Air Pollution and Control
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Lecture 51
International Environmental Treaties to Reduce Air Pollution and GHG Emissions

Hello, friends. As you know this air pollution is no more a local problem, it has crossed boundaries of even nations also. So, it is a global issue and at the national level, each country has certain air quality standards or programs, acts, policies, which can tackle air pollution related issues. So, in the same way, at the international level, there have been several treaties or agreements and policy frameworks, which have been ratified by most of the countries to deal with the pollution problem, which is global in nature.

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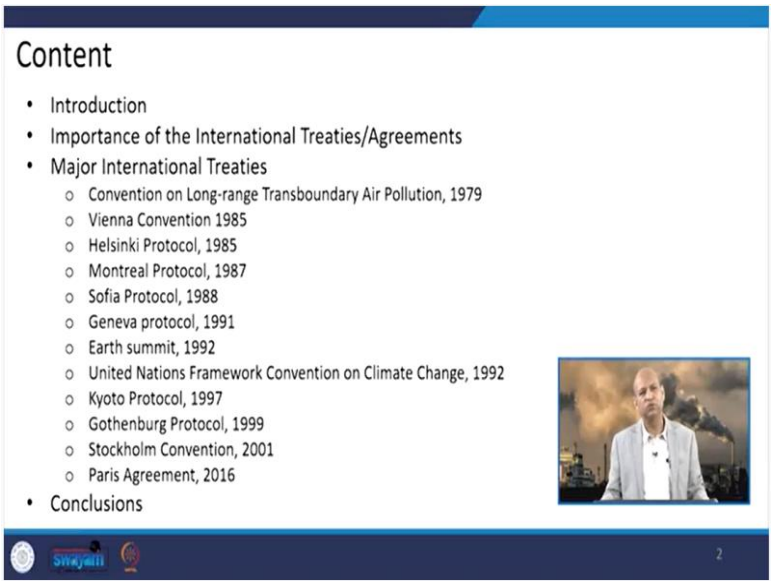

So, this is the content of today's lecture. Basically, we will look into what is the importance of global level treaties or agreements and which are the international treaties means major, there are several, the list can go in several pages, but, we will discuss only major international treaties or agreements like Convention on Long-Range Transboundary Air Pollution which was signed in 1979, then Vienna Convention of 1985.

After that, this Helsinki Protocol, which was signed in 1985, again, and Montreal Protocol of 1987, Sofia Protocol of 1988, Geneva Protocol of 1991, Earth Summit, which was held in 1992 and United Nations Framework Convention on Climate Change, which was offshoot of Earth summit, so in 1992 itself, this UNFCC was established, Kyoto Protocol of 1997, then Gothenburg Protocol of 1999, Stockholm Convention of 2001.

And latest this Paris Agreement of 2016 to deal with climate change related issues. So, all these major treaties, we will discuss one by one, and we will also see their constructive effects, means, what positive effects were as a result of these conventions or treaties.

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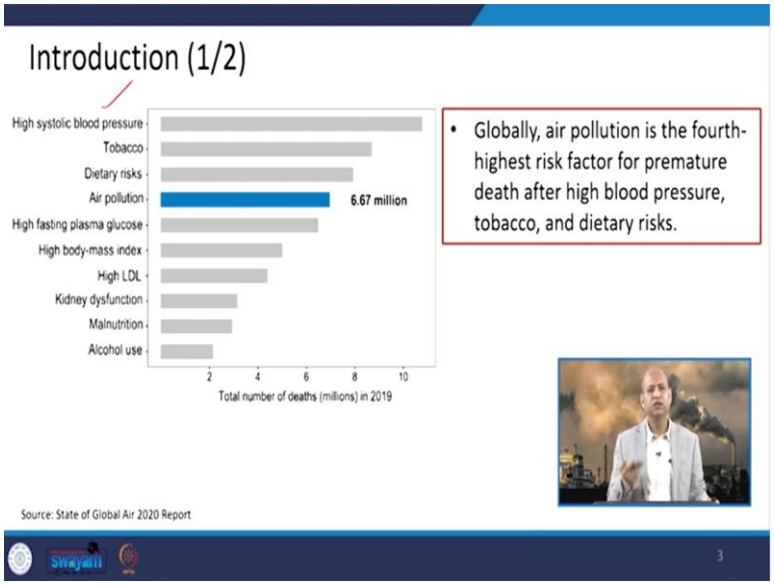

So, if you set the problem as an introductory remark basically at the global level air pollution is estimated as the fourth highest risk factor for premature death after this high blood pressure or tobacco or dietary related risks.

So, this is the fourth highest risk factor for the premature deaths basically, so that way it is very important aspect to deal and to look into, so that we can reduce the air pollution levels and that way we will reduce the premature mortality or we will increase the longevity of the people, indirectly.

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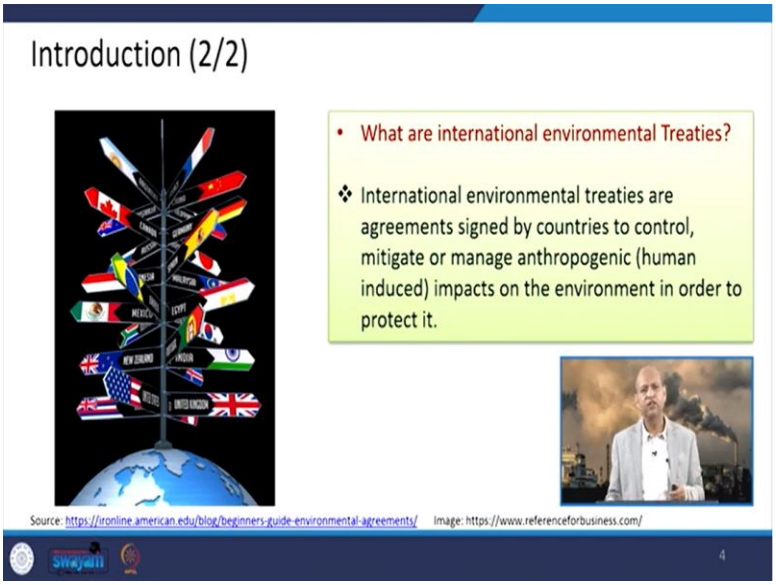

What are the international environmental treaties? Basically, these treaties or agreements or conventions or protocols are signed by a number of countries to control or mitigate or manage anthropogenic emissions of air pollution as well as greenhouse gas emissions, so that we can protect the environment and that way, we can also protect the human health.

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Well, so, the importance of international treaties or agreements can be seen in terms of these activities which have been over the years in the form of industrialization, urbanization and which has resulted in several global level issues or problems of environment like climate change, ozone depletion, acid rain, or global warming, deforestation, all these issues which are of regional and continental and global scale, basically.

So, to deal with those issues, it is not possible that only one country can make efforts and address those issues. No, we have to do collective efforts at the international level. So, we have to come on the same table, we have to discuss, we have to compromise, we have to collaborate only then these things can be tackled. So, for that these international treaties are required. And that is why it is very important that we should look into these treaties and their effects.

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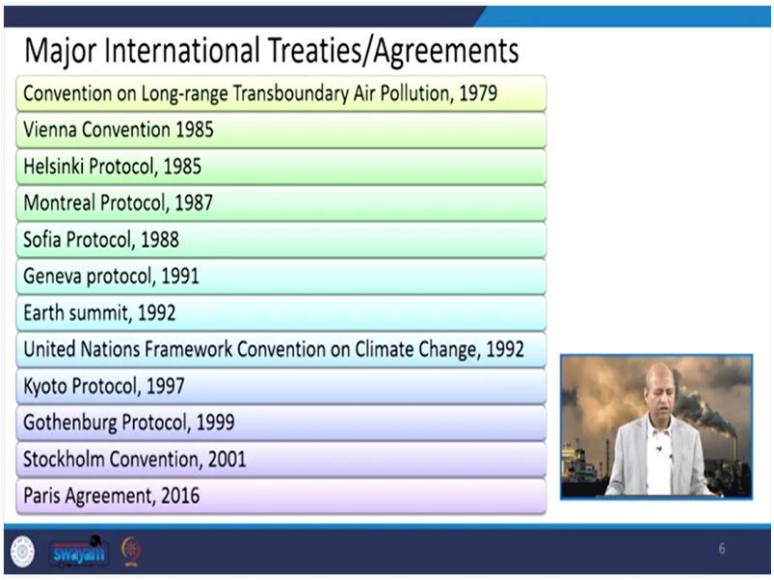

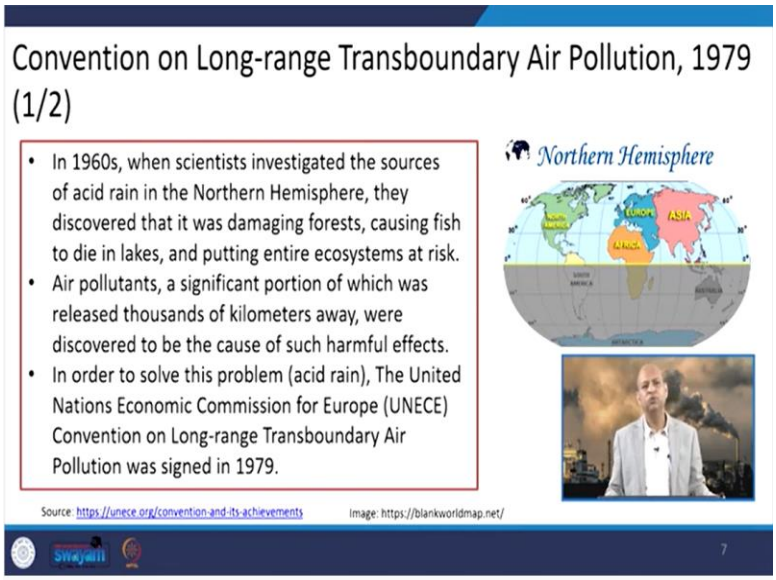

Then if we talk about these major international treaties, one by one. So, the first one is Convention on Long-Range Transboundary Air Pollution, which was signed in 1979. Basically, the background of this convention was that in 1960s, when it was found that the northern hemisphere emissions from coal based thermal power plants etc like sulphur dioxide, so they were damaging forest and harming the water bodies in the downwind direction.

