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Date: December 7, 2022
Subject: Tata Steel UK

We would like to submit the analytical report that is due on November 16, 2022. The analytical report consists of information on the current situation of Tata Steel UK and the strict emission laws in the UK. The purpose of the report is to identify the problems faced by Tata Steel in the UK because of the new emission laws set by the UK government. This report also consists of recommendations for Tata Steel UK to work with the UK government to overcome these problems.

The report is divided into four different parts each focusing on different aspects found based on our research. Firstly, it consists of problem statement which describes the problems faced by the Tata Steel in the UK. Secondly, it consists of the background of the Tata Steel UK and the UK government. Thirdly, we focus on the findings which contains all the information on the problems Tata Steel UK is facing and why it threatened the UK government to leave the UK. Finally, it includes a recommendation that is best suitable for the problems faced by Tata Steel UK.

We would like to show our gratitude for this opportunity provided to us to work on this report. This research has helped us to understand how major steel industries like Tata Steel understand the current emission laws set by the UK government. We learned about carbon emissions and various methods implemented to avoid the emissions in accordance with the strict emission laws of the UK. As we continued to research Tata Steel UK, we understood how the steel industry works in the UK as well as in Europe. We have learned how the UK gov is trying to support industries while still maintaining the parameters of international emissions laws and guidelines.

This report is a collaborative work consisting of information contributed by team members. Abhishek Vakada prepared the memo of transmittal, title page, findings - Vision for decarbonization, Tata steel at Port Talbot and its livelihood, Tata Steel collaboration with universities and research centers. Craig Albuquerque worked on the executive summary, summary, and findings of the Climate Change Agreement, decarbonization, Employment patterns, and the European trading system. Siddharth contributed with a table of contents, part of the recommendation, background of Tata Steel's origin in the United Kingdom, business after Acquisition, and findings of Energy Consumption for Tata Steel UK, Business financial year Report 2021-2022, sustainability Initiatives and vision in comparison to UK's policies, innovation facilities linked with Tata Steel UK, economic Impact to Tata Steel UK, Europe's Emissions Trading System, business impact and the Appendix.

We appreciate the valuable time and patience you have taken to read this report. If there is anything we can do to answer your queries on the subject or the report, kindly let us know.

Tata Steel UK Navigating Emission Laws

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Executive Summary

The inception of the United Kingdom's emission impositions on Tata Steel seems to lie with the Paris Climate Change act of 2008, where multiple countries have signed and agreed to reduce carbon emissions. The United Kingdom has gone ahead and established a legally binding agenda to reduce carbon emissions and render the country with zero carbon emissions by 2050. Such a bold move by the UK has impacted multiple industries. And Tata Steel is one such organization.

In response to this stance by the UK, Tata Steel has focused its efforts on all fronts of innovation to reduce carbon emissions. They have shown that they want to align themselves with the direction of the UK government. They have asked the UK government for their support in terms of direct compensation for the shift to green, net zero steel production.

Tata has done exceptionally well with regard to the effort of producing green steel through lower carbon emissions. They have set up global R&D centres and created and nurtured partnerships with multiple organizations in this regard. They have ventured into multiple technologies that will reduce carbon emissions at their steel production plant in Talbot. In terms of financials, Tata is doing well in the United Kingdom and is making a profit.

Based on the reduction in employment numbers in the UK Steel Industry it is clearly evident that the country is shifting its core from metals production. On the other hand, the UK has multiple other industry sectors that depend on steel for manufacturing products. Another facet of this data is related to the concentration of steel production in China and India. This may lead to a monopoly of steel. This in its fact is detrimental to the UK. Based on the above factors the UK is most likely to support efforts made by Tata Steel to reduce carbon emissions and would settle with a staggered fix as long as there is a plan of progress in the future.

Another aspect to consider is related to the carbon credits system introduced by the UK Government in collaboration with other countries. Companies are allocated carbon credits based on industry. Additionally, these companies can trade carbon credits based on need. It is also seen that Tata Steel has been allocated the highest number of carbon credits in the UK.

The way ahead for Tata Steel is to continue operations in the country, this decision is backed by excellent profits in the UK market. Additionally, the UK Government relies heavily on steel production from Tata Steel to keep the international trade balances stable and at the same time avoid reliability on China. The UK government extended support to Tata with a huge deposit of free carbon credits.

Tata Steel can navigate this by initially utilizing the free carbon credits in the United Kingdom. Additionally, they can purchase additional carbon credits if the need arises. Next, they could accelerate their programs of generating green carbon steel. Once these green technologies are implemented, they will be able to promote green carbon products rolled out by Tata in other markets. And use the surplus carbon emissions to support the industry.

This approach will have business impacts in the short term as well as in the long term. The constant push for innovation will give them a competitive advantage in terms of green steel production. However, this means they will need to first invest heavily in research and innovation.

TABLE OF CONTENTS

Executive Summary.....	ii
Table of Figures.....	iv
Purpose.....	1
Problem Statement.....	1
Background.....	2
Tata and Tata Steel History.....	2
Origin in the United Kingdom.....	2
Global steel Production capacities.....	3
Tata Steel production capacities	3
Business after the acquisition of Corus.....	4
Methodology.....	4
Findings.....	5
Paris Climate change agreement.....	5
Climate change and its impact on the UK	6
Decarbonatization.....	8
Tata Steel at Port Talbot and it's livelihood.....	8
Energy Consumption for Tata Steel UK.....	8
Business Financial Year Report 2021-2022.....	9
Sustainability Initiatives and vision in comparison to UK's policies.....	9
Innovation facilitates linked with Tata Steel UK.....	10
Tata Steel: Green Steel Solutions.....	12
Economic Impact to Tata Steel UK.....	13
Employment in the UK Steel Industry.....	15
Major Steel Producers.....	17
Europe Emissions Trading system.....	18
EU ETS Major Tata companies in the UK.....	18
Summary.....	19
Recommendation.....	19
Business Impact.....	21
Appendix.....	21

TABLE OF FIGURES

Figure 1: Return on Capital employed.....	2
Figure 2: Capital Base.....	3
Figure 3: Steel Manufacturing by Country.....	4
Figure 4: Carbon Budgets in The UK.....	7
Figure 5: UK Steel Products by Quarter.....	14
Figure 6: Employment in The Steel Industry.....	16
Figure 7: Global Steel Production.....	17
Figure 8: EU ETS Indirect Cost Compensation awarded in 2020.....	18
Figure 9: Carbon Credits Allocation to Tata Group in UK.....	19
Figure 10: Carbon Credits Allocation in Steel Sector.....	19

PURPOSE

Tata Steel UK Group is facing stringent new regulations based on UK climate change agreements. It has faced conditions set by the UK government of regarding changing its industry equipment to green solutions, which will reduce carbon emissions to an acceptable level. Tata Steel will need to decide on the path ahead based on its financial strength and climate change regulations. It is looking for an appropriate solution best suited for the organization's growth and overall economic well-being in the long run. This report will evaluate different aspects of emission laws and regulations faced by Tata Steel UK Group and recommend a strategic plan of action.

PROBLEM STATEMENT

Tata Steel is facing stringent decarbonization rules and regulations without any support from the UK government. The UK government hopes to have decarbonized the country by 2050 in accordance with global climate change agreements. In order to achieve this, Tata Steel is required to reduce carbon emissions from its steel production industries, among others. There are multiple ways for Tata Steel to achieve this, which includes changing all the machinery, which will cost Tata (approximately) \$1.5 billion US. Tata Steel has asked the UK government for support by footing half the bill, but the UK government does not align with these terms. This stance by the UK government has now prompted Tata Steel to consider exiting the steel production business in the UK market. Such a move may damage Tata in terms of lost revenue and profits and its foothold in the international market.

BACKGROUND

Tata and Tata Steel History

Tata Group, a conglomerate of multiple businesses, started, from humble beginnings. The company was first founded as a trading company in 1868 in Colonial India. Since then, the Group has diversified into multiple sectors, including but not limited to chemical, consumer products, energy, engineering, information systems, materials, and services. Tata Steel, then Tata Iron and Steel company (TISCO) was established in 1907 in Sakchi, India (Tata, n.d).

