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Climate Change: World and India

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Climate Change

- A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
- Climate Change is the defining issue of our time and we are at a defining moment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale without drastic action today, adapting to these impacts in the future will be more difficult and costly.
- India's average temperature has already increased by around 0.7 degree Celsius during the 1901–2018 period due to greenhouse gas emissions and by the end of 2100 it is expected to rise by approximately 4.4 degree Celsius (relative to 1976–2005 average, in the worst-case scenario), warns the first-ever climate change.

TIMELINE OF MAJOR UN CLIMATE CONVENTION

- **1992-** The UN Framework Convention on Climate Change (UNFCCC) was adopted and opened for signatures in Rio de Janeiro, Brazil, at the UN Conference on Environment and Development, also known as the Earth Summit. 154 signatories to the UNFCCC agreed to stabilize "*greenhouse gas concentrations* in the atmosphere at a level that would prevent dangerous interference with the climate system." The United States was the fourth nation to ratify the UNFCCC, and the first industrialized nation to do so. The treaty is not legally binding because it sets no mandatory limits on GHG emissions. Instead, the treaty provides for future negotiations to set emissions limits. *The first principal revision is the Kyoto Protocol.*
- **1994-** The UNFCCC Treaty entered into force after receiving 50 ratifications.

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- **1995-** The first Conference of the Parties (COP 1) to the UNFCCC was held in Berlin, Germany. Parties agreed that mechanisms under the UNFCCC were inadequate and agreed to what would be called the Berlin Mandate, which allows parties to make specific commitments. Non-Annex 1 countries are exempted from additional obligations.
- **1996-** COP 2 was held in Geneva, Switzerland. Attendees endorsed the results of the IPCC's second assessment report. The Geneva Ministerial Declaration, which in part called on parties to accelerate negotiations on a legally binding protocol, was noted, but not adopted.
- **1997-** COP 3 was held in Kyoto, Japan. On December 11, the Kyoto Protocol was adopted by consensus with more than 150 signatories. The Protocol included legally binding emissions targets for developed country Parties for the six major GHGs, which are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The Protocol offered additional means of meeting targets by way of three market-based mechanisms: emissions trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI). Under the Protocol, industrialized countries' actual emissions have to be monitored and precise records have to be kept of the trades carried out.

  The United States signed the Kyoto Protocol, but the Clinton administration never sent it to Congress for ratification. In July 1997, the Senate expressed its opposition to the terms of the Berlin Mandate by passing the "Byrd-Hagel" Resolution.
- **1998-** COP 4 was held in Buenos Aires, Argentina. Parties adopted the Buenos Aires Plan of Action, allowing a two year period to develop mechanisms for implementing the Kyoto Protocol. The COP also decided to review the financial mechanism of the Convention every four years.
- **1999-** COP 5 was held in Bonn, Germany. According to the UNFCCC, Parties continued negotiation efforts with a focus on "the adoption of the guidelines for the preparation of national communications by [developed] countries, capacity building, transfer of technology and flexible mechanisms."

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- **2000-** COP 6 part I was held in The Hague, Netherlands. Negotiations faltered, and parties agreed to meet again. COP 6 part II was held in Bonn, Germany. Consensus was reached on what was called the Bonn Agreements. All nations except the United States agreed on the mechanisms for implementation of the Kyoto Protocol. The U.S. participated in observatory status only.
- **2001-** COP 7 was held in Marrakesh, Morocco. The detailed rules for the implementation of the Kyoto Protocol were adopted and called the Marrakesh Accords. The Special Climate Change Fund (SCCF) was established to "finance projects relating to: adaptation; technology transfer and capacity building; energy transport, industry, agriculture, forestry and waste management; and economic diversification." The Least Developed Countries Fund was also "established to support a work programme to assist Least Developed Country Parties (LDCs) carry out, inter alia [among other things], the preparation and implementation of national adaptation programmes of action (NAPAs)."
- **2002—** COP 8 was held in Delhi, India. Parties adopted the Delhi Ministerial Declaration that, among other things, called for developed countries to transfer technology to developing countries.
- **2003—** COP 9 was held in Milan, Italy. New emisssions reporting guidelines based on IPCC recommendations were adopted. The Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF) were further developed.
- **2005—** COP 11/CMP 1 was held in Montreal, Canada. This conference was the first to take place after the Kyoto Protocol took force. The annual meeting between the parties (COP) was supplemented by the first annual Meeting of the Parties to the Kyoto Protocol (CMP). The countries that had ratified the UNFCCC, but not accepted the Kyoto Protocol, had observer status at the latter conference. The parties addressed issues such as "capacity building, development and transfer of technologies, the adverse effects of climate change on developing and least developed countries, and several financial and budget-related issues, including guidelines to the Global Environment Facility (GEF)." (UNFCCC).
- **2009-** June, as part of the UN Framework Convention on Climate Change (UNFCCC)

