Course Name: Architectural Approaches to Decarbonization of Buildings

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Lecture 04

India's stand on Carbon Neutrality

So, we have seen in our previous classes what is GHG emissions, impact of GHG emissions, what are the policies and regulations that India is trying to foster. Now, we will come to what is India's stand on carbon neutrality? What does India as a country feel for carbon neutrality? So, now this lectures, this lecture and the forthcoming lectures It will discuss about India's current economic, social, environmental and energy characteristics, previous policies for decarbonization, the statements India has given in different climate forums, And the points that has not been included in the given statement because we as a country have to be very careful in what we declare that we would do, commit and what we cannot do. Certain things are necessary for the development of the country. So, what does India stand on it? Now, these lectures will also discuss about India's long term low carbon development strategy considering India has committed to be a carbon neutral country by the year 2070. So, it is a very very important commitment. India's long term low carbon development strategy include India's approach to long low carbon development.

So, strategic low emissions development transitions, research and innovation, adaptation and resilience, mission life, lifestyle for environment and international cooperation. So, these are the things that we will see in the forthcoming lectures. India with its cultural and diverse cultural scenario has enormous growth potential in terms of its large workforce, resource abundance and ability to attract investment. So India's growth rates were very high until the COVID-19 pandemic.

It was around 8.9% of annual growth which is more than double the global average GDP growth rate. Though India's GDP shrunk by 7.3% due to COVID-19, the economy has again bounced back to its previous growth rate by the year 2022. Due to its size and current growth trajectory, India therefore exerts strong economic influence on sustainable development path of the world in the future because a stronger economy has a lot of requirements.

One of it is also related to building and building requirement per se is not isolated or solitary. It is dependent on industry. and industry is dependent on electricity and electricity source becomes very important to be carbon neutral. So, this economic track because of this growth trajectory, India has a huge role to play in the sustainable development path. the future so indian government has been focusing on fight against poverty since the beginning of 2000s so the share of india's population living under the national poverty line it decreased steadily through the 2010s this is as per world bank report a world bank report which came out in 2021 But as per the latest estimates, India's urban households are more vulnerable to falling into poverty than they were before COVID-19.

Because one major reason for this could be because of humongous amount of migration that is happening resulting in the urban poor. So, if you see here, the purchasing parity of India has increased phenomenally. So, you can see that the purchasing power how it has because here there was a smile mild slump we all know why it is it is because of the covid where we were not able to and then we are projected to increase in this manner. If you look at the multi-dimensional poverty index of India, the percentage of people who are deprived that also has a significant impact on how we, for example, I would draw a line here. If you look at the standard of living, the standard of living in certain areas, in most of the areas is not very high.

It has come down in certain areas. It has because the share of population or the growth has increased. Let us look at India's current scenario in terms of environmental and energy characteristics. Now, that is very important. India's current scenario in terms of environmental and energy characteristics is directly related to the building industry and the construction industry.

So, India has been ranked one of the world's highest GHG emitters over the recent decades. Though its per capita emission remain below global average. So, you can see the GHG emission percentage of India. The total emission percentage of India forms this bulk. So, this forms the bulk of India's GHG emission.

So, India is one of the third largest emitter of GHG in terms of quantity. But if you look in terms of GDP, India is way below. It is very, very low. So, there is a pressure on India to reduce this further. As much as there is pressure on other countries also, but India has tremendous pressure.

And we are part of this lecture series because a lot of this emission relates to the building industry. And we as a fraternity have a role to reduce the GHG emission because of how we deal with in the building industry, the building construction industry. And if we look

at this, look at China, China is having 30.9% and US is 13.

5%. By GDP, they would be way ahead. Rest of the world in comparison to what India is doing, look at rest of the whole world is 21.7% and India is 7.3%, which is giving us a good perspective of where we stand and how we ought to reduce this. Now, due to the large economy, India has been ranked one of the world's highest GHG emitters over the recent decades, though its per capita emission is much below the global average.

