

Energy Transition: Mechanisms and Implications in the European Union

Talina Contreras*

PhD, International Economics and Development, Complutense University of Madrid, Spain

Abstract: *In the face of IPCC warnings about global warming, the EU's current goal is not to eliminate GHG emissions, but to compensate them to achieve climate neutrality. The objective is a transition to the green era without ending fossil energy production, and implementing new processes that generate high CO₂ emissions, in a context of energy dependence that limits the transition project, which will lead to productive restructuring with negative consequences for the working class.*

Keywords: *European Union, Climate Neutrality Mechanisms, Energy Transition Implications.*

1. Introduction

The capitalist society-nature relationship between production and trade of goods and the continuity of life per se, are at risk due to a worldwide climate crisis caused by global warming and the emission of greenhouse gases, mainly CO₂, which will have increasing negative consequences. Since 1990, these have been the declarations of the United Nations Intergovernmental Panel on Climate Change (IPCC). In 2022, its sixth report argued that the fight must be fast and hard to reach the main objective of the 2015 Paris Agreement, to keep global warming below 2 °C, compared to pre-industrial (pre-1750) levels. Far from it, at the end of 2024, the secretary general of the UN's World Meteorological Organization (WMO) said that we might find these years average temperature's increase, above the agreed goal, being a record year with the warmest surface temperature on the planet in millennia.

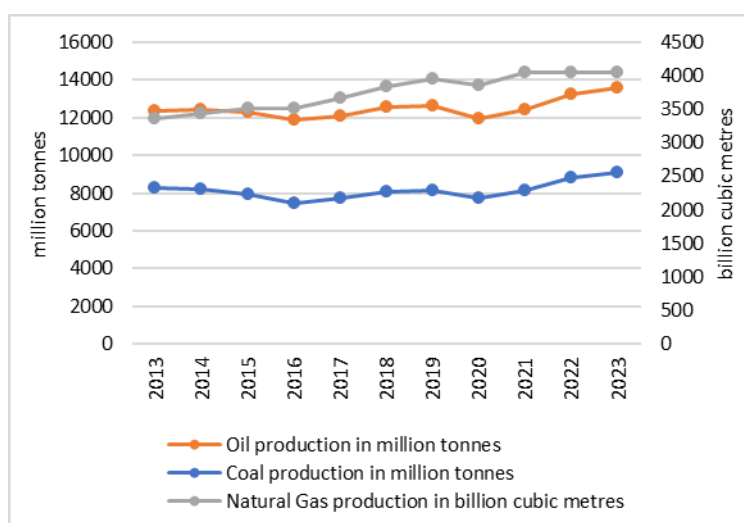
If we fully accept the assertions of these international organisms, we must say that one of the main causes of global warming is the consumption of fossil fuels (coal, oil, natural gas), which has intensified along with the expansion of the capitalist means of production. In the mid-18th century, coal was the protagonist for the operation of the steam engine that led to the development of industry, transport, and commerce. In the second half of the 19th century, oil consumption would begin with the invention of the internal combustion engine; and in the 20th century, fossil gas, mainly composed of methane, became important thanks to the advance of transport technologies. Given the predictions, the logical thing to do would be to stop using these fossil fuels immediately to avoid GHG emissions, but this is not happening. Today, the fight to combat climate change is limited to neutralising GHG emissions with mechanisms such as net zero, or to compensating them. At the same time, investment and production of fossil fuels is increasing and the high GHG emissions required for the production and maintenance of compensation mechanisms question the good intentions.

