Petroleum Technologies and Sustainability in the Era of Climate Change

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1 Introduction

The climate change is the biggest challenge that the human kind have ever had to deal with. Despite a residual skepticism on the topic, "climate change is real"[1] and it is already influencing and it will influence the life on Earth.

The cause of climate change is attributed to the significant increase of greenhouse gases (mainly CO_2) in the atmosphere, able to trap heat radiating from Earth toward space. By means of the analysis of ice cores[2] it has been discovered that, for millennia, the concentration of carbon dioxide in atmosphere has been below 300 ppm. As it is shown in the Figure 1, such threshold was broken in 1950 and, since then, the concentration of CO_2 has never stop growing reaching in 2019 the value of 410 ppm[3].

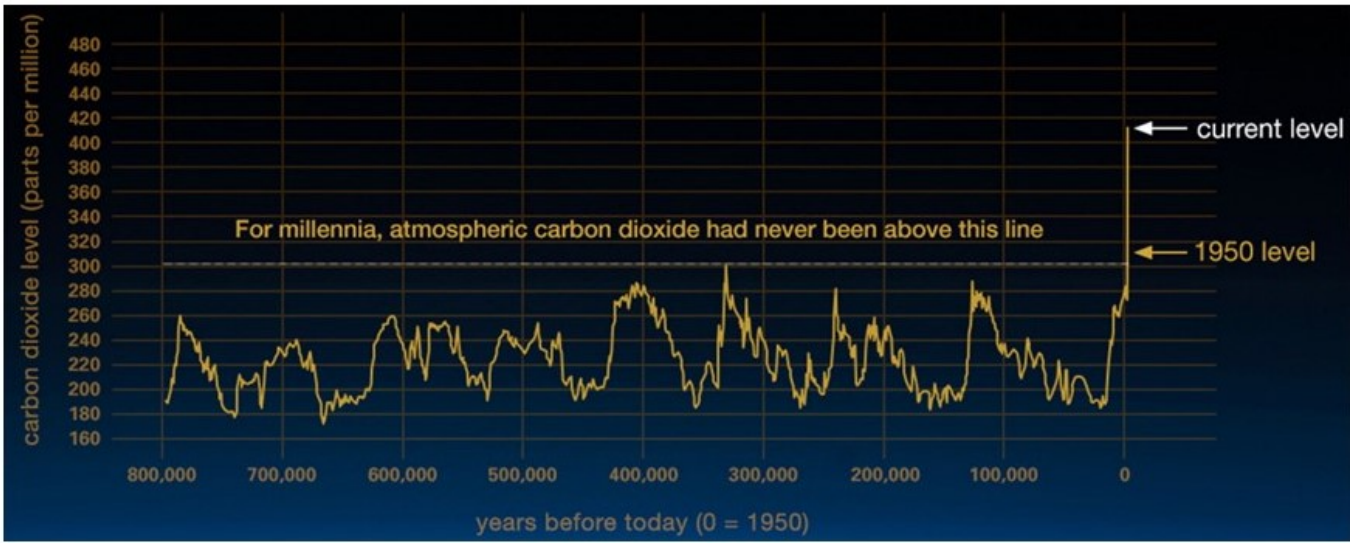


Figure 1 Variation of carbon dioxide concentration during millennia estimated from atmospheric samples collected from ice cores[3].

According on the considerations mentioned above, the 21st century is indeed recognized as the "*era of climate change*" mainly characterized by the increase of the land-ocean mean surface temperature (GMST) and, as a consequence, by other environmental phenomena such as the increase of the average sea level and the retreat of glaciers.

The reason why the amount of GHGs in the atmosphere is increasing so rapidly is strictly connected to the growth of the world population driven by the development of the industrial sector. Since the mid-20th century the anthropogenic CO_2 emissions have raised exponentially (see Figure 2) in line with the trend detected of the carbon dioxide concentration in atmosphere. On top of this, the human action is identified as the main cause of the global warming.