So, several countries suffered from this particular kind of pollution, transboundary transportation of the pollution. And then so several European countries and United States and Canada, they brought into this convention and they agreed that we should control those particular emissions.

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So, basically 32 countries signed this particular convention and it came into force in 1983 after 4 years. This was the first international treaty to deal with air pollution on a broad regional basis, if you want to look into in that frame work, basically.

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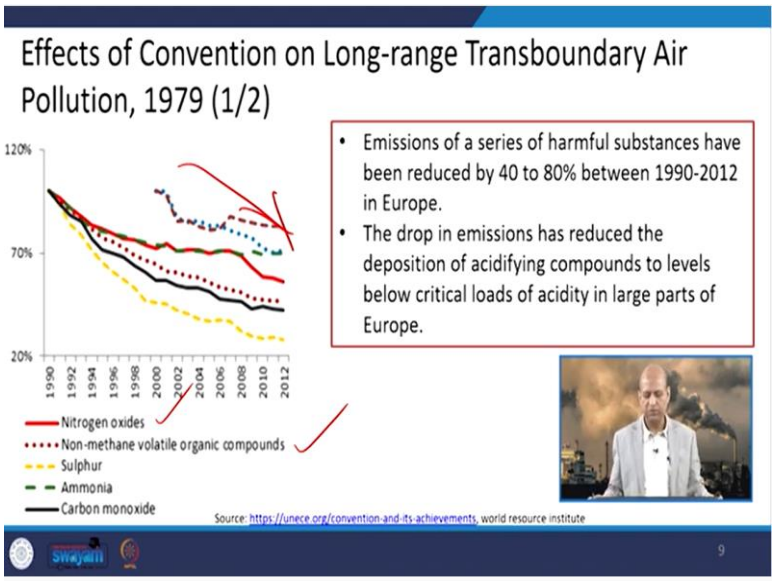

So, the effect of this convention was quite encouraging. These trends like 40 to 80 percent reduction or in the emissions of these harmful substances, like NOx or non-methane volatile

organic compounds, VOCs, sulphur related or ammonia related, carbon monoxide related emissions, they are showing this decreasing trend and that decreasing trend is because of this convention, because, then they put into place several policies and technological interventions to reduce these emissions. So, dropping those emissions were the result of this particular convention.

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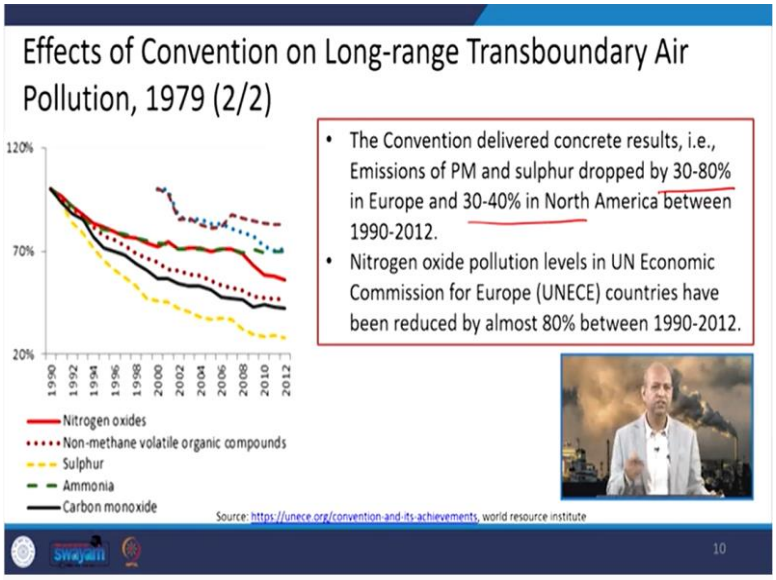

And not only these emissions of other gaseous components, but also particulate matter and sulphur it decreased around 30 to 80 percent in Europe and 30 to 40 percent in Northern America between 1990 to 2012. So, this convention gave very fruitful results.

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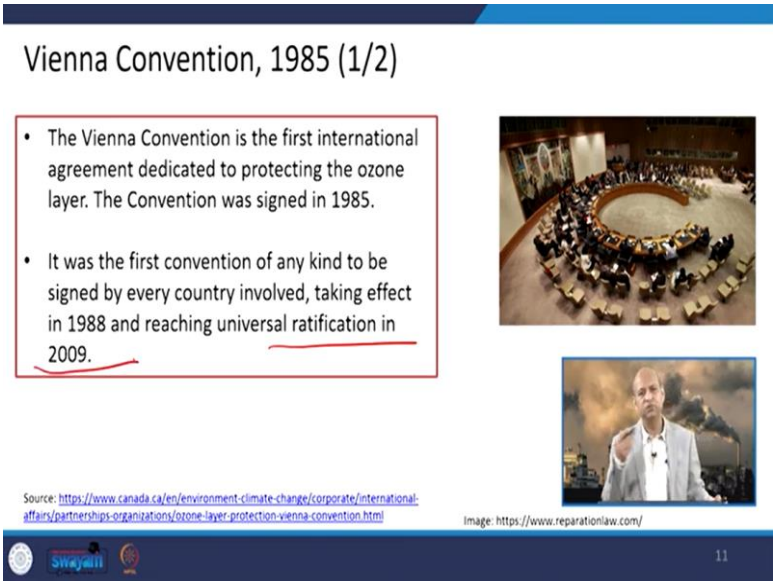

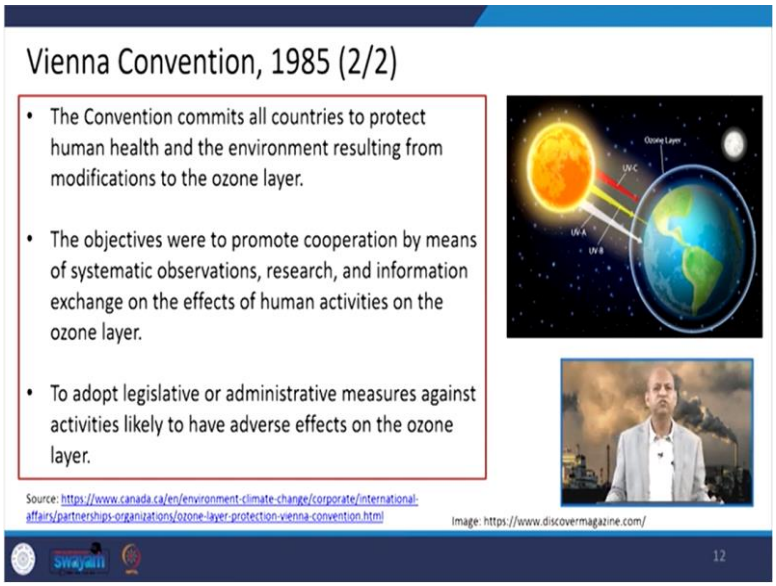

Next is Vienna Convention of 1985. And this, it was the convention which was signed by every country taking into effect in 1988. And this ratification was done in 2009, universal ratification means, all countries agreed to follow this Vienna Convention.

And the commitment was there to do, to make efforts, so that this ozone layer related issues can be tackled properly. So, some observations were made and these corporations were initiated and the legislative and administrative measures were also taken into account, so that the activities which were, having adverse effect on the ozone layer, which could be curtailed.

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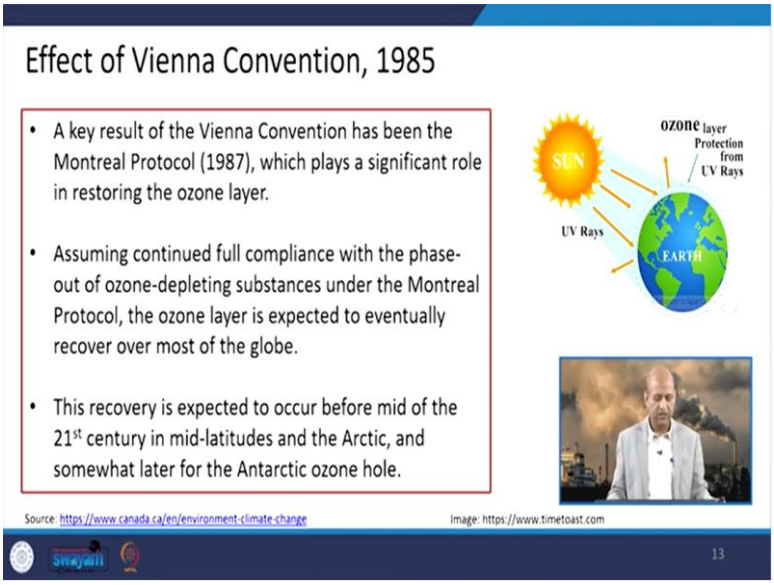

So, effect of this Vienna Convention was in the form like Montreal Protocol in 1987 was signed. So, that was the real action, and that was the offshoot of this particular Vienna Convention. So, that is a very, encouraging and inspiring protocol, because after that ozone layer related problem was properly addressed and it was found that up to mid-21st century, this ozone hole related problem can be addressed properly, completely.

