

ECONOMIC SURVEY OF INDIA

CHAPTER 7: CLIMATE CHANGE AND ENVIRONMENT

LECTURE-6

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2. PROGRESS ON INDIA'S CLIMATE ACTION

1) NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC)

- **NAPCC** was launched by India in 2008. It established eight National Missions covering various dimensions of fight against climate change.

Figure VII.2: Progress on Eight National Missions of the NAPCC highlighting achievements across various domains

National Solar Mission	•Solar power capacity of 61.62 GW installed by October 2022
National Mission for Enhanced Energy Efficiency	•PAT Cycle-VII notified in October 2021 for energy saving target of 6.63 Million Tonnes of Oil Equivalent (MTOE)
National Mission on Sustainable Habitat	•721 km of metro rail network made operational by August 2022. •62.79 lakh individual household toilets and 6.21 lakh community and public toilets constructed by April 2022
National Mission for a Green India	•₹ 626.96 crore for afforestation targets over an area of 2.1 lakh ha
National Water Mission	•Jal Shakti Abhiyan: Catch The Rain 2022
National Mission on Strategic Knowledge for Climate Change	•Created and strengthened 12 Centres of Excellence for climate change (June 2021)
National Mission for Sustaining Himalayan Ecosystems	•Inter-University Consortium •8 Major R&D Programmes initiated
National Mission for Sustainable Agriculture	•Key targets for FY 2022-2023 covering 0.15 lakh ha under organic farming and 10 lakh ha under micro irrigation

2) NATIONAL ADAPTATION FUND FOR CLIMATE CHANGE (NAFCC)

- A central sector scheme was initiated in 2015-16 to **support adaptation activities in the States and Union Territories (UTs)** of India that are vulnerable to the adverse effects of climate change.
- NAFCC is **implemented in project mode**, and to date, 30 projects have been sanctioned in 27 States and UTs with total project cost of ₹847.5 crore.
- **NAFCC supports adaptation action**, in, inter alia, agriculture, water, forestry, livestock, and restoring ecosystems.
- At present (November 2022), 28 projects are under implementation

3) UPDATED NDC SUBMITTED TO UNFCCC (AUG 2022)

- India submitted its INDC on 2nd Oct 2015.
- The NDC submitted in Aug 2022 is India's first NDC under the Paris Agreement. The Article 4, paragraph 9 of the Paris Agreement provides that each Party shall communicate a nationally determined contribution every five years in accordance with the decision of COP21.
- So, in Aug 2022, India communicated an update to its first NDC submitted earlier on Oct 2, 2015 for the period upto 2030, as under:

- To put forward and further propagate a **healthy and sustainable way of living** based on traditions and values of conservation and moderation, including through a mass movement for '**LiFE**'– '**Lifestyle for Environment**' as a key to combating climate change [UPDATED].
 - To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
 - To **reduce Emissions Intensity of its GDP by 45 percent by 2030**, from 2005 level [UPDATED].
 - To achieve about **50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030**, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) [UPDATED].
 - To create an **additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent** through additional forest and tree cover by 2030.
 - To better **adapt to climate change by enhancing investments in development programmes** in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
 - To **mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions** in view of the resource required and the resource gap.
 - To **build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology** in India and for joint collaborative R&D for such future technologies.
- This update to India's existing NDC is a step towards our long-term goal of reaching net-zero by 2070.

4) MISSION LIFE (LIFESTYLE FOR ENVIRONMENT)

- It was first proposed by PM Modi at COP 26 of UNFCCC in Nov 2021. It is envisioned as **an India led global mass movement that will nudge individual and collective action to protect and preserve the environment**.
 - PM Modi has underlined that Mission LiFE makes the fight against climate change democratic, in which everyone can contribute with their respective capacities.
 - It emboldens the spirit of the P3 Model: Pro Planet People.
 - It functions on the basic principles of 'Lifestyle of the planet, for the planet and by the planet'.
- At the launch, PM Modi also highlighted that the concept of 'Reduce, Reuse and Recycle' and circular economy; and mentioned that it has been part of the Indian Lifestyle for thousands of years.
- LiFE also resonates with **climate justice** -> it highlights enhanced obligations for those in developed countries and supports climate adaptation and mitigation for those most affected and yet least responsible.
- **NITI Aayog and MoEF&CC**, in collaboration with Government of Gujarat, organized the global launch of Mission Life.
 - NITI aayog will curate and incubate Mission Life in the first year, and it will subsequently be implemented by MoEF&CC.
 - It is a five-year program.

