Course Name: Architectural Approaches to Decarbonization of Buildings

Professor: Dr. Iyer Vijayalaxmi Kasinath

Department of Architecture,

School of Planning and Architecture, Vijayawada

Week: 02

Lecture 02

India's approach to long term low Low Carbon Development- Part 2

Hello all. In our last class we saw about several strategies which will help us become carbon neutral. All the strategies were not directly related to architecture and building construction but most were extrapolated, and most can be extrapolated so that we do our part. This time in this class, for this first segment we will see about research and innovation. We will look at the innovative technologies in energy sector. Now India considers research and innovation in new technologies to be essential to meeting the challenge of climate action including both adaptation and mitigation either globally or nationally.

There are many sectors where such innovation is especially crucial for a developing country for promoting low carbon development, where the twin challenges of growth as well as the need for progressively decoupling emissions from such growth must be met. Additional technologies such as solar photovoltaic, offshore wind, advanced ultra supercritical cold technologies, light emitting diode bulb, room air conditioners, iron and steel manufacturing, biofuels, lithium ion batteries and flow battery has to be installed. Innovative technologies in energy sector such as smart grid development, developing bio-based clean energy, innovations and carbon dioxide removal technologies, energy storage systems, hydrogen economy, nuclear energy development of biomass to liquids, from thermochemical processes, commercialization and initiatives of cellulosic ethanol, integrated gasification combined cycle technology, waste heat recovery systems for utilizing the flue gas, low carbon development of the industrial sector has to be given importance. Each of this sector is a specialization by itself, some of which is directly related to architecture and the building construction industry and some of which is indirectly related.

Nevertheless, any technological advancement and research in any of this domain is going to help us aid carbon neutrality. So, in the energy sector, the innovative technologies could be any of these which could be say smart grid developments or trying to go for bio-based clean energy. There have been attempts to get energy from agro products. Energy

storage systems- (because batteries are becoming very heavy in its embodied energy,) nuclear energy and biomass to liquid fuel production. This is another important sector which can have a direct impact on the energy consumption in buildings.

So, the scope of research is extremely vast. This is specifically why I talk about it is, it is a good atmosphere, it is a good ecosystem today in the country to take up research and innovation which is encouraged very well -what with the humongous number of start-ups that are coming into the country. Next one is Adaptation and Resilience. Development and growth are the first considerations in adaptation and resilience for developing countries. Adapting to climate change will require an understanding of risks and vulnerabilities.

Economies and infrastructural development strengthened individual resilience through enhancing livelihoods and incomes, new governance capacities and improved coordination, raising resources for adaptation including in the form of adaptation finance, addressing loss and damage and ensuring equitable and inclusive strategies. The adaptation finance required is significantly higher than current adaptation finance flows. So development and growth, these are the first consideration in adaptation and resilience for a country like India. We need to understand the risk and vulnerabilities when we adapt to climate change. We need economic and infrastructural development.

All that is built over decades cannot get washed out and in order to again bounce back, we need to be resilient as well as economically strong. Strengthened individual resilience here becomes very important. It can be done through enhanced livelihoods and income. New governance capacities and improved coordination. So the model that we follow of governance cannot remain the same in the face of climate change which has already become a reality.

Raising resources for adaptation including in the form of adaptation finance. And we need to have a good method to assess and address the loss and damage. This should ensure equitable and inclusive strategies. So, the adaptation process must comprise of assessing the impacts, assessing the impacts to know the economic damage that is done. The vulnerability and risks we have towards the impact.

What plan of action do we have in our adaptation? How do we implement the adaptation measures on ground? How do we monitor and evaluate the adaptation? And when again an issue comes, how do we assess its impact? We can assess impacts, vulnerability and risks by raising awareness and ambition. Plan for adaptation has to be a political engagement. Implementing again can be, it has to be through political and governance based system but by sharing information, knowledge, guiding, hand holding. We also

need to strengthen technical and institutional capacities We can monitor and evaluate adaption by facilitating the provision of financial and technological support and again when we are faced with the situation we need to engage a wide range of stakeholders. Only then we will be able to boil down to the actual issue which needs to be addressed to ensure that the resilience of the people is supported.

Now, to put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement of life, lifestyle for environment as a key to combating climate change. life is envisaged as a global movement to effect a paradigm shift from the mindless and destructive consumption to the mindful and deliberate utilization of natural resources there have been very small baby steps taken which have now snowballed into larger initiatives For example, we had the use of carry bag. The use of carry bag has been discouraged of late. People have shifted either to clothes bag or for want of need, we have eco-friendly carry bags. There is also a group of people who are working towards recycling of these carry bags.

So, we have to make this is what is a lifestyle change. So, we need to make many more lifestyle changes. There are many. For example, the agarbattis and dhoops that are made from flowers of the temple. The flowers from the temple are all dumped into waste and it's a big challenge for civic workers to clear the waste.

So these are recycled. Then old clothes. There are many designers and there are many companies which recycle old clothes and make them into new ones. One large one is also in Florence. So, initiatives have been taken by governments and all these initiatives that I say are taken by NGOs and the aware public and it is supported by the government.

