Assignment 2: SDR Energy Indicators and SDG Index
Country: Germany

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1 Extract data from EIA website on CO_2 emissions and total electricity generation. Calculate the ratio of CO_2 emissions and total electricity generated. Compare with SDR data indicator sdg7_co2twh (7.2).

Data from EIA website on CO_2 emission and total electricity generation for all countries has been downloaded and modified using excel for further analysis. The modified csv files, namely 'CO_2 emmission EIA.csv' and 'Electricity generation EIA.csv' have been attached. Further analysis has been conducted using python programming language. Details of such analysis can be found in attached jupyter notebook file *sdg.ipynb*.

Here we will look at Germany in particular. We can clearly see from the figure 1 and table 1 that the two values are nearly same. Comparison can beeen made on following counts:

1. Unit of reporting: EIA uses MMtonnes as unit for CO_2 and SDG uses MtCO_2 which are equivalent. For electricity generation they use 'billion KWh' and 'TWh' which are again same.

2. Data source: SDG source its data from IEA which has different way of collecting and reporting data. This can also be the reason for the small differences observed.

Table 1: Comparison of sdg7_co2TWh value for Germany from EIA (calculated) and SDR (original)

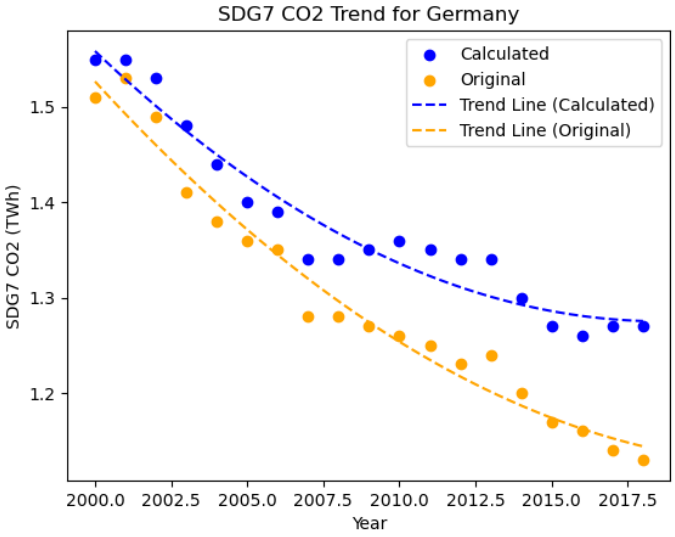
Year	sdg7_co2TWh (Calculated)	sdg7_co2TWh (Original)	Difference
2000	1.55	1.51	0.04
2001	1.55	1.53	0.02
2002	1.53	1.49	0.04
2003	1.48	1.41	0.06
2004	1.44	1.38	0.06
2005	1.40	1.36	0.04
2006	1.39	1.35	0.04
2007	1.34	1.28	0.05
2008	1.34	1.28	0.07
2009	1.35	1.27	0.08
2010	1.36	1.26	0.10
2011	1.35	1.25	0.10
2012	1.34	1.23	0.11
2013	1.34	1.24	0.10
2014	1.30	1.20	0.11
2015	1.27	1.17	0.10
2016	1.26	1.16	0.10
2017	1.27	1.14	0.13
2018	1.27	1.13	0.14

2 Compare the SDR data on indicator sdg7_renewcon (7.2.1) with World Bank data on the same indicator. Do you observe any differences? State the possible causes of the difference.

Refer to the attached excel sheet for comparison of the values obtained from SDR and World Bank data. Here we will primarily focus on the case of Germany. The value of percentage share of renewable energy to the total energy consumption is almost same for Germany. While this may not be true for some other countries due to some of the possible reasons given below:

- Difference in data sources.
- Difference in the way renewable energy is defined by the reporting organizations i.e. World Bank and UN such as inclusion of traditional biomass for low income countries in world bank data.

Figure 1: Trend comaprison of sdg7_co2TWh value for Germany from EIA (calculated) and SDR (original)



Year	SDR Values	World Bank Values
2014	14	14.0
2015	15	14.6
2016	14	14.2
2017	15	15.2
2018	16	16.0
2019	17	17.1

Table 2: Comparison of Values by Year

3 Study the methodology used to calculate the SDG progress. Using the raw data for the indicators tracked under energy goal, estimate the SDG index for goal 7.

Using data from attached excel file on SDR 2023, the SDG index for Goal 7, i.e. Ensure access to affordable, reliable, sustainable and modern energy for all, has been calculated for all the countries from 2001-2023. Detailed steps have been mentioned in the attached jupyter notebook file, named sdg.ipynb.

Steps involved in calculation of SDR index[1]:

1. Extraction of data on all the four indicators under Goal 7.

[1]For detailed discussion on methodology, refer to Sustainable Development Report website[2]

2. Normalization and truncation of the values: Based on the methodology suggested on SDR website and using bounds as given in the 'codebook' sheet of the attached excel file 'SDR2023-Data.xlsx'.

3. Calculation of index for Goal 7: By taking arithmetic mean of the normalized and truncated values for each indicators.

Year	SDG7 Index	Goal 7 Score	Difference	Rank
2000	68.93	68.9	0.03	45
2001	68.94	68.9	0.04	47
2002	69.37	69.4	-0.03	45
2003	70.16	70.2	-0.04	40
2004	70.72	70.7	0.02	37
2005	71.31	71.3	0.01	35
2006	71.96	72.0	-0.04	36
2007	73.17	73.2	-0.03	29
2008	73.05	73.1	-0.05	33
2009	73.32	73.3	0.02	35
2010	73.78	73.8	-0.02	35
2011	74.27	74.3	-0.03	32
2012	74.88	74.9	-0.02	32
2013	74.82	74.8	0.02	35
2014	75.22	75.2	0.02	36
2015	75.62	75.6	0.02	32
2016	75.46	75.5	-0.04	33
2017	76.01	76.0	0.01	35
2018	76.52	76.5	0.02	33
2019	77.16	77.2	-0.04	31

Table 3: Comparison of SDG7 Index calculated and Goal 7 Score in SDR2023 for Germany

Additionally the trend in the SDG index for Goal 7 has been plotted in figure 2.

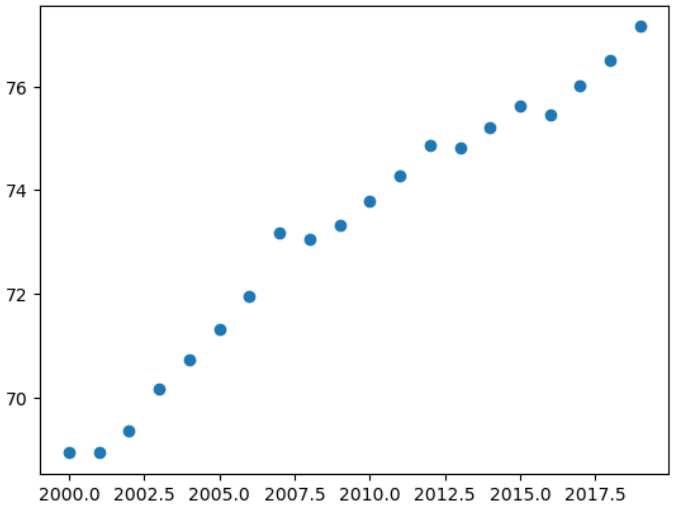


Figure 2: Trend in SDG of Germany