SDG Goal 9	**Industry, innovation and infrastructure**
SDG Target 9.4	**By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities**
SDG Indicator 9.4.1	**CO2 emission per unit of value added**
Time series	**CO2 emissions per real GDP**

1. General information on the time series

- Date of national metadata: 31 March 2022
- National data: http://sdg-indikatoren.de/en/9-4-1/
- Definition: The time series measures the CO2 intensity of the total economy. By indicating how much CO2 is emitted (needed) to produce one unit of gross domestic product (GDP), the carbon intensity is a proxy for clean technology production and the developmental state of an industry.
  The time series does not include emissions from land use, land-use change and forestry.
- Disaggregation: Not available.

2. Comparison with global metadata

- Date of global metadata: February 2021
- Global metadata: https://unstats.un.org/sdgs/metadata/files/Metadata-09-04-01.pdf
- The time series is compliant with the global metadata. GDP used in the calculation of the time series is given in terms of constant euro and not in terms of US dollar as requested in the global metadata.

3. Data description

- The data is derived from the National Inventory Report submitted under the United Nations Framework Convention on Climate Change 2009 by the German Environment Agency (UBA).
  The data on GDP is calculated by the Federal Statistical Office's National Accounts as a secondary statistic. GDP is adjusted based on a price base changing every five years (previous year's price base (constant prices)). After several revisions due to new data input, final results are available four years after the first preliminary release.

4. Accessibility of source data

- Table on trend summary – Green House Gas (GHG) Inventory UBA (only available in German):
  https://www.umweltbundesamt.de/themen/klima-energie/treibhausgas-emissionen
- National accounts - Gross value added, gross domestic product (nominal/price-adjusted) – GENESIS online 81000-0001:
  https://www-genesis.destatis.de/genesis//online?operation=table&code=81000-0001&bypass=true&language=en

5. Metadata on source data

- Submission under the United Nations Framework Convention on Climate Change and the Kyoto Protocol 2020, Chapter 1: https://www.umweltbundesamt.de/en/publikationen/submission-under-the-united-nations-framework-5
- Quality Report - National Accounts: https://www.destatis.de/EN/Methods/Quality/QualityReports/National-Accounts-Domestic-Product/national-accounts.pdf

6. Timeliness and frequency

- Timeliness: CO2: t + 17 months; GDP: t + 0.5 months
- Frequency: Annual

7. Calculation method

- Unit of measurement: Grams per EUR, constant (2010)
- Calculation method:

$$\textbf{CO}_2\textbf{ emissions per real GDP} = \frac{\text{Total CO}_2\text{ emissions [g]}}{\text{GDP (price adjusted) [EUR]}}$$

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SDG Indicator 9.4.1	**CO2 emission per unit of value added**
Time series	**CO2 emissions per gross value added (price adjusted) in manufacturing industries**

1. General information on the time series

- Date of national metadata: 31 March 2022
- National data: http://sdg-indikatoren.de/en/9-4-1/
- Definition: The time series measures the CO2 intensity of the manufacturing sector. By indicating how much CO2 is emitted (needed) to produce one unit of gross value added, this carbon intensity is a proxy for clean technology production and the developmental state of an industry.
- Disaggregation: Not available.

2. Comparison with global metadata

- Date of global metadata: February 2021
- Global metadata: https://unstats.un.org/sdgs/metadata/files/Metadata-09-04-01.pdf
- The time series is compliant with the global metadata. Gross value added used in the calculation of the time series is given in terms of constant euro and not in terms of US dollar as requested in the global metadata.

3. Data description

- The data on CO2 emissions and value added of manufacturing sector is calculated by the Federal Statistical Office of Germany as secondary statistics.
  The emissions are based on the national energy balance by the Working Group on Energy Balances (AGEB).
  Gross value added of manufacturing sector is calculated at constant 2010 price. For price adjustment, the nominal value of 2010 is taken as basis year. This value is then multiplied by the prices of 2010 adjusted index for gross value added of the reference year. After several revisions of the indexes due to new data input, final results are available 4 years after the first preliminary release.

4. Accessibility of source data

- Air emissions: Germany, years, type of air emission,homogeneous branches – GENESIS online 85111-0001:
  https://www-genesis.destatis.de/genesis/online?operation=table&code=85111-0001&bypass=true&language=en
- Gross value added: Persons employed, turnover, output and value added of enterprises in manufacturing – GENESIS online 42251-0001:
  https://www-genesis.destatis.de/genesis/online/data?operation=table&code=42251-0001&bypass=true&language=en
- National accounts - Gross value added (nominal/price-adjusted): industries – GENESIS online 81000-0103:
  https://www-genesis.destatis.de/genesis//online?operation=table&code=81000-0103&bypass=true&language=en

5. Metadata on source data

- Environmental-economic accounts - Methodology of air emission accounting (only available in German): https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/UGR/energiefluesse-emissionen/Publikationen/Downloads/methode-luftemissionsrechnung-5851317199004
- Quality Report - Structure Statistics in Manufacturing, Mining and Quarrying (only available in German): https://www.destatis.de/DE/Methoden/Qualitaet/Qualitaetsberichte/Industrie-Verarbeitendes-Gewerbe/struktur-verarbeitendes-gewerbe.pdf
- Quality Report - National Accounts: https://www.destatis.de/EN/Methods/Quality/QualityReports/National-Accounts-Domestic-Product/national-accounts.pdf

6. Timeliness and frequency

- Timeliness: CO2: t + 17 months; value added: t + 14 months
- Frequency: Annual

7. Calculation method

- Unit of measurement: Grams per EUR, constant (2010)
- Calculation method:

$$\textbf{CO}_2\textbf{ emissions per gross value added (price adjusted) in manufacturing industries} = \frac{\text{CO}_2\text{ emissions in manufacturing sector [g]}}{\text{Gross value added (price adjusted) in manufacturing sector [El}}$$