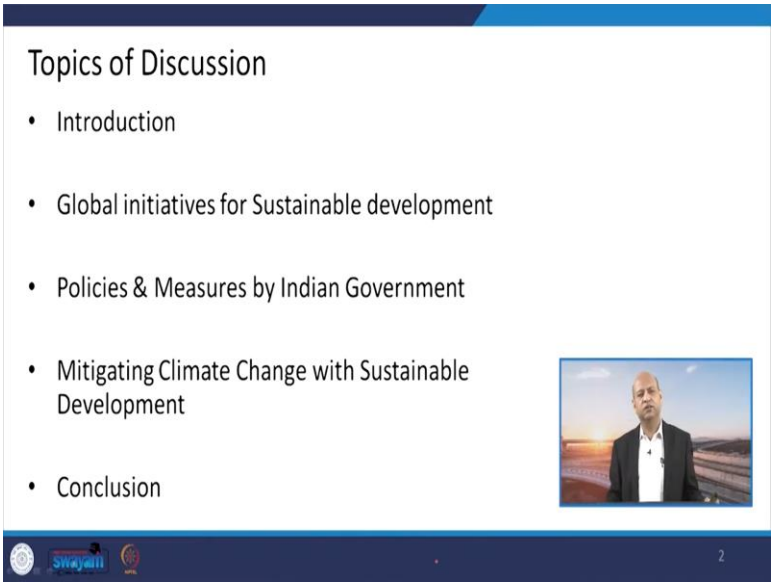
Sustainable Transportation Systems
Professor. Bhula Ram Gurjar
Department of Civil Engineering
Indian Institute of Technology, Roorkee
Lecture No. 44
Initiatives and Policies for Environmental Sustainability

Hello friends, today we will discuss the global level initiatives and policies and also at the Indian level policies which have been in the direction of environmental sustainability. So, that the sustainable development aims and objectives can be achieved through various kind of programs.

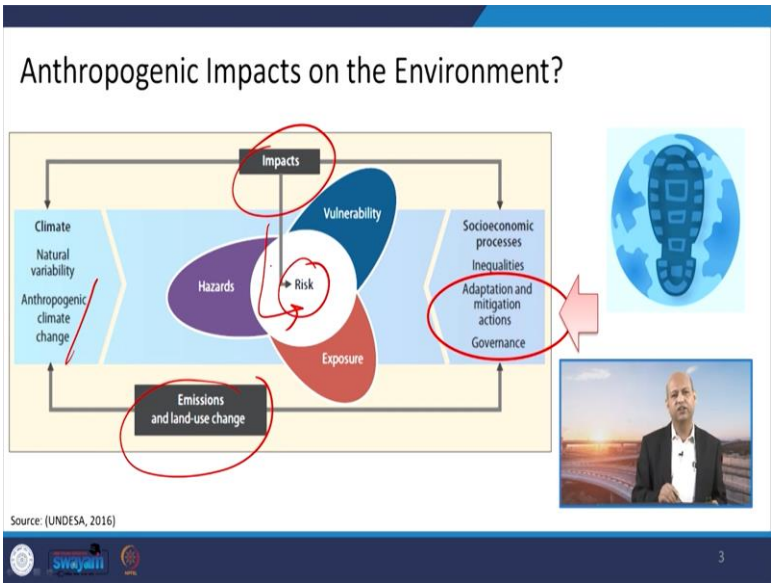
So, today we will discuss first of all a little bit introduction about what are the global initiatives and in the direction of sustainable development. Then we will see the in a chronological manner what are those initiatives which have been taken at the global level by all the countries through certain those bodies international bodies.

(Refer Slide Time: 1:10)



And then the policies and measures which have been initiated by Indian government to achieve the sustainable development or especially focused on transportation sector. Those things like fuel quality emission norms all those things we will discuss. And then we will see what are those mitigating climate change related ideas and policies or technologies which can help us to go towards or to travel towards sustainable development and ultimately we will conclude today's lecture.

(Refer Slide Time: 1:42)

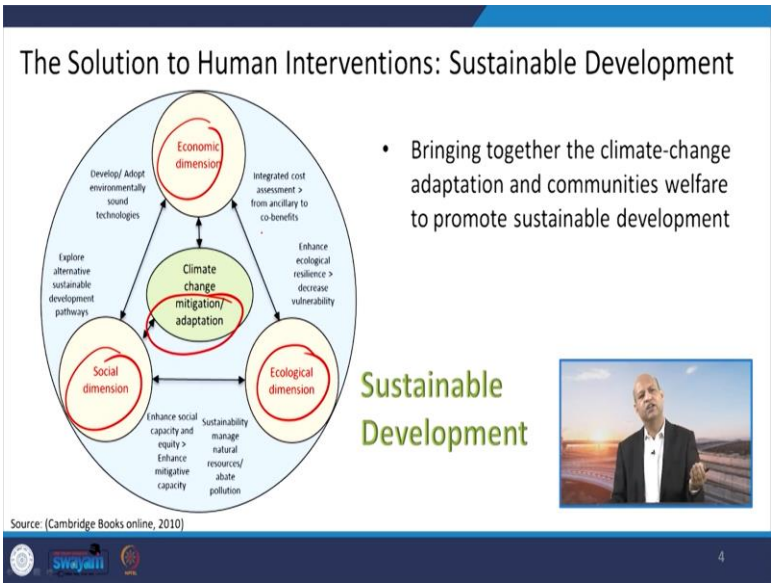


So, if we talk about like anthropogenic impacts or the man-made impacts on the environment. Then as you know that basically these emissions or the land use change because of several activities whether industrialization or having infrastructure developments or road construction or railways whatever kind of infrastructure or man-made activities are there they in influence or impact the environment which we have discussed in detail during environmental impact assessment if you may recall.

So, that picture gives this kind of pictorial representation like there are certain emissions or the land use change kind of activities which will give this vulnerable situation to the climate and anthropogenic climate change will be induced anthropogenic means man-made okay. And then because these changes they translate itself into like hazards or vulnerability or exposure so health risk assessment kind of things come into picture.

So, we can say there are impacts certain impacts and those impacts may be positive or negative but the negative impacts which are kind of risk positive may be opportunities. When we do something, then there are of course positive impacts also like we have greater job opportunities those kind of things of if we are having hospitals etc. So, health benefits are there so positive impacts are there right but there may be some negative impact. So, those negative impacts are termed as risk so there may be some risk also which we should estimate.

(Refer Slide Time: 3:27)



And when we talk about like how to solve those human interventions which are leading to negative impacts then we talk about these three dimensions of economic dimension ecological dimension and social dimension. So, all these three trade of there is trade off always means something we lose something we gain right so as per our priority national priority or social priority we do things.

And then it can also result into climate change and we also do some activities which are for mitigation or adaptation means we do not mean something change has happened then we adapt to that. So, adaptation is also a great strategy because all over these centuries or millennium kind of activities if we look into then lot of things are there which really give signals or science that we have adapted.

That is why we are now not only on the land mass but in oceans so many activities of the human in space also so as per technological inventions. And then adaptation as per the situation of sea or ocean or the land or deserts you just name it and everywhere whatever harsh climate may be there harsh weather may be there but we have adapted by technological uses or application of science and technology you can say.

So, that is there and this you can see this integrated cost assessment and because economic features are there. And then co benefits are also there like if you are reducing let us say

greenhouse gas emissions and within this effort you also end up reducing some air pollutants also. So, those kind of co benefits can be there.

In economic terms other benefits may be there like you are having one industry to meet some certain demands and with that industry we also gain other benefits because of related infrastructure development those kind of things. So, all these things we have to integrate and we have seen other in other slides or other presentations also.

(Refer Slide Time: 5:40)

Now if you talk about those important global initiatives which have been taken by collective efforts by governments means all the countries governments are participating in these kind of efforts through United Nations bodies meant for protecting the climate protecting the environment. So, the first this conference United Nations conference on the human environment it took place in 1972 that was the first effort to kind of highlight it or to make aware all the governments and to make it on the important agenda kind of thing.

Then this Brundtland report came into existence in 1987 that was kind of very important milestone in that direction because it defined our aims and objectives and what are challenges are there. Then this in 1992 Rio Earth Summit was there and that way you can see in this list in 1994 this Barbados program of action BPOA that was initiated in 1994 then the Kyoto Protocol was initiated in 1997. And then after 5 years of this BPOA plus 5 in 1999 it was again put into place.

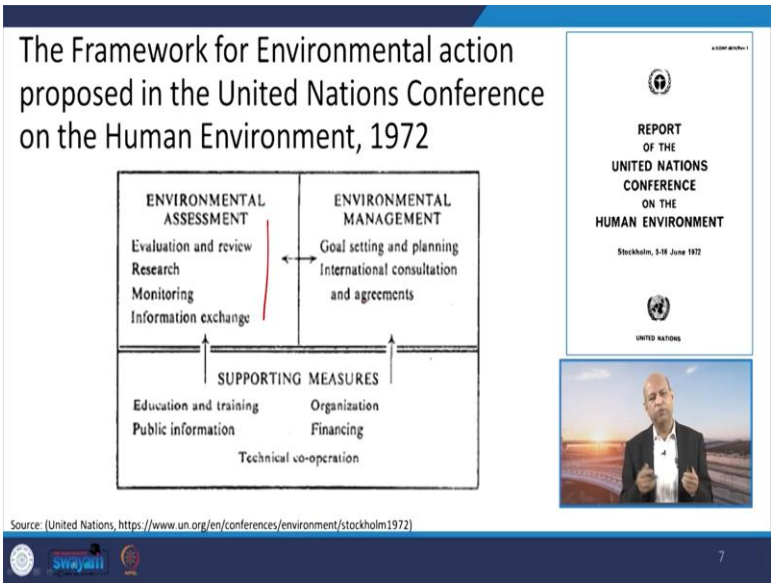
Then world summit on sustainable development 2002 ok that was there. Then BPOA plus ten means after 10 years after this 1994 so in 2005 this was again discussed and many decisions were made. Then United Nations conference on sustainable development that is UNCSD 2012 that was very important gathering in several decisions were made.

And thereafter in 2015 United Nations this UNSD summit was organized. And the Paris agreement was in 2015 and thereafter also there are many meetings of this international level are going on and several decisions are being made and commitments are also made by governments so that we can move towards sustainable development path.

(Refer Slide Time: 8:06)

So, the three main categories were also part of the action plan like global environmental assessment program that is the watch plan. And then environmental management activities properly those listed and international measures to support assessment and management activities which are carried out at the national and international level. So, this was very important kind of activity from environmental or sustainable perspective.

(Refer Slide Time: 8:27)



Well, then framework of the environmental action plan of this 1972 United Nations conference on human environment was published. And it was kind of commitment was made by participating countries so you can see like assessment was evaluation and review research monitoring information exchange those were the part of the exchange in the environmental assessment for management like some setting of the goals, goal setting and then planning to achieve those goals, international consultation and agreements all those things were properly planned.

And then supporting measures so that these can be carried out properly so capacity building education and training. And then financing also how much money should be given by the relevant ministry appropriate ministry and how public information should be given so that more and more awareness comes in the public towards the environmental sustainability.