2. We are not giving up Fossil Fuels

It is difficult to imagine a prompt transformation to a post-fossil fuel society if we look at the reserves of oil that still exist, not to mention the production and consumption of this and other fossil fuels in recent years. The

2024 report of the International Energy Agency (IEA) predicted that oil production will be almost 113.8 million barrels per day in early 2030, resulting in an extraction surplus of about 8 million barrels, some 2 million barrels more than now. As for reserves, they had reached 1.73 trillion barrels by 2020, which could still cover some fifty years considering our consumption, which seems to be constant. In this respect, Covert and Greenstone of the University of Chicago and Knittel of the Massachusetts¹ Institute of Technology found that the relationship between fossil fuel reserves and annual consumption from 1980 to 2014 was constant for both oil and natural gas, regardless of the variations in market prices. In fact, world oil consumption has been rising steadily over the past three decades, reaching 102.2 million barrels per day (mbd) in 2023 (2% more than the previous year), and, on average, 104.1 mbd in 2024. The only decline during this period was observed around the crisis that started in 2008 and the so-called coronavirus pandemic in 2020. The International Energy Agency forecasts that its production will be almost 113.8 mbd in early 2030, with global demand reaching 105.4 mbd in the same year.

On the other hand, in 2024, global coal demand reached 8.77 billion tonnes, with annual growth of 1%, and global production is still expected to exceed 9 billion tonnes in 2025. In 2024, coal accounted for 41% of fossil emissions. Another fossil fuel is natural gas, composed mainly of methane. Gas production comes from activities such as oil and gas extraction and fracking, agriculture, and natural phenomena such as volcanic eruptions or in the release of ice embedded in the Arctic. After oil and coal, gas is the world's third largest source of energy, mainly used in power plants to generate electricity and in the chemical industry. In 2023, global natural gas reserves amounted to approximately 206 trillion cubic meters, and its use has been strongly promoted by governments because it generates approximately 40% less CO₂ emissions than coal. However, it is necessary to consider the losses that occur in the extraction and use processes. This is important, because the methane released is about 35 times more potent in producing GHG than CO₂².



Own elaboration with data from Statistical Review of World Energy 2024.

Fig. 1. Total world fossil fuel production 2013-2023

As we can see, the production of fossil fuels continues and is increasing. The 2023 Production Gap report, which includes the collaboration of several researchers and academic institutions, stated that government plans and projections will increase global coal production until 2030, and oil and gas until at least 2050, which contradicts the commitments made in the Paris Agreement, and dashes expectations that global demand for coal, oil and gas would peak in this decade³.

¹ Thomas Covert, Michael Greenstone y Christopher R. Knittel. (2016). Will We Ever Stop Using Fossil Fuels?, febrero de 2022, de Journal of Economic Perspectives.

² The calculation of 35 times higher is considering a period of 100 years, taking into account that the lifetime of a methane molecule in the atmosphere is about 10 years and of a CO₂ molecule more than 100 years. For more information on the effects of methane, see the 2021 report of the Intergovernmental Panel on Climate Change (IPCC).

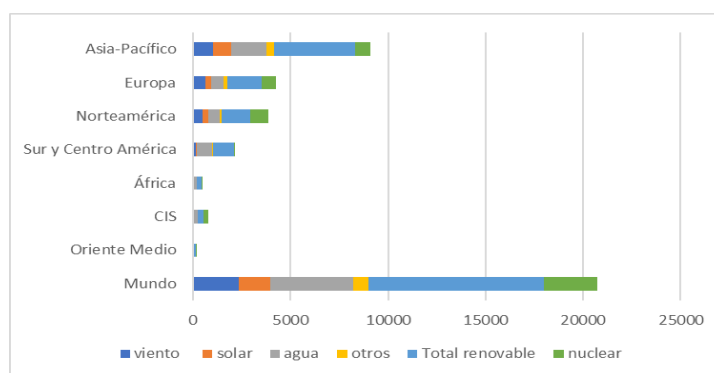
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WG1_SPM_Spanish.pdf

³ SEI, Climate Analytics, E3G, IISD, UNEP. (2023). Phasing Down or Phasing Up? Top Fossil Fuel Producers Plan Even More Extraction Despite Climate Promises: Production Gap Report 2023. <https://doi.org/10.51414/sei2023.050>

3. The Main Mechanisms for Achieving Climate Neutrality are Not Total Green, and the EU is Resource Dependent

As I mentioned, the objective is not to eliminate GHG emissions, but to compensate them through certain mechanisms. The aim is to move into the *green era* without ceasing to produce fossil energy, and implementing new processes that require the emission of large quantities of CO₂ into the atmosphere. This is a real incongruity and a major setback for the climate challenge being propagated.

