Method Paper

The Corporate Sustainability Challenge “Climate-neutrality at own sites and achievement of Science Based Targets”

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Introduction

Without suitable countermeasures, global temperature will rise by well over 2 degrees Celsius. This will threaten our planet’s ecosystems, jeopardize the health of people, animals and plants, and place the food supply for a growing world population at risk. Bayer is therefore taking several steps to reduce greenhouse gas emissions within our company and along our entire value chain in accordance with the Paris Agreement, an agreement within the United Nations Framework Convention on Climate Change.

Bayer aims to be climate neutral in our own operations by 2030. To accomplish this, we will for example implement energy efficiency measures at our sites and convert 100 percent of the purchased electricity to renewable energies. The remaining emissions will be offset by purchasing certificates from climate protection projects with recognized quality standards. Additionally, we aim to reduce greenhouse gas emissions along the up- and downstream value chain through cooperation with suppliers and customers. Our targets for Scope 1&2 are in line with the goal of the Paris Agreement to limit global warming to 1.5 degrees Celsius, and the target for Scope 3 helps to limit global warming to a 2 degrees Celsius scenario. We have joined the world's leading Science Based Targets initiative (SBTi), which transparently reviews our reduction targets.

The progress of our Corporate Sustainability Challenge is monitored with Key Performance Indicators (KPIs), which are shown below with the respective targets:

KPI Sub-KPI	Document Reference	Unit	Target	Target year
Scope 1&2 greenhouse gas emissions	Scope 1&2 KPI	million metric tons CO_2 equivalents	42%	2029
Purchased electricity from renewable sources in tera joule	Renewable Electricity KPI	TJ	100%	2029
Off-setting of remaining Scope 1&2 greenhouse gas emissions	Offsetting KPI	million metric tons CO_2 equivalents	100%	2030
Scope 3 greenhouse gas emissions from relevant categories	Scope 3 KPI	million metric tons CO_2 equivalents	12.3%	2029

This document describes the methodology applied to calculate the respective KPIs, as well as the different data sources used.

Definitions

In the following table, key terms needed to understand the GHG KPIs are defined.

Key term	Definition
Activity data	Quantitative measure of a level of activity that results in GHG emissions (e.g. liters of fuel consumed, Euros of material or services purchased, or kilograms of waste incinerated).
Emission factor	Factor that converts activity data into GHG emissions data. For example, kg CO_2 emitted per liter of fuel consumed, or kg CO_2e emitted per kilograms of material produced.
Greenhouse gas (GHG)	GHGs are basically the gases listed in the Kyoto Protocol[i]: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
GHG Offset	Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere. Offsetting is only to be considered by Bayer if it follows certified standards.
GHG Protocol	Greenhouse Gas (GHG) Protocol, coordinated by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions.
Inventory	A quantified list of an organization’s GHG emissions and sources.
Renewable Energy Certificate System (RECs)	RECs are a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource.
Science Based Target (SBT)	As defined by the Science Based Targets initiative, targets adopted by companies to reduce greenhouse gas (GHG) emissions are considered “science-based” if they are in line with what the latest climate science says is necessary to meet the goals of the Paris Agreement: to limit global warming to well-below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit warming to 1.5 degrees Celsius.
Scope	Defines the operational boundaries in relation to indirect and direct GHG emissions, according to the GHG protocol.
Scope 1	The organization’s direct GHG emissions (e.g. site fuel combustion, process emissions or fugitive emissions).
Scope 2	The organization’s indirect emissions from the generation of purchased energy (e.g. emissions resulting from the production of grid electricity).
Scope 3	The organization’s emissions from sources owned or controlled by other entities in the value chain, other than those covered in scope 2. For example, upstream transportation and distribution and wastes generated in operations.

Methodology

For this challenge, all divisions, business units, regions and corporate functions within the entire Bayer Group have been taken into scope.

As mentioned above, there are three sub-KPIs under the GHG challenge, i.e. Scope 1&2 (with sub-target Renewable Electricity), Offsetting and Scope 3. The methodology session briefly describes the methods adapted to measure the progress for each of the KPIs.

