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Chapter 5: Mineral and Energy Resources

About this Chapter

Chapter 5 maps India's mineral and energy resources, ferrous and non-ferrous metals, non-metallic minerals, coal-petroleum-gas, and the four pillars of India's power mix: thermal, hydel, nuclear and non-conventional (solar, wind, biomass).

Topics covered: Ferrous & Non-Ferrous Minerals • Non-Metallic Minerals (Mica, Limestone) • Coal, Petroleum, Natural Gas • Thermal, Hydel & Nuclear Power • Non-Conventional Energy

Also see for this chapter: [Revision Notes](#)

Exercises

Q 5.1 Choose the right answers of the following from the given options.

- (i) In which one of the following States are the major oil fields located?
(a) Assam (b) Bihar (c) Rajasthan (d) Tamil Nadu.
- (ii) At which one of the following places was the first atomic power station started?
(a) Kalpakkam (b) Narora (c) Rana Pratap Sagar (d) Tarapur.
- (iii) Which one of the following is non-renewable source of energy?
(a) Hydel (b) Solar (c) Thermal (d) Wind power.

SOLUTION

Concept used. India's three biggest oil-producing states are Assam (the original), Gujarat and offshore Maharashtra (Bombay High). The country's *first* atomic power

station was **Tarapur** (Maharashtra), commissioned in 1969. Energy sources split into **renewable** (sun, wind, water, biomass, tides, geothermal) and **non-renewable** (coal, oil, gas, nuclear fuel); thermal power runs on coal or gas and is therefore non-renewable.

- (i) Assam's oilfields, *Digboi* (commissioned 1889, the oldest in the country), *Naharkatiya* and *Moran*, sit in the Brahmaputra valley. Bihar, Rajasthan and Tamil Nadu do not have major oilfields (Rajasthan has the more recent Barmer-Sanchore field but not at the textbook anchor level). Answer: **(a) Assam**.
- (ii) The **Tarapur** Atomic Power Station, on the Maharashtra coast, began generating in 1969 and is recognised as India's first nuclear power station. Rana Pratap Sagar, Narora and Kalpakkam came later. Answer: **(d) Tarapur**.
- (iii) Hydel, solar and wind energy renew themselves on a human timescale. *Thermal power* burns coal or natural gas, both finite fossil fuels, making thermal a non-renewable source. Answer: **(c) Thermal**.

Anchor facts

Oil: Assam (Digboi), Gujarat (Ankleshwar), Maharashtra offshore (Bombay High). Nuclear: Tarapur (1969) was first. Renewables: sun, wind, water, biomass, tides, geothermal. Thermal = coal/gas = non-renewable.

Final Answer: (i) **(a) Assam**; (ii) **(d) Tarapur**; (iii) **(c) Thermal**.

Exam Tip

For renewable-vs-non-renewable MCQs ask: "Does this source recharge itself on a human timescale?" Sun and wind blow back every day; rivers flow back every monsoon; biomass regrows in years. Coal, oil, gas and uranium take millions of years; they are non-renewable.

EXPERT'S SOLUTION : Dr. Naveen Pillai, M.A. Energy Geography, IIT Kanpur

Strategic angle. Each MCQ tests one specific chapter fact. Anchoring on the chapter's named places (Digboi, Tarapur) and the renewable / non-renewable dichotomy is enough.

- **(i) Assam's oilfield story.** Digboi struck oil in 1867 and began producing in 1889, making it Asia's oldest commercial oilfield. Naharkatiya and Moran joined in the 1950s. Together they make Assam one of India's top three oil-producing states. Bihar, Rajasthan and Tamil Nadu do not feature in the chapter's named-states list for oil. Answer: **(a)**.
- **(ii) Tarapur, the first.** Tarapur Atomic Power Station (TAPS) began generating commercial nuclear power on 28 October 1969. Two boiling-water reactors of 160

MW each made it not just India's first but Asia's first commercial nuclear plant. Rana Pratap Sagar followed in 1973, Kalpakkam in 1984, Narora in 1989. Answer: **(d)**.

- **(iii) Renewable vs non-renewable.** The renewable list (solar, wind, hydel, biomass, tidal, geothermal) shares one feature: nature replenishes them on a timescale humans can plan around. Thermal power burns coal or natural gas; both are fossil fuels that took millions of years to form and cannot recharge meaningfully in a human lifetime. So **thermal** is non-renewable. Answer: **(c)**.

Pattern. For energy MCQs, hold two lists in your head: renewables (sun, wind, hydel, biomass, tides, geothermal) and non-renewables (coal, oil, gas, nuclear). The MCQ picks one item and asks which list it belongs to.

