Air Pollution and Control
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Lecture 53
Sector Wise Mitigation Measures to Control Air Pollution

Hello, friends. So, you may recall so far we have discussed so many issues about air pollution and its control like policies then specific control to sources. Today we will discuss the sector wise mitigation measures to control air pollution means, broadly speaking, what are the mitigation measures which can be implemented to a specific sector.

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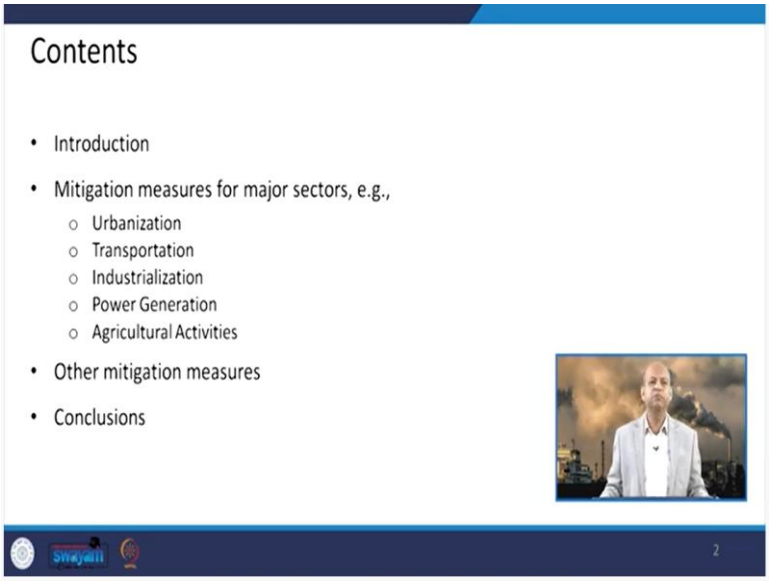

For example, urbanization sector or transportation sector those kinds of things we will today discuss. So, the mitigation measures for major sectors which have been included in this particular lecture are like urban centers or in urbanization what kind of things we should take care so, that emissions are less and air quality is better, than transportation sector related emissions, how to control or how to deal with it, then industrialization, power generation, agricultural activities, then some other mitigation measures and then we will conclude.

So, basically, like in power generation, we have seen the ESPs etc. or baghouse filters, but today we will see the complete sectors related policies and mitigation measures basically, policies, programs and mitigation measures. So, what are those mitigation measures or the strategies which can be implemented in an overall sector?

So, that is today's focus means, you should not get confusion, like we have discussed several other control mechanisms already, but today we will see the sector specific broadly mitigation

measures. So, that way you will have a holistic viewpoint about these sectors and their mitigation measures.

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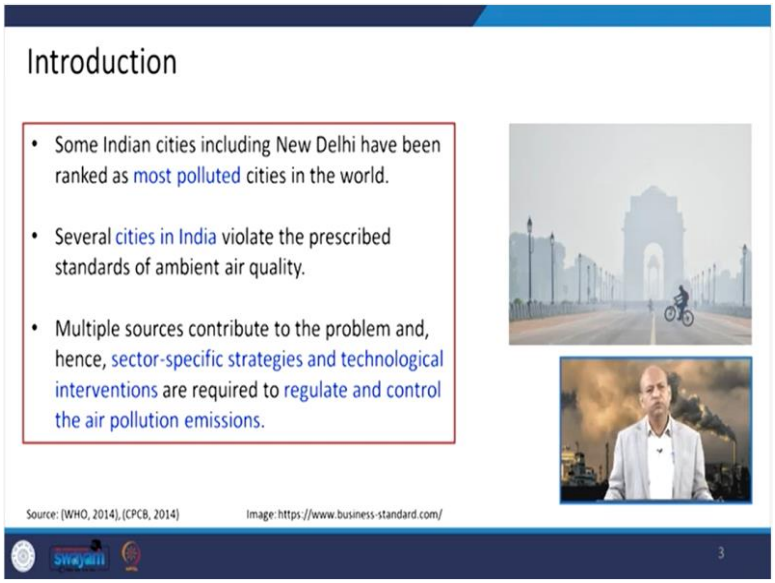

So, when we talk about like Indian cities, in recent reports and even for several years, we have been seeing that some of the Indian cities are figured out as most polluted cities in the world and several Indian cities violate those standards of ambient air quality which are prescribed by CPCB or MoEF and the multiple sources contribute to the problem of air pollution.

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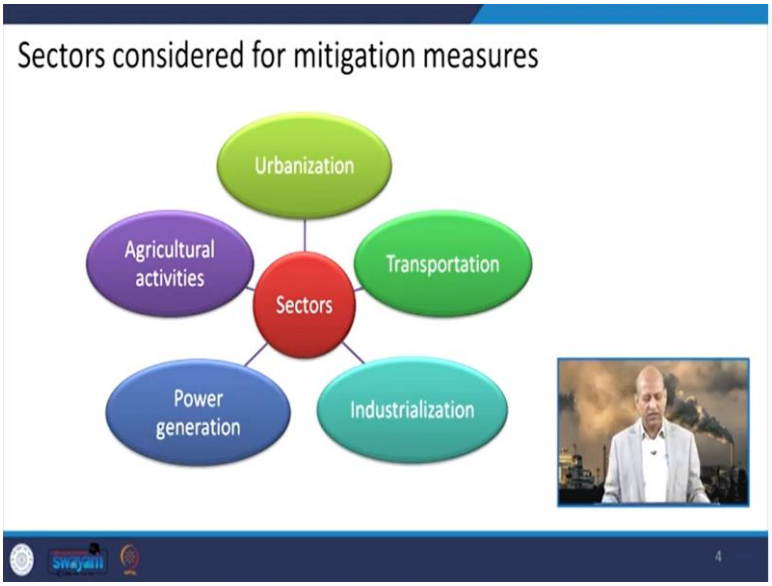

Therefore, the sector specific strategies and technological interventions are required to regulate and control the air pollution emissions in overall sense basically. So, the sector's which have

been considered in today's lecture for mitigation measures, are like urbanization, transportation, industrialization, power generation and agricultural activities.

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So, let us start with urbanization. So, when we talk about city planning and management focusing on city planning. So, when we adopt a balanced sub regional approach for regional and metropolitan development with integrated mass transit, you might have heard TOD, this term is Transit Oriented Development. So, when we have these kind of integrated mass transit systems, then it has been observed there these are the systems which are helpful in reducing the trip lengths as well as motorized travel and urban sprawl is reduced basically. So, that emissions are also reduced ultimately.

Well, land use planning with plans of reduced population density around industrial areas or industrial zones or in downwind direction of those industrial zones can help in reducing exposure to the pollution released by industries. So, we have to be careful that the population should not be in and around the industrial zones or in the downwind direction, because the pollution emissions will travel to the downwind directions.

So, when we talk about like supply of cleaner fuels, in the stoves, which are used in rural areas and urban slums, I am sure you might be knowing that in the rural areas, a lot of dung and woods etc are used for cooking purposes and they emit lot of smoke, lot of air pollution.

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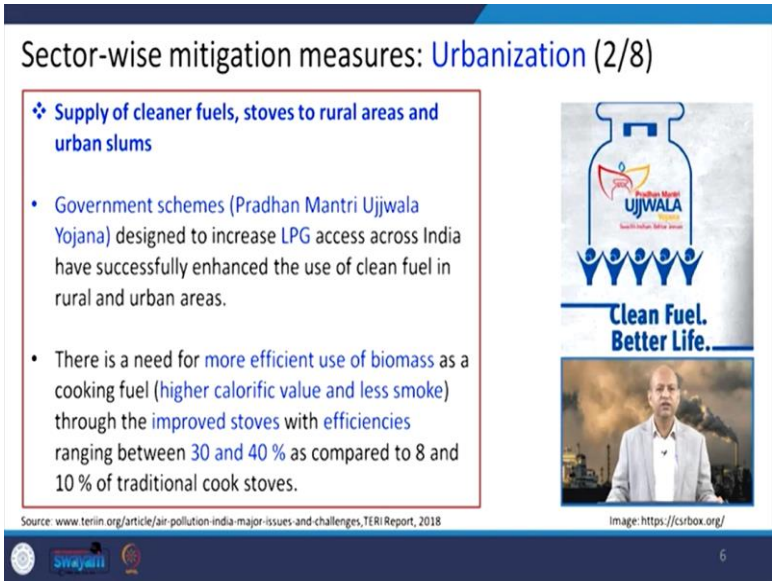

So, the government schemes like Pradhan Mantri Ujjwala Yojana these schemes have been designed to increase the LPG access across India to the poor people also and this has successfully enhanced the use of clean fuel in rural as well as urban areas in urban slums especially those are the poor segment of the population. So, it has resulted in very less of air pollution emissions, that way the indoor air quality has been improved.

Also, the energy has this, the total energy utilization has increased and when we go for usage of biomass, or biofuels or biomass as a fuel, then we have to see what kind of cooking stoves we are using. Basically, the traditional way of cooking they are using only to 8 to 10 percent of that, this energy which is available in the biomass. So, to enhance that efficiency, we have to have better efficient stoves and Nirdhum Chulha those kinds of terminology you might have heard, so, that we can have less smoke or less pollution in the household activities.

