Education for Sustainable Development
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Lecture - 32
Sustainable and Clean Energy (Contd.)

Welcome back viewers. So, we were discussing about the economic, social, political and the environmental benefits of renewable energy. So, just we will be just discussing about some of the statistics and some of the strategies that we can, these are some of the statistics we can go forward.

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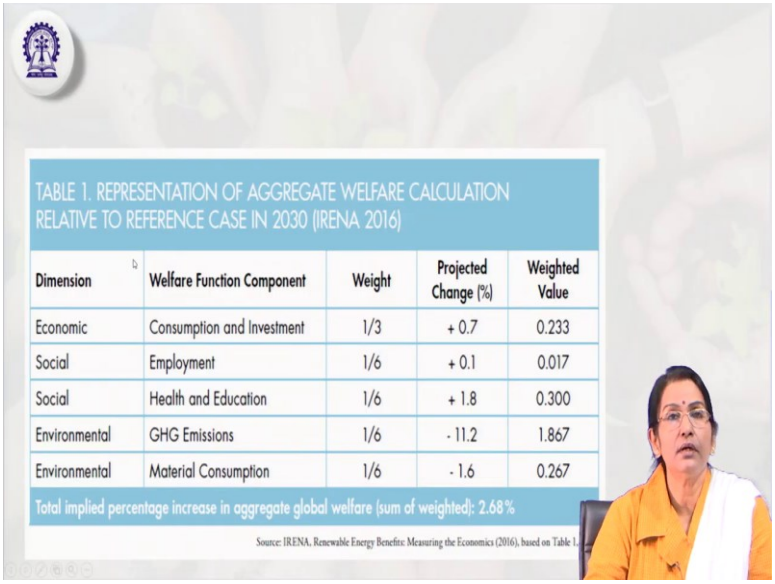

So, these are the some of the statistics like you know economic you know dimensions like what are the relative benefits like economic aspects and social so, then environmental etcetera so, how those that means, the calculations that is the above all aggregate welfare calculations it has been given the in a statistics in a table so, that has been given by renewable energy benefits measuring of the economics 2016 given by the society IRENA.

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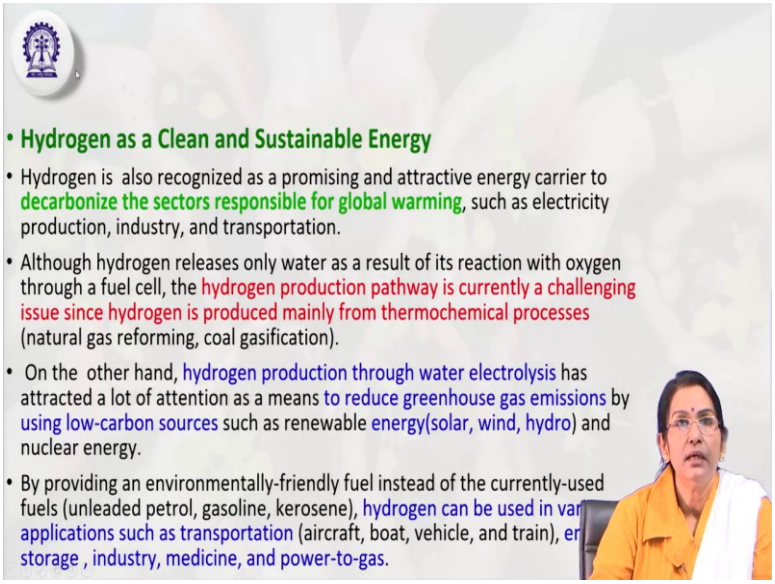

So, to move forward, now we can say again yes so, renewable energy again hydrogen has been taken as a major venture towards the clean and sustainable energy. So, hydrogen as a clean and sustainable energy, it is also it has becoming gradually very popular see because hydrogen is also recognized as a promising energy source and a carrier to decarbonize the sectors responsible for global warming.

So, the sectors which are responsible primarily for polluting the environment such as electricity, carbon, thermal, coal and petroleum products and transportation etcetera so, hydrogen, how hydrogen can decarbonize these sectors which are responsible for global warming.

So, hydrogen productions pathway is actually is currently challenging issue since hydrogen is produced mainly from the thermochemical process like coal that means, through gasification etcetera even though it is a challenge like hydrogen, but however, hydrogen production through water electrolysis has attracted a lot of attention from the innovators, from the researchers centre to reduce the greenhouse gas emission by using a low-carbon sources like such as the by using this renewable energy like solar, wind and power and hydro and the nuclear power how to create the hydro energy as a clean and sustainable energy source.

So, therefore, by providing an environmentally-friendly fuel instead of currently used all kinds of gasoline, petrol and kerosene etcetera, hydrogen can be used in various

applications such as transportation like we are talking about the electricity electric; electricity electric battery vehicle now, we can also say that hydrogen based vehicles, hydrogen based aircraft, vehicles trains etcetera that is these kind of things can also be.

So, energy storage industry, medicines and power to gas all kinds of things in this transportation of all these things we can use the hydro hydrogen created energy, hydrogen-based energy.