Final Answer: (i) **(a)**; (ii) **(d)**; (iii) **(c)**.

Q 5.2 Answer the following questions in about 30 words.

- (i) Give an account of the distribution of mica in India.
- (ii) What is nuclear power? Mention the important nuclear power stations in India.
- (iii) Name non-ferrous metal. Discuss their spatial distribution.
- (iv) What are non-conventional sources of energy?

SOLUTION

Concept used. **Mica** is a non-metallic mineral prized for its insulating and dielectric properties. **Nuclear power** is electricity generated by controlled fission of atomic nuclei. **Non-ferrous** metals (copper, bauxite, zinc, lead) lack iron and are spread across the peninsular mineral belt. **Non-conventional** energy sources, also called renewables, replenish themselves naturally and include solar, wind, biomass, tidal and geothermal.

- **(i) Distribution of mica in India.** India's mica belt runs through the *Chhota Nagpur plateau*, especially Jharkhand (Koderma, Giridih, Hazaribagh, Bermo), Bihar (Gaya, Munger) and the *Andhra Pradesh* mica belt around Nellore. Rajasthan (Bhilwara, Ajmer) also has mica deposits. India's mica is mostly muscovite, the high-grade variety.
- **(ii) Nuclear power and India's stations.** *Nuclear power* is electricity from heat released in controlled fission of heavy atomic nuclei (mainly uranium-235 or plutonium-239) inside a reactor. The six main commercial stations are **Tarapur** (Maharashtra, 1969), **Rana Pratap Sagar / Rawatbhata** (Rajasthan), **Kalpakkam**

(Tamil Nadu), **Narora** (UP), **Kaiga** (Karnataka) and **Kakrapar** (Gujarat).

- **(iii) Non-ferrous metals and their distribution.** *Copper*: Khetri (Rajasthan), Singhbhum (Jharkhand), Balaghat (Madhya Pradesh). *Bauxite (Aluminium)*: Amarkantak plateau (MP, Chhattisgarh), Maikala range (Odisha), Bilaspur (Chhattisgarh), parts of Jharkhand and Tamil Nadu. *Lead and Zinc*: Zawar (Rajasthan), Sargipalli (Odisha). *Gold*: Kolar (Karnataka, now closed), Hutti (Karnataka). Most non-ferrous deposits cluster in the peninsular Indian shield.
- **(iv) Non-conventional energy sources.** *Non-conventional* (renewable) sources are those that nature replenishes continuously. They include **solar** (PV panels, solar water heaters), **wind** (Tamil Nadu, Gujarat, Maharashtra wind farms), **biomass** (gobar gas, agricultural waste, biofuels), **tidal** (Gulf of Kachchh, Sundarbans), and **geothermal** (Puga Valley, Manikaran). India has set ambitious capacity targets through the National Solar Mission and the National Wind-Solar Hybrid Policy.

Region-and-name memory hook

Mica = Chhota Nagpur + Nellore + Bhilwara. Nuclear = Tarapur, Rana Pratap Sagar, Kalpakkam, Narora, Kaiga, Kakrapar. Non-ferrous = Khetri (copper), Amarkantak (bauxite), Zawar (lead-zinc). Non-conventional = solar, wind, biomass, tidal, geothermal.

Final Answer: Mica clusters in the Chhota Nagpur plateau, Nellore (AP) and Bhilwara (Rajasthan). Nuclear power = controlled fission; six stations (Tarapur, Rana Pratap Sagar, Kalpakkam, Narora, Kaiga, Kakrapar). Non-ferrous metals (copper, bauxite, lead-zinc, gold) cluster on the peninsular shield. Non-conventional energy = solar, wind, biomass, tidal, geothermal.

EXPERT'S SOLUTION : Prof. Asha Sundaram, Ph.D. Mineral Resources, IIT Kharagpur

Quick reading. Pack each sub-part with chapter terms plus two or three named regions. For (i) name Chhota Nagpur + Nellore; for (ii) define fission and name three or four stations; for (iii) name four metals and their belts; for (iv) name five renewable sources.

- **(i) Mica in detail.** The Koderma belt in Jharkhand is India's principal mica zone; the Nellore belt of Andhra Pradesh is the second; the Bhilwara and Ajmer pockets in Rajasthan add the third. India was the world's largest mica producer for decades; output has fallen as synthetic substitutes have replaced electronic-grade mica.
- **(ii) Nuclear power, the chapter's six.** Definition: fission heat boils water to drive a turbine generator. India's six stations: Tarapur (Maharashtra), Rana Pratap Sagar (Rajasthan), Kalpakkam (Tamil Nadu), Narora (UP), Kaiga (Karnataka), Kakrapar (Gujarat). The Department of Atomic Energy operates them through the Nuclear Power Corporation of India.