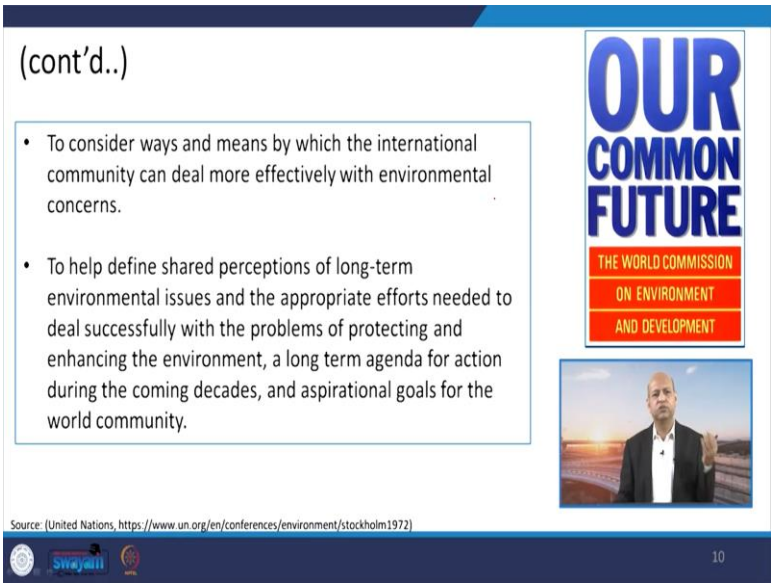
(Refer Slide Time: 9:25)

Well, if you talk about this Brundtland report which is known al also like our common future that was the name of the report it was in 1987. So, that was the part of this formulation of this report from world commission on environment and development WCED. So, in October 1987 it was published by United Nations and it is also known as our common future.

And then environmental issues were kind of in political agenda that was the first time it was taken into account as a political agenda so that political will can be exercised and every country can have certain commitments to meet. At that time this definition of sustainable development proper official definition came into picture and that was like we should go for that kind of development which can meet the needs of the present without compromising the ability of future generations to meet their own needs.

That was the first definition of course afterwards several schools of thoughts and several thought leaders they challenged this definition and they came up with other definitions of sustainable development. And because the resources and capacities can be different in different ages so those were the issues.

(Refer Slide Time: 10:51)

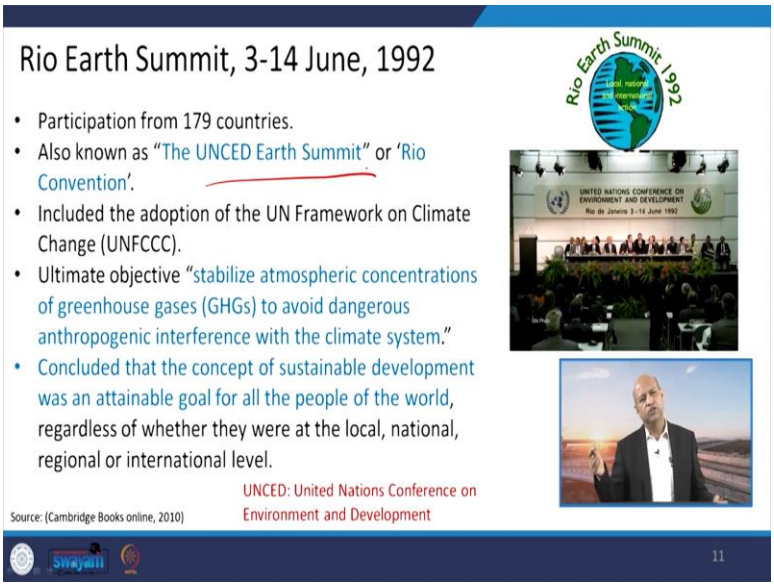


Outcome of this Brundtland report was like long term environmental strategies were formulated. And then it will al it was also decided that it should we should do those kind of activities intergovernmental activities participatory activities which can lead to the achievement of common and mutually supportive objectives ok, that account for all kind of development like interrelationships between people resources environment and the development activities.

So, nothing is left out the integrated approach or holistic approach that was the time when it was with full force it was discussed and debated and put into policy majors and action plans

also. So, the wage and means by which the international community can deal more effectively with the environmental concerns was the part of this our common future report. And to help define all shared perceptions which may be positive negative but for the long term environmental issues this was the kind of first effort which was made so collectively and forcefully I would say.

(Refer Slide Time: 12:06)



Well, then this was the Rio Earth Summit from third to fourteenth June in 1992and this Rio summit is also known like UNSCD or summit or Rio convention ok that was also important milestone in that direction. And the objective the main ultimate objective which was decided during this convention it was like to adopt the UN framework on climate change UNFCC that was very important initiative at that time.

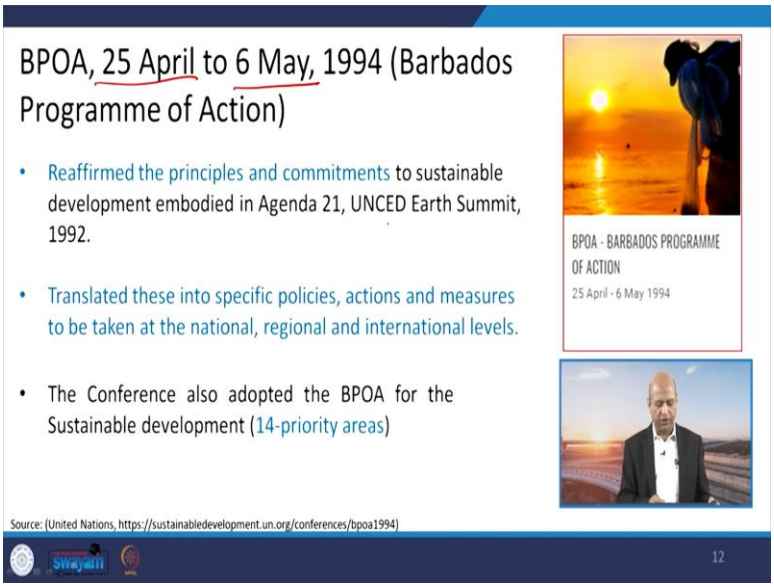
And it was decided that the objective should be like to stabilize atmospheric concentrations of greenhouse gases because almost it was agreed although IPCC reports every after certain years they publish this report. And they give what are the concentration of CO2 and what kind of activities or policies are people or countries are following to reduce the greenhouse gas concentration into the atmosphere.

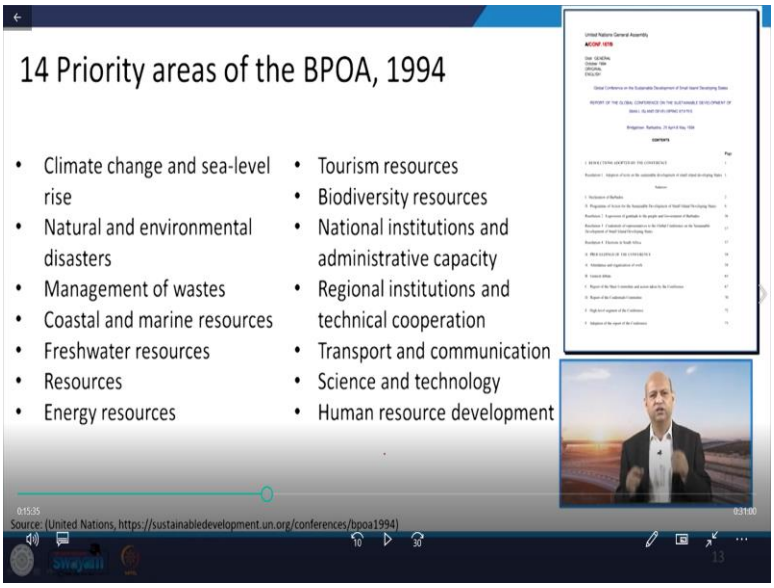
But it was in 1992 when with very dedication and very commitment this was decided that we should reduce the global concentration or atmospheric concentration of greenhouse gases so that the dangerous anthropogenic interferences of in the climate change or climate

system can be avoided. Otherwise it may be very problematic in terms of so many problems whether sea level rise or different kind of precipitation patterns and all those storms etc.

And then it was concluded that the concept of sustainable development is an attainable goal it is not like just to think and debate but something which is attainable within a time framework within a time frame. And it can be kind of part of all activities at the local level national level regional level and international level. So, means the whole this critical mass was achieved at that time in terms of thought leadership you can see.

(Refer Slide Time: 14:13)





Then this Barbados program of action be poor in 20 on 25th April to 6th May this was the conference. And again those principles and commitment commitments for the sustainable development were reaffirmed and agenda 21 of this UNCED earth summit of 1992 that was again it was commitment was repeated that we should go for that with the dedication. And14 priority areas were also decided in this particular conference of 1994 BPOA.

So, these 14 priority areas are listed here like climate change and the sea-level rise are very important issues. And the natural and environmental disasters they can be avoided if human interventions can be properly managed. Then management of wastes because that is also very important if our view of waste management is like harmful in terms of its practices then also we should take care of it properly.

Coastal and marine resources fresh water resources several kind of resources were the part of these14 priority areas regional institutions and technical cooperation all those human resource development. So, with the focus on sustainable development all these priority areas were listed and work started to focus on those priority areas.

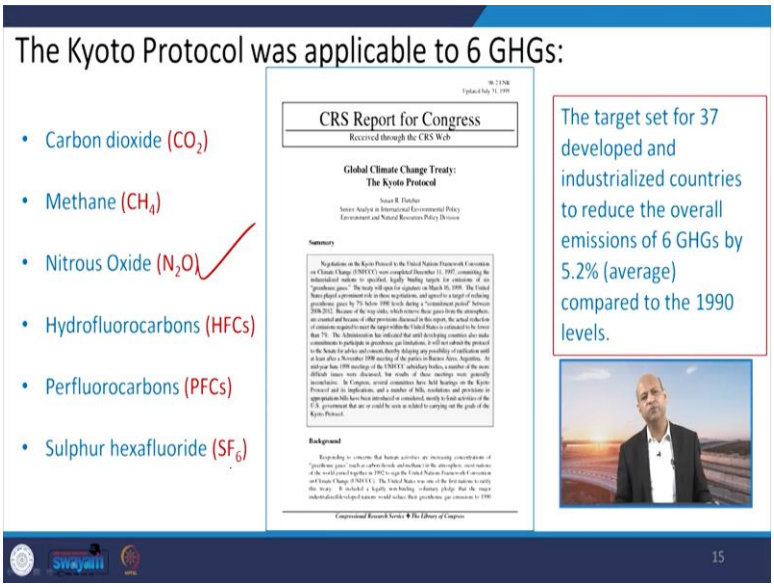
(Refer Slide Time: 15:43)

Then in 1997 the Kyoto Protocol was decided and it was adopted and 192 parties 192 countries signed this and they agreed, they agreed in 2005 to complex ratifications of this process afterwards. And then UNFCC also gave this kind of commitment for industrialized

countries so they were responsible for so many greenhouse gas so much quantity of greenhouse gas emissions, because rapid industrialization and energy intensive activities.