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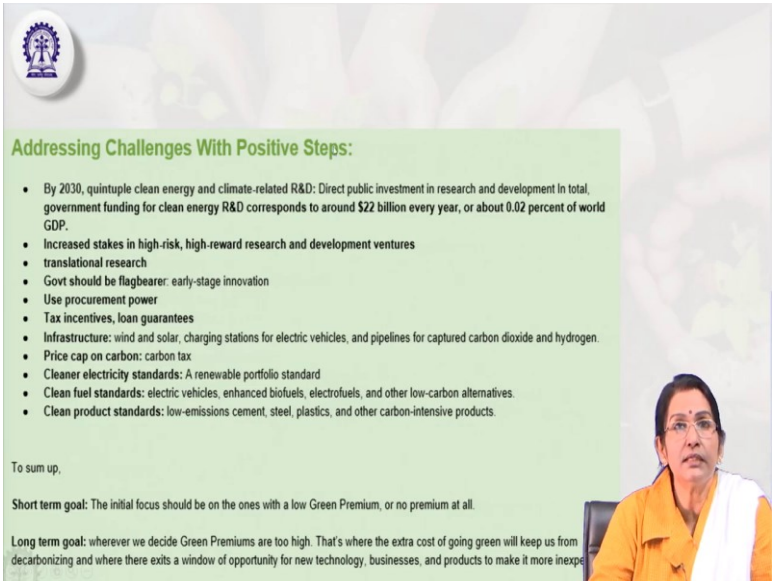

So, however, these are some of the challenges that we are facing, challenges that we face with the positive steps like in order to achieve the SDG's by 2030, these are some of the challenges not only in health sector, but energy sector then in the food sector and you know energy as because it is the major source of all kinds of economic activity and human life activities so then, what are the risks and challenges involved in it and how to solve it, how to resolve these things with the positive steps ok.

So, as you can see by 2030, these are the statements given by different you know different societies, different database, different commissions, different organizations like by 2030, quintuple clean energy and climate related R and D, it has its very it has become very very important so, direct public investment, direct public investment research and development by the global funding as well as the you know CSR funding of the private sectors so, for the clean energy in so, research and development corresponds around 22 billion dollar every year ok about the 2 percent of the worlds GDP.

So, by 2030, it has to be; it has to be enhanced like these thing so, in increase takes in the high risk, high reward research and development ventures. So, we have to or we have to invest a lot in the and especially in the public investment in the high energy or renewable energy sector so, there is therefore, the in increased stake in the high-risk and high reward research and development ventures these are there again, the these are the challenges nowadays.

So, again translational research, research how to implement it after creating the doing the basic research in the renewable energy sector, then how to translate it into implication in the application so, therefore, government should be the flagbearer, that means, governments should take the initiative in the early-stage innovation, research, R and D development investment etcetera.

So, again use the procurement power, use the procurement power tax incentives, then long term guarantees, loan guarantees, startups all these kinds of facilities are to be provided by the government. Hence, government will be the major stakeholder here to invest to start the whole operations.

So, and again infrastructure is also another important factor. Infrastructure for the wind energy, for the solar energy so and the charging stations for the electric vehicles, then pipelines for you know for capture carbon dioxide and hydrogen so, then the price cap so, these are the challenges, these are the emerging challenges that has come up with the use or use of reuse and production of the renewable energy.

Similarly, carbon, carbon tax; carbon tax price cap on the carbon then the then again how to that means, cleaner electricity standard to set up the criteria, to renewable portfolio standard to maintain that in the electricity standard, clean electricity standard, clean fuel standard that is for the electric vehicles and biofuels eco electro electro-fuels, low-carbon alternatives, what should be the standard, what should be the clean fuel standard like now nowadays ISO for 1000, ISO 1000, whatever the standards we are getting from the um; that means, from the criteria level standardization.

Similarly, clean product standards clean product standards low with low carbon emission cement steel plastic for all kinds of consumable goods and services as well as a industrial things. So, these are some of the challenges on the day-to-day basis we are have to face, we are facing and we have to get ready with the solution.

So, therefore, for the short short-term goal, we can say the short-term goal is the initial focus would be on the ones with the low green premium and the no premium at all so, that means, suppose we are starting with an own our own in initiative so, with the minimum premium or the minimum kind of loan, minimum EMI should know it should begin with this kind of opportunities being provided to the stakeholder as a short-term goal.

However, the long-term goal can be so, when we whenever we decide the green premiums are too high so, that is the extra cost of going green. So, gradually slowly can we increase this green taxes, green taxes that will make us more make our society more decarbonized and where there exits the window and opportunity for the new technology, new business, new eco friendly products, organic food system, organic foods, organic agriculture.

Then so and products that and slowly how to make these products very you know affordable and the inexpensive so, that is the long-term goal, but the short-term goal is that how to in order to mitigate these challenges, immediate challenges, then how to how can we go with start with a low green premium kind of things; that means, minimum with minimum cost how can we plan for our short-term achievements.

