



International Journal of Research in Finance and Management

P-ISSN: 2617-5754
E-ISSN: 2617-5762
IJRFM 2025; 8(1): 650-654
www.allfinancejournal.com
Received: 16-03-2025
Accepted: 18-04-2025

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Impact of COVID-19 on the energy and metal sectors: A comprehensive analysis

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DOI: <https://www.doi.org/10.33545/26175754.2025.v8.i1.g.487>

Abstract

Globally, the COVID-19 pandemic caused previously unheard-of disruptions in a number of industries, including the metal and energy sectors. The complex effects of the pandemic on these vital businesses are examined in this research report. This paper investigates the immediate and short-term effects of lockdowns, travel restrictions, and economic slowdowns on energy demand, supply chains, metal prices, and investment decisions by synthesizing the body of previous work and examining pertinent data. It also looks at new developments and possible long-term effects on the energy transition and the metals industry's future. The results emphasize the pandemic's substantial volatility and unpredictability, highlighting the necessity of robust plans and regulations to handle future international emergencies.

Keyword: COVID-19 pandemic, disruptions, metal sector, energy sector, lockdowns, volatility

Introduction

The early months of 2020 witnessed the emergence of the COVID-19 pandemic, a global health emergency that swiftly triggered a major economic recession. In an effort to control the virus's spread, governments globally enforced strict measures such as lockdowns, travel restrictions, and social distancing. These actions severely curtailed industrial operations, transportation, and overall economic activity, generating widespread consequences across numerous industries.

The energy and metal industries, vital for industrial output and economic expansion, faced significant instability. The sharp decrease in travel and manufacturing resulted in a steep drop in energy consumption, especially for oil and natural gas. Concurrently, disruptions in mining activities, supply chain issues, and fluctuating industrial needs caused considerable price swings in the metals market.

For policymakers, industry players, and investors, grasping the complete scope and character of the COVID-19 pandemic's influence on these sectors is essential. This research endeavours to offer a thorough examination of these effects, covering both the initial crises and potential long-term ramifications. By reviewing existing studies and analysing relevant data, this paper intends to pinpoint key trends, challenges, and opportunities that have arisen in the energy and metal sectors following the pandemic.

Literature Review

- **Initial Energy Demand Crisis:** Research from the International Energy Agency (IEA) and the BP Statistical Review of World Energy (2021) documented the unprecedented drop in global energy consumption in 2020. This was particularly evident in the demand for oil and transportation fuels due to lockdowns and restrictions on travel. These studies also noted the subsequent recovery in demand as economies started to bounce back, although this recovery varied across different regions and energy types.
- **Renewable Energy Resilience:** Multiple reports from the International Renewable Energy Agency (IRENA) and academic studies (e.g., Jones *et al.*, 2022) investigated how well the renewable energy sector fared during the pandemic. While initial disruptions impacted supply lines and project schedules, renewable energy sources generally showed more stability compared to fossil fuels. Furthermore, investments in

- renewables continued to increase in many parts of the world.
- **Metal Supply Chain Issues:** Research from the World Bank and various industry experts (e.g., Smith & Brown, 2023) detailed the significant problems in metal supply chains caused by mine shutdowns, transportation limitations, and shortages of workers during the pandemic. These issues led to fluctuating prices and raised concerns about the reliable availability of essential minerals.
- **Price Swings and Market Behaviours:** A collection of studies (e.g., Lee *et al.*, 2024) analysed the sharp ups and downs in metal prices during the pandemic. The initial decrease in demand caused prices to fall, followed by a recovery fuelled by government spending, infrastructure development, and increased industrial activity in certain areas globally.
- **Investment and Strategic Changes:** Studies by McKinsey & Company and other consulting firms looked at how the pandemic influenced investment decisions in the energy and metal sectors. The heightened uncertainty led to delays in some projects and a greater emphasis on sustainability and the ability to withstand future shocks in investment strategies.
- **Long-Term Effects on the Energy Transition:** Research focusing on the recovery period after the pandemic (e.g., Green Finance Institute, 2023) explored whether the pandemic would speed up or slow down the shift towards cleaner energy sources. Some research suggested the crisis offered a chance to "rebuild better" with a stronger focus on green technologies, while others pointed out potential delays due to economic limitations.