Since its inception, the company witnessed two world wars. Steel being a fundamental resource during the wars, allowed the company to flourish. As with any war, a period of economic depression follows, and this was also true for the steel industry. During the post-war era, Tata Steel faced a slack time in business. This was mainly due to government restrictions on expansion in lieu of nationalizing the sector. It was not until 1991 that restrictions on licensing, pricing, and distribution were removed, which gave way to the increased capacity of production. With these restrictions out of the way, Tata Steel expanded to a point where it was exporting 43,000 tons of iron ore to China, a market it had not entered previously (Parker et al., 2010).

The year 2005 marked the first global expansion for Tata Steel. It strengthened its foothold in the Asian markets by its acquisition of NatSteel (Asia), a subsidiary of Singaporean steel producer

NatSteel Limited. In the following year, Tata Steel acquired the London-based steel and metal manufacturer Corus Group, which provided a pathway to the European markets (Parker et al., 2010).

Origin in the United Kingdom

The Corus Group International Corporation, founded in 1999, was a manufacturer of international steel and metals and the largest steel producer in Britain. It operated plants in the United Kingdom and the Netherlands. It employed a global workforce of more than 50,000 employees to manufacture and administer metals. In April 2007, Corus was acquired by Tata Steel (India) for US\$ 12.11 billion. This was a prominent acquisition in 2007. Moreover, it was a revolutionary entry for an Indian steel manufacturing company, impacting the whole steel industry worldwide. As a result, Tata Steel rose from 56th to 6th in global steel production (Nayak, 2008).

Based on a 2013 detailed article about the impact of the Tata Steel and Corus merger and acquisition by Manoj Kumara and Dr. Satyanarayana Kumar, in terms of profitability, performance, turnover, capacity, economies of scale, and improved control, it was a success. Profitability, capital base, dividends, and shareholder earnings were all positively impacted (Kumara, Satyanarayana, 2013).

This will contribute to a prosperous future. There will be several opportunities for synergy in the companies' exchange of best practices. From the charts below, it can be seen that after 2006 the company saw a nine-percentage point increase in 2007, an effect of the acquisition. In addition, the company experienced gradual returns in the capital base as well.



Figure 1. Return on Capital employed (Kumara, Satyanarayana, 2013).

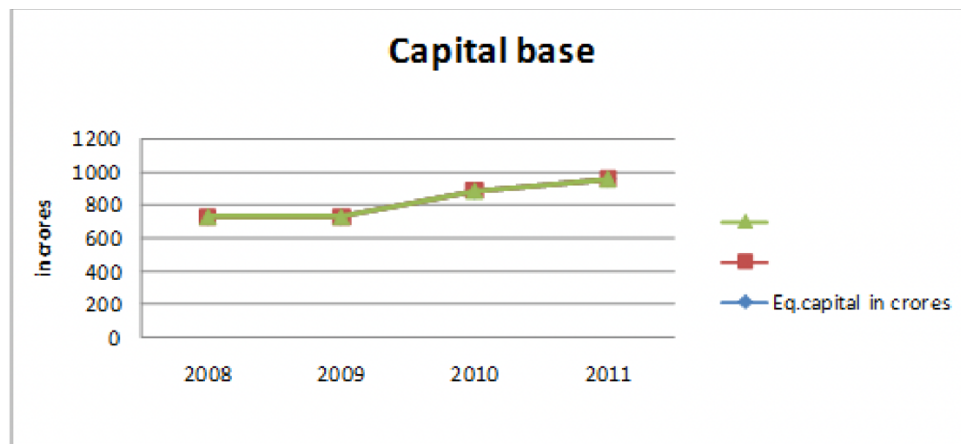


Figure 2. Capital Base (Kumara, Satyanarayana, 2013).

Global steel production capacities

The global steel industry produces over 1800 million metric tons of steel annually. The major producers of steel are China, Japan, the US, India, South Korea, Russia, and Germany (Dun and Bradstreet First research, 2022).

Major companies producing steel include ArcelorMittal (Luxembourg); China Baowu Steel Group and HBIS Group (both of China); JFE and Nippon Steel & Sumitomo Metal (both of Japan), POSCO (South Korea), Tata Steel (India), and ThyssenKrupp (Germany) (Dun and Bradstreet First research, 2022).

Tata Steel's production capacities

Tata Steel produces steel in India, Europe, and Thailand. Of the three, based on the statistical report in the figure below, India produces the highest quantity of steel from its four plants located in Jamshedpur (10.2 million tonnes), Gamharia (0.7 million tonnes), Kalinganagar (3.2 million tonnes) and Mermandali (4.9 million tonnes). The plants located at Port Talbot (UK) and Ijmuiden (Netherlands) account for 3.4 million tonnes and 6.45 million tonnes, respectively. The plants in Thailand produce 1.3 million tonnes from three units located in Chonburi Province, Saraburi Province, and Rayong Province (Tata Steel, n.d).

Steel manufacturing		
Geographies	Asset / Location	Production FY 2021-22 (million tonnes)
India	Jharkhand:	
	› Jamshedpur	› 10.2
	› Gamharia	› 0.7
	Odisha:	
	› Kalinganagar	› 3.2
Europe	› Meramandali	› 4.9
	› Port Talbot (UK)	› 3.4
	› IJmuiden (Netherlands)	› 6.45
Thailand	› NTS Plant, Chonburi Province	› 1.31 (total production of 3 units)
	› SISCO Plant, Saraburi Province	
	› SCSC Plant, Rayong Province	

Figure 3. Steel Manufacturing By Country (Tata Steel, n.d)

Business after the acquisition of Corus

According to Dr. Atul Bansal's case analysis of Tata Steel acquiring the Anglo-Dutch company Corus Group, Tata Steel Group saw a positive outcome. This acquisition resulted in a moderate increase in profit after tax (PAT) of Tata Steel in the post-acquisition years. Additionally, in the year 2007-2008, Tata Steel observed a significant increase in PAT of \$1,534,079,950 as compared to the previous year (2006-07) of only \$518,854,40 (Bansal, 2006).

-

Tata Steel saw an increase of approximately 312 percent in net revenue after the acquisition. A moderate outcome has been observed in earnings per share (EPS) as well. The EPS of 2006-07 was \$0.89 to \$2.01 in 2007-08. In conclusion, the Tata Steel-Corus merger is now the world's fifth largest steel producer, with a capacity of producing 23 million tons of steel in a year (Kumara & Satyanarayana, 2013).

METHODOLOGY

World steel association

As a significant portion of this report is based on data related to the steel industry, the World Steel Association was selected because it is a non-profit organization which is a collective of steel industries and therefore does not have a hidden agenda for itself (Worldsteel.org, n.d). The Association is fairly public, and the data from this source is used by Bloomberg (Bloomberg, 2022). Moreover, it has a strong antitrust policy (Worldsteel.org, n.d). The World Steel Association is associated with the United Nations Economic and Social Council, the United Nations Framework on Climate Change, and the International Organization for Standardization (International Organization for Standardization, n.d) (United Nations Climate change, n.d) (United Nations Department of Economic and Social Affairs, n.d).

The United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international entity responsible for aligning the world's objectives towards climate change. The Convention is open to all countries which promote transparency in their work. The sole objective of the UNFCCC is to reduce greenhouse gas levels in the atmosphere to levels that are safe for sustaining life. The UNFCCC is public and has a significant social presence. Its website has one million visits each year and has close to two million combined followers on Twitter, Facebook, Instagram, and LinkedIn (UNFCCC, n.d).

Diana Kinch – S&P Global

Diana Kinch works for S&P Global Platts in London, where she has been the editor of the fortnightly feature magazine *Platts' Metals Insight* since May 2014, covering themes of importance to the world's steel, metals, and mining industries. She spent 25 years in Brazil as a reporter and editor for global news organizations covering commodities. She has produced various articles related to the steel industry around the globe and especially the UK. She works closely with various other news companies to produce news related to steel (Kinch, 2022).

Howard Mustoe – The Telegraph

Howard Mustoe is a renowned journalist at *The Telegraph*. As posted on *The Telegraph* website, his expertise lies in finance and industry journalism. He has completed his postgraduate degree from Cardiff University and is an exceptional journalist with over 14 years of experience. He is the current Industry Editor for *The Telegraph*. He has also worked with BBC News for seven years as a business producer and a reporter (Mustoe, n.d; The Telegraph, n.d)

FINDINGS

The UK government passed the Climate Change Act of 2008 with the motive of reducing carbon emissions in the UK. It is the first target set by a sovereign state that is also legally binding. The Act requires the UK to reduce carbon emissions by 80 percent by 2050 (Graham Research Institute on Climate Change and the Environment, 2020).

