

IMPACT OF RUSSIA-UKRAINE WAR ON EUROPEAN STEEL PRODUCTION

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Abstract

In recent years, global and domestic market demands for quality steel were on the increase. Combined with the strict legislation of the European Union and its ambitious plan to reach carbon neutrality by 2050, this created pressure in the metallurgical sector, necessitating innovation and optimization of its current processes. However, the sector is currently struggling with a stagnant demand, international trade restrictions, and a pandemic which, along with the conflict between Russia and Ukraine, causes disruption in supply chains and affects downstream sectors. As of today, the steel industry is one of the three largest emitters and is therefore a good candidate for decarbonization. Although the industry needs to adapt to these new circumstances, it can also use them as a chance to ensure its competitiveness in the market in the long run. Steel is one of the basic pillars of today's society and as one of the most important engineering and building materials it is present in many aspects of our lives. Nevertheless, the industry must first cope with the environmental and economic pressure to reduce the amount of carbon dioxide production. All the more so as the energy and economic crisis caused by the war between Ukraine and Russia puts great pressure on the steel industry in Europe. These geopolitical events are also generating unprecedented challenges for Europe's society. As to the energy crisis, the concerns over security, affordability, and sustainability of energy sourcing have never been as acute as today, which highlights the vulnerability of Europe's industry and economy as a whole.

Keywords: Decarbonisation, energy crisis, emissions, steel industry

1. INTRODUCTION

The current trend in metallurgy is to achieve the production of high quality and competitive steel on the global market. However, steel production is highly energy and emission intensive, with this high share largely due to the sector's high dependence on fossil fuels, which are mainly in the form of imports from Russia. Given the current economic and geopolitical situation in the conflict in Ukraine, leading European officials say that while promoting renewable energy and finding alternative fuel importers is a way to reduce dependence on Russian energy fuels, several member states are looking for a solution in coal. The Russian invasion of Ukraine will accelerate the dismantling of Europe and its member states from energy supplies from Russia. However, this cannot be done overnight and, moreover, in a way that could jeopardize the functioning of one's own economy and worsen the living conditions of citizens. When making any decisions, the risk of an increase in energy poverty must be taken into account and, therefore, effective measures must be put in place to regulate prices, tax incentives, or protect households and businesses from the point of view of supplying affordable and sustainable energy sources. The "REpowerEU" plan, which promises to reduce EU gas demand by two-thirds by the end of the year and accelerate disconnection from Russian oil and coal [1,2,3].

2. EUROPEAN UNION ENERGY ANALYSIS

Gross available energy **Table 1** in the European Union in 2020 decreased compared with 2019 by -8,1%. Oil (crude oil and petroleum products) continued to be the most significant energy source for the European

economy, while natural gas is the second largest energy source. Both oil and natural gas are primarily imported from outside of EU [4].

Table 1 Gross available energy - European Union (EU-27)

Energy Source	2019 [PJ]	2020 [PJ]
Oil and petroleum products	22 822,66	19 918,61
Natural gas	14 034,11	13 696,18
Renewables and biofuels	9 713,89	10 046,86
Solid fossil fuels	7 197,36	5 874,64
Nuclear heat	8 213,7	7 334,23
All other fuels	864,67	871,8

The EU imports up to 90% of its gas consumption, with Russia providing 41,1% of the EU's total gas consumption, 26,9% of oil and 46,7% of coal are also imported from Russia [5,6]. According to the International Energy Agency, a temporary return to coal is one way to reduce gas demand. The plan to reduce Russian gas consumption sets out a 10-point plan to reduce the European Union's dependence on Russian natural gas and fossil fuels, with the most important points for the steel industry being: No new gas supply contract with Russia, replace Russian gas supplies from alternative sources and the European Commission's proposal of 5. April, the fifth package of sanctions against Russia, which includes a ban on Russian coal imports [7].

Steel production is highly energy and emission intensive, accounting for approximately 8% of global energy demand and 7% (2.6 Gt CO₂) of total energy system emissions. This high share comes largely from the sector's high dependence on coal, which supplies 70% and natural gas with more than 10% of its energy inputs in Blast Furnace – Basic Oxygen Furnace (BF-BOF) method which is still the majority steel production process in Europe despite the changing trend in favour of electrification [8,9].

In the first quarter of 2022 European energy market are experiencing the impact of the current energy crisis - short-term gas prices on the largest European exchange were five times higher than their 2021 average and coal prices were more than three times higher as shown in **Figure 1** [10,11]. The upward price pressures come from a confluence of long-term trends and current events. In energy-intensive industries such as Steel Industry, these extraordinary increases are having a profound impact on production costs, which have risen by almost 50 percent in some sectors. The situation is likely to be prolonged [12].

