सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF
COAL

ENERGY CELL

ANNUAL REPORT 2023-24

NOMINATED AUTHORITY

MINISTRY OF COAL

Shastri Bhavan, New Delhi-110001

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1.1 Introduction

Energy plays a key role in advancement of any nation by improving its socio-economic conditions and enhancing the standard of living. Energy plays a crucial role not only in the development of the nation but also in day-to-day activities like household electric appliances, maneuverability, information/communications, and machinery operation in every sector of every country. The major obstacle to the development of any nation is the inaccessibility to reliable and green energy sources, which improve the standard of living.

Along with the development of the human standard of living, we are equally responsible for the increasing effect of global warming due to anthropogenic greenhouse gases (GHG). The role of renewable energy has increased drastically with many advancements and commitments to address various challenges like deprivation and global warming. In order to achieve net zero and the world's sustainability, it is crucial to establish and provide access to modest, secured, sustainable, and advanced energy supplies while addressing GHG. The analysis and compilation of energy statistics are crucial to maintaining a composed energy situation in any country.

Energy resources include renewable and fossil fuel energy resources in various forms such as solid, liquid and gaseous state under the earth's crust. Energy reserves need to be explored and excavated with a justification for the growing global concern on net zero emissions considering technical, economic and other crucial factors. Energy products are mainly used as a source of energy directly or indirectly while undergoing some chemical or other process.

The United Nations Statistical Commission developed International Recommendations on Energy Statistics, a statistical framework, suggeted its adoption in every country irrespective of their economic standards. IRES provides a detailed framework for collecting, compiling and disseminating energy statistics. Energy flows represent the production/consumption energy products and their export, import and use, and other various economic activities of a country and is shown in *Figure 1.1.*

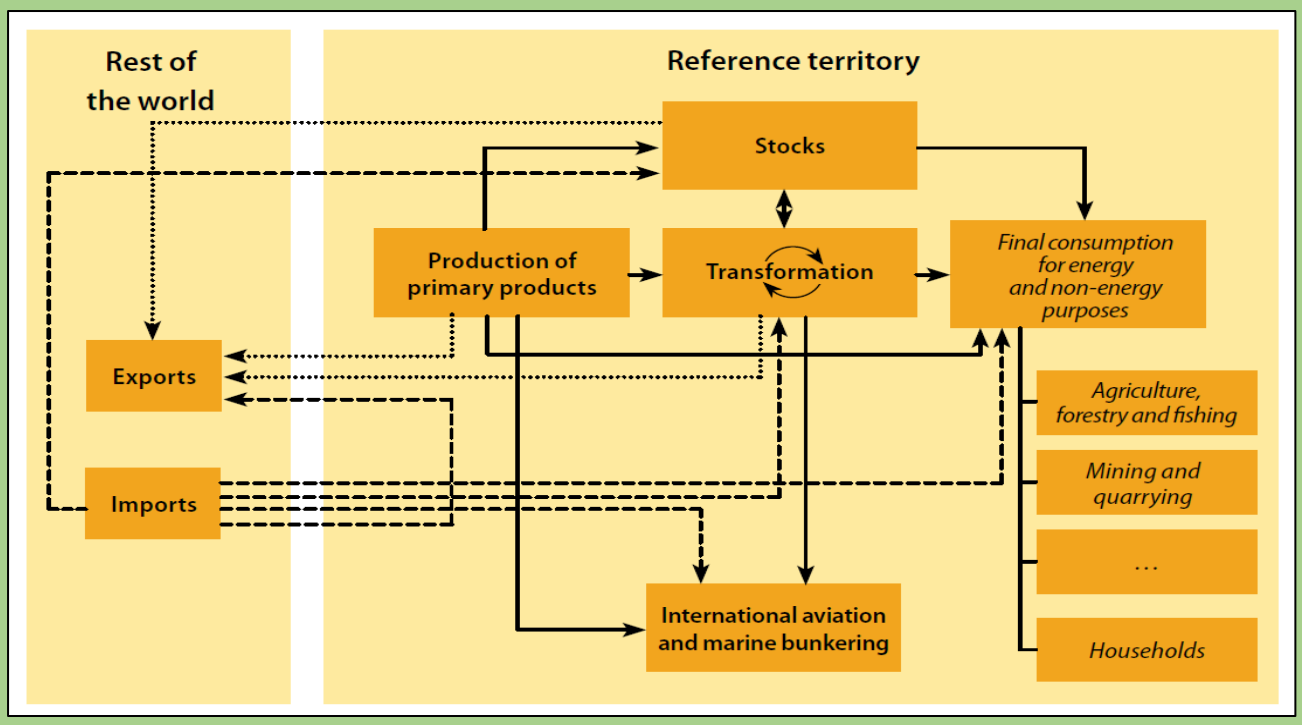


Figure 1.1 Flowchart of the main energy flows. (Source: IRES)

1.2 Sources of Energy

In the Stated Policies Scenario (STEPS), energy demand is projected to rise from 630 EJ (2022) to 670 EJ by 2030, with a growth rate of 0.7%. This growth rate is slower compared to the previous decade. In contrast, the Announced Pledges Scenario (APS) anticipates a slight decline in energy demand at a rate of 0.1% till 2030. This reduction is primarily attributed to increased adoption of renewables, enhanced energy efficiency measures, and accelerated electrification compared to the STEPS scenario.

In the Net Zero Emissions (NZE) Scenario by 2050, electrification is expected to accelerate further through enhanced energy efficiency measures, leading to an average annual decline of 1.2% in primary energy consumption by 2030.

In emerging markets and developing economies (EMDE), energy demand is expected to increase by 16% from 2030 to 2050, contrasting with a 9% decline expected in advanced economies. *Figure 1.2* illustrates the global energy demand trends from 2010 to 2050.

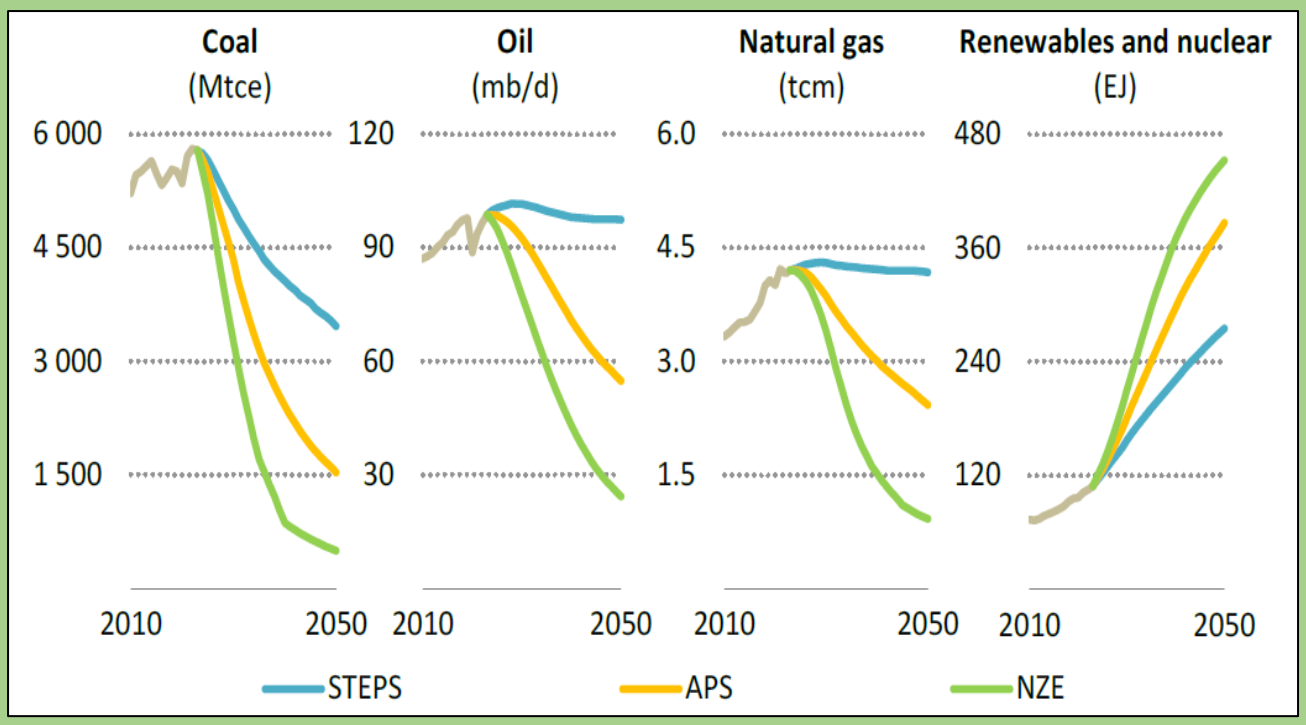


Figure 1.2 Global Energy Demand 2010-2050 (Source: IEA)

1.2.1 Coal

Globally, Coal is still an irreplaceable component that contributes around one-third of global electricity generation. Global coal production increased by 1.8% in 2023, marking another all-time record high of 8741 Mt. China, India, and Indonesia resulted in steady growth, whereas United States of America (USA) and European Union (EU) showed a declining trend. Due to Russo-Ukrainian war, coal demand touched a record high in 2022, which eventually surged prices and disrupted trade flows. The major coal-producing and coal-dependent countries like China and India renewed coal investment and enhanced domestic coal production due to increased coal prices and growing concern towards energy security to reduce dependency on imports. Many governments, banks, entrepreneurs, investors, and mining companies have declined their interest in coal sector investment as a step towards clean energy.

The replacement of unabated coal from the global energy mix is a complicated task, but there is an improving trend with the steady rise in deployment of renewables in advanced economies. Still, coal is a dominant fuel required for developments in emerging markets and developing economies. In the STEPS, coal demand is expected to decline gradually. In the APS, coal demand is anticipated to lower by 25% and 75% in 2030 and 2050, respectively. In NZE Scenario, global demand is anticipated to decline from 2030 to 2050 by 45 % and 90%, respectively.

1.2.2 Crude Oil

Oil demand has increased drastically to 18 mb/d compared to the last two decades. Due to the COVID pandemic and the Russo-Ukrainian war, global oil markets have restructured and undergone drastic changes in demand and supply trends and are expected to ease to 1.2 mb/d in 2024 and 1.1 mb/d in 2025. In OPEC member countries, Latin America and the Caribbean, crude oil production in 2050 is expected to be 2 mb/d lower compared to *WEO-2022* projections, and in North America, it is expected to be 1 mb/d lower. According to WEO, Oil prices are expected to be steady in STEPS at around USD 80/barrel. In the APS, it is expected to decline gradually to USD 60/barrel by 2050. In the NZE Scenario, oil prices are expected to reach the marginal production cost of USD 40/barrel by 2030 and decline further.

1.2.3 Natural Gas

Natural gas contributes around 20% of the world's electricity generation. Due to Russo-Ukrainian war, natural gas markets have been upended, and a sharp decline in the supply chain of Europe affected global markets. In 2022, Natural gas demand touched record high prices and a decline of 1% and 13% in global and European markets, respectively and also resulted in first-ever decline in EMDE. The dominant natural gas producing countries proclaimed their self-reliance with an improved output. This crisis outlined the necessity and security of supply chain of gas-dependent countries and to increase additional investment.

1.2.4 Nuclear

Nuclear power contributes around 10% of global electricity generation and is also a crucial low-emission energy source. Net-zero target is practically impossible to achieve without nuclear power. Globally, consistent steps are being taken to maintain nuclear power steady with Net Zero Emissions by 2050. Globally, existing nuclear power plants are expected to extend for lifetime, as this is a reliable and economical source of low-emission. In order to achieve this, sustainable policy changes are adopted/amended accordingly. It is the key source of low-emission options to achieve a net zero scenario.

1.2.5 Solar PV

Solar PV electricity generation achieved another significant increase in 2022, advancing towards the milestones set for 2030 under the NZE Scenario. Solar energy, derived from the most abundant energy source on Earth, fuels plant growth, provides energy for food production, and powers atmospheric phenomena like wind and weather patterns. In recent years, the cost competitiveness of

electricity generated from solar cells has improved across many regions, leading to large-scale deployment of photovoltaic systems to bolster electricity grid capacities. As illustrated in Figure 1.3, global solar capacity has grown exponentially, expanding more than tenfold compared to installed capacities in 2011.

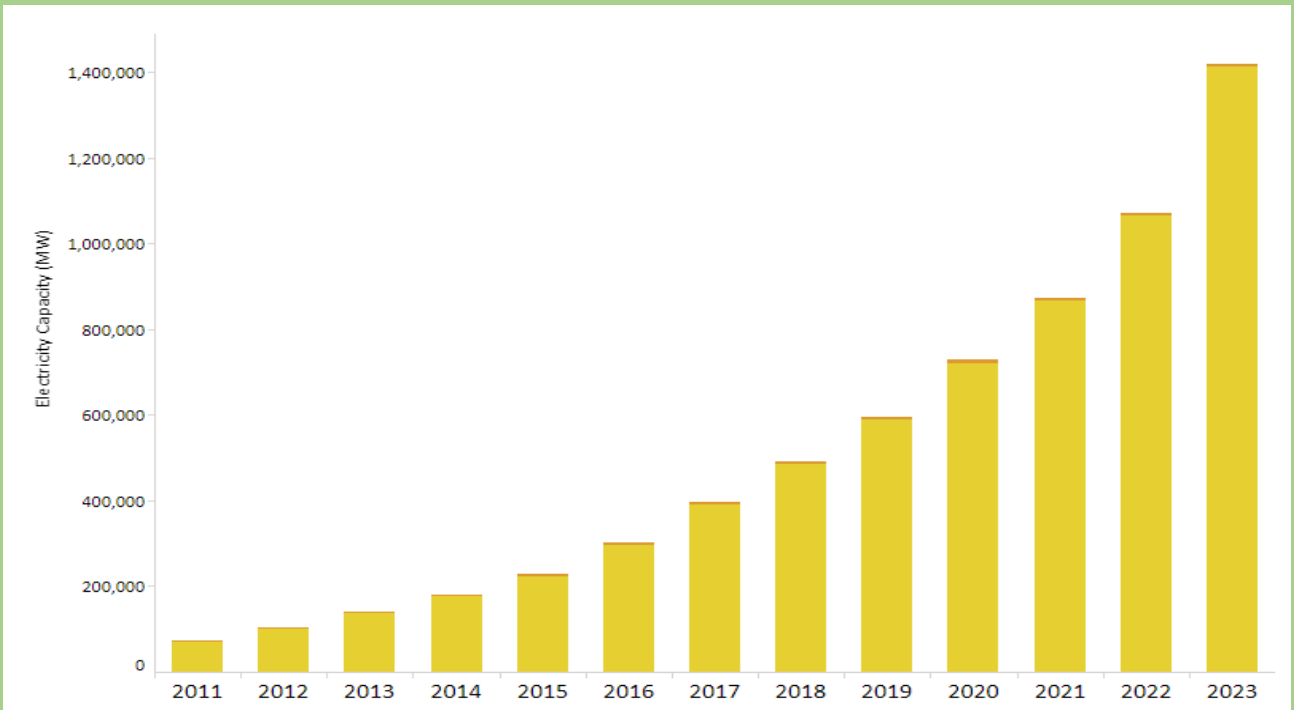


Figure 1.3 Installed Capacity of Solar PV (Source: IRENA)

1.2.6 Wind

Wind energy remains at the forefront among non-hydro renewable technologies, experiencing significant growth in electricity generation throughout 2022. This renewable source harnesses the kinetic energy of moving air to generate electricity. Since the early 2000s, wind power has expanded rapidly due to advancements in R&D, aligning government policies, and lowering costs. From 1998 to 2018, globally, the installed capacity for wind energy onshore and offshore has been raised drastically, increasing around 100 times from 7.5 GW to 733 GW. Between 2010 and 2020, onshore wind capacity and offshore wind capacity rose to 699GW from 178 GW and 34.4 GW from 3.1 GW, respectively. From 2009 to 2019, wind power production rose over a factor of 5.2, achieving 1412 TWh. The global installed wind capacity is shown in *Figure 1.4*

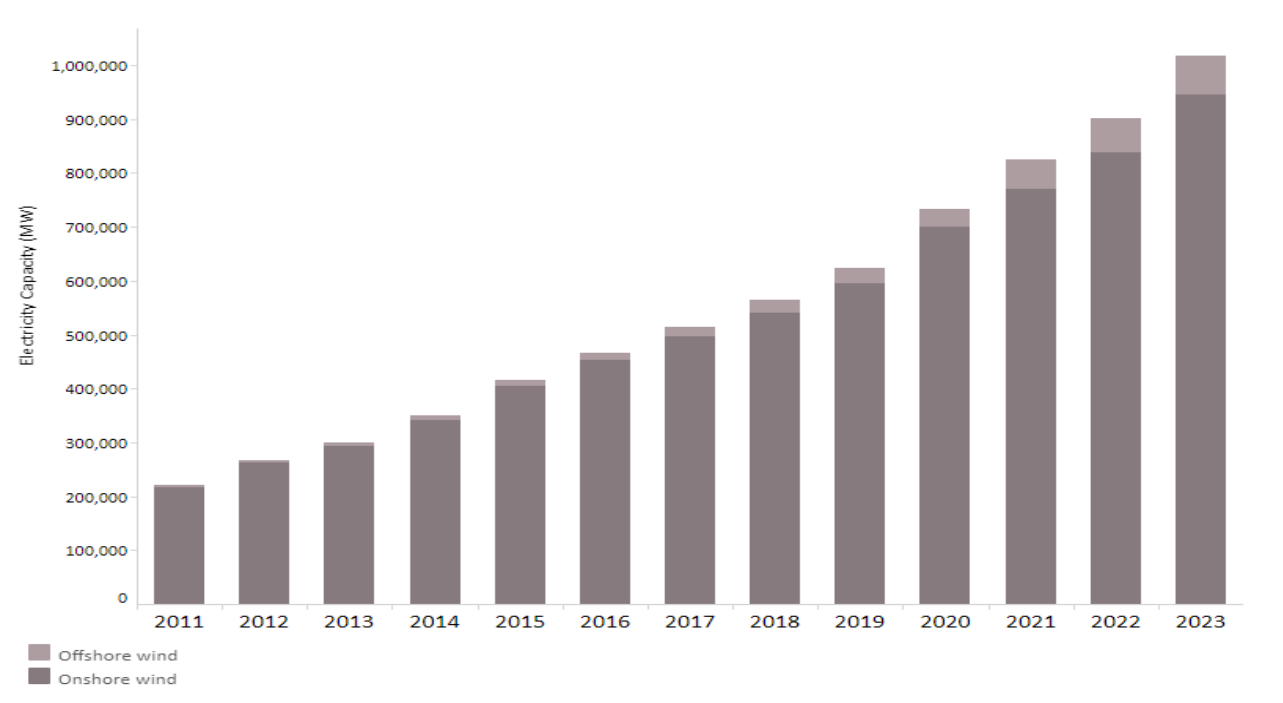


Figure 1.4 Installed Capacity of Wind Power (Source: IRENA)

1.2.7 Renewable Hydropower

Hydropower is the leading renewable energy technology for electricity generation and is anticipated to maintain this position well into the 2030s. Hydropower facilities, particularly those with mega reservoirs, store water for short or extended periods, thereby meeting peak demand accordingly. In remote areas, small-scale micro-hydropower projects can significantly improve access to electricity and benefit local communities. Norway, for example, relies on hydropower for more than 90% of its electricity supply. The global installed capacity of renewable hydropower is shown in *Figure 1.5*

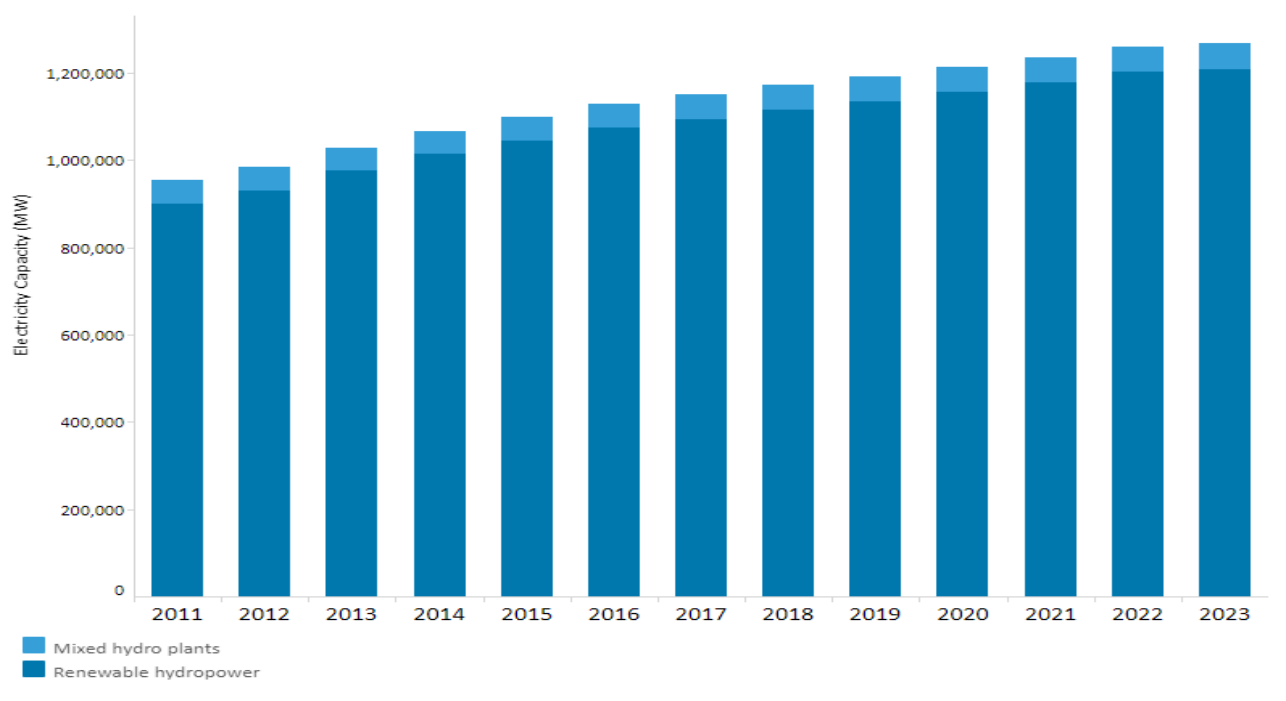


Figure 1.5 Installed Capacity of Renewable Hydropower (Source: IRENA)

1.3 Reserves and Potential of Energy Resources in India

Globally, India has the largest coal reserves, with a total estimated reserves of 378.21 billion tonnes as of 01-04-2023, as shown in *Figure 1.6*. The primary coal reserves in India are concentrated predominantly in three states: Odisha, Jharkhand, and Chhattisgarh, collectively holding about 69% of the nation's total coal reserves. Among these reserves, approximately 52% are classified as measured reserves, indicating their economic viability and feasibility for extraction based on detailed geological exploration and feasibility studies.

India's energy policy objectives determined to raise renewable energy share in the energy mix, aligning with climate, environmental, and macroeconomic priorities. This strategic shift intends to reduce reliance on fossil fuels, enhance energy security, and mitigate CO2 and other greenhouse gas emissions.

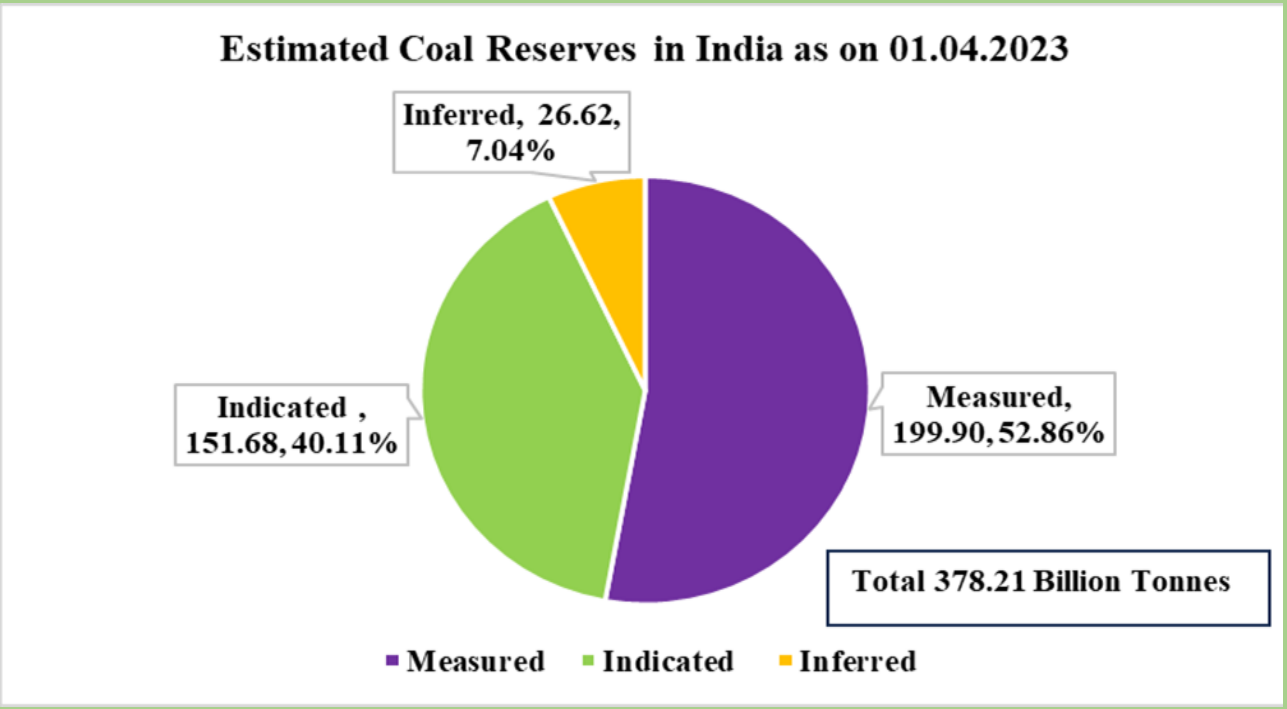


Figure 1.6 Estimated Coal Reserves in India -01.04.2023 (Source: GSI)

Lignite

As of April 1, 2022, India's total estimated lignite reserves stood at 46.20 billion tonnes, reflecting a slight increase of 0.18 billion tonnes compared to the previous year, as indicated in Figure 1.7. This marks a rise of 0.39% during the FY 2021-22 over 2020-21. The majority of these reserves are in Tamil Nadu. Out of total reserves, measured reserves, indicated reserves and inferred reserves contribute around 16%, 56%, and 28%, respectively.

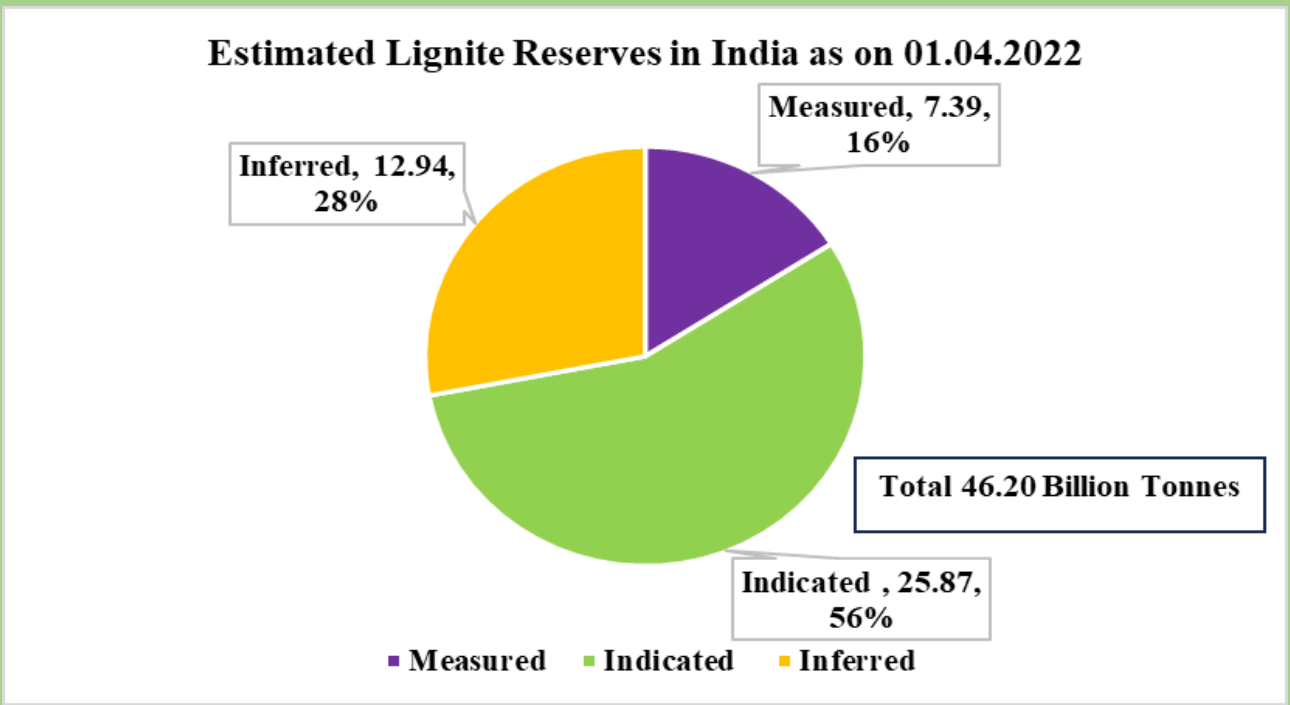


Figure 1.7 Estimated Lignite Reserves in India as of 01.04.2022 (Source: GSI)

Crude Oil

As of April 1, 2023, India's total estimated reserves of crude oil amounted to 653.02 million tonnes, marking a growth of 10% from 591.92 million tonnes in the corresponding period, as illustrated in Figure 1.8. The largest concentration of crude oil deposits is found in the western offshore sector, comprising 33% of the total reserves, followed by the Assam sector, which accounts for 23%.

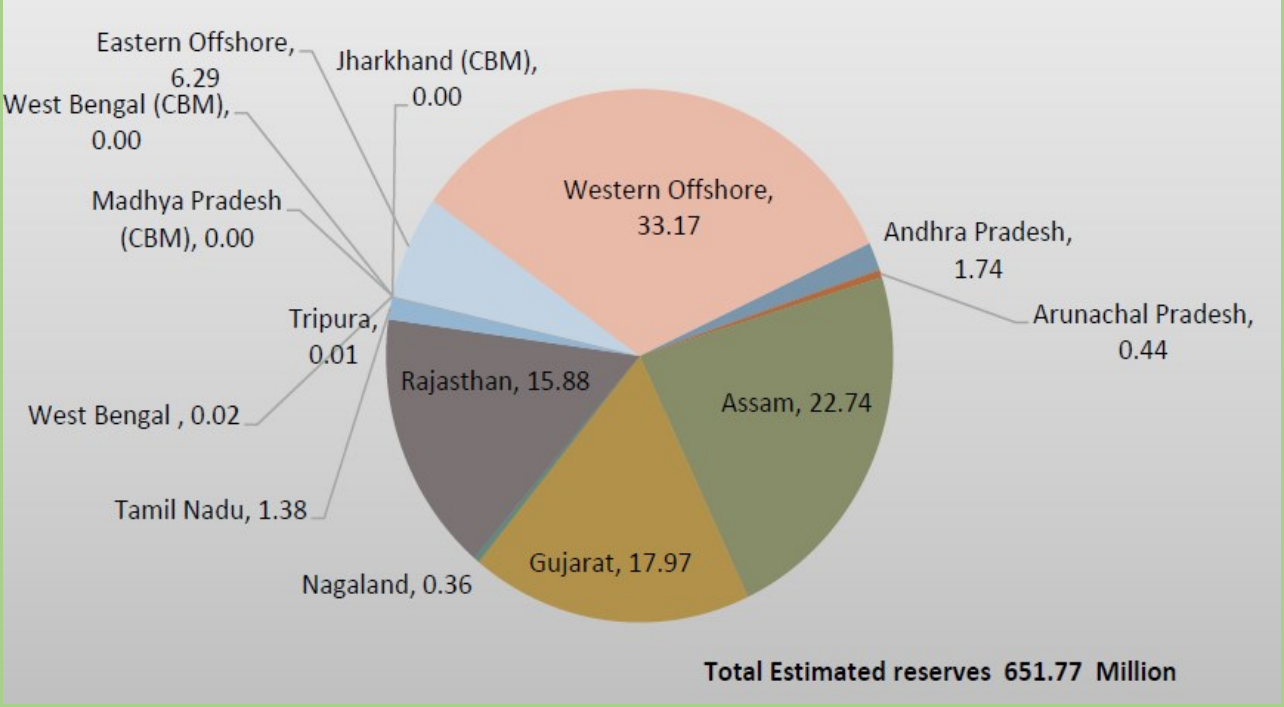


Figure 1.8 Estimated Crude Oil Reserves in India as of 01.04.2023 (Source: MOSPI)

Natural Gas

As of April 1, 2023, India's estimated reserves of natural gas stood at 1149.46 billion cubic meters. The largest reserves are located in the Western Offshore region, comprising 29.34% of the total reserves, followed by the Eastern Offshore region with 23.45%, as depicted in Figure 1.9.

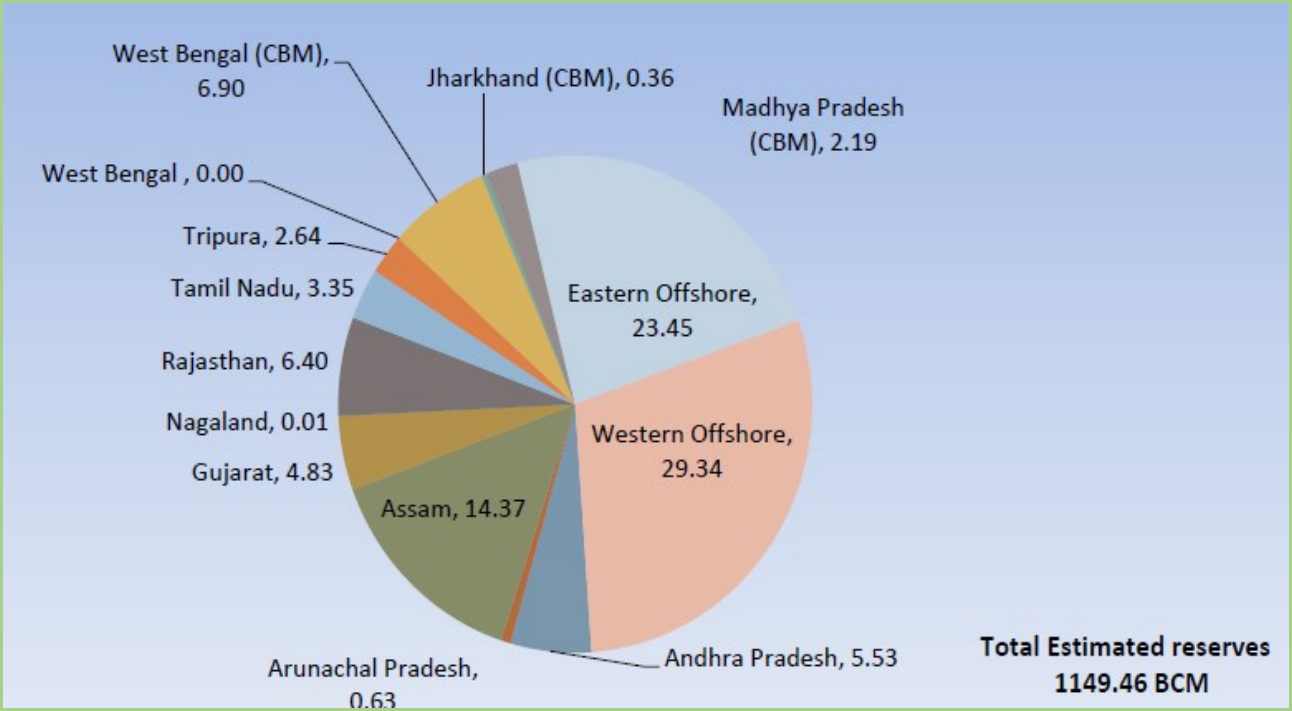


Figure 1.9 Estimated Natural Gas Reserves in India as of 01.04.2022 (Source: MOSPI)

Renewable Energy

Even though India is highly dependent on coal for energy security, consistent measures are adopted to increase the capacity and generation of renewable energy. As of March 31st , 2023, the estimated potential for renewable power generation in India is illustrated in *Figure 1.10*. The total potential stands at 2,109,654 MW, comprising various sources: solar power with a potential of 748,990 MW (35.50%), wind power at 150m hub height with a potential of 1,163,856 MW (55.17%), large hydropower potential of 133,410 MW (6.32%), small-hydro power (SHP) potential of 21,134 MW (1%), biomass power potential of 28,447 MW (1.35%), and 13,818 MW (0.66%) from bagasse-based cogeneration in sugar mills.

