NPTEL
NPTEL ONLINE COURSE
ECOLOGY AND ENVIRONMENT
Sustainability and Case Studies
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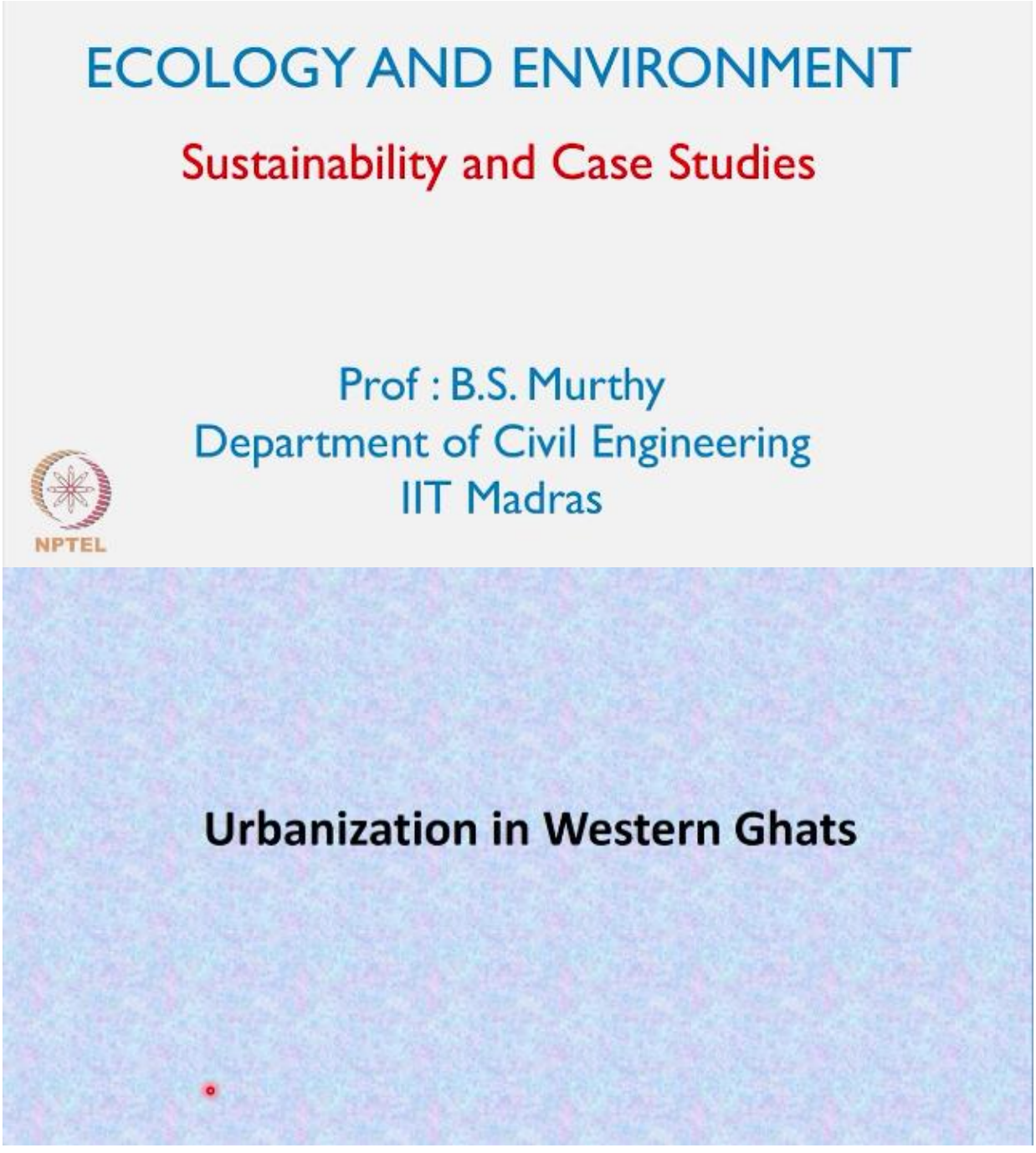
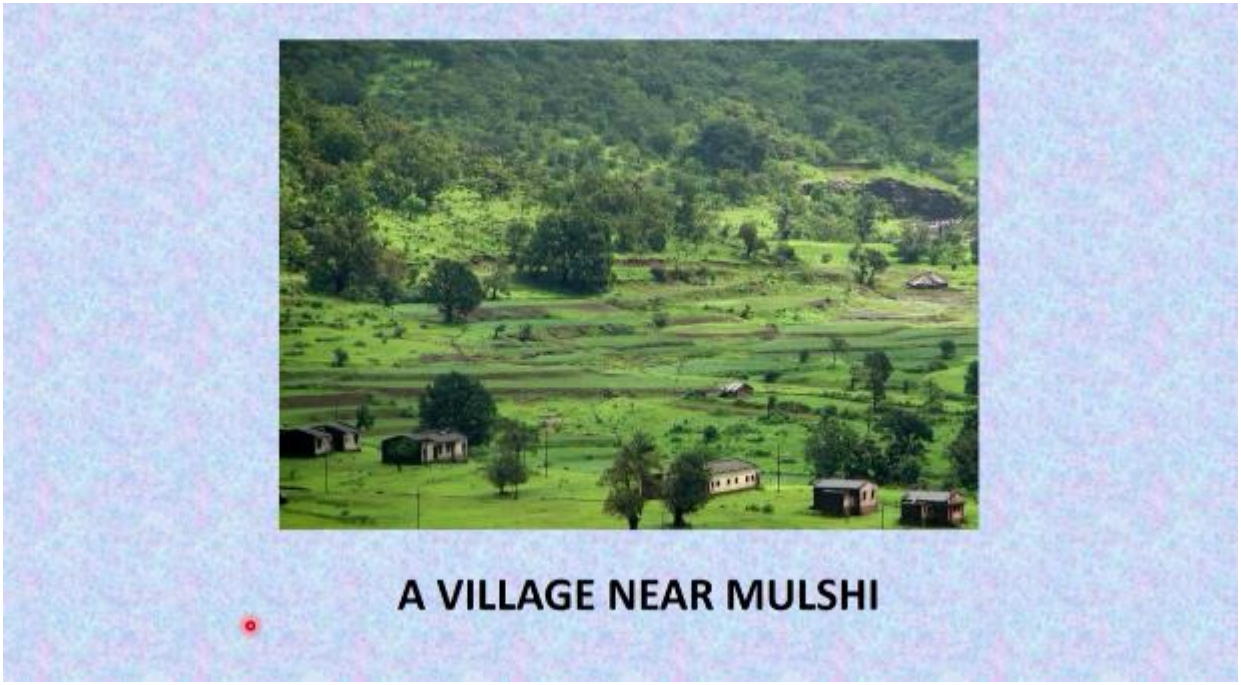
URBANIZATION IN WESTERN GHATS



