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BUSINESS STRATEGY IN (AND FOR) A DECARBONISED WORLD

SCENARIO-BASED ANALYSIS: A POWERFUL TOOL FOR ANALYSING THE RESILIENCE OF YOUR BUSINESS

Strategy practice
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Which mechanisms explain the damage that has been caused to the planet?

On what basis can businesses make strategic decisions in a rapidly changing world?

How can scenario-based analysis be a powerful tool in helping businesses to perform well in the medium and long term?

The deterioration of the planet challenges the limits of a societal model built around the mass energy consumption responsible for global warming. Making the right strategic decisions in a rapidly changing world that finds itself under duress is a real challenge for decision-makers. Scenario-based analysis is a powerful tool that can help them adapt to this new state of play, and it is this approach that we will be introducing here.

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KEY FACTS

The planet's environment (physical, chemical and biological) is in an alarming condition and deteriorating exponentially. At the same time, humankind has made **exceptional and exponential socio-economic progress** since the Second Industrial Revolution. These advances in the human condition have been based primarily on a huge growth in energy consumption, and in the use of fossil energies in particular. This abundant energy is therefore also a source of the greenhouse gas emissions that have led to **global warming**, which has largely been delayed in relation to the emissions generated. It has also given humanity a greater ability to transform, which has inevitably been accompanied by a certain **deterioration** in its **environment**. **'Progress' has therefore come at the expense of nature.**
Other societal and economic limitations are also emerging, when exponential growth is still the number one priority.

That said, allowing the trends of the last century to continue is neither physically possible nor, in all likelihood, societally desirable. With this in mind, basing a company's long-term strategic decisions on the assumption of the growth in the company's activity over the period ('Business As Usual[1] approach) would appear inappropriate, or even risky, even though it is common practice.

Scenario-based analysis is therefore a relevant and powerful tool for exploring the levels of freedom that exist within a constrained context, which is vital to supporting the decision-maker in making the decision. This is particularly true in situations of **profound and systemic change**, such as those brought about by global warming and/or the transition to a low-carbon world. There are, however, a number of rules that must be followed if such an analysis is to be useful, including using **at least 2-3 different scenarios** that are individually **coherent** and display **relevant trajectories with regards to the company's activity**, including at least one low-carbon transition trajectory.

In order to take full advantage of the possibilities that scenario-based analysis offers, Carbone 4 recommends using a methodological physical flow approach. This approach consists of **two steps:**

- **modelling the impact** of a global and exogenous physical restriction (on available energy stores, on the maximum carbon budget for limiting global warming to a certain value) **on physical activity** of the company, first and foremost;
- **translating the physical trajectories under constraint** (e.g. demand for the company's products or services) into **financial results.**

It is vital to ensure this sequence of putting the physical aspect ahead of the economic, because it permits an in-depth understanding of the strategic impact of each scenario. Performing a strictly economic analysis, on the other hand, masks the underlying physical reality behind each trajectory, which is nevertheless a vital component of the decision-making process.

Carbone 4's scenario-based analysis method, based on a physical flow approach, makes it possible to perform an innovative medium and long-term SWOT analysis, as well as the following:

- **to assess the resilience of the company's business activities** in accordance with various trajectories, including some that reflect the transition to a low-carbon world, by taking into account **changes in the competitive landscape;**
- **to identify major strategic directions** that will help improve its resilience and **to characterise opportunities** relating to the scenario and to the act of transforming its operations before its competitors **for improved medium and long-term performance.**

1 Assuming notably that there is a global growth in GDP of 3-5% a year, which is generally considered by main-stream economists and observers to be desirable.