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- process, governments met in Bonn, Germany, to begin discussions on draft negotiations that would form the basis of an agreement at Copenhagen.December – COP 15 was held in Copenhagen, Denmark. It failed to reach agreement on binding commitments after the Kyoto Protocol commitment period ends in 2012. During the final hours of the summit, leaders from the United States, Brazil, China, Indonesia, India and South Africa agreed to what would be called the Copenhagen Accord.
- **2014-** At COP 20 in Lima in 2014, Parties adopted the 'Lima Call for Action', which elaborated key elements of the forthcoming agreement in Paris. More on the Lima Call for Action.
- **2015-** Intensive negotiations took place under the Ad Hoc Group on the Durban Platform for Enhanced Action (ADP) throughout 2012-2015 and culminated in the adoption of the Paris Agreement by the COP on 12 December 2015. More on the Paris Agreement.
- **2019-**The 2019 United Nations Climate Change Conference, also known as COP25, is the 25th United Nations Climate Change conference. It was held in Madrid, Spain, from 2 to 13 December 2019 under the presidency of the Chilean government.

Effects of climate change:

The UN Intergovernmental Panel on Climate Change (IPCC)

- The Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization (WMO) and United Nations Environment to provide an objective source of scientific information. In 2013 the IPCC provided more clarity about the role of human activities in climate change when it released its Fifth Assessment Report.

Fifth Assessment Report

- The report provides a comprehensive assessment of sea level rise, and its causes, over the past few decades. It also estimates cumulative CO_2 emissions since pre-industrial times and provides a CO_2 budget for future emissions to limit warming to less than 2°C. About half of this maximum amount was already emitted by 2011. The report found that:
- From 1880 to 2012, the average global temperature increased by 0.85°C.

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- Oceans have warmed, the amounts of snow and ice have diminished and the sea level has risen. From 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded due to warming and ice melted. The sea ice extent in the Arctic has shrunk in every successive decade since 1979, with 1.07 × 106 km² of ice loss per decade. Given current concentrations and ongoing emissions of greenhouse gases, it is likely that by the end of this century global mean temperature will continue to rise above the pre-industrial level. The world's oceans will warm and ice melt will continue. Average sea level rise is predicted to be 24–30 cm by 2065 and 40–63 cm by 2100 relative to the reference period of 1986–2005. Most aspects of climate change will persist for many centuries, even if emissions are stopped.
- There is alarming evidence that important tipping points, Ecosystems as diverse as the Amazon rainforest and the Arctic tundra, may be approaching thresholds of dramatic change through warming and drying. Mountain glaciers are in alarming retreat and the downstream effects of reduced water supply in the driest months will have repercussions that transcend generations.

Global Warming of 1.5°C

- In October 2018 the IPCC issued a special report on the impacts of global warming of 1.5°C, finding that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society.
- The report also highlights a number of climate change impacts that could be avoided by limiting global warming to 1.5ºC compared to 2ºC, or more. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2ºC.
- The report finds that limiting global warming to 1.5°C would require "rapid and far-reaching" transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that
- any remaining emissions would need to be balanced by removing CO2 from the air.

