CHAPTER - 22

INDIA AND CLIMATE CHANGE

22.1. INDIA'S POSITION ON CLIMATE CHANGE

- India emitted 2,136.84 million tonnes of CO_2 equivalent greenhouse gases in 2010.
- Energy sector was the prime contributor to emissions and with 71% of total emissions in 2010. Energy sector includes - electricity production, fuel combustion in industries, transport and fugitive emissions.
- Industrial processes and product use contributed 8%; agriculture and waste sectors contributed 18% and 3% respectively to the national GHG inventory.
- About 12% of emissions were offset by carbon sink action of forests and croplands, considering which the national GHG emissions are arrived at a total of 1,884.31 million tonnes of CO_2 equivalent.
- India's per capita GHG emission in 2010 was 1.56 tCO_2 equivalent, which is less than one- third of the world's per capita emissions and far below than many developed and developing countries.
- A reduction of emission intensity of GDP by about 12% between 2005 and 2010 has been achieved against our voluntary pledge to reduce the emission intensity of its GDP by 20–25 per cent by 2020, compared with the 2005 level.
- India will continue to be a low-carbon economy (World Bank study).
- India's primary focus is on "adaptation", with specific focus for "mitigation".
- India has already unveiled a comprehensive National Action Plan on Climate Change whose activities are in the public domain.
- India advocates collaborative research in future low-carbon technology and access to intellectual property rights (IPRs) as global public goods.

22.2. OBSERVED CLIMATE AND WEATHER CHANGES IN INDIA

- India's National Communication (NATCOM) to UNFCCC has consolidated some of the observed changes in climate parameters in India. No firm link between the documented changes described below and warming due to anthropogenic climate change has yet been established.

22.2.1. Surface Temperature

- At the national level, increase of – 0.4° C has been observed in surface air temperatures over the past century. A warming trend has been observed along the west coast, in central India, the interior peninsula, and north-eastern India. However, cooling trends have been observed in north-west India and parts of south India.

22.2.2. Rainfall

- While the observed monsoon rainfall at the all-India level does not show any significant trend, regional monsoon variations have been recorded.
- A trend of increasing monsoon seasonal rainfall has been found along the west coast, northern Andhra Pradesh, and north-western India (+10% to +12% of the normal over the last 100 years) while a trend of decreasing monsoon seasonal rainfall has been observed over eastern Madhya Pradesh, north-eastern India, and some parts of Gujarat and Kerala (-6% to –8% of the normal over the last 100 years).

22.2.3. Extreme Weather Events

- Instrument records over the past 130 years do not indicate any marked long-term trend in the frequencies of large-scale droughts and floods. Trends are however observed in multi-decadal periods of more frequent droughts, followed by less severe droughts.

- There has been an overall increasing trend in severe storm incidence along the coast at the rate of 0.011 events per year. While the states of West Bengal and Gujarat have reported increasing trends, a decline has been observed in Orissa.

22.2.4. Rise in Sea Level

- The records of coastal tide gauges in the north Indian Ocean for more than 40 years, reports that sea level rise was between 1.06-1.75 mm per year. These rates are consistent with 1-2 mm per year global sea level rise estimates of IPCC.

22.2.5. Impacts on Himalayan Glaciers

- The Himalayas possess one of the largest resources of snow and ice and its glaciers form a source of water for the perennial rivers such as the Indus, the Ganga, and the Brahmaputra.
- Glacial melt may impact their long-term lean-season flows, with adverse impacts on the economy in terms of water availability and hydropower generation.
- The available monitoring data on Himalayan glaciers indicates that while recession of some glaciers has occurred in some Himalayan regions in recent years, the trend is not consistent across the entire mountain chain. It is accordingly, too early to establish long-term trends, or their causation, in respect of which there are several hypotheses.

Do you know?

Tripura is one of the highest CVP (Climate, Vegetation, Precipitation) index zones (a measure of potential productivity) in the country.

22.3. CURRENT ACTIONS FOR ADAPTATION AND MITIGATION

- Adaptation, in the context of climate change, comprises the measures taken to minimize the adverse impacts of climate change, e.g. relocating the communities living close to the sea shore, for instance, to cope with the rising sea level or switching to crops that can withstand higher temperatures.
- Mitigation comprises measures to reduce the emissions of greenhouse gases that cause climate change in the first place, e.g. by switching to renewable sources of energy such as solar energy or wind energy, or nuclear energy instead of burning fossil fuel in thermal power stations.
- Current Indian government expenditure on adaptation to climate variability, exceeds 2.6% of the GDP, with agriculture, water resources, health and sanitation, forests, coastal-zone infrastructure and extreme weather events, being specific areas of concern.

22.3.1. AGRICULTURE

- Two risk-financing programmes support adaptation to climate impacts. The Crop Insurance Scheme sup-ports the insurance of farmers against climate risks, and the Credit Support Mechanism facilitates the extension of credit to farmers, especially for crop failure due to climate variability.

22.3.2. CROP IMPROVEMENT

- The present programmes address measures such as development of arid-land crops and pest management, as well as capacity building of extension workers and NGOs to support better vulnerability reducing practices.

22.3.3. DROUGHT PROOFING

- The current programmes seek to minimize the adverse effects of drought on production of crops and livestock, and on productivity of land, water and human resources, so as to ultimately lead to drought proofing of the affected areas.
- They also aim to pro¬mote overall economic development and improve the socio-economic conditions of the resource poor and disadvantaged sections inhabiting the programme areas.

22.3.4. FORESTRY

- India has a strong and rapidly growing afforestation programme. The afforestation process was accelerated by the enactment of the Forest Conservation Act of 1980, which aimed at stopping the clearing and degradation of forests through a strict, centralized control of the rights to use forest land and mandatory requirements of compensatory afforestation in case of any diversion of forest land for any non-forestry purpose.
- In addition an aggressive afforestation and sustainable forest management programme resulted in annual reforestation of 1.78 mha during 1985-1997, and is currently 1.1 mha annually. Due to this, the carbon stocks in Indian forests have increased over the last 20 years (during 1986 to 2005) to 9 -10 gigatons of carbon (GtC).

22.3.5. WATER

- The National Water Policy stresses that non-conventional methods for utilization of water, including inter-basin transfers, artificial recharge of groundwater, and desalination of brackish or sea water, as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, should be practised to increase the utilizable water resources. Many states now have mandatory water harvesting programmes in several cities.

