right°

Greenhouse Gases in the XDC Model

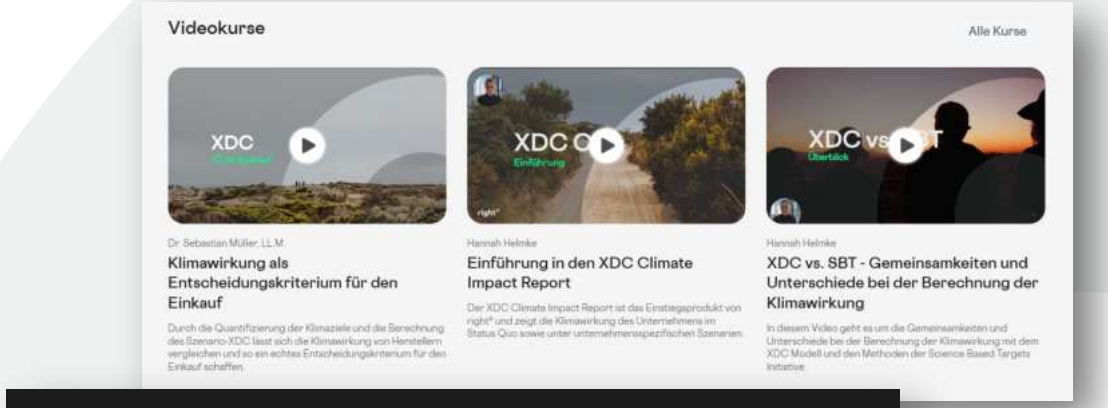
Specialist: Dr. Elnaz Roshan (Head of Model Development)

Competence Jour Fixe | XDC Direct Access

Relevant Case Resources in the XDC Academy

Your Resources | Relevance | Theoretical Background | The XDC Solution | Takeaways

Learning about our XDC Model can be supported by the following resource in our digital **XDC Academy:**



XDC Academy (right-basedonscience.de)

The Company

right on target 1.5°C

Right° provides transparency on the climate impact of economic activities - plain & simple in °C. Our software and metrics enable stakeholders from the real economy, finance, and real estate to plot pathways to 1.5°C alignment.

Our pioneering X-Degree Compatibility (XDC) Model creates science-based 'temperature alignment' metrics that correspond directly to the goal of the Paris Agreement. That means, we guide your climate-related decisions with the best, most relevant science and data.

Selected Clients: Real Economy

Selected Clients: Finance

Selected Clients: Real Estate

right° Presence in the Media

Extraordinary Attention for our Systematic Approach

Business Insider

Calculate the Climate Impact of a Business Model

"It's not about making companies look bad, but (...) calculating how strongly the respective business model influences the climate."

ZDF

Consider Emissions in Relation to Solutions

"The new analysis model looks at CO_2 emissions in relation to possible solutions for the 1.5 degree target."

brand eins

Measure Climate Impact According to the Paris Agreement

"The Frankfurt-based start-up right° enables companies to measure their climate impact according to the logic of the Paris Agreement: in degrees Celsius."

FAZ

Transform Climate Issues into a Competitive Advantage

"If approached correctly, Europe's credibility on climate issues could become a competitive advantage for companies."

Handelsblatt

CO_2 Emissions Shouldn't be the Only Indicator

"The carbon footprint alone (cannot) be a yardstick for assessing sustainability efforts."

Die Zeit

The Sector Must Be Considered in the Climate Impact

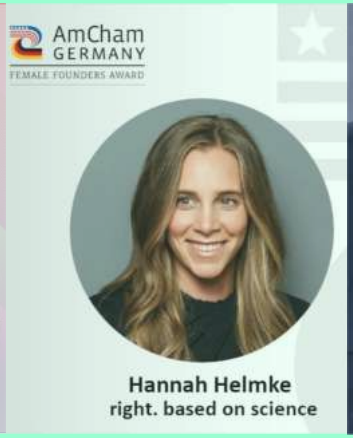
"When evaluating the respective climate efforts, it is taken into account that not all sectors are able to reduce emissions to the same extent."