The UK has pioneered and chosen to be the first to instate not guidelines but laws that are binding. Based on this, it can be inferred that the UK has strived to be a pioneer in the green industrial revolution.

Paris Climate change agreement

The Paris Agreement is a legally binding document confirming an international treaty on climate change. It was adopted on December 12, 2015, and was enforced on November 4, 2016. This treaty was created with the sole purpose of limiting global warming to acceptable levels. The target was set at two degrees Celsius (preferably 1.5 degree Celsius). In the treaty, countries set a maximum limit on greenhouse emissions to achieve a climate-neutral world by 2050 (United Nations Framework Convention on Climate Change, n.d).

Both economic and social transformations are key elements in order to enable this initiative.

To plan for this transformation, countries will submit their plans called nationally determined contributions (NDCs). These documents will be created or updated every five years. In order to meet the objectives of the Paris Agreement, countries communicate the steps they will take in their NDCs to reduce their greenhouse gas emissions. Additionally, nations describe in their NDCs the actions they will take to strengthen their capacity for adaptation to the effects of rising temperatures (United Nations Framework Convention on Climate Change, n.d).

Long-term strategies that must be submitted to the UN, are another way countries can put forth their goals and ambitions. These documents provide a broad understanding of a country's goals toward the common cause. However, unlike NDCs, these cannot be tracked (United Nations Framework Convention on Climate Change, n.d).

In order to track progress, an enhanced transparency framework (ETF) will be created (to be initiated by 2024), which will lay down the structure of clear reporting of countries with regards to risk mitigation related to climate change and ways in which some adaptation could be accommodated in order to battle the common enemy. All of this information provided from various countries will be aggregated, sorted, and analyzed. The data will form a platform to measure performance at a global level. Also, inferences will be made as to what measures could be taken to set up more ambitious plans in the future (United Nations Framework Convention on Climate Change, n.d).

This agreement adds to legal bindings in the UK. Now they will need to implement strategies that will cut back on greenhouse gases that are negatively impacting the climate. Based on these global agreements, the UK will need to plan and implement steps to decarbonize its industries.

Climate change and its impact on the UK

In accordance with the laws and regulations set up by the Paris Climate Change agreement, the UK has taken certain measures to align itself with a shift in trends and positioning itself to align with the green Industrial revolution (Her Majesty Government, 2021)

In 2021, then Prime Minister Boris Johnson asserted that the UK's Strategy of Net Zero would make them pioneers in decarbonization to such an extent that they will not impact climate change. He envisioned that this move would bring prosperity to the UK based on new job opportunities related to reducing carbon emissions (Her Majesty Government, 2021).

This statement by the Prime Minister suggests that the UK government sees the changes related to climate change policy as a positive development. Also, these laws and regulations are legally binding. The determination of the UK in this regard ascertains that there is little to no middle ground. Therefore, it is in the best interest of industries like Tata Steel to take a stance on which side of the fence they would rather remain.

The UK's NDC was based on the temperature goals set by the Paris Agreement. It has committed to reducing greenhouse gases in every industry by 68 percent or more by the year 2030, in comparison to 1990 levels. Also based on the NDC submitted by the United Nations,

the UK plans to achieve net zero carbon emissions by the year 2050 (Her Majesty Government, 2021).

Based on this document, the United Kingdom will address issues related to education and skills, sustainable lifestyles, sustainable patterns of consumption and production, ocean and marine environments, and food security and policy, which will align with the underlining objective Paris Agreement (Her Majesty Government, 2021).

The Climate Change Act of 2008 has required the UK to reduce carbon emissions to net zero by 2050. In accordance with this, the UK has reduced the production of carbon from multiple sources and has been able to meet the carbon budgets of the years 2008-2012, 2013-2017, and 2018-2022, which will be published in May 2024. For the future, forecasts indicate that there will be headroom of 20MtCO₂e in the fourth carbon budget (2023-2027). And in the following budgets, there will be a shortfall of the 73 MtCO₂e and 976 MtCO₂e in the fifth and the sixth budget respectively (Department of business, energy & Industrial strategy, 2022).

The figure below graphically depicts the carbon budget forecasts.

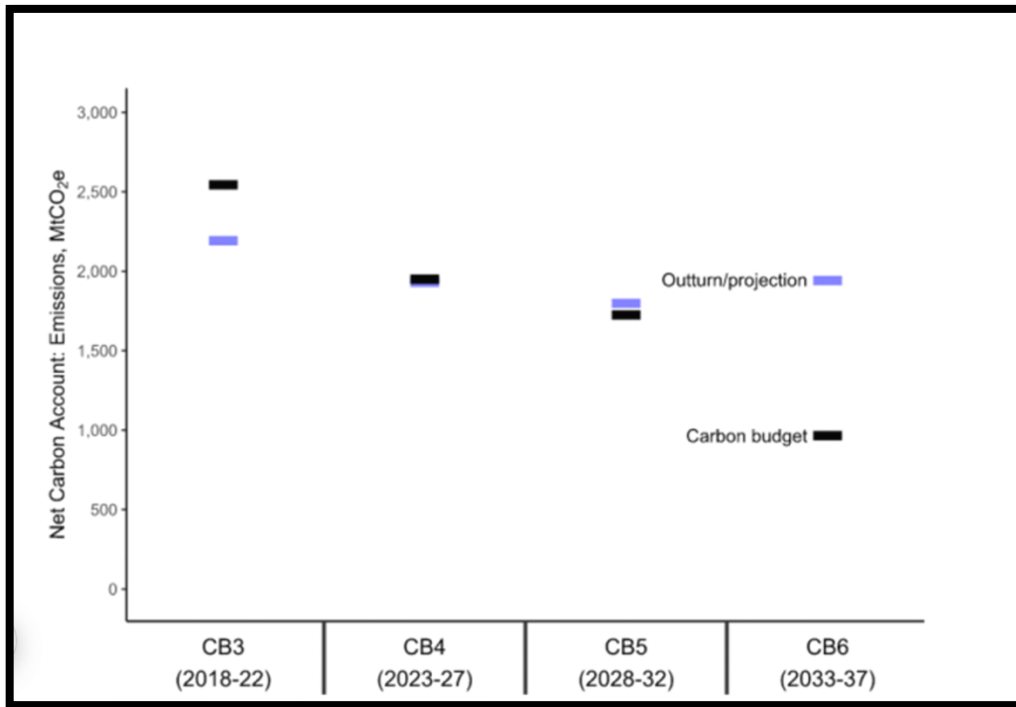


Figure 4 Carbon Budgets in The UK
(Department of business, energy & Industrial Strategy, 2022)

Based on the figure above, the UK has set significantly high standards of 1000 MtCO₂e Emissions, which are approximately half of the previous carbon budget. This shows how the UK has partitioned decarbonization into two phases, one up until 2030 and one until 2050.

Decarbonization

Carbon-emitting gases that are trapped in the atmosphere and cause the planet to heat up are called greenhouse gases (United States Environmental protection agency, 2022).

The First Industrial Revolution, pioneered by Great Britain, was machine-based manufacturing. Following that was the Second Revolution which introduced the use of fossil fuels. Now we are witnessing a new revolution namely the “Green Industrial Revolution,” which started towards the end of the 20th century. Although it was thought to happen in northern Europe, it actually started in Asia and Japan. However, where the facts in the origin reside is of little importance. On the other hand, there is no denying the fact that there is much at stake compared to the previous two revolutions (Clark, 2014).

Tata Steel at Port Talbot and its livelihood

Port Talbot is the biggest steel-producing plant in the UK, and Tata Group, the owner of the UK's largest steelworks, has threatened to shut down operations if the government does not agree to fund \$1.35 billion in carbon-cutting subsidies within the next year. Tata Steel UK operates the Port Talbot factory and employs roughly 8,000 workers in total. As one of the largest industrial organizations in the United Kingdom, it is one of the largest carbon dioxide emitters. Executives have been in discussions with the government regarding decarbonization plans, but these have come to a halt (Raval et al., 2022).