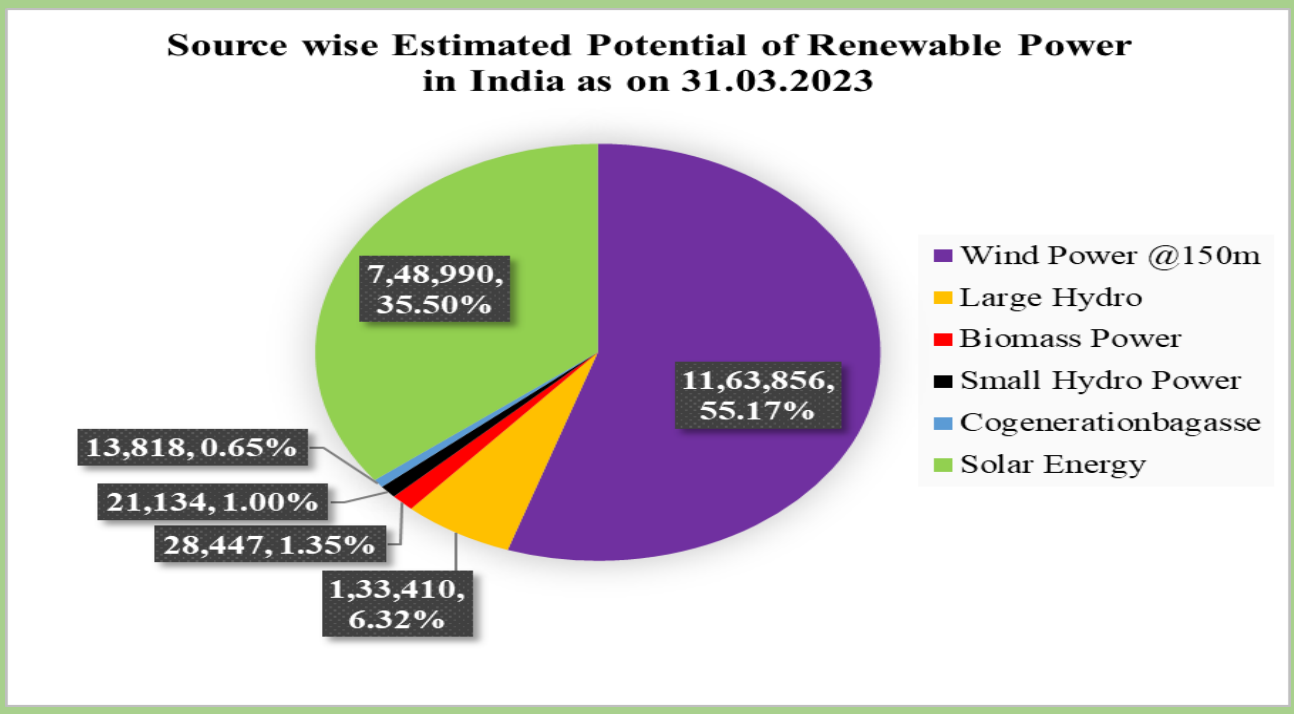


Figure 1.10 Estimated Potential Renewable Power in India as of 01.04.2022 (Source: MOSPI)

1.4 Yearwise Production of Energy Resources in Energy Units (in Percentage)

In India, Coal is the most dominant source of energy, contributing around 77% of total energy generation. Subsequently, other energy sources, lignite, crude oil, natural gas and renewable contribute around 2.19%, 6.39%, 6.82% and 7.58%, respectively, in FY 2022-23. The year-wise production of energy resources in the last four years is shown in *Figure 1.11*

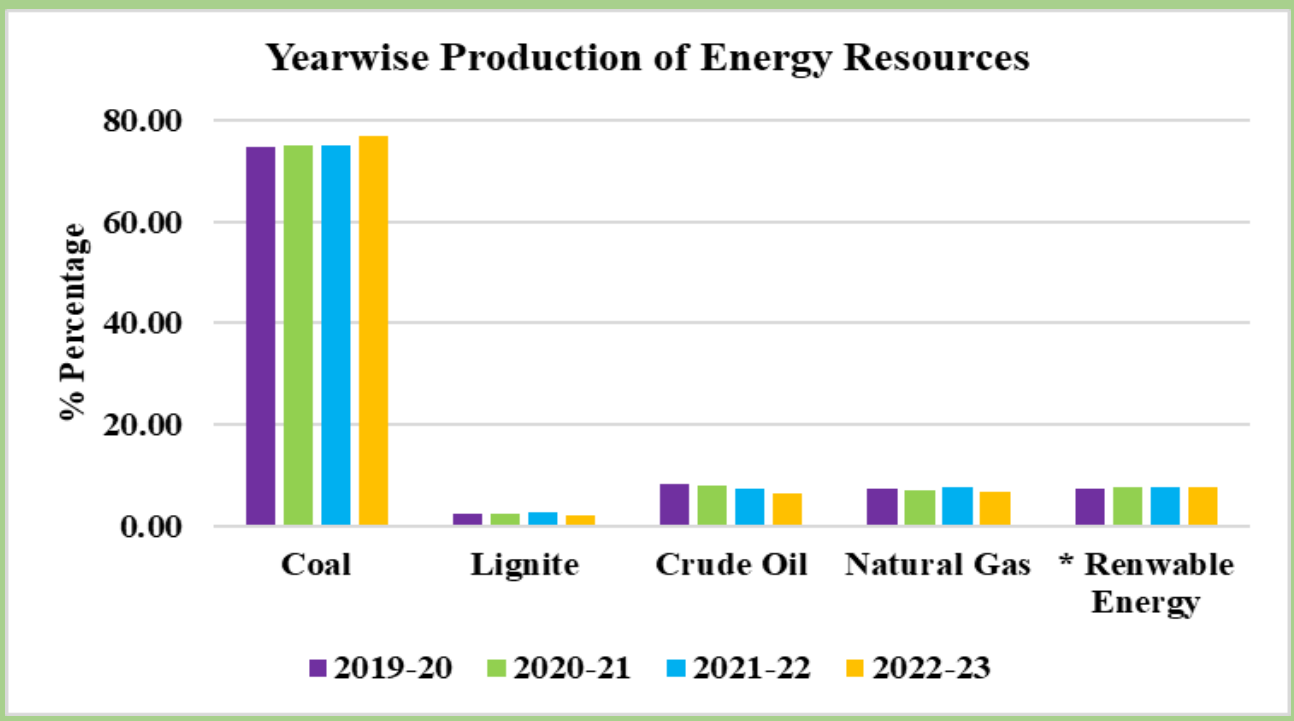


Figure 1.11 Yearwise Production of Energy Resources in Energy Units (in Percentage) (Source: MOSPI)

1.5 Yearwise Consumption of Energy Resources in Energy Units (in Percentage)

In India, primary energy consumption has expanded by approximately 700% over last four decades. Currently, India's per capita commercial primary energy consumption stands at around 350 kgoe/year, notably less than that of developed nations. Fueled by a growing population, expanding economy, and aspirations for an enhanced standard of living, energy demand is anticipated to escalate significantly.

Considering constraints on petroleum and natural gas reserves, environmental considerations limiting hydropower projects, and geopolitical factors affecting nuclear power, coal is expected to maintain its dominance in India's energy landscape. As of 2023, the breakdown of primary energy consumption in India is as follows: Coal (57.62%), Lignite (1.27%), Crude Oil (31.06%), Natural Gas (6.61%), and Renewables (3.44%). The consumption of energy resources in the last four years is shown in *Figure 1.12*.

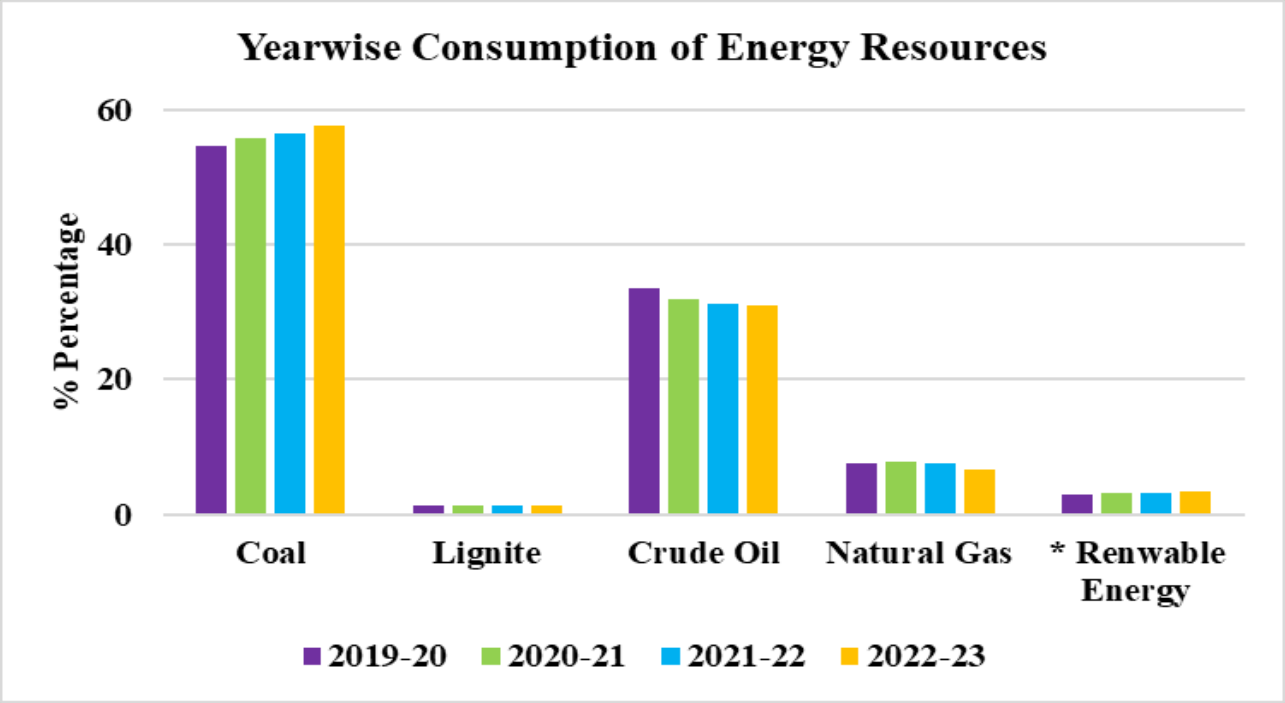


Figure 1.12 Yearwise Production of Energy Resources in Energy Units (in Percentage) (Source: MOSPI)

1.6 Effect of Anthropogenic Greenhouse Gases on Global Climate

Emissions in the energy sector stem from two primary sources: fuel combustion and fugitive emissions. Fuel combustion encompasses emissions from electricity generation, transportation, industrial processes, agriculture, commercial activities, and residential sectors. Fugitive emissions, on the other hand, arise during fuel production. The increase in emissions from the energy sector is primarily driven by heightened fuel combustion across these diverse sectors.

Considering the impact of greenhouse gases (GHGs) on global warming, international efforts have been mobilized to curb emissions. Globally, GHG emissions from industrial sectors and human activities have been rising by an average of nearly 1.5% annually since 1990, resulting in a 62% increase by 2022 compared to 1990 levels.

Specifically in India, GHG emissions have surged by approximately 174% compared to 1990 levels, underscoring the country's significant contribution to global emissions growth over the past decades. The GHG emissions in the Global and Indian scenarios in absolute terms of CO2eq and in percentage are shown in *Figure 1.13* and *Figure 1.14*. The sectoral growth in GHG Emissions in the Global and Indian scenarios is shown in *Figure 1.15*.

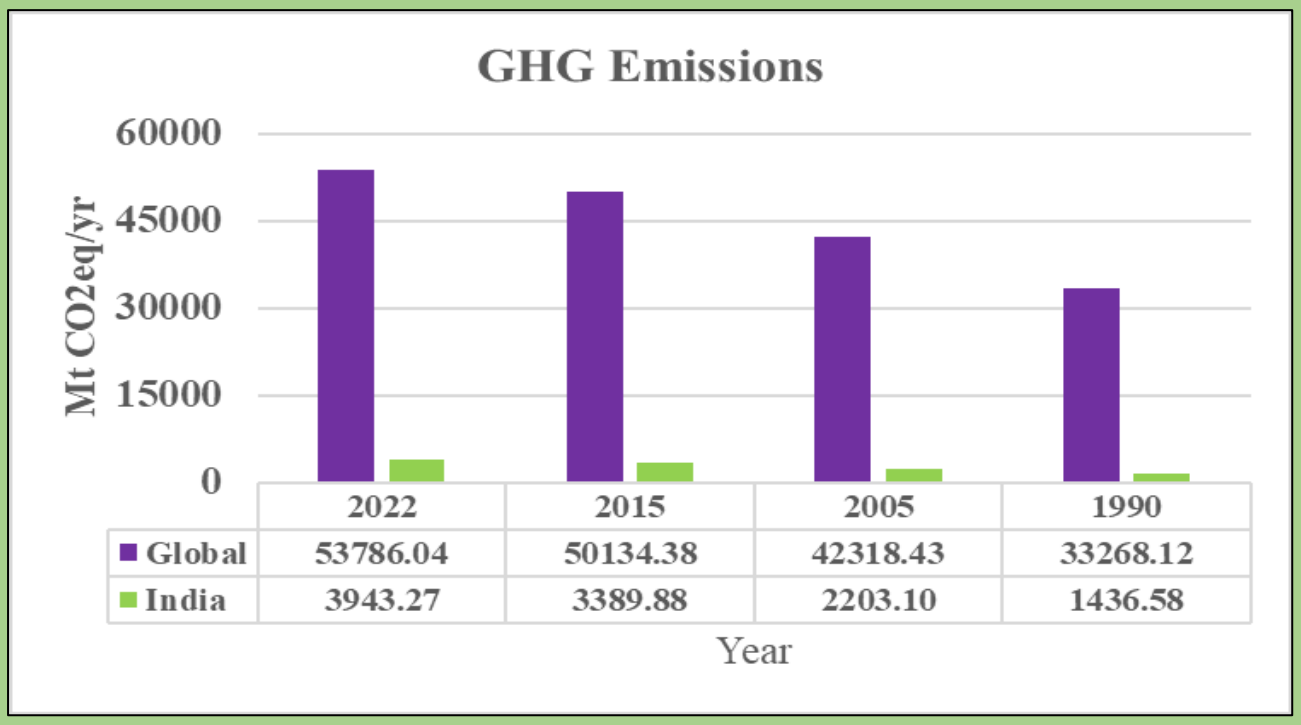


Figure 1.13 GHG Emissions 1990 -2022 (Source: EC JRC 2023)

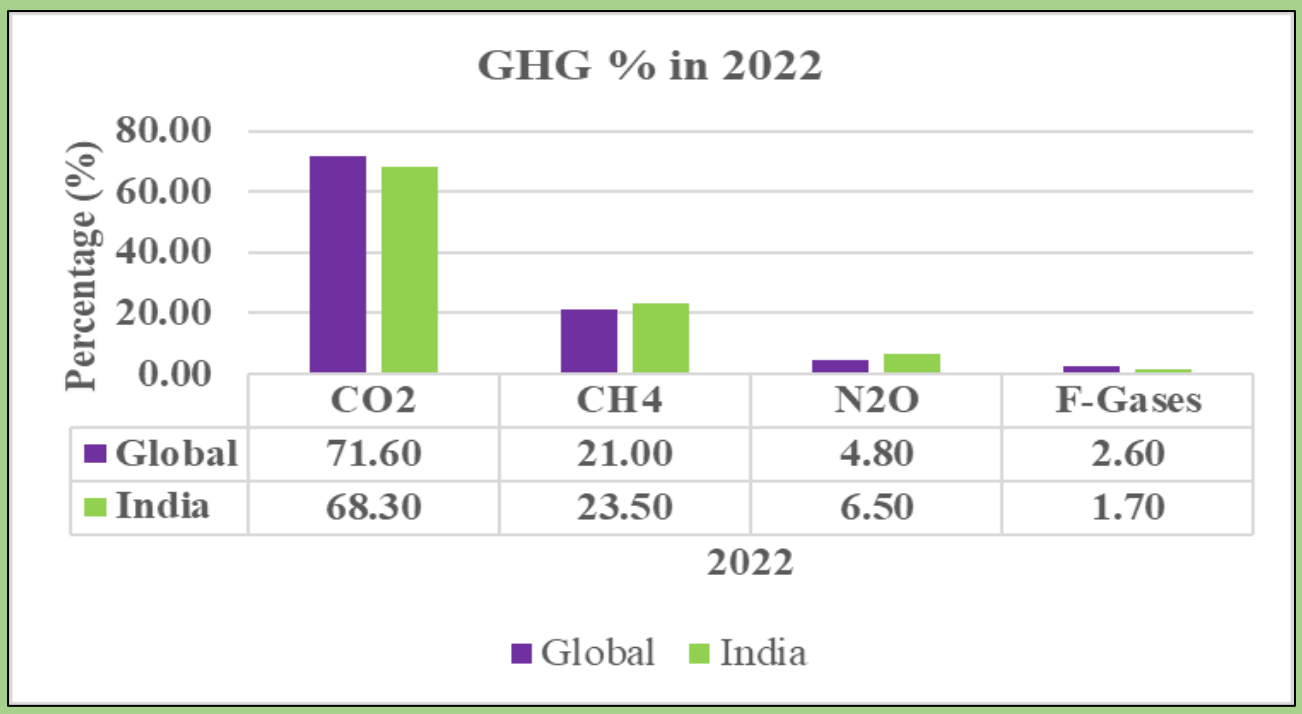


Figure 1.14 GHG Emissions 2022 (Source: EC JRC 2023)

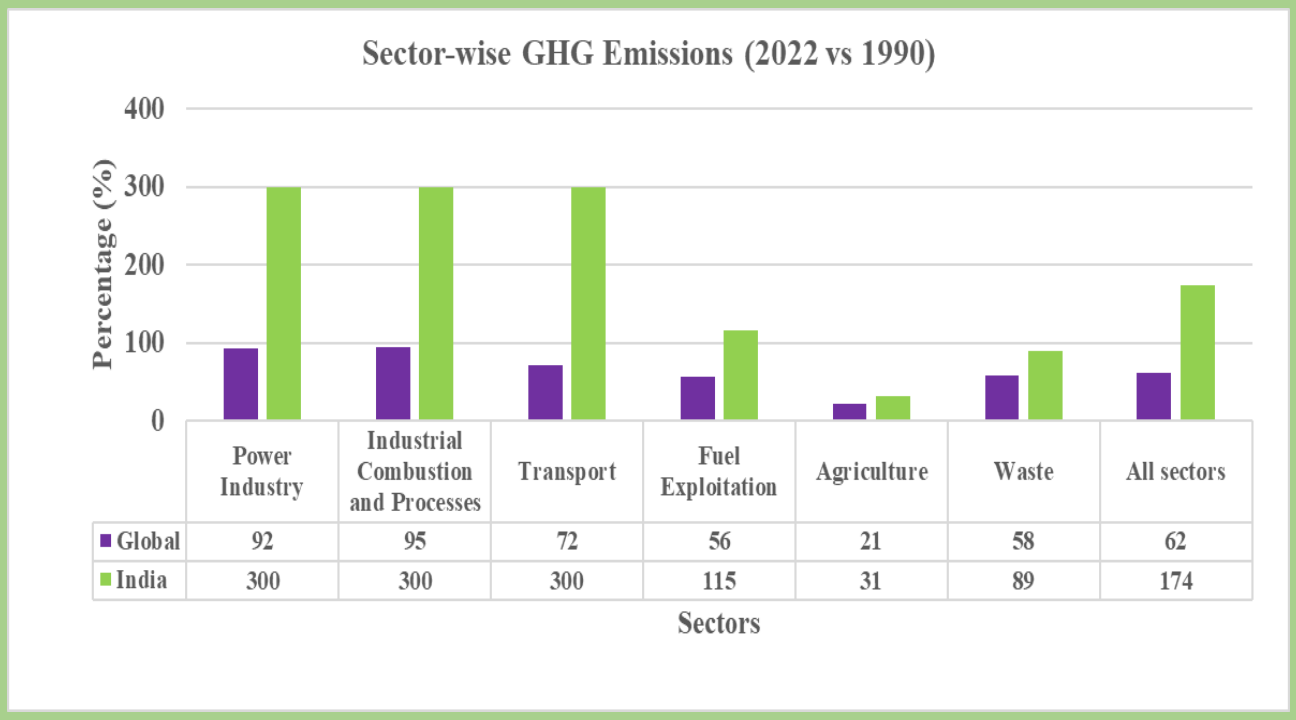


Figure 1.15 Sector-wise GHG Emissions (2022 vs. 1990) (Source: EC JRC 2023)

2 Role of Coal in the Indian Energy Scenario

2.1 Introduction

Despite the global push towards clean energy and a just transition, shifting entirely away from coal remains impractical, particularly in countries like India, where coal is the dominant source of primary energy and electricity generation. Coal continues to be a crucial and affordable energy source worldwide to sustain universal energy access goals. It remains the only viable option for critical industries and is essential for constructing renewable energy infrastructure.

Globally, coal accounts for nearly 40% of total power generation, providing reliable baseload electricity, which is essential for modern life and supported by the UN Sustainable Development Goals. Despite efforts, more than 3.5 billion people still lack reliable electricity access, with around 93% of new access between 1990 and 2010 facilitated by coal.

Emerging economies, driven by their growing energy demands, rely on coal for its reliability and affordability. Unlike variable renewable energy sources like wind and solar, which are intermittent due to natural variability, coal offers continuous baseload power that can be dispatched on demand. This reliability makes coal indispensable as economies expand and require abundant energy to power opportunities and alleviate poverty.

Moreover, coal plays a critical role in industrial processes, particularly in metallurgical coal used to produce coke for steelmaking. Around 70% of the world's steel production relies on coal, which is also crucial for manufacturing essential infrastructure and goods such as healthcare equipment, telecommunications networks, and transportation systems. Steel is vital for the renewable energy sector, supporting the development of wind turbines and other renewable technologies.

Coal's demand in industrial applications such as cement, aluminum, and lime production is expected to rise further, supporting the growth of global infrastructure necessary for transportation and modern living.

The transition to cleaner energy sources is essential. Still, coal remains indispensable for meeting current and future energy demands, supporting economic growth, and ensuring reliable access to essential services and infrastructure worldwide.

2.2 Coal Reserves

The country-wise coal reserves and coal production are shown in *Figure 2.1* and *Figure 2.2,* respectively. The reserves-to-production (R/P) ratio is the time taken for the complete extraction of proven/measured coal reserves of any year at the production rate of the corresponding year. It is evaluated by dividing the remaining reserves at the year's end by the production in same year. The country-wise R/P ratios are shown in *Figure 2.3*.

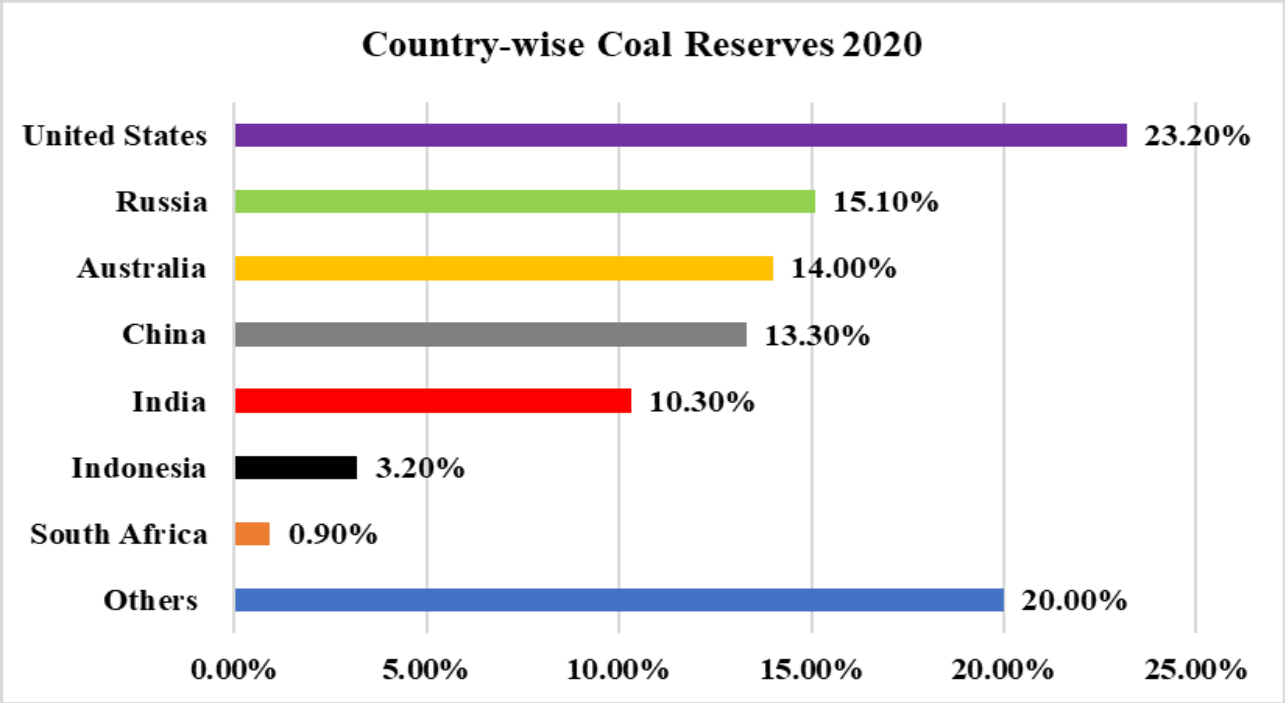


Figure 2.1 Country-wise Coal Reserves 2020 (Source: BP 2021)

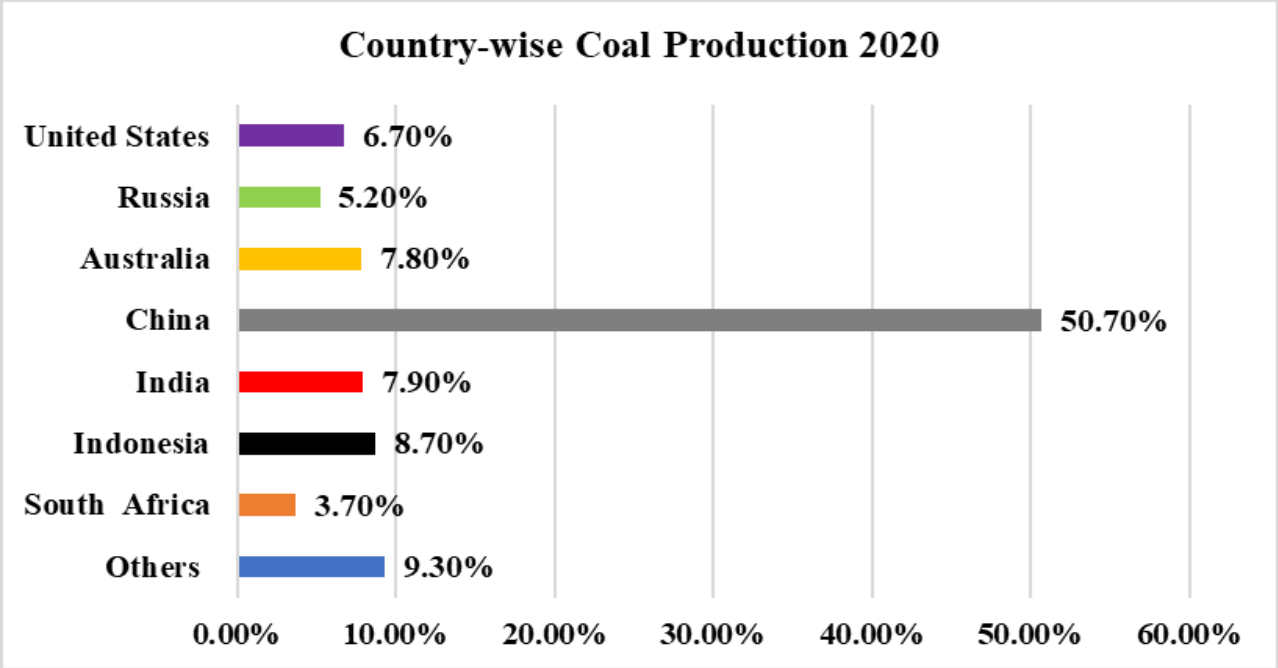


Figure 2.2 Country-wise Coal Production 2020 (Source: BP 2021)

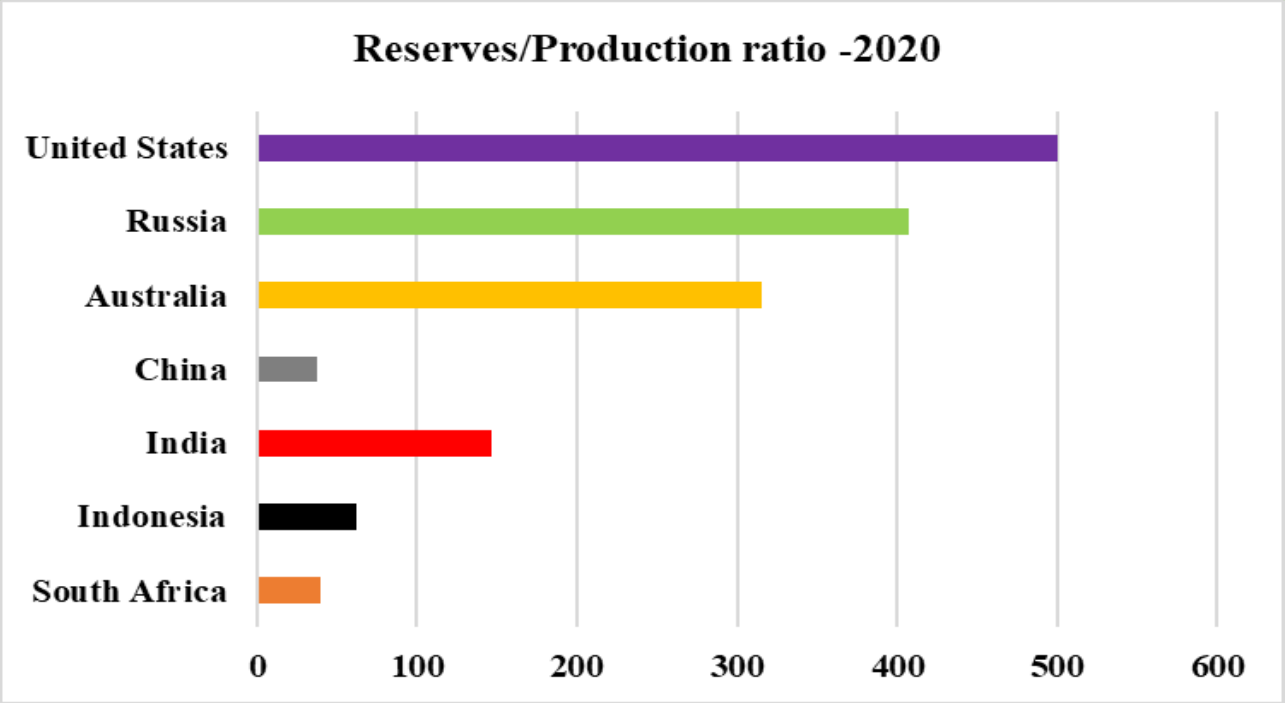


Figure 2.3 Country-wise Reserves/Production Ratio 2020 (Source: BP 2021)

In India, a total of 378.21 BT of coal reserves has been estimated to be up to depth 1200 m. The total estimated coal reserves, state-wise estimated coal reserves, depth-wise coal reserves, and depth-wise category of coal reserves are shown in *Figure 2.4*, *Figure 2.5, Figure 2.6* and *Figure 2.7,* respectively. Out of the total resources, the Gondwana coalfields account for 376.51 BT (99.56%), while the Tertiary coalfields contribute 1.65 BT (0.43%). The Measures, Indicated and Inferred resources are 199.90 BT, 151.68 BT and 26.62 BT, respectively. The increase in 'Measured/Proved Resources' in Inventory of April 1 2023 is mainly due to proving of coal resources in Talcher (3101.26.27 Mt), Mand Raigarh (2113.16 Mt), Korba (1714.21 Mt), Jharia (1082.41 Mt), Sohagpur (1067.40 Mt), North Karanpur (845.30), Tatapani Ramkola (770.33 Mt), Sonhat (585.32 Mt), South Karanpura (430.70 Mt), Ib (372.35 Mt), Raniganj (225.46 Mt), Singrauli (160.21 Mt), East Bokaro (145.75 Mt), Godavari (103.69 Mt), Wardha Valley (81.12 Mt), coalfields.

