Energy Consumption, Greenhouse Gas Emissions and Türkiye

V Ismet Ugursal[1,*]

[1]Department of Mechanical Engineering, Dalhousie University, Halifax, NS, Canada B3H 4R2

Abstract. This paper explores the relationships amongst energy consumption, greenhouse gas emissions, development, and the state of the population and the economy. Using a comparative and critical analysis of economic and developmental data, the paper addresses these questions from the perspective of Türkiye. However, the analysis, arguments and conclusions are transposable to countries in similar socio-economic conditions.

1 Introduction

Türkiye, as all middle- and low-income developing countries, is under intense pressure to reduce its greenhouse gas emissions, switch to renewable energies and achieve net-zero energy and emissions targets in order to fight the presumed existential threat to "the planet", caused by climate change and global warming, presumed to be unprecedented in the 4.5 billion year history of the earth, due, presumably, to anthropogenic greenhouse gas emissions, primarily carbon dioxide emitted from the combustion of fossil fuels. The pressure is exerted through many mechanisms, not excluding trade barriers that directly affect the already struggling population and economy.

This paper does not delve into the discussion of the nature and magnitude of the climate change, or its possible causes, potential consequences and remedies as the scientific literature discussing both sides of the arguments is abundant and comprehensive. The focus of this paper is less emotive, but more immediate as the paper explores the relationships amongst energy consumption, greenhouse gas emissions, development, and the state of the population and the economy. Using a comparative and critical analysis of economic and developmental data, the paper addresses these questions from the perspective of Türkiye. However, the analysis, arguments and conclusions are transposable to countries in similar socio-economic conditions.

2 Energy consumption and wealth

In Figure 1, the annual per capita energy consumption of nations (each represented by a data point) measured in kilograms of oil equivalent (kgoe) is plotted against the annual per capita gross domestic product (GDP) measured in constant 2015 US$ for years 1984, 1994,

* Corresponding author: Ismet.Ugursal@Dal.Ca

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2004 and 2014. As the plots in Figure 1 indicate, wealthy nations have a high energy consumption while nations with low energy consumption are poor. Consequently, for the wealth of a nation to increase, its energy consumption also has to increase.

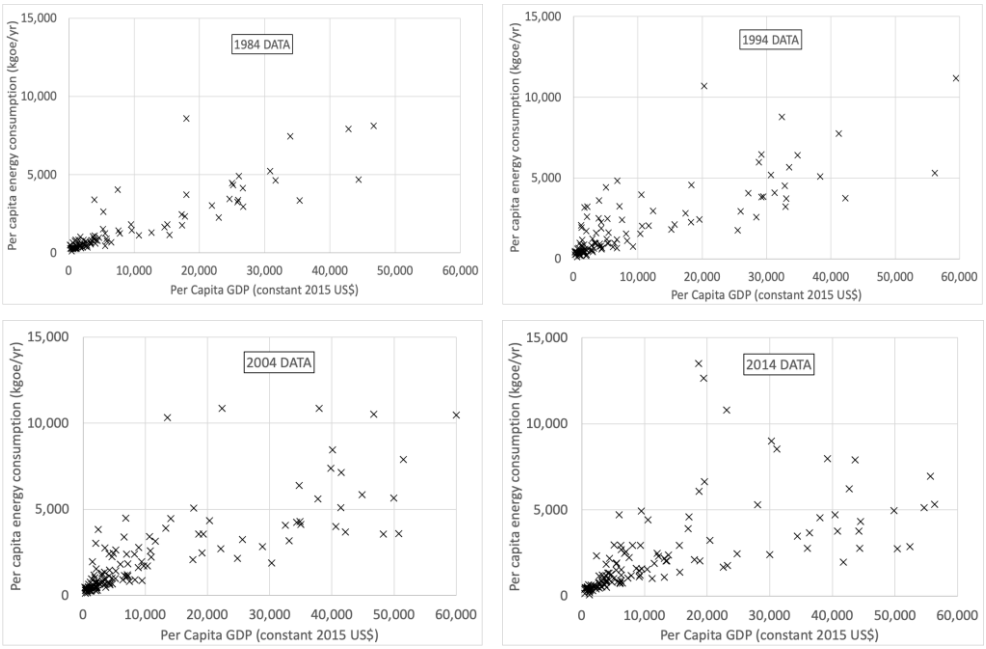

Fig. 1. The relationship between per capita GDP and per capita energy consumption (data from [1]).