In 2020, the Indian sectors which contributed the most to the emissions were power generation by Because largely we are a coal based power generation. Iron and steel manufacturing and this is where we as a building construction fraternity must come together in reassessing what we are doing. And road transport. After the COVID-19 pandemic, the share of coal and power generation reached the highest in India in 2021 and pushing its emission 13% above 2020 levels. This is as per reports by IEA in year 2022.

So coal continues to be a significant part of India's emission and I will say India's economy also. Chasing out unbated coal from power generation and industry is a key policy challenge for India to align its emission with its current ambitions and goals. commitment that it has given for what we would do in the future. So, these are all quite well known facts. So, now if we look at sector wise CO2 carbon dioxide emissions in India we can see that electricity and heat producers this is 51.

3 percent and this has got direct relationship to building industry how because we need a lot of electricity to run our not only buildings but also the products manufacture which get into the building industry is also dominated in this sector and the next to that is the industries and transport so industry constitutes about 25 percent and transport constitute 13 percent Residential is 3.9%. So, exclusive use by energy in the residential sector is 3.9% in area of interest for us. So, if you look at GHG emissions of all sectors in comparison to the building construction sector, we can see that the building and construction sector alone consumes 32 percent of contribution to GHG emission.

and all other sector put together is 68 percent. So, this is a matter of concern for us because this is in our hands how we as designers can reduce this 32 percent and that should be the focus of either our design or construction tool. Let us look at India's current scenario when it comes to GHG emission gas wise scenario. In the emissions that come out about 79 percent of emission is CO2 emission. So, 79 percent approximately 78.

59 is CO2 emission. So, the energy sector accounted for 75 percent of the total GHG emissions for the year 2016. Electricity production was the single largest source in this

category and it accounted for about 40 percent of the national total GHG emissions in 2016. The manufacturing industries and construction together emitted about 18.5% of total emission from the energy sector. Transport contributed to 13% of emissions from the energy sector with predominant share of 90% arising from road transport followed by civil aviation which is 6% and railways is 3%.

Domestic water borne navigation is about 1% or slightly less than that too. In the year 2016, the other sectors together contributed about 10% to energy sector emissions with approximately 60% share coming from the residential sector and 32% from the commercial sector and the remaining 8% from biomass burnt for energy. which is non-CO2 emissions, non-CO2 GHGs come from that and agriculture and fisheries sector put together. So, this is the glimpse of or this is the gist of the kind of emissions that have been coming out and What is sad is that 79 percent is CO2 emissions approximately when we look at it gas wise and then methane which is We have seen methane equivalent is about 21 percent, 21 to 28 that is the range we get from various literature.

That accounts for 14.43 percent. Nitrous gases form 5.12 percent and all other gases they constitute 1.86. But this is also because of the initiative by the government to phase out CFCs.

Otherwise, it would have been much more and it would have been at a drastically bad position. Let us look at the previous policies for decarbonization in India. Now, India's NDC target was set in 2015 and aims to reduce emissions intensity by 33%, which is 35% below 2005 levels, reaching 40% non-fossil capacity in power generation and creating a carbon sink of 2.5 to 3%. GT carbon dioxide equivalent through additional forest and tree cover all by 2030.

So, we have given a commitment to go for extensive creating carbon sink. How do we create carbon sink? Last class we saw that is through afforestation. These targets are on track to be accomplished early in the next few years through our current policies and current actions we are taking on these policies. And they are seen as not ambitious enough to keep on track towards limiting the global temperature increase. Now because of GHG gases there has been a increase in global temperature.

And it is estimated that the global temperature will increase by 1.5 degrees centigrade. India's plans and the world's plans are to ensure that this 1.5 gets reduced. We cannot afford a global warming but our whether our actions are good enough to know kind of support this target of 1.

5 degree centigrade above pre-industrial levels. by 2100 it is predicted that the global

temperature average temperature will increase by one and a half degree centigrade as compared to pre-industrial level this is what the climate action tracker of 2022 states so coal power plant is one of the major contributors All the power plants based on coal is a major contributor. How do we reduce this? Through green fuel, green energy and what are the green energy sources? Solar and wind. And humongous amount of work and impetus is given by the government of India towards pushing solar energy. wind, any of the green energy policies.