Let us consider renewable energies as a compensating mechanism, taking the actions of the European Union (EU) as an example. The EU, through the Green Pact, aims to make Europe the first climate-neutral continent in the world by 2050. According to the Energy Institute 2024, Europe is the second region in terms of renewable electricity generation (1,769.3 terawatt-hours), behind Asia-Pacific (4,147.7 terawatt-hours); mainly hydro. The data also show that nuclear power generation is more significant in North America (917.6 terawatt-hours) and Asia-Pacific (781.1) than in Europe (735.9). At the same time, this institution states that fossil fuels represent 60% of global electricity production. It should be noted that the report of the United Nations Economic Commission for Europe (UNECE) showed that nuclear power generation generates lower CO₂ emissions over its entire life cycle than any other source of electricity production, including renewables, which raises doubts about the benefits of these.



Own elaboration with data from Energy Institute, 2024.

*Commonwealth of Independent States (CIS) member countries include Azerbaijan, Belarus, Kazakhstan, Russian Federation, Turkmenistan, Uzbekistan and others. Other energy includes electricity generated from: geothermal, biomass and other renewable energy sources (not broken down).

Fig. 2. Electricity generation from renewable and nuclear energy.
Based on gross production, 2023 (terawatt-hours)

French researchers Vidal, Goffé and Arndt argue that renewable energies such as wind turbines and solar power stations require infrastructures built with industrial minerals and base metals such as iron, copper and aluminum, or rarer metals such as selenium and neodymium, whose extraction and processing require large amounts of energy (approximately 10% of the world's energy). They also point out that, over their lifetime (20 to 30 years), the maintenance of infrastructures, that cannot be recycled, will require enormous quantities of base metals obtained through chemical processes that will significantly increase CO₂ emissions⁴. Thus, the environmental impact of the production process and useful life of renewable energies is negative.

The production and maintenance of renewable energy will lead to the extraction of several metals, such that "the transition to renewable energy will replace a non-renewable resource (fossil fuel) with another (metals and minerals)"⁵, while continuing to use energy that will come from fossil fuels, in addition to large quantities of water. Solar and wind power plants, for example, require "up to 15 times more concrete, 90 times more aluminum, and 50 times more iron, copper, and glass than fossil fuels or nuclear power. However, current wind and solar power production only covers about 1% of global demand, and hydropower about 7%." Another example is the extraction of platinum, used in jewelry and catalysts. To obtain an ounce of pure platinum, 14 tons of ore are required⁶. In addition, the demand for rare earth metals, which are important in the manufacture

⁴ O. Vidal, et. al. (November 2013). Metals for a low-carbon society, *Nature Geoscience*.

⁵ Metals for a low-carbon society, *Nature Geoscience*, vol. 6, 894-896, November 2013.

⁶ S. Furley, March (2008). Platinum, the eighth metal. *Europa Star*. Time. Keeper.

of magnets needed for wind turbines and electric vehicle motors, requires large quantities of water to crush the stones using chemical processes: “The purification of each ton of rare earths requires the use of at least 200 cubic meters of water...”⁷.

Another European mechanism to achieve climate neutrality is the implementation of stricter CO₂ emission standards for cars. Emissions from new cars will have to be reduced by 55% from 2030 and 100% from 2035 compared to 2021 levels. This means stopping the production of combustion engine cars. Regarding this, the Energy, Economics and System Dynamics Group of the University of Valladolid, Spain (GEEDS), studied four global transportation decarbonization strategies for 2050 and obtained as a result that “a massive replacement of individual petroleum-powered vehicles with electric vehicles alone cannot generate greenhouse gas reductions consistent with climate stabilization and could result in scarcity of some key minerals such as lithium and magnesium”⁸. On the other hand, a study made by the Ifo Institute in Munich showed that the emissions of the electric motor are about one tenth higher than those of the diesel engine in the best case, and a quarter higher in the worst case, so they qualify as a mistake that policies are focused on these vehicles⁹. Following the same line, a Volvo report from 2021, recognized that the manufacturing and refining of materials, and the production of batteries for its C40 Recharge electric car, represents almost 70% more GHG emissions compared to the same gasoline model. The difference is mainly due to the manufacture of lithium-ion batteries, which adds seven more tons of CO₂.