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So, now, here it is now we can see a green technology framework ok. So, definitely we need the technological breakthrough so, what would be the green technology

frameworks? These are the components of the green technology frameworks like the production of hydrogen without carbon emission. How can we create the energy from the hydrogen? Through hydrogen or hydro energy, but with minimum carbon emission.

Then, the grid scale electricity storage and seasons worth capacity, advanced biofuel, electro fuels, zero-carbon, zero-carbon steel, then zero-carbon bio fertilizer, then next-generation nuclear fusion, nuclear fusion, underground electricity these are some of the things.

Plastic management, solid waste management, drought and flood tolerant food crops and the multiple crops creating the multiple crops in through in seasonal multiple crops throughout the year then, coolants that do not contain fuel gases, fuel gases, then other non-conventional renewable sources, cost reduction, technical innovation more you know CSR that means, more CSR fund, the industries and the organizations they should spend CSR fund, major CSR fund in renewable energy production.

And the eco-friendly; eco-friendly business, eco-friendly you know and then power installations in rural areas so, all maintenance, all these are the these are some of the you know strategies you can say, some of the strategies, some of the techniques and strategies that we can use to grow to make our energy system more green. So, green technology framework green energy framework how can we develop by just starting this kind of strategies and implementing it into the our action plan.

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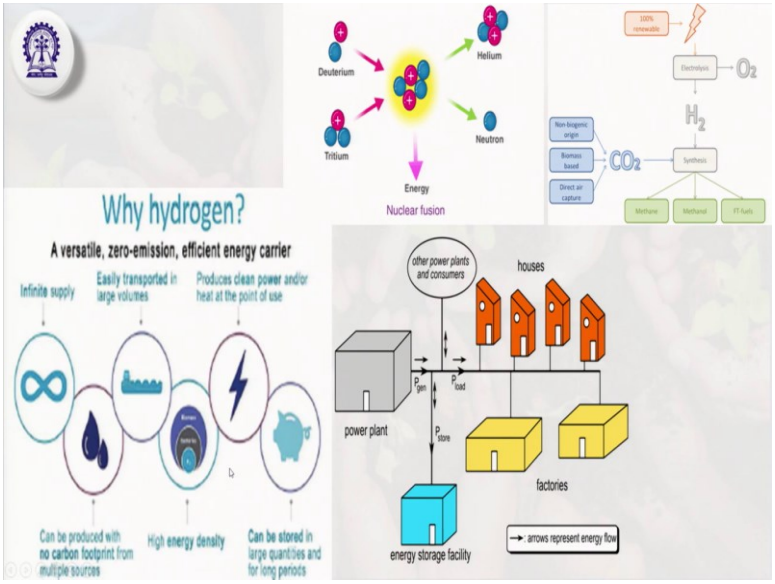

So, here these are some of the clips that you can see how hydrogen energy can be very versatile and zero-emission and efficient energy a carrier hydrogen created hydro; that means, high energy density can be produced with no carbon footprint and can be stored with a large you know large quantities.

You might have observed in this pandemic in the Covid era then oxygen cylinders we fall short of the oxygen cylinders required for the hospitals and the patients. So, here again, it gave us gave us a challenge to create more and more oxygens, but again oxygens should be more cleaner not that means, that will be created from the; that means, clean water, there should be clean water.

So, our self-sustainability in creating the clean oxygen and oxygen cylinders and providing and providing and helping the health system that also it has also a lesson that we have learned from this pandemic. Similarly, through hydrogen, the power plant, hydrogen-based power plants, energy storage facilities and factories how they can run through this hydrogen power plant so, these kind of things we can also our factories and industries can also be based on hydrogen hydro energy provided we take care of all these kind of operation and the supply chain processes.

So, here, we can see this is the, these are the basic functionality the basic formula basic basic functionality or operations of this hydrogen energy, hydro energy nuclear fusion of these energies so, that we have to be the so, that you know that is why we have to invest more and more in scientific research.

So, nowadays that is our government is also facing more importance to you know that is why this core science, basic science like physics chemistry you know using mathematics for all kinds of the geoscience, geographical science and the geological science so, these kind of things main mainstream science subjects, science research should be should be promoted, should be enhanced.

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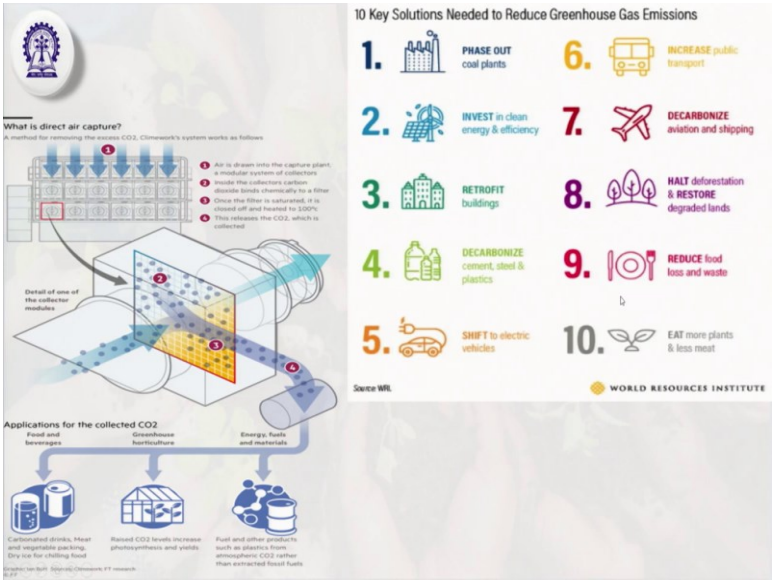