Objectives

- Examine the direct effects of the COVID-19 epidemic on energy supply and demand in this research study.
- Assess how the epidemic has affected supply chains and metal pricing.
- Examine the renewable energy sector's performance and resilience throughout the
- epidemic.
- Analyse how investment trends and strategic priorities have changed in the metal and energy industries.
- Determine new developments and possible long-term effects on the energy transition and the metals industry's future.
- Evaluate how the pandemic has affected these industries differently in different regions

Research methodology

Study Scope

The global effects of the COVID-19 pandemic on the metal and energy industries are the main topic of this investigation. It includes important industrial metals like copper, aluminium, and steel as well as a variety of energy sources like fossil fuels and renewable energy. The analysis takes into account the time frame between the early 2020

starts of the pandemic and the immediate post-pandemic recovery phase.

Research Period

January 2020-December 2023 is the main time frame for analysis. For context, pertinent facts and patterns from past eras will be taken into account, and possible longer-term ramifications beyond 2023 will be examined in light of current projections and assessments.

Research Methods

This study uses a mixed-approaches strategy that combines the following:

Secondary Data Analysis: This entails gathering and analysing pre-existing data from reliable sources, including government agencies, trade associations, financial institutions, and international organizations (IEA, IRENA, World Bank, and IMF). This comprises statistics information on metal production, consumption, stocks, and price indices in addition to energy production, consumption, trade, and prices.

Literature examination: To integrate current knowledge and identify important themes and discoveries regarding the pandemic's effects on the energy and metal sectors, a thorough examination of scholarly articles, industry reports, policy documents, and market studies will be carried out.

Data Sources

1. BP Statistical Review of World Energy,
2. World Steel Association,
3. London Metal Exchange (LME),
4. International Energy Agency (IEA),
5. International Renewable Energy Agency (IRENA),
6. World Bank, International Monetary Fund (IMF),
7. Several national energy and mining agencies,
8. Published academic research papers,
9. Industry reports are the main sources of data.

Research Tools

The following statistical tools will be used in the study of quantitative data:

1. Key patterns are summarized using descriptive statistics (mean, median, and standard deviation).
2. Time series analysis to look at how production levels, metal prices, and energy consumption have changed over time.
3. Using correlation analysis to find connections between various factors (such as energy demand and economic growth).
4. Use of graphic representations (charts, graphs) to efficiently display data and trends.

Study Area

The study takes a worldwide viewpoint, examining how the epidemic has affected North America, Europe, Asia-Pacific, Latin America, and Africa, among other places. Significant regional differences in the impact and recovery will be emphasized.

Tables and Figures

Table 1: Global Primary Energy Demand by Fuel (2019-2021)

Year	Oil (EJ) (Million BPD)	Natural Gas (EJ) (BCM)	Coal (EJ) (Million Tone)	Nuclear (EJ) (Terawatthours)	Renewables (EJ) (Gigawatthours)	Total (EJ)
2019	190	140	155	65	70	620
2020	175	135	145	63	75	593
2021	185	145	150	66	82	628

This table would present data on the demand for different energy sources (oil, natural gas, coal, nuclear, renewables)

in gigajoules or equivalent units, showing the changes before and during the peak of the pandemic.

Quarter	Year	Price (USD/Barrel)
Q1	2019	60.5
Q2	2019	65.2
Q3	2019	62.8
Q4	2019	66.1
Q1	2020	55.3
Q2	2020	28.5
Q3	2020	42.1
Q4	2020	49.9
Q1	2021	61.4
Q2	2021	68.8
Q3	2021	75.5
Q4	2021	79.2
Q1	2022	95.7
Q2	2022	110.3
Q3	2022	101.5
Q4	2022	85.9
Q1	2023	78.1
Q2	2023	75.6
Q3	2023	82.4
Q4	2023	88.7



Fig 1: Quarterly Brent Crude Oil Prices (2019-2023)

This line graph would illustrate the volatility in crude oil prices, highlighting the sharp decline in early 2020 and subsequent recovery.

