FIPI

Federation of Indian Petroleum Industry

POLICY & ECONOMIC REPORT

OIL & GAS MARKET

October 2022

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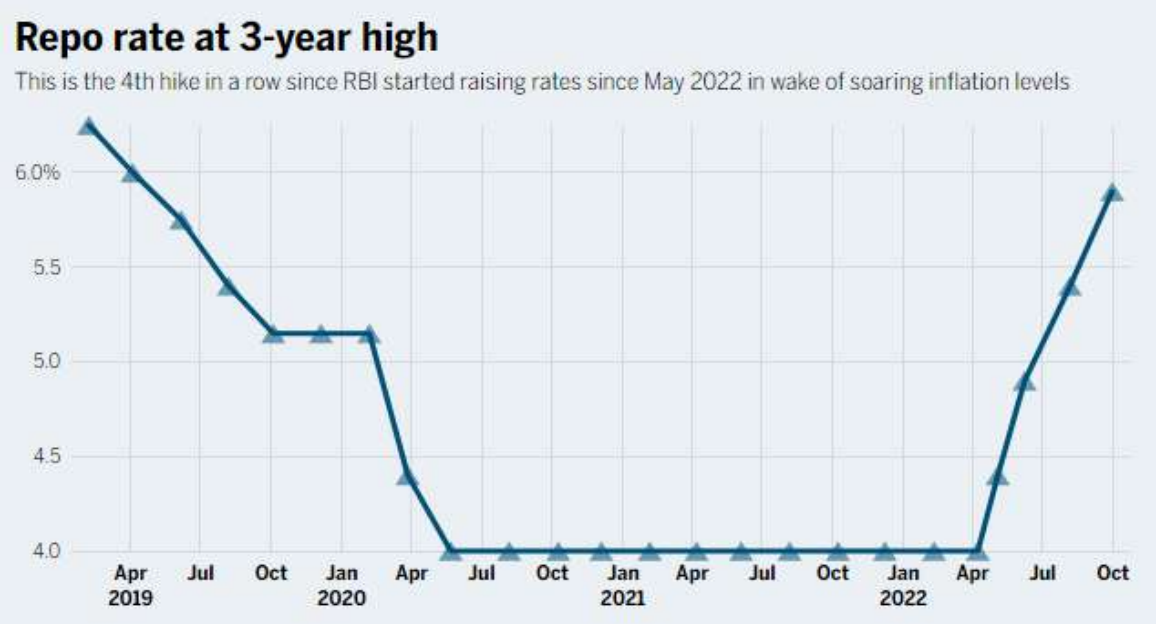
Executive Summary

According to IMF's World Economic Outlook published in October 2022, global growth is forecasted to slow from 6.0 % in 2021 to 3.2 % in 2022 and 2.7 % in 2023. The cost-of-living crisis led by rising food and fuel prices, tightening financial conditions in most regions, and Russia-Ukraine crisis, weigh a heavy impact on the global outlook.

The Reserve Bank of India (RBI) revised its economic growth estimate for fiscal year 2023 to 7% from 7.2% forecast earlier. India's central bank has lowered its growth estimates on risks emanating from geopolitical tensions, monetary policy tightening across nations and elevated inflation. Real GDP growth in the first quarter of the current fiscal was 13.5%. For Q2 of FY23, RBI has projected GDP at 6.3%, for Q3 it is 4.6% and 7.2% for Q1 of FY24. According to RBI, an improvement in capacity utilisation, buoyant bank credit expansion and government's continued thrust on capital expenditure are the main factors that support GDP growth.

India's retail inflation rose to a five-month high of 7.30% in September due to surging food prices, staying well above the Reserve Bank of India's (RBI) upper tolerance band for a ninth month. RBI retains inflation projection for FY23 at 6.7% amid global geopolitical concerns. RBI projected retail inflation at 6.5% for third quarter and 5.8% for the March 2022-23 quarter.



Source- RBI

RBI has taken slew measures to curb the rising inflation in the country. Increase the policy repo rate under the liquidity adjustment facility (LAF) by 50 basis points to 5.90 %. Consequently, the standing deposit facility (SDF) rate stands adjusted to 5.65 % and the marginal standing facility (MSF) rate and the Bank Rate to 6.15 %.

The CMIE data for October suggest that the quantum of employment has deteriorated, as the unemployment rate has risen to 7.95% in the month of October 2022 with urban unemployment rate at 7.48 % and the rural unemployment rate is 8.18 % in October 2022.

Indian Rupee has depreciated significantly against US dollar. US retail inflation for September remained high at 8.2 %. Quantitative tightening and rate hikes by the US Fed to contain this record high inflation has raised interest rates which has further attracted capital to the US and in turn has resulted in a strong US dollar. On September 21, the US Federal Reserve hiked its policy rate by 75 basis points (bps). The rate hike led to FII outflows from India.

Disruptive market forces are multiplying as the world struggles to navigate the worst global energy crisis in history. The OPEC+ bloc's plan to sharply curtail oil supplies to the market has derailed the growth trajectory of oil supply through the remainder of this year and next, with the resulting higher price levels exacerbating market volatility and heightening energy security concerns.

The decision by OPEC+ to curtail oil supplies will certainly drive up the oil prices, as crude oil prices are controlled by supply and demand, a reduction in supply will have a noticeable effect. As the world consumes about 100 million barrels of oil per day, eliminating two million barrels per day will significantly impact oil prices at a time when inflation is soaring and consumers are dealing with interest rate hikes that are intended to slow down the economy.

Natural gas spot prices at the U.S. Henry Hub benchmark averaged $7.88 per million British thermal units (MMBtu) in September 2022. As the heating season approaches, prices are expected to remain high over the remainder of 2022 on the back of strengthening demand for natural gas from the residential and commercial users.

Economy in Focus

Global economic situation

According to IMF's World Economic Outlook published in October 2022, global growth is forecasted to slow from 6.0 % in 2021 to 3.2 % in 2022 and 2.7 % in 2023. The cost-of-living crisis led by rising food and fuel prices, tightening financial conditions in most regions, and Russia-Ukraine crisis, weigh a heavy impact on the global outlook.

- For advanced economies, growth is projected to slow from 5.2 % in 2021 to 2.4 % in 2022 and 1.1 % in 2023. The projected slowdown is concentrated in the US and European economies. Growth in the United States is projected to decline from 5.7 % in 2021 to 1.6 % in 2022 and 1.0 % in 2023. In the Euro area, projected growth is 3.1 % in 2022 and 0.5 % in 2023.

- Growth in the emerging market and developing economy group is expected to decline to 3.7 % in 2022 and remain there in 2023, in contrast to the slowdown in advanced economies. In emerging and developing Asia, growth is projected to decline from 7.2 % in 2021 to 4.4 % in 2022 before rising to 4.9 % in 2023.

Global Inflation

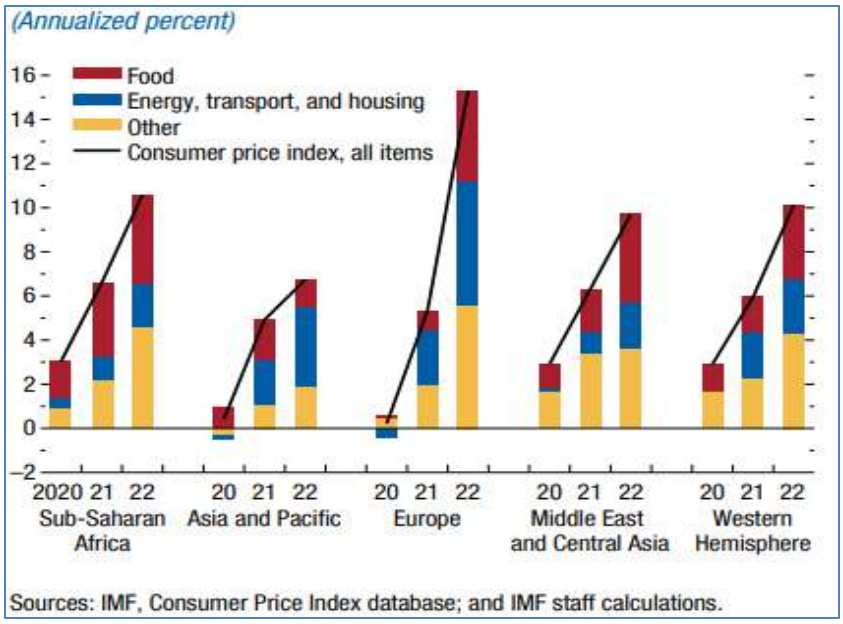
- Global inflation is forecast to rise from 4.7 % in 2021 to 8.8 % in 2022 but to decline to 6.5 % in 2023 and to 4.1 % by 2024.

- US inflation reached one of its highest levels in about 40 years, as prices touched 8.3% in August, while Euro area saw inflation reached 10 % in September, the UK saw annual inflation at 9.9 %.

- One factor explaining the rise in inflation was unexpected adverse shocks from the disruption of supply chains and the rise in energy prices.

- The Russia-Ukraine war and reduction in supplies of gas to Europe have driven the natural gas prices higher. Further, recent extreme heat waves and droughts are a constant threat from climate change and its impact on agricultural productivity would impact the food prices significantly.

Figure- Inflation Driven by Food and Fuel



- To prevent inflation from becoming entrenched, central banks have rapidly lifted nominal policy rates. The Federal Reserve has increased the federal funds target rate by 3 % points since early 2022 and has communicated that further rises are likely. The Bank of England has raised its policy rate by 2 % points since the start of the year. The European Central Bank has raised its policy rate by 1.25 % points this year.