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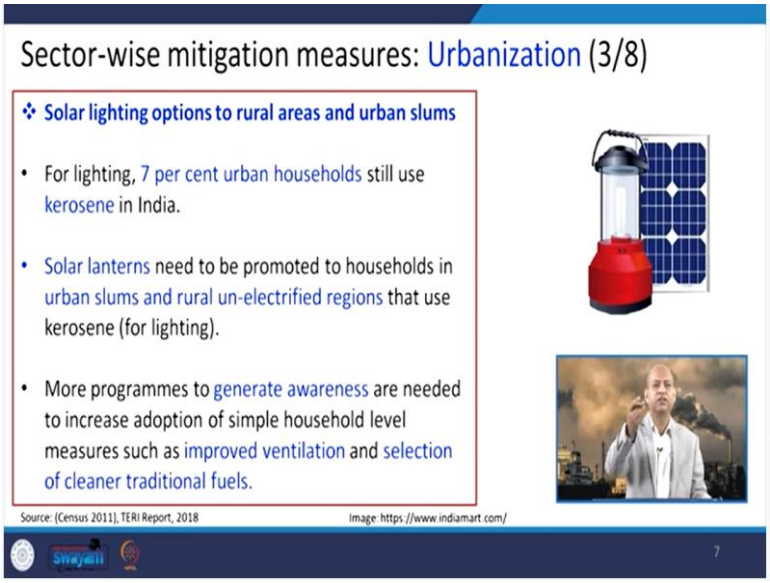

Well, when we talk about solar lighting options to rural areas and urban slums, then for lighting purposes around still 7 percent of the urban households using kerosene in India for lighting purposes. I recall that in my childhood in whole village, we did not have the electricity. So, these kerosene lamps used to be used for lighting purposes, but slowly this development phenomena has gone to the rural areas also. So, a lot of change has been there.

Now, solar lanterns or they are needed for promoting the households in urban slums, in urban and unelectrified regions. So, these solar lanterns are becoming very popular, because you can charge during the daytime and in the nighttime you can use and these kind of solar lanterns are there.

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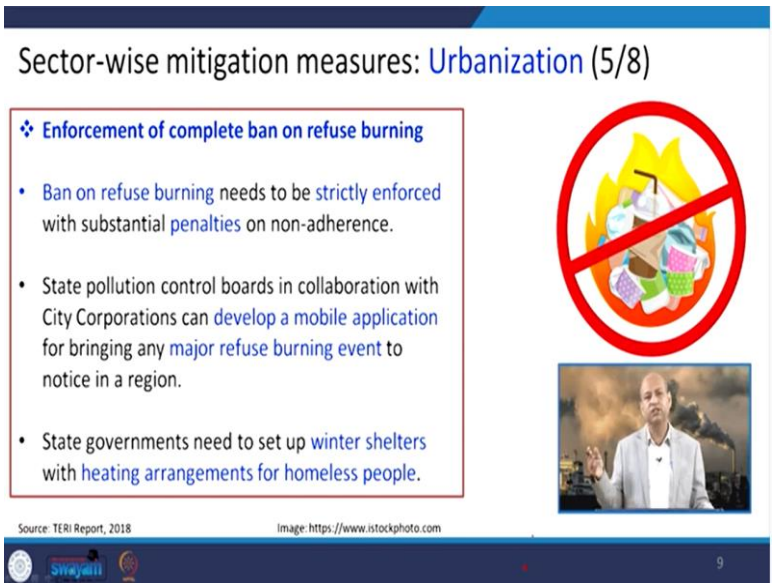

So, the next is like in urbanization, in urban areas, if we can enforce strictly the complete ban on refuse burning, then also we can improve air quality because this is a very bad habit, many people just collect the refuse or the waste material and they just burn it rather than disposing at the proper place. So, the burning the refuse, this refuse burning needs to be strictly enforced with the substantial like penalties or non-adherence. So, the implementation is very important.

Then, for that purpose like State Pollution Control Boards, in collaboration with city corporations can develop some mobile apps nowadays, this digital age, mobile apps are quite popular, and so that people can bring in these major refuse burning events to notice for particular people in a particular region. And that community can be sensitized about these kinds of activities.

And these state governments, they need to set up winter shelters with the heating arrangements for homeless people otherwise, the people who are roaming around or they do not have proper homes, they have to warm up themselves by burning these waste materials here and there and a lot of air quality deterioration occurs because of that. So, it is our responsibility that we should as this urban local bodies or government, they should provide them some shelters.

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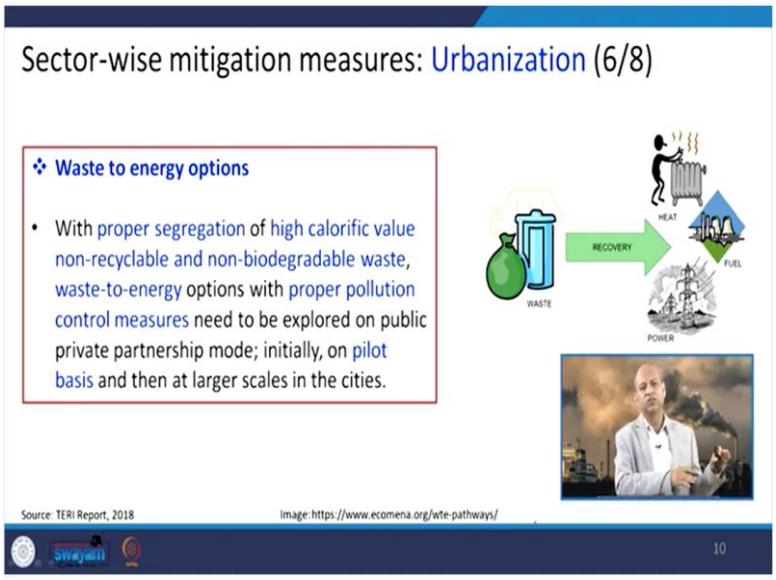

Then we talk about like waste to energy options. So, you might have heard like waste to wealth or waste to energy. So, the proper segregation of high calorific value materials and non-recyclable and non-biodegradable waste can be burnt basically, which have high calorific value, but that is the condition. So, waste to energy option can be utilized in that sense.

And it needs to be explored on public private partnership mode, initially on pilot basis and then it can be applied at the larger scale at the city levels. So, that means, the segregation is very important and like I recall, in Germany when I was doing postdoc, there is lot of segregation of the waste like these papers, newspapers will go in a different bin and this kitchen waste will go differently and bottles or toxic waste will go differently, though all those kinds of things are there, plastic will go in different bin so, that segregation at the source itself happens.

So, that way we can take the things like recyclable things can go to recycle flowchart or those are like for composting purpose, biodegradable things can go to those places where this anaerobic digestion occurs and like papers or some waste material, which has high calorific value, but they are not recyclable in a proper way, then they can be burned and you can have this steam, you can generate the steam and through steam you can generate the electricity, there are such plants in developed countries and they are using their cities waste for generating lots of energy.

Like in Sweden there is a Linköping city, the whole city this public transport system is running through this biogas they are generating from slaughterhouse, related waste and other biodegradable waste. And those waste which has high calorific value, which is not biodegradable then they take it and they burn and then they generate steam. So, steam is used for running turbines, electricity is produced and then the hot water is circulated in entire city for warming up their houses because in Sweden a lot of cold seasons are very long and that way they use this hidden energy.

And our country which are energy deficit and we have so much waste, but because we do not have proper segregation and that is the reason we are not segregating the calorific value related waste from biodegradable waste and other recyclable waste and all things are mixed and then it becomes very difficult to recycle them or to go for converge into energy.

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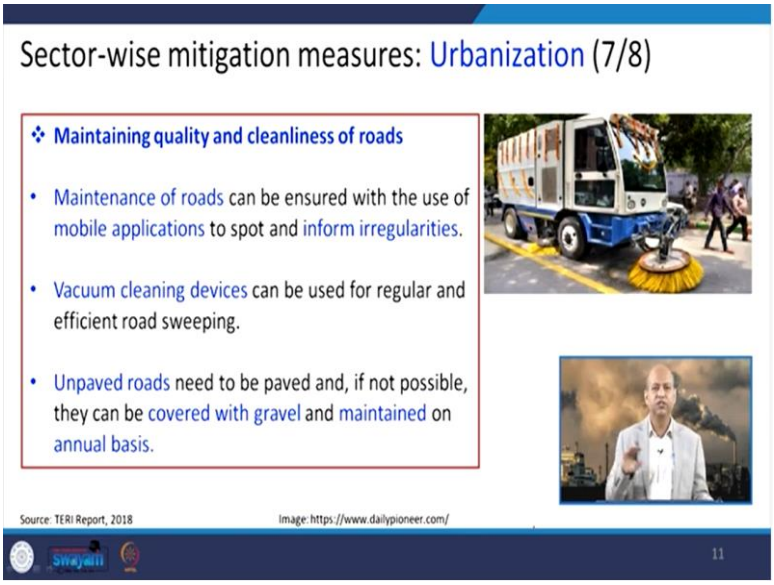

Well, then we come to this maintaining quality and cleanliness of roads. So, we can have better mechanism like this, nowadays vacuum cleaning devices are there which can be used and several cities are using these kinds of devices nowadays, unpaved roads need to be paved because otherwise resuspension of dust occurs, and then we can cover them with gravel or maintain, we can maintain them on annual basis so, that this dust pollution is significantly reduced.