In today's lectures, we will look at two aspects of sustainable development. I mean two case studies, the first one with regard to Urbanization in the Western Ghats in India, and the other one is the bio diesel.



There is a lot of urbanization that is going on in the Western Ghats particularly in the localities between Mumbai and Pune. Here in this picture you would see a village near Mulshi reservoir in the Western Ghats, not much of habitation and then it is pretty green, and it is very nice.

Now a lot of investment is being made in constructing townships and then you know a lot of houses in this area like I give you another picture of this one, the urbanization that is taking place in this area, a large-scale urbanization that is taking place.

Now when you do this, when you construct the houses in this hilly areas you would be disturbing the soil conditions there and also you would be intervening, I mean you would be changing the local hydrology of that area, and there are lots of these small small Nalas in this area, they are not very long.

You can see that a waterfall that is coming here, there is another waterfall is here and then this little small, small streams or mountainous streams or what they call Nalas, and they feed into a reservoir, this is the Mulshi reservoir in that area.

MULSHI RESERVOIR

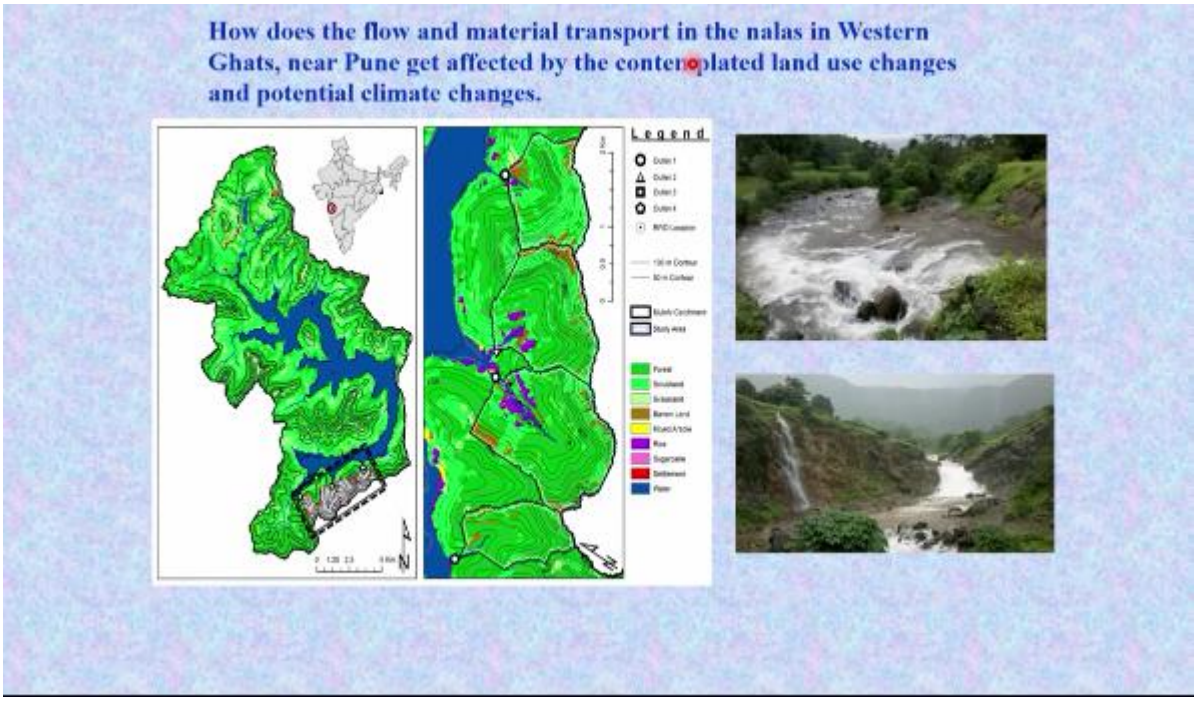
And this reservoir is actually used for storing water to do the, you know, the development. I mean a hydroelectric power station is there which uses the water from this reservoir.