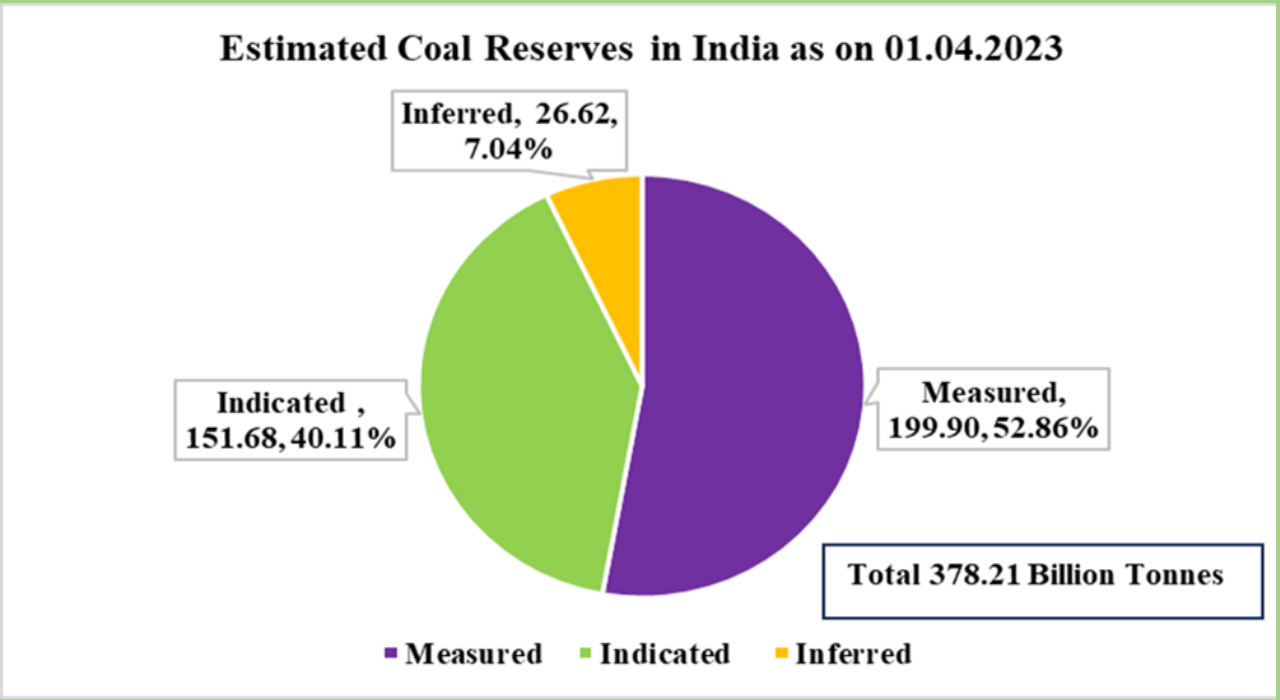


Figure 2.4 Category-wise Coal Resources in India (Source: GSI)

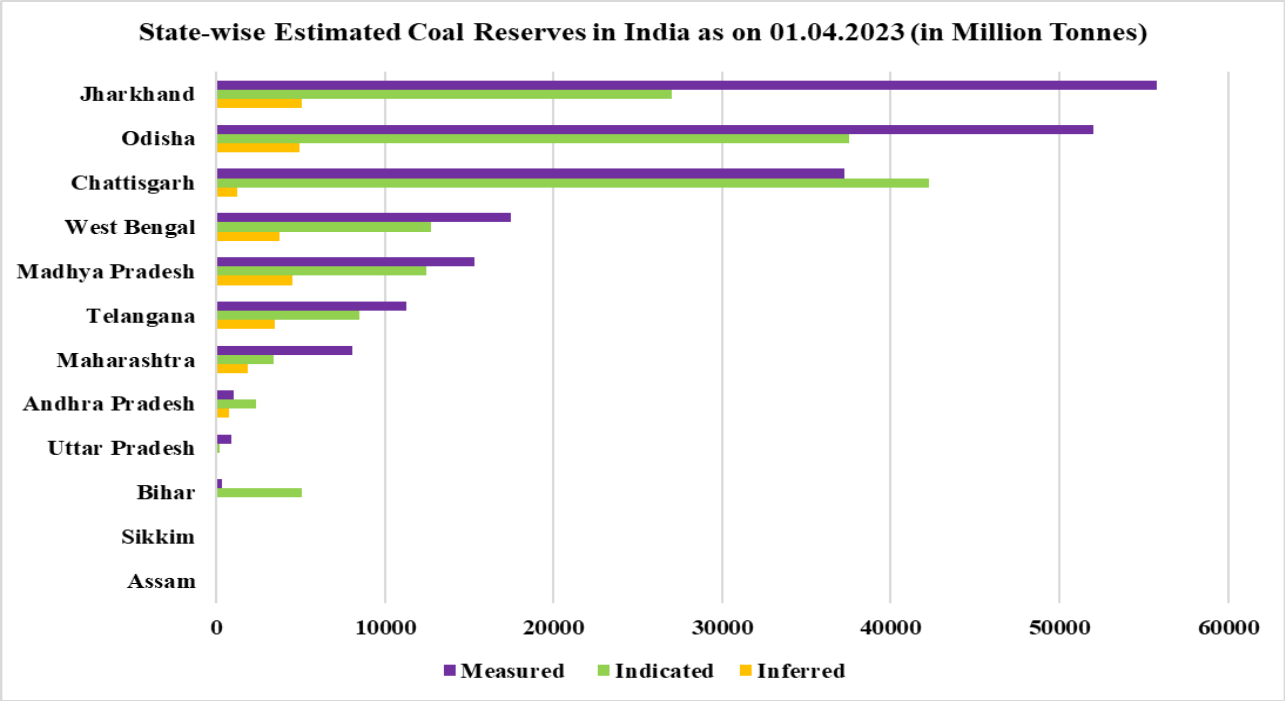


Figure 2.5 State-wise Estimated Coal Reserves in India (Source: GSI)

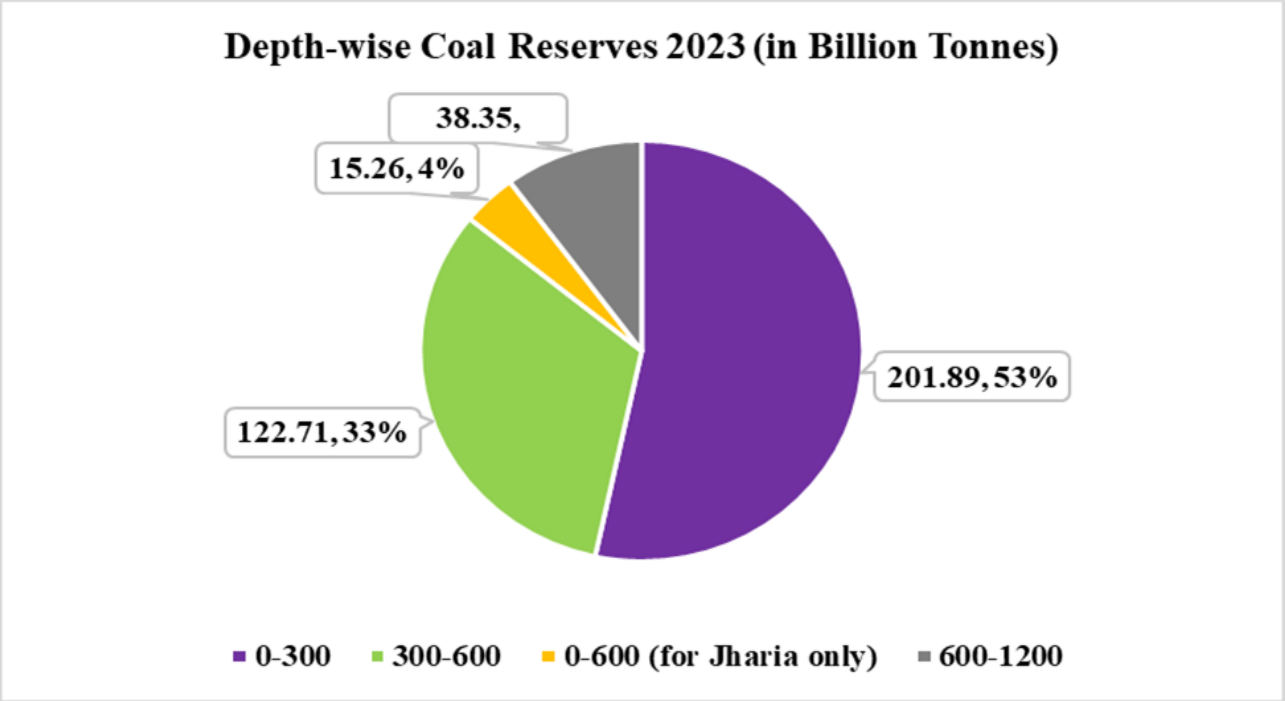
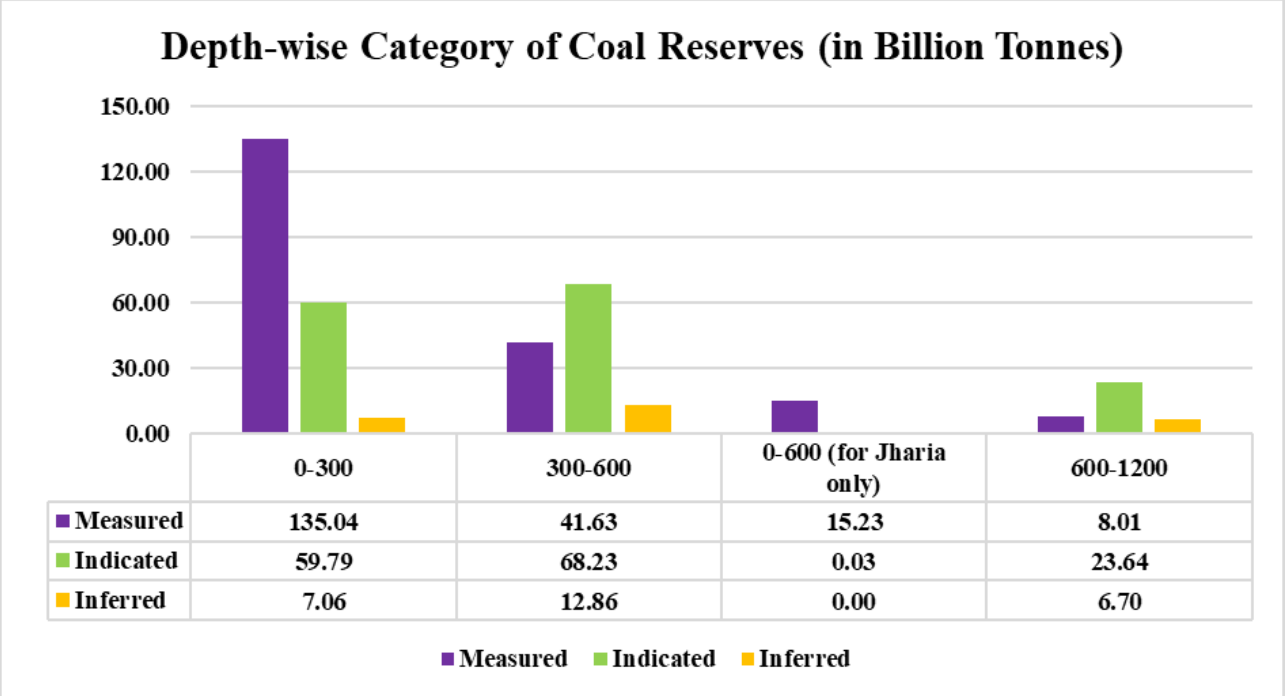


Figure 2.6 Depth-wise Estimated Coal Reserves in India. (Source: GSI)



	0-300	300-600	0-600 (for Jharia only)	600-1200
Measured	135.04	41.63	15.23	8.01
Indicated	59.79	68.23	0.03	23.64
Inferred	7.06	12.86	0.00	6.70

Figure 2.7 Depth-wise Category of Estimated Coal Reserves in India. (Source: GSI)

2.3 Coal Production

Ministry of Coal initiated notable measures to ensure the nation's energy security through adoption of Mass Production Technologies (MPT) in coal mines, such as continuous miners (CMs), high-wall miners, high-capacity excavators, dumpers, and surface miners. Digitization is being tried on a pilot scale in 7 mega mines. CIL has also offered 15 mines in MDO mode. Further, CIL has offered 30

discontinued/abandoned mines to reopen on a revenue-sharing basis. Through consistent efforts and the adoption of mechanized production technologies, it has been possible to raise the All-India coal production to 997 MT, just short of 1 BT in 2023-24, making it the highest ever, with a positive growth of 11.62%. The total coal production and monthly coal production in India in the last four years are shown in *Figure 2.8* and *Figure 2.9.*

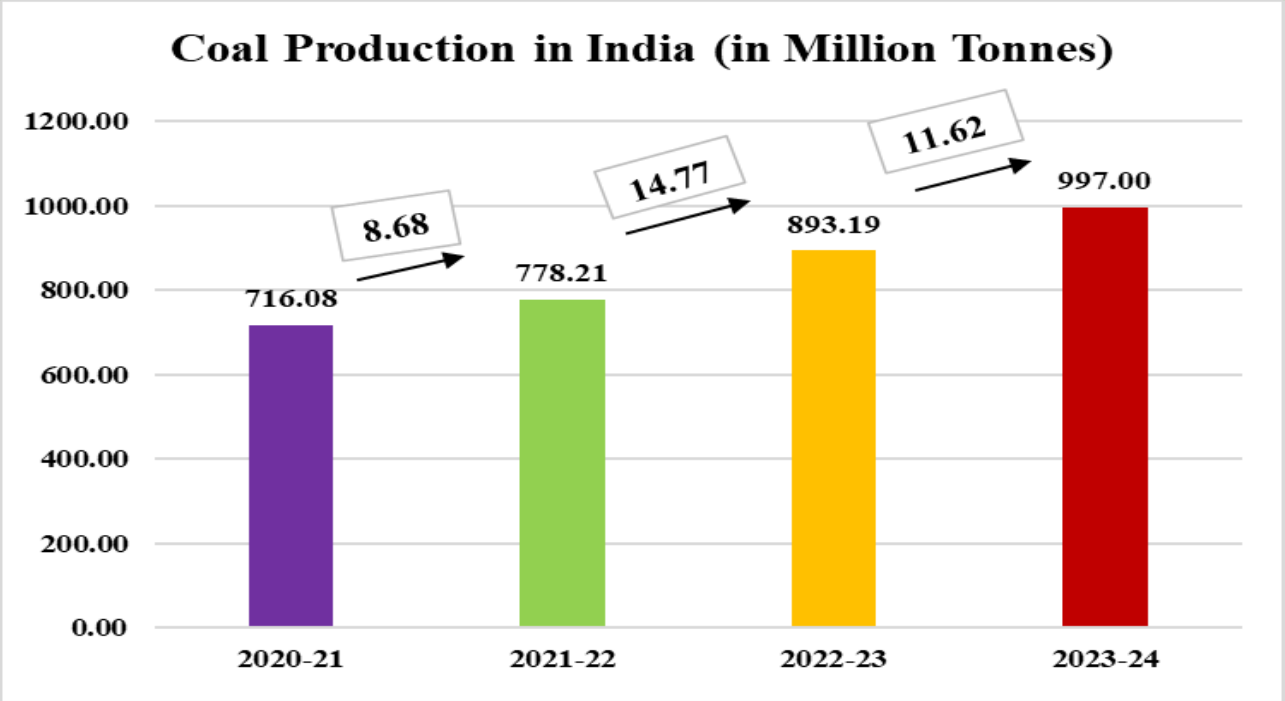


Figure 2.8 Coal Production in India

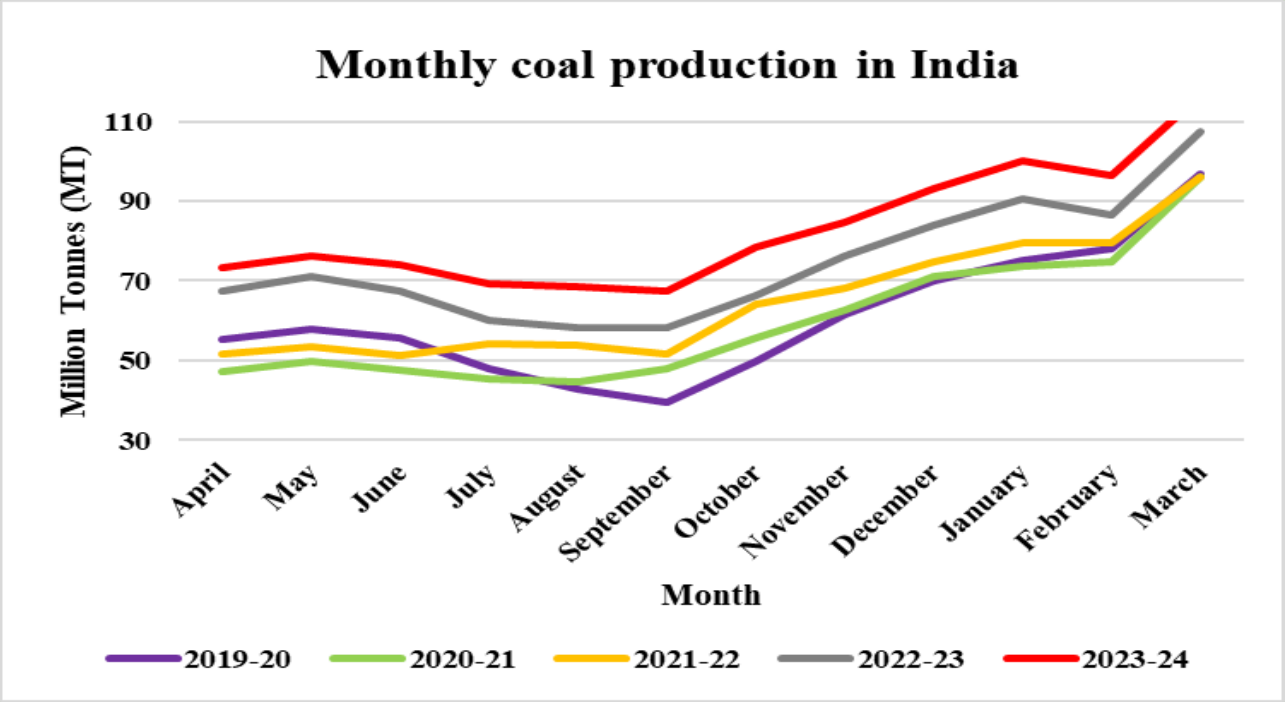


Figure 2.9 Monthly Coal Production in India.

2.4 Coal Consumption

Coal remains the predominant source of primary energy consumption and electricity generation in India, supporting its rapid industrial growth and aiming to become the third-largest economy. The demand for coal has surged over the past decade and is projected to continue rising to meet the nation's escalating energy needs.

Between 2020-21 and 2023-24, India's coal consumption has notably increased from approximately 904.70 million metric tons (MT) to about 1230.88 MT. This significant growth is attributed to economic expansion, population increase, and technological advancements driving higher energy consumption across various sectors.

According to the 20th Electric Power Survey Report, the projected electrical energy requirement and peak electricity demand for all of India are estimated at 2473.7 billion units (BU) and 366.4 gigawatts (GW), respectively, by the FY 2031-32. Meeting these demands will necessitate substantial coal consumption to ensure a reliable and robust energy supply across the country. The total coal consumption and monthly coal consumption in Inda in the last four years are shown in *Figure 2.10* and *Figure 2.11,* respectively.

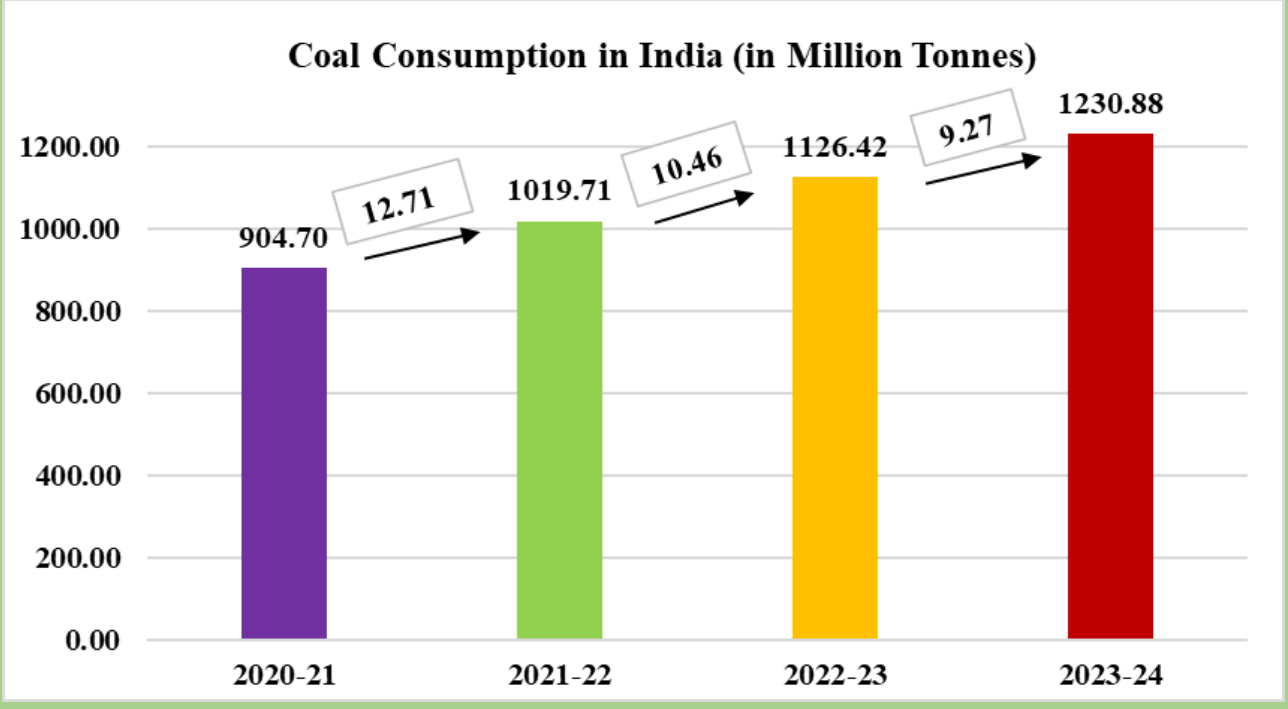


Figure 2.10 Coal Consumption in India

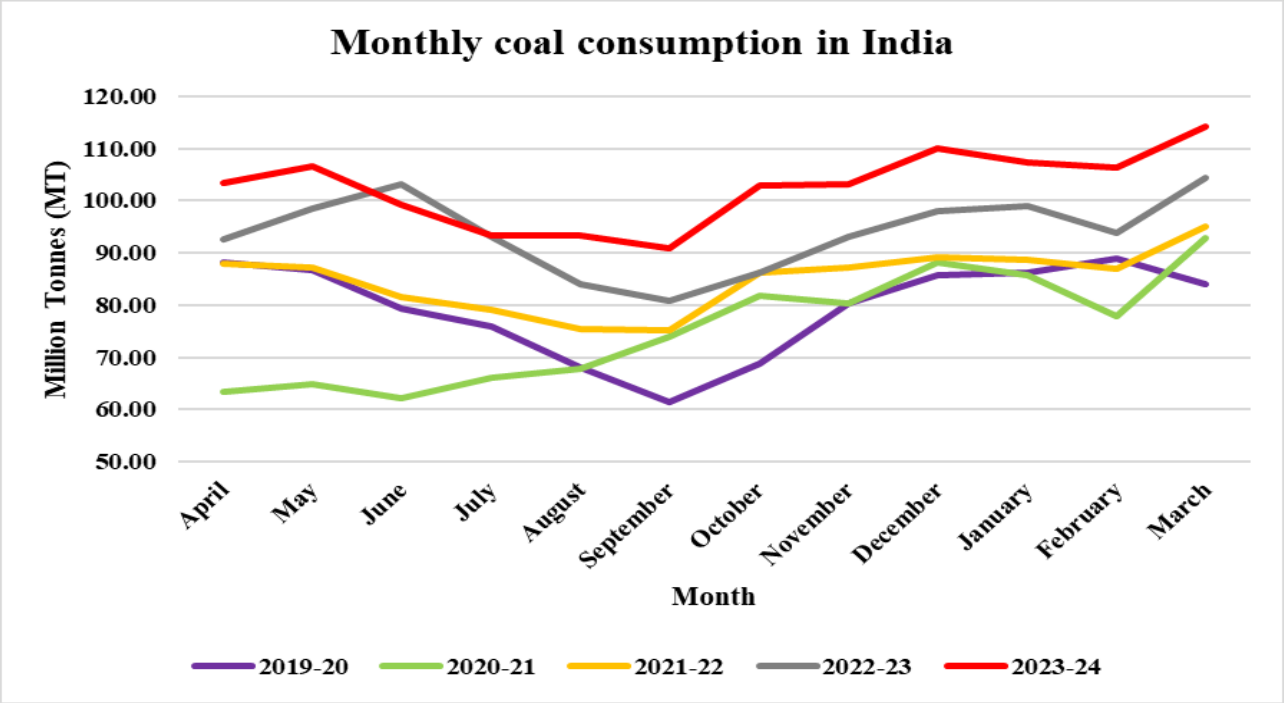


Figure 2.11 Monthly Coal Consumption in India.

2.5 Sector-wise coal consumption

Apart from electricity generation, coal is also a dominant source in various sectors. Iron and Steel industry is also highly dependent on coal to produce coke. It is also being utilized in manufacturing, cement, paper, textiles, fertilizers & chemicals, bricks, construction, transport, agriculture, commercial, public services, and households. It is also used as a raw material to produce chemical feedstock from coal tar. The term "consumption" is commonly understood to include all of the above end-uses. The sector-wise coal consumption in India is shown in *Figure 2.12*

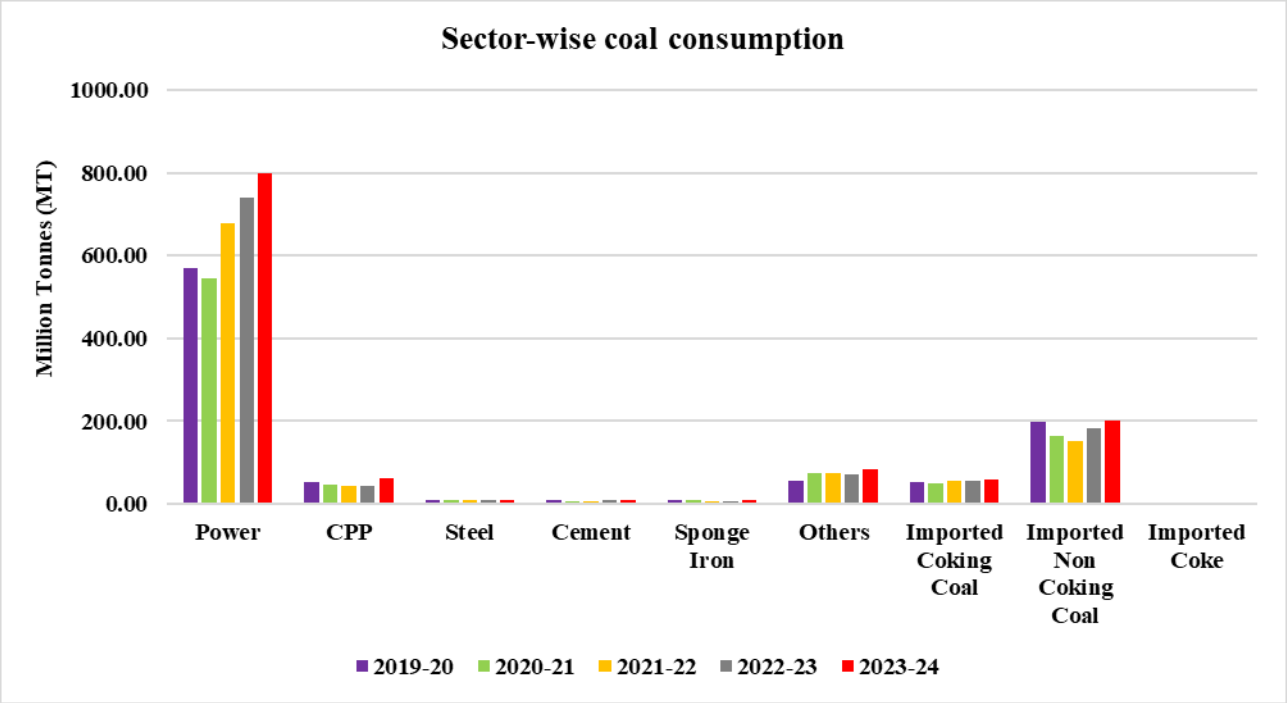


Figure 2.12 Sector-wise Coal Consumption in India.

2.6 Coal Imports

Despite the country's effort towards declining coal imports, it has been observed that there is an increase in total coal imports by 12.86% to 268.24 MT in FY 2023-24 over 237.67 MT in the corresponding FY 2022-23, as shown in *Figure 2.13*. This rise is mainly due to adjustments to Covid-19 and Russo-Ukrainian war. As India is making notable efforts towards self-sustainability in fossil fuels, the coal imports trend is expected to decline in the future unless there is a sudden spurt in demand and a significant softening in seaborne prices.

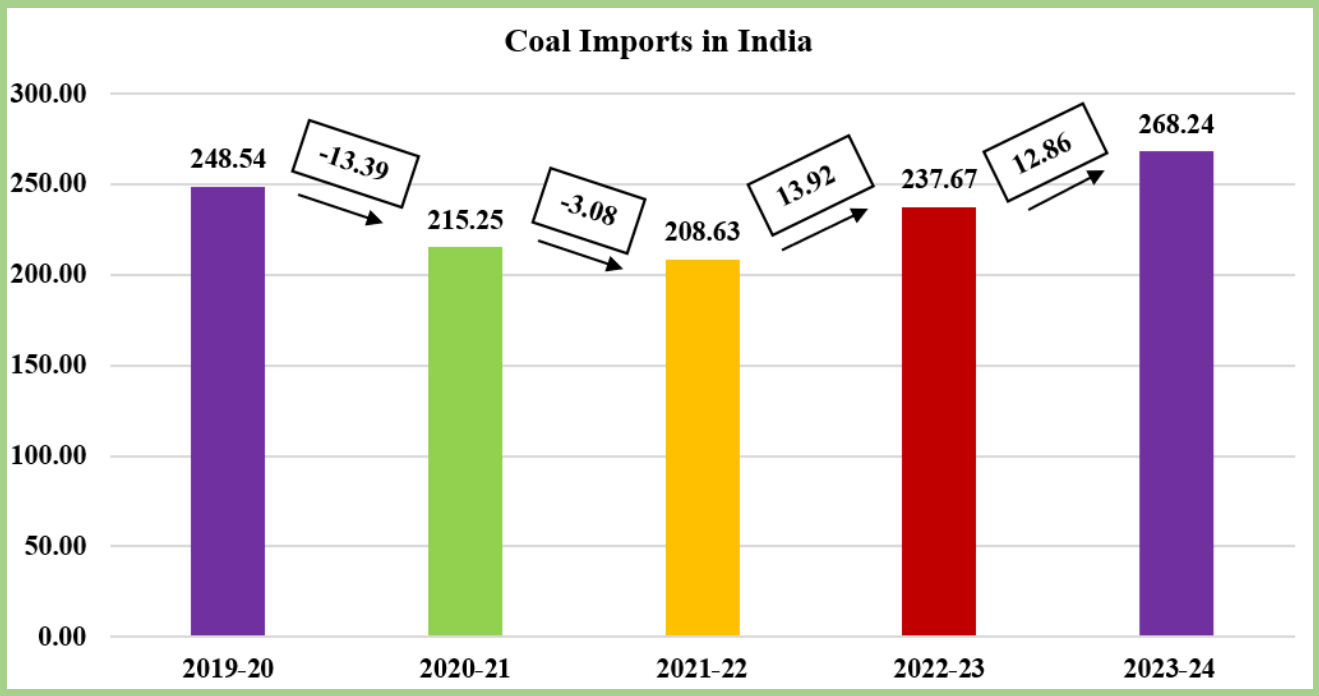


Figure 2.13 Coal Imports in India ((Source: ICMW)

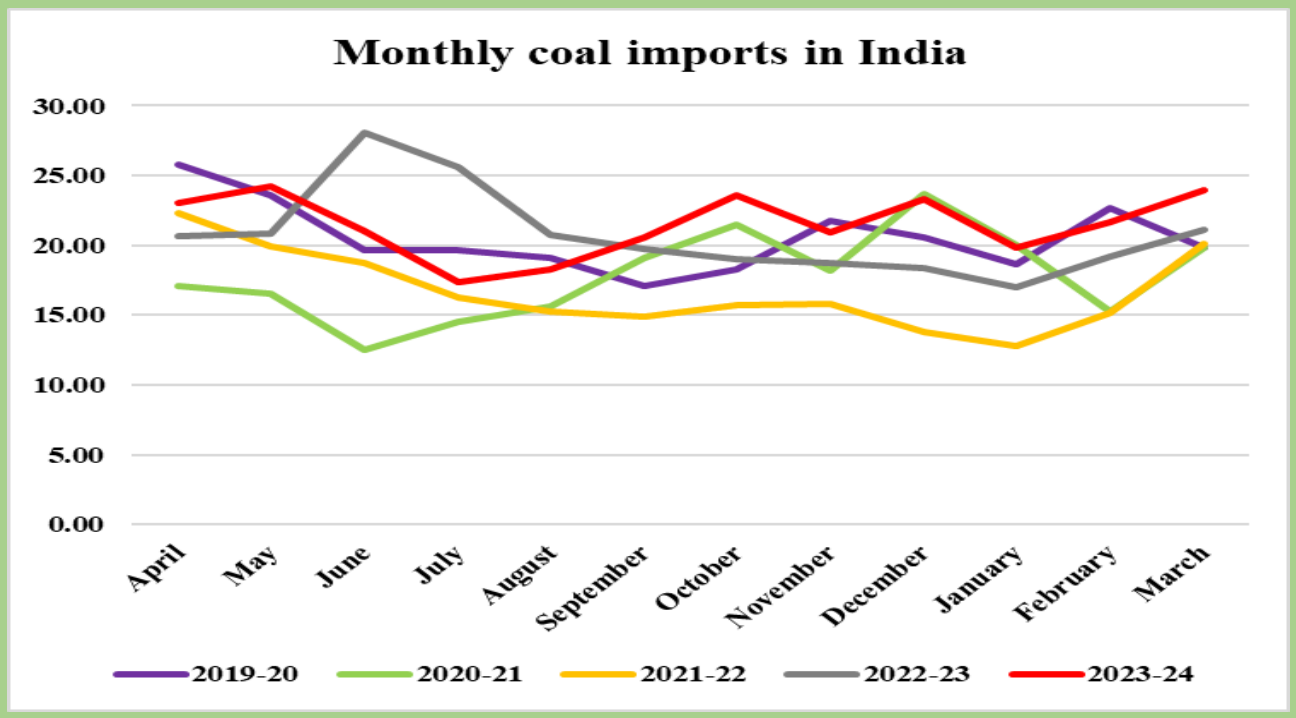


Figure 2.14 Monthly Coal Imports in India. (Source: ICMW)

2.7 Coal Mines Allocated/Auctioned

After the cancellation of 204 out of 218 coal blocks allocated since 1993 by the Hon'ble Supreme Court, the central government enacted the CMSP Act 2015 to meet energy demand of the nation. Under CMSP Act, 121 coal mines were successfully allotted/auctioned, promoting transparency, private sector participation with liberal eligibility conditions, increased production, ensuring energy

security, increased government revenue, employment generation, and environmental sustainability. Under MMDR Act 1957, 34 coal mines have been successfully allotted/auctioned. As of 01.06.2024, a total of 155 coal mines have been successfully allotted/auctioned under CMSP Act MMDR Act with a total PRC of 545.30 MT. The state-wise PRC of coal mines allocated/auctioned is shown in Figure 2.14.

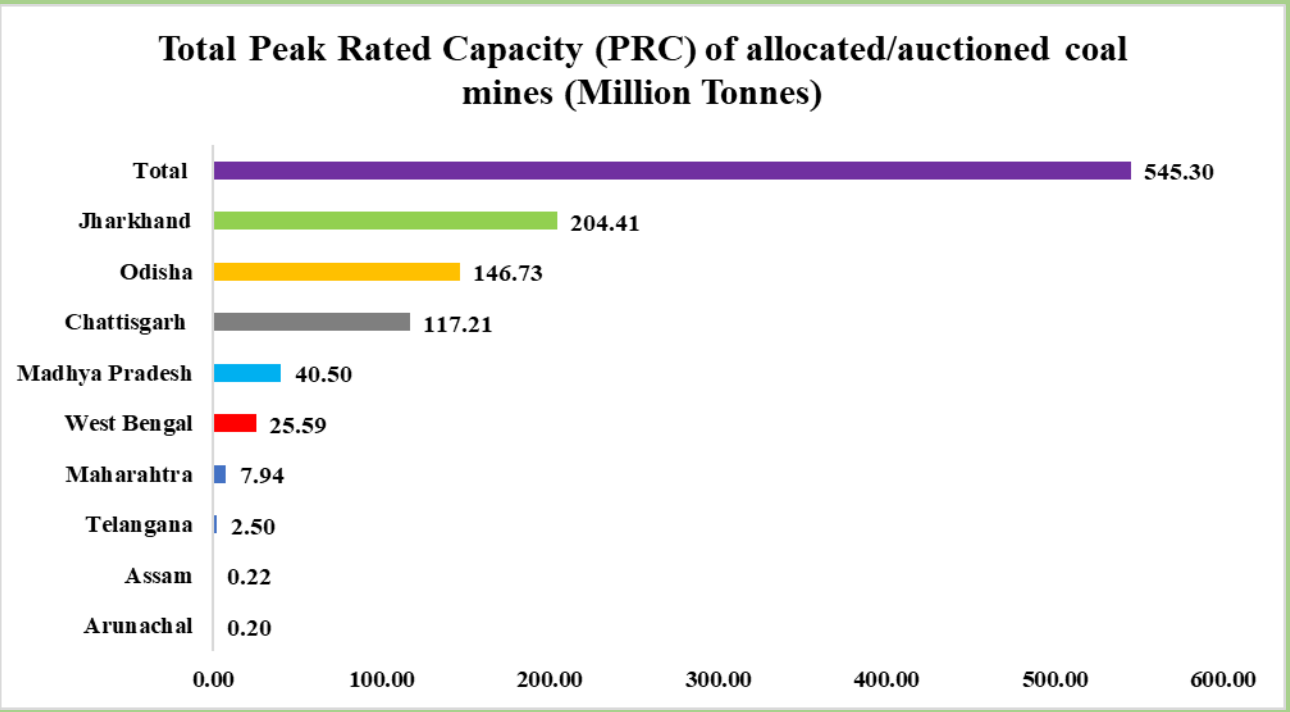


Figure 2.15 Total PRC of allocated/auctioned coal mines.

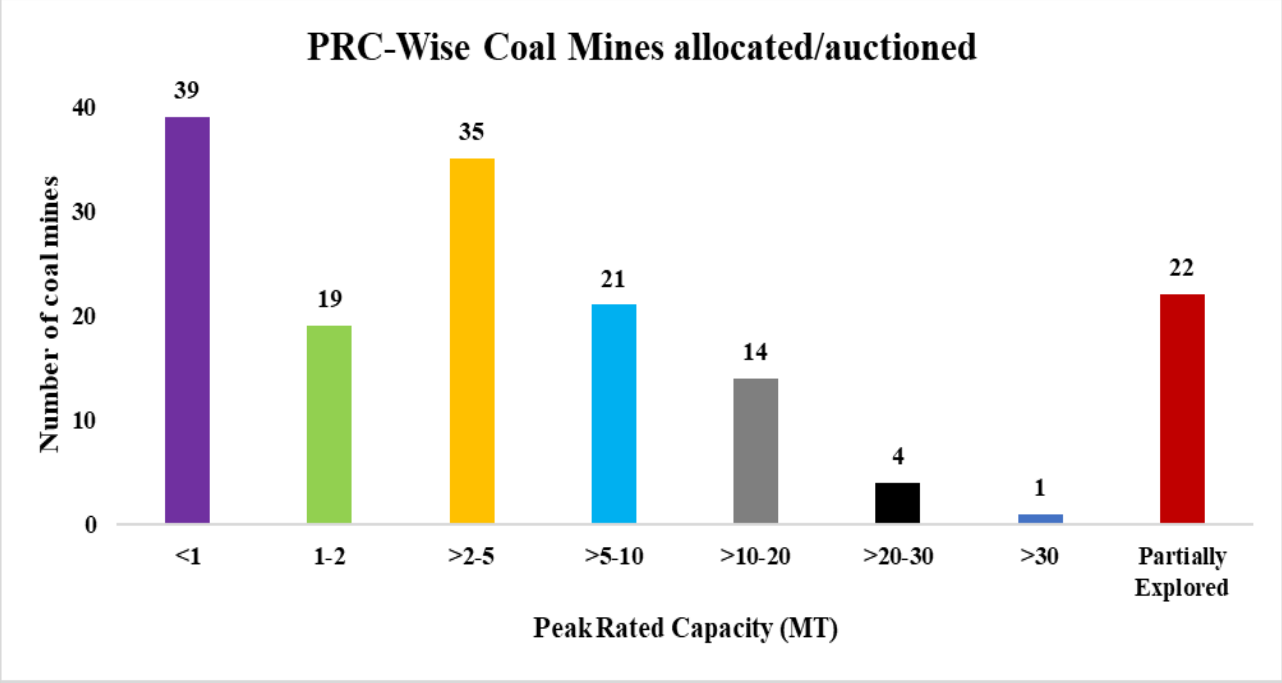
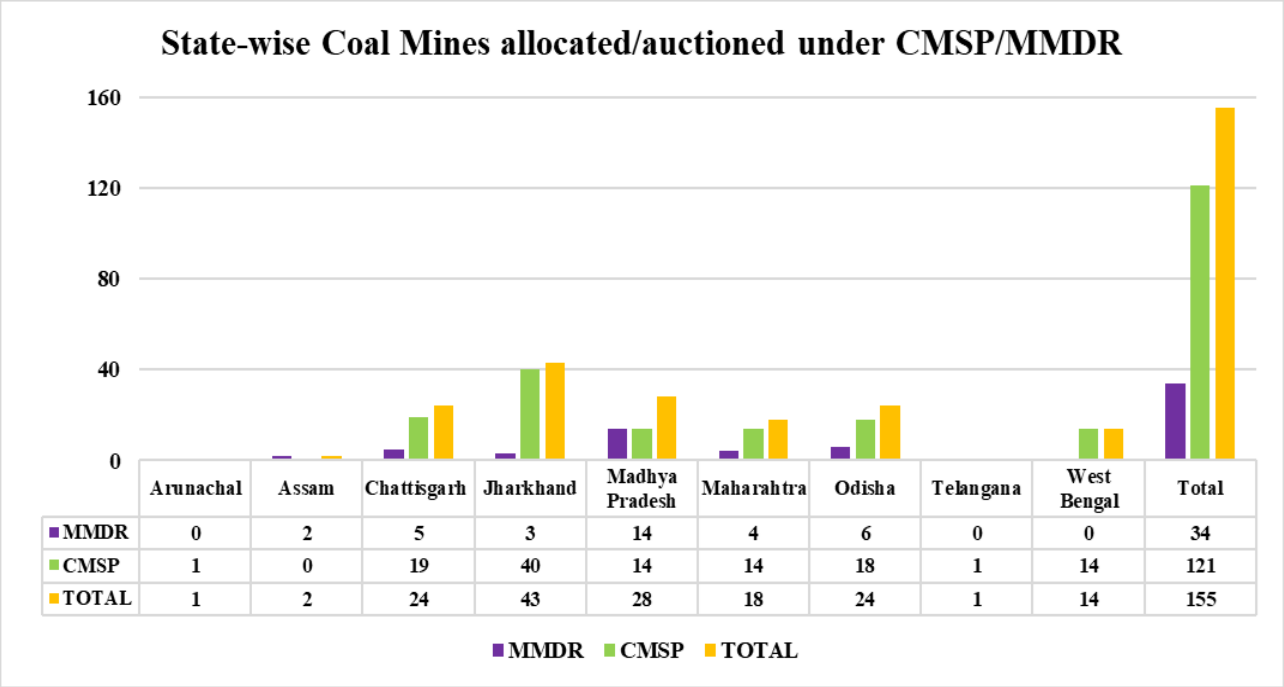


Figure 2.16 PRC-Wise Coal Mines allocated/auctioned



	Arunachal	Assam	Chattisgarh	Jharkhand	Madhya Pradesh	Maharahtra	Odisha	Telangana	West Bengal	Total
MMDR	0	2	5	3	14	4	6	0	0	34
CMSP	1	0	19	40	14	14	18	1	14	121
TOTAL	1	2	24	43	28	18	24	1	14	155

Figure 2.17 State-wise Coal Mines allocated/auctioned coal mines.