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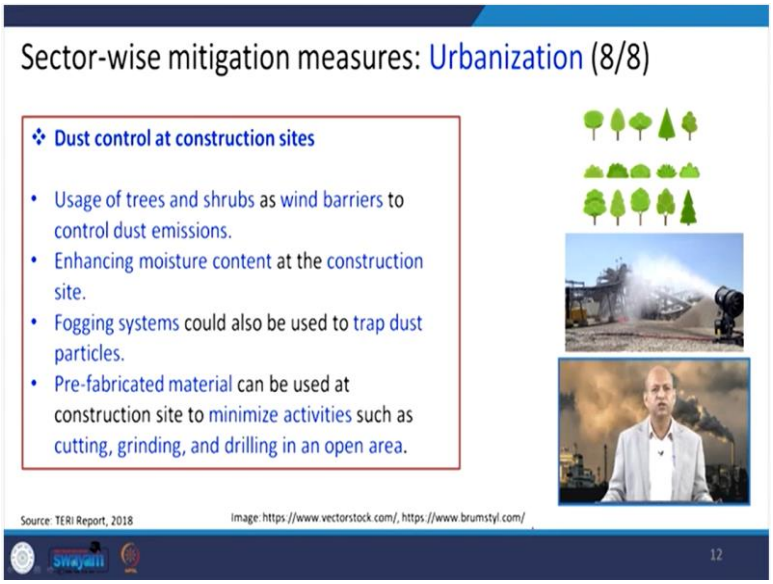

Then another way of controlling the dust from these construction sites could be like using trees or shrubs or wind barriers to control the dust emissions here and there and fogging system is also sometimes used for trapping the dust particles. Then there is also one possibility that if we

use prefabricated material rather than constructing in-situ then also we can avoid lot of dust emissions basically.

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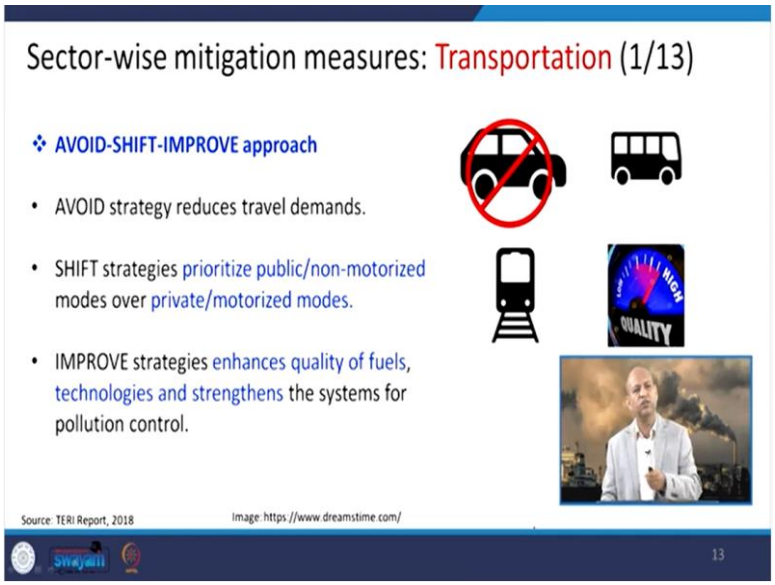

Then, there is another way of for transportation if we talk like we have discussed all those measures, mitigation measures, which are city focused or urban areas focused, if we focus on the transportation sector, then the first thing comes like AVOID, SHIFT and IMPROVE. So, this very thumb rule of AVOID, SHIFT, IMPROVE is like we should not unnecessarily travel, whatever things we can do through telephone or other ways of communication rather than going somewhere that should be done like that only.

So, we can reduce the travel demands basically, then we can also shift from private or motorized modes to public transportation or non-motorized modes of transportation so, that we also gain per capita emissions reduce very much. Then we can improve the strategies to enhance the quality of fuels or technologies and like we will discuss like BS-IV, BS-VI those kinds of quality of fuels and technologies like two stroke to four stroke engine those kinds of things, we can always go for innovation and improvement in the technology.

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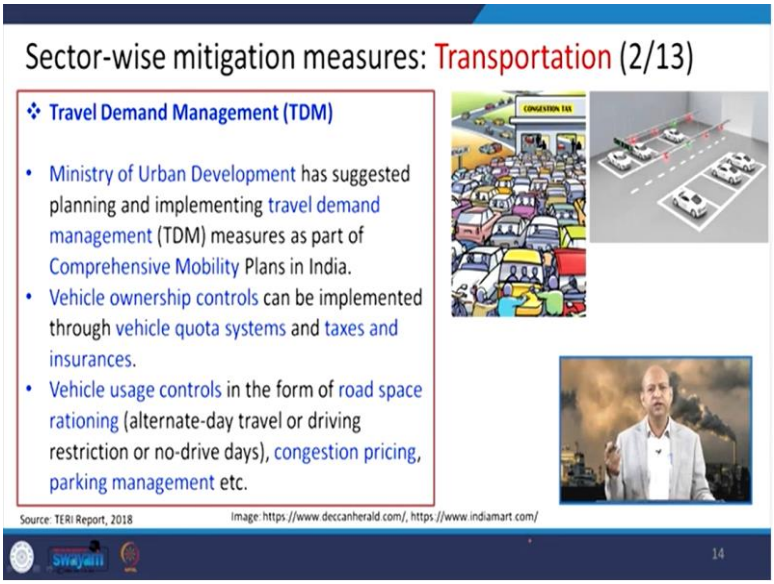

When we talk about Travel Demand Management, TDM then basically this ministry of urban development has suggested planning and implementing travel demand management system. These measures as part of the comprehensive mobility plans in India. And the vehicle ownership, control can be implemented through vehicle quota system and taxes and insurances.

Like if you are having vehicle and if you want to buy more vehicle, more number of vehicles, then there should be some sort of policy so that ownership of vehicle does not go just without any control. So, there are other ways also like vehicle use control can also be in the form of road space rationing, you can have congestion pricing or parking management or high price for parking at the those critical zones, where there are chances that more traffic may rush to that particular location. So, that way a smooth movement of traffic can be management.

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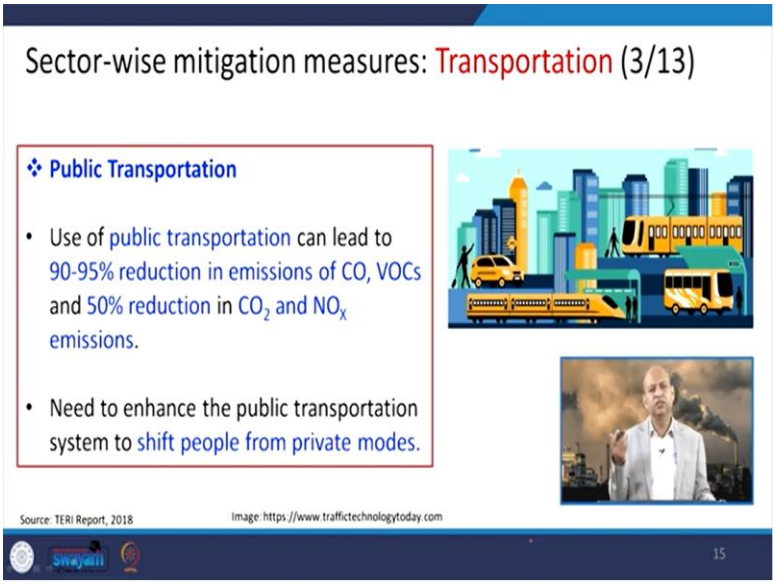

Then the public transportation, the use of public transportation can lead to 90 to 95 percent reduction of emissions of carbon monoxide and VOCs it has been studied and 50 percent reduction in CO_2 and NOx emissions. So, that way great benefits are there, if we can shift to the public transportation system, but people can have incentive to shift towards public transportation system, when it is reliable in time we can have it and then comfort level is also there or wherever we want to go there some connectivity is there. If there is no connectivity, then people will not feel encouraged to use the public transportation system.

Well, we also need to enhance the public transportation system to shift people from their private modes, but that is just when only when this public transportation system will provide the comfort, high comfort level journey and reliability and punctuality all those kinds of things are there.

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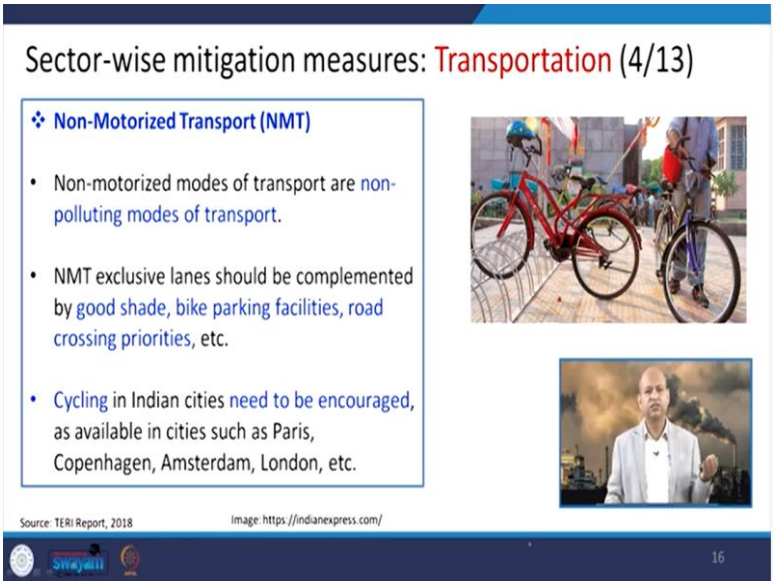

Well, the non-motorized transport system promotion can also be there basically, because it is not emitting any kind of emissions. So, for shorter distances also, when, if we have good infrastructure dedicated lanes for cyclists or pedestrians then people feel motivated otherwise it is difficult to walk on the road where all kinds of traffic is there.