22.3.6. COASTAL REGIONS

- In coastal regions, restrictions have been imposed in the area between 200m and 500m of the HTL (high tide line) while special restrictions have been imposed in the area up to 200m to protect the sensitive coastal ecosystems and prevent their exploitation.
- This, simultaneously, addresses the concerns of the coastal population and their livelihood. Some specific measures taken in this regard include construction of coastal protection infrastructure and cyclone shelters, as well as plantation of coastal forests and mangroves.

22.3.7. HEALTH

- The prime objective present of health programmes is the surveillance and control of vector borne diseases such as Malaria, Kala-azar, Japanese Encephalitis, Filaria and Dengue. Programmes also provide for emergency medical relief in the case of natural calamities, and to train and develop human resources for these tasks.

22.3.8. DISASTER MANAGEMENT

- The National Disaster Management programme provides grants-in-aid to victims of weather related disasters, and manages disaster relief operations. It also supports proactive disaster prevention programmes, including dissemination of information and training of disaster-management staff.

Do you know?

A Chapter on Sustainable Development and Climate Change has been for the first time introduced in the annual Economic Survey. This new chapter reflects the growing challenges of sustainable development and climate change. Pressures on land, air, water, forests and loss of plant and animal habitant are growing.

22.4. INDIA'S NATIONAL ACTION PLAN ON CLIMATE CHANGE

In dealing with the challenge of climate change we must act on several fronts in a focused manner simultaneously. The National Action Plan hinges on the development and use of new technologies. The implementation of the Plan would be through appropriate institutional mechanisms suited for effective delivery of each individual Mission's objectives and include public private partnerships and civil society action. The focus will be on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

There are Eight National Missions which form the core of the National Action Plan, representing multipronged, long-term and integrated strategies for achieving key goals in the context of climate change.

Do you know?

The Economic Survey 2011-12, suggests to make lower carbon sustainable growth a central element of our Twelfth Five Year Plan commencing in April 2012. The Survey points out that India's per capita CO_2 emissions are much lower (1.52 CO_2 tons) than those of the developed countries even if historical emissions are excluded.

22.4.1. NATIONAL SOLAR MISSION

- The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge.

Objective

- To establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.
- The Mission will adopt a 3-phase approach,
  - spanning the remaining period of the 11th Plan and first year of the 12th Plan (up to 2012-13) as Phase 1,
  - the remaining 4 years of the 12th Plan (2013-17) as Phase 2 and
  - the 13th Plan (2017-22) as Phase 3.
- At the end of each plan, and mid-term during the 12th and 13th Plans, there will be an evaluation of progress, review of capacity and targets for subsequent phases, based on emerging cost and technology trends, both domestic and global.

- The aim would be to protect Government from subsidy exposure in case expected cost reduction does not materialize or is more rapid than expected.
- The first phase (up to 2013) will focus on capturing of the low hanging options in solar thermal; on promoting off-grid systems to serve populations without access to commercial energy and modest capacity addition in grid-based systems.
- In the second phase, after taking into account the experience of the initial years, capacity will be aggressively ramped up to create conditions for up scaled and competitive solar energy penetration in the country.

Mission targets are:

- To create an enabling policy framework for the deployment of 100 MW of solar power by 2022.
- The Centre has revised cumulative targets under National Solar Mission from 20,000 MW by 2021-22 to 1,00,000 MW- a quantum jump.
- The target will principally comprise of 40 GW Rooftop and 60 GW through Large and Medium Scale Grid Connected Solar Power Projects.

Do you know?

In Kaziranga, which has the highest concentration of the one-horned rhinoceros, the figure has gone up from 2,048 in 2009 to 2,990 now, despite the death of roughly 120 rhinos between 2009 and 2011. The rhino census, also registered 100 rhinos in Orang National Park and 93 in Pobitora wildlife sanctuary, besides 22 that have been translocated to Manas National Park over the past four years.

22.4.2. THE NATIONAL MISSION FOR ENHANCED ENERGY EFFICIENCY (NMEEE)

- The National Mission for Enhanced Energy Efficiency (NMEEE), which seeks to strengthen the market for energy efficiency by creating conducive regulatory and policy regime.
- NMEEE has been envisaged to foster innovative and sustainable business models to the energy efficiency sector.
- The NMEEE seeks to create and sustain markets for energy efficiency in the entire country which will benefit the country and the consumers".

Objective

- Promoting innovative policy and regulatory regimes, financing mechanisms, and business models which not only create, but also sustain markets for energy efficiency in a transparent manner with clear deliverables to be achieved in a time bound manner.

Mission Goals

- Market-based approaches to unlock energy efficiency opportunities, estimated to be about Rs. 74,000 Crores

  By 2014-15:

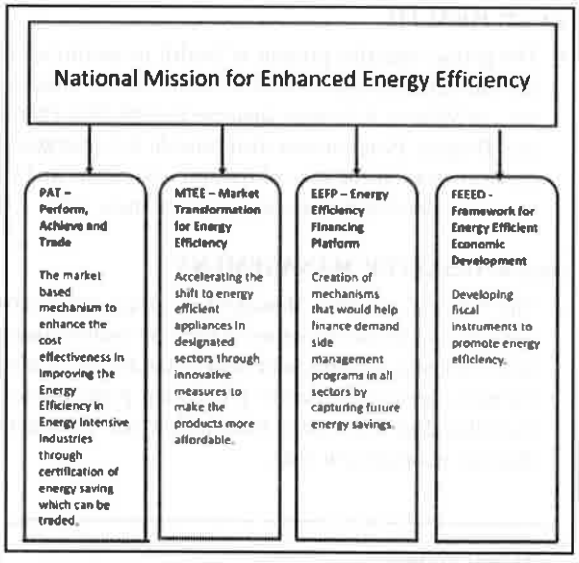
  - Annual fuel savings in excess of 23 million toe
  - Cumulative avoided electricity capacity addition of 19,000 MW
  - CO_2 emission mitigation of 98 million tons per year
- Four New Initiatives to Enhance Energy Efficiency:

a) Perform Achieve and Trade

b) Market Transformation for Energy Efficiency

c) Energy Efficiency Financing Platform (EEP)

d) Framework for Energy Efficient Economic Development (FEEED)



22.4.3. NATIONAL MISSION ON SUSTAINABLE HABITAT

- "National Mission on Sustainable Habitat" seeks to promote sustainability of habitats through improvements in energy efficiency in buildings, urban planning, improved management of solid and liquid waste, modal

shift towards public transport and conservation through appropriate changes in legal and regulatory framework.

