SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

SUPPLEMENTAL DATA MEMORANDUM FOR THE CHEMICALS SECTOR GUIDANCE CONSULTATION DRAFT

May 2024

Introduction

This document provides a summary of how the Science Based Targets initiative (SBTi) and Guidehouse have estimated direct emissions, electricity and production values for the total chemicals sector, and for ammonia, methanol and high value chemicals (HVCs). These values have been used to develop the SBTi Chemicals Sectoral Decarbonization Approach (SDA) pathways for each primary chemical, which are based on an emissions intensity pathway of combined scope 1 and 2 emissions per unit of production activity from 2020 to 2050. The International Energy Agency (IEA) Net Zero by 2050 (IEA, 2021a) Scenario forms the basis of our calculations, and this has been supplemented by other IEA sources such as the World Energy Outlook Report (IEA, 2023a), the Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach (IEA, 2023b) and the Ammonia Technology Roadmap Report (IEA, 2021b).

About SBTi

The Science Based Targets initiative (SBTi) is a corporate climate action organization that enables companies and financial institutions worldwide to play their part in combating the climate crisis.

We develop standards, tools and guidance which allow companies to set greenhouse gas (GHG) emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at latest.

The SBTi is incorporated as a charity, with a subsidiary which will host our target validation services. Our partners are CDP, the United Nations Global Compact, the We Mean Business Coalition, the World Resources Institute (WRI), and the World Wide Fund for Nature (WWF).

Disclaimer

This document was developed by the SBTi with advisory support from Guidehouse Netherlands B.V ("Guidehouse"). Any decisions on the content are exclusively taken by SBTi. Guidehouse's advice to SBTi represents Guidehouse's professional judgement based on the information available at the time the document was prepared.

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Where data is collected from public sources by outsourced analysts or other third parties, such data has gone through a quality assurance process. Nonetheless, some errors are likely to occur due to the nature of the exercise. In terms of data interpretation and entry, errors could include missing relevant disclosure on a company website, occasional errors during the transcription of figures, or misinterpretation of reported information.

Summary of data used to develop SDA pathways for each primary chemical

CATEGORY	PARAMETER	BASELINE 2020	2030	2040	2050
Whole sector	Scope 1 emissions (Gt CO_2)	1.296	1.199	0.654	0.066
	Electricity (EJ)	0.66	1.6		
	Production - primary chemicals (Mt)	529	641	686	688
Ammonia	Scope 1 emissions (Gt CO_2)	0.450	0.340	0.145	0.020
	Electricity (EJ)	0.29	0.72	2.52	4.32
	Production (Mt)	185	205	220	230
	Scope 2 emissions (Gt CO_2)	0.033	0.020	0.013	0.001
	Total scope 1 and 2 emissions (Gt CO_2)	0.483	0.360	0.158	0.021
	Emissions intensity (Mt CO_2 / Mt ammonia)	**2.61**	**1.76**	**0.72**	**0.09**
Methanol	Scope 1 emissions (Gt CO_2)	0.222	0.222	0.134	0.012
	Electricity (EJ)	0.29	0.72	1.26	1.80
	Production (Mt)	99	127	136	133
	Scope 2 emissions (Gt CO_2)	0.033	0.020	0.006	0.000
	Total scope 1 and 2 emissions (Gt CO_2)	0.255	0.242	0.140	0.012
	Emissions intensity (Mt CO_2 / Mt methanol)	**2.59**	**1.91**	**1.03**	**0.09**
HVCs	Scope 1 emissions (Gt CO_2)	0.251	0.251	0.151	0.014
	Electricity (EJ)	0.08	0.16	0.30	0.58
	Production (Mt)	245	309	330	325
	Scope 2 emissions (Gt CO_2)	0.010	0.004	0.002	0.000
	Total Scope 1 and 2 emissions (Gt CO_2)	0.261	0.255	0.153	0.014
	Emissions intensity (Mt CO_2 / Mt HVCs)	**1.06**	**0.83**	**0.46**	**0.04**

Table legend:

- **Green** – Values provided by IEA in published reports.
- **Amber** – Values not directly provided, but calculated from IEA values in published reports.
- **Blue** – Values interpolated or estimated from already reported IEA values for other year. supplemented with other sources where noted.
- **No color** – Values directly calculated using the above data.