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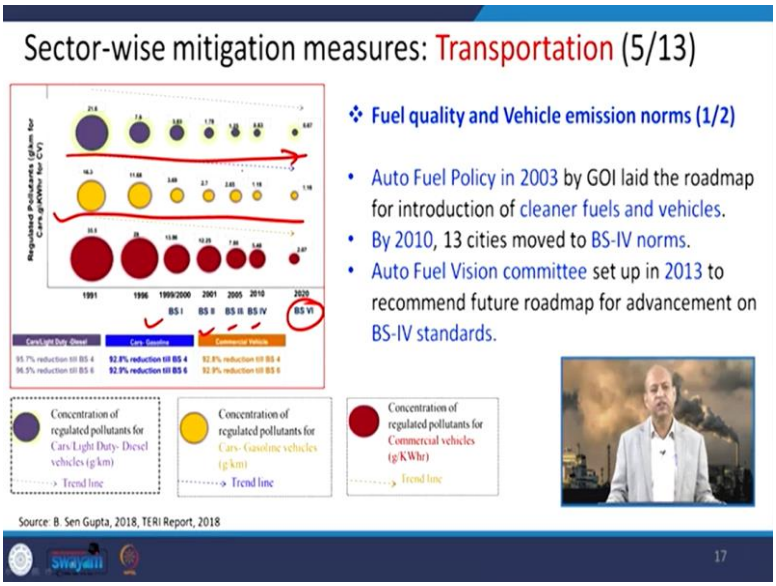

Then if we talk about like fuel quality and vehicle emission norms, then over the years this like BS-I, BS-II, BS-III, BS-IV and now BS-VI we have jumped from BS-IV to BS-VI. So, that way these concentration of regulated pollutants from commercial vehicles it has decreased so significantly and from regulated pollutants, from cars and gasoline vehicles, it has also reduced and cars light duty diesel vehicles, it has also reduced.

So, over the years basically emission norms have been better in terms of BS-I to BS-IV and now BS-VI. So, that way, emissions are decreasing, but the number of vehicles are increasing that is the problem. So, the total emission grow day by day when population also grow in the city centers.

And if you look into perspective of the policy related timeline, then the auto policy in 2003 by Government of India laid the roadmap for introduction of cleaner fuels, and by 2010, 13 cities moved to BS-IV norms, that was within 7 years it was achieved. An auto fuel vision committee set up 2030 to recommend future roadmap for advancement on BS-IV standards.

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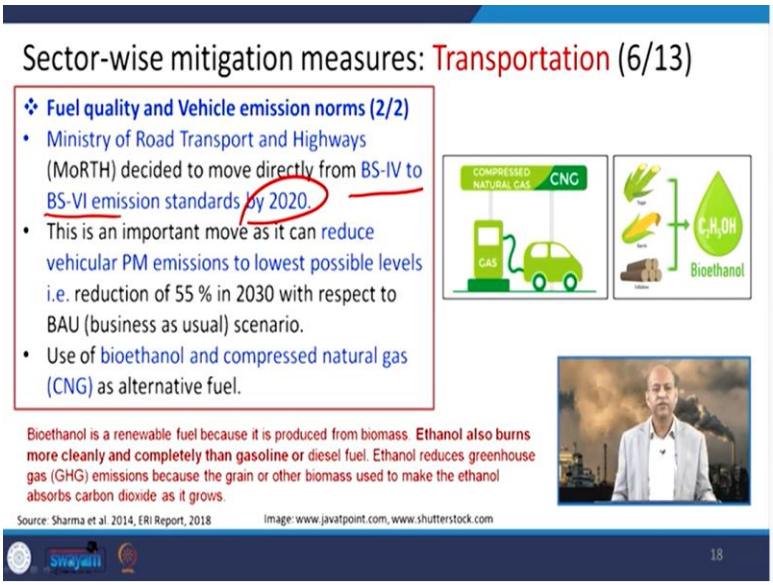

And now, like this Ministry of Road Transport and Highways has decided to move directly from BS-IV to BS-VI and it is already implemented in 2020. So, this is a great leapfrog or achievement in that sense. And we can say that because of this lot of reduction of emissions will occur.

Basically, this is an important move because it is estimated that it will be able to reduce vehicle this particulate emissions from vehicle segment to the lowest possible levels like 55 percent in 2030 with respect to this business-as-usual scenario. And if technology grows, then more emissions will be reduced.

The use of bio-ethanol and this compressed natural gas promotion is also in the plate of our government policies as alternate fuels and this bioethanol is a renewable fuel because it is produced from the biomass and ethanol also burns more cleanly and completely then gasoline or diesel that means, complete combustion process occurs in this bio-ethanol more quickly

basically. And this is also possible to reduce greenhouse gas emissions, if you blend it with the conventional fuels.

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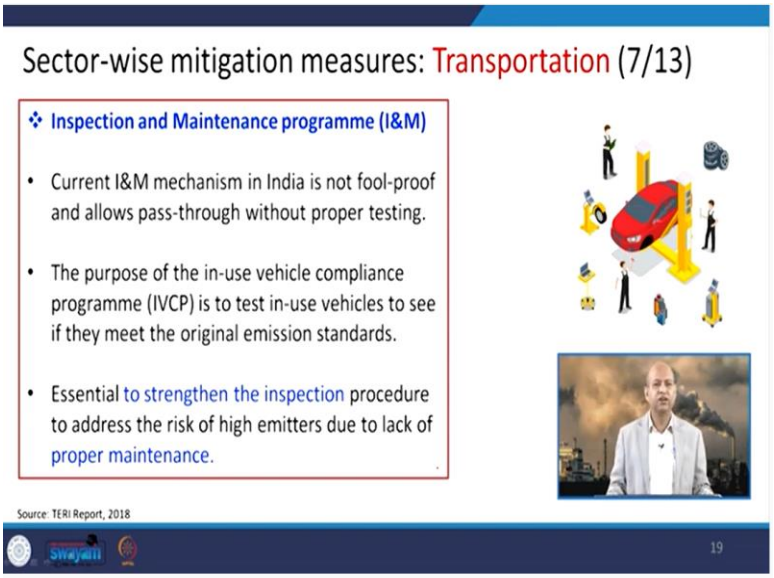

Well, then, we talk about inspection and maintenance programs, which is, if we do not maintain our vehicle, then they emit lot of emissions. If we keep on doing regular maintenance, and that way we can keep the vehicle fit and it emits less.

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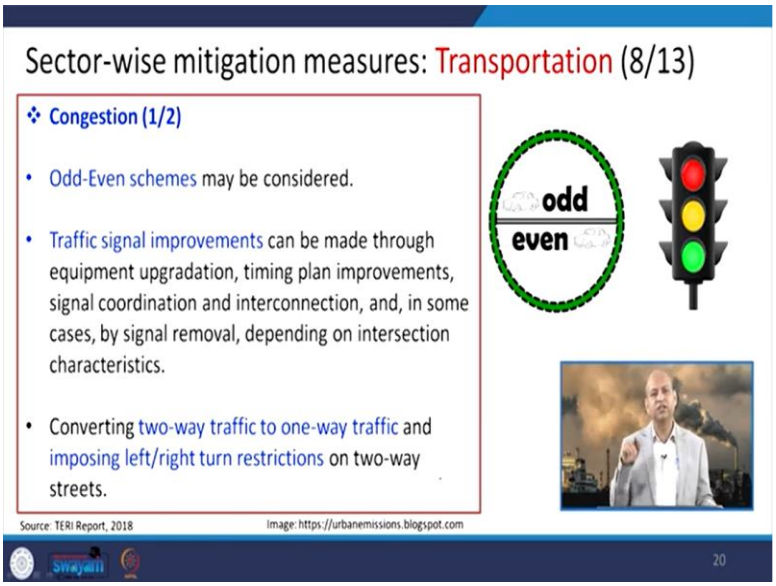

Then there are other ways like we can go for odd-even scheme so, that traffic is less in number on the roads, but it also has some other issues linked with it, because sometimes people need and then they use their old vehicle with the other number plate which is even or odd as per the

need and rather than reducing the emission it can increase. So, it can backfire also, so, we have to implement these kinds of schemes very smartly or with the proper care.

Well, then there are other ways like converting two-way traffic to one way traffic and imposing left right related turn restrictions on two-way streets so that this traffic movement is very smooth and when traffic movement is smooth and at higher speed then emissions are lower, when we apply a lot of brakes and the speed is slow, then lot of emissions occur and that deteriorate the air quality.