- It also seeks to improve ability of habitats to adapt to climate change by improving resilience of infrastructure, community based disaster management and measures for improving advance warning systems for extreme weather events.
- It will broadly cover the following aspects:
  - Extension of the energy conservation building code - which addresses the design of new and large commercial buildings to optimize their energy demand;
  - Better urban planning and modal shift to public transport - make long term transport plans to facilitate the growth of medium and small cities in such a way that ensures efficient and convenient public transport;
  - Recycling of material and urban waste management - a special area of focus will be development of technology for producing power form waste.
  - The National Mission will include a major R&D programme, focusing on bio-chemical conversion, waste water use, sewage utilization and recycling options.

Do you know?

A rainforest is a forested biome with high annual rainfall. Tropical rainforests arise due to the inter-tropical convergence zone. The largest tropical rainforests exist in the Amazon basin, Nicaragua, equatorial Africa, southeastern Asia from Myanmar to Indonesia, eastern Queensland and part of Australia.

The beneficial effects of rain forests are manifold. It is also called "lungs of the world" and act as major consumers of atmospheric carbon and play a large role in cooling air.

It is estimated that the rainforests were reduced by about 58,000 km^2 annually in the 1990s. Rainforests used to cover 14% of the Earth's surface. This percentage is now down to 6% and it is estimated by study that the remaining natural rainforests could disappear within 40 years.

22.4.4. NATIONAL WATER MISSION (NWM)

MISSION OBJECTIVES

- Ensuring integrated water resource management for conservation of water, minimization of wastage and equitable distribution both across and within states.
- Developing a framework for optimum water use through increase in water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing, taking the National Water Policy (NWP) into consideration.
- Ensuring that a considerable share of water needs of urban areas is met through recycling of waste water.
- Meeting water requirements of coastal cities (with inadequate alternative sources of water) through the adoption of new and appropriate technologies such as low-temperature desalination technologies allowing use of ocean water.
- Revisiting NWP to ensure basin-level management strategies to deal with variability in rainfall and river flows due to climate change, including enhancement of storage both above and below ground, implementation of rainwater harvesting and establishment of equitable and efficient management structures.
- Developing new regulatory structures to optimize efficiency of existing irrigation systems, to rehabilitate run-down systems and to expand irrigation to increase storage capacity.
- Promotion of water-neutral and water-positive technologies through the design of a proper incentive structure combined with recharging of underground water sources and adoption of large-scale irrigation programme based on efficient methods of irrigation.

Do you know?

1. The 2009 State of the Environment Report by the Ministry of Environment and Forests (MoEF) clubs the issues under five key main challenges faced by India, which are climate change, food, security, water security, energy security and managing urbanization.
2. Mercury in the environment can be reduced by using alternative products that don't contain mercury, cleaning up spills properly, recycling mercury-containing products and properly handling and disposing of mercury-containing equipment.

22.4.5. NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM (NMSHE)

- The most crucial and primary objective of the mission is to develop a sustainable National capacity to continuously assess the health status of the Himalayan Ecosystem and enable policy bodies in their policy-formulation functions and assist States in the Indian Himalayan Region with their implementation of actions selected for sustainable development.

Mission Objectives

- Building Human and Institutional capacities on climate change related aspects
- Network knowledge institutions and develop a coherent database on all knowledge systems
- Detect and decouple natural and anthropogenic global environmental changes and project future trends on potential impacts
- Assess the socio-economic and ecological consequences of global environmental change and design appropriate strategies for growth in the economy of the region
- Study traditional knowledge systems for community participation in adaptation, mitigation and coping mechanisms
- Evaluate policy alternatives for regional development plans
- Create awareness amongst stakeholders in the region
- Develop regional cooperation to generate a strong knowledge and database for policy interventions

22.4.6. NATIONAL MISSION FOR A GREEN INDIA

Mission Objectives

- Increased forest/tree cover on 5 million hectares (ha) of forest/non- forest lands and improved quality of forest cover on another 5 million ha of non-forest/forest lands (a total of 10 million ha)
- Improved ecosystem services including biodiversity, hydrological services, and carbon sequestration from the 10 million ha of forest/non-forest lands mentioned above
- Increased forest-based livelihood income of about 3 million households, living in and around the forests
- Enhanced annual CO_2 sequestration by 50 to 60 million tones in the year 2020

Mission Targets

- Improvement in the quality of forest cover and ecosystem services of forests /nonforests, (including moderately dense, open forests, degraded grassland and wetlands: 5 million ha)
- Eco-restoration/afforestation of scrub, shifting cultivation areas, cold deserts, mangroves, ravines and abandoned mining areas (2 million ha)
- Improvement in forest and tree cover in urban/peri-urban lands (0.20 million ha)
- Improvement in forest and tree cover on marginal agricultural lands/fallows and other non-forest land under agro-forestry/social forestry (3 million ha)
- Management of public forest/non-forests areas (taken up under the mission) by community institutions
- Adoption of improved fuel wood-use efficiency and alternative energy devices by households in the project area
- Diversification of forest-based livelihoods of about 3 million households living in and around forests

Sub Missions

- Sub-mission 1: Enhancing quality of forest cover and improving ecosystem services (4.9 million ha)
- Sub-mission 2: Ecosystem restoration and increase in forest cover (1.8 million ha)
- Sub-mission 3: Enhancing tree cover in urban and peri-urban areas (including institutional lands): 0.20 million ha
- Sub-mission 4: Agro-forestry and social forestry (increasing biomass and creating carbon sink): 3 million ha
- Sub-mission 5: Restoration of wetlands: 0.10 million ha

Do you know?

Indian government has announced a domestic goal of reducing the carbon emission intensity by 20-25 per cent of its GDP of the 2005 level by 2020.