Quellen: Business Insider (2022); ZDF (2023); brand eins (2023); FAZ (2023); Handelsblatt (2021); Die Zeit (2019)

Nominierungen & Preise

Extraordinary Attention for our Systematic Approach

Digital Female Leader 2023 | **Menschen des Jahres 2023** | **Female Founders Award 2023** | **Female Finance Award 2023**



Next Economy Award | Change 2020 | **Portfolio Institutionell | Vordenker Award 2022**

Quellen: Digital Female Leader Award (2020); Deutscher Nachhaltigkeitspreis (2020); Handelsblatt (2022); AmCham Germany (2021); portfolio institutionell Awards (2022); FOCUS MONEY (2023)

Stage Presence

Market Access through Large Stages

SEPT. 2023	Handelsblatt Tagung ESG-Reporting und -Steuerung
	Maschinenraum Momentum
	ZEIT WISSEN Kongress
JUL. 2023	Forum Bellevue zur Transformation der Gesellschaft
JUN. 2023	Deutscher Immobilientag (IVD)
	Konferenz ESG & Holzbau
MÄR. 2023	Süddeutsche Zeitung Nachhaltigkeitskongress
	Fachtagung Digitalisierung (VDW)

Quelle: DAPB (2023)

XDC Solutions
Our Model and Software

Software Solutions by right°

Your Resources | Relevance | Theoretical Background | The XDC Solution | Takeaways

1

XDC Climate Impact Report: Status Quo.

Understand where your customer stands today. Help them grasp the 1.5°C ambition and develop a vision.

2

XDC Scenario Explorer: Scenario Analysis.

Apply your know-how of the XDC scenario analysis to develop a Paris-compliant strategy for your client.

3

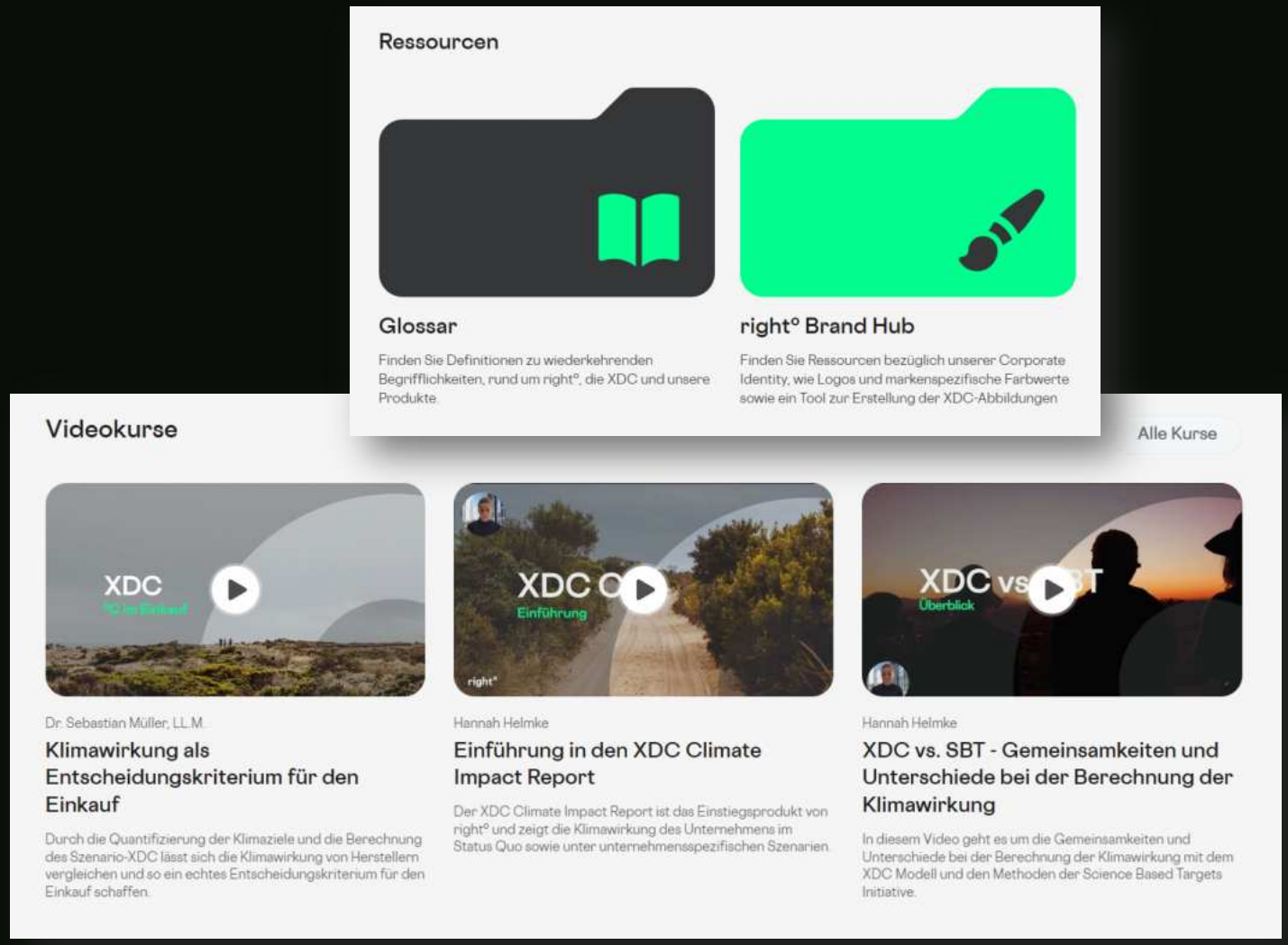
XDC Public API: Integration.

