Investment and Fiduciary Analysis of Prudent Strategies for Divestment of Securities Issued by Fossil Fuel Reserve Owners

Response to NY Comptroller RFI

Paris, June 15, 2018

carbon 4 finance

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Executive Summary

Company Name	*Carbon4 Finance*
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Carbon4 Finance develops solutions with its financial clients (through API and decentralized self-assessment tools) to embed climate data in the credit and investment decision-making processes and to automate these processes.

Different climate indicators lead to different financial decisions. Carbon4 Finance's pioneering bottom-up methodology for analyzing underlying assets allows asset owners, managers, and banks to make decisions based on the real climate performance of their assets, not on statistics or partial approaches. The methodology is specially adapted to capturing the opportunities of a changing world, in addition to evaluating exposure to transition and physical climate change risks.

A fully independent entity, Carbon4 Finance has already enabled its clients to demonstrate their alignment with the Paris Agreement and to build successful low-carbon indexes.

Carbon4 Finance recommends a bottom-up approach to analyzing securities as part of the System's divestment strategy, consisting of security-level analysis and indicators.

To ensure a robust analysis of the System's securities in line with their fiduciary duty, the System should call upon two types of specialists: a carbon expert and a financial expert. Carbon4 Finance envisions a collaboration between these two areas of expertise in order to ensure optimization of investment and carbon constraints.

In addition to fossil fuel reserves, a consistent set of indicators should be evaluated for all fossil fuel reserve owners in order to accurately compare performances and reduce selection bias. Indicators such as emissions savings and forward-looking ratings, when measured from the bottom-up, provide the best basis for selecting the best- or worst-in-class.

A. General Information

Company Name	*Carbon4 Finance*
Address	*54 Rue de Clichy, 75009 PARIS, France*
Website	*carbon4finance.com*
Representative	*Matthieu MAURIN*
Phone	*+33 689 32 07 59*
Email	*Matthieu.Maurin@Carbon4Finance.com*
Occupational and professional status and background	*Managing Director, Carbon4 Finance* *Matthieu Maurin develops the service offer of Carbon4 Finance which provides relevant and reliable information to investors to adapt their climate policy. Before joining Carbon4 Finance in September 2017, Matthieu worked for over fifteen years in the energy and finance sectors where he acquired a strong expertise in integrating ESG into credit & investment processes and in the development of climate-oriented financing policy. Matthieu developed the CSR Screening used by BNP Paribas Corporate Bankers and led the business development effort of BNP Paribas CIB Sustainable Finance team towards corporates involved in clean energy.* *Matthieu is a French national and holds an engineering degree from INPG and a MS from ENSAM Paris.*
Investment Analysis Services	*Carbon4 Finance is able to provide the investment analysis services described in the RFI "Investment and Fiduciary Analysis of Prudent Strategies for Divestment of Securities Issued by Fossil Fuel Reserve Owners" and is likely to respond to the resulting RFP. Please refer to Attachment 1 for further information.*

B. Information Requested Regarding RFP and Investment Analysis Services

RFP Structure for Investment Analysis Services

1. What specific areas, factors, risks and impacts should an RFP consider in order to enable selection of a provider or providers that can best conduct comprehensive and in-depth Investment Analysis Services?

The capacity to provide reliable indicators on which to base divestment decisions is paramount. Therefore, Carbon4 Finance recommends that the robustness of the methodology applied be a key factor in selecting a provider. A bottom-up approach to the carbon analysis of securities is essential in order to accurately compare company performances and select best- or worst-in-class. With a bottom-up approach, each portfolio constituent undergoes in-depth analysis, using consistent method and scope, to avoid two commonly made errors: analyzing only data reported by companies, and filling gaps with statistical analysis which is too limited or false. Other reasons supporting a bottom-up approach are summarized in the following table.

	Bottom-up Carbon4 Finance	Input-Output model
Use of physical emissions factors (rather than monetary EFs)	Yes	No
Data precision and certainty level	High	Low
Estimation of emissions savings (focus on opportunity not just risks)	Yes	No
Ability to capture forward-looking trend (alignment of investments and targets with 2-degree goals)	Yes	No
Enables intra-sector comparison (best in class) and stock-picking	Yes	No
Enables dialogue with companies on what and *how* they can improve	Yes	No
Adapts to level of information reported by the company (e.g. fuel efficiency of vehicles produced when available vs. average)	Yes	No

2. What other important questions should be included in an RFP that includes Investment Analysis Services?

3. What information and format do you believe would be useful for soliciting and evaluating Investment Analysis Services?

4. What criteria, experience and qualifications for services providers should be considered for Investment Analysis Services?

Approaches to Investment Analysis Services

5. What do you believe are best approaches to:

a. Determining the scope of companies, including further defining fossil fuel reserve owners, appropriate for divestment.

The following factors, in addition to fossil fuel reserves, should be measured and considered in defining the scope of companies for divestment:

- **Scope 3 emissions:** how dependent is the company's financial performance on its upstream and downstream emissions? This is a critical factor that applies to all sectors, not just fossil fuel companies. For instance, automobile manufacturers, whose revenues are dependent on the downstream combustion of fossil fuels.
- **Emissions savings**: for each metric ton equivalent of CO_2 emitted, how many tons of emissions are avoided or saved?
- **Forward-looking assessment**: Where is the company headed? Are its investments (capex, R&D) in line with a 2-degree trajectory?

b. Determining the timetable and specific milestones within a five-year period appropriate for divestment.

c. Assessing appropriate divestment approaches based on asset classes, strategies and styles.

A consistent set of indicators should be evaluated for all companies / all sectors within a portfolio in order to maintain diversification. The indicators mentioned in part A., when measured from the bottom up, provide the best basis for selecting the best- or worst-in-class within a sector.

Different methods lead to different investment decisions

Example from a sample portfolio: top 3 performers based on various indicators

		Scope 1&2	Scope 1, 2 & 3		Total avoided / total induced
Name	Sector	Induced emissions intensity (Scope 1+2) tCO2e/M€	Total Induced emissions intensity (Scope 1+2+3) tCO2e/M€	Total emissions savings intensity tCO2e/M€	Savings per unit of induced emissions
Company A	Transport	97	111	-	-
Company B	Heavy industry	780	780	(23)	0,03
Company C	Building material	3	9	(78)	8,43
Company D	Heavy industry	25	25	(1)	0,05
Company E	Energy	174	216	(100)	0,46
Company F	Building	0	0	(0)	0,16
Company G	Energy equipment	4	119	(66)	0,56
Company H	Waste	136	136	(89)	0,65
Company I	Forest & paper	46	64	(37)	0,58
Company J	Wind energy equipment	82	82	(815)	9,89

d. Analyzing the investment risks posed by climate change and fossil fuel reserve owners to the Systems' portfolios (including scenario analysis).

e. Analyzing potential investment impacts on the Systems' portfolios of divesting from the securities of fossil fuel reserve owners, including impacts on return, risk, diversification and cost (including tracking error).

f. Assessing potential alternative investments available to the Systems that have risk and return characteristics equivalent to the securities that may be divested.

6. Are there any precedents that can help guide the approach to analyzing the impacts of and determining a prudent strategy for divesting from fossil fuel reserve owners?

7. What are ways to address the costs of externalities in investment portfolios that can help mitigate risk?

8. How do you view the extent to which the market currently prices in climate change risk and, specifically, the economic and investment risks related to the carbon intensive businesses such as fossil fuel reserve owners?

9. How could divestment be effective in influencing fossil fuel reserve owners to take steps toward addressing carbon risk?

Attachment I – Specifications and Requirements

a. What services can you provide that could satisfy the Investment Analysis Services sought in the above-referenced RFP? Describe briefly what other services relating to mitigating climate change or carbon risk you can you provide.

Having reviewed the objectives of the Investment Analysis Services, Carbon4 Finance recommends a collaborative approach to fulfilling these objectives. Two main areas of expertise are required: carbon risk and investment/financial risk. As an expert in the former, Carbon4 Finance is qualified to provide robust and consistent analysis of a selected universe of securities from a carbon/transition risk point of view. More specifically, Carbon4 Finance is prepared to respond to all objectives requiring in-depth knowledge and practice in the analysis of carbon risk with respect to investment portfolios, and to collaborate with outside firms on the analysis of financial risk and returns, as identified in the table below.