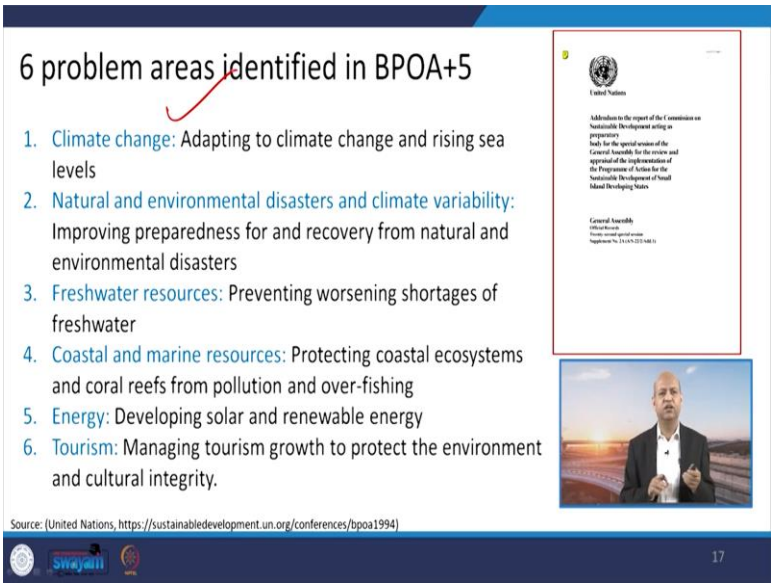
So, those kind of decisions were made that these industrialized or developed economies will have more responsibility their commitment will be more in comparison to those developing countries which are still making efforts to fulfill energy related needs to their citizens. So, the rigorous monitoring and review and verification system was also established properly so that was very good decision at that time during Kyoto Protocol.

(Refer Slide Time: 16:53)



And these are the greenhouse gases co2 carbon dioxide methane nitrous oxide and then these HFCs hydrofluorocarbons or these PFCs and SF SF6 these 6 were categorized properly that we should focus on reduction of these six greenhouse gases so that we can achieve this target of reducing the amount of Co2 equivalent in a great way.

(Refer Slide Time: 17:24)



Well then after five years of 1994 of this BPoA this BPoA plus 5 was organized in 1999. So, the 5 year review was kind of this program action and it was adopted the state of the progress and initiatives for the future implementation of the program of action for the sustainable development. And then the 6 problems were identified these 6 problem areas are basically like climate change natural and environmental disasters and climate variability, because if you are long list then sometimes it becomes difficult.

So, they narrowed down so that priority areas can be narrowed and more activities can be taken into account fresh water resources coastal and marine resources then energy related

issues in like developing renewable resources for the energy solar and other tourism should be like in that way so that the environmental those resources can be protected and cultural integrity must be protected. So, tourism industry should reshape itself in that way it should not harm the environment by this activity.

(Refer Slide Time: 18:36)

Well, in 2002 this world summit on sustainable development in South Africa it was organized in and it is also known as Johannesburg summit or earth summit 2002. And the focus of this summit was to give proper attention and direct the actions or resources towards meeting difficult challenges including like improving people's lives and conserving natural resources and the focused areas, for these challenges were like growing population because population is rapidly growing in all parts except some developed economies where population growth is not so much but in developing countries the population growth is quite high.

And then this increasing demands for food because if population is growing then need of the food is also growing, shelter for the need sanitation energy health all those kind of activities which are related to meeting the demands of the population. These are the focused areas so that they can be met without harming the environment so that it can be sustainable way of life.

(Refer Slide Time: 19:43)

After 10 years of that BPOA so in 2005, 10 year review was conducted ok. That is also known as Mauritius strategy for implementation and the focus on additional key areas were also decided like trade sustainable production and consumption, health issues knowledge management and culture because in this digital age now this data science knowledge management is also becoming very crucial and important thing and the culture also like without affecting the local culture can we have the development. Development should not be like if we lose our roots that is also not good because roots give you very confident kind of viewpoint or world view of the reality.

(Refer Slide Time: 20:30)

Well, when we talk about this UNCSD that was held on 20th June to 22nd June in 2012 this Rio plus 20 after Rio's 20 years. So, this is also known as Rio plus 20 United Nations conference on sustainable development. So, this resulted in focused political outcome as I said earlier because earlier discussions were on in more like scientific groups and techno technocrats or those researchers or NGOs etc., but now this political will was also tested and countries heads were requested to make commitments.

So, that was the time when it was became the part of political programs in each country and then green economy for achieving sustainable development that was the ground breaking guideline for across the world all countries governments were given this kind of mandate that we should develop in that direction.

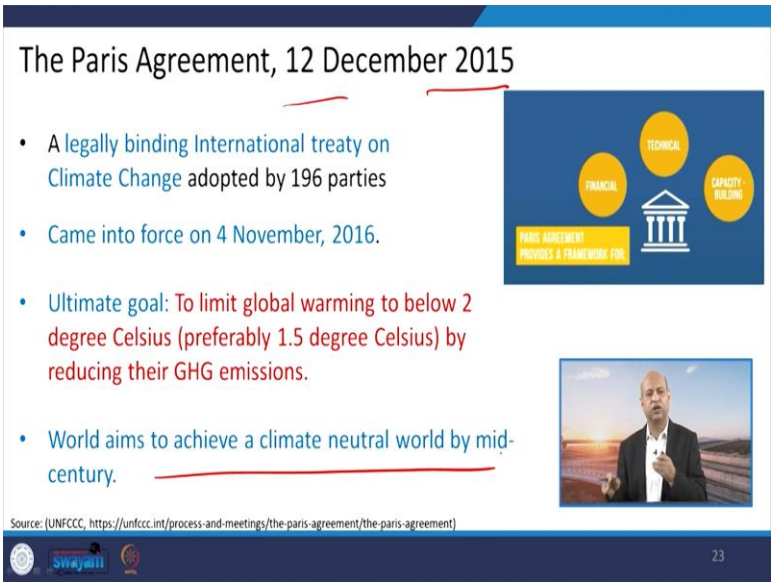
(Refer Slide Time: 21:35)

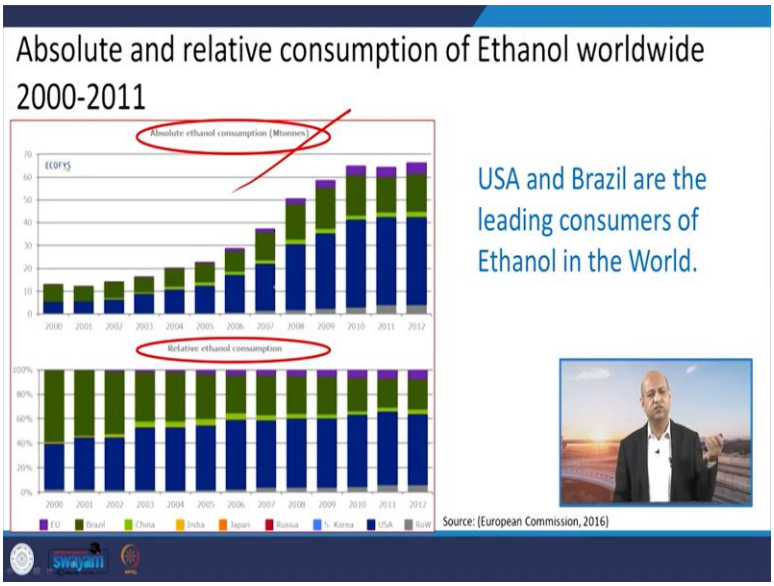
And some countries became very serious in that direction for example I will give you later on some data where you will know that India is giving making great efforts towards this renewable resources. Well, in New York in 2015 this UNSD summit was held and the agenda for sustainable development was like what will happen in 2030. So, that was the futuristic kind of agenda and how can we transform world our world with that perspective that long term kind of perspective.

And the seventeen sustainable development goals were decided at that time with 169 associated targets so as these SDGs always you read in several policy documents. So, in

2015 in New York this was the first time when the 17 sustainable development goals were decided. So, that was very important kind of initiative in in at that time. So, these are the sustainable development goals 17 goals for transforming our world you can see no poverty, zero hunger all those you can see gender equality, so all important aspects have been taken into account to achieve the sustainable development you can say.

(Refer Slide Time: 22:56)



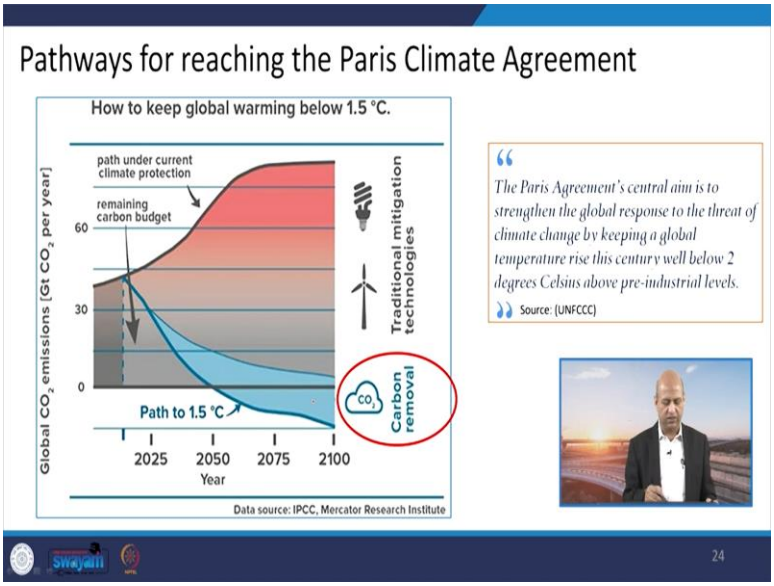


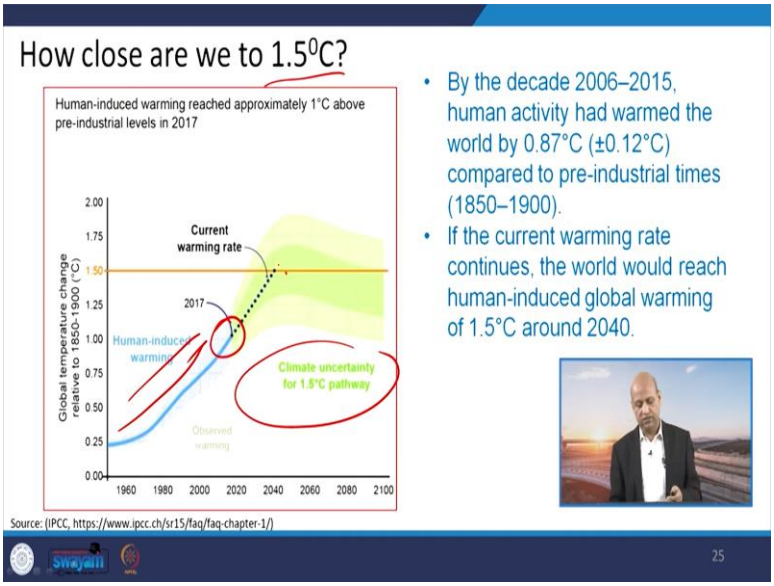
In Paris in 2015 this agreement was done on 12 December this was the legally binding kind of international treaty. And 196 countries signed on that so this came into force in 2016 next year on 14 November and then the goals were like to limit the global warming to below two

