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### Colour Codes:

1. Recently in News & Very Important
2. Important for Prelims + Mains
3. Important for Prelims
4. Very Important for Prelims
5. Important for Mains
6. Key Word or Key Phrase

## {Geo – DM – 2021/04} Climate Vulnerability Assessment

**PIB** | Prelims + Mains | GS3 > Disaster Management

- **Context:** The report titled ‘Climate Vulnerability Assessment for Adaptation Planning in India Using a Common Framework’ was released by **Ministry of Science** (not Ministry of Earth Sciences).
- It identifies the most vulnerable states & districts in India with respect to current climate risk.

### Findings of Report

- It identified **Jharkhand, Mizoram, Orissa, Chhattisgarh, Assam, Bihar, Arunachal Pradesh, & West Bengal** as states **highly vulnerable to climate change**.
- **Eastern part of the country** requires prioritization of adaptation interventions.

### What is Climate Vulnerability Assessment?

- It is key tool in the **adaptation process** & helps in **planning & framing policies**.
- It includes species, habitats, or systems of interest, & helps identify the risks to them from climate change.
- It identifies factors that contribute to vulnerability.
  - ✓ It includes both the direct & indirect effects of climate change.
  - ✓ For ex. land use change, habitat fragmentation, pollution, & invasive species.
- It involves:
  - ✓ **Vulnerability Assessment**
  - ✓ **Hazard Assessment**

## ✓ Exposure Assessment

### Why Vulnerability Assessment is necessary?

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- Assessing vulnerability is the first step towards assessing climate risk.
- While climate vulnerability assessments for various states & districts already exist **but data cannot be compared as framework used for assessments are different**, thereby limiting decision-making capabilities at the policy & administrative levels.
- This necessitated an assessment using a Common Vulnerability Framework.

**Mains Practice:** 'Failing to plan is planning to fail', In light of this statement discuss the importance of early & effective climate vulnerability assessments in India. (250 Words)

### {Geo – DM – 2021/04} Droughts

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**TH | Prelims + Mains | GS1 > Important Geophysical Phenomenon | GS3 > Disaster Management**

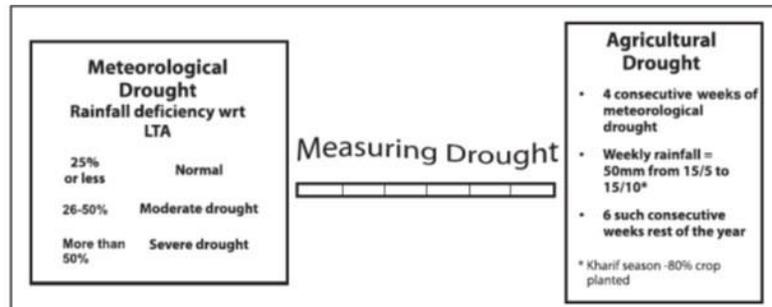
- Flash droughts are droughts that **intensify more rapidly than normal**, posing a risk to agriculture, ecosystems & water availability.
- **Flash drought** develops at an **unusually fast rate** due to **extreme weather conditions** & persists from a few weeks to some months.
- **Conventional droughts** on the other hand take months to years to develop to full intensity.
- Flash droughts can be localised to a specific region or can become widespread.
- Several factors including atmospheric anomalies, anthropogenic GHG emissions play an important role.
- **In 1979, India faced a severe flash drought, affecting about 40% of the country.**

### What is Drought?

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- As defined by the IMD, drought is a consequence of the **natural reduction in the amount of precipitation for a long period of time**.
- It is associated with other climatic factors like **high winds & temperatures** & **low relative humidity**.
- These factors can aggravate the severity of the drought event.
- As per the **Manual for Drought Management 2016**, drought is declared considering following two indicative factors:
  1. **The extent of rainfall deviation (depreciation)**
  2. **The consequent dry spell**
- A **drought year** is defined by the Indian Meteorological Department (IMD) as a year in which:

- ✓ The overall rainfall deficiency is **more than 10% of the Long Period Average value (LPA) value**; and
- ✓ If more than **20% of its area is affected by drought conditions, either moderate or severe or combined moderate & severe.**
- When the spatial coverage of drought is **more than 40%**, it will be called **All India Severe Drought Year.**
- The 2009 Manual of Drought Management classifies droughts into 3 categories:
  1. **Meteorological drought**
  2. **Hydrological drought**
  3. **Agricultural drought**



[Sources & credits](#)

## International Efforts for Drought Management

- The **United Nations Development Programme (UNDP)** launched the **Integrated Drylands Development Programme (IDDP)**:
  - It aims to strengthen resilience by working on the **twin vulnerabilities** of
    - ✓ **poverty &**
    - ✓ **unsustainable land management in the drylands.**
- The **United Nations Office for Disaster Risk Reduction (UNISDR)** developed a **Drought Risk Reduction framework** that provides a comprehensive framework for both higher-level & local action.
- In 2013, the **World Meteorological Organization (WMO)** and the **Global Water Partnership (GWP)** launched the **Integrated Drought Management Programme (IDMP)** to address drought issues.
- The **IDMP** & its partners have adopted 3 pillars of drought management.
  1. **Monitoring & Early Warning Systems:** Monitoring & analyzing drought indicators such as precipitation, temperature etc.
  2. **Vulnerability & Impact Assessment:** It considers social, economic & environmental factors to determine a community's susceptibility to drought hazards.
  3. **Mitigation & Response:** Drought mitigation includes both the structural (i.e., appropriate crops, dams & engineering projects) & non-structural measures (i.e., policies, public awareness, & legal framework).

## Drought Management in India

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- There is **no single, legally accepted definition of drought in India**.
- Some states resort to their own definitions of drought.
- **State Government is the final authority** when it comes to declaring a region as drought affected.
- India has published two important documents in respect of managing a drought.
  1. **Manual for Drought Management, 2009** by **Ministry of Agriculture** (not Ministry of Earth Sciences).
  2. **Guidelines for Management of Drought, 2010** by **National Disaster Management Authority**.
- However, these documents **have no binding force** & are mere guidelines to be followed, if so advised.
- **Drought would certainly fall within the definition of “disaster”** as defined under Section 2(d) of the Disaster Management (DM) Act, 2005 – SC in Swaraj Abhiyan Vs Union of India in 2016.
  - ✓ **National Disaster Management Authority (NDMA)** to be the **agency responsible for drought management** particularly with respect to chalking out long term preventive & mitigation measures.
  - ✓ However, the **state government concerned would be the final authority to declare a drought**.
  - ✓ **Droughts can also be declared for particular village in a district or a taluka or tehsil or block**.

## Way forward

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- Need for efficient **drought monitoring & early warning systems** in India.
- **Drought Vulnerability & Impact Assessment** needs to be done at regular intervals.
- **Framework for the Assessment of Benefits of Action or Cost of Inaction (BACI)** for Drought Preparedness must be adopted:
  - ✓ It suggests a methodological framework for assessment of **BACI** as a tool to support a shift in drought policy & programs from **crisis management to a risk management approach**.
- **National Drought Management Policy Guidelines** must be included while formulating policies:
  - ✓ It was codified by the **WMO** & the **Global Water Partnership (GWP)**.
  - ✓ It provides a template for action that countries can use in the development of a national drought management policy & drought preparedness/mitigation plans.
- **Preventive Methods:**
  - ✓ Judicious use of surface & groundwater.
  - ✓ **Cloud seeding in Drought Prone regions** of India.
  - ✓ Use of modern micro-irrigation methods like drip & sprinkler irrigation.
  - ✓ Afforestation
  - ✓ Use of traditional water conservation & storage techniques.

- **Mitigation measures**

- ✓ Contingency Crop Planning by providing other options to farmers like **drought resistant crops**.
- ✓ Arrangement must be made for relief employment programmes on the lines of MGNREGA.
- ✓ **Crop Insurance schemes** like PM Fasal Bima Yojna.

**Mains Practice:** *There is need for robust & effective national drought management framework in India. Analyse (250 words)*

## **{Geo – EG – 2021/04} Production Linked Incentive (PLI) Scheme**

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[Livemint](#) | **Prelims + Mains** | **Geography > Economic Geography > Manufacturing | GS3 > Manufacturing**

- Indian electronics manufacturing sector faces lack of a level playing field vis-à-vis competitors like China.
- The sector suffers disability of around 8.5% to 11% on account of
  - ✓ lack of adequate infrastructure,
  - ✓ lack of domestic supply chain & logistics;
  - ✓ high cost of finance;
  - ✓ inadequate availability of quality power;
  - ✓ limited design capabilities & focus on R&D by the industry; &
  - ✓ inadequacies in skill development.
- The vision of **National Policy on Electronics 2019** (NPE 2019) is to position India as a **global hub for Electronics System Design & Manufacturing (ESDM)**.
- As a part of the **National Policy on Electronics**, the Ministry of Electronics & Information Technology (**MeitY**) had notified **Production Linked Incentive (PLI) Scheme in April 2020**.
- PLI scheme would give **domestic production linked incentives** of 4-6% to electronics companies which manufacture mobile phones & specified electronic components, including Assembly, Testing, Marking & Packaging (ATMP) units.
- It offers a simple & direct incentive based on incremental sales (over the base year), designed to **boost domestic manufacturing** & attract large investments in the sector.