World Bank cuts 2022 East Asia growth outlook

- According to World Bank reports, growth in the East Asia and Pacific region for the year 2022, which includes China, is expected to slow to 3.2%, down from its 5.0% forecast in April, and the previous year's growth of 7.2%.

- The weaker forecast is due mainly to a sharp slowdown in China, caused by its strict zero-COVID rules that have disrupted industrial production, domestic sales and exports.

- China, which constitutes 86% of the 23-country region's economic output, was projected to grow 2.8% this year. In 2021, China's economy expanded 8.1%.

World Trade Organization (WTO) Cuts 2023 Global Trade Forecast Amid Looming Recession

- The World Trade Organization (WTO) projected a slowdown in global trade growth in 2023 as sharply higher energy, food prices and rising interest costs curb import demand.

- WTO predicted that merchandise trade would jump by 3.5 % in FY 2023, up from its April estimate of 3.0 %, and expects trade growth of just 1.0 % in 2023, compared with a previous forecast of 3.4 %.

- UN stated that as major economies have slowed down, there has been a slack in the import demand from these countries. Europe's economies are suffering from soaring energy prices, which have led to decline in their household spending and further raised the manufacturing costs. In the United States, aggressive Fed rate hikes have reduced spending in areas such as housing, motor vehicles, and fixed investment. In China, the zero-Covid policy and weak external demand are challenges to the economy. According to WTO, major central banks are already raising interest rates to tame inflation and this could eventually trigger recessions in some countries, which would further impact the import demand.

World Faces Worst Food Shock in More Than a Decade: IMF

According to the International Monetary Fund, the world is facing a severe food crisis. The food insecurity is likely to worsen because of factors such as supply bottlenecks, challenges to Ukraine's crops and high prices of fertilizers and energy.

According to IMF, this food crisis is at least equal to that seen in 2007-08, which spurred severe food shortages and led to social and political unrest. Forty-eight countries have been identified as most affected by the crisis due to significant balance of payments pressures, acute food insecurity, and the Sahel region and other parts of sub-Saharan Africa.

According to the World Food Programme, in less than one year, the population exposed to high food prices and financial difficulties has risen to 1.6 billion people. Up to 345 million people are estimated to suffer from acute food insecurity. Since 2020, food prices have risen steeply, and the FAO food price index is currently at historical record high levels.

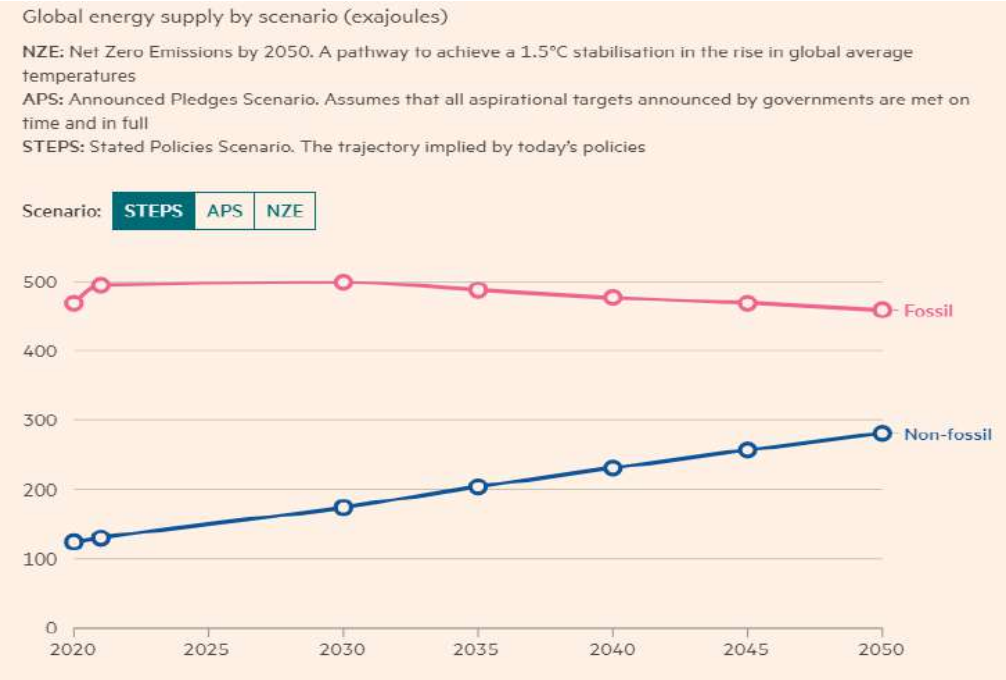
Figure- FAP Food price index in real terms

Source- IMF

The effects of increased food and energy price and supply constraints have led to lower living standards, increased poverty, lower long-term growth, social unrest and large-scale migration. A highly uncertain outlook, declining food stockpiles and negative prospects for rice is also expected to weigh on markets.

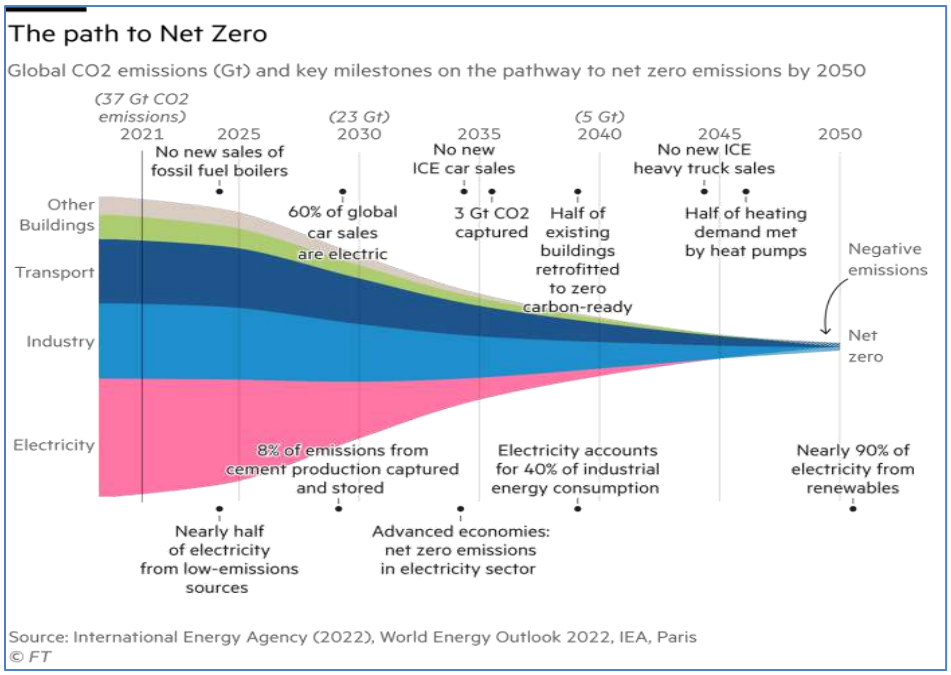
IEA forecasts fossil fuel demand will peak this decade

According to International Energy Agency, Russia-Ukraine crisis will accelerate a peak in the world's consumption of fossil fuels, with gas demand also expected to join oil and coal among fuels nearing to replenish at the end of this decade.



SOURCE- IEA- World Energy Outlook 2022

According to IEA, the investments in clean energy is expected to rise by about 50 % by the end of the decade to $2tn a year. While the IEA expects global emissions to peak by 2025, they would remain well above levels needed to limit the rise in average temperatures to 1.5C as targeted by the Paris climate agreement.



India

RBI cuts FY23 GDP growth forecast to 7%

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Real GDP growth in the first quarter of the current fiscal was 13.5%. For Q2 of FY23, RBI has projected GDP at 6.3%, for Q3 it is 4.6% and 7.2% for Q1 of FY24. According to RBI, an improvement in capacity utilization, buoyant bank credit expansion and government's continued thrust on capital expenditure are the main factors that support GDP growth.

However, like RBI, several rating agencies have also revised their annual growth rate projections for India.

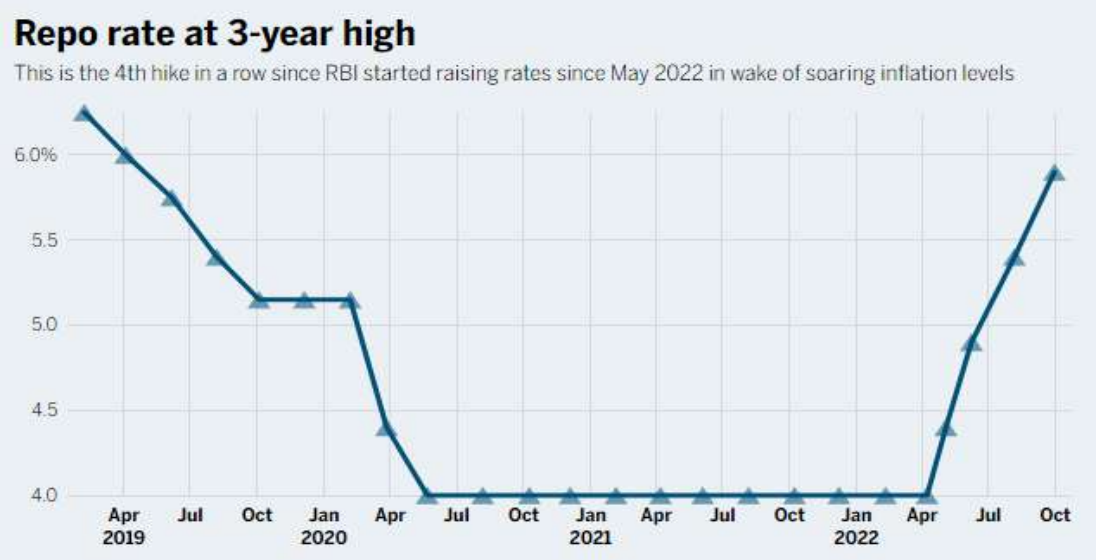
Institution	GDP forecast cut FY23	Earlier projection
Moody's	5.2% (Calendar year 2023)	5.4%
International Monetary Fund (IMF)	7.4%	8.2%
Nomura	4.7%	5.4%
FICCI	7%	7.4%
Goldman Sachs	7%	7.2%
Asian Development Bank	7%	7.5%
CRISIL	7.3%	7.8%
SBI	6.8%	7.5%
YES Bank	6.9%	7%

Inflation in India

India's retail inflation rose to a five-month high of 7.30% in September due to surging food prices, staying well above the Reserve Bank of India's (RBI) upper tolerance band for the ninth month.