5) STATUS OF FOREST AND TREE COVER

- **The forest and tree cover in India has shown a gradual and steady trend of increase in the last one and a half decades**.
- **The country ranks third globally with respect to the net gain in average annual forest area** between 2010 and 2020.
- This **gain is mainly attributed to the robust framework and policies of the National and State Governments** that have promoted and safeguarded forests. Schemes like the Green India Mission (GIM), Compensatory Afforestation Fund

Management and Planning Authority (CAMPA), National Afforestation Programme (NAP), Green Highway Policy - 2015, Policy for enhancement of Urban Greens, National Agro-forestry Policy, and Sub-Mission on Agro-forestry (SMAF), etc. are among the most important ones

6) CARBON STOCK IN INDIA'S FOREST AND TREE COVER

- **Forest Survey of India (FSI) assessed the carbon stock** (which is the amount of carbon sequestered from the atmosphere and stored in biomass, deadwood, soil, and litter in the forest) in India's forests for the first time in 2004 and then biennially since 2011.
- The Indian State of Forest Report (ISFR) estimates the carbon stock of forests to be about **7,204 million tonnes in 2019**, which is an increase of 79.4 million tonnes of carbon stock as compared to the estimates of the previous assessment for 2017. This translates into **carbon emissions sequestered through forest and tree cover to be 30.1 billion tonnes** of CO2 equivalent
- **Among the Indian States, Arunachal Pradesh** has the maximum carbon stock in forests (1023.84 million tonnes), followed by **Madhya Pradesh** (609.25 million tonnes).
- The per-hectare forest carbon stock among different States/UTs indicates that Jammu & Kashmir is contributing the maximum per-hectare carbon stock of 173.41 tonnes, followed by Himachal Pradesh (167.0 tonnes), Sikkim (166.2 tonnes) and Andaman & Nicobar Islands (162.9 tonnes).

3. RIVER CONSERVATION AND REJUVENATION

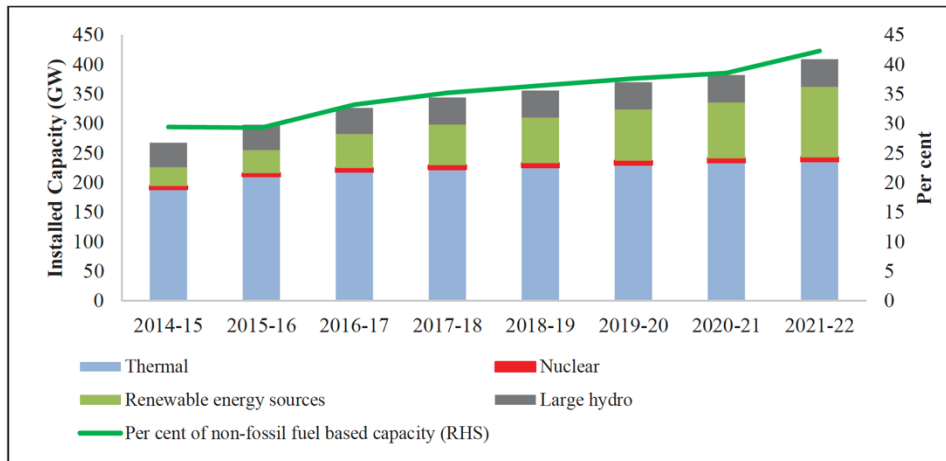
- It is the responsibility of states/UTs/local bodies to ensure treatment of sewage and industrial effluents before it being discharged into water bodies.
- **MoEF&CC** is contributing in conservation of rivers by **providing financial and technical assistance** for abatement of pollution in identified stretches of rivers in the country through the Central Sector Scheme of Namami Gange for rivers in Ganga Basin and the Centrally Sponsored Scheme of National River Conservation Plan (NRCP) for other rivers.
- In addition, the government has recently released **Detailed Project Reports (DPR)** for the rejuvenation of 13 major rivers prepared by the **Indian Council for Forestry Research and Education (ICFRE), Dehradun** in consultation with the State Forest Departments and other line departments.
 - Work proposed under DPRs include afforestation of river banks, fighting soil erosion, recharging ground water, sequester carbon dioxide, catchment area treatment, ecological restoration etc.
- Further, under MGNREGA, rejuvenation of small rivers is being prioritized.
- In Addition, sewerage infrastructure is created under the AMRUT and Smart Cities Mission of MoHUA.
- **Law and Regulations:**
 - As per the Environmental (Protection) Act, 1986 and the Water (Prevention and Control of Pollution), Act 1974, the industrial units are required to install effluent treatment plants (ETPs) and treat their effluents to comply with stipulated environmental standards before discharging into river and water bodies.
 - CPCBs, SPCBs and Pollution Control Committees (PCCs) monitor the industries with respect to treatment of effluent discharge standards and take action for non-compliance under the provision of various acts.

