks or how this sensitivity is changing as their strategy and exposure evolves.

Chart 23: Calculating the cost of equity using CAPEM

### CAPM formula

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

**$E(R_i)$  = cost of equity**

**$R_f$  = risk-free rate**

**$\beta_i$  = beta of asset i; a measure of systematic risk**

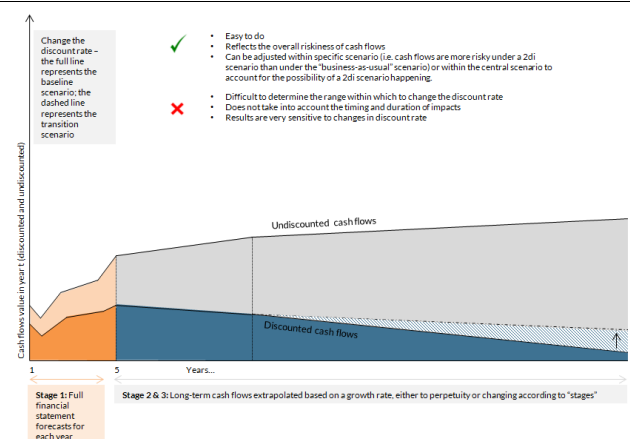
**$E(R_m)$  = Return on equity**

**$[E(R_m) - R_f]$  = Equity market risk premium, a measure of the excess return of the market portfolio over the risk-free rate**

$E(R_i)$  feeds into the "weighted average cost of capital", used as the **discount rate** in DCF models.

Source: Kepler Cheuvreux

Chart 24: Adjusting the discount rate



Source: Kepler Cheuvreux

## Research so far has been on integration into baseline scenarios

The literature has explored how to adjust the discount rate in *current* valuation models based on the required rate of return for investors, or cost of equity, to accept additional risk due to a specific transition-related risk, such as carbon or oil prices. We provide an example on European utilities and carbon prices' impact on the beta.

We argue that this approach suffers from two main shortcomings, beyond the fact that this does not qualify as "scenario analysis" in its strictest sense:

- The scenario consists of more than one impacting factor (e.g. energy consumption and carbon prices), sometimes moving in opposite directions. For sectors that are highly sensitive to one transition variable, this method could still be interesting in our view, but depends on the dataset and how the analysis is performed. We provide one example below from the literature.
- This type of analysis is mostly based on historical data, which may not reflect the *future sensitivity* of stocks' returns to specific variables. In addition, most transition risks are emerging and historically have not been fully priced by the market, thereby limiting the usability of time-series analysis.

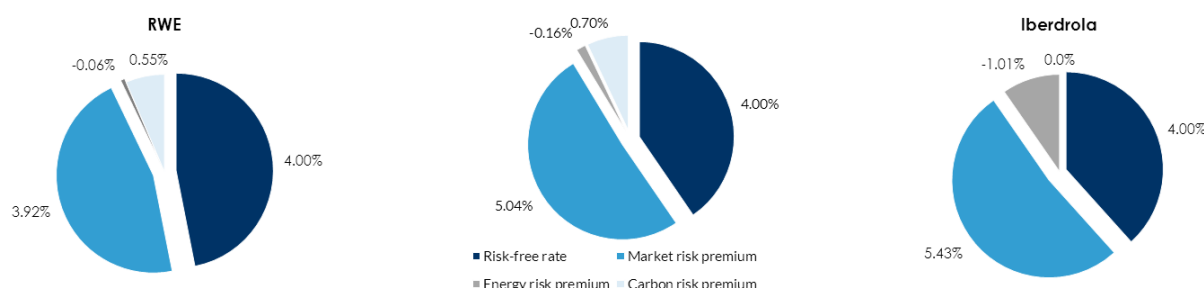
*Adjusting the discount rate in current valuation models based on the required rate of return for investors, or cost of equity, to accept additional risk due to a specific transition-related risk is subjected to several shortcomings*

## Case study on European Utilities

Collecting data from April 2005 to December 2011 (Phase II) for 23 European utilities, Massari et al (2016) identified a statistically relevant carbon beta of 0.03 on average for high emitters (>500kg CO<sub>2</sub> per MWh) and 0.06 for low emitters (<300kg/MWh). For the former, the risk lies in buying allowances; for the latter, the risk lies in selling allowances.

We note that these estimates are not aligned with previous research from Koch and Bassen (2013), which found statistically relevant results only for high-emitting companies (>200kg/MWh) but not for low-emitting companies (<100kg/MWh).