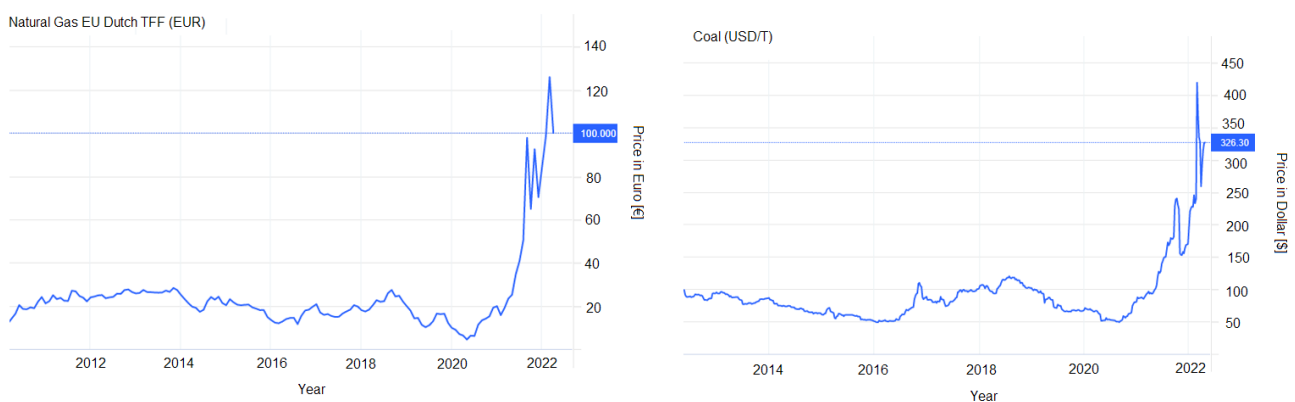


Figure 1 The price of natural gas on the European market in euros (left) the price of coal on the global market in dollars (right) based on Trading Economics (1.5. 2022)

Energy annual inflation in the EU hit more than 30% in March 2022, continuing the upward trend. This information comes from data published by Eurostat - Harmonised Index of Consumer Prices (HICP) **Figure 2**.

The inflation rate for energy is the highest since the HICP was first published in 1997. In October 2021, it surpassed the highest point recorded so far: 17% in July 2008 during Financial Crisis [13,14].

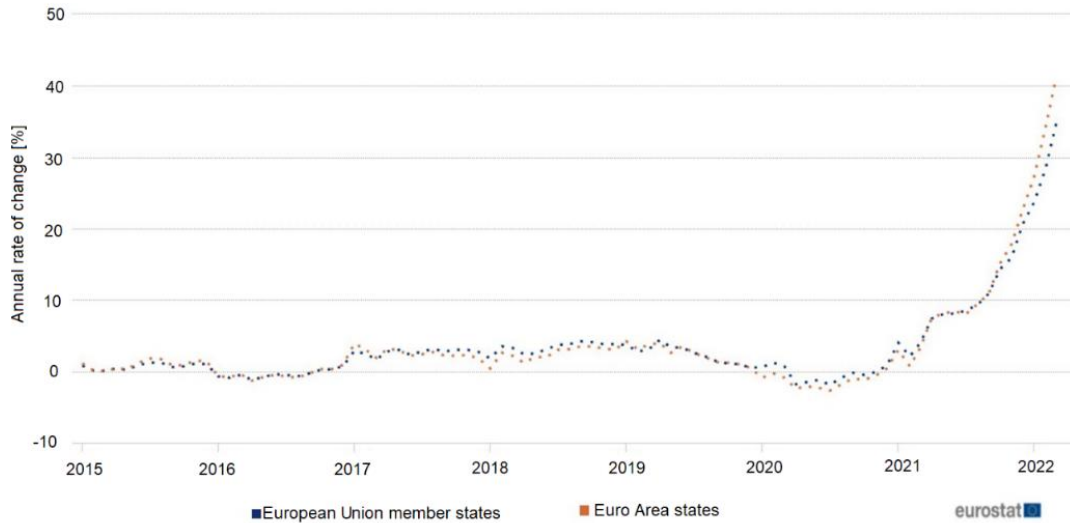


Figure 2 Evolution of energy prices in Europe EUROSTAT (last update: 29/04/2022 11:00)