4. APPROACH TO TRANSITION TO RENEWABLE ENERGY SOURCES

- India's NDC and Renewable Energy:

- While the **target was to achieve 40 per cent of the installed electric capacity from non-fossil fuel** sources by 2030 in the initial NDC submitted in 2015, the target **has already been achieved**. India is **now striving to achieve the target of 50 per cent cumulative electric power installed capacity** from non-fossil fuel-based energy resources by 2030, in line with updated NDCs

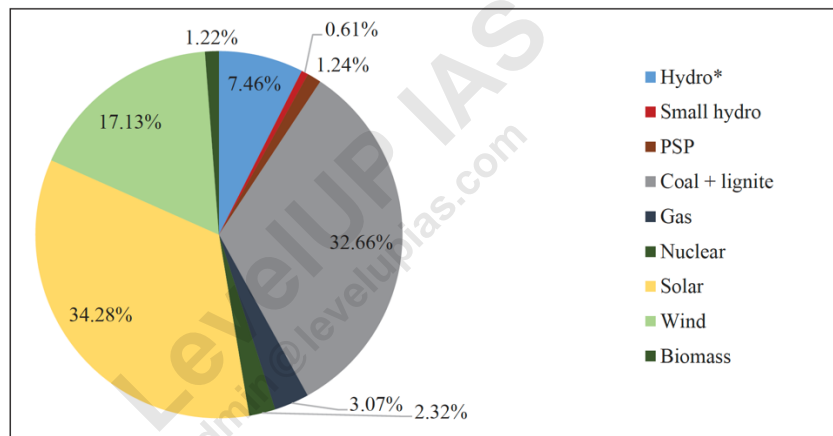
Figure VII.5: Increasing installed Electricity Generation Capacity with a rising share of non-fossil fuel-based capacity



Source: Based on data from the Ministry of Power.

- Projected optimal mix of installed capacity for 2029-30 by Central Electricity Authority (CEA)**

Figure VII.7: Projected optimal mix of installed capacity for 2029-30



Source: Central Electricity Authority
* Including hydro imports of 5856 MW

5. HYDROGEN ENERGY

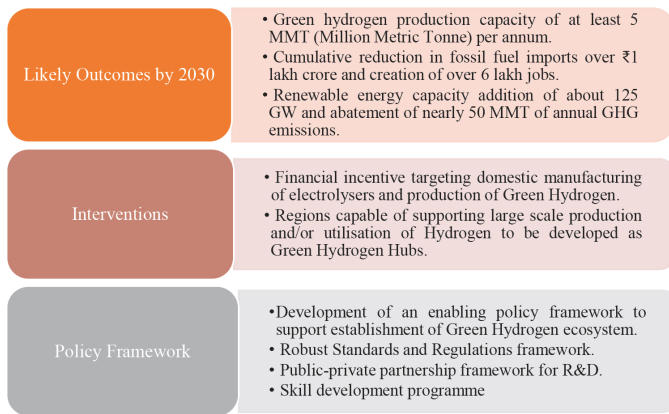
- Note:** Hydrogen is an **energy carrier, not a source of energy**. Hydrogen fuel must be transformed into electricity by a device called a **fuel cell stack** before it can be used to power a truck.
- Advantages of Hydrogen Fuel:**
 - Abundance:** It is the most abundant element in the Universe.
 - Energy Density** -> High
 - Can contribute in achieving Net Zero by 2050**
 - No Pollution** (only releases water)
 - Leading options for storing energy from renewables**