Chart 25: Deriving a carbon beta for European utilities



Source: Koch and Bassen (2013)

In our view, a more prospective approach consists of calculating the implied discount rate within each scenario to answer the question: what adjusted discount rate would make the NPV under the current case equal

to the adjusted NPV under a transition scenario? This will yield the risk premium/discount attributable to a specific scenario.

Certain investors may then use that adjusted discount rate in their base case (together with probability weighting if need be) to model the impact of the energy transition on financials. This approach should not be used together with cash flow adjustments, as it could lead to double-counting.

While prospective by nature and conceptually closer to what we would call "scenario analysis", this approach does not reflect the *changing* risk profile of a company *within a specific scenario*.

### **Changing risk profiles in alternative scenarios**

*Within a specific scenario*, the equity risk premium and stock beta might change altogether. How can we adjust the discount rate within a specific alternative scenario in order to reflect a change in the uncertainty profile *within that specific scenario*? We explore this in this section.

The equity risk premium is determined by our judgement of the equity market risk level and what price we require to compensate for that risk. Research by Mercer ([link](#)) shows that, in the context of climate change, the equity risk premium could vary depending on:

- The degree of uncertainty, as determined by climate policy transparency, technological changes and other trends;
- Overall risk aversion, potentially increasing in turbulent times or economic transformation, transparency of information;
- While the International Energy Agency and other bodies do specify the conditions that need to be met in order to be on a certain trajectory (e.g. what rate for carbon taxes would be needed for a 2°C world), they do not provide a view as to how this is reached – e.g. through global, concerted action (thereby decreasing the level of uncertainty) or through divergence (thereby increasing the level of uncertainty).

We argue that global concerted action will have to be taken if we are to limit temperature increases to below 2°C. Therefore, uncertainty levels and equity risk premiums should remain unchanged or even decrease. However, for any other trajectories, the equity risk premium is likely to rise due to increased uncertainty, as shown by research from Mercer.

*Equity risk premium is likely to rise due to increased uncertainty, as shown by research from Mercer*



**Table 9: Impact of scenarios on equity risk premium**

Action scenario	Likelihood	Global policy response	Equity risk premium volatility
Regional divergence	Most	Divergent and unpredictable (-30% carbon emissions vs. baseline to 2030)	Higher volatility
Delayed action	Close second	Strong mitigation but only after 2020, little support for adaptation (-40% carbon emissions vs. baseline to 2030)	Higher volatility, lower realised premium
Stern action	Much less	Strong, transparent, and internationally coordinated action, generous support for vulnerable regions for adaptation (-50% carbon emissions vs. baseline to 2030)	Lower volatility, higher realised premium
Climate breakdown	Least likely	Worst-case scenario, little mitigation, little support for vulnerable regions	Unchanged, risk of higher volatility

Source: Mercer ([link](#))

Understanding changes in equity risk premium matters when looking at how the energy transition could impact strategic asset allocation. In our case, it is not as important given that we look at the relative changes in equity risk of one company vs another. What matters more is therefore the beta, the cost of equity or the overall discount rate (Chart 26).

