

## CHANDRAYAAN-3 MISSION - EXPLORING THE MOON'S SOUTH POLE

### GS III: Sci and Tech (Space)

Source: TH

#### Why is ISRO interested in the Moon's South Pole?

- India is preparing to launch Chandrayaan-3, its third lunar mission, aiming to become the **first mission to soft-land near the lunar South Pole**.
- Previous lunar landings have occurred in the equatorial region, closer to the lunar equator.

#### About the Chandrayaan-3 Mission:

- Chandrayaan-3 is an upcoming lunar exploration mission by ISRO, designed to demonstrate **safe landing and rover operations** on the lunar surface.
- It consists of a propulsion module, a lander module (**Vikram**), and a rover (**Pragyan**).
- Unlike Chandrayaan-2, it will not have an orbiter, and the propulsion module will **serve as a communications relay satellite**.

#### Exploring the Lunar South Pole:

- Chandrayaan-3 is expected to land near the Moon's South Pole, similar to the landing site of Chandrayaan-2, at a latitude of 70 degrees.
- Previous landings**, including China's **Chang'e 4**, have occurred **near the lunar equator** or at latitudes around 45 degrees.

#### Challenges of Landing in the Lunar South Pole:

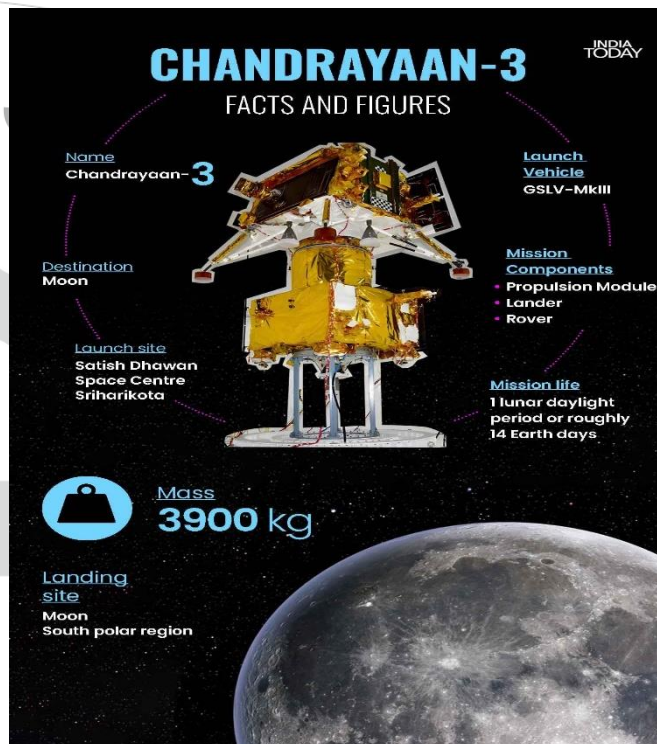
- Landing near the equator is easier and safer due to favorable terrain, temperature, and sunlight conditions.
- The lunar South Pole presents more difficult terrain, with **uneven surfaces, steep slopes, and a greater presence of craters**.
- The region experiences **extreme temperatures**, reaching below -230 degrees Celsius, and some areas are in **complete darkness with no sunlight**.

#### Significance of Exploring the Lunar South Pole:

- The polar regions of the Moon have remained largely unexplored, offering new discoveries.
- There are indications of substantial amounts of **ice molecules in the deep craters** of the lunar south pole.
- The extreme cold and preservation of trapped materials in this region can provide valuable insights into the early Solar System.

#### Permanently Shadowed Regions (PSRs):

- Due to the Moon's unique geometry, certain areas near the lunar poles, known as Permanently Shadowed Regions (PSRs), never receive sunlight.**



- These PSRs exist because the Moon's axis tilts only 1.5 degrees compared to Earth's 23.5-degree tilt.
- The exploration of these PSRs could provide valuable scientific information.

**Conclusion:**

ISRO's Chandrayaan-3 mission aims to explore the challenging terrain of the lunar south pole, where new discoveries, including the presence of ice, could offer insights into the early Solar System and the Moon's unique characteristics.

**Q.1 Consider the following statements: (2016)**

**The Mangalyaan launched by ISRO**

1. is also called the Mars Orbiter Mission
2. made India the second country to have a spacecraft orbit the Mars after USA
3. made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt

**Which of the statements given above is/are correct?**

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (c)

**Mains**

**Q.1** What is India's plan to have its own space station and how will it benefit our space programme? (2019)

**Q.2** Discuss India's achievements in the field of Space Science and Technology. How the application of this technology has helped India in its socio-economic development? (2016)

The orbiter of Chandrayaan-2 which originally has a mission life of 1 year has been given an extension and will now be operational for 7 years.