Develop a verifiable controlling model for your client's transition pathway by making complexity manageable.

The XDC Member Platform enables a completely new collaboration model between right° as an innovative climate tech company and established consulting experts to offer strong solutions.

XDC Direct Access Member Portal (right-basedonscience.de)

The **XDC Academy** is a Toolbox for XDC users to acquire knowledge and skills about the right° XDC model and learn to tackle climate-related challenges directly.



XDC Academy (right-basedonscience.de)

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Understanding the Relevance

GHGs in the XDC Model

Relevance of Competency: Understanding GHGs & Climate Change

Aspiration

Fulfill desire in **understanding the fundamental scientific background** of the XDC Model

Relevance	The XDC Solution
Gain **confidence in measuring and steering climate impacts and strategic actions** using the XDC Model.	The XDC Model **integrates a scientifically-validated, open-source, multi-gas climate model** with full tranparency.

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Understanding the Theoretical Background

Climate Change and the XDC Model

Theoretical Background: Introducing Climate Change

What is weather?
Weather is the state of the atmosphere at a particular place during a short period of time.

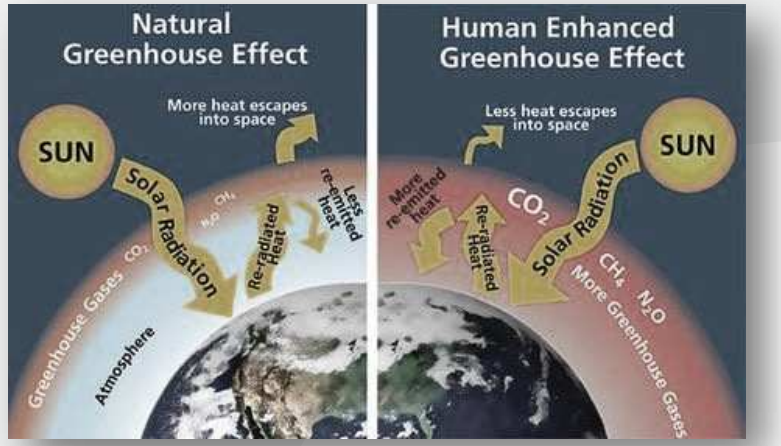
What is climate?
Climate is defined as an area's long-term weather patterns.

What is climate change?
Climate change means altered patterns.

Theoretical Background: Introducing Climate Change

Components of Climate Change

- **Infrared radiation** is heat energy, which is **emitted from all objects** that have a temperature **above - 273.16 °C**.
- **GHGs increase the amount of heat** in the atmosphere.
- This **cumulative increase in the amount of heat** in the atmosphere **raises the average air temperature**, which is known as global warming.