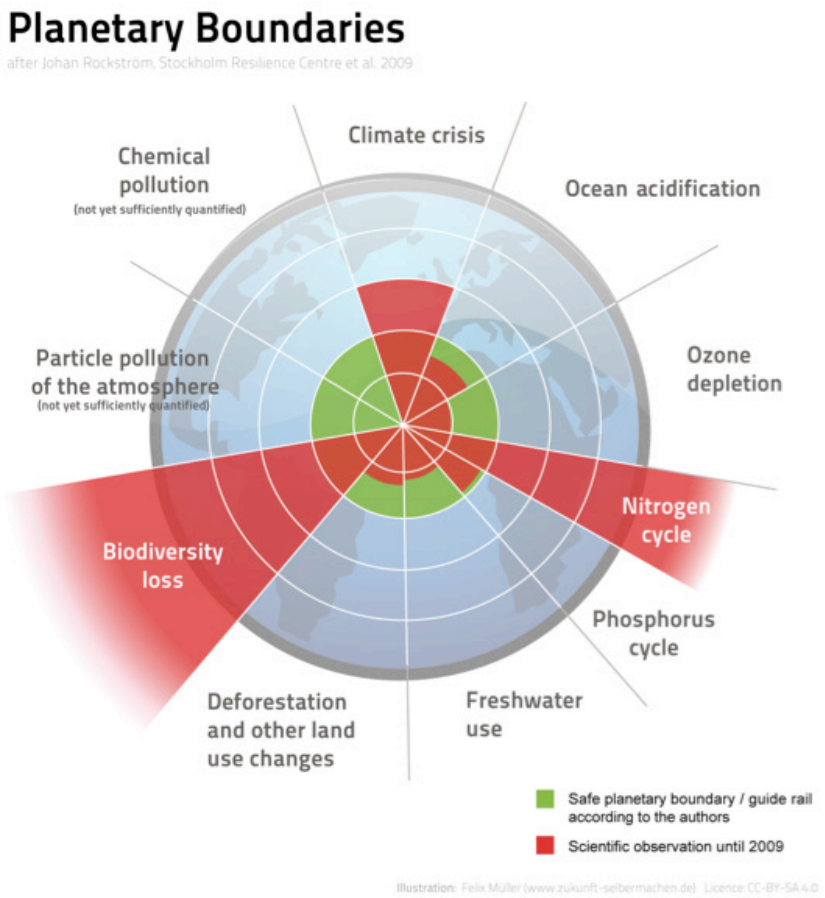
1 CLIMATE CHANGE: A SYSTEMIC ISSUE

1.1 THE SIGNIFICANT DETERIORATION OF THE ENVIRONMENT: A FACTUAL AND ALARMING OBSERVATION

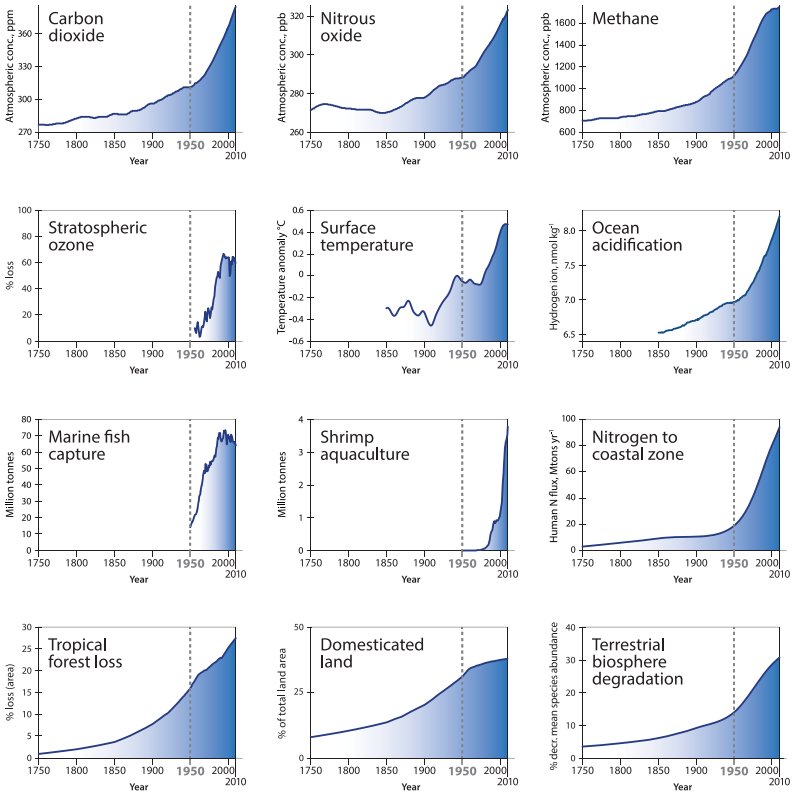
The planet's environment is in poor condition and is only getting worse, with 4 of the 10 global environmental limits believed to have already been exceeded. Indeed, climate change is accelerating, wild (and sometimes domestic, as in the case of bees, for example) flora and fauna is in decline, heralding an even more violent erosion of our biodiversity, and the nitrogen and phosphorous cycles are being disrupted. If things remain as they are, the other limits will also be exceeded over the coming years and decades.

