



**NSE NATURAL GAS**  
**DERIVATIVES**

**Performance Review**

**2023-24**

## Table of Contents

<b>1. Background</b>	<b>3</b>
<b>2. Trading related parameter</b>	<b>7</b>
<b>3. Price movements</b>	<b>11</b>
<b>4. Other parameters</b>	<b>13</b>
<b>5. Any other information to be disclosed as deemed important by the exchange or as suggested by the PAC.</b>	<b>16</b>

## **Performance Review of Commodity Derivatives - FY 2023-24**

Natural Gas Futures, Natural Gas Options on Futures and Natural Gas Mini Futures

### **1. Background**

#### **a. Brief about the commodity such as sample picture, lifecycle and various varieties/grade of the commodity found in India**

Natural gas is a colourless, odourless, highly flammable gaseous hydrocarbon which gives off a great deal of energy when burned. Although it consists primarily of methane, it can also contain ethane, propane, butane and pentane. These coproducts, once removed from the gas stream, are called natural gas liquids (NGLs). Natural gas is relatively clean burning, emitting relatively low levels of harmful combustion by-products. Although there is some evidence for the abiogenic existence of methane in the earth's mantle, most geologists favour the view that gas, like coal and oil, was formed via the compression and decomposition of organic material over long periods of time. It is typically found in the same geologic formations below the Earth's surface that trap oil, that is, in permeable mineral layers that are capped by non-porous sedimentary rock.

Like oil, natural gas is described as sweet or sour depending on, in the case of gas, its hydrogen sulphide content. Hydrogen sulphide is highly poisonous and is removed during processing. Because methane is odourless, natural gas distribution companies add a harmless, but stinky chemical (mercaptans) to the gas prior to distribution to end-users so that consumers can more easily detect leak.

#### **b. Commodity fundamentals and balance sheet as per the following format (to be prepared based on publicly available information on best effort basis):**

**Table – Fundamentals & Balance Sheet (billion cubic metres)**

<b>Global Scenario</b>	<b>2022</b>	<b>2023</b>
Production	4048.6	4059.2
Consumption	4008.7	4010.2
Inter-regional Trade	962.0	936.9

**Source:** Statistical Review of World Energy 2024, Energy Institute

#### **Natural Gas India Balance Sheet (MMSCM)**

<b>Global Scenario</b>	<b>2022-23</b>	<b>2023-24</b>
Production	33,664	35,717
Imports	26,304	30,917
Consumption	59,969	66,634

**Source:** Petroleum Planning and Analysis Cell, MoPNG, GOI

### Top 10 major producing countries (billion cubic metres)

Name of the country	2022	2023
United States	993.4	1035.3
Russia	618.4	586.4
Iran	247.7	251.7
China	221.8	234.3
Canada	184.8	190.3
Qatar	178.5	181.0
Australia	154.2	151.7
Norway	123.0	116.6
Saudi Arabia	116.7	114.1
Algeria	97.6	101.5

**Source:** Statistical Review of World Energy 2024, Energy Institute

### Top 10 major consuming countries (billion cubic meters)

Countries	2022	2023
United States	879.6	886.5
Russia Federation	448.4	453.4
China	377.6	404.8
Iran	239.4	245.6
Canada	123.8	120.7
Saudi Arabia	116.7	114.1
Japan	100.2	92.4
Germany	77.5	75.7
United Kingdom	70.9	63.5
United Arab Emirates	66.1	66.9

**Source:** Statistical Review of World Energy 2024, Energy Institute

### Top 10 major exporting countries/regions (billion cubic meters)

Countries	2022	2023
Qatar	110.5	108.4
Australia	107.4	107.4
United States	104.5	114.4
Russia	43.4	42.7
Malaysia	37.3	36.3
Algeria	14.4	19.0
Nigeria	20	17.5