Theoretical Background: Contributors to Climate Change

GHG

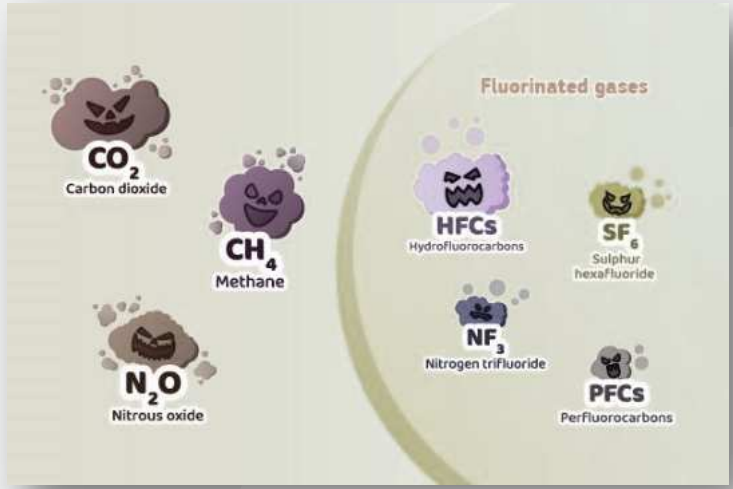
Gases that absorb infrared radiations include, but are not limited to the following compounds:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Fluorinated gases

