DAILY CURRENT AFFAIRS 15-04-2026

Prelims Perspective

1. **Sentinel Species**
2. **South Atlantic Anomaly**
3. **Vitamin D**

Mains Perspective

4. **Khanij Bidesh India Limited**
5. **Electric Cooking in India: Challenges**

Sentinel Species

Syllabus: Prelims Bits – Wildlife in news.

Context:

- Recently, the International Union for Conservation of Nature (IUCN) declared the Emperor Penguin to be an **endangered sentinel species**.

About Sentinel Species

- **Definition:** A species whose members' health signals the condition of the ecosystem in which they live.
- **Characteristic features:**
  - Among the first to respond to environmental stressors such as pollution and disease.
  - Their response tends to be more apparent than most other species.
  - Provide early warnings of ecosystem decline.
  - Tend to occupy a fixed territory and live long enough to accumulate toxins.
  - Possess physiologies that amplify the effects of environmental change → hence show early signs when habitat is disturbed.

Examples of Sentinel Species

- **Frog:**
  - Permeable skin absorbs substances from water/soil → highly sensitive to pesticides and pathogens.
- **Canaries in coal mines:**
  - Faster metabolism → succumb to carbon monoxide before human miners, indicating toxic conditions early.
- **Honeybees:**
  - Used by researchers to track agricultural chemical loads.
- **Polar bears:**
  - Observed to monitor contaminant accumulation in the Arctic ecosystem.

Emperor Penguin – Brief Notes

- **Scientific name:***Aptenodytes forsteri*
- **Habitat:** Endemic to Antarctica; breeds on sea ice.
- **Status:** Listed as **Endangered** by the International Union for Conservation of Nature (IUCN).

Key Features

- **Largest penguin species**; highly adapted to extreme cold.
- **Flightless seabird**; excellent diver (can dive >500 m, long submergence).
- **Thermoregulation:** Dense feathers + fat layer; huddling behavior reduces heat loss.

Breeding & Life Cycle

- **Unique breeding cycle during Antarctic winter.**
- Female lays one egg → male incubates on feet under brood pouch (~2 months, fasting).
- Females return with food; cooperative parental care.

Diet

- Mainly **fish, krill, and squid**; forages in Southern Ocean.

Ecological Significance

- Acts as a **sentinel species** → population trends reflect sea-ice conditions and marine ecosystem health.

Threats

- **Climate change:** Loss/instability of sea ice affects breeding platforms.
- **Food web shifts** due to ocean warming and krill decline.
- **Extreme weather events** impacting chick survival.

South Atlantic Anomaly

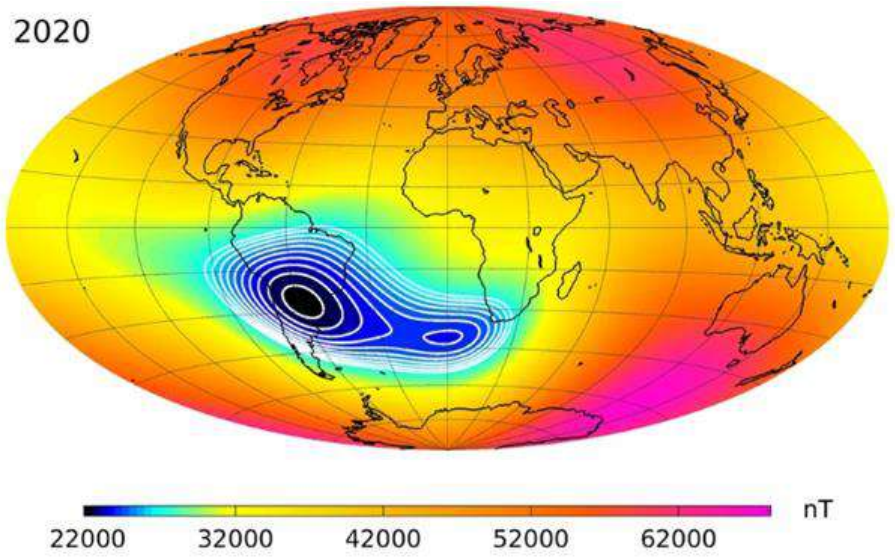
Syllabus:GS-3: Science and Technology – Solar System.

Context:

- The South Atlantic Anomaly is **splitting into two zones**, making things **trickier for satellites in low Earth orbit**.