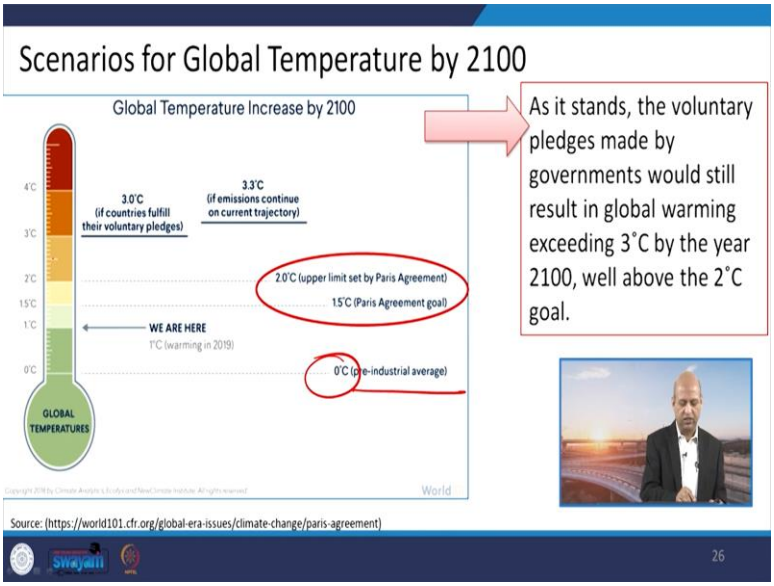
degree Celsius beyond that which was pre-industrial area error temperature of the global atmosphere or preferably 1.5 degree. So, that kind of target was set so that these greenhouse gas emissions can be reduced to achieve this target. That was very very important goal at that conference and to achieve the climate neutral world by mid-century that was also decided at that time.

So that because it is not a one day job every economy has certain strengths and weaknesses if you are shifting from this carbon based economy or fossil fuel based economy towards renewable and zero carbon kind of or zero carbon emissions kind of economy then lot of efforts have to be made. So, much infrastructure is there you cannot just wish away that thing you know. So, lot of investment is also needed it is not one day job that is why this long term target was decided.

(Refer Slide Time: 24:26)





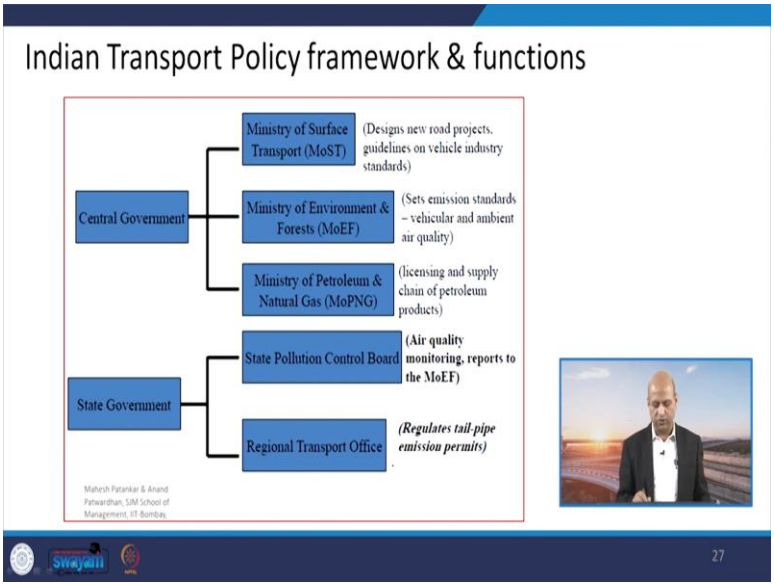


Well, so Paris climate agreement basically you can see this1.5 degree Celsius beyond this pre industrial era concentration temperature that was decided although 2 degree but 1.5 was targeted. You can see how close we are up to 1.5 degree that is beyond that it will be kind of catastrophic for our human existence. So, you can see we are presently this climate uncertainties of course there human induced burning warming trend you can see.

So, 2017 it was there around 1 degree Celsius already ok and it could reach like 1.5 and beyond that scientists warned that it would be difficult to survive on this planet. So much problems may be there because of this temperature increase. So, you can see we are here at present around 1 degree Celsius. And this preindustrial average is set 0 you can say and

beyond that so some if countries fulfill their voluntary pledges then we can go for 3 degree or so but this is the target upper limit set by Paris agreement 2 degree beyond that we should not go this is the aim and objective.

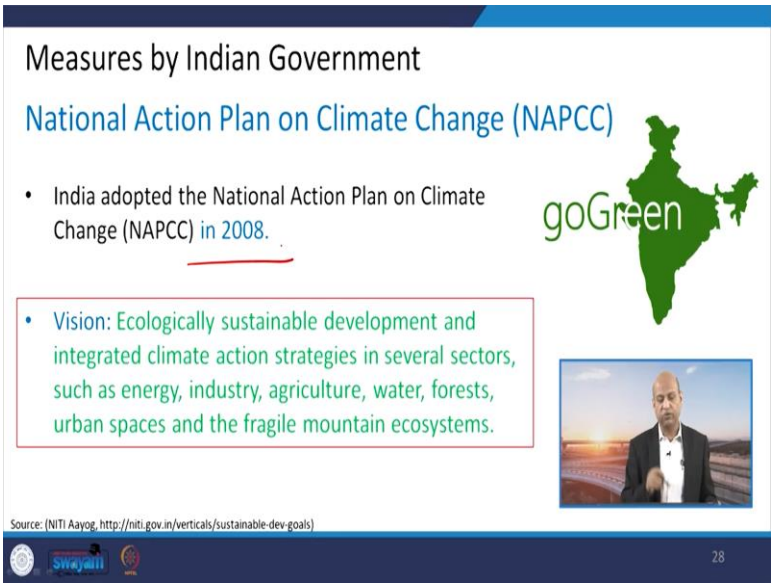
(Refer Slide Time: 25:49)

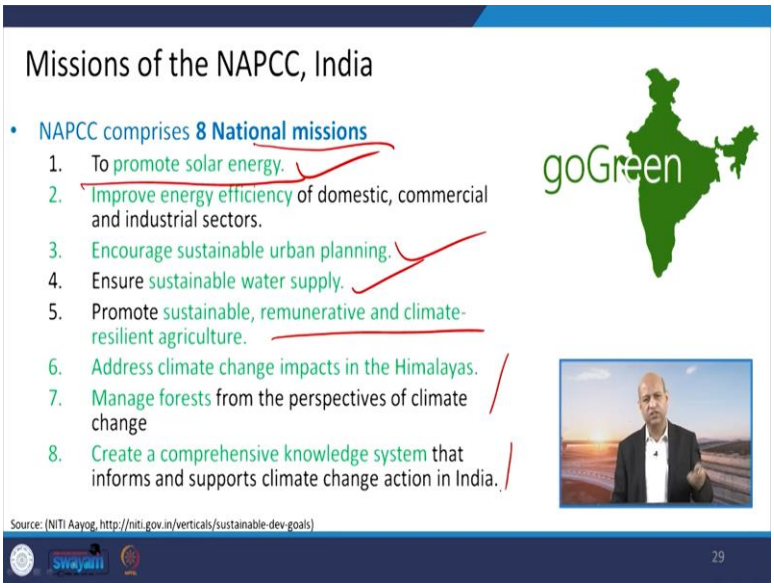


Now after global means even after 2015 there have been several meetings global international treaties and meetings. But now I will shift my focus on Indian transportation policy so you have seen the global policy initiatives for sustainable development now we will see what India is doing in that direction from transportation perspective because our course is sustainable transportations.

So, you can see here there are certain ministries like surface transport ministry of environment and forest, ministry of petroleum natural gas, state pollution control boards, regional transport office all these are working in in a very integrated way to implement certain policies which we will discuss now.

(Refer Slide Time: 26:37)





So, national action plan on climate change has been decided in 2008 it was adopted ok. So, accordingly commitments are there which our government is fulfilling timely every year they submit reports and so on. Then if you talk about missions of this NAPCC, so they are comprised of eight national missions like promoting solar energy so this is the area where government of India has achieved great results. And in fact they are having big plants through solar energy so lot of share we can expect in future from solar okay improve energy efficiency domestic commercial or industrial.

So, the technology should be energy efficient rather energy intensive that direction we have to take then encourage sustainable urban planning so that people do not need to move transport one place to another for meeting their demands so that sustainable urban planning has to be there. Then to ensure sustainable water supply ok you might be knowing that government of India is committed to give safe water and pure water up to the household ok up to your family or at your door house door. So, that kind of programs are there so sustainable water supply and then sustainable remunerative climate resilient agriculture.

So, that we are not dependent on those kind of practices which are harmful ok we should go for ecocentric development in agriculture in other areas also. Then to address climate change impacts on Himalayas because our many rivers are fed by those glaciers and we need to protect the Himalayas ecosystem. Then we need to manage forest from perspective of climate change because forests are great sink of CO2 greenhouse gas that also they provide so many things including rains etc., because of forest you know we have that kind of weather pattern.

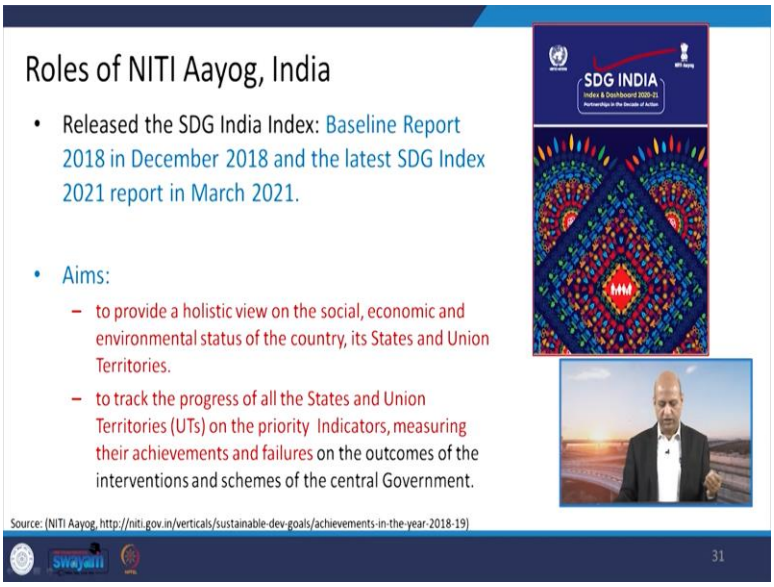
Create a comprehensive knowledge systems that it informs and supports climate change action in India. So, that kind of digital and information ecosystem is to be developed so 8 missions were part of this NAPCC.

(Refer Slide Time: 28:57)

Then NITI Aayog had something in their policy documents like transforming our world 2030 agenda for sustainable development in September 2015 this disease. So, they were given NITI Aayog has adopted them to incorporate in several policy majors you can say. So, the central government NITI Aayog has been assigned the role of overseeing the implementation of these sustainable development goals in the country. So, whatever industrial related policies or transport related policies are there we have to be focused on SDGs.