It would cost Tata Steel \$3.6 billion to make two electric arc furnaces. Tata is seeking \$1.8 billion from the government as a part of under carbonization plans so that it can shut down the existing two blast furnaces at Port Talbot. If Tata Group is to achieve this ambitious goal, it needs to decarbonize the industry (Raval et al., 2022)

Tata Group chairman Natarajan Chandrasekaran told the *Financial Times* that their objective is to convert to a greener steel factory. However, this is only doable with government assistance. Tata group and the UK government have been talking about it for the last two years (Raval et al., 2022).

Energy Consumption for Tata Steel UK

As per the current reports by the Tata Steel (2022) Group, the total energy consumption of the Tata Steel Europe Group for the year 2021- 2022 was 10,222,729,357 kWh. The total gross emission from gaseous fuel of the Group was 5,788,553 tCO₂e (tCO₂e stands for tonnes (t) of carbon dioxide (CO₂) equivalent (e)). On a more detailed front, the total gross emission per tonne of liquid steel was 1.655 tCO₂e/tls (tCO₂e/tls stands for tonnes (t) of carbon dioxide (CO₂) equivalent (e) per tonne liquid steel (UK Steel, 2022).

The majority of the carbon emissions affiliated with Tata Steel's UK operations occur at Port Talbot integrated steelworks. At Port Talbot, iron ore and coal are integrated together in the process of a blast furnace, creating a major amount of emission of gaseous fuels (Tata Steel, 2022).

Business Financial Year Report 2021-2022

The global steel demand increased 2021-2022 by 2.7 percent in 2021, and the steel-dependent industries in the UK experienced strong demand for steel, which peaked in the second quarter of the year 2021. The liquid steel production of Tata Steel Europe was 10.1 metric tons in 2021-2022 (Tata Steel reports and accounts, 2022; Singh, 2015).

The total group revenue of Tata Steel UK in 2021-2022 was €8,876 million. 54 percent higher than the previous year. Along with the production it also delivered 9.0 metric tons of steel for the same year 2021-2022. In the financial year 2022, Tata Steel disclosed the highest ever EBITDA (earnings before interests, taxes, depreciation, amortization) of \$1,080 million in comparison to only \$69 million in the previous year 2021. Along with an increase in the EBITDA margin of 14 percent. The working capital to turnover ratio increased from 14.3 percent to 15.4 percent in 2021-22. The company earned a profit of €882 million after taxation for the year 2021-2022. This year marks the epitome of the success of Tata Steel Europe as well as the European economy along with employment of 8,000 and plus workforce in the Tata Steel Europe Group (Tata Steel reports and accounts, 2022; Singh, 2015).

If Tata Steel exits the UK, the company will face a lot of loss in terms of net revenue. Apart from that, the Tata UK group had a 54 percent increase to the previous year making 2022 the best year for returns. This indicates that the group has a better future in the existing markets and can conquer markets that have less innovation comprised competitors.

Sustainability Initiatives and vision in comparison to UK's policies

Europe has set ambitious and revolutionary targets to become a net zero economy by 2050. To simplify, net zero refers to creating a balance between the number of greenhouse gases that are emitted and those that are eliminated from the atmosphere. Tata Group acknowledges the future vision and strongly adheres to following the rules and regulations. It is committed to innovating products and services while reducing its own emissions. The Group has also set forth its goal to attain carbon-neutral steelmaking by 2050 (Climate strategies, 2019).

In addition, it has set a milestone to achieve at least a 30 percent reduction in carbon dioxide gas emissions by 2030 with respect to its emissions from the year 2018. However, the foundations laid out by the “Net Zero Steel Pathway Methodology Project” are vigorous and robust for the steelmakers rather than being realistic and credible. The UK and Dutch governments have aimed to take positions of leadership in global climate action. The European Commission has embraced a package of proposals for Europe in 2021 which aims to reduce greenhouse gas emissions by at least 55 percent by the year 2030 as compared to the levels of Greenhouse emissions in 1990. The UK government has also set out adapting the policies and recommendations by the UK Climate Change Committee to make certain that the UK gains a 78 percent reduction in emissions by 2035 and apart from that the ore-based steel manufacturing industry in the UK should fulfill “near zero” emissions by 2035 (Climate strategies, 2019).

The Tata Group supports the leadership position on impacting the climate action taken by the Dutch and UK governments. The Group supports and pledges to collaborate closely with the decision-makers to offer a crucial contribution to accomplishing the aspirations of the UK.

However, the Group seeks support from the UK government to make this possible as it cannot do this alone (Tata Steel, 2022).

To optimize to its fullest capabilities and move towards the goal of net zero emission, the Group introduced a new hydrogen route to decarbonization at its steelworks plant. This route involves a new technology that makes iron using Hydrogen or natural gas before converting it to steel. Tata Steel UK has been actively exploring a variety of options to decarbonize its operations on a higher scale. But the Group also focuses on not sacrificing the quality of the products to sustain itself in the steel market. A plethora of technology options is being assessed on a step-by-step method. To set and determine an exact path to decarbonize, the Tata group has been engaged in extensive discussions with the UK and Welsh governments (UK Steel, 2022).

Innovation facilitates linked with Tata Steel UK

Tata Steel UK Group inaugurated its research center at the University of Warwick's Science Park in 2015. This opened a portal for engineers, data scientists, metallurgists, product engineers, researchers, and scientists to develop modernized steel products and solutions. In addition, it enables access to work in advanced research laboratories for new innovations, leading the UK to acquire new heights. Professor Lord Kumar Bhattacharya, the chairman of Warwick Manufacturing Group at the University of Warwick hailed the research center to be one of the most crucial research centers for the UK and manufacturing. The R&D centers are committed to carrying out and innovating revolutionary technologies benefiting UK development (Warwick News & Events, 2015).

A similar-sized research center, founded in 2020, is situated at Swansea University, Wales, United Kingdom. This research center deals with building high-tech research labs which aim for higher excellence for steel innovation. Tata Steel UK and Swansea University are working together to reduce carbon emissions by making high-value products using carbon dioxide creating a greener and stronger economy (Tata Steel UK Factsheet, 2020).

Additionally, a new three-year research partnership between Swansea University and Tata Steel UK will be centered on developing solar roofing panels that are more environmentally friendly, lighter, cheaper, and flexible and that can be printed on the steel used in structures. Buildings would be able to produce, store, and release their own reliable source of electricity thanks to the solar rooftops. This would ease the strain on the National Grid and lessen dependency on fossil fuel energy sources like gas, especially when excess electricity produced by a building may be utilized to recharge electric vehicles. The idea is known as Active Buildings, and it has already been proven to be effective. On the Swansea University campus, two Active Buildings have successfully operated for several years. The objective of the new research is to accelerate the process of developing this technology into items that the industry can produce while further exploring its potential (ENP Newswire, 2022).

The R&D centers are in focus to develop technologies that will help create low-carbon products adhering to the UK climate action Laws.

At the University of Warwick, a team of researchers led by Professor Claire Davis are working together with the experts of the Tata Steel UK Group. Their major aim is to develop low-carbon steel and batteries for electric vehicles which are more sustainable. The group aims to achieve success in this program in a span of two years. Both parties are collaborating to make steel cleaner, more efficient, and greener. This partnership and research program benefits the UK's future steel industry and strengthens the economy (Warwick news & events, 2015).

In collaboration with Tata Steel UK, Aggregate Industries, and specialist mineral processing company Darlow Lloyd & Sons, EMR, a leading global metal and plastics recycler, will investigate how the use of recycled materials obtained from the urban mine can lead the UK's foundation industries toward net-zero. Using materials like glass, concrete, and other mineral fractions that are separated during the recycling of steel, they will also create sustainable, mineral-rich substitutes for the manufacturing of cement (Arksey, 2022).

Because of their process technology and the high purity of the recycled metal they need to produce their high-quality finished goods, leading UK steelmakers like Tata Steel UK are only able to add a certain amount of recycled metal to their products. In order to reduce the requirement for virgin iron ore, EMR has undertaken early testing with Tata Steel UK that shows how new grades of recycled steel can be provided with the chemical performance needed for high-quality low carbon steelmaking (Arksey, 2022).