Now, what is the problem with the development in these places? When you have a lot of urbanization that is taking place, it will change the land use pattern. We may go, I mean, you know many areas will get paved and so rainfall - runoff relationship will change. So, for the same amount of rain that may occur, the amount of water that runs into these reservoirs through these nalas, these small small nalas would change. And that will also change the velocity the amount of water is going, not only the amount of water, but also it will change this velocity of this water that is flowing through these small nalas, and you also have disturbed the soil nearby

and then so the amount of soil that is getting eroded that would change. Where does this soil go? All this soil would be going along with the water, all this sediment that is eroded from the catchment, this is the catchment area all the sediment that is eroded will go into this Nala and then along with the water it would go into the reservoir. It may, I mean we do not know how much of sediment would get you, know eroded because of the changes in the, you know, the land use pattern because of the urbanization that is taking place. But certainly there would be some effect, we would like to know how much of that is going into the reservoir and then what does it do there, it will go and then sit there and then it will reduce the reservoir capacity.

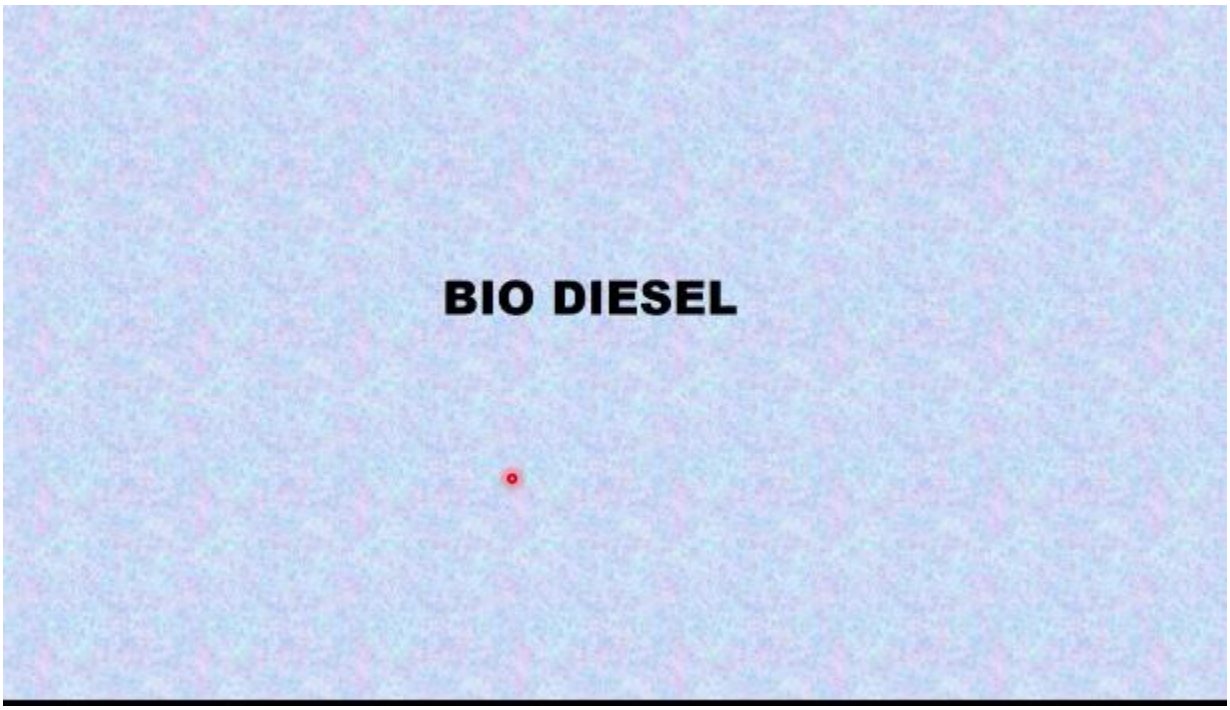
And what is the reduction in the reservoir capacity due to this sedimentation that is taking place because of the urbanization that is taking place in the catchment area is a question that one should seriously look into. And if that is a serious problem, then we may like to basically have some kind of a policy regarding how much of urbanization we can allow in that locality.

I will show, it is not only the sedimentation of the reservoir but definitely whatever the, you know, the land use change that are occurring, and the urbanization is occurring is going to have an effect on the hydrology. Which means the amount of water that goes through this nalas and then when they will go through these nalas and then what is the increase in the velocity and all those things will have a significant effect on the in stream biota. There is a lot of biota, flora, and fauna which are very unique to these small nalas. And all that you know when you change the flow patterns through these nalas because you have changed the land use pattern will have, may have, we don't know will have, or it can have some effect on these in-stream biota and that can change the ecology of that area, so one has to look into these aspects.



