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1. Ethanol Blending in India: Evaluating the Shift Towards E25

Source: *The Hindu*

Subject: Environment | Economy | Energy Security

Why in News?

With **E20 (20% Ethanol Blended Petrol)** now available nationwide, the Government is preparing for a **calibrated transition to E25 (25% ethanol blend)**. However, the proposal has triggered concerns from the automobile industry and consumers regarding **vehicle compatibility, fuel economy and long-term engine performance**.

What is E25 and Why is India Moving Towards It?

- **E20** has become the standard petrol across India under the **Ethanol Blended Petrol (EBP) Programme**.
- Recent measures such as:
 - **Central Excise Duty exemption** on petrol containing **22–30% ethanol**, and
 - **Bureau of Indian Standards (BIS)** notification of new fuel specifications, indicate preparations for **E25**.
- The Government intends to introduce E25 **only after scientific evaluation, stakeholder consultation and phased implementation**.

Advantages of Higher Ethanol Blending

- **Reduces crude oil imports**, strengthening **energy security**.
- Lowers **greenhouse gas emissions** due to ethanol's lower carbon content.
- Promotes **Atmanirbhar Bharat** by utilising domestically produced ethanol.

- Generates **additional income for farmers** through sugarcane, maize and other feedstocks.
- Ethanol has a **higher octane number**, improving combustion efficiency and reducing engine knocking.
- Supports India's **Net Zero 2070** and clean mobility goals.

Concerns Regarding E25 Ethanol Blending

- Lower calorific value than petrol reduces fuel efficiency (mileage).
- Older vehicles face higher risks of cold-start problems, fuel system corrosion, deterioration of rubber components, and engine wear due to ethanol's hygroscopic nature.
- Automobile manufacturers must undertake engine recalibration, material upgrades, durability testing, corrosion validation, and fresh homologation before large-scale E25 adoption.
- Higher manufacturing and compliance costs are expected due to vehicle redesign and certification requirements.
- Consumers fear increased maintenance costs, shorter vehicle life, lower resale value, and a rushed transition without adequate E25-compatible vehicles and infrastructure.



Government's Approach

- The Government has clarified that **E25 will not be introduced abruptly**.
- Transition will be:
 - **Science-based**,

- **Calibrated and graded,**
- Supported by **extensive testing** and industry consultations.
- Objective is to balance **environmental benefits, consumer interests and automobile readiness.**

Ethanol Blended Petrol (EBP) Programme

- **Launched:** 2003.
- **Nodal Ministry:** Ministry of Petroleum & Natural Gas.
- **Implemented by:** Oil Marketing Companies (OMCs).
- **Objectives:** Reduce crude oil imports, lower vehicular emissions, enhance farmers' income, promote renewable biofuels, and strengthen India's energy security.
- **Major feedstocks:** Sugarcane molasses, sugarcane juice, damaged food grains, maize, and surplus rice.

Challenges Ahead

- Sustainable availability of ethanol feedstock without affecting food security.
- Water-intensive cultivation of sugarcane.
- Development of nationwide fuel distribution infrastructure.
- Faster adoption of **flex-fuel vehicles (FFVs)** for higher ethanol blends.
- Balancing environmental gains with consumer costs.

Way Forward

- Adopt a **phased rollout** of E25 based on scientific evidence.
- Encourage production of **flex-fuel compatible vehicles.**
- Diversify ethanol feedstocks towards **second-generation (2G) biofuels** and agricultural residues.
- Continue R&D on engine compatibility and fuel efficiency.
- Ensure coordinated policy support for farmers, fuel producers and automobile manufacturers.

UPSC Prelims MCQ

Q. With reference to Ethanol Blended Petrol (EBP), consider the following statements:

1. Ethanol has a higher octane number than petrol.
2. Ethanol has a higher calorific value than petrol.
3. Ethanol is hygroscopic and can absorb moisture, increasing the risk of corrosion in older vehicles.

Which of the statements given above is/are correct?

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

Answer: (a)

UPSC Mains Question (15 Marks)

"India's Ethanol Blended Petrol (EBP) Programme seeks to balance energy security, environmental sustainability and farmers' welfare. Examine the opportunities and challenges associated with the proposed transition from E20 to E25 ethanol blending."

2.INS Mahendragiri: Sixth Indigenous Project 17A Stealth Frigate

Source: *The Hindu*

Subject: Defence & Security | Maritime Security

Why in News?

The **Indian Navy** will commission **INS Mahendragiri**, the **sixth Project 17A (P17A) indigenous stealth frigate**, on **11 July 2026** at **Visakhapatnam**. The induction strengthens India's indigenous warship-building capability under **Aatmanirbhar Bharat** and enhances maritime security in the **Indo-Pacific**.