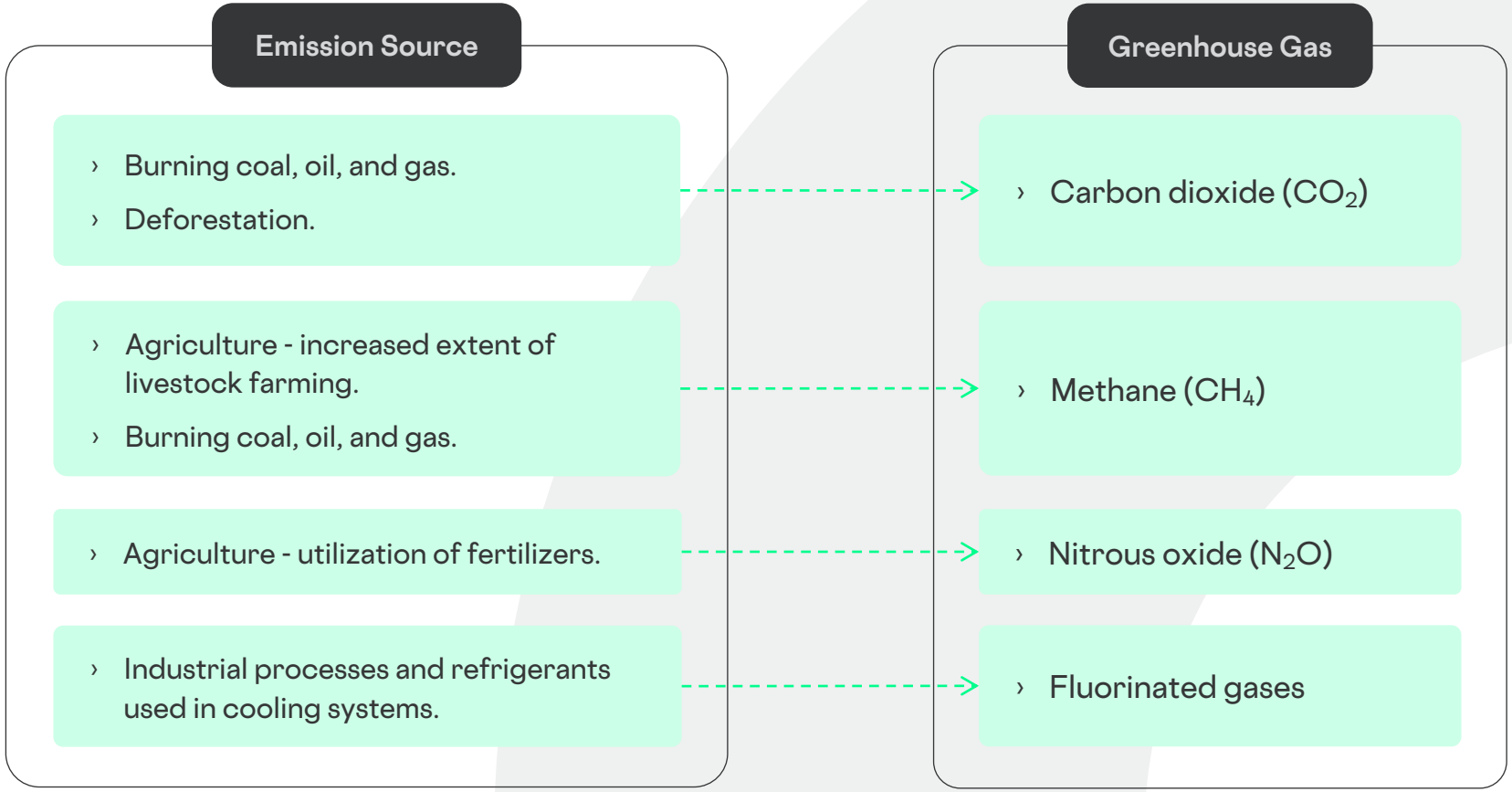
Non-GHG

Gases that can't absorb infrared radiations include but are not limited to the following compound:

- Sulfur dioxide (SO_2)



Theoretical Background: Contributors to Climate Change



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Impact of GHGs on Climate Change

Implications for Abatement Strategies

The Impact of GHGs on Global Climate

There are **two factors that determine the impact of an emitted greenhouse gas** on future climate.

1

Persistance

The **persistance of a GHG in the Earth's atmosphere**, which is measured in **number of years**.

2

Absorption

The **ability of a GHG to absorb available infrared radiation** as emitted from the Earth's surface.

The Impact of GHGs on Global Climate: Persistance

1

Persistance

The **persistance of a GHG in the Earth's atmosphere**, which is measured in **number of years**.

		Lifetime (yr)	Impacts
Long-lived GHGs	Carbon dioxide (CO_2)	300 - 1000 (NASA)	› Long-term warming › Ocean acidification
	Nitrous oxide (N_2O)	109	› Long-term warming › Ozone depletion
Short-lived GHGs	Methane (CH_4)	11.8	› Near-term warming
	Hydrofluorocarbons (HFCs)*	< 15	› Near-term warming

Source: IPCC AR6 WGI (2021) Table 7.SMS.7
**Most HFCs have a shorter lifetime, however, long-lived HFCs also exist.*

The Impact of GHGs on Global Climate: Absorption

2

Absorption

The **ability of a GHG to absorb available infrared radiation** as emitted from the Earth‘s surface.

- Global warming potential (GWP) is a measure of **how much energy the emissions of 1t of a gas will absorb over e.g. 100 years**, relative to the emissions of 1t of CO_2.
- Gases with a **higher GWP absorb more energy**, per ton emitted.
- **Non-CO_2 gases** might have a lower lifetime than CO_2 , but they **are more potent in warming** the Earth.

	Global Warming Potential *(GWP) 100*
Carbon dioxide (CO_2)	1
Nitrous oxide (N_2O)	273
Methane (CH_4)	27,9
Hydrofluorocarbons (HFCs)	up to 14600*

CO_2e = GWP100 x GHG

IPCC AR6 WGI (2021)

**HFCs can reach this potential but might also remain at lower levels.*

Understanding the Role: CO_2 vs. Non-CO_2

Contribution to Global Warming

Why are we talking about CO_2?

- CO_2 is the most important climate forcer.
- CO_2 has contributed 0,8 °C to historical warming thus far. *(IPCC AR6 Working Group I Report)*

Which role do non-CO_2 gases play?

- Non-CO_2 gases have also contributed to historical warming .
- Non-CO_2 forcing agents influence the carbon cycle as they impact temperature, which affects the efficiency of carbon sinks.

Understanding the Role: CO_2 vs. Non-CO_2

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!

Reduction Potential

Strong efforts to reduce non-CO2 emissions will complement efforts to reduce CO2 emissions in limiting global warming.