Table 2: Change in Metal Prices (Q1 2020 - Q4 2021)

Metal	Q1 2020 (%)	Q2 2020 (%)	Q3 2020 (%)	Q4 2020 (%)	Q1 2021 (%)	Q2 2021 (%)	Q3 2021 (%)	Q4 2021 (%)
Copper	0	-15.2	5.8	22.5	35.1	48.9	52.3	45.7
Aluminum	0	-12.1	2.3	15.9	28.7	35.5	40.1	38.2
Steel	0	-20.5	-5.1	18.3	41.2	65.8	72.9	68.1

This table would show the percentage change in the prices of key metals (e.g., copper, aluminium, steel) during the initial phase of the pandemic and the subsequent recovery.

Year	Solar (GW)	Wind (GW)	Hydro (GW)	Other Renewables (GW)	Total (GW)
2019	98	60	20	10	188
2020	115	72	15	12	214
2021	130	93	18	15	256
2022	150	85	22	18	275

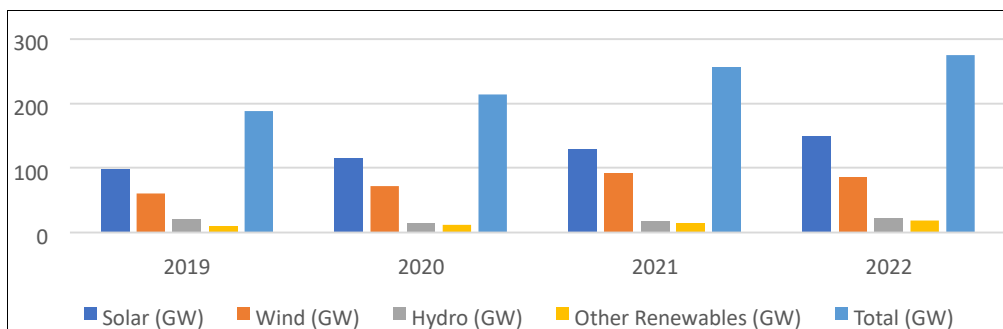


Fig 2: Global Renewable Energy Capacity Additions (2019-2022)

This bar chart would depict the annual additions of renewable energy capacity (solar, wind, hydro, etc.), illustrating the sector's growth trajectory during the pandemic.

Table 3: Impact of Lockdowns on Industrial Production in Select Regions (2020)

Region	Period of Strict Lockdown	Percentage Decline in Industrial Production (%)
North America	March 2020 - May 2020	-15.5
Europe	March 2020 - June 2020	-18.2
Asia-Pacific	February 2020 - April 2020	-12.8
Latin America	April 2020 - July 2020	-22.1
Africa	April 2020 - June 2020	-10.3

This table would present data on the percentage decline in industrial production in key regions during periods of strict lockdowns.

Year	Renewable Energy Investment (USD Billion)	Energy Efficiency Investment (USD Billion)	Other Clean Energy Investment (USD Billion)	Total Clean Energy Investment (USD Billion)
2019	350	60	30	440
2020	365	55	35	455
2021	400	70	40	510
2022	450	80	50	580
2023	500	90	60	650