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Melting of glaciers:

Wild fires:

Disasters in recent times

- March 2019, Cyclone Idai took the lives of more than 1000 people across Zimbabwe, Malawi and Mozambique in Southern Africa and it devastated millions more who were left destitute without food or basic services. Lethal landslides took homes and destroyed land, crops and infrastructure. Cyclone Kenneth arrived just six weeks later, sweeping through northern Mozambique, hitting areas where no tropical cyclone has been observed since the satellite era.
- The start of 2020 found Australia in the midst of its worst-ever bushfire season following on from its hottest year on record which had left soil and fuels exceptionally dry. The fires have burned through more than 10 million hectares, killed

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at least 28 people, razed entire communities to the ground, taken the homes of thousands of families, and left millions of people affected by a hazardous smoke haze. More than a billion native animals have been killed, and some species and ecosystems may never recover

- More than 44 percent of India's area was under drought conditions according to IMD (Indian meteorological department 23 percent below the normal rainfall during the time of year.
- Higher sea temperatures, linked to climate change, have doubled the likelihood of drought in the Horn of Africa region. Severe droughts in 2011, 2017 and 2019 have repeatedly wiped out crops and livestock. Droughts have left 15 million people in Ethiopia, Kenya and Somalia in need of aid, yet the aid effort is only 35 percent funded. People have been left without the means to put food on their table, and have been forced from their homes. Millions of people are facing acute food and water shortages.
- The last year deadly floods and landslides have forced 12 million people from their homes in India, Nepal and Bangladesh. Just 2 years ago exceptionally heavy monsoon rains and intense flooding destroyed, killed, and devastated lives in the same countries. In some places the flooding was the worst for nearly 30 years, a third of Bangladesh was underwater. While some flooding is expected during monsoon season, scientists say the region's monsoon rains are being intensified by rising sea surface temperatures in South Asia
- An El Niño period, supercharged by the climate crisis, has taken Central America's Dry Corridor into its 6th year of drought. Guatemala, Honduras, El Salvador and Nicaragua are seeing their typical three-month dry seasons extended to six months or more. Most crops have failed, leaving 3.5 million people, many of whom rely on farming for both food and livelihood, in need of humanitarian assistance, and 2.5 million people food insecure.

INDIA's progress in combating climate change

- In recognition of the growing problem of Climate Change, India declared a voluntary goal of reducing the emissions intensity of its GDP by 20–25%, over 2005 levels, by

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2020, despite having no binding mitigation obligations as per the Convention. A slew of policy measures were launched to achieve this goal.

- As a result, the emission intensity of our GDP has decreased 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.
- India has a definite plan of action for clean energy, energy efficiency in various sectors of industries, steps to achieve lower emission intensity in the automobile and transport sector, a major thrust to non-fossil based electricity generation and a building sector based on energy conservation. India's on-going mitigation and adaptation strategies and actions are detailed in the following sections, along with the expected direction of activities in the near future.

Calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the recovering capacity of the community of the area affected".

In simple words it is an event or a series of events, which give rise to life threatening circumstances and acute damage or loss of property, environment and most importantly means of livelihood on a scale which is beyond comprehension and far beyond the recovering capacity of the community affected. These unfortunate events disturb the balance and progress of infrastructure development activities pushing nations back by several years in terms of GDP. Therefore, efficient disaster management has received great attention.

Disaster Management can be described briefly by the integration the following:

- Planning and implementation of disaster specific measures which are mandatory
- Mitigation of consequences
- Capacity building
- Pre-planned and prepared response
- Assessment of the severity
- Evacuation, Rescue and Relief
- Rehabilitation and Reconstruction

Largely due to its geo-climatic conditions combined with high population density and

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other socio economic factors, India is one of the most disaster prone countries in the world. The risk of damage of lives and property during and even after the occurrence of such an event is high due to the population spread and tendency of people to rehabilitate the areas prone to natural disasters such as earthquakes, Bhuj in Gujarat being a perfect example of such an occurrence.