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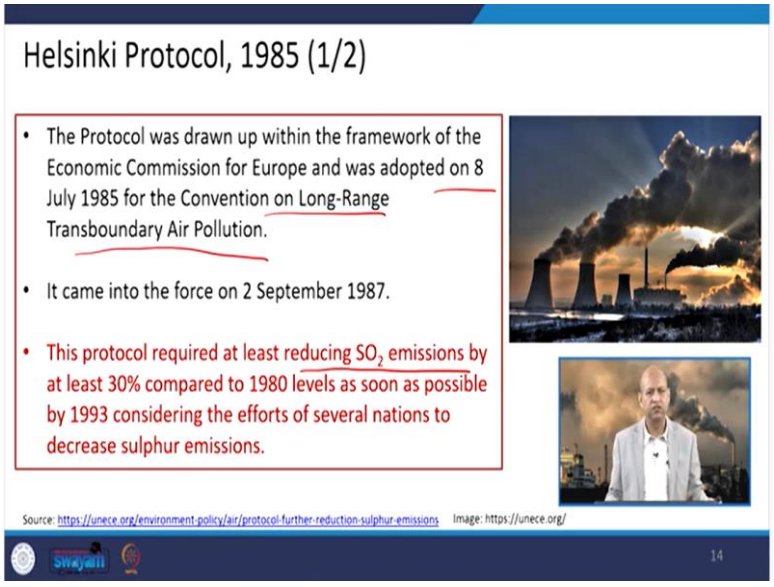

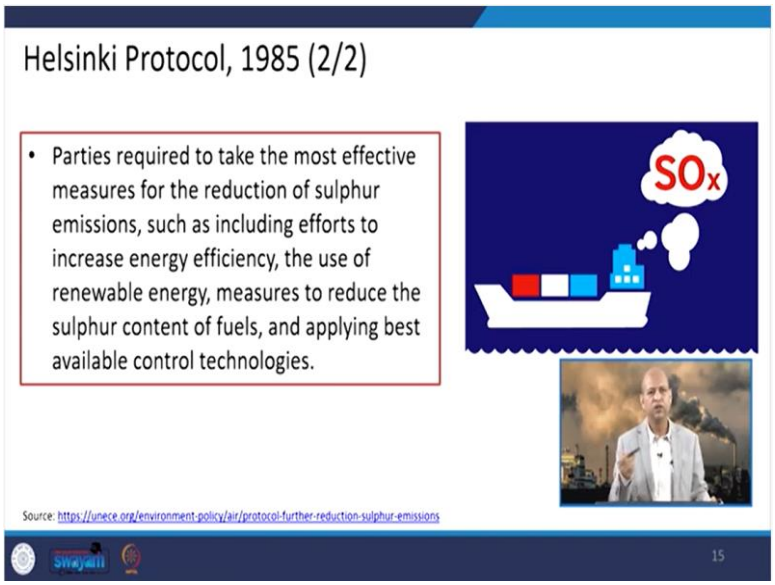

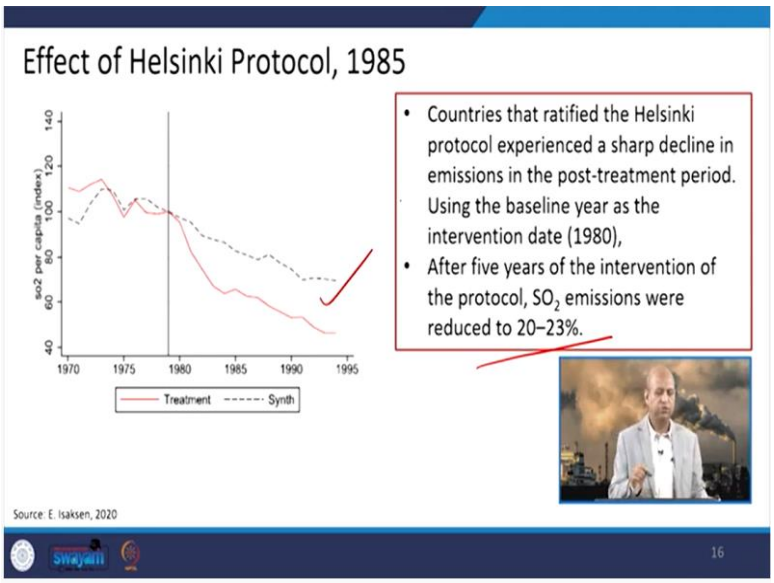

So, then this in 1985, this Helsinki protocol was also signed, and this was the framework within the European this Economic Commission, and on 8 July 1985, this Convention on the Long-Range Transboundary Air Pollution, which was initiated in 1979. So, they had meetings periodically. So, in this 1985, this particular protocol was signed, and they included the reduction SO_2 emissions basically, by at least 30 percent in comparison to 1980 levels. And as soon as possible like by 1993, it was estimated that this target could be achieved.

So, the parties which were into this protocol, they were required to take most effective measures to reduce sulphur emissions, like to go with better quality of coal and other technologies. So, that efficient burning of coal can be achieved to reduce the sulphur emissions and like scrubbers, the usage of different technologies, so that it does not go into the atmosphere.

So, those technologies plus shifting from fossil fuel-based energy to renewable energy, those measures were also adopted. And a very visible effect is there around 20 to 30 percent emission reduction of SO_2 within the 5 years was achieved.

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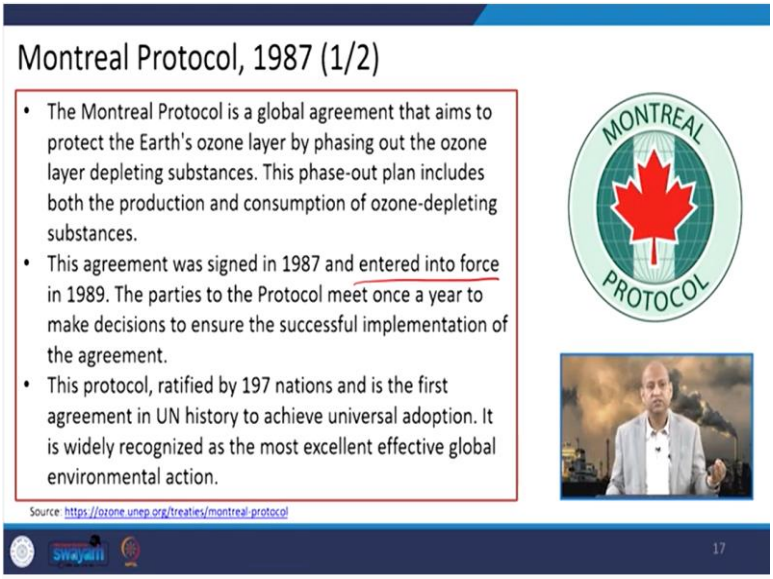

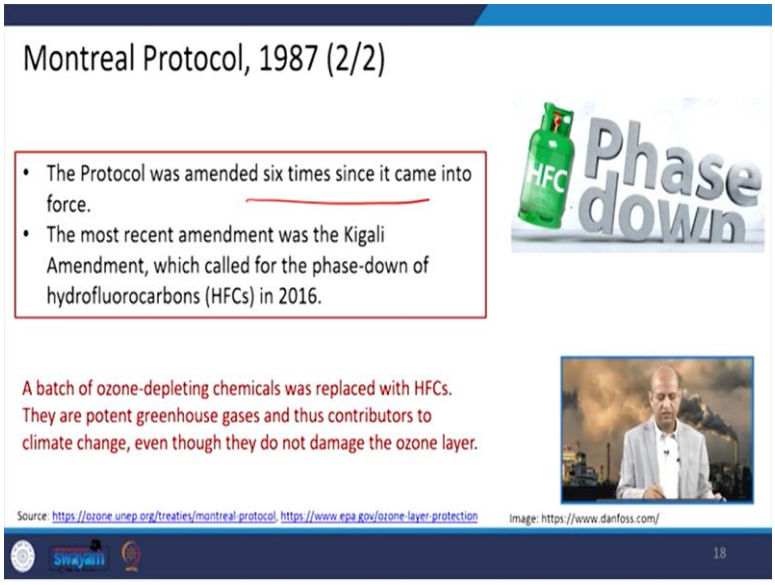

Well, then, this Montreal Protocol, which is very, very important protocol in terms of addressing the ozone hole related issue, ozone layer related issue. So, it was signed in 1987, and it was entered into force in 1989. And it was, this is the protocol which was ratified by 197 nations and this is the first agreement in the United Nations history to achieve this universal adoption that because the problem of ozone hole was such a grave problem, it was the problem of humanity, like climate change.

So, it is widely recognized as the most excellent effective global environmental action, which has been success story. So, this protocol was later amended, because many new things were found by scientific investigation. So, different pollutants or though emissions were taken into account to reduce and those like, these HFCs, earlier other chemicals were there like CFCs etc, but as HFCs were also considered to phase down, means to reduce their emissions basically, because they are also climate change related greenhouse gas effect they cause.

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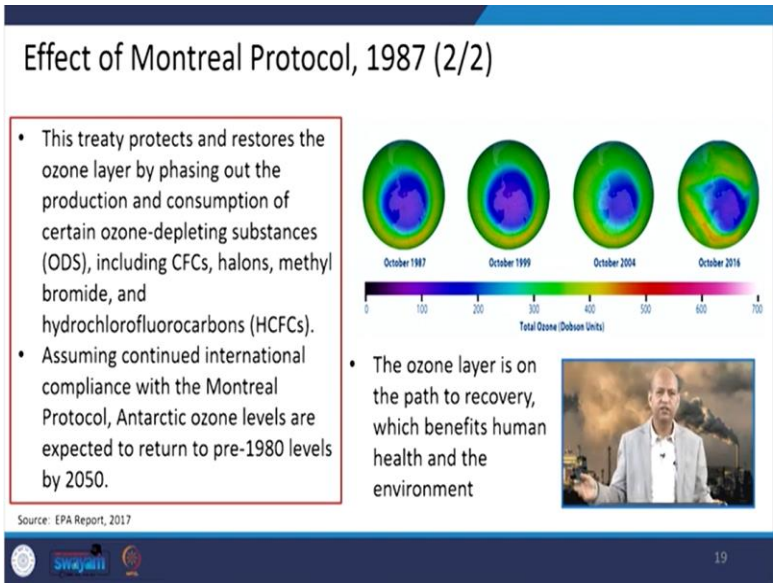

Then the effect of Montreal Protocol has been quite visible and it is estimated that by 2050, we can get rid of this ozone hole or we can get back that ozone layer which was originally there to protect us from ultraviolet rays.