So, similarly, these you can also these are the pictures ok so, how this solution, key solutions to need needed to reduce the greenhouse gas emission, how slowly, steadily and progressively we can move towards the more cleaner energy. For example, phase out of the coal plants gradually we have to invest more in the clean and energy efficiency, techniques through solar energy etcetera, then re retrofit the buildings to; restructure retrofit the buildings of, then decarbonize the cement, steel, plastics and other goods and the consumable goods, similarly shifting to the electric vehicles; electric vehicles.

Then similarly, increase in the public transport; increase in the public transport rather than and gradually slowing down the private transport system so, like for example, the best example is that nowadays you know every family has at least three not earlier having a possessing a four-wheeler was the luxury, but now in every family there are at least two to three personal vehicle, personal four-wheeler to for their own movement so, that again how to reduce this towards the toward moving towards the public transport system. So, decarbonize the aviation and shipping that is also.

Then, halting the deforestation restoring the and restoring the degraded lands by enhancing the soil quality, making it more fertilized land, then plantations the plantation that means, improving the plant improving the plant life in the on land, reducing the lose waste or waste management, waste recycling, waste management, reducing the food wastage, food loss and waste management that is also very important and eat more.

And then, gradually slowly we will have to change our habits, eating habits consumption habits like eating more towards the waste and being be gradually to becoming more vegetarians than the non-vegetarians and moving towards plants eat more plants and veggies and the greens than the non-veg and the meats etcetera. So, these are some of the steps that we can take both at the individual level as well as the collective level.

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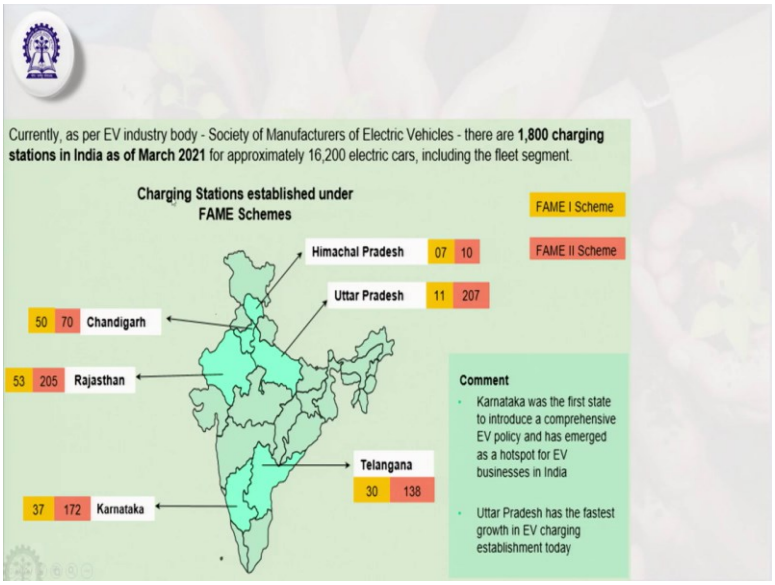

So, these are the some of the states, these are the so the charging stations for the different kinds of renewable energy sources like charging stations established under the fame schemes like yes charging centers like started from the March 2021 Himachal, it has is electricity charging system for the electric cars ok Himachal Pradesh, then Uttar Pradesh and that is Chandigarh, Rajasthan and Karnataka and Telangana also those who have already become self-sufficient in creating sustainable and renewable energy.

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So, moreover again, judicial decision regarding the highlighting the climate action so, international cases and climate action so, these are some of the cases like you know Netherlands and some of the legal in legal cases, judicial actions and taking decisions have been taken highlighting the climate action some of the cases are like this federation of like some federation in the Pakistan 2015.

And some of the Irish government they have also taken the some of the cases Government of Ireland and Attorney General so, then again pollution control board even nowadays in every state, we have the pollution control board. Similarly, in different agencies working for this climate change mitigation, action against the climates change, international bodies organizations NGO's so, acting primarily acting on the climate action.

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So, legality of the instruments that is of one is that UNFCC preamble is there and UNFCC principles are there; principles are there so, the parties should protect the climate system for the benefit. So, we have to even we have to be active from different dimension politically, socially, financially, economically, technologically so, therefore, so, the developed countries also they also should take the lead in combating this kind of climate change and mitigating its adverse effect.

So, the developed countries along with the UNESCO and the green economy fund so, they should take the lead to guide the whole world towards more sustainable and clean energy system.