Whilst it may be confined to man-made assets[2], the cost of natural disasters has already reached record levels of over $300bn in 2017 in the USA[3] , as opposed to $3-4bn a year in the 80s.

All of the environmental indicators point to what is ultimately an alarming situation. In fact, it would take two planets to meet all of our needs, whereas we only have one.



2 The loss of natural assets as a result of deterioration, whether gradual or violent, caused by human activity, such as a river that has become unfit for use, a species that has become extinct, arable land that has been lost, or the fact that snow no longer falls in a certain area, is never included in these calculations, which therefore significantly underestimate the actual consequences for our species.
3 Source: Munich RE



Indicators of changes in the Earth system (1750-2010)[4]

More worrying still, this deterioration is occurring at an exponential rate, as shown in the graph opposite for the lengthy 1750-2010 period.

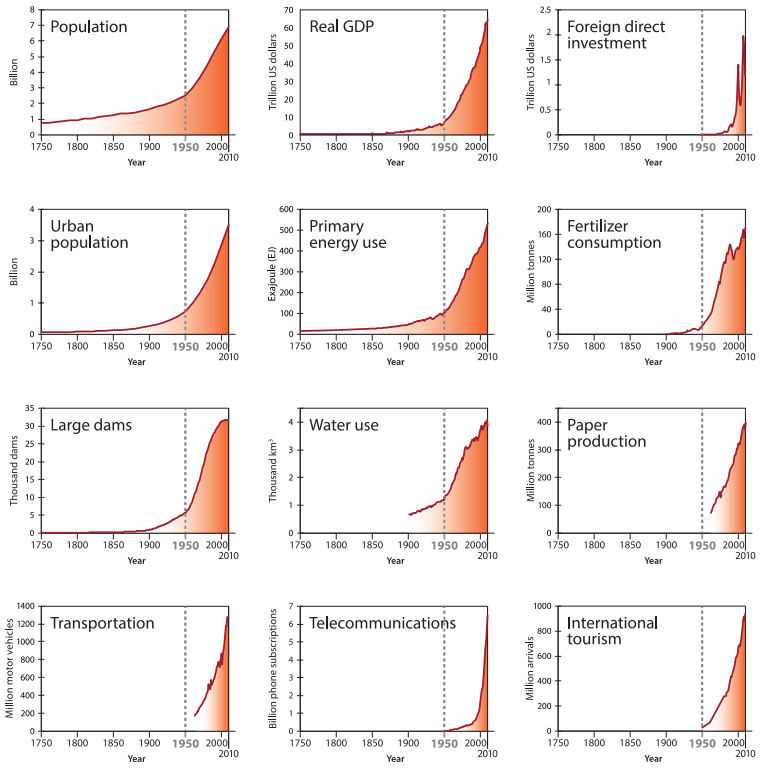
A basic arithmetical reminder, but one that is nevertheless enlightening when looking at perpetual growth in physical flows: a 4% annual increase in any quantity (in terms of waste, GHG emissions, etc.) means a two-fold increase in volume in just 17 years. The 'Earth system' simply cannot withstand this sort of environmental pressure increasing at this rate indefinitely.

1.2 SOCIO-ECONOMIC PROGRESS - ANOTHER WAY OF MEASURING OUR 'ENVIRONMENTAL CONSUMPTION'?

Why has our environment been affected to such a degree and why is the situation intensifying further still?

The situation is not, however, quite as it seems.