22.4.7. NATIONAL MISSION FOR SUSTAINABLE AGRICULTURE (NMSA)

Mission Objectives

- To devise strategic plans at the agro-climatic zone level so that action plans are contextualised to regional scales in the areas of research and development (R&D), technology and practices, infrastructure and capacity building

- To enhance agricultural productivity through customised interventions such as use of biotechnology to develop improved varieties of crops and livestock, promoting efficient irrigation systems, demonstration of appropriate technology, capacity building and skill development
- To facilitate access to information and institutional support by expanding Automatic Weather Station networks to the panchayat level and linking them to existing insurance mechanisms including the Weather Based Crop Insurance Scheme and the National Agriculture Insurance Scheme (NAIS), scaling the returns at that level
- To promote "laboratory to land" research by creating model villages and model farm units in rainfed and dryland areas
- To strategise long-term interventions for emission reduction from energy and non-energy uses by way of introduction of suitable crop varieties and farm practices, livestock and manure management
- To realise the enormous potential of growth in dryland agriculture, through the development of drought and pest resistant crop varieties, adopting resource-conserving technologies, providing institutional support to farmers and capacity building of stakeholders.
- The NMSA has identified 10 key dimensions for adaptation and mitigation:
  1. Improved Crop Seeds, Livestock and Fish Culture
  2. Water Efficiency
  3. Pest Management
  4. Improved Farm Practices
  5. Nutrient Management
  6. Agricultural Insurance
  7. Credit Support
  8. Markets
  9. Access to Information
  10. Livelihood Diversification

22.4.8. The National Mission on Strategic Knowledge for Climate Change (NMSKCC)

Mission Objectives

- Formation of knowledge networks among the existing knowledge institutions engaged in research and development relating to climate science and facilitating data sharing and exchange through a suitable policy framework and institutional support
- Establishment of global technology watch groups with institutional capacities to carry out research on risk minimised technology selection for developmental choices
- Development of national capacity for modeling the regional impact of climate change on different ecological zones within the country for different seasons and living standards
- Establishing research networks and encouraging research in the areas of climate change impacts on important socio-economic sectors like agriculture, health, natural ecosystems, biodiversity, coastal zones, etc.
- Generation and development of the conceptual and knowledge basis for defining sustainability of development pathways in the light of responsible climate change related actions
- Providing an improved understanding and awareness of key climate processes and the resultant climate risks and associated consequences
- To complement the efforts undertaken by other national missions, strengthen indigenous capacity for the development of appropriate technologies for responding to climate change through adaptation and mitigation and promote their utilisation by the government and societies for the sustainable growth of economies
- Creating institutional capacity for research infrastructure including access to relevant data sets, computing and communication facilities, and awareness to improve the quality and sector specific scenarios of climate change over the Indian subcontinent
- Ensuring the flow and generation of human resources through a variety of measures including incentives to attract young scientists to climate science
- Building alliances and partnerships through global collaboration in research & technology development on climate change under international and bilateral science and technology (S&T) cooperation arrangements

Do you know?

The concept of "green GDP" arose in the early 1990s in reaction to the deficiencies of the traditional gross domestic product (GDP) to account for the economic costs of depleted natural resources and incurred pollution, which in turn affect human welfare.

22.4.9. National Bio-Energy Mission

- According to estimates, biomass from agro and agro-industrial residue can potentially generate 25,000 MW of power in India. This can be further raised with wasteland-based integrated energy plantation and power generation systems.

Bio Energy

- "Bioenergy is renewable energy derived from biological sources, to be used for heat, electricity, or vehicle fuel. Biofuels derived from plant materials is among the most rapidly growing renewable energy technologies."

Sources of Bio – Energy

- Existing Sources
  - Leftover organic residue
  - Leftover farm organic residue
  - Leftover forest residue
  - Leftover organic urban residue
  - Algal residue
- New Sources
  - Cultivation of short rotation energy crops
  - Social forestry

Advantages of Bio – Energy

- Capital efficient
- High energy generation potential
- Significant carbon emission reduction potential
- Substantial employment and income generation potential
- Investments & benefits remain within the country
- Sizable economic value add to GDP
- Wasteland regeneration

Do you know?

India is highly vulnerable to climate change due to a combination of; (i) high levels of poverty, (ii) population density, (iii) high reliance on natural resources, and (iv) an environment already under stress (for instance water resources).

22.5 INDC

Conference of Parties (COP) of United Nations Framework Convention on Climate Change (UNFCCC) at 19th Session held in Warsaw in November 2013 invited all Parties to initiate domestic preparations for their INDC towards achieving the objective of the Convention and to communicate them, well in advance of the 21st session of the Conference of Parties.

The concept of 'Nationally Determined Contributions', taking into account the outcomes of both Warsaw COP 19 and Lima COP 20 has to (i) reflect the principles of equity and Common But Differentiated Responsibilities (CBDR) and (ii) the Country's contributions must be seen in a balanced and comprehensive context.

India declared a voluntary goal of reducing the emissions intensity of its GDP by 20–25%, over 2005 levels by 2020, despite having no binding mitigation obligations as per the Convention. A slew of policy measures to promote low carbon strategies and Renewable Energy have resulted in the decline of emission intensity of our GDP by 12% between 2005 and 2010. It is a matter of satisfaction that United Nations Environment Programme (UNEP) in its Emission Gap Report 2014 has recognized India as one of the countries on course to achieving its voluntary goal.

INDC outlines the post-2020 climate actions they intend to take under a new international agreement. The INDC centre around India's policies and programmes on promotion of clean energy, especially renewable energy, enhancement of energy efficiency, development of less carbon intensive and resilient urban centres, promotion of waste to wealth, safe, smart and sustainable green transportation network, abatement of pollution and India's efforts to enhance carbon sink through creation of forest and tree cover. It also captures citizens and private sector contribution to combating climate change.

The INDC proposals are on the following:

a. Sustainable Lifestyles
b. Cleaner Economic Development
c. Reduce Emission intensity of Gross Domestic Product (GDP)
d. Increase the Share of Non Fossil Fuel Based Electricity
e. Enhancing Carbon Sink (Forests)
f. Adaptation
g. Mobilizing Finance
h. Technology Transfer and Capacity Building

In the INDC, the country has focused on adaptation efforts, including:

a) developing sustainable habitats;

b) optimizing water use efficiency;

c) creating ecologically sustainable climate resilient agricultural production systems;

d) safeguarding the Himalayan glaciers and mountain ecosystem; and,

e) enhancing carbon sinks in sustainably managed forests and implementing adaptation measures for vulnerable species, forest-dependent communities and ecosystems.

India's Intended Nationally Determined Contribution: At a Glance

India has submitted its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change. Some of the salient points of the INDC are:

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
- To adopt a climate-friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.
- To achieve about 40 per cent 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.
- 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 and 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.