Objective	Required Expertise
1. Identifying a potential divestment strategy that fulfills the Systems' fiduciary duty to their beneficiaries	Carbon risk expertise Financial risk expertise
2. Achieving and fulfilling the Systems' investment policy and objectives, including risk and return goals	Financial risk expertise
3. Identifying the investment risks posed by the assets considered for divestment to the Systems' portfolios	Financial risk expertise
4. Determining the scope of companies for divestment consideration	Carbon risk expertise
5. Determining an appropriate timetable for divestment	Carbon risk expertise Financial risk expertise
6. Evaluating the impacts of divestment on the returns, risk, diversification and costs of the Systems' investment portfolios	Financial risk expertise
7. Identifying the availability of alternative investments with equivalent economic features to the assets considered for divestment	Carbon risk expertise Financial risk expertise

In order to fulfill the above-mentioned objectives of Investment Analysis Services, Carbon4 Finance is able to provide the following services:

i. Coverage test of securities held by the System
ii. Application of Carbon Impact Analytics (CIA) methodology* to the System's portfolios
iii. Selection of securities most at risk (from a carbon/transition risk point of view), according to a variety of CIA indicators (indicators include fossil fuel reserves)
iv. Proposition of alternative securities with similar economic characteristics, both within and outside of the System's portfolio
v. Optimization of the portfolio via reweighting to achieve the carbon goals outlined in the System's divestment strategy, which may include achieving alignment with a global warming trajectory and the goals of the Paris Accord
vi. Cross-check of carbon-optimized results with investment constraints (diversification, returns, tracking error, etc.)
vii. Repeat of the previous steps as necessary in order to optimize both carbon and investment constraints

*Please refer to Attachment II for details on the Carbon Impact Analytics methodology.

In addition, we offer the following support services:

a. Workshop:

When the carbon impact analysis of a portfolio analysis is done, Carbon4 Finance organizes a workshop to explain its results.
This workshop will cover:
- key conclusions regarding the carbon impact of the System's portfolios, which includes an analysis of the sectorial/geographical distribution impact and, thanks to our bottom-up methodology, constituent-level comments,
- positioning of the System's portfolios in relation to a 2°C scenario, benchmarking with the broader economy and drafting the key milestones of a roadmap to meet the objectives of the System's divestment strategy
- recommendations for next steps

b. Support from the research team:

The System's would have access to Carbon4 Finance's research team to follow-up on every corporate or sovereign assessed.
A dedicated email address is available to engage with the analyst team with a commitment to reply to any query within 2 business days.

c. Training & marketing support services:

Carbone 4, thanks to its consultancy branch, is able to offer consultancy services to follow-up on the results of analysis and help the Systems to better understand their climate impact and to reconcile carbon and investment constraints.

b. Describe your business including your primary business activity and all the professional services that you or your company or organization provide.

Carbon4 Finance develops carbon data solutions for financial service providers to help them align their strategy with a 2-degree compatible pathway.

Carbon4 Finance supports asset managers, asset owners, banks, and index providers who wish to report their climate performance or develop climate investment tools and policies based on custom data solutions.

We offer four main services:

i. TRANSITION RISKS AND AVOIDED EMISSIONS

Carbon Impact Analytics (CIA) is a methodology for assessing the climate impact of portfolios through measurement of greenhouse gas (GHG) emissions directly and indirectly induced and saved by companies.

Carbon Impact Analytics also provides an assessment of the alignment of investor and lender portfolios with a climate-focused strategy.

Our clients use Carbon Impact Analytics data in a variety of ways:

- To measure the climate impact of investments and benchmark portfolios to a 2°C compliant world
- To disclose or anticipate disclosure on climate impact, in line with TCFD recommendations
- To integrate transition risks into investment or credit decision-making
- To enhance dialogue and engagement efforts
- To enhance internal research or insights

Carbon Impact Analytics features two main delivery methods:

- **Portfolio analysis and reporting**: for clients wishing to measure and report the climate impact of their investment or credit portfolios
- **Database access**: for clients wishing to drive their own research and investment strategy and create new products.

Key Figures:

- 3 gigatonnes CO2 emissions savings calculated, equivalent to the emissions saved by 1,500,000 wind turbines over 1 year
- 500 process and geo-specific emissions factors used in calculations

ii. PHYSICAL RISKS

Climate Risk Impact Screening (C.R.I.S) is a method developed for financial service providers to assess the exposure of their asset portfolio to physical risks. The method applies to multi-asset investment portfolios (stocks, corporate and sovereign bonds, real assets).

Clients use C.R.I.S to measure the exposure of their investments to growing climate risks, factor these risks into their strategy. C.R.I.S provides several indicators that allow us to obtain multiple levels of detail on physical risks: from an overall assessment for reporting purposes to a detailed assessment to engage with underlying companies.

More information on crisforfinance.com

Key figures:

- 60 sector-specific vulnerability profiles developed
- 16 direct and indirect climate hazards studied

iii. SECTORIAL KPIs

The Sectorial KPIs offer is geared towards financial service providers who wish to use relevant and reliable company data to implement their climate policy (exclusion of some activities, investment or exclusion criteria involving weighting of some businesses, etc.)

Our set of KPIs, issued from Carbon Impact Analytics, allow clients to identify the share of their investment portfolio that is green or climate-friendly with a unified methodology.

We operationalize climate policy by directly screening corporates within a defined investment universe that align with custom investment or credit policies.

We filter investment or credit portfolios to flag corporates based on defined KPIs (green share, activities with strong positive or negative climate impacts, etc.).

Key figures:

- 40 high-stakes sectors analyzed on a bottom-up basis
- 1,000 individual company-level, sector-specific data items that can be used to develop exclusion or financing policies

iv. CLIMATE INTEGRATION & INDICES

This offer is designed for structured financing teams willing to develop climate indices or derivative products, or to embed climate criteria into their financing, as well as index providers who require reliable data to develop climate-driven indices or to develop a climate filter for

an existing index. Asset managers may also benefit from this offer to develop a thematic fund with relative climate data.

Our CIA and CRIS methodologies can be used to develop holistic or sector-specific investment strategies.

Euronext has used the Carbon Impact Analytics methodology since 2015 for its Low Carbon 100 index.

Other climate indices distributed by Euronext are built with Carbon4 Finance data and used in structured debt products distributed in several retail networks.

Key figures:

- 2017 - LC100 outperformed its benchmark in terms of yield and volatility

c. What skills, experience, expertise or tools do you have that enable you to provide Investment Analysis Services? Please include a list of similar prior projects and/or services; a description of experience with providing similar services to public pension funds or other institutional investors; and the length of time that you and your company or organization have provided such services.

Our value added:

- The reference independent carbon data provider with a unique blend of expertise and experience. Stability of the structure with over 10 years of experience and a stable and independent ownership,
- Proven track-record with leading asset owners and managers in the EU and the US,
- Most comprehensive analysis available on the market: Bottom-up analysis which goes beyond sector-level analysis, including scope 3 and avoided emissions
- Alignment of portfolio emissions with a 2°C scenario which enables implementation of a forward-looking action plan
- Physical risk analysis. Single independent climate data provider addressing all TCFD's recommendations
- Member of the Technical Expert Group on Sustainable Finance appointed by the European Commission

Innovation

Carbon4 Finance allows asset owners, asset managers and banks to make financial decisions based on the real climate performance of their assets, not on statistics or partial approaches. This is accomplished through a **unique bottom-up approach** to measuring **Scope 3 emissions, emissions savings, and other sector-specific indicators including forward-looking ratings**. The bottom-up nature of Carbon4 Finance data greatly enhances data precision, better enabling you to identify the best-in-class within a sector or sub-sector, realign portfolios to meet 2-degree goals, create new products, and drive insights and engagement efforts.

Carbon4 Finance's methodology is **transparent and scientific**, allowing clients to improve and maintain their reputation. The methodology is ambitious and **compatible with tomorrow's international disclosure standards, including TCFD recommendations**, therefore positioning its clients as industry leaders and reducing the risk of mid-course adjustments.

Developments

Carbon4 Finance develops solutions with its financial clients (through API and decentralized self-assessing tools) to embed carbon data in the credit and investment decision-making processes and to automate these processes (list of excluded and monitored companies, automatic carbon footprint reports, etc.).

Going further, Carbon4 Finance will develop an optimization engine to automatically reallocate existing portfolios to be compliant with a low-carbon trajectory and 2-degree goals, either through sectoral allocation of capital or through cost-efficient stock-picking.