Over the same 1750-2010 period, human societies have experienced a very high level of growth in GDP. Many socio-economic indicators have also shown signs of distinct improvement, including annual production per capita, life expectancy at birth[5], the production of metals, cement and consumer goods in the wider sense and even energy consumption. Extreme poverty has also decreased, as has violence.



Indicators of socio-economic development (1750-2010)[6]

4 Source: The trajectory of the Anthropocene: The Great Acceleration, W.Steffen et. al
5 Source: World Bank
6 Source: The trajectory of the Anthropocene: The Great Acceleration, W.Steffen et. al

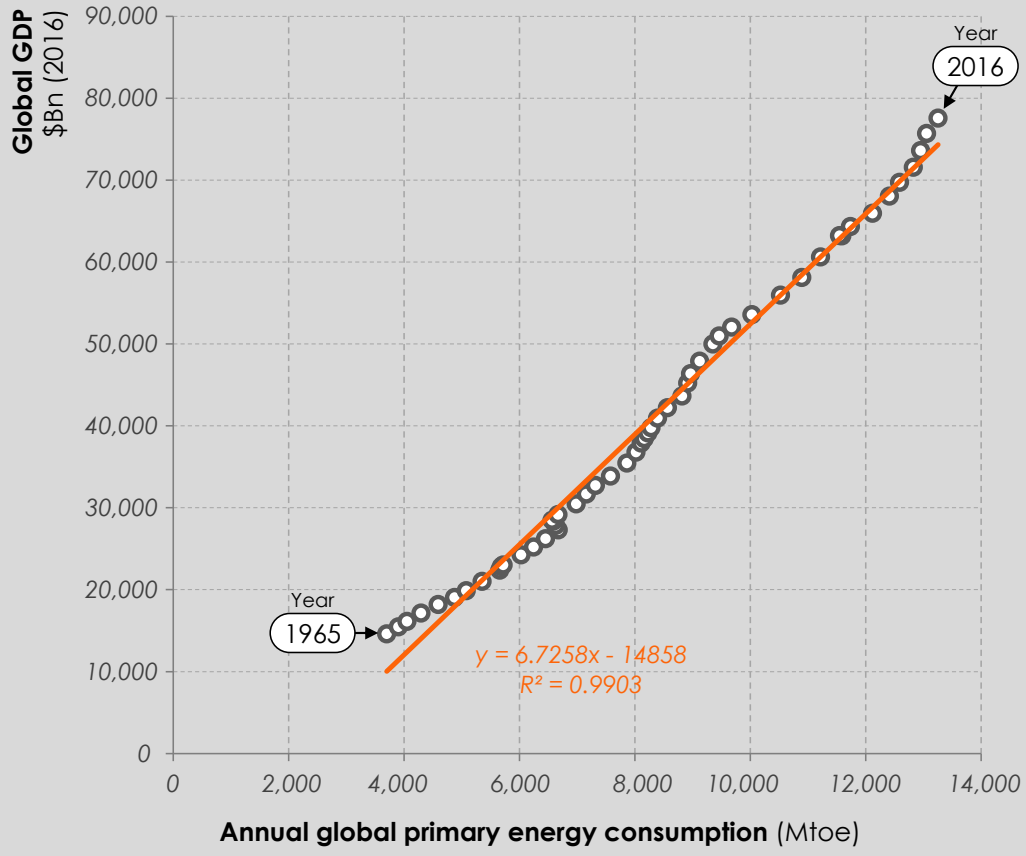
Is this simultaneous occurrence of deterioration on the one hand and improvement on the other actually contradictory?
As a matter of fact, no.
Such socio-economic progress is, unfortunately, largely another way of measuring our 'environmental consumption'. Producing a tonne of plastic, by its very nature, means another part of our oil deposits gone, an increase in the levels of CO_2 in the atmosphere and various other adverse environmental effects that inevitably occur.

With this in mind, the economic growth that has been observed since the Second Industrial Revolution (around 1850), which was welcomed on all sides for the short-term benefits it brought with it, is 'simply' a way of measuring growth in all kinds of physical flows, including energy flows.

After all, energy is merely what we use to transform a material. The economic and material 'fairytale' that our societies experienced was therefore based on the ten-fold increase in primary energy consumption that was observed over the course of the 20th Century. This increase in the amount of energy consumed is the main driver of economic growth, as shown by the graph opposite and the work of various economists[7].