So, in fact, we have taken up a study to look into, how does the flow and material transport in the nalas in the Western Ghats near Pune get affected by the you know contemplated land use changes. And of course, there is an additional effect that may come in into the future that is the

climate change, how does the land use change and climate change together you know have an effect on the water in these Nalas. And then again consequently what is the effect it is going to have on the Mulshi reservoir, these things needed need to be looked into.
We have done some little effort in this area, in the sense what is going to be a change. That is, I mean how do we go about you know learning, I mean how do we go about you know estimating this effect, and then how do we translate that research into some kind of a policy is also an issue.



The next issue I would like to talk about in this lecture is the bio diesel. Look at this, this is a rapid increase in the population all over the world, now there are of course the standards of living have also been increasing tremendously, and people require more air conditioners, require more cars, more trucks, more vehicles, more and more and more, there is going to be a significant increase in the fuel needs. And this significant increase in fuel needs is causing a lot of worries to the society because more amount of fuel burnt there is more greenhouse gas emissions which can lead to a global warming. And for many nations which input this fuel from other countries, there is a question of energy insecurity, and of course, there could be a significant increase in fuel prices.

Rapid Increase in the Population

Better Standards of Living

More Air Conditioners

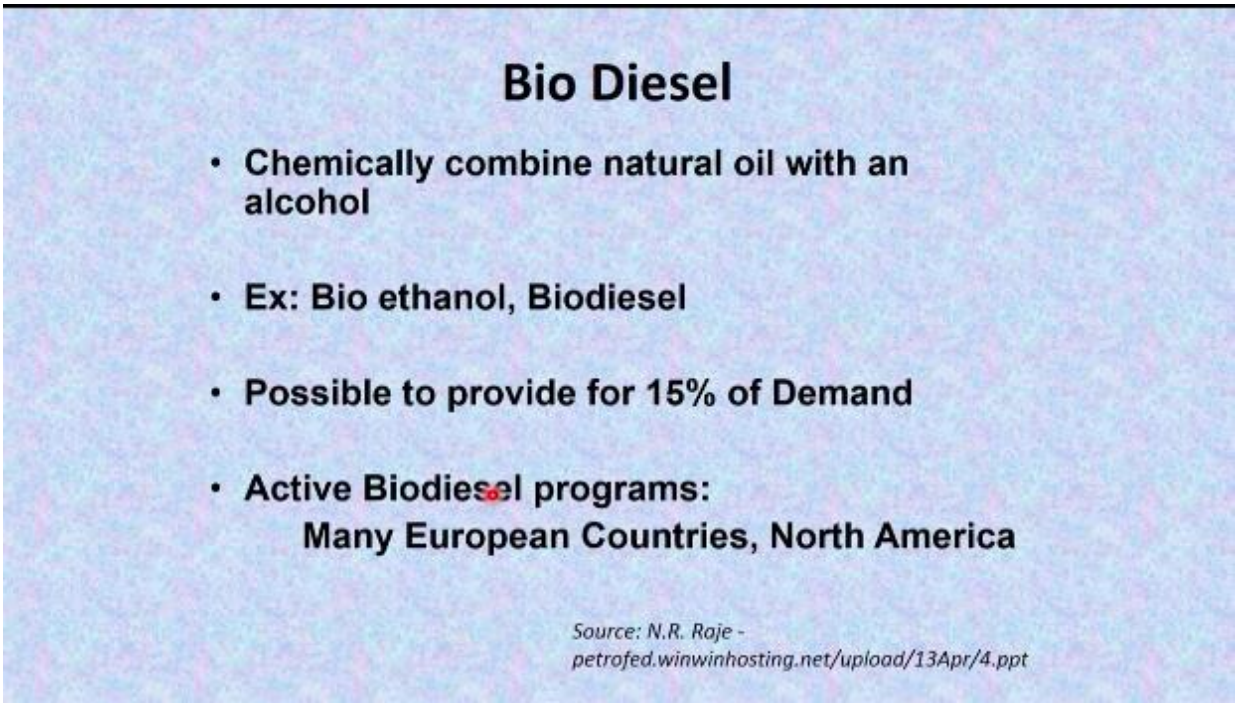
More Cars, Trucks and Vehicles

Significant Increase in Fuel needs

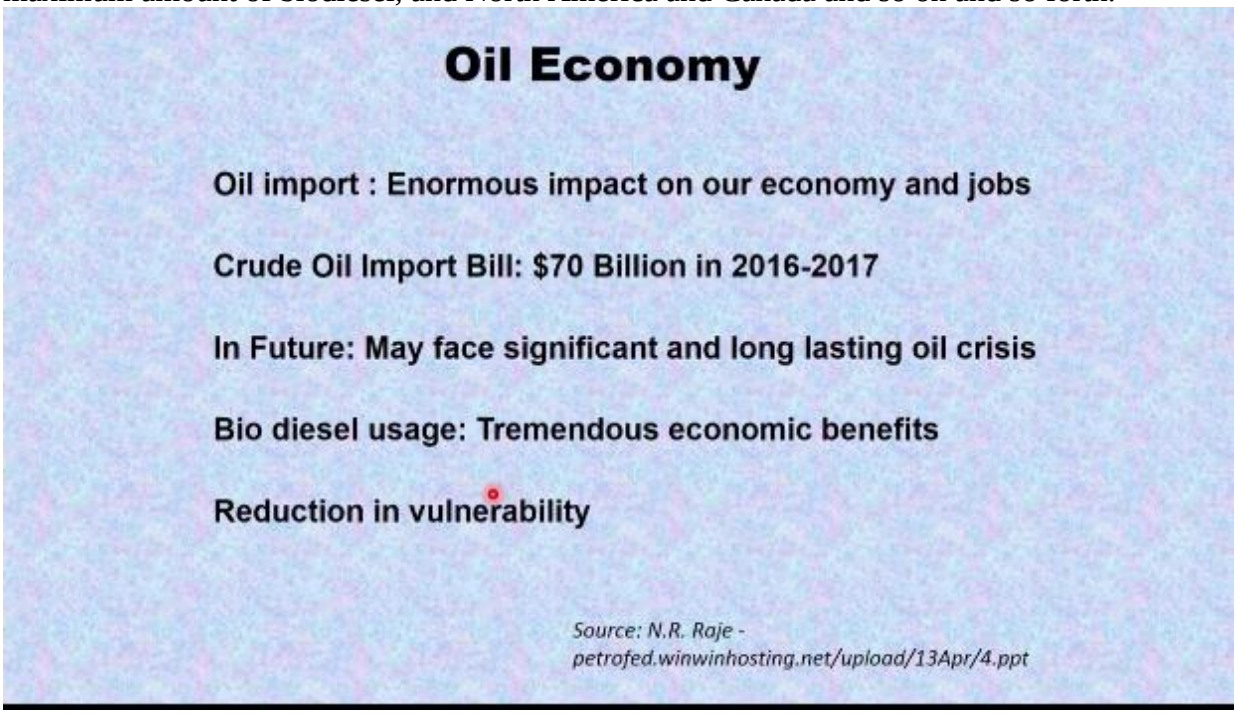
Source: Professor Bernard L. (Baruch):
www.tau.ac.il/lifesci/departments/plant_s/manna/epel.ppt

Main Worries

- More GHG Emissions - Global Warming!!
- Energy insecurity
- Increase in Fuel Prices