About South Atlantic Anomaly (SAA)

- The **South Atlantic Anomaly (SAA)**, or the *"Bermuda Triangle of Space"*, is a **dip in the Earth's magnetic field** allowing **cosmic rays and charged particles to reach lower into the atmosphere**.
- It is located **southeast of South America and southwest of Africa**, where the planet's **magnetic field dips down**.
- It lies roughly between **latitudes 5° and 40° South and longitudes 0° and 80° West**; the **strength, shape, and size vary with seasons**.
- It was **first identified in the 19th century**.



Why Does it Occur?

- Earth's magnetic field acts as a **protective shield**, repelling and trapping **charged particles from the Sun**.

- SAA exists because the **inner Van Allen radiation belt comes closest to Earth's surface**, causing **increased flux of energetic particles**.
- This leads to **penetration of solar energetic particles deep into the atmosphere**, posing **problems for airplanes, ships' positioning systems, and spacecraft electronics**.

Van Allen Radiation Belts

- The **Van Allen radiation belt** is a **zone of energetic charged particles**, mostly originating from the **solar wind**.
- These particles are **captured and held by Earth's magnetic field**, forming a protective region around the planet.
- It **surrounds Earth**, creating a **nearly impenetrable barrier** preventing highly energetic electrons from reaching the surface.

Structure

- **Outer belt**: Contains **billions of high-energy particles from the Sun**, trapped in the **magnetosphere**.
- **Inner belt**: Formed due to **interaction of cosmic rays with Earth's atmosphere**.

Spatial Characteristics

- Most **intense over the Equator** and **effectively absent above the poles**.

Significance

- **Protective role**: Shields Earth from **harmful cosmic radiation**.
- **Hazardous role**: Poses risks to **satellites and human space missions** due to **interference with electronic systems**.

Discovery

- Discovered in **1958 by** James A. Van Allen, who designed instruments on **Explorer 1**, the first U.S. spacecraft.

Vitamin D

Syllabus: Prelims Bits – General Science.

Context:

- A new study indicates that vitamin D level in the 30s and 40s is a determining factor of brain age in the 60s and 70s

About Vitamin D

- **Vitamin D (calciferol)** is a fat-soluble vitamin naturally present in few foods, added to others, and available as a dietary supplement
- It is **produced endogenously** when ultraviolet (UV) rays from sunlight strike the skin and trigger synthesis
- During periods of sunlight, **vitamin D is stored in fat** and released when sunlight is not available
- Very few foods naturally contain vitamin D; most intake is through fortified foods (milk, cereal, yogurt)
- Natural sources include egg yolks, saltwater fish, and liver
- Daily requirement varies depending on age

Importance of Vitamin D

- **Promotes calcium absorption** and maintains adequate levels of calcium and phosphorus in blood → essential for healthy bones and teeth
- Deficiency leads to bones becoming thin, brittle, or misshapen
- Plays roles in reduction of inflammation and modulation of cell growth, neuromuscular and immune function, and glucose metabolism

Vitamin D Deficiency

- **In children** → causes rickets (bones become soft, weak, deformed, painful)
- **In teens and adults** → causes osteomalacia (bone pain and muscle weakness)
- More common in people with higher skin melanin content (darker skin) and those wearing clothing with extensive skin coverage

Toxicity / Harmful Effects

- Very high levels → nausea, vomiting, muscle weakness, confusion, pain, loss of appetite, dehydration, excessive urination and thirst, kidney stones
- Extremely high levels → kidney failure, irregular heartbeat, and death

Khanij Bidesh India Limited

Syllabus: GS-1: Resource Geography – Institutions.

Context:

- State-owned **KhanijBidesh India Limited (KABIL)** received environmental clearance from **Argentina govt** for deep exploration of five brine lithium blocks in the South American country

About KhanijBidesh India Limited (KABIL)

Establishment & Structure

- Joint venture company of three Central Public Sector Enterprises: **National Aluminium Company Ltd. (NALCO), Hindustan Copper Ltd. (HCL), Mineral Exploration and Consultancy Ltd. (MECL)** in ratio **40:30:30**
- Incorporated on **08.08.2019** under the **Companies Act, 2013**
- Under the aegis of the **Ministry of Mines, Government of India**

Objective & Mandate

- Objective to **identify, explore and acquire overseas mineral deposits & bring strategic minerals into India**

Focus Areas

- Focus on two prime **critical and strategic minerals: Lithium and Cobalt**
- Significant projects underway in **Argentina, Australia and Chile**

Capital Structure

- Authorized capital: **Rs. 500 crore**
- Paid-up capital: **Rs. 100 crore**

Promoter Entities – Key Features

- **NALCO**: One of the largest integrated primary producers of aluminum in Asia
- **HCL**: India's only vertically integrated copper producer
- **MECL**: One of the largest mineral exploration agencies of India

Administration

- Registered office situated in **New Delhi**
- Managed by the lead partner **NALCO**

Analytical Note

- Ensures **resource security** for critical minerals (Lithium, Cobalt) essential for **EVs, batteries, clean energy transition**
- Supports India's **Atmanirbhar Bharat** and **energy transition goals**
- Strategic overseas asset acquisition reduces **import dependence and supply chain vulnerability**

Electric Cooking in India: Challenges

Syllabus: GS-3: Industry - Energy Sector

Context:

- Recent **West Asia conflict** and fuel disruptions highlighted India's vulnerability as an import-dependent energy economy → LPG shortages and rising prices
- Triggered shift toward **electric cooking options** (induction & infrared cooktops) → sales surged significantly
- Government exploring measures to boost production of such appliances
- While reducing LPG dependence, transition likely to **increase electricity demand**, adding strain on already stressed power grid during peak periods

Induction Cooktops as an Alternative to LPG

Affordability

- Basic induction cooktop costs around ₹3,000–4,000 → comparable to LPG cylinder (black market)
- Makes it an **affordable entry point** for households shifting to electric cooking

Working Mechanism

- Do not use open flame
- Generate rapidly changing **electromagnetic field** → heats vessel directly
- Heat produced through **electrical resistance**, converting energy into thermal heat efficiently
- Direct vessel heating → **higher energy efficiency**
- Absence of flame → safer and cleaner than gas stoves

Compatibility Constraints

- Require **ferromagnetic cookware** (cast iron or magnetic stainless steel)
- Not all traditional utensils compatible due to differences in electrical resistance
- Induction-compatible cookware relatively expensive → less attractive for temporary/partial LPG shift

Infrared Cooktops – Working Mechanism & Rising Adoption

Working Mechanism

- Electricity heats coil/halogen element beneath ceramic glass surface
- Element becomes red-hot (similar to toaster coil) → emits **infrared radiation**
- Infrared radiation passes through glass and is absorbed by cookware
- Causes molecular vibration → generates heat → cooks food

Growing Market Demand

- Works with **all types of cookware** (steel, aluminium, glass, ceramic) → no specialised utensils required
- Demand surged significantly → sales increased nearly fourfold on platforms like Amazon India
- Ease of use and flexibility → key drivers

Challenges of Infrared Cooktops

- **Lower Energy Efficiency** → 70–80% vs 85–95% (induction); multi-stage heating (coil → glass → vessel) leads to losses
- **Higher Electricity Consumption** → indirect heating increases power usage for same task
- **Heat Control Limitations** → uses phase-angle control (on-off cycling), unlike efficient power electronics in induction
- **Power Quality Issues** → waveform distortion & reduced power factor → extra non-useful current flow
- **Impact on Power Grid** → increased distribution losses & stress on local infrastructure

Electric Cooking & Power Grid Infrastructure

Peak-Time Demand Pressure

- Cooking demand concentrated in morning & evening
- Even **3–5 GW increase** during peak hours → significant strain on distribution networks

Localised Load Challenges

- Cluster-based adoption → overloading of distribution transformers
- Leads to outages and infrastructure stress

Infrastructure Limitations

- Existing grid not designed for sudden demand spikes
- Managing sharp increases → major operational challenge for utilities

Long-Term Demand Implications

- Sustained shift from LPG → **persistent rise in electricity demand**
- Requires significant upgrades in generation capacity & grid infrastructure

Seasonal & Supply Pressures

- Hotter-than-normal summer → rising electricity demand
- Government may rely on **coal-based power and emergency measures** to meet peak demand

Analytical Takeaway (UPSC Value Addition)

- Energy transition from LPG → electricity reflects **energy security vs grid stability trade-off**
- Induction → efficient but limited by cookware compatibility; Infrared → flexible but inefficient
- Policy challenge: **balancing electrification of cooking with grid resilience, renewable integration, and demand management**