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Sofia Protocol, 1988 (1/2)

- The Protocol was drawn up within the Economic Commission for Europe framework and was adopted on 31 October 1988 for the Convention on Long-Range Transboundary Air Pollution.
- It came entered into force on 14 February 1991.

Source: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-1-c&chapter=27&clang=_en

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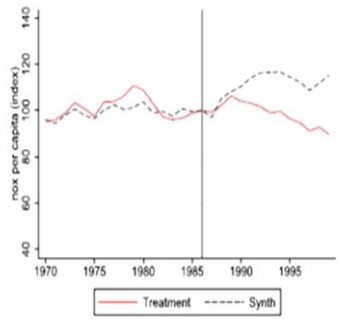
Sofia Protocol, 1988 (2/2)

- According to this protocol, nitrogen oxide emissions or transboundary fluxes must be controlled.
- Parties requested to introduce pollution control measures for the significant existing stationary sources and apply national emissions standards to primary new stationary and mobile sources, based on the best available economically feasible technologies.

Source: https://unece.org/environment-policy/air/protocol-concerning-control-emissions-nitrogen-oxides, (P Bhave & Kulkarni, 2015)

Image: www.shutterstock.com/

Sofia Protocol, 1988 (2/2)



- The general reference year was 1987.
- Five years after the intervention, NO_x emissions were around 11% lower, while this difference was 17–18% ten years after the intervention.

Source: E. Isaksen, 2020

Then Sofia Protocol in 1988, so this was drawn in 1988 and again during this Convention on Long-Range Transboundary Air and it came into force in 1991 basically, within the framework of economic emissions for Europe, this was taken into account.

And this is especially focused on nitrogen oxide emissions, they are transboundary, flux transboundary, movement, because these NO_x emissions are also again responsible for several problems related to acid rain or even like acidification of lakes etc.

So, all these stationary sources or mobile sources, wherever these NO_x emissions were their technologies were suggested to reduce these emissions. And the general reference here was 1987. And after 5 years, it was targeted to lower the emissions of NO_x by 11 percent and within 10 years, this reduction was around 17 to 18 percent.

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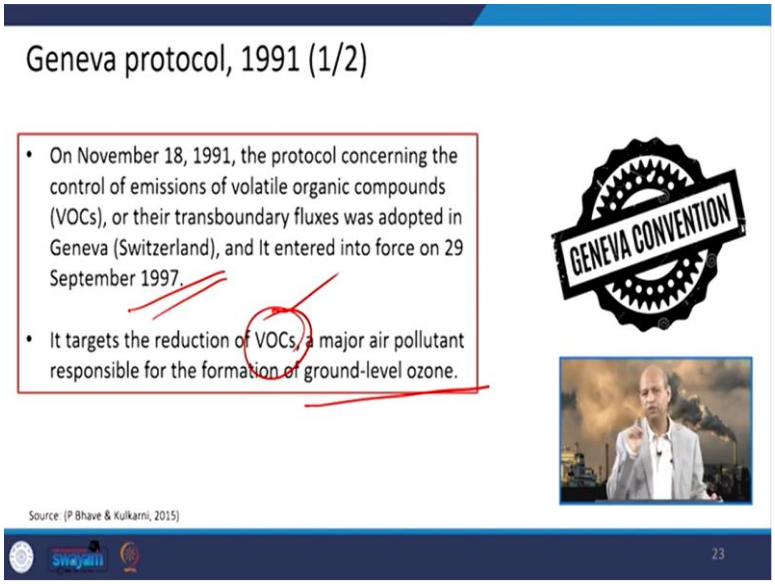

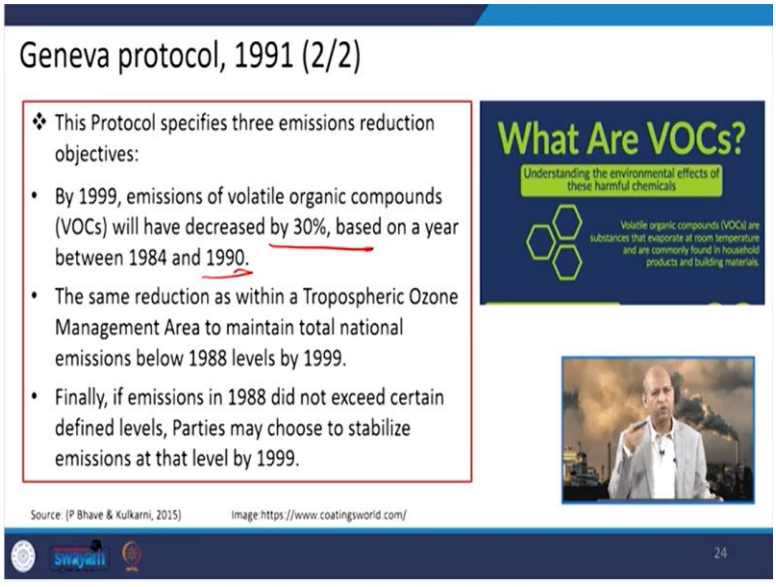

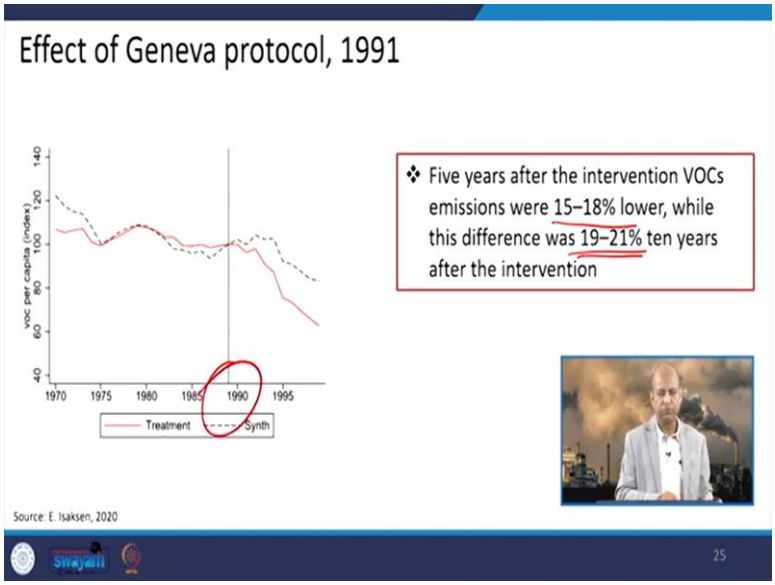

Then we came to Geneva Protocol of 1991. So, this was related to the reduction or control of emissions of Volatile Organic Compounds, VOCs, they also have this tendency of transboundary fluxes or like movement across the nation.

So, in 1997, this was, signed in Geneva and major air pollutants, responsible for formation of ground level ozone is VOCs, in addition to like other hydrocarbons or CO etc, even NOx is also a precursor of the, this ground level ozone or troposphere ozone, tropospheric ozone. We want ozone in stratosphere, but we do not want ozone in troposphere as you know, because in troposphere, it is toxic, it is also greenhouse gas.

Well, so, this particular protocol gave several initiatives to reduce emissions of volatile organic compounds like around 30 percent in comparison to 1984. So, between 1984 to 1990, 30 percent reduction was achieved because of this particular protocol.

So, that way, these protocols have been really implemented, and real reductions in those emissions have been achieved. So, 15 to 18 percent was initial five years reduction, and 19 to 21 percent it was within the next 10 years reduction in comparison to 1990 or so.

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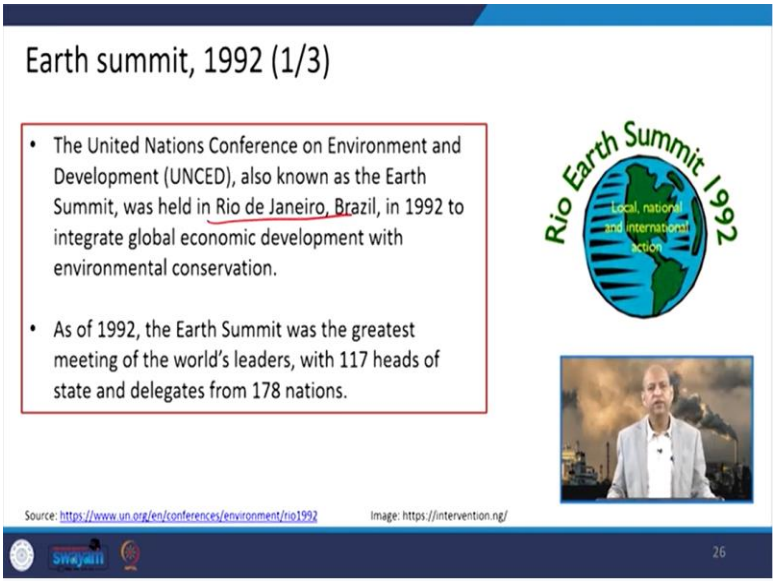

Then this Earth Summit, the United Nations Conference on Environment and Development, UNCED which is highly popular, because they set the agenda at the global level with a big force, because 117 countries, heads means Prime Ministers, Presidents, they attended this conference in, Brazil, in Rio de Janeiro. And 178 nations participated, they are representatives in terms of NGOs or other institutions, which are very much concerned about environment and development issues.