The annual rate of inflation based on all India Wholesale Price Index (WPI) number was 10.7% for the month of September, 2022 against 12.41% recorded in August 2022. Inflation in September, 2022 is primarily contributed by rise in prices of mineral oils, food articles, crude petroleum & natural gas, chemicals & chemical products, basic metals, electricity, textiles etc. as compared to the corresponding month of the previous year.

RBI retains inflation projection for FY23 at 6.7% amid global geopolitical concerns. RBI projected retail inflation at 6.5% for third quarter and 5.8% for the March 2022-23 quarter.



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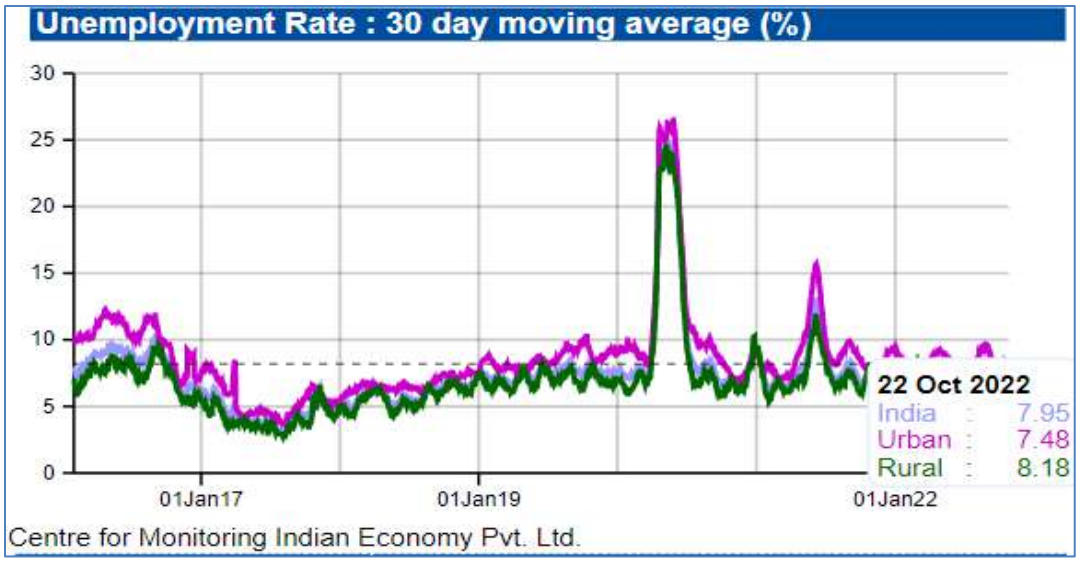
Unemployment in India

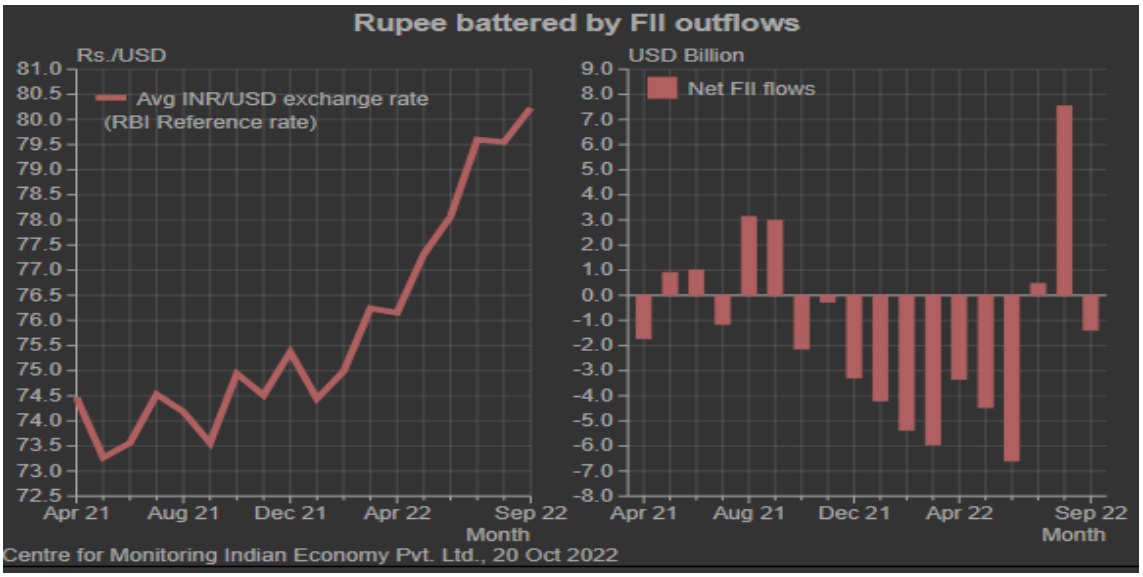
The CMIE data for October, 2022 suggest that the quantum of employment has deteriorated, as the unemployment rate has risen to 7.95% in the month of October 2022 with urban unemployment rate at 7.48 % and the rural unemployment rate is 8.18 % in October 2022.



India's external position

Indian Rupee has depreciated significantly against US dollar due to the rising global inflation particularly in US. US retail inflation for September remained high at 8.2 %. Quantitative tightening and rate hikes by the US Fed to contain this record high inflation has raised interest rates which has further attracted capital to the US and in turn has resulted in a strong US dollar. On September 21, the US Federal Reserve hiked its policy rate by 75 basis points (bps). The rate hike led to FII outflows from India.

Consequently, the rupee sank sharply in a short span and depreciated from Rs.79.92 per US dollar on September 21 to Rs.82.4 per US dollar on October 7. Further, the INR/USD exchange rate dropped to Rs.83.2 on the October 20.



India to grow 5.7% in 2022, slow down to 4.7% in 2023: UNCTAD

According to the United Nations Conference on Trade and Development (UNCTAD) estimates, Indian economy is expected to grow 5.7% in 2022 and 4.7% in 2023. The UN agency attributes the decline in growth to the impact of weakening global economy and the fiscal pressures that may prevent the government from ramping up its overall capital expenditure beyond a point. The global economy is estimated to grow 2.5 % in 2022.

According to UNCTAD's report, the Production-Linked Incentive Scheme introduced by the government is incentivizing corporate investment, but rising import bills for fossil energy are deepening the trade deficit and eroding the import coverage capacity of foreign exchange reserves.

World Bank slashes India's economic growth forecast to 6.5% for FY23

The World Bank reduced India's real GDP growth prediction for 2022–2023 from 7.5% to 6.5% and stated that the impact of Russia- Ukraine crisis and the tightening of global monetary policy will negatively affect the country's outlook for the economy. The World Bank had made the following observations relate to India's economic growth: -

- Rising borrowing costs and elevated inflation due to higher prices for key commodities will have an adverse effect on domestic demand, particularly private consumption, while sluggish global growth will limit demand growth for India's exports.
- Services exports have recovered more rapidly in India than anywhere else in the world, and the country's large foreign reserve buffers have provided resilience to the country's external sector.
- Moreover, due to ongoing geopolitical unrest and aggressive global monetary policy tightening, the Reserve Bank of India (RBI) has lowered its outlook for economic growth for the current fiscal year from 7.2% to 7%.
- In the first quarter of FY'23, real GDP increased by 13.5%, surpassing the pre-pandemic level by 3.8%. A strong rise in private consumption and investment demand supported this growth.
- Also, India's services sector activity reached a six-month low in September due to inflationary pressures and competitive conditions as new business inflows increased at their slowest rates.

Multidimensional Poverty Index (MPI): Improved Picture of Poverty in India

- According to the global Multidimensional Poverty Index (MPI), over 41.5 crore people came out of poverty in India during the last 15 years (2005-06 and 2019-21).
- The index also suggests that two-thirds exited in the first 10 years and one-third in the next 5 years.
- The United Nations Development Programme (UNDP) and the Oxford Poverty and Human Development Initiative (OPHI) have released a report, showing that poverty fell from 55.1% in 2005/06 to 16.4% in 2019/21 in India.