22.6. INDIAN NETWORK ON CLIMATE CHANGE ASSESSMENT

- The Indian Network on Climate Change Assessment (INCCA) was launched in October 2009 by the Ministry of Environment and Forests (MoEF) in an effort to promote domestic research on climate change, and build on the country's climate change expertise.
- INCCA is a network-based programme of the MoEF, which consists of over 120 institutions and over 250 scientists country wide is aimed at bringing in more science-based policy-making, based on measurements, monitoring and modelling.
- The INCCA has been conceptualized as a Network based Scientific Programme designed to address and assess the drivers and implications of climate change through scientific research; climate change assessments on various aspects of climate change, associated vulnerabilities and adaptation; devise decision support systems; and build capacity towards management of climate change related risks and opportunities.
- The INCCA will carry out research on the effects of climate change in different regions and sectors in India and suggest suitable adaptation and mitigation steps.
- Objective - to have an independent body of Indian scientists who could "prepare scientific reports at the domestic level about the impact of climate change on various sectors, which can give a real picture and influence the world debate".
- Reports prepared by the INCCA will form a part of India's National Communication (Nat Com) to the United Nations Framework Convention on Climate Change (UNFCCC).

22.6.1. INCCA – First Assessment 'India: Greenhouse Gas Emissions 2007'

- The first publication to come out from the INCCA has been an updated greenhouse gas emissions inventory for India for the year 2007.
- The first Assessment of the Green House Gas emissions was released on May 11, 2010.
- INCCA prepared the country's greenhouse gas (GHG) emission data "India: Greenhouse Gas Emissions 2007" which said the country's emissions grew by 58 per cent during 1994 to 2007
- It covers the sectors of Energy, Industry, Agriculture, Land Use Land Use Change and Forest and Waste by sources and removal by sinks presented in this document.

22.6.2. INCCA - Second Assessment 'Climate Change and India: A 4×4 Assessment'

- A 4×4 Assessment' addresses the impact of climate change in 2030s to the natural resources and livelihoods of the people in the four climate sensitive regions of Himalayan region, North-East region, the Western Ghats and the Coastal plains for the 4 key sectors of Agriculture, Water, Health and Natural Ecosystems and Biodiversity.
- The 4 region, 4 sectors Assessment in short has been referred to as a 4×4 Assessment.
- The assessment examines the implications of the climate change scenario in 2030s using a regional climate model (PRECIS).
- The assessment also brings out the future areas of work to enhance the knowledge and areas of further improvement in the future assessments.
- 4 Regions: Western Ghats, Himalayan Region, Coastal India, North-East
- 4 Thrust Areas: Agriculture, Water, Forests, Human Health

Impacts

- Warmer seasons: Avg. temp rise: 2.0 deg C predicted. 1.0-4.0 deg C at extreme ranges
- Increased annual precipitation with lower frequency of rainy days; increased intensity
- Cyclonic disturbances of lower frequency; increased intensity and increased risk of storm surges
- Sea-level rise: 1.3mm/year on average

Agriculture

- Up to 50% reduction in maize yields
- 4-35% reduction in rice yields (with some exceptions)
- Rise in coconut yields (with some exceptions); reduced apple production
- Negative impacts on livestock in all regions
- Fresh water supply
- High variability predicted in water yields (from 50% increase to 40-50% reduction)
- 10-30% increased risk of floods; increased risks of droughts

Forests and natural ecosystems

- Increased net primary productivity
- Shifting forest borders; species mix; negative impact on livelihoods and biodiversity

Human health

- Higher morbidity and mortality from heat stress and vector/water-borne diseases
- Expanded transmission window for malaria

Do you know?

Article 21 conferring the Right of Life has been assigned the broadest interpretations by the judiciary to encompass the right to a clean environment, right to livelihood, right to live with dignity and a number of other associated rights.

22.7. NATIONAL COMMUNICATION (NATCOM)

- In pursuance of the implementation of the provisions of the Convention, India's Initial National Communication (NATCOM) to the UNFCCC has been initiated in 2002 funded by the Global Environment Facility under its enabling activities programme through the United Nations Development Programme, New Delhi.

Parties to the Convention are enjoined to communicate the following information to the Secretariat of the Conference of Parties:

- A national inventory of anthropogenic emissions by sources and removal by sink of all GHGs not controlled by the Montreal protocol, to the extent its capacities, permit, using comparable methodologies to be promoted and agreed upon by the Conference of Parties.
- A general description of steps taken or envisaged by the Party to implement the Convention.
- Any other information relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including if feasible, material relevant for calculation of global emission trends.

- The National Communication process envisages comprehensive scientific and technical exercises for preparation of inventories of greenhouse gases of anthropogenic origin, reduction of uncertainities in these estimations and vulnerability assessment and adaptation due to climate change, besides other related

information of India's initiatives which address the objectives of the Convention.

- Towards preparation of National Communication, a broad participatory approach involving research institutions, technical institutions, universities, government departments, and non governmental and private organizations has been adopted, necessitated by vast regional diversity and sector complexities in India.

Implementation arrangements

- The Ministry of Environment and Forests (MoEF) is implementing and executing agency of the project.

Work Programme envisaged

- Development of comprehensive inventory for the base year 1994 and improvement of its reliability vis-à-vis earlier estimates. This would entail reducing uncertainties of GHC emission coefficients in key source categories.
- Identification of key steps to be taken towards implementing the Convention.
- Vulnerabilty and adaptation assessment for presentation of information on specific needs and concerns arising from the adverse impacts of climate change.
- Creation of reliable and comprehensive database for all the outputs produced through the establishment of a 'Data Centre' (DC). This information will be accessible on the Internet.
- Enhancement of capacity to respond to projected climate change through the preparation of a 'Targeted Research Proposal' for developing a medium to long-term action plan.

GHG Inventory Estimations

- In accordance with the provisions of Article-4 and 12.1 of UNFCCC, preparation of inventories of a basket of gases has been started for the areas of energy, industrial processes, agriculture land use and land use change and forestry (LULUCF) and waste.
- The gases to be inventoried include carbon dioxide methane, nitrous oxide, hydrofluorocarbons, perfluorocarbon and sulphur hexafluoride released from various anthropogenic sources of the base year 1994.
- This is in addition to estimating historical trends of GHG growth as a part of the initial National Communication to UNFCCC.
- The estimation of national GHG inventories for all sectors is based on the 1996 guidelines of the 'Intergovernmental Panel on Climate Change' (IPCC) and as good practices guidelines.

Do you know?

Strengthening of ecological security is one of the goal of the Mahatma Gandhi Rural Employment Guarantee Programme (MGNREGA). MGNREGA is designed to strengthen ongoing efforts in the areas of water harvesting, watershed management and soil health care and enhancement.