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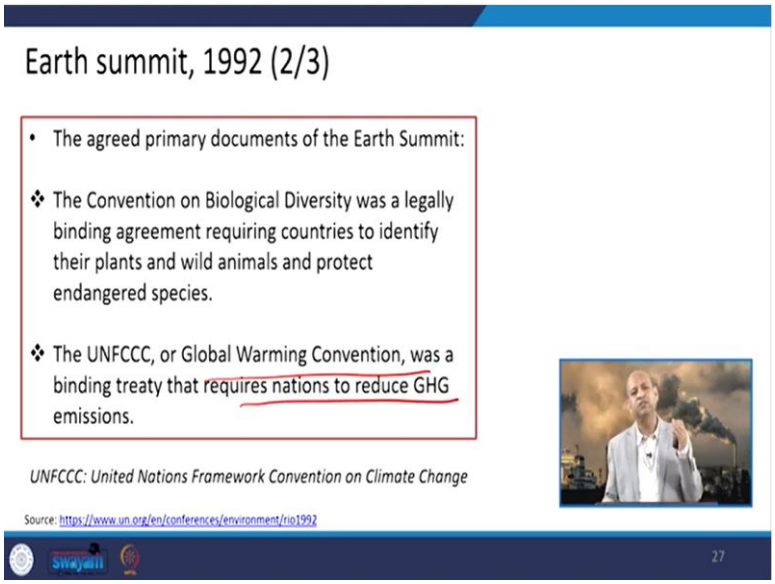

So, the primary agreement on during this Earth Summit was like several new initiatives were made. For example, Convention on Biological Diversity. This was legally this was established

as a legally binding agreement so, that the endangered species can be protected. Each country has to make efforts very focused efforts or very intensive efforts in that direction.

Then global warming convention, UNFCCC, United Nations Framework for Climate Change. So, this was also established to legally binding the countries to reduce GHG emissions so, that climate change related issues can be tackled.

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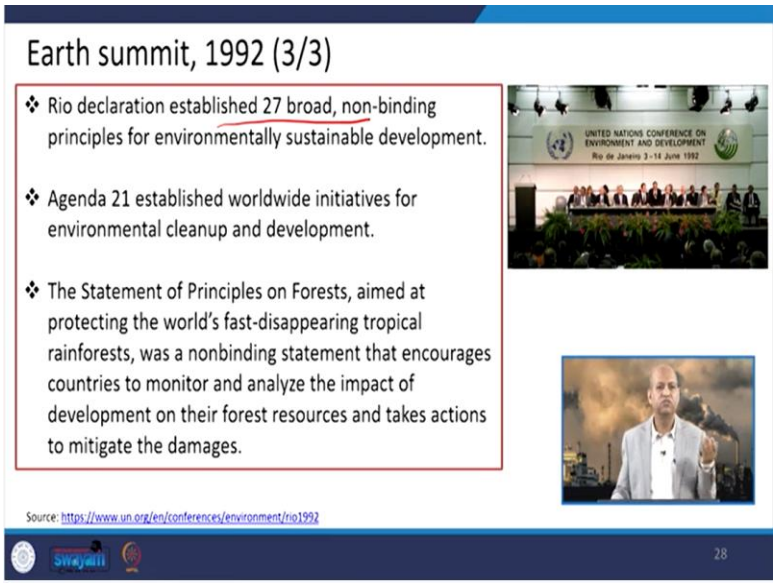

Then this Rio declaration has published 27 broad and non-binding principles like guidelines for environmentally sustainable development. And Agenda 21 was also established worldwide initiatives for environmental cleanup and development. So, it was a huge success in that way. The Statement of Principles on Forest aimed at protecting the world's fast disappearing tropical rainforest was a non-binding statement in that, so, that means, even if it is not binding, but the importance was established in that way.

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UNFCCC, 1992 (1/3)

- In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), at the United Nations Conference on Environment and Development (Earth Summit) to address the problem of climate change.
- The UNFCCC entered into force on March 21, 1994, ratified by 197 countries.

United Nations Framework Convention on Climate Change

Source: KF Kuh, 2018

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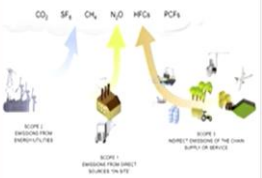
UNFCCC, 1992 (2/3)

- The parties announced a goal of stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- Developed countries agreed to adopt national policies to mitigate climate change and return to their 1990 levels of anthropogenic emissions of GHGs.
- Developing countries were expected to contribute to climate mitigation because of their superior capacity to undertake mitigation and more significant contribution to the problem of climate change.



Source: KF Kuh, 2018

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UNFCCC, 1992 (3/3)

- The UNFCCC instituted a process for the countries to generate and share data about domestic GHG emissions.
- Under the UNFCCC, all parties were required to submit national GHG inventories, and developed countries must submit more detailed descriptions of mitigation policies and projections of the estimated impacts of these policies on GHG emissions.

Source: KF Kuh, 2018

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So, the UNFCC 1992 came into existence because of that 1992 Earth Summit. So, this international treaty was in several countries joined for UNFCC means all countries which participated, they joined and 197 countries ratified this in 1994 with respect to UNFCC.

So, that means, the greenhouse gas emissions inventories were brought into legal framework. So, each country was bound to submit their emission inventory to the UNFCC. So, that everyone, those who are researching in that or those who are related to policy framework, they can download emission inventories, they can compare, they can see what progress is there.

So, then, but there were some differential commitment also, differential means developed countries were made to go for higher reduction of anthropogenic emissions of greenhouse gases and developing countries were encouraged to take initiatives towards that great goal plus, these domestic GHG emissions, there was a process and several countries they generate and share data. So, this is a common framework, all parties are required to submit their national level GHG emission inventories.

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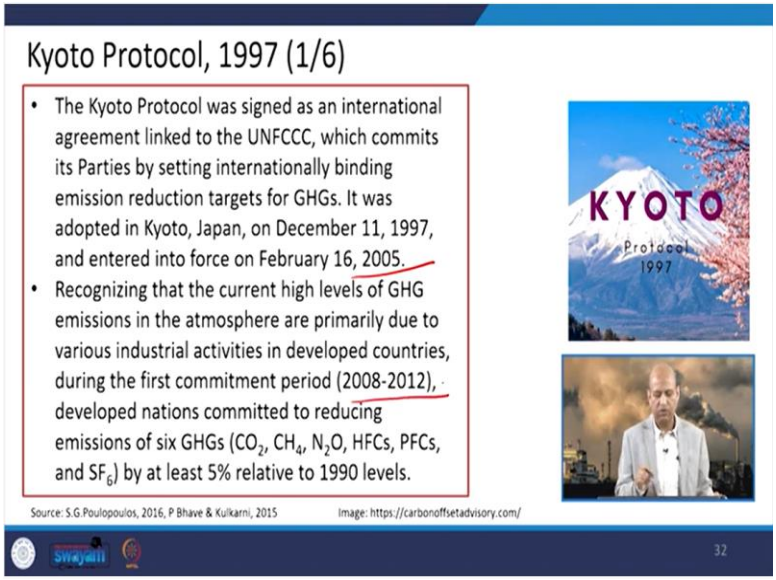

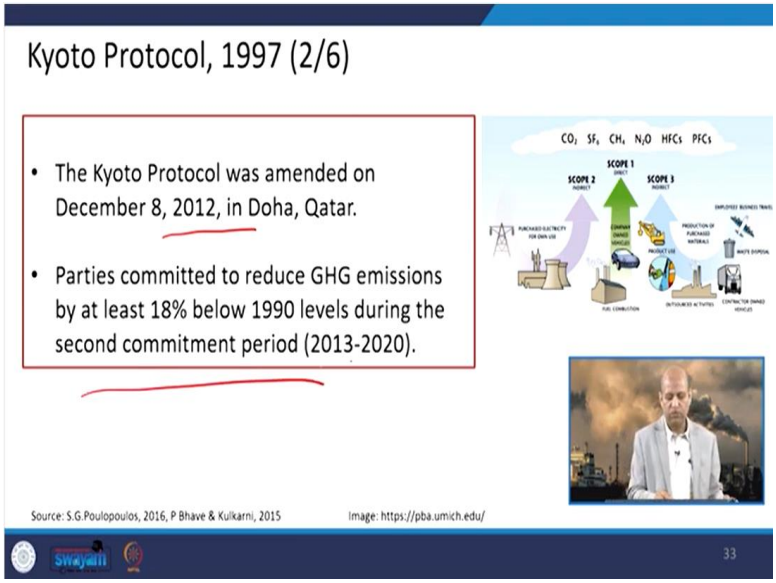

So, this Kyoto Protocol in 1997 was established or signed as a next step of UNFCC related efforts. So, the commitment was there and in 2005, it came into force, so, it was recognized that developed countries are emitting lot of greenhouse gas emissions and they are primarily responsible for these climate change related issues.

So, the six gases like CO_2, methane or nitrous oxide or HFCs, these gases were, it was written that 5 percent reduction in respect to, with respect to 1990 level will be achieved by the developed countries within the period of 2008 to 2012. And later on, this was given that maybe this is not so, good.

So, in 2012, when this Kyoto Protocol was amended in Doha, Qatar, so, the parties committed that we can go for reduction of GHG emissions for at least 18 percent below the 1990 levels, otherwise, we will not be able to catch up this speed of climate change, as a second commitment for the 2013 to 2020 period, this was established.