Experience

Carbon4 Finance's team of analysts leverage on the **10 years of experience** of Carbone 4, a leading advisor in climate analysis which designed the methodologies used and owned by Carbon4 Finance to assess transition and physical risks.

For the past five years, we have conducted >20 assignments in the financial sector and our data are being used to manage over € 1,7 Tn of assets under management.

Selected Recent References:

AG2R La Mondiale, French Asset Owner

Date of appointment: Jan. 2017

Project Overview: Development of a methodology to calculate the scope 3 of financial institutions, carbon footprint of the investment portfolio, supply of a database on the carbon footprint on a broad investment universe, alignment of the portfolio with a 2°C-compatible trajectory.

Euronext, Dutch Stock Exchange

Date of appointment: 2015

Project Overview: Development of the Low Carbon 100. This index and three other climate indices are manufactured with our data and commercialized by Euronext.

Mirova, French Asset Manager

Date of appointment: oct. 2014

Project Overview: Carbon footprinting and risk transition analysis of Mirova Public Equity, Fixed Income Private Equity and Infrastructure portfolio.

Russell Investments, US Asset Manager

Date of appointment: 2017

Project Overview: provision of sector-level and Key Performance Indicators to embed in Equity Research.

Gecina, Real Estate Manager

Date of appointment: 2017

Project Overview: Physical risk screening of their real estate portfolios and adaptation plan.

Agence Française de développement, French Development Bank

Date of appointment: 2015

Project Overview: Development of an online tool to assess physical risks on infrastructure projects in several emerging countries.

Meridiam, French Infrastructure Fund

Date of appointment: 2015

Project Overview: Portfolio carbon footprinting and several climate due diligences on infrastructures.

d. Would you be willing to serve as a fiduciary to the Systems if you performed the Investment Analysis Services?

Yes, Carbon4 Finance would be willing to serve as a fiduciary to the Systems if it performed the Investment Analysis Services.

e. What are your sources of income other than from clients? If you are a not-for-profit organization, please identify your donors.

None.

f. What is the estimated pricing structure and cost for provision of Investment Analysis Services?

The following price structures correspond to our standard offers and would require adjustments to meet the specific needs of Investment Analysis Services.

1. Carbon Impact Analysis of a portfolio

The assessment of the Systems' portfolios would be priced at 10k€/portfolio.

Transition risks will be assessed on all constituents of the System's universe included in the C4F database and the coverage ratio will be maximized by statistical analysis.

Results will be aggregated at the portfolio level and line-by-line data disclosed for database subscribers.

A report in word or ppt format will be provided with an analysis of the portfolio's performance.

The Systems would be authorized to publish this report or use its contents. A workshop will be organized to debrief System members on our conclusions.

2. Data Offer

The below price structure is for our basic offer. In this offer are included rights to consult, download, store and use the data.

Specific offers can be made to have redistribution rights and rights to sell indexes and benchmarks based on C4F data.

We are ready to customize our approach for the Systems as need be and will be happy to work with you towards meeting your divestment goals. We encourage you to discuss the below price structure with us should you have any concerns, as the scope of services and hence the fees can always be adjusted.

The fees to subscribe to the whole content of the database (transition risk and physical risk on c. 2,500 constituents, corporates, covered bonds or sovereigns) is set at a lump sum of **120,000€/y**.

The fees to subscribe to the whole database but for CIA (transition risk) data only is set at **60,000€/y**.

Tailor-made subscription for specific service/universe is possible at the below prices (by year):

	CIA (transition risk)	***CRIS (Physical Risk)***
License fixed term	***10,000 k€***	***10,000 k€***
Term depending on the universe subscribed		
All Equities	***30,000€***	***30,000€***
Equities Europe (c.600 lines of which all constituents of Eurostoxx 600)	*7,500 €*	*7,500 €*
Equities US (c. 500 lines, of which all constituents of S&P 500)	*7,500 €*	*7,500 €*
Equities World (c. 1450 lines, of which all constituents of MSCI W)	*27,000 €*	*27,000€*
All Fixed Income Issuers	***30,000€***	***30,000 €***
Sovereign issuers (77 lines of which all emitters of bonds listed in BB EURO Aggregate)	*3,000 €*	*3,000 €*
Corporate EURO issuers (833 lines of which all corporate issuers of bonds listed in BB EURO Aggregate)	*18,000 €*	*18,000 €*
Green Bonds (130 lines of which all constituents of BB MSCI Green Bonds index	*20,000 €*	*20,000€*

The License price is not related to the number of persons using the data nor to the AUM.

5 users will be registered and be authorized to communicate with the C4F Research Team.

If more users would like to be registered and be granted access to the Research Team, a tailor-made offer can be made.

Prices by line are available for additional lines:

- Fixed income and Public Equity:
    - 500 € for a bottom-up review of issuers not included in the OECD High Income country list,
    - 400 € for a bottom-up review of within OECD High Income Country list.

Extension of the universe to other corporates and sovereign on a statistical basis : 4,000€ for 1,000 lines.

3. Advisory services

Our Man.daily rates are the following:

- Manager level: 1,600 € excl tax

- Analyst level: 1,200 € excl tax

Attachment II - Research Methodology for Transition Risk Services

Investors are increasingly inclined to address climate change issues (fostered by TCFD recommendations), and legislators require investors to report on both types of risks. Climate change exposes companies to several types of risk, all with a likely impact on their financial performance.
For instance, the consequences of climate change will have an impact on the value of investment portfolios and on the asset owners' solvency. Bottom-up analysis is recommended for this type of risk.

We propose that the Systems use Carbon4 Finance proprietary methodology, Carbon Impact Analytics (CIA), to calculate the carbon footprint of its investments at the portfolio and issuer levels. This method was developed in 2015 with support from a consortium of leading asset managers and asset owners, including Mirova and MAIF, and has been used by Carbon4 Finance clients ever since to report on and optimize the carbon footprint of their investments.

Here, we summarize the main methodological foundations of CIA.

CIA is based on the bottom-up assessment of an issuer's climate impact and can be applied to any kind of security (stocks, bonds, etc.). It assesses key carbon metrics (Scope 1, 2 and 3 induced and saved emissions) for each holding.

1. Methodological approach

1.1 Overview

CIA is a sector-specific approach to measure corporate energy and climate performance. The following Key Climate Indicators are assessed individually for companies in high-stakes sectors:

- **Induced emissions scope 1, 2 and 3:** CO2e emissions directly or indirectly induced by the activities of the company.
  - Bottom-up calculation of each company, company-level data and aggregated at the portfolio level
  - Differentiation of the carbon footprint by emission scope (scope 1 and 2 vs. scope 3)
  - Induced emissions expressed in absolute and intensity terms (per million euro of enterprise value and / or turnover).

- **Scope 1, 2 and 3 emissions savings**: CO2e emissions directly or indirectly saved by the activities of the company; calculation methods vary by sector and include reduced emissions (based on changes in carbon intensity over the past 5 years) and avoided emissions (i.e. against a reference scenario, i.e. an IEA scenario 2C).
  - Bottom-up calculation of each company, company-level data and aggregated at the portfolio level
  - Differentiation of the carbon footprint by emission scope (scopes 1 and 2 vs. scope 3)
  - Emissions expressed in absolute and intensity terms (per million euro of enterprise value and / or turnover).

- **The Carbon Impact Ratio (CIR):** a simple and effective indicator of carbon performance, equal to the ratio of emissions saved over induced emissions.

- **A forward-looking rating:** assessment of the company's overall long-term strategy based on four sub-criteria: long-term climate change strategy, alignment of investments with 2-degree scenarios (R&D, capex for low-carbon projects, etc.), the level of ambition of its carbon intensity reduction targets (scope 1, 2 and 3).

- **Green share:** share of revenue that currently contributes to the low-carbon transition. The criteria used to calculate the green share vary by sector:
  - Energy sectors: For electricity and heat producers, the Green share is equal to the share of MWh derived from low-carbon sources (hydro, wind, solar, and, depending on the wishes of the entity that communicates, nuclear).
  - Transport: share of revenue generated by low-carbon means of transport.
  - Suppliers of equipment and solutions with potential for reducing emissions: share of revenues related to low-carbon equipment (more efficient replacement equipment in the building sector such as heat pumps or some car manufacturers, wind turbine towers, solar panels, etc.).