Scope 1&2

Scope 1 refers to direct emissions occurring from sources owned or controlled by Bayer, while scope 2 refers to indirect emissions from the generation of purchased energy.

The process of calculating GHG emissions from Scope 1&2 can be described with the following four basic steps.

Step 1 is to adjust the environmental questionnaire in our internal data collection system (BaySIS) according to internal and external requirements, guidelines and standards. Persons responsible for data entry at the sites are trained on existing and new content and prepared for data collection and calculation.

Step 2 is to collect the activity data. The data are collected globally via questionnaires from all environmentally relevant sites, i.e. all organizational units with a minimum net energy usage of 1.5 tera Joule per year, in order to quantify our total GHG impact.

Step 3 is to compile the emission factors, which helps to convert activity data into GHG emissions data in step 4. Available emission factors used are fuel- and/or site-specific and follow the recommendations of the GHG protocol. Examples for emission factors are kilograms CO_2 emitted per liter of gasoline consumed or electricity consumed.

Step 4 is to calculate inventory result by multiplying the activity data obtained from step 2 with the emissions factors from step 3. Results are verified and reviewed in an internal control process.

Renewable Electricity

Step 1 is to coordinate the central operative and strategic procurement activities of renewable energy certificates.

Step 2 is to extract the data of total electricity and share of renewable electricity purchased of the current year from an internal database. The information of total electricity and the share of renewable electricity purchased from the sites is used to calculate the demand of Renewable Energy Certificates (RECs) to reach yearly targets.

Step 3 is to purchase the Renewable Energy Certificates (RECs). The information such as the volume of certifications, type of generation as well as purchased energy attribution certificates are obtained and verified for the final Renewable Electricity KPI calculation.

Step 4 is to finalize the KPI calculation. The Renewable Electricity KPI is collected at the sites in absolute numbers measured in TJ/year, whereas the target is expressed in relative terms. The calculation approach for the Renewable Electricity KPI is described in the following formula. The total amount of electricity from renewable sources of the reporting year (as extracted in step 3) is divided by the total amount of electricity consumed in the reporting year (as extracted in step 2) expressed in percentage.

$$TA_{PERS}\,[\%] = \left[\left(\frac{Total\ Purchased\ electricity\ from\ Renewable\ Sources^{*}}{Total\ Electricity\ Purchased^{*}}\right) \mathrm{x}\ 100\right]$$

TA_{PERS}: Target achievement Purchased Electricity from Renewable Sources (Renewable Electricity KPI) [%]

* measured in tera joule per year (TJ/year)

Offsetting

Step 1 is to coordinate the offsetting activities and to analyze offsetting status and available budgets.

Step 2 is to obtain the Scope 1&2 greenhouse gases emissions data from the BaySIS system, which are collected in the Scope 1&2 KPI.

Step 3 is to extract the data of purchased carbon credit certificates. The information of carbon credit certificates is collected from centralized and decentralized purchase, including the amount of carbon offset for the final Offsetting KPI calculation.

Step 4 is to finalize the KPI calculation. The Offsetting KPI is measured in absolute numbers (million tons per year), whereas the target is expressed in relative terms. The calculation approach for the Offsetting target is described in the following formula. Total amount of carbon offset

purchased for the reporting year (as extracted in step 3) is divided by the total amount of GHG emissions from Scope 1&2 emissions of the reporting year (as extracted in step 2) and expressed in percentage.

$$TA_{OS}\,[\%] = \left[\left(\frac{Total\ GHG\ emission\ offset\ ^{*}}{Total\ Scope\ 1\&2\ GHG\ emissions\ ^{*}}\right) \text{x } 100\right]$$

TA_{OS}: Target achievement KPI offsetting of remaining Scope 1&2 GHG emissions [%]
* measured in million tons per year (MT/year)

Scope 3

Scope 3 emissions are the indirect GHG emissions resulting from value chain activities for the Bayer Group. The methodology used is based on the GHG Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard[ii].