In the meantime, Aggregate Industries will be able to utilize new mineral-rich products developed by EMR and Darlow Lloyd that are created during the steelmaking and metal recycling processes. EMR will make investments in brand-new facilities for separating recovered minerals and recycled steel. Additionally, it will oversee the project's overall coordination, including the dissemination of the findings to the government and other companies involved in the UK cement and steel supply chain so they are aware of the project's successes. Tata Steel will make improvements to its Port Talbot steelmaking facilities (Arksey, 2022).

The Tata Steel plant in Port Talbot, Wales, is reducing energy use and carbon emissions by using laser technology at the site's two slab reheating furnaces. The technology has improved the quality and consistency of products produced by the site, it said. The furnaces that are used to produce the products are the first globally to use the technology. The installed laser sensors analyze the furnace's molecules to measure the combustion products and the temperature profile of the furnace to produce live visual data. This information helps Tata Steel Process Technologist Jonathan Richards to improve the furnace's performance. Heating the slab to the correct temperature is critical to ensure the metallurgical properties match the requirements of customers. The system also allows the company to monitor and control gas usage more accurately, saving energy and costs and reducing the carbon footprint. The furnaces use around 60 percent of the fuel that is burned (Holman, 2022). Electric oven installation, transition to renewable electricity, and increased use of steel waste are a few of the initiatives that are reducing CO2 emissions by tens of thousands of tons annually (Kinch, 2022).

At Port Talbot, using essential new high-tech addition, the Energy division is using less expensive natural gas, emitting fewer emissions, and saving the corporation millions of pounds annually. The increase could not have come at a better moment, given the urgency of the climate

change crisis and the exorbitant cost of electricity. Currently, the Port Talbot site produces over 70 percent of its own energy needs. It does this by using process gases to generate electricity through its on-site power plant, recently updated with a new \$33.3 million turbo alternator to replace natural gas (Contify Energy News, 2022).

Until recently, imported natural gas has continuously been added to the on-site gases used in the power plant to make up for changes in calorific value. The site's native gases are now intelligently topped up by a new Gas-enrichment station that costs just under \$360,000 just when necessary, reducing the need for imported gas. Imran Shabbir, a project process engineer at Tata Steel, stated that the on-site boilers produce steam using site gases like blast furnace gas. It has been utilizing a lot of natural gas as a backup fuel because that gas' calorific value, or energy content, occasionally lowers. As opposed to the continuous firing it had previously, natural gas is now only injected when the calorific value of the blast furnace gas. As a result, Shabbir explained that they can reduce natural gas consumption in our service boilers by around 80 percent, which equates to around 3300 Gigajoules a week. The initiative will reduce CO₂ emissions by more than 10,000 tons per year, which is the equivalent of flying an airplane 888 times. This will have a substantial positive impact on the environment (Contify Energy News, 2022).

Tata Steel: Green Steel Solutions

According to executives and the company's annual report for 2021–2022, Tata Steel Netherlands plans to gradually phase out its blast furnaces and coal over the course of the next ten years in favor of electric furnaces and Direct Reduced Iron (DRI) technology based on hydrogen. This methodology is a boon for Tata Steel Europe as this can be used for the strict emission laws in the UK (Tata Steel Europe, 2022).

The trade body UK Steel has said that the steel industry will need to consider all possible methods of cutting emissions, including methods that use hydrogen instead of coking coal. In 2020, the industrial sector accounted for 11.1 percent of Britain's total emissions (Tata Steel Europe, 2022).

After switching to hydrogen-based steel production, Tata Steel's IJmuiden factory in the Netherlands has signed an agreement with American automaker Ford to supply Zeremis green steel. Tata Steel is attempting to transition its steel production in the UK and the Netherlands to low-carbon technology in Europe. According to the company's CEO & MD T V Narendran and Executive Director and CFO Koushik Chatterjee, both Tata Steel UK and Tata Steel Nederland have been developing comprehensive plans for the transition to low CO₂ technologies in line with the company's goal to produce CO₂-neutral steel by 2050 in Europe (Outlook India, 2022).

In a news release, it was stated that Tata Steel Nederland has signed a memorandum of understanding with Ford in Europe to provide the automaker with Zeremis green steel once the IJmuiden steelworks shift to green hydrogen-based steelmaking. With this arrangement, Ford becomes the first client committed to acquiring the green steel that Tata Steel intends to produce using the hydrogen route, which is more environmentally friendly and sustainable than the

present steelmaking process. One hundred percent carbon neutral is how Zeremis carbon lite steel is marketed (Outlook India, 2022).

Tata Steel Nederland's Chairman of the Board of Management, Hans van den Berg, stated that Tata Group is transforming to become a manufacturer of substantial amounts of high-quality green steel, and it can supply clients with a sizable volume of high-quality low-CO₂ steel. It can establish an early market for green steel if Tata Steel works with clients like Ford to align its sustainability goals. Steel of various sorts, with varying strengths, weights, magnetic characteristics, and coating types, makes up more than half of the weight of a typical car (Outlook India, 2022).

The largest steel producer in the UK, Tata Steel, said on October 3, 2022, that it has started selling certified low-CO₂ steel to clients. A business representative said in an email that the lower CO₂-certified steel, Optemis Carbon Lite, is based on CO₂ savings realized by Tata Steel in the UK and is verified by independent assurance specialists DNV. According to a statement from Tata Steel UK, the availability of Optemis Carbon Lite is the result of increasing demand from consumer-facing industries such as construction, automotive, packaging, and white goods companies (Kinch, 2022).

However, the spokeswoman characterized client feedback as extremely good. The representative explained that this is a flexible certificated scheme (using a mass-balanced approach) that allows clients to define the CO₂ reduction they want. It was stated that the premium demand for the new steel brand was a commercially sensitive issue. In order to lower CO₂ emissions, the company has been working on a variety of projects. These projects can now be passed along to consumers in the form of certificates, enabling them to save on Scope 3 emissions. According to the company, the certificate-based inseting scheme is flexible and lets customers select the amount of CO₂ intensity reduction they require (Kinch, 2022).

Optemis Carbon Lite certificate sales revenues, according to Jhanji, will be utilized to fund additional projects providing further CO₂ savings. DNV would then verify these initiatives, accelerating decarbonization. Additionally, the savings will percolate down supply chains and assist customers in meeting their CO₂ targets. The integrated Port Talbot plant in South Wales will commit to becoming accredited to the ResponsibleSteel certification, the first international standard to provide certifiable requirements for the responsible processing and manufacture of steel, according to a separate announcement by Tata Steel UK (Kinch, 2022).

Economic Impact on Tata Steel UK

Tata Steel's sales to UK manufacturers are 60 percent of the total production. The key markets of the Tata Steel industry are the automotive industry, construction, and packaging. Out of 60 percent of sales, the automotive industry accounts for 35 percent of sales in revenue. Tata Steel produces body panels, wheels, and chassis components for 50 percent of the carmaker companies in the UK. These companies also include big names such as BMW, JLR, and Nissan. As per Tata Steel UK Factsheet report (2020), the vehicle (car) production is forecasted to exceed two million vehicles. Construction accounts for 30 percent of revenue in sales out of the 60 percent

of sales by Tata Steel UK (Global Steel Trade Monitor, 2017; Tata Steel UK Factsheet, 2020; Mustoe, 2015).

The major automotive industries are highly dependent on the machinery and items manufactured by Tata Steel. After an exit, the companies will have to face shortcomings in the supply of items, resulting in a loss to the economy.

Tata Steel UK exports 40 percent of the manufactured steel. Out of which, 30 percent is exported to mainland Europe and 10 percent to other continents. The top three markets for export are Germany, France, and Turkey. Along with long-time partnerships with Chevron, Shell, and Total companies supplying high-quality pipe products for deep water pipeline systems which run through the Gulf of Mexico, Brazil, and the North Sea (Global Steel Trade Monitor, 2017b).

As per the steel imports report by Global Steel Trade (2017a) the United Kingdom is the world's nineteenth-largest steel importer. It has shown a significant 74 percent increase in the import industry since 2009. The report shows that most of the steel is imported from China. The question arises if there is a huge steel industry in the UK, why import from other countries? The imports are mainly done to maintain the 'Steel Trade Balance,' to maintain a balance between the number of exports and imports ratio. The steel that is exported from the UK, the major contribution comes from Tata Steel, being the largest producer of steel. If Tata Steel exits from the UK, the economy of the UK will be heavily dented because of the imbalance in the ratio. Below is a graphical representation of the steel trade balance ongoing in the UK steel imports and exports.