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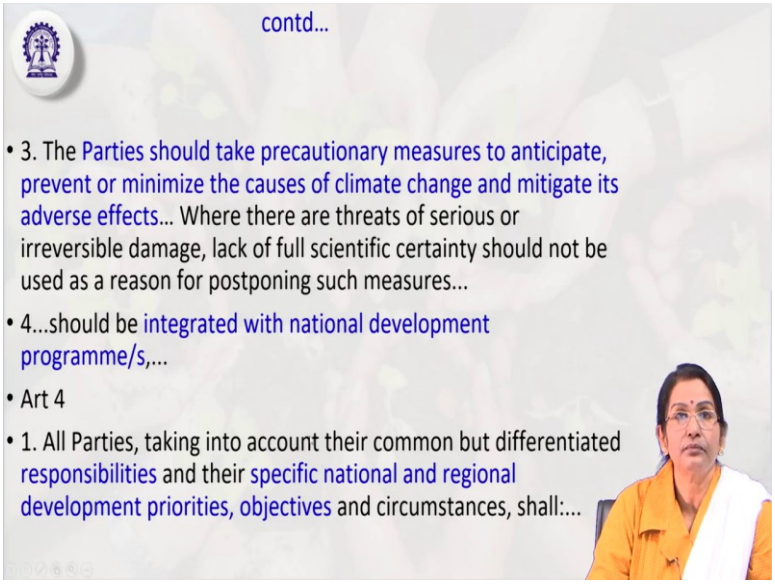

Therefore, the parties should take the precautionary measure to anticipate and prevent the minimized causes of the climate change mitigate. If you can do it at our own level, individual level, definitely we can proceed and progress. So, then, but again it should require also the integrated with its so, in national development programmes also. So, all the state governments and the local government activities should go hand in hand with the national development programmes and the schemes.

So, therefore, all the political parties they should be accountable, they should take a common stand ok and take the responsibility as the specific national goal, regional goal, priorities and the you know and prior take it as a prior development priorities and objectives to you know to plead for, to move ahead to progress to take them democratic decision in this regarding this dimension.

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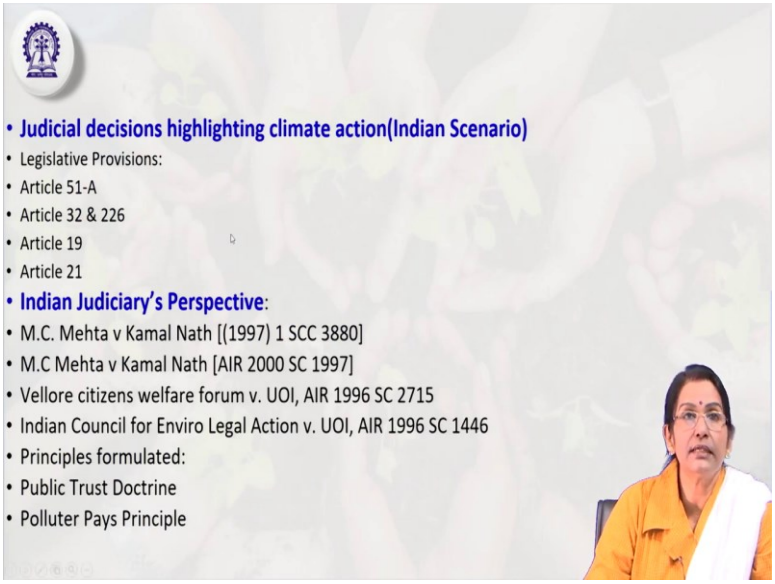

So, these are some of the judicial acts related to article, different kinds of articles. So, Indian judiciary perspective is also like this kind of things, these are the principles formulated, doctrines formulated as per the a all India record, supreme court record and this all kinds of thing, these are the rules and regulation the judicial letters legislative judicial acts.

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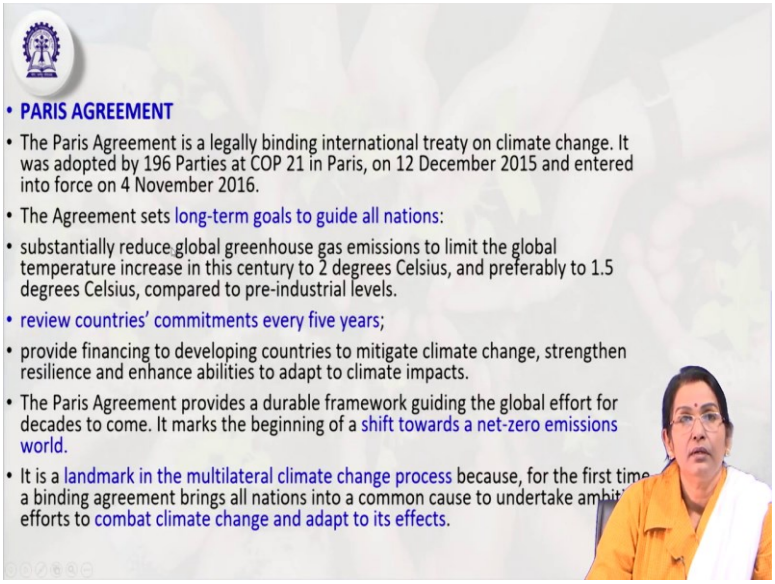

So, say these are the details of the you know these are the again Paris agreement, Paris agreement its long-term goal to guide all the nations, it is long-term goal Paris

agreements long-term goal needs to guide all the nations and the review the country's commitments towards the climate change for every year to review it, monitor it and evaluate their commitment towards this climate change.