Indonesia	15.6	16.1
Oman	15.3	15.3
Papua New Guinea	11.4	11.5

**Source:** LNG Exports - Statistical Review of World Energy 2024, Energy Institute

**Top 10 major importing countries/regions (billion cubic meters)**

<b>Countries</b>	<b>2022</b>	<b>2023</b>
Japan	98.0	90.3
China	87	97.8
South Korea	63.8	60.6
India	28.4	31.0
France	35.5	30.7
Taiwan	27.5	27.4
Spain	28.8	24.9
United Kingdom	26.1	19.4
Netherlands	11.5	16.1
Turkey	15.1	14.8

**Source:** LNG Imports - Statistical Review of World Energy 2024, Energy Institute

**Top Major Natural Gas Producing States in India (MMSCM) Million Standard Cubic Metres.**

<b>Name of the State</b>	<b>2023-24</b>
Assam	3489.19
Rajasthan	2198.92
Tripura	1524.86
Tamil Nadu	1015.77
Gujarat	926.01
Andhra Pradesh	721.91
West Bengal	410.94
Madhya Pradesh	234.16
Arunachal Pradesh	39.63
Jharkhand	5.37

**Source:** Petroleum Planning and Analysis Cell, MoPNG, GOI

### **c. Major changes in the policies governing trade in the spot markets of the commodity.**

Between April 2023 and March 2024, India's natural gas sector underwent significant policy changes to enhance production and streamline trade. The Petroleum and Natural Gas Regulatory Board (PNGRB) introduced the Unified Tariff (UFT) policy in April 2023, aiming to create a consistent tariff structure for natural gas transportation across the country. This reform was designed to benefit consumers, especially those far from domestic gas supply sources or LNG terminals. India's natural gas production increased by 6.2% in March 2024, reflecting steady progress in domestic production by companies like ONGC, OIL, and joint ventures. The increase in production was accompanied by a slight decrease in LNG imports, suggesting a balanced reliance on both domestic production and imports. The total availability of natural gas for sale in March 2024 showed a 2.2% increase from the previous year, indicating a growing domestic market. Consumption patterns also changed, with the refinery sector showing the highest cumulative growth of 49% from April 2023 to March 2024. These policy changes are part of India's broader energy strategy, which aims to increase the share of natural gas in the country's total energy mix to 15% by 2030. The government's efforts and budget allocations for renewable energy uptake have been positive, and natural gas demand is expected to grow over fivefold in the coming years.

### **d. Geopolitical issues in the commodity and its impact on the Indian scenario**

The period between April 2023 and March 2024 was marked by significant geopolitical events that had a profound impact on India's natural gas imports and trade. The ongoing Russia-Ukraine conflict continued to disrupt global energy markets, leading to fluctuations in natural gas prices and availability. India, which had been increasing its reliance on imported natural gas, saw its import dependency rise to 46.1% during this period, compared to 43.6% in the previous fiscal year. This increase was attributed to a recovery in demand amid relatively lower prices compared to the supernormal levels seen in the previous fiscal year due to the Ukraine war.

India's geopolitical strategy during this time also included diversifying its natural gas sources and engaging with different gas-producing countries to secure its energy needs. This strategy was part of a broader geopolitical evaluation of India's energy relationships, considering the changing dynamics of the global natural gas markets. Furthermore, India's role as the G20 Chair and its position as a non-permanent member of the UN Security Council allowed it to shape conversations on global issues, including those related to energy security. The country positioned itself as the "voice of the Global South," advocating for the interests of developing and less-developed countries in the face of global challenges.

The geopolitical landscape also saw India navigate through regional crises, such as the economic and political turmoil in Sri Lanka, where India provided substantial humanitarian aid and helped negotiate an economic debt relief package with the International Monetary Fund. These actions underscored India's commitment to maintaining stability in its neighbourhood, which is crucial for its own energy security and strategic interests. The country's efforts to manage the impacts of global events on its energy imports, while also pursuing a diversification strategy and engaging in regional diplomacy, reflect the complex interplay of geopolitics and energy security in India's foreign policy.

## 2. Trading related parameter

NSE had the following Natural Gas derivatives available for trading on its Commodity Derivatives Segment in FY 2023-24.