3 Energy consumption and human development

In Figure 2, the annual per capita energy consumption of nations (each represented by a data point) measured in kilograms of oil equivalent (kgoe) is plotted against the Human Development Index (HDI) for years 1990 and 2010. As the plots in Figure 2 indicate, nations with higher HDI have a high energy consumption while nations with low energy consumption have lower HDI. Consequently, for the HDI of a nation to increase, its energy consumption also has to increase.

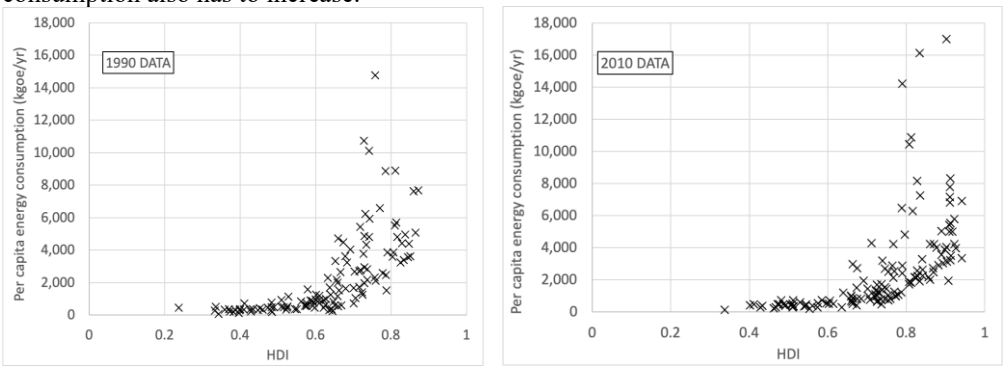

Fig. 2. The relationship between HDI and per capita energy consumption (data from [1, 2]).

4 Proposed and legislated climate actions and costs

Influential international organizations widely declare that intensifying climate impacts across the globe require that anthropogenic greenhouse gas emissions must be reduced rapidly to slow and limit global warming to acceptable limits [3, 4]. The International Energy Agency (IEA) states that with an unprecedented clean technology push to 2030 and a complete transformation of how energy is produced, transported and consumed, global carbon dioxide (CO_2) emissions must be reduced to net-zero by 2050 to limit the long-term increase in average global temperatures to 1.5℃ [3]. The unprecedented clean energy push foreseen by the IEA requires further rapid deployment of available technologies such as installing the world's current largest solar park roughly every day and increasing electric vehicle sales from around 5% of global car sales to more than 60% by 2030, as well as widespread use of technologies that are not on the market yet [3]. To achieve the global transformation from a heavily fossil fuel- and unsustainable land use-dependent economy to a low-carbon economy is expected to require investments of at least US$4–6 trillion a year, which is 20–28 per cent in terms of the additional annual resources to be allocated [4]. The IPCC assesses that global mitigation investments need to increase by a factor of three to six, and even more for developing countries [4].

On the legislative front, the European Union (EU) announced the European Green Deal (EGD) in 2019, which envisions transforming Europe into the world's first climate-neutral continent by 2050 by reducing emissions by at least 55% by 2030 compared to 1990 levels [5]. One of the tools of the EGD to unilaterally impose its climate mitigation measures on non-EU countries is the Carbon Border Adjustment Mechanism (CBAM), which subjects covered carbon intensive imports to the same carbon price imposed on internal producers under the EU Emission Trading System [6]. The CBAM allows the EU to unilaterally impose a levy on such imports from countries that do not meet the environmental standards set by the European Union. Debate on the negative spill-over effects of the CBAM for developing and least developed countries has been intense [7].

5 Comparison of key indicators: Türkiye vs. EU

Türkiye is a middle-income developing country with a per capita gross national income (GNI) of US$ 9,900 in 2021, which is US$ 2,100 below the world average [1].

