CO2 Emission per Capita Forecast 2020-2100

Joseph Nowarski, M.Sc., ME – Energy Conservation Expert

Version 1.1.1, 30 October 2022
DOI:10.5281/zenodo.7264407
all versions DOI: 10.5281/zenodo.7264406

Abstract

This work includes Business As Usual (BAU) forecast of the world's global CO2 emissions per capita (CpC) in the period 2020-2100.
The CO2 emission forecast is from the publication "*Dataset Global Warming Forecast using Acceleration Factors*" [3]. According to this publication, the CO2 emissions without international transport will change from 33,803 MtCO2/y in 2020 to 70,191 MtCO2/y in 2100, a 108% increase.
The population forecast applies a parabolic trendline of the last 30 years. According to this calculation, the world population will change from 7,795 million in 2020 to 15,206 million in 2100, a 95% increase.
CO2 emissions per capita (CpC) are calculated by dividing the CO2 emissions per year by the population in the same year.
The world CpC was 4.3366 tCO2/y,cap in 2020. The BAU CpC forecast for 2100 is 4.6160 tCO2/y,cap, 6.4% increase.

Keywords: Climate Change, Global Warming, CO2 emissions, CO2 emissions per capita, CO2 per capita, CO2 per capita forecast

Glossary

Ave	average
BAU	Business As Usual
CO2	emissions of Carbon Dioxide, CO_2
CpC	CO2 emissions per capita, tCO2/y,cap (ton CO2 per year, per population)
Global Warming	global surface temperature above the 1850-1900 baseline, land+ocean, °C
MtCO2/y	Mega-ton CO2 per year, 106 ton, 10^6 ton, 1,000,000 ton CO2 per per
OWID	Our World in Data – Internet site [1] [2]
Ref	reference
tCO2	ton CO2

Dataset

Table 1 - CO2 emissions and population dataset [1] [2]

	CO2 emissions	Population
Source of data	OWID	OWID
Reference	[1] [2]	[1] [2]
From year	1750	1800
To year	2020	2020
CO2 from fossil fuels	Yes	
CO2 from cement production	Yes	
CO2 from other sources	No	
Other GHG	No	
Land use change	No	
Units	MtCO2/y	
Resolution	1 tCO2/y	1 Resident

The datasets are from the publication [1] [2], CO2 emissions produced from fossil fuels and cement production only – land use change is not included.

The publication "*Dataset Global Warming Forecast using Acceleration Factors*" [3] includes Global Warming and CO2 emissions time series 2020-2100.

Business As Usual Scenario

All calculations and estimations in this work are for the Business As Usual (BAU) scenario, the effectiveness of the future CO2 emissions mitigation will be as in the past.

CO2 Emissions

Chart 1 - Global CO2 emissions per year without international transport 1990-2020 [tCO2/y] [1] [2]