- Natural Gas Futures
- Natural Gas Options on Futures
- Natural Gas Mini Futures

### a. Monthly and Annual traded volume (quantity in appropriate units)

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

Month	1250 mmBtu
	Natural Gas Futures
April 2023	NA
May 2023	9,271
June 2023	8,291
July 2023	5,358
Aug 2023	10,803
Sep 2023	7,028
Oct 2023	1,787
Nov 2023	1,059
Dec 2023	210
Jan 2024	83
Feb 2024	73
Mar 2024	60
FY 2023-24	44,023

### b. Annual traded volume as proportion of total deliverable supply (quantity in appropriate units)

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

Contract	Annual Traded Volume (MMSCM)	Deliverable Supply (MMSCM)	Annual traded volume as proportion of total deliverable supply (%)
Natural Gas Futures	0.11	66,634	0.0002

**c. Annual traded volume as proportion of total annual production (quantity in appropriate units)**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

<b>Contract</b>	<b>Annual Traded Volume (MMSCM)</b>	<b>Annual Production (MMSCM)</b>	<b>Annual traded volume as proportion of total annual production (%)</b>
<b>Natural Gas Futures</b>	0.11	35,717	0.0003

**d. Annual average Open interest as proportion of total production**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

<b>Contract</b>	<b>Annual Average OI (MMSCM)</b>	<b>Annual Production (MMSCM)</b>	<b>Annual traded volume as proportion of total annual production (%)</b>
<b>Natural Gas Futures</b>	0.0002	35,717	0.00

**e. Annual average Open interest as proportion of total deliverable supply**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

<b>Contract</b>	<b>Annual Average OI (MMSCM)</b>	<b>Deliverable Supply (MMSCM)</b>	<b>Annual traded volume as proportion of total deliverable supply (%)</b>
<b>Natural Gas Futures</b>	0.0002	66,634	0.00

**f. Monthly and Annual value of trade (in Rs. Crores)**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

<b>Month</b>	<b>Rs Crores</b>
	<b>Natural Gas Futures</b>
April 2023	NA
May 2023	241.73
June 2023	208.54
July 2023	146.89
Aug 2023	298.22



Sep 2023	196.83
Oct 2023	58.27
Nov 2023	33.76
Dec 2023	5.64
Jan 2024	2.18
Feb 2024	1.45
Mar 2024	1.13
FY 2023-24	1,194.64

**g. Monthly and Annual quantity of delivery (in appropriate units)**

Natural Gas derivatives are Cash Settled contracts. Thus, the same is not applicable.

**h. Monthly and Annual value of delivery (in Rs. Crores)**

Natural Gas derivatives are Cash Settled contracts. Thus, the same is not applicable.

**i. Monthly and Annual Average Open Interest (OI) (in appropriate units)**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

Month	1250 mmBtu
	Natural Gas Futures
April 2023	NA
May 2023	85
June 2023	365
July 2023	126
Aug 2023	59
Sep 2023	116
Oct 2023	31
Nov 2023	44
Dec 2023	39
Jan 2024	30
Feb 2024	31
Mar 2024	30
FY 2023-24	88

**j. Annual average volume to open interest ratio**

The traded volume for Natural Gas Options on Futures and Natural Gas Mini Futures in FY 23-24 was NIL/Negligible.

Contract	Unit	Annual Average Traded Volume	Annual Average Open Interest	Annual average OI as a proportion of Annual average volume (%)
Natural Gas Futures	1250 mmBtu	195	88	45.12

**k. Total number of unique members and clients who have traded during the financial year.**

The traded volume for Natural Gas Mini Futures in FY 23-24 was NIL.

<b>Contract</b>	<b>Unique Member Count</b>	<b>Unique Client Count</b>
<b>Natural Gas Futures</b>	94	511
<b>Natural Gas Options on Futures</b>	6	11

**l. Ratio of open interest by FPOs/farmers/Hedge/VCP positions to total open interest (Annual average as well as maximum daily value)**

The traded volume by FPOs / farmers and VCPs/hedgers\* for Natural Gas Derivatives in FY 2023-24 was NIL/Negligible.

\* Based on the self-declaration available for the categorization of clients/members

**m. Number of unique FPOs / farmers and VCPs/hedgers who traded in the financial year.**

The traded volume by FPOs / farmers and VCPs/hedgers\* for Natural Gas Derivatives in FY 2023-24 was NIL/Negligible.