Scope 1 and 2 data calculation process

The primary basis for the primary chemicals scope 1 CO_2 emissions and production data described below is the IEA's 2021 Net Zero by 2050 report (IEA, 2021a), and certain accompanying reports. The IEA has subsequently published data from newer outputs of the NZE scenario in their World Energy Outlook 2023 Report (IEA, 2023a) and Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach Report (IEA, 2023b). The SBTi has chosen to use emissions and production data from the 2021 NZE Report (IEA, 2021a) and not the more recent reports because:

- Some data that was available in the 2021 NZE (IEA, 2021a) and accompanying reports is not available in the 2023 reports (IEA, 2023b), specifically data from the IEA's 2021 Ammonia Technology Roadmap (ATR) (IEA, 2021b) that has been used to inform the pathways for both ammonia and other primary chemicals.

- We have chosen not to partially update the data based on what is available in the 2023 NZE reports (IEA, 2023b), as this would introduce inconsistencies within pathways and between pathways.

- The chemical sector production data in the 2023 NZE Report (IEA, 2023b) includes production from refineries, which are outside the scope of our pathways.

- Based on differences in the available data, modelled projections for scope 1 CO_2 emissions from primary chemicals between the published 2021 NZE Report (IEA, 2021a) and the 2023 Report (IEA, 2023b) are relatively minor. Published primary chemical emissions data in 2020 and 2030 from the 2023 NZE Report compared to the 2021 data (presented as part of the SDA pathways above) are shown here. 2023 NZE data is from the 2023 NZE Report and the most recent IEA chemicals industry webpage (IEA, 2023c).

CHEMICAL	SCENARIO DATA	2020 SCOPE 1 CO_2 EMISSIONS (GT)	2030 SCOPE 1 CO_2 EMISSIONS (GT)
Whole sector	2021 NZE Reports	1.296	1.199
	2023 NZE Reports	1.329*	1.150
Ammonia	2021 NZE Reports	0.450	0.340
	2023 NZE Reports	0.422	0.311

CHEMICAL	SCENARIO DATA	2020 SCOPE 1 CO_2 EMISSIONS (GT)	2030 SCOPE 1 CO_2 EMISSIONS (GT)
Methanol	2021 NZE Reports	0.222	0.222**
	2023 NZE Reports	0.234	0.209
HVCs	2021 NZE Reports	0.251	0.251**
	2023 NZE Reports	0.244	0.248

*The value shown here is for 2021. 2023 NZE Report does not publish 2020 emissions data for the whole sector.
**As described below, scope 1 emissions from methanol and HVCs production in 2030 have been set equal to 2020, even though the 2021 NZE Scenario projects minor increases in scope 1 emissions for these products.

The differences in cumulative emissions between the 2021 NZE data and the 2023 NZE data from 2020 to 2030 are less than 8% across all chemicals. Differences in the reported baseline emissions for 2020 are noted, but for consistency purposes we have chosen to use the same 2021 NZE data set for the baseline year as well, as described above. These minor differences in emissions between the NZE scenario versions propose a minor risk of inconsistency between the primary chemical SDA pathways and the current IEA modelling. However, the lack of published primary chemical emissions and production data for 2040 and 2050 in the 2023 NZE Report led us to choose the 2021 NZE as our basis for the development of the pathways, because 2040 and 2050 data for ammonia was available and could be used to inform the pathways for the other chemicals. The SBTi will evaluate new scenario data in the future and will update the SDA pathways if warranted.

For electricity consumption data, the SBTi has based this mainly on IEA's 2023 WEO report for ammonia and methanol production in 2020, 2030 and 2050 (IEA, 2023a) and the current IEA chemicals webpage for total electricity used for the production of primary chemicals in 2020 and 2030 (IEA, 2023c). The IEA had not provided this information in their 2021 publications described above; therefore, we have chosen to use the more recent reports. Since there is not a significant difference in total production values in the chemical sector between the 2021 and 2023 NZE iterations, we have assumed electricity consumption in the 2023 NZE Report (IEA, 2023b) to be comparable to those in the 2021 version (IEA, 2021a), and thus compatible with the primary chemical emissions and production values described above.

As described above, data from several reports from the IEA have been used to develop primary chemical emissions intensity pathways. In most cases, these reports were published using data from the NZE scenario in 2021, therefore we have assumed consistency in data between the reports. Cases where more recent data was used to supplement the 2021 NZE information are described above.

Total chemical sector

This includes primary chemicals and non-primary chemicals, except where noted.

- Scope 1 emissions: **All years** from the 2021 NZE Report, Annex A table A.4 (IEA, 2021a).

- Electricity (only for primary chemicals): **2020** and **2030** values are from the IEA chemicals webpage, the "Energy" graph (IEA, 2023d). 2040 and 2050 values haven't been calculated as they are not required for our assessment and are not provided by the IEA in the 2023 publications.

- Production (only for primary chemicals): **All years** from the 2021 IEA NZE Report, page 200 (IEA, 2021a).