### **More sectors included under PLI Scheme**

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- In March 2020, the GOI made 53 bulk drugs eligible for PLI worth INR 6,940 crore.
- In November 2020, the PLI scheme was extended to ten more sectors, including food processing, battery storage, automobile components & specialty steel.

- The scheme gives eligible manufacturing companies a 4-6% incentive on incremental sales over the **base year of 2019-20** for a **five-year period**.
- It is a kind of subsidy paid from the budget for domestically manufactured goods.
- The incentive amount varies across sectors & savings generated from PLI of one sector can be utilized to fund other sectors, maximizing returns.

Sectors	Implementing Ministry/Department
1. <b>Advance Chemistry Cell (ACC) Battery</b>	NITI Aayog & Department of Heavy Industries
2. <b>Electronic/Technology Products</b>	Ministry of Electronics & Information Technology
3. <b>Automobiles &amp; Auto Components</b>	Department of Heavy Industries
4. <b>Pharmaceuticals drugs</b>	Department of Pharmaceuticals
5. <b>Telecom &amp; Networking Products</b>	Department of Telecom
6. <b>Textile Products &amp; technical textiles</b>	Ministry of Textiles
7. <b>Food Products</b>	Ministry of Food Processing Industries
8. <b>High-Efficiency Solar PV Modules</b>	Ministry of New & Renewable Energy
9. <b>White Goods (ACs &amp; LED)</b>	Department for Promotion of Industry & Internal Trade
10. <b>Speciality Steel</b>	Ministry of Steel

- ⇒ **White Goods:** large electrical goods used domestically such as refrigerators & washing machines, typically white in colour.
- ⇒ **Advance Chemistry Cells (ACCs):** new generation advance storage technologies that can store electric energy as electrochemical energy & convert it back to electric energy as & when required.

## Eligibility & Objectives of the PLI Scheme

### The PLI scheme is designed with four objectives

- 1) Target specific product areas;
- 2) Introduce **non-tariff measures** in order to compete more effectively with cheap imports;
- 3) Blend domestic & export sales to make manufacturing competitive & sustainable; &
- 4) Promote manufacturing at home while **encouraging investment from within & outside India**.

### Eligibility criteria

- Companies that are registered in India & are involved in the manufacturing of goods covered under the target segments of the scheme can apply under the PLI Scheme.

## Incentivization of manufacturing

- Globally, the incentivization of manufacturing mostly takes a handful of different forms:
  - 1) **Special Economic Zones:** by creating special jurisdictions, tailored logistics & specific incentives, many countries have boosted manufacturing, most notably China in its **Pearl River Delta**;



- 2) **Tax-based & credit-based approaches:** Many countries, particularly those with federal structures, offer credit and/or tax incentives in their provinces to attract investment & employment; &
- 3) **Productivity & research & development-based approaches:** Countries have chosen to incentivize technology clusters (advanced batteries in China, nanotechnology in the US) & research in specific areas like plant biology or the human genome.
- India's PLI scheme resembles the '**piece rate**' method, which has actually been in decline worldwide.
- In this concept, which dates back to an era when it was common for producers to make only one product off an assembly line, teams & companies were incentivized to raise output.
- As manufacturing grew more complex, incentives grew in complexity as well, & generally today focus on productivity & quality rather than quantity.

## Why is PLI Scheme a hit?

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- The application process is not complicated.
- The incentive offered is very simple & tied to conditions that are specific & easy to calculate.
- By its very construct, the PLI scheme does not link the eligibility of its subsidy to exports & local value addition, thus making it **WTO-compliant**.
- **Win-win:** Tax incentives matter only when companies become profitable. Credit incentives often turn into non-performing assets. Revenue incentives kick in immediately & generate assured results.

## {Geo – EG – Energy – 2021/04} Hydrogen Economy

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[PIB](#) | [Prelims + Mains](#) | [GS1](#) > [Economic Geography](#) > [Energy Resources](#) > [Renewable Energy Resources](#)

- **Hydrogen Economy** is the vision of using **hydrogen as a low-carbon energy source**.
- Hydrogen is the **most abundant chemical substance** in the universe.
- It is **not found in pure form on Earth**.
- It must be produced from other compounds such as **natural gas, biomass, alcohols, or water**.
- At standard temperature & pressure, hydrogen is a **nontoxic, nonmetallic, odorless, tasteless, colorless, & highly combustible diatomic gas with the molecular formula H<sub>2</sub>**.
- There are 3 types of hydrogen – grey, blue & green.
  1. The fuel **produced from fossil fuels** is called **grey hydrogen**.
  2. Fuel produced from fossil fuels with **carbon capture & storage** options are called **blue hydrogen**.
  3. Those produced from **renewable power sources** are called **green hydrogen**.

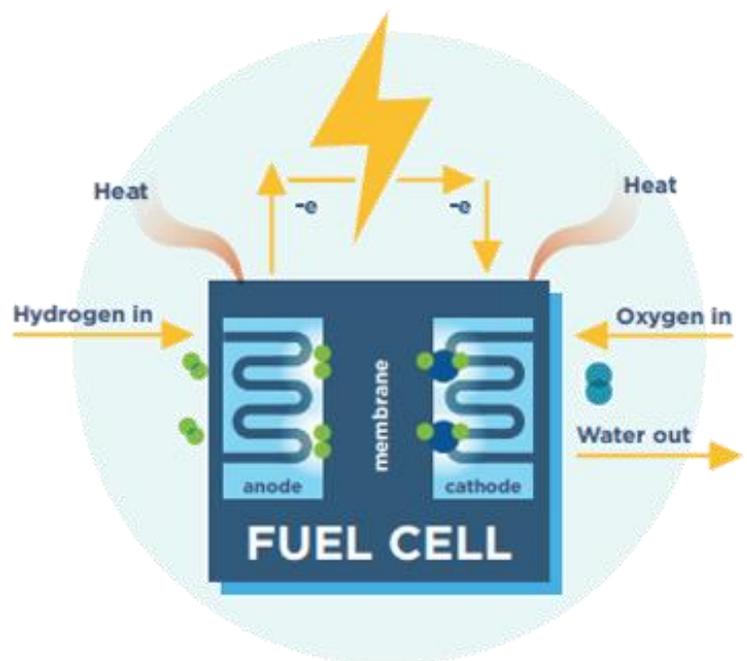
## How Hydrogen Fuel Cells Work?

- **Hydrogen is an energy carrier, not a source of energy.**
- The energy used to produce it usually comes from a more conventional source.
- Hydrogen fuel **must be transformed into electricity** by a device called a **fuel cell stack** before it can be used to power a car or truck.
- **A fuel cell converts chemical energy into electrical energy using oxidising agents through an oxidation-reduction reaction.**
- Inside each individual fuel cell, hydrogen is drawn from an onboard pressurised tank & **made to react with a catalyst**, usually made from **platinum or palladium or gold (used to speed up the reaction)**.
- At the anode, **catalyst** causes hydrogen to undergo **oxidation** & generates **+ve charged ions** & **electrons**.
- The ions move from the anode to the cathode and at the same time, the **electrons flow from the anode to the cathode through an external circuit**, producing direct current **electricity**.
- At the cathode, another catalyst causes ions, electrons, and oxygen to react, forming **water as by-product**.

### HOW FUEL CELLS WORK

A fuel cell is an electrochemical energy conversion device - it utilizes hydrogen and oxygen to generate electricity, heat, and water.

- 1** The hydrogen atoms enter at the anode.
- 2** The atoms are stripped of their electrons in the anode.
- 3** The positively charged protons pass through the membrane to the cathode and the negatively charged electrons are forced through a circuit, generating electricity.
- 4** After passing through the circuit, the electrons combine with the protons and oxygen from the air to generate the fuel cell's byproducts: water and heat.