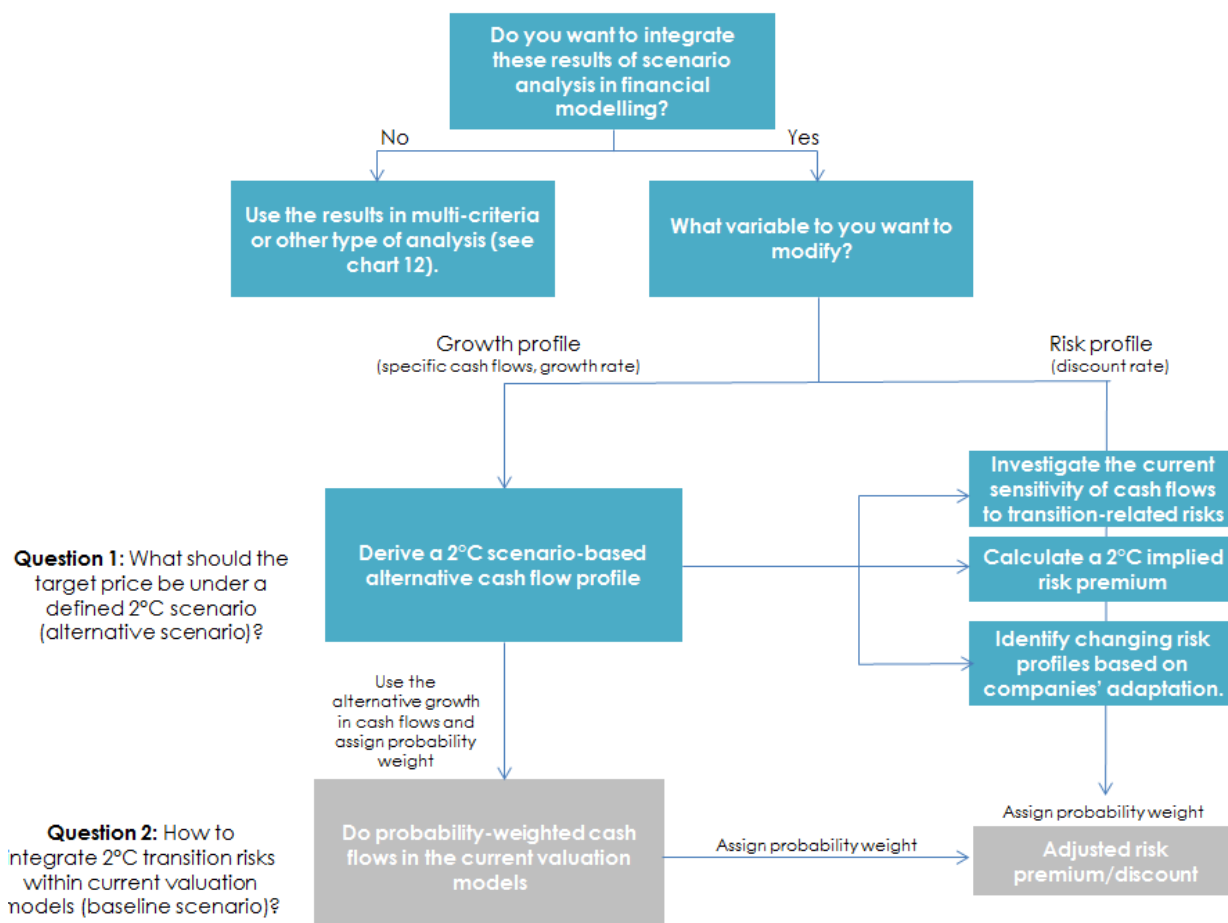
We run into an additional conceptual difficulty when trying to estimate the company-specific beta under different scenarios. Indeed, there is a relative lack of data and research on how to assess the change over time of a company's relative risk profile versus the overall equity market (beta) in the context of transition risks and scenarios.

A company may change its asset base through time, for example its generation mix, and therefore have a different long-term sensitivity profile to carbon prices, for example (carbon-beta). Research by Carbon Tracker provides a good example in the context of Oil & Gas companies. They find that a 2°C compatible asset portfolio is less sensitive to oil price changes that could arise under a 2°C scenario than a business-as-usual portfolio, and therefore warrants a lower beta than the baseline ([link](#)).

## What option should you choose?

It ultimately depends on the focus of your analysis.

Chart 26: How to use the results of scenario analysis in the context of company valuation?



Source: Kepler Cheuvreux

In summary, the six steps highlighted on p. 33 help us overcome the obstacle of data availability by using scenario analysis in order to understand the potential impact of the climate and energy transition on a company's financials. Analysts may, under certain circumstances, go one step further and use these results to understand the impact on a company's valuations by asking two questions:

- **Question 1:** What should the target price of a company be under a defined 2°C scenario (alternative scenarios)?
- **Question 2:** How do you integrate 2°C transition risk into current valuation models (baseline scenario), possibly using the results of the first question?

To answer these questions, we need to overcome the obstacle of ill-suited valuation tools and models in the context of long-term analysis, as highlighted on p. 15. We explore how this can be done in this section from a conceptual perspective. Upcoming reports on specific sectors will explore how this can be applied to specific sectors.

# Outlook

## Further areas of research

### Asset level data: Availability and quality

One modelling building block is asset-level data. While companies are generally not reporting this type of data, some providers exist. However, challenges remain with respect to data availability, quality and granularity. Future research and disclosure might help:

- **Coverage:** Data often only comprises a subset of global assets. In particular, in emerging countries like China and India, asset-level data is often lacking coverage.
- **Ownership:** Allocation of assets to companies can be difficult, particularly when companies have subsidiaries. A lack of ownership data might lead to mismatches between bottom-up and top-down data from companies' disclosures.
- **Level of detail:** A considerable level of detail on assets is required to assess climate-related risks and opportunities, and databases are not yet optimised for that purpose.
- **Timeliness:** Assets change in terms of type and capacity over time so that having most recent data is crucial.
- **Easy-to-grasp:** Databases should provide sufficient guidance to allow a non-technical person to use asset-level data correctly. Often, errors arise from using the wrong filters on technical parameters.