Due to its physical proximity as well as a host of other reasons, Türkiye has strong ties with the EU and many EU countries, trade being one of the most important. In 2022, 41% of Türkiye's exports, which amounted to US$ 103 billion, went to the EU, ranking EU as its largest export partner [8]. In return, Türkiye imported US$93 billion worth of goods from the EU, which constituted 26% of its imports [8]. While these numbers are highly substantial for Türkiye, they constitute a small fraction of the trade for the EU. The imports from Türkiye constituted only 3.3% of EU's import volume, and its exports to Türkiye constituted only 3.9% [8].

The disparity in these numbers is also reflected in a comparison of other key indicators. In Figure 3, the evolution of per capita GDP (measured in constant 2015 US$) since 1960 is plotted for Türkiye and four selected EU countries (Belgium, France, Germany, Italy) and the average of all EU countries. Figure 3 shows the substantial and expanding difference in wealth between Türkiye and the four selected EU countries and the EU average.

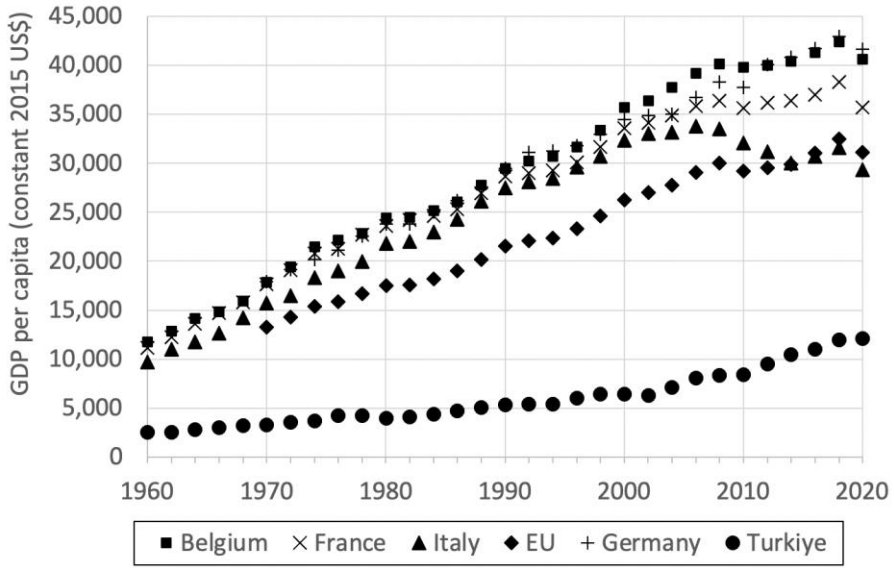

Fig. 3. The evolution of GDP per capita (constant 2015 US$) since 1960 (data from [1]).

As discussed in Section 2, wealth of nations is strongly related with the per capita energy consumption. This is also evident in Figure 4, where the evolution of energy and electricity consumption per capita is plotted since 1960. With the exception of Italy in 2012 and 2014 (the last year for which data is available), the per capita energy consumption of Türkiye was less than one half, and as low as 15% of the per capita energy consumption of all selected countries and the EU average. The ratios of electricity consumption (given country/Türkiye) over the years are much bigger.

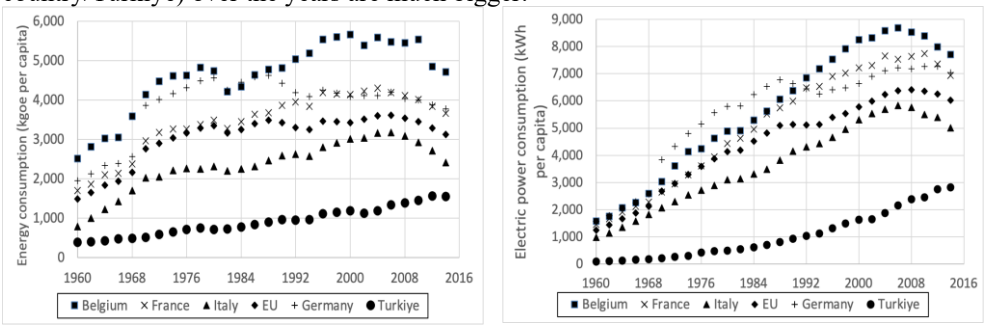

Fig. 4. The evolution of energy and electricity consumption per capita (data from [1]).