And again, shifting towards a net zero emission world gradually not reducing the carbon emission but shifting gradually towards the zero-emission world so ok. So, it will be landmark in the multilateral climate change process; a multilateral climate changes process to combat the climate change and adapt to its effects.

So, according to the Paris agreement from time-to-time evaluation, monitoring, regulation and shifting takes place to how quickly, how early can we get the zero-emission plan the zero-emission zero net zero emission world for all of us.

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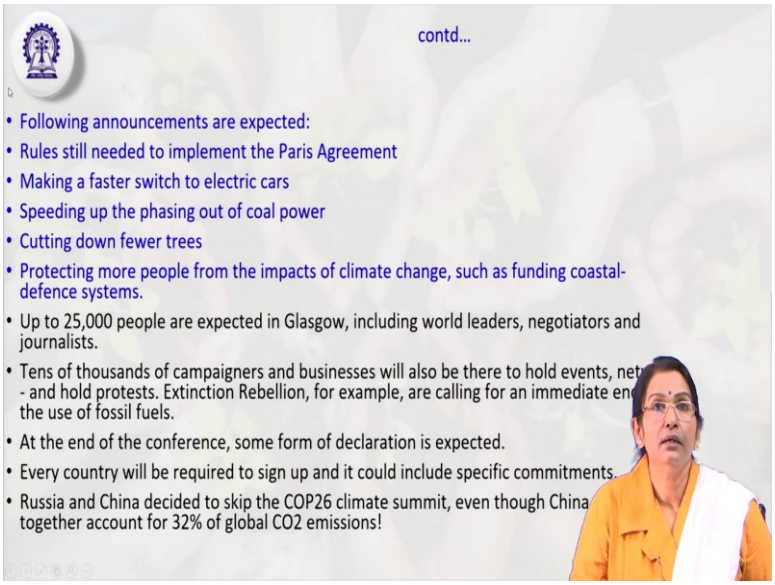

So, following the to announcements some of the announcements are expected rules are needed to implement as per the Paris agreement guideline so, every country must take the faster, must make fast must make their action plans very fast, very and quickly to switch over to electric vehicles, speeding up the phasing out of the phasing out of the coal power.

And being dependent more on solar power wind, power and the hydropower so, and enhancing, increasing the greenery forest land, enhancing the greenery so, for improving the temperature, for reducing the temperature in the climate, temperature in the

environment and environmental temperature protecting more people from the impacts of the climate change such as fundraising, funding the coastal in defence system, funding the for agriculture farmers so, these are things.

So, in different already in different countries they are already invested in this huge amount of money this R and D and this kind of activities and they are also achieving the um; achieving the goals slowly and steadily. So, we have to focus more towards this renewable energy and how it benefits our society, economy and the environment. So, we have to move ahead keeping in mind the 2030 targets.

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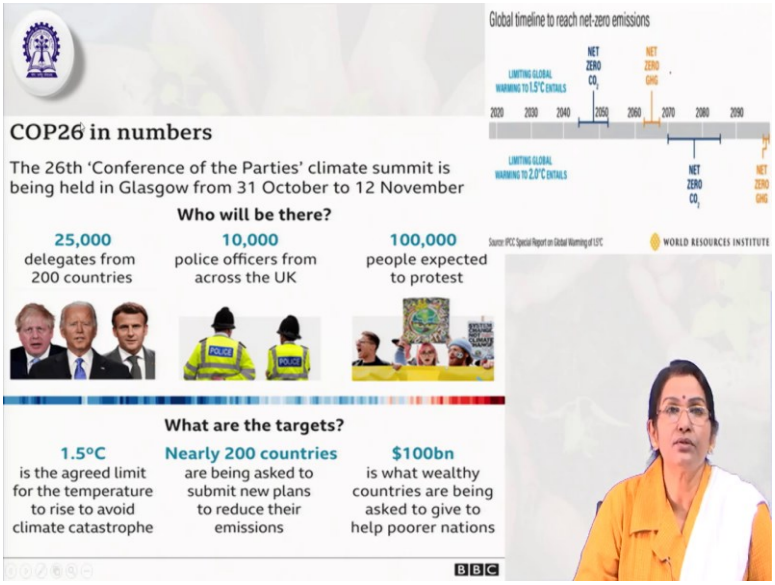

So, these are the members these are the COP members, 26 members communities that is the who will be there in the committee and what are the decisions they used to take, these are some of the clippings.

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Then again, after the that means, how to track this Paris agreement process like how to monitor, how to control, how to regulate this you know this improvement, this commitment of the different countries, different nations towards this global you know climate change process and the agreement.

