Course Name: Architectural Approaches to Decarbonization of Buildings

Professor: Dr. Iyer Vijayalaxmi Kasinath

Department of Architecture,

School of Planning and Architecture, Vijayawada

Week: 01

Lecture 03

Policies, initiatives and future trends to reduce GHG in the Building Industry

Hello all the students. In the last class, we looked at the strategies to reduce greenhouse gas and the major strategies we focused was, of course, it was primarily related to the building sector. We looked at various strategies to reduce the embodied carbon without actually getting into the definition or knowing embodied carbon with the basic understanding that reduced embodied carbon products means reducing emission of GHG gases. We saw those strategies. Now, we need to look at the policies and regulations and initiatives by the government of India. So, what are we as a country, what is our role, what is our stand on how we would like to reduce GHG emissions? So, the National Action Plan on Climate Change NAPCC - It's a comprehensive strategy and it comprises of eight missions formulated to tackle climate change issues and foster sustainable development in India.

Notably, the National Mission on Sustainable Habitat, NMSH - it focuses on the built environment and urban areas. The mission aims to encourage sustainable and eco-friendly practices within the habitat and building sector to mitigate the impact of climate change. Now, that is one of its key roles. This mission will always want to push for sustainability.

Not only sustainable, I mean when I say sustainable and green friendly practices in the building sector, it is not related only to choice of building material. It is related to choice of building material, construction technology and the method in which that construction happens. Key objectives of NMSH encompasses the development of very high habitat standards which are sustainable and promotion of energy with emphasis on green energy. The extension of the ECBC, what is ECBC? Energy Conservation Building Code is a code which is brought out by the government of India. Now, as of now, that code is voluntary.

It is not mandatory, but the move has been made. We have various energy conservation building codes for various typologies of buildings. For example, it is called as Eco-Nivas

Samhita. ECBC code for residences is called as Eco-Nivas Samhita. Through these initiatives, the NMSH under NAPCC strives to enhance environmental sustainability and resilience in India's urban infrastructure.

Now, if you look at The various missions or various national missions on sustainable habitat, you can see that India is laying a lot of focus on national solar mission. So, there are various schemes under national solar mission and each and explaining each of this is going to take a long time. But please be aware that there is a national solar mission under which you have the scheme ranges from very small to very large scale of use of solar energy. National Mission on Sustainable Habitat, NMSH, which we are already seeing and that is what we will be focusing more on. I am just mentioning the other schemes because NMSH is directly related to sustainable housing habitat and sustainable housing standards.

We have the national mission on sustaining the Himalayan ecosystem. The Himalayan ecosystem is a very sensitive ecosystem. You all would be noticing the impact of climate change on this in the recent years, but there is a separate mission on this. There is a national mission for enhanced energy efficiency. This is somehow indirectly and in a way directly related to know the building sector.

This is not necessarily directly only for buildings, but it is also related to contraptions. You have the national water mission which is also being taken in a big way, the way in which water conservation is to happen and the way villages have to be given water. National mission on strategic knowledge for climate change. Yes, what can be controlled only that which can be measured can be controlled and therefore, national mission on strategic knowledge for climate change becomes important. You have the national mission for a green India and national mission on sustainable agriculture.

Out of this what is important to us in terms of policy, regulation and initiative of the government of India is the national mission on sustainable habitat. Now, this is regulated by the Ministry of Housing and Urban Affairs and it focuses mainly the targets which are on development of sustainable habitat standards and promoting energy efficiency as a core component of urban planning by extending the existing ECBC which is Energy Conservation Building Code. There are other important policies and initiatives of the government of India and the India's National Determined Contribution, NDC, it delineates its commitment to combat climate change. Noteworthy elements which comprise reducing the emissions intensity of GDP by 33 to 35 percent from 2005 levels by 2030. So, we need to reduce our emission intensity of GDP by at least 33 percent, minimum 33 percent by the time we reach 2030.

With respect to what we were emitting in 2005, elevating the non-fossil energy capacity to 40 percent. So, we have to increase our non-fossil- meaning where we are not using coal as a source of electricity production, which means more or less like a green energy, to 40 percent we have to increase. Establishing a carbon sink of 2.5 to 3 billion tons of carbon dioxide. Now how do you have a carbon sink? What is a carbon sink? Carbon sink is nothing but suppose, you have a room and the room is very warm.

What do you do? You have an air conditioner. What is the air conditioner doing? It is just taking away the heat inside and throwing it out. In this process, it makes the indoors cool and the outdoor becomes warm and therefore the outside acts as a heat sink. How do you ensure that we increase the heat sink? That is carbon heat sink. Now we are coming to carbon.