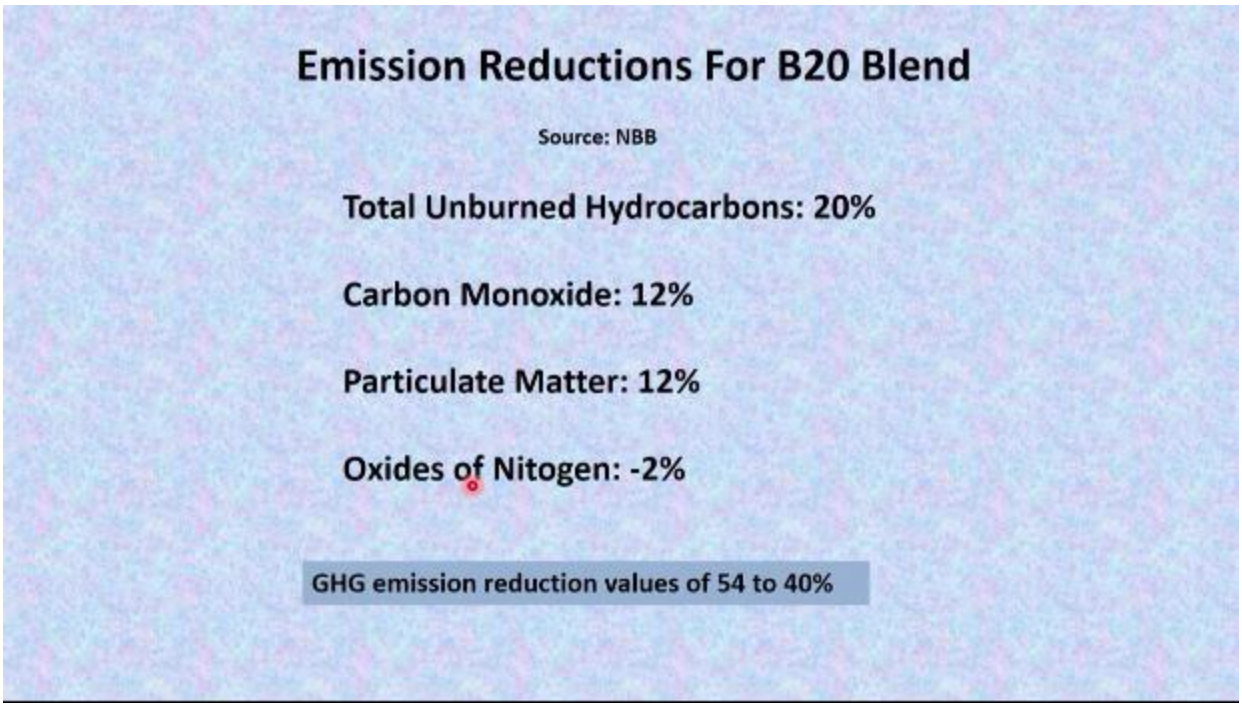


So, in this context, bio diesel is thought to be a very good thing that one should pursue or introduce into the market. What is bio diesel? It is a chemically, how is it produced? Chemically combine natural oil with an alcohol. In simple terms like for example bio ethanols and biodiesels, and then it is estimated that one can provide for 15% of the fuel demand through use of this biofuels, like biofuel and bioethanol. There have been lot of active biodiesel programs especially in many countries in Europe, France is supposed to be producing the maximum amount of biodiesel, and North America and Canada and so on and so forth.

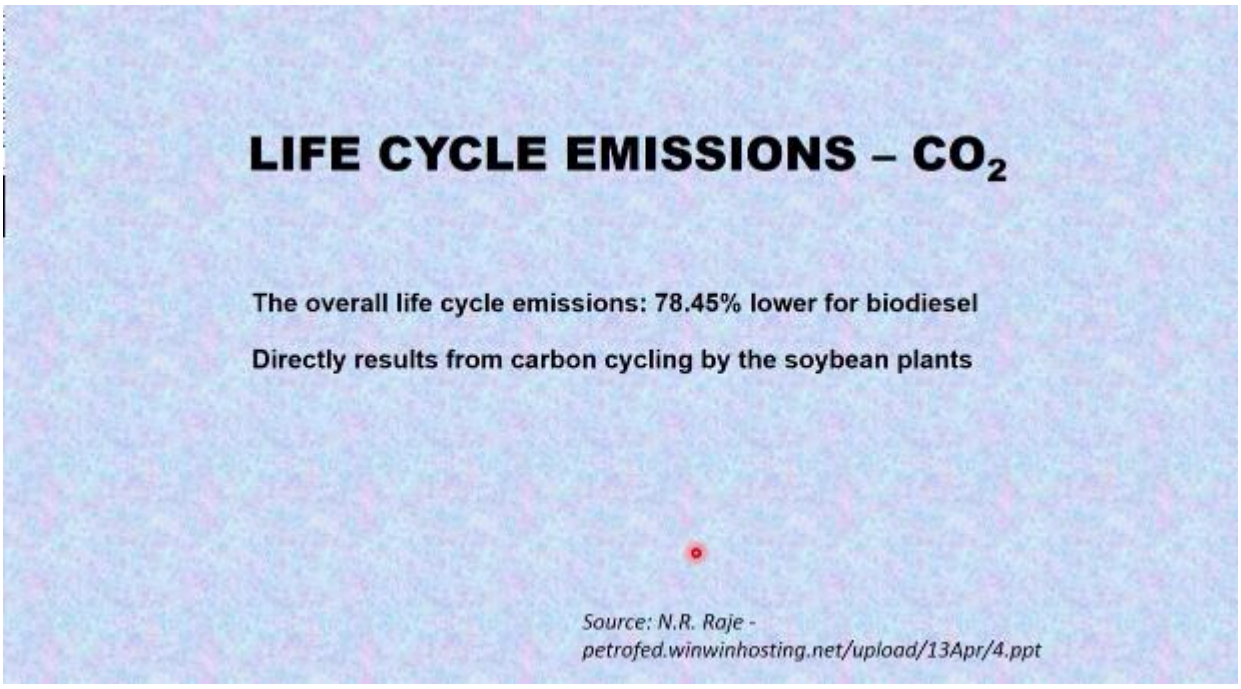


Now if you look at our own country's oil economy. Our imports, we import a lot of oil, it can have an enormous impact on our economy in jobs, our crude oil import bill was 70 billion dollars in the previous year that is 2016-2017, and it is expected that in future we may face a significant and long-lasting oil crisis. And in this context it is been said that biodiesel usage can have tremendous economic benefits, and of course it will also and it may have reduce, I mean the introduction of biodiesel into the market can reduce our vulnerability.