About INS Mahendragiri

- Sixth and final stealth frigate under **Project 17A**.
- **Designed by:** Indian Navy's **Warship Design Bureau (WDB)**.
- **Constructed by:** Mazagon Dock Shipbuilders Limited (MDL), Mumbai.

- Named after the **Mahendragiri Hills** in the Eastern Ghats, symbolising resilience and strength.
- Built with **over 75% indigenous content**, reflecting India's growing defence manufacturing capability.

Key Features

- Advanced **stealth technology** with reduced radar, acoustic and infrared signatures.
- Powered by **Combined Diesel or Gas (CODOG)** propulsion for high speed and long endurance.
- High degree of **automation** and improved survivability.
- Equipped with indigenous **surface-to-surface missiles, surface-to-air missiles**, advanced radar and electronic warfare systems.
- Comprehensive **Anti-Submarine Warfare (ASW)** capability using sonar, torpedoes and anti-submarine helicopters.
- Capable of **network-centric warfare** through integrated combat management systems.



Operational Role

INS Mahendragiri is a **multi-role stealth frigate** capable of:

- **Anti-Air Warfare (AAW)**
- **Anti-Surface Warfare (ASuW)**
- **Anti-Submarine Warfare (ASW)**
- Maritime surveillance and sea control.
- Escort operations for carrier and naval task groups.
- **Humanitarian Assistance and Disaster Relief (HADR)** and Non-Combatant Evacuation Operations (NEO).

- Protection of **Sea Lines of Communication (SLOCs)** and safeguarding India's interests in the **Indian Ocean Region (IOR)**.

About Project 17A

- Follow-on programme to the **Project 17 (Shivalik-class)** stealth frigates.
- **Total Ships: 7**
 - **Mazagon Dock Shipbuilders Ltd. (MDL):** 4 ships
 - **Garden Reach Shipbuilders & Engineers (GRSE):** 3 ships

Significance

- Strengthens **Aatmanirbhar Bharat** and **Make in India** in defence manufacturing.
- Demonstrates India's capability to design and construct sophisticated frontline warships.
- Boosts indigenous defence ecosystem involving **MSMEs** and domestic industries.
- Enhances India's maritime deterrence and blue-water naval capability.
- Supports India's **SAGAR (Security and Growth for All in the Region)** vision and Indo-Pacific strategy.
- Improves the Navy's ability to address traditional and non-traditional maritime security challenges.

UPSC Prelims MCQ

Q. With reference to Project 17A, consider the following statements:

1. Project 17A is the successor programme to the Shivalik-class (Project 17) stealth frigates.
2. INS Mahendragiri has been designed by the Indian Navy's Warship Design Bureau.
3. The frigates under Project 17A are equipped only for anti-submarine operations.

Which of the statements given above is/are correct?

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

Answer: (a)

UPSC Mains Question (15 Marks)

"Indigenous warship construction has become a key pillar of India's maritime strategy and defence self-reliance." Discuss the significance of Project 17A stealth frigates in strengthening India's naval capabilities and Indo-Pacific security.

3.Sponge Cities and Urban Flood Resilience

Source: *The Hindu*

Subject: Environment | Urban Development | Disaster Management

Why in News?

Heavy rainfall has caused **widespread flooding in Mumbai**, exposing the limitations of conventional drainage systems. Experts have called for adopting the '**Sponge City**' approach and **blue-green infrastructure** to improve urban flood resilience in the face of increasing climate-induced extreme rainfall.

Why is Mumbai Vulnerable to Urban Flooding?

- Mumbai is largely built on **reclaimed land**, with many areas lying only a few metres above sea level.
- The city relies mainly on a **gravity-based stormwater drainage system**, which becomes ineffective during **high tides**.
- Rapid urbanisation has encroached upon **wetlands, mangroves, creeks, salt pans and natural drainage channels**, reducing water absorption capacity.
- Increased concretisation and impermeable surfaces generate higher **surface runoff** during intense rainfall.
- Climate change has increased the frequency of **short-duration, high-intensity rainfall events**, overwhelming existing infrastructure.

What is a Sponge City?

A **Sponge City** is an urban planning model that enables cities to **absorb, store, filter, reuse and gradually release rainwater**, thereby reducing flooding while improving groundwater recharge and urban ecology.

Key Features

- Permeable pavements and porous roads.
- Green roofs and rooftop gardens.
- Rain gardens and bioswales.
- Restoration of wetlands, lakes and urban rivers.
- Urban forests and green open spaces.
- Artificial lakes and detention ponds for temporary water storage.
- Rainwater harvesting and groundwater recharge systems.