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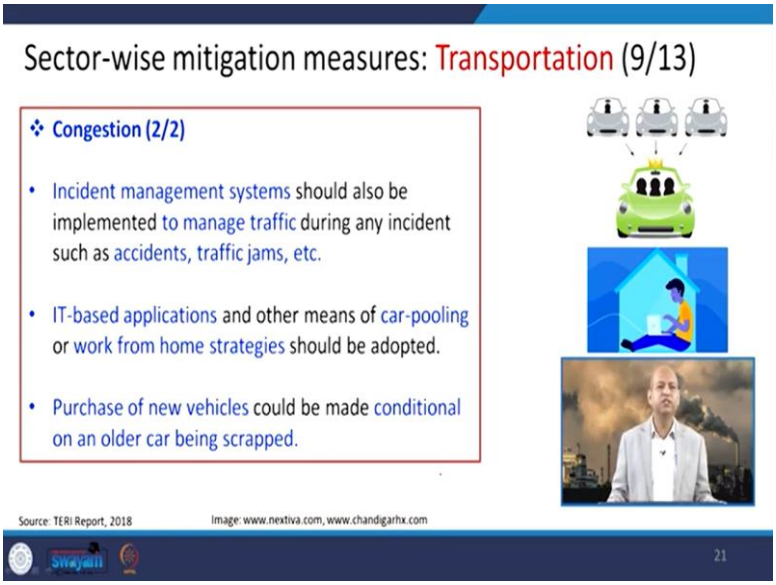

Then congestion, similarly, if congestion occurs then basically in idle conditions, lot of fumes come out of the engine, basically carbon monoxide and other. And so, it can be, it can also result in traffic jams or accidents etc. So, to avoid that, we can use this IT-based applications or other means for like carpooling or work for, work from the home those kinds of things can be there to reduce the traffic and to reduce the chances of congestion. Then purchase of new vehicles could be made conditional on an older car being scrapped. So, nowadays, even this scrapping policies also is in force.

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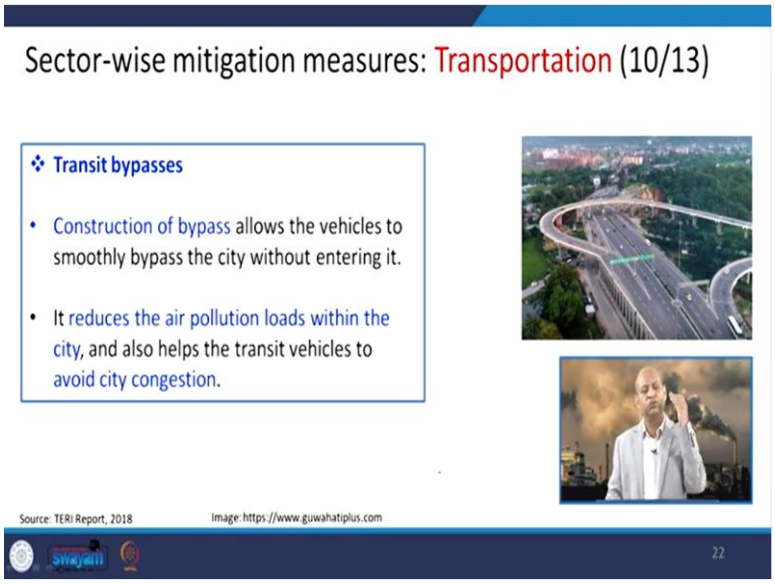

If we talk about like transit bypasses so that vehicles do not enter these trucks or those are people who are going on long distances so, they do not need to enter in every kind of city, if there are bypasses for those particular cities. So, they go with the same speed, they bypass the city, they do not enter into the city and if a lot of vehicles enter into the city then of course, they will emit lot of emissions. So, that way those emissions can be avoided in the city.

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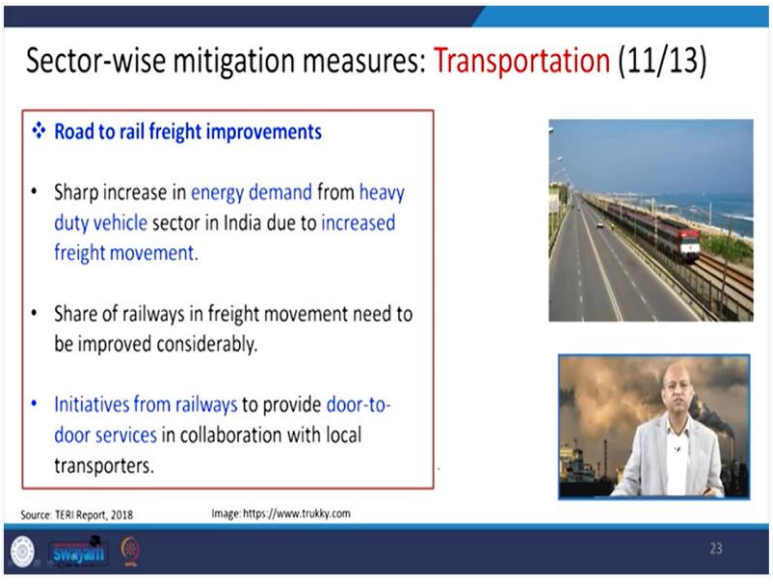

Then this road to rail freight improvement is also needed, because over the years it has been observed that a lot of freight has gone to on through the trucks basically. So, we need to shift this load to the railways, that way we can reduce lots of emissions, otherwise, these trucks are responsible for huge emissions of greenhouse gases as well as air pollutants.

And even this inland waterways also has a lot of scope to increase the freight transportation through inland waterways, that is also very environment friendly and very cost effective way in fact, and government of India is investing a lot of money to develop infrastructure related to inland waterways.

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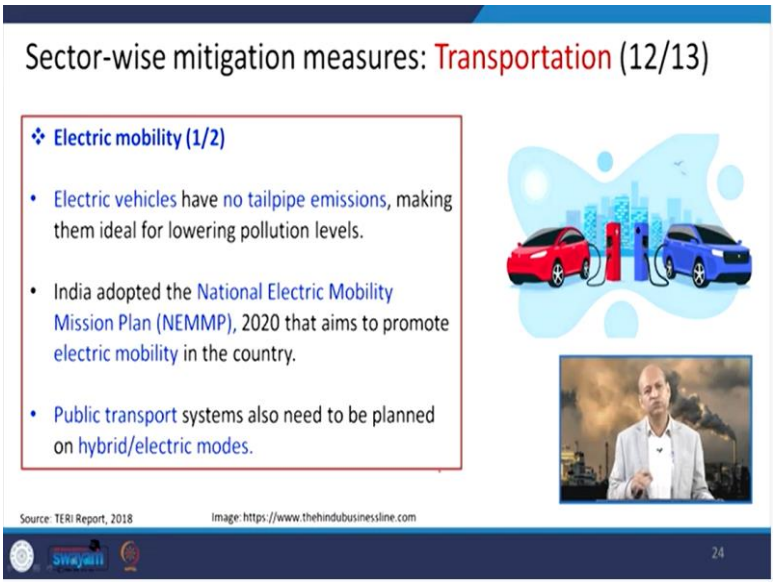

Well, then this electric mobility related policies also has been in our government has implemented or adopted this National Electric Mobility Mission Plan (NEMMP) in 2020, and the aim is to promote electric mobility, battery-based mobility. So, the public transport system also need to be planned on hybrid or electric modes so, that these vehicular emissions can be get rid of from the cities basically.

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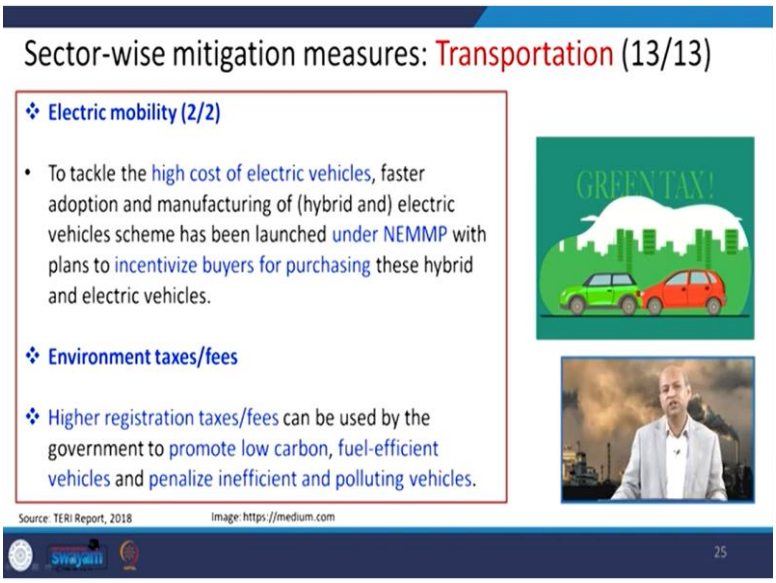

Then, but it needs a lot of incentives, some subsidies, so that the production and marketing and selling of these electric vehicles becomes good and mass production, when it will happen then the prices will also go low, right now prices are high. But as you know in case of like bulbs, we have seen these LED etc, it was expensive, initially, even mobiles were expensive initially, but when the utilization became very large and the mass production happens, then prices got reduced, it is very simple economics of the demand and supply.

Well, then environment related taxes and fees can also be implemented, higher registration taxes can be used for promoting on those vehicles, which are more polluting in comparison to these electric vehicles. So, the differential taxation can also be there. And some policymakers argue that maybe we can make free these electric vehicles, free from the taxes basically for certain years.