- **(iii) Non-ferrous regional belts.** *Copper:* Khetri (Rajasthan), Singhbhum (Jharkhand), Balaghat (MP). Hindustan Copper Limited runs the smelters. *Bauxite:* Amarkantak plateau, Maikala range, the Eastern Ghats; Odisha alone holds about half of India's reserves. *Lead-Zinc:* Zawar (Rajasthan), Sargipalli (Odisha), Rampura-Agucha (Rajasthan). *Gold:* Kolar (closed) and Hutti (Karnataka), with some by-product output from copper mining.
- **(iv) Five non-conventional sources, by region.** Solar (Rajasthan, Gujarat, Karnataka); Wind (Tamil Nadu, Maharashtra, Gujarat); Biomass (Punjab paddy stubble, sugar-mill bagasse, dairy goar); Tidal (Gulf of Kachchh, Sundarbans); Geothermal (Puga Valley in Ladakh, Manikaran in Himachal). The National Solar Mission and the Wind-Solar Hybrid Policy are the main central schemes.

Why this matters. Examiners reward students who pair each mineral or energy source with a named region. Doing this once builds a state-by-state minerals-and-energy map that you can reuse for short-answer and long-answer questions across the chapter.

Final Answer: Mica = Koderma, Nellore, Bhilwara. Nuclear = controlled fission; six stations (Tarapur first). Non-ferrous = copper (Khetri), bauxite (Amarkantak), lead-zinc (Zawar), gold (Hutti). Non-conventional = solar, wind, biomass, tidal, geothermal.

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Q 5.3 Answer the following questions in about 150 words.

- (i) Write a detailed note on the Petroleum resources of India.
- (ii) Write an essay on hydel power in India.

SOLUTION

Concept used. **Petroleum** (crude oil) and **natural gas** together fuel transport, petrochemicals, domestic heating and electricity. Their reserves in India are concentrated in three sedimentary basins. **Hydel power** is electricity generated by falling water; it is renewable, almost zero-carbon and one of India's oldest organised power sources (Sivasamudram, 1902).

- **(i) Petroleum resources of India.** *Reserves and basins.* India's petroleum reserves are concentrated in three basins. *Assam-Brahmaputra valley:* Digboi (1889, the oldest), Naharkatiya, Moran-Hugrija, Lakwa-Rudrasagar in upper Assam. *Gujarat plain:* Ankleshwar (the biggest onshore field), Kalol, Nawagam, Mehsana, Lunej. *Western*

offshore: Bombay High (Mumbai High, discovered 1974) is the largest single Indian oilfield; Bassein and Aliabet are nearby. *Production and refining*. Domestic production meets only about 15–18% of India's demand; the rest is imported, mainly from West Asia. India's refineries include those at Digboi (the oldest), Barauni, Koyali, Mathura, Mumbai (HPCL, BPCL), Visakh, Chennai, Jamnagar (Reliance, the world's largest single site) and Paradip. *Policy*. ONGC and Oil India Limited dominate upstream; the New Exploration Licensing Policy (NELP) and now the Hydrocarbon Exploration and Licensing Policy (HELP) open exploration to private and foreign companies.

- **(ii) Hydel power in India.** *Definition*. Hydel power is electricity generated by passing water through a turbine, usually from a dammed reservoir to a lower point. It is renewable, non-polluting, and well-suited to peak-load supply. *History*. India's first hydel plant, Sivasamudram on the Cauvery, started in 1902, making India one of the earliest hydel countries in Asia. *Major projects*. *North*: Bhakra Nangal (Punjab/HP), Salal (J&K), Pong (HP), Tehri (Uttarakhand). *East*: Damodar Valley Corporation (Maithon, Panchet, Tilaiya), Hirakud (Odisha). *West-Central*: Sardar Sarovar (Gujarat), Indira Sagar (MP), Koyna (Maharashtra). *South*: Mettur and Sivasamudram (Tamil Nadu/ Karnataka), Sharavati (Karnataka), Idukki (Kerala), Srisaillam and Nagarjunasagar (Andhra Pradesh/Telangana). *Capacity and policy*. India's installed hydel capacity is about 47 GW (2023), roughly 11% of total power capacity. The National Electricity Policy prioritises pumped-storage and small-hydel for balancing the growing solar and wind grid. *Concerns*. Big dams have raised serious displacement, ecological and seismic concerns (Tehri, Sardar Sarovar), pushing the country towards small-hydel and pumped-storage as the future path.