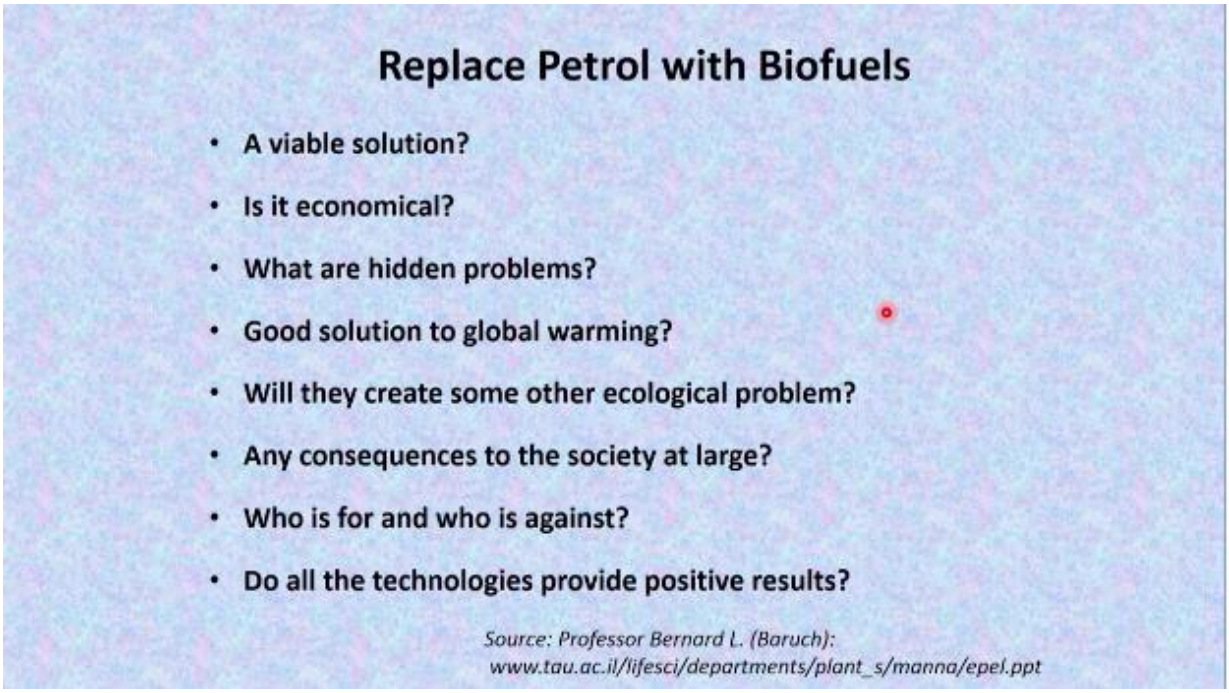
What are the other benefits? We can have the security of supply, we can have sustainability, and as I mentioned earlier we can have greenhouse gas reductions, and there is going to be a rural development too because you have to produce raw material to make this biofuels and then that may, I mean increase the rural development. And there is an emission reductions have been studied for different blends of biodiesel.



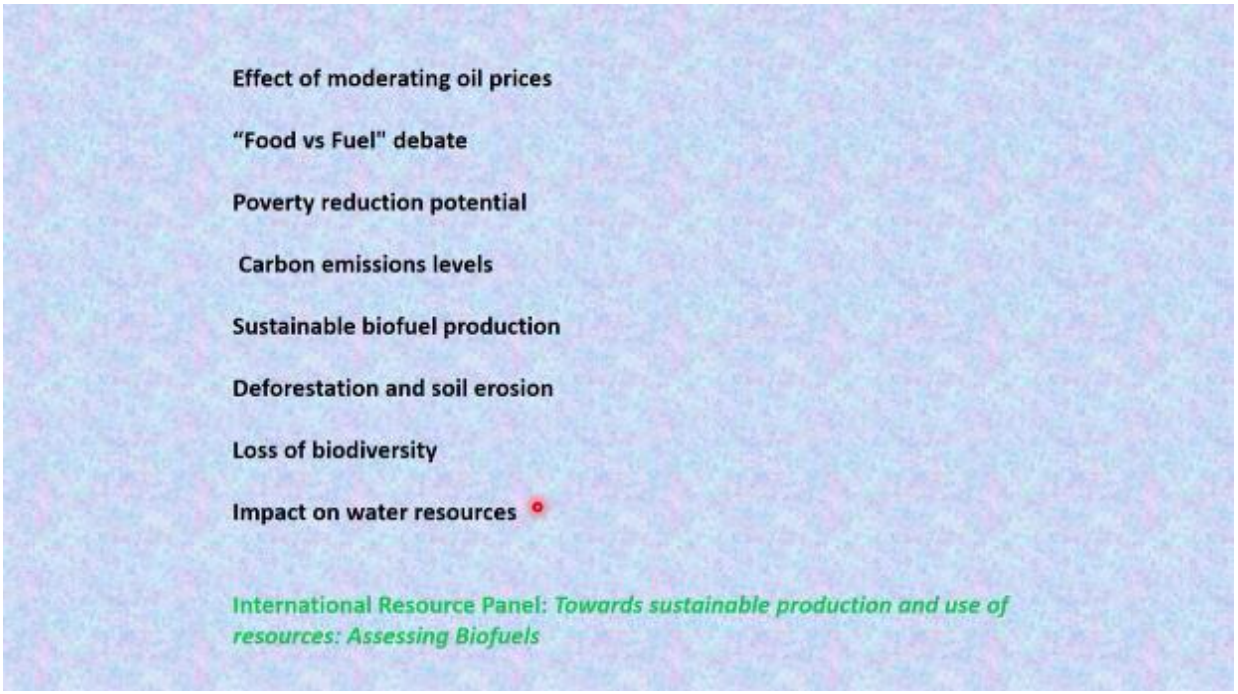
And here we give for example there is an emission reduction for B20 blend, there is a total unburned hydrocarbon is about 20% reduction, carbon monoxide there is a 12% reduction, and particulate matter there is a 12% reduction, there is a slight increase in the emission of oxides of nitrogen but then GHG emission reduction values are expected to be between 54 to 40%. And of course, these numbers change with the blend.