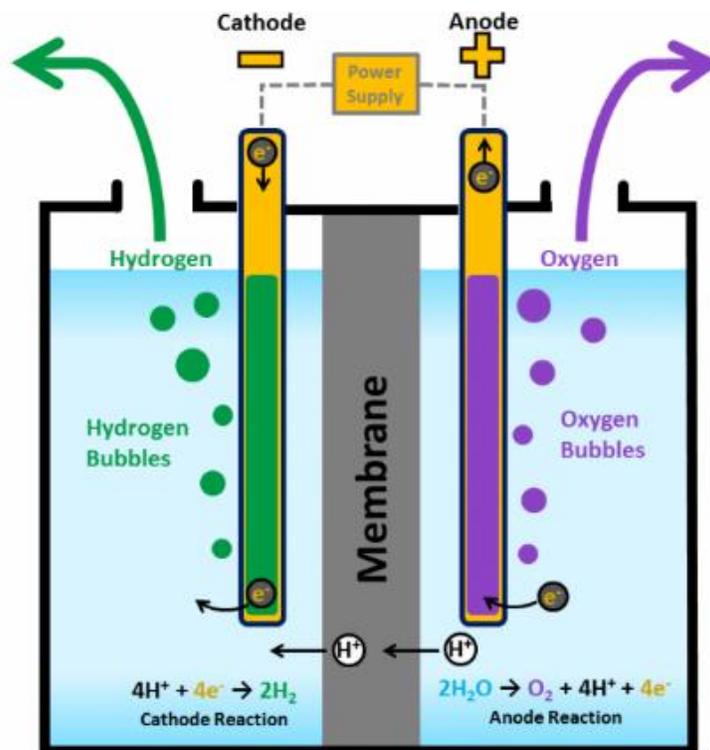
[Source & Credits](#)

## Advantages of Hydrogen as Fuel

- Fuel cells are more efficient than thermal power plants (thermal energy → mechanical energy → electrical energy → less efficient due to loss of energy in the form of heat) as there is **direct conversion of chemical energy into electrical energy**.
- Hydrogen fuel is abundantly available.
- It is **renewable & non-polluting** (only by-product hydrogen fuel cell leaves is **water**).
- Compared to diesel or gas, H<sub>2</sub> is **more fuel efficient** as it can produce more energy per pound of fuel.
- It can be **produced from a wide variety of resources** & can be used in a wide range of applications, such as power generation, as a transport fuel for low carbon vehicles, etc.

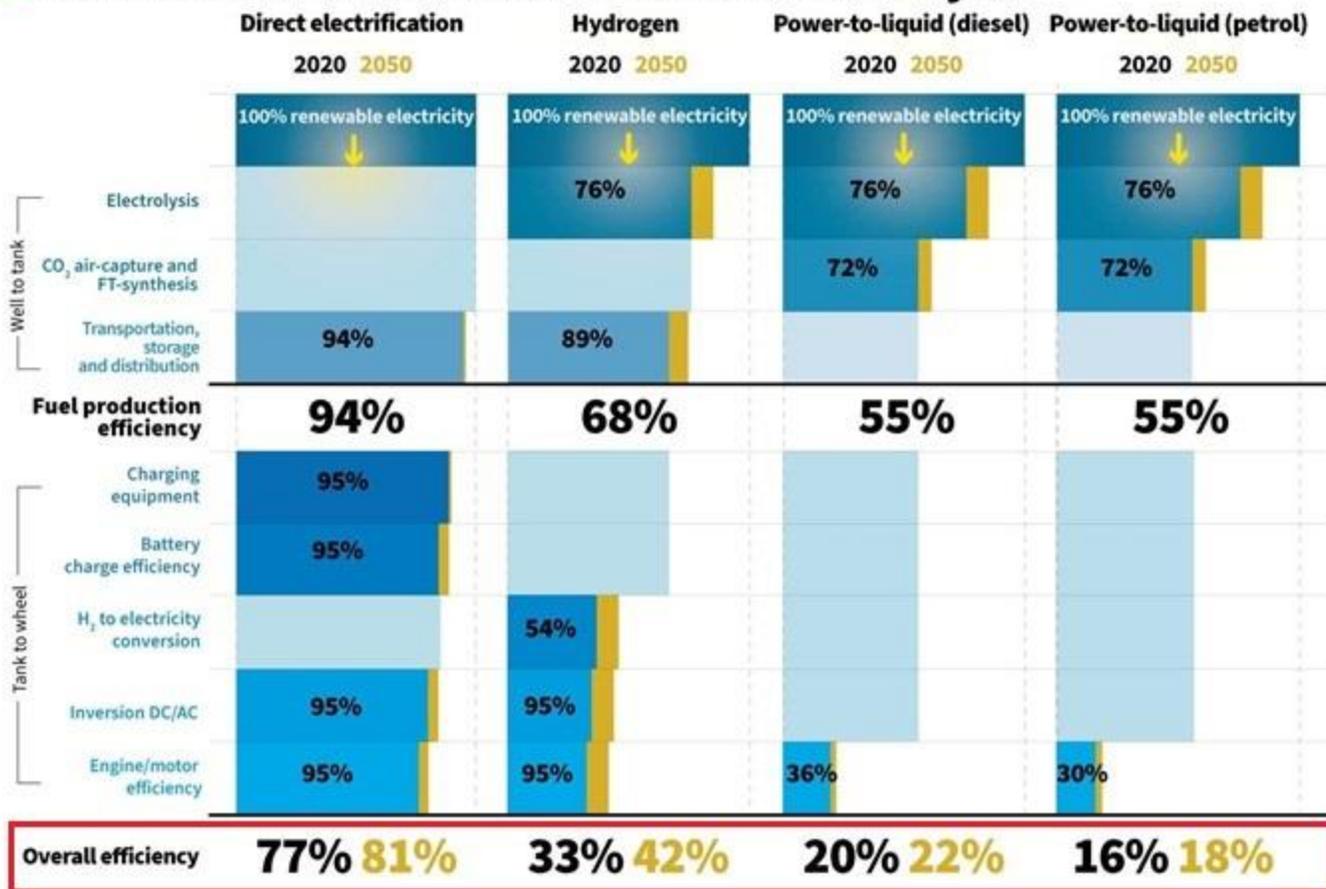
## Disadvantages of Hydrogen as Fuel

- Fuel cells are very expensive to produce (**platinum, palladium catalysts are expensive**).
- It is difficult to transport & store hydrogen.
- A **relative lack of off-the-shelf engine technology** that can currently run safely on hydrogen.
- Safety concerns due to the **high reactivity of hydrogen fuel with environmental oxygen**.
- Hydrogen has to be produced from either water or organic compounds like **methane** through **electrolysis** (**energy intensive** → **high carbon footprint**).



- Lack of efficient photochemical water splitting technology.
- Lack of fuelling station infrastructure (hydrogen vehicle economy is not promising).
- **Electric vehicles are a lot more efficient than hydrogen powered vehicles.**

## Cars: direct electrification most efficient by far



Notes: To be understood as approximate mean values taking into account different production methods. Hydrogen includes onboard fuel compression. Excluding mechanical losses.

⇒ In the Decreasing order of overall efficiency: EVs > Hydrogen > Diesel > Petrol vehicles

## Current Status of Hydrogen Economy in India

- Hydrogen is used extensively in India, mainly as an industrial feedstock in the creation of ammonia-based fertilisers.
- Most H<sub>2</sub> in India is produced through reforming methane (CH<sub>4</sub>), resulting in significant CO<sub>2</sub> emissions.
- **National Hydrogen Energy Road Map (NHERM)**: It was adopted by the **National Hydrogen Energy Board in 2006** for implementation.
- The main objective of NHERM was to identify the pathways, which will lead to **gradual introduction of hydrogen energy & facilitate the creation of hydrogen energy infrastructure** in the country.
- The **Union Budget for 2021-22** has announced a **National Hydrogen Energy Mission (NHM)** that will draw up a **road map for using hydrogen as an energy source**.

- **Delhi** became the **first city in India** to operate buses with **hydrogen-enriched CNG (HCNG)**.
- For the current financial year, **MNRE has been allotted Rs 25 crore** for R&D in hydrogen.
- Road & Transport Ministry last year issued a notification proposing amendments to the Central Motor Vehicles Rules, 1989, to **include safety evaluation standards for hydrogen fuel cell-based vehicles**.

## Hydrogen-enriched compressed natural gas (HCNG)

- Ministry of Road Transport has allowed the use of H-CNG (18% blending of H<sub>2</sub> with CNG) in CNG engines.
- Central Motor Vehicles Rules 1989 were amended for inclusion of H-CNG as an automotive fuel.
- HCNG reduces emissions of CO up to 70%.
- Engines can be calibrated to release lower amounts of NO.
- Ideal fuel for high load applications and heavy-duty vehicles. It enables up to 5 % savings in fuel.
- Better performance due to **higher Octane rating of H2**.

## {Geo – EG – Energy – 2021/04} National Programme on Solar PV Modules

**PIB | Prelims + Mains | GS1 > Renewable Energy | GS3 > S&T Developments & applications etc.**

- **Context:** The cabinet approved a **production linked incentive (PLI) scheme** with an outlay of Rs 4,500 crore **to add 10,000MW capacity of integrated solar PV modules manufacturing plants**.
- Solar capacity addition presently depends largely upon **imported solar PV cells & modules**.