So how do you increase the carbon heat sink? It is through afforestation. We need to have more forests. We need to grow more plants. So it's been taken at a rapid pace. India's NDC demonstrates a well-balanced approach and it acknowledges the importance of sustainable development while actively participating in global climate mitigation endeavors.

So, the national determined contribution NDC is extremely pro-sustainable development. Now look at if we look at the goals- I have taken only the goals which are not directly related to building industry and architecture. If you look at India's national determined contribution goal 3, it aims to reduce or it desires to reduce the emission intensity of its GDP by 33 to 35 percent. So, this has to happen. Now, we also have to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy sources.

So, what all are the ways in which we can do it? One is building, another is also an important sector is transportation sector. and you can notice this it is it is visibly happening by means of incentivizing or by means of encouraging use of electric vehicles. When instead of going for petroleum based fuels like petrol and diesel we can go for electric based. Goal 8 of NDC is 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. This is a very important component which architects, designers and construction engineers must focus on.

How do you do this? How do you go for creating a framework? And that is where ECBCs are also trying to play a part by giving us a framework. And having, , cutting edge climate technology. So, at every level, low rise buildings, high rise buildings, through use of building materials, through use of technology, through use of, monitoring

these technologies, these can happen in various ways. We can go for, vernacular and renewable building materials. We can go for agro-based building materials or we can even go for smart building materials where we are integrating technology to create new and smart building materials.

So, there are various ways of doing it. And then the goal 5 is to create an additional carbon sink (this is important) of 2.5 to 3 billion tons of carbon dioxide equivalent. I told you CO2e. I said you will hear a lot of CO2 equivalent.

What is it? I will tell you later. Through additional forest and tree cover by the year 2030. So, the government of India is very keen on having these initiatives. Apart from this the challenges in greening the building industry include retrofitting existing infrastructure with older technologies and facing hurdles due to constraints. So, there are challenges because the technology that is existing is old and you need to retrofit it and upgrade it which is not a small thing.

The upfront costs of implementing these sustainable practices can be a barrier especially in a developing country with many areas which are still in many regions which are still underdeveloped. There is limited awareness and understanding among stakeholders. So, there is the builders, the first one are the clients, the clients, the builders, the designers, consumers, there has to be a lot of awareness of the importance of reducing GHGs. Because what happens is most of these technologies are also associated with cost. So, it is not about reducing cost.

It is just that when you apply certain technologies along with GHG, the cost can also either increase or decrease. Only awareness on the part of the client and all the stakeholders is going to propel the idea that we have to aim at reduced GHGs. And then there are lax regulatory frameworks in certain regions which hinder the adoption of green practices. So, if you actually see most of the rules that I cannot say rules, most of the framework are not mandatory.

So, they are only voluntary. So, and that gives a very lax attitude to many people. And additionally challenges in the supply chain such as availability and affordability of sustainable materials. When I said smart materials sometime back, smart materials can become expensive also. If you look at smart technology, they become expensive in the overall construction of the building in the initial stage. So, all these contribute to complexities of transitioning to a more environmentally friendly building practices, environmentally building practices meaning which ultimately lead to less GHG emissions.

So, these are all the reasons why there is a, why the propelling of reduction in GHG and adoption of green building practices at every level. That is not happening at a pace it should happen. So this slide shows the crux of all this. So strategies of CO2 emissions in the building sector. First is we should have good standards and policies.

We have excellent standards and policies, some of which are climate responsive and climate sensitive also. But the thing is, these are so far not mandatory. And therefore, when people have a choice and they choose the other option, then all these standards and policies- they fail to reach the aim or the goal. Then adopting low carbon technology, yes that is another important strategy which we can adopt. And how do we adopt low carbon strategy will form the basis of the forthcoming classes.

There is a restriction, there should be a restriction of energy utilization. Restricting it mandatorily may or may not be a sustainable option. Rather, it will not be a sustainable option. Though certain states had followed this policy, when there was shortage of power, certain states went in for a mandatory power cut. But that would not be sustainable because it has its own repercussions and impact.

The manufacturing industry gets affected. People become very unhappy to be sitting in uncomfortable environment because active use of energy is reduced. Active use of energy which facilitates endothermal comforts get reduced. Then next is impact assessment of building process and material. So, it is very important for us to assess the impact of the building materials that you use and the building process that you use.