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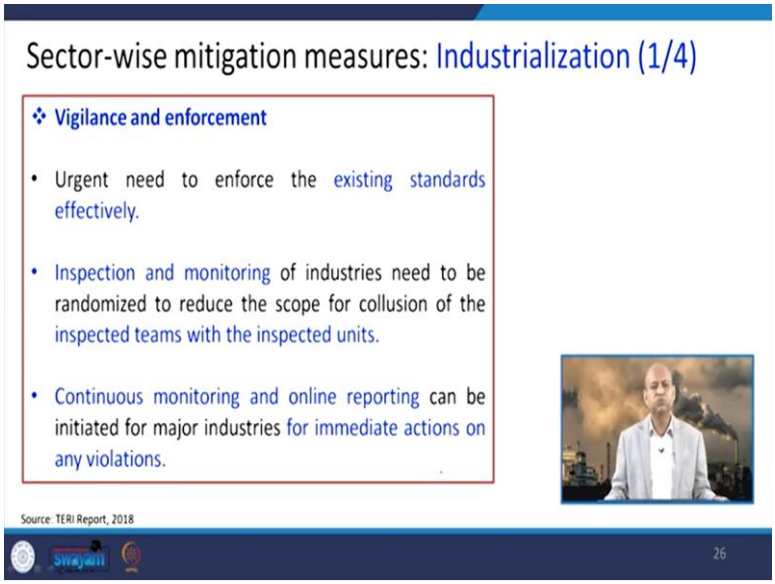

Well, then vigilance and enforcement, it is also very important and the inspection and monitoring of industries need to be in a random manner like I have heard that in Germany, these inspectors from pollution control boards, the same inspector does not go to the same industry twice, some other inspector will go. So, those chances when people can get into agreement of shortcuts kind of things that can be avoided. Then there may be online reporting system where this personal contacts is avoided. So, those possibilities can be ruled out basically.

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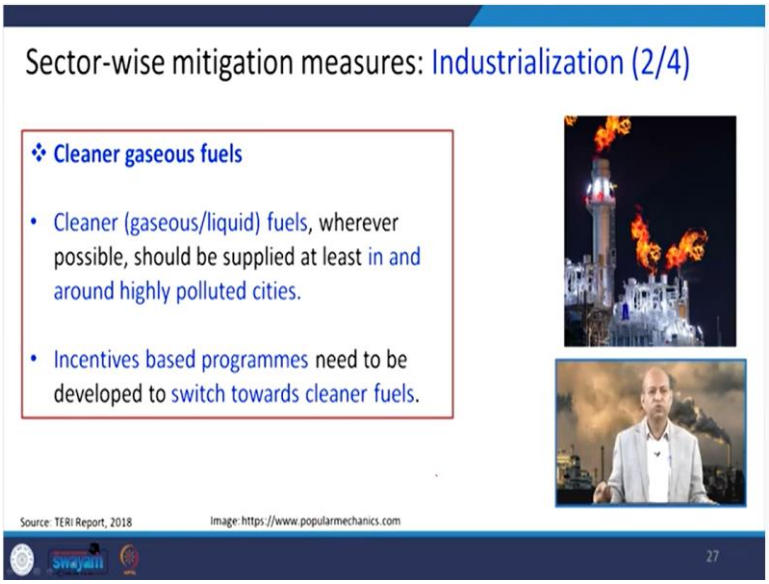

Then if we talk about like cleaner gaseous fuels, so, we can have better fuels and we can switch over to cleaner fuels, which are available and like from solid fuels to liquid fuels, liquid fuels to gas fuels, those kinds of things are related in the industries basically. So, now, we are talking about industries, transportation has been there already. So, industrial sector is now under our focus.

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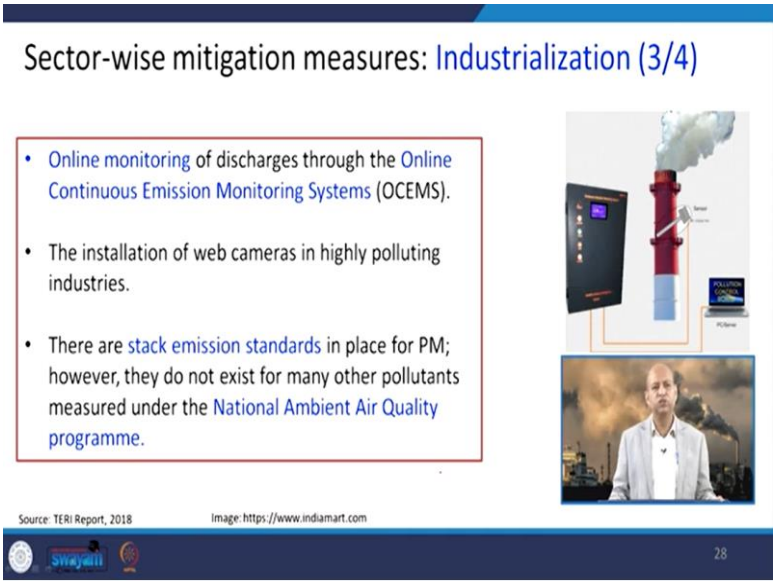

Then we can go for online monitoring basically. So, the online continuous emission monitoring system have been there in the market, but it is expensive, and again, if we promote it with some sort of policy incentives, then it can be there and it would be very easy to monitor those kind of emission streams.

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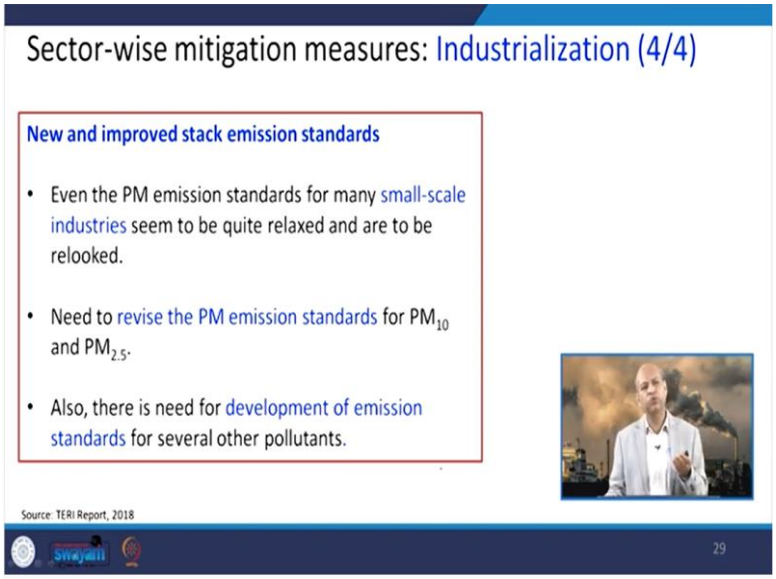

These stack emission standards are also need to be improved, because for certain pollutants, they are not there like for PM emission standards for PM_{10} and $PM_{2.5}$ they need to be revised and there are certain pollutants for them, these stack emissions standards are not there. So, they need to be developed. So that we can implement those based on those.

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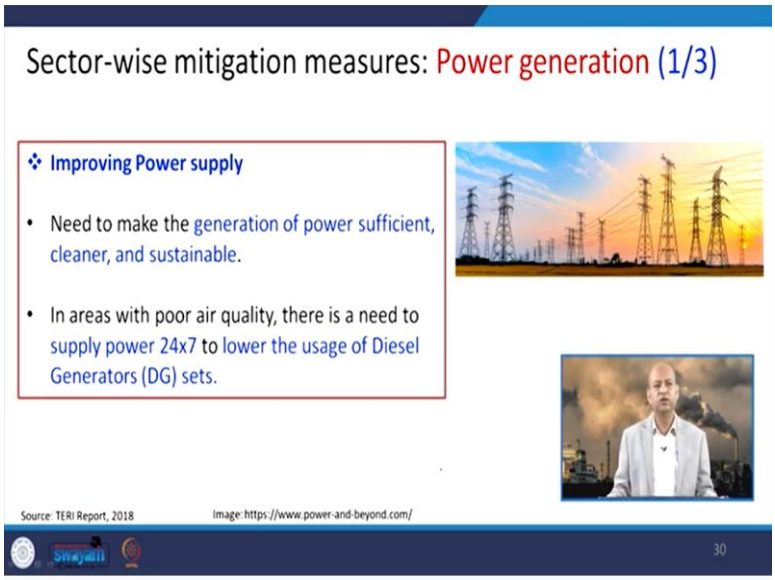

Now, we come to the power generation, power generation, we have seen those ESPs etc. Now, we go for the power sector basically we were at that time focusing on particular coal-based power plant also. So, we are now talking about the complete power generation sector. So, we need to make this generation of power sufficient, cleaner and sustainable.

This is the need of the hour. And that is why a lot of policies are there for generating power from solar, from hydro and those kinds of renewable resources and slowly going away from coal based thermal power plants, so, that these polluted ways of generating power can be replaced by nonpolluting ways of power generation.

Plus, at the same time like some places or in the towns or small cities if power supply is not continuous then people start using DG sets, diesel generator sets and sometimes they are quite polluting if they are not a very good quality and very good quality they need a lot of money. So, people go for those kinds of DG sets and they are polluting. So, it is better that if we supply 24 by 7 electricity, then there is no this possibility of using DG sets unnecessarily and that way again, this is one way of getting better air quality.