- **Brown share**: share of investments in coal-related assets. For energy sectors, the brown share is equal to the percentage of MWh generated from coal. For fossil fuel producers, the brown share corresponds to the company's share of revenue generated by the sale of coal.

These KPIs are then consolidated at the portfolio level via a weighted average.

1.2 A bottom-up approach

CIA measures the exhaustive carbon footprint of companies through **a bottom-up approach.** Each asset is analyzed **individually and in a discriminating manner** before consolidation of results at the portfolio level. Carbon Impact Analytics therefore delivers both the results at the portfolio level and at the level of each analyzed company.

This methodological choice allows for the comparison of the carbon performance of companies within the same sector, contrary to statistical methodologies, which calculate the carbon footprint based on sectorial ratios.

The stakes of the low-carbon transition vary according to the economic sectors. Most GHG emissions are generated by certain sectors, on which transition efforts must be focused. The same could be said about levers to reduce emissions and provide low-carbon innovations.

Therefore, the Carbon Impact Analytics methodology distinguishes high-stakes sectors from low-stakes sectors and carries out **a very detailed analysis for high-stakes sectors**, in order to focus the analysis effort on assets that have a material impact on the carbon performance of the portfolio. Carbon4 Finance develops sector-specific indicators and calculation modules to factor in the specificities of each sector.

This in-depth assessment of portfolio constituents covers all operating segments and is based on several operational and company-specific data: production volumes (tons of steel, MWh per source, etc.), production or sales locations, energy efficiency of the process, sources of supply, etc. The analysis is based on the various reports published by the company (annual, CSR and ESG reports).

High-stakes sectors are listed below:

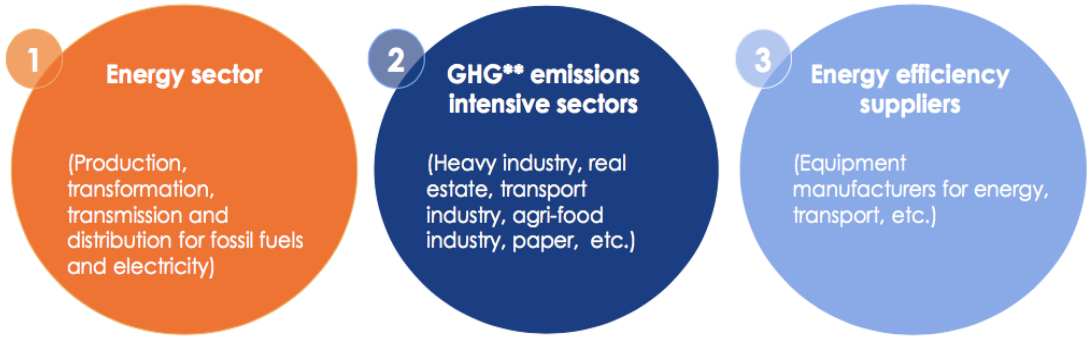


Figure 1: List of high-stakes sectors for the low-carbon transition

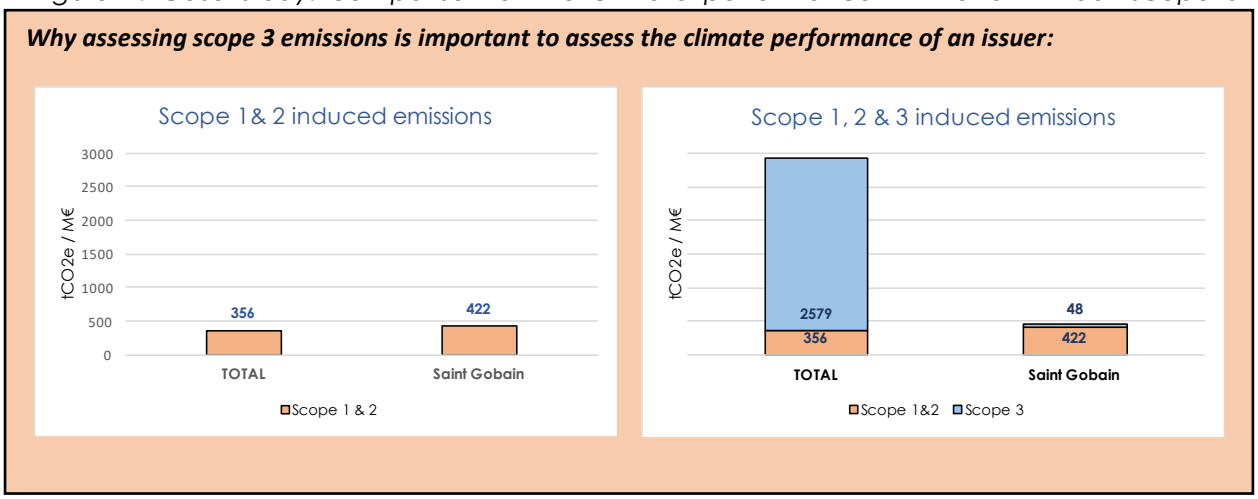
For low-stakes companies, Scope 1 and 2 data is provided. When Scope 1 and 2 data has not been published by the company, the analysis is based on the company's revenue and its sector's segmentation. An average ratio (emissions/M€) is calculated per sector on a representative sample of companies. This ratio is then applied to the company's revenue to estimate its GHG emissions.

1.3 A comprehensive measure of the carbon footprint

1.3.1 Calculation of induced emissions

Carbon4 Finance, with its unique experience in carbon footprinting and analysis since 2007, has in-depth experience in the main sources of GHG emissions. Indirect emissions (categorized in scope 3) are predominant for many sectors of activity. In order to have a real picture of the risks and opportunities linked to climate, accounting for these emissions is paramount.

Figure 2: Case study: comparison of the climate performance with and without Scope 3 emissions



Scopes 1 and 2 are recalculated, and if the result is consistent with the issuer's reported emissions, we select the issuer's reported emissions. Scope 3 is always calculated, to ensure a consistent approach within a sector.

1.3.2 Calculation of emissions' savings

Beyond the carbon footprint, it is necessary to take into account a company's capacity to contribute to the low-carbon transition: reduce its emissions, decarbonize its customers, etc. CIA measures **emissions savings (scopes 1, 2 and 3)** to steer investments towards solutions for the low-carbon transition. Induced and saved emissions (scopes 1, 2 and 3) are calculated over the same scope of activity and the same period.

To evaluate the alignment of an investment portfolio with the low-carbon transition, an additional indicator is necessary, complementary to the carbon footprint. A firm in a highly carbon intensive sector could contribute significantly to decreasing emissions, for instance by creating a disruptive product or process. This additional indicator should therefore help to understand how disruptive an underlying firm is, either through more efficient processes or through carbon-efficient products or services.

Calculation methods vary by sector and include reduced emissions (based on changes in carbon intensity over the past 5 years) and avoided emissions (i.e. against a IEA's reference 2°C scenario). The reference scenario is sector-specific. Emissions savings are always calculated to ensure a consistent approach within a sector.