And you might have heard that now decarbonizing transportation sector is a big issue with the support of NITI Aayog which government is moving towards and this industry of transportation is moving towards. NITI Aayog has organized several national and regional level consultations to spread awareness about these SDGs and to bring together all stakeholders so that we can build the capacities for realization of these sustainable development goals. Because they are good for society good for economy good for the whole world you can say.

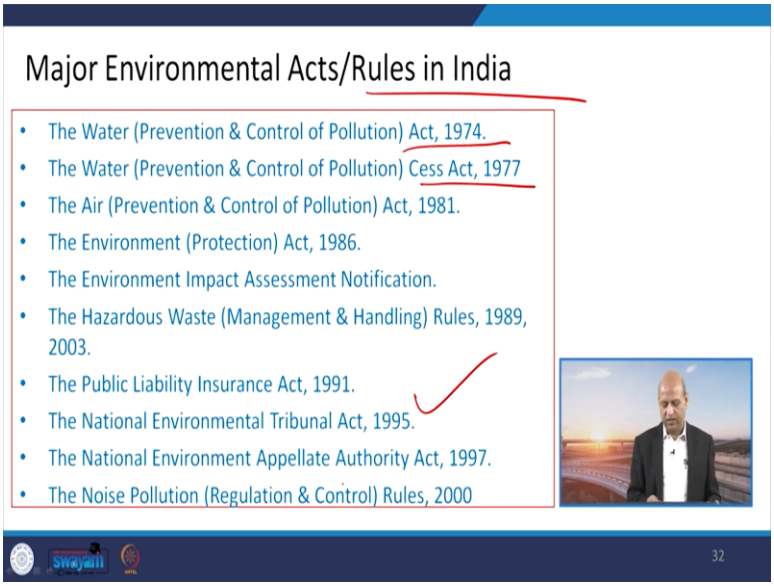
(Refer Slide Time: 30:12)



Well, so the SDG India index baseline report in 2018 it was released by NITI Aayog so that we are you can say we are properly committed and we have a proper document a guideline document which we will adopt to move towards achieving these SDGs. So, this is the aims of this report you can say holistic view to the social economic and environmental status of

the country. And at the states or union territories level you can see and then the track the progress how to monitor, so monitoring of this progress and certain priority indicators because if those indicators are made then we can say that we are moving towards achieving the SDGs.

(Refer Slide Time: 31:00)



This is major environmental acts and rules in India which are helping us to protect the environment and achieving our sustainable environment or sustainable life in overall sense the water prevention control pollution act 1974. So, since long and India is very much committed towards the environmental awareness, environmental protection and conservation. Then this water preventions as act was 1977 in 1981 this year prevention and control pollution act was enacted. And this environmental protection act in 1986 that was brought into place.

Then this environmental impact assessment notification in nowadays it is being revised and then hazardous waste public liability insurance act national environmental tribunal act this NET act was there. This national environmental this authority act and the noise pollution regulation control rules. All these work towards fulfilling our commitment to protect the environment and having better life.

(Refer Slide Time: 32:04)

Policies and Norms for Emission Reduction from Vehicles

Policy and Norms	Year of Implementation
1996	1996
1998 (Catalytic convertor norms)	1998
Bharat Stage I (Euro I)	1999
Bharat Stage II (Euro II)	2000/2001
Bharat Stage III (Euro III)	April, 2005
Bharat Stage IV (Euro IV)	April, 2010
Bharat Stage VI (Euro VI)	April, 2020

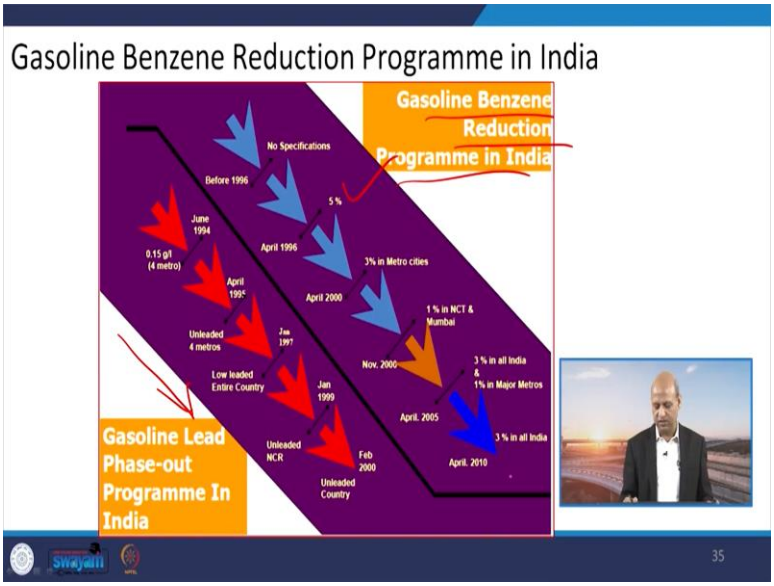
Source: (B. Sen Gupta, 2004)

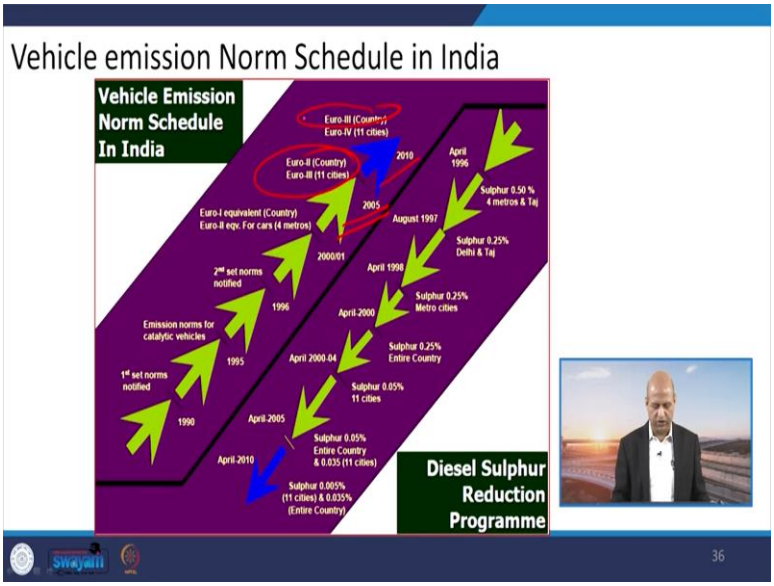
Norms for Fuel Quality Improvement in India

Norms	Year of Implementation
0.5% S-Diesel	1996
Low Smokes 2 T oil	1998
Phasing out of 15 year old vehicles	1998
Unleaded Petrol	2000
0.25% S-Diesel	2000
CNG Vehicles	2002
0.05% S-Diesel	2003
0.035% S-Diesel	2005

2 T oil = **Two-stroke** oil
(also known as two-cycle oil, 2-cycle oil, or 2-stroke oil)

Source: (B. Sen Gupta, 2004)





These are the policies in in in terms of emission reduction from the vehicles so you can see they are Bharat stage one birth stage to these euro one zero two related. Now from four we are directly jumping towards Bharat is age six or euro six that is a big big decision of the government so that the technology may be more energy efficient and very less amount of pollution should be emitted by those technologies.

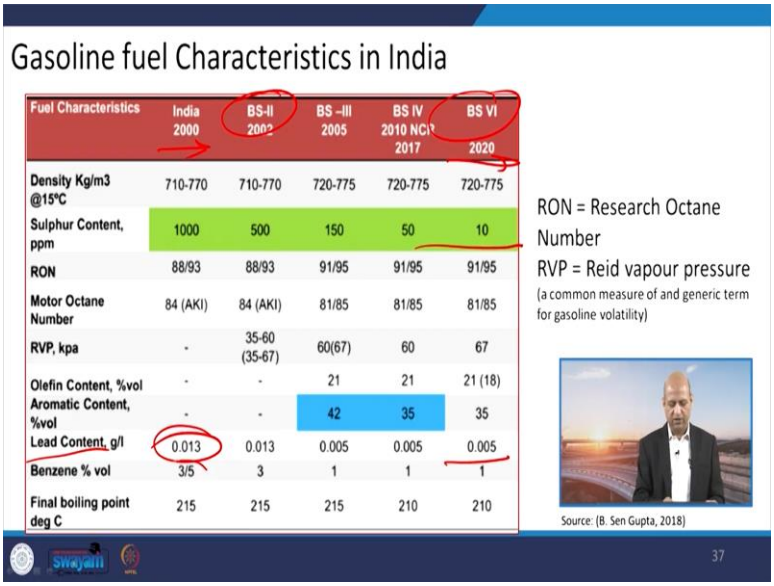
The norms of the fuel quality improvement have been there in focus so since 1996 several initiatives are there like only 0.5 percent Sulphur diesel was allowed in 96, in 1998 2 T oil was introduced. And for low smoke then phasing out of 15 year old vehicles in 1998 so that

way you can see several diesel and means low Sulphur diesel related policies were implemented year to year like up to 2005.

Here also you can see like unleaded petrol that was in different phases it was implemented unleaded petrol in cities, then entire India. Similarly, this benzene free gasoline benzene reduction program also implemented so from 5 % in April 1996, 3 % in 2010. So, those kind of reduction measures are being implemented.

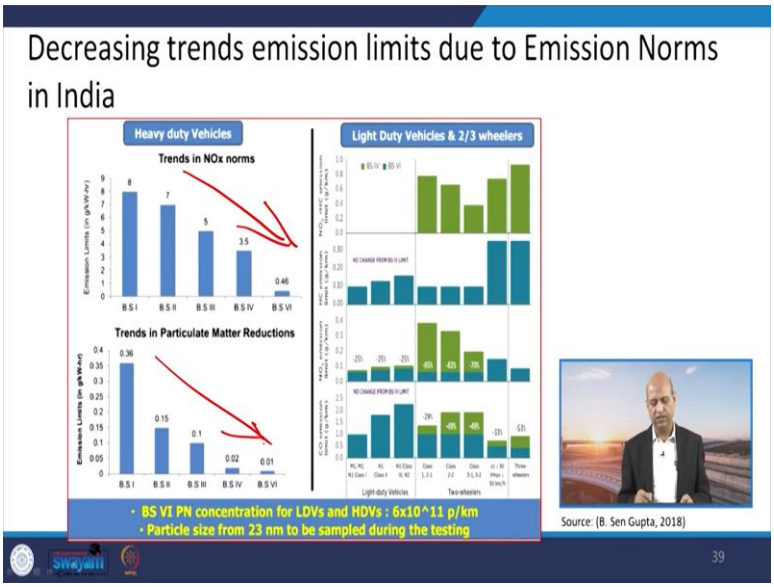
If you think about emission norms so you can see like euro second in 11cities in 2005 and in entire country there was this euro 3. So, stages because we cannot just go for complete country in a one go we have to implement these things stage wise or phase wise. Diesel Sulphur reduction as you have already seen in that table so that program was also there to have ultra-low Sulphur diesel.