3. STEEL PRODUCTION IN THE EUROPEAN UNION

The European steel industry has a long history and is a leader in innovation, quality, and environmental performance. However, in recent weeks, the sector has been struggling with international trade disruptions, war, and the energy crisis, which has disrupted supply chains and affected downstream sectors. At the same time, the European steel industry is expected to invest in R&D, review its production processes and ensure substantial emission reductions to remain competitive and contribute to climate neutrality by 2050. This combination creates an extremely challenging business environment and illustrates many of the challenges, which EU industry currently faces. The transformation itself is all the more challenging given that it should take place during production, or with its minimum limitation, in order to ensure not only employment but also demand for steel [15]. European EU27 steel production share in percentages by country and energy consumption by fuel in European Iron & Steel industry sector is shown in **Figure 3**. The share of individual technological processes in the steel process in Europe is shown in **Table 2** [9,16].

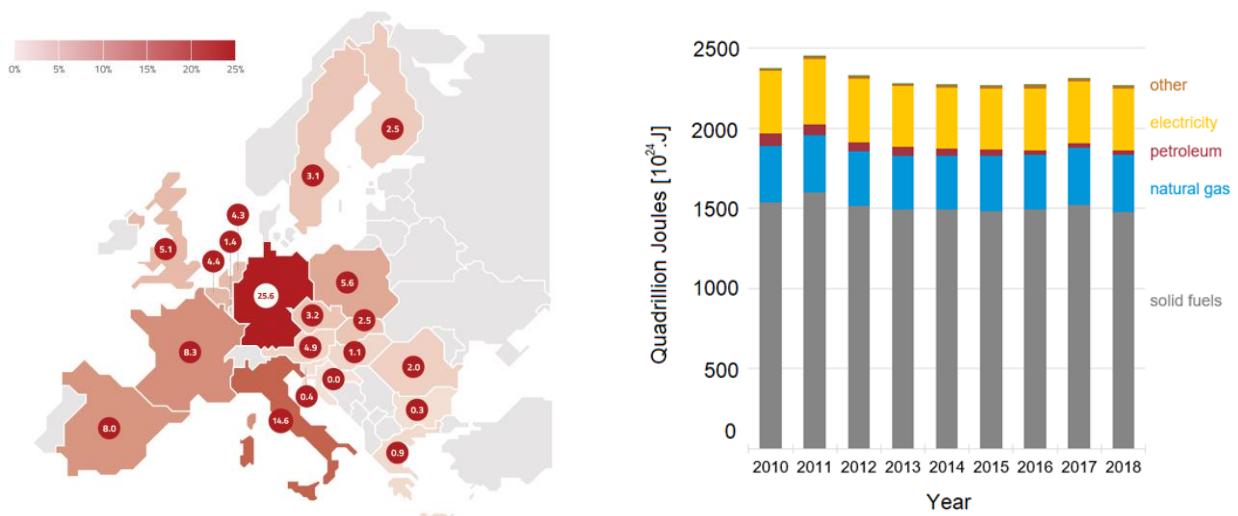


Figure 3 Percentage of steel production in the European Union 2020 (Left) & EU-27 Iron and Steel industry energy consumption by fuel (Right)

The European steel industry has more than 500 production plants in 23 Member States and directly employs 330,000 people and taking into account indirect and induced jobs in other sectors, creates 2.6 million jobs across the EU. However, current geo-political situation can significantly disrupt this sector [17].

Table 2 Steel production by technology in the EU

Technological process (in '000 metric tons)	2017	2018	2019	2020	2020 [% Share]
BF-BOF	99 925	97 588	92 343	79 905	57,4%
EAF	68 437	69 745	65 120	59 380	42,6%
Total	168 362	167 333	157 463	139 285	100%

The gradual transition from fossil fuels used in the BF-BOF method to electricity in the EAF and hydrogen will be highly energy-intensive. A carbon free net-zero steel sector requires 3-5 times more electricity compared to current steel production [18]. The new geopolitical and energy market reality requires Europe and its member states to drastically accelerate the clean energy transition and increase Europe's energy independence from unreliable suppliers and volatile fossil fuels. Following the invasion of Ukraine, the case for a rapid clean energy transition has never been stronger and clearer.