Let us look at the statement of India in various climate forums because it is important that we understand what India has committed in the climate forums. So, India at the 26th session of the United Nations Framework Convention on Climate Change COP26 in November 2021 announced its target to achieve net zero by 2070. It's a huge commitment, an applaudable commitment that India will go no carbon neutral and all our buildings will become net zero by 2070. So, there is humongous responsibility on all of us to be part to ensure that we keep up to our commitment. India has said to reduce the emission intensity of its GDP by 33 to 35 percent by the year 2030.

That is also a big commitment that we will reduce our CO2 emissions by say let me say 33 percent at least by 2030. India will reduce 1 billion tons of the total projected carbon emissions. It will reduce 1 billion tons of the total projected carbon emissions by the year 2030. So not only in terms of percentage but absolute values also we have given a commitment. India has also confirmed pledges to generate 50% of its electricity from non-fuel sources.

This should be done by the year 2030 and its target for maintaining forest cover which acts as a carbon sink. In a world where forest covers are getting depleted, India has pledged to increase its carbon cover because afforestation is very very important for us to have a good carbon sink. The Prime Minister has also announced at the last COP a target for 500 gigawatts of its energy capacity from non-fossil fuel sources by the year 2030. So, these are the various statements India has given in important climate forums and the world has watched us make these commitments and the world is watching us on how we are taking steps to reach this commitment. Emissions coverage at COP26, India referred to achieving the target of net zero without specifying excuse me, without specifying whether this covers all greenhouse gas emissions or CO2 emissions only.

So, India has said that we will achieve the target of net zero. But when it comes to GHG gases, India has not given a commitment on which of the GHG gases would be reduced by how much. So, India's NDC update also only refers to net zero by 2070 without specifying gas coverage. So, the target excludes international aviation and shipping. So, our targets are clearly not to include shipping and international shipping and international

aviation.

Reductions or removals outside of own borders does not explicitly provide information on its intention to use international emissions reduction credits to meet its net zero target. Separate reduction and removal targets are in place. India did not modify its forestry sector sink target in its NDC update. That target remains to create an additional carbon sink of by about 2.

5 to 3 by 2030. It is unclear how India envisages the forestry sector's contribution to achieve its 2070 net zero target. So, we are yet to see this. This is the outcome of the analysis, but then we know very well that a huge part of the commitment has to be borne by the building industry sector as well in terms of how we move towards carbon neutrality. A green new deal for a net zero India. As India grows richer, its energy as well as material consumption will also grow.

and it's a vicious cycle. In its current trajectory, this growth could imply a significant expansion of India's GHG footprint. Unlike most developed nations that have built their past five to six decades of growth on high GHG footprint infrastructure, one major reason why India refused to withdraw itself from 100% usage of coal, because developed countries have built themselves Why having high GHG footprint manufacturing? India has a unique opportunity to leapfrog this journey through low or no emission technologies. India has an opportunity. We need many more things which we have seen in the last class. What all should be there? What are the challenges? Only if they are met, India will be able to keep pace of its commitment.

So, mission 2070 a new green new deal for net zero India. So, this is a very interesting thing. How do we go low carbon energy? First thing is we have to go low carbon energy. How do we do that? By accelerated adoption of renewable and green energy across India.

Our second aspect of the mission is green mobility. So, adoption of electric, hydrogen, LPG, LNG and other alternative green technology based mobility platforms. So, as we had seen in the previous slide transport also consume humongous amount of energy and this is the way in which we can reduce it. Decarbonization of energy intensive industries. So, we need to modernize and decarbonize energy intensive industries through the adoption of green technologies and standards. So, we need to set those standards and we need to make these green technologies more popular.

We need to have more green buildings. We need to have more green infrastructure and we need to have green cities. How do we do that? By promoting green cities, energy efficient buildings and green construction technologies in future infrastructure projects.

So we need to , this is what we saw in the last class also. I mean in the second class where we have to promote green buildings. Sustainable agriculture another way - By transitioning to sustainable methods of farming.