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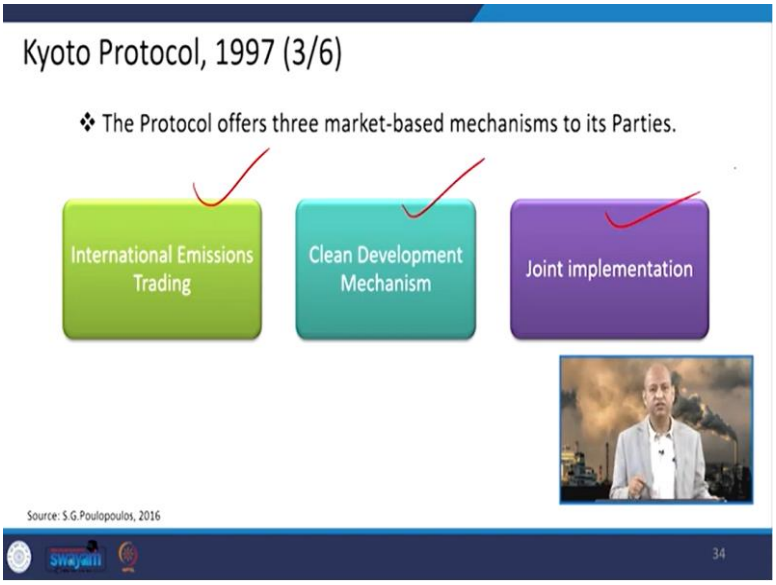

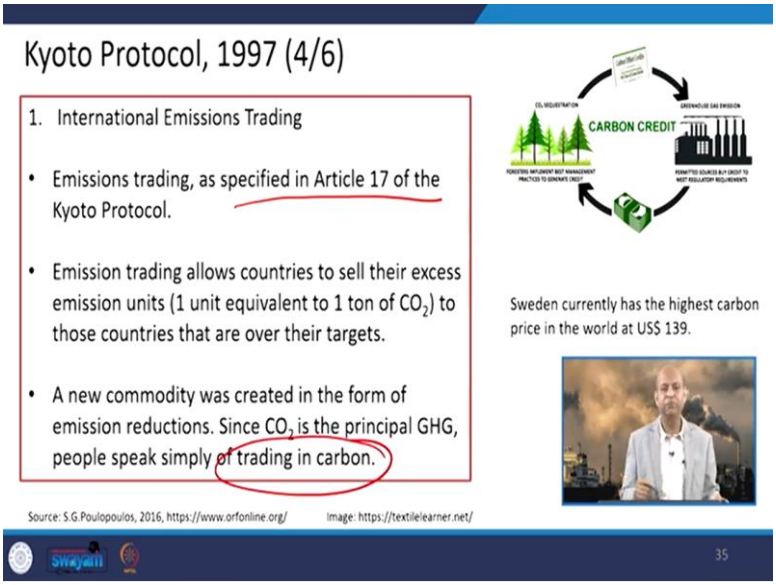

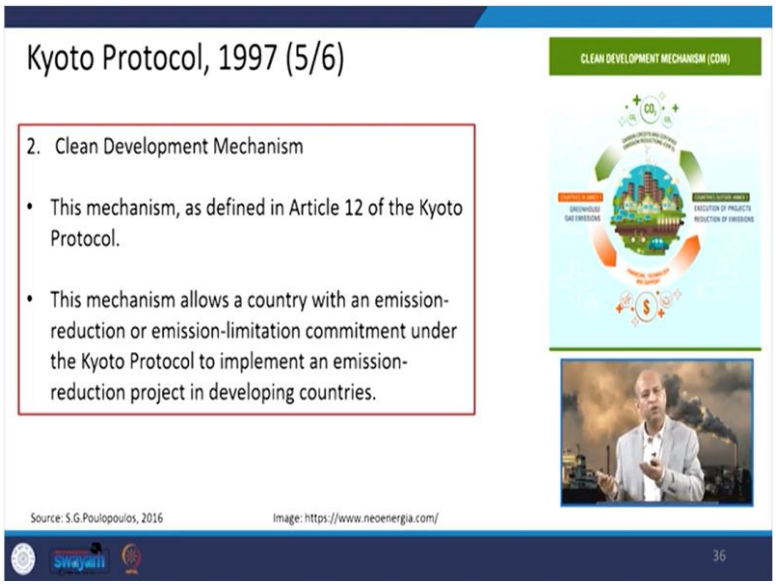

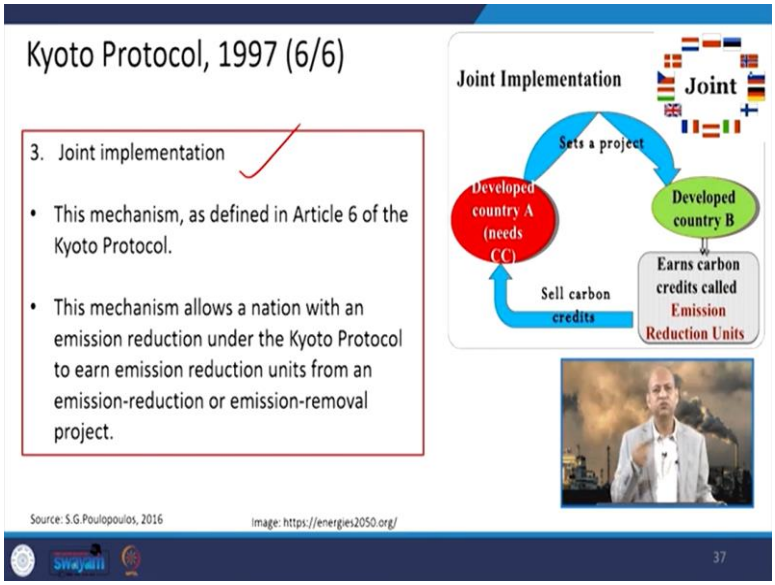

Then the application of the Kyoto Protocol was, can be seen in three market-based mechanism, that was the application oriented or ground level action plan, like international emissions trading, clean development mechanism, and joint implementation, these three initiatives were, taken into force with the help of Kyoto Protocol.

And they have been very successful, you will see just now, like international emissions trading, if we talk about so, this is part of Article 17 of the Kyoto Protocol. And this emission trading allows countries to sell their excess emission units, like 1 unit equivalent to 1 ton of CO_2 to those countries that are over their target. So that kind of business activity in terms of CO_2 market economy-based CO_2 reduction initiatives were made, and that is why it is called as carbon trading, very simple in simple terms, we call it carbon trading.

Then clean development mechanism, which was the part of Article 12 of the Kyoto Protocol. This mechanism basically allows a country with an emission reduction on emission limitation commitment under the Kyoto Protocol to implement and emission reduction projects in developing countries. The reason is in developed countries the same amount of reduction of GHG cost more.

So, they can go for reduction in developing countries where with less amount of money investment of less amount of money, they can achieve more reduction of greenhouse gas emissions, but as you know, greenhouse gas emissions have global effect. So, it does not matter whether you reduce in the developed country or in developing country. So, this makes sense that economically you can reduce greenhouse gases in developing countries projects. So, that was very successful in that way.

Joint implementation this mechanism is the part of Article 6 of Kyoto Protocol and this mechanism allows a nation within emission reduction under the Kyoto Protocol to earn emission reduction units. So, those trading can be very helpful in that from an emission reduction or emission removal project. So, that way, they can generate several credits and exchange of credits can also be allowed.

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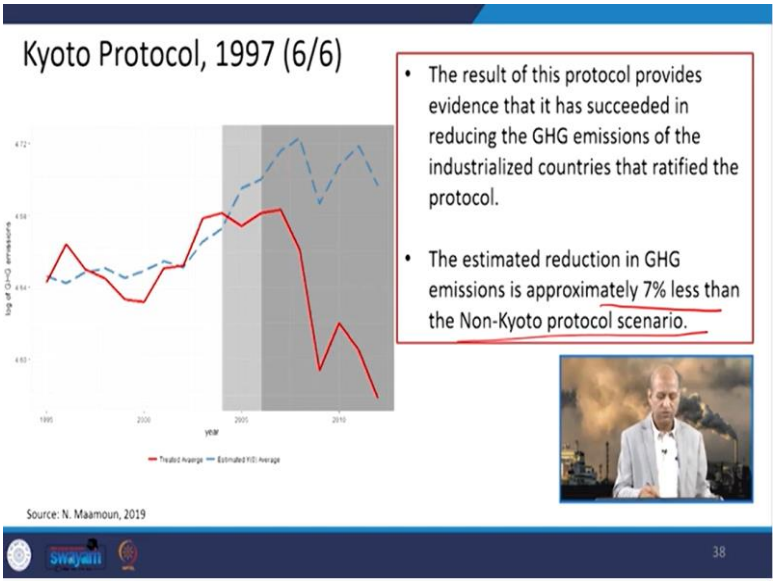

So, these three mechanisms were integrated, each mechanism helped other one, and that way big achievements were made in reduction of greenhouse gases and carbon trading. The effect the effect is very, very encouraging, 7 percent, this greenhouse gas emissions reduction of the 7 percent in non-Kyoto Protocol scenarios were estimated or achieved.

So, fabulous results of Kyoto Protocol soon after, when it was implemented or came into force, the reduction can be seen in a significant way. So, around 7 percent reduction in GHG emissions was observed after this Kyoto Protocol was forced in 2000 later part of the 2005. So, between this grey area, the significant reduction is there in greenhouse gas emissions.

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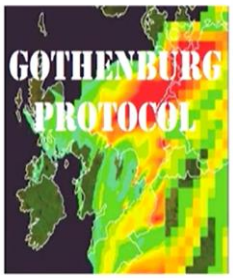
Gothenburg Protocol, 1999 (1/3)

- The protocol was adopted in Gothenburg (Sweden) on 30 November 1999 to abate acidification, eutrophication, and ground-level ozone.
- With the 2010 emissions target, the Protocol required parties to control and reduce emissions of four pollutants: SO_2, NO_x, volatile organic compounds (VOCs), and NH_3.
- The Protocol also sets tight limit values for specific emission sources (e.g., combustion plant, electricity production, dry cleaning, and cars).