The 'development' of the human condition has therefore come at the expense of nature. Indeed, this abundance of energy that humankind is experiencing today and that is a cornerstone of its development has come about as a result of the use of fossil fuels, with 80% of the energy used on Earth in 2016 coming from coal, oil or gas.

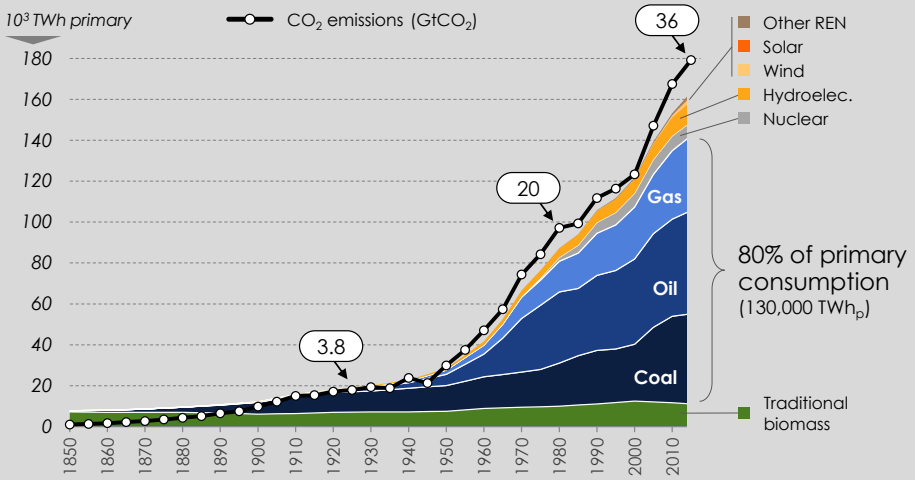
Correlation between energy consumption and global GDP | 1965-2016



Sources: World Bank, BP Statistical Review of World Energy (2017)

7 Source: How dependant is growth from primary energy ? G.Giraud, Z.Kahraman, 2014

Annual global primary energy consumption by source and CO_2 emissions | 1850-2015



Emissions from fossil fuels combustion and cement production
Sources : BP Statistical Review of World Energy (2017), Vaclav Smil: Energy Transitions: Global and National Perspectives (2017), Our World in Data, CDIAC, analyses Carbone 4

These sources of energy emit CO_2 when burned, and combined with other greenhouse gas (GHG) emissions produced through farming and deforestation, these human-made emissions throw the Earth's climate out of kilter.

In practical terms, this energy is what fuels the machines that give humankind its great ability to transform its environment, ultimately leading to its deterioration. Our economy has been mining-based since the Industrial Revolution, meaning that it has thrived primarily on reducing stocks of non-renewable resources.

Having our societies pursue this sort of exponential growth at all costs also means that other limits are at risk of being exceeded, including the following:

In energy terms:

- Energy Return On Investment (EROI)[8] has significantly decreased, from ~100:1 in 1900 to ~10:1 today (or even 3 to 5:1 – perhaps less - in the case of the most recent of resources, such as tar or oil sand, shale oil, corn or maize biofuels, stored photovoltaic energy, etc), meaning that it is becoming increasingly difficult and expensive to fuel the economic system, thus limiting the growth in GDP;

In environmental terms:

- the vast majority of the resources that human activity requires are finite and increasingly difficult to extract as deposits become increasingly depleted (the economic impact of this issue is a growing need for investment per unit of resource extracted);
- pollution in our soils, seas, lakes and waterways has reached unprecedented levels.

Furthermore, we are seeing the emergence of different types of limits that are calling into question the practicality of a global exponential growth objective:

In economic and financial terms:

- levels of both public and private debt have reached record highs, whereas our ability to repay them in the medium term has diminished.

In social terms:

- very significant inequalities, leading to social instability;
- as a result, we are witnessing a strong surge in populist and protectionist political agendas.

8 The EROI represents the ratio of usable energy obtained from a given source of energy in relation to the amount of energy expended to obtain this energy.