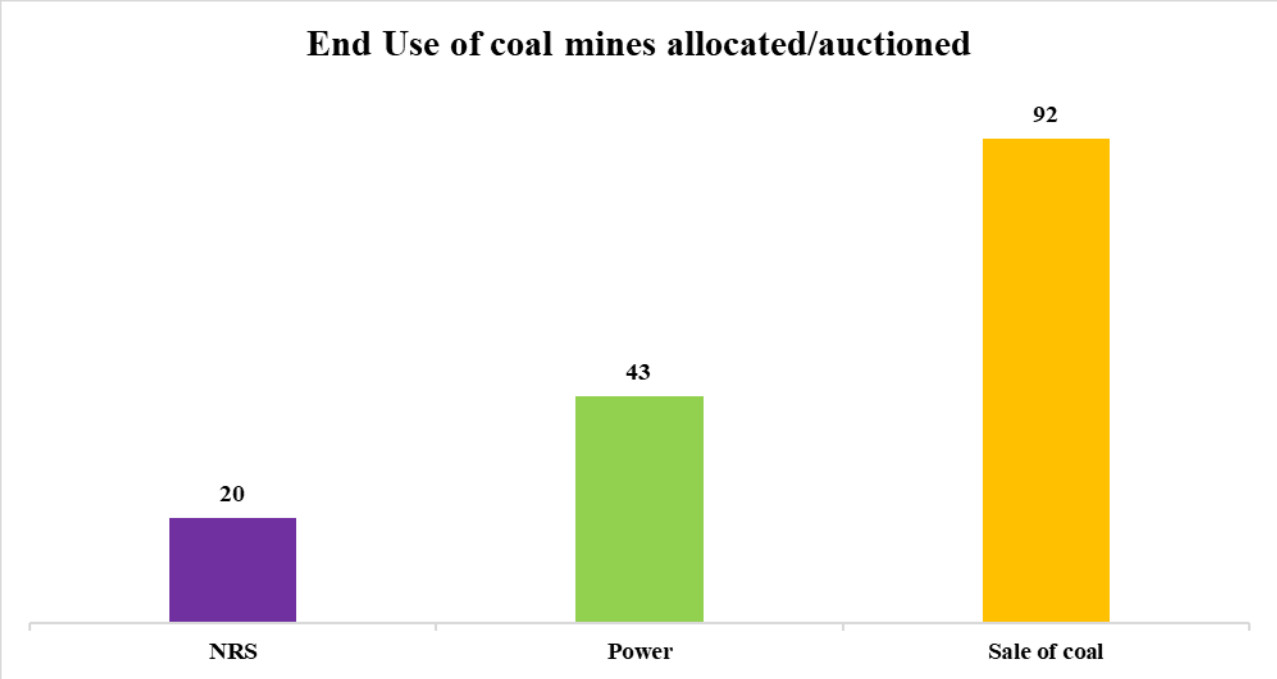


Figure 2.18 End Use of coal mines allocated/auctioned

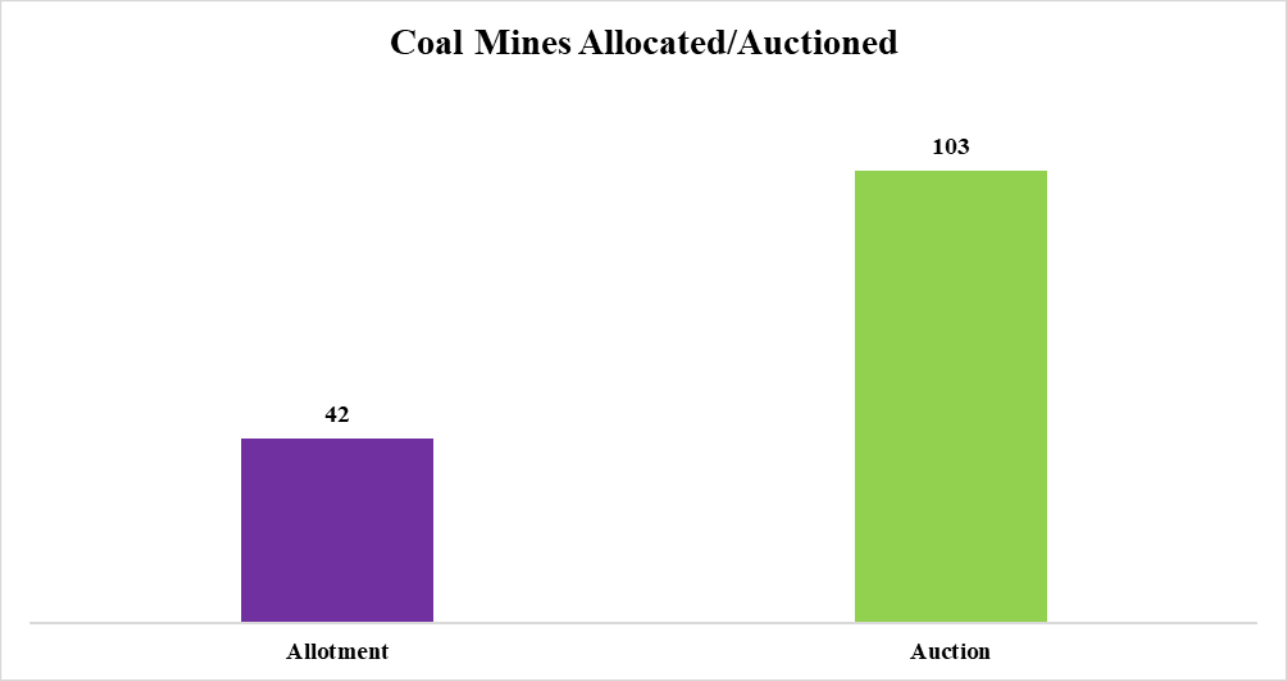


Figure 2.19 Coal Mines Allocated/Auctioned

2.8 National Coal Index

The Ministry of Coal has initiated the commercial auction of coal mines on a revenue share basis, introducing the National Coal Index (NCI) to determine revenue shares based on market prices. The NCI, with a base year of FY 2017-18, reflects domestic coal price movements and monthly price changes relative to the base year. This index aims to provide a market-based mechanism for determining revenue shares. Prior to the NCI, the Wholesale Price Index (WPI) was used to analyze coal prices, but it only accounted for notified prices and did not accurately reflect market conditions. The NCI improves upon this by considering prices from all sales channels: notified, auction, and import prices, resulting in a more comprehensive index.

The NCI is a weighted average of the change in coal prices since FY 2017-18, and it is compiled for different grades of coal, resulting in five sub-indices:

- Coking Top: Steel-I and Steel-II
- \Coking Bottom: Washery-I to Washery-IV
- Non-Coking Top: G1 to G6
- Non-Coking Middle: G7 to G14
- Non-Coking Bottom: G15 to G17

In June 2020, the NCI was launched and has shown steady movement throughout 2020 and 2021. The Representative Price (RP) is also calculated as a weighted average of coal prices from all sales channels. The weights for each sales channel are based on transaction volumes at each grade.

Figures 2.16 to 2.21 illustrate the year-wise (April) movement of the NCI and RP. The NCI increased by 3.55% in April FY 2021-22 compared to April FY 2020-21, rising from 100.13 to 103.68 points. However, it saw a significant surge of 124.56% in April FY 2022-23 over April FY 2021-22, jumping from 103.68 to 232.81 points. This surge was largely due to market resettlements post-COVID-19. The peak NCI of 238.83 points was observed in June 2022, reflecting the post-COVID-19 market dynamics. However, FY 2023-24 witnessed a significant decline of 27.38% in the NCI, indicating an abundant coal supply in the market.

Both non-coking and coking coal indices showed similar trends over the past four years. The declining premiums on coal auctions also indicate sufficient coal availability in the market. The downward trend of the NCI and its sub-indices suggests a balanced market, aligning supply with demand. This ensures that the nation can meet its growing energy needs, supporting a more resilient and sustainable coal industry and contributing to a prosperous future for India.

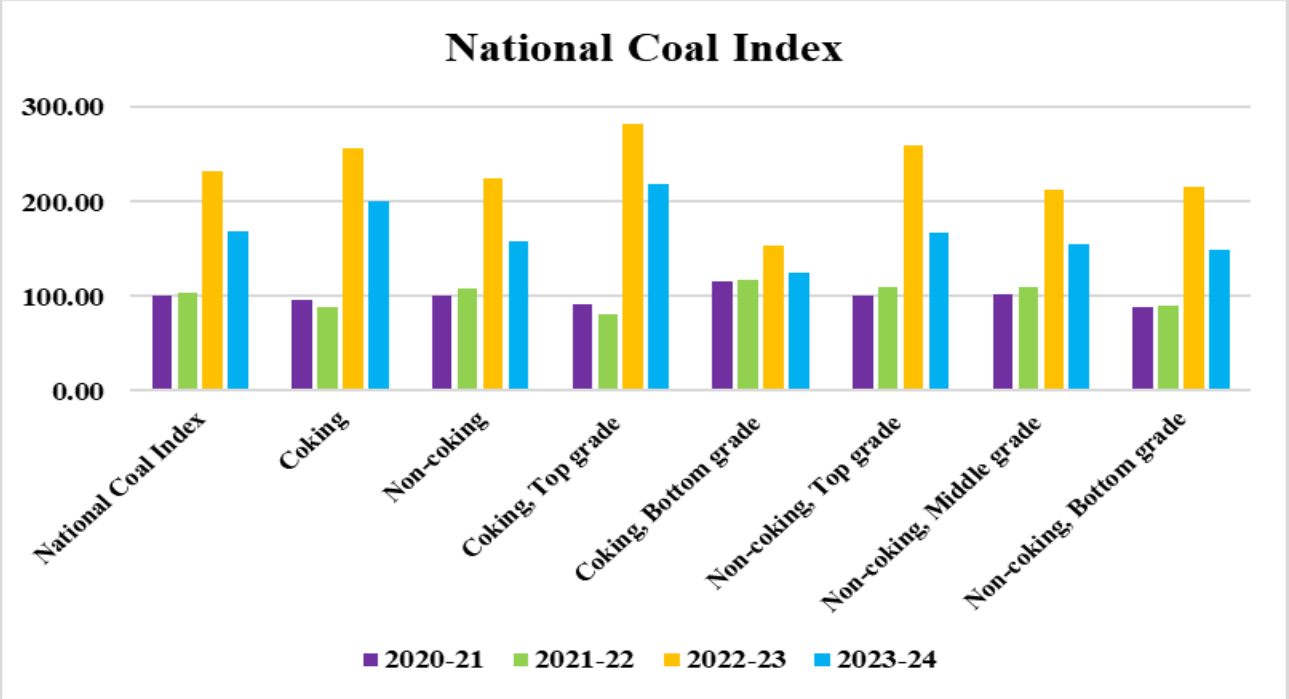


Figure 2.20 National Coal Index

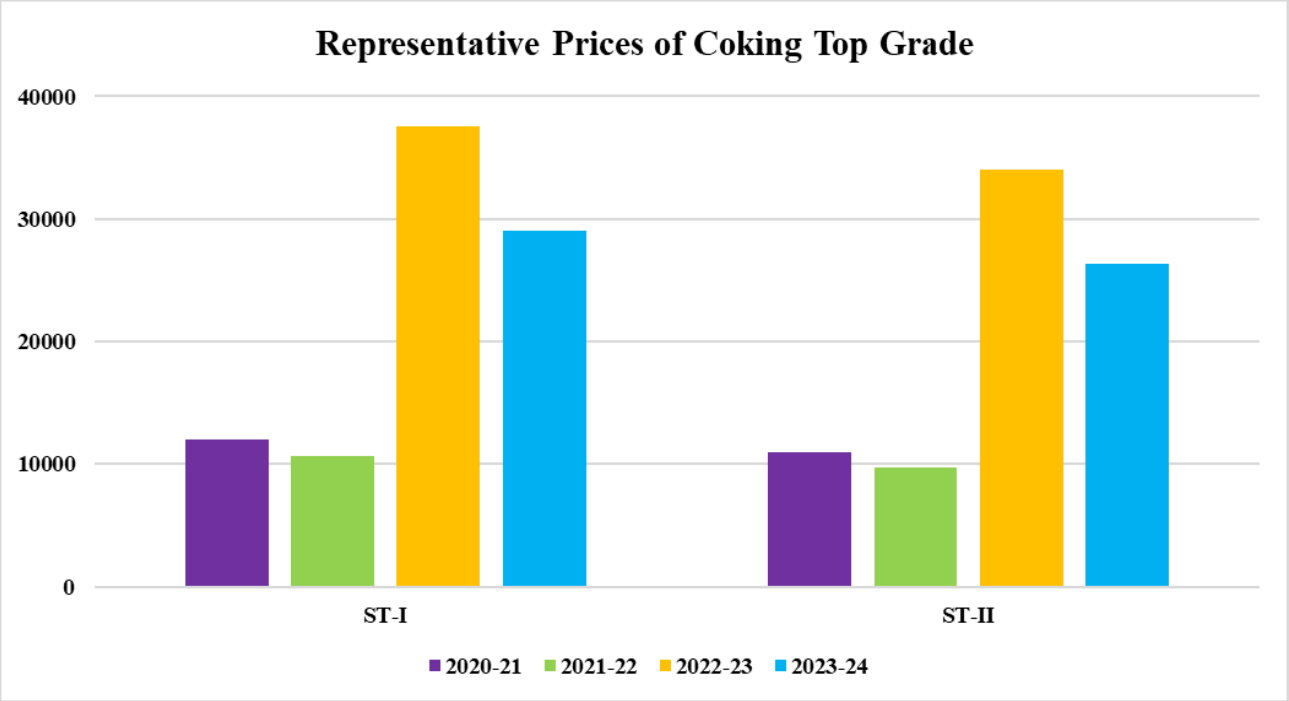


Figure 2.21 Representative Prices of Coking Top Grade

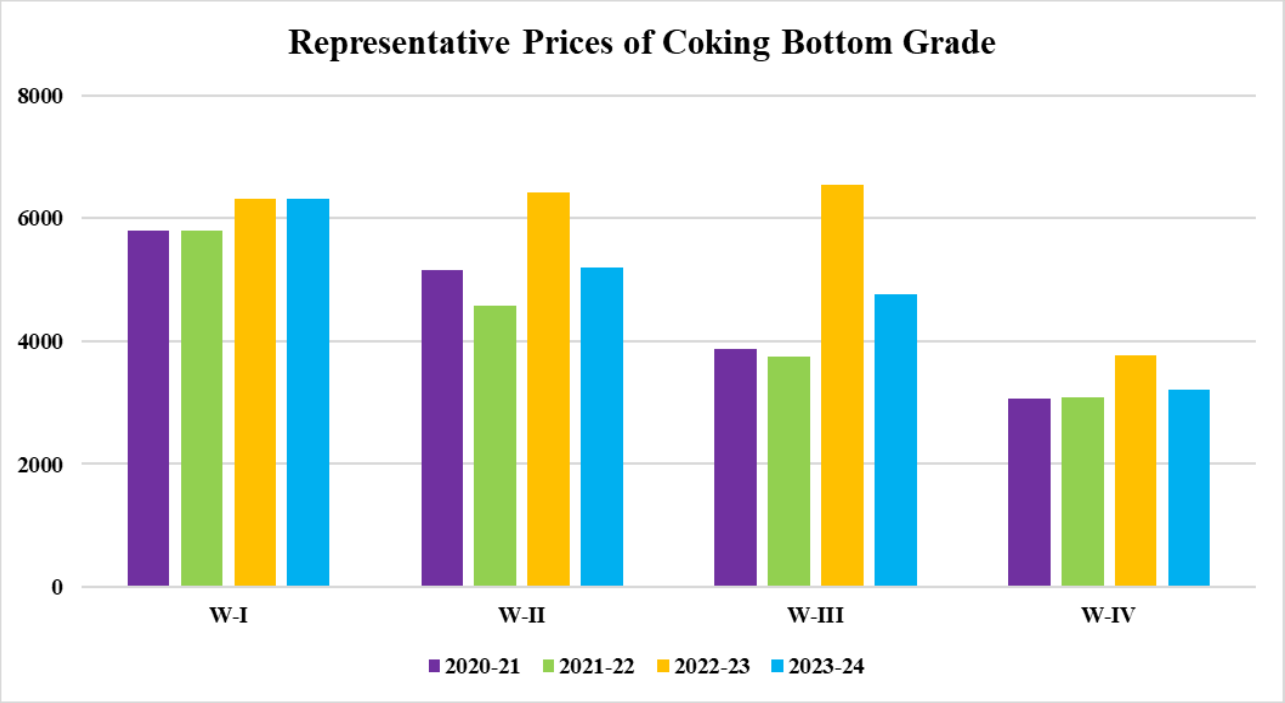


Figure 2.22 Representative Prices of Coking Bottom Grade

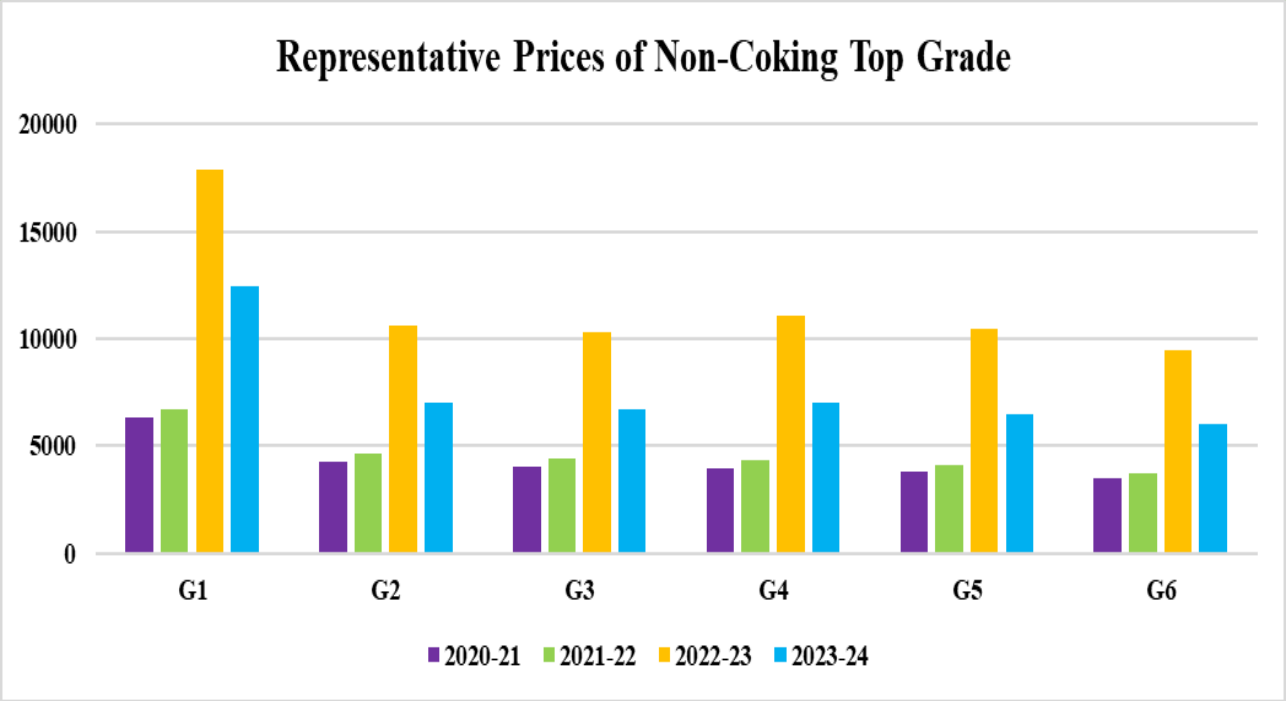


Figure 2.23 Representative Prices of Non-Coking Top Grade

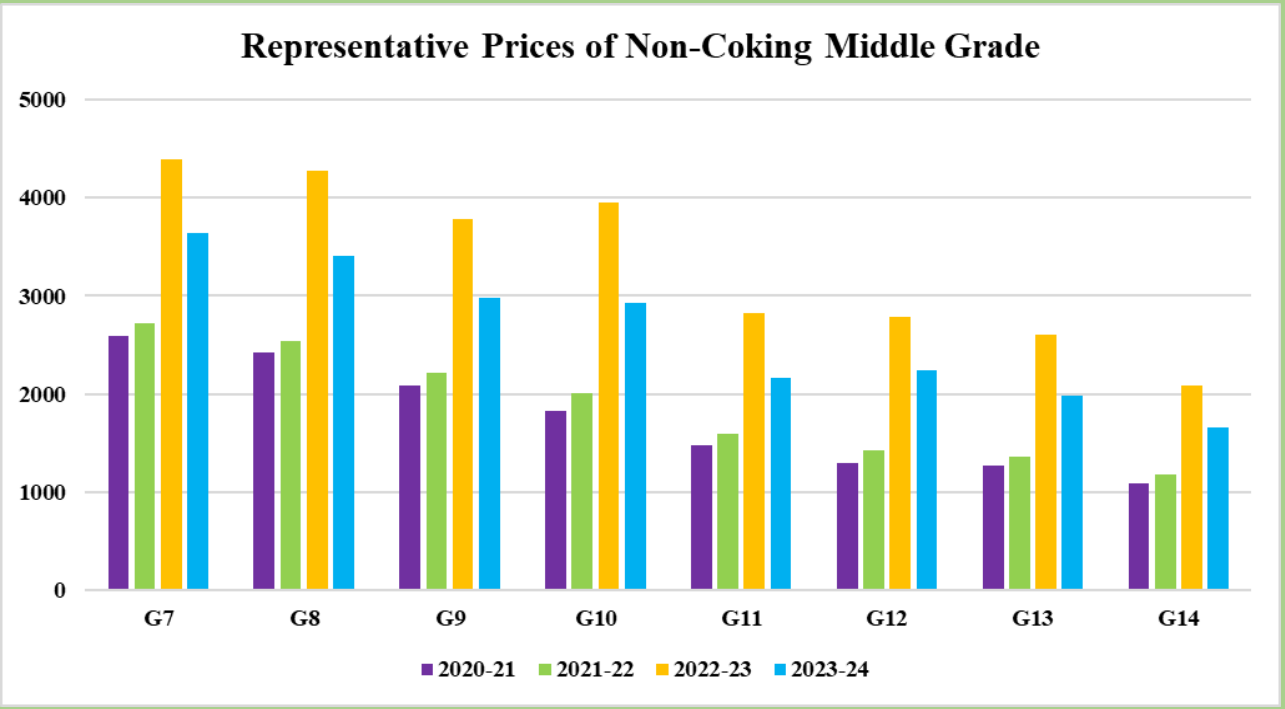


Figure 2.24 Representative Prices of Non-Coking Middle Grade

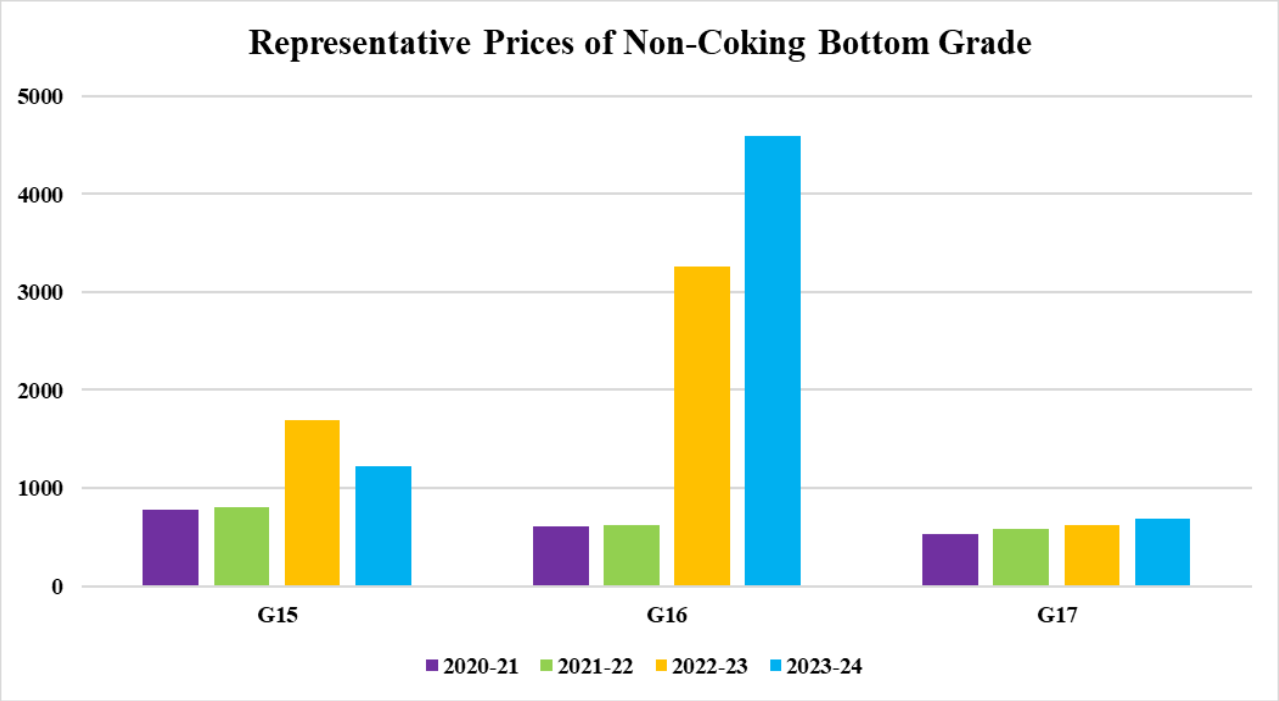


Figure 2.25 Representative Prices of Non-Coking Bottom Grade

2.9 Global Coal Demand

Globally, coal is the key contributor to electricity, with a share of around 30%. As the world is completely reliant on electricity, risks associated with increasing electrification and decarbonizing the power supply may play a key role in achieving net zero targets. Key considerations should be given to policy changes and technology choices in emerging markets and developing economies that may pave the way for the development of a new lower-carbon environment.

All fossil fuels are expected to peak before the end of 2030 and may follow a declining trend thereafter. Considering the above trends, some important issues need to be considered. Firstly, the projected declines are not steep enough to be consistent after the peak demand. It may require rapid clean energy deployment and much-determined policy making. Secondly, the projected demand for fossil fuels may vary region-wise. In advanced economies, demand may be reduced; meanwhile, in emerging markets and developing economies, it may be partially offset by continued growth. Thirdly, the demand trajectories may not be linear in practice, and the trend may inevitably be spikes, dips and plateaus along the way. For example, solar and wind power may follow inconsistent trends considering heatwaves and droughts, which may cause fluctuations in coal demand for electricity, where hydropower output may be constrained. Even with a declining trend in fossil fuels in the future, the transition process may not be that simple, easy, and quick to implement, and energy security may be the key issue to address while attaining a clean energy transition. For example, today's peak demand may not remove the necessity for investment in coal supply. Subsequently, it underlines the

economic and financial risks of major new coal-fired power plants over their risks for climate change. The estimated total Fossil Fuel consumption and Sector-wise global coal demand in the STEPS 2000-2050 is shown in *Figure 2.26* and *Figure 2.27,* respectively.

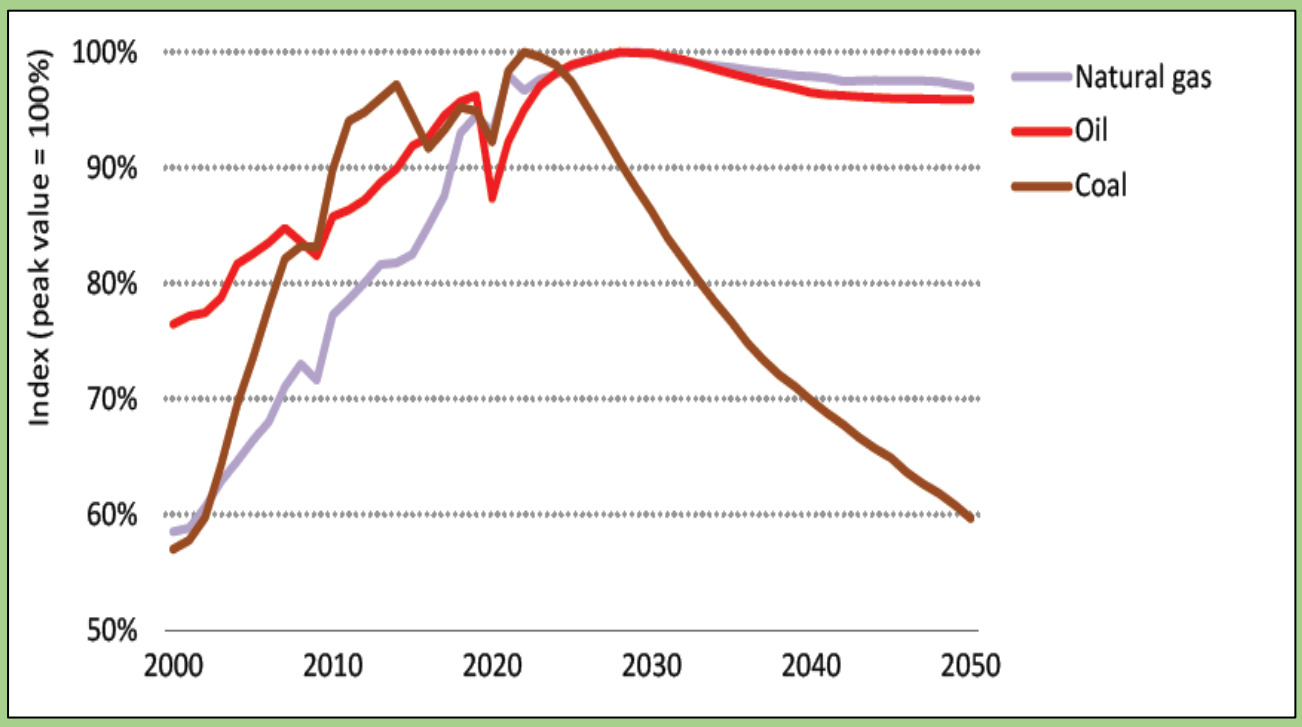


Figure 2.26 Fossil Fuel consumption in the STEPS 2000-2050 (Source: IEA)

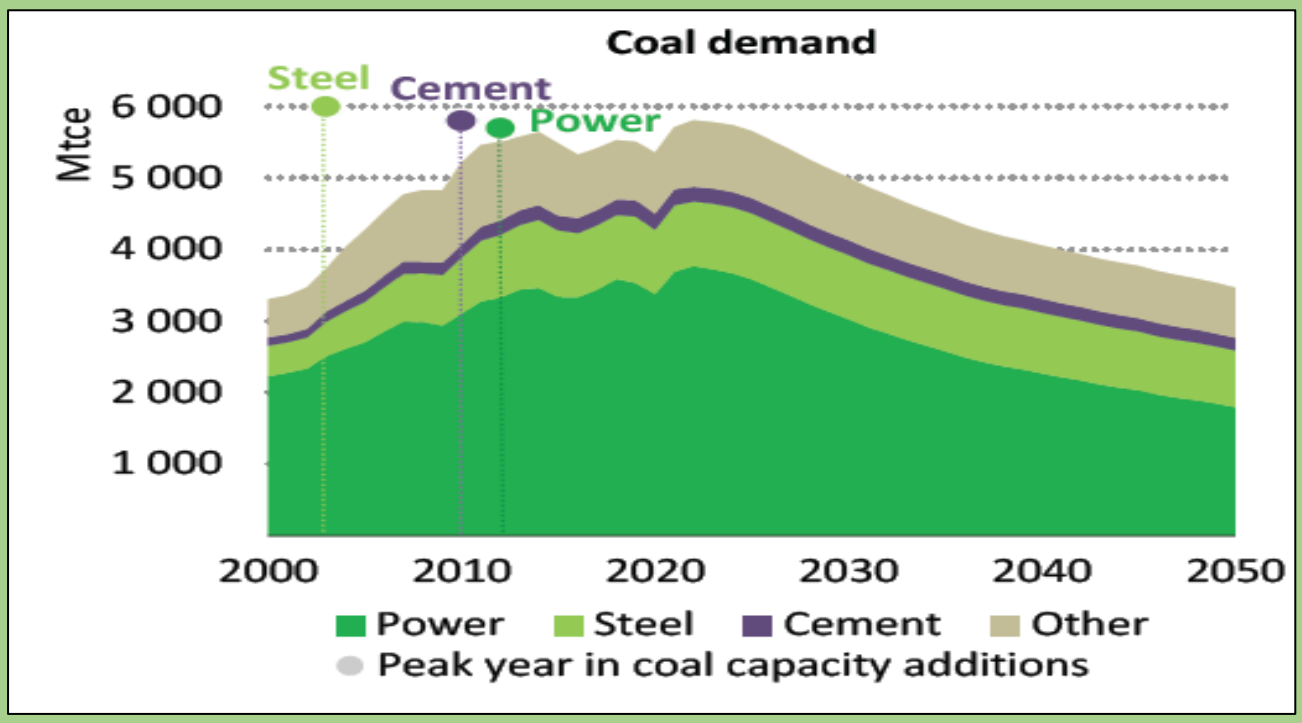


Figure 2.27 Sector-wise global coal demand in the STEPS, 2000-2050 (Source: IEA)

In the STEPS, global coal demand is expected to decline within the next few years after a consistent peak demand. The projected downward trend of coal may impact the future capacity additions of both

coal-dependent power generation and iron and steel plants, which are major consumers of total coal consumption with a share of 65% and 16%, respectively.

As per IEA, World fossil fuel demand is set to peak by 2030 as more electric cars hit the road and China's economy grows more slowly and shifts towards cleaner energy, undercutting the rationale for any rise in investment**.** The industrialized countries contrast with the view of the oil producer group, the Organization of the Petroleum Exporting Countries, which sees oil demand *rising* long after 2030 and calls for trillions in new oil sector investment. As per the report World Energy Outlook 2023, peaks in oil, natural gas and coal demand were visible this decade in its scenario based on governments' current policies. "The Transition to clean energy is happening worldwide, and it's unstoppable. It's not a question of 'if,' it's just a matter of 'how soon,' and the sooner, the better for all of us,"

2.10 India's Coal Demand

In India, a Just Transition is unlikely to occur in the foreseeable future. Despite significant efforts to promote renewable and non-fossil-based energy sources, coal will continue to play a substantial role in the country's energy mix for years to come. The Ministry of Coal has established a Sub-Committee to address the comprehensive closure of abandoned or legacy mine sites and those closing due to reserve depletion viability issues and to consider the social aspects of mine closure based on Just Transition principles, in addition to physical and environmental closure.

As coal remains a major energy source in India, its demand is expected to persist, potentially peaking between 2030 and 2035. Electricity generation from coal-based power plants increased by 10% between 2021-22 and 2022-23, with no decline observed in coal-based electricity generation during this period. There have been no reports of coal-based power plants shutting down due to coal shortages in 2021-22 and 2022-23. According to India's net zero commitment, coal's share in the power mix is anticipated to decrease to half by 2030. Renewable energy sources, particularly solar, are expected to meet new demand, although projections for large hydropower and wind energy remain modest.