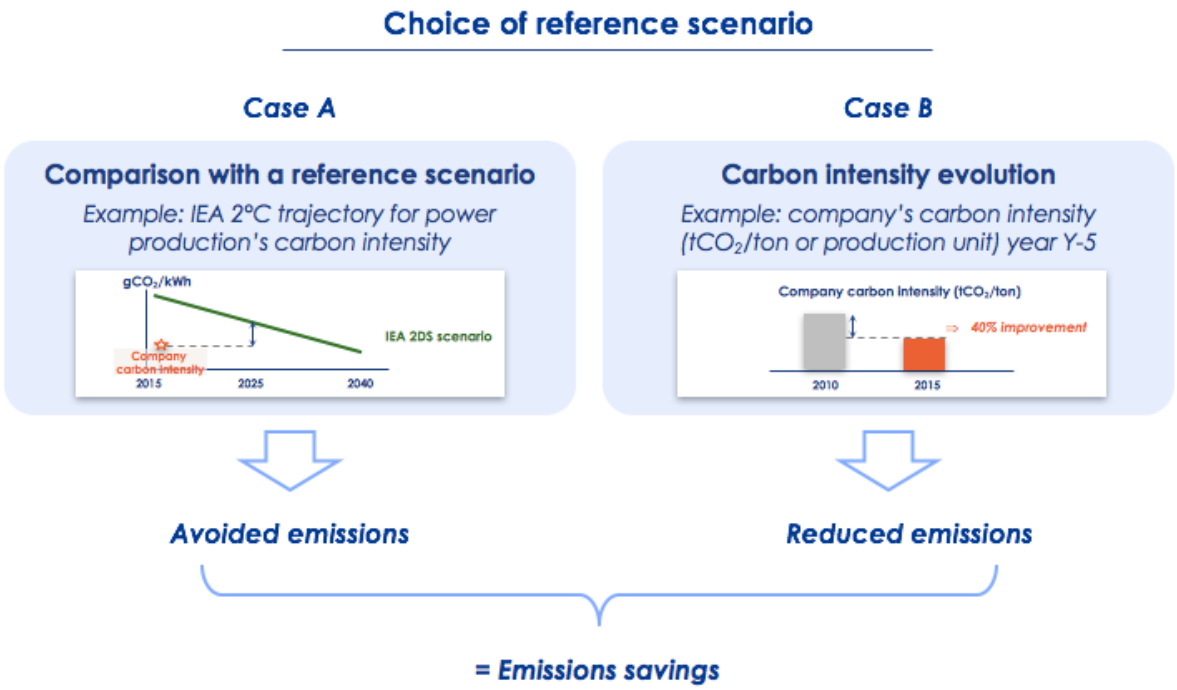


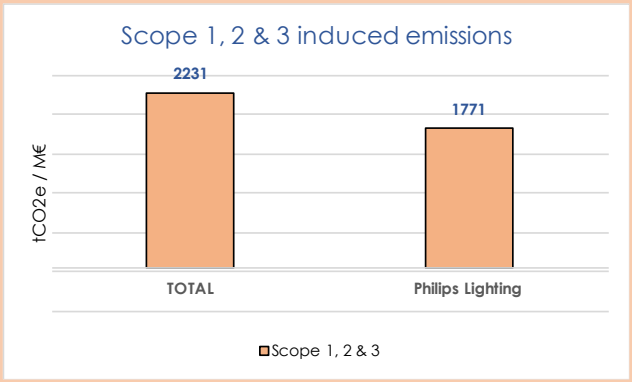
Figure 3: Choice of reference scenario to compute emissions savings

In addition to the absolute figure of induced or avoided emissions, the extent to which a firm reduces GHG emissions relative to its total emissions is a key performance indicator.

Note: emissions savings cannot be subtracted from the induced emissions. To calculate a global performance indicator, we divide the emissions savings by the induced emissions. This ratio is call the CIR: Carbon Impact Ratio.

$$\text{Carbon Impact Ratio (CIR)} = \frac{\text{Emissions Savings}}{\text{Induced Emissions}}$$

Why assessing emissions savings is important to assess the climate performance of an issuer:



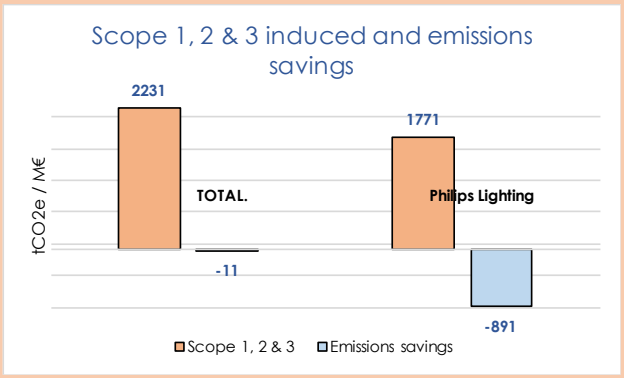


Figure 4: Case study: comparison of the climate impact with and without emissions savings

Omitting avoided emissions in investment decision-making would skew the carbon performance of a portfolio. The previous example shows that when only induced emissions are considered, TOTAL and Philips Lighting are both emissions intensive. But, once emissions savings are considered, Philips Lighting has a strong contribution to the low carbon transition ($CIR_{TOTAL} = 0.005 < CIR_{Philips} = 2.0$).

1.3.3 Financial carbon intensity

The carbon intensity may be calculated using several metrics.
For corporates, we recommend using the Enterprise Value (EV), which is relevant for both stocks and bonds.
For Sovereigns, we recommend using the GDP or National Debt.

Other financial or sectorial ratios are available and these ratios can therefore be customized with the client.

At portfolio level, for securities, we generally aggregate the financial carbon intensity of corporate constituents using the EV ratio and, separately, aggregate sovereign issuers by using the ratio of emissions to GDP.

1.3.4 Forward looking rating

In order to evaluate the company's long-term strategy, we examine four criteria:

- The company's long-term strategy
- Investments and projects in high-stakes GHG-related issues for the industry
- Reduction target of scope 1&2 emissions intensity
- Reduction target of scope 3 emissions intensity.

The rating of each criterion is adapted to each sector.

1.3.5 Calculation of the overall rating

Finally, an overall rating is provided for each company. This rating seeks to assess the company's impact on climate change and its contribution to reduced GHG emissions, while taking into account induced emissions, avoided emissions and the forward-looking analysis.

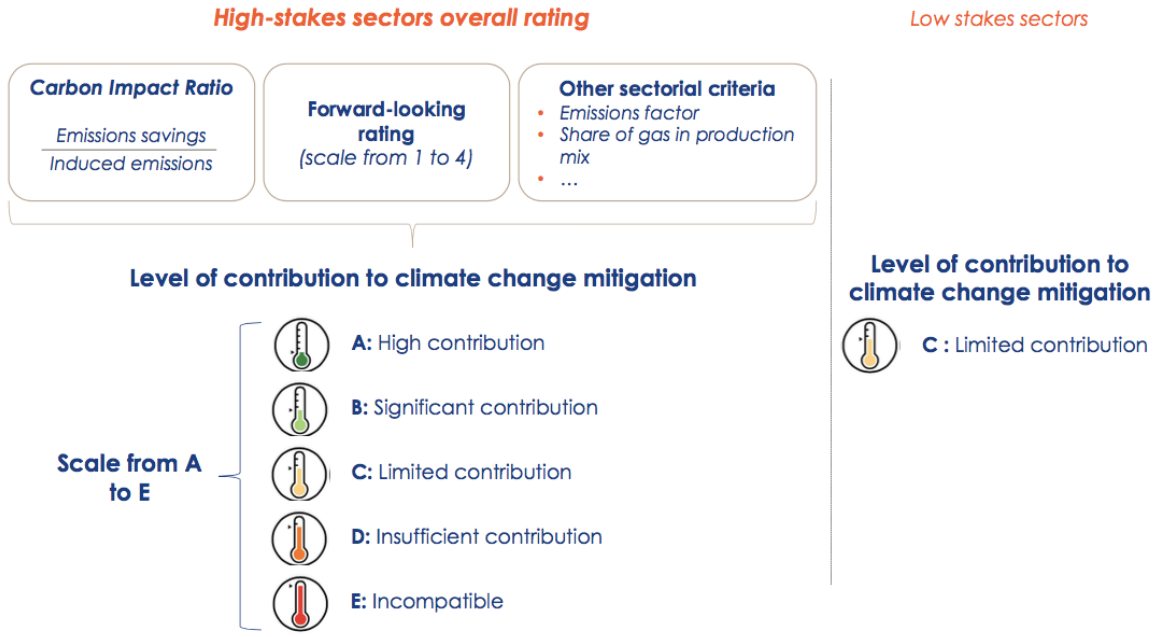


Figure 5: Overall rating construction

This rating is sector-based, which allows benchmarking within sectors and between sectors.

1.3.6 Aggregation principle for the overall rating at the portfolio level

At the constituent level, the overall rating is a synthesis of all indicators previously analyzed (induced and avoided emissions, Carbon Impact Ratio and qualitative forward-looking indicator). It provides an evaluation of the overall carbon performance of a constituent. At the portfolio level, it is necessary to evaluate the carbon performance of the portfolio, so two particular representations of the ratings are of greatest interest for asset managers:

- An overall carbon performance rating of the portfolio, calculated based on the overall ratings of financial securities in the portfolio;
- A distribution of overall ratings of underlying companies in the portfolio (weighted share of overall ratings of companies).