- The report revealed that 1.2 billion people are multidimensionally poor globally, of which half of them live in extreme poverty. Sub-Saharan Africa and South Asia together account for 83% of poor people.
- At present, India is home to the highest number of poor people worldwide at 22.8 crore, followed by Nigeria at 9.6 crore. In 2015-16, Bihar, the poorest state, witnessed the fastest reduction in MPI value in absolute terms as it fell from 77.4 % in 2005-06 to 52.4 % in 2015-16 and further to 34.7 % in 2019-21.
- The Multidimensional Poverty Index is used to measure acute multidimensional poverty in developing countries. It monitors 10 indicators including health, education, and standard of living and "it also includes both incidences as well as the intensity of poverty
- In 2010, the Oxford Poverty and Human Development Initiative (OPHI) and the Human Development Report Office of the UNDP launched the index.

Lesson From Economics

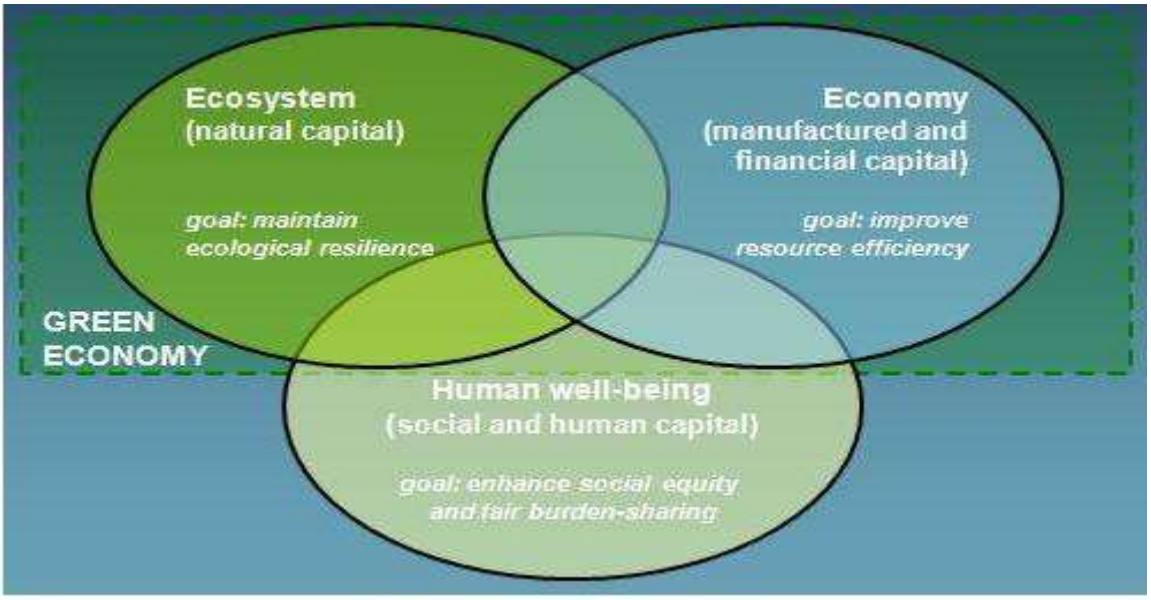
Green Economics

Green economics is a methodology of economics that supports the interaction between humans and nature and attempts to meet the needs of both simultaneously. Green economists study the impact of alternative energy sources, sustainable agriculture, wildlife protection, or environmental policies.

It is the practice of sustainable development through the support of public and private investment to create infrastructure that fosters social and environmental sustainability. The importance of green economy is that it encourages economies to become more sustainable and low-carbon, and ensures that natural assets continue to provide the resources and environmental services for our continued well-being. The green economy has the following main principles are:

- wellbeing
- justice and good governance
- poverty eradication
- energy-efficiency
- low-carbon development

European Environmental Agency (EEA) has published the concept of green economy and its importance.



Source- European Environmental Agency (EEA)'s flagship report 2010

Advantages of Green economy

- McKinsey estimates that green economy business opportunities could generate between $9 trillion and $12 trillion in new revenue by 2030 in sectors including transport, power, and hydrogen.
- According to the OECD, some sectors by focusing on supporting the idea of green economics, will grow more than others, but within each sector, companies using resources more efficiently will have a competitive advantage.

- The 2011 United Nations Environment Programme (UNEP) Green Economy Report states green economy must not only be efficient, but also fair. Fairness implies recognizing global and country level equity dimensions, and thereby assuring a just transition to an economy that is low-carbon, resource efficient, and socially inclusive.

- The Global Climate Prosperity Scoreboard launched by Ethical Markets Media and The Climate Prosperity Alliance to monitor private investments in green companies estimated that over $1.248 trillion has been invested in solar, wind, geothermal, ocean/hydro and other green sectors since 2007. This number represents investments from North America, China, India, and Brazil, as well at other developing countries.

Measuring economic output through Green Indices

Green indices emerged from the need to measure human ecological impact, efficiency sectors like transport, energy, buildings and tourism, as well as the investment flows targeted to areas like renewable energy and cleantech innovation.

- 2016 - 2022 Green Score City Index is an ongoing study measuring the anthropogenic impact human activity has on nature.
- 2010 - 2018 Global Green Economy Index (GGEI) published by consultancy Dual Citizen LLC is in its 6th edition. It measures the green economic performance of 130 countries along four main dimensions of leadership & climate change, efficiency sectors, markets & investment and the environment.
- 2009 - 2013 Circles of Sustainability project scored 5 cities in 5 separate countries.
- 2009 - 2012 Green City Index- A global study commissioned by Siemens

Issues related to green economics

- Green economies require a transition to green energy generation based on renewable energy to replace fossil fuels as well as energy conservation and efficient energy use.
- The market failure arises as high external costs and high initial costs are associated for research, development, and marketing of green energy sources and green products.

- The green economy may need government subsidies as market incentives to motivate firms to invest and produce green products and services.
- Change in consumer's perceptions from use of fossil fuel-based technology to clean energy and low-cost green products.

Oil Market

Crude oil price – Monthly Review

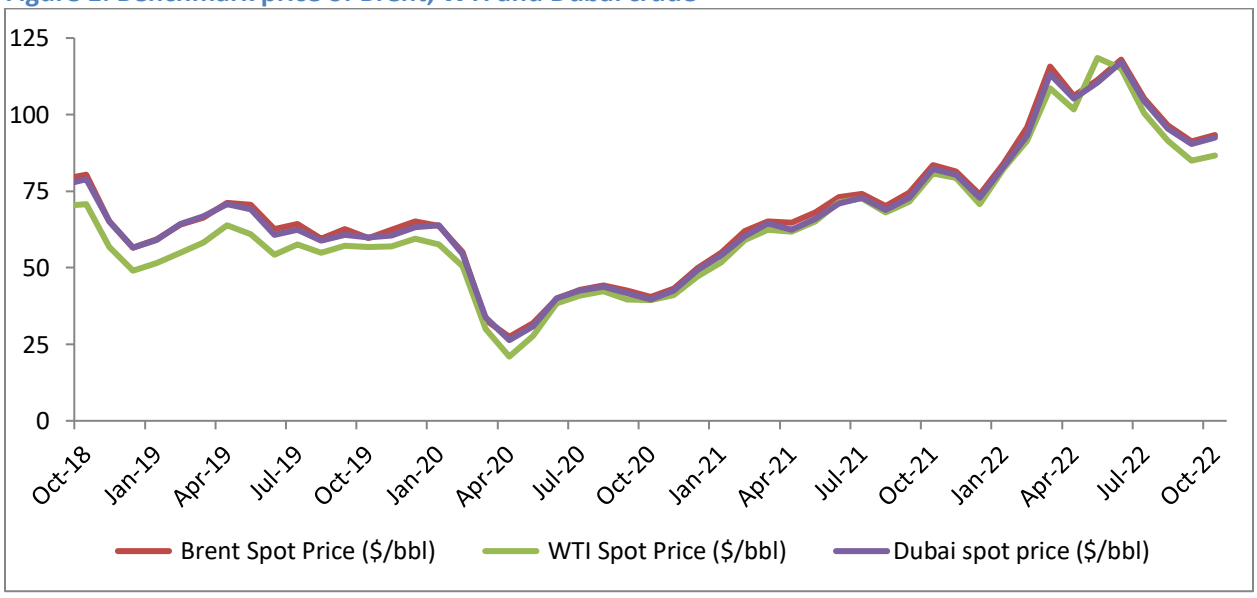
Disruptive market forces are multiplying as the world struggles to navigate the worst global energy crisis in history. The OPEC+ bloc's plan to sharply curtail oil supplies to the market has derailed the growth trajectory of oil supply through the remainder of this year and next, with the resulting higher price levels exacerbating market volatility and heightening energy security concerns.

The decision by OPEC+ will certainly drive up the oil prices, as crude oil prices are controlled by supply and demand, a reduction in supply will have a noticeable effect. As the world consumes about 100 million barrels of oil per day, eliminating two million barrels per day will significantly impact oil prices at a time when inflation is soaring and consumers are dealing with interest rate hikes that are intended to slow down the economy.

Further, with the U.S. ban on Russian oil, Russia pivoted from Europe to customers in India and China and with the ongoing war in Ukraine, the sanctions against Russia continue, which will further force a reconfiguration of the global oil supply.

Brent crude ranged an average to $93.27 a barrel and WTI ranged to $86.72 per barrel in the month of October.

Figure 1: Benchmark price of Brent, WTI and Dubai crude



Source: World Bank

- Brent crude price averaged $93.27 per bbl in October 2022, up by 2.3% on a month on month (MoM) and 11.7% on year on year (YoY) basis, respectively.