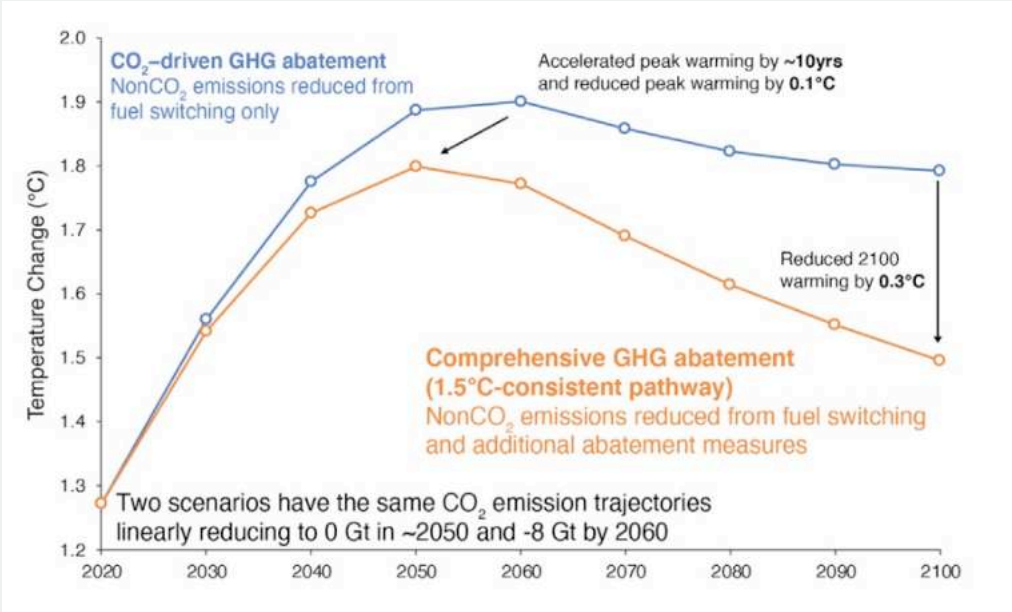
Abatement Strategies: CO_2-only vs Comprehensive GHGs

Comprehensive Abatement Strategies

› Potential for a **reduction i.e. earlier onset of peak** warming.

› Could enable a **reduction in end-of-century warming**.

› Used across different sectors, they might **facilitate the achievement of the Paris-aligned 1,5 °C target** with lower temperature overshoot.



Ou, Y. et. al.(2022) https://doi.org/10.1016/j.oneear.2022.11.012

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The XDC Solution

Ensuring Appropriate Understanding of GHG and Climate Change in the XDC Model

Understanding the Difference: CO_2 vs. CO_2e & non-CO_2

CO_2 vs. CO_2e

What is the difference of CO_2 vs. CO_2e/CO_2eq/$CO_2equivalent$?

CO_2 means that only CO_2 emissions are counted.

CO_2e accounts for the effect of difference GHGs on the climate by converting other sources of emissions to the equivalent amount of CO_2 counted.

Solution

Which climate data does the XDC Model use?

To ensure consistency with sector data, emissions of the entity should be in CO_2e.

Use of CO_2e for GHGs in the XDC Model

1

Prompt

The **X-Degree Compatibility (XDC) Model answers the following question**...

...how much global warming would occur if the entire world had the same climate performance as the entity in question?

2

Approach

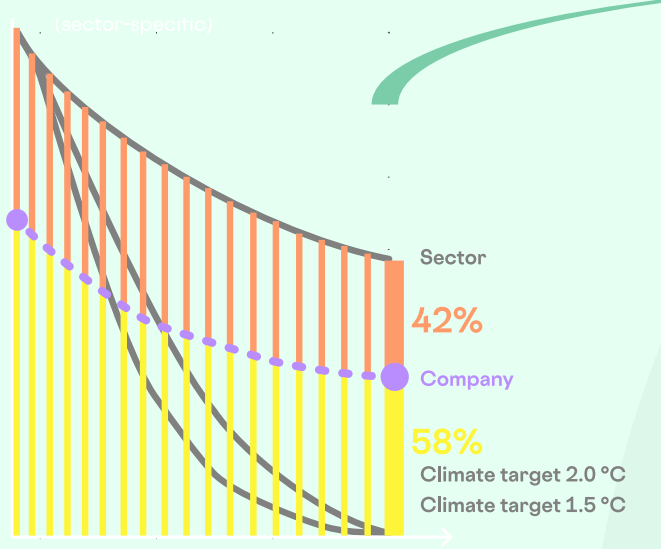
The **X-Degree Compatibility (XDC) Model calculates the climate performance**...