Scope 3 emissions are divided into 15 categories. The Bayer scope 3 inventory consists currently of categories 1, 2, 3, 4, 5, 6, 7, and 12. For these categories, a short description and the calculation method are introduced below. The remaining categories (i.e., categories 8, 9, 10, 11, 13, 14, and 15) currently do not contribute to the inventory because they are either not relevant, not applicable, or no mature-standardized calculation method is available for them. With respect to the latter, an internal assessment of those categories demonstrated that the related potential emissions would not cause Bayer to violate its scope 3-coverage threshold set by the Science Based Target initiative.

The process for preparing the scope 3 inventory for all relevant categories follows the same four process steps, that are listed below.

Step 1 is to prepare and plan the processes, and align on internal checks to be performed on the activity data, emission factors, calculation methods, etc.

Step 2 is to collect the activity data from the relevant systems. 'Activity data' is a quantitative measure of a level of activity that results in GHG emissions within a scope 3 category, e.g., liters of fuel consumed, euros of material or services purchased, kilograms of waste incinerated, etc.

Step 3 is to define or update the emission factors. 'Emission factors' convert activity data into GHG emissions data in Step 4. Examples of emission factors are kg CO_2 emitted per liter of fuel consumed, CO_2e emitted per euro spend per material, kg CO_2e emitted per kg of material produced, etc.

Step 4 is to calculate the inventory. In this step, the inventory result is obtained by multiplying the activity data obtained from Step 2 with the emission factors from Step 3. Results are verified and reviewed in an internal control process.

In the following table, a more specific description and activity data source as well as emission factor source are provided for each category in scope.

1. Purchased goods and services		
Description: Upstream emissions from all purchase volumes except related cost types for capital goods, fuel & energy, transport & distribution, waste and business travel.		
	Activity Data Source	**Emission Factor Source**
Purchased goods and services	Procurement system of Bayer under consideration of yearly changes in prices and currencies for direct materials	estell 6 under consideration of average inflation rates for those materials and services where no primary data are available
2. Capital Goods		
Description: Upstream emissions from all purchase volumes which are related to the purchase of capital goods.		
	Activity Data Source	**Emission Factor Source**
Capital goods	Procurement system of Bayer.	estell 6 under consideration of inflation effects
3. Fuel- and energy related activities		
Description: Emissions from extraction, production, and transportation of fuels and energy purchased or acquired		
	Activity Data Source	**Emission Factor Source**
(A) Upstream emissions of purchased fuels	BaySIS	Sphera's GaBi 2020 Product Sustainability Database
(B) Upstream emissions of purchased electricity and steam	BaySIS	Sphera's GaBi 2020 product Sustainability Database
(C) Transmission and Distribution losses	Already considered in (A) and (B)	
4. Upstream transportation and distribution		
Description: Emissions from transportation and distribution services as well as warehousing services which Bayer has explicitly purchased, i.e. also those emissions caused by our produced goods are accounted here, as long as Bayer paid explicitly for the related service.		
	Activity Data Source	**Emission Factor Source**

(A) Cargo Transport: all in- and out-bound transport and logistic based emissions from up- and down-stream	SAP	CEFIC
(B) Warehouses	Procurement system of Bayer	estell 6 under consideration of inflation effects
(C) Logistic Services	Procurement system of Bayer	estell 6 under consideration of inflation effects
Remarks to (A)	Distance calculation are computed with geo-data.	
5. Waste generated in operations		
Description: Emission from disposal and treatment of waste generated in Bayer’s operations in facilities not owned or controlled by Bayer, i.e. emissions from third-party disposal and treatment of solid waste and wastewater generated in Bayer.		
	Activity Data Source	**Emission Factor Source**
(A) Incineration	BaySIS	Site specific waste information or literature data
(B) Landfill	BaySIS	IPCC
(C) Recycling	BaySIS	IPCC
(D) Other	BaySIS	IPCC
(E) Wastewater treatment	BaySIS	IPCC
6. Business travel		
Description: Emission from transportation of employees for business related activities in vehicles not owned or operated by Bayer.		
	Activity Data Source	**Emission Factor Source**
(A) Air travel	Bayer’s travel agencies	DEFRA
(B) Rental cars	Europcar, Sixt, National/Enterprise (GHG emission data are gathered directly from these companies)	
(C) Train travel	If available, local rail company, e.g. in Germany: Deutsche Bahn Else, spend data and passenger-kilometers used for estimation	Sphera’s GaBi 2020 Product Sustainability Database
7. Employee commuting		