Source: https://unece.org/environment-policy/air/protocol-abate-acidification-eutrophication-and-ground-level-ozone

Image: https://antonantonio.blogspot.com/

Gothenburg Protocol, 1999 (2/3)

- VOCs emissions from such products as paints or aerosols also must be cut. Finally, farmers have to take specific measures to control ammonia emissions.
- Parties must report on their emissions once a year. In addition, the Protocol requires Parties to provide projections of their future emissions.
- The Protocol was amended in 2012 to include national emissions reduction commitments to be achieved by 2020 and beyond.

Source: https://unece.org/environment-policy/air/protocol-abate-acidification-eutrophication-and-ground-level-ozone

Image: https://samrajpolytexltd.com/

Gothenburg Protocol, 1999 (3/3)

- The revised Protocol was also the first binding agreement to include emission reduction commitments for fine particulate matter (PM).
- Reducing particulate matter (including black carbon) through the implementation of the Protocol was thus a significant step in reducing air pollution.
- In 2012, European Union (EU) Member States were jointly required to reduce SO_2 emissions by 59 %, NO_x emissions by 42 %, VOCs by 28 %, NH_3 by 6 %, and particulate matter by 22 % up to 2020.

Source: https://discovery.ucl.ac.uk/id/eprint/10038773/1/reel12219.pdf

Then came this new protocol of Gothenburg in 1999. And that was basically for reduction of SO_2, NO_x, volatile organic compounds and ammonia, these particular pollutants. So, to limit these values, combustion related plants or electricity production, related mechanism or dry cleaning, those standards were given a stringent value, so, that reduction can be achieved in a nice way.

So, those VOCs which come from several products like paints or aerosols, those kinds of sources, maybe there, and then farmers were also expected that they can control ammonia emissions, because from agriculture or animal husbandry, those ammonia emissions are also there. And these parties, should report as per this protocol that emissions once in a year that this much of amount has been reduced or those kinds of policies they have implemented.

So, this was amended in 2012, 1999, it was established, but in 2012, it was amended to include national emission reduction commitments to be achieved by 2020 and beyond. So, that way more commitment was expected from different countries. Then the revised protocol, it was, binding agreement included for emission reductions, commitment was taken for fine particulate matter also. So, this was also included in that reduction of other pollutants.

So, reducing particulate matter, including like black carbon, through the implementation of this protocol initiatives was a significant step reducing in air pollution, because particulate matters are responsible for several, respiratory diseases, as you know, and you can relate it with our this uncap program when we are targeting reduction of $PM_{2.5}$ those fine particles.

In 2012, this European Union, EU member states, they jointly required to reduce SO_2 emissions by 59 percent, NO_x emissions by 42 percent, VOCs by 28 percent. So, that way, different targets were given so that upto 2020 this could be achieved.

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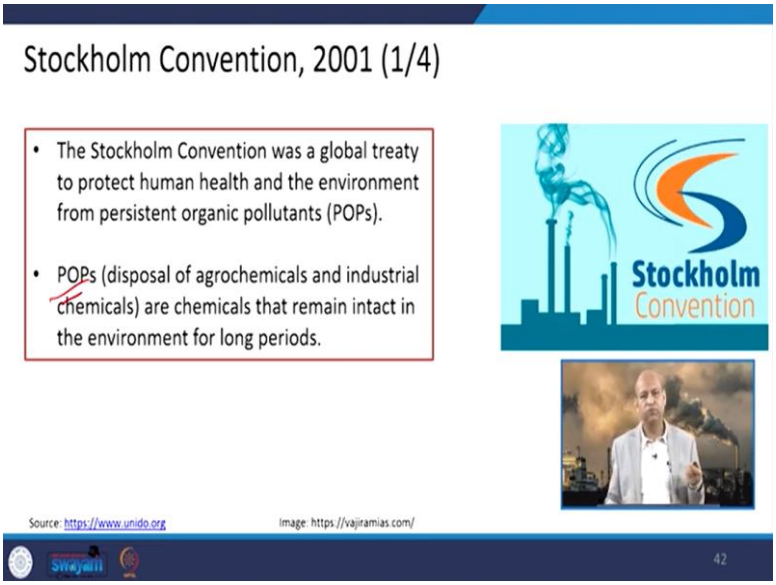

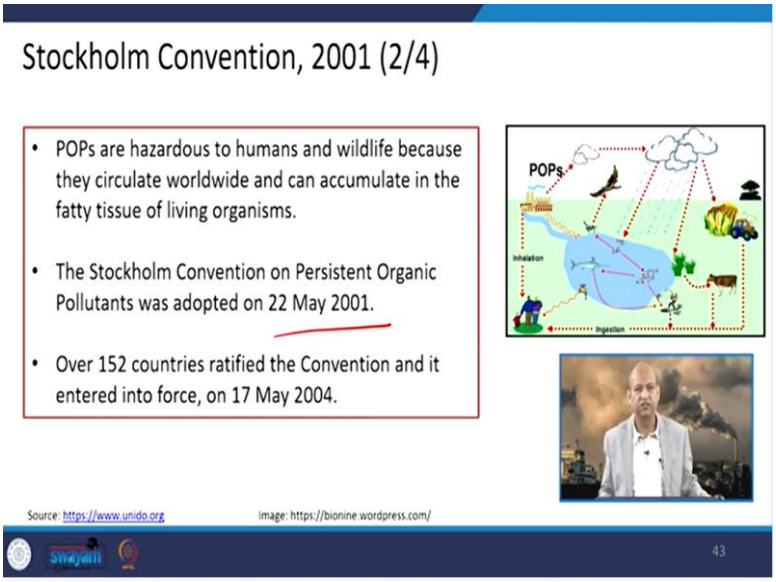

Next convention was the Stockholm Convention of 2001. And this is the global treaty basically, to protect human health and the environment from persistent organic pollutants, POPs, that is also very important because those POPs, these are persistent, by name, they do not degrade and their life span is very high, and they can travel throughout the globe.

So, the disposal of these agrochemicals or industrial chemicals or POPs nature, are the chemicals which can remain for longer periods so to reduce them is very important, to control them is very important because several of POPs are carcinogenic and they are very toxic to humans and wild life basically. So, it was adopted in May 2001 and 152 countries ratified this convention and it was brought into force in May 2004.

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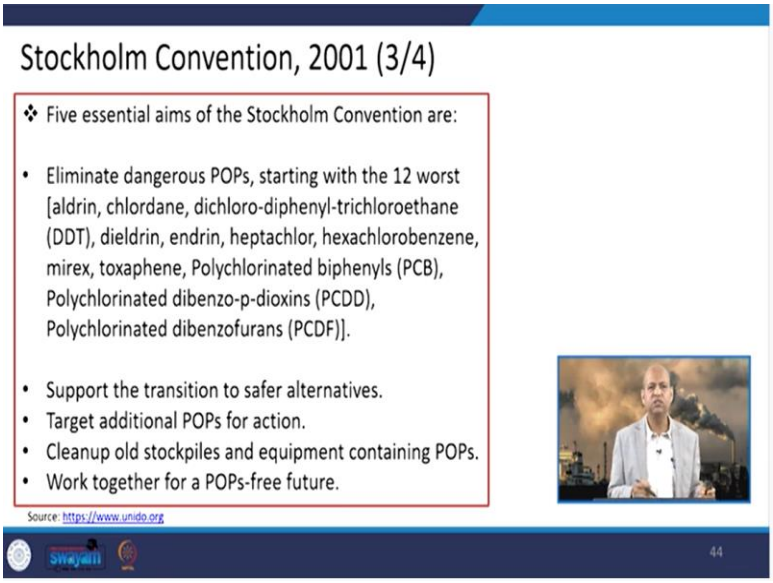

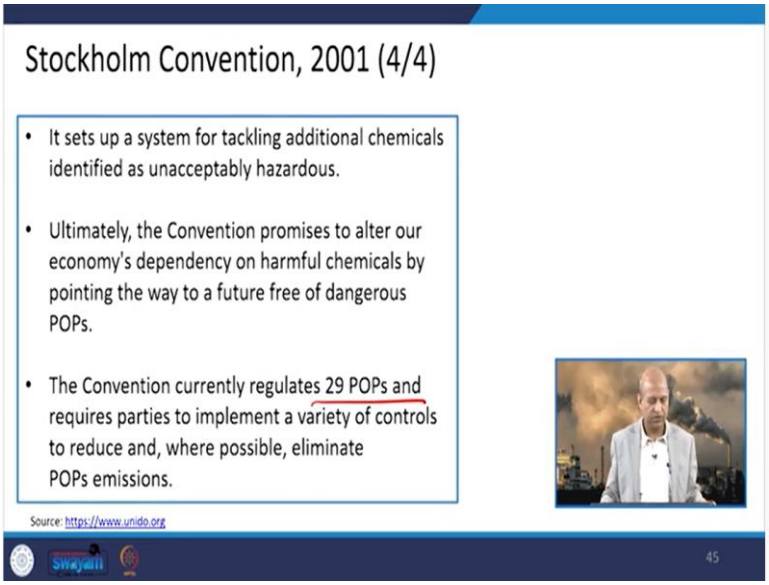

Stockholm Convention of 2001 basically the five essential aims were like POPs, 12 worst POPs like aldrin or DDT all those you might have heard about those because even DDT is as a one theory DDT is associated with the reduction in population of vultures. So, these are very toxic chemicals and they have severe harmful impacts on the environment and animal kingdom and human health.

It can support safer alternatives. So, that was the part and it was the target that POPs has to be reduced as soon as possible. So, this Stockholm Convention basically, now targets around 29 POPs, at this particular time, and to eliminate those POPs by some alternatives are the part of this convention.