- **Advantages of Hydrogen Vehicles (Fuel cell Stack) over other Electric Vehicles (Lithium-ion batteries)**
 - A fuel cell electric vehicle can be **refueled in just 5 minutes**. EV takes 30-45 minutes for charging.
 - **Energy storage per unit volume and weight** is higher in fuel cells than other types of electric vehicles.
 - **EV battery materials** are controlled by a few larger players. Scaled up hydrogen fuel cell will bring countries on equal footing.
 - **EV batteries** (like Lithium-ion batteries) have still not been found viable for heavy vehicles like trucks.
- To get support in **Regulatory Framework** - the MoRTH in 2020 have issued a notification proposing amendments to the Central Motor Vehicle Rules, 1989, to include **safety evaluation standards for hydrogen fuel cell-based vehicles.**
- **Some limitations of Hydrogen fuel**
 - **Hydrogen** molecule is not available in abundance on earth and is found in combination with other elements.
 - Thus, external energy source is required to isolate hydrogen. If coal or other fossil fuel is used for this extraction, it is called grey hydrogen and has carbon footprint.
 - Hydrogen technology is "**yet to be scaled up**". Tesla CEO Elon Musk has called fuel cell technology "mind-bogglingly stupid".
 - **Lack of fueling station infrastructure**
 - There are fewer than 500 operational hydrogen stations in the world today, mostly in Europe.
 - **Safety is a concern**
 - Hydrogen is pressurized and stored in a cryogenic engine. Some companies like Toyota and Hyundai have said that safety and reliability of hydrogen fuel tanks is similar to that of standard CNG engines.
- **Note: Various types of Hydrogen:** The most common element in nature is not found freely. It exists only combined with other elements and has to be extracted from naturally occurring compounds like water (which is a combination of two hydrogen atoms and one oxygen atom). This process is energy intensive.
 - **Grey Hydrogen**
 - Hydrogen produced from fossil fuels. This constitutes a bulk of hydrogen produced today.
 - **Blue Hydrogen**
 - Hydrogen generated from fossil fuels with carbon capture and storage options
 - **Green Hydrogen**
 - Hydrogen generated entirely from renewable power sources. Here electricity generated from renewable energy is used to split water into hydrogen and oxygen.

A) NATIONAL GREEN HYDROGEN MISSION

- **Ministry:** MNRE
- With a vision to make India an energy independent nation, and to decarbonize critical sectors, the Government approved National Green Hydrogen Mission on Jan 4, 2023 with an initial outlay of Rs 19744 crores.
- The mission will facilitate demand creation, production, utilization, and export of Green Hydrogen and mobilization of Rs 8 lakh crores of investment by 2030.

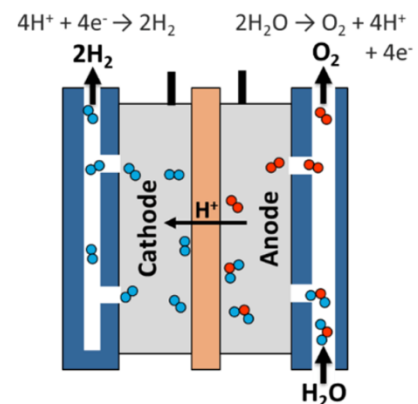
Figure VII.9: Salient Features of the National Green Hydrogen Mission



Source: Ministry of New & Renewable Energy

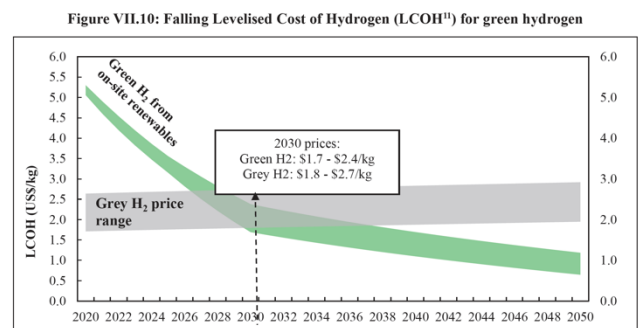
B) ELECTROLYSERS:

- Electrolysers are a critical technology for the production of low-emission hydrogen from renewable or nuclear electricity.
 - Note:** Electrolysis is the process of using electricity to split water into hydrogen and oxygen. This reaction takes place in a unit called an Electrolysers.
 - How does it work?**
 - Like fuel cells, Electrolysers consist of an anode and a cathode separated by electrolyte. Different electrolyzers function in different ways, mainly due to the different type of electrolyte material involved in the ionic species it conducts.