2. Aggregation principles for a portfolio

2.1 Aggregation principle for emissions

- Eliminating double-counting of carbon emissions

Double-counting of emissions takes place when the same ton of GHG emissions is counted more than once within a portfolio, typically due to compilation of indirect induced and avoided emissions within the same value chain. For example, GHGs emitted by a truck's fuel combustion is taken into account as a direct emission for the company operating the truck, as an indirect emission for the company producing the fuel, and as an indirect emission for the company that manufactured the truck. In this example, if all 3 companies are included in the portfolio (the freight company, the truck manufacturer and the energy supplier), induced emissions from fuel combustion in the truck's engine will be taken into account three times. Addressing double-counting is therefore a crucial issue in the Carbon Impact Analytics methodology.

Double-counting tends to occur between three categories of actors in the value chain:

- energy suppliers (the oil company providing fuel in the above example)
- energy and carbon intensive companies (the company operating the truck in the above example)
- companies providing equipment and solutions (the truck manufacturer in the above example)

Therefore, the Carbon Impact Analytics methodology reprocesses total figures of GHG emissions by allocating one third of the emissions of each category. Both induced and avoided emissions are reprocessed, thereby eliminating double-counting at the portfolio level.

- Aggregation of results at the portfolio level

After taking action to eliminate double-counting, the figures for induced and avoided carbon emissions are summed up separately according to their weight in the portfolio:
Step 1: Calculation of the carbon emissions (induced and avoided emissions separately) per euro of enterprise value for each underlying company in a portfolio
Step 2: Multiplication of the exposure of the portfolio to this underlying company (in million euros)
Step 3: Summation of all underlying companies' emissions at the portfolio level, induced emissions on one side and avoided emissions on the other (again, induced and avoided emissions must not to be added together)

2.2 Aggregation principle for the forward-looking qualitative indicator

Portfolio-level aggregation of the forward-looking qualitative indicator consists primarily of the distribution of the underlying companies' qualitative indicator scores. It provides the percent of portfolio values which should see their carbon intensity decrease in the coming years (thus have forward-looking ratings of + or ++), as well as those for which the opposite is true. Illustrated below is an example of this distribution:

Forward-looking rating	*Weight in the portfolio*
++	*10%*
+	*55%*
-	*30%*
--	*5%*

2.3 Aggregation principle for the overall rating

At the firm level, the overall rating is a qualitative synthesis of all indicators previously analyzed (induced and avoided emissions, Carbon Impact Ratio and qualitative forward-looking indicator). It provides an evaluation of the overall carbon performance of a firm. At the portfolio level, it is necessary to evaluate the carbon performance of the portfolio, so two particular representations of the ratings are of greatest interest for asset managers:

- An overall carbon performance rating of the portfolio, calculated based on the overall ratings of financial securities in the portfolio;
- A distribution of overall ratings of underlying companies in the portfolio (weighted share of overall ratings of companies).

3. Approach by asset class

3.1 Public equity and corporate bonds

A detailed bottom-up approach is performed for every corporate within a high-stakes sector (cf. Fig 1. above), reflecting the importance of an in-depth analysis of the low-carbon transition.

All the other companies with low stakes for the low-carbon transition are analyzed using a simplified approach, based on emissions reported by the company or on proprietary sector emission factors.

The universe covered in our CIA proprietary database is wide (about 1,860 lines) and includes all constituents of the MSCI World, S&P 500 and Eurostoxx 600 indexes.

Statistical analysis based on corporate sector distribution and our proprietary benchmark can be used to reach 100% coverage within a portfolio investment universe for every emitter not currently in our database.

Some examples of CIA analysis are provided in annexes.

3.1.1 Method

- Segmentation between high-stakes sectors and low-stakes sectors
- 40 sub-sectorial modules for high-stakes sectors
- Bottom-up approach: data collection based on annual, CSR and ESG-reports for high stake sectors
- Simplified analysis (induced scope 1&2) for low-stakes sectors.

3.1.2 Indicators

- Indicators available at both the company and portfolio level:
  - Induced emissions scope 1, 2 & 3
  - Emissions savings scope 1, 2 & 3 + CIR
  - Overall rating
  - Financial carbon intensity

- Specific portfolio indicators for equity & bonds:
  - Exposure to coal & fossil fuels, electricity mix.

- Specific company indicators for equity & bonds:
  - Forward looking strategy of the company.

3.2 Infrastructure

3.2.1 *Method*

The perimeter of an infrastructure's analysis includes the construction of the project, including the manufacturing of the materials, amortized on the lifetime of the project, the yearly exploitation and maintenance and the yearly use.
A bottom-up analysis can be undertaken, knowing that, for an unlisted infrastructure, an exchange with the infrastructure's team is needed and a data collection must be performed.

For large portfolios, we rather perform a semi-statistical approach which will be based on one, two or three characteristics of the infrastructure, generally available on the internet or in the description of the project (for example, length and type of road, power capacity and type of power plant…).

Carbon4 Finance developed a very detailed database of sectoral ratios, enabling the carbon footprint calculation of the infrastructure based on these few data. Emissions savings are also calculated depending on the sector.

3.2.2 *Indicators*

- Indicators available both at company and portfolio level:
  - Induced emission scope 1, 2 & 3
  - Emissions savings scope 1, 2 & 3 + CIR
  - Overall rating
  - Financial carbon intensity (for unlisted infrastructure, the financial data should be provided to Carbon4 Finance).

3.3 Private equity

3.3.1 *Method*

The methodology on private equity / unlisted corporate is the same as the methodology used for public corporate methodology: we assess scopes 1,2 and 3 emissions and emissions savings.

A bottom-up analysis can be undertaken, knowing that, for an unlisted corporate, an exchange with the staff of the corporate is needed and a data collection must be performed.

For large portfolios, we rather perform a statistical approach which will be based on the sector of the company.

Carbon4 Finance developed a very detailed database of sectoral ratios, enabling the carbon footprint calculation of the company based on the sector and the turnover. Emissions savings are also calculated depending on the sector.

3.3.2 *Indicators*

- Indicators available both at company and portfolio level:
  - Induced emission scope 1, 2 & 3
  - Emissions savings scope 1, 2 & 3 + CIR
  - Overall rating
  - Financial carbon intensity (the financial data should be provided to Carbon4 Finance).

3.4 Sovereign bonds

Carbon4 Finance methodology can cover all sovereign issuers. Our existing coverage includes at least all EU and IG large issuers (50 lines) and it can be extended to other sovereign issuers on demand.

3.4.1 *Method*

CIA for sovereign bonds uses a territorial approach to measure the states' carbon intensity: the underlying asset considered is the whole state without imports and exports., i.e. what is produced on the national territory.

The financed carbon intensity is then calculated by dividing the territorial emissions by the debt or the GDP in million euros. The carbon intensity of sovereign debt is likened to that of the country (with or without imports).

3.4.2 *Indicators*

The following Key Climate Indicators are assessed individually for sovereign issuers:

- Indicators available at security and portfolio level:
  - Induced emissions, territorial and consumption approach
  - Financed carbon intensity (debt and GDP)
  - 2° C alignment -see transition risk analysis.

- Indicators specific to sovereign bonds:
  - Emissions associated with fossil fuel reserves (as well as fossil fuel imports)
  - National energy emissions factors (primary energy and power production)
  - INDC alignment with a 2°C trajectory.
  - Qualitative assessment of the INDC credibility.