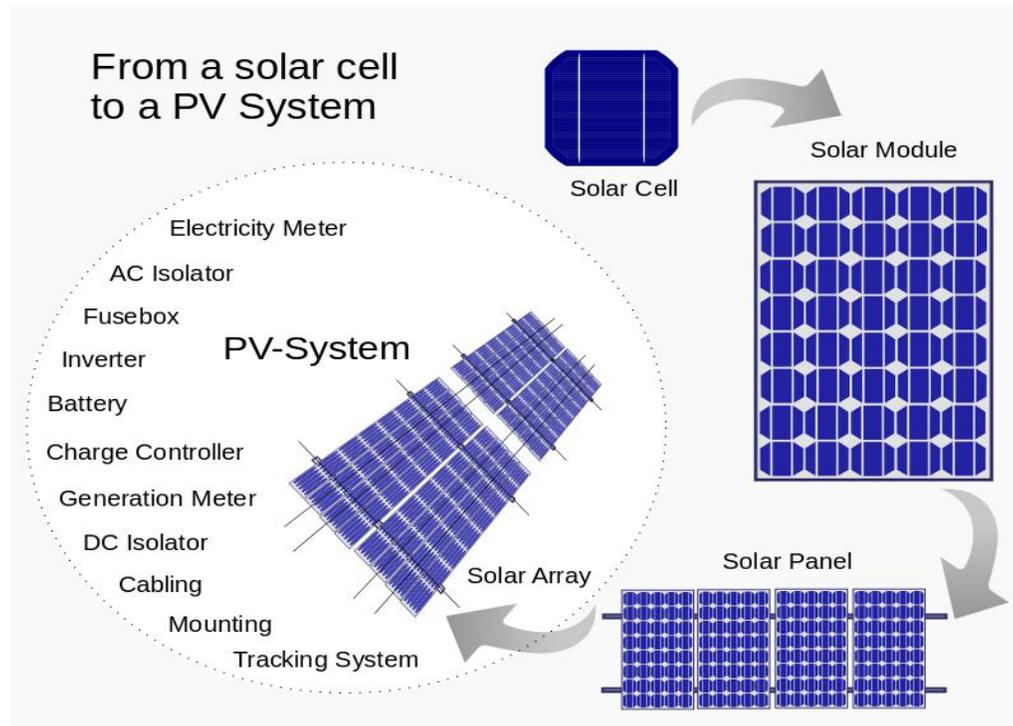
## Expected Benefits

- **Additional 10,000 MW** capacity of integrated solar PV manufacturing plants.
- **Direct investment** of around Rs.17, 200 crore in solar PV manufacturing projects.
- **Increased Demand** of Rs.17, 500 crore over 5 years for 'Balance of Materials'.
- **Direct employment** of about 30,000 & indirect employment of about 1, 20,000 persons.
- Import substitution of around Rs.17, 500 crore every year (**Reduce imports in sectors like fuel**).
- **Impetus to Research & Development** to achieve higher efficiency in solar PV modules.
- It will support the Atmanirbhar Bharat initiative.

## What is Solar PV Module?

- **Solar cells or Photovoltaic cells** use sunlight as a source of energy & generate **direct current** (an **electric generator** on the other hand produces **alternating current**).
- A single solar cell cannot provide required useful output.

- So, to increase output power level of a PV system, it is required to connect number of such PV solar cells.
- A PV module is an **assembly of photo-voltaic cells or solar cells**.
- A **collection of PV modules** is called a **PV Panel** & system of panels is an array.
- Arrays of a photovoltaic system supply solar electricity to electrical equipment.
- These are connected in same fashion as the battery cell units in a battery bank system.
  - ✓ Positive terminals of one cell connected to negative terminal of another solar cell.



[Source & Credits](#)

## Types of PV Modules:

- **Crystalline Silicon (Semiconductor) PV Module**
  - ✓ Costly
  - ✓ High Conversion Efficiency
- **Amorphous Silicon (Semiconductor) PV Module**
  - ✓ Suitable for low-cost product.
  - ✓ Low Conversion Efficiency

Semiconductors, Photoelectric effect & Photovoltaics will be covered under Science & Tech

**{Geo – EG – Water – 2021/04} Groundwater depletion & its effects on crops**

[TH](#) | Prelims + [Mains](#) | Geography > Economic Geography > Water Resources

- **Context:** Groundwater depletion in India could result in a reduction in food crops by up to 20% across the country & up to 68% in regions projected to have low future groundwater availability in 2025, says a study.

## Findings

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- India is the **2<sup>nd</sup> largest producer of wheat in the world.**
- But with severe groundwater depletion, the cropping intensity in the winter season may decrease by up to 20% by 2025. (Some of the important **winter crops are wheat, barley, mustard & peas**)
- 13% of the villages in which farmers plant a winter crop are in critically water-depleted regions.
- Study has now pointed out that India could experience **more flash droughts** by the end of this century.
- Even if all regions that are currently using depleted groundwater for irrigation will switch to using canal irrigation, cropping intensity may decline by 7% nationally.

## Status of Groundwater in India

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- About **85% of the rural water supply** in India is dependent on groundwater.
- Due to rampant drawing of the subsurface water, the **water table in many regions** of the country has **dropped significantly** in the recent years resulting in threat to groundwater sustainability.
- The **Indo-Gangetic Plain, North-western, Central & Western parts** of India account for most intensive groundwater-based irrigation.
- And among these regions, **Western India & the Indo-Gangetic Plain** have **more than 90% of the area irrigated using groundwater.**
- An average drop in groundwater level by 1 m would **increase India's total carbon emissions by over 1%.**

## Causes for depletion

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- Unsustainable usage of water.
  - ✓ Frequent pumping of water from the ground.
  - ✓ Usage rate is greater than Recharge rate.
- Low-intensity rainfall during the monsoon.
- Agricultural needs require a large amount of groundwater.
- Groundwater depletion is further worsened by the substantial increase in the **concurrent hot & dry monsoon** in India.
- **Green Revolution** era led to unsustainable groundwater use for irrigation:
  - ✓ Green Revolution led to large **increase in rice cultivation** in north-western India mainly in Punjab & Haryana which are less suitable for rice cultivation due to **predominantly light soils.**

- There are **limited storage facilities** owing to the **hard rock terrain in central India**.

## Effects

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- Large bodies of water will become shallower from groundwater depletion.
- As large aquifers are depleted, food supply & people will suffer.
- A lack of groundwater limits biodiversity & dangerous sinkholes results from depleted aquifers.

## Measures Taken by India for Managing its Ground Water Resources

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- **National Water Policy (2012)** has been formulated by Department of Water Resources:
  - ✓ It advocates for rainwater harvesting & conservation of water.
  - ✓ It highlights the need for augmenting the availability of water through direct use of rainfall.
- **Central Ground Water Authority (CGWA)** has issued directions under the **Environment Protection Act, 1986** for mandatory Rain Water harvesting for all target areas in the Country including UTs.
- **Central Ground Water Board (CGWB)** prepared document entitled "**Master Plan for Artificial Recharge to Ground Water in India**" during the year 2013:
  - ✓ It envisages construction of 1.11 crore rainwater harvesting & artificial recharge structures in the country by harnessing surplus monsoon runoff to augment ground water resources.
- **Ministry of Housing & Urban Affairs** has released Model Building Bye-laws, 2016:
  - ✓ It recommends Rainwater Harvesting for all types of Building with plot size 100 sq. m or more.
- Government of India has approved **Atal Bhujal Yojana (Atal Jal), a Rs. 6000 Crore Central Sector Scheme**:
  - ✓ **It aims for sustainable management of ground water resources** with community participation in water stressed blocks of Gujarat, Haryana, Karnataka, MP, Maharashtra, Rajasthan & Uttar Pradesh.
- Creation of a **new Ministry of Jal Shakti** for dealing with **all matters relating to water at one place in an integrated manner**.
  - ✓ It has been created by **merger of Ministries of Water Resources, River Development & Ganga Rejuvenation along with Drinking Water & Sanitation**.
- Government has **launched various schemes & programmes**:
  - ✓ **Jal Jeevan Mission (JJM)**.
  - ✓ **Jal Shakti Abhiyan** for water conservation launched that would focus on 1,592 "water-stressed" blocks in 257 districts.
  - ✓ **Pradhan Mantri Krishi Sinchayi Yojna**
  - ✓ **Micro Irrigation Fund under NABARD**.