22.8. INDIA'S POLICY STRUCTURE RELEVANT TO GHG MITIGATION

1. Integrated Energy Policy

- India has in place a detailed policy, regulatory, and legislative structure that relates strongly to GHG mitigation: The Integrated Energy Policy was adopted in 2006.
- Some of its key provisions are:
  - Promotion of energy efficiency in all sectors
  - Emphasis on mass transport
  - Emphasis on renewables including biofuels plantations
- Accelerated development of nuclear and hydropower for clean energy
- Focused R&D on several clean energy related technologies

2. The Rural Electrification Policy, 2006

- It promotes renewable energy technologies where grid connectivity is not possible or cost-effective. The New and Renewable Energy Policy, 2005, promotes utilization of sustainable, renewable energy sources, and accelerated deployment of renewables through indigenous design, development and manufacture.
- The National Environment Policy, 2006, and the Notification on Environment Impact Assessment (EIA), 2006, reform India's environmental assessment regime. A number of economic activities are required to prepare environment impact assessments, and environment management plans, which are appraised by regulatory authorities prior to start of construction. The EIA provisions strongly promote environmental sustainability

Several other provisions

- It relates to reforming energy markets to ensure that energy markets are competitive, and energy prices reflect true resource costs. These include: Electricity Act 2005, Tariff Policy 2003, Petroleum & Natural Gas Regulatory Board Act, 2006, etc.

- The provisions taken together are designed to:
  - Remove entry barriers and raise competition in exploration, extraction, conversion, transmission and distribution of primary and secondary energy
  - Accomplish price reform, through full competition at point of sale
  - Promote tax reform to promote optimal fuel choices
  - Augment and diversify energy options, sources and energy infrastructure
  - Provide feed-in tariffs for renewables (solar, wind, biomass cogeneration)
  - Strengthen, and where applicable, introduce independent regulation

Do you know?

Rajiv Gandhi Environment Award for Clean Technology is given to industrial units that make a significant contribution towards the development of new or the innovative modification of existing, technologies or adoption and use of clean technologies and practices that substantially reduce or prevent environmental pollution.

22.9. INTRODUCTION OF LABELLING PROGRAMME FOR APPLIANCES

Do you know?

The UN General Assembly on 23.01.95 adopted a resolution which proclaims 16th September as the International Day for the Preservation of the Ozone Layer, to commemorate the signing of the Montreal Protocol on the Substances that Deplete the Ozone Layer which was signed on 16th September, 1987

- An energy labelling programme for appliances was launched in 2006, and comparative star-based labelling has been introduced for fluorescent tube-lights, air conditioners, refrigerators, and distribution transformers.
- The labels provide information about the energy consumption of an appliance, and thus enable consumers to make informed decisions. The Bureau of Energy Efficiency has made it mandatory for refrigerators to display energy efficiency label and is expected to do so for air conditioners as well. The standards and labelling programme for manufacturers of electrical appliances is expected to lead to significant savings in electricity annually.

22.10. ENERGY CONSERVATION BUILDING CODE

- An Energy Conservation Building Code (ECBC) was launched in May, 2007, which addresses the design of new, large commercial buildings to optimize the buildings' energy demand based on their location in different climatic zones. Commercial buildings are one of the fastest growing sectors of the Indian economy, reflecting the increasing share of the services sector in the economy.
- Nearly one hundred buildings are already following the Code, and compliance with the Code has been incorporated into the mandatory Environmental Impact Assessment requirements for large buildings.
- It has been estimated that if all the commercial space in India every year conform to ECBC norms, energy consumption in this sector can be reduced by 30-40%. Compliance with ECBC norms is voluntary at present but is expected to soon become mandatory.

22.10.1. Green Building

- Buildings are one of the major pollutants that affect urban air quality and contribute to climate change.
- Human Habitats (Buildings) interact with the environment in various ways. Throughout their life cycles, from construction to operation and then demolition, they consume resources in the form of energy, water, materials, etc. and emit wastes either directly in the form of municipal wastes or indirectly as emissions from electricity generation.
- Green building is the essence of which would be to address all the pollution related issues of a building in an integrated and scientific manner.
- A green building depletes as little of the natural resources during its construction and operation.
- The aim of a green building design is to:
  - Minimize the demand on non-renewable resources and maximize the utilization efficiency of these resources when in use, and
  - Maximize reuse and recycling of available resources
  - Utilization of renewable resources.
- It costs a little more to design and construct a green building.

- However, it costs less to operate a green building that has tremendous environmental benefits and provides a better place for the occupants to live and work in.
- It maximizes the use of efficient building materials and construction practices; optimizes the use of on-site sources and sinks by bio-climatic architectural practices; uses minimum energy to power itself; uses efficient equipment to meet its lighting, air-conditioning, and other needs; maximizes the use of renewable sources of energy; uses efficient waste and water management practices; and provides comfortable and hygienic indoor working conditions.
- It is evolved through a design process that requires all concerned (the architect and landscape designer and the air conditioning, electrical, plumbing, and energy consultants) to work as a team to address all aspects of building and system planning, design, construction, and operation.
- They critically evaluate the impacts of each design decision on the environment and arrive at viable design solutions to minimize the negative impacts and enhance the positive impacts on the environment.
- In sum, the following aspects of the building design are looked into in an integrated way in a green building:
  - Building system designed in a way to efficiently use HVAC (heating ventilation and air conditioning), lighting, electrical, and water heating.
  - Integration of renewable energy sources to generate energy onsite.
  - Selection of ecologically sustainable materials (with high recycled content, rapidly renewable resources with low emission potential, etc.) for Water and waste management.
  - Indoor environmental quality (maintains indoor thermal and visual comfort and air quality)

Do you know?

The 42nd Amendment to the constitution brought about in the year 1974 inserted two new Articles namely.

Art. 48-A under Directive principles of State Policy, making it the responsibility of the State Government to protect and improve the environment and to safeguard the forests and wildlife of the country

Art. 51-A (g) under Fundamental duties of citizens; making it the fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures

22.10.2. Green Rating for Integrated Habitat Assessment (GRIHA)

- GRIHA is a Sanskrit word meaning – 'Abode'.
- GRIHA has been conceived by TERI and developed jointly with the Ministry of New and Renewable Energy, Government of India.
- The green building rating system devised by TERI and the MNRE is a voluntary scheme.

Objective

- The primary objective of the rating system is to help design green buildings and, in turn, help evaluate the 'greenness' of the buildings.

Aim

- The rating system aims to achieve efficient resource utilization, enhanced resource efficiency, and better quality of life in the buildings.