The evolution of per capita CO_2 emissions since 1990 (the first year for which data is available) is shown in Figure 5. Amongst the selected countries, only France achieved lower per capita CO_2 emissions than Türkiye since 2016. The CO_2 emissions of all selected countries as well as the EU average have been substantially higher than the CO_2 emissions of Türkiye since 1990.

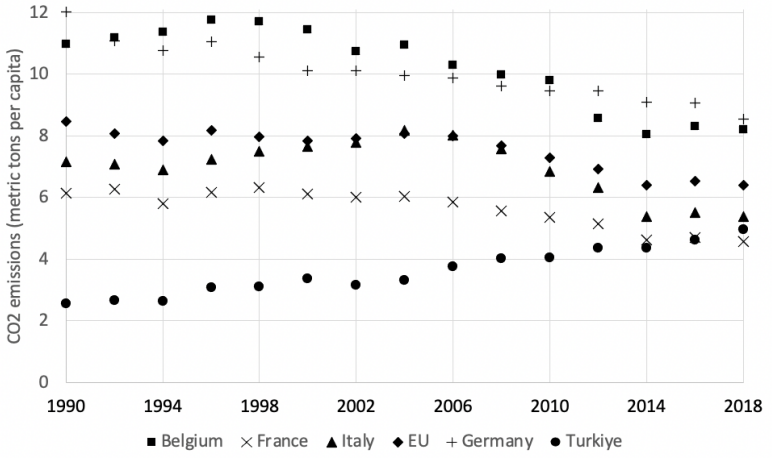

Fig. 5. The evolution of CO_2 emissions per capita (data from [1]).

The data given in Figures 3-5 show that the selected EU countries and the EU average have been substantially wealthier, consumed substantially more energy and electricity, and produced more CO_2 emissions throughout the period for which World Bank DataBank [1] provides data publicly. From the available data, the accumulated difference in wealth, energy and electricity consumption, and CO_2 emissions over the years can be calculated. With access to more data, it is possible to expand these plots to longer periods and calculate accumulated values of wealth, energy and electricity consumption, and CO_2 emissions.

6 Conclusion

Even with the limited publicly available data presented above, it is clear that the selected EU countries (Belgium, France, Italy and Germany) and the EU average enjoyed for many years, and continues to enjoy, high energy consumption, and produced for many years, and continues to produce, high CO_2 emissions, and as a consequence, developed much wealth and high human development in its populace.

As it was shown in Sections 2 and 3, the wealth and human development of nations is strongly related with per capita energy consumption. Higher energy consumption brings higher wealth and higher human development. On the other hand, for medium- and low-income countries such as Türkiye expensive energy means unaffordable energy, i.e. lower energy consumption, and renewable energy sources solar and wind are expensive and unaffordable. Countries with high solar and wind energy content in their energy mix pay substantially more for energy as shown in Table 1.

Table 1. Household electricity prices, September 2022 (US$/kWh) [9].

Denmark	Italy	Germany	Belgium	Türkiye
0.57	0.57	0.55	0.51	0.08

Forcing Türkiye and other developing countries to switch, in large scale and quickly, to solar and wind energy to reduce their already low CO_2 emissions is condemning them to poverty and low human development. This is not only inhumane, it is also patently unfair because as it is shown above, wealthy nations consumed much and inexpensive energy, and emitted high levels of CO_2 for decades with impunity to acquire their wealth.

Furthermore, to protect their economy and standard of living, wealthy nations do not hesitate to turn to inexpensive “dirty” coal as soon as cleaner energy prices escalate to

levels that they consider unacceptable [10, 11]. However, using tools such as the CBAM, they are prepared to economically punish poor developing countries for doing the same.

Developing countries need to form strong alliances and push back against unfair pressures in the name of fighting climate change from wealthy countries which enjoy their wealth and development largely due to decades of using cheap and "dirty" energy. Until developing countries achieve similar levels of wealth and development as wealthy countries, or wealthy countries reduce their wealth and development to similar levels of poverty and under-development as developing countries, all forms of economic and political forcing in the name of fighting climate change must be abandoned. The highly questionable rhetoric of "saving the planet for future generations" should not be forced at the expense of the billions of people who are suffering right now.

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