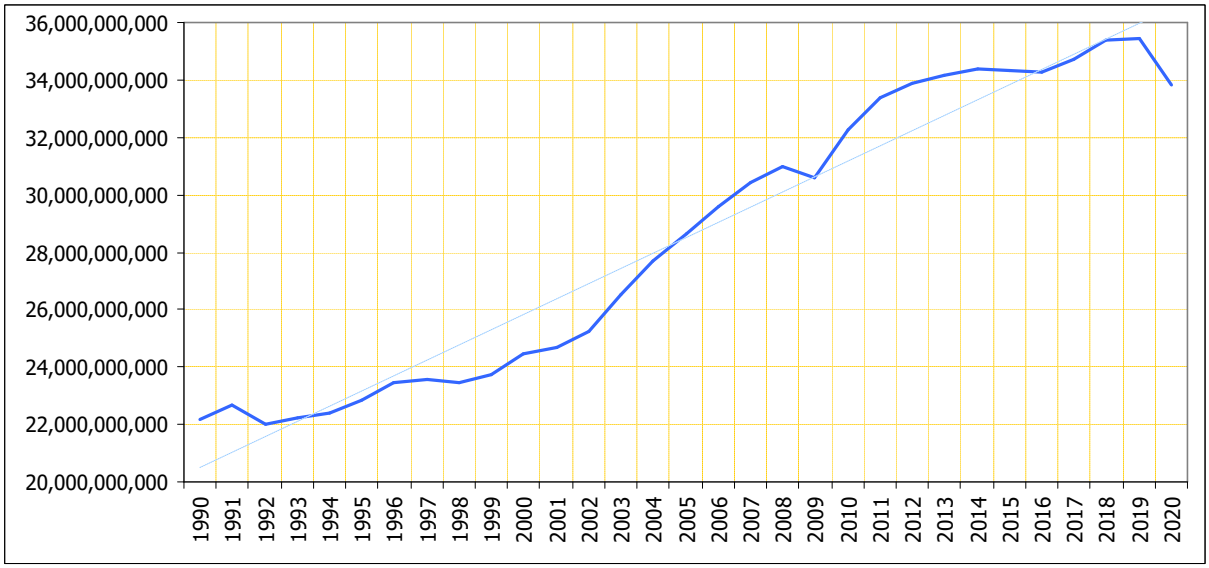
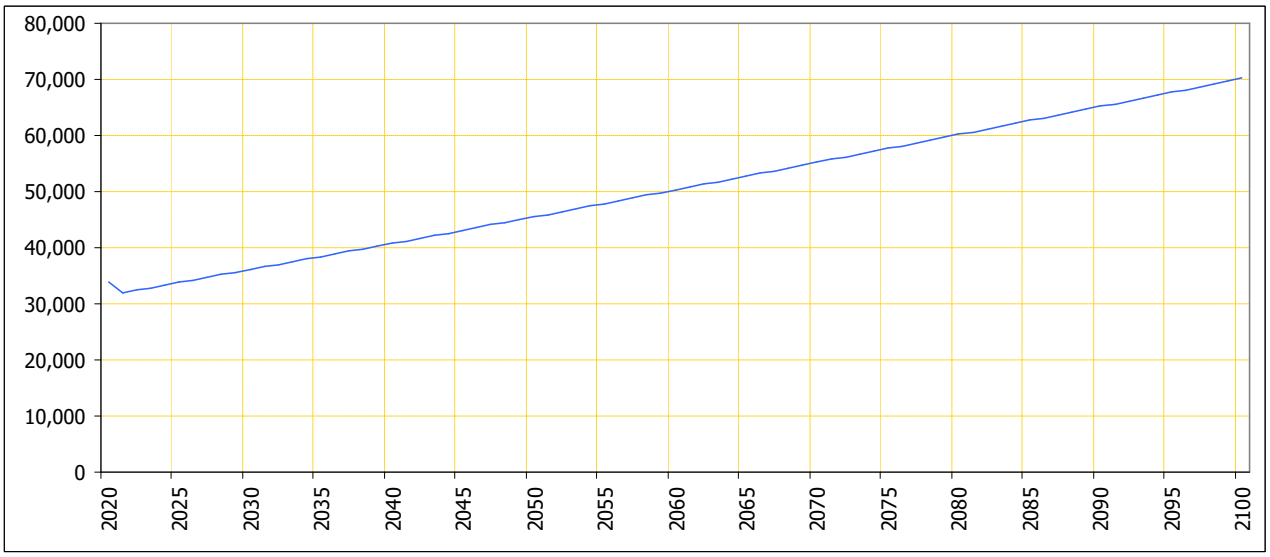


Chart 2 - CO2 emissions per year without international transport BAU forecast 2020-2100 [MtCO2/y] [3]



The dataset of CO2 emissions forecast for 2020-2100 is available in the publication [3].