\* Based on the self-declaration available for the categorization of clients/members

**n. Algorithmic trading as percentage of total trading**

The traded volume for Natural Gas Mini Futures in FY 23-24 was NIL.

<b>Contract</b>	<b>Algorithmic trading as percentage of total trading (%)</b>
<b>Natural Gas Futures</b>	53.45
<b>Natural Gas Options on Futures</b>	23.08

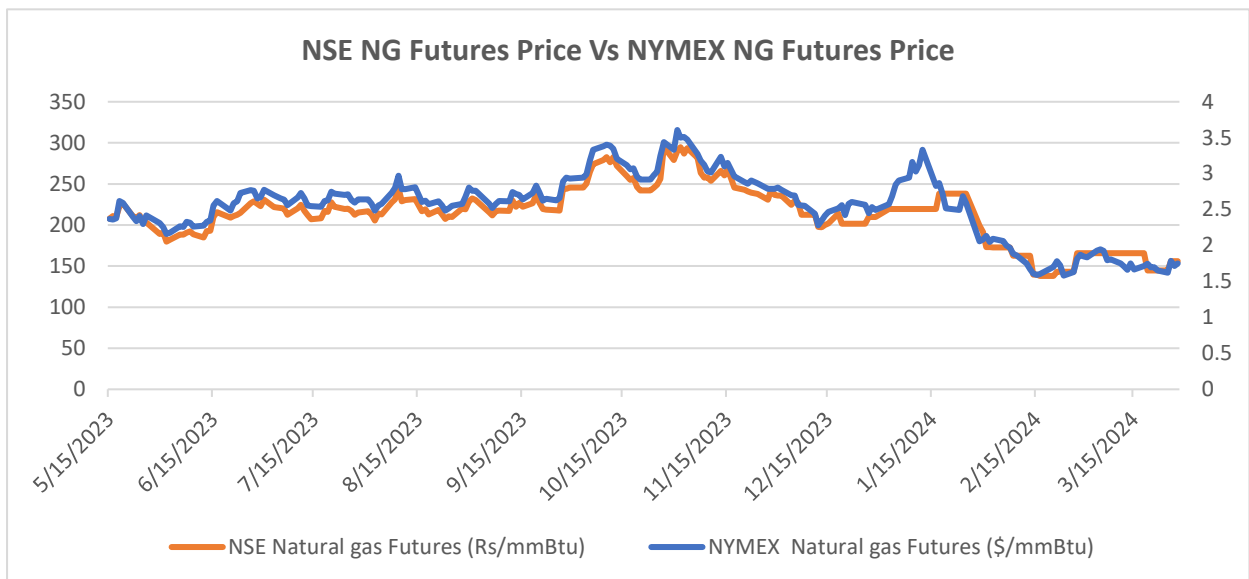
**o. Delivery defaults**

- i. Number of instances**
- ii. Quantity involved**
- iii. Value involved**

Natural Gas derivatives are Cash Settled contracts. Thus, the same is not applicable.