Which means, inventory is very important and that is because as I said what can be measured can only be monitored. So, if you want to bring in a change in a certain thing you need to know what you have in hand and therefore, you need to have a impact assessment of what building materials you are using. What does that comprise of? What would be its impact on GHG? So, these are the basic strategies we should follow in the building sector if we want to strategize low CO2 emissions. Now, what are the future trends in reducing GHG in the building industry? Future trends in the building industry for reducing greenhouse gases- they include emergence of net zero building. which are capable of not utilizing any amount of energy from the grid.

These are net zero buildings. So, the future trend would be either net zero or we have gone one step further and that is called as regenerative buildings. What are regenerative buildings? These buildings produce surplus energy as compared to what they would consume. So, we need to adopt, adapt and adopt all these technologies. The integration of advanced low carbon building materials with improved insulation for cooler climates is another thing which we can anticipate, another thing which we can use. There has to be

an awareness of what are low carbon materials.

Sometimes low carbon materials could also mean a vernacular building material and we are not to assume that anything vernacular is out of fashion. That is the first thing. That is where we need to respect our history also. Irrespective of that, some of the low carbon materials could be very advanced materials or they can be vernacular materials. So, we need to adapt or integrate these in our buildings.

We need to use smart technologies, IoT devices, which will play a vital role in real-time monitoring, energy optimization and adaptive control systems so this is more like having the electricity meter we know that last month the consumption of electricity was x units and this month the consumption of electricity is x plus 20 percent of x units it is monitored and therefore we are able to strategize on how we can reduce the consumption of electricity so somewhere real-time monitoring of all sub areas which consume energy must be brought in. A circular economy approach in construction which emphasizes on recycling waste reduction and these things are we assume or we expect these will gain importance because circular economy, circularity is the way ahead undoubtedly. There is no way the earth can take so much of waste to be dumped unnecessarily. When we can have new technologies which can reuse these waste and therefore bring back the materials into the economy and complete the circle, we must not go into completely dumping of the materials. Governments are foreseen to strengthen policies and incentives, fostering the adoption of sustainable building practices and enhancing the economic viability.

So, in a brief this is what was there for this slide and what we will just see what all I meant. I meant that we must go for net zero buildings first, we must go for second regenerative buildings, advanced building materials must be used, advanced building materials meaning building materials which are low carbon. Next is use of smart technologies. Why smart technologies? So, that we can monitor smart technologies for monitoring and energy optimization. Circular economy approach, there is nothing like a waste that can be dumped, but it can be brought back and policies and incentives must be in place.

So, let us have a summary of this lecture. What we saw today is solar radiation is a crucial factor in warming earth surface and atmosphere and the global warming potential which is a measure of warming impact of gases relative to carbon dioxide over 100 years. GHG emissions are influenced by various factors such as energy production, industrial activities, transportation, agriculture, land use changes, waste management, industrial processes and use of fluorinated gases. We also have direct emissions which occur within a sector such as carbon dioxide released due to no fuel combustion in the energy sector

while indirect emissions they occur elsewhere due to the sector's activity like emissions that are embedded in products consumed by the buildings industry. Globally, electricity and heat production contributes to 25% of greenhouse gas emissions, with the building sector being the highest indirect contributor at 12%. Effective strategies to reduce greenhouse gas emissions involve designing bioclimatic buildings, integrating renewable energy, employing green rating systems and adopting embodied carbon reduction strategies like using low carbon materials and recycling of materials.

Don't throw away something and discard it completely until you find that there is absolutely no use in it. And I think our ancestors have been very very correct in what they were doing. Say for example with a waste piece of cloth. You know what happens to a good shirt or a good saree.

Until it becomes a mop it is never discarded. It becomes a hand-me-down to several people and then it ends up becoming a mop. So India's National Action Plan on Climate Change, NAPCC, it emphasizes sustainable development addressing building aspects through the national mission on sustainable habitat. India's National Determined Contribution, NDC, it commits to reducing GDP emissions intensity and increasing non-fossil energy capacity. However, the building industries faces a lot of challenges because we need to focus on retrofitting the existing infrastructure.

The initial costs are very high. Awareness is limited. That's the most important thing. What can be done? Only what you want can be done. When will you want? When you are aware of certain things. There is limited awareness, regulatory inconsistencies and supply change challenges. The future trends should include the development of net zero buildings, advanced materials, smart technologies, circular economy practices and the strengthening of policies and incentives.

This is the way forward or rather this is also the summary. So, I will see you in the next segment with another fresh subtopic which will create more awareness or add to our existing knowledge of what is embodied carbon and operational carbon.