The Central Electricity Authority (CEA) report "Optimal Generation Mix 2030 Version 2.0" provides projections for India's energy mix in 2030. While coal's share is expected to drop from 73% to 55% of power generation, its capacity will increase by 19% and generation by 13% between 2023 and 2030. The estimated peak electricity demand and energy requirement for 2029-30 are 334.80 GW and 2279.70 BU, respectively.

Renewable sources like small hydro, pumped hydro, solar, wind, and biomass are projected to increase their share of the electricity mix from 12% in 2022-23 to 31% in 2030. The United Nations Framework Convention on Climate Change highlights India's effort to expand renewable capacity, aligning with global targets to triple renewable capacity by 2030. The Ministry of New and Renewable Energy aims to achieve about 50% of cumulative electric power installed capacity from non-fossil fuel-based resources by 2030.

The projected gross electricity generation for 2029-30 is approximately 2440.7 BU, including 1364.50 BU from thermal sources (coal, gas, and lignite), 984 BU from renewable sources (including 222.50 BU from hydro), and 92.20 BU from nuclear. Non-fossil fuel generation is expected to contribute around 44% of the gross electricity generation in 2029-30.

By the end of 2029-30, the installed electric power capacity is estimated to be 777.14 GW, comprising hydro (53.86 GW), pumped storage (18.99 GW), small hydro (5.35 GW), coal (251.68 GW), gas (24.82 GW), nuclear (15.48 GW), solar (292.57 GW), wind (99.90 GW), and biomass (14.50 GW), along with a battery energy storage capacity of 41.65 GW/208.25 GWh. With this capacity, India is on track to surpass its Nationally Determined Contributions (NDC) commitment under the Paris Agreement, achieving 50% of installed power capacity from non-fossil sources by 2030. The share of capacity from non-fossil sources is projected to be 62% by 2030, rising to 64% when including nuclear power. *Figure 2.28* and *Figure 2.29* illustrate the installed power capacity versus power generation for FY 2022-23 and the likely installed power capacity versus power generation for FY 2029-30.

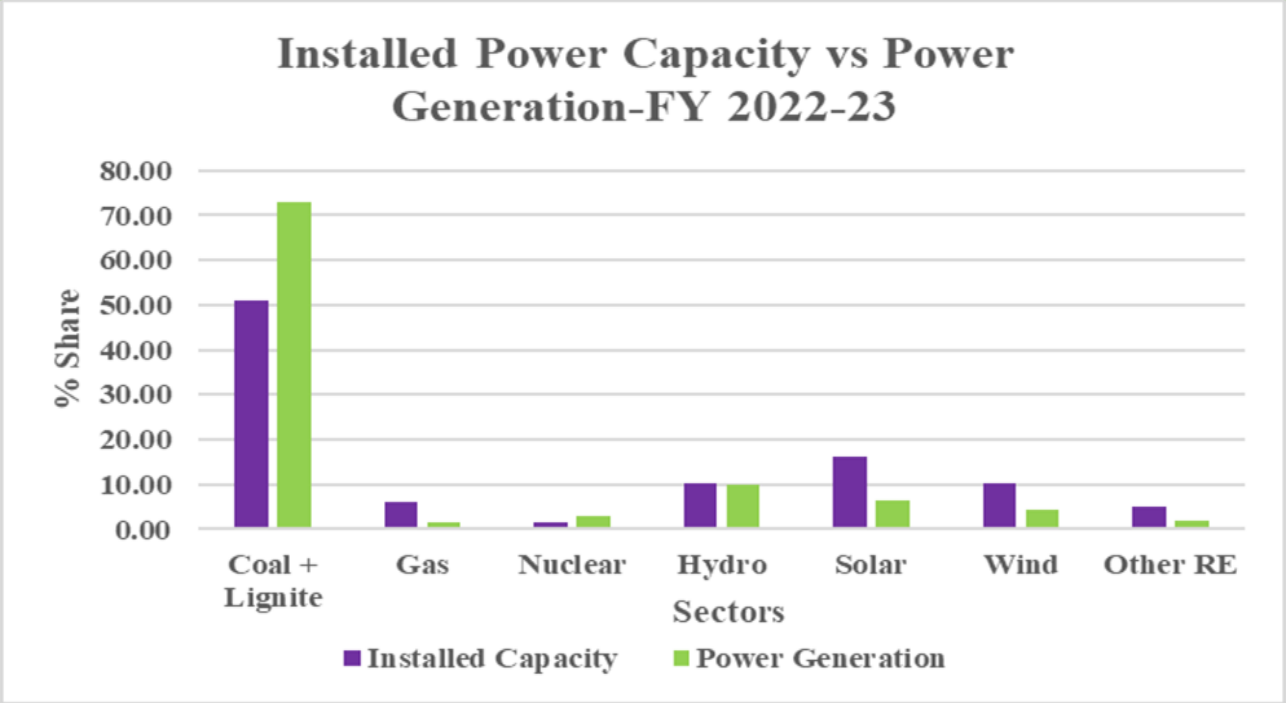


Figure 2.28 Installed Power Capacity vs Power Generation FY 2022-23 (Source: CEA)

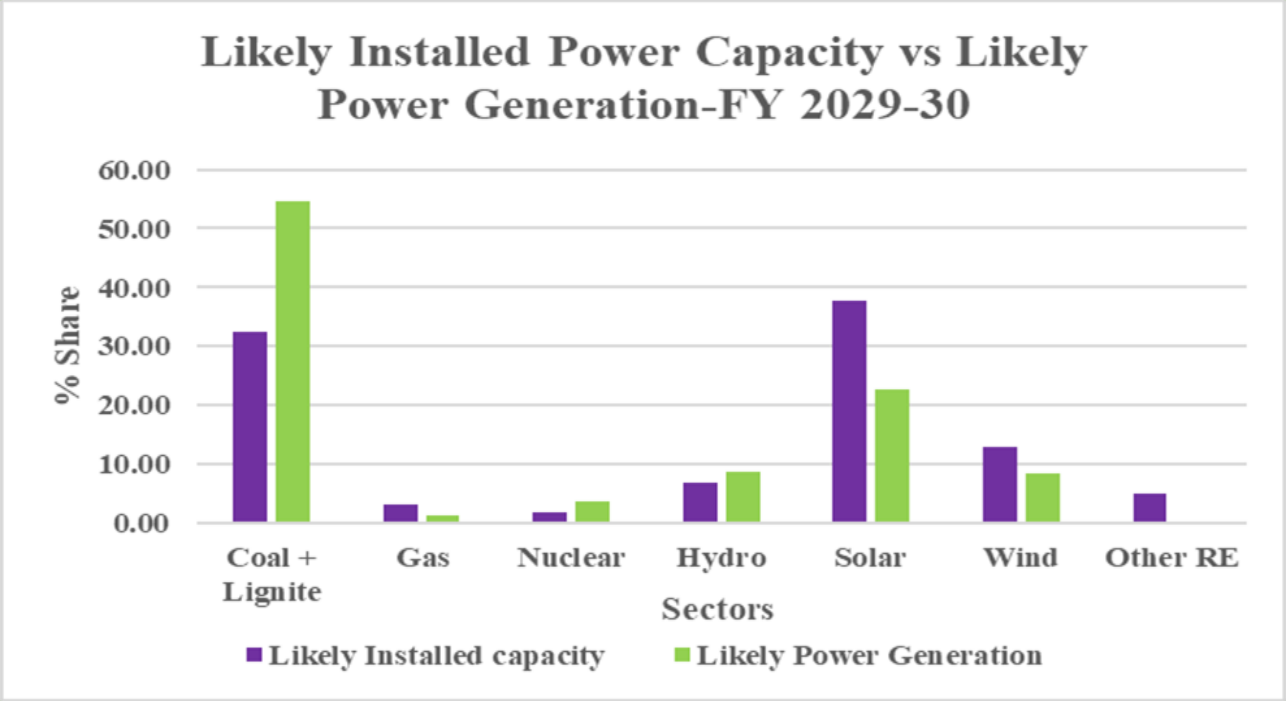


Figure 2.29 Likely Installed Power Capacity vs Likely Power Generation FY 2029-30 (Source: CEA)

India's aim to develop green hydrogen will require an additional 250 BU of energy by 2030. In 2022-23, India produced only 173 BU from solar and wind energy for its essential power needs, which must be significantly increased to prioritize hydrogen production.

According to the Economic Survey 2022-23, coal demand is projected to be around 1.3-1.5 billion tonnes by 2030. The Coal Vision 2030 report estimates that total coal demand in India will range from 1,500 to 1,900 MTPA by 2030, as illustrated in Figure 2.29. The higher end of this range aligns with an 8% GDP growth rate, while the lower end corresponds to a more energy-efficient scenario. Overall, thermal coal demand in 2030 is expected to be between 1,150 and 1,750 MTPA, with the remainder being coking coal. The coal supply target or requirement by 2030 is also estimated to be around 1,180 to 1,915 MTPA, as depicted in *Figure 2.31.*

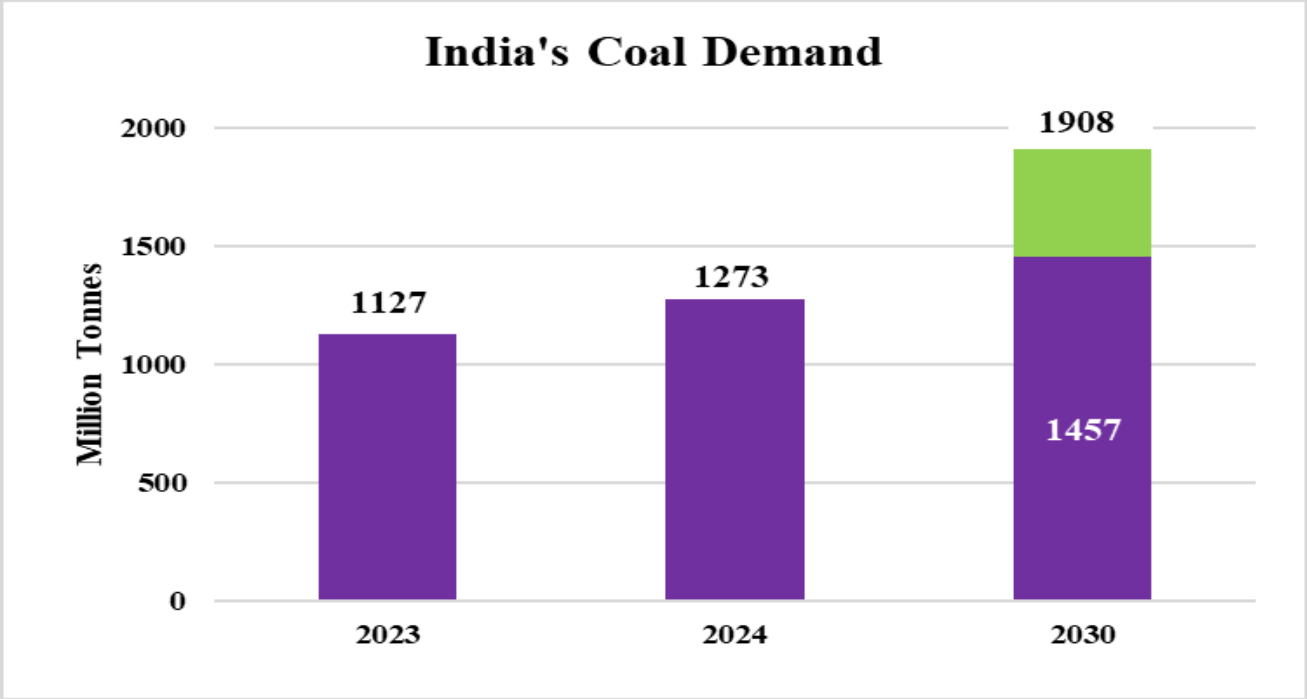


Figure 2.30 Estimated Coal Demand in India (Source: KPMG)

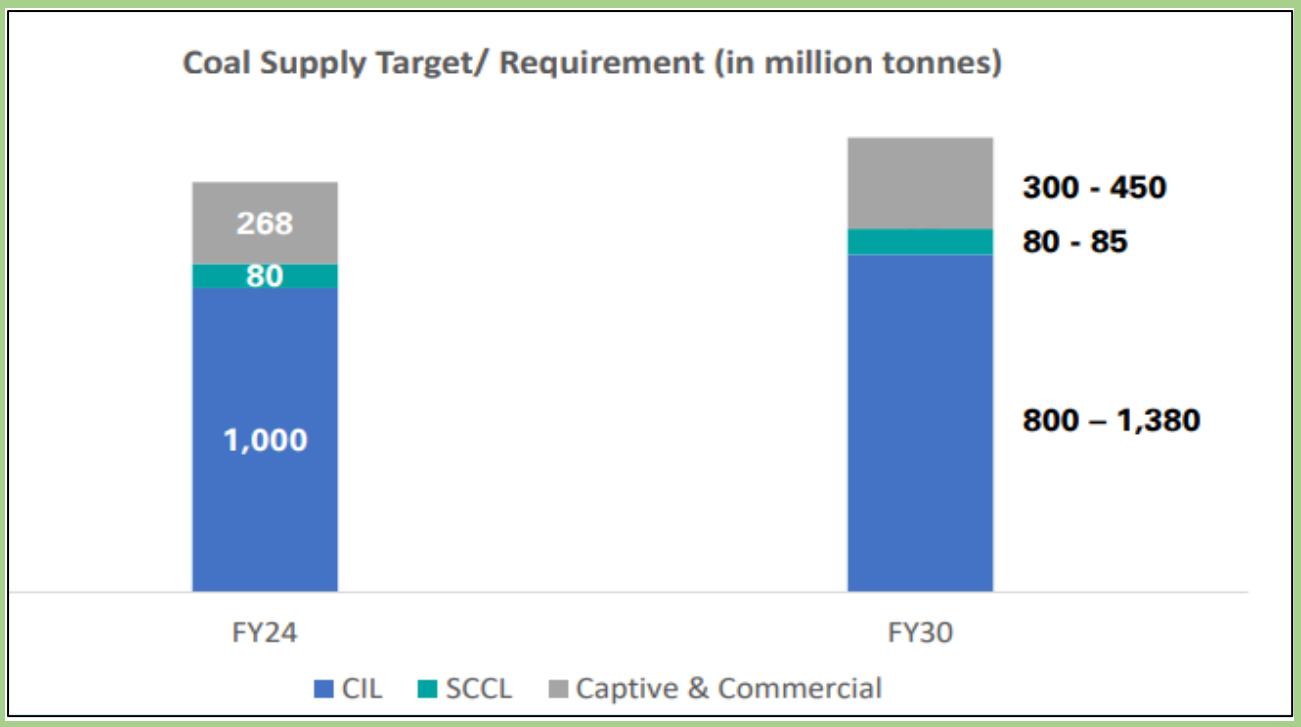


Figure 2.31 Coal Supply Target/Requirement (Source: KPMG)

According to Coal Vision 2030, India currently has a coal production capacity exceeding 1500 MTPA, with allocations to Coal India Limited (CIL), Singareni Collieries Company Limited (SCCL), and other entities, including captive coal blocks. The gross electricity generation from coal and lignite-based power plants is projected to be 1515.82 BU for the year 2029-30. This estimate accounts for potential increases in coal-based generation due to uncertainties in the expected or scheduled capacity additions from hydro, nuclear, and variable renewable energy (VRE) sources, as well as climatic factors like drought conditions. The corresponding coal requirement for electricity generation in 2029-30 is estimated to be approximately 1019.6 MT.

It is anticipated that auctioned coal blocks will take three to five years to reach full production capacity. Coal India Limited (CIL) is expected to achieve its one billion tonne production targets around the same time. Consequently, there will likely be an oversupply of coal, estimated at 100-200 MT, by 2025, even if state PSU and private coal mine production levels remain constant. If CIL reaches only 800 MT by 2024-25, India can still increase production from already allotted or auctioned coal blocks to meet the additional coal demand.

2.11 Global Scenario of Coal Mining (Countries closed/restarted)

Despite global efforts to reduce carbon emissions by phasing out coal, the world is also looking back at coal as the only source of options until full-fledged energy security is built. The significant increase in gas prices, coupled with high natural gas costs and intense global competition for fuel, has led to greater demand for thermal coal in power generation. Many countries are reopening dormant coal plants to ensure sufficient energy supply this winter, while others are ramping up production to capitalize on lucrative export opportunities, aiming to reduce reliance on Russian energy and explore more affordable alternatives.

Europe

Austria

In June 2023, Austria's government, in response to an energy emergency, decided for conversion of gas-based power plant to coal-based in collaboration with the utility company Verbund (VERB.VI).

Bosnia and Herzegovina

The Transition Report 2022-23 "Business Unusual" indicates that the Federation of Bosnia and Herzegovina decided to expand the lifespan of thermal power plants Tuzla 4 and Kakanj 5 to meet energy demands. Alumina has signed a contract with local coal mining company RMU Banovici to supply approximately 0.2 MT of coal in 2024. Over the past 11 years, the coal miner has provided Alumina with about 1.75 MT of coal.

Denmark

In order to maintain energy security of nation, the Danish government decided to maintain and recommence activities at 3 oil and coal-based power plants, out of which two were actually scheduled for decommissioning on March 31, 2023.

Finland

Finland based Fortum decided to recommence an idle coal-based power plant and also to increase its capacity to 560 MW.

France

The coal-based power plant "Emile Huchet" was recommenced in October 2023, just after 6 months of its closure.

Greece

In order to overcome the energy crisis in nation, Greece's DESFA decided to continue their operations in 7 coal-based power plants than actually scheduled dates of decommissioning.

Germany

Germany's Cabinet decided to extend the activities of coal-fired power plants and reactivate idled brown coal capacity. The Economy Ministry indicated that reintroducing coal-fired power plants would add 10 GW of capacity to address the energy crisis. Uniper decided to continue operations at Ratcliffe coal power station.

Italy

Italy expressed its interest in increasing output from its operational fossil fuel power plants.

North Macedonia

The closure of Bitola and Oslomej coal-fired power plants has been postponed till 2030 in connection to the opening of two new coal mines.

Poland

In September 2022, Poland suspended the ban on use of lignite until April 2023 to mitigate the supply crisis. Additionally, there are plans to improve coal production from operational mines to 1.5 MT.

Serbia

To overcome drought conditions and energy supply crisis, Serbia decided to improve coal production and plans a new unit to operationalize at Kostolac power plant by 2023.

Spain

Spain decided to delay Endesa's As Pontes coal power plant's closure.

United Kingdom

The power companies Drax Group and EDF Energy signed contracts with UK's National Grid to continue operations at four coal-fired power units to ensure energy security.

Ukraine

Ukraine plans to increase domestic coal production from 2 MT to 3 MT considering the fact most of coal mines in Ukrain are in Donbas which is controlled by Russian forces.

Africa

Botswana

The Botswana government anticipated increased demand from Europe due to Russia-Ukraine war.

South Africa

Europe imported more than 40% coal from South Africa in first five months of 2022 over FY 2021 to address energy crisis raised due to shortage of imports due to Russia-Ukraine war.

Asia & Oceania

Australia

Since 2022, Federal Environment Ministry approved 4 new coal mines and 25 additional coal mines are currently waiting for approval

China

Beijing decided to add 15 GW new coal based power plant and 30 MT coal based iron plant.

Indonesia

ESDM decided to increase coal production to address energy crisis, marking record high coal production 775 MT against target 695 MT for 2023.

Americas

Colombia

Colombia announced an increase in coal and petroleum production to address the crisis left by sanctions on Russia.

United States

US decided to delay scheduled closures of coal based plants till 2025 to address energy crisis.

2.12 World Electricity Generation

With the growth of the global economy, rapid advancements in industrialization, and increasing population, global electricity demand is expected to grow rapidly in all scenarios. Electricity demand in 2050 is expected to rise by 80%, 120% and 150% from its current level in the STEPS, APS, and NZE Scenario, respectively. With growing concern about global warming, additional demand may be expected by adopting carbon capture, gasification of fossil fuels, and increasing the capacity of renewables. The unabated fossil fuels are expected to decline drastically within a few years. The Source-wise generation (% percentage) and monthly generation (in TWh units) of World Electricity for FY 2019-20 to FY 2023-24 are illustrated in *Figure 2.32* and *Figure 2.33,* respectively.

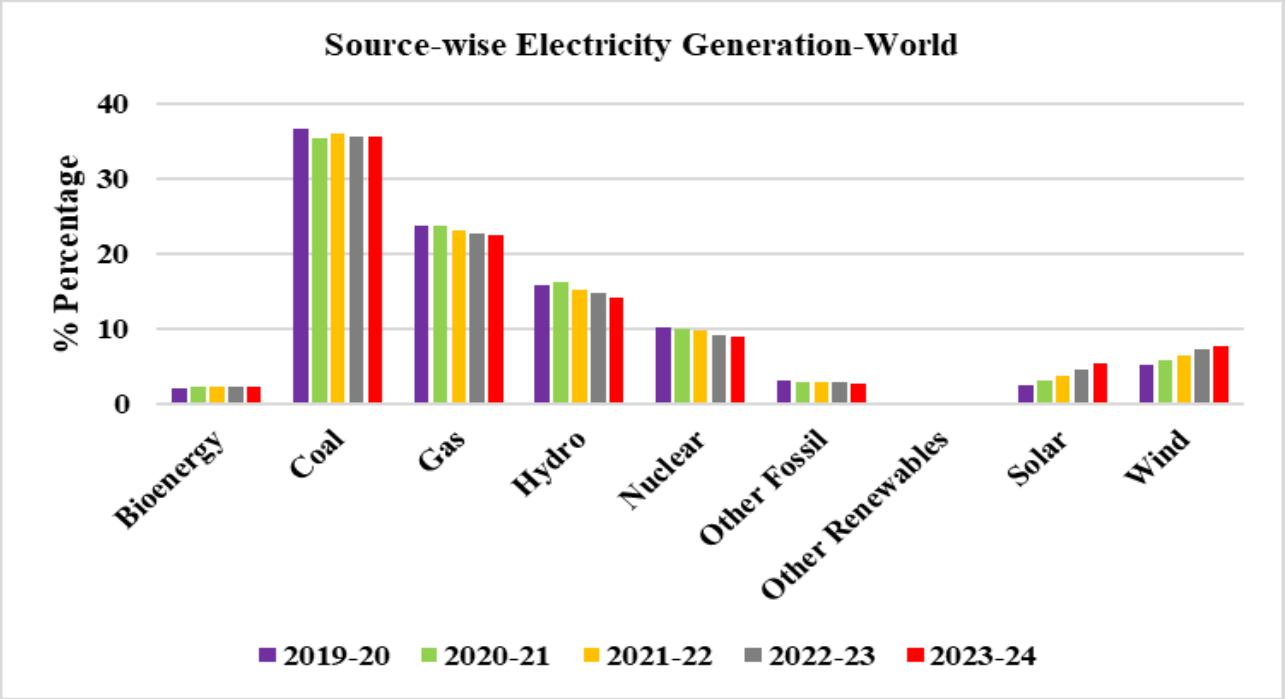


Figure 2.32 Source-wise World Electricity Generation (Source: Enerdata)

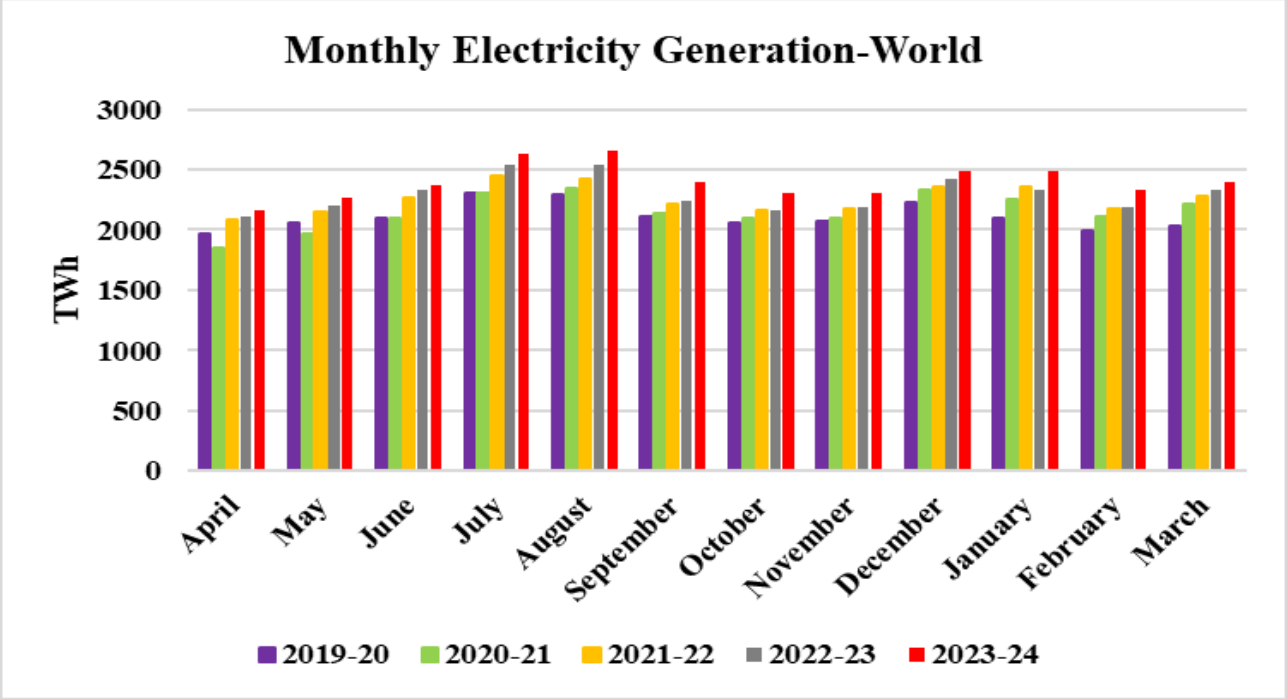


Figure 2.33 Monthly Generation of World Electricity 2019-2022. (Source: Enerdata)

2.13 Indian Electricity Generation

India has undergone significant social, economic, cultural, and demographic transformations, particularly intensifying over the last ten years. Between 2002-03 and 2022-23, the nation's electrical energy demands rose consistently from 546 TWh to 1616 TWh. This period also saw substantial

economic modernization and growth, reflected in the increasing GDP. Consequently, there is a notable positive correlation between income levels and the demand for electrical energy. *Figure 2.34* and *Figure 2.35* depict the source-wise generation percentages and monthly electricity generation in TWh units from FY 2019-20 to FY 2023-24, respectively.

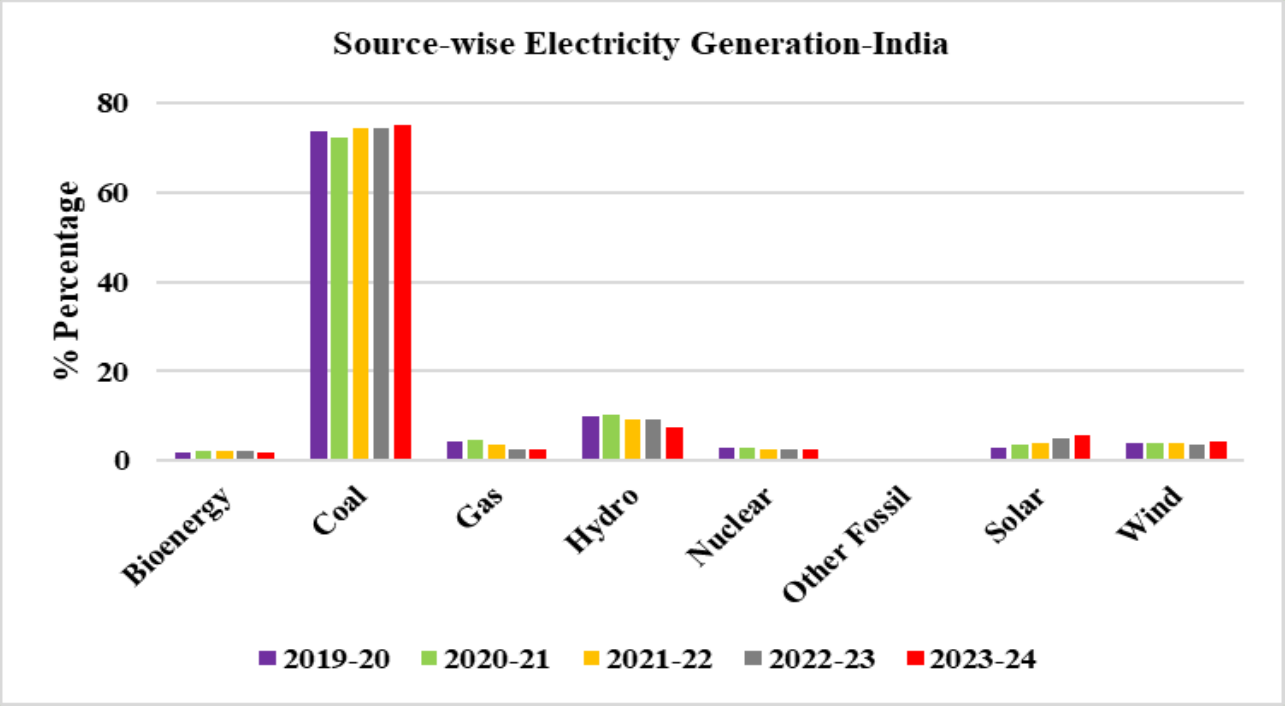


Figure 2.34 Source-wise India Electricity Generation (Source: Enerdata)

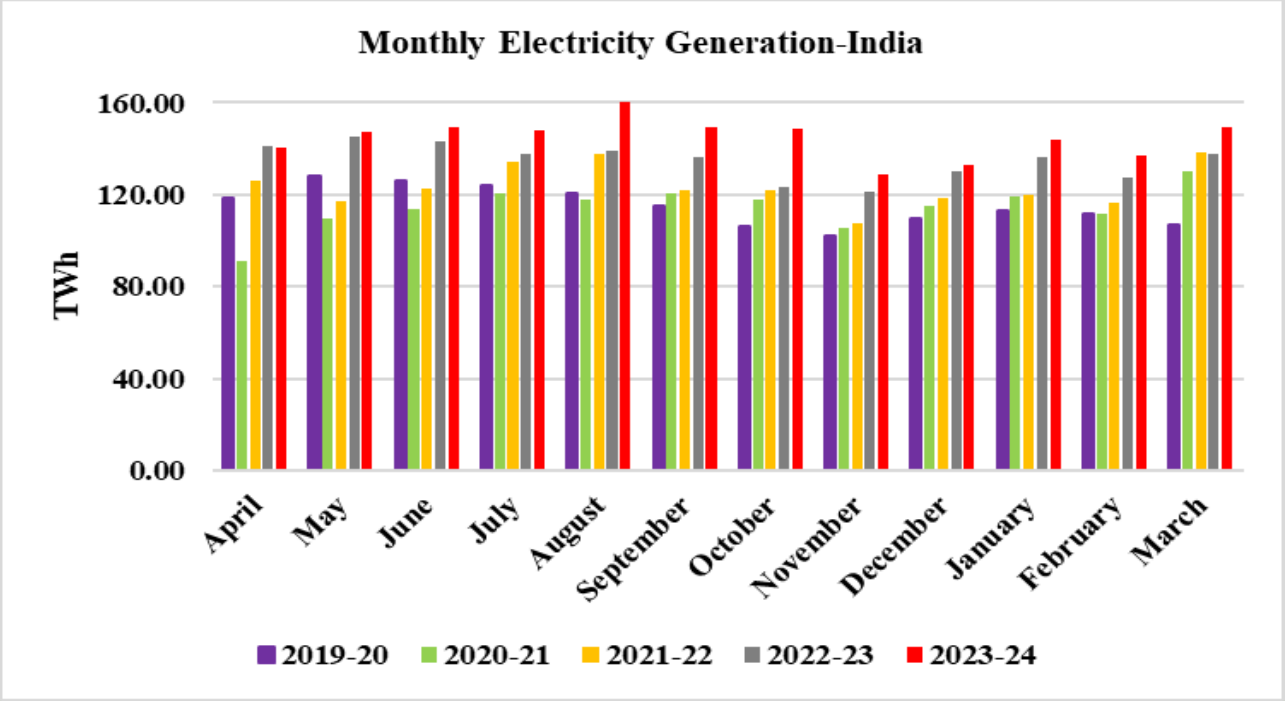


Figure 2.35 Monthly Generation of India Electricity 2019-2022. (Source: Enerdata)

3 Sustainable Mining/Sustainable Carbon

Misconceptions About Coal-"The world doesn't need coal; it can be replaced by renewables and other sources."

Coal cannot simply be eliminated from the energy mix. To address the challenges and opportunities faced by developing countries, a diverse array of fuels and technologies is essential. Approximately 37% of global electricity and over 70% of steel production rely on coal. Clean coal technologies, such as upgrading current coal plants to the best available technology, can help minimize CO2 emissions.

In 2023, coal demand rose by 1.4%, exceeding 8.5 billion metric tons, with increases in China, India, and Indonesia, and declines in the United States, the European Union, and Japan. Demand from the power sector is projected to be 0.4% lower for the year at about 5,597 Mt, while the non-power sector saw growth, reaching 2,791 Mt in 2023. Factors such as global economic growth, industrialization, urbanization, and weather conditions affecting renewable energy influence the demand for coal. Post-COVID-19 and the Russo-Ukrainian war, markets normalized in 2023. The International Energy Agency (IEA) predicts that by 2030, the number of electric cars worldwide will be nearly ten times greater, with clean energy policies in key markets impacting future fossil fuel demand.

3.1 Coal Bed Methane

One alternative use of coal, particularly popular in Australia, is coal bed methane (CBM). This process accesses deep coal deposits by extracting water from the seam, releasing the methane attached to the coal. It's essential to consider water contamination, land subsidence, and safe wastewater disposal, as the process is water-intensive and sometimes involves fracking. CBM is an unconventional natural gas source. With the fifth-largest proven coal reserves globally, India holds significant prospects for CBM exploration and exploitation, particularly in the Gondwana sediments of eastern India.

3.2 Coal Gasification

The Ministry of Coal aims to reach 100 MT, reflecting a commitment to harnessing coal gasification by FY 2030 to revolutionize the coal sector, secure raw materials and reduce import dependency. Currently, India imports around 50%, 90% and 13-15 % of natural gas, methanol consumption, and ammonia respectively.

In 2022, MoUs between BHEL & CIL and IOCL, GAIL & CIL, were signed to start a gasification plant. In 2024, Bharat Coal Gasification & Chemicals Limited (BCGCL), joint venture company of

CIL and BHEL was established to start a gasification plant for production of amminium nitrate. The land acquisition process is ongoing and expected to be completed by September 2024.

The government has initiated steps to execute four pilot coal gasification projects announced in Budget 2022-23. Gasification utilizes coal's chemical properties to produce gaseous fuels like hydrogen and substitute natural gas, liquid fuels such as methanol and ethanol, and chemicals like methanol derivatives and olefins. CIL has undertaken several SCG projects at various stages of execution, including:

Talcher Fertilizer Ltd: A coal gasification-based urea plant in Odisha, utilizing high ash coal and Pet-coke to produce 1.27 MMTPA neem-coated urea.

Coal Gasification Projects: Initiatives at the pit head of coal mines in ECL, MCL, and WCL.

Lignite to Methanol Plant: An NLCIL project in Neyveli.

Environmental concerns in the coal gasification process are addressed by mandating Environmental Clearance, including Environmental Impact Assessment studies and an Environment Management Plan.

The Cabinet approved Rs.8,500 crore in incentives for coal gasification projects as follows:

Case I: Rs. 4,050 crore allocated to Government PSUs, supporting up to three projects with a grant of Rs. 1,350 crore or 15% of the capital expenditure (capex), whichever is lower

Case II: Rs. 3,850 crore for both the private sector and Government PSUs, providing a grant of Rs. 1,000 crore or 15% of capex, whichever is lower. At least one project in this category will be awarded through a tariff-based bidding process.

Case III: Rs. 600 crore for demonstration projects utilizing indigenous technology and small-scale gasification plants. This includes a grant of Rs. 100 crore or 15% of capex, whichever is lower, for projects with a minimum capex of Rs. 100 crore and a production capacity of 1,500 Nm3/hr of syngas.

3.3 Carbon Capture, Utilization and Storage (CCUS)

Carbon Capture and Storage (CCS) is a proven technology that prevents CO2 from being released into the atmosphere or removes it directly. The process involves capturing CO2 from industrial sources, compressing it for transportation, and injecting it deep underground into secure geological storage sites. CCS is crucial for achieving net-zero greenhouse gas emissions by 2050. Understanding the costs and economics of CCS is vital, as costs vary widely based on application, location, and scale. Advances in technology and operating experience are driving down costs, with significant research and development focused on more cost-effective CCS technologies.

3.4 Carbon Tax

The Energy Conservation Amendment Act 2022 came into force on January 1 2023. Significant amendments were made to this Act to facilitate the attainment of the 26th UN Climate Change Conference of the Parties (COP-26) goals.