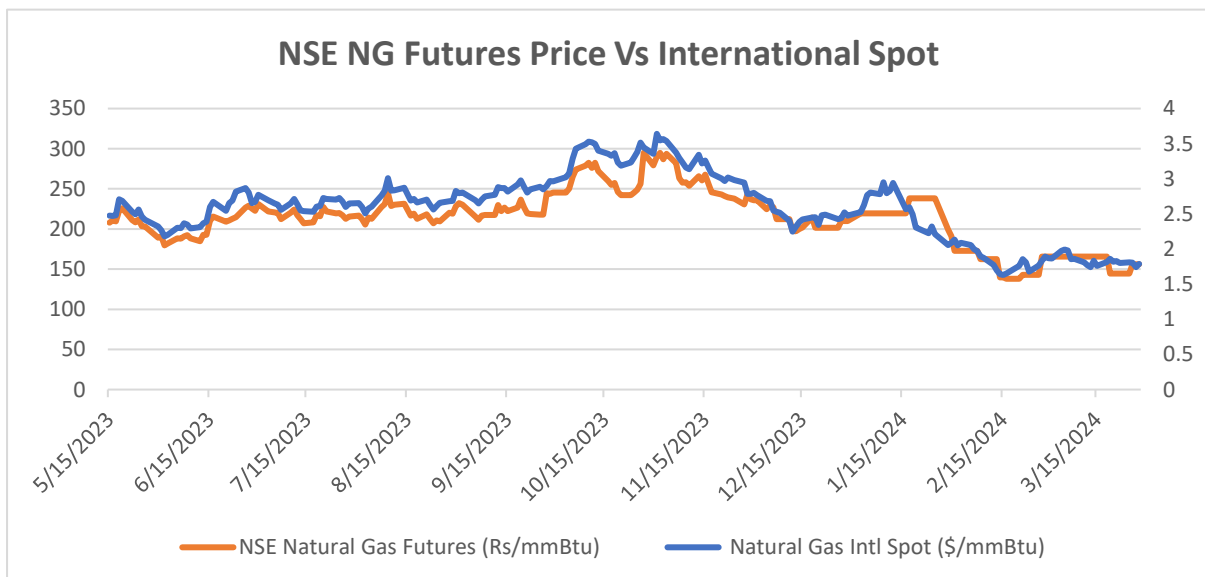
### 3. Price movements

#### a. Comparison, correlation and ratio of standard deviation of Exchange futures price vis-à-vis international futures price (wherever relevant comparable are available)



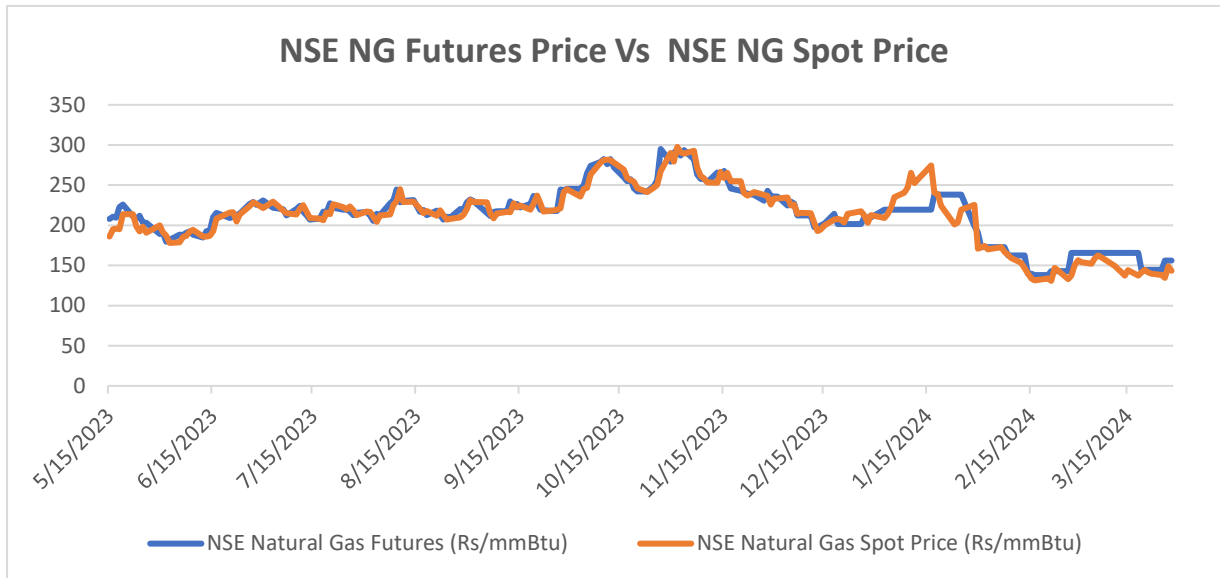
Correlation: 96% | Ratio of Std Deviation: 0.94

#### b. Comparison, correlation and ratio of standard deviation of Exchange futures price vis-à-vis international spot price (wherever relevant comparable are available) and domestic spot price (exchange polled price).