Blue-Green Infrastructure

Blue-Green Infrastructure integrates **water bodies (Blue)** with **vegetation and green spaces (Green)** to manage stormwater naturally.

Blue Components

- Rivers
- Lakes
- Wetlands
- Canals
- Stormwater ponds

Green Components

- Parks
- Urban forests
- Green roofs
- Green corridors
- Bioswales

India's Initiatives

- **AMRUT 2.0** – Urban water management and stormwater infrastructure.

- **Smart Cities Mission** – Sustainable urban planning.
- **Atal Bhujal Yojana** – Groundwater recharge.
- **National Disaster Management Plan (NDMP)** – Urban flood risk management.
- Municipal lake restoration and rainwater harvesting initiatives in several cities.

Challenges

- Encroachment of wetlands and floodplains.
- Outdated stormwater drainage infrastructure.
- Poor urban planning and weak enforcement of land-use regulations.
- Limited adoption of **Nature-based Solutions (NbS)**.
- Increasing climate variability and sea-level rise in coastal cities.

Way Forward

- Integrate the **Sponge City concept** into urban master plans.
- Protect and restore **wetlands, mangroves and natural drainage networks**.
- Expand **blue-green infrastructure** and permeable urban landscapes.
- Upgrade stormwater drainage using climate-resilient design standards.
- Promote rainwater harvesting, groundwater recharge and community participation.
- Strengthen urban flood forecasting, early warning systems and climate-resilient city planning.

UPSC Prelims MCQ

Q. With reference to the 'Sponge City' concept, consider the following statements:

1. It promotes the use of permeable surfaces and restoration of wetlands to reduce urban flooding.
2. It primarily relies on large underground concrete drainage tunnels for stormwater management.
3. It contributes to groundwater recharge and urban climate resilience.

Which of the statements given above is/are correct?

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

(c) 1, 2 and 3

(d) 3 only

Answer: (a)

UPSC Mains Question (15 Marks)

"Climate change has exposed the limitations of conventional urban drainage systems in India." Discuss how the Sponge City approach and blue-green infrastructure can improve urban flood resilience and sustainable urban development.

4.Oldest Quasars Deepen Mystery of Early Universe

Source: *The Hindu*

Subject: Science & Technology | Space Technology | Astronomy

Why in News?

The **European Space Agency's (ESA) Euclid Space Telescope** has discovered **31 new quasars**, including the **oldest quasars ever observed**, dating back to when the Universe was only **670 million years old**. The discovery raises fresh questions about **how supermassive black holes formed so rapidly in the early Universe**.

Key Highlights

- **31 new quasars** have been identified by the **Euclid Space Telescope**.
- The **two oldest quasars** emitted their light when the Universe was about **670 million years old** (around **5% of its current age of 13.8 billion years**).
- The discovery has **doubled the number of known ancient quasars** within just two years.
- Findings were published in the journal **Astronomy & Astrophysics**.

What are Quasars?

- **Quasars (Quasi-Stellar Objects)** are the **extremely luminous cores of active galaxies**.
- They are powered by **supermassive black holes (SMBHs)** located at the centre of galaxies.

- As gas and dust fall into the black hole (**accretion**), enormous amounts of **gravitational energy** are converted into radiation, making quasars among the **brightest objects in the Universe**.
- Despite their small size, a single quasar can outshine an **entire galaxy**.

Why is this Discovery Important?

- The quasars belong to the **Epoch of Reionisation**, when the **first stars and galaxies formed**, ending the Universe's **Cosmic Dark Ages**.
- Their existence suggests that **supermassive black holes had already grown to enormous sizes** within a few hundred million years after the **Big Bang**.
- Current theories cannot fully explain **how such massive black holes formed and evolved so quickly**, making it one of modern astronomy's biggest puzzles.
- The findings will help scientists reconstruct the Universe's **first billion years** and understand early galaxy evolution.

About the Euclid Space Telescope

- **Launched:** 2023
- **Developed by:** European Space Agency (ESA)
- **Mission Objective:**
 - Map the **large-scale structure of the Universe**.
 - Investigate **Dark Matter** and **Dark Energy**.
 - Study galaxy formation and cosmic evolution.
- Works alongside observatories like the **James Webb Space Telescope (JWST)** for detailed observations of distant objects.

Related Concepts

Epoch of Reionisation

- Period between **~400 million and 1 billion years** after the Big Bang.
- Radiation from the first stars and galaxies ionised neutral hydrogen, making the Universe transparent to light.