- WTI crude price averaged $86.72 per bbl in October 2022, up by 2.0% on a month on month (MoM) and 7.5% on year on year (YoY) basis, respectively.
- Dubai crude price averaged $92.57 per bbl in October 2022, up by 2.5% on a month on month (MoM) and 12.4% on year on year (YoY) basis, respectively.

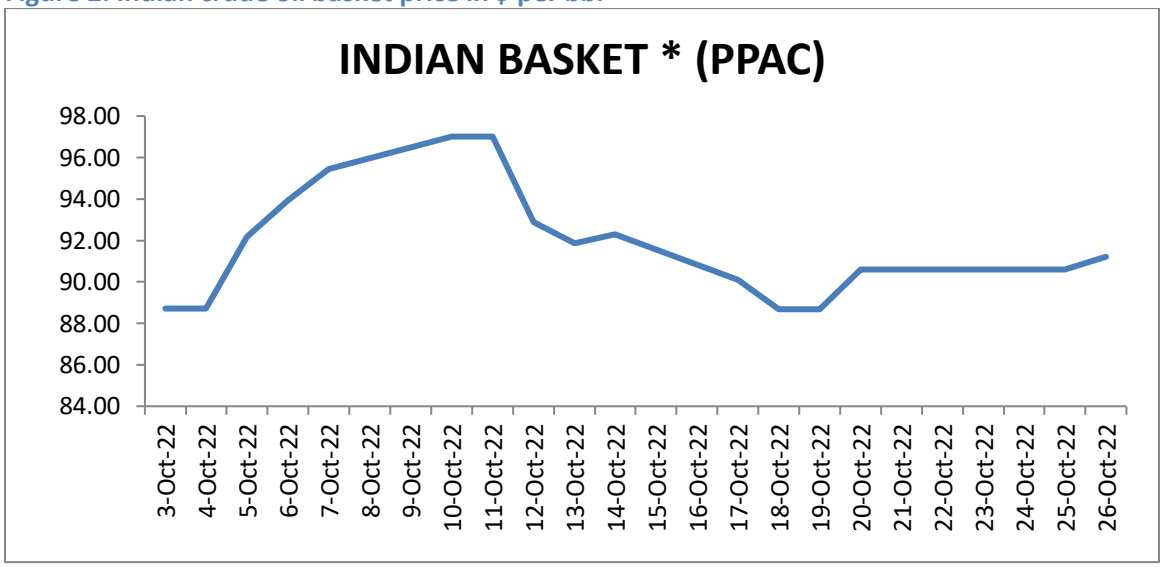
Table 1: Crude oil price in October, 2022

Crude oil	Price ($/bbl)	MoM (%) change	YoY (%) change
Brent	93.27	2.3%	11.7%
WTI	86.72	2.0%	7.5%
Dubai	92.57	2.5%	12.4%

Source: World Bank

Indian Basket Crude oil price

Figure 2: Indian crude oil basket price in $ per bbl



Source: PPAC

- Indian crude basket price averaged $91.72 per barrel in October 2022, down by 0.6% on Month on Month (M-o-M) and up by 11.8% on a year on year (Y-o-Y) basis, respectively.

Oil production situation

- World oil supply rose by 300 kb/d in September to 101.2 mb/d, with OPEC+ providing over 85% of the gains. After a massive 2.1 mb/d boost from 2Q22 to 3Q22, growth is forecast to decelerate markedly, to 170 kb/d from 3Q22 to 4Q22, following the OPEC+ decision to cut official production targets by 2 mb/d from November – a 1 mb/d cut to actual output given the bloc's underperformance vis-à-vis quotas.

- The decline in OPEC+ supply will be smaller than the announced 2 mb/d reduction in production targets, with the majority of the alliance's members already producing well below their ceilings due to capacity constraints.

Figure 3: Non-OPEC liquids production in 2022, mb/d

Non-OPEC liquids production	2021	1Q22	2Q22	3Q22	4Q22	2022
Americas	25.25	25.86	26.27	26.91	27.26	26.58
of which US	*17.85*	*18.27*	*18.83*	*19.19*	*19.44*	*18.93*
Europe	3.76	3.73	3.43	3.62	3.91	3.67
Asia Pacific	0.51	0.49	0.51	0.50	0.53	0.51
Total OECD	**29.52**	**30.08**	**30.22**	**31.03**	**31.69**	**30.76**
China	4.31	4.50	4.50	4.44	4.43	4.47
India	0.77	0.77	0.77	0.76	0.81	0.78
Other Asia	2.41	2.37	2.31	2.31	2.38	2.34
Latin America	5.95	6.11	6.15	6.37	6.53	6.29
Middle East	3.24	3.29	3.33	3.38	3.35	3.34
Africa	1.35	1.33	1.32	1.33	1.31	1.32
Russia	10.80	11.33	10.63	10.91	10.59	10.86
Other Eurasia	2.93	3.05	2.77	2.73	3.17	2.93
Other Europe	0.11	0.11	0.11	0.10	0.10	0.11
Total Non-OECD	**31.87**	**32.85**	**31.89**	**32.34**	**32.68**	**32.44**
Total Non-OPEC production	61.39	62.94	62.11	63.37	64.38	63.20
Processing gains	2.29	2.40	2.40	2.40	2.40	2.40
Total Non-OPEC liquids production	**63.67**	**65.34**	**64.51**	**65.77**	**66.78**	**65.60**
Previous estimate	63.67	65.33	64.48	66.17	67.12	65.78
Revision	0.00	0.00	0.03	-0.39	-0.34	-0.18

Source: OPEC

- From the above table, it can be inferred, that the total non-OPEC liquids production is expected to reach 65.60 mb/d by 2022.
- OPEC NGLs and non-conventional liquids production in 2022 is forecasted (as per OPEC monthly report) to grow by 0.1 mb/d to average 5.4 mb/d.
- OPEC-13 crude oil production averaged 29.77 mb/d in September 2022, higher by 146 tb/d m-o-m.

Oil demand situation

- The relentless deterioration of the economy and higher prices sparked by an OPEC+ plan to cut supply are slowing world oil demand, which is now expected to contract by 340 kb/d y-o-y in 4Q22. Demand growth has been reduced to 1.9 mb/d in 2022 and to 1.7 mb/d next year, down by 60 kb/d and 470 kb/d, respectively, from last month's Report. World oil demand is now forecast to average 101.3 mb/d in 2023.

- According to IEA, the revisions are underpinned by further downgrades to global GDP growth expectations from major institutions, with recession now expected in several European countries and risks increasing for emerging and developing economies.

Table 2: World Oil demand in mbpd	2021	1Q2022	2Q2022	3Q2022	4Q2022	2022	Growth	%
Total OECD	**44.85**	**45.79**	**45.39**	**46.50**	**47.12**	**46.20**	**1.35**	**3.05**
~ of which US	*20.03*	*20.38*	*20.41*	*20.58*	*20.83*	*20.55*	*0.52*	*2.58*
Total Non-OECD	**52.18**	**53.58**	**52.95**	**52.83**	**54.53**	**53.47**	**1.29**	**2.47**
~ of which India#	*4.77*	*5.18*	*5.16*	*4.95*	*5.35*	*5.16*	*0.39*	*8.11*
~ of which China	14.97	14.74	14.56	14.69	15.64	14.91	-0.06	-0.40
Total world	**97.03**	**99.36**	**98.34**	**99.33**	**101.64**	**99.67**	**2.64**	**2.72**

Source: OPEC monthly report, October 2022

 # During 2022 rising oil demand will be supported by increasing requirements in all main petroleum product categories, however, some downside risks pertain relating to rising COVID-19 cases, new variants and their associated containment measures, as well as fuel substitution.

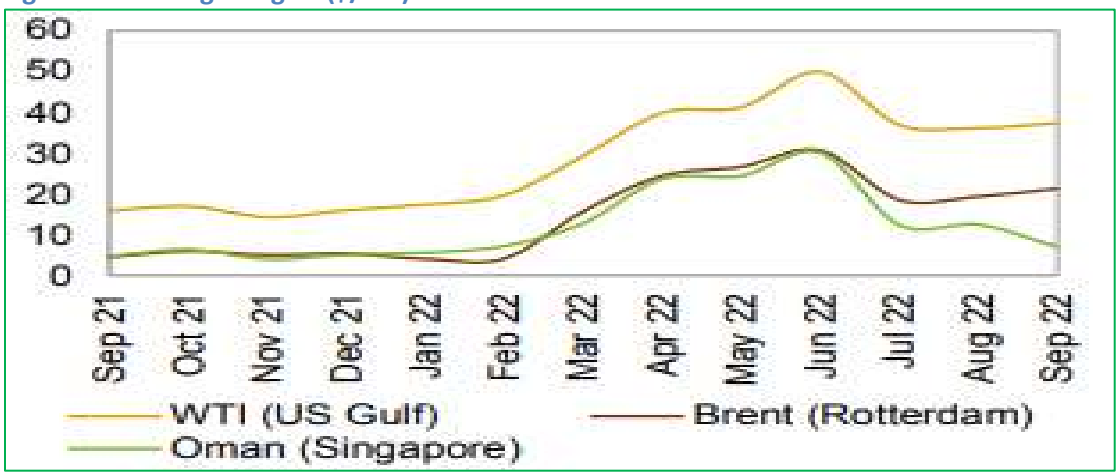
*Note: *2021=Estimation and 2022 = Forecast. Totals may not add up due to independent rounding*

Global petroleum product prices

USGC refining margins against WTI recovered from the previous month's losses in September, but remained below the high levels seen in June. Product output levels were strong in the first half of the month, but declined thereafter, affected by planned and unplanned shut-downs. A prolonged shutdown due to a reported fire at the 160 tb/d BP Toledo refinery in Ohio, amid the start of heavy maintenance work in the country, weighed on utilization rates towards the end of the month. Across the barrel, jet fuel was the top performer, as inventories for the same product declined over three consecutive weeks of the month. This resulted in significant strength across the barrel in September, particularly regarding middle distillates, as the jet fuel crack spread rose by $4.34/b, the greatest monthly rise compared with other key products in the USGC.