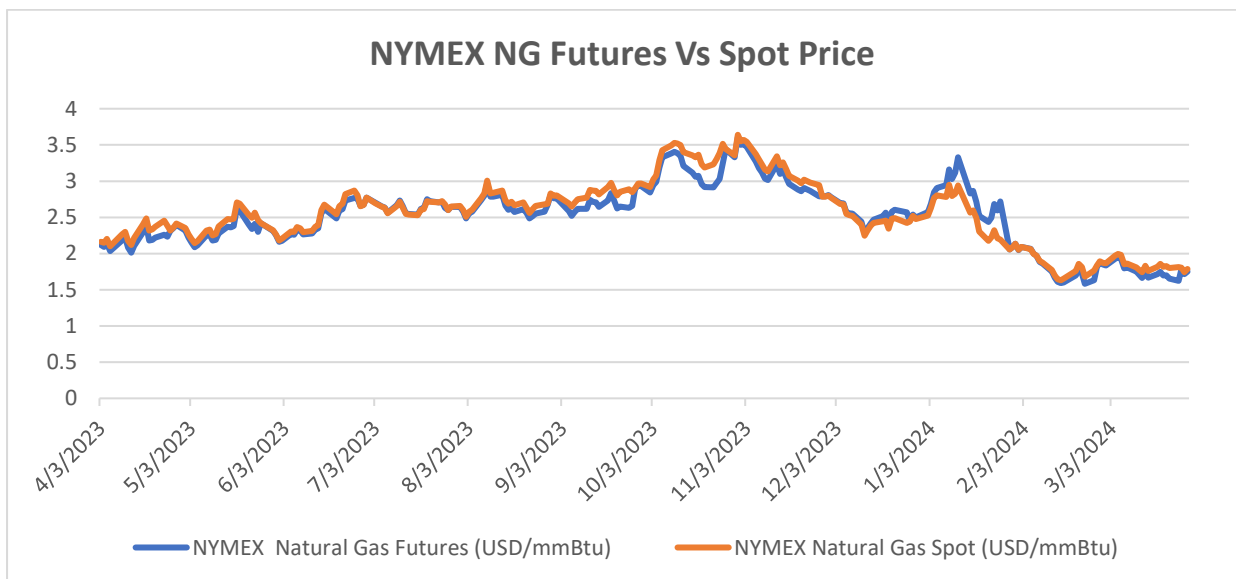
Correlation: 95% | Ratio of Std Deviation: 1.14

**c. Correlation between exchange futures & domestic spot prices along with ratio of standard deviation.**



Correlation: 95% | Ratio of Std Deviation: 1.10

**d. Correlation between international futures & international spot prices along with ratio of standard deviation (wherever relevant comparable are available).**



Correlation: 97% | Ratio of Std Deviation: 1.02

**e. Comparison of Exchange polled price and mandi price (in case of agricultural commodities) / other relevant price (in case non-agricultural commodities) at basis centre.**

Comparison could not be plotted as relevant domestic benchmark is unavailable in public domain.

- f. **Maximum & Minimum value of daily futures price volatility and spot price volatility along with disclosure of methodology adopted for computing the volatility.**

Commodity	Max Volatility in Futures Prices (%)	Min Volatility in Futures Prices (%)	Max Volatility in Spot Prices (%)	Min Volatility in Spot Prices (%)
Natural Gas Futures	16.37	0.04	24.22	0.04

Volatility calculation:  $(\text{Day} - \text{Previous day's price}) / \text{Previous day's price}$

- g. **Number of times the futures contract was in backwardation/contango by more than 4% for the near month contract in the period under review.**

No instance has been observed where the backwardation or contango exceed 4% for the near month contract.