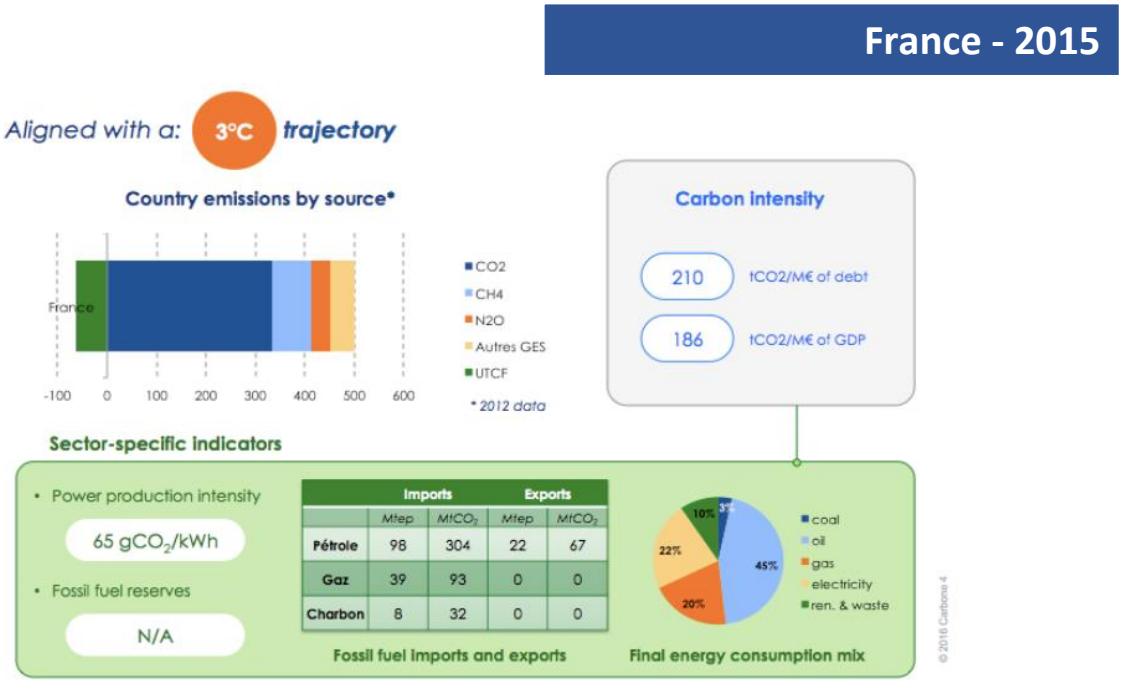


Figure 6: Results for France

1. From overall rating to 2 ° C compatibility

1.1 2°C trajectory for corporate portfolios

Once the analysis has been conducted for each underlying company included in the portfolio, indicators can be aggregated to obtain key results at the portfolio level and evaluate its transition risk.

Carbon Impact Analytics provides conclusions on the alignment of a portfolio or index with a 2°C - compliant scenario.
This alignment is a convention based on a scale of average overall ratings of underlying constituents, calibrated with two benchmarks:

- The +4°C trajectory is represented by the CIA Universe which consists of 1,860 companies, including all constituents of the MSCI World, the Stoxx 600, and the S&P 500. This universe is representative of the current developed economy. The current economy is representative of a business-as-usual economy and therefore aligned with a 4°C trajectory;
- The +2°C trajectory is represented by the "Euronext Low Carbon 100" index, a low carbon 'CIA-optimized' index (including low carbon pure players, not included in the Stoxx 600). Indeed, the LC 100 is designed to scale the weights of the fossil and green companies to reflect the investment needs of reaching a 2°C world, based on the IEA's outlook (low-carbon energy and energy efficiency investments). Sectorial methods may be applied at several granularity levels in conjunction to maximize results. For example, a best-in-class + fossil fuel-free index may be constructed by first excluding the fossil fuel sector and then applying a CIA best-in-class approach to all remaining sectors.

This approach to building a low-carbon and 2°C-compatible portfolio was validated by Euronext LC100's Scientific Committee, chaired by Pascal Canfin and composed of academics, non-governmental organizations and environmental experts.

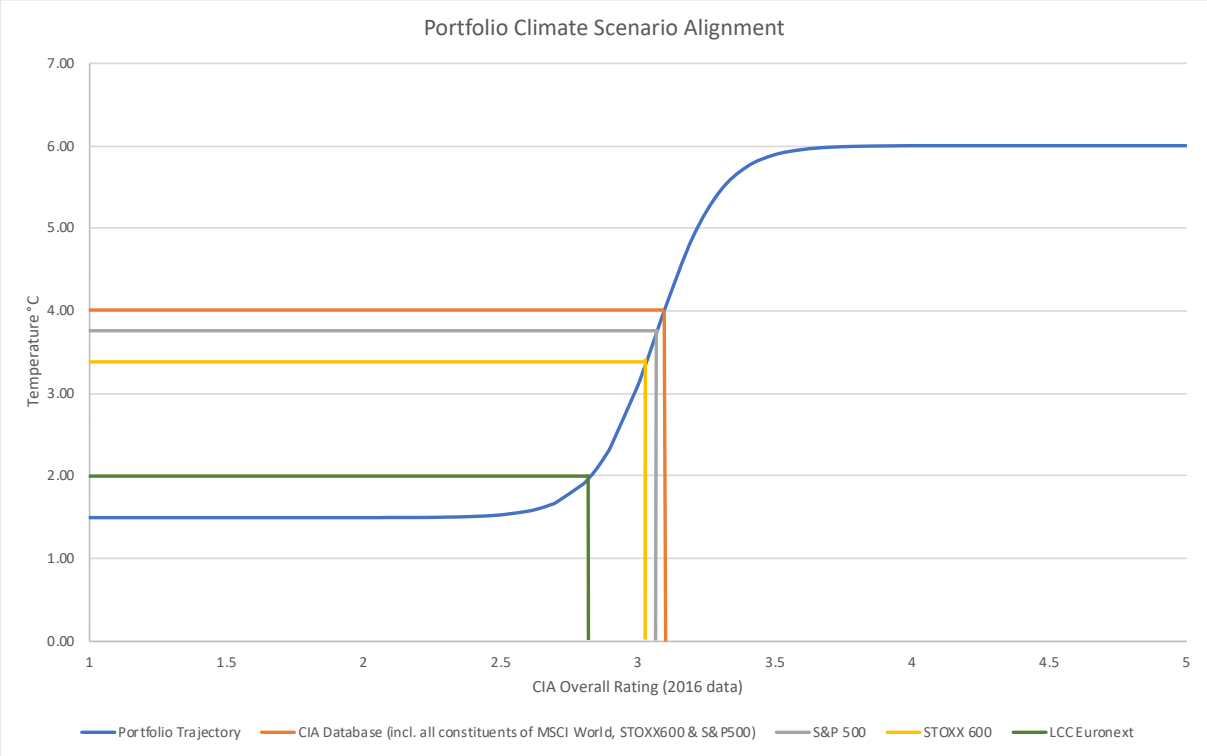


Figure 7: Portfolio overall rating / alignment

1.2 2-degree trajectory for sovereigns

The 2-degree alignment is determined from per capita emissions. A Science Based Target approach is applied with a convergence trajectory on the indicator emissions per capita. The objectives stated during the Intended Nationally Determined Contributions (INDC, submitted by all countries for the COP21) are analyzed and compared with the IAE scenarios from which the 6, 4 and 2°C trajectories are calculated.

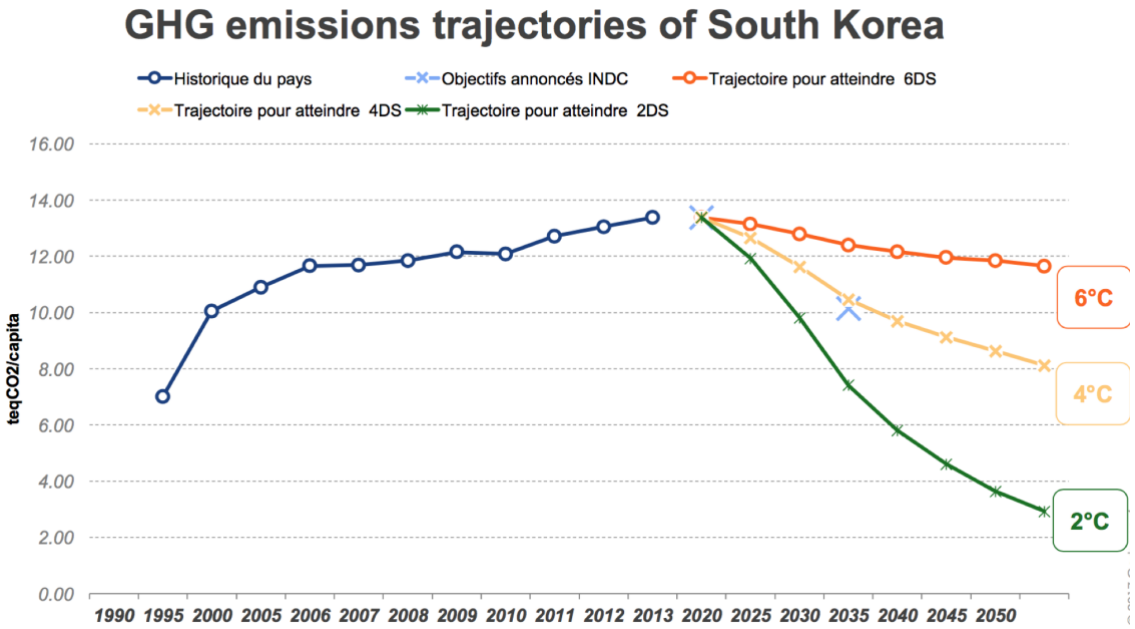


Figure 8: Example of 2-degrees alignment of a country

This score is completed by a qualitative assessment of the credibility of the INDC objective, looking for deployment progress of the countries 'action plans.