Refinery margins in Rotterdam against Brent increased for the second consecutive month, showing the greatest gain compared with other key regions. The most support emerged from the gasoil and naphtha markets, while low sulphur fuel oil and jet fuel added to positive performance. The start of the maintenance season in Europe led to a considerable reduction in processing rates and product output. Moreover, in France, a strike in the refining sector led to a 40% loss in capacity towards the end of the month. Despite firm gains, margins were lower for refiners using natural gas as a burning fuel and power source due to elevated operational costs. Refinery throughput in Europe declined by 240 tb/d due to planned and unplanned outages, to average 9.86 mb/d according to preliminary data. Refinery margins against Brent in Europe averaged $21.22/b in September, up by $1.96/b compared with a month earlier and higher by $16.74 y-o-y.

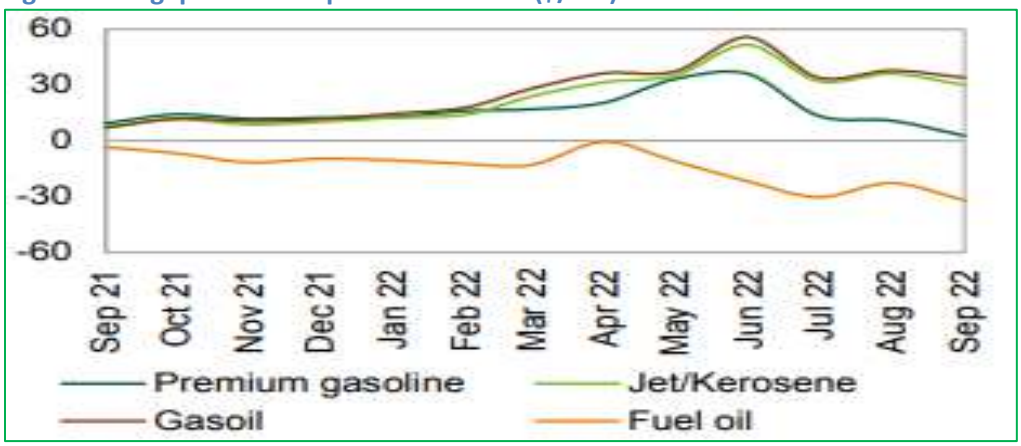
Figure 4: Refining Margins ($/bbl)



Source: Argus and OPEC

The Asian gasoline 92 crack spread fell mainly impacted by supply-side dynamics and growing gasoline availability in the region. The Singapore gasoline crack spread against Oman in September averaged $2.81/b, down by $8.11 m-o-m and $6.67 y-o-y.

Figure 5: Singapore crack Spreads vs. Dubai ($/bbl)



Source: Argus and OPEC

The Singapore gasoil crack spread declined, but remained at healthy levels. This was reflective of supply-side dynamics, which triggered concerns over gasoil oversupply within the region in the near term. The Singapore gasoil crack spread against Oman averaged $33.89/b, down by $3.87 m-o-m but up by $26.80 y-o-y.

Table 3: Singapore FOB, refined product prices ($/bbl)

Singapore product prices	Price ($/b) in September 2022	MoM (%) change	YoY (%) change
Naphtha	68.09	-6.3%	-9.4%
Premium gasoline (unleaded 95)	97.45	-11.9%	15.9%
Regular gasoline (unleaded 92)	93.79	-12.6%	14.3%
Jet/Kerosene	120.92	-8.7%	51.4%
Gasoil/Diesel (50 ppm)	128.58	-7.6%	55.7%
Fuel oil (180 cst 2.0% S)	124.55	-6.8%	56.7%
Fuel oil (380 cst 3.5% S)	59.20	-19.8%	-14.4%

Source: OPEC

Petroleum products consumption in India

Monthly Review:

- Overall consumption of all petroleum products in September 2022 with a volume of 17.2 MMT registered a growth of 7.92% on volume of 15.9 MMT in September 2021.
- MS (Petrol) consumption during the month of September 2022 with a volume of 2.83 MMT recorded a growth of 8.80% on volume of 2.60 MMT in September 2021.
- HSD (Diesel) consumption during the month of September 2022 with a volume of 6.26 MMT recorded a growth of to 13.49% on volume of 5.51 MMT in the month of September 2021.
- LPG consumption during the month of September 2022 with a volume of 2.44 MMT registered a growth of 3.58% over the volume of 2.36 MMT in the month of September 2021.
- ATF consumption during September 2022 with a volume of 0.592 MMT registered a growth of 44.92% over the volume of 0.409 MMT in September 2021.
- Bitumen consumption during September 2022 with a volume of 0.473 MMT registered a growth 6.42% over volume of 0.445 MMT in the month of September 2021.
- Kerosene consumption registered de-growth of 68.88% during the month of September 2022 as compared to September 2021.

Table 4: Petroleum products consumption in India, September 2022

CONSUMPTION OF PETROLEUM PRODUCTS (P)	Consumption in '000 MT	MoM (%) change	YoY (%) change
LPG	2,447	2.2%	3.6%
Naphtha	1,076	-7.0%	-3.5%
MS	2,827	-5.9%	8.8%
ATF	592	-0.6%	44.9%
SKO	41	29.7%	-68.9%
HSD	6,255	-1.3%	13.5%
LDO	63	-6.3%	-26.9%
Lubricants & Greases	385	13.3%	-1.4%
FO & LSHS	593	-1.4%	8.3%
Bitumen	473	0.5%	6.4%
Petroleum coke	1,319	6.4%	15.9%
Others	1,109	-29.4%	-6.5%
TOTAL	17,179	-3.5%	7.9%

Source: PPAC

Natural Gas Market

Natural Gas Price – Monthly Review

- Natural gas spot prices at the U.S. Henry Hub benchmark averaged $7.88 per million British thermal units (MMBtu) in September 2022. Prices are expected to remain elevated over the remainder of 2022 on the back of strengthening demand for natural gas from the residential and commercial users as the heating season approaches.

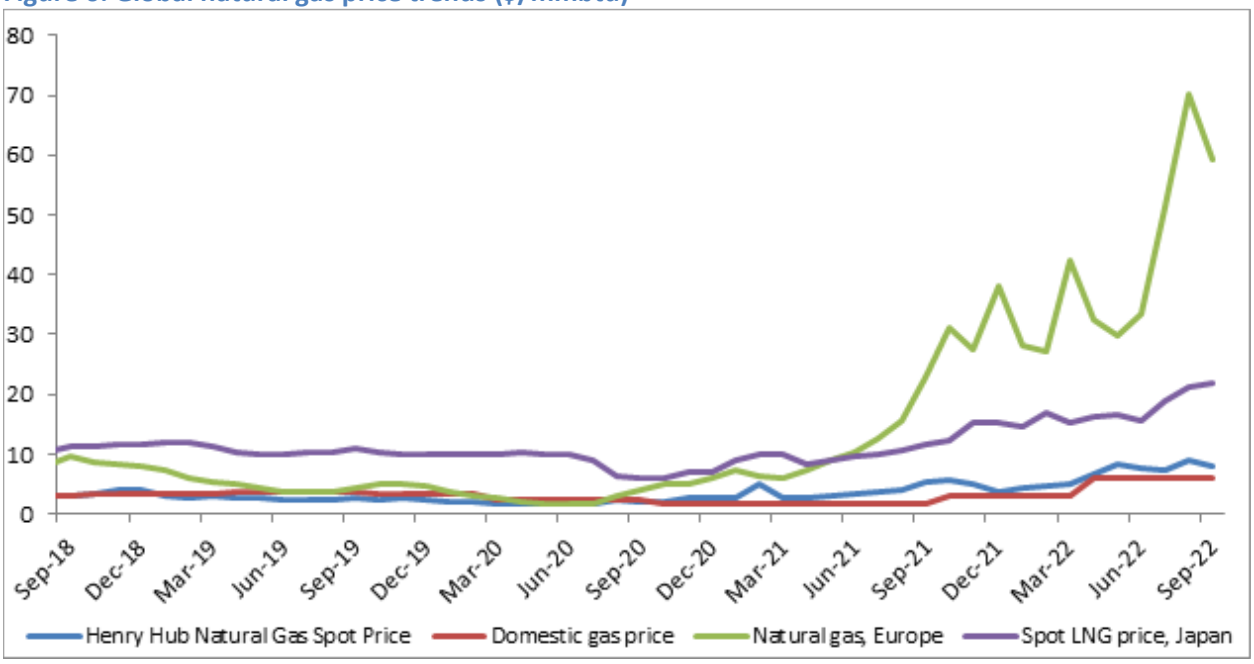
- The natural gas spot price at the Title Transfer Facility (TTF) in the Netherlands in Europe has been trading at averaged $59.1 per MMBtu. Gas prices in Europe remain historically elevated, even after the recent decline, trading at twice the level set at this time a year ago and even higher versus long-term averages.