### Mapping climate risk assessments and company reporting

Multi-divisional companies in particular tend not to report the sources of their margins and cash flows on the basis of business units and regions, and the definitions of business units do not necessarily match the sector definitions in climate scenarios or the definition of the sectors with the highest climate transition-related risks. Thus, outside-in mapping is required. Upcoming disclosure might support this process.

### Scenario selection

As scenario analysis becomes more prominent, existing climate scenarios are increasingly well understood and their assumptions are being challenged. This process might result in a set of well-explained (based on the narratives) scenarios, including explanations of their key assumptions and traits, facilitating scenario selection by the market.

### Alignment of 2°C pathways and financial performance

Current initiatives, such as the Science Based Targets initiative, encourage businesses to validate their alignment with a 2°C pathway. This, however, might not be the best decision from a financial point of view. On the other hand, companies might not be able to achieve a 2°C pathway, as they hold onto the last "dirty" assets that are still allowed (or potentially even

*As scenario analysis becomes more prominent, existing climate scenarios are increasingly well understood, and their assumptions are being challenged*

need, such as in utilities) in a 2°C world. Understanding and differentiating this would allow the two strands of analysis to be linked.

### **Cash flows sensitive to external parameters under each scenario**

Research by Cired shows, for instance, that investments in energy assets (fossil-fuel based or renewables) are sensitive to macro-economic changes under a 2°C scenario. Indeed, there is a range of oil prices and GDP levels that are compatible with a 2°C scenario and could lead to different investments levels, all compatible with that scenario ([link](#)). The IPCC has also highlighted the range of carbon prices compatible with a 2°C scenario in its mitigation report ([link](#)). The scenarios that we use in the Utilities report are operationalised based on the IEA scenarios that only take into account one possibility. Therefore, as a next step one could analyse the sensitivity of cash flows to changing external parameters under each scenario.

### **Probability weighting**

The results of scenario analysis could be interpreted as bull and bear cases, depending on the data chosen and worldview of the user. Yet, there is an infinite number of “event” combinations that could lead to a specific climate outcome. It is therefore very complicated to determine whether the chosen scenario corresponds to a best- or worst-case scenario for a specific sector and company.

Analysts could be tempted to synthesise the results of multiple scenarios in their financial modelling by using probability weighting. At this stage, scenario developers do not attach probabilities to their research. While on the one hand this is understandable. A scenario that includes probabilities would be, wrongfully, confused with a forecast. It opens the door to a range of “politicised” scenarios that could give the impression that the world is evolving in one direction.

### **Granularity versus coverage**

While we explore different options for adjusting DCF models to reflect the results of scenario analysis, we believe that at this stage it is very difficult to strike a balance between granularity/specificity and coverage. Extending the specific cash flow forecasting period to 2050 is often not a realistic option and fraught with uncertainties. At the same time, modifying the discount rate or terminal growth rate does not account for the specific timing of impacts. Further research is needed in this area.

### **Modelling disruption**

In addition, this raises the question of whether valuation models are at all adapted to business model disruption. Indeed, energy transition scenarios need not only lead to higher/lower cash flows and volatility. They could lead to bankruptcy or the disappearance of listed companies altogether. Discounted cash flow models assume in their perpetuity formula that companies will exist forever. This need not be the case under specific scenarios.

### **Beyond carbon: adopting a systemic view**

Transition scenarios exclude the impact of physical risks, such as the potential rise in the number and strength of extreme weather events. In addition, far less work has been done on other environmental themes that could interact with climate change. For example, the IEA 2°C (450ppm) scenario (2016 version) has a higher water consumption footprint than the New Policy Scenario. We therefore recommend investigating the possibility of building multi-theme scenarios.

# Research ratings and important disclosure

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Total	100%	100%

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The objective of the ET Risk project is threefold:

- Help investors and policymakers understand the materiality of energy transition risk
- Help investors assess the materiality of energy transition risk for equity and bond portfolios
- Engage with investors and policymakers on responding to Energy Transition risk and mobilizing capital for sustainable energy investments.



The ET Risk project published reports concerning:

- Making climate risk assessment work
- Electric utility sector
- Automotive sector
- Steel sector



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