So, information collection and preparation you know from time to time and from time to time from and monitoring the putting the governments, monitoring agencies these are some of the mechanism to monitor and evaluate and regulate the climate change actions; climate change action through by using the renewable energy.

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So, communicating and acting on the findings yes, low carbon solutions for the new markets, zero-carbon solutions becoming competitive and 2030 as the zero-carbon solutions should be competitive in the sectors representing 70 percent of the global emission.

Similarly, like just like diversity friendly you know brand name, diversity brand which country; which country which companies are diversity friendly etcetera similarly, now the companies, the industries, the countries will be rated will be ranked according to the you know zero-carbon shall use zero-carbon emission, zero-carbon emission and 100 percent, by going 100 percent renewable energy sources so, on that basis, the countries, the companies the um across the globe will be rated will be ranked that parameters will be there.

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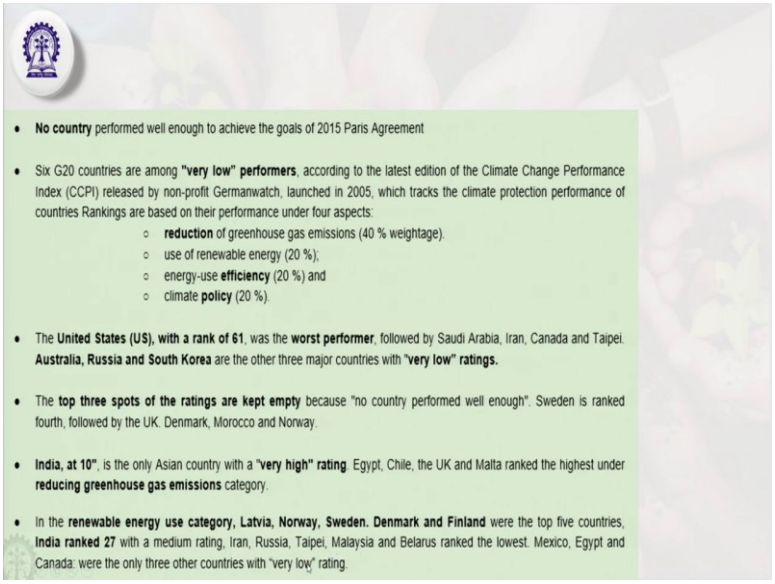

So, here no country performed well and up till date no country has performed well enough to achieve the goals of 2015 Paris agreement, how there are low performers, very low performers and optimum performers are there, but however, so, reduction of the greenhouse emission gas emission by 40 percent weightage, use of the renewable energy 20 percent, energy use efficiency increasing by 20 percent and climate policy.

So, the United States with a rank of 61, global rank of 61 is the worst performer, was the worst performer followed by Saudi Arabia, Iran, Canada, Taipei, Australia, Russia, South Korea etcetera and other three major countries, those who are also with very low rating.

So, the top three spot in the rating global rating are kept actually kept no country performed well enough, Sweden is ranked as the fourth. So, all the top three ranks are vacant, Sweden; Sweden lies in the fourth rank followed by the UK, Denmark and Morocco and Norway with the this Paris agreement commitments and the actions.

So, India at 10 is the only Asian country with very high rating ok. Egypt, Chile, UK and Malta ranked etcetera higher highest under the reducing the greenhouse emissions category which country emits how much gas greenhouse gas emission on the basis that India ranks 10.

So, in renewable energy use category, Latvia, Norway, Sweden, Denmark and Finland were the top five countries and India rank 27. So, who is using how much creating producing consuming renewable energy in the renewable use category? Latvia, Norway, Sweden, Denmark. So, Scandinavian countries are always a well ahead similarly, Finland is also (Refer Time: 24:54) all the three Scandinavian countries and the Finland. So, they are in the top rankers and the India rank in the 27 with a medium with a medium rating.

So, Iran, Russia, Taipei, Malaysia, Belarus all these things they rank the lowest. Mexico, Egypt, Mexico, Egypt are also of the very lower countries with the low ratings, countries with the low ratings.

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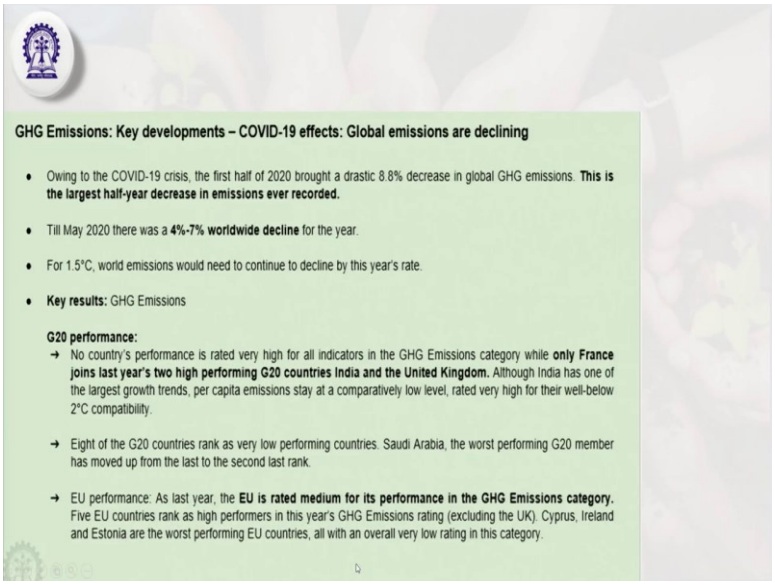