4. RESPONSE OF SELECTED EU27 COUNTRIES AND THE STEELMAKERS TO THE ENERGY CRISIS

Given the current economic and geopolitical situation associated with the conflict in Ukraine, leading European leaders say that the way to reduce dependence on Russian energy fuels is to promote renewable energy sources and find alternative fuel importers. However, several EU member states are looking for a solution in coal. In the European Parliament, there is a strong effort to increase the target for the share of renewables in energy consumption by 2030 from the current 40% to 45% [19]. CO₂ emissions are set to hit a record high in 2022, growing 2.5% over 2021, despite greater focus on climate and the continuing impact of the COVID-19 pandemic. This follows a rise in CO₂ emissions already last year on higher coal usage and growing energy demand as economies recovered from the pandemic [20].

Selected EU member states take the following steps [21]:

- Germany: The German government is not yet planning to reopen domestic coal mines. However, Germany is starting to build up strategic coal reserves, and energy companies have already requested that decommissioned coal-fired power plants be kept on standby.
- Italy: planned to shut down coal-fired power plants in 2025. However, at the beginning of the Russian attack on Ukraine, the Prime Minister stated that the reopening of already shut down power plants could also be a short-term solution to the energy crisis.
- Bulgaria: The Bulgarian government also planned to shut down coal thanks to a large new gas-fired power plant. Its construction was part of the Bulgarian recovery plan. However, the project is halted, and Sofia will use coal at least until it starts two new nuclear reactors.
- Romania: The Romanian government does not plan to open new coal mines but will increase production in existing ones. It will restart production in existing coal-fired power plants.
- Czech Republic: several Czech companies are already revising their plans and are returning to coal from natural gas. The government has not changed official policy yet.
- Slovakia is completely dependent on Russian gas and oil. Switching to a new technology for processing oil from other sources will not be easy for Slovak industry. The same is true for gas, because in Slovakia many factories are set up to compose Russian gas.

European steelworker's response to the energy crisis [22,23,24,25,26,27,28]:

- ArcelorMittal said it has been operating its stop-start electric furnaces in Germany, Luxembourg, Poland, Romania, and Spain for months, "to avoid peak electricity prices that would significantly affect competitiveness".
- German steelmakers are starting to limit the amount of steel produced. In March 2022 Germany as the largest steel producer in Europe decreased its production by -11,8% compared to 2021.
- Salzgitter Germany - Germany's second-largest steelmaker said it does not source coking coal from Russia and the very low volume of PCI (pulverised coal injection) material that had come from Russia has been replaced.
- Tata Steel EU - Indian steelmaker said it has suspended further shipments of coal from Russia. The company has adequate stocks of raw materials at its Port Talbot steelmaking site and has identified alternative sources for coal.
- Italian steelmakers - Acciaierie Venete closed three of its steel mills for several days as prices rose several times above normal. Producers of high-quality steel for automotive and agricultural machinery had enough stocks to work on the finished product and waited for prices to fall so that they could reopen.
- ArcelorMittal in Spain has announced a temporary cessation of steel production due to rising raw material and energy prices.
- Steel mills in the UK have been forced to start temporary shutdowns as steel production has become so expensive due to high energy prices that production is unprofitable.
- Acerinox SA, Salzgitter AG and Liberty Steel are reducing production capacity due to high energy prices.
- U.S. Steel Košice, s.r.o. - informed that, depending on the state of raw material stocks, they had a planned production of at least 90 days, even if supplies were suspended.
- However, despite the current geopolitical situation, some steel mills show the most successful period with record production capacities - for example, Slovak U.S. Steel Košice s.r.o. and Czech Liberty Ostrava [29,30].
- European steel mills are gradually removing Russian materials from the supply chain.
- In February 2022 EU (27) produced 11.7 Mt of steel, down 2.5% compared to last year. In March the EU (27) produced 36.8 Mt of crude steel in the first quarter of 2022, down by 3.8% compared to the same quarter of 2021 [31]

5. CONCLUSION

The European Union must first and foremost deal with its own energy independence and ability to face the energy crisis. In the event of a shutdown of raw materials and fuels import from foreign sources, it must be able to secure not only domestic production but especially the inhabitants of its member states. Before fully embarking on deep decarbonisation in order to achieve carbon neutrality by 2050, it must secure energy supplies to the industries most affected by this transformation. The steel industry is currently one of the three largest emitters and is therefore a good candidate for decarbonisation. Although the industry needs to adapt to these new circumstances, it can also use them as a chance to ensure its long-term market competitiveness. However, this transformation will not be possible without renewable energy sources in the form of clean electricity and green hydrogen produced in Europe. This fact is further confirmed by the current geopolitical situation in which Europe finds itself, and other potential sanctions exacerbate the need for green, sustainable, and domestic energy infrastructure.

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