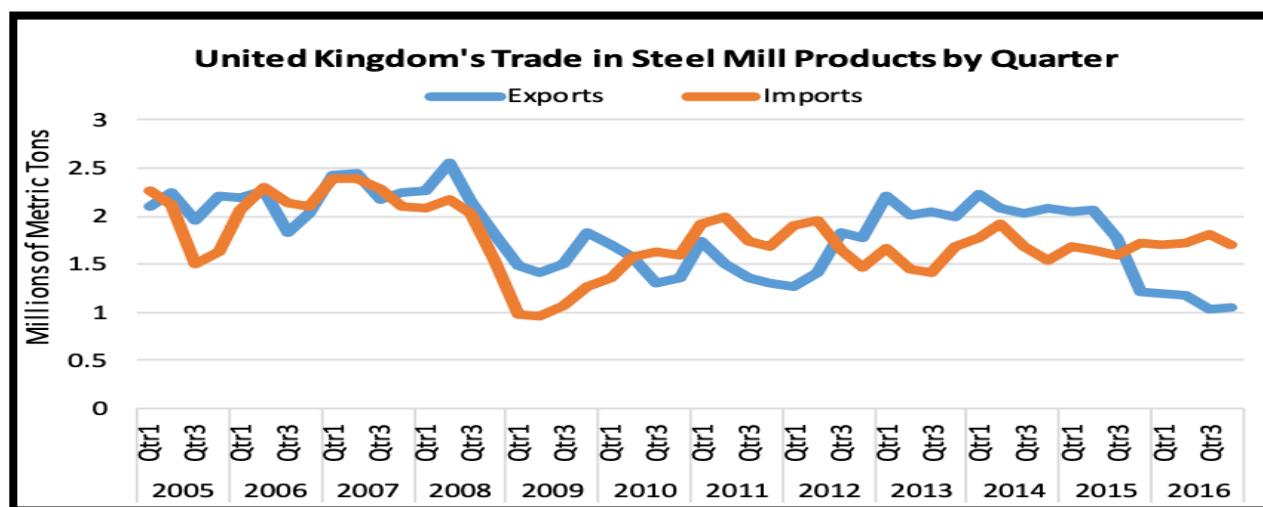


Figure 5. UK Steel Products by Quarter (International Trade Administration, 2017a).

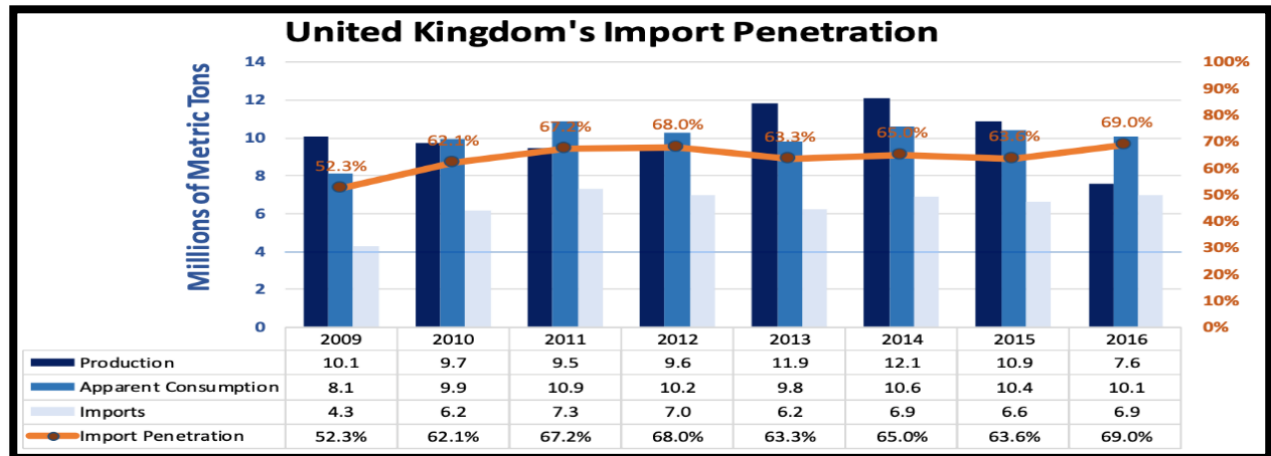


Figure 5. United Kingdom Import Penetration (International Trade Administration, 2017a).

Because of major imports and exports from and within the United Kingdom, Tata Steel exiting the market would land a huge blow to the UK government. In terms of maintaining the import-export steel balance trade, Tata Steel UK plays a vital role, exporting major high-quality steel and bringing in revenue to the UK economy. If Tata exits, this will impact the balance and result in a high dependency on steel in other major countries.

Employment in the UK Steel Industry

As seen in the figure below, between the period of 1970 to 2014, and thereafter, there has been a significant decline in the number of people employed in the steel production industries in the UK. To put this into perspective, roughly 350,000 people were employed in steel industries compared to the total population of 55,780,100, which is roughly 0.58 percent of the population. And as per the data available in 2014, there were roughly 35,000 people out of a total population of 64 million, which equates to 0.05 percent (Office of National Statistics, 2016). This clearly indicates overall, the UK was phasing out the production of steel at home, the reasons for which will be discussed in the following chapters.

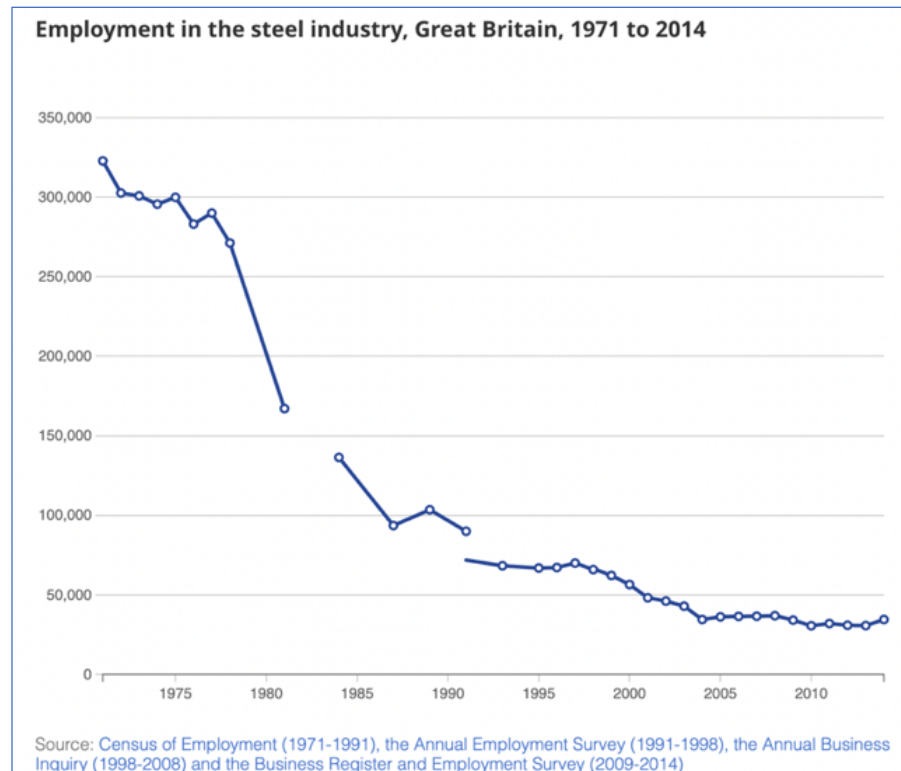


Figure 6. Employment in The Steel Industry (Office of National Statistics, 2016)

This decrease in overall employment could be attributed to many factors. However, during the period between the mid-1970s and the early 1980s, there was a sharp decline in employment related to steel. This drop can be closely attributed to the national strikes, employment reform, and many plant closures, such as those in County Durham, Northampton, and Shotton (Office of National Statistics, 2016).