World Population Forecast

The population forecast for the period 2020-2100 is based on the Excel chart parabolic trendline formula of the actual world population in the period 1990-2020 [1] [2].

Chart 3 - World population parabolic trendline formula 1990-2020 [1] [2]

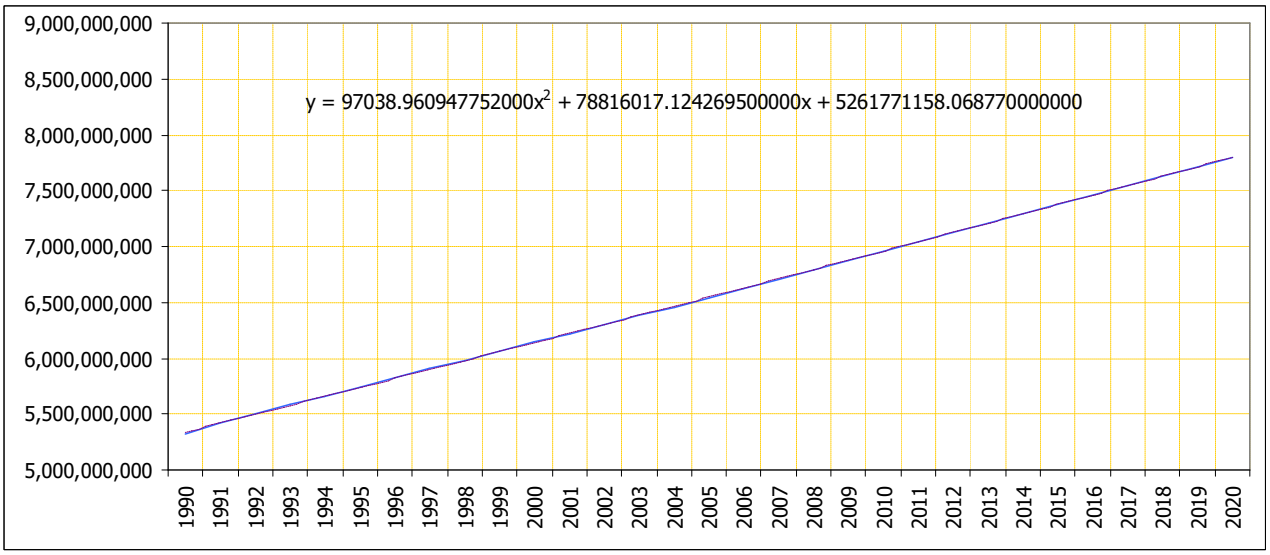


Table 2 - World population parabolic trendlines formula 1990-2020 [1] [2]

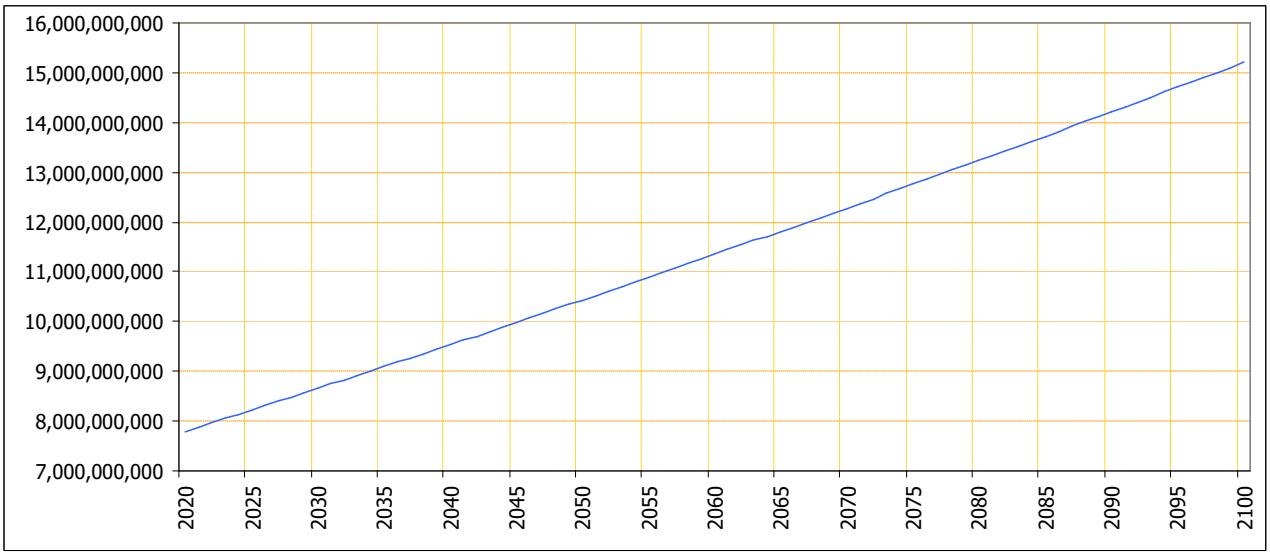
y = 97038.960947752000x2 + 78816017.124269500000x + 5261771158.068770000000