- The Act mandates the use of renewable energy and carbon-neutral technologies, as well as the implementation of sustainability features across industries. In addition, the Act aspires to establish a domestic carbon market and implement a carbon trading mechanism to assist India in meeting its climate mitigation obligations. The Act adds new concepts such as carbon trading and requires designated users to use renewable/non-combustible sources to facilitate carbon removal and accomplishment of sustainable development goals.
- The Act introduced Carbon Credit Trading Scheme to encourage the reduction of carbon emissions in the economy. The central government will now prescribe a minimal percentage of use of renewable/non-combustible sources as energy or feedstock by selected consumers. These consumers include sectors such as aluminium, steel, cement, fertilizers, paper, sugar, railways, petrochemicals, and so on.
- The amendment mandates that state governments should establish energy conservation funds to promote energy efficiency and conservation initiatives. This fund will receive contributions from the central government's loans and grants, as well as all fees collected by the state government under its primary statute.
- The Act imposes penalties on vessels and vehicles in case of non-compliance to prescribed norms. In the case of non-compliance for vessels, an individual shall be responsible for paying an penalty of double the price of each Mtoe consumed than the stipulated norms, in addition to a penalty of up to Rs. 10,00,000, the Act further imposes a minimum of Rs. 2000 and a maximum of Rs. 5000 for every violation of the standards specified by the Central government. Vehicle manufacturers who violate the fuel consumption norms will face a penalty of Rs. 25,000/vehicle for violating norms up to 0.2L/100 km and a penalty of Rs. 50,000/vehicle for violating norms above 0.2L/100 km. Failure to give information to the BEE, as prescribed, has been rendered punishable by a penalty of up to Rs. 50,000 for the first violation and an penalty of up to Rs.10,000 for each successive violations.

3.5 Just Transition

The Just Transition initiative emphasizes increasing investment in clean energy system than fossil fuels. In alignment with its NDC goals and commitments made in the Panchamrit declaration at COP

26, India aims to promote renewable and non-fossil-based energy sources. However, coal will be critical in the energy mix for coming years, with demand not yet reaching its peak. The IEA projects that while the share of coal in the overall energy mix will gradually decrease to 34% by 2040, the total demand for coal will remain robust to meet the energy needs of a rapidly growing economy. Consequently, coal transitions and related activities are not expected in the short to medium term. Instead, new coal mines will be opened to satisfy the energy and coal demand, including the consolidation of larger mines. Furthermore, substantial coal demand is anticipated for the implementation of clean coal technologies such as coal gasification and coal liquefaction.

In India, coal consumption is projected to peak between 2035 and 2040, followed by a gradual decline. This may lead to the phased and measured closure of mines, starting with low-capacity mines, based on just transition principles. Additionally, mines may close during this period due to reserve depletion, safety issues, or viability problems, necessitating proper closure plans to prevent income loss for those dependent on these mines.

The coal sector in India is deeply intertwined with other sectors and local communities. Regions with coal deposits have developed monoculture societies focused on coal mining and its use, resulting in significant economic and social dependence on the coal sector. This dependence impacts livelihoods, infrastructure, environmental conditions, state revenues, and quality of life. Coal-bearing states are often economically disadvantaged, with many people earning a living directly from mining activities and indirectly from related sectors.

Therefore, while the long-term closure of coal-based assets is essential for the transition, it will be disruptive to the sector and local communities. However, this transition also offers an opportunity to tackle existing developmental challenges and improve opportunities for affected communities. It allows for reimagining development in these regions, addressing not only current issues but also the aspirations of the communities involved. Strategic and comprehensive planning for this reimagined development should occur across interconnected sectors at the regional and district levels.

A multi-level action and implementation framework is developed to address the complex and inter-sectoral issues with the aim of building a firm base and capacity to enable the seamless handling of the closure of coal-based assets in the long term is highly recommended, as shown in *Figure 3.1*.

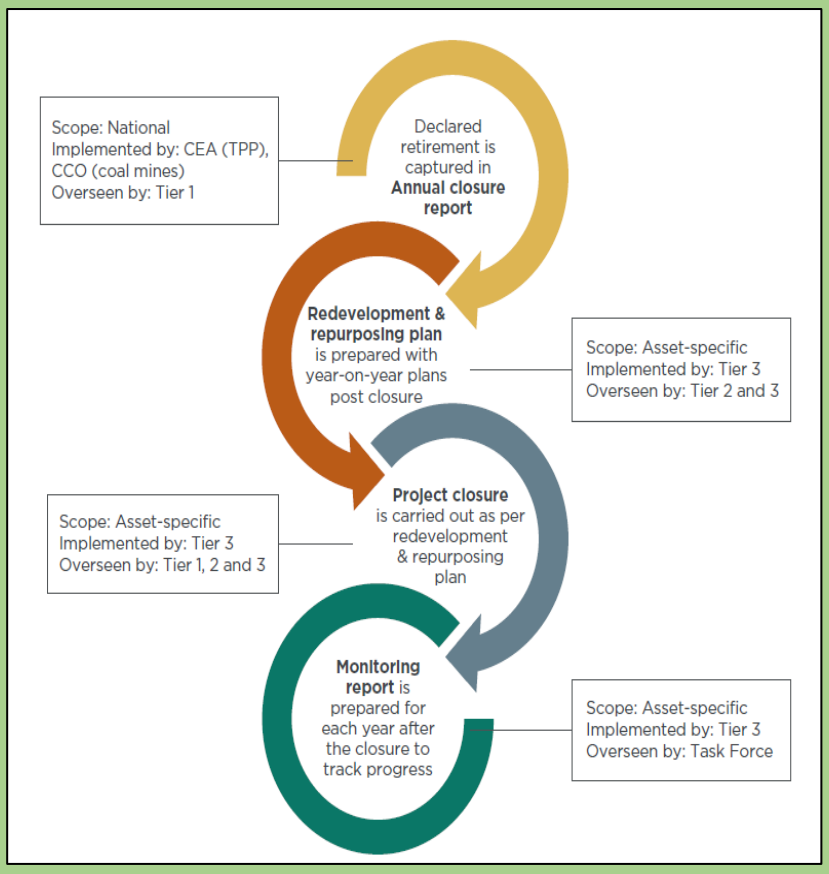


Figure 3.1 Action and Implementation Plan of Just Transition (Source: NITI Aayog).

Consuming energy from non-renewable resources should be offset by an equal amount of energy from renewable resources. To achieve a sustainable future, Transition to renewable energy sources like solar, wind, and hydro-electric power. To offset the environmental impact of past non-renewable energy usage through initiatives like carbon capture and reforestation. By neutralizing non-renewable energy consumption, we can mitigate climate change and create a more environmentally friendly energy landscape. Coal PSUs NCLIL, SCCL and CIL towards the Net Zero target commissioned solar capacity of 1421 MW, 224 MW and 41MW, respectively, whereas wind capacity of 51 MW is installed only by NLCIL.

3.6 Energy Efficiency

The Ministry of Coal is actively managing energy efficiency initiatives in Coal/Lignite PSUs, implementing measures like LED lighting, energy-efficient air conditioners, fans, electric vehicles, water heaters, motors, auto timers, and capacitor banks. These efforts have led to a savings of 14.34 crore kWh units, amounting to Rs 107.6 crore, and reduced CO2 emissions by 1.17 lakh tonnes, demonstrating a strong commitment to sustainability in the coal sector. The efficient use and conservation of energy resources are crucial, as saving one unit of energy at the consumption level

may lower the need for capacity by 2 to 2.5 times. These savings can be achieved at less than one-fifth the cost of creating new capacity and significantly reduce the carbon footprint.

Coal companies have several areas where they can implement energy efficiency measures, including:

- Residential colonies, buildings, offices, industrial establishments, and rest houses.

- Various mining activities such as heavy earth-moving machinery (HEMM), transport, ventilation, and pumping.

- Efficient power supply management and other related avenues.

Over the years, coal companies have implemented various energy conservation and efficiency measures and plan to continue these efforts, including:

- Reducing electricity and diesel consumption through comprehensive energy audits.

- Replacing conventional lights with LED lights.

- Switching to energy-efficient Star-rated appliances.

- Installing capacitor banks and other measures to improve the power factor.

- Adopting energy-efficient pumps (EESL).

- Adopting electric vehicles (EESL).

By adopting these measures, Coal/Lignite PSUs aim to create an additional carbon offset potential of 1 lakh tonnes per annum. CIL has signed an MOU with EESL to install energy efficiency equipment.

From FY 2021-22 to FY 2023-24 (up to October 2023), coal companies have undertaken several energy conservation and efficiency measures, including:

- Replacing 4.12 lakh conventional lights with LED lights.

- Installing 5,082 energy-efficient air conditioners.

- Deploying 81,627 Super Fans.

- Introducing 182 electric vehicles.

- Installing 1,565 efficient water heaters.

- Equipping 415 energy-efficient motors for pumps.

- Installing 2,511 auto-timers for street lights.

- Implementing capacitor banks.

These measures are part of an ongoing effort to further enhance energy efficiency in the coming years.

4 Policy Framework

4.1 Ensuring Coal Quality by Third-Party Sampling

The coal consumers of CIL/SCCL may go for quality assessment through independent third-party sampling agencies (TPSA).

4.2 Mission Coking Coal

Ministry of Coal launched Mission Coking Coal to promote India's 'Atmanirbhar Bharat' initiative. India's coking coal production is expected to achieve 140 MT by 2030. Coal India Limited plans to improve production from operational mines and identify new mines. The Ministry has allocated 16 coking coal blocks to the private sector, most expected to start production by 2025.

4.3 Mission Underground Coal Mining

The Ministry of Coal formulated a high-level committee to develop a policy framework to promote underground coal mining by improving its production by 100 million tonnes from the current 26 million tonnes per year."

4.4 Reopening of discontinued mines: Revenue sharing

Discontinued mines is a major threat to nation’s economy and energy security. In case, discontinued mines are not closed scientifically to revisit again for extraction in later stages or In case, they are closed permanantly may incur huge reserve losses to nation.Therefore, the MoC rolled out Revenue sharing system in order to bring these discontinued/abandoned mines back into operation.This scheme include all public and private sector participation. Out of the 34 identified abandoned mines, Letters of Allocation (LoA) have been issued for 19 mines.

4.5 Grant of Coal Linkages to the Power Sector

The SHAKTI scheme aims to shift coal linkages from nomination-based to auction/tariff-based bidding. Amendments were introduced in 2019, providing various options for power plants to obtain short-, medium-, and long-term coal linkages. Coal supplies under the SHAKTI Policy are now available against Medium- & Short-Term Power Purchase Agreements.

4.6 Coal Mine Surveillance and Management System (CMSMS) and 'Khanan Prahari' App

CMSMS, a web-based application, and 'Khanan Prahari' a mobile-based application, were launched on 04.07.2018 to identify, monitor and take measures against illegal coal mining activities within and around the coalfield areas.

4.7 Commercial Mining

The Ministry of Coal has successfully allocated 155 coal mines, of which 57 mines are operational, and other 98 mines are at different phases of development. These mines have a cumulative PRC (Peak Rated Capacity) of 548.37 MT. Furthermore, coal production from captive/commercial mines increased from 52.70 MT in 2014-15 to 122.7 MT in 2022-23, a growth of 132.83%.

- CIL and NLCIL have planned to diversify their business.
- CIL 1×660 MW TPP Madhya Pradesh and 2×800MW TPP in Odisha.
- NLCIL - 3 X 800 MW TPP in Odisha and 3 X 660 MW TPP in UP

4.8 Energy Conservation (Amendment) Bill 2022

The Energy Conservation Act powers central government to establish standards of energy consumption. The Bill expands on this by allowing the government to mandate that designated consumers achieve a minimal percentage of their energy consumption from non-combustible/renewable sources. Various consumption thresholds can be set for various non-combustible sources and consumers. Designated consumers: (i) industries such as mining, steel, cement, textile, chemicals, and petrochemicals, (ii) the transportation sector and (iii) private buildings. Non-compliance with requirement to utilize energy from non-combustible sources lead to penalty of upto Rs 10 lakh, along with fine of up to two times the price of the oil equivalent of the energy consumed beyond the specified limit.

The Bill also authorizes the central government to implement a carbon credit trading scheme. Carbon credits are tradable permits that allow the holder to emit a certain amount of carbon dioxide. The entities may obtain carbon credit certificates from central government or authorized company by meeting the requirements of the scheme. These entities can buy or sell the certificates, and individuals may obtain carbon credit certificates on a voluntary basis.

5 Conclusion

In India, coal is the dominant source of energy contributing to around 73% of electricity generation. The energy demand in our country is completely driven by the emerging economy to meet the

aspirations of the country. Even though there is immense pressure from the global community to phase out coal, it is practically not feasible for developing countries like India which is highly relied on coal and also had abundant coal reserves compared to other energy resources. Even though the nation is largely dependent on coal for energy security, consistent efforts are also being made considering mine closure guidelines and just transition activities. In addition to that, the Ministry of Coal is looking forward to the adoption of large-scale commercialization of clean coal technologies to extract coal reserves without affecting the environment on a large scale compared to regular mining activities. MoC committed to maintain consistent and unparalleled efforts to meet the energy security of the nation through coal production and supply for reliable energy sector, making continual contribution in India's growth and economic development. As India is making notable efforts towards self-sustainability in fossil fuels, the coal imports trend is expected to decline in the future unless there is a sudden spurt in demand and a significant softening in seaborne prices.

- With consistent efforts, the Ministry of Coal made remarkable achievement in domestic coal production in FY 2023-24 by reaching an all-time high of 997 MT, with a positive growth of 11.21% over FY 2022-23, and coal consumption have shown strong positive growth of 9.27%, with a total volume of 1230.88 MT in FY 2023-24 over FY 2022-23, total coal imports have been increased by 7.82% in FY 2023-24 over FY 2022-23 which signifies coal demand in the nation.
- As of 01.04.2023, India has abundant coal reserves. 378.21 BT geological reserves have been estimated up to depth of 1200 m. Of which, majority of reserves, 376.51 BT (99.56%) are mainly in the Gondwana coalfields, remaining reserves 1.65 BT(0.43%) are in Tertiary coalfields.
- As per Economic Survey 2022-23 and Coal Vision 2030, coal demand in India by 2030 is estimated to be around 1.3-1.5 BT and 1.5-1.9 BT, respectively.
- Coal demand in our nation is likely to rise to 1.5 BT by 2029-30 and to 2 BT by 2047. Despite significant RE capacity developed in recent years, Coal is anticipated to continue playing a crucial role due to the uncertainties surrounding the expected or scheduled generation and capacity additions from hydro, nuclear, and variable renewable energy (VRE) sources, as well as climatic factors such as drought conditions and also consistent efforts of the nation to become third largest economy with GDP of $ 5 trillion and $ 7 trillion by 2027 and 2030 respectively.
- Ministry of Coal is looking forward to sustainable mining and transition activities, coal bed methane, coal gasification, carbon capture, revised the mine closure guidelines, and

implemented energy efficiency measures in coal mines and also allocated/auctioned various coal blocks and formulated various committees for mission coking coal, mission underground coal mining, and repurposing of abandoned/closed mines to maintain self-reliance on fossil fuels, energy security and to achieve zero coal imports.