C) NITI AAYOG ON GREEN HYDROGEN:

- NITI Aayog has published a study: '**Harnessing Green Hydrogen - Opportunities for Deep Decarbonization in India**' in June 2022. It says that electrolyser cost are expected to fall in future and renewable tariffs are already falling. This shows good future for Hydrogen fuel in future.
- It also says that cumulative value of the green hydrogen market in India will be US\$ 8 billion by 2030 and US\$ 340 billion by 2050.
- The electrolyzer market will also be US\$ 5 billion by 2030 and US\$31 billion by 2050.
- Further, adoption of green hydrogen will also result in 3.5 Giga tonnes of cumulative CO2 emission reduction by 2050. This will also generative enormous import saving, ensure stability in industry input prices, and strengthen foreign exchange reserves in the long run.
- However, all this is based on the assumption that access to critical minerals for renewable energy at a reasonable cost will continue - an assumption that could be an effective constraint in the face of the concentration of these minerals in certain geographies with a monopoly in access to some countries.

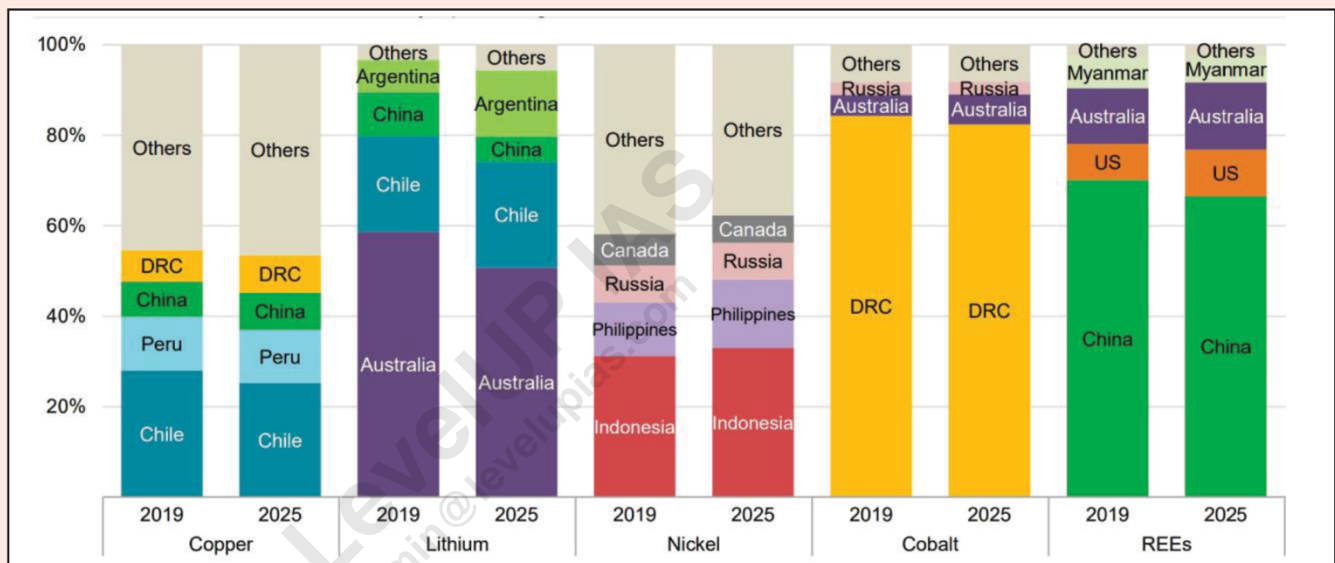


Source: NITI Aayog

1) CRITICAL MINERALS – RARE EARTH MINERALS

- The shift to a clean energy system is set to drive a **huge increase in the requirements for critical minerals**. This is because an energy system powered by clean energy technologies differs profoundly from one fuelled by traditional hydrocarbon resources.
- **Cobalt, copper, lithium, nickel, and rare earth elements (REEs)** are critical for producing electric vehicles and batteries and harnessing solar power and wind energy.
- Solar photovoltaic (PV) plants, wind farms and electric vehicles (EVs) generally require more minerals than their fossil fuel-based counterparts. A typical electric car requires six times the mineral inputs of a conventional car, and an onshore wind plant requires nine times more mineral resources than a gas-fired plant.
- The types of mineral resources used vary by technology.
 - **Lithium, nickel, cobalt, manganese, and graphite** are crucial to battery performance, longevity and energy density.
 - **REEs are essential for permanent magnets** that are vital for wind turbines and EV motors.
 - **Electricity networks** need a huge amount of copper and aluminium, with copper being a cornerstone for all electricity-related technologies.
- While the demand for critical minerals is set to increase because of the global preference and emphasis towards renewable energy, the global supply chain of the critical minerals is highly concentrated and unevenly distributed. The skewed distribution of the resource poses a supply risk in the face of its enhanced demand.

Figure VII.11: Concentration of production of selected minerals in 2019 and 2025



Source: International Energy Agency Report on 'The Role of Critical Minerals in Clean Energy Transitions'

- A **carefully crafted multi-dimensional mineral policy** would reduce our dependence and address the problems for the future.