**CHANDRAYAAN-3**

Chandrayaan-3's payload will be similar to Chandrayaan-2. It will also have a lander-rover like its previous iteration. Changes will be made to the sequence of powered descent, during which as velocity loss had caused the Chandrayaan-2's lander-rover to crash.

GSLV Mark-III had to be operationalized for launching Chandrayaan -2 that's already in place will be used by the lander-rover to communicate with Earth.

India will launch its third mission, Chandrayaan-3, to the moon in an attempt to land on its surface in 2020-21. The mission will target a soft-landing near the Lunar South Pole.

<u>India's Chandrayaan Missions</u>	<u>Exploring the Moon</u>
<b>Chandrayaan-1: India's First Lunar Exploration Mission</b>	<ul style="list-style-type: none"> <li>• Launched in 2008.</li> <li>• Aimed to create a detailed <u>three-dimensional atlas of the moon</u> and <u>conduct mineralogical mapping</u>.</li> <li>• It used the <b>PSLV - C11</b> launch vehicle.</li> <li>• Made <u>significant discoveries</u>, including <b>detecting water</b> and <b>hydroxyl</b> on the lunar surface.</li> </ul>
<b>Chandrayaan-2: Partial Success and Notable Discoveries</b>	<ul style="list-style-type: none"> <li>• Launched using the <b>GSLV MkIII-M1</b>.</li> <li>• Consisted of an <b>Orbiter, Lander, and Rover</b>, with a specific focus on exploring the <b>lunar south pole</b>.</li> <li>• <b>Lander and rover crashed on the moon's surface</b>, the Orbiter successfully collected data and made remarkable discoveries.</li> </ul>

## E-AUCTION OF RICE UNDER OPEN MARKET SALE SCHEME (OMSS) TO CONTROL PRICES

### GS III: Growth & Development

Source: TH

#### Background:

- The Food Corporation of India (FCI) has initiated an e-auction of rice to regulate retail prices.
- The **Ministry of Consumer Affairs, Food and Public Distribution** stated that this decision aims to serve the public interest.

#### Open Market Sale Scheme (OMSS):

- OMSS involves the **government selling food grains in the open market** at predetermined prices.
- Its **objective** is to **increase grain supply, especially during lean seasons, and stabilize market prices in deficit regions.**
- The **Ministry of Consumer Affairs, Food and Public Distribution** oversees this scheme.

#### Mechanism:

- FCI periodically sells surplus food grains, mainly wheat and rice, from the central pool to traders, bulk consumers, and retail chains through e-auctions.
- The e-auctions take place on the NCDEX platform (**National Commodity and Derivatives Exchange Limited**), allowing open market bidders to purchase specified quantities.
- **State governments and union territory administrations can also participate** in the e-auction if they require **wheat and rice outside the Targeted Public Distribution System (TPDS).**
- OMSS consists of **three schemes: e-auction of wheat to bulk consumers/private traders, e-auction of wheat with dedicated movement, and e-auction of Grade 'A' raw rice to bulk consumers/private traders.**

#### About Food Corporation of India (FCI):

- Established in 1965, **FCI is a statutory body under the Food Corporations Act of 1964.**
- It operates under the Ministry of Consumer Affairs, Food and Public Distribution, with headquarters in New Delhi.
- FCI has five Zonal Offices, twenty-five Regional Offices, and 170 District Offices.
- **Objectives of FCI** include price support operations for farmers, nationwide distribution of food grains, maintaining operational and buffer stocks for national food security, and market intervention for price stabilization.

#### Functions of FCI:

- Procurement, storage, transportation, distribution, and sale of food grains and other foodstuffs.
- Ensuring remunerative prices for farmers.
- Providing food grains at reasonable prices, particularly for vulnerable sections of society.
- Maintaining buffer stocks as a measure of food security.
- Intervening in the market to stabilize prices.

## Prelims

**Q1. With reference to the provisions made under the National Food Security Act, 2013, consider the following statements: (2018)**

1. The families coming under the category of 'below poverty line (BPL)' only are eligible to receive subsidised food grains.
2. The eldest woman in a household, of age 18 years or above, shall be the head of the household for the purpose of issuance of a ration card.
3. Pregnant women and lactating mothers are entitled to a 'take-home ration' of 1600 calories per day during pregnancy and for six months thereafter.