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12. Geological Society of India
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14. Coal Controller's Organization
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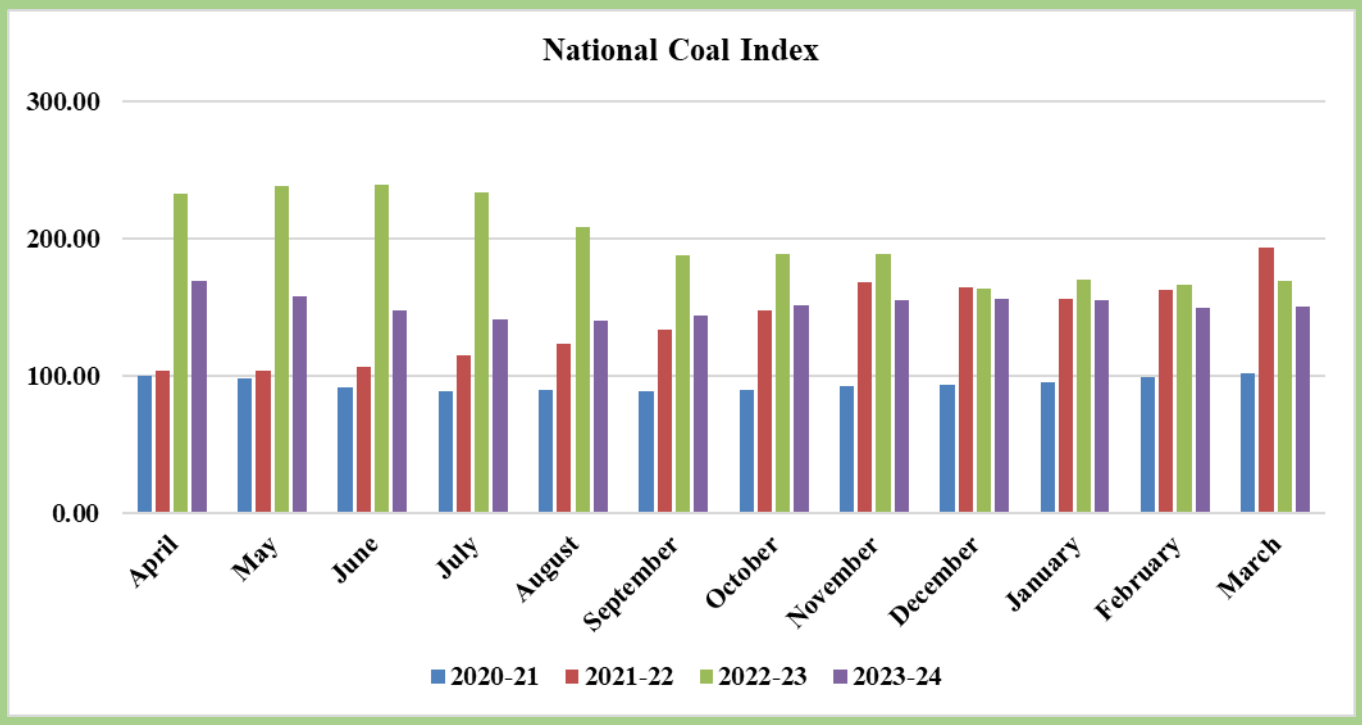
Annexure -I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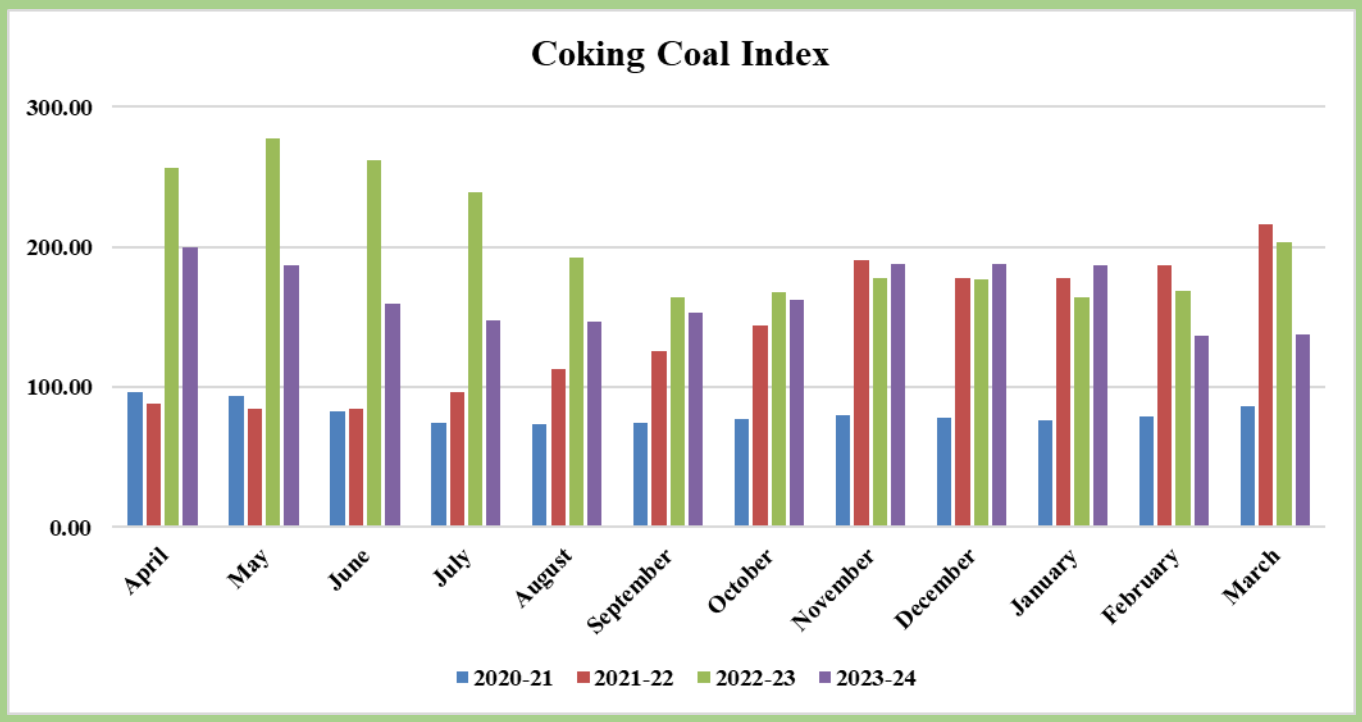
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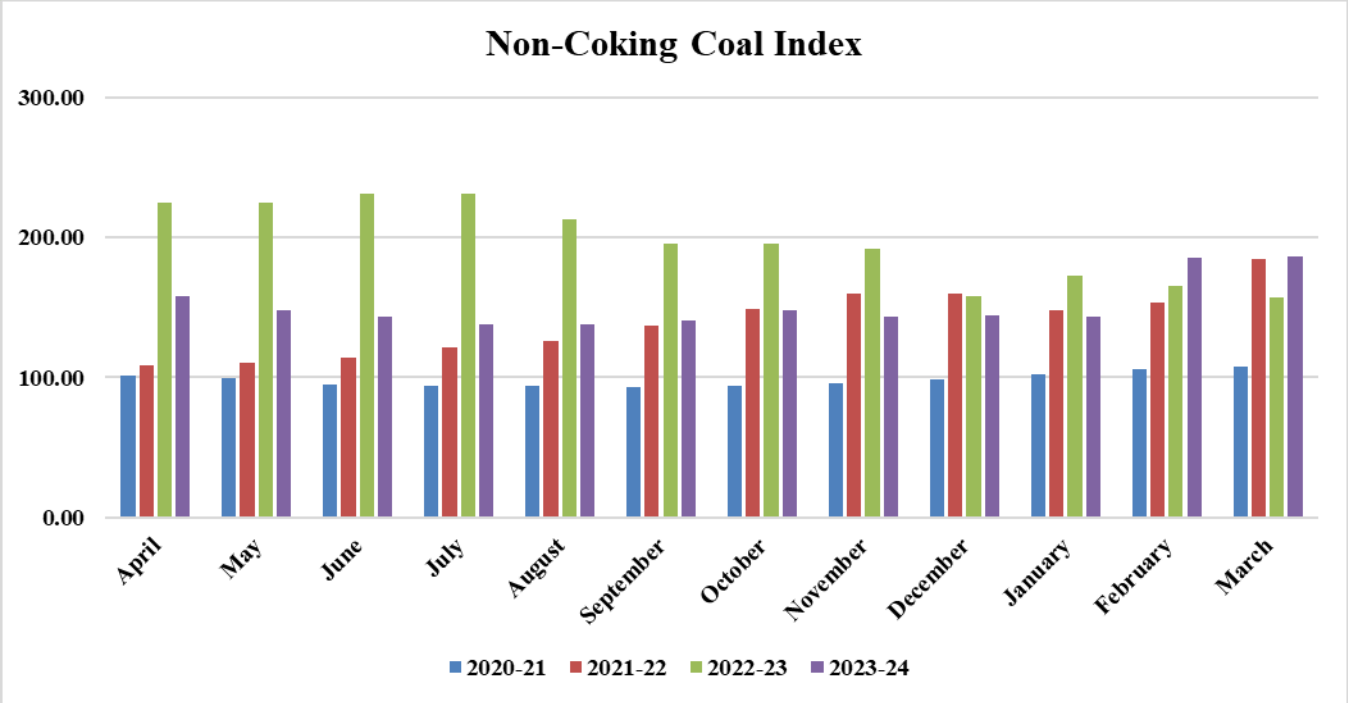
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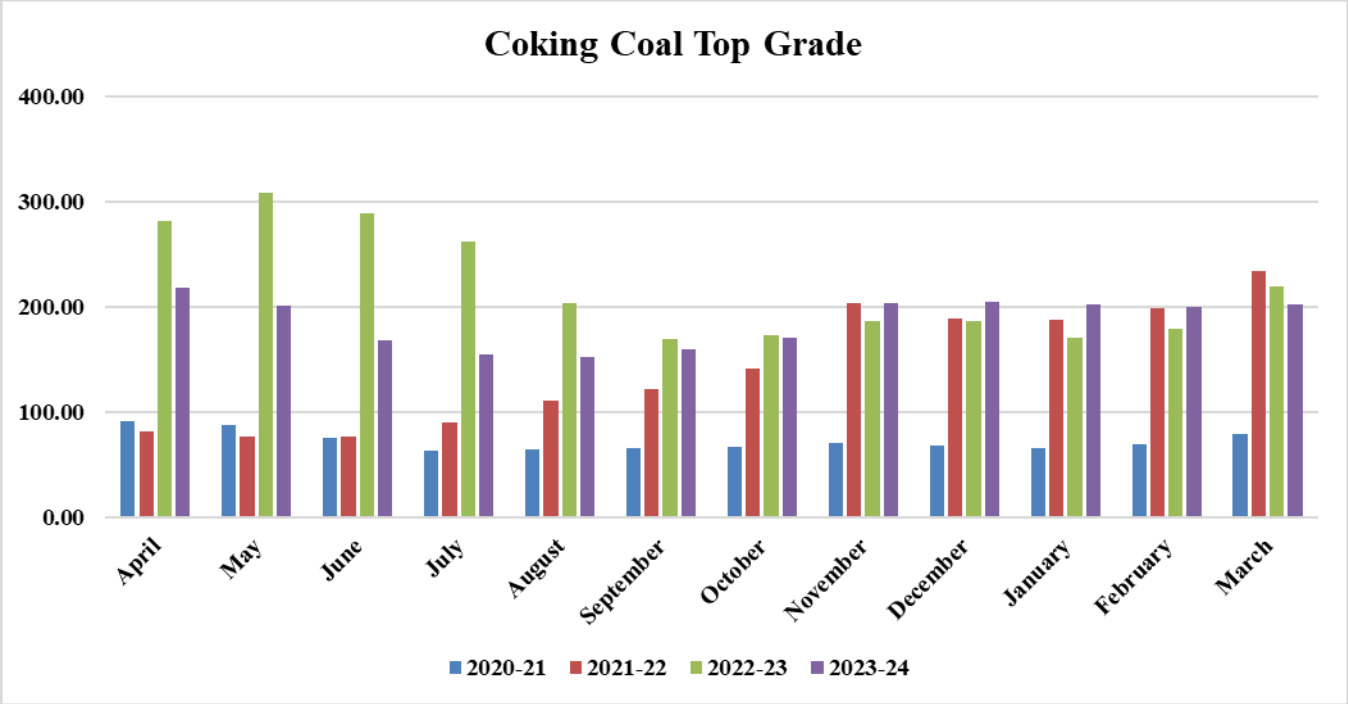
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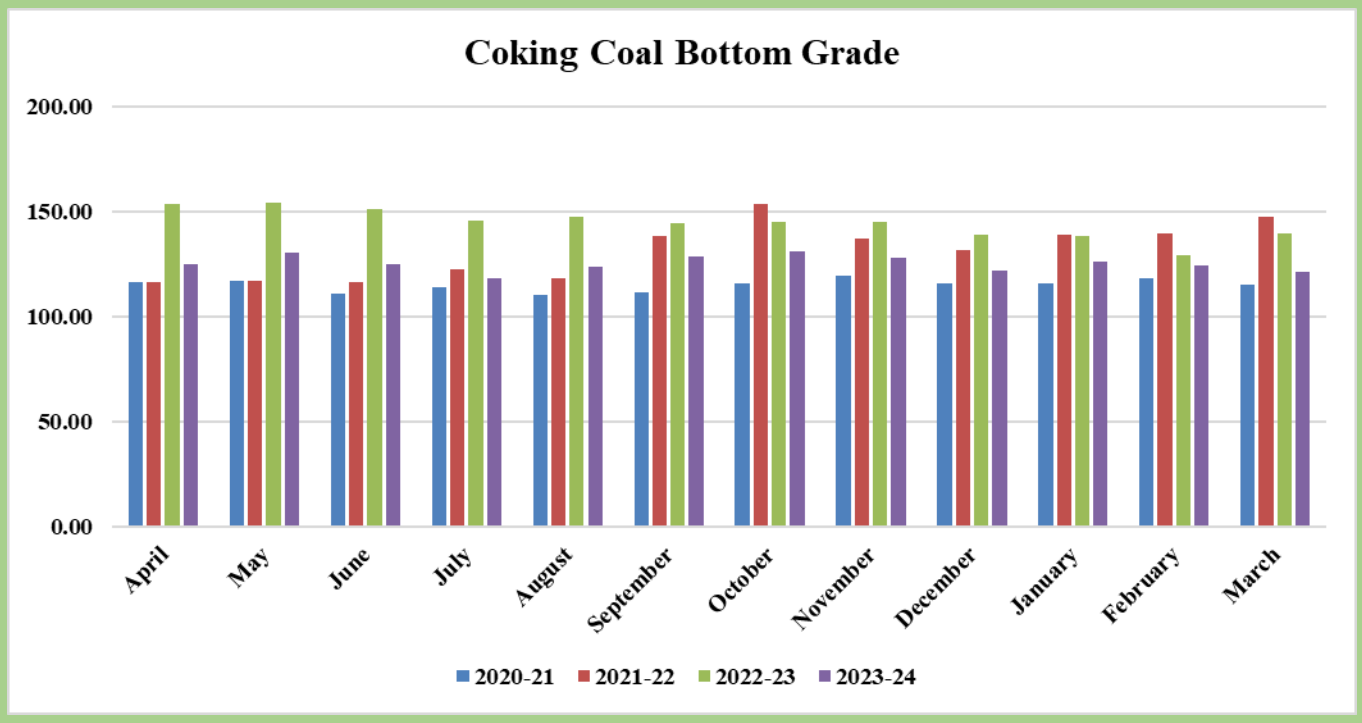
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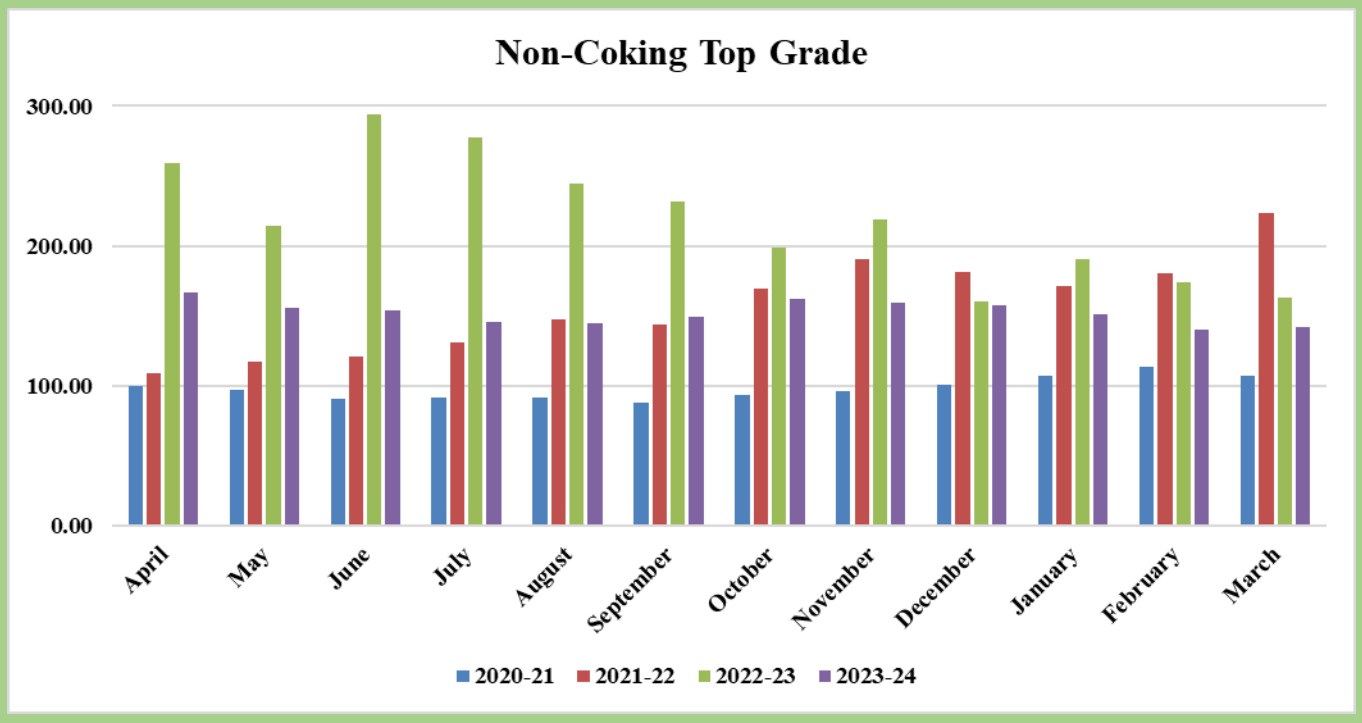
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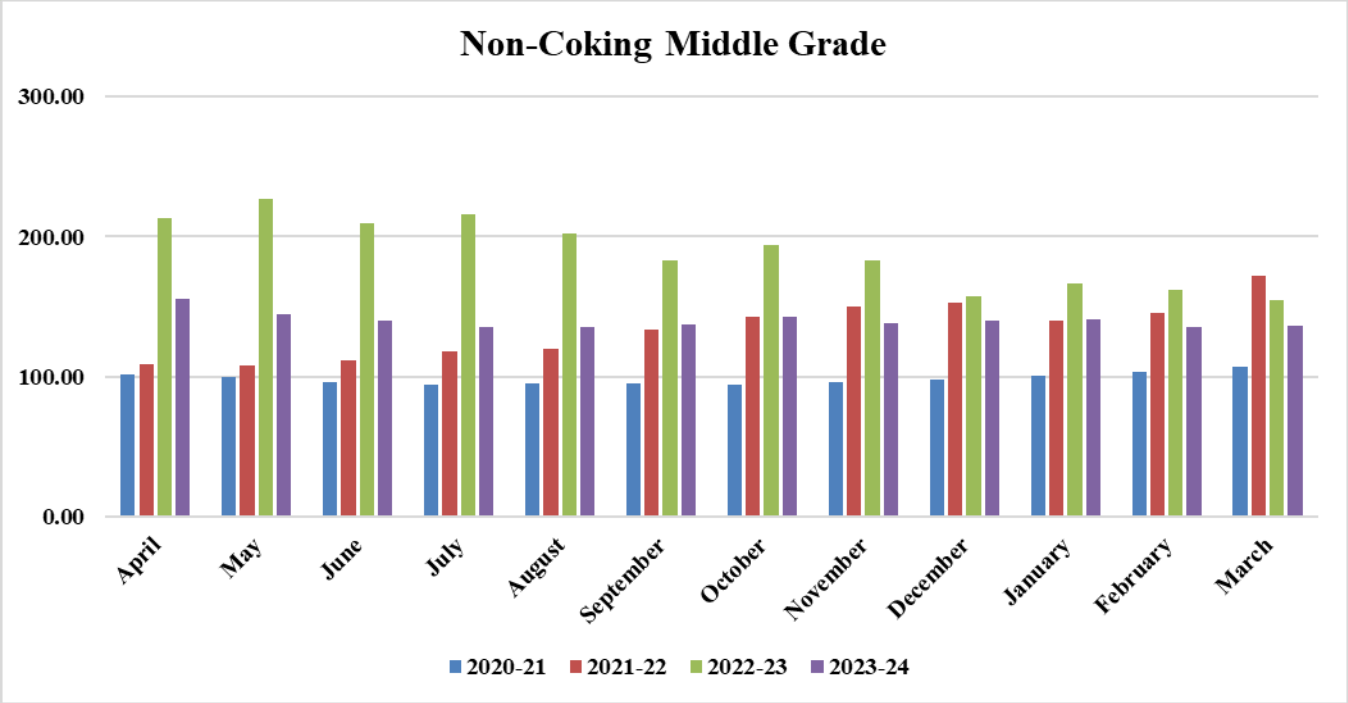
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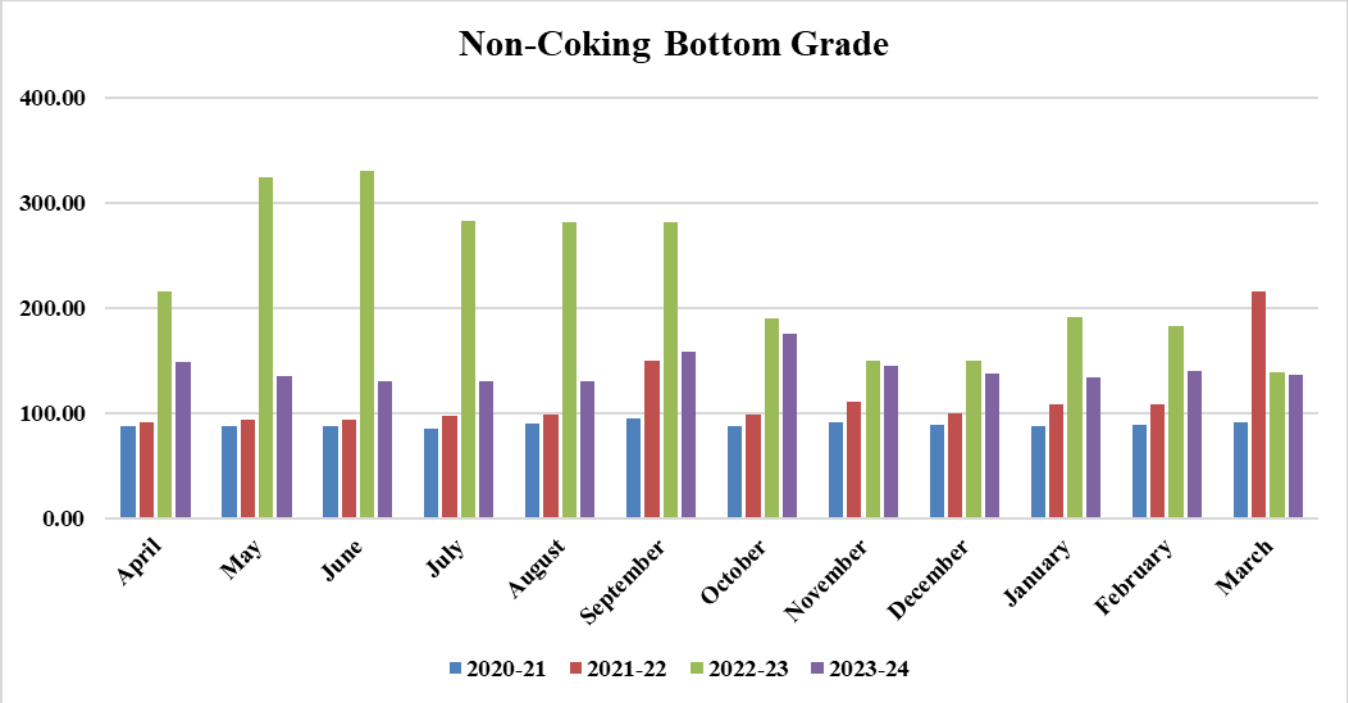
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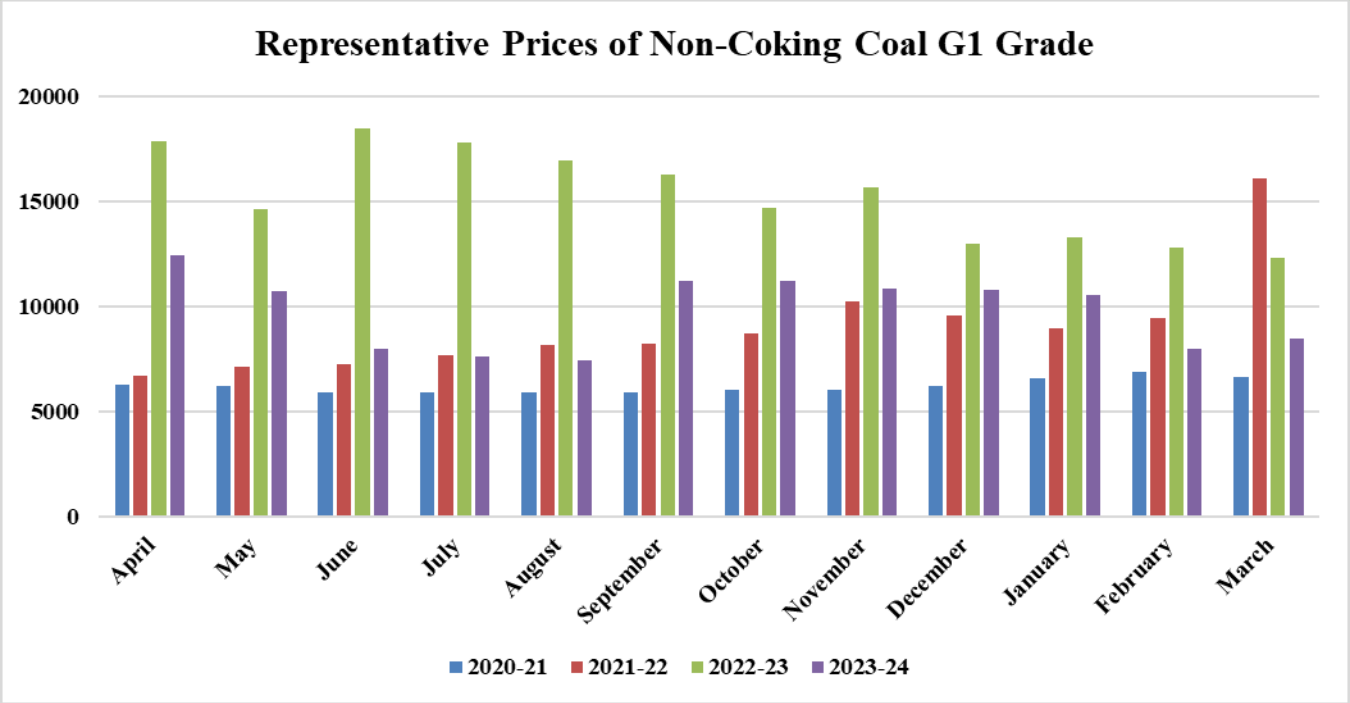
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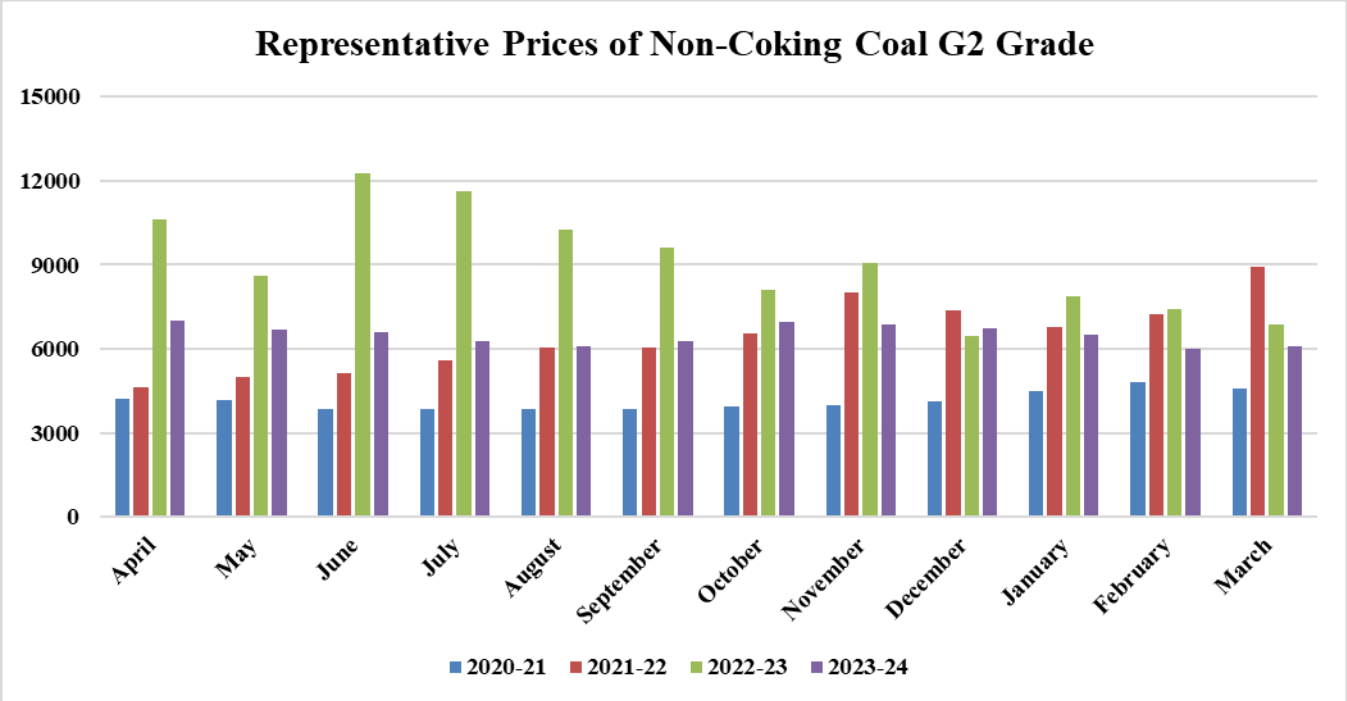
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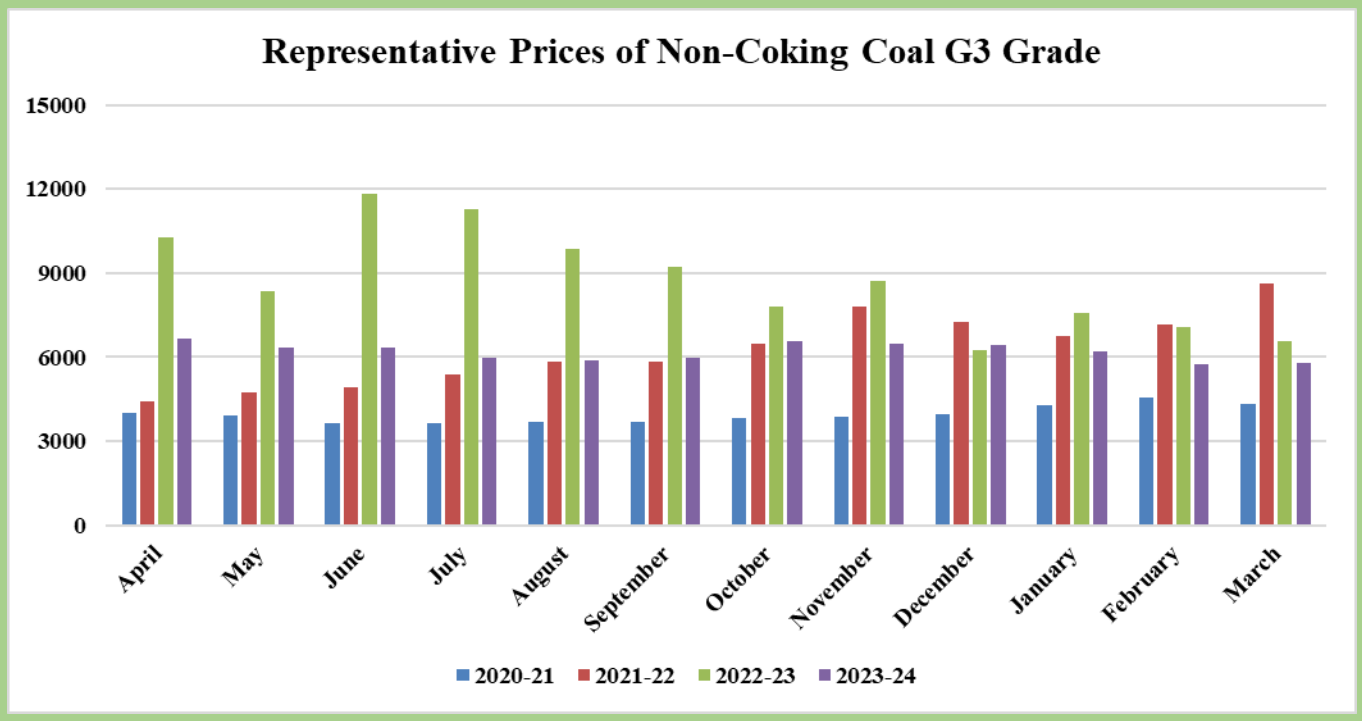
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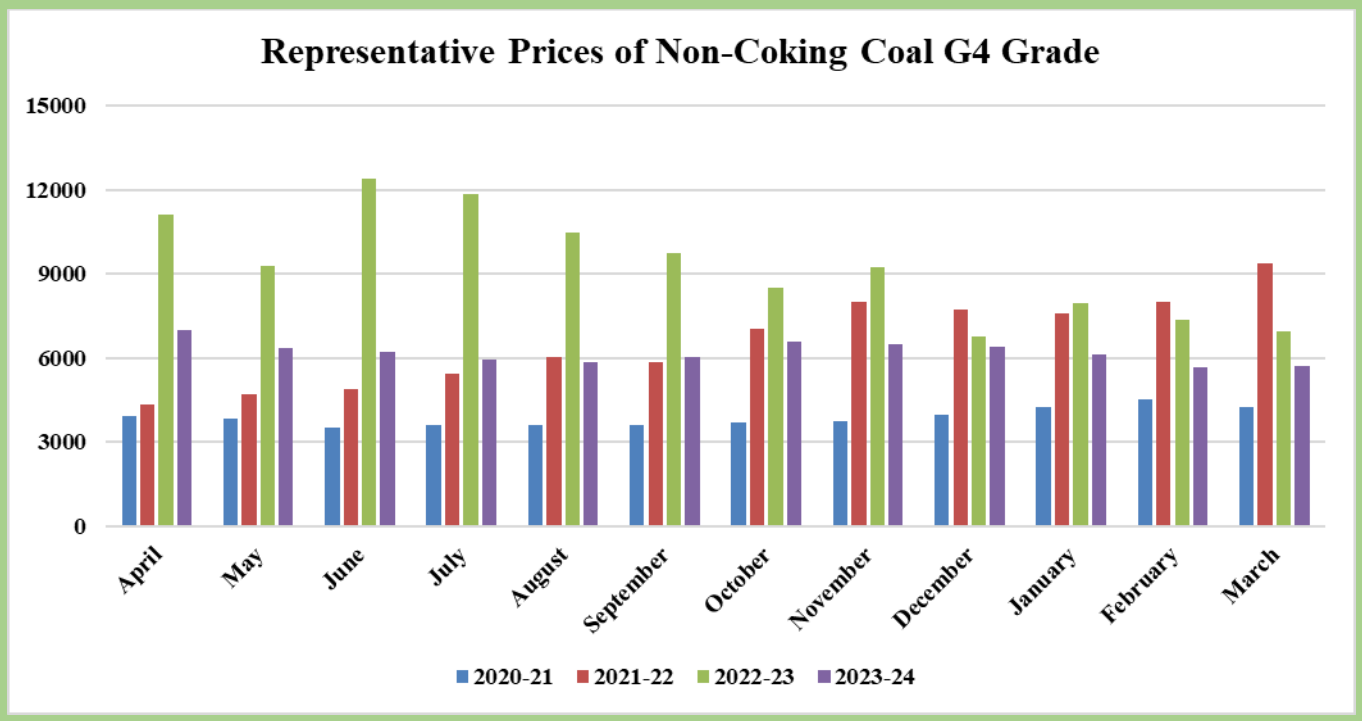
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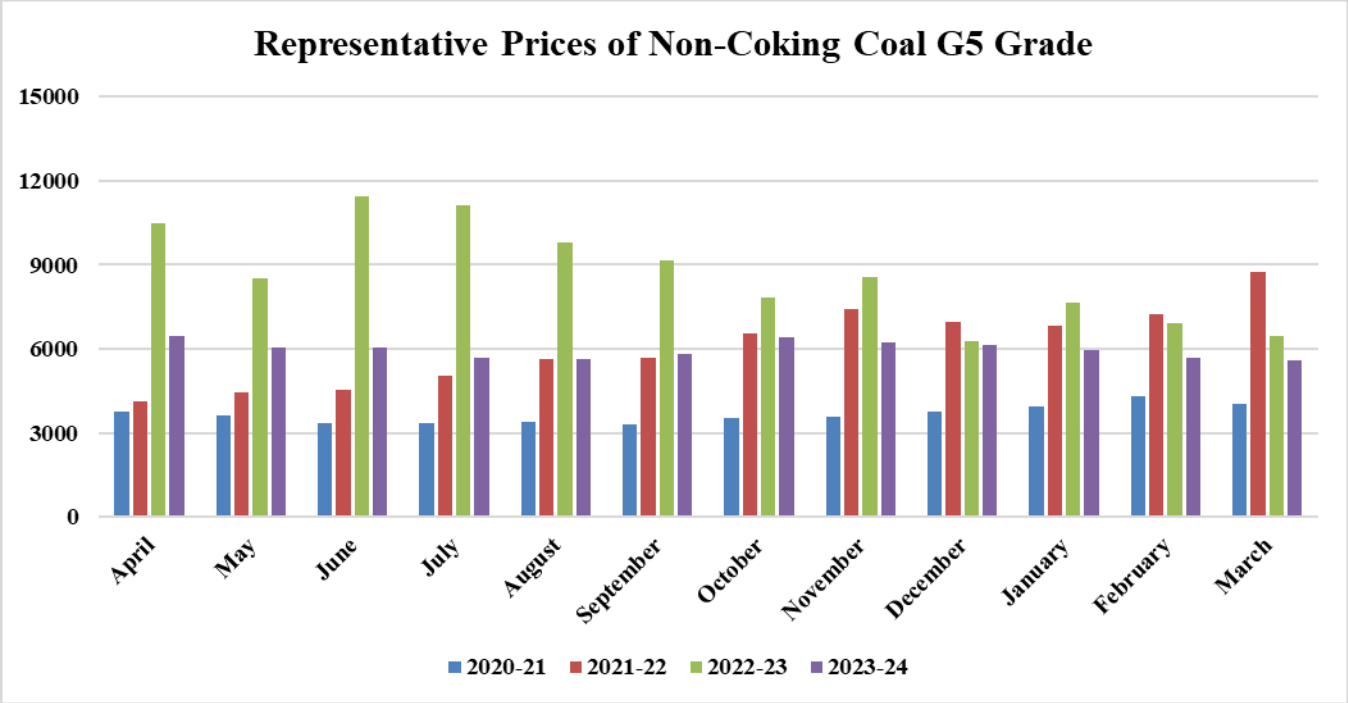
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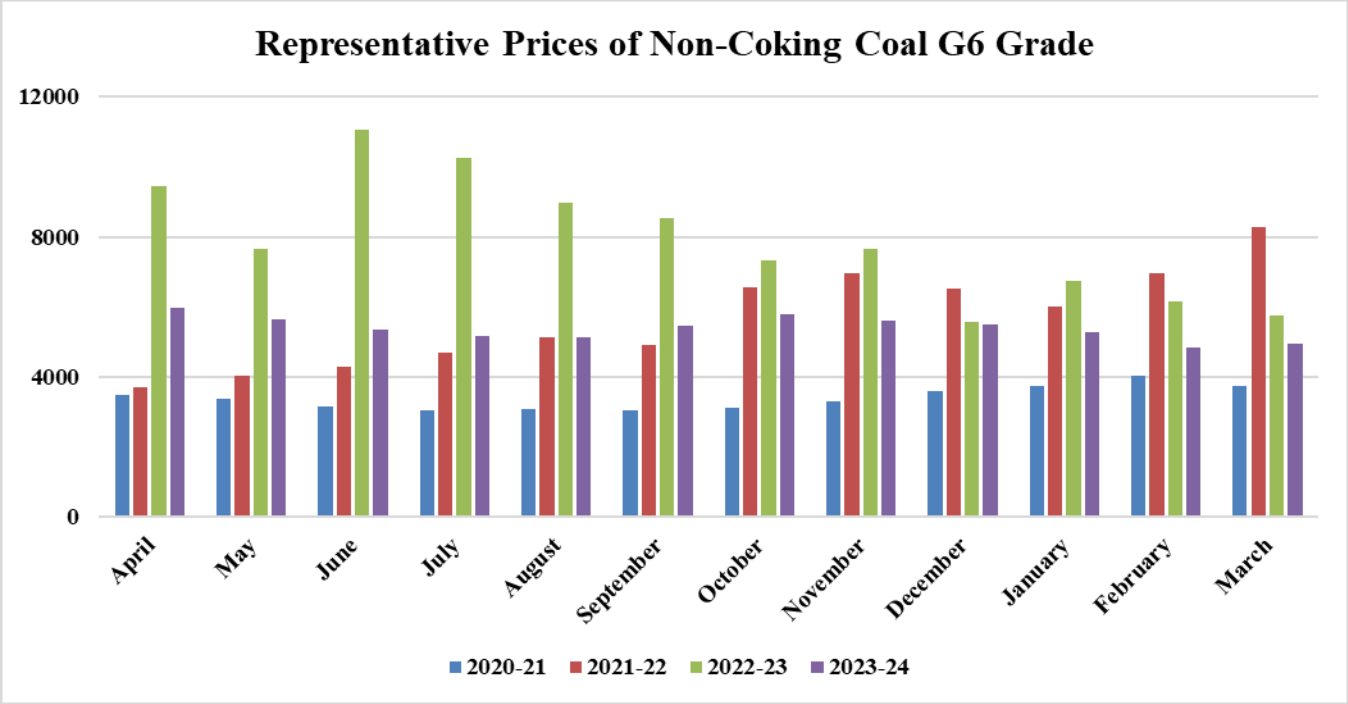
Representative Prices of Non-Coking Coal G6 Grade
12000
8000
4000
0
April
May
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July
August
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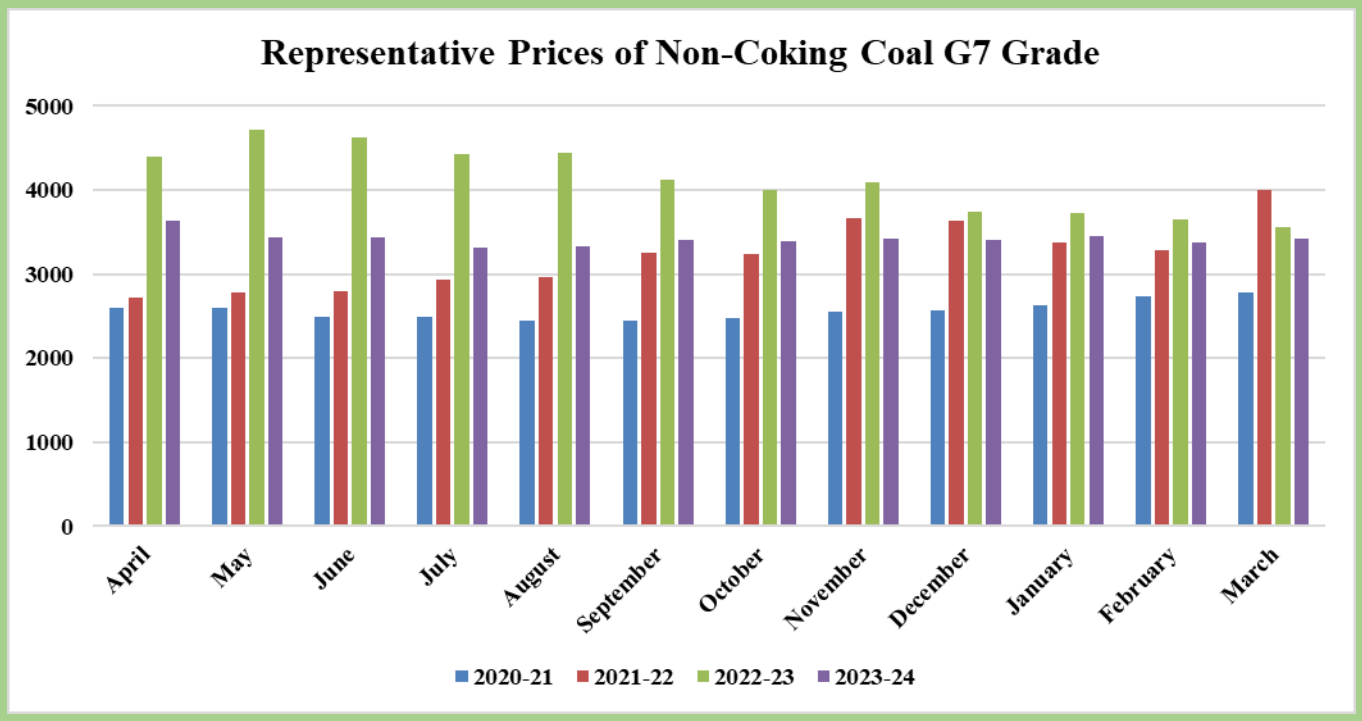
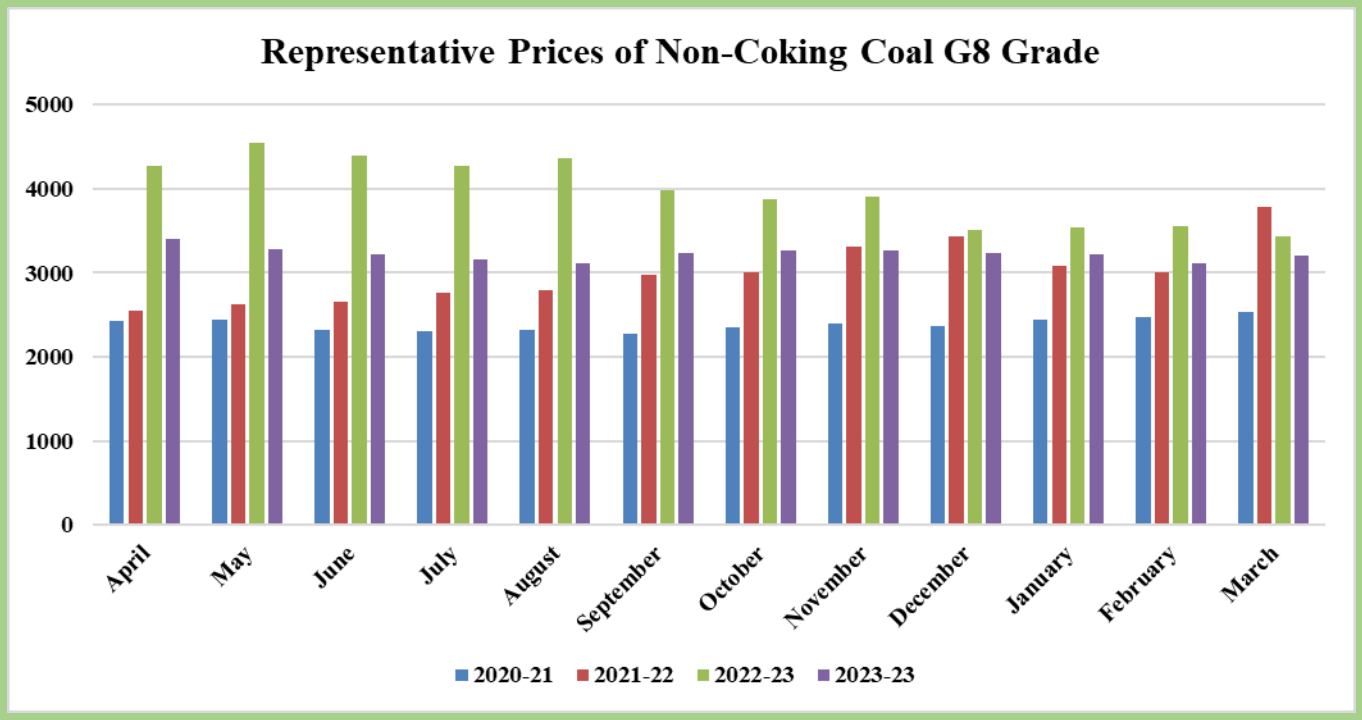
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G7 Grade
5000
4000
3000
2000
1000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G8 Grade
5000
4000
3000
2000
1000
0
April
May
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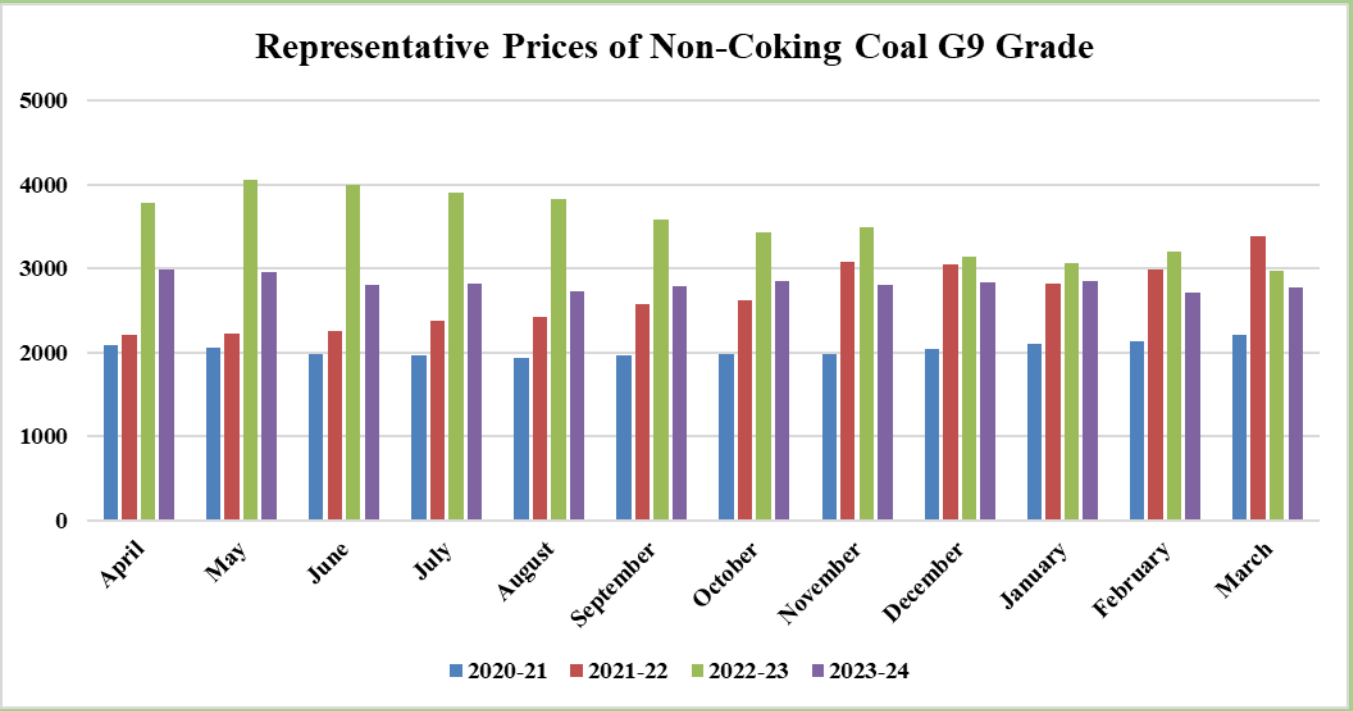
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-23