Rating Tool

- GRIHA is a rating tool that helps people assess the performance of their building against certain nationally acceptable benchmarks and is suitable for all kinds of buildings in different climatic zones of the country.
- Going by the old adage 'what gets measured, gets managed', GRIHA attempts to quantify aspects such as energy consumption, waste generation, renewable energy adoption, etc. so as to manage, control and reduce the same to the best possible extent.
- It will evaluate the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'.
- The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts, both national and international.
- The guidelines/criteria appraisal may be revised every three years to take into account the latest scientific developments during this period.

The basic features

- The system has been developed to help 'design and evaluate' new buildings (buildings that are still at the inception stages).
- A building is assessed based on its predicted performance over its entire life cycle - inception through operation.
- The stages of the life cycle that have been identified for evaluation are:

Rating system

- GRIHA rating system consists of 34 criteria categorized under 4 categories.
- They are
  1. Site Selection and Site Planning,
  2. Conservation and efficient utilization of resources,
  3. Building operation and maintenance, and
  4. Innovation points.
- Eight of these 34 criteria are mandatory, four are partly mandatory, while the rest are optional. Each criterion has a number of points assigned to it.
- It means that a project intending to meet the criterion would qualify for the points. Different levels of certification (one star to five stars) are awarded based on the number of points earned. The minimum points required for certification is 50.

Do you know?

Medini Puraskar Yojana - This award is given to Indian authors each year to encourage original works in Hindi on environment and its related subjects such as wildlife, water resources and conservation

The benefits

- On a broader scale, this system, along with the activities and processes that lead up to it, will benefit the community at large with the improvement in the environment by reducing GHG (greenhouse gas) emissions, reducing energy consumption and the stress on natural resources.
  - Reduced energy consumption without sacrificing the comfort levels
  - Reduced destruction of natural areas, habitats, and biodiversity, and reduced soil loss from erosion etc.
  - Reduced air and water pollution (with direct health benefits)
  - Reduced water consumption
  - Limited waste generation due to recycling and reuse
  - Reduced pollution loads
  - Increased user productivity
  - Enhanced image and marketability

The challenges

- The Indian building industry is highly de-centralized with people and/ or groups engaged in design, construction, equipment provision, installation, and renovation working together.
- Each group may be organized to some extent, but there is limited interaction among the groups, thus disabling the integrated green design and application process.
- Hence, it is very important to define and quantify sustainable building practices and their benefits.
- It is also important to separate the role of different participants in ensuring that the building consumes minimal resources over its entire life cycle and leaves behind a minimal environmental footprint.

Do you know?

Amrita Devi Bishnoi Wildlife Protection Award is given for significant contribution in the field of wildlife protection, which is recognised as having shown exemplary courage or having done exemplary work for the protection of wildlife.

22.11. ENERGY AUDITS OF LARGE INDUSTRIAL CONSUMERS

- In March 2007 the conduct of energy audits was made mandatory in large energy-consuming units in nine industrial sectors. These units, notified as "des¬ignated consumers" are also required to employ "certified energy managers", and report energy con¬sumption and energy conservation data annually.

22.12. MASS TRANSPORT

- The National Urban Transport Policy emphasizes extensive public transport facilities and non-motor¬ized modes over personal vehicles. The expansion of the Metro Rail Transportation System in Delhi and other cities (Chennai, Bangalore, Jaipur, etc) and other mass

transit systems, such as the Metro Bus project in Bangalore, are steps in its implementation. The state government of Maharashtra recently announced that it will impose a congestion tax to discourage the use of private cars in cities where it has created "sufficient public trans¬port capacity".

Do you know?

Rajiv Gandhi Wildlife Conservation Award is Awarded annually for significant contribution in the field of wildlife conservation which has made or has the potential to make, a major impact on the protection and conservation of wildlife in the country

22.13. CLEAN AIR INITIATIVES

- In urban areas, one of the major sources of air pollution is emissions from transport vehicles.
- Steps taken to reduce such pollution include
  (i) introduction of compressed natural gas (CNG) in Delhi and other cities;
  (ii) Retiring old, polluting vehicles; and
  (iii) Strengthening of mass transportation.
- Some state governments provide subsidies for purchase and use of electric vehicles. For thermal power plants, the installation of electrostatic precipitators is mandatory. In many cities, polluting industrial units have either been closed or shifted from residential areas.

22.14. PROMOTION OF ENERGY SAVING DEVICES

- The Bureau of Energy efficiency has introduced "The Bachat Lamp Yojana", a programme under which households may exchange incandescent lamps for CFLs (compact fluorescent lamps) using clean devel¬opment mechanism (CDM) credits to equate pur¬chase price.
- Some states have made mandatory the installation of solar water heaters in hospitals, hotels and large government and commercial buildings. Subsidy is provided for installation of solar water heaters in residential buildings.

22.15. PROMOTION OF BIOFUELS

- The Biodiesel Purchase Policy mandates biodiesel procurement by the petroleum industry. A mandate on Ethanol Blending of Gasoline requires 5% blend¬ing of ethanol with gasoline from 1st January, 2003, in 9 States and 4 Union Territories.

Do you know?

Indira Gandhi Paryavaran Puraskar is Awarded each year to Indian nationals or any Indian organisation for significant contributions in the field of environment

22.16. INDIAN SOLAR LOAN PROGRAMME

- In April 2003, the United Nations Environment Programme ("UNEP") initiated a, three-year Programme, credit facility in Southern India to help rural households finance the purchase of Solar Home Systems.
- Canara Bank and Syndicate Bank, along with their eight associate Regional Rural Banks, partnered with UNEP to establish and run a Loan Programme through their branch offices across Karnataka State and part of the neighbouring Kerala State.
- In addition to providing financial support in the form of interest rate subsidies for borrowers, UNEP provides assistance with technical issues, vendor qualification and other activities to develop the institutional capacity for this type of finance.

22.17. NATIONAL INITIATIVE ON CLIMATE RESILIENT AGRICULTURE (NICRA)

- The ICAR has launched National Initiative on Climate Resilient Agriculture (NICRA) during 2010-11 with an outlay of Rs.350 crores for the XI Plan.
- This initiative will primarily enhance the resilience of Indian Agriculture covering crops, livestock and fisheries.