(Refer Slide Time: 34:06)



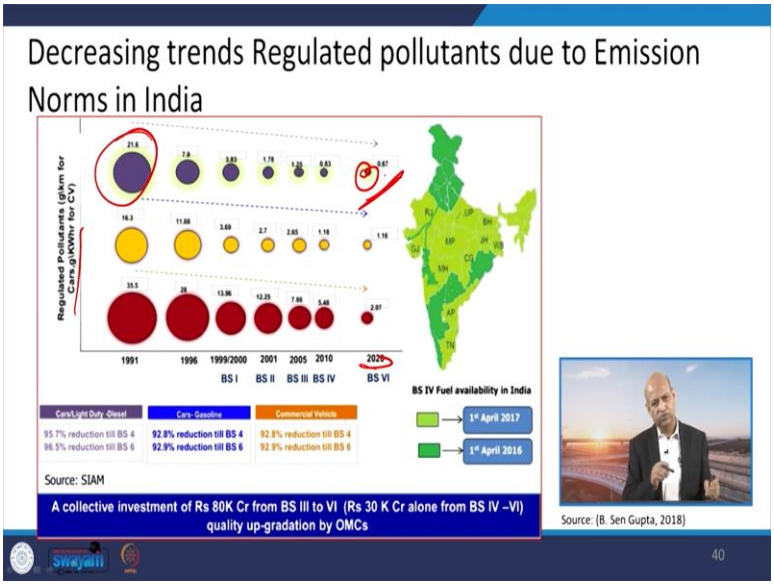
Well, you can see these characteristics of the gasoline so over the years like from 2000 to 2020 if you see from vs Bharat stage second to Bharat stage VI. So, all these Sulphur content related reduction is there whatever your lead content you can see very low now from 0.013 to 0.005. So, benzene like here three to one percent so those kind of targets have been achieved that's a great achievement if you look at the Indian perspective.

(Refer Slide Time: 34:38)



Similarly, decreasing trends of emissions because of these norms when we are having better norms Bharat stage II, III, IV, and then VI, so naturally emissions are also reducing or decreasing. Trends of knocks norms you can see particulate matters are also decreasing. So, that way light duty vehicles or 2-3 these wheelers also they are having better kind of picture.

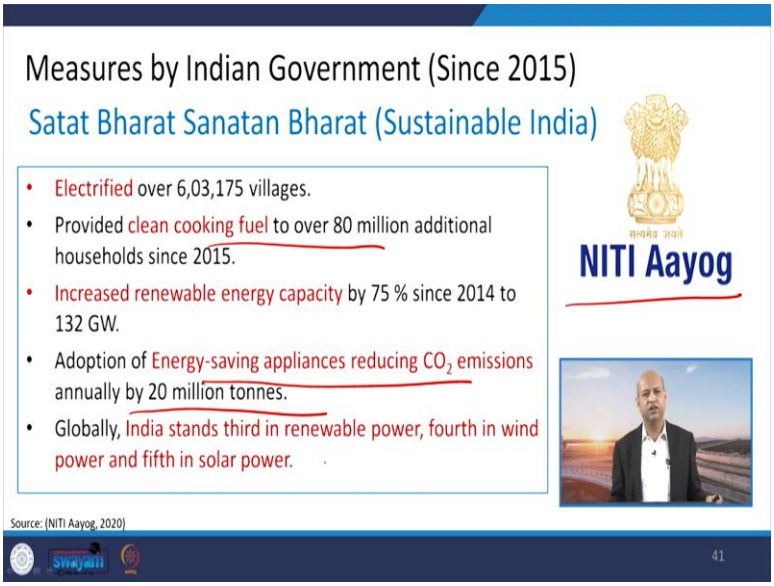
(Refer Slide Time: 35:05)



Decreasing trends of regulated pollutants due to emission norms, you can see these pictorial representation of regulated pollutants from the cars and all those so reduction is there over

the years up to 2020. So, this pictorial representation give from 21.6 only 6.67 so that kind of you know trend is there.

(Refer Slide Time: 35:30)



Well, if we go for like measures for this electrification of the villages so that's great achievement has been seen because otherwise people use different kind of fuels to have light also earlier those kerosene etc., kerosene bulb kerosene kind of lamp etc., we used to use in our childhood but now electrification is there in the villages.

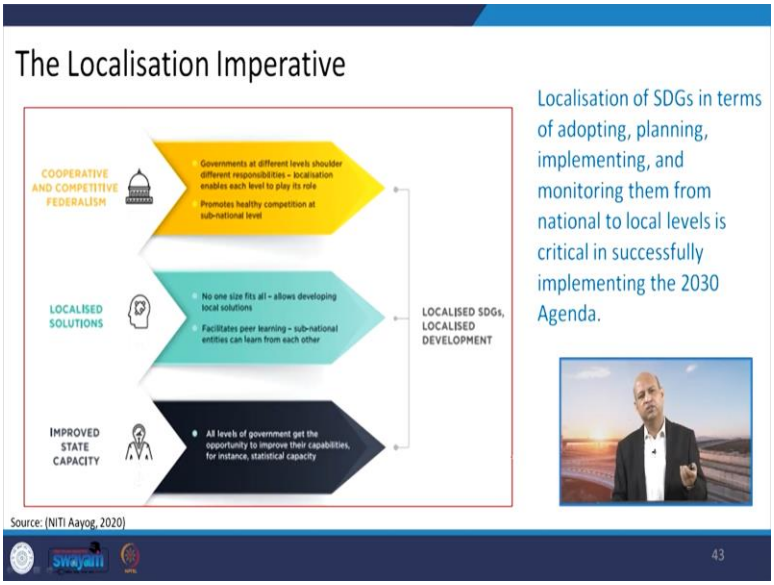
And also clean cooking fuel is there for this Ujjwala Yojna is there according to that many families poor families have been given this LPG connections liquid petroleum gas. So, that better energy efficient tools they use so less pollution is there those kind of initiatives by with the help of NITI Aayog this have been there.

And this energy saving appliances reduction of CO2 emissions ok so this reaches 20 million tons of reduction you can say. Globally so India stands third in renewable power that is a great achievement in that sense and fourth in the wind power and fifth in the solar power but slowly it is increasing and I am sure that it will have more share of these renewable resources in the kitty of total energy harnessing or energy usage.

(Refer Slide Time: 36:48)

Sustainable related like initiatives and achievements since 2015 if you see like world's largest renewable energy expansion program by 2030 we are having. This is already going on and then you can see these 30 % in 2020 the total electricity generation from renewable energy thirty percent it was in 2014. So, day by day wear year by year we are increasing the share of renewable resources.

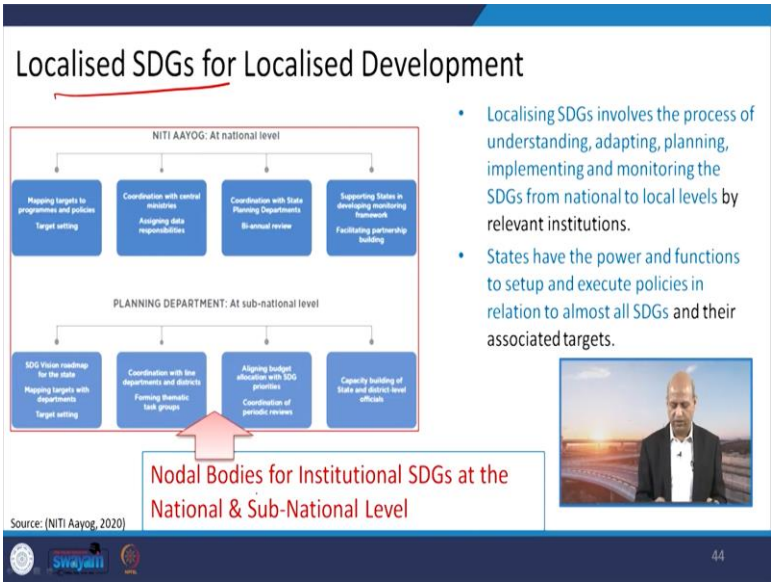
(Refer Slide Time: 37:20)



Localization imperative like local level activities we are also increasing because that also boosts SDGs. If you are implementing certain policy measures at the local level so that you

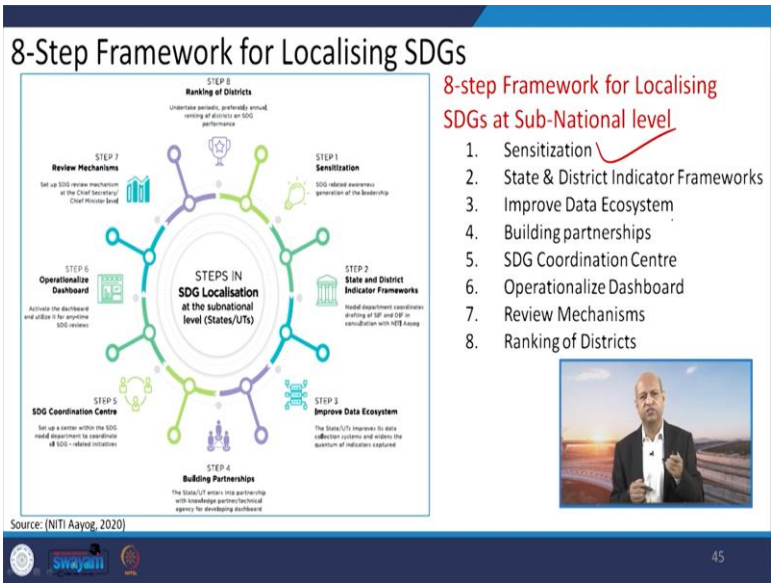
do not need to have this need of the movement or mobility for several kilometers if you can fulfill many of your materialistic demands at the local level that is a good. Like Mahatma Gandhi said that we should have this Gram Swaraj those kind of things. So, if you can have that that kind of economy that benefits the environment as well as the society also.

(Refer Slide Time: 37:44)



So, these are the localized SDGs the sustainable development goals are listed here which can be and through nodal institutions like district level or panchayat level kind of activities may be there and they may be responsible.

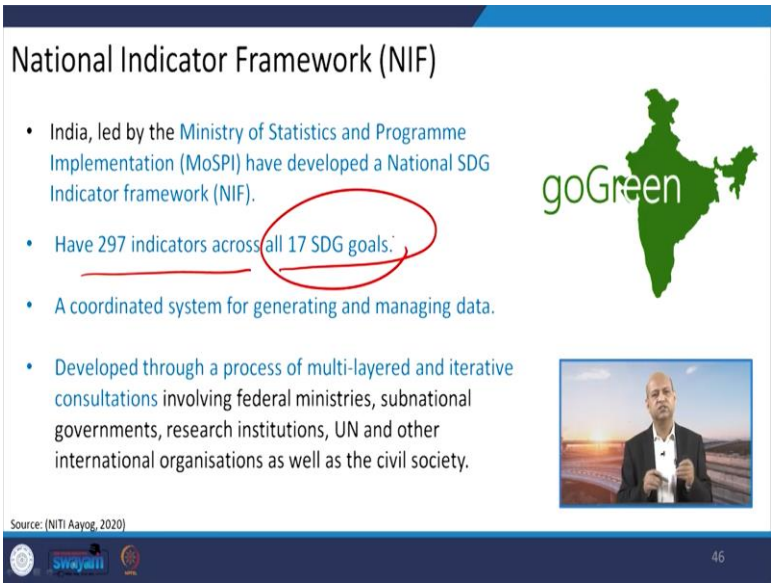
(Refer Slide Time: 38:14)



Then this 8 step framework for localizing as SDGs, so the sensitization is important then state and district indicator framework must be implemented so that we know whether progress is being made or not. We have to improve this data ecosystem so that nothing is imagination or nothing is hypothesis ok assumption like that. We should be focused on data based kind of ecosystem.