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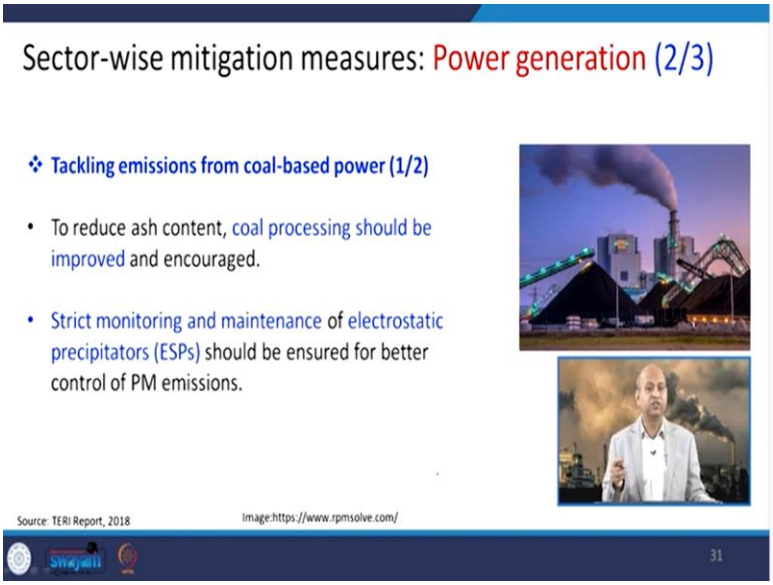

Then tackling emissions from coal-based power plants. So, we can go for better coal quality or processing of those coal so that ash content can be removed, there are already technologies which are in use in our country. Then a strict monitoring of maintenance and this electrostatic precipitators ESPs which we use, which is also necessary so that it is working. Otherwise sometimes if it is not working then the whole pollution goes out without controlling it through ESP.

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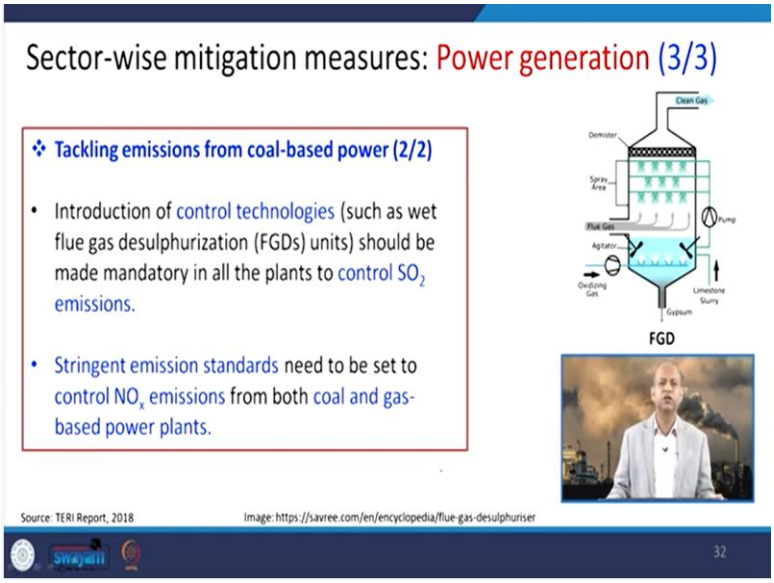

If you talk about like, these coal-based power plant, then there are other ways also like wet this flue gas desulfurization FGDs units. So, those things we have already seen in a scrubber kind of mechanism, which we discussed about controlling of air pollutants from different sources.

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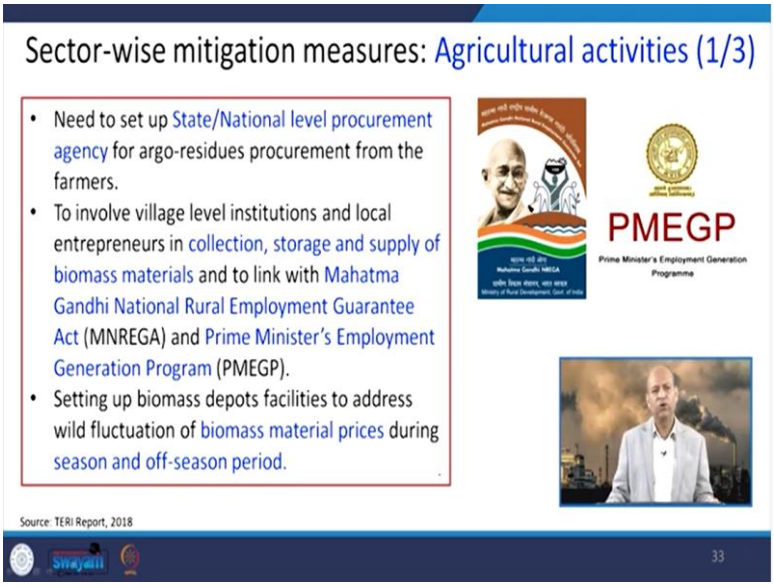

Well, then if we talk about like agriculture activities, so, you might have heard that lot of agricultural waste is burnt or like this paddy fields after this harvesting season, when they want to prepare it for another crop, then they burn the waste. So, rather than burning it, there can be some technologies, although people are doing research and they are giving ways to use that particular biomass for generation of fuel or converting into value added product.

So, there are many ways but that needs lot of efforts, cooperative efforts at the village level at the Panchayat level and at the government level also. So, those kinds of things are needed and that can be even linked with the MNREGA or those kinds of schemes which are already there. So, that it is very easy to implement those particular things.

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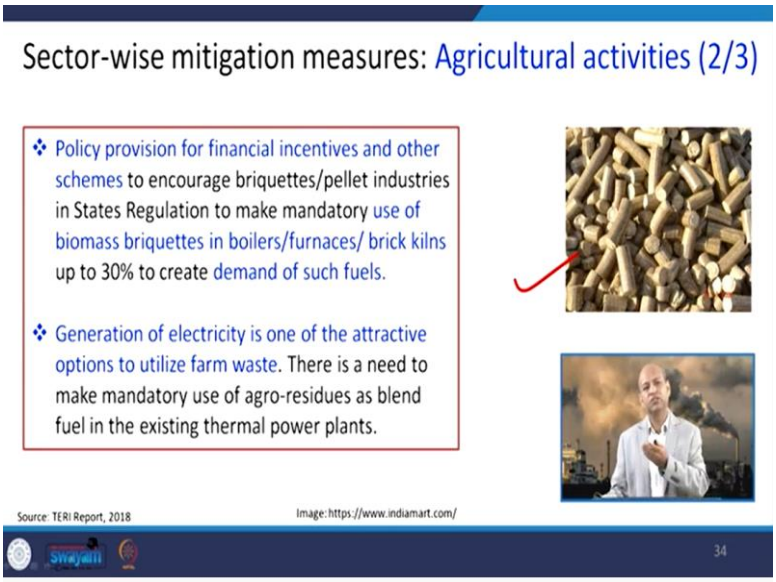

Like these agricultural waste can be converted into these briquettes and pellets, which are kind of concentrated energy source and it is, efficient burning can be ensured by these kinds of things. So, this is generation of electricity is one way of attractive options for utilizing farm waste, and there are certain plants in fact, and certain industries also need these kinds of waste for like making boards etc, but the constant supply is the issue.

If government and these cooperative societies can make this they can ensure the supply, constant supply to the industries, then they can really dependent upon these kinds of local supply. Otherwise, I have heard that many industries import these agriculture waste from Malaysia etc, it is very funny to, or strange to look into that kind of matter that we are burning our agriculture waste and people, those industries are meeting their demands by importing the waste from outside, that is not a good thing. So, better policies and their better implementation is the need of the hour basically.

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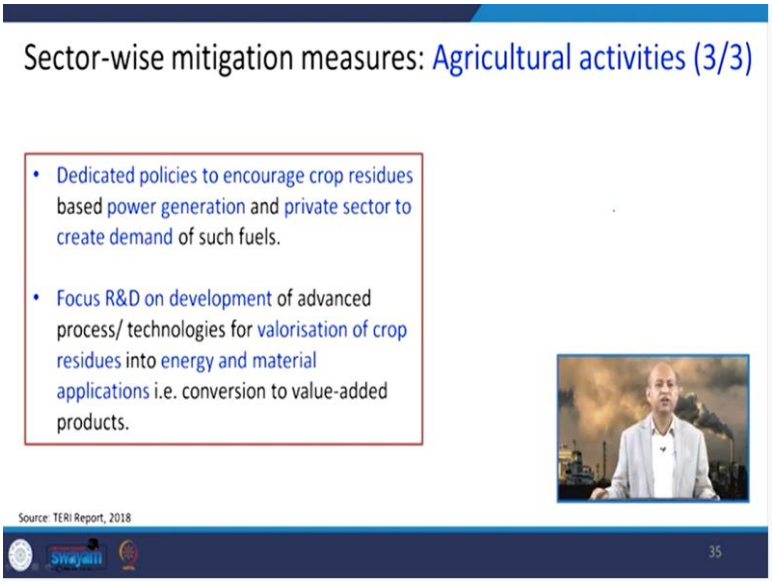

Then dedicated policies can be there for these crop residues, power generation as we have discussed, private sector and the government R&D and other agencies can join hands for that.