## Measures Required

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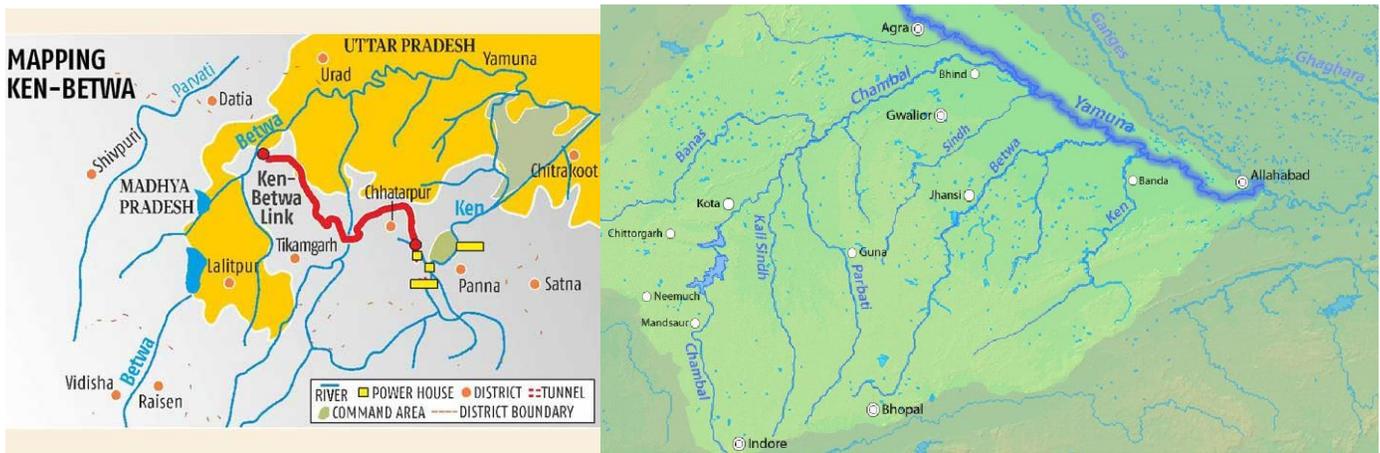
- We need **better policies in eastern India** to **expand the irrigation** & thus increase agriculture productivity. This will also release some pressure from north-western Indian states.
- Water resource management plans need to **incorporate the effects of climate change** in order to accurately predict future supplies.
- **Traditional water conservation/harvesting methods must be revived** like:
  - ✓ Constructing farm ponds, check dams, gully plugging, dug wells, borewells.
  - ✓ Artificial glaciers in Ladakh.
  - ✓ Tamaswada Pattern nallahs treatment in Maharashtra.
- **Need for greater regulation & strict penalties:**
  - ✓ Currently regulations are more of toothless tiger.
- Encouraging farmers to **adopt micro-irrigation techniques** such as drip irrigation & micro-sprinklers.
  - ✓ Government has initiated schemes like **DRIP programme, more drop per crop, Krishi Sinchai Yojana** to ensure economical water use practices in agriculture.
- **Artificial recharge** of tube wells, water reuse, afforestation, scientific methods of agriculture should also be done.
- It is **recommended to study the aquifer geometry:**
  - ✓ Establish the saline fresh interfaces within few km of the coastal area.
  - ✓ To study the effects of glaciers melting on recharge potential of aquifers in the Ganga basin & its effects on the transboundary aquifer systems, particularly in the arid & semi-arid regions.

## {Geo – EG – Water – 2021/04} Ken–Betwa Project

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[TH](#) | [Prelims + Mains](#) | [Geography](#) > [EG](#) > [Water Resources](#) | [GS3](#) > [Environment degradation](#)

- **Context:** The Ken – Betwa project if implemented will take a tremendous toll on the ecosystem.
- **UP, MP & the Centre signed a tripartite agreement** last month to transfer “surplus” water from the **Ken basin in MP** to the “deficit” **Betwa basin in UP**
- **Ken–Betwa Project** is part of the **national river linking project**.
- **National river linking project** proposes **to connect 14 Himalayan & 16 peninsular rivers with 30 canals & 3,000 reservoirs** to irrigate 87 million hectares of land.
- **Centre will contribute 90% of the cost** of the Ken–Betwa Project (has status of **National Project**).
- It is **India’s first river linking project** & will take 8 years to complete.



[Source & Credits](#)

## Advantages

- It can help in **reducing recurring droughts** in **Bundelkhand region**.
- It will facilitate groundwater recharge & reduce the occurrence of floods.
- It will curb the rate of farmer's suicide & will ensure them stable livelihood by reducing the dependence on groundwater.
- It will not only **accelerate the water conservation** by construction of a multipurpose dam but will also produce 103 MW of hydropower & will supply drinking water to 62 lakh people.

## Concerns with the Project

- **Submergence area includes** a critically **important section of the Panna Tiger Reserve**.
- Of the 12,500 ha of land to get submerged, more than 9,000 ha are categorized as forest land.
- Around 40% of the area of the tiger reserve will be irretrievably damaged if the project is implemented.
- The claims of **Ken having surplus water may be unrealistic as the river is not perennial**.
- Another difficulty will be that the **Ken flows 60-70 feet lower than the Betwa** & at least 30% of the 103 MW power generated will be used for pumping the water up.

## Panna Tiger Reserve, National Park

- **Panna National Park** along with **Ken Gharial Wildlife Sanctuary** form a significant part of the catchment area of the **Ken River (a tributary of Yamuna)** which **runs northeast through the park**.
- In the **Ken Gharial Sanctuary gharials (CR fish-eating freshwater crocodiles)** are bred in captivity and then released.



- Vegetation: fragmented deciduous forests.
- Major Fauna: tiger, leopard, chital, chinkara, nilgai, sambhar and sloth bear.



## {Geo – HG – 2021/04} Draft Recommendations of National Migrant Policy

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[D2E](#) | Prelims + Mains | GS1 > Human Geography > Migration (Covered in previous month's CA)

- **Context:** NITI Aayog has released the **first draft of National Migrant Policy**.
- Migration should be acknowledged as an **integral part of development** & government policies should not hinder but seek to **facilitate internal migration**.
- The draft describes **two approaches to policy design**:
  - ✓ First to focus on cash transfers, special quotas, & reservations.
  - ✓ Second to enhance capability of the community & remove aspects that come in the way of an individual's own natural ability to thrive.
- The policy rejects a handout approach, opting instead for a **rights-based framework**.
- It initiates **discussions on**:
  - ✓ Creation of a database of workers, particularly those in the informal economy.
  - ✓ An increase in minimum wages.
  - ✓ Employment creation in the rural belt in order to stem migration.
  - ✓ Measures to deal with workplace accidents, registration of grievances & provision of adequate shelter.
- Most relevant feature of the draft policy is the requirement of several Ministries to work in tandem.
  - ✓ The **Labor Ministry is proposed to be the nodal Ministry for implementation of policies**.
  - ✓ The policy suggests that the **Ministries of Panchayati Raj, Rural Development, Housing & Urban Affairs, & Tribal Affairs** use migration data to set up the **migration resource centers**.
  - ✓ Ministry of Skill Development should **focus on skill building at these centers**.

### Issues with existing law

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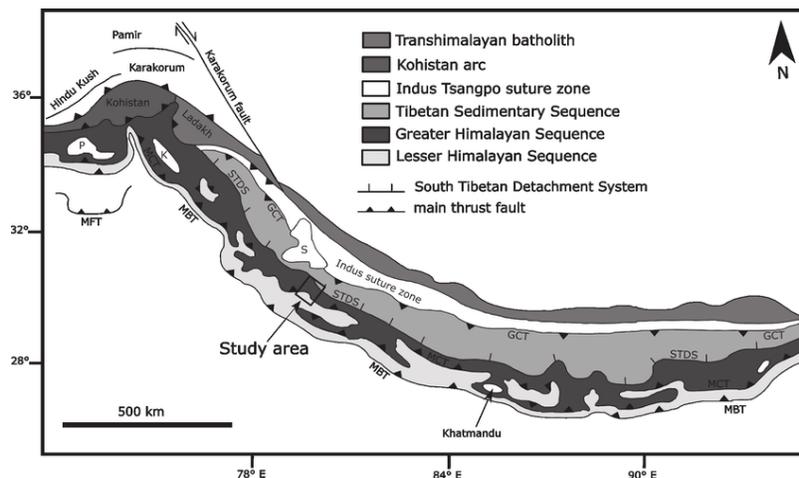
- The **Migrant Workmen Act, 1979**, is a key piece of legislation that is enacted by Indian Parliament **to regulate the condition of service of inter-state laborers** in Indian Labor Law.
  - ✓ Whenever an employer faces shortage of skills among the locally available workers, they would employ better skilled workers available outside the state as per the provision created through this act.
  - ✓ It was designed to protect laborers from exploitation by contractors by safeguarding their right to non-discriminatory wages, travel & displacement allowances, & suitable working conditions.
- But it had several limitations.
  - ✓ The law **covers only laborers brought by a contractor & not independent migrants**.
  - ✓ The requirement set out in the law makes employment more expensive as compared to hiring intra-state workmen.

- ✓ **No state has implemented this legislation** in letter & spirit.