22.17.1. Objective

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies

Project Components

- The project is comprised of four components.
  1) Strategic research on adaptation and mitigation
  2) Technology demonstration on farmers' fields to cope with current climate variability

3) Sponsored and competitive research grants to fill critical research gaps

4) Capacity building of different stake holders

Strategic Research

- The strategic research has been planned at leading research institutes of ICAR in a network mode covering crops, horticulture, livestock, natural resource management and fisheries sectors.
- To begin with, the project is focusing on crops like wheat, rice, maize, pigeonpea, groundnut, tomato, mango and banana; cattle, buffalo and small ruminants among livestock and both marine and freshwater fish species of economic importance.
- The major research themes are:
  - Vulnerability assessment of major production zones
  - Linking weather based agro-advisories to contingency planning
  - Assessing the impacts and evolving varieties tolerant to key climatic stresses (drought, heat, frost, flooding, etc.) in major food and horticulture crops
  - Continuous monitoring of greenhouse gases in open field conditions in major production systems
  - Evolving adaptation and mitigation strategies through enhancing water and nutrient use efficiency and conservation agriculture
  - Studying changes in pest dynamics, pest/pathogen-crop relationships and emergence of new pests and pathogens under changing climate
  - Adaptation strategies in livestock through nutritional and environmental manipulations
  - Harnessing the beneficial effects of temperature in inland and marine fisheries through better understanding of the spawning behaviour.
- Seven major research institutes of the ICAR will work in unison to evolve coping technologies with Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad as the lead centre.
- Best-bet and cost-effective technologies to cope with climate variability will be demonstrated on farmers' fields in 100 most vulnerable districts of the country.
- The technologies include rain water harvesting and its judicious use, in-situ moisture conservation, drought management strategies, seed and fodder banks, timely and precision agriculture, effective agro-advisory system using Information Communication Technology kiosks.
- Small and marginal farmers in rain-fed, coastal and hill areas will benefit more in view of the focused attention in these regions.
- Capacity building of scientists in frontier areas is another core activity of the project.
- To prepare all stakeholders to face challenges, multi-pronged awareness generation programs on issues of climate change are planned.

Do you know?

MoEF&CC initiated a national campaign named "Green Good Deeds" weaving around some 500 simple lifestyle habits that can be easily adopted, in an effort to sensitise the hazards of climate and global warming.

22.18. BSE-GREENEX

- The BSE-GREENEX Index is a veritable first step in creating a credible market based response mechanism in India, whereby both businesses and investors can rely upon purely quantitative and objective performance based signals, to assess "carbon performance".
- gTrade Carbon Ex Ratings Services Private Limited (gTrade) is a company based in India, which has co-developed the BSE-GREENEX Index in close association with the BSE.

Index Description

- The BSE-GREENEX Index includes the top 20 companies which are good in terms of Carbon Emissions, Free-Float Market Capitalization and Turnover.
- The Index is a Cap Weighted Free-Float Market Capitalization weighted Index comprising from the list of BSE-100 Index.
- The Index has been back-tested from 1stOctober, 2008 (Base Date) with the base index value of 1000.
- The Index is rebalanced on a bi-annual basis i.e. end of March and September quarters.
- The September quarter review will be based on the fresh set of carbon emission numbers and the March quarter review will be based on the existing carbon emission numbers but latest financial data.

22.19 FAME-INDIA PROGRAMME

Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles (FAME India) scheme rolled out in april, 2015 by Union Minister for Heavy Industries and Public Enterprises

The scheme will help promote use of electric and hybrid vehicles, and initially, a subsidy of 30% will be provided to the buyers.

Phased replacement of fossil fuel-based vehicles with those based on latest technologies will lead to a net saving of Rs 14,000 crore.

The scheme is proposed to be implemented over six years, till 2020, which looks at sales of electric and hybrid vehicles up to 60-70 lakh units per year.

22.20. LONG TERM ECOLOGICAL OBSERVATORIES (LTEO)

- Long Term Ecological Observatories (LTEO) for Climate Change Studies are one of the components under the 'Climate Change Action Programme' with an outlay of Rs. 40 crores in the 12th Plan Period.
- A Science Plan of LTEO was released during the 21st Conference of Parties to the United Nations Framework Convention on Climate Change at Paris in December 2015.
- First phase of the LTEO Programme includes creating a network of field sites to assess the health of eight different biomes of the country namely; Western Himalaya, Eastern Himalaya, North-Western Arid Zone, Central Indian Forests, Western Ghats, Andaman & Nicobar Islands, Jammu & Kashmir and Sundarbans.
- LTEO Programme aims to understand the biophysical and anthropogenic drivers of ecosystem change in the selected biomes and their effects on social- ecological responses through a network of scientific institutions.
- Activities include experimental work to assess the change of structure and function in the natural ecosystems, identification of patterns and drivers of change in the natural ecosystems by monitoring populations of fresh water fish, birds, mammals, herbivores & carnivores, animal movements, soil processes in forests & grasslands, biophysical climatic variables, etc.

22.21. THE NATIONAL ADAPTATION FUND FOR CLIMATE CHANGE (NAFCC)

- The National Adaptation Fund for Climate Change (NAFCC) is a Central Sector Scheme set up in 2015-16. The aim of NAFCC is to support concrete adaptation activities which mitigate the adverse effects of climate change. The activities under this scheme are implemented in a project mode. The projects related to adaptation in sectors such as agriculture, animal husbandry, water, forestry, tourism etc. are eligible for funding under NAFCC. National Bank for Agriculture and Rural Development (NABARD) is the National Implementing Entity (NIE).

22.22. OTHER "CRITICAL INITIATIVES"

- In addition, India has 24 other "Critical Initiatives" in the anvil, for which detailed plans and an institutional framework is being prepared

Type	Initiative
Energy Efficiency in Power Generation	Super critical technologies Integrated Gasification Combined Cycle (IGCC)
Technology	Natural Gas based Power Plants Closed Cycle Three Stage Nuclear Power Programme Efficient Transmission and Distribution Hydropower
Other Renewable Energy Technologies Programmes	RETs for power generation Biomass based popup generation technologies Small scale Hydropower Wind Energy Grid connected systems RETs for transportation and industrial fuels
Disaster Management Response to Extreme Climate Events	Reducing risk to infrastructure through better design Strengthening communication networks and disaster management facilities
Protection of Coastal Areas	Undertake measures for coastal protection and setting up Early Warning System Development of a regional ocean modelling system High resolution coupled ocean-atmosphere variability studies in tropical oceans Development of a high-resolution storm surge model for coastal regions Development of salinity-tolerant crop cultivars Community awareness on coastal disasters and necessary action; Timely forecasting, cyclone and flood warning systems Enhanced plantation and regeneration of mangroves and coastal forests
Health Sector	Provision of enhanced public health care services and assessment of increased burden of disease due to climate change
Creating appropriate capacity at different levels of Government	Building capacity in the Central, State and other at the local level to assimilate and facilitate the implementation of the activities of national plan