- Japan Liquefied Natural Gas Import Price is averaging at $21.70 per MMBtu for September 2022, up from $21.21 per MMBtu last month. Japan plans to introduce a new framework to allow the industry ministry to help redirect liquefied natural gas supplies in the event of an emergency so that gas and power companies do not run short. The move comes amid growing uncertainty over LNG supplies given the risk of supply disruptions from Russia due to the war in Ukraine.

- The price of domestically produced natural gas is $8.57 per million British thermal unit (MMBtu) from October 1, 2022 to March 31, 2023. The price of domestic gas price has been hiked by 40% from the previous revision which was $6.1 per MMBtu for April 1, 2022, to September 30, 2022. The domestic gas price increase was driven by the significant run-up in the prices of gas at global gas hubs. Further, the maximum sale price allowed to natural gas

production from deep-water, ultra-deep-water, high pressure and high-temperature discoveries was increased from $9.92 per MMBtu to $12.46 per MMBtu.

Figure 6: Global natural gas price trends ($/mmbtu)



Source: EIA, World Bank

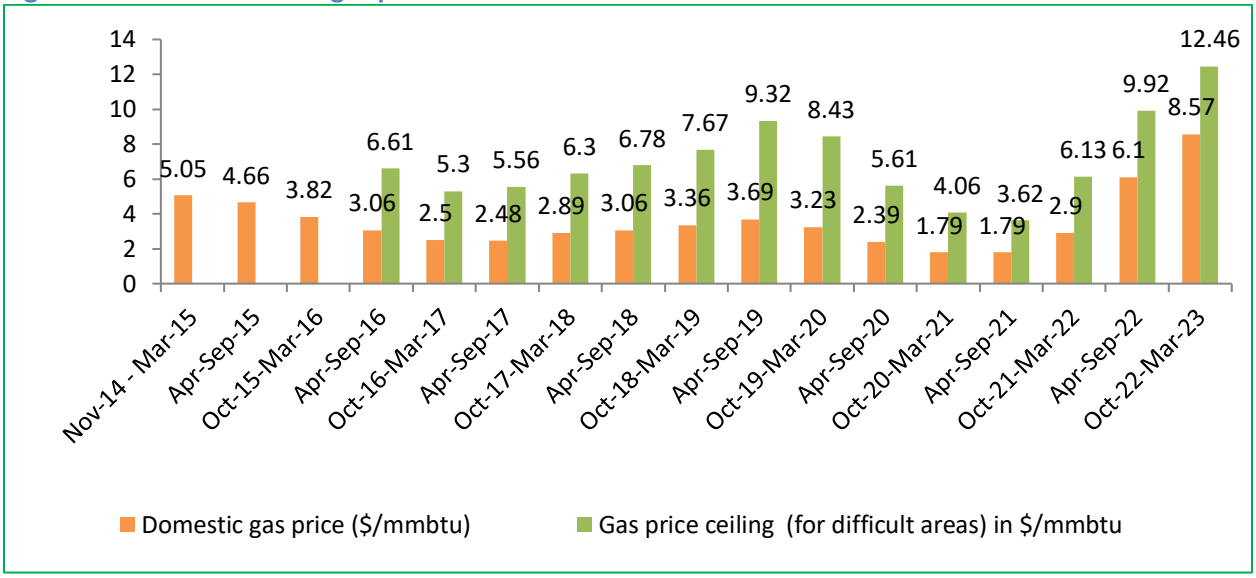
Table 5: Gas price

Natural Gas	Price ($/MMBTU) in September 2022	MoM (%) change	YoY (%) change
India, Domestic gas price [1]	8.57*	40.5%	195.5%
India, Gas price ceiling – difficult areas [1]	12.46*	25.6%	103.3%
Henry Hub	7.88	-10.6%	52.7%
Natural Gas, Europe	59.10	-15.6%	158.8%
Liquefied Natural Gas, Japan	21.70	2.3%	89.7%

Source: EIA, PPAC, World Bank

* Effective October 1, 2022, India's domestic gas price and India's gas prices for difficult areas increased

Figure 7: Domestic natural gas price



Source: PPAC

Indian Gas Market

- Gross production of natural gas for the month of September, 2022 was 2852 MMSCM (decrease of 1.7% over the corresponding month of the previous year).
- Total imports of LNG (provisional) during the month of September 2022 were 2365 MMSCM (decrease of 16.3% over the corresponding month of the previous year).
- Natural gas available for sale during September 2022 was 4711 MMSCM (decrease of 9% over the corresponding month of the previous year).
- Total consumption during September 2022 was 4669 MMSCM (provisional). Major consumers were fertilizer (36%), City Gas Distribution (CGD) (21%), Power (13%), Refinery (6%) and Petrochemicals (3%).

Monthly Report on Natural gas production, imports and consumption – September 2022

1. Domestic Natural Gas Gross Production:

Domestic natural gas gross production for the month of September, 2022 was 2852 MMSCM (decrease of 1.7% over the corresponding month of the previous year).

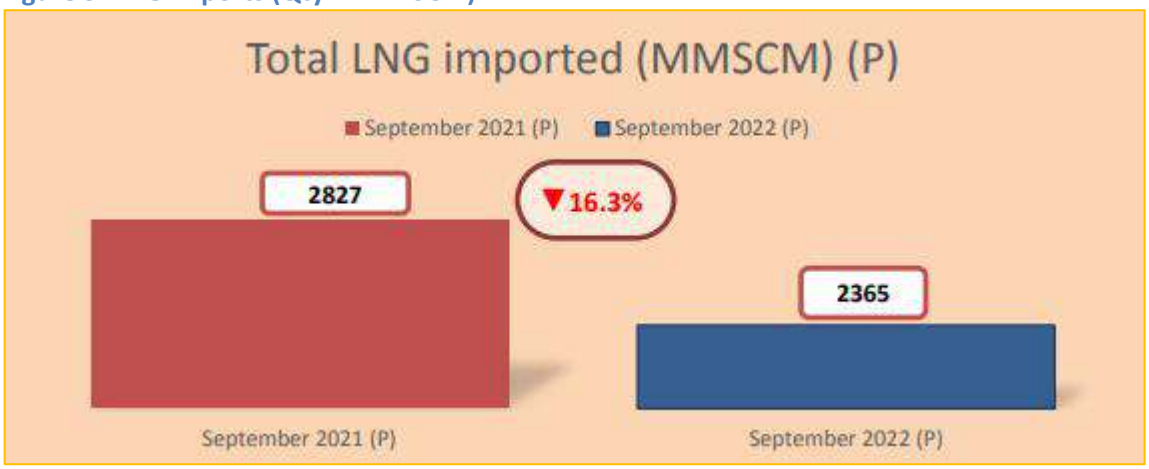
Figure 8: Domestic natural gas Gross production (Qty in MMSCM)

Source: PPAC

2. LNG imports:

Total imports of LNG (provisional) during the month of September 2022 were 2365 MMSCM (decrease of 16.3% over the corresponding month of the previous year 2827 (MMSCM).

Figure 9: LNG imports (Qty in MMSCM)

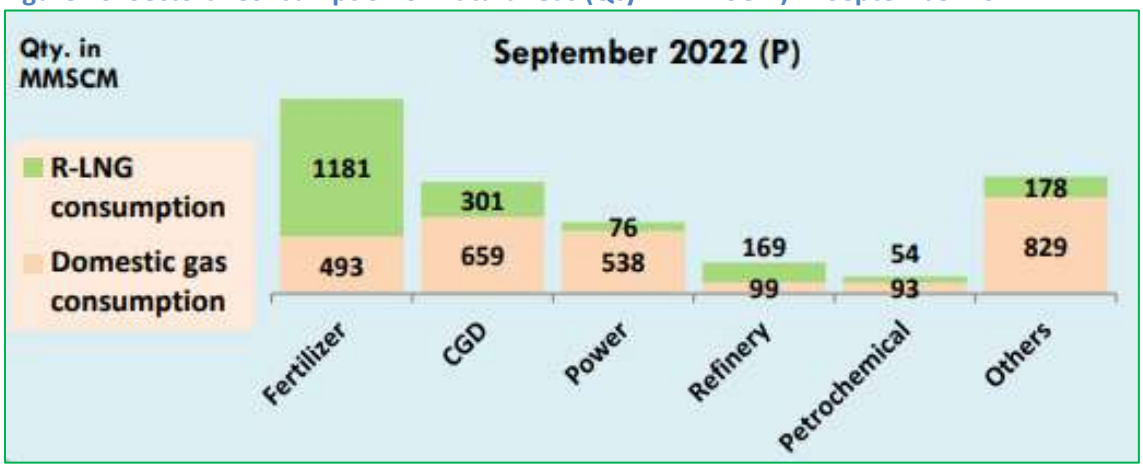


Source: PPAC

3. Sectoral Consumption of Natural Gas:

Major consumers were fertilizer, CGD, power, refinery, petrochemicals among others.

Figure 10: Sectoral Consumption of Natural Gas (Qty in MMSCM) in September 2022



Source: PPAC

Key developments in Oil & Gas sector during September 2022

- **Monthly Production Report for September, 2022**

1. Production of Crude Oil

Indigenous crude oil and condensate production during September 2022 was down by 2.3% than that of September 2021 as compared to a de-growth of 3.3% during August 2022. OIL registered a growth of 5.2% and ONGC registered a growth of 1.0% during September 2022 as compared to September 2021. PSC registered de-growth of 13.9% during September 2022 as compared to September 2021. De-growth of 1.3% was registered in the total crude oil and condensate production during April - September 2022 over the corresponding period of the previous year.