Ammonia

- Scope 1 emissions: **2020** value is from the IEA ATR report, page 9, and **2030**, **2040** and **2050** values are estimated from the ATR report, Figure 2.1 (IEA, 2021b)[1].

- Electricity: **2020** (assumed to be the same as electricity use in 2022 as little to no change in electrification is assumed), **2022, 2030** and **2050** values are from the WEO 2023 report, Figure 3.6 (IEA, 2023a). **2040** value is calculated as the average of 2030 and 2050 values.

- Production: **2020** and **2050** values are from the IEA ATR report, page 62. **2030** and **2040** are estimated from the ATR report, Figure 2.5 (IEA, 2021b).

Methanol

- Scope 1 emissions: **2020** value is recorded from the IEA's direct CO_2 emissions from primary chemical production in the Net Zero Scenario, 2015-2030 (IEA, 2021c). **2030** value is assumed to be the same as the 2020 value. Although the 2030 scope 1 CO_2 emissions from methanol in the 2021 NZE Report (IEA, 2021a) showed minor increases from 2020, we have assumed no emissions increase to prevent backsliding. Note the 2023 NZE Report supports this rationale (IEA, 2023b), with reductions in scope 1 CO_2 emissions from methanol shown[2]. **2040** and **2050** values are assumed to have the same ratio against the total chemical sector emissions (minus ammonia) as 2020 values.

- Electricity: **2020** (assumed to be the same as electricity used in 2022 as little to no change in electrification is assumed), **2022, 2030** and **2050** values are from the WEO 2023 Report, Figure 3.6 (IEA, 2023a). 2040 value is calculated as the average of 2030 and 2050 values.

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[1] The IEA modelling approach for ammonia doesn't consider CO_2 generated during ammonia production but converted to urea to be emitted under scope 1.
[2] https://www.iea.org/energy-system/industry/chemicals.

- Production: **2020** value is calculated by dividing the 2020 emissions (see above) by the methanol production emission intensity value provided in Figure 1.7 in the ATR (2.2 tCO2 / t) (IEA, 2021b). **2030** value is based on the indexed values provided in IEA's Expansion in primary chemical production in the Net Zero Scenario, 2000-2030 graphic, published in 2021 (IEA, 2021d). This value is calculated as an index against the calculated 2020 value. **2040** and **2050** values are calculated by assuming the same ratio against the total primary chemical production values (minus ammonia) as 2030 values in the 2021 NZE Report (IEA, 2021a). Note we noticed that 2020 and 2030 ratios are similar in the NZE Report. We also note that this ratio between methanol and total primary chemical production remains the same in 2030 and 2050 in the CTS scenario provided in the IEA Future of Petrochemical Report – Methodological Annex report in Table A8 (IEA, 2018).

HVCs

- Scope 1 emissions: **2020** value is recorded from the IEA's direct CO_2 emissions from primary chemical production in the Net Zero Scenario, 2015-2030 (IEA, 2021c). **2030** value is assumed to be the same as the 2020 value. Although the 2030 scope 1 CO_2 emissions from HVCs in the 2021 NZE Report showed minor increases from 2020, we have assumed no emissions increase to prevent backsliding. Note the 2023 NZE (IEA, 2023b) Report supports this rationale, with scope 1 CO_2 emissions from HVCs increasing only 1.7% from 2020 to 2030[3]. **2040** and **2050** values are assumed to have the same ratio against the total chemical sector emissions (minus ammonia) as 2020 values.

- Electricity: **2020** and **2030** values are calculated by subtracting the total electricity required to produce ammonia and methanol from the total electricity from primary chemical production in those years. Minimal electrification is assumed for the production of HVCs, therefore the same rate of increase in electricity between 2020 and 2030 is maintained for **2040** and **2050**.

- Production: **2020** value is calculated by dividing the 2020 emissions (see above) by the HVCs production emission intensity value provided in Figure 1.7 in the Ammonia Technology Roadmap (1 tCO_2 / t) (IEA, 2021b). **2030** value is based on the indexed values provided in IEA's Expansion in primary chemical production in the Net Zero Scenario, 2000-2030 graphic, published in 2021 (IEA, 2021d). This value is calculated as an index against the calculated 2020 value. **2040** and **2050** values are calculated by assuming the same ratio against the total primary chemical production values (minus ammonia) as 2030 values in the 2021 NZE Report (IEA, 2021a). Note we noticed that 2020 and 2030 ratios are similar in the NZE Report. We also note that this ratio between HVCs and total primary chemical production remains the same across 2030, 2040, and 2050 in the CTS scenario provided in the IEA Future of Petrochemical Report – Methodological Annex report in Table A8 (IEA, 2018).

[3] https://www.iea.org/energy-system/industry/chemicals.

Links to all IEA sources

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