So, life is a global movement to affect the paradigm shift from the way we are mindlessly getting into the use and throw culture leading to excessive consumption and excessive utilization of natural resources. Life focuses on energy consumption, water consumption, reduced consumption of single-use plastic, adopting sustainable food systems, reduction of waste, Swachhata actions, adoption of healthy lifestyles, reductions in e-waste. The next initiative towards carbon neutrality of India. In 2016, India's total GHG emissions excluding land use, land use change and forestry were 2838 million tons carbon dioxide equivalent and 2531 million ton carbon dioxide equivalent with the inclusion of LULUCF. Carbon dioxide emissions accounted for 2231 million tons and methane emissions for 409 million tons carbon equivalent and nitrous oxide emissions for 145 million ton carbon dioxide equivalent.

So, the amount of carbon dioxide emission was 78%, methane was 14.43% and nitrous

oxide was 5.12%. So, India has progressively continued decoupling of economic growth from greenhouse gas emissions. It is not that more the greenhouse gas emission, more is an economic activity or more is progress.

It is not so. India's emission intensity of gross GDP has reduced by 24% between 2005 and 2016, which is a humongously laudable effort. A country which is developing and developing at a very fast pace, if it is able to optimize its development along with its emission intensity, that is indeed laudable. India is therefore on track to meet its voluntary declaration to reduce the emission intensity of GDP by 20 to 25 percent by 2020 which is already over compared to 2005. Now India is implementing one of the largest renewable energy expansion programs with a target of achieving 175 gigawatts of renewable energy capacity by the year 2022 and later up to 450 gigawatts. Installed capacity of solar energy in India has increased by more than 14 times from 2.

63 gigawatts in March 2014 to 36.91 gigawatts in November 2020. As on 30th November 2020 installed capacity of wind energy was 38.43 gigawatts. The cumulative renewable power installed capacity excluding hydro above 25 MW has increased by 2.

6 times from 35 GW in March 2014 to 90.39 GW in November 2020 and constitutes over 24% of the country's installed power capacity. With the inclusion of large hydro, the total installed capacity would be 136 gigawatts and the share of renewable energy in installed capacity would be over 36%. India's forest and tree cover has increased by 1.3 million hectares between 2015 and 2019 assessment by the Forest Survey of India.

This is an increase of 1.65% of forest and tree cover area. In the India State of Forest Report 2019, the total carbon stock in forest was estimated as to increase by 42.6 million tonne as compared to the last assessment in 2017. Forest and tree covers sequestered 331 metric carbon dioxide in 2016, which is around 15% of total carbon dioxide emissions occurring in the country. India's LULUCF sink which is carbon dioxide removal is on the rise by 3.

4% between 2014 and 2016 and by approximately 40% between 2000 and 2016. Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change. All that you have been hearing so long about carbon sequestration, this is what it means. You need to capture and store the atmospheric carbon dioxide.

How do you do that? Only way to do that is to have more trees. Now, looking at further initiatives of the government, as of November 2020, more than 366.85 million LED bulbs

7207 A million LED tube lights and 2340 million energy efficient fans were distributed by EESL across India under the Ujjala scheme, which has led to cumulative emission reduction of 180 metric carbon dioxide from 2014-15 to November 2020. Taken together, India's mitigation actions speak of the enormous effect that the country is undertaking through its own resources without any significant support from developed countries in terms of climate finance, technology transfer or capacity building. India's climate actions are even more significant in the background of this huge development needs and expenditure.

As a developing country, the priorities of the country are very different. India has to deal with having to eliminate poverty. India has reduced poverty but India has to eliminate poverty. Look at youth employment. It's a very young country and yet in all this silently India has been able to do its part in climate change mitigation through the Ujjala scheme and many more schemes.

So, in conclusion, To facilitate a more rapid and just transition in India, a combination of policies needs to be done, taken up. Not just regulation or carbon pricing alone. Coal regulation in power generation is very effective at targeting large emissions reductions in the medium term, though it can be expensive because of the high costs of compensation for stranded assets. While India could decarbonize using carbon revenues or other domestic tax-raising mechanisms to fund green investments, leveraging international support would free up domestic finance for development, poverty reduction and management of social impacts, helping mitigate the negative impacts on households from higher prices and taxes. Policies to support reskilling and upskilling of the workforce across all economies would also allow workers to take full advantage of new employment opportunities that arise in a low carbon economy.

So, we need to have a combination of policies along with regulation for or carbon pricing. Coal regulation in power generation is very effective at targeting large emission reduction in the medium term, though it can be expensive because of the high cost of compensation for stranded assets. While India can decarbonize using carbon revenues or other domestic tax raising mechanisms to fund green investments, leveraging international support would free up domestic finance for development, poverty reduction and management of social impacts, helping mitigate the negative impacts on household from higher prices and taxes. We need policies to support reskilling, upskilling, providing new skills to the young workforce across our countries and across all economies so that we take full advantage of new opportunities that will arise because of a low carbon economy. So, in this lecture we have seen all the strategies and initiatives taken by the country, taken in India to try to strive for a low carbon economy.

Some of these strategies are directly related to architecture, building construction, industry and some are indirectly related. Nevertheless, the young architects, designers, civil engineers of our country need to be aware of the forthcoming challenges and skills they need to develop to survive in a low carbon economy because that day is not very far. We will meet again for the next class with another new series of learning. Thank you.