a	97039.0
b	78816017.1
c	5261771158.1
start	1989

Table 3 - World population forecast

World population 1990	5,327,529,078
World population 2020	7,794,798,725
Parabolic trendline chart formula:	
y = 97038.960947752x2 + 78816017.1242695x + 5261771158.06877	
World population 2020 according to the formula	7,798,322,130
Δ to actual	0.045%
World population 2100	15,205,966,097

Chart 4 - World population forecast 2020-2100



The dataset of population forecast for 2020-2100 is available in the publication [4].

CO2 Emissions per Capita

CO2 Emissions per Capita are calculated by dividing the CO2 emissions per year by the population in the same year.

Table 4 - CO2 emissions per capita forecast

		1990	2020	2100	2100/2020
CO2 emissions per year without international transport	tCO2/y	22,191,664,636	33,803,026,586	70,191,421,088	107.6%
World population		5,327,529,078	7,794,798,725	15,205,966,097	95.1%
CO2 emissions per capita	tCO2/y,cap	4.1655	4.3366	4.6160	6.4%

Chart 5 - CO2 emissions per capita 1990-2020 [tCO2/y,cap]

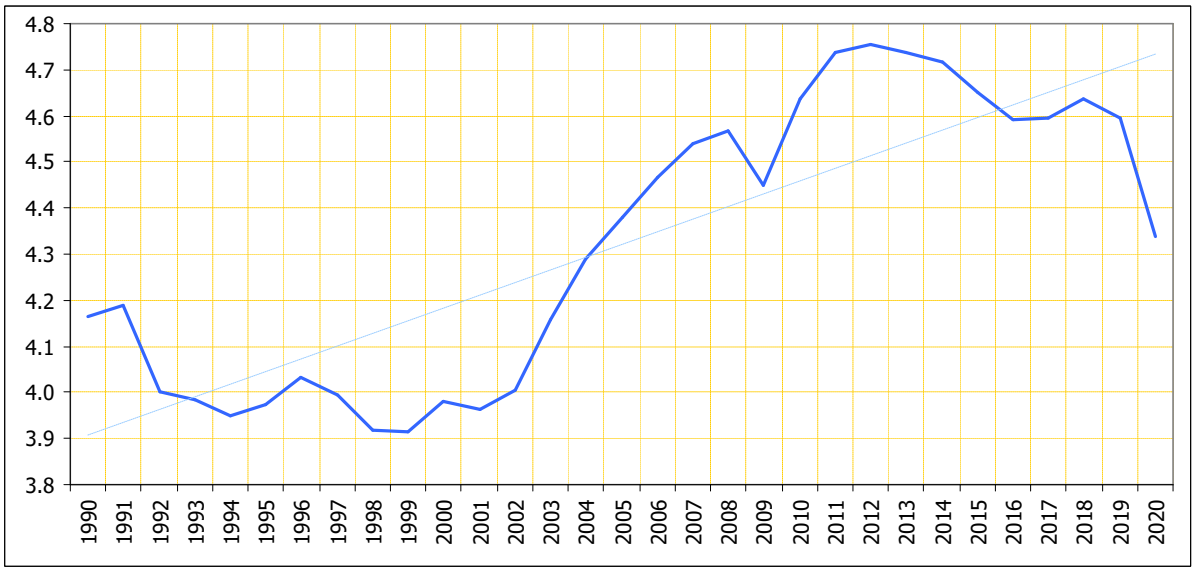
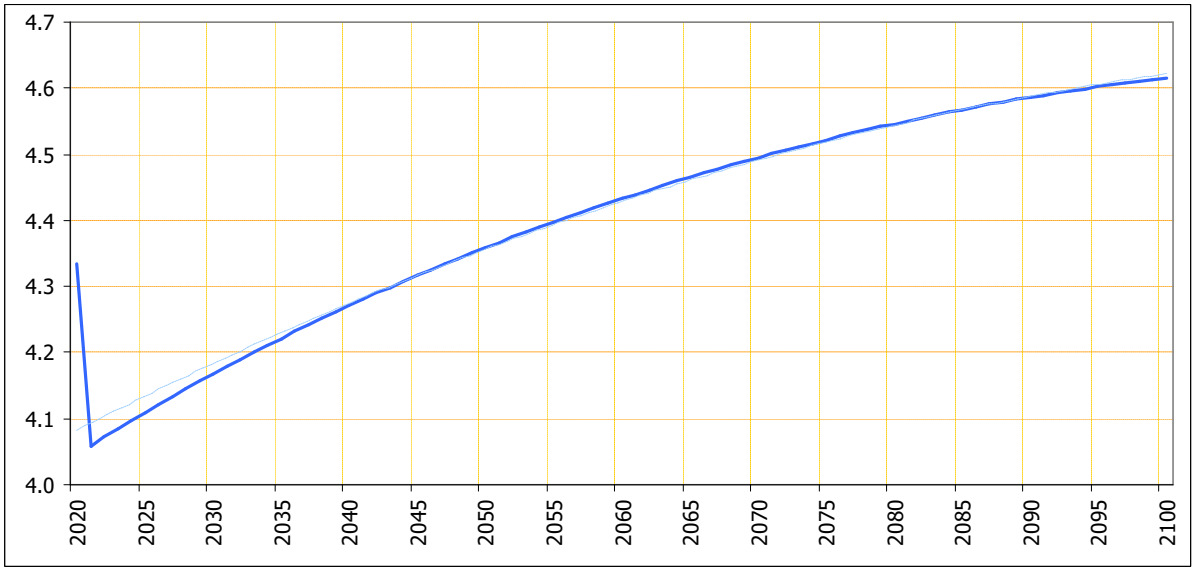


Chart 6 - CO2 emissions per capita 2020-2100 [tCO2/y,cap]



The dataset of CO2 emissions per capita forecast for 2020-2100 is available in the publication [4].

References

1. Hannah Ritchie, Max Roser, Edouard Mathieu, Bobbie Macdonald and Pablo Rosado - Data on CO_2 and Greenhouse Gas Emissions by Our World in Data
https://github.com/owid/co2-data#data-on-co2-and-greenhouse-gas-emissions-by-our-world-in-data

2. Our World in Data, Cumulative CO2 emissions, 2020
https://ourworldindata.org/grapher/cumulative-co-emissions

3. Dataset Global Warming Forecast using Acceleration Factors - Joseph Nowarski, DOI:10.5281/zenodo.7151890

4. Dataset CO2 Emission per Capita Forecast 2020-2100 – Joseph Nowarski, DOI:10.5281/zenodo.7264409

* * *