Based on the findings of the Manufacturers Organization UK, it is estimated that for every 1000 pounds of steel produced, there are roughly 4.5 jobs supported in the steel industry and 383,561 pounds added to the economy of the UK. And these numbers only account for direct contributions. When we account for auxiliary jobs and services consumed, this number increases to 10 jobs created, and 876,712 pounds contributed to the UK economy over the span of the entire supply chain (MAKEuk, 2020).

Apart from employment directly with the steel industry and those parts of the supply chain, there is a relationship between steel production jobs and those industries that heavily rely on steel for their end products. Almost all industries use steel as raw material in one form or another. However, the major consumers are the Construction and Infrastructure industry, the Automotive industry and earth movers and excavators, and Energy, Aerospace, and household products (MAKEuk, 2020). Looking at the scale, reach and potential this business has in terms of dependency on other industries proves that the issue of employment is widespread. Tata Steel employs about 65,000 employees worldwide, and of that, 8000 are employed in the UK.

Based on the constant reduction in employment in the UK, we can ascertain that the UK as a nation is not actively promoting the production of steel in the country.

Major steel producers

The major producers of steel are China, Japan, the US, India, South Korea, Russia, and Germany. China produces more steel than all the other nations combined (Dun and Bradstreet First research, 2022).

Major steel production companies in China are Baowu Steel Group (95.5 million tonnes), Hesteel Group (46.6 million tonnes), Jiangsu Shagang Group (41.1 million tonnes), Ansteel Group (39.2 million tonnes), Shougang Group (29.3 million tonnes), Shandong Steel (27.6 million tonnes), Hunan Valin Steel (24.3 million tonnes) (Dun and Bradstreet First Research, 2022).

Based on data from worldsteel.org, the table below depicts the growth rate of steel production in China. With the exception of the numbers in 2021, China has increased its production on a year-on-year basis. In contrast to this trend, production in all other countries was the same throughout the period. To give some perspective, the second largest steel producer, India, produces roughly 1/8 amount of the steel China produces. Also, in comparison to the United Kingdom, China produces 137 times more steel (World Steel Association, 2021).

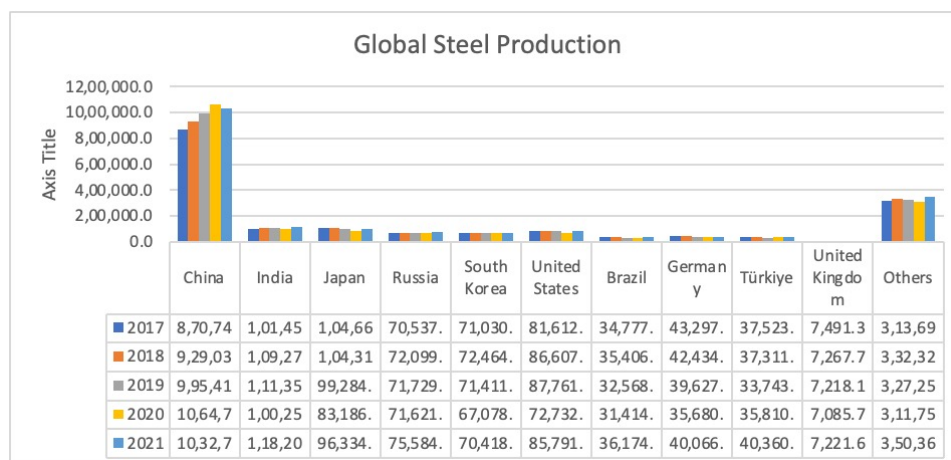


Figure 7. Global Steel Production (World Steel Association, 2021)

India has attracted multiple foreign investments in recent years, causing the steel industry to grow significantly in India. The world's largest steel producer, China, is witnessing a drop in steel production. This may suggest that production in China has hit its peak, or this may be partly attributed to the strict emission laws set up by the country.

This has created a conducive environment for the Indian steel industry to grow. The International Energy Agency predicts the growth rate to double by 2030 and quadruple by 2050. The majority of Indian companies are taking up innovative approaches to reduce carbon emissions (Basirat & Nicholas, 2021).

China is a major player in steel production, followed by India. However, there has been a decrease in production in the recent year. On the other hand, production in India has not stopped increasing. Tata Steel, an Indian company, can capitalize on this opportunity and increase production in its home country.

Europe Emissions Trading System (ETS)

The Europe Emissions Trading System (EU ETS) is a wide sector and multi-country greenhouse gas emissions trading system all over the globe. The EU ETS functions on a 'cap and trade basis.' The general idea of a cap is the limit set or amount of tradable emission allowed of the carbon.

The EU ETS provides tradable emission allowances in the market in two ways, one being free allowance and the second being auction. One allowance entitles the owner to emit one tonne of carbon dioxide. Those that are expected to emit more carbon gas than their allotted amount can either take steps to limit their emissions or purchase more allowances from the secondary market.

If Company A and Company B both emit 200 tonnes of carbon dioxide every year, the EU ETS has allotted each company an allowance of 200 tonnes. Company A recorded an emission of 180 tonnes of carbon dioxide at the end of the first year. Now company A has a surplus of 20-tonne limit which is not required for company A. It can sell this surplus allowance in the carbon market. Company B however emitted 220 tonnes of carbon dioxide. To tackle the fine or implications, Company B can simply buy the additional allowance from Company A on the carbon market. In this way, both companies can gain benefits from this trading system.

The UK ETS enables free credits to industries to use. In the figure below, it is evident that the indirect cost compensation awarded to the Iron and steel industry was the highest and followed by the chemicals Industry (Government of UK, 2021A).

Sector	Number of Businesses	EU ETS compensation
Iron & Steel	10	25.8 million
Chemicals	11	24.1 million
Paper	30	17.3 million
Non-ferrous metals	6	0.7 million
Other	3	0.7 million

Figure 8. EU ETS Indirect Cost Compensation awarded in 2020 (\$ US Dollars)
(Government of UK, 2021A)

EU ETS Major Tata companies in the UK

The figure below illustrates the spread of carbon credit allocation for Tata companies in the UK for the year 2021. The Port Talbot plant receives the highest carbon credits from the government (Government of UK, 2021B).

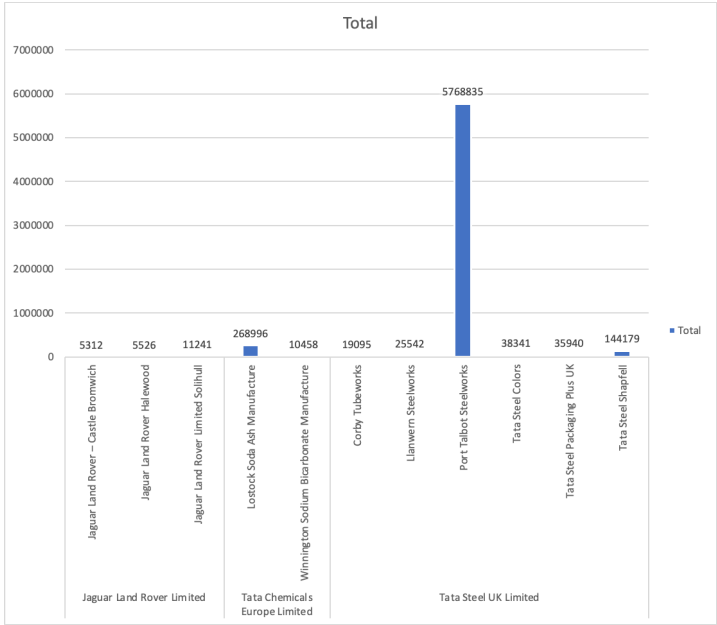


Figure 9. Carbon Credits Allocation to Tata Group in UK (Government of UK, 2021B)

It is clearly evident that Tata Steel and British Steel enjoy the highest number of carbon credits in the UK. Overall, in relation to the steel industry in the UK, Tata Steel is given about 58 percent and British Steel holds close to 41 percent of free credits (Gov.uk, 2021).