And this greenhouse gas emission key developments during the and its impact during the COVID-19 effects global emissions are declining yes, of course, with the shutdown of; with shutdown of all kinds of vehicles, shops, business transaction definitely global emissions, global greenhouse emission has declined to some extent and this is the largest that means, around 4 percent to 7 percent worldwide decline has taken place.

Now, the key result is that the G 20 performance that like the only France joins the last two years last year's two high performing G20 countries. So, G20 summit primarily aims at this g twenty countries India and the UK, two performing high performing G20 countries at the you know India and UK.

Although India has the one of the largest growth trends, per capita emission stays at comparatively low rate, rated and rated very high for the new well below 2 point 2 degrees compatibility but however, in the present time, China in the present times, China has become the you know is the major you know major contributor towards this contributor major um major you know country which emits maximum carbon into the in the gas greenhouse emissions including.

So, how to the China has been given a reminder again and again by the WHO and UNESCO. So, these are the countries ranking and the worst performing Estonia and Cyprus, Ireland and Estonia are the worst performing European countries all with the overall very low rating in this category. This is all about the data about the greenhouse gas commission emissions.

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These are the graphs also as you can see the global energy related things carbon oxide, carbon dioxide.

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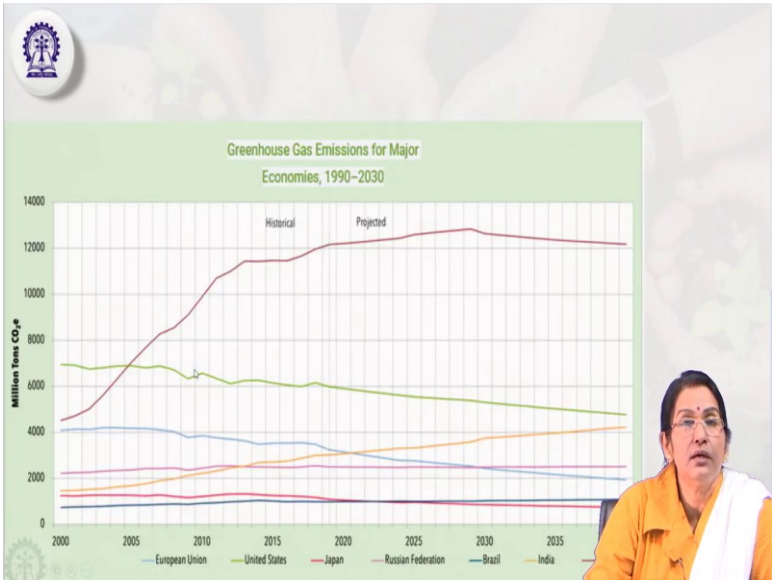

So, these are the greenhouse gas emissions for the major economics in the world since during the period 1990 to 1930, how it is increasing historically and how it is projected the greenhouse consumption has been the greenhouse emission has been increasing like anything.

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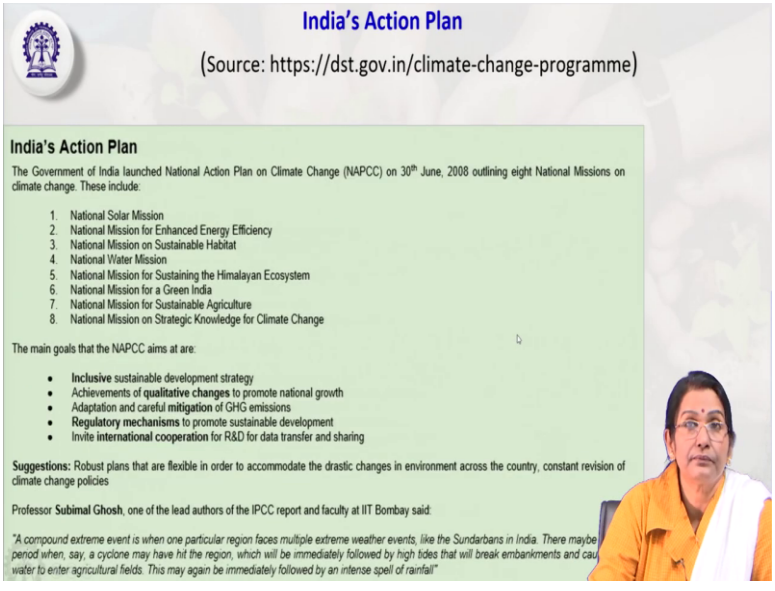

So, now, I must closing the session right now here only so, we will continue the discussion in the next class.