Description: Commuting of employees between their homes and their worksites by modes of transportation not owned or operated by Bayer		
	Activity Data Source	**Emission Factor Source**
Employee commuting	Various Bayer internal systems	Sphera’s GaBi 2020 Product Sustainability Database Various other sources
12. End-of-life treatment of sold products		
Description: Emissions from the final waste disposal and treatment of products sold by Bayer at the end of their life		
	Activity Data Source	**Emission Factor Source**
Packaging	Bayer’s spend map	Sphera’s GaBi 2020 Product Sustainability Database

Data Sources

The following sources are used in our KPI calculation process.

Source	Description
Bayer Site Information System (BaySIS)	Bayer internal data collection and calculation system for various type of information (e.g. environmental and safety data). BaySIS is externally assured with minimum limited assurance for all data collected within the environmental questionnaire and reasonable assurance for all data later reported in the Annual Report and Sustainability Report. BaySIS data is respectively used for Scope 1&2, Offsetting as well as scope 3.3 (‘fuel and energy related activities’) and 3.5 (‘waste generated in operations’).
Department for Environment, Food & Rural Affairs (DEFRA)	The United Kingdom government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities. The conversion factors published for greenhouse gas reporting are used for the emission calculation of scope 3.6 (‘business travel’).

estell	estell is a methodology and tool developed by the consulting firm Systain. It uses a detailed multi-regional environmentally-extended input output (EEIO) database based on the input-output table of the OECD with additional inputs from BEA, World Bank indicators and EXIOBASE. The version 6 of estell was applied for the baseline calculation in 2019. estell is applied for the emission calculation of scope 3.1 (‘purchased goods and services’), 3.2 (‘capital goods), and some parts (i.e., only warehouses and logistics services) of 3.4 (‘upstream transportation and distribution’).
GaBi 2020 Product Sustainability Database	GaBi is a Life Cycle Assessment modelling and reporting software from Sphera, a company specified for software and services on Environment, Health, Safety and Sustainability. Emission factors are extracted for the emission calculation of scope 3.3 (‘fuel and energy related activities’), 3.6 (‘business travel’), 3.7 (‘employee commuting’), 3.12 (‘end-of-life treatment of sold products’).
Intergovernmental Panel on Climate Change (IPCC)	The United Nations body for assessing the science related to climate change. Emission factors used for scope 1 and scope 3.5 (‘waste generated in operations’) are taken from the specific IPCC Guidelines for National Greenhouse Gas Inventories.
International Energy Agency (IEA)	Emission factors from the International Energy Agency are used to calculate the respective emissions from scope 2.
JDA	JDA is a transportation management software for planning, execution, and optimization for logistics activities management. Activity data are extracted for the emission calculation of scope 3.4 (‘upstream transportation and distribution’).
SAP	SAP is the Enterprise Resource Process System used by Bayer. Activity data are for instance extracted for the emission calculation of scope 3.4 (‘upstream transportation and distribution’).
The European Chemical Industry Council (CEFIC)	A not-for-profit making organization, which is the main European trade association for the chemical industry. Its emission factors are used for the emission calculation of scope 3.4 (‘upstream transportation and distribution’).

Outlook

In future, we will improve our emission factor accuracy for all GHG scopes, this allows us to exactly measure our performance, clearly identify key contributor and take optimal measures. For instance, in scope 3 categories 3.1 (‘Purchased goods and services’), 3.2 (‘capital goods) and the ‘warehousing’ element of 3.4 (‘upstream transportation and distribution’), we will combine the existing input-output model with supplier specific data. Data are to be collected in direct exchange with our suppliers, via questionnaires or via existing GHG company networks. This paper will be updated accordingly.

[i] https://unfccc.int/resource/docs/convkp/kpeng.pdf
[ii] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf