Explain the global distribution of renewable energy resources. Assess India's potential in harnessing these resources.

Question Understanding – Finding Information

- **Precise Syllabus Mapping:** Distribution of key natural resources across the world (including South Asia and the Indian sub-continent); factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India). **(GS Paper – I)**

- **Marks and words limit:**
  - The marks-oriented approach to answering **(10-mark, 150-word)** questions is to use **Bullet Points** (one idea per bullet point), **Brainstorming**, or a combination of both.
  - The way to score good marks in questions worth **(15 marks. 250 words)** is to use the **Heading** and **Subheading** method while writing your answers.

- **Directive words**
  - Explain → Describe patterns and reasons.
  - Assess → Evaluate potential with strengths, constraints, and future scope.

- **Focal points of the questions:**
  - Global distribution of renewable energy resources
  - India's resource potential and capacity to harness them
  - This is Geography + Environment + Energy resources (GS-I oriented, not scheme-heavy).

Answer Writing Structure

Introduction Paragraph

- Define renewable energy.
- Mention geographical control over their distribution.

Body Paragraph

A. Global Distribution of Renewable Energy Resources

Use classified headings with map-oriented logic and link each resource with physical factors (latitude, relief, plate tectonics).

- **Solar Energy:** High insolation regions- Tropics & subtropics. **Examples:** Sahara, Australia, Middle East, Atacama
- **Wind Energy:** Coastal regions, mountain passes, mid-latitudes. **Examples:** North Sea, Great Plains (USA), Patagonia
- **Hydropower:** High relief + perennial rivers. **Examples:** Himalayas, Andes, Alps, Congo Basin
- **Biomass Energy:** Agrarian and forested regions. **Examples:** Brazil, SE Asia, Sub-Saharan Africa
- **Geothermal Energy:** Plate boundaries & hotspots. **Examples:** Iceland, Japan, Philippines

B. India's Potential in Harnessing Renewable Energy

- **Solar:** High solar radiation (Tropic of Cancer). **Examples:** Thar Desert, Deccan Plateau
- **Wind:** Long coastline, Western Ghats. **Examples:** Tamil Nadu, Gujarat, Rajasthan
- **Hydropower:** Himalayan rivers, Western Ghats. Large + small hydro potential
- **Biomass:** Large agrarian economy. Crop residues, animal waste
- **Emerging Resources:** Offshore wind. **Examples:** Tidal (Gulf of Kachchh, Sundarbans). Green hydrogen (future scope)

C. Constraints & Way Forward (Brief Assessment)

- Land acquisition
- Storage & grid integration

- Environmental concerns

Conclusion (max. 40 Words)

- Emphasise sustainable development & energy security.

Dos & Don'ts

- **Do for Maximum Marks**
  - ✓ Keep concise – GS-I expects geography, not policy detail
  - ✓ Use glossary words: Insolation, Orographic conditions, Plate tectonics, Energy transition
  - ✓ Add a small world map sketch showing: Solar belt, Wind belts, Geothermal zones
  - ✓ Use map-based reasoning
  - ✓ Classify resources clearly
  - ✓ Link distribution to physical geography
  - ✓ Assess India's potential resource-wise
  - ✓ Keep answer balanced & analytical
  - ✓ Use examples, not data overload

- **Don't do these Common Mistakes**
  - × Do not write like GS-III (schemes, targets, budgets)
  - × Avoid excessive statistics
  - × Don't ignore global distribution part
  - × Avoid policy jargon (unless briefly)
  - × Don't list resources without explanation

Notes Oriented Content for Writing Answer

Renewable energy resources are geographically widespread, though the dominance and intensity of specific types (solar, wind, hydro, etc.) vary significantly by region. India is exceptionally well-positioned to harness these resources, boasting immense potential across solar, wind, and hydro power, and is a global leader in installed renewable capacity.

Global Distribution of Renewable Energy Resources

The distribution of these resources is determined by natural availability:

- **Solar Energy:** Concentrated in the tropical and sub-tropical regions (the "Global South"), particularly in desert areas like the Sahara (Africa), Atacama (South America), and parts of Australia and Western India.
- **Wind Energy:** Predominantly found in high-latitude regions and coastal areas where temperature gradients create consistent wind speeds, such as the North Sea (Europe) and the coasts of China and North America.
- **Hydropower:** Distributed in regions with high precipitation and mountainous terrain, such as the Amazon basin, the Himalayas, and the Scandinavian mountains.
- **Geothermal Energy:** Located near tectonic plate boundaries and "hot spots," such as the Pacific Ring of Fire (Iceland, USA, Indonesia, and Philippines).
- Biomass: Tied to high agricultural and forest productivity, notably in tropical countries like Brazil and India.

Assessment of India's Potential in Harnessing Resources

As of early 2026, India is the world's third-largest renewable energy producer. Its potential is evaluated through various sectors:

- **Solar Energy (Highest Potential):** India has a massive potential of approximately 748 GW, utilizing just 3% of its wasteland. In 2025, India achieved the milestone of 100 GW of solar capacity, led by states like Rajasthan and Gujarat.
- **Wind Energy:** Potential exceeds 300 GW (at 120m hub height). By early 2026, installed capacity has surpassed 50 GW, with significant growth in offshore wind projects off the coasts of Tamil Nadu and Gujarat.

- **Hydro Energy:** India has an estimated potential of 148 GW for large hydro and 21 GW for small hydro, primarily in the Himalayan and Northeastern regions.
- **Biomass and Bioenergy:** With its large agricultural base, India has a potential of nearly 20 GW. The country is on track to reach 20% ethanol blending by 2025–26.
- **Green Hydrogen:** Under the National Green Hydrogen Mission, India aims to produce 5 MMT per annum by 2030, positioning itself as a global leader in clean fuel exports.

Current Status and Targets (as of 2026)

- **Achievement:** In June 2025, India reached the milestone of 50% installed power capacity from non-fossil sources, achieving its Paris Agreement goal five years early.
- **Capacity:** Total renewable capacity (including hydro) reached approximately 254 GW by late 2025 and is expected to touch 250 GW (excluding hydro) by March 2026.
- **Future Goal:** India is working toward a target of 500 GW of non-fossil fuel capacity by 2030 and Net Zero by 2070.

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