Allowing current trends to continue is therefore not physically possible and therefore perhaps not societally acceptable. Humankind is edging ever nearer to the limits of a system that began with the Second Industrial Revolution.
This being the case, contemplating the development of a company's business activity based on a series of business-as-usual scenarios, which consider the constant exceeding of the Earth's limits to be an unchanging factor (as is the case, for example, when it comes to GDP growth forecasts from major international economic institutions, despite the fact that they are regularly refuted by the facts) is, therefore, objectively overly optimistic or even frankly unrealistic.

1.3 WHAT ARE THE PROSPECTS FOR ENDING THE CRISIS?

The socio-economic crisis that humankind is currently experiencing is manifesting itself in various ways, and a number of complementary solutions for rectifying the situation have emerged.

With regards to the climate aspect, humankind has set itself the objective of limiting global warming to a maximum of +2°C in relation to the average temperatures recorded during the pre-industrial period with the signing of the Paris Agreement. In order to achieve this we can still continue to emit a maximum total of 750Gt of CO_2eq as of the end of 2017, that is around 20 times the level of emissions recorded in 2017, although this is a fictive calculation.

Quickly and significantly reducing our GHG emissions is therefore both vital and urgent, with a need to reduce them by two-thirds at global level and three-quarters in developed countries by 2050 and achieve carbon neutrality between 2050 and 2100.

The basic principles of the transition to a low-carbon society are therefore based on three key elements:

- **Sobriety** - examining our lifestyles and our collective organisational, production and consumption patterns;
- **Efficiency** - reducing the energy required to perform a particular activity;
- **Decarbonisation** - reducing GHG emissions from the residual energy that we continue to use and from economic activity in general.

This world, as one that is significantly different than the one we currently live in, can be exhaustively described by its physical characteristics, namely population, energy consumption, energy mix, GHG emissions, steel and cement consumption, passenger-kms or tonne-kms travelled, vehicle fleet, number of m^2 built or renovated per year, etc. Such a representation could be produced at global level or narrowed down to geographical area.

2 THE LOW-CARBON TRANSITION AND ITS IMPACT ON BUSINESS STRATEGY AND ACTIVITY

2.1 SCENARIO-BASED ANALYSIS: A POWERFUL TOOL

The issue of climate change is therefore a systemic one that must take priority. The advent of a low-carbon world means lots of transformations that will have an impact on all companies' business activities, and it is therefore important to anticipate these changes in order to come up with an effective and resilient business strategy.

Scenario-based analysis is a powerful tool for initiating this sort of strategic reflection and is in fact an exploratory task that involves projecting the company's current activity onto a number of different worlds (one for each scenario) in order to understand the corresponding consequences for business. This approach is effective when it comes to gaining a comprehensive understanding of complex developments that interact with one another, which perfectly defines the changes brought about by climate change. The TCFD has realised this and recommends this approach for testing the resilience of a company's business activity[9].

The following criteria must be met in order to ensure that this scenario-based analysis approach is as relevant as possible:

- using at least 2-3 scenarios representing relevant development trajectories, regardless of whether or not they are desirable from the perspective of the company in question, including the following:
  - an as-usual growth scenario that can be used as a point of comparison with the usual forecasts, despite the unrealistic nature of such a scenario;
  - two scenarios describing differentiated low-carbon transition pathways;
- these scenarios should have a strong internal cohesion, i.e all components should be developed in such a way that they are compatible with one another. It would not be very coherent, for example, to have a sustained increase in household income and a drastic drop in consumption at the same time;
- the scenarios should be clearly different from one another.

2.2 CARBONE 4'S PHYSICAL FLOW APPROACH

A TWO-STEP METHODOLOGICAL APPROACH

The methodological approach recommended by Carbone 4 is based on the physical reality of the world, unlike certain traditional approaches that 'simply' end up distorting the economic figures in the long term. This approach consists of the following two stages: the initial **physical analysis** first of all, followed by **the economic and financial component**.