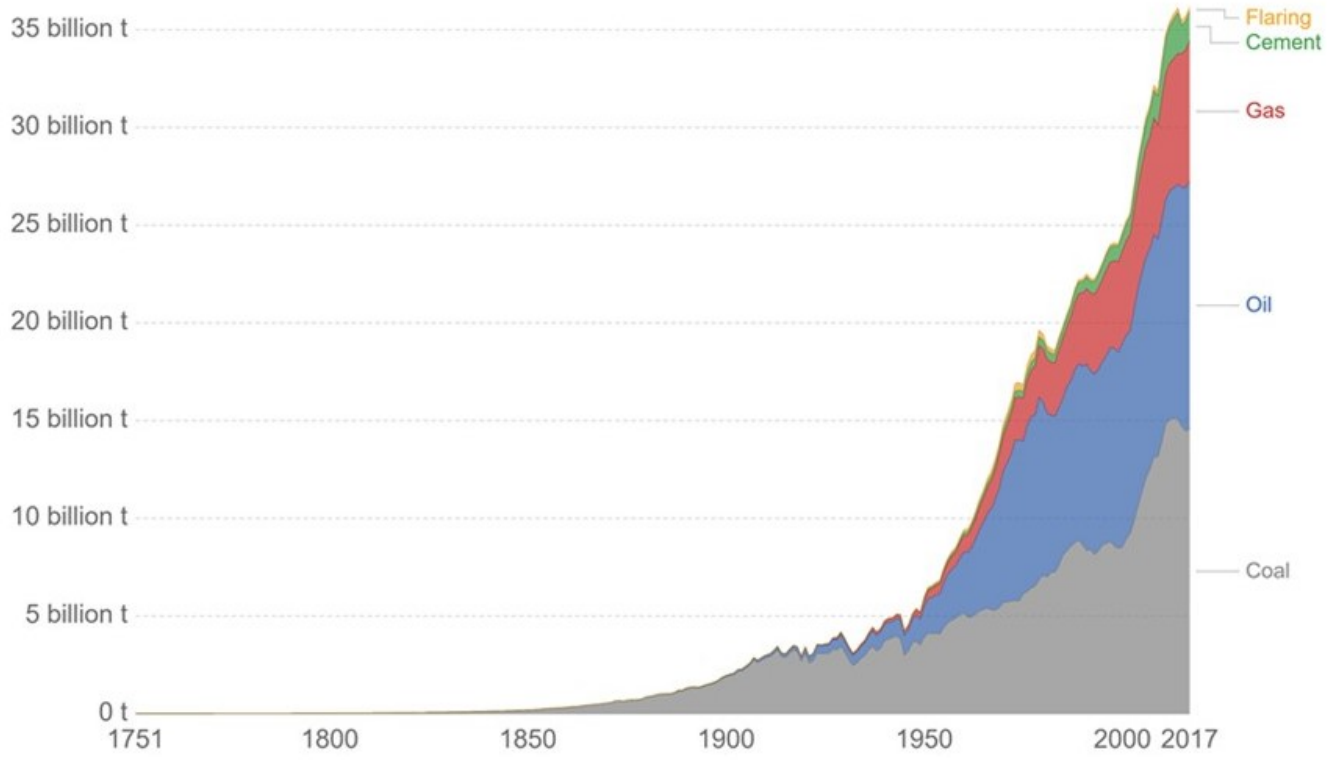


Figure 2 Global anthropogenic CO2 emissions[4].

The sign of the Paris Agreement (Paris climate conference – COP21, December 2015), the first-ever universal, legally binding global climate change agreement, represents an important act to the fight against the climate changes. Major players of the Oil & Gas and Energy sector are financing the development of sustainable technologies in order to diminish their significant carbon footprint. The actions of mitigation of the emissions of carbon dioxide are mainly directed to the main sources of CO_2 which, as shown in the Figure 3, comes from the combustion of *coal, oil and gas*, and from the operations of *flaring* and *cement production*[5].

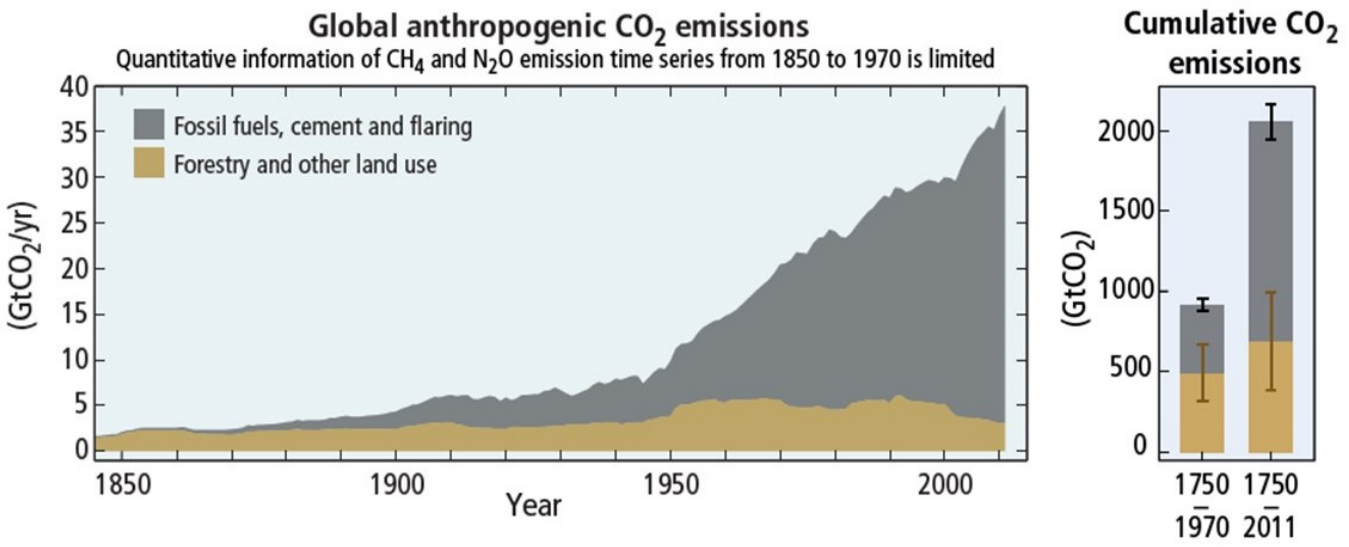


Figure 3 CO2 emissions by fuel type, [5].

[1] https://sites.nationalacademies.org/cs/groups/internationalsite/documents/webpage/international_080877.pdf

[2] To find more: https://icecores.org/about-ice-cores

[3] https://climate.nasa.gov/

[4] "Climate Change 2014 Synthesis Report Summary Chapter for Policymakers," 2014.

[5] https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

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