Supermassive Black Holes (SMBHs)

- Black holes with masses ranging from **millions to billions of times the Sun's mass**.

- Found at the centres of most large galaxies, including the **Milky Way (Sagittarius A*)**.

Significance

- Improves understanding of **early Universe evolution**.
- Helps test theories of **black hole formation and galaxy evolution**.
- Strengthens international collaboration in observational astronomy.

Advances research on **dark matter, dark energy and cosmology**

UPSC Prelims MCQ

Q. With reference to Quasars, consider the following statements:

1. Quasars are powered by supermassive black holes located at the centres of galaxies.
2. Quasars were observed during the Epoch of Reionisation, when the first stars and galaxies emerged.
3. The Euclid Space Telescope was launched primarily to study gravitational waves.

Which of the statements given above is/are correct?

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

Answer: (a)

UPSC Mains Question (15 Marks)

"Recent discoveries of ancient quasars have challenged existing theories of supermassive black hole formation." Discuss the significance of the Euclid Space Telescope in advancing our understanding of the early Universe and modern cosmology.

5.India's Campaign for UN Security Council Non-Permanent Seat (2028–29)

Source: *The Hindu*

Subject: International Relations | United Nations

Why in News?

- India will officially launch its campaign for election as a **Non-Permanent Member of the United Nations Security Council (UNSC)** for the **2028–29 term** on **13 July 2026** at the **UN Headquarters, New York**.
- **External Affairs Minister Dr. S. Jaishankar** will lead the campaign launch.
- India is contesting the **Asia-Pacific Group** seat against **Tajikistan**, making diplomatic outreach crucial for securing votes in the **UN General Assembly (UNGA)**.
- The campaign aligns with India's objective of strengthening its leadership in the **Global South** and advancing **UN Security Council reforms**.

India's UNSC Campaign: Strategic Significance

- Reinforces India's aspiration to play a larger role in **global governance**, international peace and multilateral diplomacy.
- Supports India's long-standing demand for a **reformed and representative UN Security Council** reflecting present-day geopolitical realities.
- India projects itself as a responsible global stakeholder through:
 - Leadership of the **Global South**.
 - Commitment to **rules-based international order**.
 - Strong record in **UN Peacekeeping Operations (UNPKOs)**.
 - Active role in **counter-terrorism, maritime security, climate action and sustainable development**.
- India's candidature also strengthens its case for **permanent membership** of the UNSC.
- The contest with Tajikistan highlights increasing geopolitical competition within the **Asia-Pacific Group**, requiring sustained diplomatic engagement and coalition-building.

UN Security Council and India's Position

- The **UN Security Council (UNSC)** is the principal organ of the **United Nations** responsible for maintaining **international peace and security**.
- It consists of **15 members**:

- **5 Permanent Members (P5):** China, France, Russia, United Kingdom and United States.
- **10 Non-Permanent Members** elected by the **UN General Assembly** for a **two-year term**.
- Elections are conducted through **secret ballot**, requiring a **two-thirds majority** of members present and voting.
- India has served as a **Non-Permanent Member eight times**, most recently during **2021–22**.
- India is a member of the **G4 (India, Germany, Japan and Brazil)**, which advocates expansion of both permanent and non-permanent categories of the UNSC.
- India argues that the present Council reflects the **post-World War II order** and inadequately represents **Asia, Africa and Latin America**, thereby reducing its legitimacy and effectiveness.

Challenges and Way Forward

- India faces competition from **Tajikistan**, which enjoys support from several members of the **Organisation of Islamic Cooperation (OIC)**.
- Securing victory requires extensive diplomatic outreach across regional blocs and developing countries.
- India must continue leveraging platforms such as **G20, BRICS, SCO, Quad and Voice of Global South Summit** to strengthen international support.
- Continued advocacy for **Intergovernmental Negotiations (IGN)** on UNSC reforms remains essential.
- India's growing economic strength, development partnerships, humanitarian assistance and peacekeeping contributions should be translated into greater influence within global institutions.

UPSC Prelims MCQ

Q. With reference to the United Nations Security Council (UNSC), consider the following statements:

1. Non-permanent members of the UNSC are elected by the United Nations General Assembly for a term of two years.
2. India has served as a non-permanent member of the UNSC eight times.

3. Elections to the UNSC are conducted through a secret ballot in the General Assembly.

Which of the statements given above is/are correct?

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

Answer: (d)

UPSC Mains Question (15 Marks)

"India's campaign for a non-permanent seat in the United Nations Security Council is part of its broader objective of securing a greater role in global governance." Examine the significance of India's candidature and discuss the need for comprehensive reforms in the UN Security Council.