## {Geo – Indian Geography – 2021/04} Kopili Fault

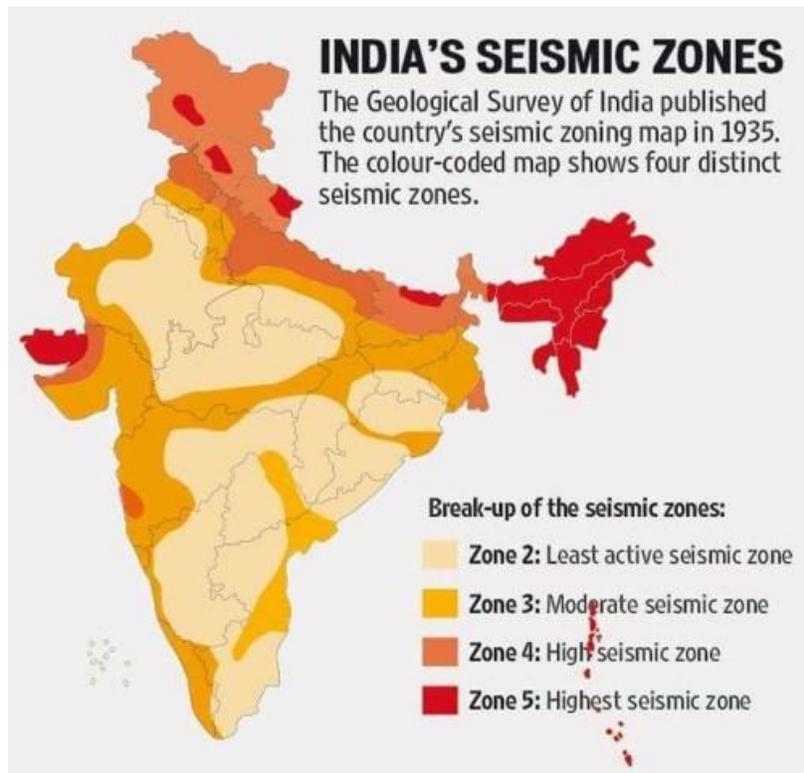
**D2E | IE | Prelims | GS1 > Important geophysical phenomenon such as earthquakes etc.**

- **Context:** The tremors in Assam have been attributed to the **Kopili Fault Zone**.
- The Kopili fault zone is a 300 km long & 50 km wide faultline extending from the western part of Manipur up to the tri-junction of Bhutan, Arunachal Pradesh & Assam.
- It is a tectonic depression filled up by the alluvium of the **Kopili river** & its tributaries.
  - ✓ **Kopili River** is an interstate river flowing through the states of **Meghalaya & Assam**.
  - ✓ It is a **south bank tributary** of the **Brahmaputra** in Assam.
- This fault is closer to **Himalayan Frontal Thrust (Main Frontal Thrust (MFT))**.
- **Himalayan Thrust Fault** is a **thrust faultline** that defines the boundary between Indian & Eurasian Plates.
- This is a seismically active area falling in the **highest Seismic Hazard Zone V**.
- It is a **convergent tectonic boundary** where the **Indian Plate** is **subducting beneath the Eurasian Plate**.
  - ⇒ Subduction is a geological process in which one crustal plate is forced below the edge of another.
- The fault zone has witnessed many **seismic activities** including the 1869 earthquake (**7.8 magnitude**) & the 1943 earthquake (7.3 magnitude).



## Earthquakes in the North East

- The **North East is a highly fragile & earthquake-prone zone**. For ex:
  - ✓ **Sikkim Himalaya** comes under high seismic hazard zone designated as **Zone IV**.
  - ✓ **Guwahati city** is placed within the highest level of seismic Earthquake hazard in **Zone V**.



### Why North East is highly seismic region?

- **Seismicity** expresses the frequency of quakes in a region in the past as well as probable future occurrence.
- The high seismicity of the northeast Indian region has been attributed to a **complex tectonic juxtaposition of the E-W trending Himalaya & the N-S trending Arakan Yoma belt.**
- **Various faults present** in the nearby region are:
  - ✓ Po Chu fault
  - ✓ Kopili Fault
  - ✓ Jiali Fault

**Suggested Reading:** [Earthquakes1](#), [Seismic Waves](#), [Earthquake in Delhi NCR](#) , [Faults](#)

### {Geo – Indian Geography – 2021/04} Non-Uniformity of Himalayas

**PIB | Prelims + Mains | GS1 > Salient features of world physical geography plus earthquakes etc.**

- **Context:** Scientists have found that the **Himalayas are not uniform** & have different physical & mechanical properties in different directions.
- Complex pattern of anisotropy is observed in **North West Himalaya & Ladakh-Karakoram zone.**

### What is Anisotropy?

- It is a property present in crystals.
- It could **result in significantly large earthquake events in the Himalayas.**
- It is mainly because the **strain induced by the Indo-Eurasia collision** (going on since 50 million years) & deformation due to the collision is found to be larger in the crust than in the upper mantle.

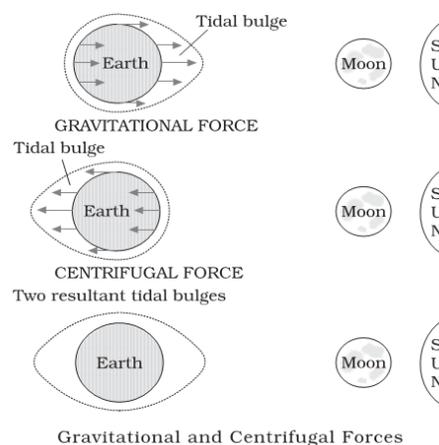
### Why it is Significant?

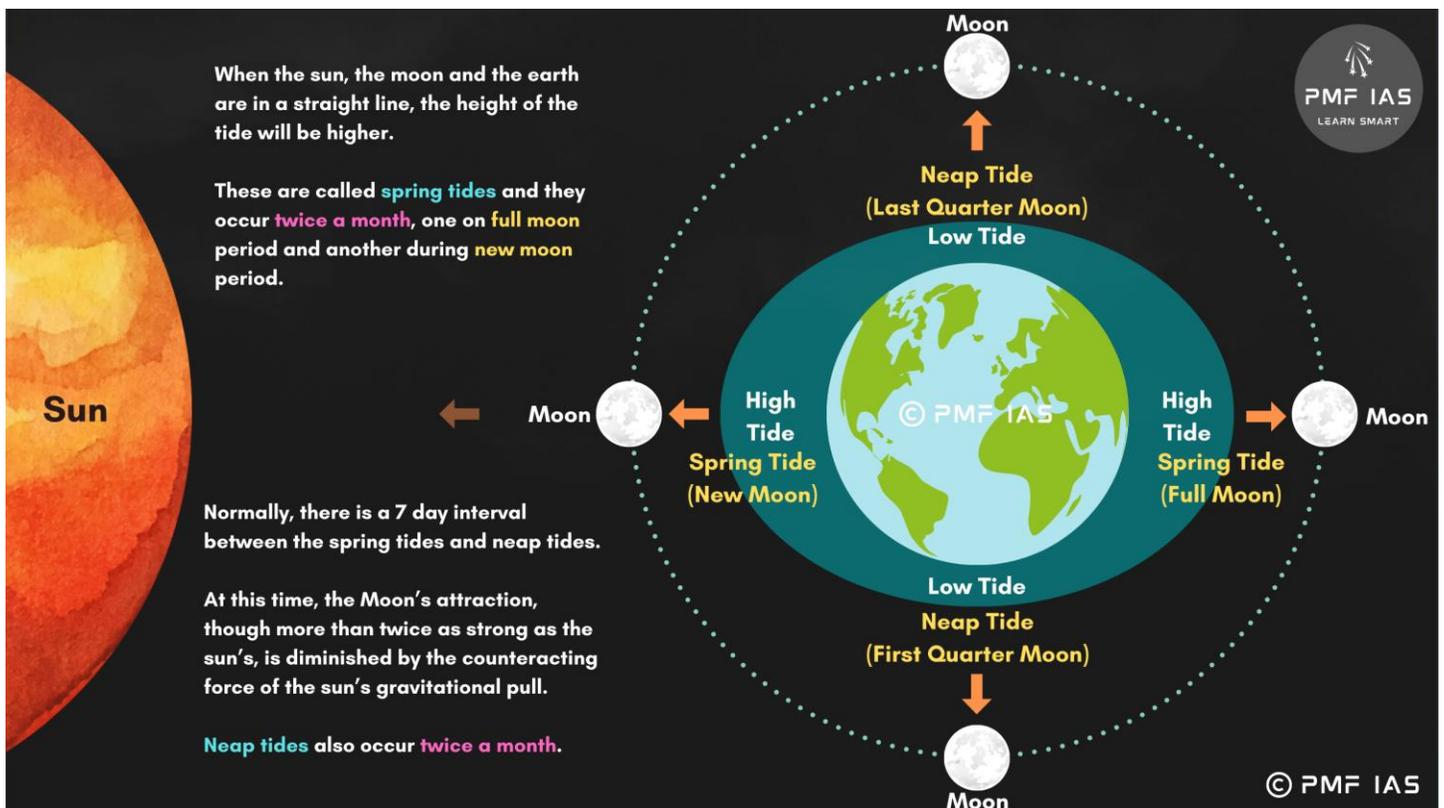
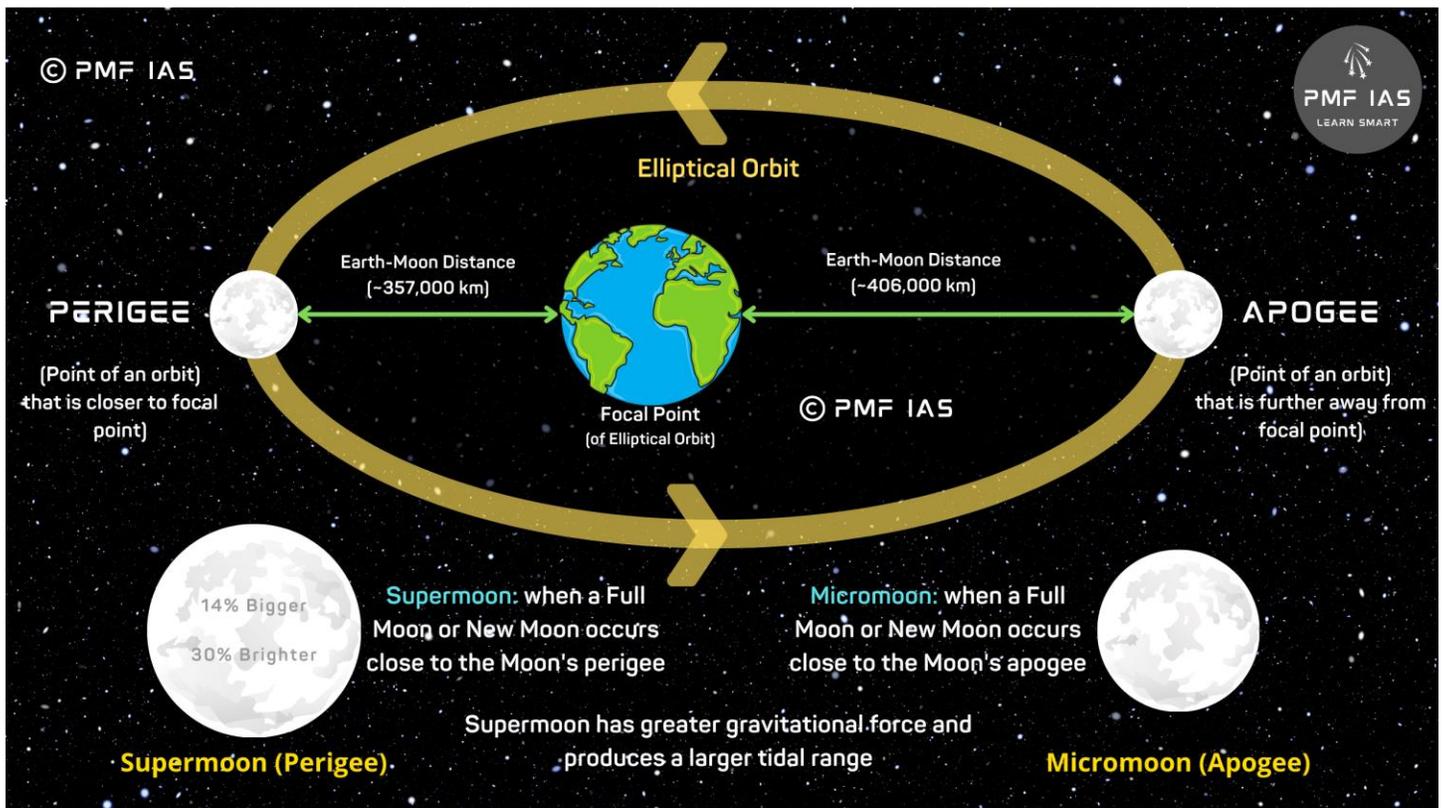
- This assumes significance given that the Himalayan region has been repeatedly hit by earthquakes.
- **Most prone being Garhwal & Himachal Pradesh** that has been hit by four destructive 'moderate to great' earthquakes since the beginning of the 20th century.
  - ✓ Kangra earthquake of 1905
  - ✓ Kinnaur earthquake of 1975
  - ✓ Uttarkashi earthquake of 1991
  - ✓ Chamoli earthquake of 1999
- This comes against the backdrop of India being one of the most vulnerable countries for extreme weather events, **ranking 20 on the Climate Risk Index (CRI).**