**Which of the statements given above is/are correct?**

- (a) 1 and 2 only  
(b) 2 only  
(c) 1 and 3 only  
(d) 3 only

**Ans: (b)**

## Mains

**Q.1 In what way could replacement of price subsidy with Direct Benefit Transfer (DBT) change the scenario of subsidies in India? Discuss. (2015)**

## National Commodity and Derivatives Exchange Limited (NCDEX): An Overview

- 1. Agricultural Product Exchange with Strong Market Share**
  - NCDEX is a prominent agricultural product exchange that holds a significant market share in the agricultural goods sector.
  - Its core focus is on facilitating the exchange of agricultural products for market participants looking to sell their goods.
- 2. Governed by a Knowledgeable Board of Directors**
  - The organization is governed by a board of directors comprising individuals with expertise in the agricultural goods sector.
  - This ensures informed decision-making and effective management of the exchange.
- 3. Establishment and Legal Status**
  - NCDEX was established as a public limited company on April 23, 2003, in accordance with the Companies Act of 1956.
  - It commenced operations on December 15, 2003, providing a platform for agricultural product trading.
- 4. Regulatory Oversight**
  - The Securities and Exchange Board of India (SEBI) exercises regulatory control over NCDEX.
  - The exchange is subject to various laws, including the Securities Contracts (Regulation) Act of 1956, the Companies Act, the Contract Act, and other relevant regulations under the Indian Penal Code.

## INDIA'S FOCUS ON BATTERY ELECTRIC VEHICLES (BEVs) IN ELECTRIC MOBILITY PLAN

### GS III : Environment & Ecology

Source : IE

#### About BEVs:

- BEVs, or Battery Electric Vehicles, are fully electric vehicles that run on rechargeable batteries and do not have a gasoline engine.
- These vehicles rely on battery power, which is recharged from the grid, making them zero-emission vehicles without harmful tailpipe emissions.
- India's electric mobility plan primarily centers around BEVs replacing internal combustion engine (ICE) vehicles, with Li-ion batteries being the most viable option currently.




#### India's Electric Vehicle Goals:

- India is the fourth-largest emitter of carbon dioxide globally and has committed to achieving net-zero carbon emissions by 2070 at the COP26 summit.
- The country aims to have EVs account for 30% of private cars, 70% of commercial vehicles, and 80% of two and three-wheelers by 2030.
- India actively promotes EV adoption through various incentives at the central and state levels for both buyers and manufacturers.
- It is also a supporter of the global EV30@30 campaign, targeting at least 30% new vehicle sales to be electric by 2030.

#### Advantages of Electric Vehicles in India:

- **Lower Cost of Ownership:** Research shows that EVs have significantly lower lifecycle ownership costs compared to fossil fuel vehicles, with savings of up to 27%.
- **Ease of Maintenance:** EVs have fewer moving parts, making maintenance simpler and reducing ownership costs.
- **State EV Policies:** Several states in India have introduced EV policies that support the supply and demand sides through incentives and benefits.
- **Cleaner Environment:** EVs do not emit pollutants into the air and operate silently, contributing to a cleaner and quieter environment.

#### Types of Electric Vehicles

Hybrid	Plug-in hybrid	100% electric
No plug	Refuel it and plug it in	Zero emissions
		
Range ⚡⚡⚡⚡	Range ⚡⚡⚡⚡⚡	Range ⚡⚡⚡
Features a dual engine, the primary (combustion) and an electric motor. The battery recharges when the vehicle reduces speed.	Combines a combustion engine and an electric motor which is primarily used. The battery charges when the vehicle reduces speed or directly when plugged in.	Exclusively electric drive and all its power and range comes from its high capacity rechargeable battery.

#### Challenges Associated with EV Adoption in India:

- **High Initial Cost:** The upfront cost of EVs is still higher than traditional vehicles, posing affordability challenges for some consumers.

- **Limited Charging Infrastructure:** The lack of charging infrastructure makes long-distance travel in EVs difficult.
- **Battery Technology:** Current battery technology has limitations, such as limited range and long charging times.
- **Limited Domestic Manufacturing:** India relies on imports due to limited domestic manufacturing capabilities for EV components and batteries.
- **Lack of Awareness:** There is a need to increase awareness among the public about the benefits of EVs.
- **Limited Government Initiatives:** While the Indian government has set ambitious goals, concrete action plans and initiatives are lacking.
- **Lack of Standardization:** Charging infrastructure and regulations vary across states and union territories, lacking uniformity.
- **Power Grid Infrastructure:** The power grid infrastructure is still underdeveloped to handle the high-power demand of EV charging stations.

#### Way Forward :

##### 1. Energy Security and Local Manufacturing:

- EVs will enhance energy security by **reducing crude oil imports**, which account for **over 80%** of the country's requirements, valued at around \$100 billion.
- The push for EVs will boost the local EV manufacturing industry, leading to job creation.

##### 2. Strengthening the Grid with EVs:

- EVs can **provide grid support services**, enabling higher renewable energy penetration while ensuring a stable grid operation.
- As **India aims for a 450 GW energy capacity target by 2030**, EVs can play a crucial role in maintaining grid stability.