Increased vulnerability to the effects of disaster can be related to country specific problems such as population expansion, urbanization and industrialization, infrastructure development within high-risk zones and global problems such as environmental degradation and climatic changes. The current scenario of preparedness of our country in case of an earthquake has been discussed very categorically further.

Literature Review

Ministry of Earth Sciences (MoES) (India Meteorological Department (IMD)) is the nodal Ministry for the management and mitigation of earthquakes in the country. In terms of National Disaster Management Guidelines on Management of Earthquakes issued in April 2007, MoES was to prepare the Earthquake Management Plan covering all aspects including earthquake preparedness, mitigation, public awareness, capacity building, training, education, research and development, documentation, earthquake response, rehabilitation and recovery. MoES did not prepare any disaster management plan for earthquakes. However, in reply to a query of the Committee regarding status of disaster management and mitigation plan for earthquake, the MHA informed as under:

"ESSO-IMD is only responsible for monitoring seismic activity in and around the country and disseminates the information to all the user agencies including the concerned State and Central Government agencies responsible for carrying out emergency response, relief and rehabilitation measures. It is to mention that the institutions of MoES/ESSO only deal with monitoring, detection and warning of cyclones and tsunamis and only carry out aspects of monitoring and detection in respect of earthquakes and hence have no experience of developing and monitoring the associated components of disaster management cycle viz., preparedness, mitigation, risk reduction, response and relief, etc., that are all along being dealt with by different Central and State Government authorities. Moreover, the implementation of disaster mitigation plans also has a significant component of techno-legal, and regulatory components that are operated by various competent authorities at different

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levels of governance in the country".

A project on "Optimum Seismological Network Program" was sanctioned in May 2009 by the IMD at an estimated cost of ₹ 48 crore, which was reduced to ₹ 25.17 crore. The project implementation was proposed to be carried out in two phases spread over a period of three years from 2009-10 to 2011-12. The objective of the project was to strengthen and modernize the National Seismological Network for improving the detection and location capability for earthquakes of magnitude greater than or equal to 3.0, occurring anywhere in the mainland of the country. The project was found by audit as still in the preliminary stages of implementation even after expiry of three years. The MHA in their submission about the status of OSNP stated as under:

"Earlier plan of "Optimum Seismological Network Program" was reviewed in the light of recent networks established in the country by various R & D groups. Under this approach, already 65-stations (40-seismic stations and 25-GPS stations) are operational and very soon the network would have 90-stations (50-seismic stations and 40-GPS stations) by which already medium and low seismic intensity is successfully getting monitored and analysed in real-time. Accordingly a new scheme was taken up for deploying a total of 78 additional state-of art broadband systems to the national seismological network in October, 2012. Global tenders have been floated and technical evaluation of bids received has been completed. Further action is in process for placement of order is under progress".

MOES/IMD had set up the Earthquake Risk Evaluation Centre at Delhi, in February 2004. During 2007-12, IMD proposed to carry out three projects:

(a) Seismic micro-zonation of Mumbai, Guwahati, Ahmedabad and Dehradun on 1:10000 scale;

(b) Creation of national database for seismic hazard and regional risk appraisal; and

(c) Impact assessment of utilization of database in planning and mitigation

An allocation of ₹ 298.38 crores was made for these projects. MoES stated (September 2012) that the micro-zonation of Guwahati, Bangalore, Ahmedabad, Dehradun and Delhi was completed. IMD initiated a project titled "Archival digitization of seismic analogue chart" in May 2008 at an estimated cost of ₹ 13.50 crores for two years. The duration of the project was extended from time to time and finally till June 2012. In their submission, the MHA furnished as under:

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"Seismic data base comprises scanning and digitization of analog seismic charts for the period 1927-1996, on-line archival of digital wave form seismic data since 1996 in real time. The scanning of about 89,000 analog charts and out of which digitization of about 5000 earthquake events are taken up since 2008. As things stand today, the scanning of all the charts is completed and digitization of events is in its final stage. Archival-digitization of seismic analogue charts is pursued till December 2013 to complete the activity. The National NDMA had undertaken the task of preparing the upgraded hazard maps and atlas of Indian land Mass. In this connection the MHA informed that as per the recommendations of the Working Committee of Experts (Geophysical-Hazards), NDMA has undertaken a project through Building Materials Technology Promotion Council (BMTPC) for upgradation of Earthquake Hazards Maps for the country at a cost of ₹ 76.83 lakh. Project which started in June, 2011 is yet to be completed. It is getting delayed due to non-availability of district boundaries data from the Census of India.

NDMA has also taken up National Earthquake Risk Mitigation project. This Project was still in preparatory phase after a lapse of five years. The Ministry while furnishing the status of project stated as under:

"The Centrally Sponsored Scheme for National Earthquake Risk Mitigation (Preparatory Phase) has been approved in April, 2013 at an outlay of ₹ 24.87 crore, to be implemented within a period of two years viz. 2013-2015. The aim of the project is to demonstrate the effectiveness of strategies proposed for implementation of activities under four components namely, **(i) Techno-legal Regime, (ii) Institutional Strengthening, (iii) Capacity Building and (iv) Public Awareness**. The scheme will be implemented in 21 States/UTs that lie in seismic Zones V & IV in the country.

Present Status

1. NDMA has initiated preliminary steps for implementing the scheme
2. A Project Steering Committee has been constituted under chairmanship of Member(Earthquake), NDMA and Secretary, NDMA, JS(DM), Financial Advisor, Town & Country Planner, Technical experts, representatives from BMTPC, CPWD, NIDM etc. as members."

The Committee has noted that considering the vulnerability of the country's landmass to the risks of earthquake, various efforts are underway to prepare for such eventualities. It includes

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archival-digitisation of seismic /analogue charts since 1996, preparation of hazards map and atlas of India etc. Also following the Optimum Seismological Network Programme sanctioned in 2009 by the IMD, 65 stations are now operational and the capacity is being further enhanced. However the Project for up gradation of Earthquake Hazards Maps for the Country costing ₹ 76.83 lakh, which started in June 2011, is yet to be completed due to non-availability of district boundaries data from the Census of India. Another project 'National Earthquake Risk Mitigation', approved in April, 2013 is under implementation during 2013-15 [8]. Considering the increased seismic activity in the Himalayan region, which has been witnessed recently, the Committee emphasise upon an early completion of the earthquake preparedness activities at all levels. They desire that the MHA must take up the matter urgently with the Census Commissioner for supply of requisite boundaries data so that the hazard atlas/map could be completed early. The Committee hope that the preparatory phase of the Earthquake Mitigation project would be completed this year as stipulated and final phase would start on time. Meanwhile the MHA must strive to create maximum public awareness on earthquakes in the Country as an essential part of disaster preparedness.

Conclusion

India, one of the fastest growing GDPs of the world estimates unprecedented growth over the next decade, a situation both exciting and challenging. The growth prospects for all those in the construction industry are huge, yet with the possibility of repeating many of the potentially fatal mistakes discussed above. The most important among the unfinished agenda to improve this construction process are:

(a) Competence-based licensing for engineers in general and structural engineers in particular

(b) Enforcement of building codes by the municipal authorities, and

(c) Development and propagation of building typologies that are inherently earthquake-resistant.

The emphasis, with particular urgency, should be on new construction of all kinds, from the millions of housing for the masses that the central government has identified as a priority, to the expensive apartment buildings for the affluent. Clearly, India has come a long way on the road to earthquake safety and yet, much remains to be done before this journey is completed. Creating a system and culture for building safe houses in 21st century India is something not

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only possible but an absolute necessity. This is the least that the general masses of our country expect from technically qualified engineers and management professionals and others associated with the construction industry. Provisions for such safe housing are both our challenge and obligation.