2. Production of Natural Gas

Gross production of natural gas for the month of September 2022 was 2852 MMSCM which was lower by 1.7% compared with the corresponding month of the previous year. The cumulative gross production of natural gas of 17184 MMSCM for the current financial year till September 2022 was higher by 1.7% compared with the corresponding period of the previous year.

3. Crude Oil Processed (Crude Throughput)

Crude oil processed during September 2022 was 19.5 MMT, which was 7.3% higher than September 2021 as compared to a growth of 5.9% during August 2022. Growth of 11.5% was registered in the total crude oil processing during April September 2022 over the corresponding period of the previous year.

4. Production of Petroleum Products

Production of petroleum products saw a growth of 6.6% during September 2022 over September 2021 as compared to a growth of 7.0% during August 2022. Growth of 9.9% was registered in the total POL production during April- September 2022 over the corresponding period of the previous year.

Key Policy developments in Energy sector

- **Cabinet approved Rs. 22,000 crore one time grant of PSU OMCs for losses in Domestic LPG**

The Union Cabinet, chaired by the Prime Minister Shri Narendra Modi, has approved the proposal of Ministry of Petroleum & Natural Gas to give one time grant amounting to Rs.22,000 crore to three Public Sector Undertaking Oil Marketing Companies (PSU OMCs). The grant will be distributed among Indian Oil Corporation Limited (IOCL), Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL). Grant will help the PSU OMCs to continue their commitment to the

Atmanirbhar Bharat Abhiyaan, ensuring unhindered domestic LPG supplies and also supports the procurement of Make in India products.

- **Asia's largest Compressed Bio Gas plant inaugurated in Sangrur by Union Minister Hardeep S. Puri**

Shri Hardeep S. Puri inaugurated Asia's largest CBG plant in Sangrur. The Plant has been commissioned with an FDI investment of Rs. 220 crores (approx.) by Verbio AG, one of Germany's leading Bio-energy companies.

The Compressed Bio Gas (CBG) plant inaugurated by Shri Hardeep S. Puri in Sangrur is a step in achieving objectives of the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme, which was launched by Government of India in October 2018 to establish an ecosystem for production of Compressed Bio Gas (CBG) from various waste/ biomass sources in the country. The scheme aims to empower and unleash the rural economy by supporting farmers, increase India's domestic energy production and self-sufficiency and also reduce the air pollution, and help India lead the world toward a clean energy transition. Apart from this plant, 38 CBG / Biogas Plants have been commissioned under the SATAT initiative.

Talking about the benefits of the Sangrur CBG plant for rural economy, the Minister observed that this plant will consume 100,000 tons of paddy straw, which will be procured from 6-8 satellite locations within a 10 km radius of the plant. There shall be daily production of about 600-650 Tons of FOM (Fermented Organic Manure), which can be used for organic farming. The CBG Plant shall also provide direct employment to 390 and indirect employment to 585 people.

Not only will this plant generate additional income for Sangrur's farmers, but it will also provide a much-needed alternative to stubble burning, the Minister added further. He said that this Plant will reduce stubble burning of 40,000 – 45,000 acres of fields, translating into an annual reduction of 150,000 tons of CO2 emissions, which will not only ensure that the citizens of Sangrur, Punjab, breathe in cleaner air but also contribute towards India's COP26 Climate Change targets of total projected carbon emissions by one billion tonnes from now to 2030 achieving the target of net zero emissions by 2070.

- **NTPC and GE Gas Power signed MoU for demonstrating Hydrogen co-firing in Gas Turbines to Further Decarbonize Power Generation**

In its efforts to adopt advanced powering technology to decarbonize power generation in India, NTPC Ltd., the country’s largest power generating utility, and GE Gas Power signed a Memorandum of Understanding (MoU) for feasibility to demonstrate of hydrogen (H2) co-firing blended with natural gas in GE’s 9E gas turbines installed at NTPC’s Kawas combined-cycle gas power plant in Gujarat. Under this significant collaboration, the two companies will jointly explore the pathways to reduce CO2 emissions

from the Kawas gas power plant and further implementation at scale across NTPC's installed units in India.

NTPC's Kawas gas power plant is powered by four GE 9E gas turbines operating in a combined-cycle mode and has an installed capacity of 645 megawatts (MW). Further, GE's advanced E- Class gas turbine portfolio currently can burn up to 100% by volume of hydrogen when blended with natural gas. This capability varies depending on the type of combustion system used. For fuels with over 5% hydrogen by volume, gas turbine accessories need to be evaluated and possibly modified to reliably deliver the fuel to the combustors.

In this first-of-its-kind MoU with NTPC in India, GE Gas Power will evaluate the possible modifications in the gas turbine unit and auxiliaries required for blending H2 with natural gas. Thereafter, a pilot project for 5% Co-firing of hydrogen may be implemented at the Kawas gas power plant in a safe environment based on the feasibility report. NTPC shall provide H2 required for the project.

- **NTPC and Siemens Limited signed MoU for demonstrating Hydrogen co-firing in Faridabad Gas Power Plant**

NTPC and Siemens Ltd. signed a Memorandum of Understanding (MoU) to demonstrate the feasibility for hydrogen co-firing blended with natural gas in Siemens V94.2 gas turbines installed at NTPC Faridabad gas power plant. The total installed capacity of Faridabad gas power plant is 432 megawatt (MW) with two V94.2 gas turbines operating in combined cycle mode. The MoU was signed by both the companies in the presence of Shri Ujjwal Kanti Bhattacharya, Director (Projects), NTPC Ltd. and Shri Satya Prakash Chowdary N, General Manager, Siemens Ltd.

Achieving de-carbonizing targets requires a concerted and wide-ranging roadmap across all energy intensive sectors. As a part of this road map, hydrogen co-firing in gas turbines can play a key role in reducing the CO2 emissions. NTPC Ltd., being the largest power generator in India, intends to play a major role in energy transition and achieving the COP26 commitments. As a part of this initiative, NTPC is exploring various new hydrogen generation technologies along with hydrogen usage so as to ensure future readiness, develop the required capabilities, technical expertise, aligned with the national decarbonizing and hydrogen mission targets.

Under this MoU, both the companies will collaborate to study the feasibility of introducing hydrogen co-firing in Faridabad gas power plant. Based on the feasibility studies, a pilot project for 5% (by volume) hydrogen co-firing may be implemented for demonstrating the capability and the hydrogen required for the project shall be arranged by NTPC.

- **NTPC, Mitsubishi Heavy Industries and MPI Limited signed MoU for demonstrating Hydrogen co-firing in Auraiya Gas Power Plant**

NTPC Ltd., signed a Memorandum of Understanding (MoU) with Mitsubishi Heavy Industries, Ltd. Japan and its subsidiary Mitsubishi Power India Private Limited to demonstrate the feasibility for Hydrogen co-firing blended with natural gas in MHI 701D gas turbines installed at NTPC Auraiya Gas Power Plant in Uttar Pradesh. The total installed capacity of the Auraiya Gas Power Plant is 663 MW with four gas turbines operating in combined cycle mode. The MoU was signed by both companies in the presence of Shri Ujjwal Kanti Bhattacharya, Director (Projects), NTPC Ltd., Mr. Tatsuto Nagayasu, CMD, Mitsubishi Power India and Mr. Hiroyuki Shinohara, Vice President, Mitsubishi Power India.

Achieving decarbonizing targets requires a concerted and wide-ranging roadmap across all energy intensive sectors. As a part of this road map, hydrogen co-firing in gas turbines can play a key role in reducing CO2 emissions. NTPC Ltd., being the largest power generator in India, intends to play a major role in energy transition and achieving the COP26 commitments. As a part of this initiative, NTPC is exploring various new hydrogen generation technologies along with hydrogen usage so as to ensure future readiness, develop the required capabilities, and technical expertise, and align with the national decarbonizing and hydrogen mission targets.

Under this MoU, both companies will collaborate to carry out the study and identify key actions for introducing hydrogen co-firing at NTPC Auraiya Gas-based combined cycle power plant. The study will identify key actions for co-firing for various percentages of hydrogen e.g., 5%, 15%, 30%, 50% and 100% and the hydrogen required for the project will be supplied by NTPC.

- **REC & PFC signed Memorandum of Loan Agreement with STPL for financing Buxar Thermal Power Plant**

REC Limited and Power Finance Corporation Limited (PFC) - CPSEs under the Ministry of Power signed a Memorandum of Loan Agreement (MoA) with SJVN Thermal Private Ltd. (STPL) for financing 2x660 MW coal based Buxar Thermal Power Plant (BTPP). The MoA was signed in the presence of Shri R S Dhillon, CMD – PFC, Shri N L Sharma, CMD – SJVN, Shri Ajoy Choudhury, Director (Finance) – REC and Shri V K Singh, Director (Technical) - REC and other senior officials.

SJVN Thermal Private Limited is a 100% wholly owned subsidiary of SJVN Ltd (Mini Ratna CPSE under administrative control of Ministry of Power, Govt. of India). STPL is currently executing 2x660 MW coal based Buxar Thermal Power Plant (BTPP) which is a green field project designed on supercritical technology with the objective to improve the reliability of India's Eastern Electricity region and providing power to the state of Bihar. The Foundation stone for the project had been laid by the Hon'ble Prime Minister Shri Narendra Modi.

The total estimated Project Cost is ₹12,172.74 Cr. with debt requirement of ₹8,520.92 Cr. As per the MoA, the debt requirement shall be financed by REC & PFC.

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