Sources for this section: Tradingview and NSE

#### 4. Other parameters

- a. **Qualitative and quantitative measure for Hedge effectiveness ratio and basis Risk (Volatility of Basis) along with disclosure of methodology adopted for such calculations.**

Date	Price		Price Change		Hedge Effectiveness
	NSE Natural Gas Spot	NSE Natural Gas Futures	NSE Natural Gas Spot	NSE Natural Gas Futures	
5/31/2023	191.2	190.7	-8.7	1.5	680.00
6/15/2023	192.8	210.2	6.1	17.4	64.94
6/30/2023	221.5	230.9	-5	5.3	194.34
7/14/2023	209	207	-7.6	-5.1	-49.02
8/14/2023	229.3	231.6	0.4	1.3	69.23

8/31/2023	231.4	232.2	11.4	3.9	-192.31
9/15/2023	224.7	222.1	2.4	-4.7	151.06
10/13/2023	278.2	271.9	-2.9	-10.7	72.90
10/31/2023	279.1	289.9	-10.9	10.8	200.93
11/15/2023	258.8	267.8	-7.6	7.3	204.11
12/27/2023	212.1	209.7	4.9	-4.5	208.89
1/17/2024	240.6	238.2	31.4	18.9	-66.14
1/31/2024	172.6	173	1.8	-18.3	109.84
2/14/2024	140.2	139.6	-23	-22.8	-0.88
3/26/2024	134.6	156.1	-6.6	11.4	157.89
			Overall Average		120.39

The Dollar Offset Method of determining Hedge Effectiveness is one of the quantitative methods used extensively. It involves comparing the ratio of the change in fair value or present value of future expected cash flows of the hedging instrument (NSE Futures) with the change in the fair value or present value of future cash flows of the hedged item (Spot Price) attributable to the hedged risk.

## Methodology

To examine the hedge effectiveness twelve random dates were chosen with minimum gap between the period as 15 days and maximum being 3 months period (matching various operating cycles of the bullion value chain participants). For each of these chosen dates, Spot Price and Futures closing rates were recorded. The change in value of Spot rates as well as Futures closing rates for two consecutive periods was recorded. Hedge effectiveness is the ratio of change in the value of Spot prices to the change in Futures value

**Values between 80% to 125% indicate the hedge effectiveness is good. Values below 80% indicate that the hedge effective is not good. Based on the observations, it can be noticed that overall hedge effectiveness is over 120.39%.**

Longer period hedge tends to be less effective. It could be due to roll-over and related contango issues or liquidity issues. Second aspect is when there is a disruptive change in the underlying market, hedge effectiveness declines.

### Basis risk:

Basis is the difference between the spot price and the futures price at a particular point in time. Basis is usually very small and tends to decrease as futures contract moves towards expiry.

### **b. Details about major physical markets of the commodity vis-à-vis market reach in terms of availability of delivery centers (information to be provided state-wise and UT-wise).**

Natural gas is used mainly in the industrial, commercial, transportation, and household sectors. The power and fertilizer sectors are the largest consumers of Natural Gas. In the case of Natural Gas, industries across the country, have exposure to Natural Gas. Natural Gas Derivatives are offered as cash settled products which such industry players can use to hedge their exposures without the necessity of taking physical delivery of Natural Gas.

### **c. Details about major physical markets of the commodity and average Open Interest for each month generated from those regions.**

Natural gas is used mainly in the industrial, commercial, transportation, and household sectors. The power and fertilizer sectors are the largest consumers of Natural Gas. In the case of Natural Gas, industries across the country, have exposure to Natural Gas. The region wise OI data is not available.

### **d. Details, such as number and target audience, of stakeholders' awareness programs carried out by the exchange.**

For education initiatives, the exchange has conducted 411 awareness campaigns across INDIA covering all the commodities available on the NSE platform. These programs were attended by more than 15,000 stakeholders.

### **e. Steps taken / to be undertaken to improve hedging effectiveness of the contracts as well as to improve the performance of illiquid contracts.**

NSE is constantly striving to encourage hedgers to participate in the Natural Gas contracts. We have value chain participants such as Bharat Petroleum Corporation Ltd (BPCL), Oil & Natural Gas Corporation (ONGC), Indian Oil Corporation (IOCL), Hindustan Petroleum Corporation Ltd (HPCL), Chennai Petroleum Corporation Ltd (CPCL), etc. as part of our Energy PAC, who guide us on how to get more participation from physical as well as other market participants.

**5. Any other information to be disclosed as deemed important by the exchange or as suggested by the PAC.**