What about the hydrogen alternative? Replacing fossil fuels with this element in vehicles has been a popular idea. But the problem is that hydrogen does not exist in molecular form. It must be produced by electrolysis water (decomposition of water (H₂O) into oxygen-O₂ and hydrogen-H₂), using a continuous electric current; this process is between 3 and 6 times more expensive than producing it from oil. In addition, storing and distributing hydrogen is a delicate matter, because it must be certain that it will not react with oxygen to avoid explosions. But what should really eliminate hydrogen as an alternative is that its production process requires equipment composed of metals, whose extraction generates large amounts of CO₂, and electrical energy difficult to obtain from non-fossil fuels. Hydrogen is currently produced from hydrocarbons, usually gas. According to the IEA, global hydrogen production in 2023 was 97 million tons, and less than 1% was generated with low emissions.

Analyzing the EU's dependence on fossil resources and critical metals leads to questioning the real possibility of the energy transition project. In 2021, Europe's dependence on metals called rare earths was 98%, coming mainly from China¹⁰, which has had a monopoly market since 1990. These metals are important in the manufacture of magnets for wind turbines and electric vehicle motors, requiring large quantities of water: The purification of each ton of rare earths requires at least 200 cubic meters of water¹¹. But the EU is also dependent on natural gas. In 2010 was 67.7% dependent, and in 2020 and in 2024 imported more than 80%. 46,6% came from Norway, 19,7% from Algeria, and 17,3% from Russia. The liquefied natural gas was imported mainly from the United States (47,4%), from Russia 17,7%, and Algeria (9,9%). Regarding dependence on oil imports, was 97.7% in 2022 and 97% in 2024%. In that year imported 70% of its coal consumption¹².

Antonio Turiel, a researcher at the Institute of Marine Sciences of the Spanish National Research Council in Barcelona (ICM-CSIC), argues that the EU's dependence on fossil resources alone, especially gas, and on critical metals that are not abundant on the planet, and which are necessary to produce alternative energy sources to fossil fuels, makes the European energy transition project a “failed project from the beginning”¹³.

⁷ Dwindling Applies of Rare Earth Metals Hinder China's Shift from Coal], TrendinTech, September 7, 2016. Cited by S. Marati (2021).

⁸ I. Blas, et. al. (2020). The limits of transport decarbonisation under the current growth paradigm. January 2022, The Energy Strategy Reviews.

⁹ B. Christoph / K. Hans-Dieter / S. Hans-Werner. (2019). Kohlemotoren, Windmotoren and Dieselmotoren: Was zeigt die CO₂- Bilanz?. marzo de 2022, de Ifo Institute.

¹⁰ Study on the Critical Raw Materials for the EU, 2023.

¹¹ S. Marati. Op.cit.

¹² Official State Gazette, 2024.

¹³ Antonio Turiel. (April 2022). “We must avoid falling into the trap of false technology promises”. *Climática-La Marea* Sitio web: <https://www.climatica.lamarea.com/entrevista-antonio-turiel/>

4. Productive restructuring with negative consequences for the working class.

The energy transition will require the restructure of production processes in several industries and the dismantling of entire sectors of unprofitable companies, causing the dismissal of millions of workers, while introducing new technologies and opening markets for new green products.