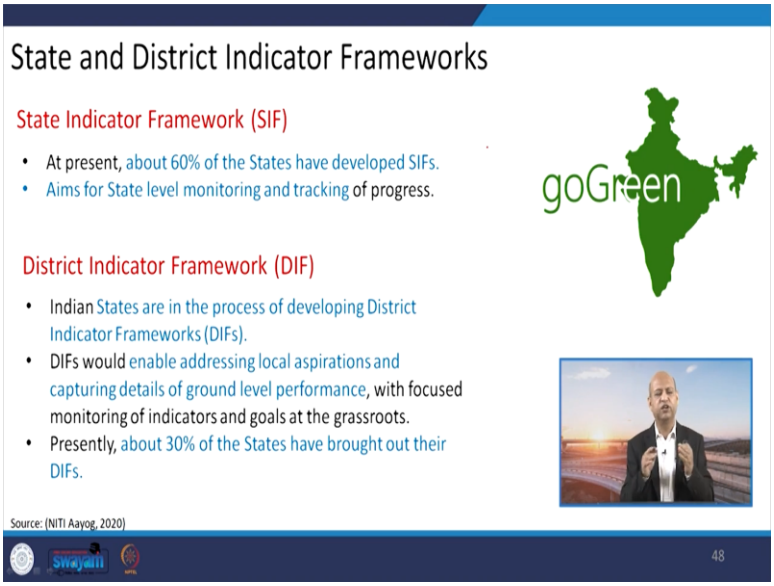
Then building partnerships at several levels whether local regional and then this coordinator center must be there who is responsible for SDGs those activities. And operationalize this dashboard so that information is available to everybody and review mechanism must be there ranking of districts according to the SDG. So, that if some district is achieving better goals then they should be recognized so that healthy competition may be there.

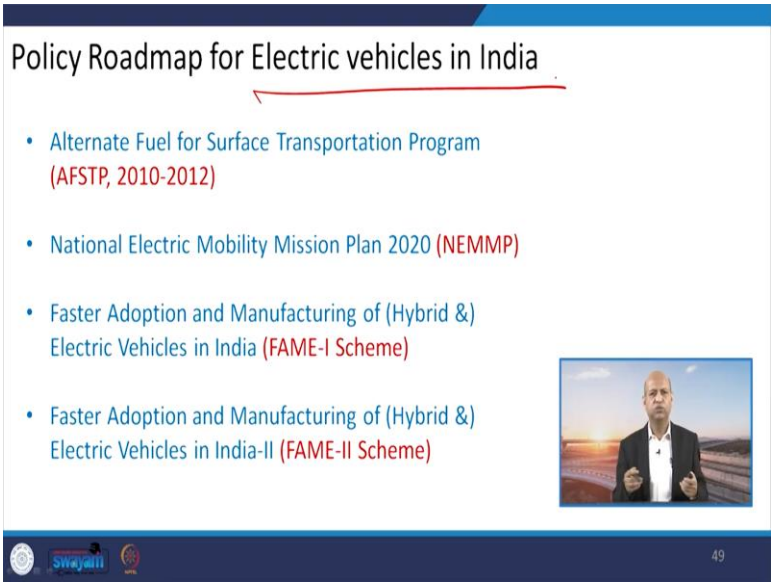
(Refer Slide Time: 39:09)



If you talk about national indicator framework, then also there are 297 indicators across these 17 SDGs. So, those indicators help us to know that we are moving towards achieving as disease or not.

(Refer Slide Time: 39:23)



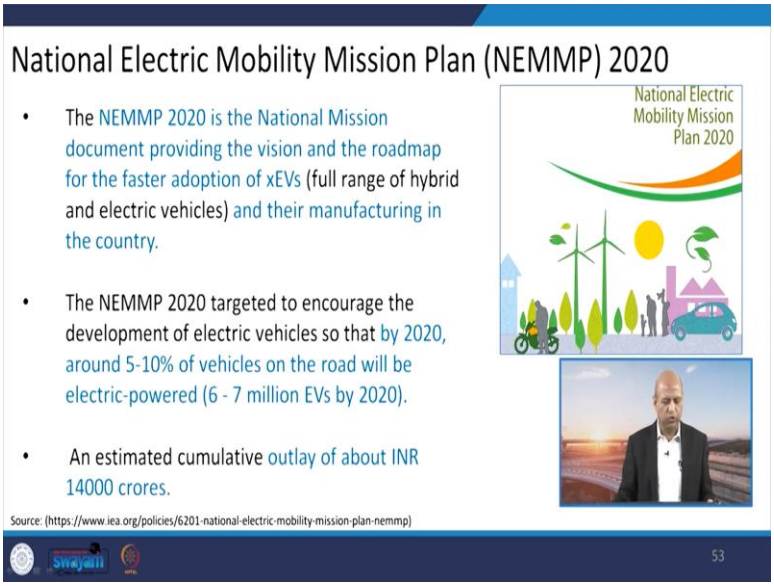


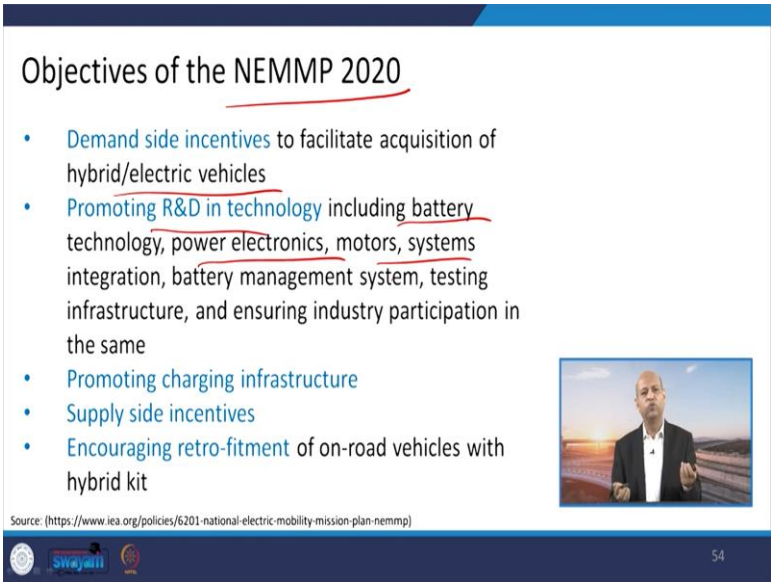
NITI Aayog developed these SDG India index in 2018 and there are many majors which have been taken place through NITI Aayog and through several institutions of the government which are helping us to achieve SDGs. At the state level district level all those indicator framework have been properly implemented. So, that way it is a very systematic approach from top to the low the end you can say district level or block level kind of activities are going on to achieve the disease so we are very much committed in that sense.

Policy road maps of electric vehicles are also coming in a big way and alternate fuels as we have seen in other presentations also that we are going towards this E-vehicles or electric vehicles or battery based vehicles. So, that will gives a big boost in reducing pollution as

well as reduction of greenhouse gases. So, you can see these are the alternate fuel which we have already discussed in another presentation so I will just skip them and you can see all these slides we have already discussed in that presentation you can go through them again.

(Refer Slide Time: 40:40)



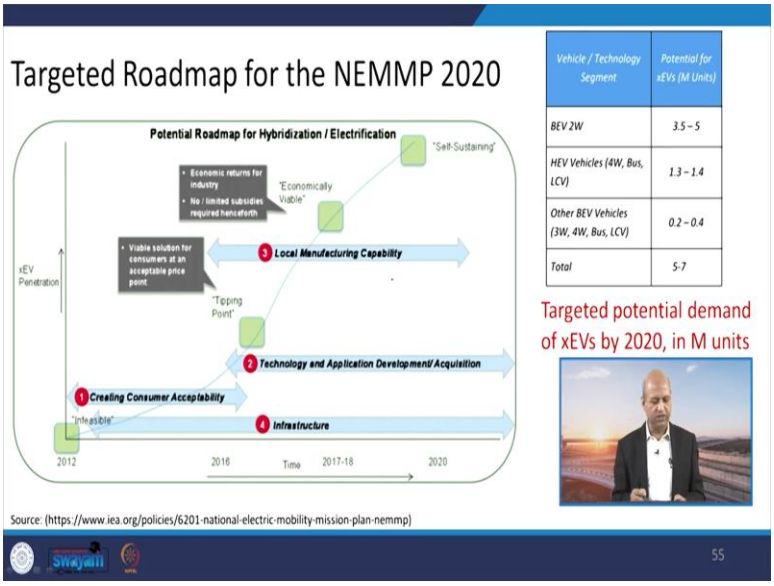


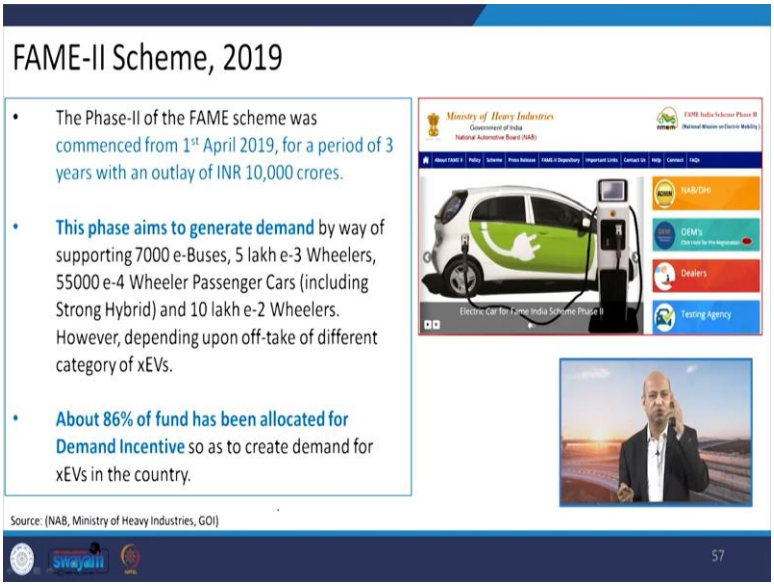
So, the national electric mobility mission plan have been there ok so that is giving complete focus and tremendous force towards moving from fossil fuel based transportation system to electric or battery based transportation system. So, this even on fifteenth august if you remember our prime minister has announced that we are committed towards hydrogen cell and hydrogen fuel hydrogen economy kind of thing. So, that will give us this great in

motivation and inspiration to move towards the renewable resources based our transportation system.

So, the objectives of this NEMMP 2020 is like having hybrid and electric vehicles promoting R and D in that sense for battery technology like Athma Nirbhar, self-reliant kind of technology can be there in battery. Power electronics motor systems integrations all those promoting charging infrastructure so that you do not feel scared that your battery will be discharged how will you move. So, as we have petrol pumps so we can have those charging infrastructure in places that you can move comfortably from one place to another.