Final Answer: Petroleum is found mainly in Assam (Digboi), Gujarat (Ankleshwar) and the Western offshore (Bombay High); India imports > 80% of its needs. Hydel power, India's oldest organised electricity, runs from Bhakra and Tehri in the north through Hirakud and DVC in the east to Sharavati and Idukki in the south, ~ 47 GW capacity in 2023.

✗ Common Mistake

Do not write that India is self-sufficient in oil. The chapter is explicit: domestic output covers only a small fraction of demand; the rest is imported. Saying "self-sufficient" is one of the most common scoring errors in this chapter.

♥ Why This Matters

Petroleum and hydel together hold the key to India's energy transition. Cutting oil imports is a national-security goal; expanding hydel and renewables is a climate-change goal. Understanding the geography of both, where the reserves are, where the dams are, sets up

every contemporary debate from “Atmanirbhar Bharat” to “net-zero by 2070”.

EXPERT’S SOLUTION : Dr. Karthik Mishra, Ph.D. Energy and Environment, TERI School

Structural observation. Q3(i) and Q3(ii) are parallel essays: one on a non-renewable fuel, the other on a renewable electricity source. Use the same four-row scaffold for both, reserves / production / major sites / policy, and the 150-word budget falls into place.

- **(i) Petroleum, four-row essay.** *Reserves:* Assam basin (Digboi, Naharkatiya), Gujarat basin (Ankleshwar, Kalol), Western offshore (Bombay High), with newer reserves in the Krishna-Godavari and Cauvery basins. *Production:* India produces ~ 30 million tonnes a year; demand is ~ 230 MT, so imports cover about 85%. *Major sites:* Digboi (oldest), Bombay High (largest), Ankleshwar (largest onshore), and refineries at Mathura, Jamnagar (Reliance, world’s largest single site), Koyali and Paradip. *Policy:* NELP-1999 opened acreage to private bidders; HELP-2016 unified all hydrocarbons under one regime; the Strategic Petroleum Reserve at Visakhapatnam, Mangalore and Padur stores emergency crude.
- **(ii) Hydel power, four-row essay.** *Definition and origin:* hydel power converts the kinetic energy of falling water into electricity via a turbine; Sivasamudram (1902) was India’s first plant. *Capacity:* India’s installed hydel capacity is roughly 47 GW (2023), about 11% of total power installed. *Major projects, region-wise:* Bhakra-Nangal, Tehri (north); Hirakud, DVC (east); Sardar Sarovar, Indira Sagar, Koyna (west and central); Mettur, Sharavati, Idukki, Srisaillam, Nagarjunasagar (south). *Policy and outlook:* the National Hydroelectric Power Corporation (NHPC) leads big-dam projects; small and pumped-storage hydel are gaining importance as India ramps up solar and wind. Displacement and ecological costs (Narmada agitation, Tehri concerns) have pushed for community consent and proper rehabilitation packages.

Marker’s eye. For Q3(i) name at least three basins, two major fields, one refinery and one policy. For Q3(ii) name at least four major projects across four regions, one capacity figure and one named concern. Examiners reward this kind of state-and-figure precision over generic prose.

Final Answer: India’s petroleum is concentrated in Assam (Digboi), Gujarat (Ankleshwar) and the Western offshore (Bombay High), with 80%+ import dependence and big refineries at Jamnagar and Koyali. Hydel power (India’s oldest organised electricity from 1902 at Sivasamudram) supplies ~ 47 GW across Bhakra-Tehri-Hirakud-DVC-Sardar Sarovar-Koyna-Mettur-Sharavati-Idukki-Srisaillam.

Key Takeaways

- Minerals split into **ferrous** (iron ore, manganese), **non-ferrous** (copper, bauxite, lead-zinc, gold), **non-metallic** (mica, limestone, dolomite) and **fuel** (coal, oil, gas) categories.
- India's major oilfields cluster in Assam (Digboi, Naharkatiya), Gujarat (Ankleshwar) and offshore Maharashtra (Bombay High).
- **Tarapur** (Maharashtra) was India's first commercial nuclear power station, commissioned in 1969.
- Energy sources are **conventional** (thermal, hydel, nuclear) and **non-conventional** (solar, wind, biomass, tidal, geothermal). Thermal is non-renewable.
- **Hydel power** (Sivasamudram 1902 onwards) is India's oldest organised power source, currently ~ 47 GW installed.

End of Exercises

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