 - The country has resources of nickel, cobalt, molybdenum, and heavy REEs, but **further exploration would be needed to evaluate the quantities** of their reserves.
 - There is a need to **create strategic mineral reserves** along the lines of strategic petroleum reserves to ensure a continuous supply of minerals.
 - Also, **policies should consider investing in internal research** including technological innovation for mineral exploration and processing and the development of Recycling, Reusing, and Repurposing (R3) technologies.
- **Steps Taken:**

- In order to ensure the mineral security of the nation and to attain self-reliance in the area of critical and strategic minerals, the Ministry of Mines has created a Joint Venture company, namely **Khanij Bidesh India Ltd (KABIL)**, with participating interests of NALCO, HCL and MECL.
 - KABIL is mandated to identify and acquire overseas mineral assets of critical and strategic nature, such as Lithium, Cobalt etc.
- Further, the Ministry of Mines, Government of India and the Department of Industry, Science, Energy and Resources (DISER), Government of Australia, signed an **MoU** on June 3, 2020, for cooperation in the field of mining and processing of critical and strategic minerals.
- Further, **KABIL has also signed a detailed MoU** with a collaborative framework with the Critical Minerals Facilitation Office under the DISER on March 10, 2022, to identify lithium and cobalt mineral assets for final joint investment decisions and acquisition of the assets in Australia catering to the critical and strategic ecosystem of both the countries

6. LONG TERM LOW EMISSION DEVELOPMENT STRATEGY

- In Nov 2022, India submitted its LT-LEDs at COP-27. The salient features are:
 - Focus on the **rational utilisation of national resources with due regard to energy security**. The transitions from fossil fuels will be undertaken in a just, smooth, sustainable and all-inclusive manner.
 - Encompasses the **objectives of the National Hydrogen Policy**. The rapid expansion of green hydrogen production, increasing electrolyser manufacturing capacity in the country, and a three-fold increase in nuclear capacity by 2032 are some of the other milestones that are envisaged alongside the overall development of the power sector.
 - **Increased use of biofuels, especially ethanol blending in petrol**. India aspires to maximise the use of electric vehicles, ethanol blending to reach 20 per cent by the Ethanol Supply Year 2025-26, and a strong modal shift to public transport for passengers and freight.
 - **Climate-resilient urban development** will be driven by smart city initiatives, integrated planning of cities for mainstreaming adaptation and enhancing energy and resource efficiency, effective green building codes and developments in innovative solid and liquid waste management
 - India's **industrial sector will continue on a strong growth path**, with the vision of 'Aatmanirbhar Bharat' and 'Make in India'.