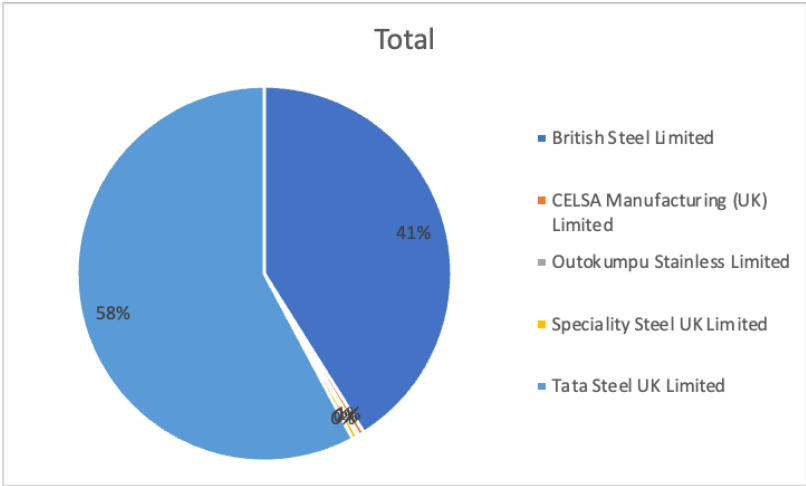


Figure 10. Carbon Credits Allocation in Steel Sector (Government of UK, 2021B)

This data clearly shows how the UK government has aligned with the difficulties faced by major industries to transition to low carbon emission guidelines.

SUMMARY

The inception of this issue seems to lie with the Paris Climate Change Act of 2008, where multiple countries signed and agreed to reduce carbon emissions. The United Kingdom has established a legally binding agenda to reduce carbon emissions and render the country with zero carbon emissions by 2050. Such a bold move by the UK has impacted multiple industries. And Tata Steel is one such organization.

It is clearly evident based on the declining employment numbers in the UK Steel Industry, the country is shifting its core from metals production. On the other hand, the UK has multiple other industry sectors that depend on steel for manufacturing products. Another facet of this data is related to the concentration of steel production in China and India. This may lead to a monopoly of steel. This would be detrimental to the UK.

Based on the above two factors the UK is most likely to support any effort made by Tata Steel to reduce carbon emissions and would settle with a staggered fix as long as there is a plan of progress in the future. Carbon credits have been employed by the government of the United Kingdom as a framework for carbon emissions. Companies are allocated carbon credits based on industry. Additionally, companies can trade carbon credits based on their need. It is seen that Tata Steel in has been allocated the highest number of carbon credits in the UK.

Tata Steel has displayed efforts on all fronts of innovation to reduce carbon emissions. It has set up global R&D centers and created and nurtured partnerships with multiple organizations in this regard.

RECOMMENDATION

Tata Steel should remain in the UK. consider staying back in the sovereign state. Reviewing Tata Steel UK's financial report, the time period of 2021-22 has been reported as the most profitable year, indicating a huge steel market held by the Tata Group in the UK.

Tata Steel UK has also excelled in its innovation game and has continually set a higher bar for itself and its sister companies. It has also demonstrated that it can achieve this progress in a staggered manner. This innovative culture by the Tata Group, combined with the support of the UK government, has great potential for success for Tata. It has recently ventured into green steel production with its initiatives in Zeramis and Optimus.

Tata Steel UK could initially consider purchasing carbon credits in order to offset the excess emissions. Additionally, the Tata Steel UK can also utilize free credits, made available by the UK government in 2021. The UK government has allocated these carbon credits to industries facing challenges in transitioning to greener solutions for their businesses.

Tata and the UK both share a common goal of decarbonizing the industry. Tata Steel can continue the promising innovation in different areas with step-by-step progress to net zero planned in the future.

Action plan:

Tata Steel UK has ongoing developments and innovations at the global R&D centers for developing steel with the least carbon emissions. Tata Steel can plan future proceedings with respect to carbon credits usage, continuing the business operations along with a strong focus and research for reaching its goal as a net zero emission company.

The Group can comply with the UK regulations with a gradual decrease in carbon emissions by implementing hotfixes, such as the technology recently implemented at Port Talbot that reduces carbon emissions by 10,000 tonnes a year. The technology generates approximately 70 percent of Port Talbot's electricity using natural gas, saving millions of pounds for Tata Steel UK. The group has multiple other projects in the pipeline which will help its cause.

Tata Steel UK could leverage this innovation to reduce carbon emissions and sell the excess carbon credits allotted by the UK ETS. The revenue generated could be used to sustain itself. Another upside to this could be the use of carbon credits for other businesses. These funds could also be diverted to restructuring and upgrading other plants by selling the extra carbon credits.

BUSINESS IMPACT ON TATA STEEL UK

Long-term business impact:

The ongoing projects and innovations at Tata Steel UK focus on producing steel involving a lesser negative impact on the environment. The Group has been completing several milestones and progressing step-by-step in producing net zero carbon emission steel. By utilizing the carbon credits, the Group can continue with the ongoing developments without disruption. This will help to build and upgrade the manufacturing plants for the net zero vision.

The company will acquire a stronghold in other markets where there is less innovation in technology and equipment by competitors to sustain the UK environmental laws and policies.

Short-term business impact:

Tata Steel will have to install equipment and technologies used in Port Talbot, which helps to convert carbon dioxide into electrical energy. This will help the company to comprise the CO₂ emissions. However, this upgrade will cost money to the company. Heavy research operations and developments with the partnered universities will require consistent Tata Steel UK Group funding.

In addition, buying extra carbon credits from the carbon markets will force the company to increase the price of the products.

APPENDIX

Tata Steel UK products:

Tata Steel's UK operations produce a wide range of steel products to satisfy unique requirements of various markets of the continent. The portfolio of steel includes high quality strips, long products, hot rolled steel, metallic coated steel, pre-finished steels, alloy steels, construction systems. The company also offers remedies in building foundations, envelope and structural fit-out foundations, and highway engineering. Moreover, it also provides services through consulting and records management (Tata Steel, n.d).

Tata Steel provides steel products to a wide range of industries around the world, including packaging, lifting, and excavating, energy and power, consumer goods, defense and security, automotive, construction and aerospace. Construction accounts for 30 percent of the business sales revenue and the tubes division of Tata Steel UK is a market leader in the supply of hot finished and cold formed steel tubular goods. Key products launched by Tata Steel UK:

- a) 'Full finished' steels used for making car body panels for automobile customers like JLR, BMW, Nissan.
- b) 'Advanced Colorcoat' used for building envelope and cladding applications.
- c) 'Polymer-coated packaging steels' known as 'Protact' which reduces energy made by tin can and CO2 emissions.
- d) 'Celsius' which includes axles on trailers and gantries in UK motorways.
- e) Deep water pipelines to import oil and gas from deep water bodies around the globe.
- f) 'Catnic lintels' used in steel window and door lintels.
- g) 'Comflor' Steel flooring which provides sound proofing.
- h) 'Coretinium' is core used by bus manufacturers to build lightweight vehicles and reduce CO2 emissions (Tata Steel, n.d).

A list of key products outperforming in the steel market of UK:

Ympress®, Ympress® Laser, Valast®, Ymagine®, Ymvit®, MagiZinc®, Durbar®, Hybox® TT, Celsius®, HILUMIN®, Radecol®, Advantica®, Coretinium® (Tata Steel, n.d).

Tata Steel UK focuses on providing high quality products along with ensuring cleaner environment. The key products of the Tata Steel UK Group are high performing and environment friendly. Its uses technology which helps in compressing the carbon dioxide emission to its minimum.

TATA steel UK products in the automotive industry

Tata Steel is a major part of the automotive industry, providing a vast range of quality products. The automotive products portfolio includes strip and processed steels, including electrical steels for electric vehicles, and electro-plated steels for batteries and fuel cells. The following is a list of key products used in the automotive industry of Tata Steel UK: Hot-rolled, Direct-rolled, Cold-rolled, Metallic coated, Electro-plated steel, and Electrical steel Tubes (Tata Steel, n.d).

Electricity consumption in the steel industry

Among other European countries, the UK has the highest electricity consumption. Due to this, the steel industry in the UK finds it very difficult to stay competitive in this market. There is a huge gap in the prices paid by steel makers in other European countries compared to the United

Kingdom, and this disparity is after the government subsidizes the cost of electricity to the industry. The major factors at play here are related to the additional carbon pricing towards the steel industry and network charges that other countries do not levy on their steel manufacturers. To top this, gas prices in the UK have increased considerably in the recent past (MAKEuk, 2022 July).

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