Representative Prices of Non-Coking Coal G9 Grade
5000
4000
3000
2000
1000
0
April
May
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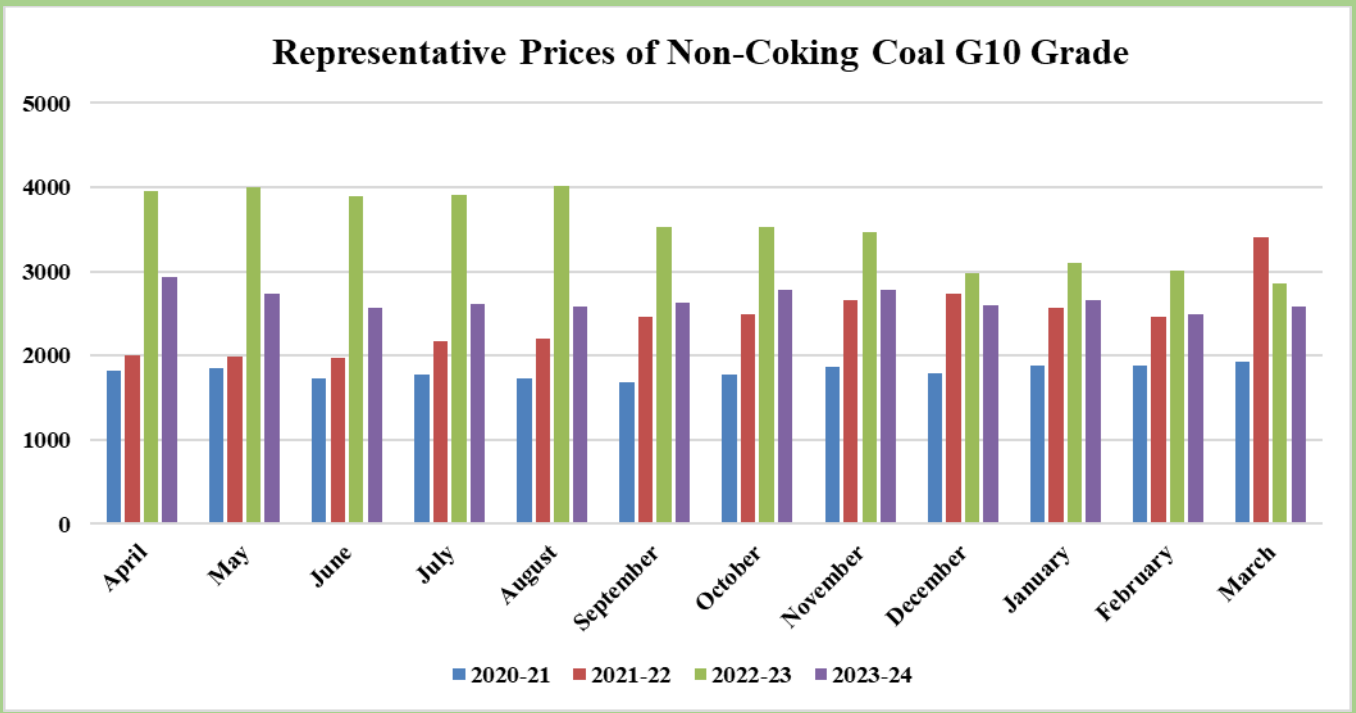
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G10 Grade
5000
4000
3000
2000
1000
0
April
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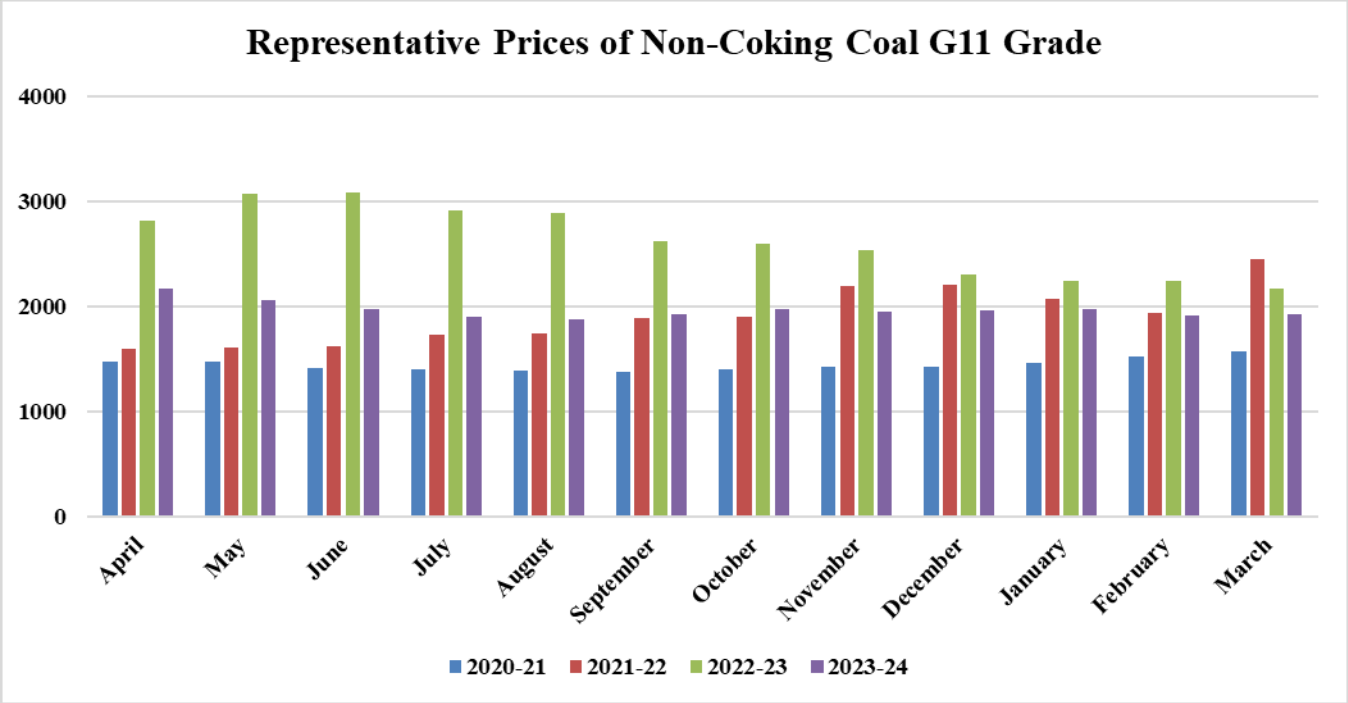
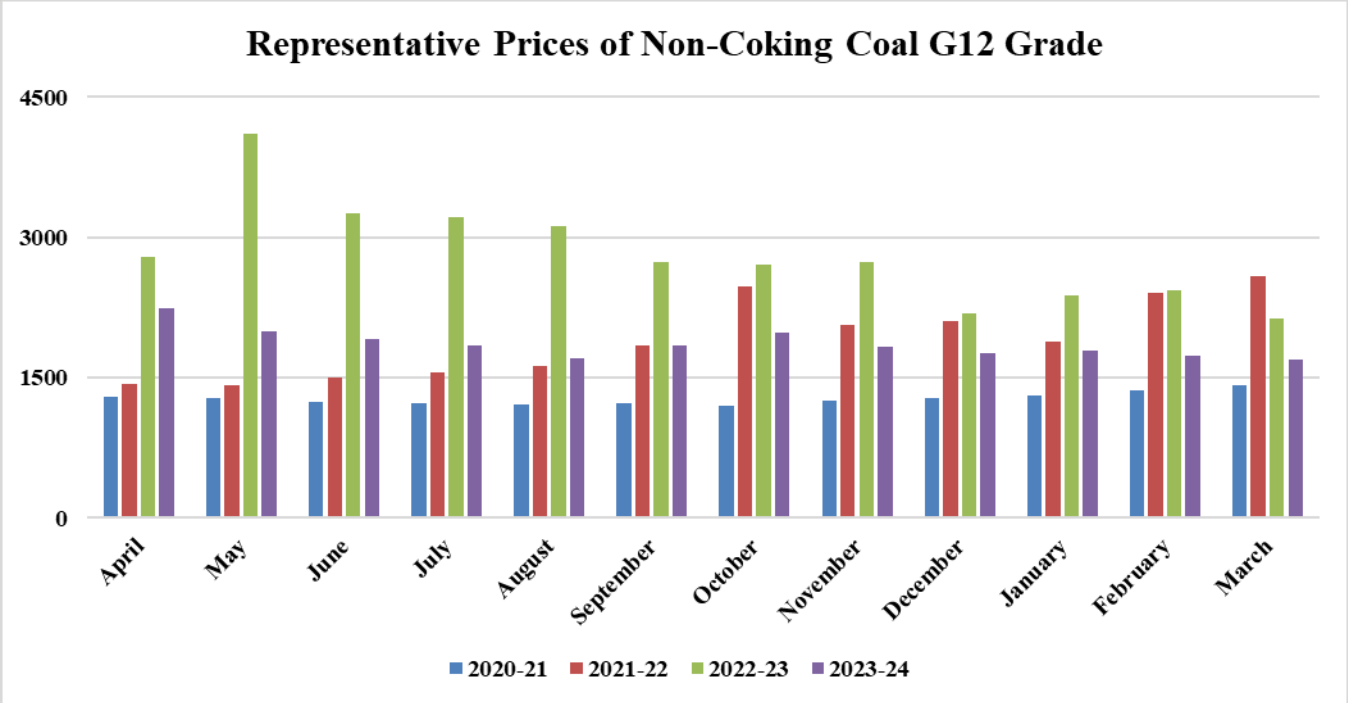
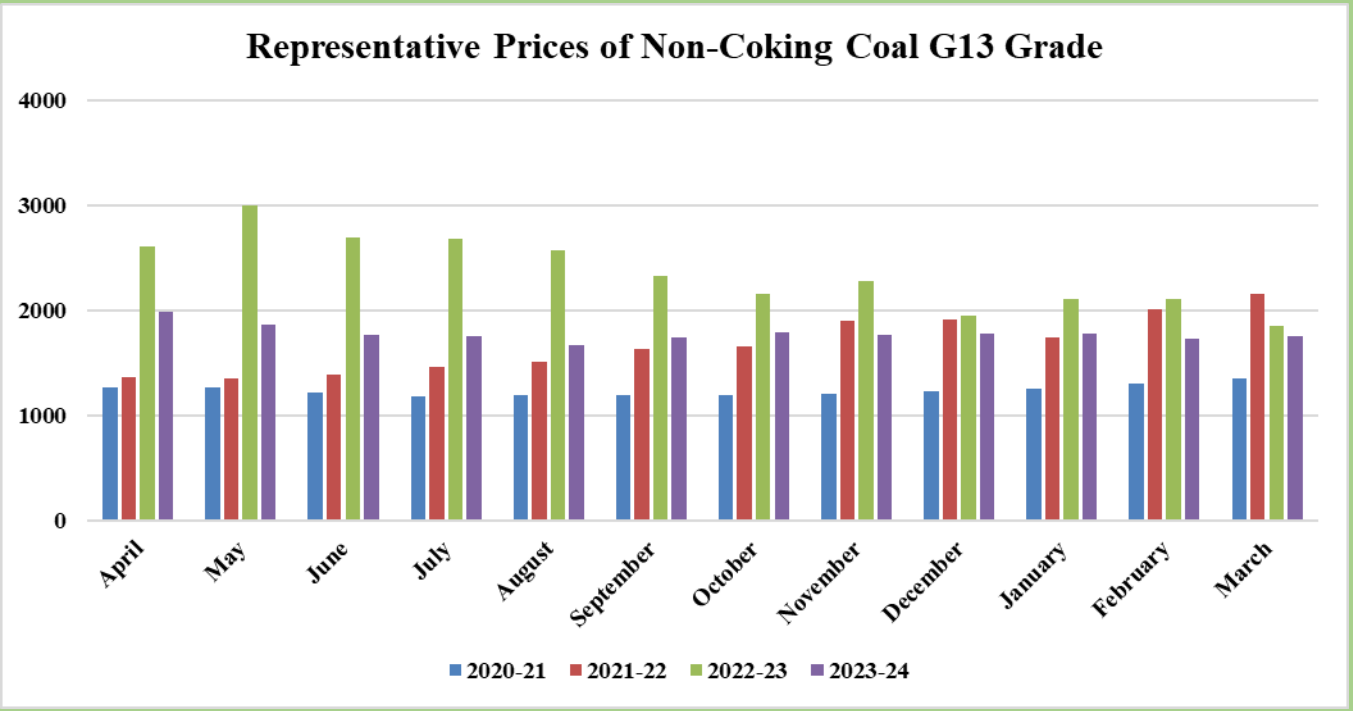
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G11 Grade
4000
3000
2000
1000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G12 Grade
4500
3000
1500
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of Non-Coking Coal G13 Grade
4000
3000
2000
1000
0
April
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August
September
October
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December
January
February
March
2020-21
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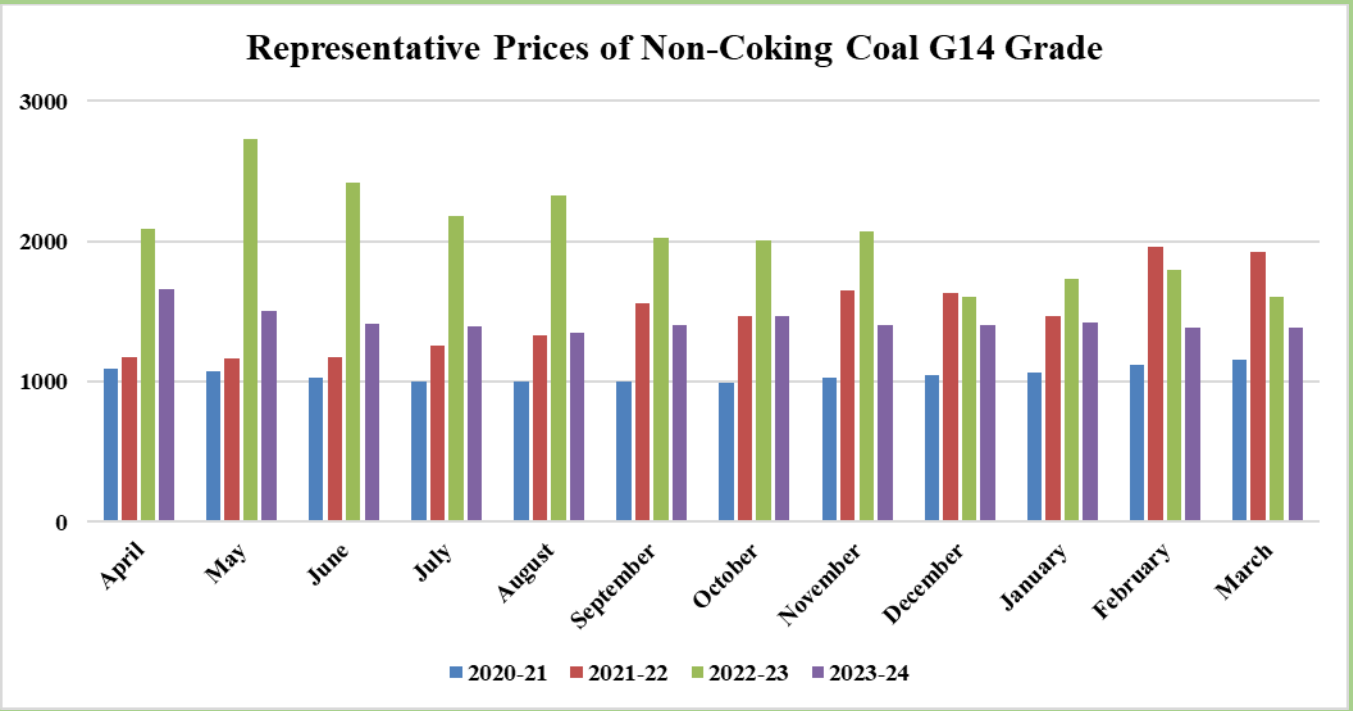
2022-23
2023-24


Representative Prices of Non-Coking Coal G14 Grade
3000
2000
1000
0
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January
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March
2020-21
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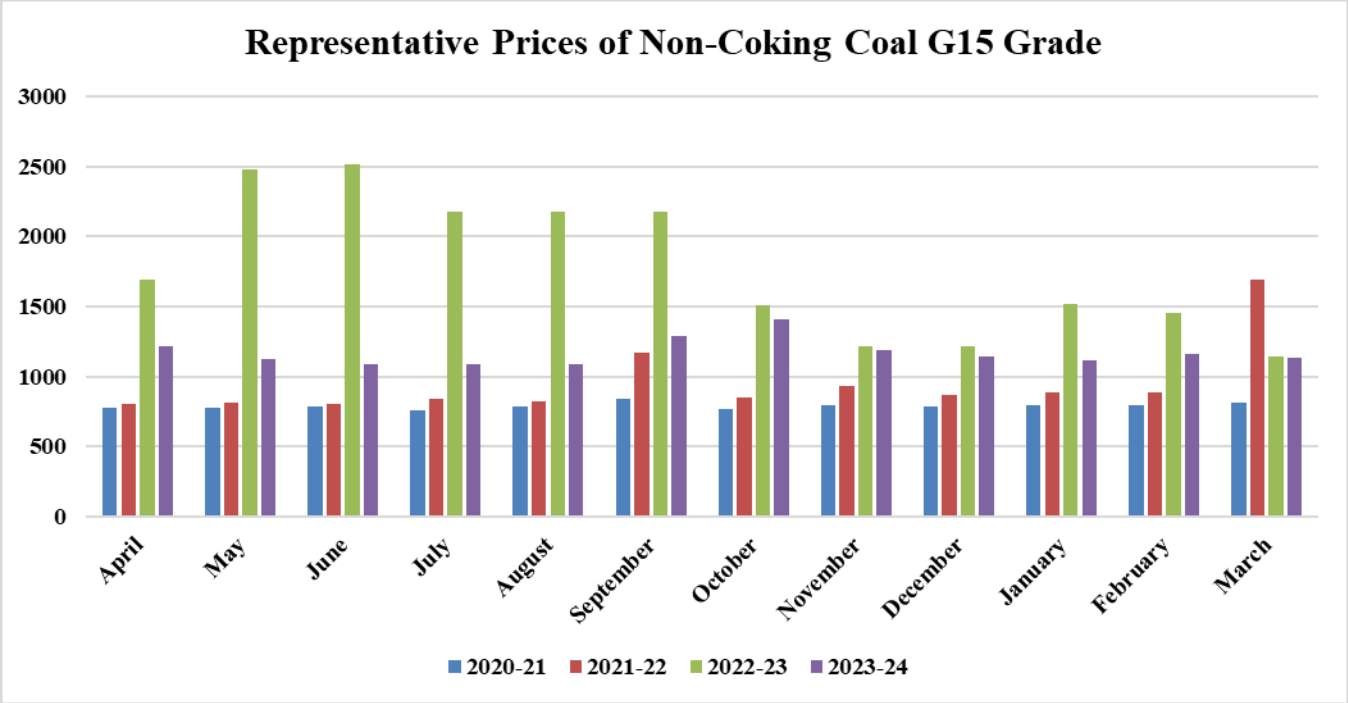
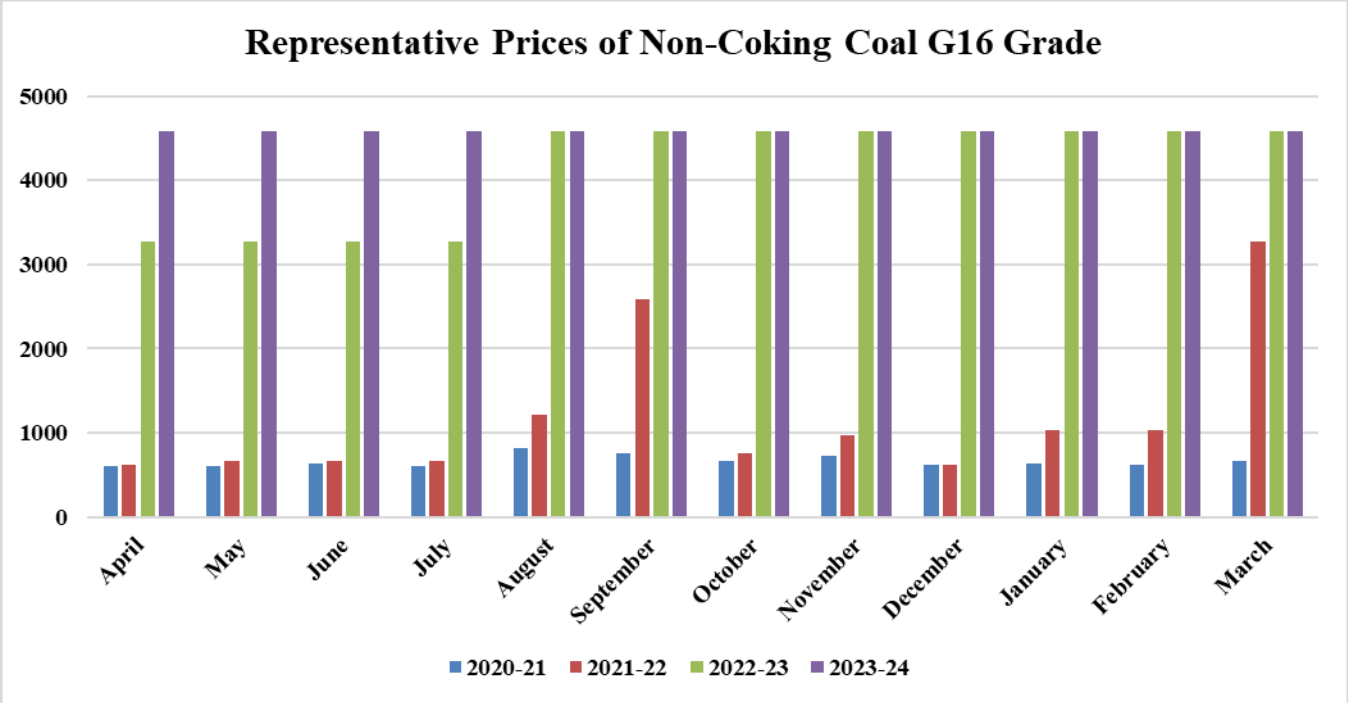
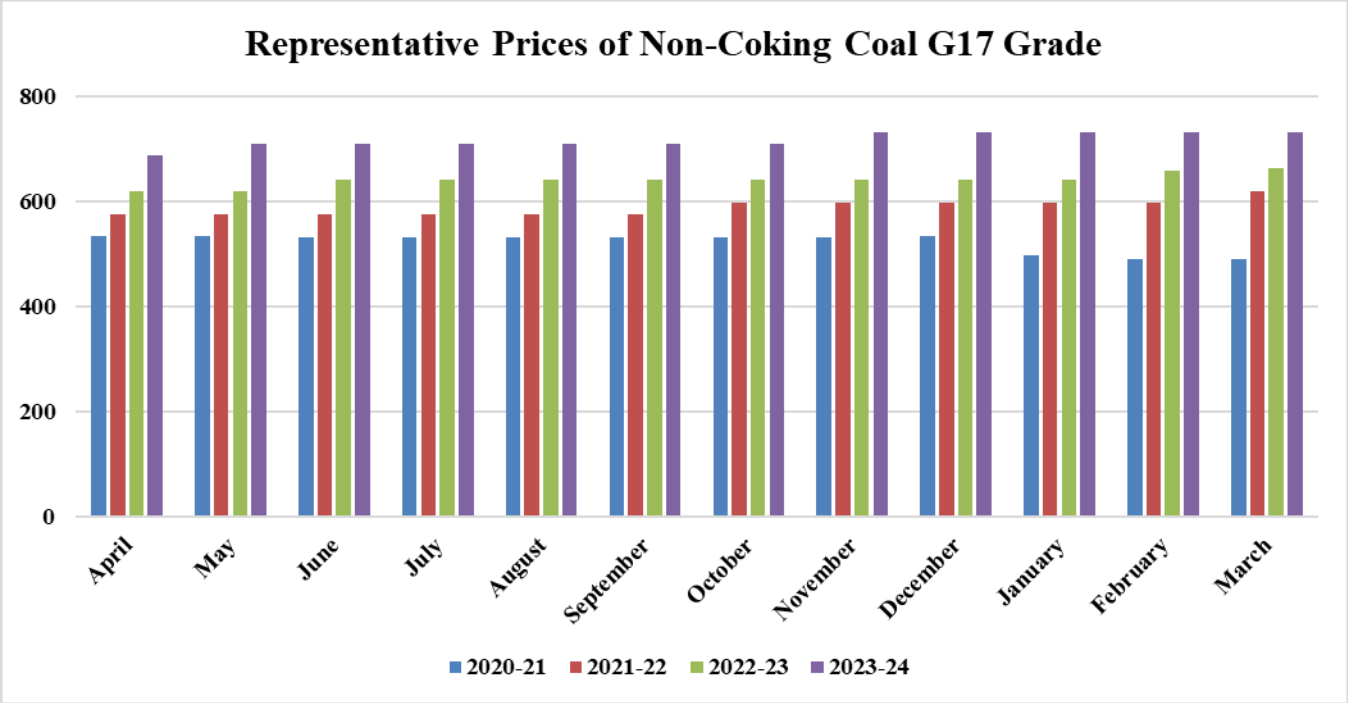
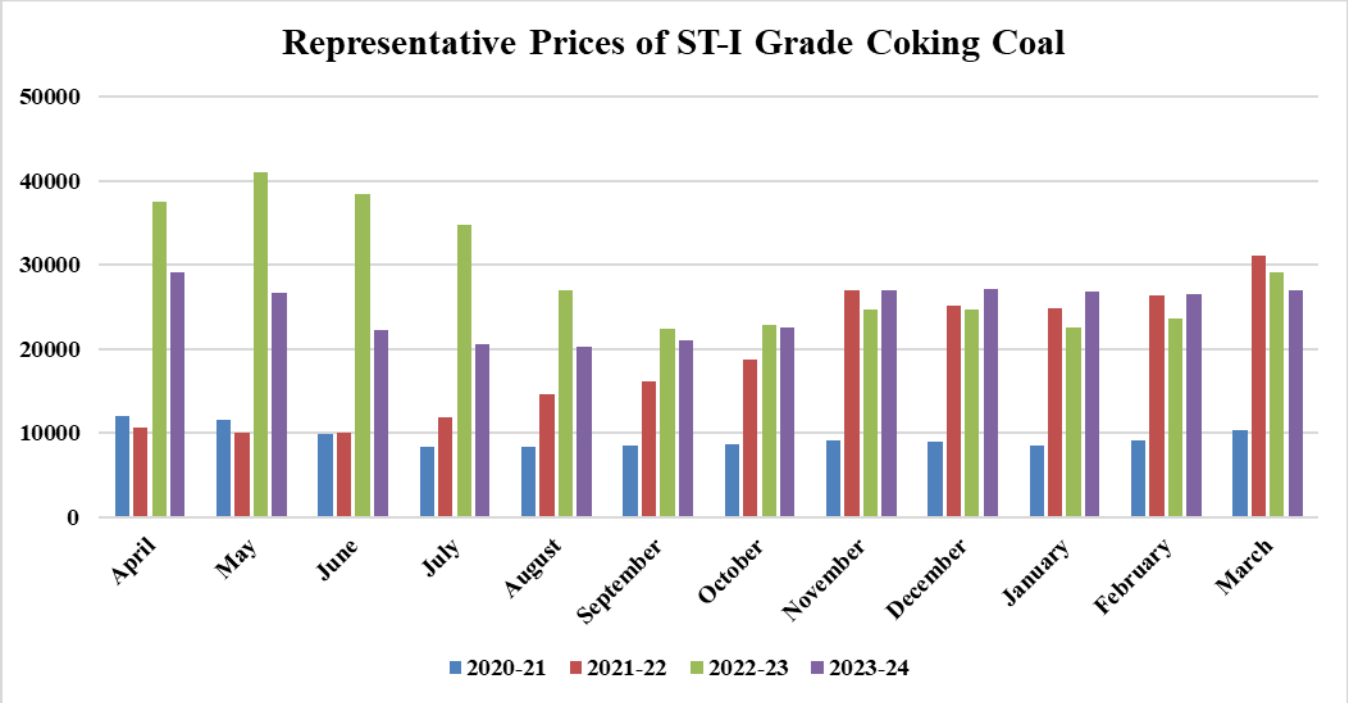
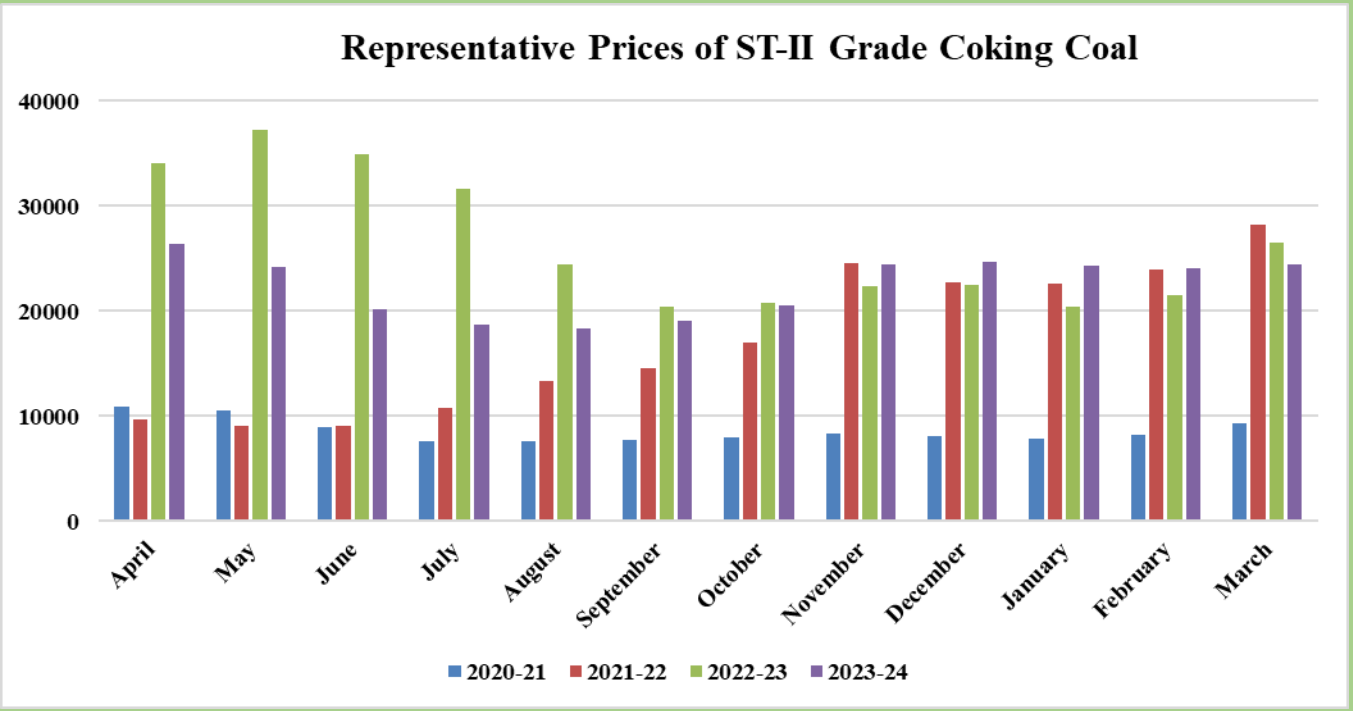
2022-23
2023-24

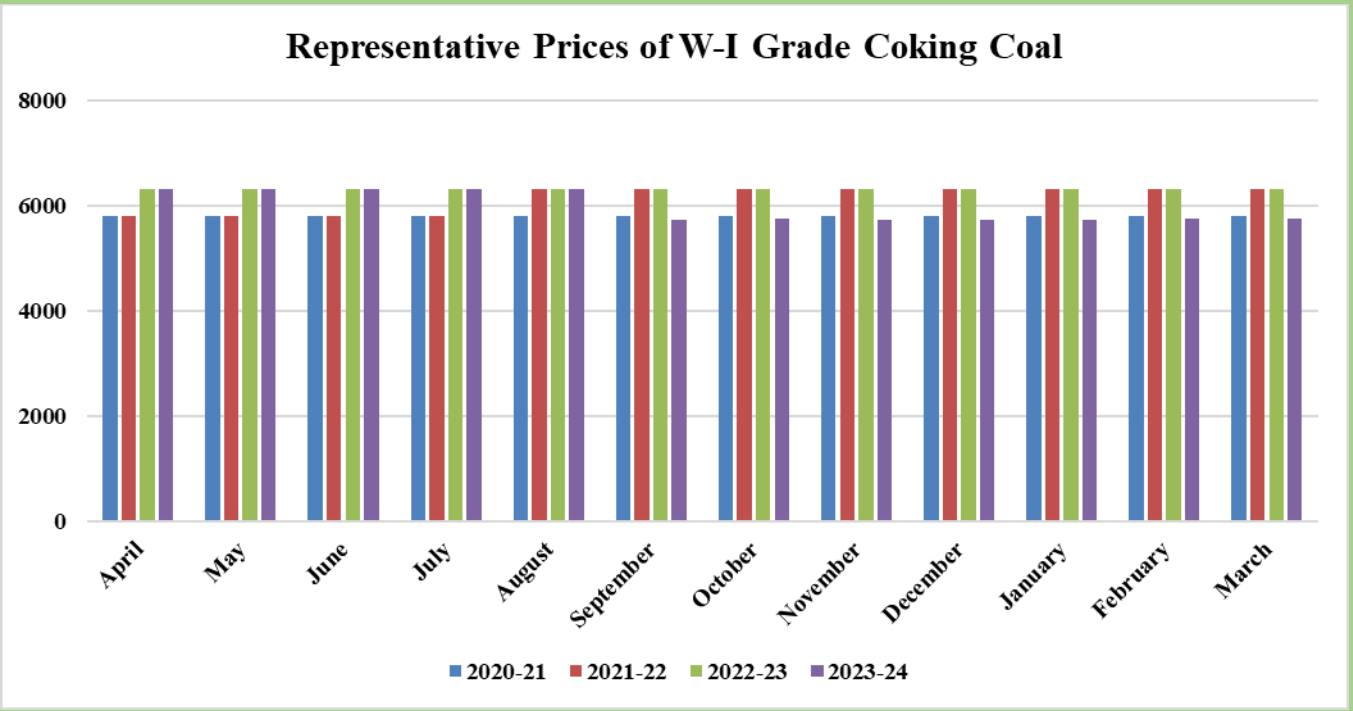

Representative Prices of Non-Coking Coal G15 Grade
3000
2500
2000
1500
1000
500
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24

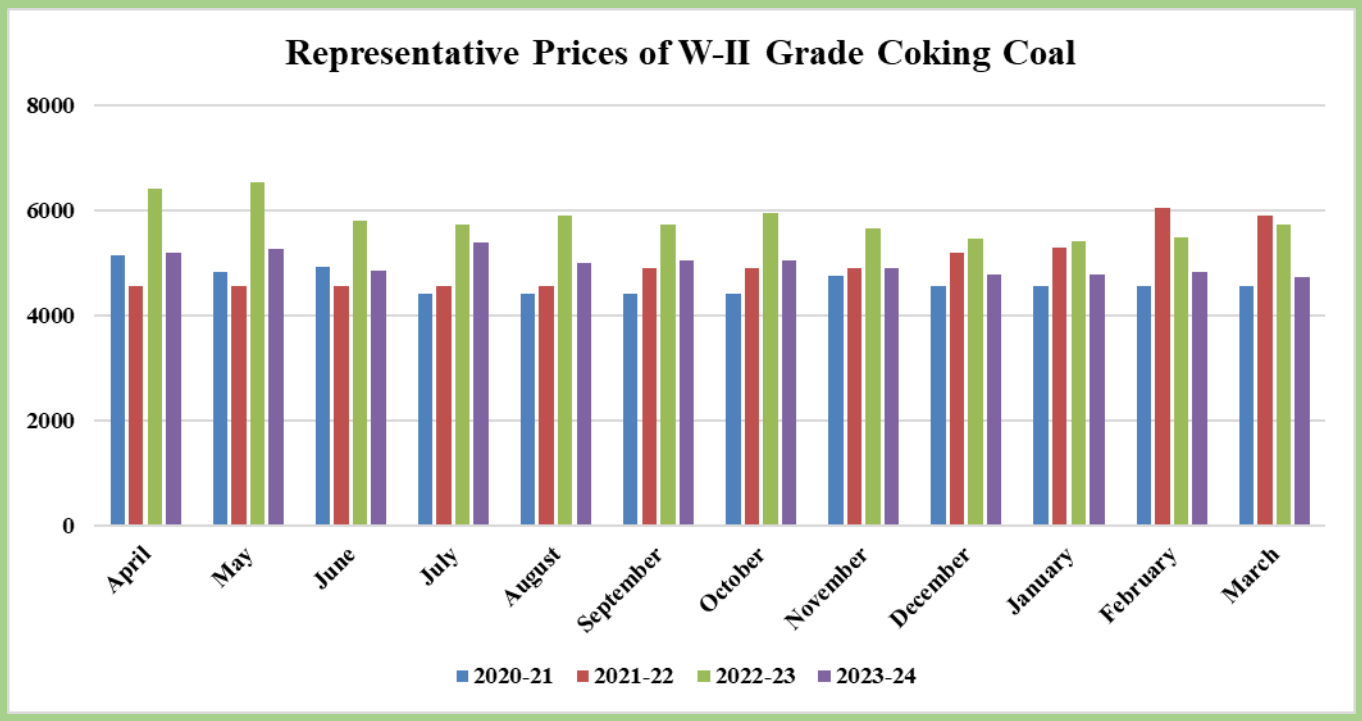

Representative Prices of Non-Coking Coal G16 Grade
5000
4000
3000
2000
1000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24

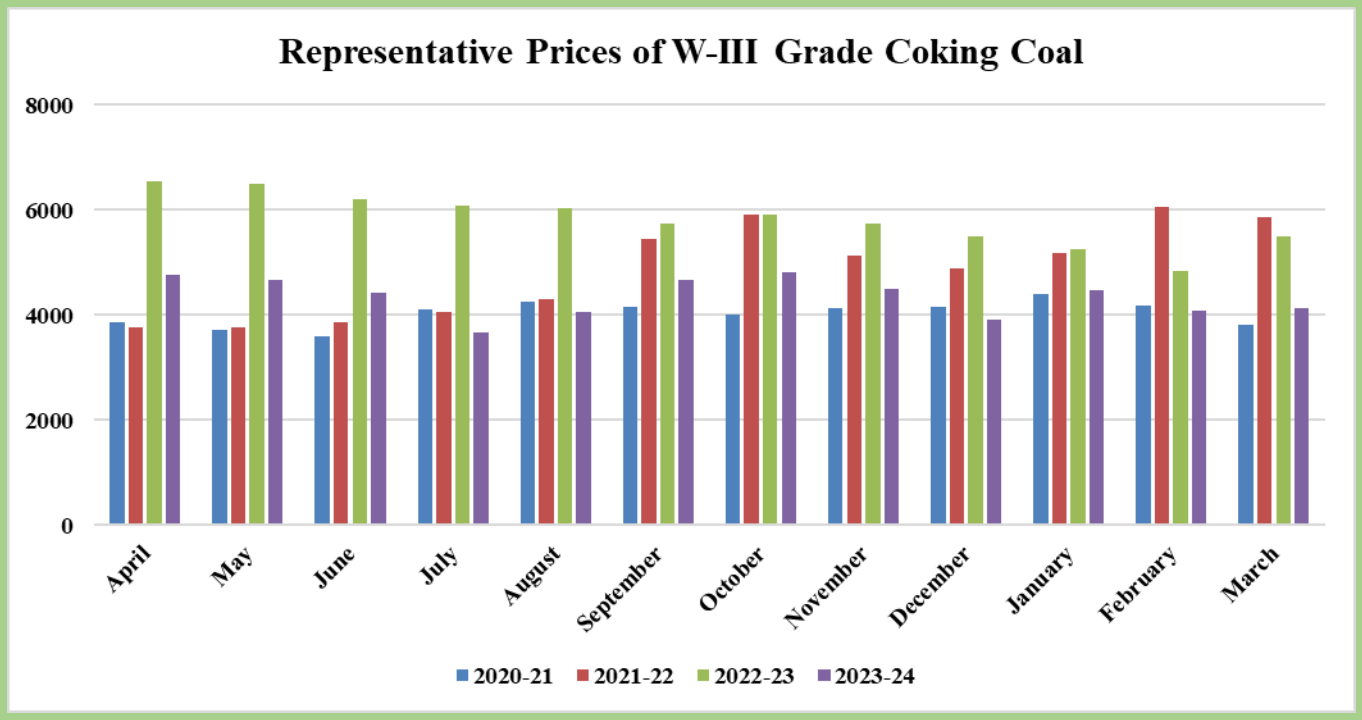

Representative Prices of Non-Coking Coal G17 Grade
800
600
400
200
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24

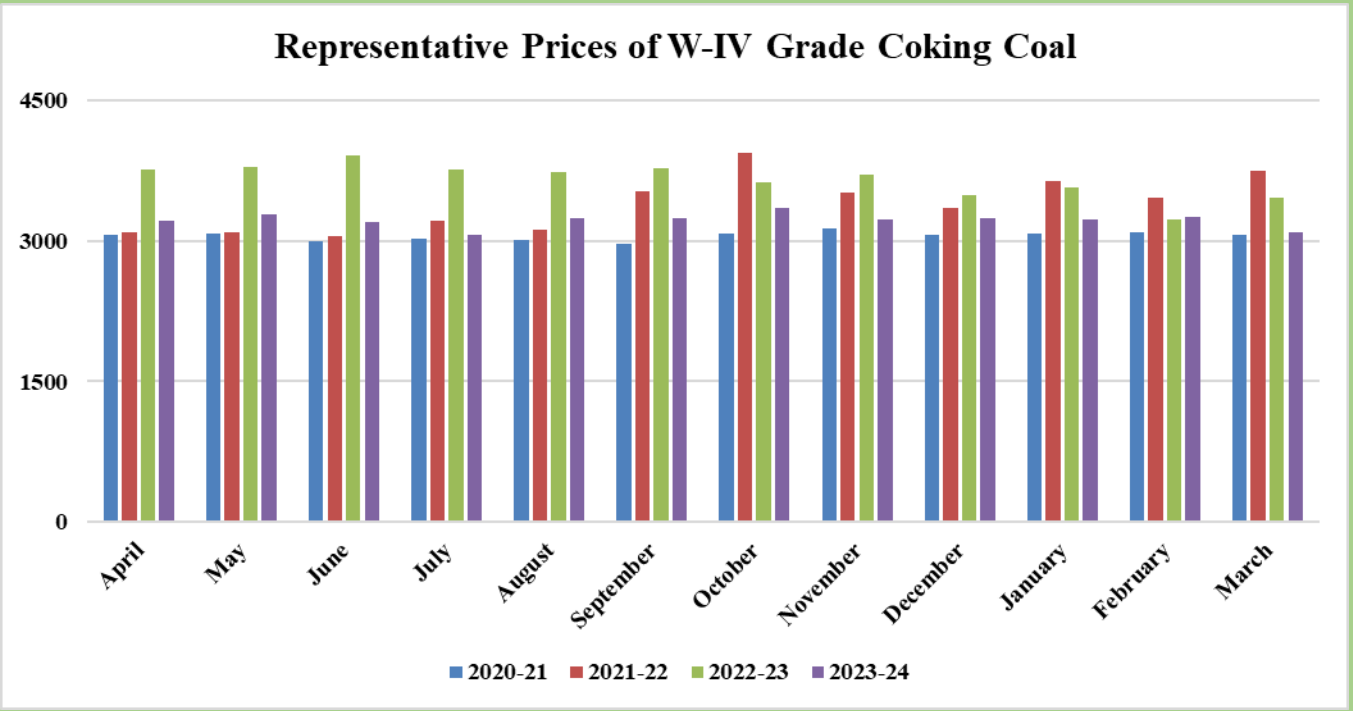

Representative Prices of ST-I Grade Coking Coal
50000
40000
30000
20000
10000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of ST-II Grade Coking Coal
40000
30000
20000
10000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of W-I Grade Coking Coal
8000
6000
4000
2000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of W-II Grade Coking Coal
8000
6000
4000
2000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of W-III Grade Coking Coal
8000
6000
4000
2000
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24


Representative Prices of W-IV Grade Coking Coal
4500
3000
1500
0
April
May
June
July
August
September
October
November
December
January
February
March
2020-21
2021-22
2022-23
2023-24