7. FINANCE FOR SUSTAINABLE DEVELOPMENT

- Though the Paris Agreement provides for mobilization of resources from developed countries, the process has been very slow.
- Thus, **India has scaled up its efforts towards greater mobilization of private capital to meet its ambitious climate action goals**.
- **Green Bonds** are financial instruments that generate proceeds for investment in environmentally sustainable and climate suitable projects.
 - Developed countries such as UK, France, Germany etc have been using green bonds to raise billions of dollars of sovereign green debts.
- In India, as per **SEBI's data** between 2017 and Sep 2022, 15 Indian corporates have issued green bonds of value of Rs 4,539 crores. Most of this is related to renewable energy generation.
- **Union Budget 2022-23** announced the issuance of **Sovereign Green Bonds (SGrB)**.
 - The final sovereign green bond framework of India has been issued.
 - The Green Financing working committee has also been set up to oversee and validate key decisions on the issuance of Sovereign green bonds.

- The committee has the mandate to select the projects for allocation of proceeds, do a time-bound review of the allocation and carry out annual reporting along with an impact assessment of the proceeds from sovereign green bonds issued
- The RBI has notified the indicative Calender for the issuance of SGrB (two auctions - 25th Jan 2023 and 9th Feb 2023)
 - The **security-wise allocation would include 5 year and 10-year SGrBs for ₹4,000 crore each for both auctions.**
 - **Five per cent** of the notified amount of sale has been **reserved for retail investors** as specified under the 'Scheme for Non-competitive Bidding Facility in the auction of Government of India Dated Securities and Treasury Bills'.
 - The SGrBs will be designated as specified securities under the 'Fully Accessible Route' for investment in Government Securities by non-residents.
 - Over time, the SGrBs would provide a pricing reference for private sector entities in India for their domestic borrowings through Environment, Social, and Governance (ESG) bonds.
 - Thus, the issuance of SGrBs would help in creating an ecosystem which fosters a greater flow of capital into green projects and entities undertaking such projects.

1) REGULATORY FRAMEWORK FOR ISSUANCE OF GREEN DEBT SECURITIES

A) RESERVE BANK OF INDIA

- In Nov 2021, the RBI published its 'Statement of Commitment to Support Greening India's Financial System' - NGFS.
- Also, in 2007, the RBI advised banks to put in place an appropriate action plan for making a meaningful contribution to sustainable development.
 - Over time, **RBI has incentivised bank lending towards greener industries** and projects.
 - For example, renewable energy projects have been included under Priority Sector Lending (PSL).

B) SECURITIES AND EXCHANGE BOARD OF INDIA (SEBI)

- SEBI **introduced the regulatory framework for issuance of green debt securities** as a mode of sustainable finance under the erstwhile SEBI (Issue and Listing of Debt Securities) Regulations, 2008, (**ILDS Regulations**), in 2017.
- **At the time of review of the ILDS Regulations, the provisions of the erstwhile circular were subsumed, and the definition of "green debt security" was incorporated as Regulation 2(1)(q) in the SEBI (Issue and Listing of Non-Convertible Securities) Regulations, 2021 ('NCS Regulations').** The disclosure requirements were prescribed vide Operational Circular dated August 10, 2021.
- In Nov 2022, SEBI has allowed an issuer under the SEBI (Issue and Listing of Municipal Debt Securities) Regulations, 2015 ('ILMDS Regulations') to issue a green debt security if it falls within the definition of "green debt security" as per Regulation 2(1)(q) of the NCS Regulations. Such an issuer must comply with both ILMDS Regulation and NCS Regulations
- In the backdrop of increasing interest in sustainable finance in India as well as around the globe, and **with a view to aligning the extant framework for green debt securities with the updated Green Bond Principles recognised by International Organisation of Securities Commission (IOSCO)**, SEBI undertook a review of the

regulatory framework for green debt securities. Based on the review, it has been **decided in the SEBI board meeting** dated December 20, 2022, to:

- Enhance the scope of the definition of green debt security by including new modes of sustainable finance in relation to pollution prevention and control, eco-efficient products, etc.;
- **Introduce the concept of blue bonds** (related to water management and marine sector), yellow bonds (related to solar energy) and transition bonds as subcategories of green debt securities

Note: We will cover some of this chapter in our regular Environment classes



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