## {Geo – Oceanography – 2021/04} Lunar Nodal Cycle & Rising Sea Level

### D2E | Prelims + Mains | GS1 > Changes in critical geographical features etc. > Tides

- **Context:** A "super full moon" has brought heightened risk of tidal flooding for coastal cities like Miami.
- **Exceptionally high tides** are common when the:
  - ✓ Moon is **closest to the Earth**, known as **perigee**.
  - ✓ When it is **either Full Moon or New Moon**.
  - ✓ **In the case of supermoon, it is both Full Moon (super full moon) or New Moon (super new moon) & at perigee.**

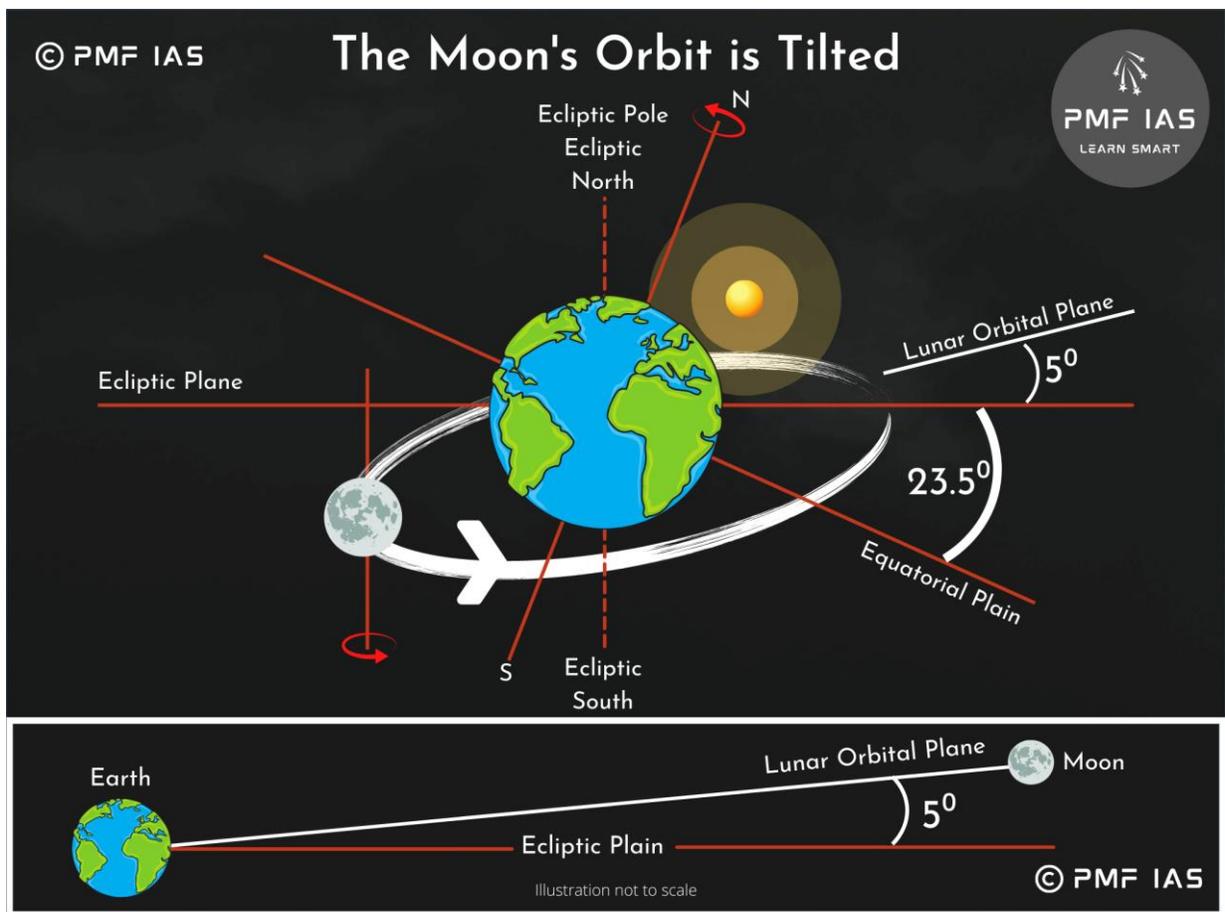
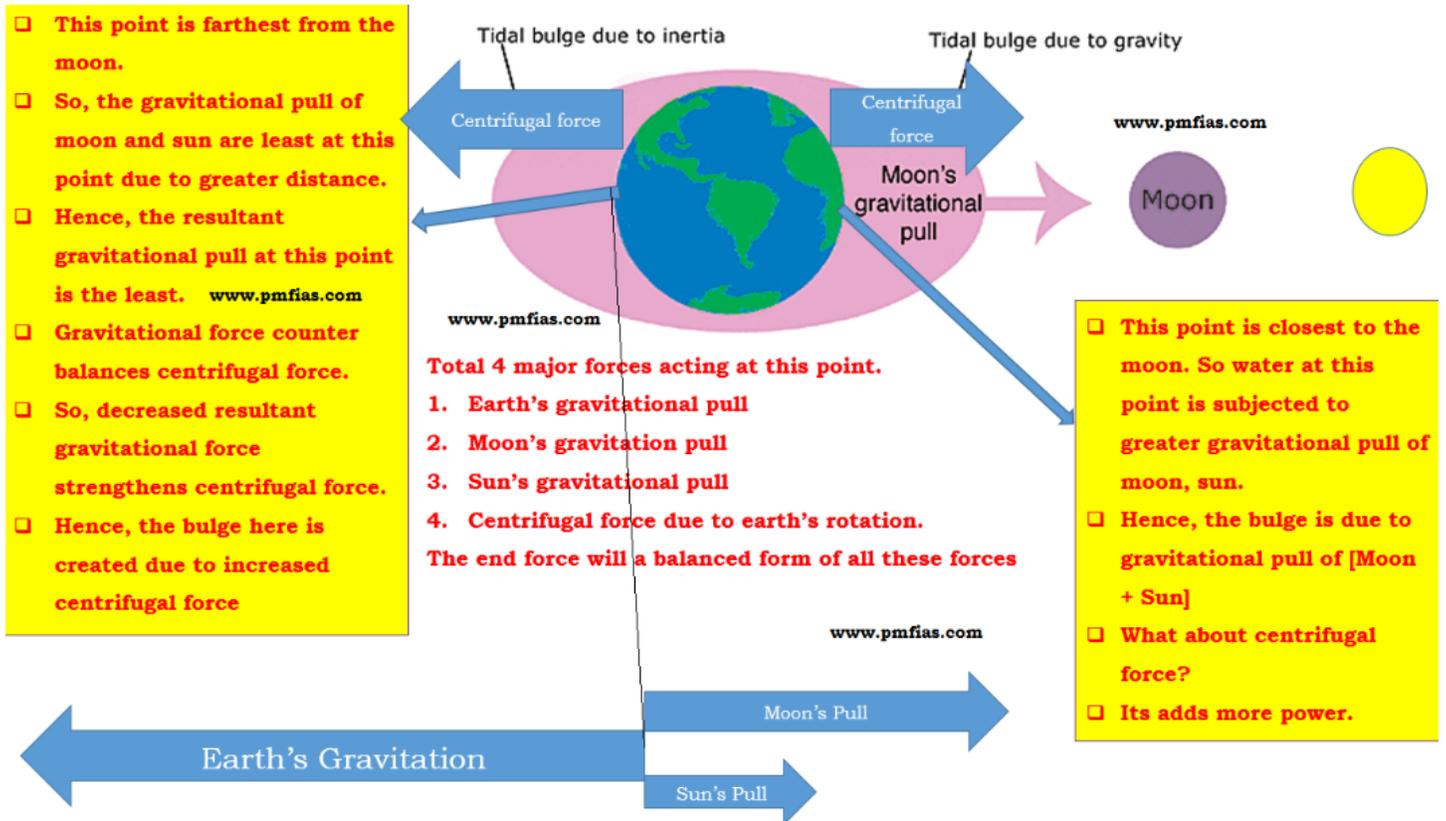