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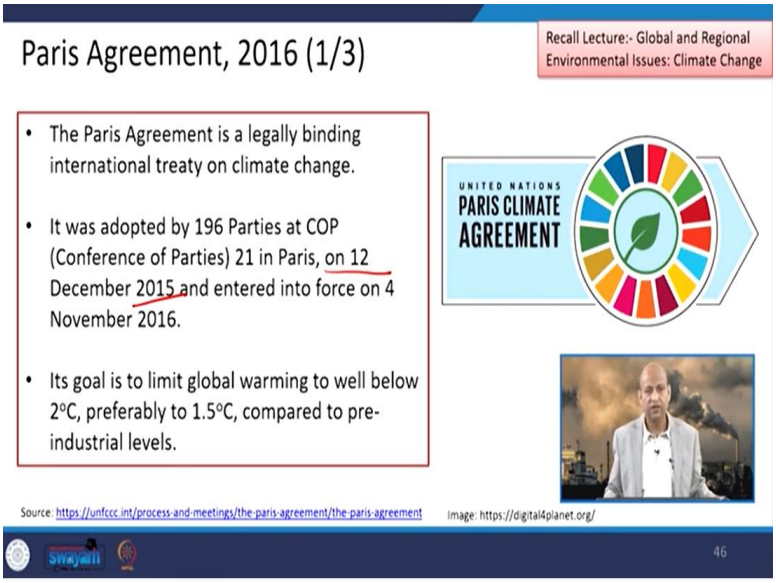

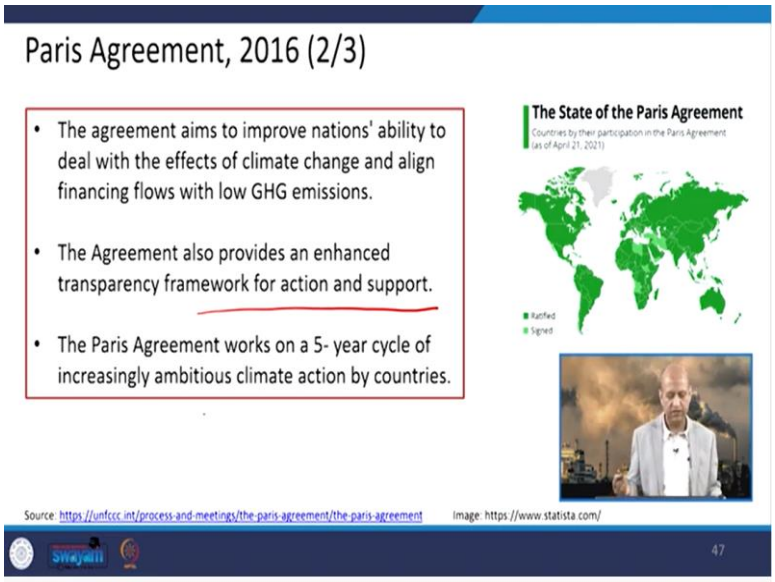

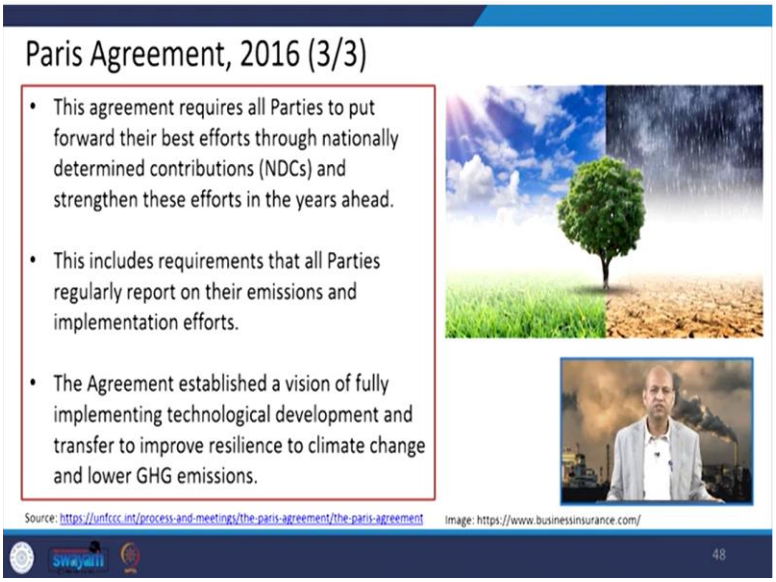

So, now, we come to the very important treaty Paris Agreement of 2016. And you can recall this lecture on global and regional environmental issues, where we have discussed it in a very detail. So, this agreement was signed by 196 parties, and during the COP 21, Conference of Parties, recently COP 26 was there as you can recall.

So, on 12 December 2015, this was signed and in 2016, it was brought into force. And the goal through this Paris Agreement was that the global warming, to limit below 2 degrees Celsius, preferably 1.5 degrees Celsius compared to pre-industrial levels of global temperature. And this agreement, this particular Paris Agreement aims to improve capabilities of nations, abilities of the nations to deal with the climate change related all activities.

And this agreement provides enhanced transparency framework of action and support, so that they can support each nation and technologies can be transferred. So, that reduction can be achieved very fast and also we can see from carbon economy to green economy, or fossil fuel-based economy to green economy, so, that renewable resources can be harnessed and we can have energy sources which do not emit a lot of emissions.

This agreement for 5 year cycle and it has ambitious climate actions from all the countries which are the signatories and this requires in all parties to put forward best efforts, so, that nationally determined contributions can be achieved.

And like India is very much committed and we are going towards solar power, wind power, those renewable resources, we are harnessing at a fast pace also, we are going to shift our transportation from fossil fuel to waste to like electric vehicles. So, this will have a very positive impacts in later on and these are the part of climate change related policies and programs.

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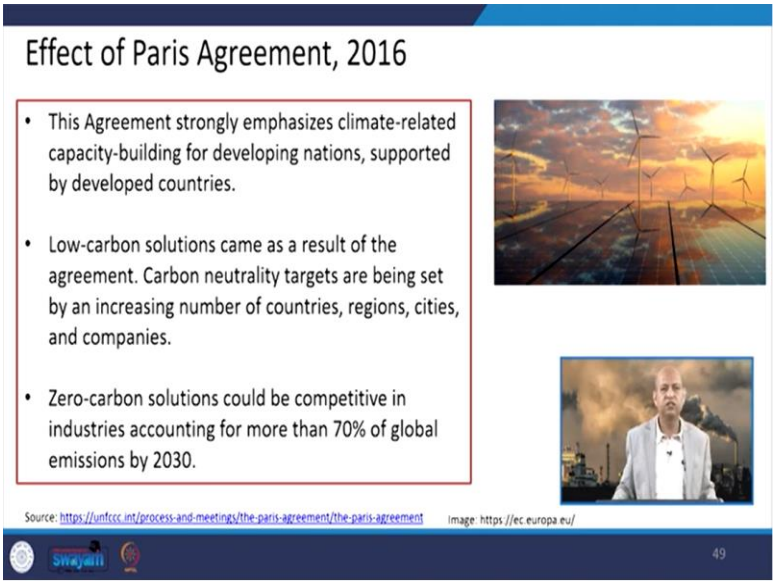

This agreement strongly emphasizes on climate related capacity building for developing nations especially, so, that developed countries can support them in various ways like capacity building to train their people, as well as to exchange the technologies. And low carbon solutions like, solar and wind etc.

And zero carbon solutions could be competitive in industries accounting for more than 70 percent of global emissions by 2030. These kinds of ambitious targets are there, which will definitely, will help us to address the climate change related issue, as we collectively have addressed through Montreal Protocol this ozone layer related issue. So, this is very much encouraging.

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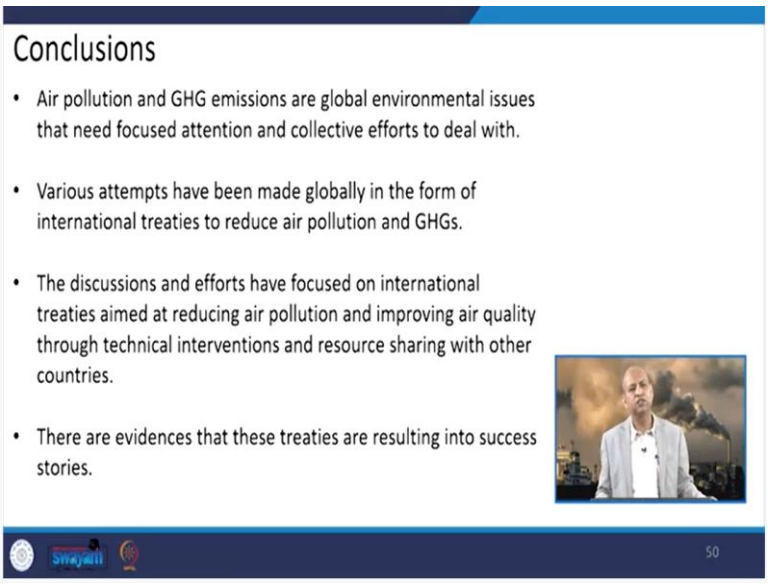

In conclusion, we can say that this air pollution and greenhouse gas emissions are the global environmental issues basically, they are no more national or local issues. And various attempts are being made, you can now appreciate like through these treaties, which we have seen, these major treaties, that all countries are concerned and they come on the table to talk, to commit, to initiate several initiatives or activities or actions so that emissions can be reduced significantly.

And the problem which is in the form of climate change or in the form of toxic emissions or POPs they can be addressed timely. So, there are evidences that these treaties have given positive results. So, we should go for these kinds of treaties and we should implement their targets to achieve in time.

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So, this is all for today, these international treaties of environment nature, and you can go through if you want to know more through these references. So, thank you for your kind attention and see you in the next lecture. Thanks again.