And people have done life cycle emissions for CO2 emissions. Okay, lifecycle emissions of CO2 for biodiesel, when I say lifecycle emission it means a cradle to grave kind of analysis you know, this overall life cycle emissions supposed to be 78.45% lower for biodiesel, and this directly results from carbon cycling by soybean plants, so there is a lot of push for replacing petrol with biofuels. But then before we do that there are some pertinent questions, we should ask, and many people feel that we have to ask some few hard questions that is, is it really a viable solution? Is it economical, what are the hidden problems? In the sense, do we know everything about what kind of an effect it will have on the ecology? And we have understood completely, or there are any hidden problems, is it a good solution to global warming or is it the only solution to global warming or there are better ways of solving the global warming. Problem, again as I mentioned, will they create some other ecological problems, we are solving one problem like reducing I mean global warming, but then are we going to create some other ecological problem in its place.



What are the consequences of introducing biodiesel into the market to the society at large, again who is for introducing biodiesel and who is against for introducing biodiesel into the market, and what are the reasons? What are the hidden agendas of different stakeholders? There are lots of technologies that are being developed in biofuels, now all these technologies provide positive results, which technologies are good? Which technologies are not so good? These are some of the questions that we need to ask before we go ahead with the large-scale introduction of biofuels into the market.



Again what is the effect of moderating on oil prices, is it really having an effect on the oil prices? Introduction of biodiesel. What about food versus fuel debate, that is if lots of you know, our thing, agricultural land, this food versus fuel debate, a lot of agricultural land if it is taken away for producing the raw material that is needed for production of biofuels then that much of land will not be available for producing the food. So, how do we tackle this? This is what the food versus fuel debate is all about, do we really transfer all the land to producing the raw material for the biofuels, where do we cap it? What is the poverty reduction potential of introducing these biodiesels, and carbon emission levels? Have we understood everything about carbon emission levels or whatever the carbon emission levels reduction in the carbon emission levels is it, you know, commensurate with the amount of investment are we making. Then sustainable biofuel production, that is we introduce the biofuel into the market, and then, later on, we find that, let us say we change lot of cars and then the vehicles which run on the biofuels and then lot of tech, I mean other things. And then suddenly we find that we are unable to produce. You know the biofuels, the amount of biofuels that is required to run these cars and vehicles. So, this production, biofuel production, is it sustainable, or there are some bottlenecks in that.

Another question that you may ask is, when we go in for this biofuel productions or when we make more and more raw material that can be used for biofuel, what is the effect on, I mean this deforestation and soil erosion, it is going to have on the environment? And large tracks of land if they are changed from you know growing certain kind of crops that they are growing now to growing the raw material for the biofuels, what is the effect of this on the biodiversity? Is there going to be a loss of biodiversity? Is it going to be significant? And another issue that is of importance is what is the impact of increased biofuel production on the water resources that we have. Our water resources are already dwindling, the quantity of potable water or quantity of usable water that is getting reduced and the qualities are getting affected. So, if you increase the biofuel production in the country what is the consequence of this on available water resources?

Water resources that are available for other purposes particularly drinking water, other agriculture production etcetera, etcetera. So, some of these questions we need to address before we go and then you know introduce these biofuels and these are the kind of similar questions we should ask whenever we introduce the new technologies into the market.

Of course, a lot of work has been going on in these aspects, and I will give a quote from one of the research papers, who have done a lot of research in this area. And this is the opinion of that particular research group that is, if biofuels are produced in ways, okay, if biofuels are produced in ways that minimize conversion of habitat; for example by utilizing waste products or cover crops rather than going for you know converting the lands which are used for, let us say rice production or wheat production or food productions of that. Can we do this, you know minimize conversion of habitat? Okay and then utilize a lot of wastes that is being produced these days and utilize this waste products to go for I mean, to make the biofuels or use cover crops for making the biofuels and increase the yields. Let us say you take the same amount of, I mean area of land but increase the yield from that particular land for the biofuel, I mean, the raw material for the biofuel, increase the yield. And targeted degraded pasture and abandoned cropland, there is lot of land which is not being utilized which is a degraded pasture or which is basically a cropland which has been abandoned for many many reasons, utilize those lands.

Now if that is the case, if you address those issues then biofuels could play a positive role in mitigating the climate change. And this is what many research studies in the lifecycle you know analysis has shown up, it can increase enhance the environmental quality and of course, it will strengthen the global economy. So, what is being said here is, yes there could be a lot of issues, with/when we introduce the biodiesel in the fuel, I mean biodiesel into the market, I am sorry. But then, if we do this introduction, or if we do this production of bio biofuels by considering all the other effects it may have, and then addressing those issues, we may be able to you know have a sustainable use of biodiesels. And that is what is all, I mean the few lectures that I am

giving until now and then maybe few more in the future. That is what we are, the message that we would like to send. That is, keep an eye on what kind of effects a new technology might have or a new process might have and then address those issues so that sustainability is achieved. Thank you.