Since the ultimate aim of the low-carbon transition is to bring our human societies into line with the physical limitations of our environment, it is absolutely vital that we begin with a physical representation of the

9 Recommendations of Task Force for Climate related Financial Disclosure (TCFD), June 2017

world resulting from the scenario in question in terms of the amount of energy consumed, raw material flows, vehicle fleet, number of m^2 built or renovated, etc. It is then possible to analyse the impact that the profound changes brought about by the selected decarbonised transition scenarios will have on a company's business activity (demand, supply, competitive pressure, etc.).
Modelling the financial impact on business activity comes later, based on the results of the initial step.

It is vital that this chronology be adhered to. Beginning these analyses with a purely economic and financial approach, i.e. 'simply' distorting economic figures without having understood the underlying physical processes, can make it impossible to achieve an accurate understanding of the impact each scenario would have on the company's business activity as it would be masked by a series of economic and financial factors that, standing alone, would make it impossible to do the following:

- physically represent the developments taking place within the world;
- identify the risks and opportunities that such developments would present to the business;
- assess the compatibility of this trajectory with the planet's environmental limitations and available resources.

The CEO's strategic decision-making capabilities would then be significantly affected, particularly in the medium and long term.

STEP 1: THE PHYSICAL ANALYSIS

A 4-step process is used to model the impact on demand in various transition scenarios by physical flow:

Principles of the physical flow approach

- Identifying and quantifying **the impact of transition scenarios** on **demand** can help to formulate some **initial major strategic recommendations** for the company.
- These conclusions regarding the 'demand' component can be supplemented where the **'supply' component** is concerned by **modelling competitors' awareness of changes in the demand**, notably by analysing their respective competitiveness and differentiation factors.

STEP 2: THE ECONOMIC AND FINANCIAL MODELLING OF THE IMPACT ON BUSINESS

With the impact on the company's business activity having been physically quantified in each scenario, this will then need to be translated into potential economic consequences for the company in question.

The following information is modelled in order to do so:

- **Unit sale price** (volumes are obtained from the physical analysis);
- **CAPEX**: investments affected by the scenario;

- **OPEX**: an analysis of the cost structure: cost of inputs, cost of energy (differentiated by source), salary levels...
- **Taxation**: carbon tax and environmental taxation in particular.

These developments are incorporated in order to recreate the balance sheet, P&L and statement of cash flows for each scenario within the relevant time scale. The various trajectories can then be compared with one another, allowing company directors to identify strategic directions that combine resilience with performance.

The exact impact on the competitive landscape also becomes clearer at this stage thanks to a more accurate modelling of the changes in the relative competitiveness of the players concerned. The winners and losers of the major disruptions caused by transitional trajectories are also better identified as a result.

2.3 TAKING THE NEXT STEP

The scenario-based analysis tool combined with Carbone 4's physical flow approach makes it possible to do the following:

- **to assess the resilience of the company's business activities** in different scenarios, including some that reflect the transition to a low-carbon world;
- **to identify strategic directions** that will improve its resilience for improved performance in the medium and long term.

This scenario-based analysis is recommended by the TCFD and Carbone 4 has already supported a number of **Departments of Strategy, Executive Committees and top-management teams of major companies in a variety of sectors** (including mining and metallurgy, heavy industry, manufacturing, environmental services, logistics and transport, and property) in this respect.

The publication of the results of these works, which focus on matters of strategic importance for the company, **is something that each company will need to look into further itself. Publishing confidential strategic information is, of course, out of the question,** but **factual information**, both qualitative and quantitative, can indeed be shared for the purposes of **gauging the resilience** of the company's **business activity**. Global mining industry leader BHP is a fine example, showing the variation in the EBITDA of its various business units between a BAU scenario and a 2°C scenario.

Finally, this issue of publication is part of a second phase and must be dealt with in a manner appropriate to the specific context. It should not be seen as an excuse for not using this type of analysis, which provides key information relating to the company's strategic thinking.

Finally, Carbone 4 has been working on **continually improving** this powerful scenario-based analysis tool in the following ways:

- **by developing holistic '2°C' scenarios** designed to reflect differentiated transition trajectories and serve as alternatives to the AIE's 2DS scenario (which places a lot of emphasis on energy efficiency and the capturing and storing of CO_2);
- **by modelling and monetising the physical risks** associated with climate change, focusing on the company's material assets.