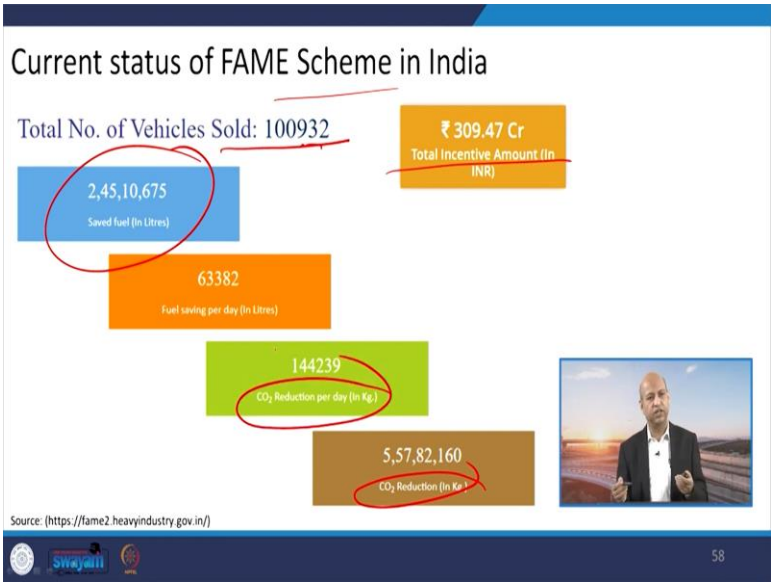
(Refer Slide Time: 41:52)





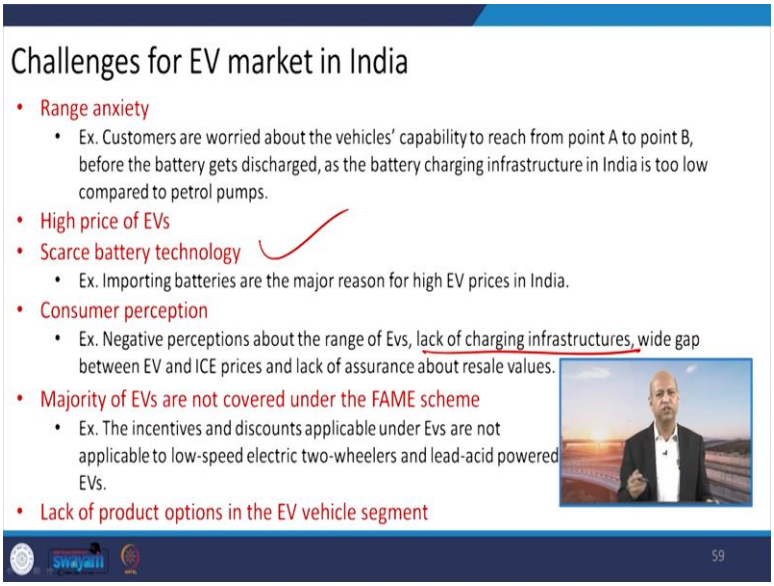
So, these are the targeted roadmap for NEMMP you can see which is very ambitious but we will achieve in that sense. Then this faster adoption and manufacturing hybrid and electric vehicles are in the priority top priority policies of the government of India. So, that way we are moving very fast in that direction and you will see that in few years we will have many battery operated electric or hybrid vehicles. Already IIT Roorkee has two cars of this battery operated if you want to those students who are studying in IIT Roorkee they can easily see and use those cars.

(Refer Slide Time: 42:37)



If you talk about current status of FAME scheme then you can see like more than 1 lakh vehicles have been already sold and there are other figures which like CO2 reduction in kg this much amount and per day this much amount of CO2 reduction is being achieved by those kind of initiatives.

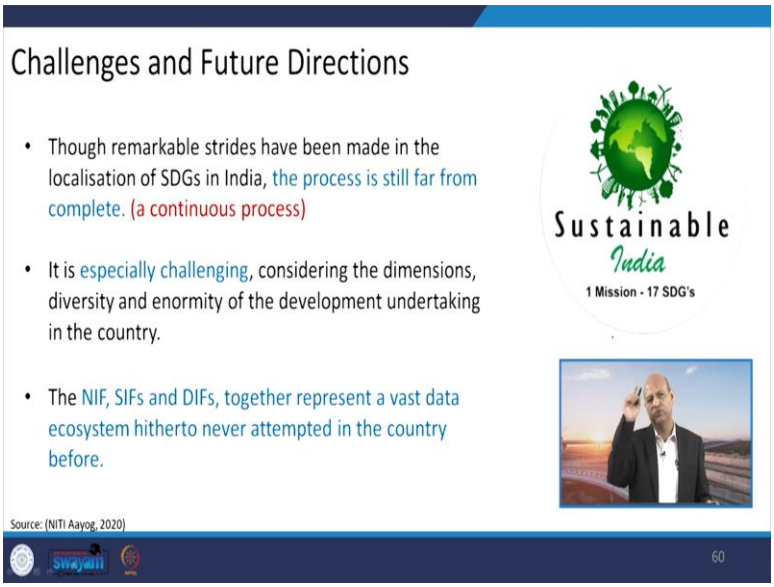
(Refer Slide Time: 42:52)



Well, there are challenges because like range anxiety as I said people may feel if my battery exhausts in midway then what will happen. So, infrastructure is needed and that way government and public private partnership related infrastructure development are going on. High prices of EVs so subsidies may be given to reduce the price of the electric vehicles then the technology of battery has to be indigenous otherwise it may problem.

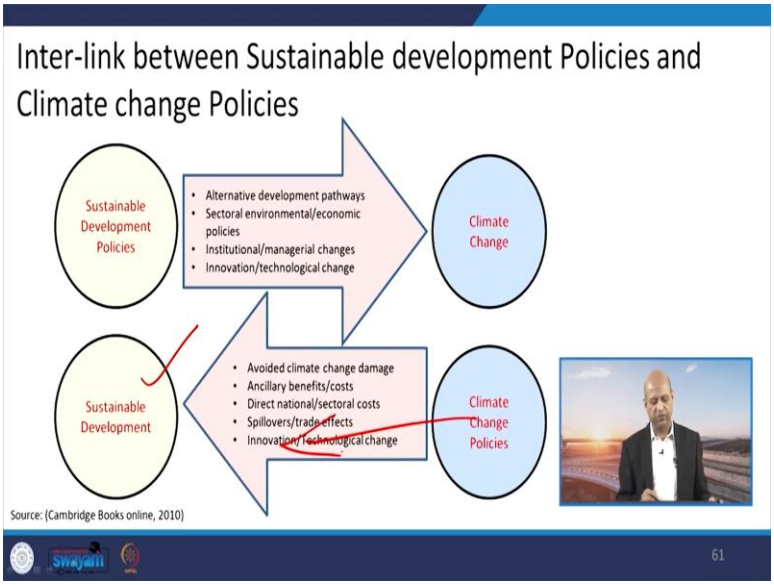
Consumer perception those that has to be converted from negative to positive because of this lacking of charging infrastructure. Once this charging infrastructure takes place people will be very confident to take vehicle several hundred kilometers also.

(Refer Slide Time: 43:42)



So, these are the things which are challenges in Indian context and then but if we go for this like NITI Aayog related systematic approach from national level to district and block level kind of indicators and different institutional setup to achieve those goals then it can be easily achieved.

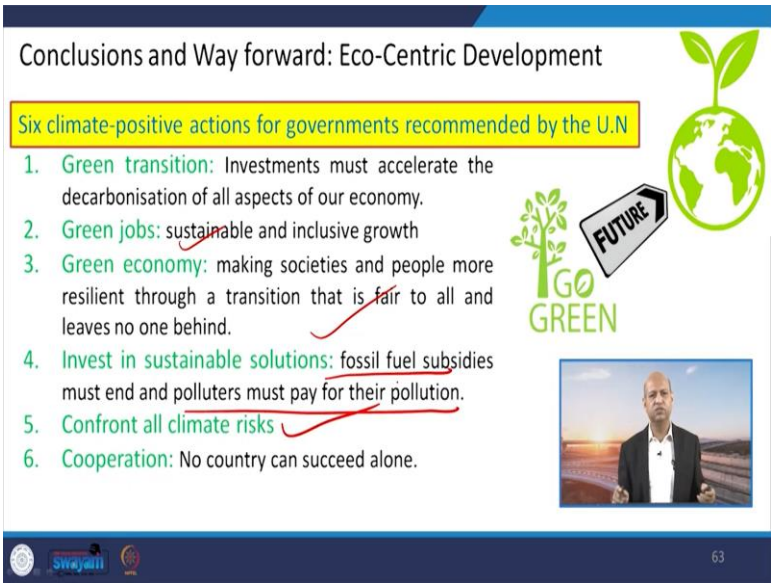
(Refer Slide Time: 44:00)



And these are like interlinking of different policies and climate change related issues so we can have sustainable development and the climate change related policies can lead us to the sustainable development and sustainable development policies can lead us to better climate change related policies so these are interrelated basically.

The common mitigation approach can be there which can identify certain barriers how to like cost related implementation challenges may be there. So, how to overcome those barriers so if we can identify those barriers and opportunities it is easy to address them.

(Refer Slide Time: 44:40)

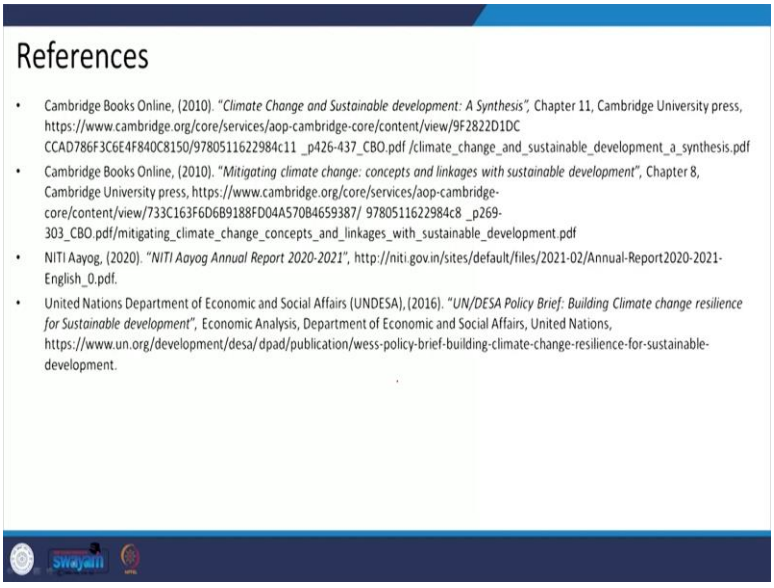


Well, if we talk about conclusions and the way forward then it is the basic Eco centric development which we should focus and move towards. So, the green transition greens of sustainable and inclusive growth investment in sustainable solutions related like subsidies towards electric vehicles. Then subsidies to fossil fuel must end only then people will be more comfortably transiting from fossil fuel to these renewable resources.

So, whatever is harming the environment we should not give them such subsidy very simple thing. Polluters must pay their pollution that is the policy which we should stick to confront all climate related risk and we should cooperate with the at the country level at international level so that we can collectively achieve this sustainable development goals related issues.

And this is all for today's presentation so that these initiatives and policies will give you a good picture that how to move towards sustainable development and sustainable transportation as we have seen.

(Refer Slide Time: 45:50)



These are the references for additional information so thank you for your kind attention see you again thanks.