...of an entity **based on emissions data as given in CO_2e** due the lack of existing data for the remaining greenhouse gases.

XDC Model: Calculating Climate Performance

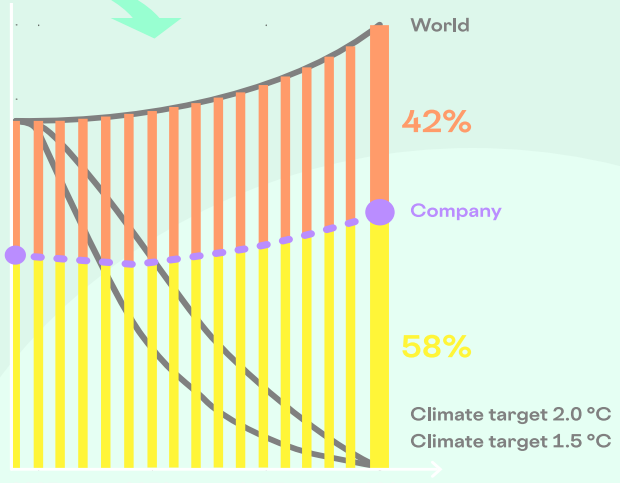
1.

For each year until 2100, we calculate the climate performance of the entity relative to the benchmarks.



2.

We map this performance to the global scale to calculate the emissions that would reach the atmosphere if the whole world would show the same climate performance as the entity across the same timeframe.



Inclusion of non-CO_2 GHGs in the XDC Model

1

FaIR Model

The **X-Degree Compatibility Model calculates XDCs based on...**

...the climate model FaIR, which takes 39 individual GHGs and other climate forces into consideration as its main input.

2

XDC Model

Temperature **(°C) values resulting from the multi-gas model are more accurate** than those retrieved from a CO_2-only model.

If emission data for additional GHGs becomes available, the **XDC model is compatible to use gas-specific performance**.

Our Guide: Explaining GHGs in the XDC Model

Context: What is the scientific basis of the XDC model?

1 The XDC Model draws on the *Finite Amplitude Impulse Response* (FaIR) climate model to calculate global warming and determine the corresponding XDCs.

2 The FaIR model includes a sufficient level of complexity, ...

2a It is less computationally expensive compared to the complex earth system models:

- It can emulate the temperature of such models.
- It is ideal for large probablistic ensemble and quiantifying uncertainty.

2b FaIR input includes the emission data for 39 gases whilst also considering thier individual lifetimes as well as the interaction between gases and different Earth system feedbacks:

- Calculates concentration of GHGs.
- Calculates effective radiative forcing from GHGs, aerosols, ozone, and other agents.
- Considers different timescales in carbon uptake by geological processes, the deep ocean, the biosphere, and the ocean mixed layer.

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Takeaways

Key Considerations in the Execution of Reduction Strategies for Clients

Understanding GHGs in the XDC Model

Your Resources | Relevance | Theoretical Background | The XDC Solution | Takeaways

Aspiration

› Cultivate a **deeper understanding of the fundamental scientific background** of the XDC Model.

Takeaways

› The XDC metric **(°C) is calculated integrating a climate model**, which is scientifically validated.

› **CO_2** is widely reported **as the crucial anthropogenic GHG as it currently accounts for the greatest portion** of the emissions/warming associated with human activities **and can remain in the Earth's atmosphere for centuries**.

› **Temperature** (°C) over the coming decades **can also be strongly affected by** non-CO_2 climate pollutants.

› The **more detailed emissions data** we have (including non-CO_2 gases) **at company and sector level**, **the more representative the global mean temperature** (°C) becomes in climate impact analyses.

Best Practice

› Explain the **scientific difference between CO_2 and CO_2e** during project conversations and result presentations.

› Practice **including both CO_2 and non-CO_2 gas-related reductions in climate strategy development** to assure reaching the 1.5 °C goal whilst taking the varying climate impacts of different greenhouse gases into consideration.

Q&A

to support your understanding

Contact

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