##### 3. Battery Manufacturing and Storage Opportunities:

- Battery storage presents a significant opportunity for promoting sustainable development in India.
- Government initiatives for e-mobility and renewable power create a favorable environment for battery manufacturing.
- Rising demand for consumer electronics requiring **advanced chemistry batteries** further enhances the economic potential.

#### Types of Batteries Used in Automobiles

##### 1. Lead-Acid Batteries

- They contain a mild solution of sulfuric acid in an open container and are currently used in electric vehicles to supplement other battery loads.
- While they are high-powered, inexpensive, safe, and reliable, their short calendar life and poor cold-temperature performance limit their use in electric vehicles.

##### 2. Nickel Metal Hydride (NiMH) Batteries

- Widely used in hybrid-electric vehicles and some all-electric vehicles due to their longer life-cycle.
- However, their high cost, high self-discharge rate, and significant heat generation at high temperatures make them less suitable for rechargeable electric vehicles.

##### 3. Lithium-Ion (Li-ion) Batteries.

- Widely used in electronic devices like laptops, cell phones, and computers due to their light weight and low maintenance requirements.
- Considered the best candidate for powering electric cars of the future due to their high power-to-weight ratio, energy efficiency, and good high-temperature performance.
- Li-ion batteries hold a lot of energy for their weight, making them ideal for electric cars to travel longer distances on a single charge.
- They are environmentally friendly as most of their parts are recyclable and have good charge-holding ability over time.

#### 4. Developing EV Charging Infrastructure:

- Establishing EV charging infrastructure powered by the **local electricity supply** is essential for EV adoption.
- Charging stations can be set up at various locations, **including residential premises, petrol pumps, malls, railway stations, and bus depots.**
- Government mandates, such as the **Ministry of Power's requirement for one charging station every 3 km** and every 25 km on highways, promote widespread adoption.
- The Model Building Bye-laws, 2016, **necessitate 20% of parking spaces** in residential and commercial buildings to be reserved for EV charging facilities.

#### 5. Encouraging Indigenous Research and Development:

- India **should focus on promoting indigenous EV technologies** for strategic and economic reasons.
- **Investing in local research and development** will lead to cost reductions and improved technology.
- **Collaboration with countries** like the UK can further boost EV development by leveraging expertise and resources.

#### Conclusion:

India is emerging as a global leader in EV manufacturing, supporting higher renewable energy penetration and grid stabilization. EVs are seen as crucial for achieving India's carbon emission reduction goals and promoting sustainable transportation.

#### **MAINS PRACTICES QUESTION:**

Q. Examine the potential of Electric Vehicles (EVs) in revolutionizing India's transportation sector and their contribution towards achieving the country's objective of net zero emissions by 2070.

#### **Government Initiatives Promoting Electric Vehicle (EV) Adoption in India**

##### **1. Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme II**

- **FAME Scheme II** is a government initiative aimed at promoting the faster adoption of electric vehicles and boosting their manufacturing in India.
- It provides incentives and support for the purchase of electric vehicles and the development of EV infrastructure.

##### **2. National Electric Mobility Mission Plan (NEMMP)**

- NEMMP is a comprehensive plan designed to encourage the widespread adoption of electric mobility in the country.
- It outlines strategies and policies to promote the manufacturing and usage of electric vehicles.

##### **3. National Mission on Transformative Mobility and Battery Storage**

- This mission focuses on transforming mobility by promoting electric vehicles and supporting battery storage technologies.
- It aims to accelerate the adoption of electric vehicles and enhance the development of indigenous battery technologies.

##### **4. Go Electric Campaign**

- The Go Electric campaign is an awareness initiative to promote the benefits of electric vehicles among the public.

- It encourages people to make the switch to electric vehicles and reduce their carbon footprint.
- 5. Production Linked Incentive (PLI) Scheme for EV Manufacturing**
- The PLI scheme provides incentives to manufacturers of electric vehicles and their components.
- It aims to boost domestic manufacturing and make India a global hub for EV production.
- 6. Ministry of Power's Revised Guidelines on Charging Infrastructure**
- The Ministry of Power has issued guidelines to ensure adequate charging infrastructure for electric vehicles.
- The guidelines mandate the presence of at least one charging station in a grid of 3 km and at every 25 km on both sides of highways.
- 7. Amendment to Model Building Bye-laws, 2016 (MBBL)**
- The amendment to MBBL makes it mandatory for residential and commercial buildings to allocate 20% of parking space for EV charging facilities.
- This promotes the development of charging infrastructure in buildings.
- 8. India's Support to the Global EV30@30 Campaign**
- India is actively supporting the global EV30@30 campaign, which aims to achieve a 30% share of electric vehicles in the automotive market by 2030.
- This demonstrates India's commitment to sustainable and green mobility solutions.