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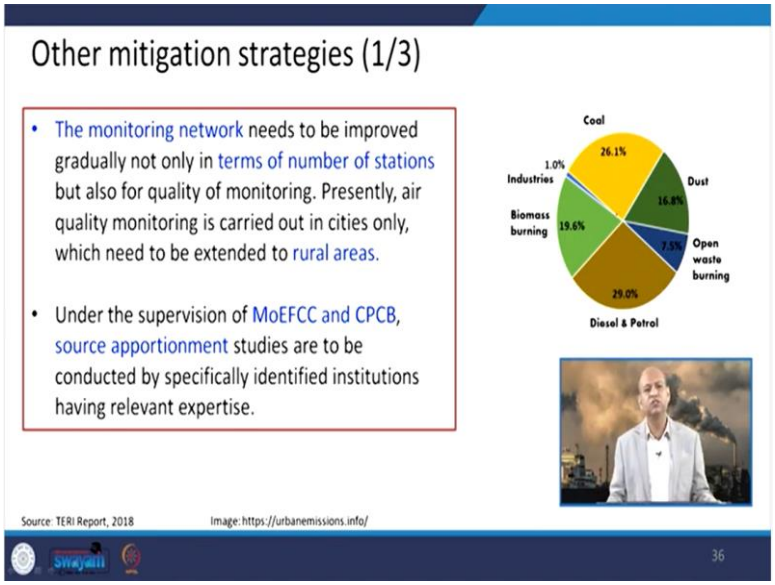

Then there may be other mitigation strategies for example, monitoring networks can be expended, air quality improvement is dependent on several things, including monitoring, modeling etc. So, nowadays, there is impetus on expanding these monitoring network to countryside also rural areas also otherwise, only in cities, lot of monitoring stations are there. So, those kinds of issues, we can tackle.

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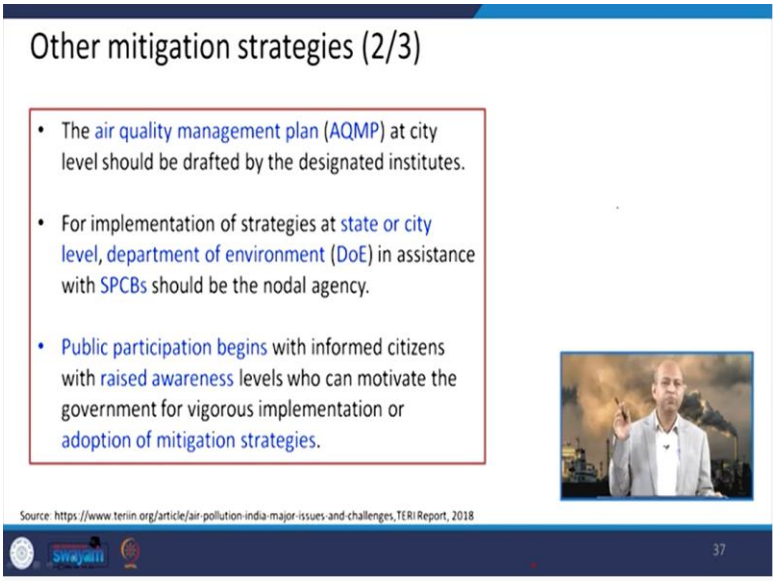

Then Air Quality Management Plan and then state or the city level department of environment and these state pollution control boards they can be the nodal agency for implementing those strategies which are related to air quality management plans. And the public participation is very important basically. So, the urban local bodies can play a very important role in that sense. And in NCAP lecture you might have heard about all those aspects which are necessary for tackling these kinds of issues, to improve urban air quality.

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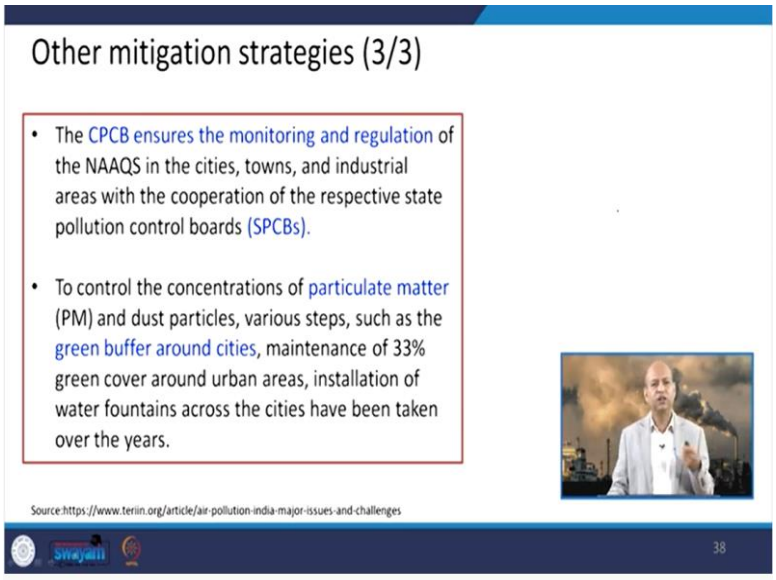

Then, there are other ways like to control the concentrations of particulate matter and the dust particles various types are there like a green buffer around the cities in and around the industrial zones and 33 percent green cover in urban areas, those kinds of things if we can ensure and we

can install like open fountains, water fountains across the cities but it is very difficult, it needs a lot of resources etc. So, better to go for eco-centric developments where we can use the trees and greenery as a buffer zones in between industrial zones and the residential zones.

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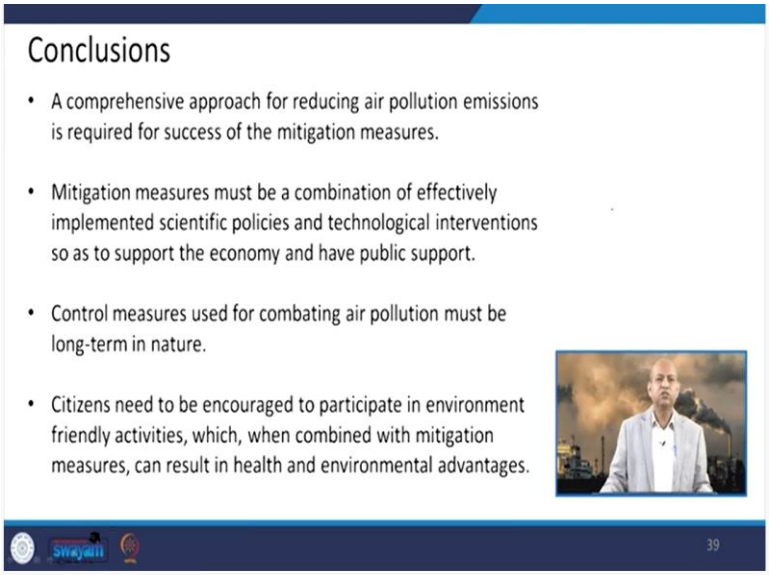

So, in conclusion, we can say that this comprehensive approach for reducing air pollution emissions is required for success of the mitigation measures, comprehensive means integrated manner, not only one sector but all sectors with better policies. And the mitigation measures must be combination of like effectively implemented scientific policies and technological interventions.

So, as to support the economy and have public support also, because sometimes we go for stringent air quality standards or stringent emission norms, but if we do not have technology to control the emissions then industry people get frustrated, they say that you are giving us those type of targets but how to meet them.

So, the public support will not be there, because economic development needs are much primary these days. So, they want the real solutions. Unless we have good solutions, it will not be effective. So, we should have this public participation according to the local needs. We should develop those technologies which can be implemented properly. Otherwise, if we import and if it is very expensive, the industry people will not like it.

Then control measures used for converting air pollution must be long term in nature, it should not be a short-term issue, it should be properly planned and implemented. And citizens need to

be encouraged to participate in environment friendly activities, which, when combined with mitigation measures can result in healthy environment.

And there are so many advantages in terms of better air quality and better health and better living conditions.

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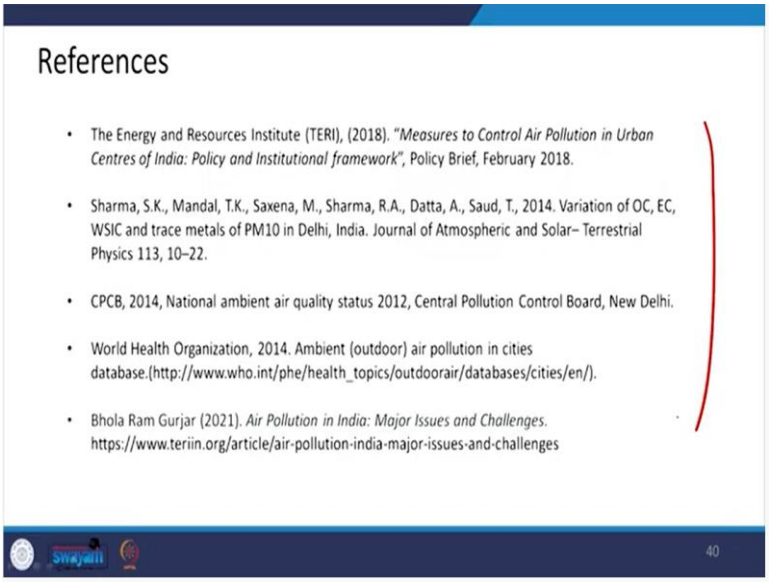

So, this is all for today. And these are the references for your additional information. Thank you for your kind attention. See you in the next lecture. Thanks again.