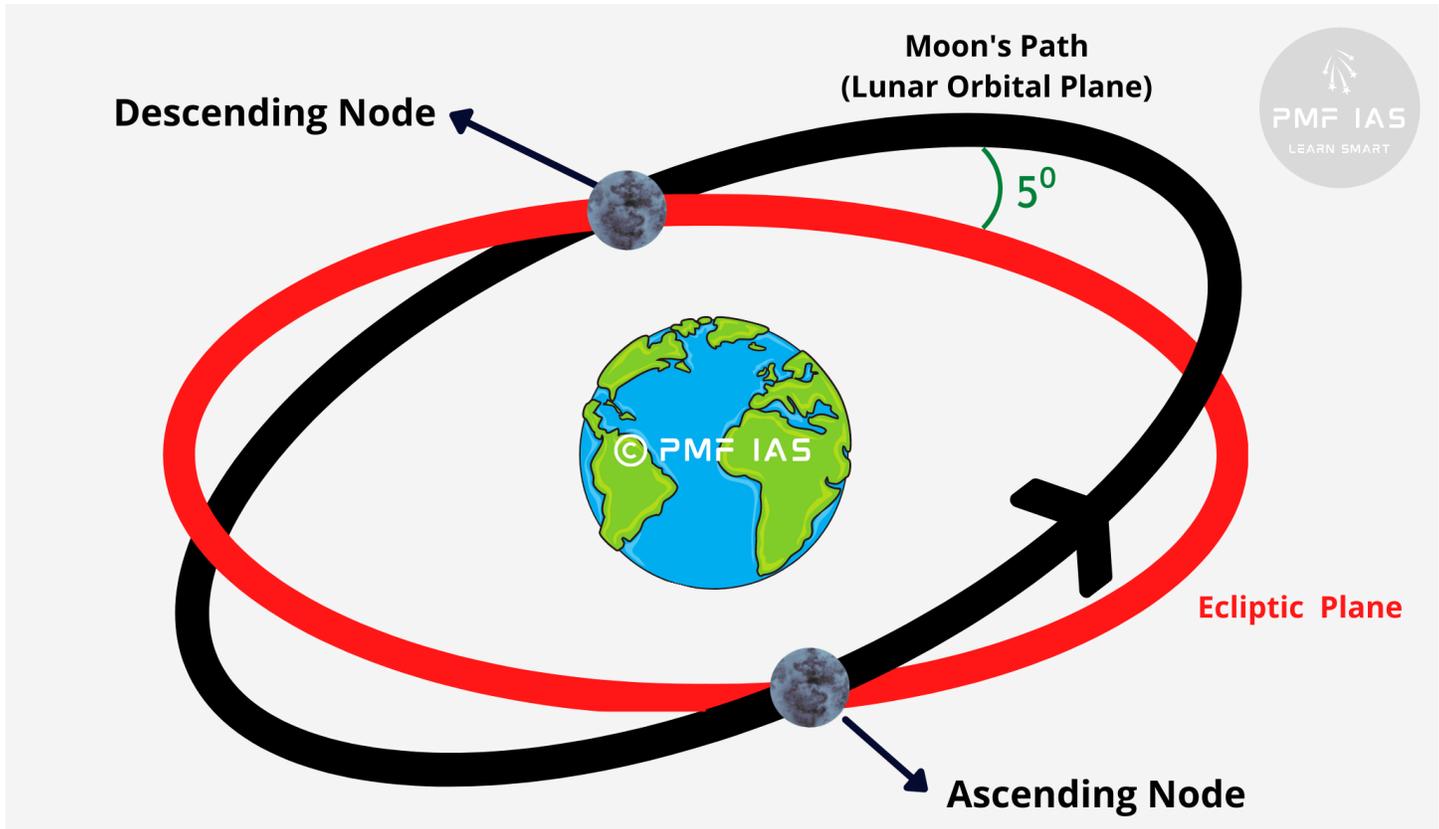
## Lunar Nodal Cycle

- Scientists claim that **Lunar Nodal Cycle** might lead to **rising sea level** in near future.
- Sea level is still rising & the **18.6-year lunar node cycle** will soon be working against us.

- Currently we are in the **phase of an 18.6-year lunar cycle** that **lessens the moon's influence on the oceans** i.e., **downward phase**.



- Earth orbits the sun in **ecliptic plane**.
- The plane of Moon's orbits around the Earth is **slightly tilted, about 5 degrees** relative to the earth-sun **ecliptic plane**.
- It means that moon's orbital plane intersects Earth's orbital plane at two points, **called nodes**.
  - ✓ The **lunar nodes** are the points where the **moon's path crosses the ecliptic**.
  - ✓ The **ascending (or north) node** is where the Moon moves into the northern ecliptic hemisphere.
  - ✓ The **descending (or south) node** is where the Moon enters the southern ecliptic hemisphere.



- The Moon's orbital plane wobbles to a maximum & minimum of +/- 5 degrees over a period of ~18.6 years. This natural cycle of orbits is called the **Lunar Nodal Cycle**.
- When the **lunar plane is more closely aligned with the plane of Earth's equator**, tides on Earth are **exaggerated** (the tidal bulge is maximum along the equator due to maximum centrifugal force).
- Conversely, when the **lunar plane tilts further away from the equatorial plane**, tides on Earth are **mutted** (the tidal bulge decreases as we move away from the equator due to decreasing centrifugal force).

## What effect does that have on sea level?

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- The effect of the nodal cycle is gradual & not easily noticeable.
- But when it comes to predictions of tides, dozens of astronomical factors are accounted for, **including the lunar nodal cycle**.
- During the most rapid **downward phase** of the lunar nodal cycle — like we are in right now — **sea level remains less & stable**, all other things being equal.

## Significance

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- These are the years (**downward cycle**) **to implement infrastructure plans to protect coastal areas** against sea level rise.
- Once we reach the bottom of the cycle around 2025 & start the **upward phase**, the lunar nodal cycle **begins to contribute more & more to the perceived rate of sea level rise**.
- During those years, the rate of sea level rise is effectively doubled in places like Miami.
- The impact varies from place to place.

**Suggested Reading:** [Tides \(explained in detail in the Geography PDF notes > Oceanography > Tides\)](#)