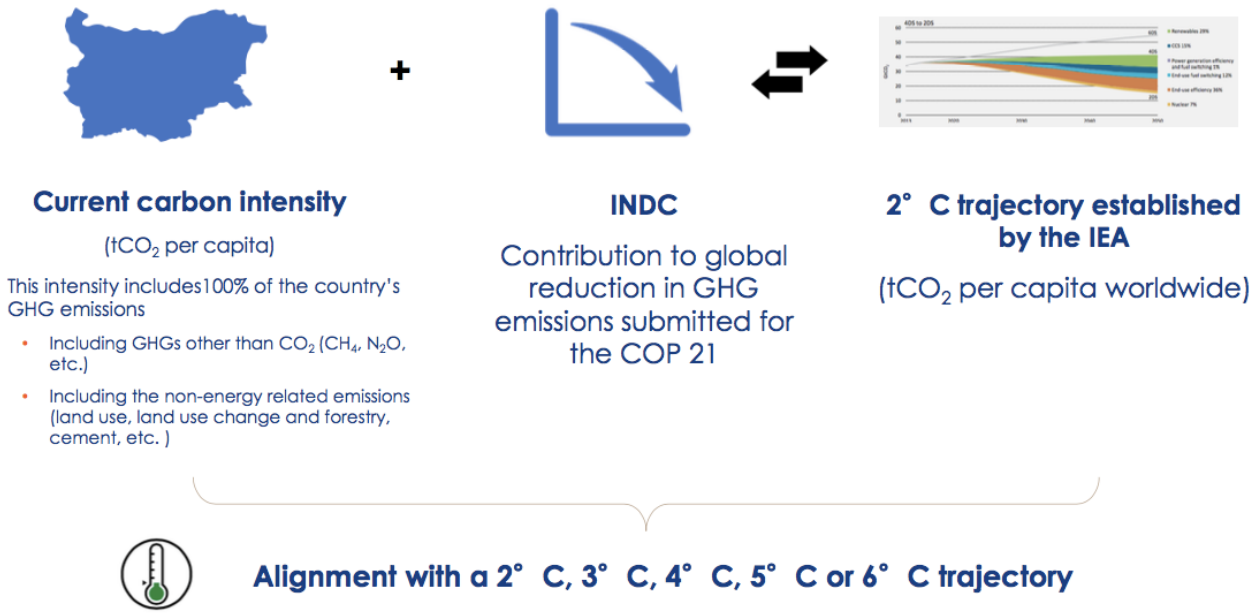


Figure 9: Temperature trajectories of countries and sovereign bond associated

2. Overall rating

Our overall rating is an exhaustive indicator of the climate performance and also a relevant measurement of the transition risk. Indeed, a good score means that the issuer is in line with the climate transition, and thus well prepared to face new carbon-related regulations compared to its competitors.
Contrarily, the worst climate performers would be the first exposed to transition risk.

That is why we advise investors to implement a sectoral best in class investment policy, based on our overall rating.

carbon 4 finance

Sample CIA Results for Corporate Issuer:

Energy Company

High Stake – Utilities

Overall rating 2016: A

A - High	B - Significant	C – Limited	D - Insufficient	E - Incompatible

Score Key – Contribution to climate change mitigation

ISIN	DE0000000000
Year of analysis	2016
Total revenue	48,578 EUR million
Enterprise value	22,560 EUR million
Company description	The Company is an energy company that operates in energy networks, renewables, nuclear, energy efficiency and distributed energy.

Indicators used for overall rating

The Carbon Impact Ratio (CIR)
The CIR is the ratio between emissions savings and induced emissions. If a company's CIR is superior to 100%, this means that its emissions savings are superior to its induced emissions.

143% CARBON IMPACT RATIO

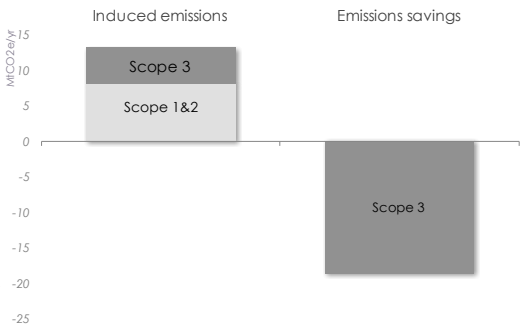
FORWARD LOOKING (-- - + ++)

35 kgCO2/kWh EMISSION FACTOR OF ELEC. PROD.

Comment on Electricity Production sector overall rating calculation
The global rating differentiates actors depending on electricity production emission factor. An emission factor under 184 CO2eq/kWh is compatible with a 2°C trajectory, and an emission factor over 533 is higher than the actual industry average hence highly incompatible with a 2°C trajectory. The global rating also includes a bonus point if : CAPEX investment ($) for new low carbon energy capacity is over 79% or CAPEX production (GWh) for new low carbon energy capacity is over 58% or retirement of fossil-fuel electricity generation capacity by 2020 can reduce emission factor under 184 gCO2/kWh.

Quantitative analysis

tCO2	Induced emissions	Emissions savings
Scope 1&2	7,976,712	/
Scope 3	5,061,820	- 18,594,524



Induced emission intensity: 180 tCO2e/M€/yr

Green share 29%

*For electricity and heat producers, the **Green share** is equal to the share of MWh derived from low-carbon sources (hydro, wind, solar, and, according to the wish of the entity that communicates, nuclear).*

Brown share 0%

*The **Brown share** is the share of investments in coal-related assets. For energy sectors, the brown share is equal to the percentage of MWh generated from coal. For fossil fuel producers, the brown share corresponds to the company's share of revenue generated by the sale of coal.*

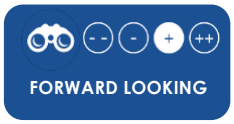
carbon impact analytics

Energy Company

High Stake – Utilities

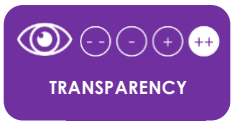
Overall rating 2016 **A**

Qualitative analysis



Comments on forward looking strategy

The Company no longer reports the CO2 intensity of its power generation, and consequently, has not set a reduction target for this intensity. It has however set a target for it total footprint. The Company mentions specific projects and investments in low-carbon sources (renewable or nuclear). Investments in Renewables represent 34% of total investments for 2016 (+6% compared to 2015). The Company has set a reduction target for its total carbon footprint (scope 1, 2, 3) : -2.5% per year in order to achieve -30% by 2030 compared to 2016 level.



Comments on transparency

The Company/Group reports its Scope 1 & 2 emissions clearly and transparently, as well as the Scope 3 emissions most relevant to its activity (if relevant) and activity data which allow for Scope 1 & 2 back-testing.

Calculation boundaries

Upstream	Operational	Downstream
Upstream raw materials	Scope 1	Downstream use of products
Upstream deforestation	Scope 2	Downstream fossil fuel combustion
Upstream packaging		Downstream owned building
Upstream externalized freight		Downstream use of infrastructure
Upstream fossil fuels		Downstream waste treatment
Upstream plant construction		

Calculation methodology

Scope 1&2 calculation	Reported (source: corporate publication) and consistent with CIA estimations.
Scope 3 calculation	For heat and power production, upstream Scope 3 emissions estimates correspond to the emissions generated during fossil fuel extraction and infrastructure production, distribution, and deconstruction of infrastructure. For fossil fuel production, Scope 3 emissions estimates are based on the downstream combustion of fossil fuel products (allocated extracted, transported, refined, or supplied volumes).
Emissions savings calculation	For heat and power production, emissions savings are estimated by comparing the emissions factor of the company with the global emissions factor aligned with the IEA's ETP 2-degree scenario for 2025. For the fossil fuel sector, emissions savings correspond to Scope 1 & 2 emissions avoided through reduction in operational carbon intensity (% reduction in tCO2e per ton of product over the last 5 years).
Comments and limits	The total induced emissions are lower than the previous year because activities related to fossil fuel are now managed by one of the Company's subsidiary. Detailed production data from "Solar and Wind" was not disclosed and it was therefore considered that 50% came from Wind and 50% from Solar.