The year 2024 was marked by the declaration of hundreds of layoffs by large companies involved in the production of renewables, electric cars and their components. GE Vernova, an energy business of General Electric, responsible for about 30% of the world's electricity generation with significant investments in renewables, announced in February that restructuring efforts in marine wind were forcing to lay off 900 workers, 750 in Europe. In May, the German energy corporation Siemens Energy AG notified 4,100 layoffs due to falling demand and profitability. In July, ZF Friedrichshafen AG, a German automobile manufacturer, declared a reduction of 11,000 to 14,000 employees by 2028, due to poor sales of electric cars and restructuring in the electromobility field. In August, Stellantis warned of 25,000 job losses in Italy by 2025, and laid off more than 2,400 workers in the Detroit assembly plant in October. In the same month, Volkswagen announced the layoff of thousands of workers and a 10% pay cut, arguing that restructuring was necessary to reduce costs in the face of strong competition with China in the production and sale of electric cars; and in November, Nissan confirmed that it was cutting nearly 9,000 jobs, and Ford 4,000, to reduce costs in the face of weak demand for electric cars. At the same time, Bosch Group announced the dismissal of some 12,000 workers worldwide, 5,500 of them in Germany, and the reduction of working hours of 10,000 employees, for the same reason.

In this context, thousands of workers went on strike and took the streets in Italy and Germany. Undoubtedly, the fight of workers must be the answer to the restructuring of production, resulting in constant unemployment and lower wages to compensate the fall of profitability.

5. Conclusions

The EU is implementing mechanisms for energy transition that are incongruent with the propagated urgency to care for the planet in two ways: 1. The continued use of fossil fuels for production with substantial investments. 2. The production and maintenance of renewable energies that require massive quantities of metals and GHG emissions. The green project is also presented in a context of high dependence on fossil and non-fossil resources of the EU, which makes the transition in the proposed terms impossible. The reality is that digital technology, the basis of all economic and communication processes, is totally incompatible with a clean energy transition, and the new energy project is provoking an indiscriminate struggle for the appropriation of critical natural and mainly mineral resources, reshaping global geopolitics and the role of states, companies, and people in general, with visible negative repercussions on the working class.

6. References

- [1] T. Covert, M. Greenstone and C. R. Knittel. (Winter 2016). Will We Ever Stop Using Fossil Fuels?, *Journal of Economic Perspectives*. [Online]. 30 (1). pp. 117-38. Available: <https://ceepr.mit.edu/workingpaper/will-we-ever-stop-using-fossil-fuels/>
<https://doi.org/10.1257/jep.30.1.117>
- [2] SEI, Climate Analytics, E3G, IISD, UNEP. (2023). Phasing Down or Phasing Up? Top Fossil Fuel Producers Plan Even More Extraction Despite Climate Promises: Production Gap Report 2023. <https://doi.org/10.51414/sei2023.050>
<https://doi.org/10.51414/sei2023.050>
- [3] O. Vidal, B. Goffé and N. A. (November 2013). Metals for a low-carbon society], *Nature Geoscience*, [Online]. 6. pp. 894-896. Available: https://www.researchgate.net/publication/258514690_Metals_for_a_low-carbon_society#fullTextFileContent
<https://doi.org/10.1038/ngeo1993>
- [4] Metals for a low-carbon society, *Nature Geoscience*, vol. 6, 894-896, November de 2013.
<https://doi.org/10.1038/ngeo1993>
- [5] Platinum, the eighth metal. Europa Star. Time. Keeper. By Sophie Furley, March 2008.
- [6] S. Marati (2021). *The Truth*. International Secretariat of the Fourth International, Paris, France. Issue 109. pp. 52-58.
- [7] I. Blas, et. al. (2020). The limits of transport decarbonisation under the current growth paradigm. January 2022, *The Energy Estrategy Reviews*.
<https://doi.org/10.1016/j.esr.2020.100543>
- [8] Buchal, Christoph / Karl, Hans-Dieter / Sinn, Hans-Werner. (2019). Kohlemotoren, Windmotoren und Dieselmotoren: Was zeigt die CO₂- Bilanz?. marzo de 2022, de Ifo Institute.
- [9] Study on the Critical Raw Materials for the EU, 2023.

- [10] Official State Gazette, 2024.
- [11] Antonio Turiel. (April 2022). “We must avoid falling into the trap of false technology promises”. *Climática-La Marea*
Sitio web: <https://www.climatica.lamarea.com/entrevista-antonio-turiel/>