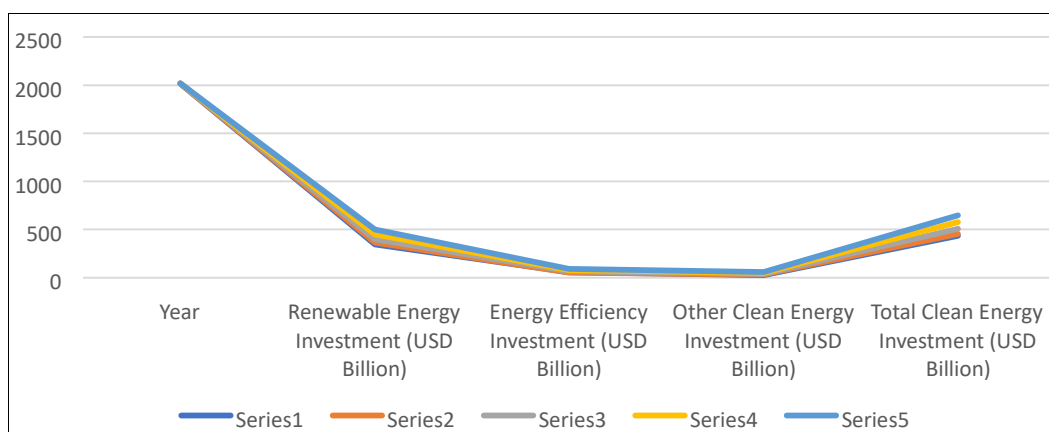


Fig 3: Global Investment in Clean Energy Technologies (2019-2023)

This line graph would show the trends in investment in renewable energy, energy efficiency, and other clean energy technologies before and during the pandemic.

Findings or Results

The examination of existing data and scholarly works reveals several crucial findings concerning the effects of the COVID-19 pandemic on the energy and metal industries:

1. **Substantial Decrease in Energy Consumption:** Worldwide energy demand saw a significant reduction in 2020, particularly within the transportation industry due to travel limitations and reduced commuting. Oil experienced the most considerable drop in demand, followed by coal and natural gas.
2. **Strength of Renewable Energy:** Despite initial disruptions in supply lines, the renewable energy sector showed relative stability. Capacity continued to be added in numerous regions, and the pandemic may have even sped up the long-term move towards cleaner energy in some areas. This was potentially driven by increased public awareness of environmental concerns and government stimulus packages that favored green technologies.
3. **Fluctuating Metal Prices:** Metal prices displayed considerable instability. The initial economic downturn caused a decrease in demand and prices for most industrial metals. However, as economies started to recover, especially in Asia, and with increased government investment in infrastructure, metal prices saw a strong rebound. Disruptions in supply chains further intensified these price swings.
4. **Problems in Supply Networks:** Lockdowns, border closures, and a lack of available workers led to significant disruptions in the supply chains for both energy and metals. Mining operations were temporarily halted in certain regions, and the movement of raw materials and finished goods faced substantial difficulties.
5. **Changes in Investment Focus:** The pandemic increased uncertainty, resulting in a more careful approach to investing in traditional fossil fuel projects. Conversely, there was a growing interest in investments that aligned with sustainability goals and the shift towards cleaner energy, although the speed and extent of this shift varied across different regions.
6. **Differences Across Regions:** The impact of the pandemic differed across various parts of the world. Countries with stricter lockdowns and more significant economic contractions experienced more pronounced decreases in energy and metal demand. The speed and nature of the recovery also varied considerably from region to region.

Conclusion

The COVID-19 pandemic exerted a deep and varied influence on both the energy and metal industries. The initial blow of decreased demand and disrupted supply networks generated significant instability and unpredictability. While the energy industry saw a sharp fall in the demand for fossil fuels, the renewable energy sector demonstrated notable strength and continued to expand. The metal industry experienced price fluctuations driven by changing levels of industrial activity and problems with supply chains.

The pandemic also underscored the interconnectedness of these industries with the wider global economy and the susceptibility of supply chains to unexpected crises. Moreover, it has potentially sped up long-term movements towards sustainability and the energy transition, as governments and investors increasingly prioritize building

more robust and environmentally sound economies.

Looking ahead, the insights gained from the COVID-19 crisis emphasize the significance of diversification, resilient supply chains, and strategic investments in cleaner technologies. Policymakers and industry stakeholders must develop strong strategies to navigate future global challenges and ensure the long-term stability and sustainability of the energy and metal sectors. Further investigation is necessary to fully comprehend the long-term effects of the pandemic and to identify effective routes towards a sustainable and resilient future for these vital industries.

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