Now who are the enablers? How will we enable this? So green technology innovation, R&D and investment in technologies that can accelerate the carbon transition. We need to have green finance which is happening. We have the International Finance Corporation which is actually trying to promote green finance, financing the green regulation. Carbon sequestration, CCUS and carbon sinks. So, catalyzing carbon capture as well as carbon offsets by having natural sinks in the form of forests and green cover.

Climate Adaptation India Cooling Plan Knowledge and capability building and indoor work transitions all of this will aid towards working for mission 2070 - a green new deal for net zero India and you can see all that I had talked of, most of it other than say sustainable agriculture, is related to buildings and cities including the transportation sector. So, we must become aware of our role as architects, designers and civil engineers and do our part. The contribution of the entire Southern Asia is only about 4% of historical cumulative net anthropogenic emissions between 1850 and 2019. Even though the region includes almost 24% of the global population. India's contribution of the entire South Asia is only 4 percent.

So, India's historical contribution to cumulative global GHG emission is therefore minuscule despite having a share of about 17 percent of the world's population. India's per capita annual emissions are about a third of the global average. So, in terms of per capita, India is extremely less. We can attribute this to the fact that it probably takes many people to ride a cycle for one person to drive a car and that is why even though in absolute terms we are high, in actually per capita terms we are extremely low in our GHG emission. You can see here the share of cumulative emission for some of the countries.

I have not taken all the countries and you can see for India, it is 4.5 percent compared to the United sStates which is 47 percent and Russia, which is 22 percent.

It's all pretty high. China is 13.4 percent. So we can be very proud that our per capita is very less. But that is not going to help the world; that is not going to deter or slow down the climate change that is happening because of GHG emission. And therefore, we cannot hold this justification for long and we need to start taking action, especially in the building sector. Energy is essential to meeting its developmental needs and aspiration.

India's annual primary energy consumption per capita in 2019 was 28.7 gigajoules- considerably lower than both developed and developing country peers. Energy is needed

for social development to support India's demographic transition and consequent job creation needs, its agrarian and urban transition, and infrastructure development. India is actively pursuing energy efficiency as one of the key means of promoting low- carbon development and that is a really good thing. One good thing India has is its rich culture and therefore we always have a history and vernacular to fall back on. So, here you can see India's energy demand demands in various sector and the growth of each of the demands.

So, knowing the demands of renewables, coal, coal is know from the year 2002, from the year 2002 say 2020, India's coal requirement has increased by probably one to about three and a half times it seems to have increased. And it is further bound to increase by 2050, which is a clear indication that our focus has to move towards renewable sources of energy. Essentially, India is- its energy is meeting its energy through coal. But it has to go to renewable and we have a big role in how we reduce this requirement of energy. By designing climate responsive buildings, one, and also by trying to incorporate renewable energy in the buildings itself.

Now, India seeks to identify and explore opportunities to shift to low carbon development pathways while ensuring adequate access to household energy, energy security and energy for the development of all sectors in the economy. Beginning in 2008 with the National Action Plan on Climate Change, NAPCC, the scope for co-benefits between climate and development is recognized by India. While also being mindful of the trade-offs and corresponding costs, India's per capita consumption of coal, its leading natural fossil fuel resource, was half the world average in 2019. And its natural gas consumption was 30 to 50 times lower than many OECD, which is Organization for Economic Cooperation and Development countries. I repeat India's per capita consumption of coal which is our leading natural fossil fuel resource.

It was half the world average in the year 2019. And its natural gas consumption was 30 to 50 times lower than many of the OECD countries. Further, global oil and gas emissions were 25% higher than coal emissions. Whereas for India, coal is its major fossil resource. So, India has also been very sensitive to the use of fossil fuel and here in this graph you can see all the statistics that I had said. So, sector wise domestic coal and lignite consumption trend- if you see power has taken most of it.

The power consumption, power sector has taken most of it and while the others -you can see relatively, others is less and compared to power all the other sectors have consumed it very less. Which means coal is its main fossil fuel resource and yet we have not been -if we look at our consumption, it is not been too extremely high.